Approved by P Zschack

ECO-003834

Change Order Title:

PHOTON DIVISION, ESM BEAMLINE, RAY TRACING LAYOUT

Detailed Description:

INITIAL RELEASE OF: Drawing # PD-ESM-RAYT-0001 REV A

ECO Properties

Change Order Number:	ECO-003834	**State:**	Review
Due Date:	2/3/2016	**Submitted by:**	stelmach
Date Submitted:	5/23/2016 10:41:05 AM		

Properties

Job Account Code	50190	**Quality Class. Risk Level**	A-1
WBS #	2.05.02.02		

Associated Items

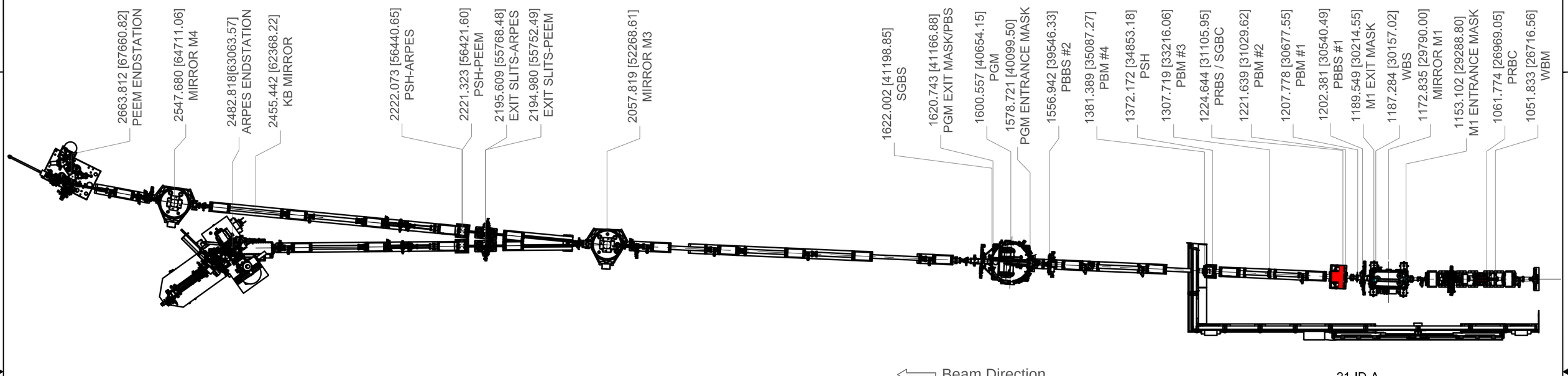
PD-ESM-RAYT-0001			
Name	PD-ESM-RAYT-0001	**Revision**	A
State (Historical)	In Review	**Title (Item,CO)**	PD-ESM-RAYT-0001

Comments

Title	Created By	Created	State
ECO-003834 Submit to Check	pjerov	5/5/2016	Work
ECO-003834 Submit to Check	pjerov	4/20/2016	Work
ECO-003834 Reject to Work	amarito	4/21/2016	Check
ECO-003834 Submit to Check	pjerov	5/23/2016	Work
ECO-003834 Reject to Work	stelmach	5/23/2016	Check
ECO-003834 Submit to Check	pjerov	5/23/2016	Work
ECO-003834 Reject to Rejected There are 10 sheets showing up in preview window but only 9 sheets in the drawing	loftus	5/25/2016	Review
ECO-003834 Re-Open to Open	loftus	5/25/2016	Rejected
ECO-003834 Submit to Work	loftus	5/25/2016	Open
ECO-003834 Approve to Review	stelmach	5/23/2016	Check

REVISION HISTORY					
REV	DESCRIPTION	DATE	DESIGNER	CHECKED BY	ENGINEER
A	RELEASE PER ECO 003834	3/28/2016	S. PJEROV	C. STELMACH	Y. ZHU

NOTES:
1. FE REFERENCE DRAWING SR-FE-EPU21-1001 REV. C
2. THE CENTER OF STRAIGHT IS THE ORIGIN FOR ALL DIMENSIONS UNLESS OTHERWISE NOTED.
3. BLUE AND MAGENTA COLORED RAYS ARE DETERMINED BY TOLERANCED APERTURES. GREEN COLORED RAYS ARE DETERMINED BY NOMINAL APERTURES.
4. DIMENSIONS PBM #1, #2, #3 AND #4 ARE TO GLIDCOP BLOCK FRONT SUFRACE.



SPECIFICATIONS		REFERENCE
Project	NEXT PROJECT	NX-C-XFD-RSI-001
Source	EPU105, EPU 57	NX-C-XFD-RSI-001
Beam Line Name	ELECTRON SPECTRO-MICROSCOPY	NX-C-XFD-RSI-001
Abbreviation	ESM	NX-C-XFD-RSI-001
Period of insertion device	105 mm, 57 mm	NX-C-XFD-RSI-001
Long / Short Straight / Cell	SHORT/21-ID	NX-C-XFD-RSI-001
Length of Source	2800 mm, 1400 mm	NX-C-XFD-RSI-001
Location of Center of Source (from Center of Straight)	+790 mm, -1492 mm	NX-C-XFD-RSI-001
Ray Tracing Procedure		PS-C-XFD-PRC-008 (Version 2)
Front End Ray Tracing Drawing		SR-FE-EPU21-1001 (REV. C)

ESM BEAMLINE LAYOUT
SCALE 1:30

ABBREVIATIONS:
ARPES - ANGLE - RESOLVED PHOTO EMISSION SPECTROSCOPY
DS - DOWNSTREAM
LCO - LEAD COLLIMATOR
PBBS - PINK BEAM BAFFLE SLITS
PBM - PINK BEAM MASK
PBS - PINK BEAM STOP
PEEM - PHOTO EMISSION ELECTRON MICROSCOPES
PRBC - PRIMARY BREMSSTRAHLUNG COLLIMATOR
PRBS - PRIMARY BREMSSTRAHLUNG STOP
PGM - PLANE GRATING MONOCHROMATER
PSH - PHOTON SHUTTER
SGBC - SECENDARY GAS BREMSSTRAHLUNG COLLIMATOR
SGBS - SECENDARY GAS BREMSSTRAHLUNG STOP
US - UPSTREAM
WBM - WHITE BEAM MASK
WBS - WHITE BEAM STOP

