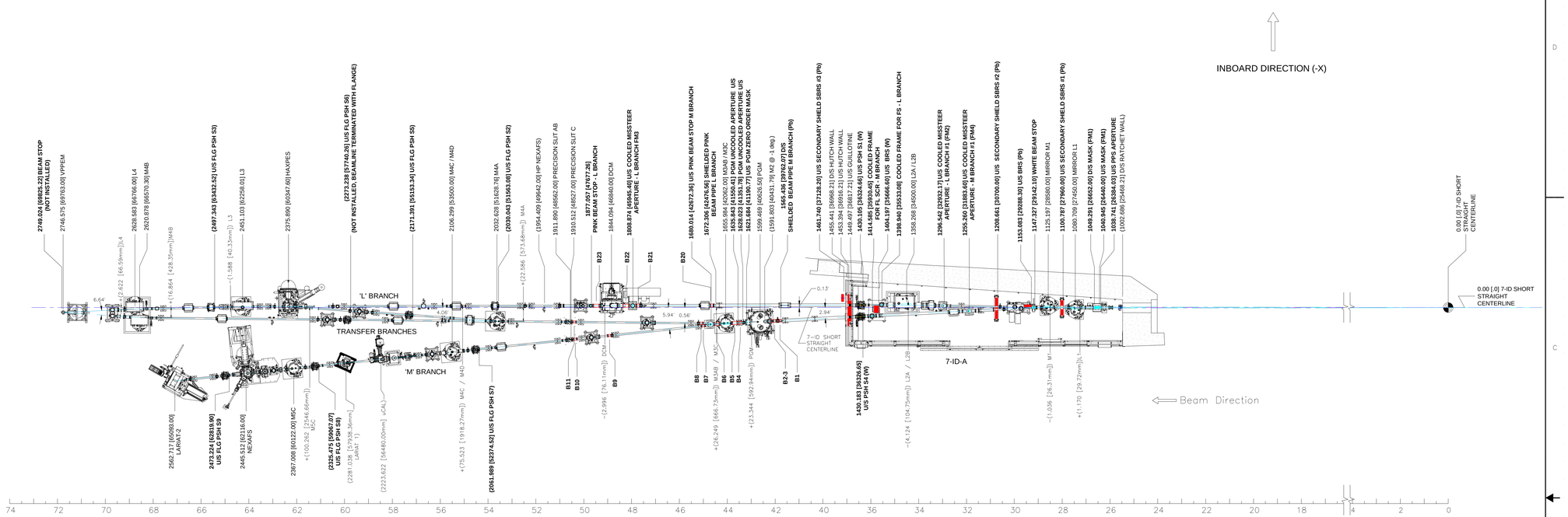
REVISION HISTORY					
REV	DESCRIPTION	DATE	DESIGNER	CHECKED BY	ENGINEER
A	RELEASE PER ECO-004456	1/2018	J.FABIJANIC	C. STELMACH	A.BROADBENT
B	RELEASE PER ECO-005423	2/2018	J.FABIJANIC	C. STELMACH	A.BROADBENT



SST(7-ID)
BEAMLINE LAYOUT
SCALE: 1:60

OUTBOARD DIRECTION (+X)

NOTES:

1. REFERENCE DRAWING SR-FE-IVU07-1001.
2. UNLESS OTHERWISE SPECIFIED THE CENTER OF THE STRAIGHT SOURCE POINT IS THE ORIGIN FOR ALL ORDINATE DIMENSIONS.
3. UNLESS OTHERWISE SPECIFIED ALL ORDINATE DIMENSIONS ARE TO THE CENTER OF EACH COMPONENT.
4. ALL END STATIONS WHERE BEAM STOPS (LARIAT-2, VPPEM), OR CHAMBER AT AN ANGLE (HAXPES) SHALL HAVE ALL REMOVABLE FLANGES ON THE DOWNSTREAM SIDE OR WITHIN THE INCIDENT BEAM CONE UNDER CONFIGURATION CONTROL..
5. RADIATION SHIELDING COMPONENTS ARE SHOWN IN BOLD TEXT.
6. SEE DRAWING PD-SST-BL-SHLD-0400 FOR ADDITIONAL BELLOWS SHIELDS.

SPECIFICATIONS		REFERENCE
Project	NPB PROJECT	PS-C-XFD-RSI-SST-BMM-001 VER 1
Source	EPU60 / U42	LT-C-ASD-RSI-003
Beam Line Name	SPECTROSCOPY SOFT & TENDER	PS-C-XFD-RSI-SST-BMM-001 VER 1
Abbreviation	SST	PS-C-XFD-RSI-SST-BMM-001 VER 1
Period of insertion device	60 / 42	PS-C-XFD-RSI-SST-BMM-001 VER 1
Cell	07-ID	PS-C-XFD-RSI-SST-BMM-001 VER 1
Length of Source	D/S 0.84m / 1.6m U/S	PS-C-XFD-RSI-SST-BMM-001 VER 1
Location of Source (from Center of Straight)	D/S 1.25m / -1.25m U/S	PS-C-XFD-RSI-SST-BMM-001 VER 1
Ray Tracing Procedure		PS-C-XFD-PRC-008 VER 2
Front End Ray Tracing Drawing		SR-FE-IVU07-1001 REV C

LIST OF ABBREVIATIONS

B1-11 BELLOWS SHIELD M & TRANSFER BRANCH(SEE BELLOWS SHIELD DRAWING)
B20-23 BELLOWS SHIELD L BRANCH(SEE BELLOWS SHIELD DRAWING)
BRS BREMSSTRAHLUNG STOP
D/S DOWNSTREAM
DCM DOUBLE CRYSTAL MONOCHROMATOR
DM DIAGNOSTIC MODULE
FGV FAST GATE VALVE
FLG FLANGE
FM FIXED MASK
FOE FIRST OPTICAL ENCLOSURE
FS FLUORESCENT SCREEN
L1 FIRST MIRROR ON L BRANCH. PLANE, INTERNALLY COOLED.
L2A SECOND MIRROR ON L BRANCH. TOROID, SIDE COOLED.
L2B ALTERNATE SECOND MIRROR ON L BRANCH. FLAT, SIDE COOLED.
L3 THIRD OPTIC ON L BRANCH. FLAT, UNCOOLED.
L4 FOURTH OPTIC ON L BRANCH. ELLIPSOID, UNCOOLED.
M1 FIRST OPTIC ON M BRANCH. FLAT, INTERNALLY COOLED.
M2 OPTIC LOCATED IN THE PG
M3AB THIRD OPTIC IN M BRANCH. SWITCHING MIRROR TO TRANSFER BRANCH (TOWARDS M4A OR M4B). PLANAR ELLIPSE, UNCOOLED.
M3C ALTERNATE THIRD OPTIC IN M BRANCH. SWITCHING MIRROR TO M BRANCH (TOWARDS M4C/D AND M5C). PLANAR ELLIPSE, UNCOOLED.
M4A FOCUS THE SOFT X RAYS AT THE HAXPES/NEXAFS END STATION
M4C FOURTH OPTIC IN M BRANCH. ELLIPSOID, UNCOOLED.
M4D ALTERNATE FOURTH OPTIC IN M BRANCH. PLANE, UNCOOLED.
M5C FIFTH OPTIC IN M BRANCH.PLANE, UNCOOLED.
NOM NOMINAL
PGM PLANE GRATING MONOCHROMATOR
RCO RATCHET WALL COLLIMATOR
SBRS SECONDARY BREMSSTRAHLUNG SHIELD
SGV SLOW GATE VALVE
SS SAFETY SHUTTER
SST SPECTROSCOPY SOFT & TENDER
U/S UPSTREAM
XBPM X-RAY BEAM POSITION MONITOR

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN MILLIMETERS
DIMENSIONS IN BRACKETS [] ARE IN INCHES
DO NOT SCALE DRAWING
INTERPRET DRAWING AS PER ANSI Y14.5-1994 OR YB-2-1975

DIMENSIONAL TOLERANCES: X ± 1.500, X ± 0.750, .XX ± 0.400, .XXX ± 0.120
ANGULAR TOLERANCES: ± .5°
FINISH: 3.2
BREAK EDGES & SHARP CORNERS 0.125 MIN. TO 0.750 MAX.

