SECTION 27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section included cable trays in corridors and telecom spaces.

1.2 SUBMITTALS

A. Submittal requirements:
   1. Submittals are to be approved by UCD IT and consultant.
   2. Provide shop drawings indicating cable tray does not to exceed 25% visually full when the project is complete. 25% full is a visual fill of 50%.
   3. Provide product data for the following:
      a. Manufacturer's data/cut sheets, product drawing/specifications and installation instructions for all products (submit with bid).
         1) Clearly mark the provided documentation to denote which part number/specific product is being submitted.

1.3 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
B. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
D. 27 05 53 IDENTIFICATIONS FOR COMMUNICATIONS SYSTEMS
E. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.4 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.

C. Strictly adhere to all BICSI, Telecommunications Industry Association (TIA) recommended installation practices when installing communications and data cabling.

D. Material and work specified herein shall comply with the applicable requirements of:
   1. ANSI/TIA/EIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces.

2. ANSI/TIA/EIA-606-C Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
3. ANSI/J-STD-607-D Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
4. BICSI – Telecommunications Distribution Methods Manual
5. NEMA – VE-1 – Metal Cable Tray Systems
6. NEMA – VE-2 – Metal Cable Tray Installation Guidelines

PART 2 - PRODUCTS

2.1 BASKET TRAY

A. Basket Tray
1. Open Wire Frame Construction.
2. Welded wire mesh with continuous safety edge wire lip.
3. Mesh forms grid at nominally 2" by 4"
4. Electroplated zinc galvanized carbon steel.
5. Accessories: Provide a complete system of accessories, including bonding and grounding connections, conduit connectors, to terminate conduits extended to basket edge, radius shields to protect cabling at inside corners, and waterfall drop-outs at each end of cabling racks and cabinets or where needed to terminate open wiring systems.
6. Manufacturers:
   a. Cablofil.
   b. PW Industries.
   c. Or approved equal.

2.2 CABLE TRAY WATERFALL (CONTRACTOR FURNISHED AND INSTALLED)

A. Provide cable tray waterfall or drop out at ends of all runs.
1. Cooper B-line 9A-1104.
2. Cooper B-line 99-1124.
3. Or approved equal.

2.3 CABLE TRAY TRANSITIONS (CONTRACTOR FURNISHED AND INSTALLED)

A. All turns, bends, and direction changes shall use manufacturer's radius 90 degree, 3-way, & 4-way transitions. Field constructed 90s, 3-ways, and 4-way transitions shall only be permitted if the manufacturers solution is proven to not be constructable.

PART 3 - EXECUTION

3.1 CABLE TRAY APPLICATION

A. Communications cable tray installations shall conform to the following:

1. Basket Tray- Horizontal station cabling outside of the communications rooms where more than 100 cables are within the pathway.

B. Size and Fill Ratio:

1. Basket Tray is not to exceed 50% visually full when the project is complete. 25% full is a visual fill of 50%. Size as shown on the drawings.

3.2 INSTALLATION

A. Each of the cable tray systems shall be installed and supported in accordance with the manufacturer's instructions and as indicated on Contractor's submittal documentation, prior to final acceptance/approval by the University.

B. Installation shall be performed and accomplished in a professional manner, by qualified personnel.

C. Installation to maintain at least 12" vertical clearance over the top of each tray for use by University’s personnel.

D. Provide access 24" wide along one side of each tray unless conditions will not allow such clearances. Deviation must be cleared by IT before installing tray. Conditions of installation not approved by IT shall be replaced at no cost to the University.

E. A minimum of 6 inches of clearance from the top of the finished ceiling to the bottom of the cable tray shall be provided.

F. Cable distance limitation of 275 ft shall be adhered to when laying out cable support infrastructure.

G. Cable fill ratio is not to be exceeded during the initial installation of cabling.

H. Separation of systems other than IT are the responsibility of the contractor. IT requires a separation of all non-Ethernet protocol systems from all Ethernet protocol systems installed.

I. Basket Tray shall not penetrate any firewall. EZ Path products shall be used as the solution with the cable or basket tray stopping short of the wall by 1 to 2 feet.

J. Where basket tray becomes inaccessible, transition to an equivalent size conduit pathway shall be provided. If fire stopping is required at either end of the conduit(s), an EZ Path retrofit EZDR-400 shall be provided on all conduits.

K. Center mount “T” style cable tray supports shall not be permitted.

END OF SECTION

1 2 3 4 5 6

E

D

C

B

A

GENERAL
G-001 COVER PAGE
G-002 GENERAL NOTES

ARCHITECTURAL
A-101 FLOOR PLAN
A-102 RIGGING PLAN
A-201 INTERIOR ELEVATIONS

STRUCTURAL
S-101 FLOOR PLAN
S-301 INTERIOR SECTIONS
S-501 PLAN AND SECTION DETAILS

MECHANICAL
M-101 FLOOR PLAN
M-501 PLAN AND SECTION DETAILS

ELECTRICAL
E-101 FLOOR PLAN
E-111 REFLECTED CEILING PLAN
E-301 INTERIOR SECTIONS
E-501 SCHEMATIC DRAWING
E-502 ELECTRICAL DETAILS
E-503 ELECTRICAL DETAILS
E-901 ELECTRICAL DETAILS

NETWORK
N-101 FLOOR PLAN

EQUIPMENT
Q-501 LASER DETAILS
Q-901 INTERIOR PERSPECTIVE

UC DAVIS

SACRAMENTO, CA

RADIXACT ® TREATMENT DELIVERY SYSTEM

ACCURAY INCORPORATED

UCDH Project Number: 9558090
UCDH Project Name: CCTR RM 0116C RAD ONC LINAC REPLACEMENT

ACCURAY

ACCURAY INCORPORATED
1310 Chesapeake Terrace
Sunnyvale, CA 94089

DRAWING INFORMATION	
A	9.13.2022
B	3.5.2024

PROJECT INFORMATION

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REGIONAL PROJECT MANAGER
JOSEPH BARTLOW

SITE PLANNING COORDINATOR
JASON LENTZ

PAGE NUMBER

1 of 20

SHEET NUMBER

G-001

COVER SHEET

GENERAL NOTES

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Sunnyvale, CA 94089

DRAWING INFORMATION

A	9.13.2022
B	3.5.2024

PROJECT INFORMATION

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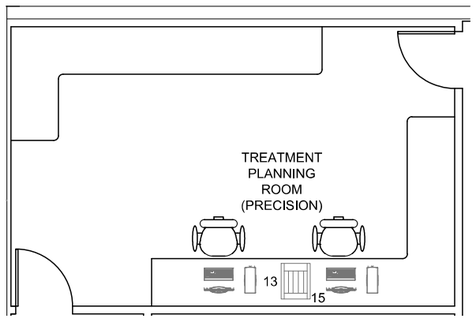
JASON LENTZ

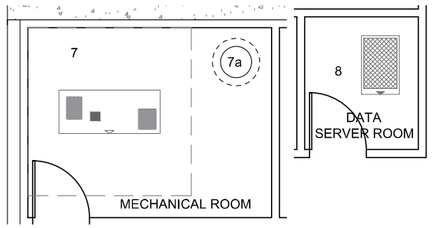
PAGE NUMBER

20 of 20

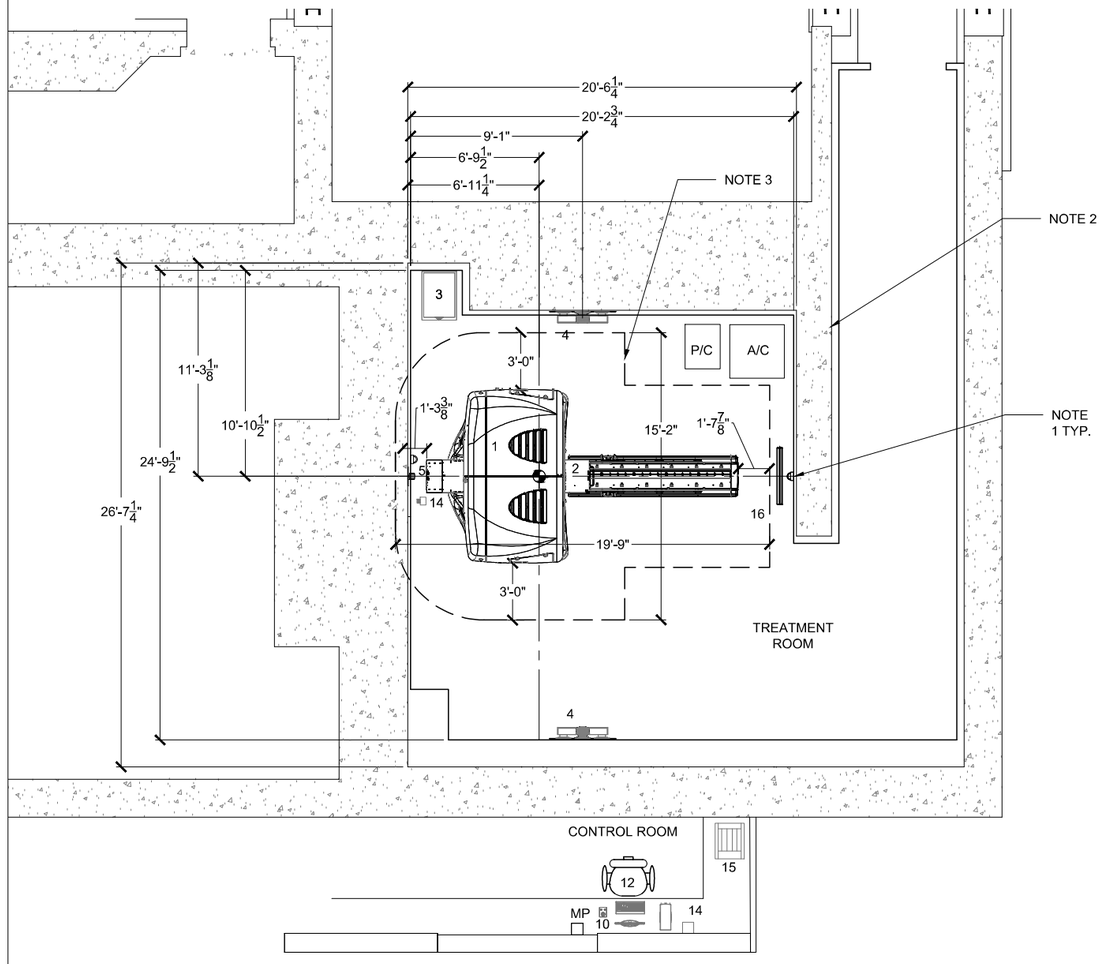
SHEET NUMBER

G-002
GENERAL NOTES





THE FOLLOWING ROOMS ARE NOT SITE SPECIFIC AND ARE FOR REFERENCE ONLY:
- TREATMENT PLANNING (DOSIMETRY)
- MECHANICAL ROOM
- DATA SERVER ROOM



A1	OVERALL FLOOR PLAN
	SCALE: 1/8" = 1'-0"

#	EQUIPMENT NAME (ACCURAY SUPPLIED)	IN	LBS
1	RADIXACT™ TREAMENT DELIVERY SYSTEM	77.5 x 110 x 99	13,000
2	RADIXACT™ SYSTEM COUCH	107.7 x 25.6 x 44.4	1,100
3	POWER DISTRIBUTION UNIT	30 x 22 x 56	1,001
4	DORADO LASER SYSTEM	31.26 x 8.66 x 7.21	48.5
5	APOLLO LASER SYSTEM	8.7 x 4.33 x 4.13	4.5
8	iDMS DATA MANAGEMENT SYSTEM	37 x 24 x 63.5	900
10	OPERATOR STATION CONTROL	8.5 x 4.5 x 3	2.6
12	CONTROL WORKSTATION	N/A	N/A
13	TREATMENT PLANNING SYSTEM	N/A	N/A
14	INTERCOM SPEAKER SYSTEM	7 x 6.3 x 9.4	5
15	PRINTER	N/A	N/A
16	SYNCHRONY	28 x 7.5 x 3	10

#	EQUIPMENT NAME (OFCI)	IN	LBS
6a	POWER CONDITIONER	N/A	N/A
6b	FREQUENCY CONVERTER	N/A	N/A
7	AIR COMPRESSOR	N/A	N/A
7a	AIR TANK	N/A	N/A

GENERAL NOTES

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C. FINAL RADIATION SHIELDING SHALL BE COMPLETED BY THE PHYSICIST OF RECORD.
D. UNLESS OTHERWISE NOTED, ALL MATERIALS SUPPLIED AND INSTALLED ARE THE RESPONSIBILITY OF THE CUSTOMER.
E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. MINIMUM 2 WALL MOUNTED CCTV (FACILITY PROVIDED). EXACT LOCATION TO BE DETERMINED BY CUSTOMER. CCTV AT FOOT OF PATIENT BED TO BE MOTORIZED. SEE SPG FOR SPECIFICATIONS.
2. FINISHED WALLS ARE FOR REFERENCE ONLY. REFER TO CONTRACT DOCUMENTS FOR DIMENSIONS/DETAILS.
3. CLEARANCE AREA FOR SERVICE.

LEGEND

ISOCENTER

MP MAIN POWER DISCONNECT

[ ] RECOMMENDED

OFCI OWNER FURNISHED/ CONTRACTOR INSTALLED

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

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DRAWING INFORMATION

A	9.13.2022
B	3.5.2024

PROJECT INFORMATION

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JOSEPH BARTLOW

SITE PLANNING COORDINATOR
JASON LENTZ

PAGE NUMBER

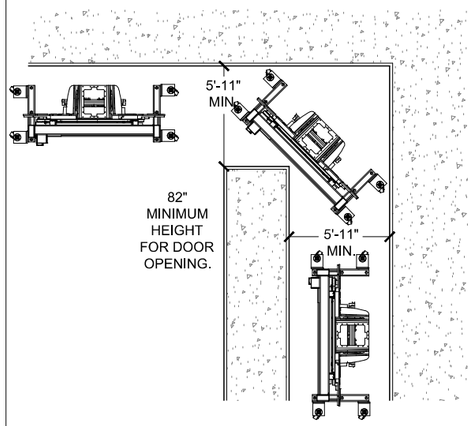
2 of 20

SHEET NUMBER

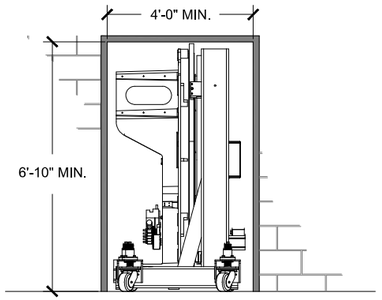
A-101

ARCHITECTURAL FLOOR PLAN

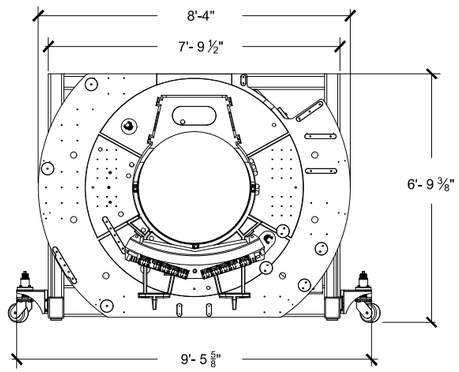
ACCURAY CONFIDENTIAL QUALITY SYSTEM DOCUMENT RADIXACT SITE PLANNING DRAWING SET T-SPD-1050322 REV D



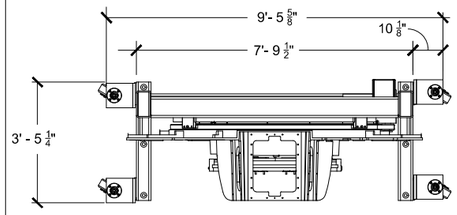
D1 | RIGHTING THROUGH MAZE- WHEELS
NOT TO SCALE



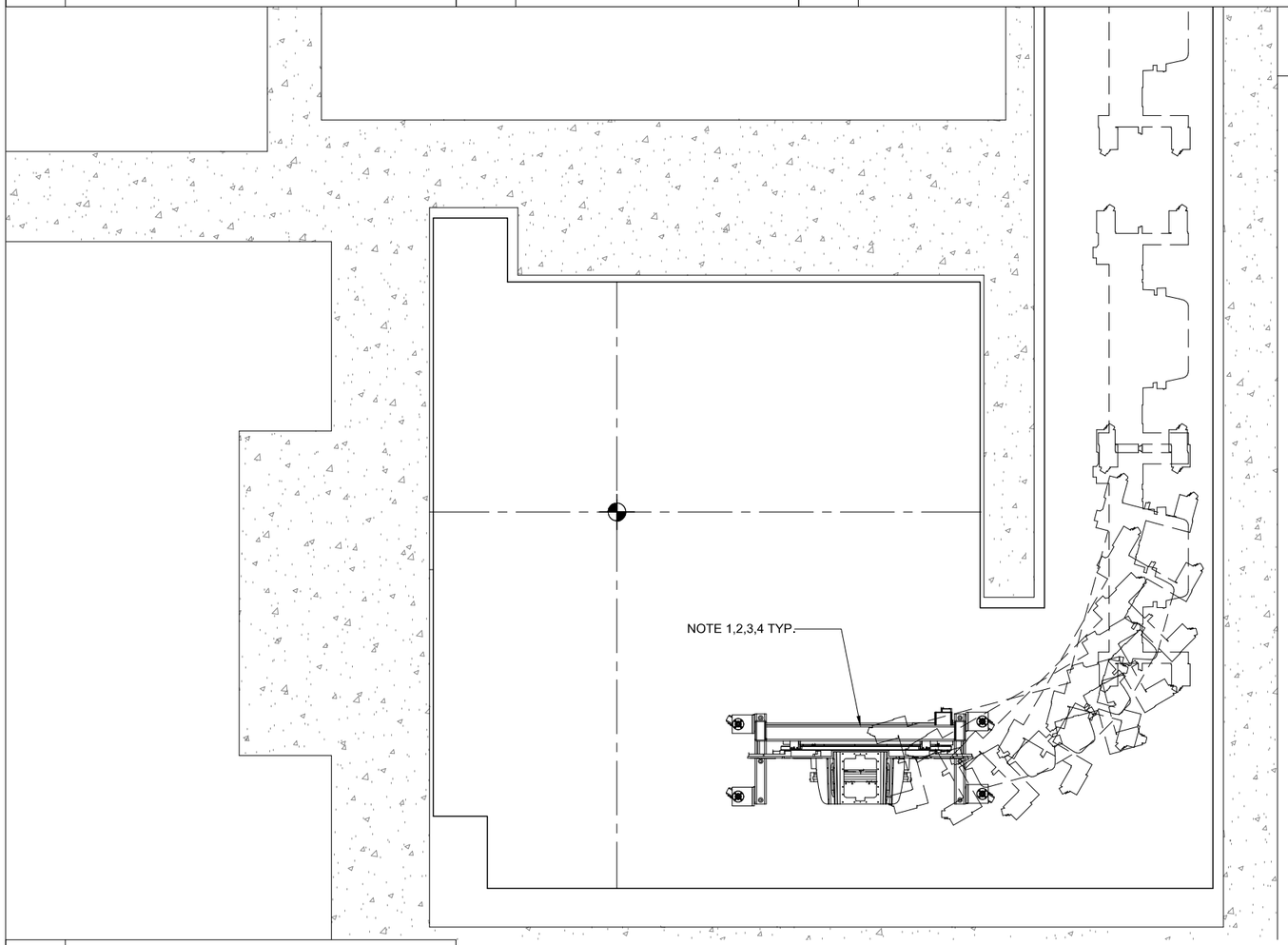
D2 | RIGGING THROUGH DOOR- WHEELS
NOT TO SCALE



D3 | GANTRY ON WHEELS
NOT TO SCALE



D5 | GANTRY ON WHEELS
NOT TO SCALE



A1 | OVERALL RIGGING PLAN
SCALE: 3/16" = 1'-0"

GENERAL NOTES

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E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. RIGGING PLAN IS FOR REFERENCE ONLY. ACTUAL ROUTE TO BE DETERMINED BY OWNER.
2. GANTRY IS 77.5"(L) x 110"(W) x 99(H) AND WEIGHTS 13,000 LBS.
3. FACILITY TO PROVIDE CLEAR ACCESS PATH MIN. 5'-11" WIDE x 82" HIGH TO OUTSIDE DELIVERY LOCATION.
4. ALL FLOOR SURFACES ALONG THE RIGGING PATH MUST BE FULLY SUPPORTED AND CAPABLE OF WITHSTANDING 13,000 LBS.

LEGEND

ISOCENTER

DIMENSION FORMAT: FEET & INCHES

ACCURAY

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DRAWING INFORMATION

A	9.13.2022
B	3.5.2024

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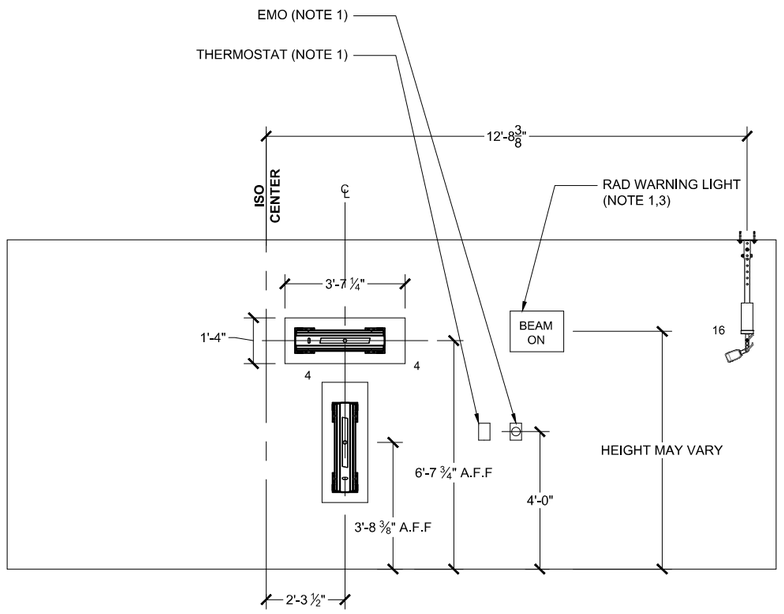
PAGE NUMBER

3 of 20

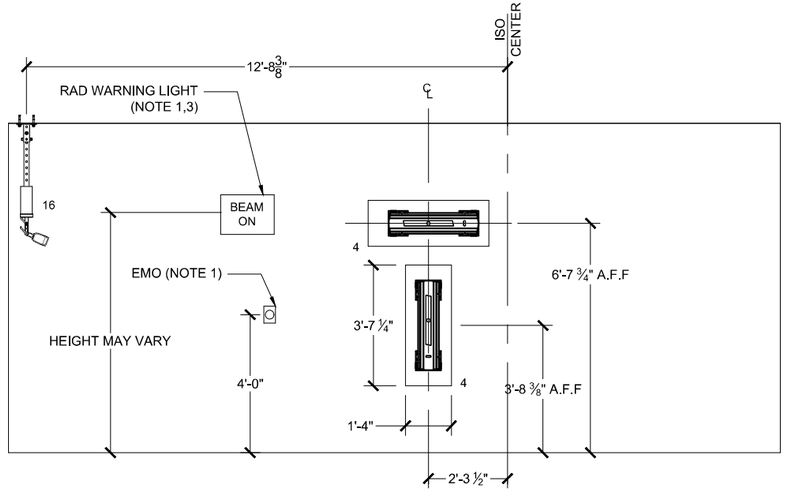
SHEET NUMBER

A-102

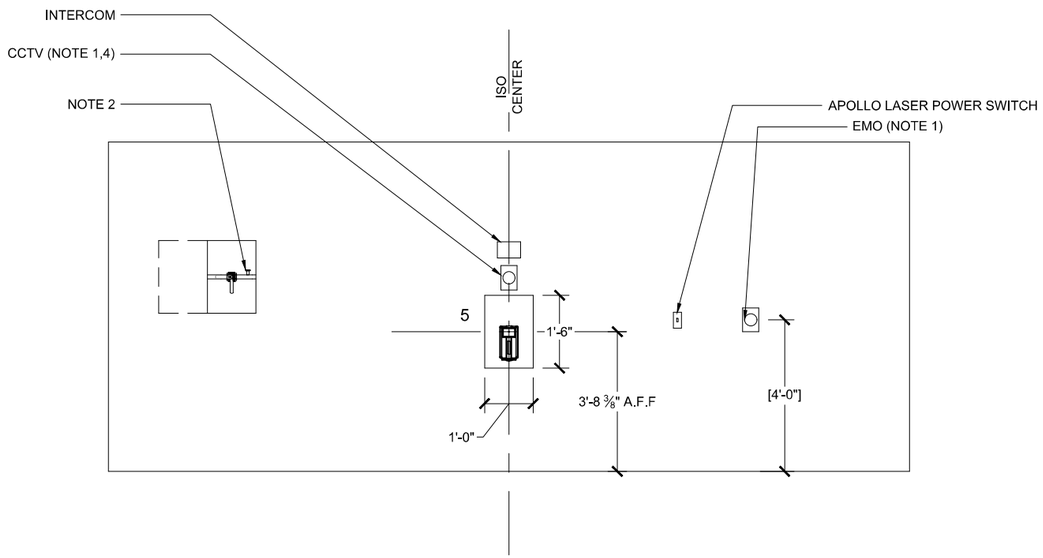
ARCHITECTURAL
RIGGING PLAN



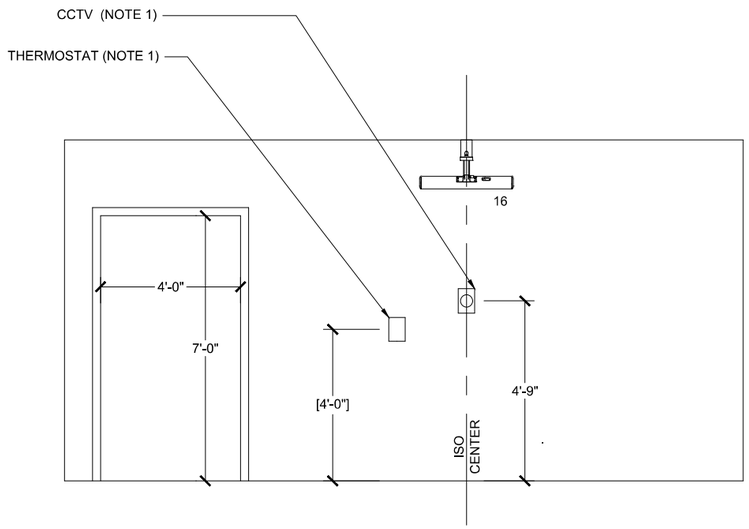
C1	GANTRY SIDE WALL	
	SCALE: NOT TO SCALE	NOT SITE SPECIFIC



C4	GANTRY SIDE WALL	
	SCALE: NOT TO SCALE	NOT SITE SPECIFIC



A1	REAR OF GANTRY WALL	
	SCALE: 1/4" = 1'-0"	NOT SITE SPECIFIC



A4	FRONT OF GANTRY WALL	
	SCALE: 1/4" = 1'-0"	NOT SITE SPECIFIC

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F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. OWNER FURNISHED, CONTRACTOR INSTALLED. EXACT LOCATION TO BE DETERMINED BY CUSTOMER.
2. AIR SHUT OFF VALVE AND QUICK DISCONNECT, LOCATION MAY VARY. SEE SITE PLANNING GUIDE (SPG) FOR ALTERNATE LOCATIONS.
3. REFER TO LOCAL REGULATIONS. COORDINATE ELECTRICAL AS NECESSARY.
4. CCTV AT THE BACK OF THE GANTRY AND NEIS NEEDS TO BE INSTALLED IN THE AXIS OF ISOCENTER AND RIGHT ABOVE THE LASER PLATE.

AFF ABOVE FINISHED FLOOR

LEGEND

ISOCENTER

4 DORADO (RED) LASER
5 APOLLO (GREEN) LASER
16 SYNCHRONY

[ ] RECOMMENDED

DIMENSION FORMAT: FEET & INCHES

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A	9.13.2022
B	3.5.2024

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JASON LENTZ

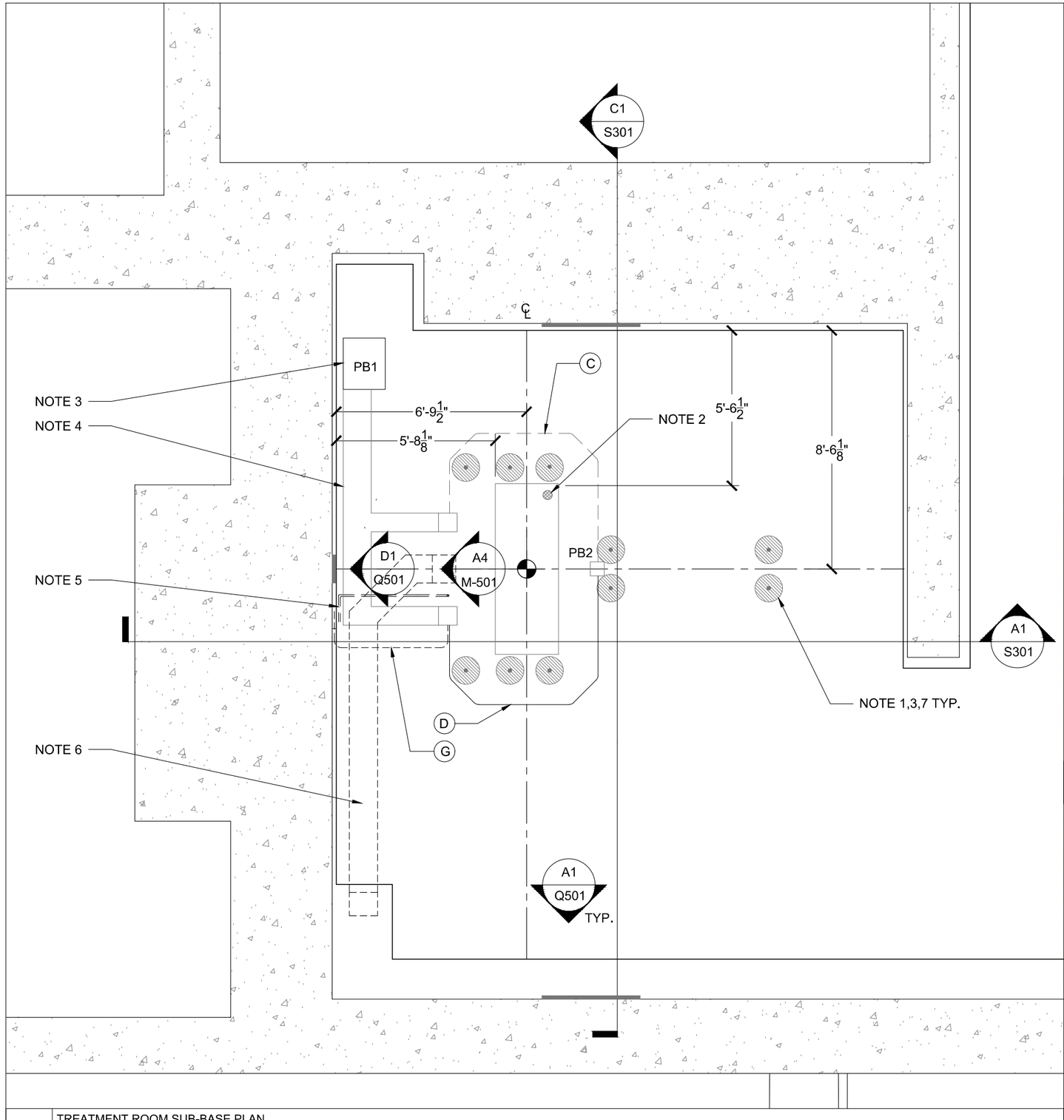
PAGE NUMBER

4 of 20

SHEET NUMBER

A-201

ARCHITECTURAL ELEVATION



A1 TREATMENT ROOM SUB-BASE PLAN
SCALE: 1/4" = 1'-0"

D3 SUB-BASE AFTER POURING CONCRETE
NOT TO SCALE

A5 SUB-BASE BEFORE POURING CONCRETE
NOT TO SCALE

GENERAL NOTES

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F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. THIS FLOOR PLAN IS CUT AT THE SUB-BASE LEVEL, WITHIN THE CONCRETE.
2. MOISTURE SENSOR WITH ALARM. A FLOOR DRAIN THAT CAN HANDLE 14 L/min. IS A POSSIBLE ALTERNATIVE.
3. SEISMIC BRACKET MAY BE REQUIRED, REFER TO CODE.
4. WHERE TRENCHES ARE NOT POSSIBLE, CONDUIT IS AN ACCEPTABLE ALTERNATIVE.
5. SUPPLEMENTAL AIR DUCT (SEE M-501)
6. COMPRESSED AIR LINE (SEE M-501)
7. REFER TO A1 ON S-501

LEGEND

ISOCENTER

6" AREA AROUND EPOXY SET ANCHOR, CLEAR OF ALL REBAR TO DEPTH OF 10".