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
DIMENSIONS IN BRACKETS [xx.xx] (WHERE PRESENT) ARE MILLIMETERS AND ARE FOR REFERENCE ONLY
INTERPRET DRAWING AS PER ANSI Y14.5-1994 OR Y32.2-1975
DIMENSIONAL TOLERANCES: X. ± 0.060, .X ± 0.030, .XX ± 0.015, .XXX ± 0.005
ANGULAR TOLERANCE: ± .5
FINISH: 125
BREAK EDGES & SHARP CORNERS 0.005 MIN. TO 0.030 MAX.
THIRD ANGLE PROJECTION
SCALE: NOTED

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

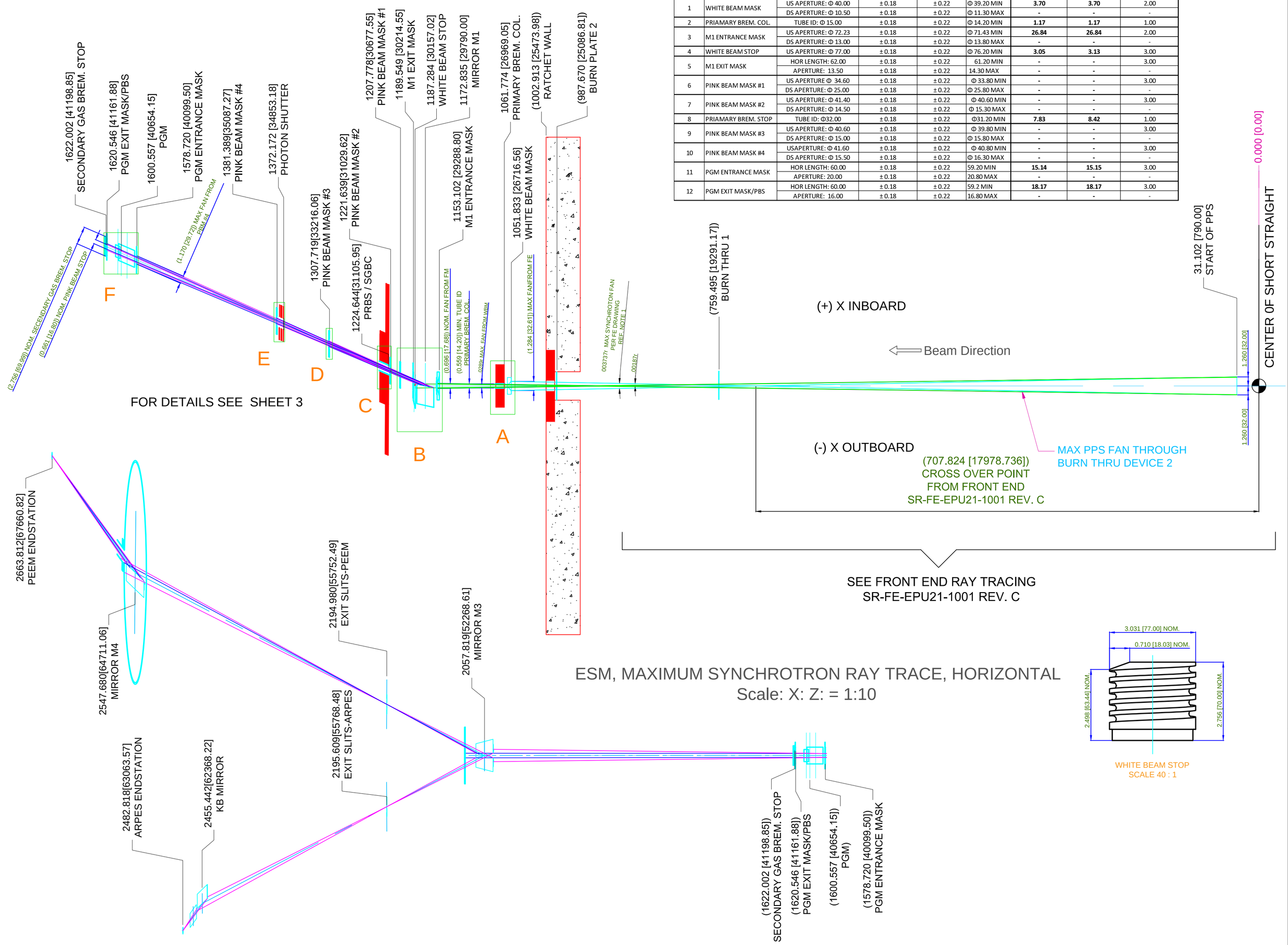
DRAWN BY	S. PJEROV	3/2016
CHECKED BY	C. STELMACH	4/2016
VACUUM APPROVAL		
ENGINEER APPROVAL	Y. ZHU	4/2016
SUPERVISOR APPROVAL	E. VESCOVO	4/2016
SAFETY APPROVAL	L. STIEGLER	4/2016
QA APPROVAL	J. ZIPPER	4/2016

PHOTON DIVISION
ESM RAY TRACING
ESM BEAMLINE RAY TRACING

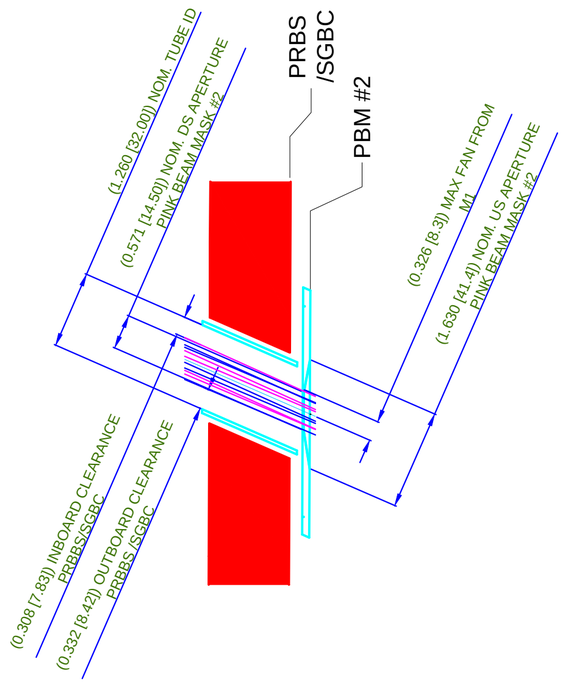
NEXT ASSY:
PROJECT: ESM BEAMLINES
WBS# 2,05.02.02
ESH&Q RISK LEVEL A-1
SHEET SIZE: E
DRAWING/PART NUMBER: PD-ESM-RAYT-0001
REVISION: A
SHEET 1 OF 9