THIRD ANGLE PROJECTION
SCALE: SEE VIEW

DRAWN BY:	J.FABIJANIC	8/2017
CHECKED BY:	C. STELMACH	8/2017
VACUUM ARTISTICAL ENGINEER:	A.BROADBENT	8/2017
SUPERVISOR ARTISTICAL:	D.FISCHER	8/2017
ES&H APPROVAL:	L. STIEGLER	8/2017
QA APPROVAL:	J. ZIPPER	8/2017

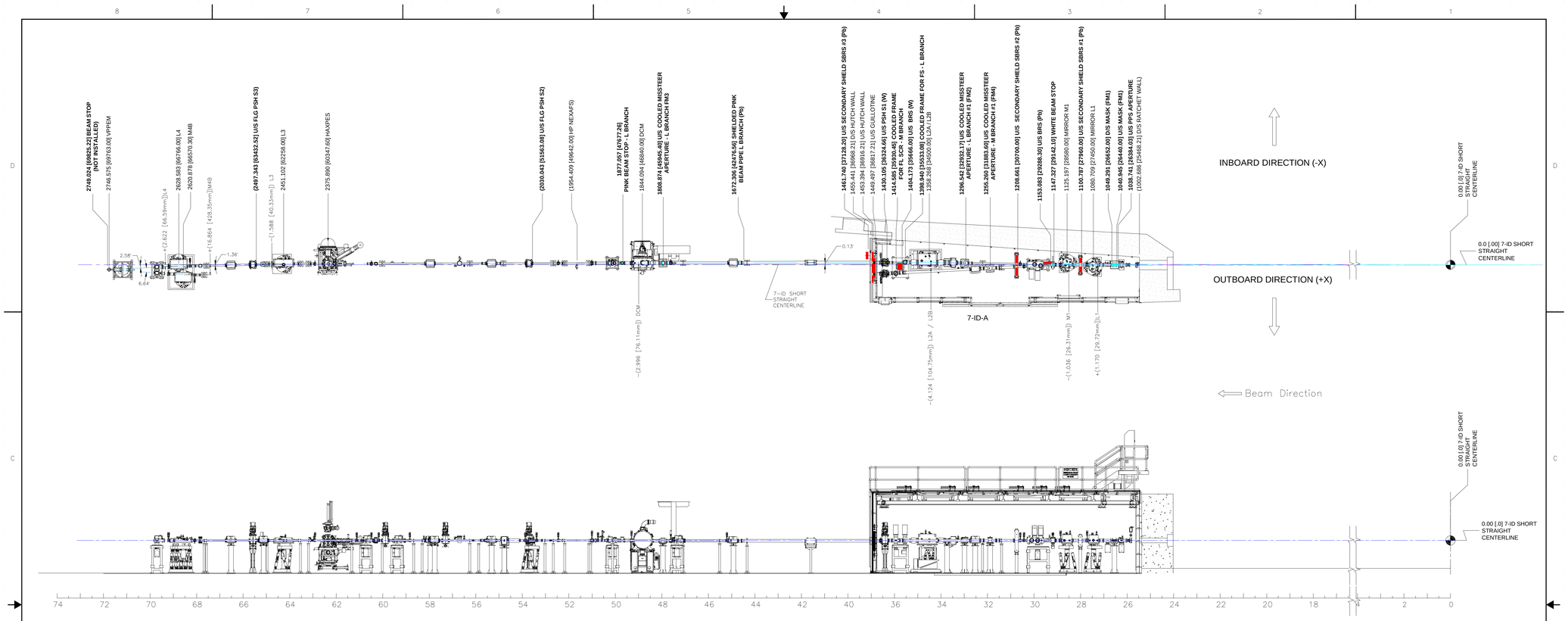
BROOKHAVEN NATIONAL LABORATORY
BROOKHAVEN NATIONAL LABORATORY
BROOKHAVEN SCIENCE ASSOCIATES
UPTON, NEW YORK 11973
Exploring Life's Mysteries, Advancing Its Future

NSLS II NATIONAL SYNCHROTRON LIGHT SOURCE II

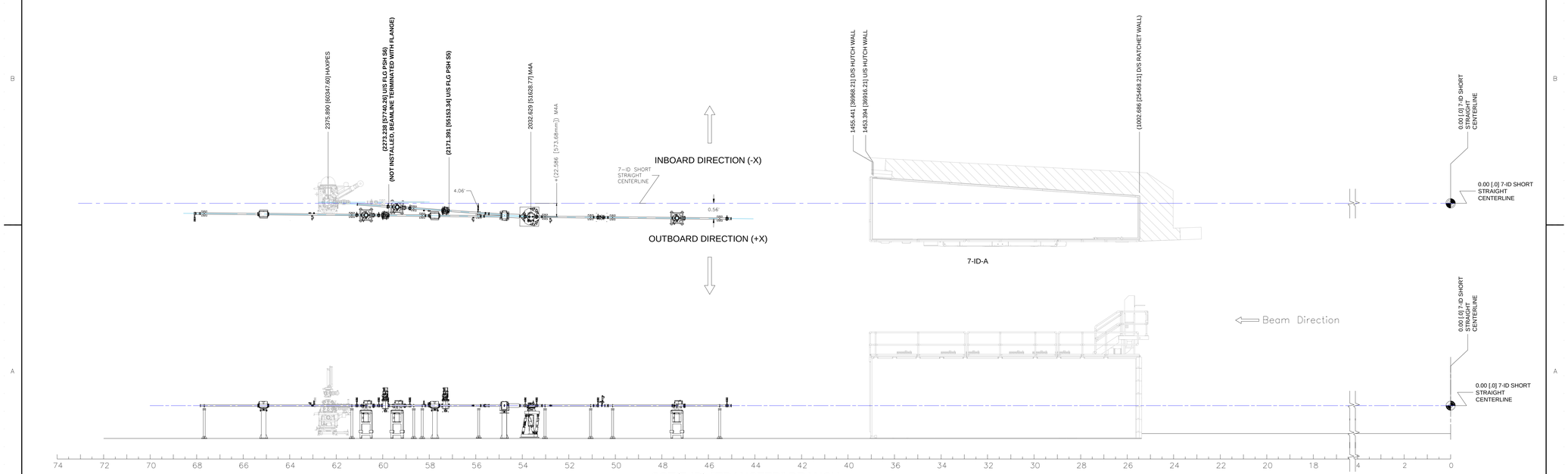
PHOTON DIVISION
SST BEAMLINE, 07-ID
SST BEAMLINE RAYTRACE

NEXT ASSY: N/A
PROJECT: PBN
WBS# 7.02.03
SHEET SIZE: E
DRAWING/PART NUMBER: PD-SST-RAYT-0001
REVISION: B
ES&HQ RISK LEVEL: A-1
SHEET 1 OF 10