PB1 2'-0" x 1'-3" x 1'-6" PDU PULL BOX

PB2 6" x 6" x 6" PATIENT TABLE PULL BOX

PB5 1'-0" x 8" x 8" GANTRY PULL BOX

(C) SIGNAL (3"Ø) - FROM PATIENT TABLE TO BACK OF GANTRY. (20'-0" MAX).

(D) POWER (3"Ø) - FROM PATIENT TABLE TO BACK OF GANTRY. (55'-0" MAX).

(G) SIGNAL (1"Ø) - INTERCOM TO BACK OF GANTRY (15' MAX)

(11) 4 (4"Ø) - JUNCTION BOX (JB1) TO JUNCTION BOX (JB5)

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

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DRAWING INFORMATION

A	9.13.2022
B	3.5.2024

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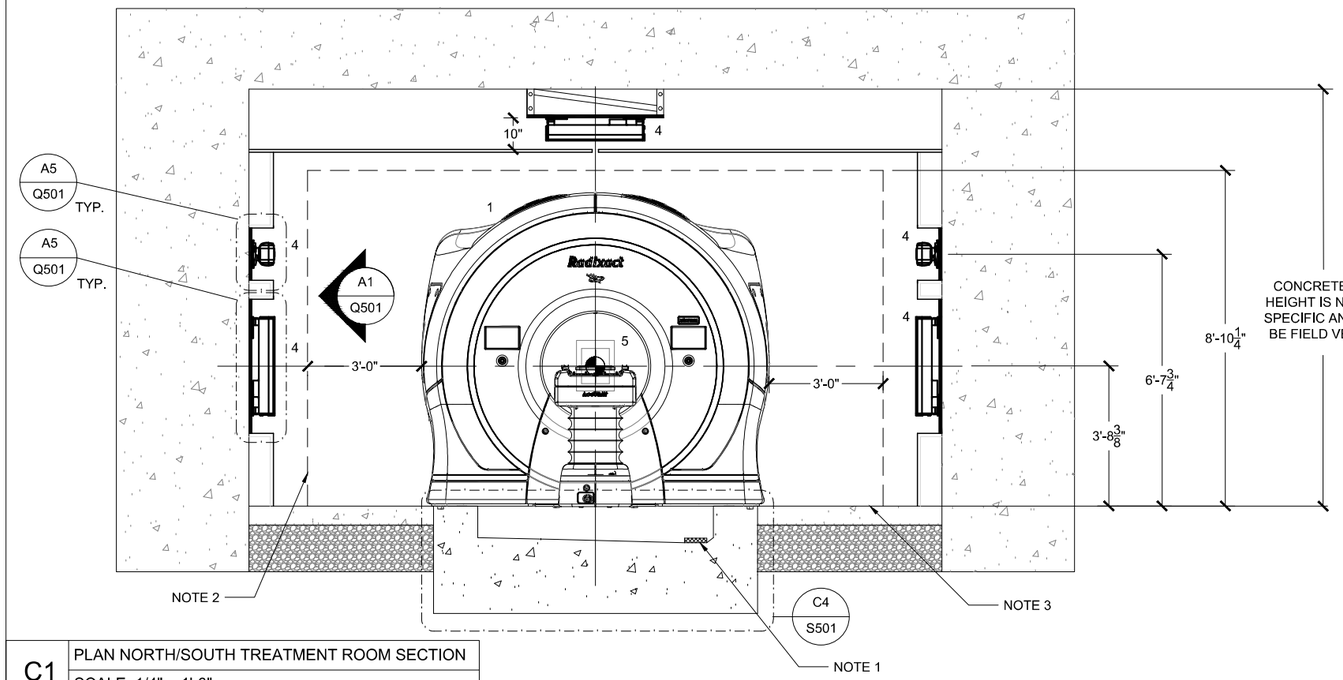
JASON LENTZ

PAGE NUMBER

5 of 20

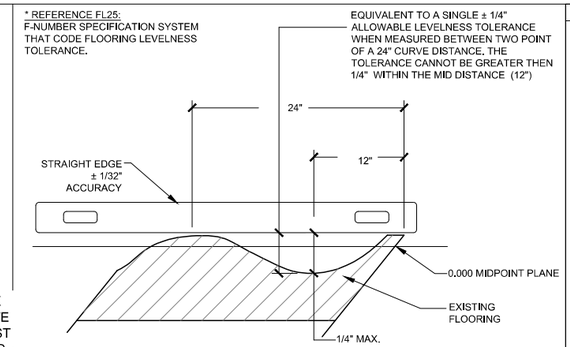
SHEET NUMBER

S-101
STRUCTURAL FLOOR PLAN



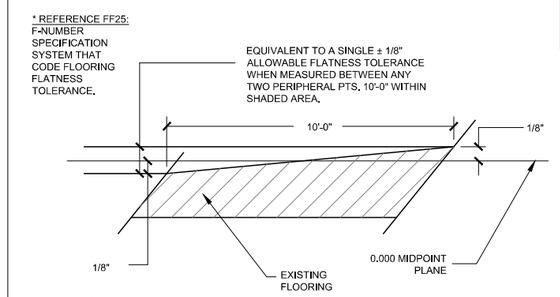
C1 PLAN NORTH/SOUTH TREATMENT ROOM SECTION

SCALE: 1/4" = 1'-0"



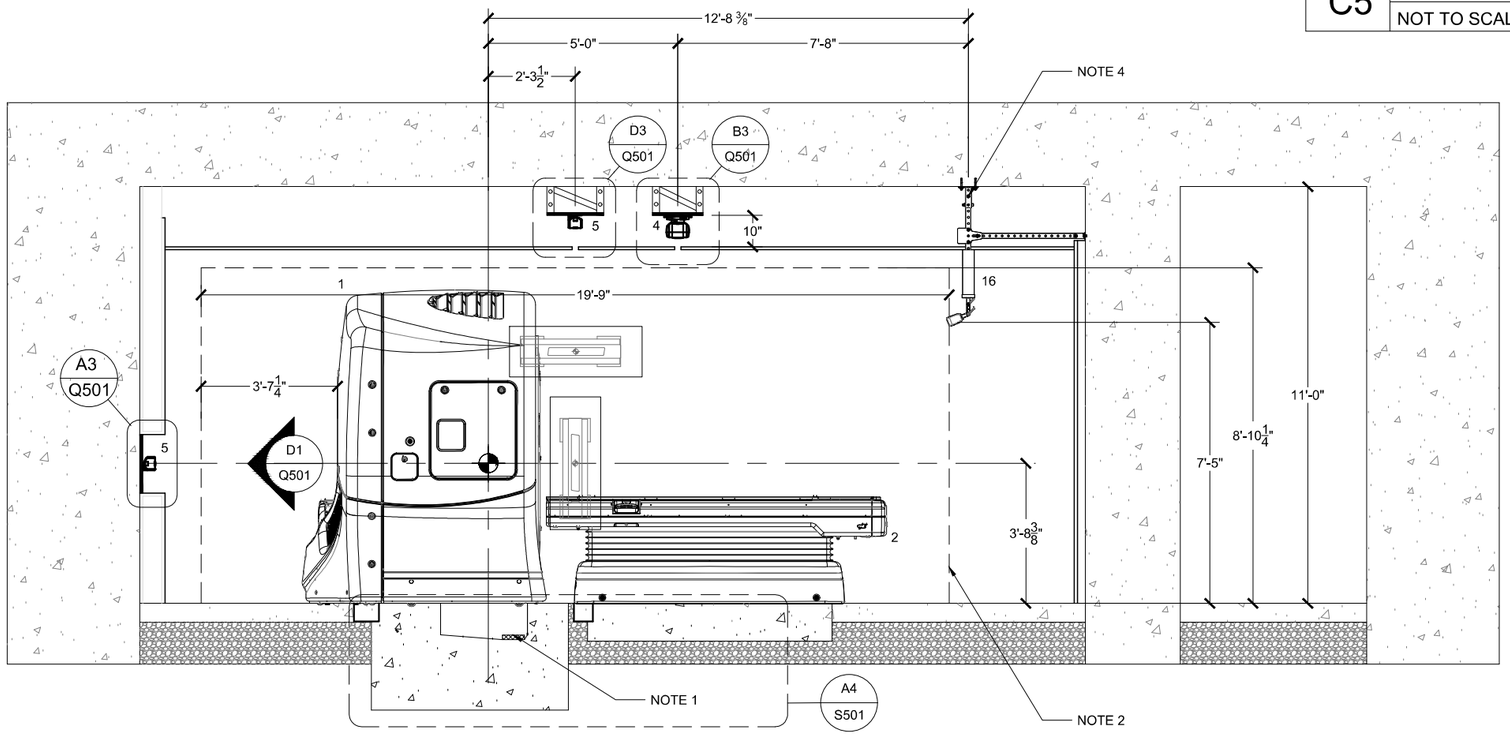
D5 FLOOR FINISH TOLERANCES

NOT TO SCALE



C5 FLOOR FLATNESS

NOT TO SCALE



A1 PLAN WEST-EAST TREATMENT ROOM SECTION

SCALE: 1/4" = 1'-0"

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F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. SLOPE PIT TOWARD MOISTURE SENSOR. A FLOOR DRAIN THAT CAN HANDLE 14 L/min. IS A POSSIBLE ALTERNATIVE.
2. WORKING SYSTEM CLEARANCE
3. THE FLOOR MUST BE LEVEL ENOUGH TO MEET A REQUIRED FLATNESS TOLERANCE OF ± 1/4" OVER 10'-10"
4. SYNCHRONY MOUNTING LOCATION. KEEP 2' CLEAR FOR INSTALLATION AND SERVICING

LEGEND

ISOCENTER

1 GANTRY AND EQUIPMENT ENCLOSURES
2 TREATMENT COUCH
4 DORADO (RED) LASER
5 APOLLO (GREEN) LASER
16 SYNCHRONY

FLOOR LEVELNESS NOTES

- DEFINITION OF FF25/FL25: COMES FROM A FLOOR FINISH TOLERANCES SYSTEM ON F-NUMBER CODES WITHIN ASTM-E1155, AC1 #117, & CSA #23.1. THESE CODES GIVE TOLERANCE REQUIREMENTS USING ABBREVIATION F - NUMBERS.
- DEFINITION OF FF25: "FF" REPRESENTS FLOOR FLATNESS & THE NUMBER REPRESENTS 0.25" [0.6] MAX. HEIGHT WITHIN A 10' [304.8] PLANE. DETAIL "B" ON THIS SHEET SHOWS AN EXAMPLE OF FF25.
- DEFINITION OF FL25: "FL" REPRESENTS FLOOR LEVELNESS & THE NUMBER REPRESENTS 0.25" [0.6] MAX. HEIGHT ON A CURVE DISTANCE OF 24" [610] WIDE. THE MAX. HEIGHT SHOULD BE TAKEN FROM THE POINT LOCATED AT MID-CURVE OF A 12" [30.5] DISTANCE. DETAIL "A" ON THIS SHEET SHOWS AN EXAMPLE OF FL25.
- HATCH AREA REPRESENTS FLOOR GRADE FLATNESS AND LEVELNESS WHICH MUST HAVE FLATNESS (FF) OF 25 FOR TOTAL AREA & LEVELNESS (FL) OF 25 PER ASTM-E 1155.
- *FLOOR FINISH TOLERANCES SYSTEM ON F-NUMBER CODES WITHIN ASTM-E1155 (US STANDARD TEST METHOD FOR DETERMINING (FF) FLOOR FLATNESS AND FL FLOOR LEVELNESS NUMBERS)

DIMENSION FORMAT: FEET & INCHES

ACCURAY

ACCURAY INCORPORATED
1310 Chesapeake Terrace
Sunnyvale, CA 94089

DRAWING INFORMATION

A	9.13.2022
B	3.5.2024

PROJECT INFORMATION

UC DAVIS
TOMOTHERAPY RADIXACT
SACRAMENTO, CA

REGIONAL PROJECT MANAGER
JOSEPH BARTLOW

SITE PLANNING COORDINATOR
JASON LENTZ

PAGE NUMBER

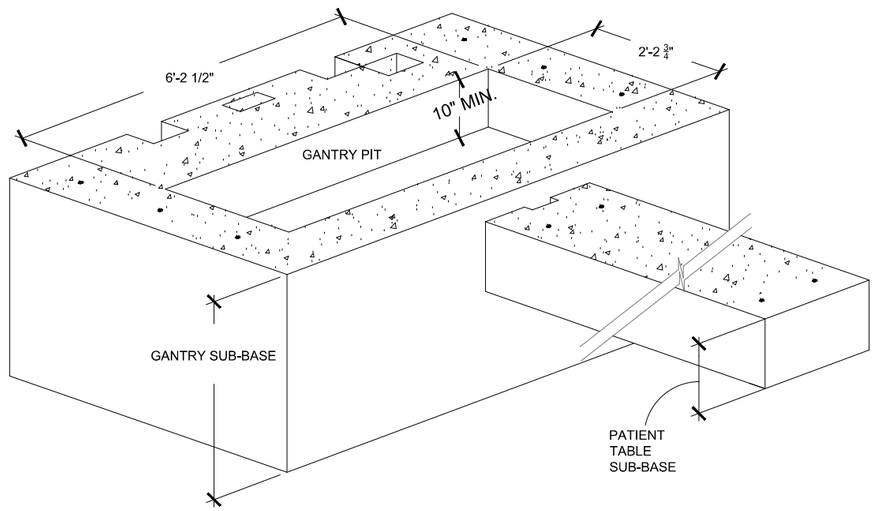
6 of 20

SHEET NUMBER

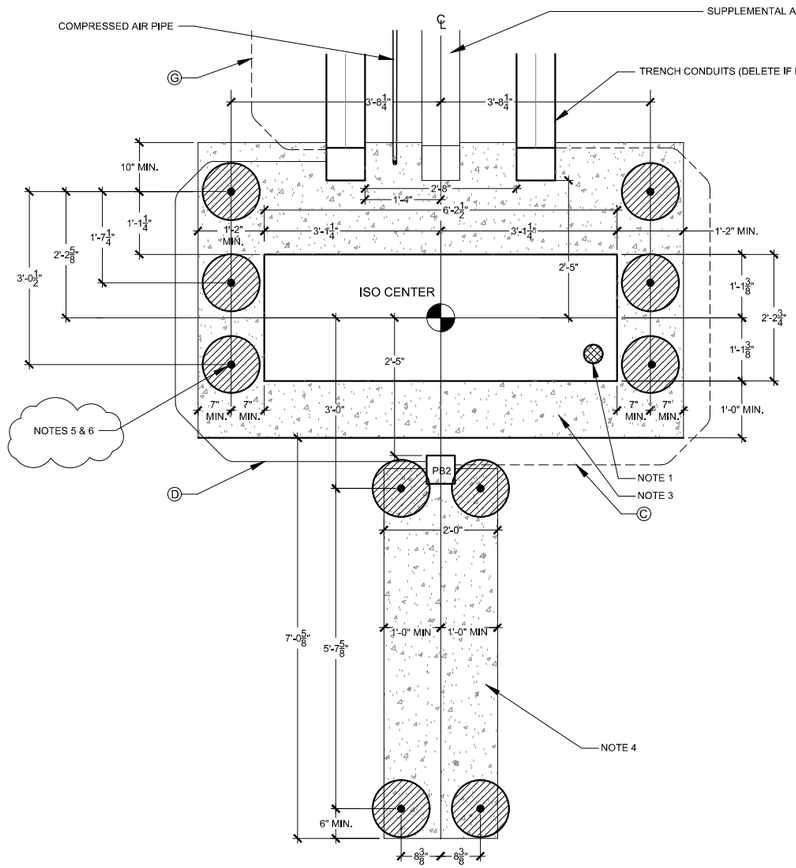
S-301

INTERIOR SECTIONS

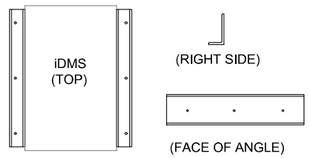
ACCURAY CONFIDENTIAL QUALITY SYSTEM DOCUMENT RADIXACT SITE PLANNING DRAWING SET T-SPD-1050322 REV D



D1 PLAN ELEVATION SOUTH
SCALE: NOT TO SCALE

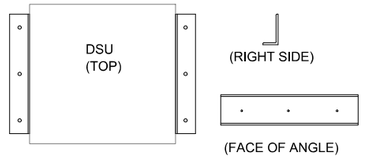


A1 PLAN ELEVATION NORTH
SCALE: NOT TO SCALE



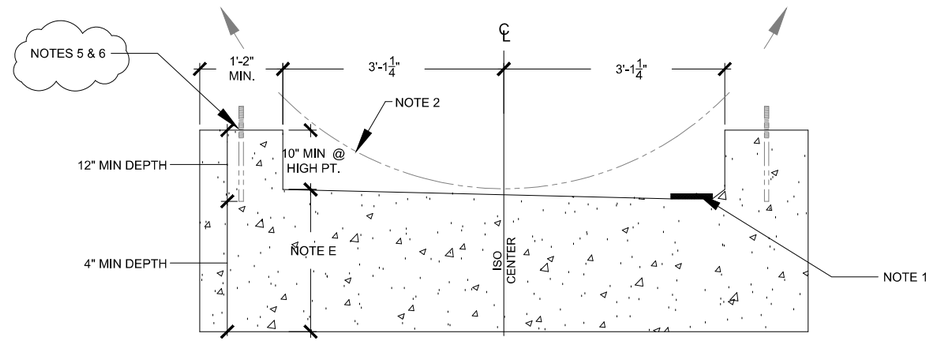
- L8X4X½"X36" STEEL ANGLE (LEFT & RIGHT SIDES) PROVIDED BY ACCURAY WHEN REQUIRED BY LOCAL REGULATORY AGENCY.
- OPM-0381

D4 SEISMIC BRACKETS (IF APPLICABLE)
SCALE: NOT TO SCALE

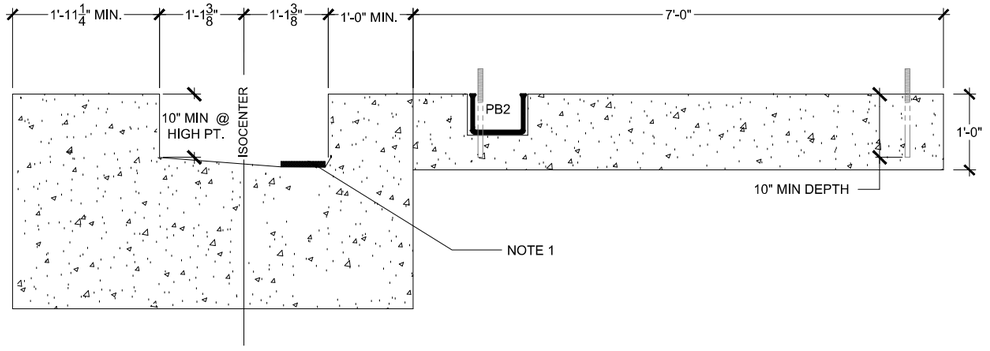


- L5X3X¼"X18" STEEL ANGLE (LEFT & RIGHT SIDES) PROVIDED BY ACCURAY WHEN REQUIRED BY LOCAL REGULATORY AGENCY.
- OPM-0381

D5 SEISMIC BRACKETS (IF APPLICABLE)
SCALE: NOT TO SCALE



C4 PLAN ELEVATION EAST
SCALE: NOT TO SCALE



A4 PLAN ELEVATION EAST
SCALE: NOT TO SCALE

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E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. SLOPE PIT TOWARDS MOISTURE SENSOR.
2. RADIUS FOR ROTATING EQUIPMENT CLEARANCE.
3. GANTRY SUB-BASE: THE GANTRY SUB-BASE MUST SUPPORT THE GANTRY'S WEIGHT AT 13,000 lbs AND LOCAL REQUIREMENTS.
4. PATIENT TABLE SUB-BASE: THE PATIENT TABLE SUB-BASE MUST SUPPORT THE PATIENT TABLE WEIGHT AT 1100 lbs AND MEET LOCAL REQUIREMENTS.
5. REFER TO OPM-0634 FOR SEISMIC ANCHORING FOR THE GANTRY
6. CONCRTE PAD AND REINFOCING COMPONENTS WILL CHANGE PER THE S_{DS}.

LEGEND

- ISOCENTER
- 6" AREA AROUND ANCHOR, CLEAR OF ALL REBAR TO DEPTH OF 10". 4 ANCHORS REQUIRED FOR COUCH AND 6 ANCHORS FOR GANTRY.
- Ⓒ SIGNAL (3"Ø) - FROM PATIENT TABLE TO BACK OF GANTRY.(20'MAX).
- Ⓓ POWER (3"Ø) - FROM PATIENT TABLE TO BACK OF GANTRY.(55' MAX).
- Ⓖ SIGNAL (1"Ø) - INTERCOM TO BACK OF GANTRY (15' MAX).
- PB2 PATIENT TABLE PULL BOX (FLOOR) 6" x 6" x 6" WITH COVER PLATE FLUSH WITH FINISHED FLOOR
- PB5 TREATMENT VAULT PULL BOX (FLOOR) 1'-0" x 8" x 8"

DIMENSION FORMAT: FEET & INCHES

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JOSEPH BARTLOW

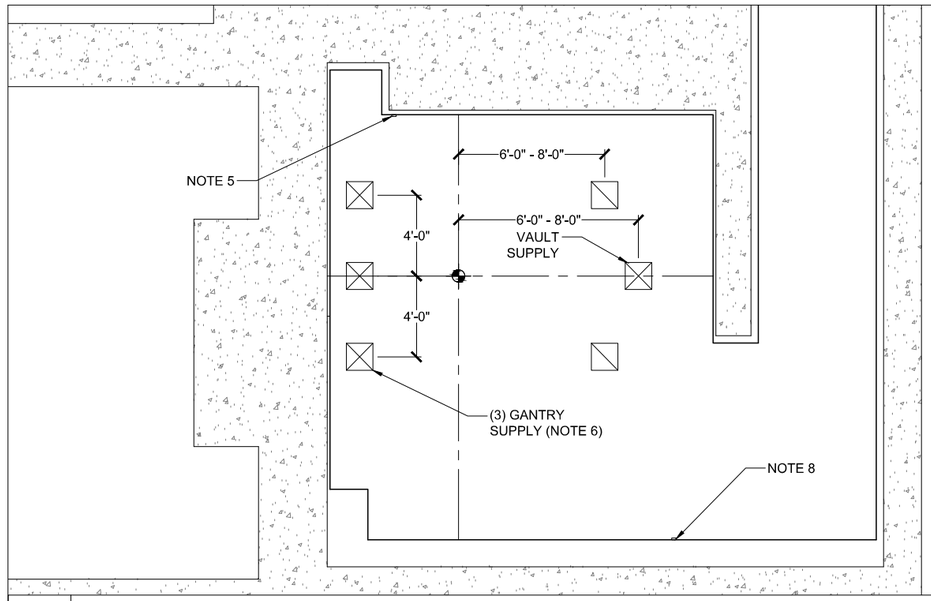
SITE PLANNING COORDINATOR
JASON LENTZ

PAGE NUMBER

7 of 20

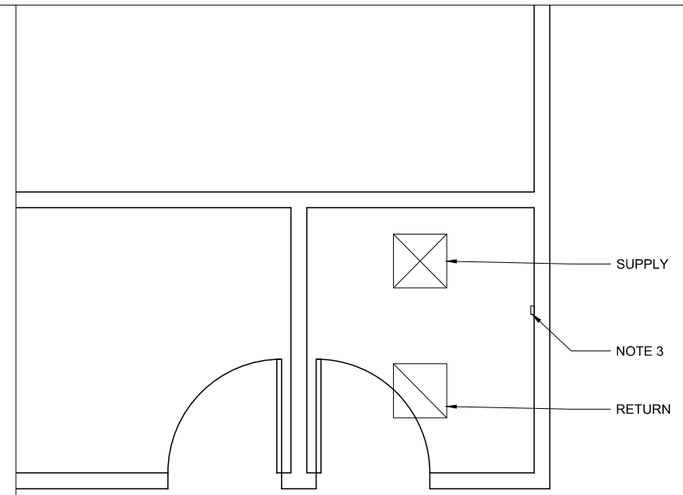
SHEET NUMBER

S-501
STRUCTURAL DETAILS



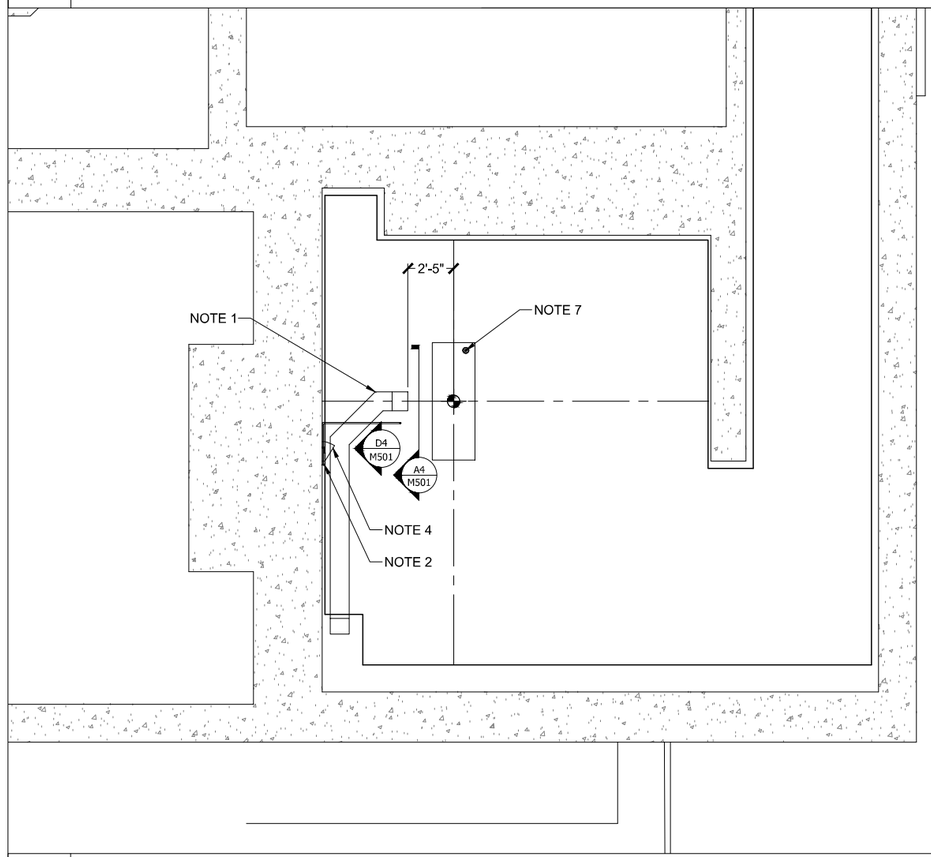
D1 TREATMENT ROOM MECHANICAL PLAN

SCALE: 1/8" = 1'-0"



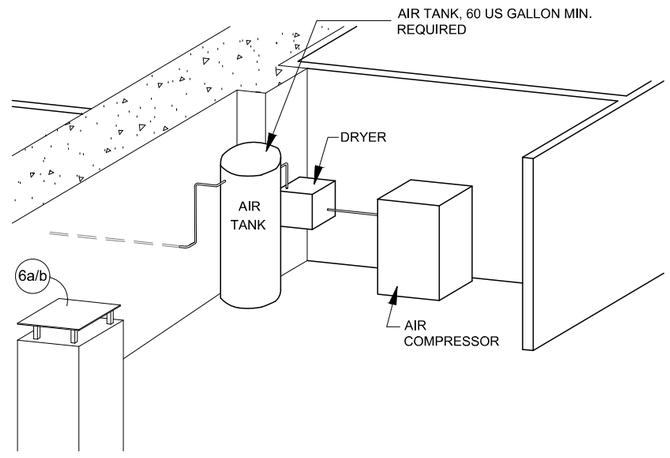
D4 DATA SERVER ROOM HEATING, VENTILATION & AIR CONDITIONING

SCALE: 1/4" = 1'-0" NOT SITE SPECIFIC



A1 TREATMENT ROOM SUB-BASE FLOOR PLAN

SCALE: 1/8" = 1'-0"



NOTE:
THE FOLLOWING EQUIPMENT MUST BE PROVIDED BY THE FACILITY AND MEET SPECIFICATIONS (SEE SITE PLANNING GUIDE): AIR TANK, DRYER, & AIR COMPRESSOR

A4 MECHANICAL ROOM PLAN

SCALE: NOT TO SCALE

GENERAL NOTES

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C. FINAL RADIATION SHIELDING SHALL BE COMPLETED BY THE PHYSICIST OF RECORD.
D. UNLESS OTHERWISE NOTED, ALL MATERIALS SUPPLIED AND INSTALLED ARE THE RESPONSIBILITY OF THE CUSTOMER.
E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. FACILITY SUPPLEMENTAL AIR DUCT: ROUTE UNDER SLAB. SEE DETAIL C2 ON PAGE E-503
2. COMPRESSED AIR PIPE: COPPER PIPE UNDER SLAB TO AIR COMPRESSOR. USE THICK-BODY OR WIDE-BODY COPPER PIPE. USE 3/4" INSIDE DIAMETER FOR UP TO 300' OR 1" FOR UP TO 500'.
3. ROOM THERMOSTAT MAINTAINED AT 68°F OR COOLER AND 30-60% RELATIVE HUMIDITY.
4. AIR SHUT OFF CABINET. LOCATION MAY VARY. SEE SITE PLANNING GUIDE (SPG) FOR ALTERNATE LOCATIONS.
5. DEDICATED EQUIPMENT THERMOSTAT BEHIND THE MACHINE ISOCENTER ON WALL A 5'-0" A.F.F. MUST SUPPLY AND MAINTAIN 65°F COOL AIR AND 30-60% RELATIVE HUMIDITY.
6. HEAT OUTPUT IN THE TREATMENT VAULT CAN REACH 51228 BTU/H (14.3 KW) AND THE PDU GENERATES UP TO 2391 BUT/H (0.7 KW)
7. MOISTURE SENSOR WITH ALARM. A FLOOR DRAIN THAT CAN HANDLE 14 L/min. IS A POSSIBLE ALTERNATIVE.
8. ROOM TEMPERATURE MAINTAINED AT 68-75°F AND 30-60% RELATIVE HUMIDITY.