PD\ESM\RAYT\PD-CSX-RAYT-0001

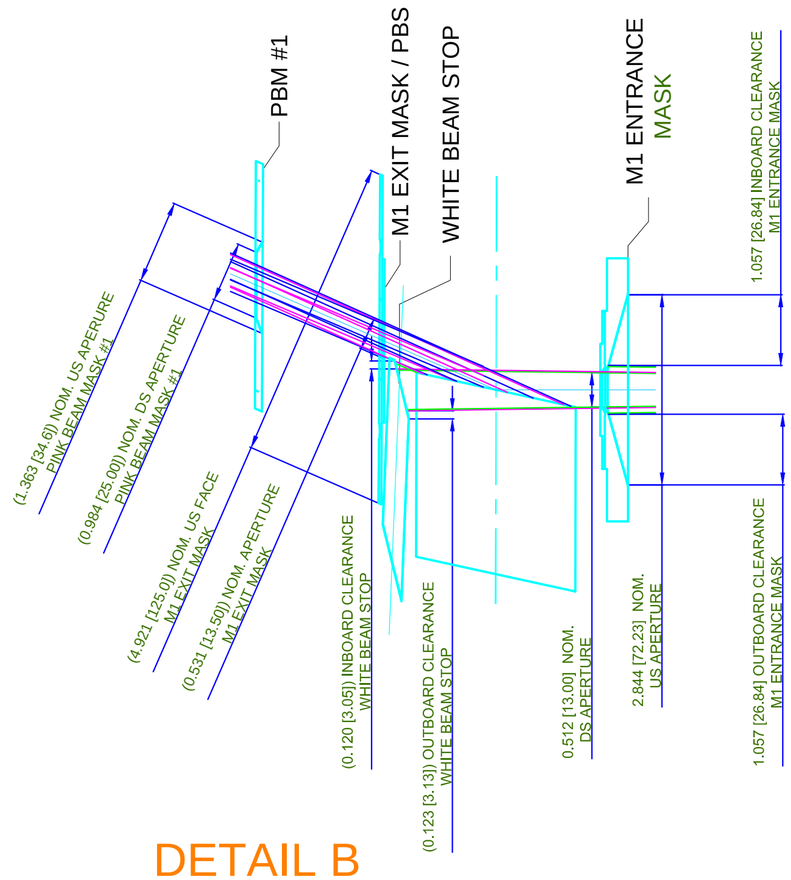
TABLE OF TOLERANCED DIMENSIONS						CLEARNACE/MARGIN SPACE		
LINE	DESCRIPTION	NORMAL	FABRICATION TOL	POSITION TOL	TOTAL	INBOARD	OUTBOARD	REQUIRED
1	WHITE BEAM MASK	US APERTURE: Φ 40.00	± 0.18	± 0.22	Φ 39.20 MIN	**3.70**	**3.70**	2.00
		DS APERTURE: Φ 10.50	± 0.18	± 0.22	Φ 11.30 MAX	-	-	-
2	PRIAMARY BREM. COL.	TUBE ID: Φ 15.00	± 0.18	± 0.22	Φ 14.20 MIN	**1.17**	**1.17**	1.00
3	M1 ENTRANCE MASK	US APERTURE: Φ 72.23	± 0.18	± 0.22	Φ 71.43 MIN	**26.84**	**26.84**	2.00
		DS APERTURE: Φ 13.00	± 0.18	± 0.22	Φ 13.80 MAX	-	-	-
4	WHITE BEAM STOP	US APERTURE: Φ 77.00	± 0.18	± 0.22	Φ 76.20 MIN	**3.05**	**3.13**	3.00
5	M1 EXIT MASK	HOR LENGTH: 62.00	± 0.18	± 0.22	61.20 MIN	-	-	3.00
		APERTURE: 13.50	± 0.18	± 0.22	14.30 MAX	-	-	-
6	PINK BEAM MASK #1	US APERTURE Φ 34.60	± 0.18	± 0.22	Φ 33.80 MIN	-	-	3.00
		DS APERTURE: Φ 25.00	± 0.18	± 0.22	Φ 25.80 MAX	-	-	-
7	PINK BEAM MASK #2	US APERTURE: Φ 41.40	± 0.18	± 0.22	Φ 40.60 MIN	-	-	3.00
		DS APERTURE: Φ 14.50	± 0.18	± 0.22	Φ 15.30 MAX	-	-	-
8	PRIAMARY BREM. STOP	TUBE ID: Φ32.00	± 0.18	± 0.22	Φ31.20 MIN	**7.83**	**8.42**	1.00
9	PINK BEAM MASK #3	US APERTURE: Φ 40.60	± 0.18	± 0.22	Φ 39.80 MIN	-	-	3.00
		DS APERTURE: Φ 15.00	± 0.18	± 0.22	Φ 15.80 MAX	-	-	-
10	PINK BEAM MASK #4	USAPERTURE: Φ 41.60	± 0.18	± 0.22	Φ 40.80 MIN	-	-	3.00
		DS APERTURE: Φ 15.50	± 0.18	± 0.22	Φ 16.30 MAX	-	-	-
11	PGM ENTRANCE MASK	HOR LENGTH: 60.00	± 0.18	± 0.22	59.20 MIN	**15.14**	**15.15**	3.00
		APERTURE: 20.00	± 0.18	± 0.22	20.80 MAX	-	-	-
12	PGM EXIT MASK/PBS	HOR LENGTH: 60.00	± 0.18	± 0.22	59.2 MIN	**18.17**	**18.17**	3.00
		APERTURE: 16.00	± 0.18	± 0.22	16.80 MAX	-	-	-



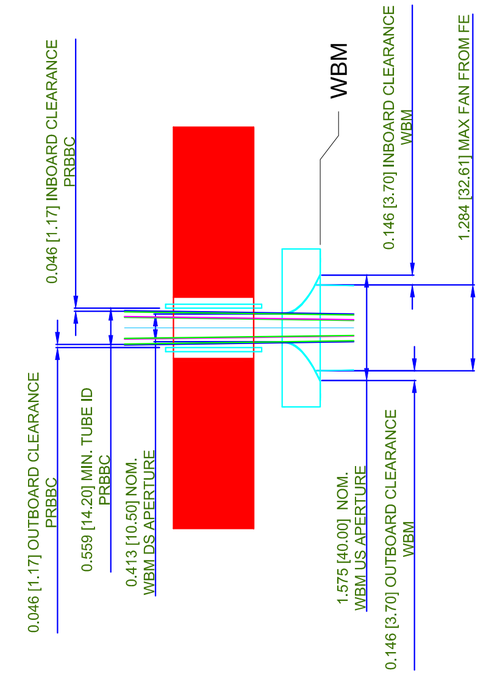
E	PD-ESM-RAYT-0001	A
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1	SHEET 2 OF 9	