RELEASED – EFFECTIVE



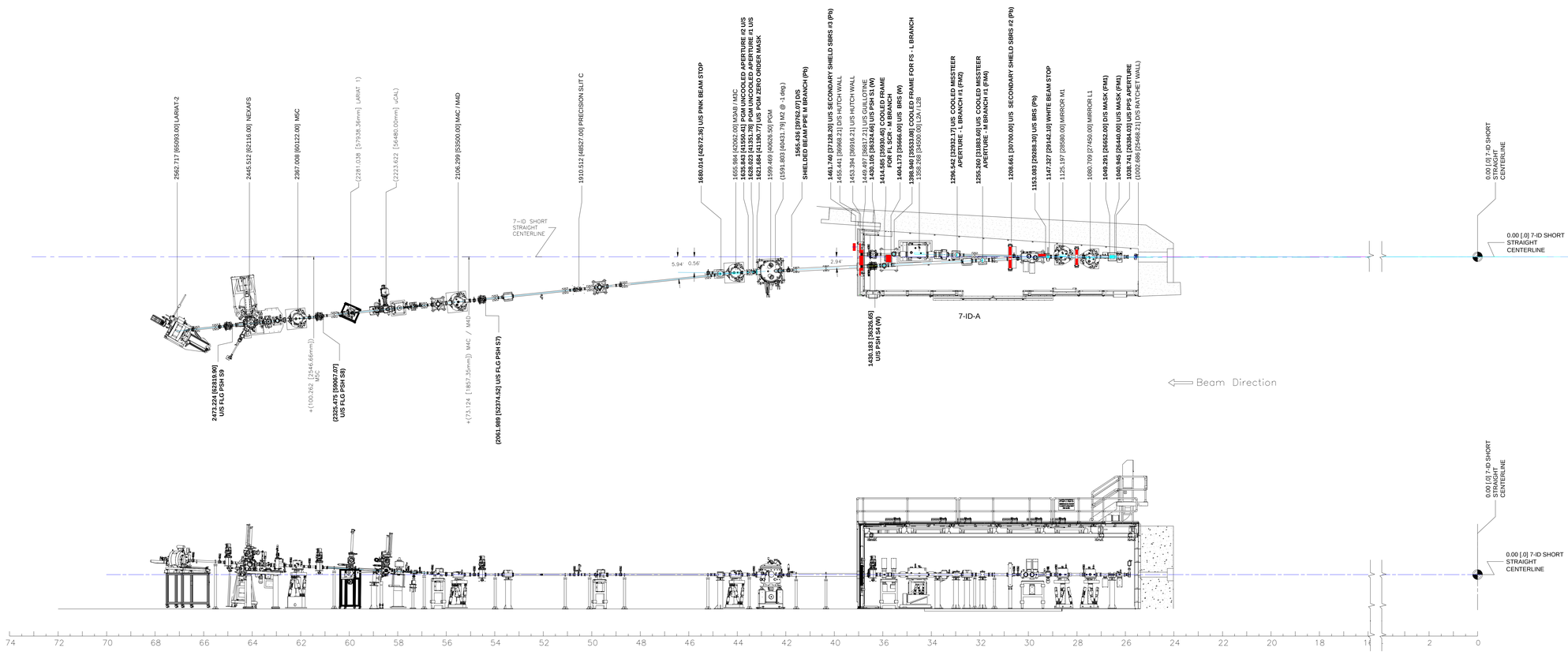
SST(7-ID) "L" BRANCH
BEAMLINE LAYOUT
SCALE: 1:60



SST(7-ID) "TRANSFER" BRANCH
BEAMLINE LAYOUT
SCALE: 1:60

E	PD-SST-RAYT-0001	B
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1	SHEET 2 OF 10	

RELEASED – EFFECTIVE



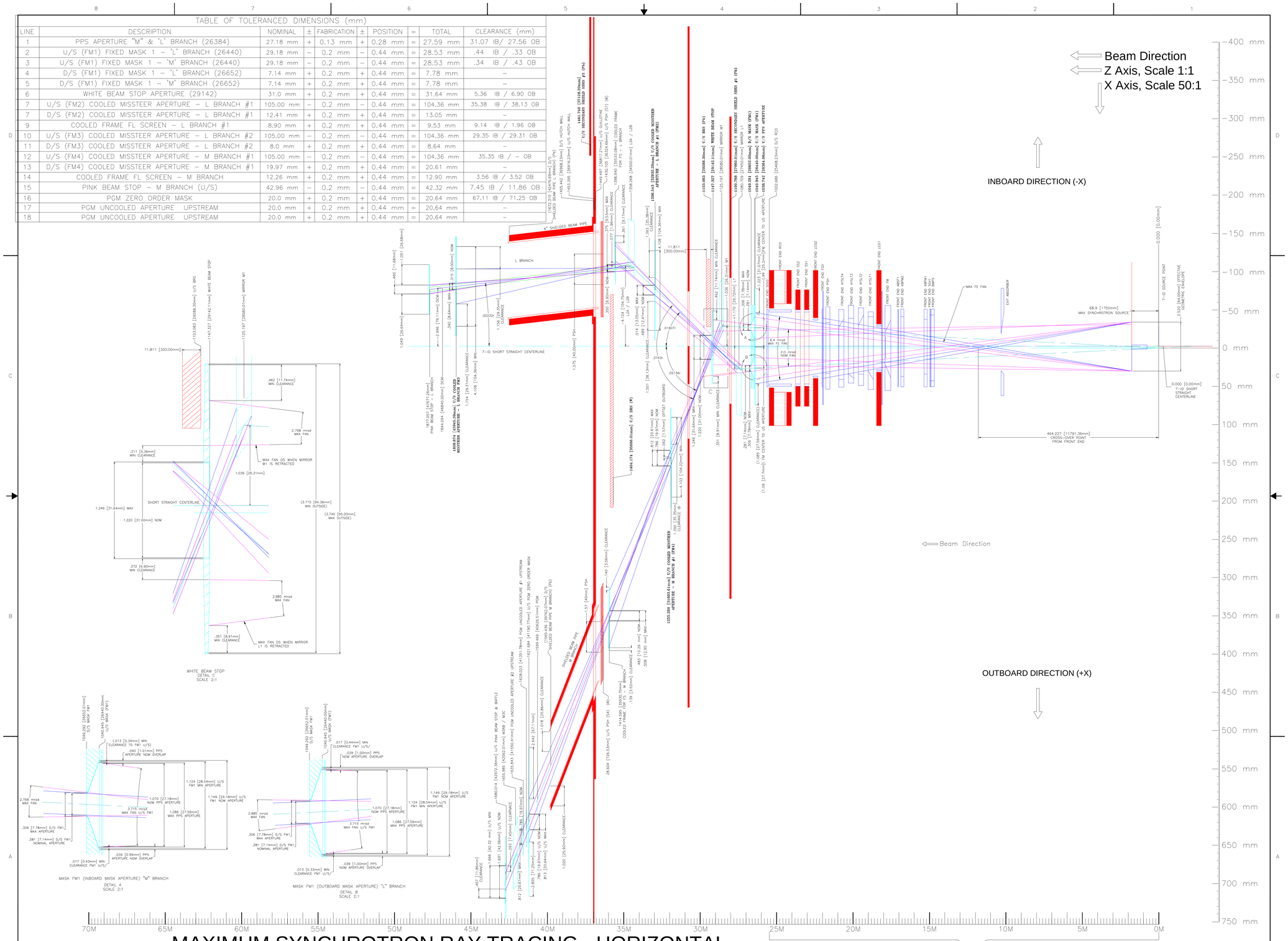
SST(7-ID) "M" BRANCH
BEAMLINE LAYOUT
SCALE: 1:60