LEGEND

- ISOCENTER
- 6a/6b POWER CONDITIONER/ FREQUENCY CONVERTER OFCI
- SUPPLY
- RETURN

DIMENSION FORMAT: FEET & INCHES

ACCURAY

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DRAWING INFORMATION

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UC DAVIS
TOMOTHERAPY RADIXACT
SACRAMENTO, CA

REGIONAL PROJECT MANAGER
JOSEPH BARTLOW

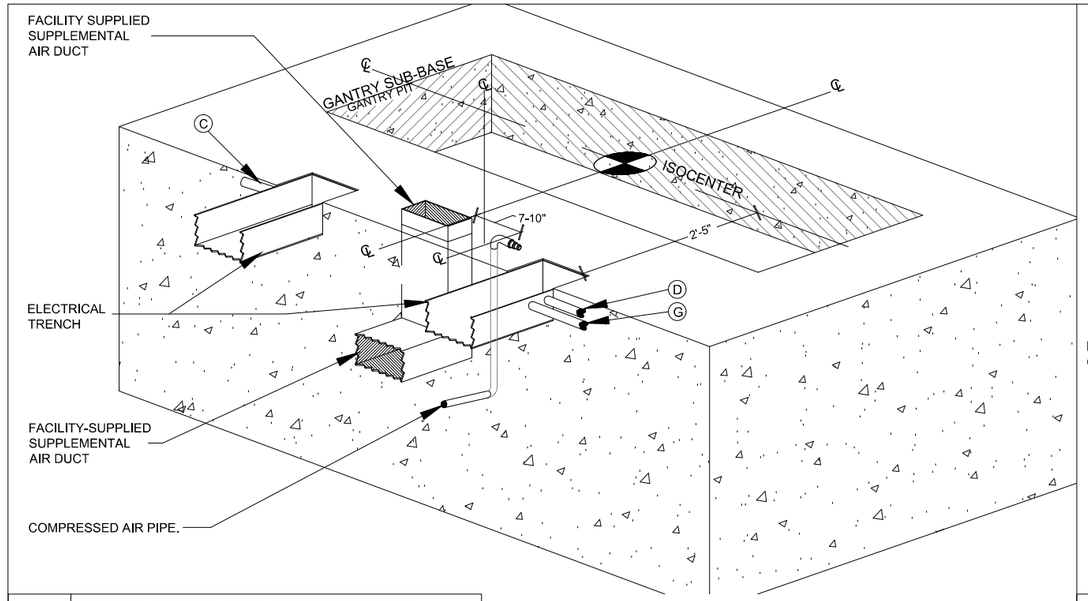
SITE PLANNING COORDINATOR
JASON LENTZ

PAGE NUMBER

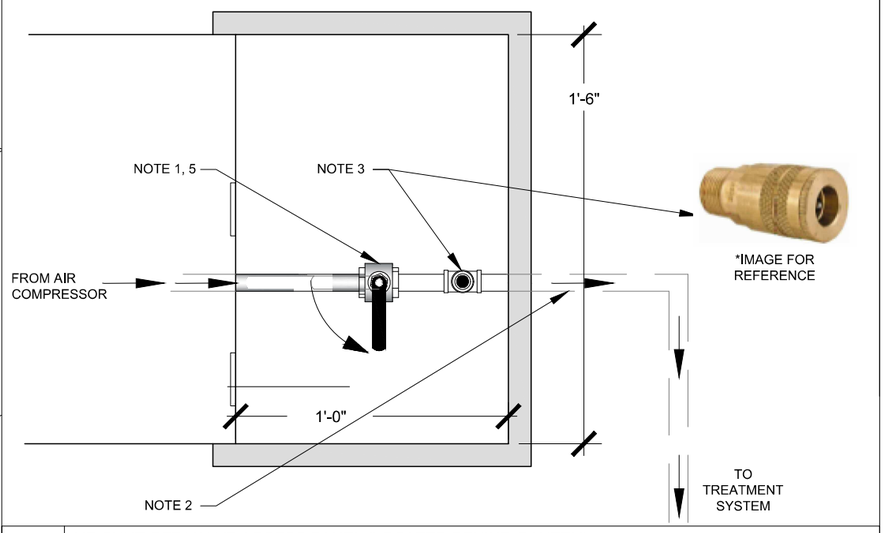
8 of 20

SHEET NUMBER

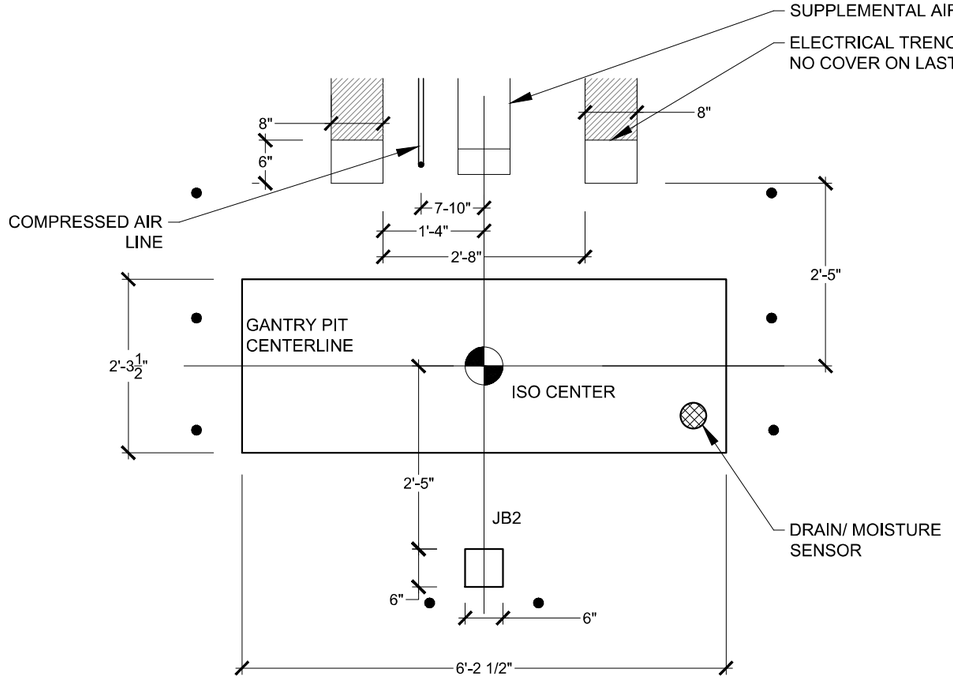
M-101
MECHANICAL FLOOR PLAN



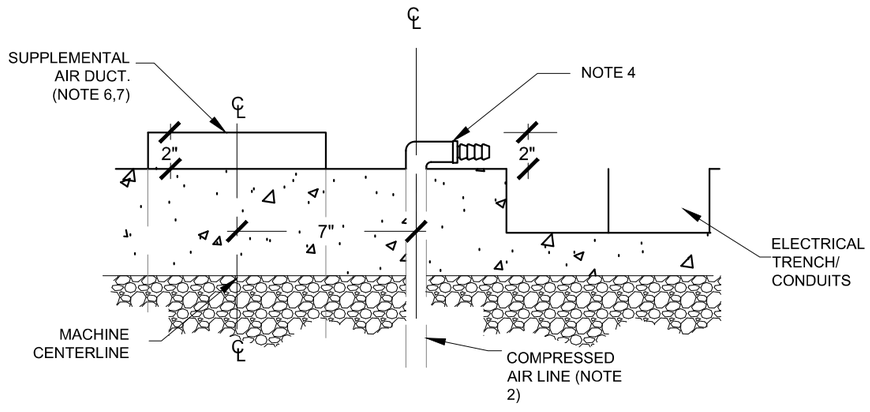
D1 | BACK OF GANTRY AXON (CONDUIT OPTION)
NOT TO SCALE



D4 | AIR SHUT OFF VALVE ACCESS PANEL (LOCATED BEHIND GANTRY)
NOT TO SCALE



A1 | TREATMENT ROOM SUB-BASE FLOOR PLAN (TRENCH OPTION)
NOT TO SCALE



A4 | MECHANICAL ROOM PLAN
NOT TO SCALE

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E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. COMPRESSED AIR SUPPLY SHUT OFF VALVE.
2. 3/4" THICK BODY OR WIDE WALL COPPER PIPE BACK TO AIR COMPRESSOR WITH FLOW RATE OF 30 SCFM AT 90 PSIG.
3. QUICK DISCONNECT FOR SERVICE AIR HOSE.
4. BARBED FITTING FOR 1/2" INSIDE DIAMETER AIR HOSE. CONTRACTOR SUPPLIED, NOT TO EXCEED 2" ABOVE FINISHED FLOOR
5. SHUT-OFF VALVE TO POINT DOWN IN CLOSED POSITION.
6. MESH PROTECTION ON TOP OF SUPPLEMENTAL AIR DUCT.
7. FACILITY TO PROVIDE 55°F SUPPLEMENTAL AIR FLOW GREATER THAN 264 CFM. INSTALL AN UNDER-SLAB 12"x10" AIR DUCT OR A 12" ROUND (OR EQUIVALENT MINIMUM CROSS-SECTIONAL AREA) PVC DUCT TO THE UNDERSIDE OF THE GANTRY COVERS. NOT TO EXCEED 2" ABOVE FINISHED FLOOR

LEGEND

- ISOCENTER
- (C) SIGNAL (3"Ø) - FROM PATIENT TABLE TO BACK OF GANTRY (20'-0" MAX).
- (D) POWER (3"Ø) - FROM PATIENT TABLE TO BACK OF GANTRY (55'-0" MAX).
- (G) SIGNAL (1"Ø) - INTERCOM TO BACK OF GANTRY (15' MAX).
- PB5 FLOOR PULL BOX (1'-0" x 8" x 8")
- PB2 PATIENT TABLE PULL BOX (6" x 6" x 6")

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

ACCURAY

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Sunnyvale, CA 94089

DRAWING INFORMATION

A	9.13.2022
B	3.5.2024

PROJECT INFORMATION

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TOMOTHERAPY RADIXACT
SACRAMENTO, CA

REGIONAL PROJECT MANAGER
JOSEPH BARTLOW

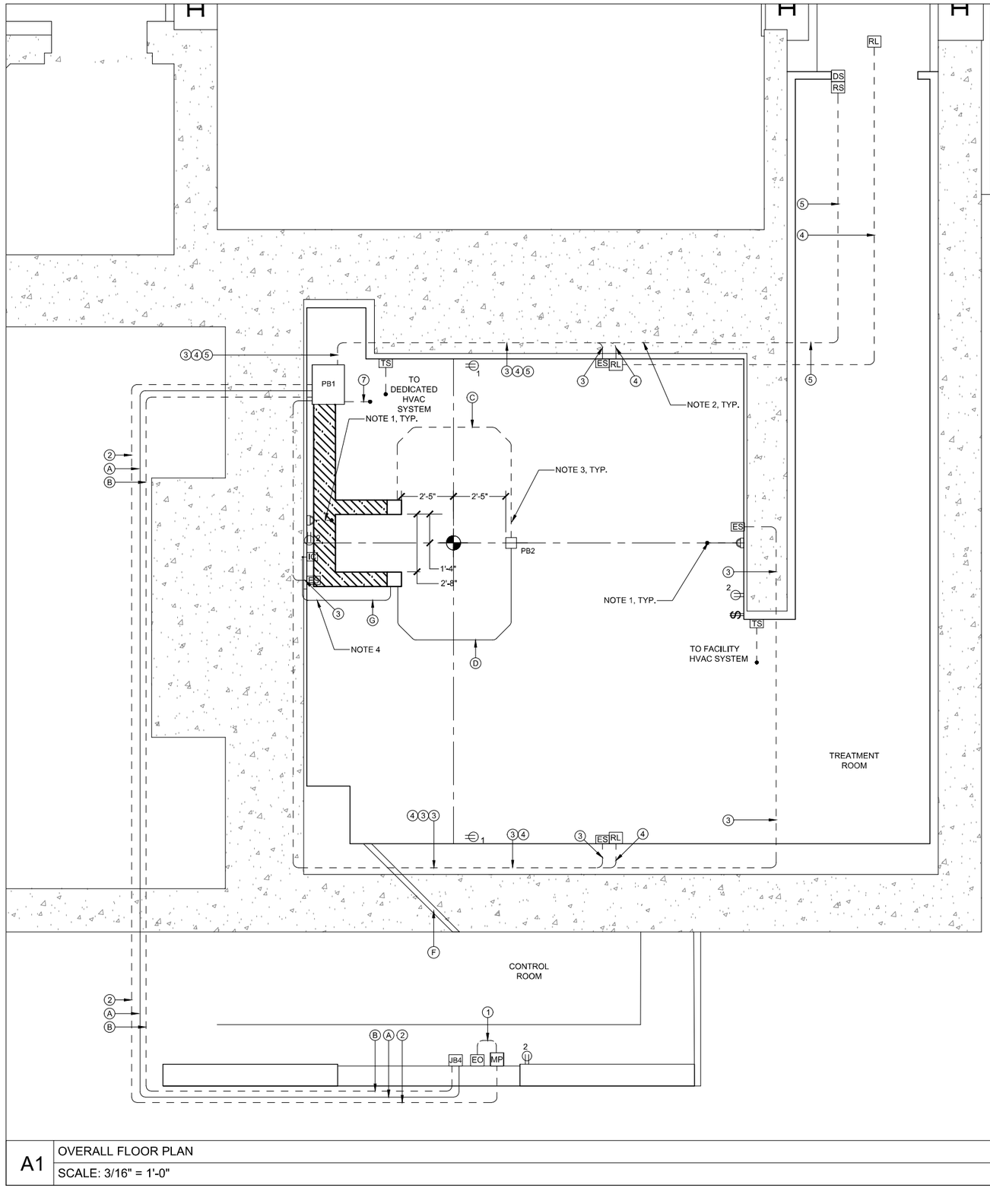
SITE PLANNING COORDINATOR
JASON LENTZ

PAGE NUMBER

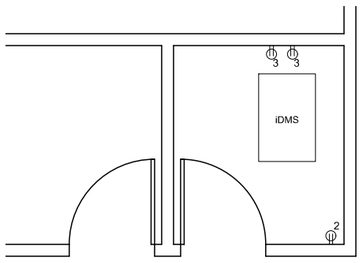
9 of 20

SHEET NUMBER

M-501
MECHANICAL DETAILS



A1 OVERALL FLOOR PLAN
SCALE: 3/16" = 1'-0"



A5 DATA SERVER ROOM FLOOR PLAN
SCALE: 1/4" = 1'-0" NOT SITE SPECIFIC

WIRED CONDUIT LEGEND

CONDUIT #	LOCATION NOTE
1	POWER (1/2"Ø) - EMERGENCY OFF BUTTON AT OPERATOR STATION TO MAIN POWER DISCONNECT PANEL.
2	POWER (4"Ø) - MAIN POWER DISCONNECT TO PDU. SEE PAGE E-501 FOR ELECTRICAL WIRING OPTIONS
3	POWER (3/4"Ø) - EMERGENCY STOP SWITCHES TO PDU.
4	POWER - RADIATION WARNING LIGHTS TO PDU. FACILITY TO DETERMINE SIZE
5	POWER (3/4"Ø) - DOOR INTERLOCK SWITCH TO PDU.
6	POWER (1"Ø) - DORADO LASERS TO WALL SWITCH.
7	LOCAL GROUNDING
8	SIGNAL (1"Ø) INTERCOM TO CONTROL ROOM
9	POWER 4" PDU TO POWER CONDITIONER TO MP
11	(4) 4"Ø CONDUIT FROM PB1 TO PB5

NON-WIRED CONDUIT LEGEND

CONDUIT	LOCATION NOTE
A	SIGNAL (3"Ø) OPERATOR STATION TO PDU. **CONTRACTOR NOTE:** THE LENGTH OF THIS CONDUIT PLUS THE LENGTH OF THE ELECTRICAL FLOOR TRENCH (PDU TO THE BACK OF THE GANTRY) CANNOT EXCEED 80'
B	POWER (3"Ø) - OPERATOR STATION TO PDU. **CONTRACTOR NOTE**: THE LENGTH OF THIS CONDUIT PLUS THE LENGTH OF THE ELECTRICAL FLOOR TRENCH (JB4 TO PDU TO THE BACK OF THE GANTRY) CANNOT EXCEED 80'
C	SIGNAL (3"Ø) - FROM PATIENT ABLE TO BACK OF GANTRY 55' MAX).
D	POWER (3"Ø) - FROM PATIENT ABLE TO BACK OF GANTRY 55' MAX).
E	SIGNAL (1 ½"Ø) - DORADO LASERS TO PDU (65' MAX).
F	PHYSICS PORT (4"Ø)
G	SIGNAL (1"Ø) - INTERCOM TO BACK OF GANTRY (15' MAX).

GENERAL NOTES

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C. FINAL RADIATION SHIELDING SHALL BE COMPLETED BY THE PHYSICIST OF RECORD.
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F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. CCTV WIRING RUN TO CONTROL ROOM TO BE DETERMINED BY CUSTOMER OR CONTRACTOR.
2. PULL STRINGS MUST BE INCLUDED IN ALL NON-WIRED CONDUITS.
3. 90 DEGREE ELBOWS OR FLEXIBLE CONDUIT ARE NOT TO BE USED IN CONDUIT RUNS.
4. SEE DETAIL A1 ON SHEET E-901

LEGEND

- ISOCENTER
- SIGNAL CONDUIT
- POWER CONDUIT

FACILITY PROVIDED

- EO EMERGENCY OFF BUTTON
- ES EMERGENCY STOP BUTTON
- DS DOOR INTERLOCK SWITCH
- RS RESET SWITCH(DOOR-LESS)
- RL RADIATION WARNING LIGHT
- MP MAIN POWER DISCONNECT
- IC INTERCOM
- TS THERMOSTAT
- PC POWER CONDITIONER
- FQ FREQUENCY CONVERTER
- APOLLO LASER WALL POWER SWITCH
- 1 POWER OUTLET (NEMA 6-15R OR EQUAL)
- 2 POWER OUTLET (MATCH LOCAL)
- 3 POWER OUTLET (220V 20AMP)
- PB1 PDU PULL BOX (FLOOR). 2'-0" x 1'-3" x 1'-6" WITH COVER PLATE. LAST 6" OPEN TO REMAIN OPEN. COVER TO WITHSTAND WEIGHT OF PDU.
- PB2 PATIENT TABLE PULL BOX WITH DIVIDER (6" x 6" x 6")
- PB4 OPERATOR STATION PULL BOX (WALL). CONTRACTOR TO DETERMINE SIZE.
- PB5 CONDUIT FLOOR PULL BOX (1'-0" x 8" x 8")

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

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JASON LENTZ

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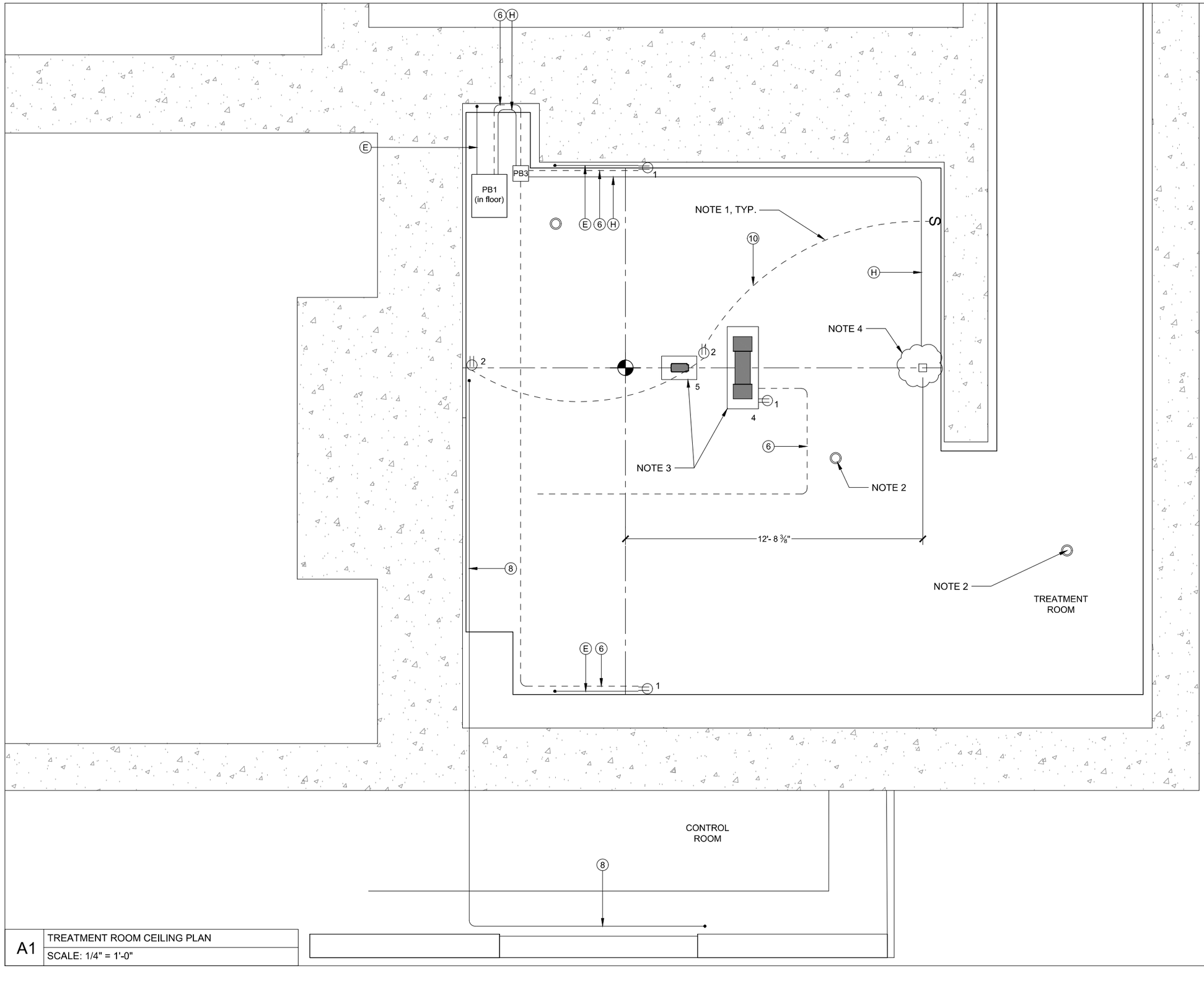
10 of 20

SHEET NUMBER

E-101
ELECTRICAL FLOOR PLAN



A1 TREATMENT ROOM CEILING PLAN

SCALE: 1/4" = 1'-0"

GENERAL NOTES

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F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. PULL STRINGS MUST BE INCLUDED IN ALL NON-WIRED CONDUITS.
2. MINIMUM 2 CEILING MOUNTED CCTV WITH PAN, TILT AND ZOOM @ 45° FROM ISOCENTER (FACILITY PROVIDED). EXACT LOCATION TO BE DETERMINED BY CUSTOMER.
3. APOLLO (GREEN) AND DORADO (RED) LASER ALUMINUM MOUNTING PLATED TO BE PROVIDED AND INSTALLED BY CONTRACTOR. ACCURAY PROVIDES AND INSTALLS ALL LASERS.
4. SYNCHRONY MOUNTING LOCATION. KEEP 2' CLEAR FOR INSTALLATION AND SERVICING

LEGEND

ISOCENTER

SIGNAL CONDUIT

POWER CONDUIT

$ WALL POWER SWITCH

1 POWER OUTLET (NEMA 6-15R)

2 POWER OUTLET (MATCH LOCAL)

WIRED CONDUITS

(6) POWER (1"Ø) - DORADO LASERS TO PDU.
(8) SIGNAL (1"Ø) INTERCOM TO CONTROL ROOM
(10) POWER (1"Ø) APOLLO LASER

NON-WIRED CONDUITS (EMPTY CONDUITS)

(E) SIGNAL (1 ½"Ø) - DORADO LASERS TO PDU. (65' MAX).
(H) (2"Ø) - SYNCHRONY CONDUIT

PB1 PDU PULL BOX (FLOOR). 2'-0" x 1'-3" x 1'-6"

PB3 DORADO POWER PULL BOX (CEILING). SIZE TO BE DETERMINED BY CONTRACTOR.

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

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JASON LENTZ

PAGE NUMBER

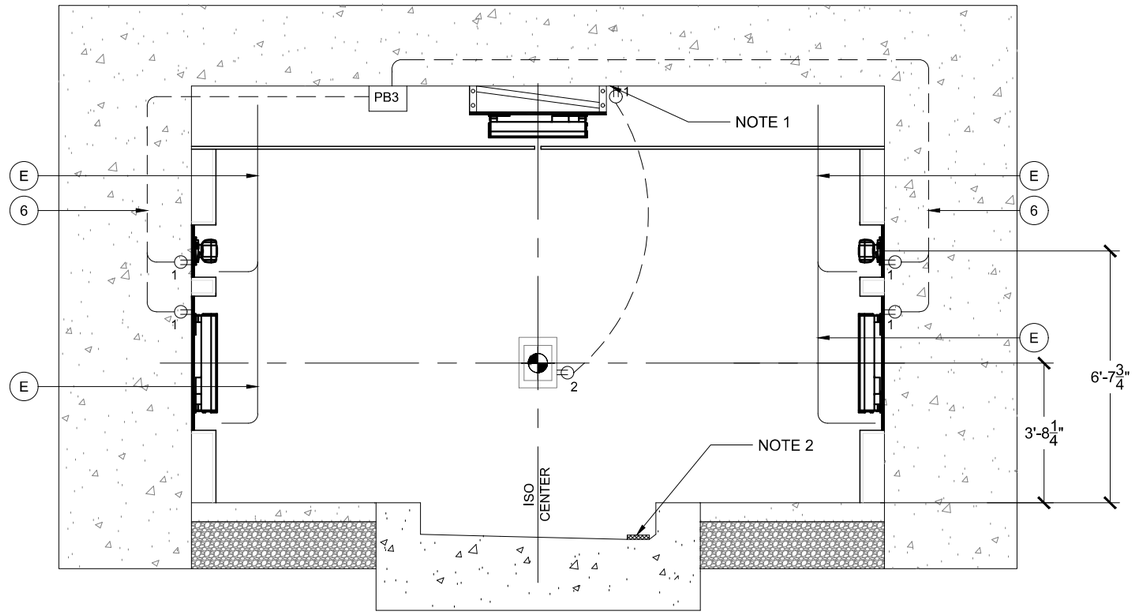
11 of 20

SHEET NUMBER

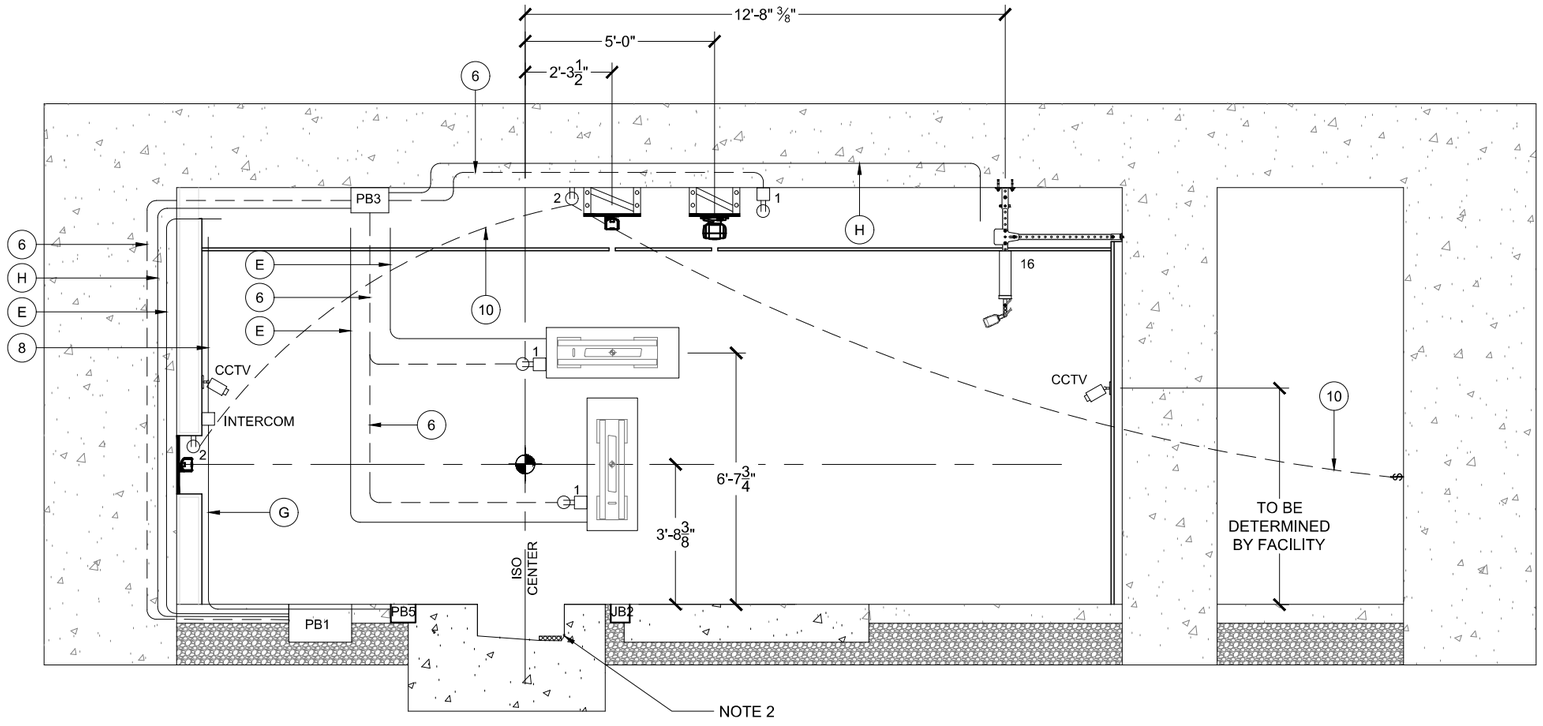
E-111

ELECTRICAL CEILING PLAN

ACCURAY CONFIDENTIAL QUALITY SYSTEM DOCUMENT RADIXACT SITE PLANNING DRAWING SET T-SPD-1050322 REV D



C1 | PLAN NORTH-SOUTH TREATMENT ROOM SECTION
SCALE: 1/4" = 1'-0" | NOT SITE SPECIFIC



A1 | PLAN WEST-EAST TREATMENT ROOM SECTION
SCALE: 1/4" = 1'-0" | NOT SITE SPECIFIC

GENERAL NOTES

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C. FINAL RADIATION SHIELDING SHALL BE COMPLETED BY THE PHYSICIST OF RECORD.
D. UNLESS OTHERWISE NOTED, ALL MATERIALS SUPPLIED AND INSTALLED ARE THE RESPONSIBILITY OF THE CUSTOMER.
E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1 LOCATION TO BE DETERMINED BY CONTRACTOR
2 MOISTURE SENSOR WITH ALARM. A FLOOR DRAIN THAT CAN HANDLE 14 L/min IS AN ACCEPTABLE ALTERNATIVE

$ WALL POWER SWITCH
1 POWER OUTLET (NEMA 6-15R)
2 POWER OUTLET (MATCH LOCAL)

LEGEND

ISOCENTER

WIRED CONDUITS
6 POWER (1"Ø) - DORADO LASERS TO PDU.
8 SIGNAL (1"Ø) INTERCOM TO CONTROL ROOM
10 POWER (1"Ø) APOLLO LASER

NON-WIRED CONDUITS (EMPTY CONDUITS)
E SIGNAL (1 ½"Ø) - DORADO LASERS TO PDU (65' MAX).
G SIGNAL (1"Ø) - INTERCOM TO BACK OF GANTRY (15' MAX).
H (2" Ø) SYNCHRONY CONDUIT

JUNCTION BOXES
PB1 PDU PULL BOX (FLOOR) 2'-0" x x 1'-3" x 1'-6" WITH COVER PLATE. LAST 6" TO REMAIN OPEN.
PB2 COUCH PULL BOX (FLOOR) 6" x 6" x 6"
PB3 DORADO POWER PULL BOX (CEILING). SIZE TO BE DETERMINED BY CONTRACTOR.
PB5 FLOOR PULL BOX 1'-0" x 8" x 8"

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

ACCURAY

ACCURAY INCORPORATED
1310 Chesapeake Terrace
Sunnyvale, CA 94089

DRAWING INFORMATION

A	9.13.2022
B	3.5.2024

PROJECT INFORMATION

UC DAVIS
TOMOTHERAPY RADIXACT
SACRAMENTO, CA

REGIONAL PROJECT MANAGER
JOSEPH BARTLOW

SITE PLANNING COORDINATOR
JASON LENTZ

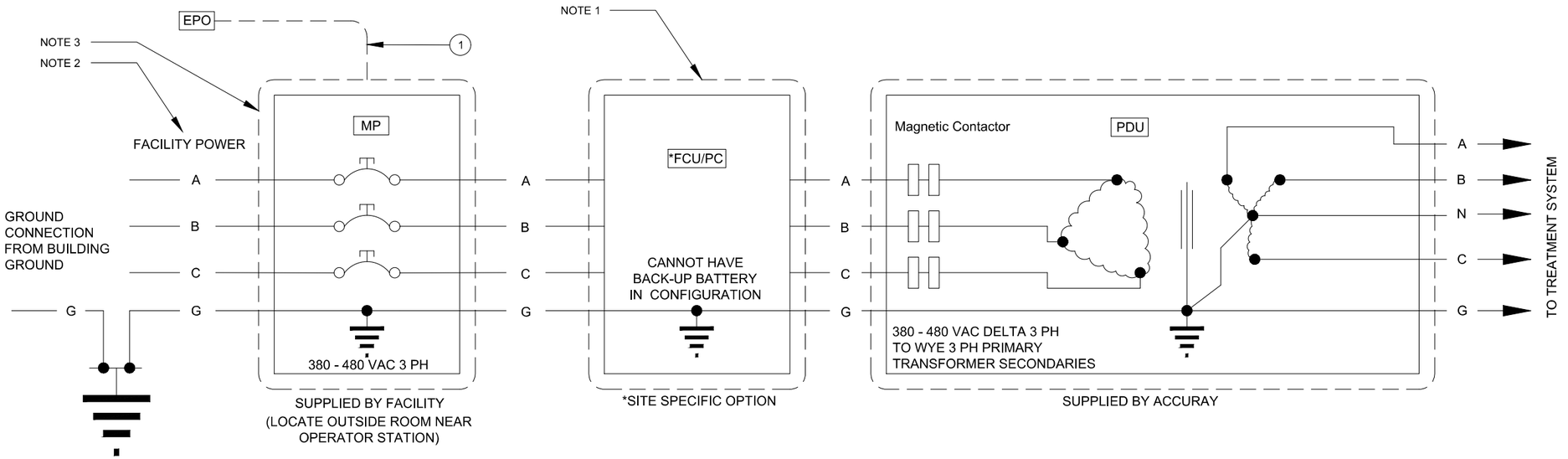
PAGE NUMBER

12 of 20

SHEET NUMBER

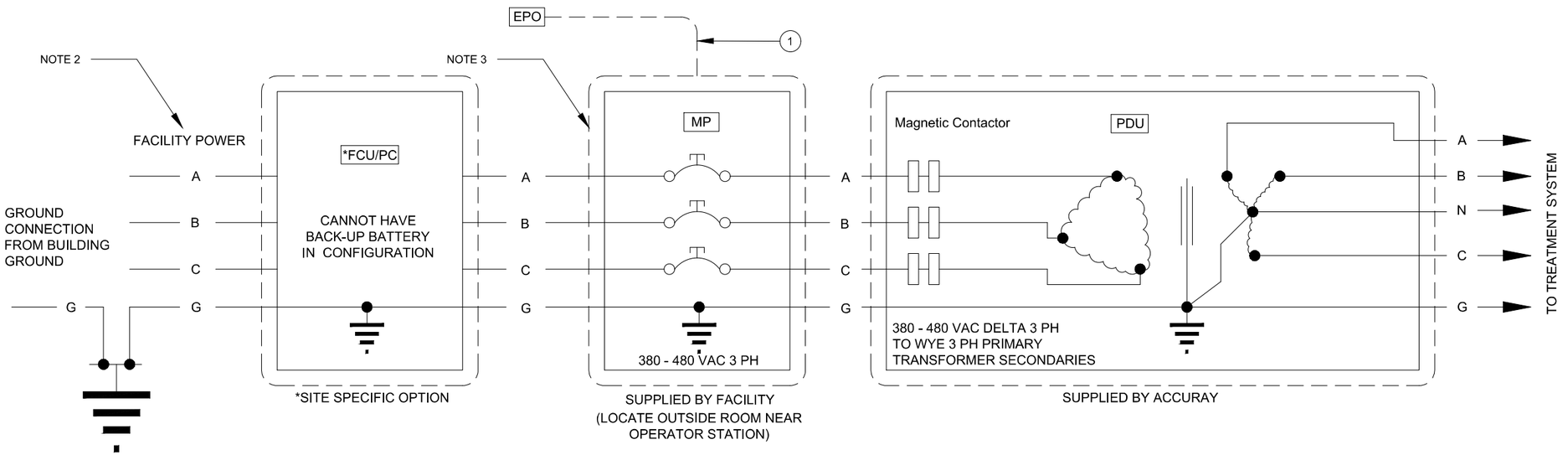
E-301

INTERIOR SECTIONS



*LOCAL GROUND TO BUILDING STEEL
OR GROUNDING ROD. TO BE
DETERMINED BY ELECTRICIAN. (NOTE 4)

C1	ELECTRICAL DIAGRAM - OPTION 1	
	NOT TO SCALE	NOT SITE SPECIFIC



*LOCAL GROUND TO BUILDING STEEL
OR GROUNDING ROD. TO BE
DETERMINED BY ELECTRICIAN. (NOTE 4)

A1	ELECTRICAL DIAGRAM - OPTION 2	
	NOT TO SCALE	NOT SITE SPECIFIC

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E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. IN CONFIGURATION OPTION 1, WHERE FACILITY POWER GOES DIRECTLY TO MP, THE FCU MUST BE RESET AFTER POWER EMERGENCY STOP.
2. CABLING FROM THE SUPPLY TO PDU IS THE FACILITY'S RESPONSIBILITY.
3. 70 AMP MAIN DISCONNECT PANEL. FACILITY TO PROVIDE MAIN POWER SUPPLY BOX FROM DEDICATED LINE OR POWER PROTECTION DEVICE.
4. GROUND TO HAVE EARTH CONDUCTED IMPEDANCE OF 25 OHMS OR LESS. MUST COMPLY WITH LOCAL CODES.