DETAIL C
SCALE 4:1

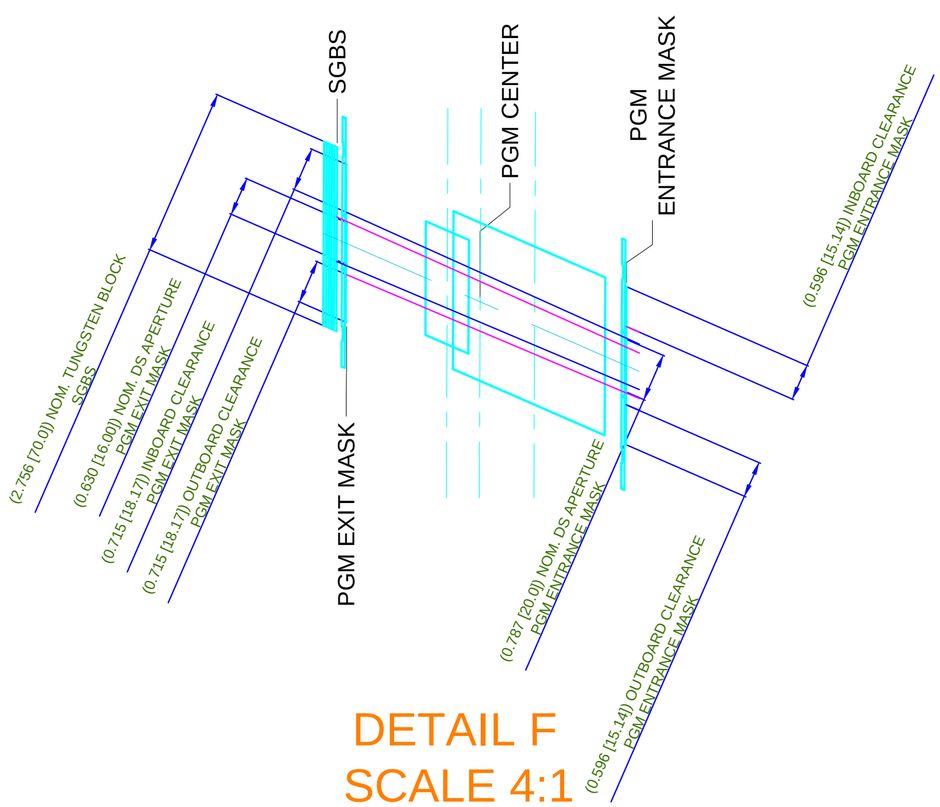


DETAIL B
SCALE 4:1

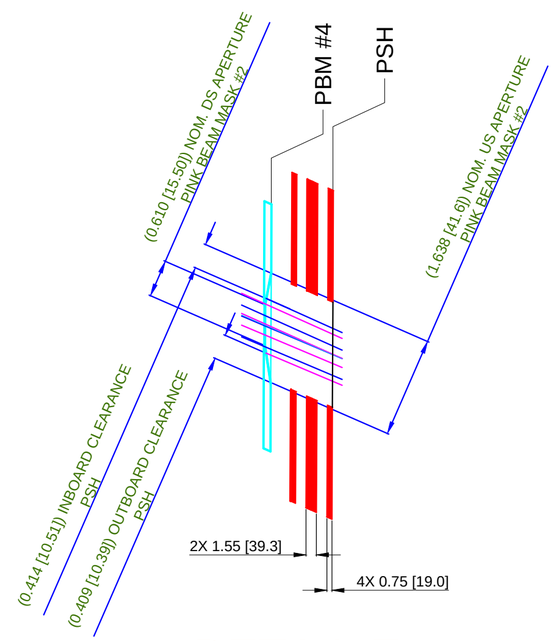


DETAIL A
SCALE 4:1

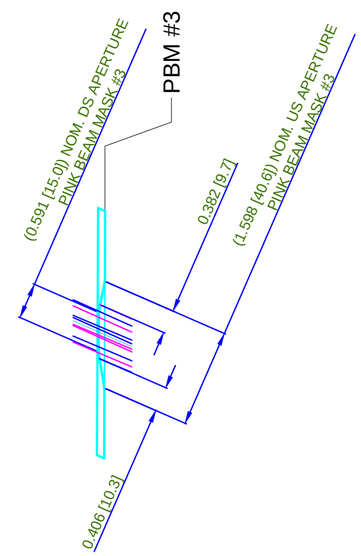
Beam Direction



DETAIL F
SCALE 4:1