E (SHEET SIZE)	PD-SST-RAYT-0001 (DRAWING/PART N.UMBER)	B (REVISION)
ESH&Q RISK LEVEL A-1		SHEET 3 OF 10

RELEASED – EFFECTIVE

TABLE OF TOLERANCED DIMENSIONS (mm)

LINE	DESCRIPTION	NOMINAL	±	FABRICATION	±	POSITION	=	TOTAL	CLEARANCE (mm)
1	PPS APERTURE "M" & "L" BRANCH (26384)	27.18 mm	+	0.13 mm	+	0.28 mm	=	27.59 mm	31.07 IB/ 27.56 OB
2	U/S (FM1) FIXED MASK 1 – "L" BRANCH (26440)	29.18 mm	–	0.2 mm	–	0.44 mm	=	28.53 mm	.44 IB / .33 OB
3	U/S (FM1) FIXED MASK 1 – "M" BRANCH (26440)	29.18 mm	–	0.2 mm	–	0.44 mm	=	28.53 mm	.34 IB / .43 OB
4	D/S (FM1) FIXED MASK 1 – "L" BRANCH (26652)	7.14 mm	+	0.2 mm	+	0.44 mm	=	7.78 mm	–
5	D/S (FM1) FIXED MASK 1 – "M" BRANCH (26652)	7.14 mm	+	0.2 mm	+	0.44 mm	=	7.78 mm	–
6	WHITE BEAM STOP APERTURE (29142)	31.0 mm	+	0.2 mm	+	0.44 mm	=	31.64 mm	5.36 IB / 6.90 OB
7	U/S (FM2) COOLED MISSTEER APERTURE – L BRANCH #1	105.00 mm	–	0.2 mm	–	0.44 mm	=	104.36 mm	35.38 IB / 38.13 OB
7	D/S (FM2) COOLED MISSTEER APERTURE – L BRANCH #1	12.41 mm	+	0.2 mm	+	0.44 mm	=	13.05 mm	–
9	COOLED FRAME FL SCREEN – L BRANCH #1	8.90 mm	+	0.2 mm	+	0.44 mm	=	9.53 mm	9.14 IB / 1.96 OB
10	U/S (FM3) COOLED MISSTEER APERTURE – L BRANCH #2	105.00 mm	–	0.2 mm	–	0.44 mm	=	104.36 mm	29.35 IB / 29.31 OB
11	D/S (FM3) COOLED MISSTEER APERTURE – L BRANCH #2	8.0 mm	+	0.2 mm	+	0.44 mm	=	8.64 mm	–
12	U/S (FM4) COOLED MISSTEER APERTURE – M BRANCH #1	105.00 mm	–	0.2 mm	–	0.44 mm	=	104.36 mm	35.35 IB / – OB
13	D/S (FM4) COOLED MISSTEER APERTURE – M BRANCH #1	19.97 mm	+	0.2 mm	+	0.44 mm	=	20.61 mm	–
14	COOLED FRAME FL SCREEN – M BRANCH	12.26 mm	+	0.2 mm	+	0.44 mm	=	12.90 mm	3.56 IB / 3.52 OB
15	PINK BEAM STOP – M BRANCH (U/S)	42.96 mm	–	0.2 mm	–	0.44 mm	=	42.32 mm	7.45 IB / 11.86 OB
16	PGM ZERO ORDER MASK	20.0 mm	+	0.2 mm	+	0.44 mm	=	20.64 mm	67.11 IB / 71.25 OB
17	PGM UNCOOLED APERTURE UPSTREAM	20.0 mm	+	0.2 mm	+	0.44 mm	=	20.64 mm	–
18	PGM UNCOOLED APERTURE UPSTREAM	20.0 mm	+	0.2 mm	+	0.44 mm	=	20.64 mm	–



MAXIMUM SYNCHROTRON RAY TRACING - HORIZONTAL

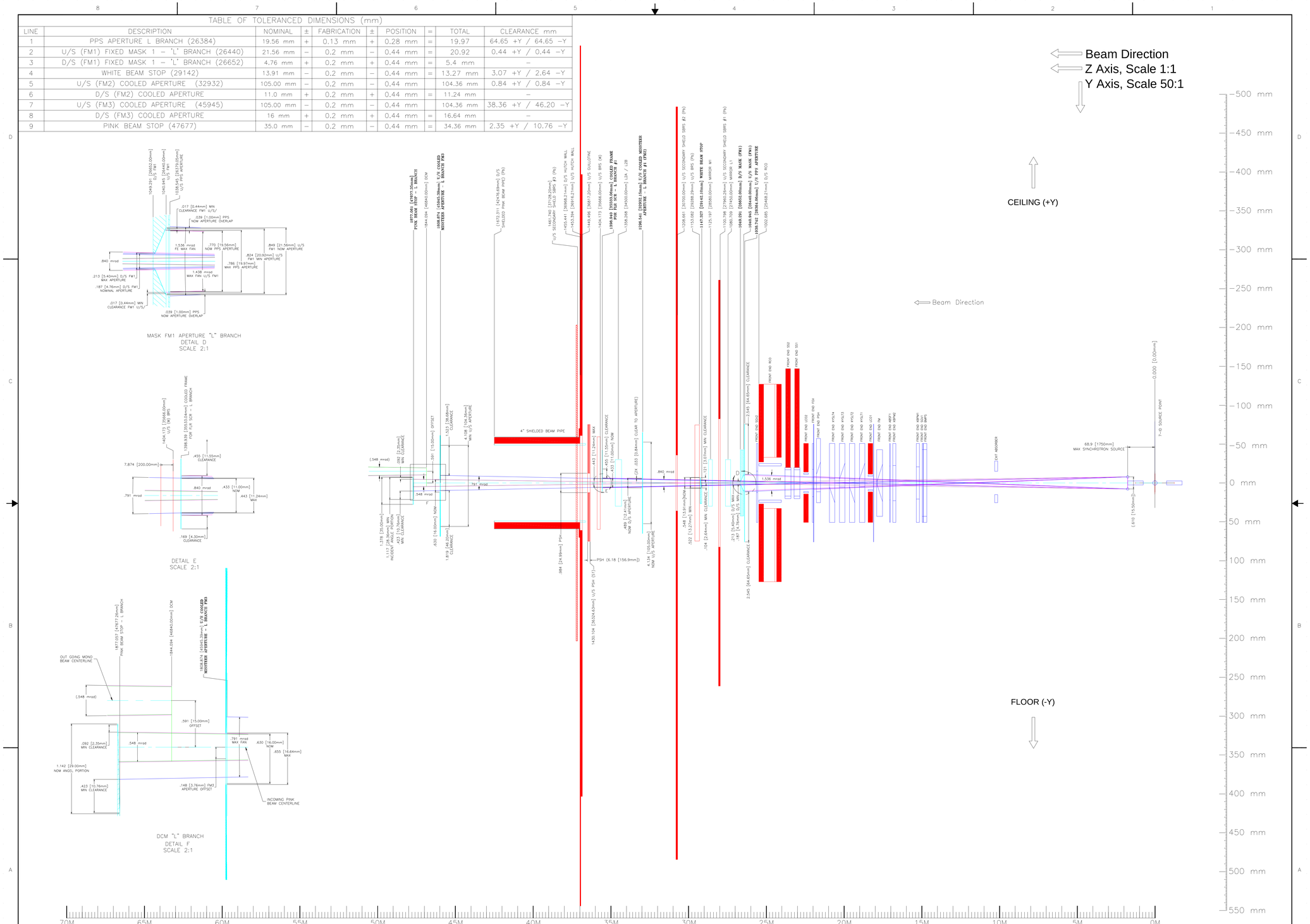
Scale 1:75

E	PD-SST-RAYT-0001	B
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ES&Q RISK LEVEL A-1	SHEET 4 OF 10	