PDU POWER DISTRIBUTION UNIT
FCU FREQUENCY CONVERTER UNIT (50Hz SITES ONLY)
MP MAIN DISCONNECT PANEL
PC POWER CONDITIONER

A PHASE A
B PHASE B
C PHASE C
G GROUND
N NEUTRAL

WIRED CONDUITS
1 POWER (1/2"Ø) - PDU TO PC/FCU TO MP

LEGEND

DIMENSION FORMAT: FEET & INCHES

ACCURAY

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1310 Chesapeake Terrace
Sunnyvale, CA 94089

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JOSEPH BARTLOW

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JASON LENTZ

PAGE NUMBER

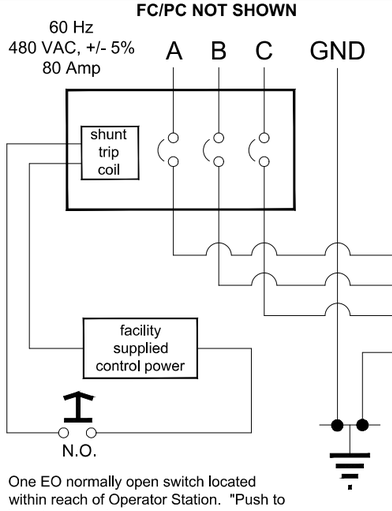
13 of 20

SHEET NUMBER

E-501
SCHEMATIC
DRAWING

Facility Responsibility

FC/PC NOT SHOWN

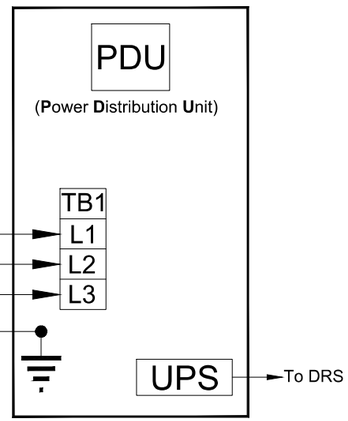


One EO normally open switch located within reach of Operator Station. "Push to lock, twist to release" switch recommended.

Notes:
- Ground conductor to be the same diameter as phases. 4 AWG MIN.
- Neutral conductor not used
- PF = 0.90 at max level
-50 kVA max

C1 | EMERGENCY OFF AND PDU POWER INPUT | NOT TO SCALE

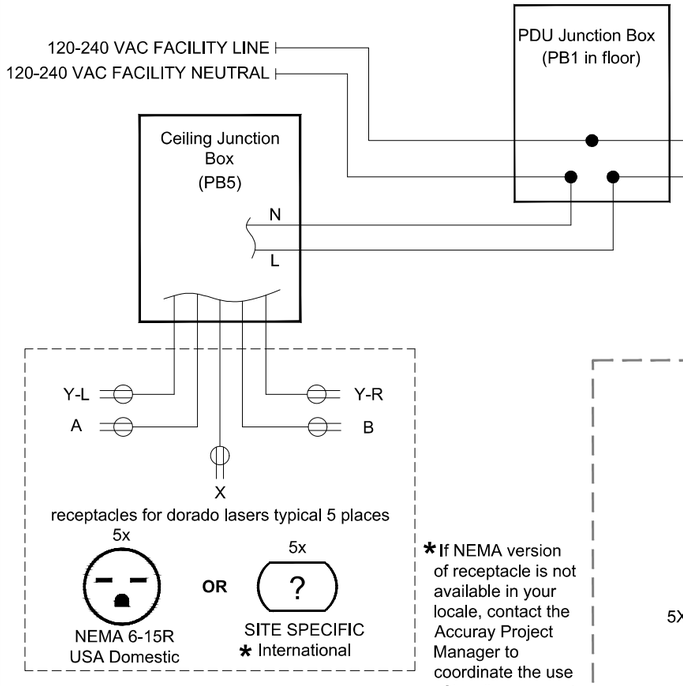
Accuray Responsibility



- The system Emergency Off (EO) located on the power control panel is responsible for shutting off all electrical power from the PDU by tripping CB1 (on the PDU) with the exception of the Un-interruptible Power Supply (UPS)

-The UPS remains on and provides power to the Data Receiver Server (DRS) for data logging.

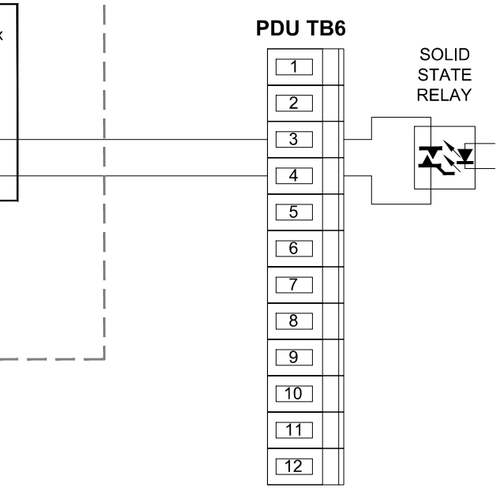
Facility Responsibility



*If NEMA version of receptacle is not available in your locale, contact the Accuray Project Manager to coordinate the use of locally approved receptacles and plugs,

C4 | DORADO LASER (RED) | NOT TO SCALE

Accuray Responsibility



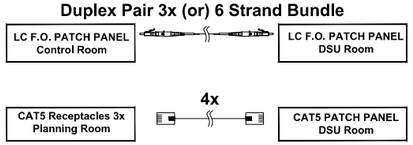
5X

LASER POWER CORDS (type SJT 18AWG)
USA domestic = Nema 6-15R to IEC320-C13
* International = site specific plug to IEC320-C13

Dorado Laser
Load = 240VAC, 30W each

Facility Responsibility

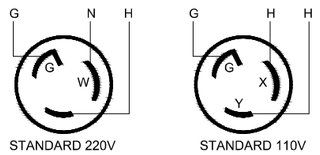
Note: The DSU communication cable connections (LC Duplex Fiber Optic and CAT5) under the responsibility of the facility are referenced in the Site Planning Guide.



Extended Network Optional

FACILITY POWER REQUIREMENTS FOR DSU
USA Domestic = (2) Nema L6-20R @ 20AMP, 200-240V 2 POLE, 3-WIRE, 50/60 Hz

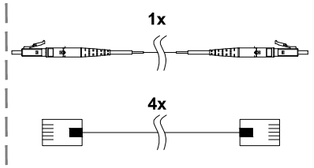
International = (2) country specific plug @ 20AMP, 200-240V 2 POLE, 3-WIRE, 50/60 Hz



A1 | DATA SERVER UNIT | NOT TO SCALE

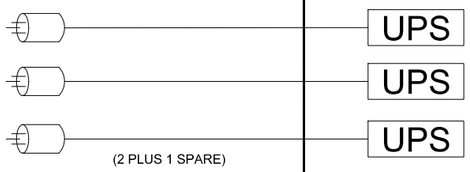
Accuray Responsibility

Note: F.O. AND CAT5 PATCH CABLES PROVIDED BY ACCURAY. (3 METERS)

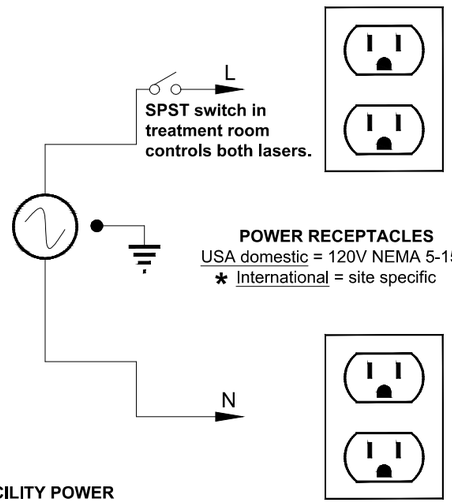


DSU
Data **S**erver **U**nit
iDMS™
(Cluster/Optimizer)

UPS INPUT CORDS (10 foot / 3 meters)
USA domestic = Nema L6-20P to IEC 320-C19 (20 AMP)
International = country site specific plug to IEC 320-C19 (20AMP)



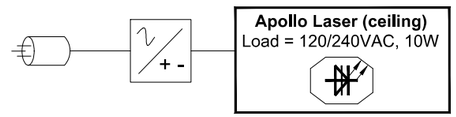
Facility Responsibility



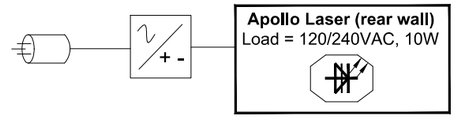
FACILITY POWER
USA domestic = 120 VAC 60 Hz, 15A
International = 120-240 VAC 50/60 Hz, 15/16A

A4 | APOLLO LASER (GREEN) | NOT TO SCALE

Accuray Responsibility



LASER POWER CORDS
Plug end converts 120/240 VAC to 5VDC
Site Specific plug adaptors provided by Accuray
USA domestic = NEMA 5-15P
* International = site specific



ACCURAY

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1310 Chesapeake Terrace
Sunnyvale, CA 94089

DRAWING INFORMATION	
A	9.13.2022
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PROJECT INFORMATION

UC DAVIS
TOMOTHERAPY RADIXACT
SACRAMENTO, CA

REGIONAL PROJECT MANAGER
JOSEPH BARTLOW

SITE PLANNING COORDINATOR
JASON LENTZ

PAGE NUMBER

14 of 20

SHEET NUMBER

E-502
ELECTRICAL DETAILS

Facility Responsibility

PDU Pull Box
(PB1 in floor)

N.C. N.C.

N.C.

Additional E-STOP switches as needed wired normally closed in SERIES.

-TB5 connections made by Accuray

-Label wires "E-STOP"

"Push to lock, twist to release"' switch
Min. 20 AWG shielded, twisted-pair wire

E-STOP prevents and/or terminates radiation by shutting off electrical power to the gantry Slip Rings and all other rotating components.

- Stops gantry rotation.
- Stops automatic couch motion.
- Stops Radiation Delivery Subsystem (RDS)
- Leads to an Unrecoverable State

C1 | FACILITY EMERGENCY STOP (E-STOP) | NOT TO SCALE

Accuray Responsibility

PDU

24VDC

3
4

TB5

C2 | FACILITY STANDBY | NOT TO SCALE

Facility Responsibility

Facility Responsibility

FACILITY L

MOTOR L

MOTOR N

MOT

FACILITY N

Accuray Responsibility

Accuray Responsibility

PDU

TB6-1

TB6-2

Facility Responsibility

Wire size = 20 AWG min.
24 VDC, 3A
Use only momentary type switch.

Door Switch

Contacts are open when door is open

PDU Pull Box
(PB1 in floor)

-Leave 6 feet (2 meters) of extra wire length in junction box.

- TB5 connections performed by Accuray

-Label wires "DOOR SW"

C4 | DOOR INTERLOCK -TREATMENT ROOM | NOT TO SCALE

Accuray Responsibility

PDU

24V

TB5

1
2

Facility Responsibility

RJ45 receptacle for Accuray Intercom, Desk Unit

1x

Label receptacles "NEIS"

RJ45 receptacle for Accuray Speaker Unit on rear wall

Facility supplied CAT5 ethernet cable between Control Room and Rear Wall of Vault

B1 | ACCURAY INTERCOM (NEIS) | NOT TO SCALE

Circuit Specifications

- 48-240 VAC, 50/60 Hz
- 24-10 AWG
- Min ON current = 40mA
- Max OFF current = 5mA
- Dedicated circuit protection recommended.
- Provide panel/breaker designation # for the facility indicator circuit. De-energizing label to be affixed by Accuray to PDU access panel.

Indicator Specifications

- 8A max each
- Incandescent lamps and/or auditory indicators.
- Fluorescent lamps (40 to 200 W)
- Inductive or electronic ballasts are ok to use.
- LED lamps may require additional facility supplied coil type relay circuits.

A1 | STATUS INDICATORS | NOT TO SCALE

Accuray Responsibility

PDU Pull Box
(PB1 in floor)

240 VAC FACILITY NEUTRAL

Power On (L**) — 240 VAC FACILITY LINE

Room Ready (L**) — 240 VAC FACILITY LINE

* Radiation On (L**) — 240 VAC FACILITY LINE

Standby (L**) — 240 VAC FACILITY LINE

*** Min. 1 lamp circuit required (Radiation On). Other lamp circuits optional per local requirements.**

**** Status indicators located inside and/or outside treatment vault as needed.**

PDU

1 2 3 4 5 6 7 8 9 10 11 12

TB6

TB6 wires connected by Accuray

ACCURAY

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1310 Chesapeake Terrace
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SACRAMENTO, CA

REGIONAL PROJECT MANAGER
JOSEPH BARTLOW

SITE PLANNING COORDINATOR
JASON LENTZ

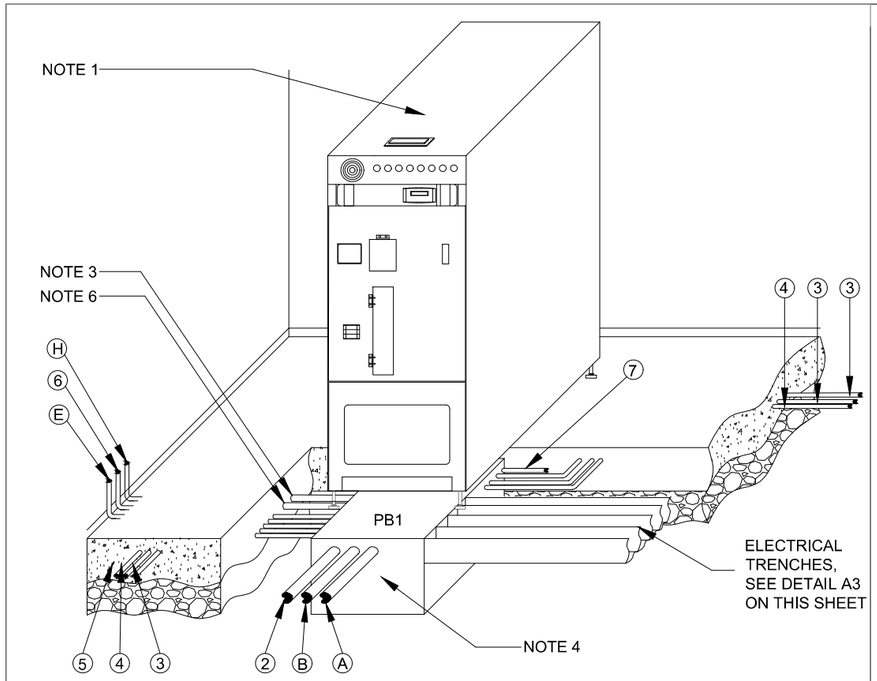
PAGE NUMBER

15 of 20

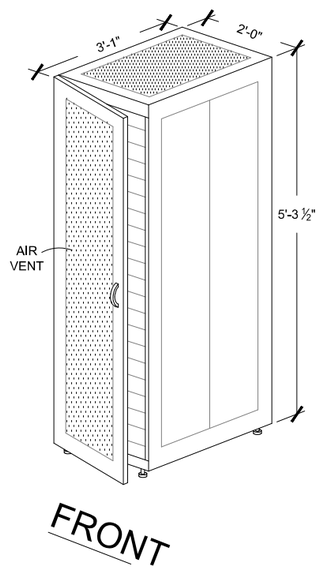
SHEET NUMBER

E-503

ELECTRICAL DETAILS

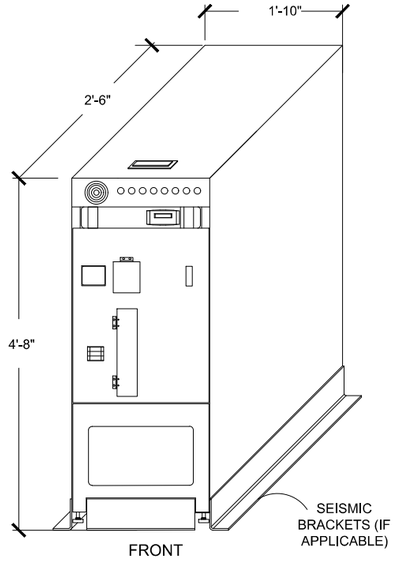


C1 | PDU FLOOR PULL BOX
NOT TO SCALE



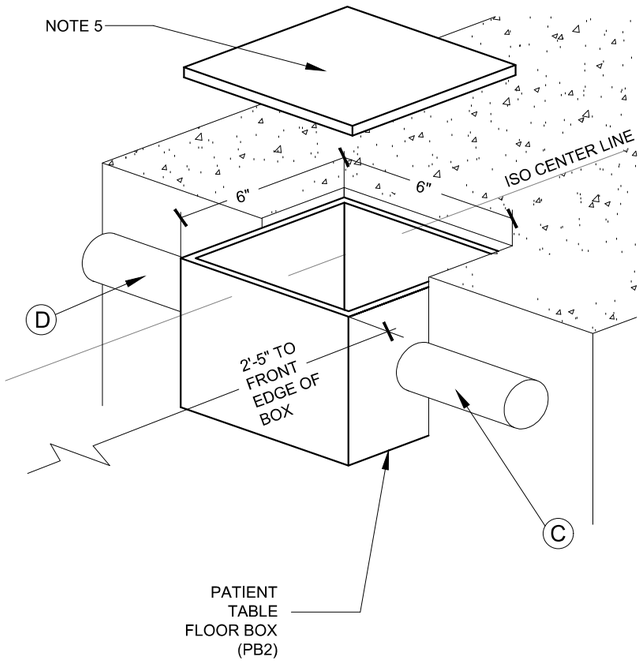
WEIGHT: 900 lb
18,000 BTUs/HOUR

C3 | iDMS
NOT TO SCALE

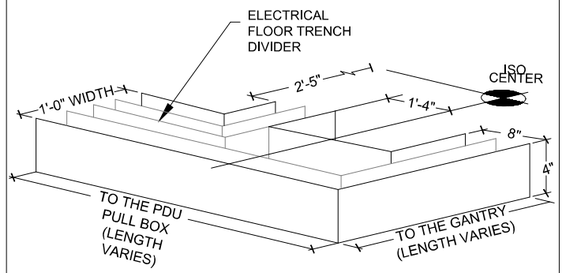


WEIGHT: 1,001 lb
3370 BTUs/HOUR

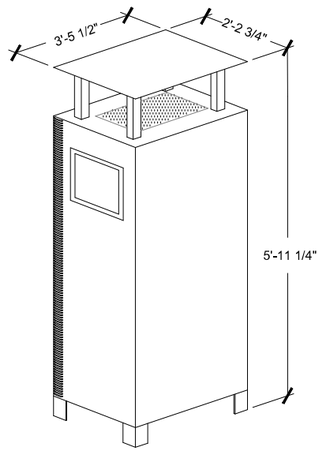
C5 | POWER DISTRIBUTION UNIT (PDU)
NOT TO SCALE



A1 | PATIENT TABLE FLOOR PULL BOX
NOT TO SCALE | NOT SITE SPECIFIC



A3 | ELECTRICAL TRENCH OPTION
NOT TO SCALE | NOT SITE SPECIFIC



ONLY FOR FACILITIES WITH 50Hz POWER

WEIGHT: 1,502 lb
12,000 BTU/HOUR

A5 | FREQUENCY CONVERTER UNIT (FCI)
NOT TO SCALE | NOT SITE SPECIFIC

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SHEET NOTES

1. POWER DISTRIBUTION UNIT
2. COVER PROVIDED BY ACCURAY.
3. INCOMING POWER ENCASED IN 2" FLEXIBLE CONDUIT ON LEFT SIDE OF PDU. CONTRACTOR PROVIDED.
4. LAST 6" OF FLOOR BOX TO REMAIN OPEN FOR WIRE CONNECTION. CONTRACTOR PROVIDED.
5. TERMINATE COVER PLATE FLUSH WITH FINISHED CONCRETE FLOOR. CONTRACTOR TO PROVIDE ALL COVER PLATES.
6. INCOMING 120-240VAC POWER TO DORADO LASERS. SEE PAGE E-502, DETAIL C4 FOR MORE INFORMATION.

LEGEND

ISOCENTER

JUNCTION BOXES

PB1 PDU PULL BOX (FLOOR). 2'-0" x 1'-3" x 1'-6" WITH COVER PLATE. LAST 6" OPEN TO REMAIN OPEN.

PB2 PATIENT TABLE PULL BOX (FLOOR). 6" x 6" x 6" WITH COVER PLATE FLUSH TO FINISHED FLOOR.

WIRED CONDUITS

(2) POWER (4"Ø)- MAIN POWER DISCONNECT TO PDU
(3) POWER (3/4"Ø)- EMERGENCY STOP SWITCHES TO PDU
(4) POWER (FACILITY TO DETERMINE SIZE)- RADIATION WARNING LIGHTS TO PDU
(5) POWER (3/4"Ø)- DOOR INTERLOCK SWITCH TO PDU
(6) POWER (1"Ø)- DORADO LASERS TO PDU
(7) LOCAL GROUNDING
(11) (4"Ø)- FROM PB1 TO PB5 (CONDUIT OPTION ONLY)

NON-WIRED CONDUITS

(A) SIGNAL (3"Ø)- OPERATOR STATION TO PDU. 80' MAX
(B) POWER (3"Ø)- OPERATOR STATION TO PDU. 80' MAX.
(C) SIGNAL (3"Ø)- FROM PATIENT TABLE TO BACK OF GANTRY. 20' MAX
(D) POWER (3"Ø)- FROM PATIENT TABLE TO BACK OF GANTRY TO PDU. 55' MAX.
(E) SIGNAL (1 1/2"Ø)- DORADO LASER TO PDU. 65' MAX.
(H) (2" Ø) -SYNCHRONY CONDUIT

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

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JOSEPH BARTLOW

SITE PLANNING COORDINATOR
JASON LENTZ

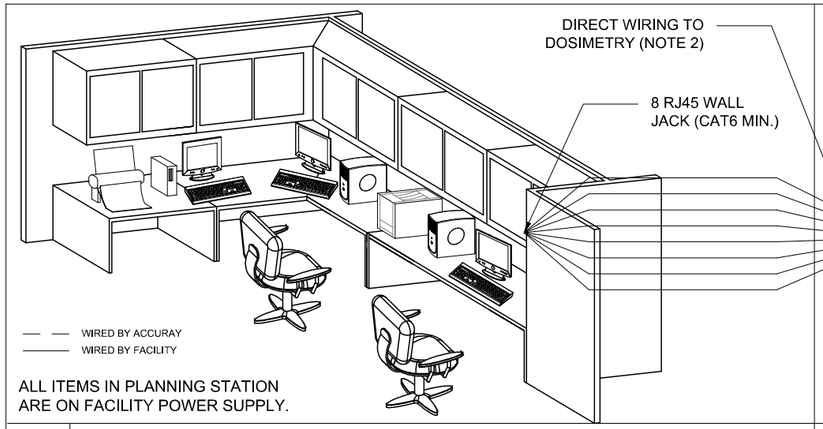
PAGE NUMBER

16 of 20

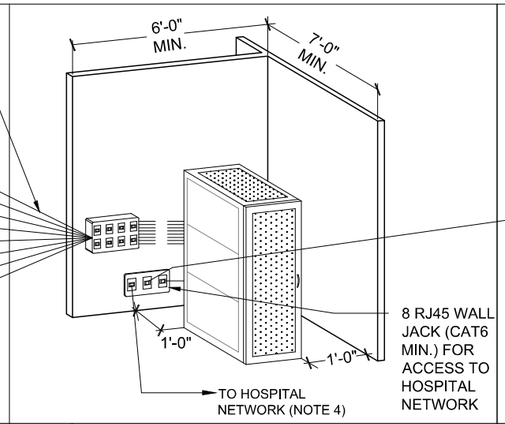
SHEET NUMBER

E-901
ELECTRICAL DETAILS

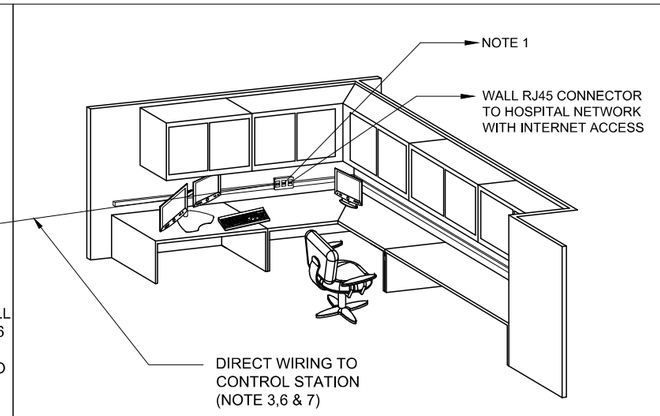
ACCURAY CONFIDENTIAL QUALITY SYSTEM DOCUMENT RADIXACT SITE PLANNING DRAWING SET T-SPD-1050322 REV D



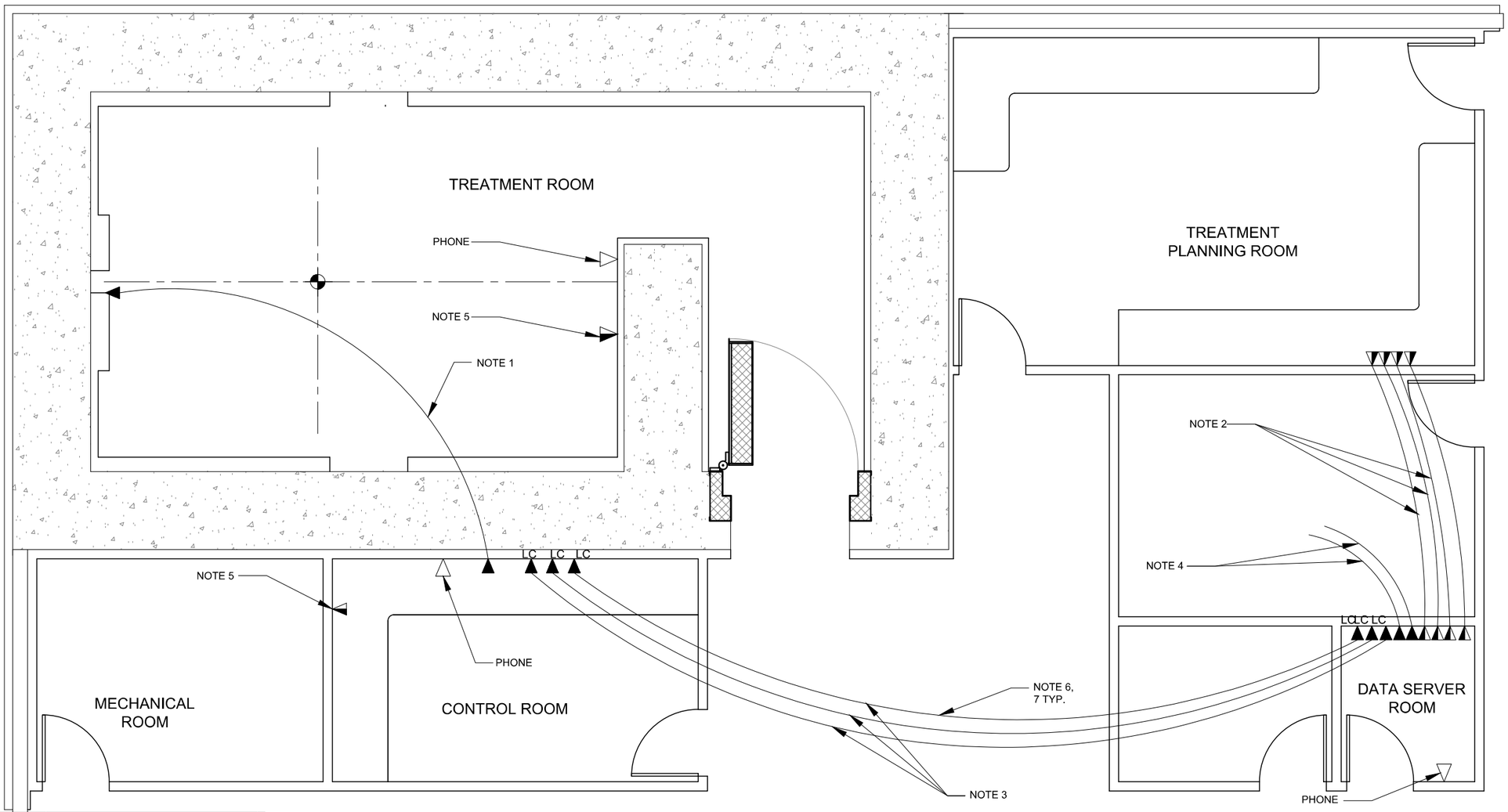
D1 TREATMENT PLANNING ISOMETRIC
NOT TO SCALE



D3 DATA SERVER ROOM ISOMETRIC
NOT TO SCALE



D5 CONTROL ROOM ISOMETRIC
NOT TO SCALE



A1 STANDARD NETWORK FLOOR PLAN
SCALE: 3/16" = 1'-0" | NOT SITE SPECIFIC

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F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. CAT6E CABLE (OR GREATER) FROM WALL MOUNTED SPEAKER TO CONTROL ROOM.
2. CAT6E CABLES (OR GREATER) FROM DATA SERVER ROOM TO TREATMENT PLANNING.
3. FIBER OPTIC NETWORK CONNECTIONS FROM DATA SERVER ROOM TO CONTROL ROOM.
4. CAT6E CABLES (OR GREATER) FROM DATA SERVER ROOM TO FACILITY NETWORK.
5. DIGITAL INTERNET DATA JACK.
6. FIBER OPTICS REQUIRED OVER 300' ALL DIRECT ROUTE.
7. BACKUP COPPER CAT6E CABLES (OR GREATER)