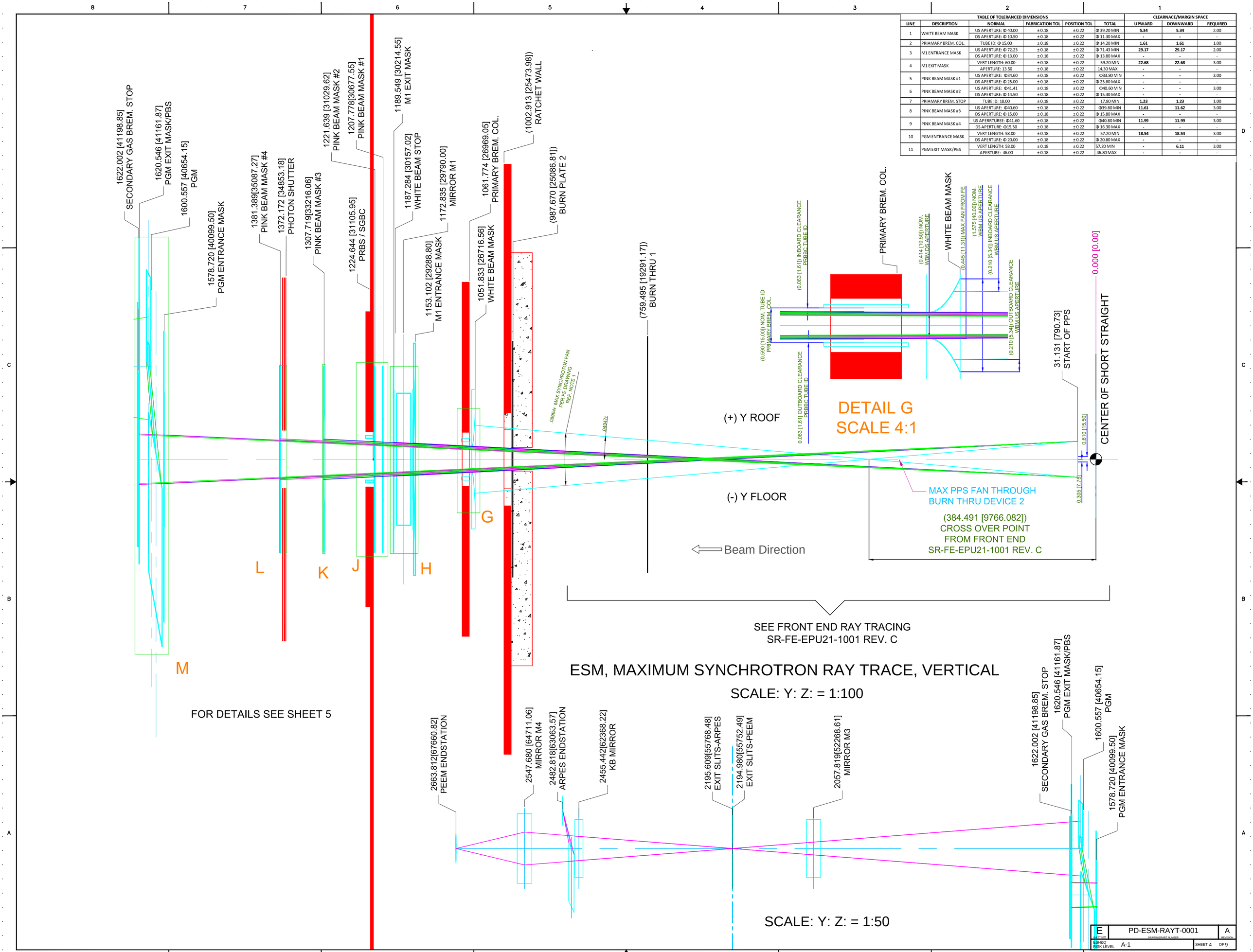
DETAIL E
SCALE 4:1



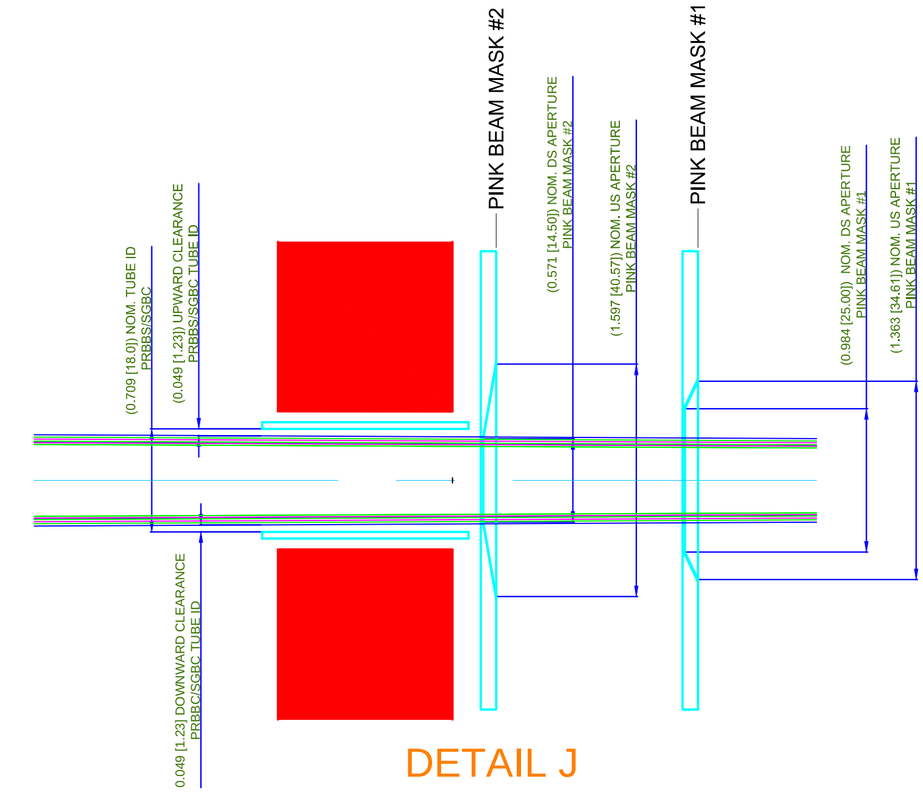
DETAIL D
SCALE 4:1

E	PD-ESM-RAYT-0001	A
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1	SHEET 3 OF 9	