RELEASED – EFFECTIVE

TABLE OF TOLERANCED DIMENSIONS (mm)

LINE	DESCRIPTION	NOMINAL	±	FABRICATION	±	POSITION	=	TOTAL	CLEARANCE mm
1	PPS APERTURE L BRANCH (26384)	19.56 mm	+	0.13 mm	+	0.28 mm	=	19.97	64.65 +Y / 64.65 −Y
2	U/S (FM1) FIXED MASK 1 – 'L' BRANCH (26440)	21.56 mm	−	0.2 mm	−	0.44 mm	=	20.92	0.44 +Y / 0.44 −Y
3	D/S (FM1) FIXED MASK 1 – 'L' BRANCH (26652)	4.76 mm	+	0.2 mm	+	0.44 mm	=	5.4 mm	–
4	WHITE BEAM STOP (29142)	13.91 mm	−	0.2 mm	−	0.44 mm	=	13.27 mm	3.07 +Y / 2.64 −Y
5	U/S (FM2) COOLED APERTURE (32932)	105.00 mm	−	0.2 mm	−	0.44 mm		104.36 mm	0.84 +Y / 0.84 −Y
6	D/S (FM2) COOLED APERTURE	11.0 mm	+	0.2 mm	+	0.44 mm	=	11.24 mm	–
7	U/S (FM3) COOLED APERTURE (45945)	105.00 mm	−	0.2 mm	−	0.44 mm		104.36 mm	38.36 +Y / 46.20 −Y
8	D/S (FM3) COOLED APERTURE	16 mm	+	0.2 mm	+	0.44 mm	=	16.64 mm	–
9	PINK BEAM STOP (47677)	35.0 mm	−	0.2 mm	−	0.44 mm	=	34.36 mm	2.35 +Y / 10.76 −Y



MAXIMUM SYNCHROTRON RAY TRACING - VERTICAL "L" BRANCH

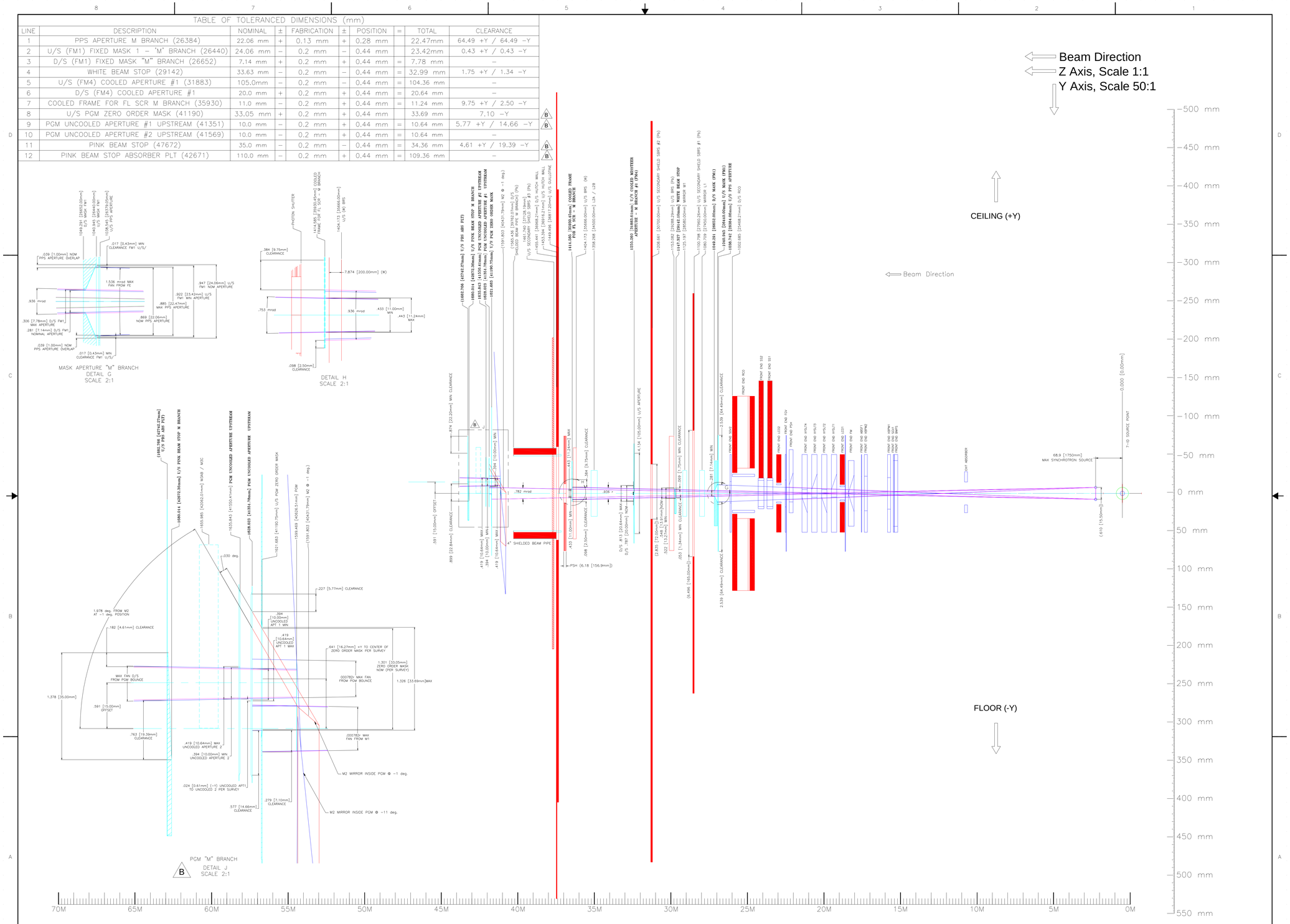
Scale 1:75

E SHEET SIZE	PD-SST-RAYT-0001 DOCUMENT NUMBER	B REVISION
ESH&Q RISK LEVEL A-1		SHEET 5 OF 10

RELEASED – EFFECTIVE

TABLE OF TOLERANCED DIMENSIONS (mm)