LEGEND

- ISOCENTER
- LC = LC CONNECTOR
- = DATA OUTLET
- = PHONE OUTLET/INTERCOM

DIMENSION FORMAT: FEET & INCHES

ACCURAY

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1310 Chesapeake Terrace
Sunnyvale, CA 94089

DRAWING INFORMATION

A	9.13.2022
B	3.5.2024

PROJECT INFORMATION

UC DAVIS
TOMOTHERAPY RADIXACT
SACRAMENTO, CA

REGIONAL PROJECT MANAGER
JOSEPH BARTLOW

SITE PLANNING COORDINATOR
JASON LENTZ

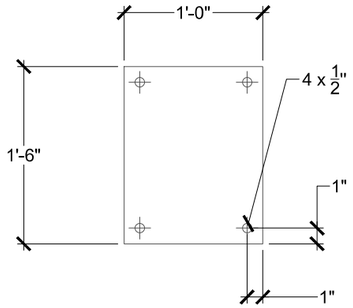
PAGE NUMBER

17 of 20

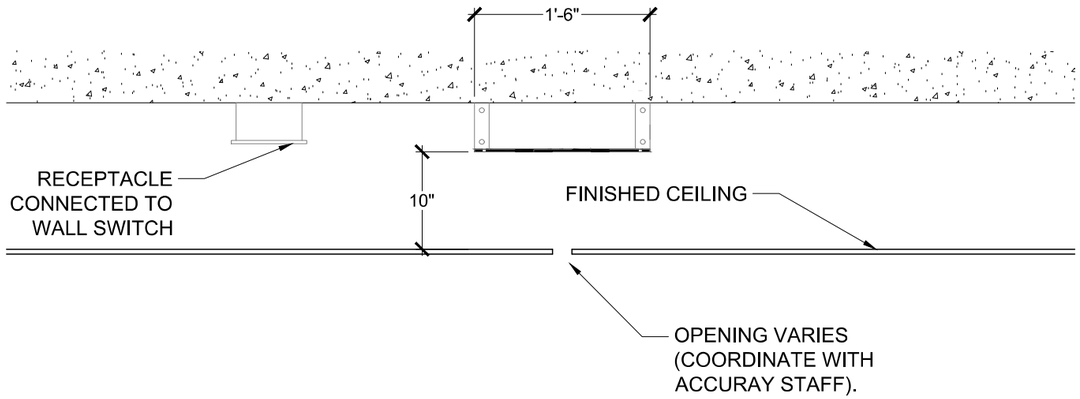
SHEET NUMBER

N-101

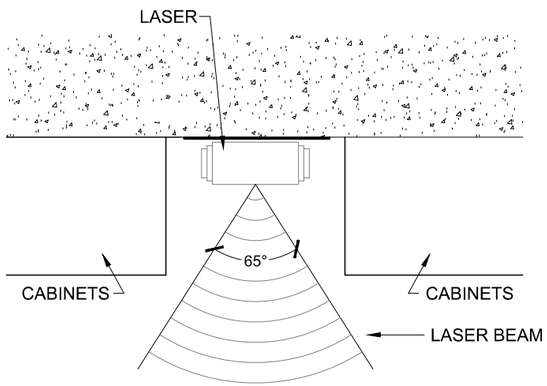
NETWORK FLOOR PLAN



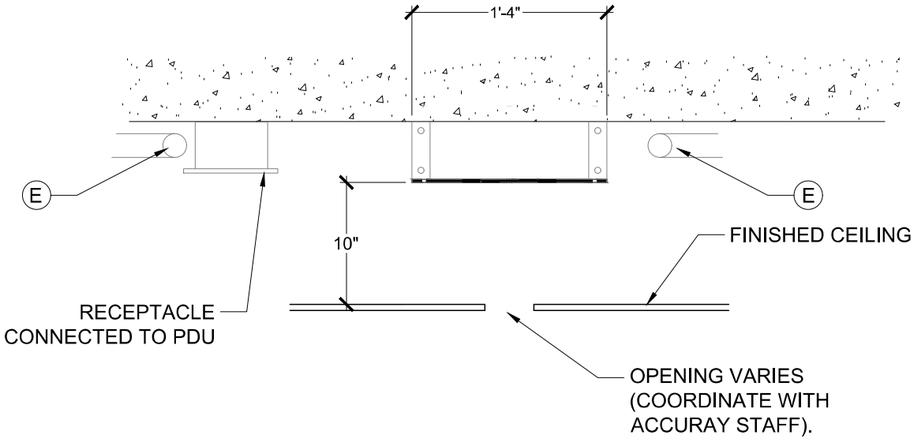
D1 APOLLO MOUNTING PLATE
NOT TO SCALE



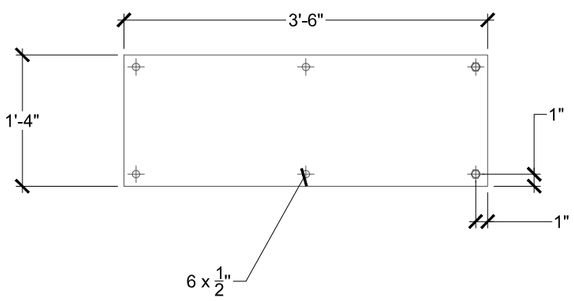
D3 APOLLO CEILING LASER - SECTION
NOT TO SCALE



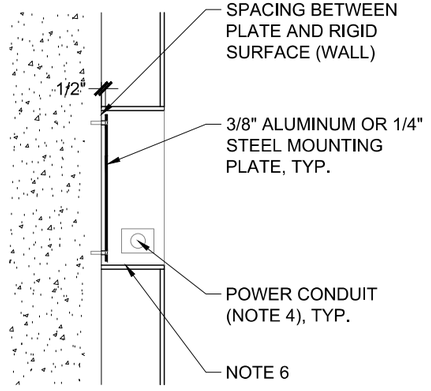
B1 DORADO MOUNTING PLATE
NOT TO SCALE



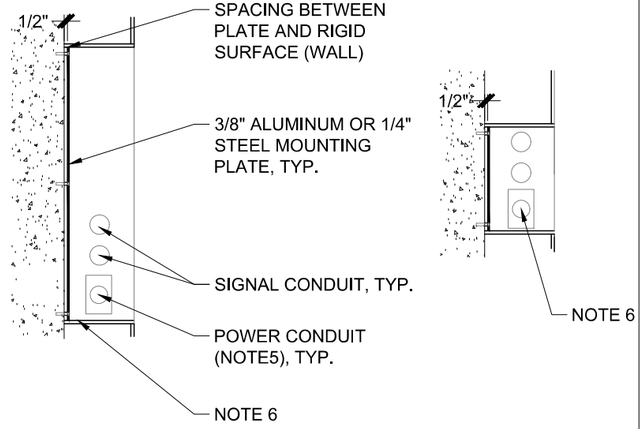
B3 DORADO CEILING LASER - SECTION
NOT TO SCALE



A1 DORADO MOUNTING PLATE
NOT TO SCALE



A3 APOLLO WALL LASER - SECION
NOT TO SCALE



A5 DORADO WALL LASER- SECTION
NOT TO SCALE

GENERAL NOTES

A. THESE DRAWINGS ARE FOR REFERENCE ONLY. THEY ARE NOT TO REPLACE CONSTRUCTION DOCUMENTS AND SHIELDING STUDIES BY LICENSED PROFESSIONALS.
B. REFER TO SITE PLANNING GUIDE (SPG) FOR ALL SPECIFICATIONS.
C. FINAL RADIATION SHIELDING SHALL BE COMPLETED BY THE PHYSICIST OF RECORD.
D. UNLESS OTHERWISE NOTED, ALL MATERIALS SUPPLIED AND INSTALLED ARE THE RESPONSIBILITY OF THE CUSTOMER.
E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. RECEPTACLE CONNECTED TO WALL SWITCH.
2. RECEPTACLE CONNECTION TO POWER DISTRIBUTION UNIT.
3. OPENING VARIES. TO BE COORDINATED WITH SITE PLANNING TEAM AT ACCURAY.
4. APOLLO LASER POWER REQUIRES LOCAL STANDARD OUTLETS DUE TO ADAPTOR PROVIDED WITH LASER.
5. DORADO LASER POWER REQUIRES NEMA 6-15R OUTLET.
6. PROVIDE ADDITIONAL SUPPORT AS NECESSARY TO RIGID SERVICE.

LEGEND

(E) SIGNAL (1 ½"Ø) - DORADO LASERS TO PDU (65' MAX).

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

ACCURAY

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TOMOTHERAPY RADIXACT
SACRAMENTO, CA

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SITE PLANNING COORDINATOR
JASON LENTZ

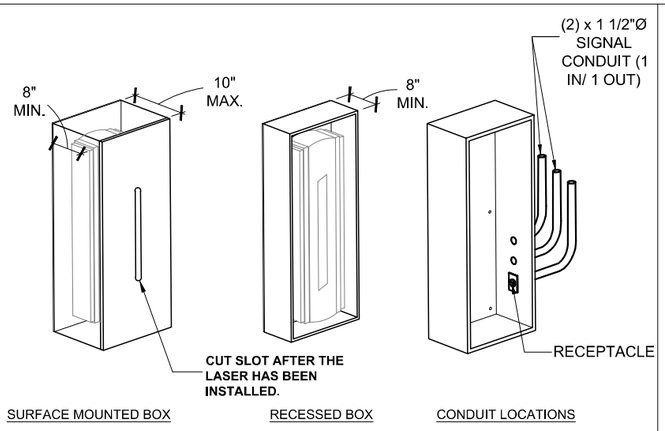
PAGE NUMBER

18 of 20

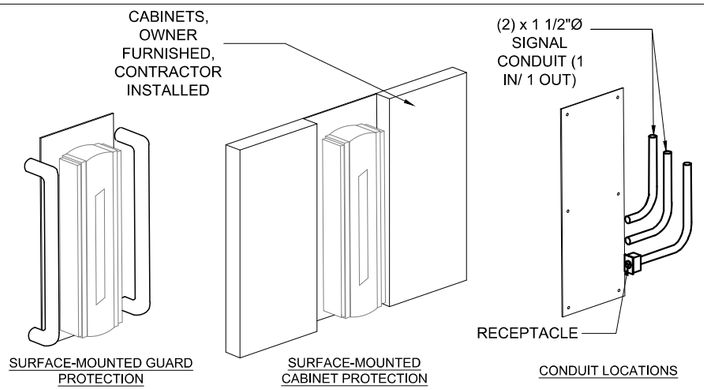
SHEET NUMBER

Q-501
LASER DETAILS

ACCURAY CONFIDENTIAL QUALITY SYSTEM DOCUMENT RADIXACT SITE PLANNING DRAWING SET T-SPD-1050322 REV D

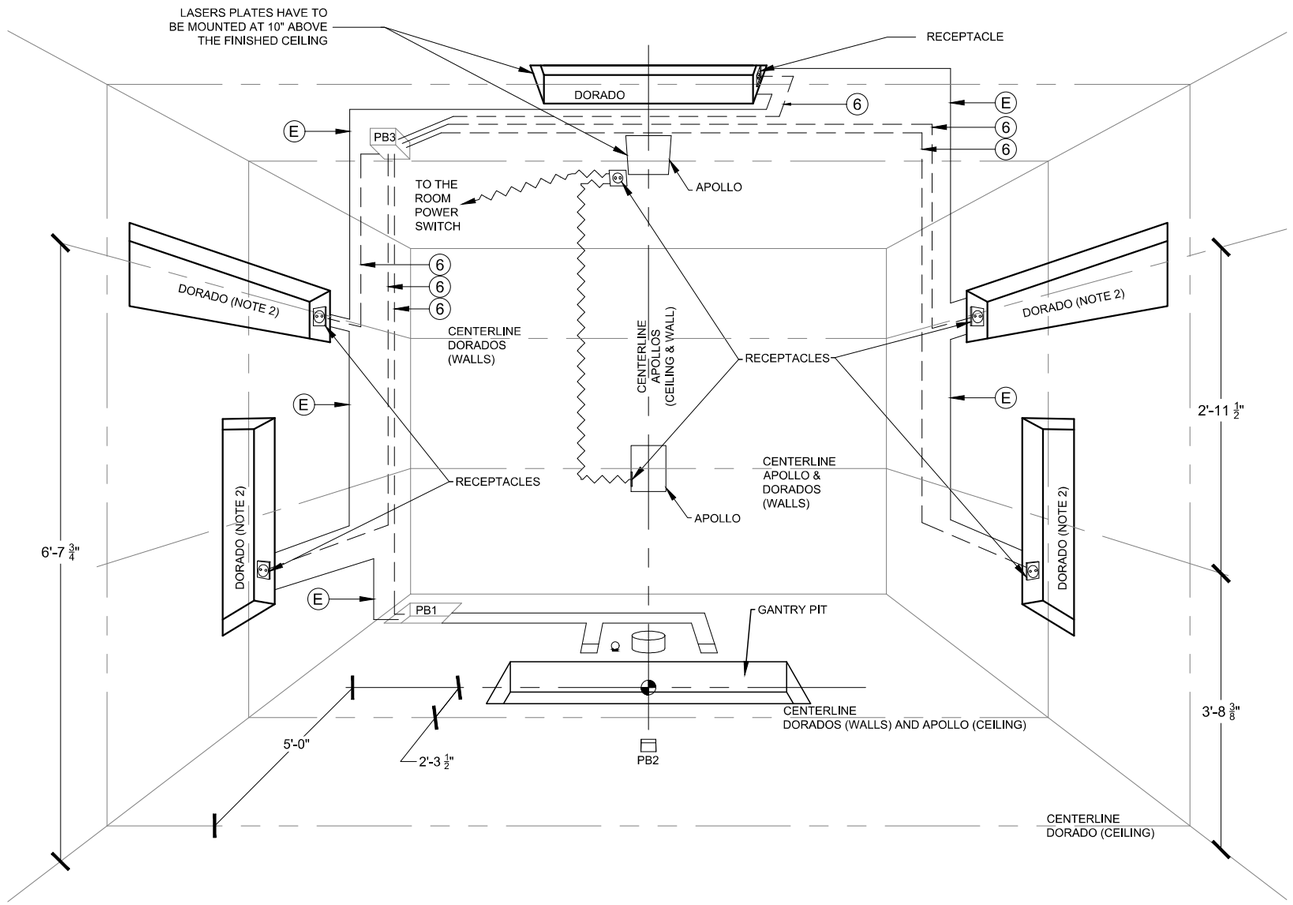


D1	DORADO WALL LASER - OPTION 1
	NOT TO SCALE



D3	DORADO WALL LASER - OPTION 2
	NOT TO SCALE

D5	RECESSED LASER ALCOVE
	NOT TO SCALE



A1	TREATMENT ROOM PERSPECTIVE	
	NOT TO SCALE	NOT SITE SPECIFIC

-OWNER TO PROVIDE POWER
-MOUNT TO 12" x 18" x 3/8" ALUMINUM PLATE
-PROVIDE LOCAL POWER OUTLET
-2 PROVIDED/INSTALLED BY ACCURAY

B5	RECESSED LASER ALCOVE
	NOT TO SCALE

-OWNER TO PROVIDE POWER & SIGNAL
-MOUNT TO 16" x 42 x 3/8" ALUMINUM PLATE
-PROVIDE NEMA 6-15R POWER OUTLET
-5 PROVIDED/INSTALLED BY ACCURAY

A5	RECESSED LASER ALCOVE
	NOT TO SCALE

GENERAL NOTES

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E. ALL STRUCTURAL CALCULATIONS TO BE COMPLETED BY STRUCTURAL ENGINEER OF RECORD.
F. ALL FINAL DIMENSIONS TO BE FIELD VERIFIED.

SHEET NOTES

1. APOLLO LASER: CONNECTED IN SERIES WITH STANDARD LOCAL DUPLEX OUTLET ATTACHED TO FACILITY POWER. NO SIGNAL CONDUIT REQUIRED.
2. DORADO LASER: RECEPTACLE NEMA 6-15R OUTLET AND 1 1/2" SIGNAL CONDUIT REQUIRED BACK TO PULL BOX (PB1).
3. ALUMINUM LASER MOUNTING PLATES ARE SUPPLIED AND INSTALLED BY CONTRACTOR. ACCURAY SUPPLIES AND INSTALLS ALL LASERS.

LEGEND

- ISOCENTER
- (E) EMPTY DATA CONDUIT 1 1/2"Ø (min)
- (6) WIRED POWER CONDUIT 1" Ø WITH OUTLET AT DORADO LASER SIDE.
- WIRED POWER CONDUIT WITH OUTLET AT APOLLO LASER SIDE, POWERED FROM THE FACILITY VIA THE WALL SWITCH.
- OUTLET MEETING LOCAL ELECTRICAL REQUIREMENTS.

PULL BOXES

PB1 PDU PULL BOX (FLOOR) 2'-0" x 1'-3" x 1'-6" WITH COVER PLATE. LAST 150 OPEN TO REMAIN OPEN.

PB2 PATIENT TABLE PULL BOX (FLOOR) 6" x 6" x 6" WITH COVER PLATE FLUSH TO FINISHED FLOOR.

PB3 DORADO POWER PULL BOX (CEILING). SIZE TO BE DETERMINED BY CONTRACTOR.

PB5 FLOOR PULL BOX 1'-0" x 8" x 8"

DIMENSION FORMAT: FEET & INCHES
DIMENSION FORMAT: L x W x H

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JASON LENTZ

PAGE NUMBER

19 of 20

SHEET NUMBER

Q-901
INTERIOR PERSPECTIVE

ACCURAY CONFIDENTIAL QUALITY SYSTEM DOCUMENT RADIXACT SITE PLANNING DRAWING SET T-SPD-1050322 REV D

ACCURAY

Site Planning Guide

Radixact® Treatment Delivery System
Accuray Precision® Treatment Planning System
iDMS® Data Management System
Accuray Helix® Configuration

Customer Support

For more information, to request documentation, or if you have a service issue, please contact Accuray Customer Support (North America) at +1-866-368-4807, contact your distributor, or visit the Services tab at https://www.accuray.com.

NOTE: If your facility works with a third-party service provider, please contact them directly for your service-related issues.

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ACCURAY

Warranty Information

If any Accuray products are modified in any manner all warranties associated with such products shall become null and void. Accuray Incorporated does not assume any responsibility or liability with respect to unauthorized modification or substitution of subsystems or components.

With proper care and maintenance, the expected service life of the Accuray System is 10 years.

The Accuray System, including each computer workstation and associated system software, has been validated to demonstrate that the system will perform as expected. The installation of additional software not released by Accuray Incorporated (e.g. third party, off-the-shelf, etc.) on these computer workstations is not permitted. This includes any operating system updates. Any effect on the safe and intended operation of the Accuray System caused by the introduction of additional software is unknown and Accuray cannot be responsible for any impact caused by adding such software.

Hardware and Software Maintenance

Only qualified service personnel should service or maintain system hardware components. If you feel that Accuray System hardware components or associated features or functions do not perform as expected, or they provide results that are inconsistent with your established clinical and research protocols, call Accuray Customer Support (North America) at +1-866-368-4807, contact your distributor, or visit the Services tab at https://www.accuray.com

Device Disposal

When an Accuray product reaches the end of its useful life and your facility desires to remove the device, contact Accuray Customer Support to decommission, uninstall, and appropriately dispose ofthe components.

Use of Third-Party Software

Accuray Incorporated's software is being distributed together with certain third-party software that is made publicly available under open-source software licenses. Notices relating to such third-partysoftware and the license terms under which these software components were obtained by Accurayare located in this user's guide, in any applicable release notes, or in the about box that displays to the customer for the appropriate software program. Source code for an applicable open-source software component is available upon written request. Automatic image registration is based on routines in *Numerical Recipes: The Art of Scientific Computing*, published by Cambridge University Press, which are used with permission.

Use of Third-Party Hardware

Use of other Medical Devices and non-Medical Devices within the Accuray Treatment Delivery system room must be assessed by the responsible party at the customer facility to ensure that useof the device does not introduce possible safety limitations or other compatibility concerns.

Instructions for Use of the Accuray System

Safe operation of the Accuray System requires careful attention to the serious hazards associated with the use of linear accelerators and complex radiation therapy equipment and ways to avoid or minimize the hazards, and familiarity with emergency procedures. Untrained or careless operation ofthe Accuray System can damage the system, its components or other property; cause poor performance; or lead to serious bodily injury and possibly death. Anyone who operates, services, maintains, or is otherwise associated with the Accuray System must read, understand, and be thoroughly familiar with the information in this manual, and take precautions to protect themselves, their associates, patients, and the equipment. At each step in the installation, specific warnings and cautions are given for specific actions. Personnel must be trained by Accuray Incorporated before the Accuray System is used for research or clinical purposes. Accuray System documentation was originally drafted, approved, and supplied in English (US).

Prescription Device Statement

Caution: Federal law restricts this device to sale by or on the order of a physician.

Table of Contents

1.0 Introduction

1.1 Scope

This guide covers the Radixact Treatment Delivery System, Accuray Precision Treatment Planning System and iDMS Data Management System.

1.2 Overview

This guide was written to provide essential information to our customers and their contractors to support the design and construction of their Radixact System, Accuray Precision System and iDMS System facility infrastructure. The information in this guide is meant to provide a starting point of general information, upon which site-specific information can be added.

Each customer will be assigned a dedicated Accuray Project Manager, who will provide both remote and on-site assistance.

Accuray's goal during the site planning process is to help our customers achieve both a timely and trouble- free system installation.

1.3 Regulatory requirements

In the United States, Accuray is available to assist our customers with their CON (Certificate of Need) or OSHPD (Office of Statewide Health Planning and Development) processes, if applicable to their state. The Accuray Sales representative will act as the contact for the CON process, and the Accuray Project Managerfor the OSHPD process.

Internationally, Accuray, or our distributor, is available to assist our customers with any regulatoryrequirements that they may have.

The customer is responsible for obtaining all local, state and national permits and requirements associatedwith site planning, shielding, site preparation, construction, system installation and system maintenance.

Accuray customers are responsible for all reports and submissions to any governing body related toradiation surveys, radiation safety and physics reports.

Use of other Medical Devices and non-Medical Devices within the Accuray Treatment Delivery system room must be assessed by the responsible party at the customer facility to ensure that use of the device does notintroduce possible safety limitations or other compatibility concerns.

1.4 Accuray Site Planning Contact Information

Accuray Incorporated Manufacturing Site

1209 Deming Way

Madison, Wisconsin 53717 USA

2.0 Roles and Responsibilities

The Accuray Project Manager (Customer Operations) assists the customer and their representatives to successfully integrate the Radixact System, Accuray Precision System and iDMS System into their facility. The roles and responsibilities are defined below.

2.1 Accuray Project Manager Responsibilities

The Accuray Project Manager (Customer Operations) is the main point of contact to assist in the successfulintegration of the Radixact System, Accuray Precision System and iDMS System into the facility. The roles and responsibilities are as follows:

- Coordinate the A-Z meeting as well as introduce additional Accuray resources such as Training, Reimbursement, Service and Sales Operations.
- Assist with project schedule, aid in achieving critical milestones and support customer timeline.
- Assist in the coordination of facility construction to Accuray specifications.
- Assist with the development of site-specific drawings, entailing the project specifications.
- Interface with the customer's architects, engineers, contractors, I.T. and other facilities-related personnel.
- Conduct all Accuray inspections and coordinate the installation of the Accuray-supplied equipment.

3.0 System Components, Site Planning Considerations

3.1 Treatment Room (Also known as the Vault or Bunker)

The treatment room typically contains the components in the following table.

Table 1 Treatment Room Equipment Specifications (Accuray supplied)

Item	Description	L x W x H (in)	L x W x H (mm)	Weight (lb.)	Weight (kg)
1	Gantry and Equipment Enclosures	77.5 x 110 x 99	1970 x 2800 x 2524	13000	5900
2	Radixact System Couch	107.7 x 25.6 x 44.4	2735 x 651 x 1127	1100	500
3	Power Distribution Unit	31 x 22 x 56	787 x 559 x 1428	1001	454
4	Dorado Laser Positioning System (5 lasers)	31.26 x 8.66 x 7.21	794 x 220 x 183.1	40	18.1
5	Apollo Laser Positioning System (2 lasers)	8.7 x 4.33 x 4.13	221 x 110 x 105	4.5	2
14	Intercom SpeakerSystem	7 x 6.3 x 9.4	177 x 160 x 240	5	2.2
16	Synchrony Respiratory TrackingSystem	28 x 7.5 x3	720 x 190 x 74	10	4.5
17	VitalHold (3 Scanners)	21.4 x 11 x 15.35	620 x 280 x 390	35	16

Item	Description	L x W x H (in)	L x W x H (mm)	Weight (lb.)	Weight (kg)
17	VitalHold (monitor/keyboard/mouse/KVM) (monitor dimensions given)	7.0 x 16.0 x 20.0 (max height)	180 x 410 x 510 (max height)	10.6	4.8

Note: The item numbers in bold refer to the identifiers on the site-specific drawings.

3.1.1 Accuray Supplied

- **Gantry and Equipment Enclosures** (Item 1 – Floor Mounted)
  - **Description**: The rotating gantry assembly generates and delivers radiation to patients. The enclosures cover the gantry. The equipment enclosures are designed to detach and roll forward for service access.
  - **Site planning considerations**: There are HVAC, pit, electrical, and mechanical considerations for the gantry. Due to gantry clearances, a pit with a sloped floor and moisture sensor is required. Conduits/trenches leading from the PDU to the gantry are required. Supplemental chilled air is required to cool the gantry. A compressed air line isrequired to supply air to the MLC. During installation, Accuray will drill and anchor the gantry to the floor. Anchor bolt locations for the gantry must be free from rebar structure,conduits and pipelines. See site-specific drawings for more information.
- **Radixact Couch** (Item 2 – Floor Mounted)
  - **Description**: The Radixact System Couch is used to position the patient during treatmentusing automatic patient positioning technology. The maximum patient weight load capacity of the Radixact System Couch is 440 lb. (200 kg).
  - **Site planning considerations**: During installation, Accuray will drill and anchor the Radixact Couch to the floor. Anchor bolt locations for the Radixact System Couch must be free from rebar structure, conduits and pipelines. See site-specific drawings for more information.
- **Power Distribution Unit (PDU)** (Item 3 – Floor Mounted)
  - **Description**: The Power Distribution Unit (PDU) isolates the power source for all criticalAccuray components in the treatment vault and control area and provides power to system components.
  - **Site planning considerations**: During installation, Accuray will install the PDU and run cables from the PDU to the gantry. For sites with specific seismic requirements Accuraywill drill and anchor the PDU to the floor.
  - **Note**: The PDU's optimal location is in the treatment vault. An optional location is outside the vault but the location of the PDU must be within 35 linear feet (10.7 meters) of the Gantry.
- **Laser Positioning System** (Items 4 & 5 – Wall and Ceiling Mounted)
  - **Description**: A laser positioning system is used in the treatment room to accurately position patients on the Radixact System Couch. The five Dorado lasers and two Apollolasers are mounted on the treatment vault walls and ceiling. There is a total of seven lasers included with the Radixact System.

  - **Site planning considerations**: The customer's contractor is required to install the mounting plates and structures that support the laser positioning system and provide power to the lasers. Accuray installation engineers will mount and align the lasers and willassist the contractor in measurements for cabinet and ceiling cutouts.

- **Intercom Speaker System** (Item 14 – Wall Mounted)
  - **Description**: The Noise Eliminating Intercom System (NEIS) is standard on the RadixactSystem which allows the patient and clinician to communicate during the treatment.
  - **Site planning considerations**: The speaker is wall mounted behind the patient on the gantry centerline above the Apollo Laser. The maximum length of the signal conduit between the speaker and the back of the gantry cannot exceed 15 ft-0 in (4570 mm). Thecustomer's contractor is responsible for: supply and installation of the conduit for the microphone cable connection. A CAT6 (or higher) signal cable running between the speaker unit in the Treatment Room and the Control Room, and junction box(es) [termination point(s)] in the bunker and in the Control Room, as called out in the site-specific drawings. The best practice is to terminate the CAT6 cable (or equivalent) with RJ45 outlets (female connectors) both in the Treatment Room and in the Control Room. These terminations must be installed near the intercom speaker unit in the Treatment Room and the desktop unit in the Control Room - to allow for short patch cords connections to these components. Accuray installation engineers will install and connectthe speaker and associated components.
- **Synchrony Respiratory Tracking System** (Item 16 – Ceiling mounted)
  - **Description**: The Synchrony Camera is used to track, detect, and correct for respiratory motion.
  - **Site planning considerations**: The Synchrony Camera is attached to a suspended strutmounted to the vault ceiling near the foot of the treatment couch. The customer's contractor will install a base plate to the concrete or steel ceiling. If steel ceiling, the contractor will weld an adaptor plate, supplied by Accuray. Service access to the Synchrony camera and Unistrut are required. Customers should install an acoustical ceiling (or at minimum large access panels) in this area.
  - **Note**: If the customer plans for a drywall ceiling, Accuray requires a 1 ft (30 cm) square access panel near the Synchrony Camera. If the space between the vault ceiling and finished ceiling is 1 ft (30 cm) or more, Accuray requires a 2 ft (60 cm) square access panel near the Synchrony Camera.
- **VitalHold** (Item 17 – Ceiling mounted)
  - **Description**: VitalHold is an optical surface scanning system. It consists of three separate scanner devices which will be attached to the ceiling of the Treatment Room, in proximity to the Linac itself. The Scanners can be used for positioning the patient before a treatment fraction, verifying that the patient remains in the desired position during a treatment fraction, as well as performing a respiratory gated treatment.
  - **Site Planning Considerations**: The 3 scanners are attached to a unistrut mounted to the vault ceiling provided by Accuray. The monitor in the treatment room should be placed so that it can be viewed comfortably while standing beside the treatment couch.

3.1.2 Customer Supplied Items (Required)

- Steel or Aluminum Plates and Mountings for the Patient Positioning Lasers
- Radiation Warning Lights, including cables and a power connection (within 48-240 VAC range)
- Emergency Off / Emergency Stop Buttons and cabling

- Door Interlock and cabling (1 required depending on vault entry configuration)
- Closed Circuit TV Cameras (CCTV)
- Conduits (wired and empty) and cable management system as shown on the site- specific drawings.
- SF6 Gas (Contact Accuray Project Manager for details)

3.1.3 Customer Supplied (Optional – Unless Required by Local Regulations)

- Nurse Call Button(s)
- Medical Gas Lines
- Customers may elect to install medical gas and vacuum outlets directly in the Treatment Room or use mobile gas carts. Please consult with the site administrator and/or physicians to determine the exact needs. These installations may include:
  - Oxygen
  - Air
  - Nitrous Oxide
  - Vacuum
  - Waste Anesthetic Gas Disposal
- Remote Patient Monitoring
  - This is typically used for monitoring anesthetized or other critical patients and can be accomplished via several methods:
  - The mobile monitoring system can be kept in the Treatment Room, with one of the pan/tilt/zoom cameras focused on the screen for viewing in the control area.
  - The remote monitoring cables can be run through the physics port that exists between the Treatment Room and the Control Room.
  - The customer can have a system built into the Treatment Room.
- Storage for QA tools, Synchrony vests, patient masks, and body immobilization devices should be taken into consideration. The Site-Specific drawings will indicate areas in the Treatment Room where it is acceptable to install sinks and cabinets.