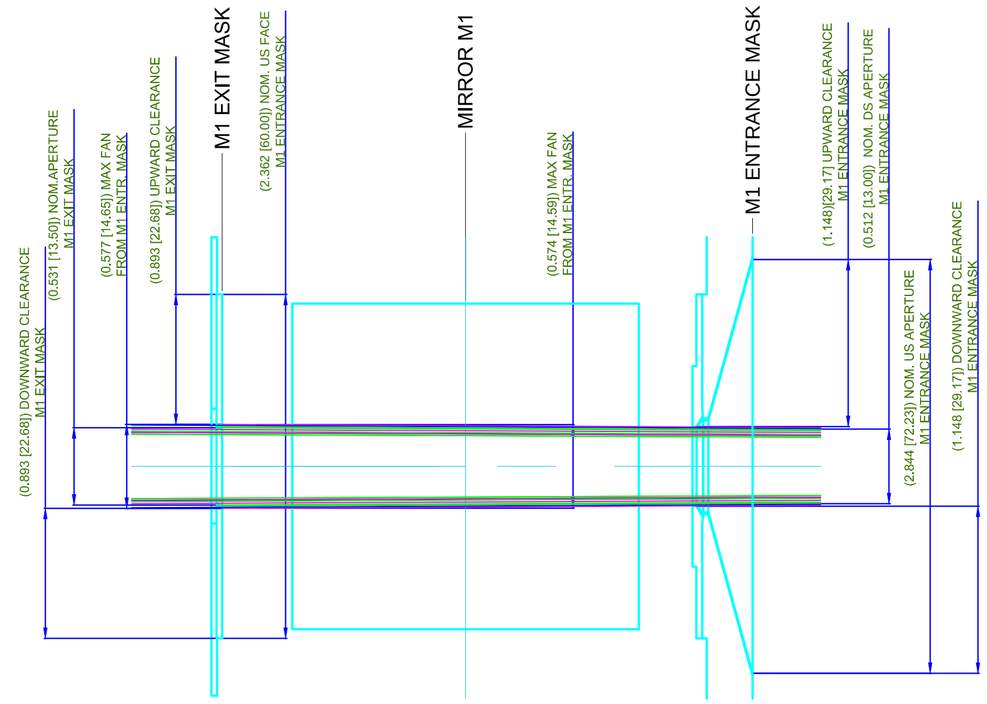
TABLE OF TOLERANCED DIMENSIONS						CLEARNACE/MARGIN SPACE		
LINE	DESCRIPTION	NORMAL	FABRICATION TOL	POSITION TOL	TOTAL	UPWARD	DOWNWARD	REQUIRED
1	WHITE BEAM MASK	US APERTURE: Φ 40.00	± 0.18	± 0.22	Φ 39.20 MIN	**5.34**	**5.34**	2.00
		DS APERTURE: Φ 10.50	± 0.18	± 0.22	Φ 11.30 MAX	-	-	-
2	PRIAMARY BREM. COL.	TUBE ID: Φ 15.00	± 0.18	± 0.22	Φ 14.20 MIN	**1.61**	**1.61**	1.00
3	M1 ENTRANCE MASK	US APERTURE: Φ 72.23	± 0.18	± 0.22	Φ 71.43 MIN	**29.17**	**29.17**	2.00
		DS APERTURE: Φ 13.00	± 0.18	± 0.22	Φ 13.80 MAX	-	-	-
4	M1 EXIT MASK	VERT LENGTH: 60.00	± 0.18	± 0.22	59.20 MIN	**22.68**	**22.68**	3.00
		APERTURE: 13.50	± 0.18	± 0.22	14.30 MAX	-	-	-
5	PINK BEAM MASK #1	US APERTURE: Φ34.60	± 0.18	± 0.22	Φ33.80 MIN	-	-	3.00
		DS APERTURE: Φ 25.00	± 0.18	± 0.22	Φ 25.80 MAX	-	-	-
6	PINK BEAM MASK #2	US APERTURE: Φ41.41	± 0.18	± 0.22	Φ40.60 MIN	-	-	3.00
		DS APERTURE: Φ 14.50	± 0.18	± 0.22	Φ 15.30 MAX	-	-	-
7	PRIAMARY BREM. STOP	TUBE ID: 18.00	± 0.18	± 0.22	17.80 MIN	**1.23**	**1.23**	1.00
8	PINK BEAM MASK #3	US APERTURE: Φ40.60	± 0.18	± 0.22	Φ39.80 MIN	**11.61**	**11.62**	3.00
		DS APERTURE: Φ 15.00	± 0.18	± 0.22	Φ 15.80 MAX	-	-	-
9	PINK BEAM MASK #4	US APERRTUREE: Φ41.60	± 0.18	± 0.22	Φ40.80 MIN	**11.99**	**11.99**	3.00
		DS APERTURE: Φ15.50	± 0.18	± 0.22	Φ 16.30 MAX	-	-	-
10	PGM ENTRANCE MASK	VERT LENGTH: 58.00	± 0.18	± 0.22	57.20 MIN	**18.54**	**18.54**	3.00
		DS APERTURE: Φ 20.00	± 0.18	± 0.22	Φ 20.80 MAX	-	-	-
11	PGM EXIT MASK/PBS	VERT LENGTH: 58.00	± 0.18	± 0.22	57.20 MIN	-	**6.11**	3.00
		APERTURE: 46.00	± 0.18	± 0.22	46.80 MAX	-	-	-



E	PD-ESM-RAYT-0001	A
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1	SHEET 4 OF 9	