LINE	DESCRIPTION	NOMINAL	±	FABRICATION	±	POSITION	=	TOTAL	CLEARANCE
1	PPS APERTURE M BRANCH (26384)	22.06 mm	+	0.13 mm	+	0.28 mm		22.47mm	64.49 +Y / 64.49 −Y
2	U/S (FM1) FIXED MASK 1 – "M" BRANCH (26440)	24.06 mm	−	0.2 mm	−	0.44 mm		23.42mm	0.43 +Y / 0.43 −Y
3	D/S (FM1) FIXED MASK "M" BRANCH (26652)	7.14 mm	+	0.2 mm	+	0.44 mm	=	7.78 mm	–
4	WHITE BEAM STOP (29142)	33.63 mm	−	0.2 mm	−	0.44 mm	=	32.99 mm	1.75 +Y / 1.34 −Y
5	U/S (FM4) COOLED APERTURE #1 (31883)	105.0mm	−	0.2 mm	−	0.44 mm	=	104.36 mm	–
6	D/S (FM4) COOLED APERTURE #1	20.0 mm	+	0.2 mm	+	0.44 mm	=	20.64 mm	–
7	COOLED FRAME FOR FL SCR M BRANCH (35930)	11.0 mm	−	0.2 mm	+	0.44 mm	=	11.24 mm	9.75 +Y / 2.50 −Y
8	U/S PGM ZERO ORDER MASK (41190)	33.05 mm	+	0.2 mm	+	0.44 mm		33.69 mm	7.10 −Y
9	PGM UNCOOLED APERTURE #1 UPSTREAM (41351)	10.0 mm	−	0.2 mm	+	0.44 mm	=	10.64 mm	5.77 +Y / 14.66 −Y
10	PGM UNCOOLED APERTURE #2 UPSTREAM (41569)	10.0 mm	−	0.2 mm	+	0.44 mm	=	10.64 mm	–
11	PINK BEAM STOP (47672)	35.0 mm	−	0.2 mm	−	0.44 mm	=	34.36 mm	4.61 +Y / 19.39 −Y
12	PINK BEAM STOP ABSORBER PLT (42671)	110.0 mm	−	0.2 mm	+	0.44 mm	=	109.36 mm	–



MAXIMUM SYNCHROTRON RAY TRACING - VERTICAL "M" BRANCH

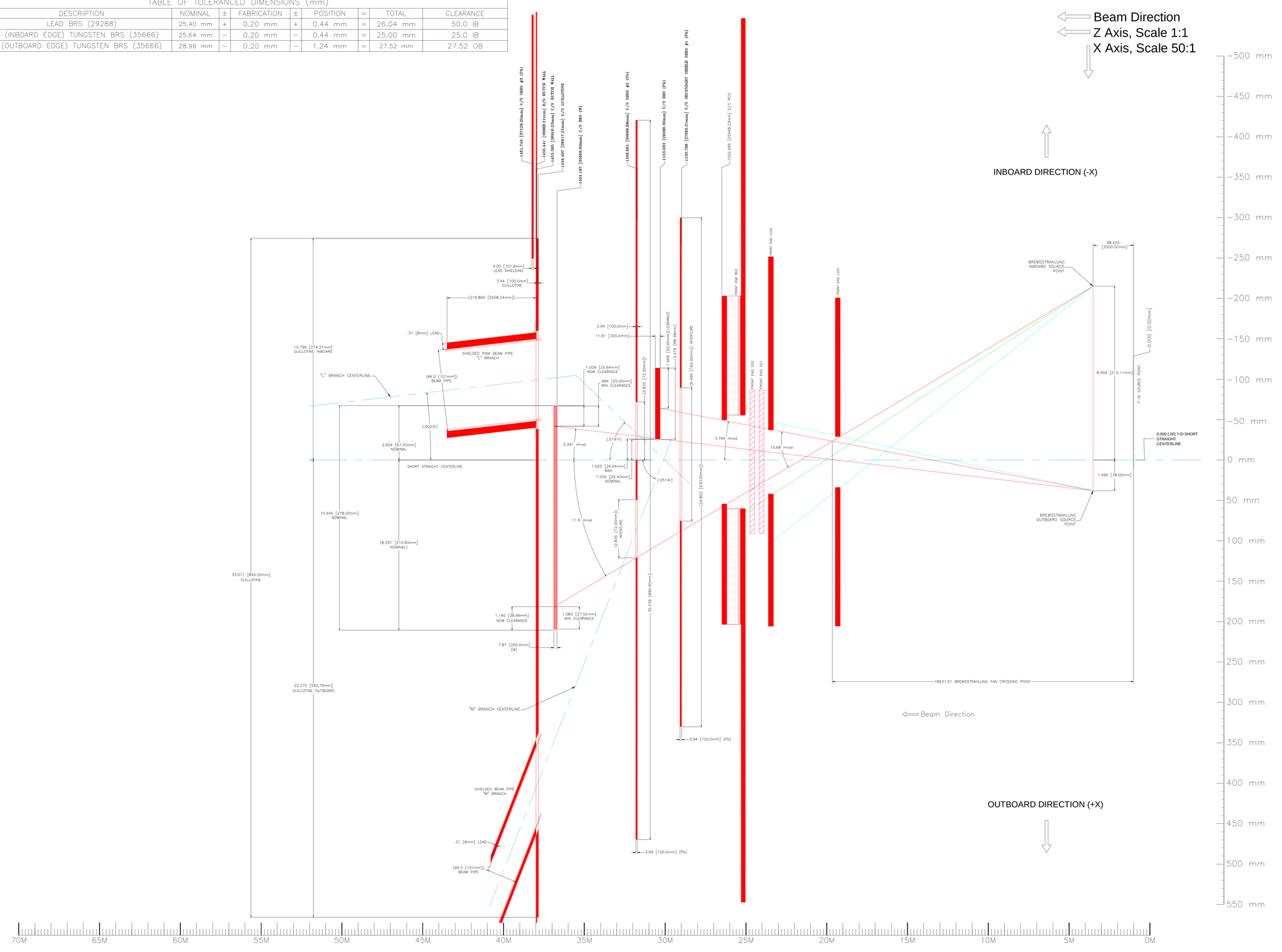
Scale 1:75

SEE FRONT END RAY TRACING
SR-FE-IVU07-1001

E	PD-SST-RAYT-0001	B
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1	SHEET 6 OF 10	

RELEASED – EFFECTIVE

TABLE OF TOLERANCED DIMENSIONS (mm)									
LINE	DESCRIPTION	NOMINAL	±	FABRICATION	±	POSITION	=	TOTAL	CLEARANCE
1	LEAD BRS (29288)	25.40 mm	+	0.20 mm	+	0.44 mm	=	26.04 mm	50.0 IB
2	(INBOARD EDGE) TUNGSTEN BRS (35666)	25.64 mm	–	0.20 mm	–	0.44 mm	=	25.00 mm	25.0 IB
3	(OUTBOARD EDGE) TUNGSTEN BRS (35666)	28.96 mm	–	0.20 mm	–	1.24 mm	=	27.52 mm	27.52 OB



Bremsstrahlung Ray Tracing - Horizontal

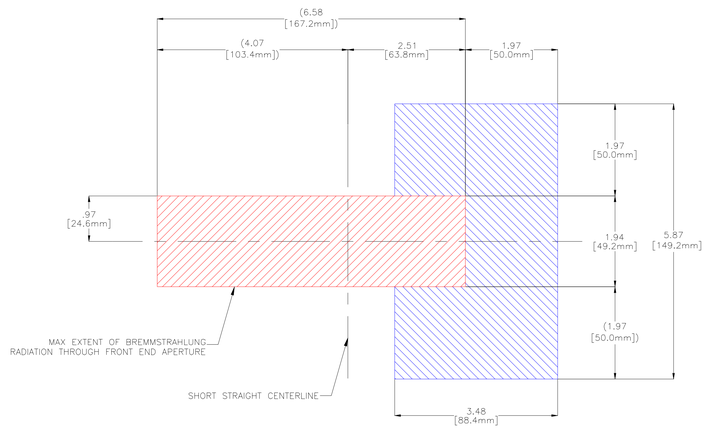
Scale 1:75

SEE FRONT END RAY TRACING
SR-FE-IVU07-1001

E	PD-SST-RAYT-0001	B
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1		SHEET 7 OF 10