3.2 Control Room

The Treatment Delivery Console (TDC) in the Control Room area can be configured in many ways, depending upon the site layout and desire of the customer. Typically, it includes the following equipment.

Table 2 Treatment Delivery Console (TDC) Equipment Specifications

Item	Description	L x W x H (in.)	L x W x H (mm)	Weight (lb.)	Weight (kg)
10	Status Console User Interface	8.5 x 4.5 x 3	216 x 114 x 76	2.6	1.1
12	Treatment Delivery Console computer (TDC)	20.75 x 7.5 x 17	527 x 190 x 432	45	21

Item	Description	L x W x H (in.)	L x W x H (mm)	Weight (lb.)	Weight (kg)
	Treatment Delivery Console accessories (flat screen monitor, keyboard, mouse) (Monitor size & weight)	24.1 x 14.9 x 20.8 x 9.8	611.8 x 378.0 x 528.0 x 250.0	13.5	6.1
14	Intercom System (desktop unit)	5.9 x 8.7 x 2.8	150 x 221 x 71	10	4.5
15	Printer	18.1 x 19.7 x 16.3	460 x 500 x 414	71.7	32.5

Table 3 VitalHold

Item	Description	L x W x H (in.)	L x W x H (mm)	Weight (lb.)	Weight (kg)
17	VitalHold Workstation	6.95 x 20.41 x 16.45	176.5 x 518.3 x 417.9	37.5	17
	Monitor (keyboard, Mouse) (Monitor size and weight)	7.0 x 16.0 x 20.0 (max height)	180 x 410 x 510 (max height)	10.6	4.8

3.2.1 Accuray Supplied

- **Status Console User Interface** (Item 10 – Placed on Countertop)
  - **Description**: Device that allows the customer to operate the emergency stop, key switchfor image/program/treat options, start button, stop button, radiation on notification.
  - **Site planning considerations**: Provide adequate counter space.
- **Treatment Delivery Console (TDC)** (Item 12 – Placed on Countertop)
  - **Description**: The Treatment Delivery Console is the computer workstation that the technologists use for calibration, patient positioning, registration, imaging and treatment.The console is composed of a computer, flat screen monitor, and keyboard. Noise level ofconsole is ~25dB.
  - **Site planning considerations**: Provide adequate counter space.
- **Intercom System** (Item 14 – Placed on Countertop)Description: The intercom desk control unit.
  - **Site planning considerations**: The intercom desk control unit is placed on Control Roomcountertop. The customer's contractor is responsible for installing the wired conduit andterminating with RJ45 connections as called out in the site-specific drawings. Accuray installation engineers will install the desk control unit and connect to the termination points.

- **Printer** (Item 15 – Placed on Countertop)
  - **Description**: Standard laser jet printer.
  - **Site planning considerations**: Provide adequate counter space and a power outlet.
- **VitalHold** - (Item 17 - Placed on Countertop)
  - **Description:** VitalHold is an optical surface scanning system.
  - **Site planning considerations:** Typically, the computer location is either in the control room itself under a desk or in a nearby dedicated server or computer room. The monitor/keyboard/mouse in the control room should be placed close to the Radixact console so that it can be comfortably viewed while operating the system. The computer is accompanied by one KVM extender if in the Control Room or two KVM extenders if in a nearby room, and six USB-to-fiber optic converters.

3.2.2 Customer Supplied

- **Main Power Disconnect**
  - **Description**: See Section 4.1: Electrical Requirements.
- **Emergency Off (EO) Push Button**
  - **Description**: The EO push button is provided and installed by the Customer's contractor.It should be installed on the wall in the Control Room. Reference the site-specific drawings for exact location.
- **Phone with Long Distance Access**
  - **Description**: The phone is used for routine service and emergency communication.
  - **Closed Circuit TV (CCTV) Monitoring System** Description: See Section 5.9: Closed Circuit TV (CCTV).
- **Customer Network Data Port with Internet Access or Wireless Internet Access**
  - **Description**: To be used by Accuray personnel during system installation and service activities.
- **System Status Indicators**
  - **Description**: "X-ray On" light and optional "Power On", "Room Ready", and "Standby" lightsare positioned above the Treatment Room door. Additional warning lights in the treatment vault need to be considered, if required by facility or local safety regulations.
  - The customer supplies all the materials related to this light, including power, within 48-240VAC range. The facility should provide two conductors for each light to the front/bottom of the PDU. The two conductors are the facility line in and then the switched line out from the PDU. The Radixact System provides solid-state relays that close and complete the circuit to illuminate the light(s). Allow for approximately 6' (2 m) extra lengthfor termination.
- **Facility Supplemental Air Relay**:
  - **Description**: The zero cross relay is provided and installed by the Customer's contractor. It should be installed in an electrical panel.Reference the site drawings for wiring details.
- **Physics Conduit Port (Dosimetry Tube) into the Treatment Room**
  - **Description**: This port is used for running QA and Commissioning tools and equipment cables between the Control Room and Treatment Room.

  - **Site planning considerations**: It is typically a 4 inch (100 millimeters) conduit that runs from the top of the Control Room desk to the lower wall of the Treatment Room at a 45-degree angle, both vertically and horizontally, with access boxes and/or doors on eitherend.

- **Computer Workstation:** A personal computer to install the TomoTherapy Electrometer Measurement System (TEMS) application to the water tank during ATP. Computer must meet these minimum specifications:
  - Microsoft Windows 7 or 10 - > 50 MB hard drive
  - .NET Framework 4.5.2 - > 1024 x 768 screen resolution
  - Adobe Acrobat Reader
  - Microsoft Excel
  - Intel or AMD Processor >1 GHz
  - CD ROM Drive
  - 2 GB (4 GB recommended) memory

3.3 iDMS System Server Room

The iDMS System Server Room location can be configured in many ways, depending upon the site layout, and desire of the customer. The iDMS System room is intended to hold the iDMS server rack.

Table 3 iDMS System Server Rack Specifications

Item	Description	L x W x H (in.)	L x W x H (mm)	WEIGHT (lb.)	WEIGHT (kg)
8	iDMS System Server Rack	37 x 24 x 63.5	940 x 609 x 1613	900	408
	Standby iDMS System Server Rack	37 x 24 x 63.5	940 x 609 x 1613	900	408

3.3.1 Accuray Supplied

- **iDMS System Server Rack** (Item 8 – Floor Mounted)
  - **Description**: The iDMS System server is where patient data is imported and stored.
  - **Site planning considerations**: Refer to the Network System Requirements document (supplied by Accuray Project Manager) for maximum cable length between the iDMS System and the Treatment Delivery Console (TDC) and Accuray Precision System. Referto Section 4.0 for the electrical and environmental requirements for the iDMS System server rack. For sites with specific seismic requirements Accuray will drill and anchor the iDMS to the floor.
- **Standby iDMS Server** (optional)
  - **Description:** The Standby iDMS Server is a purchasable option to reduce the down time on one or more connected Treatment Delivery Systems when service and repair is required on the primary iDMS server due to a catastrophic failure.
  - **Site planning considerations:** The customer may install the standby iDMS server anywhere within a 50-mile radius if it's not installed within the same room as the primary iDMS server and network bandwidth from primary iDMS to standby iDMS is 1000 Mbps or faster.

3.3.2 Customer Supplied (Required)

- **Air Conditioning Unit**
  - **Description**: See section *6.2 Environmental Requirements* of this document for more information.
- **Network Connections**
  - **Description**: Please see section *7.12 Information Technology* of this document for more information or refer to the Network System Requirements document.
- **Electrical**
  - **Description**: Please see section *6.1 Electrical Requirements* of this document for more information.

3.4 Mechanical Room

The Mechanical Room is typically located near the Treatment Room and is intended to hold the mechanical equipment required for the Radixact System product line.

Table 4 Mechanical Room Equipment Specifications

Item	Description	L x W x H (in)	L x W x H (mm)	Weight (lb.)	Weight (kg)
6a	Power Conditioner. (OPTIONAL) (Facility Supplied)	31.5 x 22 x 63	800 x 559 x 1600	640	290
7	Air Compressor (REQUIRED) Oil-Free Class “0” / Dryer and Air Tank (Facility Supplied)	Typical Comp 34 x 21 x 33 Tank 50 x 25 x 36	863 x 533 x 838 1270 x 635 x 914	300 200	136 90

3.4.1 Customer Supplied (Required)

- **Compressed Air Line**
  - The facility must supply a dedicated oil-free air compressor. In the floor of the TreatmentRoom, embed a copper compressed air line from the facility-supplied oil-free air compressor. Behind the gantry, add an access panel with a shut off valve and quick- disconnect fitting to the compressed air line. Terminate the compressed air line underneath the gantry with a barbed fitting so that a hose may be attached for system cleaning during planned maintenance procedures.
  - Use thick-body or wide-body copper pipe. Use 3/4 in (20 mm) inside diameter for up to amaximum of 300 ft (91.44 m) or 1.0 in (25.4 mm) for up to 500 ft (152.4 m). See site-specific drawings for more information. Air Compressor and Tank (Item 7 – Floor Mounted)
  - Install a dedicated, facility-supplied oil-free air compressor to meet the flow-rate and quality requirements. We recommend installing a scroll compressor. The facility must supply a 60 US-gallon (227-liter) or greater air tank and install it in the Mechanical Roomnear the air compressor. Set the air tank to automatically purge for 4 to 5 seconds every 30 minutes.

Table 5 Air flow rate and quality requirements

	Environmental Requirements
Flow Rate	30 scfm at 90 PSIG (measured at sea level), 14.2 LPS at 6.2 bar (flow rate requirement is per system)
Water Content	Free of condensed water. Dew point: -40°F (-40°C) or lower at 90 PSIG (6.2 bar).
Oil Content	Zero oil content allowed. Compressed air must be completely free of oil droplets and vapor. (Oil filters to reduce oil content are not adequate for this requirement.)
Filtration	Filtered to allow no particulate matter larger than 0.5 microns

- **Dryer**
  - The facility must supply compressed air with a dew point at or below -40°F (-40°C) at 90 PSIG (6.2 bar). This typically requires multiple dryers in series, most often a refrigerated dryer supplemented by a self-regenerating desiccant dryer.
  - **NOTE:** If a refrigerated dryer is used, consider placing it between the compressor and the tank to minimize the possibility of icing.
- **Common Supplier for Desiccant dryer**
  - Parker: https://ph.parker.com/us/en/k-mt-1-8-series-heatless-compressed-air-dryers
  - Suggested model for a single system: Parker K-MT Series

3.5 Accuray Precision System Room(s)

The Accuray Precision System can be located anywhere, and configured in many ways, depending upon the site layout and desire of the customer. It is important that this room be ready for equipment and setup prior to system installation. Typically, the Accuray Precision System room includes the following equipment:

Table 6 Accuray Precision System Room Equipment Specifications

Item	Description	L x W x H (in.)	L x W x H (mm)	Weight (lb.)	Weight (kg)
13	Accuray Precision System workstation	20.75 x 7.5 x 17	527 x 190 x 432	45	21
	Accuray Precision System accessories (flat-screen monitor, and keyboard) (monitor size & weight)	21.9 x 16.1 x 9.1	556 x 409 x 231	16.8	7.6
15	Printer	18.1 x 19.7 x 16.3	460 x 500 x 414	71.7	32.5

3.5.1 Accuray Supplied

- **Accuray Precision System** (Item 13 – Placed on a Desktop or Countertop)
  - **Description**: The Accuray Precision System workstation is the computer workstation where the clinician analyzes the patient's computed tomography (CT) data and uses it to create an optimized treatment plan. The facility must have a CT device that generates DICOM images. The sound level for the Accuray Precision workstation is ~25dB.
- **Printer** (Item 15 – Placed on a Desktop or Countertop)
  - **Description**: Standard LaserJet printer.
  - **Site planning considerations**: Provide adequate counter space and power outlets for the Accuray Precision workstation and printer.

3.5.2 Customer Supplied

- **Network Connections** (Required).
  - **Description:** Please see section *7.12 Information Technology* of this document for more information or refer to the Network System Requirements document.
- **Computer for RIT package** (If RIT option is purchased).
  - **Site planning considerations:** Provide adequate counter space and power outlets for scanner and computers.

4.0 Radiation Shielding Guidelines

4.1 Initial Site Planning

Radixact System shielded barrier thickness requirements will vary from site to site depending upon many factors including: local regulations, shielding design goals, exposure limits, adjacent area occupancy rates, and the weekly or yearly accelerator workload (these measurements typically result in facilities building walls of at least 42" (1066mm) concrete.

It is highly recommended that a qualified radiation physicist estimates the anticipated clinical case workload at each specific facility, paying particular attention to the type, duration of treatment and total number of treatments. Typically, shielding calculations performed by a Qualified Expert (using standard therapy vault and treatment system geometry, while incorporating customary design goals and weekly workload values), will indicate standard density concrete wall thicknesses of at least 42" (1066 mm).

The customeris ultimately responsible for determining the proper shielding for their treatment room and ensuring compliance with all applicable local, state and country regulations.

4.1.1 System Description and Specifications

The Radixact System combines the principles of computed-tomography imaging with intensity-modulated radiation therapy (IMRT). The two modalities delivering image guided IMRT are Radixact TomoHelical Treatment Delivery and Radixact TomoDirect TreatmentDelivery. Both modalities employ a compact linear accelerator waveguide that produces a nominal 6 MV X-Ray beam.

- Radixact TomoHelical Treatment Delivery generates a slit beam of radiation that continuously rotates on a slip-ring gantry while the patient is translated through the gantry bore opening and beam.

- Radixact TomoDirect Treatment Delivery generates a slit beam of radiation for different static angles, while the patient is translated through the gantry bore opening and radiation beam.

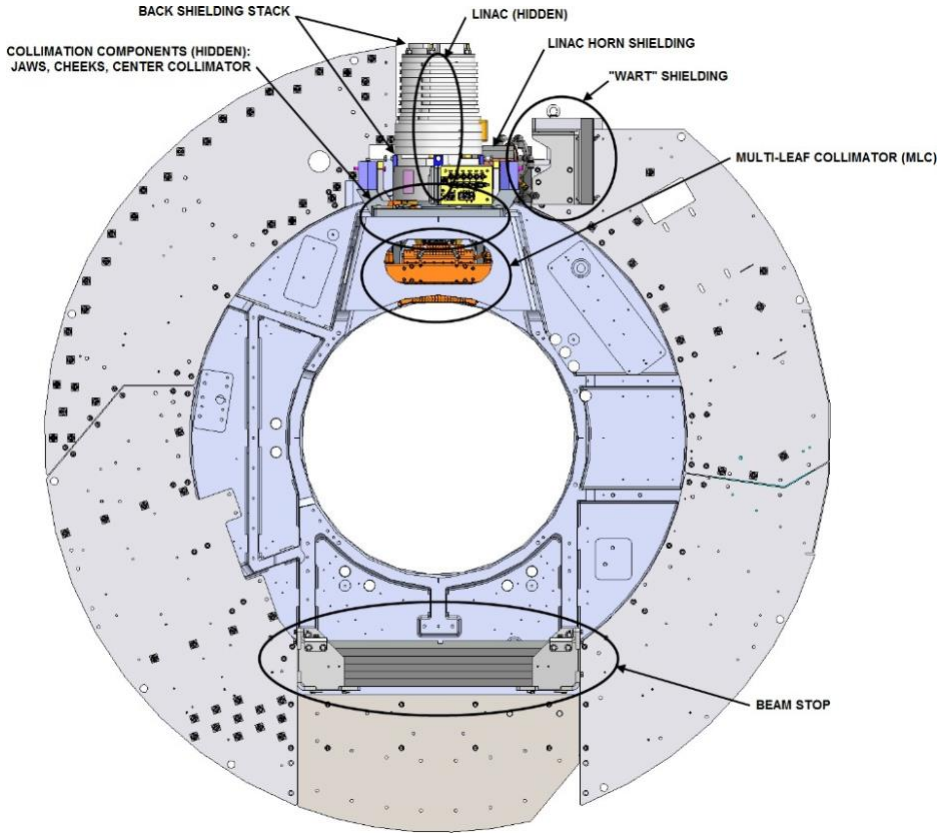


Figure 1 Radixact System critical structures related to shielding design

The Radixact System produces a maximum of 1060 +/- 30 beam monitor units (MU) per minute. Note that 1 MU is nominally equal to 1 cGy, at 850 mm source-axis distance (SAD) in a50 mm x 400 mm field size at a depth of 15 mm in water (these parameters define the reference beam conditions used in this report).

The approximate 1060 MU/min output value stated above is intended to aid with shielding design assumptions which are necessarily required in advance of system installation. However, each system's output is uniquely determined after installation. The output of each Radixact System is calibrated to achieve agreement between planning calculations and delivery measurements for helical IMRT plans.The static, open field output can vary from one machine to another, depending on how various beam and alignment parameters fall within their respective tolerance ranges.

The slit radiation beam is 400 mm wide in the transverse direction. A primary set of moveable tungsten jaws (117 mm thick in the beam axis) define the delivery slice width, which can be adjusted from 4 mm at MVCT to 50 mm in the inferior-superior direction of the patient.

Therefore, the maximum field size of the primary treatment beam, at isocenter (850 mm SAD), is limited to 50 mm in the longitudinal direction by 400 mm in the transverse direction.

The primary beam is further collimated by 64 pneumatically driven tungsten leaves, with a tongue-and groove design. The leaves are arranged on a curve with focus that is not coincident with the X-ray spot. This helps to reduce radiation leakage [1]. Each leaf is 100 mm

thick (in the beam axis) and projects to 6.25 mm along the transverse axis at isocenter. By either attenuating the radiation or allowing it to pass through, this multi-leaf collimator (MLC)enables the Radixact System to provide a range of low to high levels of intensity modulation.The system is also equipped with an on-board primary beam stop. The 152 mm thick lead- slab beam stop is located on the rotating gantry opposite the beam source and provides a high degree of primary radiation beam attenuation. **Figure 1** illustrates the location and arrangement of critical structures pertinent to shielding design. Isocenter is approximately 1125 mm above the concrete floor but may differ slightly due to leveling pad adjustments.

Workload Estimation and Intensity Modulated Radiation Therapy Factor (IMRT Factor)

Since the Radixact System is equipped with a primary beam stop, barrier thickness requirements are dominated by secondary radiation. Therefore, properly estimating the site-specific weekly leakage workload (W_L) is critical. The following equation is an example calculation for the weekly leakage workload (W_L).

$$W_L = 5\ \text{days/wk} * 32\ \text{fx/day} * 6\ \text{min/fx} * 1060\ \text{cGy/min} = 1.02\ \text{x}\ 106\ \text{cGy/wk}$$

Included within the W_L calculation (above) is the recommended IMRT factor of 16 MU/cGy applicable to a 100% IMRT facility. The IMRT factor accounts for the increase in accelerator MU due to small field sizes that are needed to achieve the desired absorbed dose to the patient. In short, for a given absorbed dose, the MU needed for IMRT is much greater than the MU needed for conventional treatment. One methodology for determining the IMRT factor involves multiplying the ratio of max. /avg. leaf open time by the ratio of max. /avg. open leaves during treatment by the ratio of max. /avg. field width (see below).

$$\text{IMRT Factor} = \text{max/avg}\ \{\text{leaf open time}\} * \text{max/avg}\ \{\#\ \text{leaves open}\} * \text{max/avg}\ \{\text{field width}\}$$

$$\text{IMRT Factor} = 100\%\ /\ 50\% * 64\ /\ 16 * 50\ \text{mm}\ /\ 25\ \text{mm} = 16$$

To determine the primary barrier weekly workload (W_{pri}), divide W_L by the IMRT Factor:

$$W_{pri} = W_L\ /\ 16\ \text{MU/cGy} = 6.36\ \text{x}\ 104\ \text{MU/wk}$$

NCRP 151 section 3.2.2 provides a thorough treatment of IMRT considerations [2]. **Table 7** provides examples of treatment parameters.

Table 7 Example Treatment Parameters

	Total Dose (Gy)	Fraction Dose (Gy)	Beam-On Time (min)	Field Width (mm)	Max. Possible/Avg. (leaf open time)
Prostate	70.0	2.0	2.5	2	30.6%
SRS Liver	40.0	8.0	7.9	25	53.7%
SBRT Lung	30	6.0	7.5	25	63.7%
Head & Neck	60.0	2.0	5. 0	25	30.4%
Breast / SC with SIB	50.4	1.8	6.5	25	55.6%

4.1.2 Primary, Leakage and Scatter Radiation Testing

Accuray determines the levels of primary, leakage, and scatter radiation from a representative Radixact System during both rotating and static beam delivery. We compared this comprehensive set of radiation measurement data to various leakage radiation related compliance tests and incorporated the standard leakage data obtained from every system we build. The results of this study are intended to provide qualified radiation physicists (shielding design experts) with the information needed tocalculate the shielding requirements at our customers' sites.

We used three different radiation measurement techniques to quantify primary, leakage and scatter radiation. The first method involved deploying National Voluntary Laboratory Accreditation Program (NVLAP) dosimetry at all locations of interest (**Figure 2**). We also obtained direct measurements, at select locations, using large-volume ion chambers. The third method of data collection involved the use of sensitive Optically Stimulated Luminescence Dosimetry (OSLD).

The data from all three measurement techniques were in close agreement but the NVLAP dosimetry (Radiation Detection Company; Code 82 TLD model XGBN) is considered the principal and official data set. All primary, leakage and scatterradiation values are presented as a percentage or fraction of the calibrated reference beam (850 mm SAD; 1 MU = 1 cGy; 50 mm x 400 mm field; 15 mm depth in virtual water).

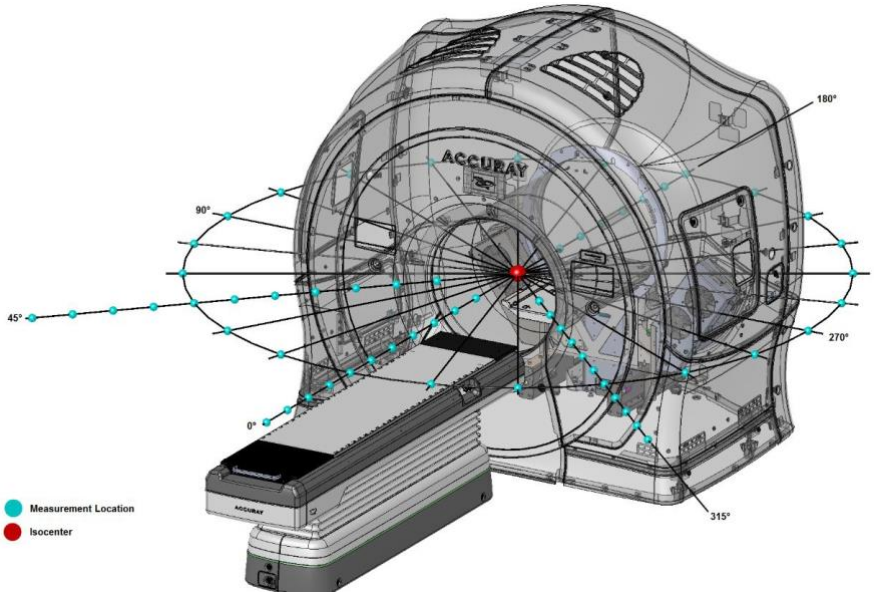


Figure 2 Measurement locations for leakage and scatter radiation within the horizontal plane

4.1.3 Leakage Radiation with Continuous Rotation

Leakage radiation was measured as a function of angle and distance from isocenter with thejaws and MLC closed while the gantry rotated at 3 rotations per minute (RPM) (20 second period). Data were collected using the three techniques outlined above at 56 locations of interest. The maximum observed %Gy/Gy values, 2 meters from isocenter, were at dosimeter positions between 60 to 105 degrees and 255 to 300 degrees (**Figure 2** and **Figure 3**)– near the plane of gantry rotation where primary beam transmission and head leakage are expected to be at a maximum. The leakage values at 2 meters from isocenter, within the plane of gantry rotation, did not exceed 2.7 x 10^{-3} %Gy/Gy or 2.7 x 10^{-5} as a fraction of the calibrated reference beam. **Table 8**, **Figure 3**, and **Figure 4** illustrate measurement locations and results.

4.1.4 Leakage and Maximum Scatter Radiation with Continuous Rotation

Leakage and maximum scatter radiation were measured as a function of angle and distancefrom isocenter with the jaws and MLC set to their maximum aperture (50 mm x 400 mm) while the gantry rotated at 3 RPM. A large, cylindrical solid water phantom (top half of the Radixact Commissioning Phantom [Virtual Water] which is 300 mm in diameter and 180 mm thick) was placed at isocenter to simulate patient scatter. Data were collected using the three techniques outlined above at 56 locations of interest. The maximum observed %Gy/Gy values, 2 meters from isocenter, were found at dosimeter positions between 30 to 75 degrees and 285 to 330 degrees (**Figure 2** and **Figure 3**). The leakage and maximum scatter values at 2 meters from isocenter did not exceed 1.0 x 10^{-2} %Gy/Gy (1/10,000th of the reference dose at isocenter; 1E-4). **Table 8**, **Figure 2**, and **Figure 3** provide greater details on measurement locations and results.

4.1.5 Leakage and Clinically Relevant Patient Scatter Radiation with Continuous Rotation

Leakage and clinically relevant scatter radiation were measured as a function of angle and distance from isocenter with the jaws and MLC configured to simulate an IMRT factor of 16 while the gantry rotated at 3 RPM.

With the Virtual Water phantom in the bore, data were collected using the three techniques outlined above at 24 locations of interest (2 meters from isocenter, within the horizontal plane, at 15-degree intervals). The maximum observed %Gy/Gy values, 2 meters from isocenter, were found at dosimeter positions between 30 to 105 degrees and 255 to 330 degrees (**Figure 2**, and **Figure 3**). While simulating an IMRT factor of 16, the maximum leakage and scatter values at 2 meters from isocenter did not exceed 3.4 x 10^{-3} %Gy/Gy. **Table 8**, **Figure 2**, and **Figure 3** provide greater details on measurement locations and results.

Table 8 %Gy/Gy values during continuous rotation for leakage and scatter radiation

Angle (degrees)	Distance (meters)	Leakage Only	Leakage & Clinically Relevant Scatter	Leakage & Maximum Scatter
0	2.0	8.3E-04	1.1E-03	4.5E-03
15	2.0	1.2E-03	1.6E-03	6.3E-03
30	2.0	1.6E-03	2.4E-03	7.6E-03
45	2.0	2.1E-03	2.7E-03	6.8E-03

Angle (degrees)	Distance (meters)	Leakage Only	Leakage & Clinically Relevant Scatter	Leakage & Maximum Scatter
60	2.0	2.7E-03	2.9E-03	9.7E-03
75	2.0	2.1E-03	2.9E-03	7.5E-03
90	2.0	2.2E-03	2.6E-03	3.1E-03
105	2.0	2.5E-03	2.6E-03	2.9E-03
120	2.0	2.1E-03	2.1E-03	2.5E-03
135	2.0	8.6E-04	9.0E-04	1.7E-03
150	2.0	5.2E-04	8.2E-04	3.8E-03
165	2.0	2.1E-04	6.6E-04	4.1E-03
180	2.0	1.8E-04	4.4E-04	2.6E-03
195	2.0	2.4E-04	6.1E-04	3.7E-03
210	2.0	5.5E-04	8.8E-04	3.6E-03
225	2.0	8.0E-04	8.1E-04	1.6E-03
240	2.0	2.2E-03	2.3E-03	2.5E-03
255	2.0	2.6E-03	2.6E-03	3.3E-03
270	2.0	2.2E-03	2.2E-03	3.1E-03
285	2.0	2.4E-03	2.7E-03	7.0E-03
300	2.0	2.6E-03	3.3E-03	8.4E-03
315	2.0	2.1E-03	2.6E-03	7.2E-03
330	2.0	1.9E-03	2.5E-03	7.4E-03
345	2.0	1.2E-03	1.5E-03	6.6E-03
0	1.0	2.7E-03	Not measured	2.1E-02
0	1.5	1.5E-03	Not measured	9.5E-03
0	2.0	8.3E-04	1.1E-03	4.5E-03
0	2.5	5.9E-04	Not measured	2.9E-03
0	3.0	4.7E-04	Not measured	2.2E-03
45	1.0	3.8E-03	Not measured	2.4E-02

Angle (degrees)	Distance (meters)	Leakage Only	Leakage & Clinically Relevant Scatter	Leakage & Maximum Scatter
45	1.5	3.0E-03	Not measured	1.2E-02
45	2.0	2.1E-03	2.7E-03	6.8E-03
45	2.5	1.4E-03	Not measured	4.5E-03
45	3.0	1.2E-03	Not measured	3.2E-03
180	1.0	3.3E-04	Not measured	1.5E-02
180	1.5	1.8E-04	Not measured	6.0E-03
180	2.0	1.8E-04	4.4E-04	2.6E-03
315	1.0	3.5E-03	Not measured	2.7E-02
315	1.5	3.1E-03	Not measured	1.2E-02
315	2.0	2.1E-03	2.6E-03	7.2E-03
315	2.5	1.3E-03	Not measured	4.8E-03
315	3.0	9.4E-04	Not measured	3.4E-03

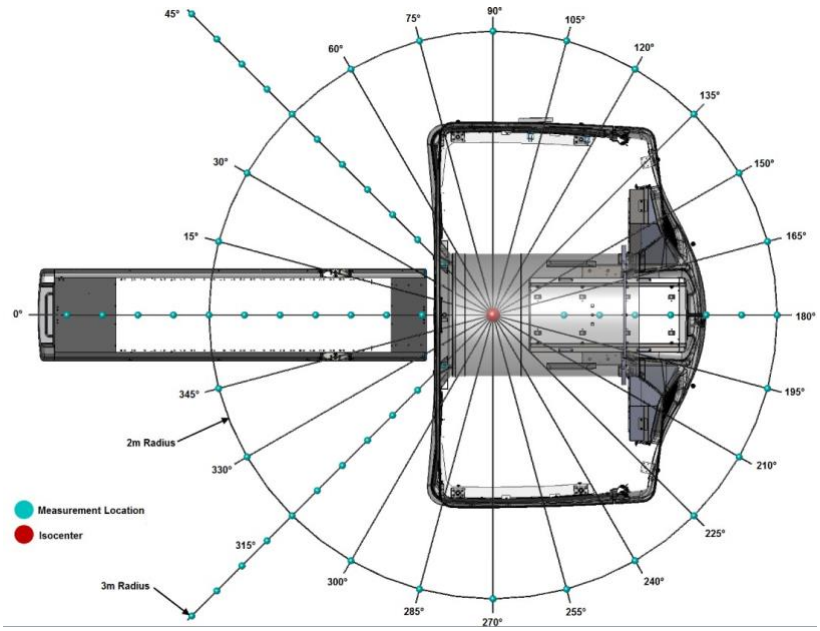


Figure 3 Top view of Radixact System with angles defined for leakage and patient scatter radiation testing within the horizontal plane (intersecting the isocenter).

4.1.6 Leakage radiation near the head area with a static gantry

Leakage radiation near the head area was measured as a function of angle and distance from the Bremsstrahlung target with the jaws and MLC closed. This trial was conducted with a non-rotating (static) gantry. Data were collected using the three techniques outlined above at 144 locations of interest. The maximum observed leakage values at 1 meter from the target did not exceed 3.6 x 10-2 %Gy/Gy. The average leakage value at 1 meter from the target was 7.0 x 10^{-3} %Gy/Gy. **Table 8** and **Figure 4** provide greater details on measurement locations and results.