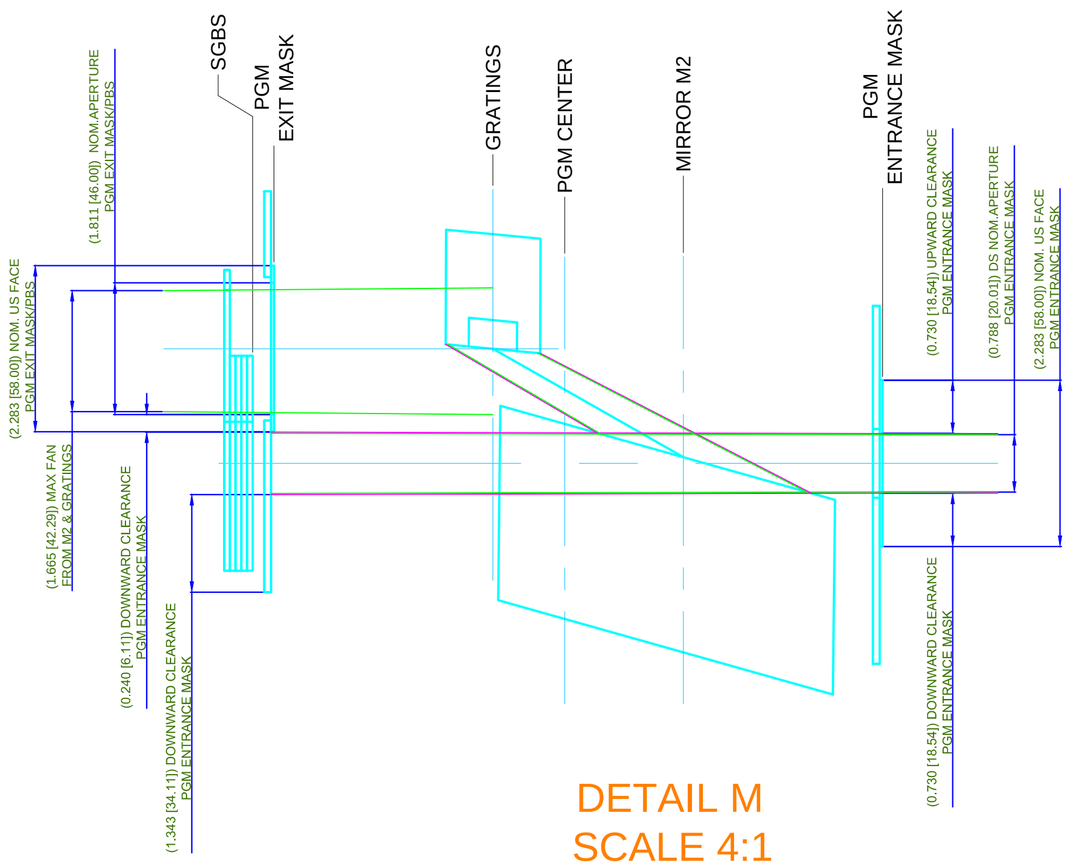
DETAIL J
SCALE 4:1



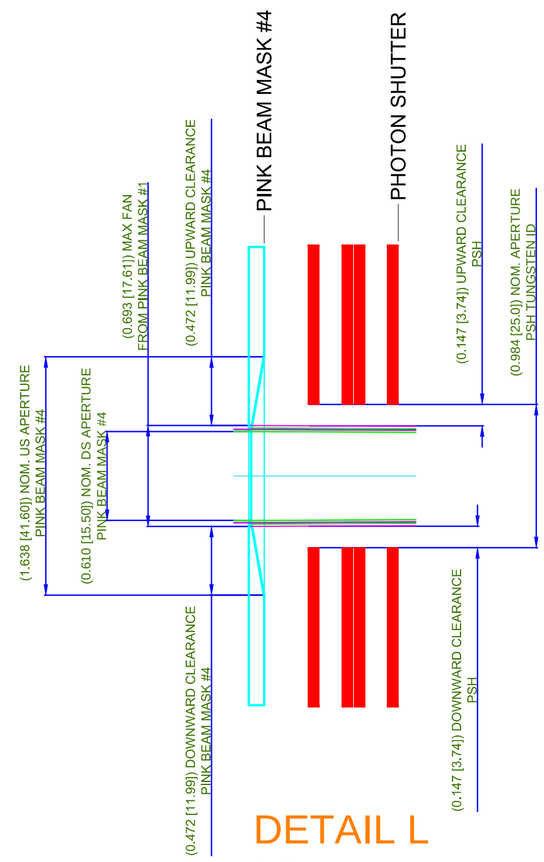
DETAIL H
SCALE 4:1

Beam Direction

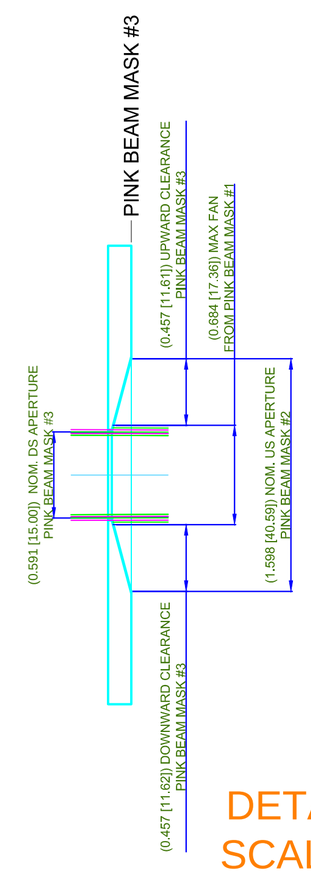
ESM, COLLIMATORS AND MASKS DETAILS, VERTICAL