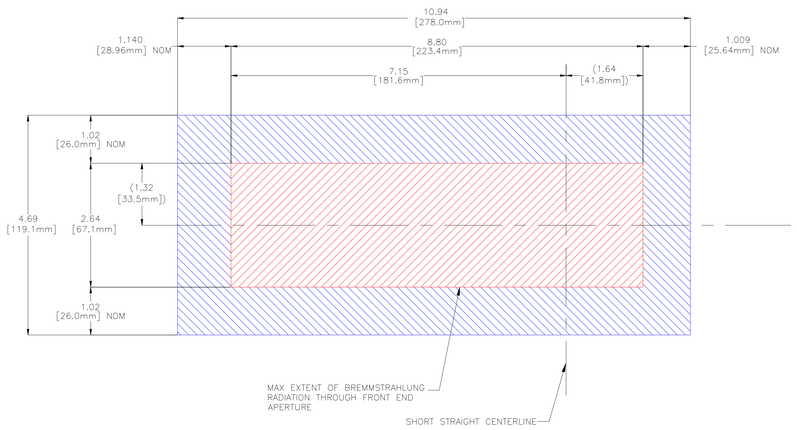
RELEASED – EFFECTIVE

TABLE OF TOLERANCED DIMENSIONS (mm)								
LINE	DESCRIPTION	NOMINAL	±	FABRICATION	±	POSITION	=	TOTAL
1	LEAD BRS (29288)	50.00 mm	–	0.40 mm	–	0.44 mm	=	49.16 mm
2	TUNGSTEN BRS (35666)	26.00 mm	–	0.40 mm	–	0.44 mm	=	25.16 mm