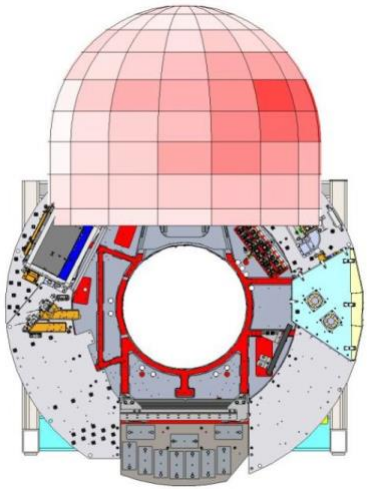


Figure 4 Front view of Radixact System with leakage radiation heat map corresponding to head area leakage only radiation measurements.

4.1.7 Primary Radiation Transmission through the Lead Beam Stop

Primary radiation transmission through the lead beam stop was measured with the jaws and MLC at their maximum aperture. We placed a large array of XGBN dosimeters (37 in total spanning an area of 125 mm x 800 mm) behind the beam stop (1689 mm from the Bremsstrahlung target). The maximum observed %Gy/Gy value was 8.2 x10^{-2}.

Table 9 %Gy/Gy values during continuous rotation for leakage and scatter radiation (the maximum observed values)

Primary Beam Stop Transmission			
Measurement ID	**Distance from Target**	**%Gy/Gy**	**%Gy/Gy @ 2 m**
Maximum Value	1689 mm	Max Value = 0.082	0.059
Anticipated %Gy/Gy with Rotating Gantry (Use Factor = 0.10)			0.0059

Head Leakage			
Measurement ID	**Distance from Target**	**%Gy/Gy**	**%Gy/Gy @ 2 m**
Maximum Value	1000 mm	0.036	0.009
Average Value (144 measurement points)	1000 mm	0.007	0.00175

4.1.8 Tenth Value Layers (TVLs)

The TVL for leakage radiation was previously measured using the standard measurement setup as described by Nelson and LaRiviere [3]. A cylindrical lead shield was used to reduce room scatter from contributing to the measurements. The leakage radiation TVL measured inordinary concrete (ρ = 2.35 g/cm^3) was 290 mm; TVL lead = 57 mm.

Similarly, the TVL for primary radiation was measured, but in this case the ion chamber was positioned beyond the lead beam stop. The primary radiation TVL measured in ordinary concrete (ρ = 2.35 g/cm^3) was 340 mm; TVL lead = 57 mm.

4.1.9 Discussion and Recommendations

Leakage only radiation (jaws and MLC closed; no solid water phantom) was at a maximum near the plane of gantry rotation. Primary radiation transmission through the lead beam stop,when modified for gantry rotation (Use factor = 0.10), was negligible compared to head leakage values. We conservatively estimate that the primary beam stop reduces transmission by 10^{-3} at isocenter. Leakage and full scatter radiation at two meters from isocenter, in the horizontal plane, is at a maximum at +/- 60 degrees from the couch centerline (60 and 300 degrees). However, the full scatter conditions used during this study with an isocenter beam projection of 5 x 40 cm^2 is not clinically relevant.

Considering that head leakage and primary beam stop transmission were contributing to leakage and scatter radiation measurements when the jaws and MLC were set to simulate a clinically relevant IMRT factor of 16, the angular specific leakage values listed in **Table 10** are most appropriate for determining therapy vault shielded barrier thickness requirements. The values in **Table 10** have been adjusted upward by 10% to account for measurement uncertainty and potential system variances. The leakage and scatter fractions at 1 meter from isocenter (listed in **Table 10**) were calculated using the inverse square law and are basedon the leakage and scatter fraction values measured at two meters. The inverse square law applies to Radixact System at distances applicable to therapy vault shielding design (dose points > 3.0 meters from isocenter). See example equations and calculations on page 27.

Additional conservatism will be achieved by applying the “two source rule” or “add HVL rule” that is applicable when the calculated, required barrier thickness is comparable among twoor more sources of radiation (primary, scatter and/or leakage).

Table 10 Fraction (not percentage) of secondary radiation (relative to calibrated reference beam) for various room angles and radial distances that are most applicable to therapy vault shielding design.

Angle (degrees)	Leakage Radiation Only @ 1 m	Leakage & Clinically Relevant Scatter @ 1 m	Clinically Relevant Scatter Only @ 1 m
0	3.63E-05	4.98E-05	1.35E-05
15	5.25E-05	6.88E-05	1.63E-05
30	7.12E-05	1.06E-04	3.45E-05
45	9.08E-05	1.20E-04	2.92E-05
60	1.17E-04	1.27E-04	9.67E-06
75	9.38E-05	1.29E-04	3.49E-05
90	9.46E-05	1.13E-04	1.84E-05
105	1.11E-04	1.15E-04	4.18E-06
120	9.28E-05	9.40E-05	1.23E-06
135	3.80E-05	3.95E-05	1.53E-06
150	2.27E-05	3.59E-05	1.32E-05
165	9.43E-06	2.90E-05	1.96E-05
180	8.03E-06	1.96E-05	1.15E-05
195	1.07E-05	2.70E-05	1.63E-05
210	2.44E-05	3.87E-05	1.43E-05
225	3.53E-05	3.55E-05	1.27E-07
240	9.80E-05	1.02E-04	3.76E-06
255	1.16E-04	1.14E-04	1.00E-07
270	9.88E-05	9.87E-05	1.00E-07
285	1.03E-04	1.19E-04	1.57E-05
300	1.14E-04	1.47E-04	3.26E-05
315	9.14E-05	1.13E-04	2.18E-05
330	8.48E-05	1.08E-04	2.32E-05
345	5.41E-05	6.69E-05	1.28E-05

4.1.10 Sample Equations and Calculations (at 90º) for Barrier Thickness Requirements

B_{scat} (scatter) = (P * d^2) / (Ψ * W_L * T)

B_{leak} (leakage) = (P * d^2) / (Ψ * W_L * T)

B_{pri} = (P * d^2) / (W_{pri} * BSR * U * T)

n(TVL) = - log (B)

B = Barrier Transmission Factor for leakage, scatter or primary radiation: B_{leak}; B_{scat}; B_{pri}

Ψ = Radixact System angular specific leakage or scatter fraction at 1 m (**Table 10**)

Note: Ψ_{scat} is clinically relevant scatter and incorporates a modulation factor of 16 MU/cGy; therefore, the leakage workload (W_L) is appropriate.

$W_L = 1.02 \times 10^4$ Gy/wk

$W_{pri} = 4.59 \times 10^2$ Gy/wk (IMRT Factor = 16; adjusted to 1m)

P = 1×10^{-4} Sv/wk (controlled or restricted area, non-public)

d = distance from isocenter to a dose point of concern

U = use factor to account for primary beam workload directed at a given barrier

T = occupancy factor (adjacent vault = 1/2)

BSR = Beam Stop Reduction Factor at isocenter (1×10^{-3})

n(TVL) = the number of tenth value layers required

Assuming a dose point of interest located 4 m from isocenter in an adjacent vault 90º;

$\Psi_{leak} = 9.46 \times 10^{-5}$; $\Psi_{scat} = 1.84 \times 10^{-5}$; U = 0.10; T = 0.5; P = 1×10^{-4} Sv/wk

B_{Leak} = (P * d^2) / (Ψ_{leak} * W_L * T) = 0.00332 => nTVL = **2.48**

B_{scat} = (P * d^2) / (Ψ_{scat} * W_L * T) = 0.017 => nTVL = **1.76**

B_{pri} = (P * d^2) / (W_{pri} * BSR * U * T) = 0.070 => nTVL = **1.16**

4.1.11 References

1. Balog, J., et al. Multileaf collimator interleaf transmission. Med Phys., 26 (2), 1999.
2. National Council on Radiation Protection and Measurements, 2005. NCRP 151: Structural shielding design and evaluation for megavoltage x- and gamma-ray radiotherapy facilities (Bethesda, MD: National Council on Radiation Protection and Measurements).
3. Nelson, W.R. and P.D. LaRiviere. Primary and leakage radiation calculations at 6, 10, and 25 MeV. Health Phys. 47 (6), 811-18, 1984.

4.1.12 Other Shielding Consideration

During Schematic Development for the Radixact System, consideration should be taken of the proximity to Magnetic Resonance Imaging (MRI) units and other magnetic field generating equipment. Magnetic fields in the proximity of the Radixact System may impact the beam steering of electron accelerators. The Radixact System shall not be installed in any location where the magnetic field can be greater than 100 µT (1 Gauss) in any orientation.

5.0 Room Specifications

5.1 Treatment Room

Figure 5 Reference picture for room dimensions

5.1.1 Floor Space

Recommended: The recommended dimensions for the treatment room are 25 ft long (B) x 17 ft wide (C) (7.6m x 5.2 m) between the finished walls. If you are including an equipment roomfor the PDU behind the vault, please add a minimum of 5 ft in length (1.5 m) but the PDU cannot exceed 35 ft (10.7 m) from the back of the gantry. The recommended dimensions will provide ample space for sink, countertops, and storage cabinets. Facility design to ensure adequate access and clearances around the Radixact couch for patient beds. Do not use floor covering that produces static electricity to cover the floors in the Treatment Vault. Selectan ion-resistant, antistatic carpet or a carpet treated with an anti-static solution.

Minimum: The minimum dimensions for the treatment room are 19 ft - 9 in long (B) x 15 ft - 2 in wide (C) (6.02 m x 4.62 m) between the finished walls.

5.1.2 Ceiling Cap Height

Recommended: 9 ft 10 in (3 m) or greater between finished floor and rough ceiling cap (whether concrete or steel). This is the absolute minimum dimension acceptable to allow for HVAC, lighting, etc. between the finished ceiling and the ceiling cap.

Finished Ceiling Height: Minimum ceiling height over the Radixact System gantry is 9 ft - 0 in (2700 mm) (A) height between the finished floor and finished ceiling.

5.1.3 Minimum Door Clearance

The required rigging clearances for installation are:

Minimum Clearances: 4 ft (1220 mm) wide x 7 ft (2082 mm) tall for rigging on wheels (standard option), at least 8 ft (2130 mm) tall for rigging on skates (depending on the skate design)

5.1.4 Recommended Equipment Orientation within the Treatment Room

Your Accuray Project Manager or Accuray Distributor Project Manager will help to determinethe optimal orientation for your Radixact System based on:

- Ease of patient loading
- Exact system configuration
- System clearances
- Shielding considerations
- Ease of access to sinks and cabinets
- Customer preferences

5.2 Control Room

5.2.1 Recommended Floor Space

150 square ft (14 m^2) will provide adequate counter space for at least 2 people and 3 to 4 workstations. This room should be large enough to easily accommodate 4 to 5 people during training and go-live activities. Do not use floor covering that produces static electricity to cover the floors in the Control Room. Select an ion-resistant, antistatic carpet or a carpet treated with an anti-static solution.

5.2.2 Recommended Location

The Control Room should be located within view of the Treatment Room door and should be designed in accordance with the facility private healthcare information policy and local healthcare informant privacy regulations. Cable lengths to the Treatment vault will limit the distance. Note: Refer to the site-specific drawings for actual distances.

5.2.3 Minimum Door Clearance

Standard door clearances are acceptable for moving equipment into the Control Room.

NOTE: If the Mechanical Room is located off of the Control Room, the door into the Control Room must meet the same minimum door clearance as the Mechanical Room to accommodate the designated equipment.

5.3 iDMS Data Management System Server Room

5.3.1 Recommended Floor Space

45 square feet (4.2 m^2).

5.3.2 Fixed Rule about Floor Space

Additional floor space must be built into the iDMS System Server Room for any customer-supplied equipment such as power conditioners (voltage stabilizers), floor mounted air conditioning units, data and server equipment, phone equipment, storage cabinets, etc.

Service access and regulatory requirements must be considered when planning for adequate space around each piece of Accuray or customer-supplied equipment.

5.3.3 Recommended Location

The iDMS System Server Rack can be located anywhere in the facility. Refer to the *Network System Requirements* document for maximum cable length between the iDMS System and the Treatment Delivery Console (TDC) and Accuray Precision System.

5.3.4 Minimum Finished Ceiling Clearance

7 ft (2134 mm) between finished floor and finished ceiling.

5.3.5 Minimum Door Clearance

3 ft wide x 7 ft high (900 x 2134 mm) for rigging the equipment into the iDMS System Room, door clearances for the rig path need to be 82 to 83 inches, the United States standard measurement.

NOTE: The iDMS System Server Room door(s) must be secure, ensuring that the room cannot be accessed during treatment by anyone other than trained operators.

5.4 Mechanical Room

5.4.1 Recommended Floor Space

160 square feet (15 m^2)

5.4.2 Fixed Rule about Floor Space

Additional floor space must be built into the Mechanical Room for any customer-supplied equipment such as transformers, power conditioners (voltage stabilizers), floor mounted air conditioning units, data and server equipment, phone equipment, storage cabinets, etc.

Service access and regulatory requirements must be considered when planning for adequate space around each piece of Accuray or customer-supplied equipment.

5.4.3 Recommended Location

The mechanical room should be located near the treatment vault.

5.4.4 Minimum Finished Ceiling Clearance

7 ft (2.135 m) between finished floor and finished ceiling.

5.4.5 Minimum Door Clearance

3 ft wide x 7 ft high (914 x 2134 mm) for rigging the equipment into the Mechanical Room, door clearances for the rig path need to be the United States standard measurement of 82–83 in.

NOTE: The Mechanical Room door(s) must be secure, ensuring that the room cannot be accessed during treatment by anyone other than trained operators.

5.5 Accuray Precision System Room(s)

5.5.1 Recommended Floor Space

Insure enough workspace for two or more workstations and a desktop color laser printer. Accuray will attempt to show the exact number of purchased workstations on the customer site-specific drawings. Otherwise, we will show a generic workspace. Contact your Accuray Project Manager for additional information.

5.5.2 Recommended Location

The Accuray Precision System can be located anywhere in the facility. The distance between the Accuray Precision System and the iDMS System will determine which network cabling option is required. See the Network System Requirements for more information.

5.5.3 Minimum Door Clearance

Standard door clearances are acceptable for moving equipment into the Accuray Precision System.

5.6 Sample Drawings

The following two illustrations show two typical floor plan layouts. For a complete package of sample drawings and design details, please contact your Accuray Regional Project Manager.

Legend

A = Treatment Room (vault)

B = Treatment Delivery Console

C= iDMS System Room

D = Accuray Precision System Room

E = Mechanical Room

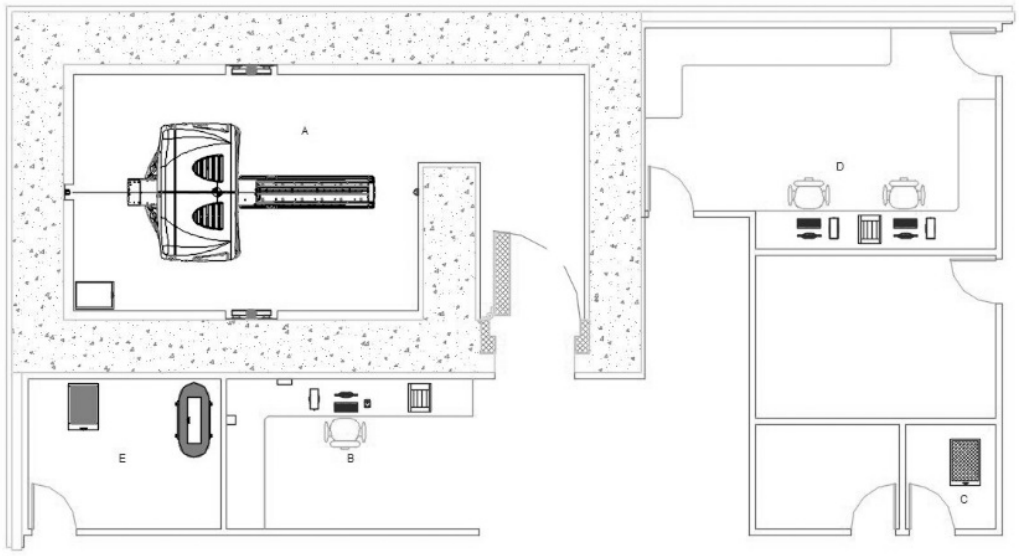


Figure 6 Typical Radixact System Floor Plan with Maze Walkway

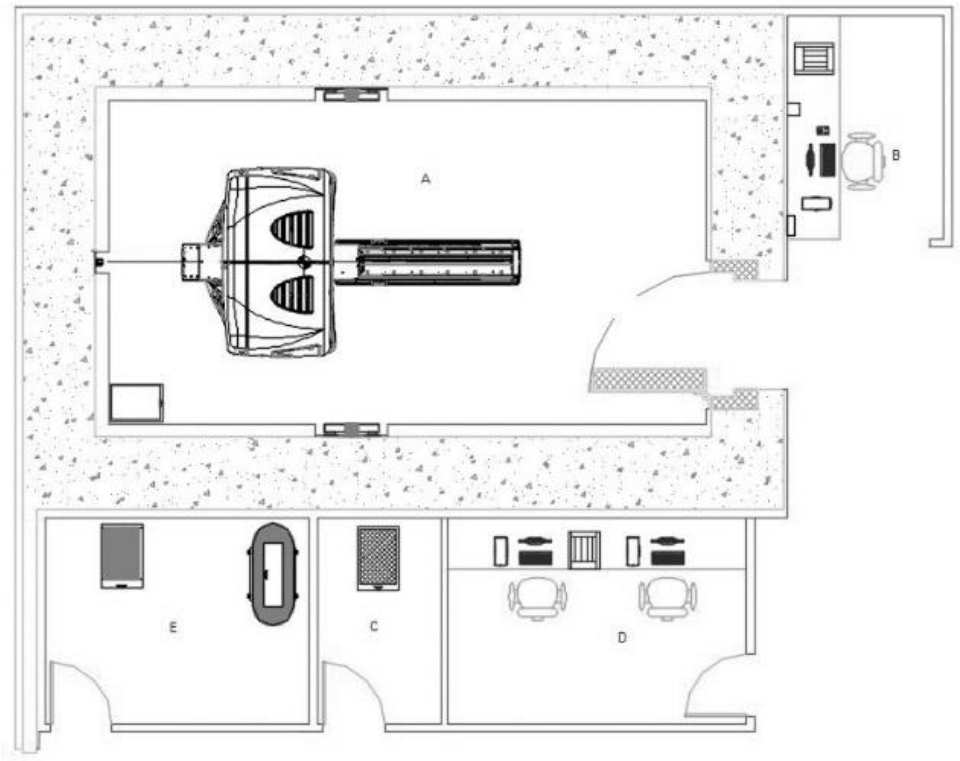


Figure 7 Typical Radixact System Floor Plan without Maze Walkway

6.0 Electrical and Environmental Requirements

6.1 Electrical Requirements

6.1.1 Power Monitoring Expectations

- New customers are responsible for initiating a power monitoring study to understand existing power conditions.
- Accuray will provide a power monitoring study for Trade In-Trade Up (TITU) customers on a service contract (US Only).
- The Customer's electrical engineer will evaluate the power monitoring results and the decision related to the purchase of a power conditioner/ Uninterrupted Power Source (UPS). The customer is responsible for the maintenance of that equipment.
- During planning and project execution, the Accuray Project Manager will schedule a dedicated site-specific environmental meeting.

6.1.2 Facility-Supplied and Installed Equipment

The table below lists the electrical equipment that the facility must supply and install.

Table 11 Facility-Supplied Equipment

Equipment	Specifications	Installed by
Main Disconnect Panel for incoming power	Shunt trip breaker required. If the main disconnect cannot be placed at the Control Room, contact the Accuray Project Manager to review alternatives. Refer to table 13 to establish disconnect breaker settings.	Facility
Emergency Off and Emergency Stop Buttons	Push to operate, twist to reset.	Facility
Door/Entrance Switch	Local regulations/facility requirements.	Facility
System Status Indicators (System Power On, Room Ready, Radiation On, Standby).	Incandescent bulbs, 40 to 200 W fluorescent bulbs, fluorescent lamp with electronic or inductive ballast, or auditory indicators. NOTE: Some LED displays may not function correctly with solid state relays. Check with manufacturer of LED display before purchasing.	Facility
Thermostats	2°F /1°C response	Facility
Temperature Sensors	Alarm activated if iDMSTM System room temperature exceeds 68°F (20°C).	Facility
Junction Boxes and Receptacles	Local regulations/facility requirements.	Facility
Power and Signal Conduits	Local regulations/facility requirements.	Facility
Electrical Trenches	Local regulations/facility requirements.	Facility
Lighting	Local regulations/facility requirements.	Facility
Fire Safety Equipment	Local regulations/facility requirements.	Facility
Emergency Power System (optional)	Configured to meet system power requirements.	Facility
Power Conditioner (optional)	Double conversion configured to meet system power requirements.	Facility

Equipment	Specifications	Installed by
Physics Conduit	Local regulations/facility requirements.	Facility
Closed-Circuit TV Cameras	Local regulations/facility requirements.	Facility
Facility Supplemental Air Relay	Zero cross relay	Facility

6.1.3 Incoming Electrical

The Accuray-supplied Power Distribution Unit (PDU) supplies power to components in the Treatment Vault and the Control Room. Power must be derived directly from a main distribution panel and be dedicated to the Radixact System. Any peripheral devices must bepowered directly by facility power and not through the PDU; for example:

- Accuray-supplied printers
- Lasers
- The Accuray Precision System workstation components
- Any facility-supplied devices such as cameras, viewing monitors, and system- status indicators.

Table 12 Power source for Radixact System and facility-supplied components

Equipment	PDU Power	Facility Power
Power Distribution Unit (PDU)		X
Gantry and Patient Table	X	
Control Room computer components (exceptprinter)	X	
Accuray Precision workstation components		X
Apollo Lasers (2)		X
*iDMS™ System Rack		X
Dorado Lasers (5)		X
Accuray-supplied printers		X
Facility-supplied Door Interlock switch	N/A Low-voltage signal	N/A
Facility-supplied System Status Indicators		X

Equipment	PDU Power	Facility Power
Facility-supplied CCTV		X
Facility-supplied Viewing Monitors		X
Facility-supplied Power Conditioner(Optional)		X
NEIS (Noise Eliminating Intercom System)		X
VitalHold		X

6.1.4 Input Power Requirements

Table 13 Input Power Requirements

	Requirements
Power Factor	0.90 at maximum level
Power Rating	50 kVA maximum
Grounding Conductor	For all routings, dedicated earth ground (conductor) should be at least the same size as the power wires. Do not use electrical conduits or electrical raceways as the sole grounding conductors. Add a ground electrode to the PDU.
Transformers	Locate power conditioners, step-down transformers or isolation transformers close to the Treatment Vault.
Conduit	Do not locate electrical conduit or junction boxes under the gantry or patient table anchor locations.
Lighting	Ensure that all lighting fixtures remain outside of the equipment service areas.
Emergency Power	Emergency power supply is not required for the Radixact System. If you do establish an emergency power supply, use the same power requirements that are specified for the PDU. Also, provide emergency power for all HVAC systems that support the Radixact System. It is critical that room temperature be maintained when operating the Radixact System. If facility power is lost, there will be an interruption in voltage during transfer to emergency power and, therefore, an interruption in treatment.

Table 14 PDU Power Requirements

<table>
<tr><th></th><th>Power</th></tr>
<tr><td>Input Frequency</td><td>50 +/- or 60 +/- 1 Hz</td></tr>
<tr><td>Nominal Input Voltage</td><td>480 VAC line voltage, 3 Phase Delta Configuration. Other voltages allowed with approval:380, 400, 415, 440, 460 VAC.
Unloaded Voltage Range: +5% nominal voltage with no load
Loaded Voltage Range: +/-5% nominal voltage at full load
NOTE: PDU trips at +/- 10% of nominal voltage to protect system components</td></tr>
<tr><td>Input PowerCable</td><td>4 AWG (25 mm^2) wire per phase and 4 AWG (25 mm^2) wire for ground, minimum. Use thesame size as the phase conductors. Rated for 194°F (90°C) The PDU accepts up to #2/0 AWG (70 mm^2) Encase incoming power in a 2” diameter (50 mm maximum) connector to the face of the PDU. The facility-contracted electrician must provide separation by means of flexible conduit within the PDU junction box for exposed wire. The input wire gauge should be sized for voltages/currents shown in table below and meet local codes.</td></tr>
<tr><td>Phase Balance</td><td>Phase voltages balanced within 2%</td></tr>
<tr><td>Main Circuit Breaker or Disconnect</td><td>Reference the table below for the PDU main circuit breaker (CB1) settings for a given facilityinput voltage.
<table>
<tr><th></th><th colspan="3">Circuit breaker CB1 settings</th></tr>
<tr><th>Input Voltage</th><th>Ir (Amps)</th><th>tLD (s)</th><th>ISD (x Ir)</th></tr>
<tr><td>380 VAC</td><td>"H" 100 A</td><td>"2"</td><td>"2"</td></tr>
<tr><td>400 VAC</td><td>"G" 90 A</td><td>"2"</td><td>"2"</td></tr>
<tr><td>415 VAC</td><td>"G" 90 A</td><td>"2"</td><td>"2"</td></tr>
<tr><td>440 VAC</td><td>"G" 90 A</td><td>"2"</td><td>"2"</td></tr>
<tr><td>460 VAC</td><td>"F" 80 A</td><td>"2"</td><td>"2"</td></tr>
<tr><td>480 VAC</td><td>"F" 80 A</td><td>"2"</td><td>"2"</td></tr>
</table></td></tr>
<tr><td>Grounding Input Conductors</td><td>The local ground should have an earth ground conducted impedance of 25 Ohms or less. Use dedicated safety grounds that are not used for grounding any functional currents from other equipment. Wiring must comply with local and national codes for safety ground conductors. The PDU requires a local grounding electrode for optimal equipment performance. Use building steel, metal water pipe, or grounding rod. If waterpipe is used, it must have ground exposure for a minimum of 10 ft (3.05 m).
Important: Do not use any pipe related to gas supplies as a grounding electrode.</td></tr>
</table>

6.1.5 Treatment Room Component Minimum Power Recommendations

Table 15 Treatment Room Components Minimum Power Requirements

Component	Power	Power Supplied by
Gantry	400 VAC, 3-phase	Accuray PDU
Patient Table	230 VAC, 3-phase	Accuray PDU
Power Distribution Unit (PDU)	See Table 14	Facility
Apollo Lasers	North America: 120 VAC, 1 phase International: 240 VAC, 1 phase	Facility
Dorado Lasers	North America: 120 VAC, 1 phase International: 240 VAC, 1 phase. Facilitymust provide over- current protection	Facility
System Status Indicators (System Power On, Room Ready, Radiation On, and Standby)	8A maximum 50/60 Hz, 48-240 VACFacility must provide over-current protection for all three indicator outputs.	Facility
Facility Supplemental Air Relay	Coil: 50/60 Hz, 24-240 VAC	Facility
VitalHold	(3 duplex outlets) 120-240 VAC / min 6 amp (3 single) 120-240 VAC / 6 amp at Workstation	Facility

6.1.6 iDMS and/or Standby iDMS System Room Component Minimum Power Recommendations

Table 16 iDMS and/or Standby iDMS System Room Component Minimum Power Requirements

Component	Facility-Supplied Power/ Rated Component Power
Cluster rack circuit 1	200-240 VAC, 20 A, 50/60 Hz
Cluster rack circuit 2	200-240 VAC, 20 A, 50/60 Hz

6.1.7 Conduits

Power cables must be separated from signal cable. Install dedicated conduits from the PDU to the Radixact System components. Due to the complexity and variety of requirements of local, state, and country electrical codes, facility-employed electrical contractors must determine the size of input conduit andthe actual layout of embedded electrical conduits that meet both code requirements and Accuray specifications.

6.1.8 Component Minimum Power Recommendations

Table 17 System Wiring

Wiring from	Wiring to	Details
Power and Signal Conduits	Main Bunker Ground	
Facility-supplied System Status Indicators (System Power On, Room Ready, Radiation On and Standby)	PDU junction box	Must meet local regulations. (24-10 AWG) Accuray recommends that facility wires be comprised of insulated conductors with an overall cable jacket. Do not use or coil excessive cable length to avoid introducing noise that could interfere with the SSI signals. Label the wire ends accordingly: System Power On, Room Ready, and Radiation On. Pull the wires to the front of the PDU via the electrical trench. Accuray will make the connection to the PDU.
Facility-supplied zero cross relay coil reference	PDU Junction Box	240 V, 10 A (PDU Relay Rating) Must meet local regulations. (24-10 AWG) Accuray recommends that facility wires be comprised of insulated conductors with an overall cable jacket. Do not use or coil excessive cable length to avoid introducing noise that could interfere with the SSI signals. Label the wire ends accordingly: Facility Temperature Control Relay. Pull the wires to the front of the PDU via the electrical trench. Accuray will make the connection to the PDU.
Door/EntranceInterlock	PDU	24 VDC, 3 A For safe machine operation and compliancewith local regulations, install a normally open switch. Use minimum 20 AWG (0.5 mm2) shielded, twisted-pair wire or wire specified by local regulations. Pull the wire back to thePDU junction box. Accuray will make the final connection.

Wiring from	Wiring to	Details
Power for Dorado & Apollo Lasers	Facility power	110/240 VAC, 20 A (Dorado Laser Rating) Use 14 AWG (2.5 mm2) wire in a line / neutral / ground configuration. Lasers wired in parallel to the JB3 ceiling junction box, then wired in series from this box to the PDU. This is a series parallel circuit. The Dorado Lasers are switched by the PDU. Apollo Laser Rating 110/240 VAC 15 A. Switched by facility switch on wall.
Emergency Stop Buttons	PDU	Set the switch in the normally closed position. Use twist-to-reset style, wired in series. 24VDC, 3A. Use minimum 20 AWG (0.5 mm2) shielded, twisted-pair wire or gauge specified by local regulations. Pull the end wire back to the PDU junction box. Accuray will make the final connection.
Emergency Off Button	Shunt trip breaker in Main Disconnect	
VitalHold	Facility Power	VitalHold Workstation: 2 power outlets, minimum 10 amp Control Room monitor location: 3 power outlets, minimum 6 amp Treatment Room monitor location: 3 power outlets, minimum 6 amp Treatment Room ceiling: 3- Duplex power outlets, 120-240 VAC min 6 amp

6.1.9 Lighting

Install lighting outside the service clearance areas. Ensure that lighting is operational beforethe system is installed. Accuray recommends:

- Fixtures which are flush with the finished ceiling.
- A combination of incandescent and fluorescent lighting.
- Dimmers to control light levels at the Control Room and in the Treatment Vault.

6.2 Environmental Requirements

6.2.1 Facility-Supplied Items

The table below lists the mechanical equipment that the facility must supply and install.

Table 18 Facility-Supplied Equipment

Equipment	Specifications	Installed by
Treatment Vault HVACequipment	Capable of cooling to 68-75°F (20-24°C).	Facility
iDMS System Room HVAC equipment	Capable of cooling to 68°F (20°C).	Facility
Remote temperature-monitoring system or temperature alarm	Alarm activated if iDMS™ System roomtemperature exceeds 68°F (20°C).	Facility
Air Compressor, tank, and dryer	See specifications below.	Facility
Fire Safety Equipment	Local regulations/facility requirements	Facility
Floor Pit Moisture Sensor	Sensor: Comply with local regulations/facility requirements	Facility

6.2.2 Treatment Room HVAC

A dedicated Heating Ventilation and Air Conditioning (HVAC) system is required to maintainthe environmental specifications. An acceptable alternative would be to dedicate a separate zone on the facility HVAC system. Environmental specifications to be maintained 24/7.

Table 19 Treatment Room environmental requirements

	Environmental Requirements
Heat output	51228 BTU/h (15 kW) (sensible only)
Room Temperature	68-75°F (20-24°C)
Relative Humidity	30-60%, non-condensing
Supply Air Temperature (maximum)	55°F (12.8°C)
Air Cleanliness	Hydrogen sulfide (H2S) < 3 ppb; Sulfur dioxide, sulfur trioxide (SO2, SO3) < 10 ppb

Note: Of the 51,228 BTU/h (15 kW) heat output in the Treatment Vault, the gantry generates up to 48,837 BTU/h (14.3 kW) and the PDU generates up to 2391 BTU/h (0.7 kW). If you place the PDU in an equipment room that is separate from the Treatment Vault, consider the heat output of all components in that room, including the added heat output of the PDU, when determining cooling needs. These numbers only represent the sensible heat load, and additional margins must be accommodated in the calculations to satisfy additional latent heat loads that are largely dependent on HVAC system losses and the ambient humidity for that geographic location. Installations including UPS or Power Conditioner equipment must include that additional heat load in HVAC requirements for UPS or Power Conditioner location.