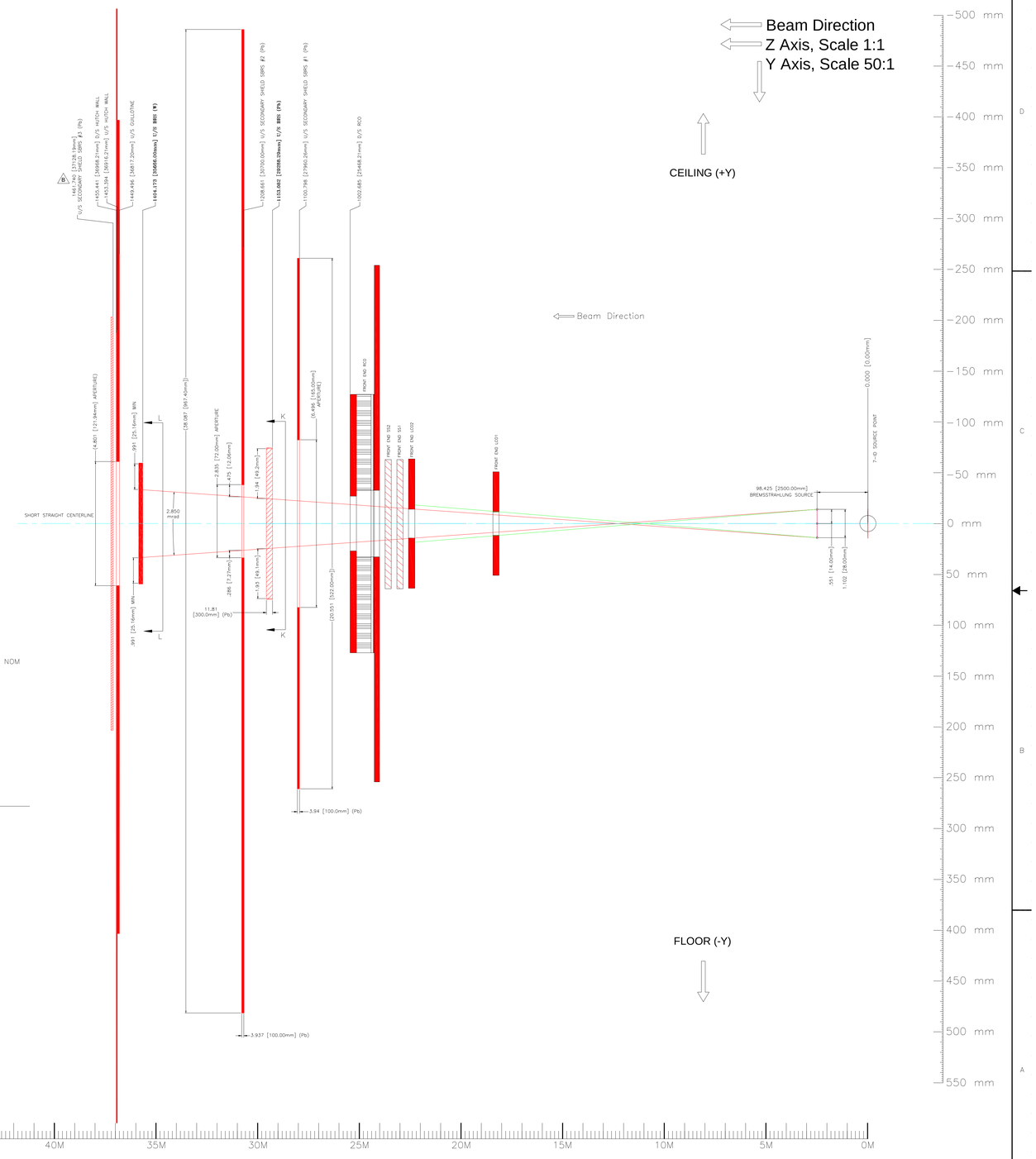
DETAIL K–K LEAD BRS
SCALE: 1:1

FRONT FACE OF FIRST BREMMSTRAHLUNG STOP, IN AIR, LEAD LENGTH 300mm AT 29.288 m



DETAIL L–L BRS
SCALE: 1:1

VIEW ON 'B' – FRONT FACE OF SECOND BREMMSTRAHLUNG STOP, IN AIR, TUNGSTEN LENGTH 200mm AT 35.666 m



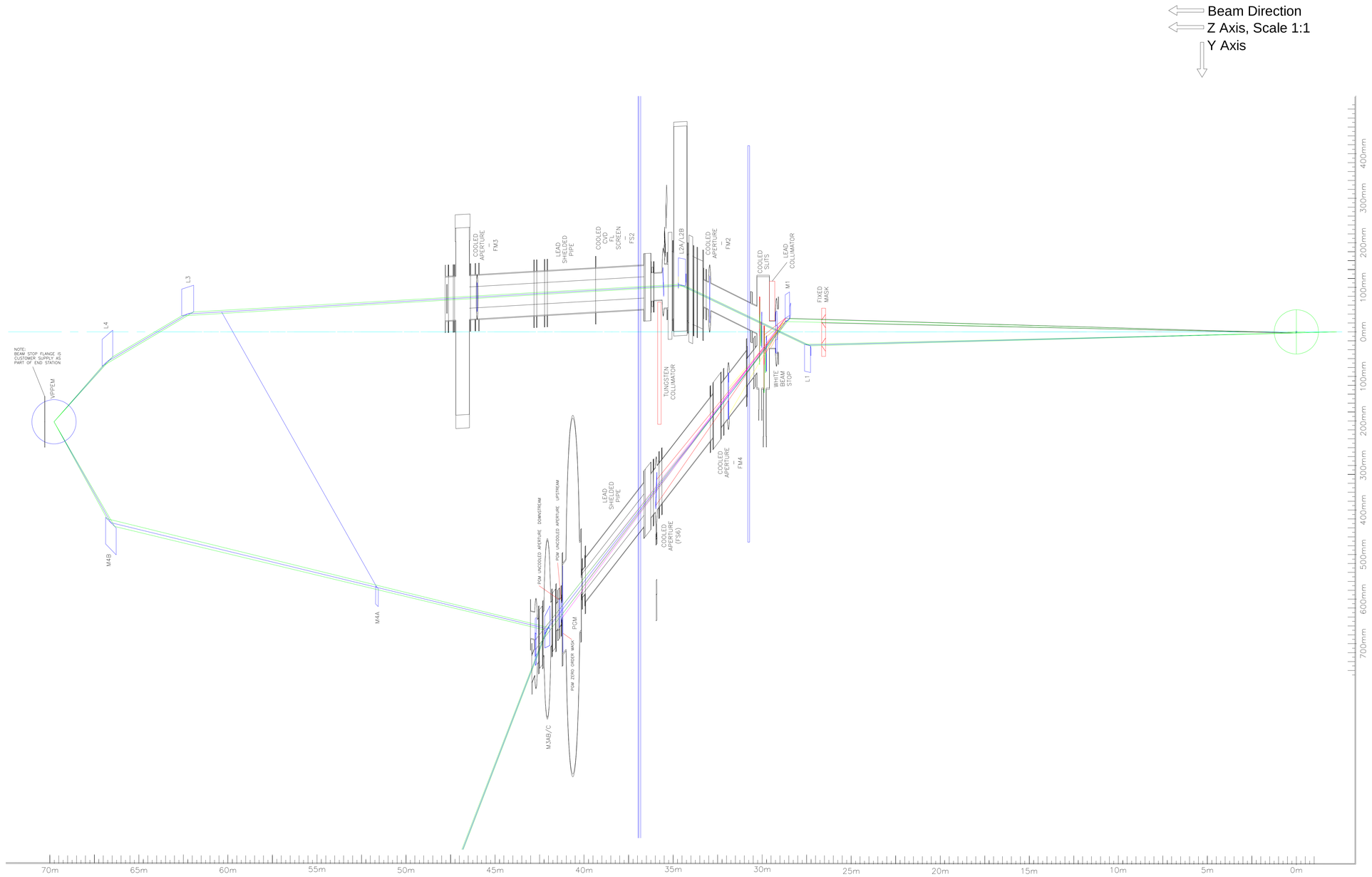
Bremsstrahlung Ray Tracing - Vertical

Scale 1:75

SEE FRONT END RAY TRACING
SR-FE-IVU07-1001

E	PD-SST-RAYT-0001	B
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1		SHEET 8 OF 10

RELEASED – EFFECTIVE



NOTE:

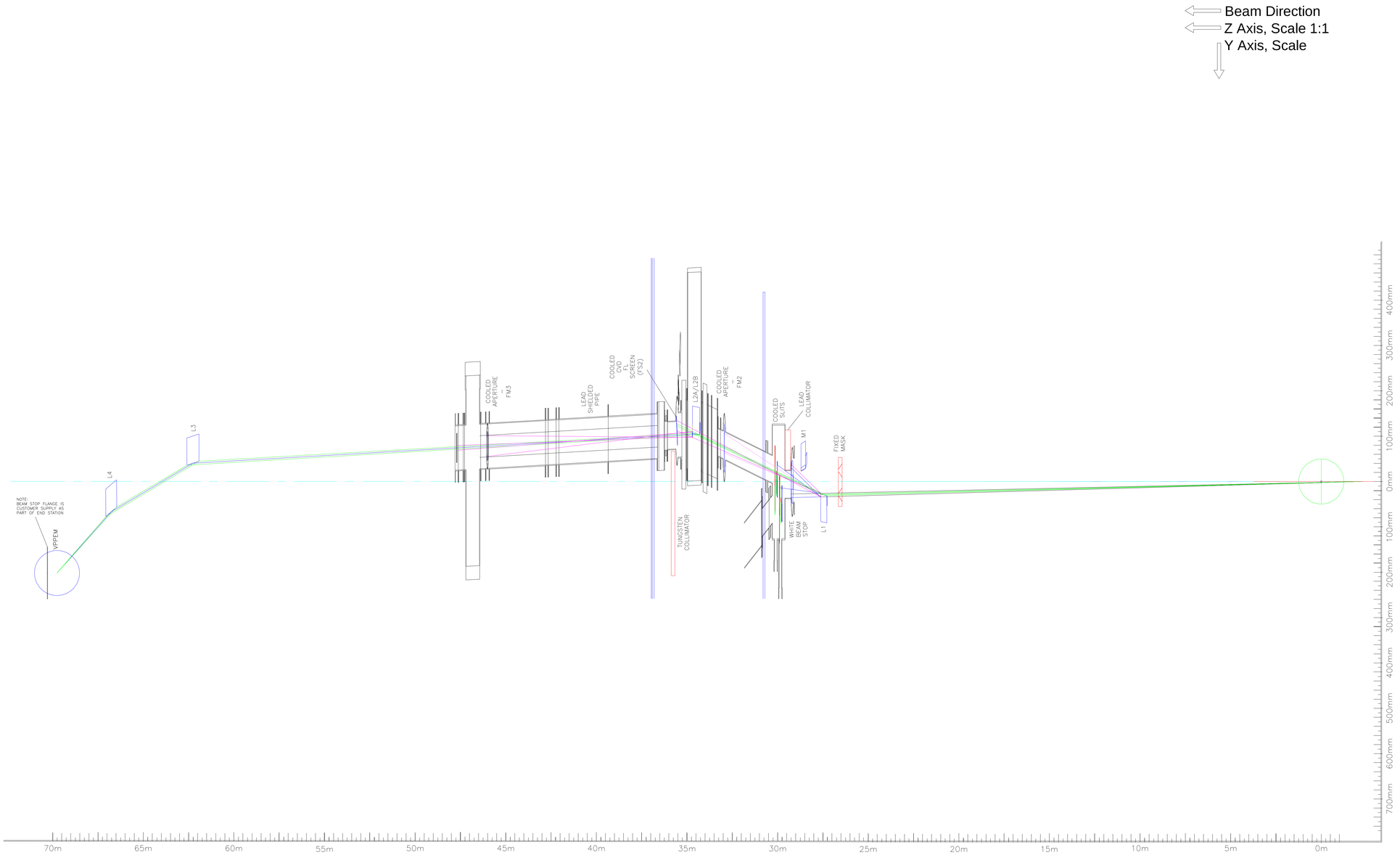
1. FMB OXFORD MIS-STEER DRAWINGS COPIED AND USED FOR REFERENCE.
   FMB DRAWING NO. AHB0531 REV 13.

Synchrotron Mis-steer (M- Branch) - Horizontal

Scale 1:75

E	PD-SST-RAYT-0001	B
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1	SHEET 9 OF 10	

RELEASED – EFFECTIVE



NOTE:

1. FMB OXFORD MIS-STEER DRAWINGS COPIED AND USED FOR REFERENCE.
   FMB DRAWING NO. AHB0531 REV 13.

Synchrotron Mis-steer (L - Branch) - Horizontal

Scale 1:75

E	PD-SST-RAYT-0001	B
ENGINEER	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1		SHEET 10 OF 10

RELEASED – EFFECTIVE