6.2.3 Thermostat Location

Install a dedicated thermostat behind the machine isocenter on the wall and 5 ft (1530 mm) above the finished floor as per the site drawings.

The thermostat should have a 2°F/1°C response range.

6.2.4 Return Air Duct

Install two or more return-air vents above the patient table. Air vents should be placed approximately 4 to 5 ft (1 to 2 meters) from the machine isocenter. If installing Synchrony or VitalHold, place vents and ducts around those mounting locations.

6.2.5 Gantry Supply Air

Provide dedicated cooling unit if possible. Install three supply-air vents behind the gantry forthe cooling air intakes. Supply 95% of the coldest air (preferably 55°F / 12.8°C) to the cooling air intakes. Provide a separate thermostat for gantry supply air.

6.2.6 Vault Supply Air

For patient comfort, provide patient side supply-air vents from the facility HVAC system. Provide a separate thermostat if for vault supply air.

6.2.7 Supplemental Air

Facility to provide 55°F (12.8°C) supplemental air flow greater than 264 CFM (449 m3/h). Install an under-slab 12 in x 10 in (305 mm x 200 mm) air duct or 12 in (305 mm) round (or equivalent minimum cross-sectional area) PVC duct to the underside of the gantry covers.

Route the duct under the slab and terminate no more than 2 in (50 mm) total height above the finished floor 2 ft- 5 in (736 mm) from isocenter (see M-101 of the Accuray site-specific drawings).

Leave open the exposed portion of the air duct under the gantry covers and include a debris screen. Facility to provide a relay from Supplemental Air Unit back to the PDU Junction Box to turn on/off the air. A damper placed on the duct is another acceptable solution. See site- specific drawings for further information.

6.2.8 Facility Standby

The standby power relay will interface with the facility supplemental cooling unit, which supplies cool air underneath the Radixact system covers. The added relay will enable the Radixact System to shut off this cool air supply while the system is not in operation. The new relay cabling will interface with the Radixact Power Distribution Unit (PDU). See site-specificdrawings for further information.

6.2.9 Treatment Room HVAC Design Summary

The Radixact System gantry is air cooled. It has two air intakes at the backside of the gantry built into the cosmetic covers. The cooling air is supplied to the rear of the gantry through (quantity 3) ceiling mounted vertical discharge supply grilles.

The supplied cooling enters the gantry intake grilles, cools the equipment, and then is discharged from the top of the gantry through two built-in grilles, towards the ceiling return diffusers. The location of the return grilles is important as it's critical to not allow the discharged air to re-circulate to the intakes at the rear of the gantry.

The gantry discharges approximately 2028 cfm (3446 m^3/h) (the gantry pulls in 1764 cfm (2997 m^3/h) of room air plus a minimum of 264 cfm (449 m^3/h) of supplemental air delivered at the bottom of the gantry) so it's critical to supply the quantity of cooling outlined above. Additional cooling and flow may be required to support UPS or Power Conditioner installations at the location of the UPS or PC equipment. The actual required air volume is to be calculated by the customer's HVAC engineer.

The Air Handle Unit (AHU) that supplies cooling to the gantry should be on a dedicated thermostat separate from the vault supply thermostat. The recommended location of the thermostat is described above as well as contained on the Accuray site-specific drawings.

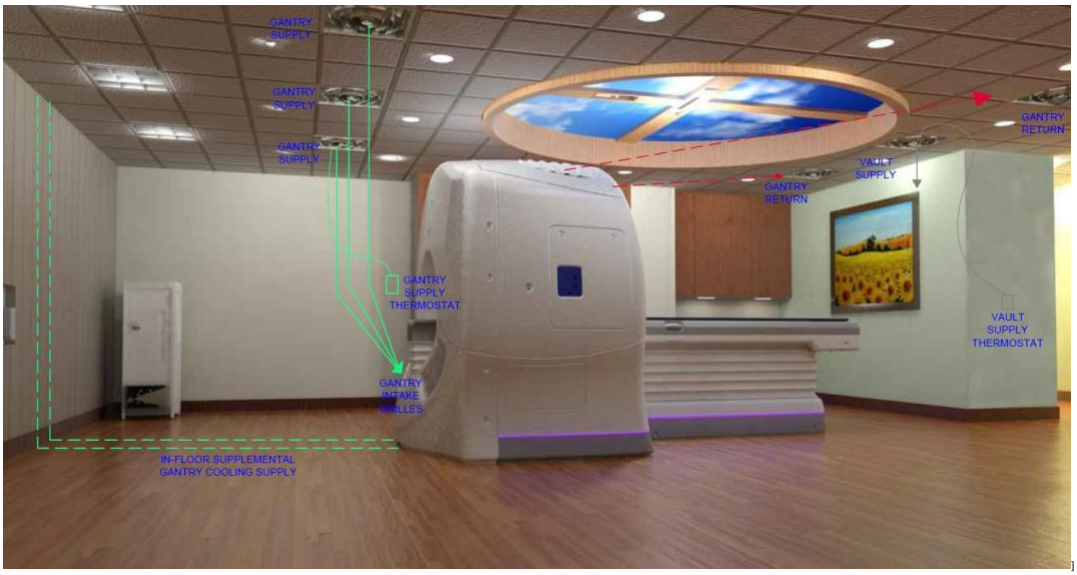


Figure 8 Radixact System Gantry HVAC Schematic

6.2.10 Control Room

There are no special environmental requirements with regards to the Radixact System in the Control Room.

6.2.11 iDMS System Server Room

Place the iDMS System Server components in a dedicated room that can be independently temperature-controlled. The iDMS System components generate an average combined heat output of 18,000 BTU/h ((5.28 kW) sensible only). Install a dedicated HVAC system on a 24-hour operation with emergency power backup. Install a thermostat with 2°F /1°C response range within 4 ft (1220 mm) of the iDMS System Rack if the requirements cannot be met shown in **Table 20**.

Table 20 Server Room environmental requirements (Primary or Standby)

	Environmental Requirements
Heat output	18,000 BTU/h (5.3 kW) (sensible)
Room Temperature	68°F (20°C) or cooler
Relative Humidity	30-60%, non-condensing
Supply Air Temperature(maximum)	53°F (12°C)

NOTE: These numbers only represent the sensible heat load, and additional margins must be accommodated in the calculations to satisfy additional latent heat loads that are largely dependent on HVAC system losses and the ambient humidity for that geographic location.

6.2.12 Remote Monitoring

Install a remote temperature-monitoring system or temperature-activated alarm. If the iDMS System room becomes overheated, you will have less than two hours to performa controlled shut down of the Radixact System. A temperature-monitoring system will alert you and allow you to respond quickly to overheating. Mechanical Room

The Mechanical Room houses the oil-free air compressor, air tank, dryer, and filter. For 50-Hz sites, it also holds the Power Conditioner if being used. The Mechanical Room should include an acoustical barrier due to noise generated by the equipment if located near patient areas.

6.2.13 Accuray Precision System Room(s)

There are no special environmental requirements with regards to the Accuray Precision workstation in the Accuray Precision System room.

7.0 Other System Implementation Considerations

7.1 Synchrony Respiratory Tracking System

Description: The Synchrony Camera is used to track, detect and correct for respiratory motion. It is attached to a strut mounted to the vault ceiling near the foot of the treatment couch or to a wall bracket if there is a wall close to the foot of the couch. The camera should be centered on the long axis of the couch.

7.1.1 Synchrony Mounting Options

Description: The camera mount is supplied by Accuray and installed by contractor. The preferred method is a single vertical strut 12'-8" (3868 mm) from Iso-Center to a mounting base attached to the ceiling. A wall mount option is also available if there is a wall at the foot end of the couch that is not more than 13’-6” (4108mm) from iso-center. If the wall is slightly beyond this distance, the customer may choose to add additional structure to the wall to close the gap or use the ceiling mounting option. The Synchrony ceiling mount system consists of several linkages, struts and mounting bases provided by Accuray and is intended to accommodate different ceiling constructions and overhead equipment.

Site planning considerations: The camera requires one cable to be routed to the back of the gantry. The cable is 28 meters in length and has a maximum diameter of 12 mm. The cable is plenum rated. A junction box or conduit or other cosmetic cover is recommended near the mounting plate to route the cable into.

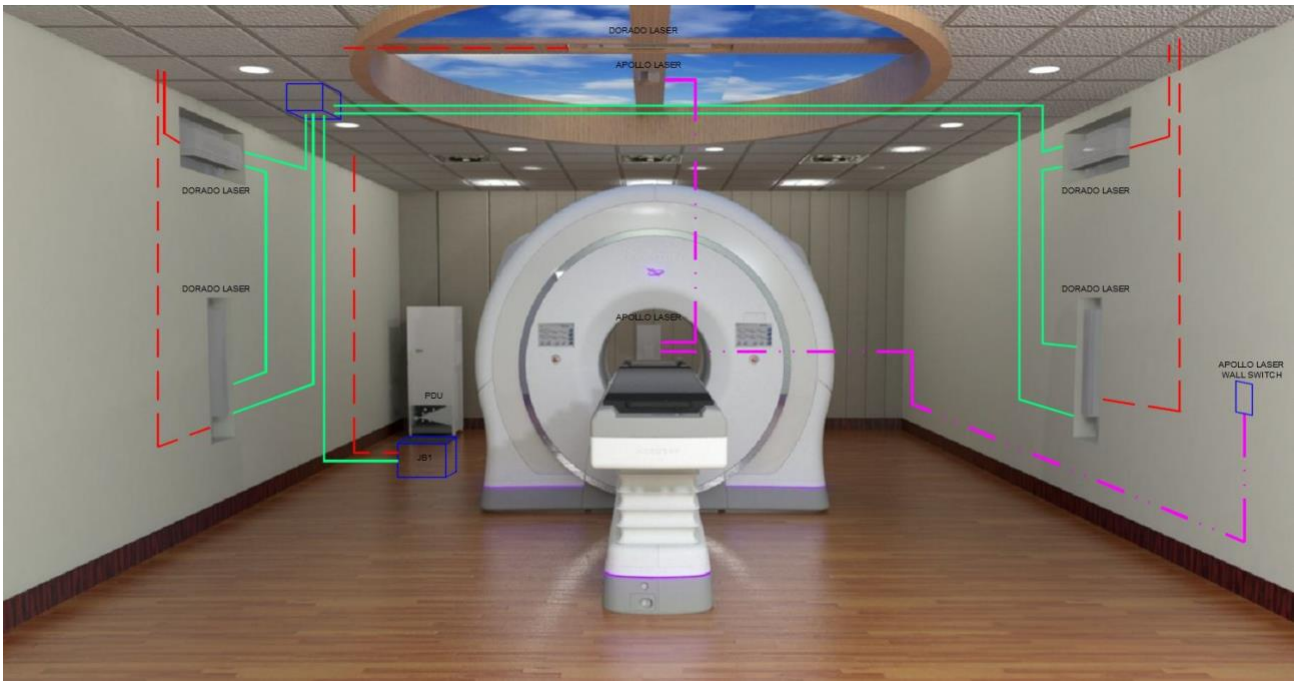
7.2 VitalHold

Description: The VitalHold system consists of 3 ceiling mounted scanners and a monitor/keyboard/mouse in the Treatment Vault. The ceiling mount system consists of several linkages, struts and mounting bases provided by Accuray and installed by the contractor.

Site planning consideration: Each scanner requires a dual 120-240 VAC outlet within 4 ft (1.2 m) at each location as shown on the Accuray supplied drawings. To reduce the effort required to shut down the systems, it is highly recommended that these outlets are on one shared wall switch. Two (2 in (50 mm)) dedicated conduits are required from the Control Room into the Treatment Vault. An existing conduit is acceptable and may be used if it contains equivalent capacity. If installing Synchrony or VitalHold options, vents and ducts should plan around those mounting locations. Please see the Site-Specific drawings (T-SPD-1050322) for exact locations.

7.3 Patient Positioning Lasers

Description: A laser positioning system is mounted in the Radixact System room to accurately position patients on the table. The five Dorado lasers and two Apollo lasers are mounted on the treatment room walls and ceiling.



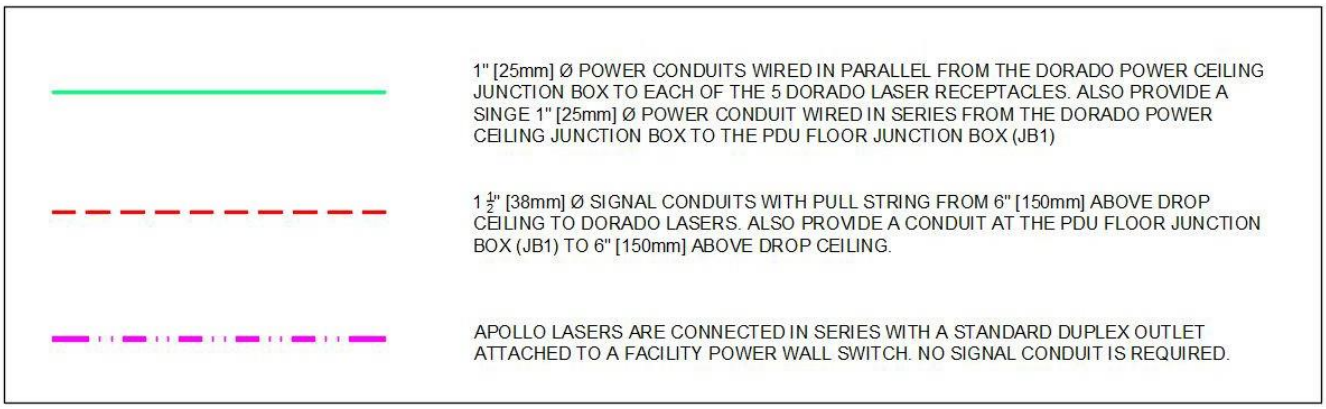


Figure 9 Required Routing of Laser Conduits

7.4 Laser Mounting Plates

Laser mounting plates must be spaced 1/2 in (12 mm) off any concrete surface. Five Dorado lasers and two Apollo lasers will be mounted to the walls and ceiling of the Treatment Roomby Accuray. To prepare for laser installation, provide and install 3/8 in (10 mm) aluminum or 1/4 in (6 mm) steel laser mounting plates either directly on the wall and ceiling surface or in recessed openings. Lasers are used to help accurately position the patient, so it is importantto install the laser mounting plates precisely in the positions listed in this guide. See the Accuray site-specific drawings for clearance and mounting information, and laser cabinet and laser guard specifications. If you protect the lasers with cabinets or doors, keep the openings free from obstructions. Do not insert windows into the cabinet or door openings.

As you plan for construction or renovation, consider which of the three mounting options described below will work best for the site.

7.5 Fully Recessed Openings

Recommended to provide fully recessed openings within the finish walls for the lasers.Consider providing additional protection by installing doors over the lasers.

7.6 Partially Recessed Openings

If the Treatment Vault lacks enough available space for a fully recessed opening, consider constructing a partially recessed open. You can provide additional protection for the lasersby constructing cabinets around them.

7.7 Surface

When a recessed opening is not feasible, you must mount the laser plates to the wall and ceiling surfaces. Construct cabinets around the lasers or install laser guards to ensure theirprotection.

NOTE: If you plan to install doors over the lasers, a facility physicist must mark the positionof the openings in the cabinet doors, with help from the Accuray Installation Technician, and a facility contractor must cut the door openings to allow the 60-degree divergent laser beamprojection.

7.8 Surface-Mounted Lasers

Construct the mounting surface with unistrut or concrete.

Install steel bars or a plastic laminate enclosure on either side of wall-surface-mountedlasers to protect them. An 8 in (200 mm) minimum recessed laser guard is required.

Table 21 Surface-Mounted Laser Plate Locations

Laser	Vault Location	Plate/Surface	Placement
Apollo Overhead	Ceiling	18 in x 12 in x 1/4 in thick steel or 3/8 in aluminum (457 mm x 305 mm x 6 mm thick steel or 10 mm aluminum)	Centered on the ceiling at virtual isocenter 2 ft 3.5 in (700 mm) from themachine isocenter.
Apollo Gantry Rear	Wall behind the gantry	18 in x 12 in x 1/4 in thick steel or 3/8 in aluminum (457	Vertical, centered at isocenter height 3 ft 8.25 in (1124 mm) above the finished floor.

Laser	Vault Location	Plate/Surface	Placement
		mm x 305 mm x 6 mm thick steel or 10 mm aluminum)	
Dorado Overhead	Ceiling	42 in x 16 in x 1/4 in thick steel or 3/8 in aluminum (1067 mm x 406 mm x 6 mm)	Centered on the ceiling, 5 ft (1524 mm) in front of the machine isocenter.
Dorado Vertical Side (2)	Each wall to the left and right side of the gantry	42 in x 16 in x 1/4 in thick steel or 3/8 in aluminum (1067 mm x 406 mm x 6 mm thick steel or 10 mm aluminum)	Vertical, centered at virtual isocenter 2 ft 3.5 in (700 mm) from the machine isocenter. Install so that the center of the plate is 3 ft 8.25 in (1124 mm.) above the finished floor.
Dorado Horizontal Side (2)	Each wall to the left and right side of the gantry	42 in x 16 in x 1/4 in thick steel or 3/8 in aluminum (1067 mm x 406 mm x 6 mm thick steel or 10 mm aluminum)	Horizontal, centered at virtual isocenter 2 ft 3.5 in (700 mm) from the machine isocenter. Install so that the center of the plate is 12 in (305 mm) minimum below the ceiling.

7.9 Recessed-Opening-Mounted Lasers

If the facility plans to install the lasers in recessed openings, follow the guidelines listed in the table below to determine the size of the openings.

The finished wall must not overlap the mounting plate. The plate must remain independent of the furred-out wall.

Table 22 Treatment Room laser opening dimensions

Laser	Vault Location	Clear Opening Size	Clear Recess Depth
Apollo Overhead	Ceiling	18 in x 12 in (457 mm x 305 mm)	At least 10 in (254 mm.) from the steel mounting plate to the ceiling plane.
Apollo Gantry Rear	Wall behind thegantry	18 in x 12 in (457 mm x 305 mm)	At least 8 in (200 mm) from the mounting plate to the recess openingon the wall plane or laser-box door.
Dorado Overhead	Ceiling	42 in x 16 in (1067 mm x 406 mm)	At least 10 in (254 mm) from the mounting plate to the dropped ceilingplane.
Dorado Vertical Side(2)	Each wall to the left and right side of the gantry	42 in x 16 in (1067 mm x 406 mm)	At least 8 inches (200 mm) from themounting plate to the recessed opening on the wall plane.
Dorado HorizontalSide (2)	Each wall to the left and right side of the gantry	42 in x 16 in (1067 mm x 406 mm)	At least 8 inches (200 mm) from themounting plate to the recessed opening on the wall plane.

7.10 Radixact System Shipping and Rigging Considerations

The following table lists typical crate measurements for any rigging or storage purposes.

NOTE: These measurements and weights may vary or change over time.

Table 23 Crate Sizes and Weights for Shipments

Item	Length	Width	Height	Actual Weight
Gantry	121 in 307 cm	62 in 157 cm	93 in 236 cm	4284 kg 9425 lb.
iDMS System Server Rack	36 in 91 cm	49 in 125 cm	70 in 178 cm	337 kg 743 lb.
Radixact System Couch	123 in 312 cm	41 in 104 cm	45 in 114 cm	667 kg 1467 lb.
PDU	35 in 89 cm	31 in 79 cm	79 in 200 cm	598 kg 1318 lb.
Gantry Back Section	77 in 195 cm	24 in 61 cm	82 in 208 cm	310 kg 682 lb.
DI Water	24 in 61 cm	24 in 61 cm	27 in 68 cm	111 kg 244 lb.
Cover Set on wheels Radixact System crate 1	92 in 234 cm	60 in 152 cm	81 in 206 cm	323 kg 710 lb.
Cover Set on wheels Radixact System crate 2	78 in 198 cm	70 in 178 cm	87 in 221 cm	445 kg 981 lb.
Cover Set on wheels Radixact System crate 3	105 in 267 cm	31 in 79 cm	96 in 244 cm	353 kg 778 lb.
Accessory E	45 in 114 cm	35 in 89 cm	40 in 101 cm	247 kg 543 lb.
Accessory F	45 in 114 cm	35 in 89 cm	40 in 101 cm	132 kg 290 lb.
Accessory G	45 in 114 cm	35 in 89 cm	40 in 101 cm	150 kg 330 lb.

Item	Length	Width	Height	Actual Weight
Accessory H	45 in 114 cm	35 in 89 cm	40 in 101 cm	164 kg 361 lb.
Accessory J	45 in 114 cm	35 in 89 cm	56 in 142 cm	189 kg 416 lb.
Accessory O	45 in 114 cm	35 in 89 cm	40 in 101 cm	130 kg 286 lb.
Accessory W2	45 in 114 cm	35 in 89 cm	40 in 101 cm	112 kg 247 lb.
Accessory R2	45 in 114 cm	38 in 97 cm	31 in 79 cm	106 kg 233 lb.
Accessory R3	45 in 114 cm	35 in 89 cm	40 in 101 cm	314 kg 692 lb.
Accessory R4	60 in 152 cm	30 in 76 cm	52 in 132 cm	506 kg 1115 lb.
Accessory T	45 in 114 cm	35 in 89 cm	40 in 101 cm	126 kg 278 lb.
Accessory D	59 in 150 cm	26 in 66 cm	21 in 53 cm	96 kg 211 lb.
Accessory K1	78 in 198 cm	36 in 91 cm	50 in 127 cm	486 kg 1071 lb.
Accessory X ***OPTIONAL***	45 in 114 cm	35 in 89 cm	40 in 101 cm	197 kg 434 lb.
Accessory Y ***OPTIONAL***	45 in 114 cm	35 in 89 cm	56 in 142 cm	132 kg 291 lb.
Total Weight				10,497 kg 23,146 lb.

7.10.1 Shipping and Rigging

The Radixact System is shipped to arrive at the site, at approximately 7:00 am. Installations typically start on a Tuesday or Wednesday but can be scheduled according to the customer's needs based on Accuray personnel availability.

Accuray will schedule and pay for the shipment of the crated system to the customer location, unless specified otherwise in the sales contract.

Unless otherwise specified in the Customer's contract Accuray is responsible for rigging. The Accuray Project Manager can answer any questions regarding contractual rigging terms.

Accuray allows a total of $8,000 (US dollars) for standard rigging cost, unless otherwise noted. The customer will be responsible for any additional cost incurred where applicable. This occasionally occurs if a crane or other special equipment is required. If the customer is responsible for rigging, the Accuray Project Manager can refer rigging resources to the customer if requested.

7.10.2 Rig-In Manpower and Equipment Requirements

Clearance

- Treatment vault minimum Clearances: 4 ft (1200 mm) wide x 6 ft -10 in (2083 mm) tall for rigging on wheels (standard option), at least 7 ft (2130 mm) tall for rigging on skates (depends on the skates' design)
- iDMS System room: 3 ft wide x 7 ft high (900 mm x 2000 mm) for rigging the equipment into the, door clearances for the rig path need to be the United States standard measurement of 82 in (2083 mm)

Manpower

- One experienced rigger, two or three additional movers.
- Our installers will be present to help answer questions and assist where required.

Equipment

- One 15,000 lb. (6800 kg) forklift with 8 ft. (2.4 m) fork blades.
- One electric two-ton pallet jack.
- One, hand-operated genie lift (>300 lb. (136 kg) capacity
- One J-bar.
- Eight (8) four-wheel dollies.
- Two metal plates for crossing doorways.
- Floor protection for the length of the route (Masonite or Lexan sheets 4 ft. x 8 ft.) (1.2 m x 2.4 m). The Gantry, at 8,500 lb. (3,856 kg), is the heaviest piece to move.
- Basic tools for uncrating the equipment.
- Tarps to cover or "stage" the equipment if the weather is an issue.
- Straps

Note: Because the rig-in typically starts at 7:00 am, it is preferred that the rigging equipment be delivered the day before the system delivery. If this is not feasible, the equipment must be on site before 7:00 am on the delivery date.

7.11 Storage

The facility must establish a locked storage area where the Accuray Installation Technicians can store tools and testing equipment for approximately one month during installation.

Choose a location that is near the installation site and that is accessible 24 hours per day. Also, supply a clean 12 ft x 12 ft (3650 mm x 3650 mm) low-traffic, indoor storage area where the Accuray Installation Technicians can place the gantry enclosures during installation. The enclosures are delivered in sections, so you may establish multiple storage areas if one area cannot accommodate all the enclosures.

7.12 Information Technology

Refer to Accuray's *Network Systems Requirements* document. The Accuray Project Managers will provide this document to you.

Note: The IT setup work must be completed prior to the system delivery.

7.13 Seismic Regulations

If the facility is required to meet local or regional seismic regulations, provide the Accuray Project Manager with the specifics of those regulations in writing as soon as possible. There are dimensional and structural considerations that need to be incorporated into the drawing package. Affected are the anchoring and clearances for the Gantry, Patient Table, PDU, iDMS Server Rack and Power Conditioner. Anchors must be specified by a facility-contracted Structural Engineer. Accuray will supply and install the specified anchors.

Accuray will supply mounting brackets for the equipment mentioned above except for the Power Conditioner. It is up to the facility contractor to specify the materials needed to secure it to the floor.

It is the facility's responsibility to contact the regulatory agencies and arrange for any required anchor inspections prior to the system installation. Timely anchor inspections are critical to landing the Gantry into its final position on rig date. Delays with inspections will also cause delays in assembly of the machine.

Note: Use link to see OPM's under the Pre-Approval Programs (HCAI Preapproval of Manufacturer's Certification (OPM)):

https://hcai.ca.gov/construction-finance/

7.14 Power Conditioners

7.14.1 Equipment Needed

The Radixact System is sensitive to line voltage variations and source impedance. A complete survey of the electrical power monitoring should be conducted prior to the equipment installation and a copy of this survey should be sent to the Accuray Project Manager and the customer's Electrical Engineer for record. The customer's Electrical Engineer will evaluate the power monitoring results and the decision related to the purchase of a Power Conditioner (PC)/ Uninterruptible Power Supply (UPS) if the input voltage cannot be regulated to within +/- 5% phase to phase. PC or UPS devices for power conditioning of facility mains for Radixact must employ double conversion architecture. The customer is responsible for the installation and maintenance of and facility PC or UPS installed and power the Radixact PDU.

7.14.2 Selection

Accuray does not supply UPS or PC devices for facility power conditioning for Radixact systems. For transient and crest factor calculations for facility power, UPS devices are equivalent to PC devices unless the UPS uses battery energy to supplement its AC input circuitry. Where the UPS runs on battery power it will deplete battery stored energy by more than the supplemental amount, and recharge time will be required to restore capacity. It is recommended that both UPS and PC be capable of handling transients with ratings for the facility power input circuitry.

The first step in selection is to determine potential UPS or PC device manufacturers' candicate series that meet input and output voltage requirements, input and output frequency requirements, expected power requirements, input noise reduction needs, and reliability needs. The next step is to ensure that the Power-On Transient can be handled by the chosen series. The final step is to determine the minimum rating within that series that will meet the Operating Transient characteristics needed.

7.14.3 Power-On Transient

A turn-on current spike will be generated when CB1 is closed. Spike magnitude will be dependent on input power voltage phase angle on the transformer at time of closure as compared to the phase angle and load at the time of last CB1 opening. This is primarily statistical due to the inability of humans to synchronize circuit breaker closure with power waveform phases. Power line source impedance also has some effect, lower impedance allowing higher peak values. The time elapsed since CB1 was last opened, and core temperature, can also have some impact on transient magnitude. Worst case for this transient generally is observed with one phase at peak current, with the other two phases having lesser and equal peaks. The peak current measured for the Radixact PDU transformer can be calculated with "normal" facility source impedance can be calculated by:

$$\mathrm{Ipk(T.O.\ spike,\ worst)} = \mathrm{Vrms(Facility\ Nominal)\ x\ 1.46A/V}$$

Any selected PC device must withstand one such pulse at turn-on. Withstand may be by means of current limiting of device output with consequent reduction of device output voltage during that spike.

Note that a sequence of subsequent spikes, each at a peak current of half its predecessor, may be expected on the same line phases occurring at the same line-voltage cycle position. Any such subsequent spike exceeding rated peak current of the PC device may also be current limited.

7.14.4 Operating Transient

Crest Factor Example

To determine the minimum kVA rating of a 3-phase PC with a crest factor rating of 2.0, for possible use to include the above operating transients:

$$\mathrm{kVA\ (PC\ required)} = \mathrm{VA(Rx,peak)\ /\ crest\ factor(PC\ rated)} = 169\mathrm{kVA}\ /\ 2.0 = 84.5\mathrm{kVA}$$

In this example, the VA (PC rated) for a crest factor rating of 2.0, a common rating would need to have been at least 84.5kVA rated. The 84.5kVA result may be negotiable with a PC manufacture, since Synchrony pulses do not occur every AC cycle period, generally exhibiting a duty cycle less than 1% with kV pulses starting from a base-load of about 14kVA during treatment.

Crest Factor Basis

All Radixact 3 and some Radixact 2 systems having kV imaging capability draw current pulses from facility power during imaging operations, as happens in many Computed Tomography (CT) systems. As the Radixact 3 system is most capable for imaging, and draws the highest pulsed load levels, that is used for computing operating transients for PC selection. The magnitude of this transient and its pulse interval depend on system patient settings and use in ClearRT or Synchrony mode. Worst peaks occur during Synchrony mode and with largest patient profiles selected (XXL Pelvis for example). Data shown here reflects the Radixact 3 Synchrony for XXL Pelvis configuration pulses prior to kV parameter updates designed to reduce the peak kV pulse adder by a factor of approximately 2 by lengthening pulse width by that factor. Radixact 2 worst peaks will be less than these peaks by about a factor of 2. Worst case peak current spikes vary with the VA load to our PDY and the input voltage to the PDU. Worst case spike for 480Varms nominal input voltage was calculated to be 203Apk, three phase. Defining

$$\mathrm{VA(Rx,\ peak)} = \mathrm{Vrms(Facility\ Nominal)\ x\ Ipk(meas)\ x\ sqrt(3)}$$
$$\mathrm{VA(Rx,\ peak)} - 480\mathrm{V\ x\ 203A\ x\ 1.73} = 169000\mathrm{VA} = 169\mathrm{kVA}$$

During Synchrony operations, a load current of about 20Arms should be estimated between kV pulses.

Using crest factor calculations, since many PC designs are rated by crest factor.

$$\mathrm{Crest\ factor} = \mathrm{peak\ waveform\ current\ /\ DC\ equivalent\ current} = \mathrm{Apeak\ x\ Vrms\ /\ Arms\ x\ Vrms}$$

$$\mathrm{Crest\ factor} = \mathrm{VA(Rx,\ peak)\ /\ VA(PC\ rated)} = \mathrm{kVA(Rx,\ peak)\ /\ kVA(PC\ rated)}$$

So

$$\mathrm{crest\ factor(required)} = 169\mathrm{kVA\ /\ kVA(PC\ rated)}$$

or similarly

$$\mathrm{kVA\ (PC,\ required)} = 169\mathrm{kVA\ /\ crest\ factor\ (PC\ rated)}$$

If Manufacturer Crest Factor Rating Is Not Available

Where crest factor information is not available for the analyzed PC, detailed information for the more difficult calculations can be found in T-SPG-01000-01.

7.14.5 Common Supplier

The Project Manager (PM) will supply the necessary documentation so that the facilities Electrical Engineer can determine which PC/UPS equipment that best serves their site.

7.15 Closed Circuit TV (CCTV) See site specific drawing for location

The facility may supply and install a video system. Accuray recommends these closed-circuit television camera locations:

- One stationary camera 5 ft (1524 mm) above the finished floor behind the gantry on the isocenter.
- One pan, tilt, and zoom camera on the wall or ceiling at the foot of the patient table.

7.15.1 Common Suppliers

- General Electric – www.gesecurity.com
- Panasonic – www.panasonic/business/security.com
- Samsung – www.samsungsecurity.com
- Nuvico – www.nuvico.com

Note: The camera system must be installed prior to the Radixact System installation as itis used during system testing and calibration.

7.16 Quality Assurance and Commissioning Tools and Equipment

Please consult with your Accuray Project Manager for specific requirements. All the required tools must be on site before the Radixact System installation.

8.0 NOTES