DETAIL M
SCALE 4:1



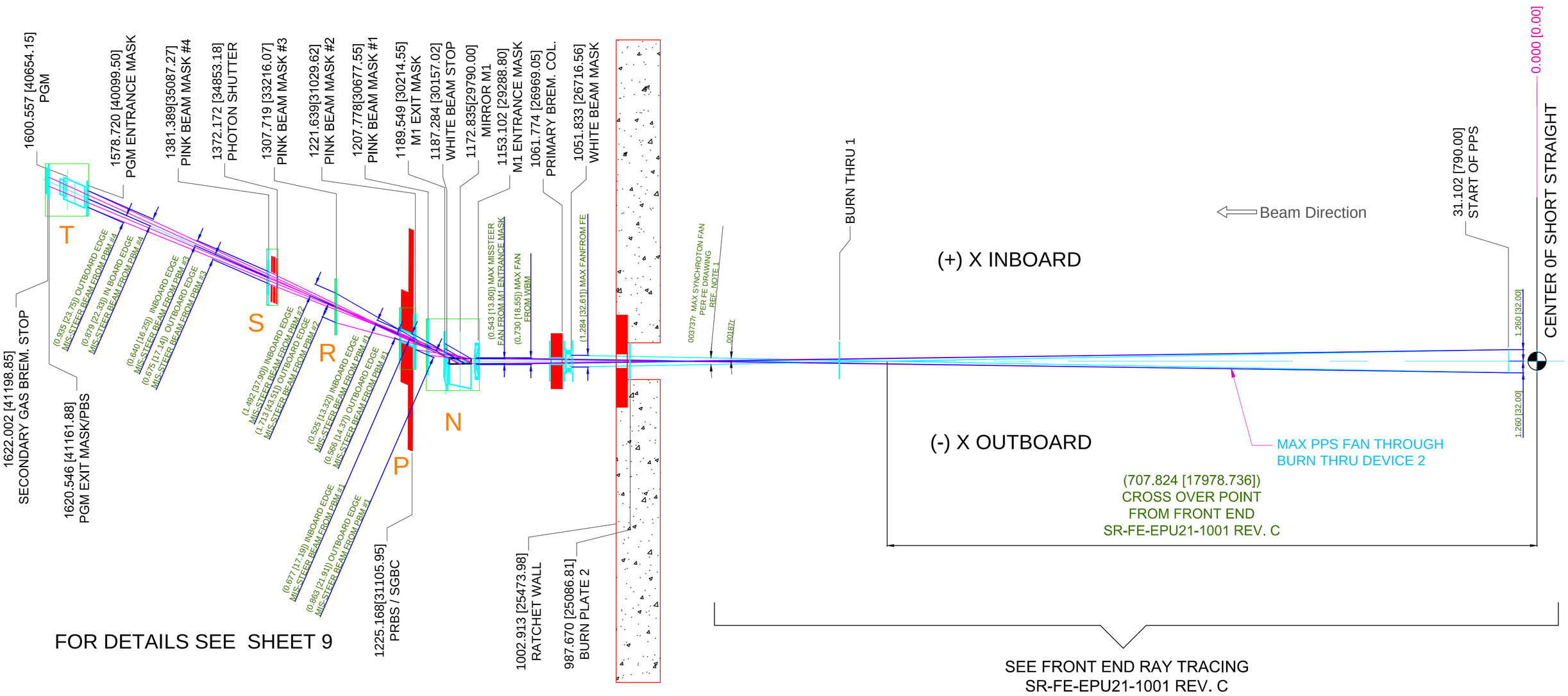
DETAIL L
SCALE 4:1



DETAIL K
SCALE 4:1

E SHEET SIZE	PD-ESM-RAYT-0001 DRAWING/PART NUMBER	A REVISION
ESH&Q RISK LEVEL A-1	SHEET 5 OF 9	

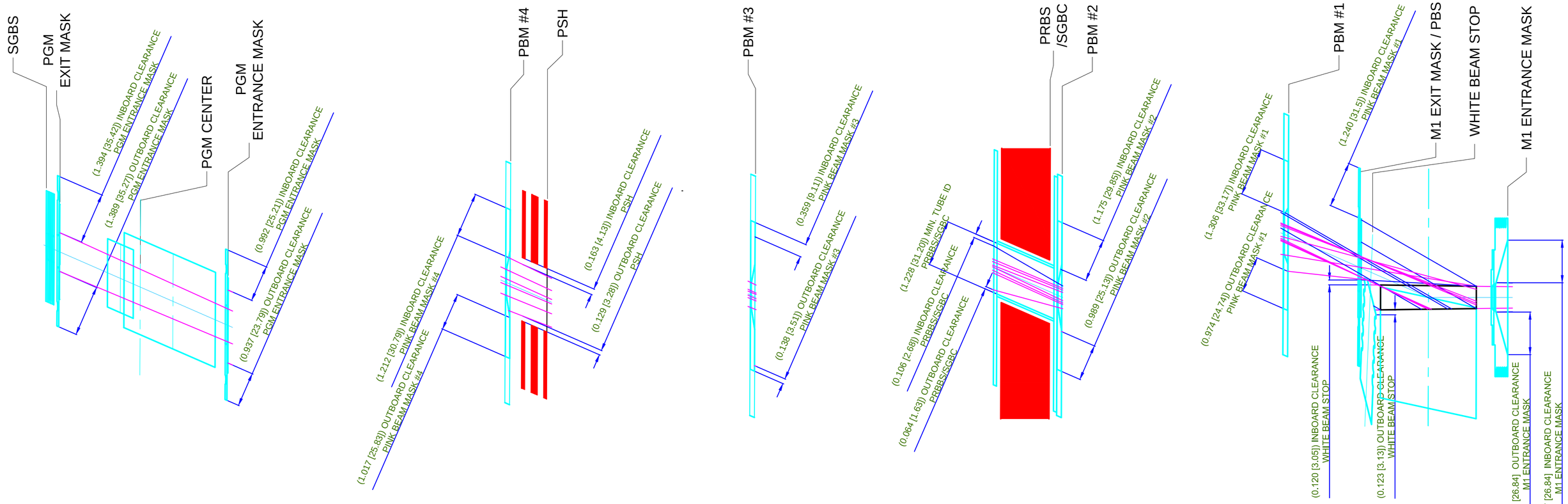
TABLE OF TOLERANCED DIMENSIONS						CLEARNACE/MARGIN SPACE		
LINE	DESCRIPTION	NORMAL	FABRICATION TOL	POSITION TOL	TOTAL	INBOARD	OUTBOARD	REQUIRED
1	WHITE BEAM MASK	US APERTURE: Φ 40.00	± 0.18	± 0.22	Φ 39.20 MIN	**3.70**	**3.70**	2.00
		DS APERTURE: Φ 10.50	± 0.18	± 0.22	Φ 11.30 MAX	-	-	-
2	PRIAMARY BREM. COL.	TUBE ID: Φ 15.00	± 0.18	± 0.22	Φ 14.20 MIN	**1.17**	**1.17**	1.00
3	M1 ENTRANCE MASK	US APERTURE: Φ 72.23	± 0.18	± 0.22	Φ 71.43 MIN	**26.84**	**26.84**	2.00
		DS APERTURE: Φ 13.00	± 0.18	± 0.22	Φ 13.80 MAX	-	-	-
4	WHITE BEAM STOP	US APERTURE: Φ 77.00	± 0.18	± 0.22	Φ 76.20 MIN	**3.05**	**3.13**	3.00
5	M1 EXIT MASK	HOR LENGTH: 62.00	± 0.18	± 0.22	61.20 MIN	-	-	3.00
		APERTURE: 13.50	± 0.18	± 0.22	14.30 MAX	-	-	-
6	PINK BEAM MASK #1	US APERTURE Φ 34.60	± 0.18	± 0.22	Φ 33.80 MIN	-	-	3.00
		DS APERTURE: Φ 25.00	± 0.18	± 0.22	Φ 25.80 MAX	-	-	-
7	PINK BEAM MASK #2	US APERTURE: Φ 41.40	± 0.18	± 0.22	Φ 40.60 MIN	-	-	3.00
		DS APERTURE: Φ 14.50	± 0.18	± 0.22	Φ 15.30 MAX	-	-	-
8	PRIAMARY BREM. STOP	TUBE ID: Φ32.00	± 0.18	± 0.22	Φ31.20 MIN	**7.83**	**8.42**	1.00
9	PINK BEAM MASK #3	US APERTURE: Φ 40.60	± 0.18	± 0.22	Φ 39.80 MIN	-	-	3.00
		DS APERTURE: Φ 15.00	± 0.18	± 0.22	Φ 15.80 MAX	-	-	-
10	PINK BEAM MASK #4	USAPERTURE: Φ 41.60	± 0.18	± 0.22	Φ 40.80 MIN	-	-	3.00
		DS APERTURE: Φ 15.50	± 0.18	± 0.22	Φ 16.30 MAX	-	-	-
11	PGM ENTRANCE MASK	HOR LENGTH: 60.00	± 0.18	± 0.22	59.20 MIN	**15.14**	**15.15**	3.00
		APERTURE: 20.00	± 0.18	± 0.22	20.80 MAX	-	-	-
12	PGM EXIT MASK/PBS	HOR LENGTH: 60.00	± 0.18	± 0.22	59.2 MIN	**18.17**	**18.17**	3.00
		APERTURE: 16.00	± 0.18	± 0.22	16.80 MAX	-	-	-



FOR DETAILS SEE SHEET 9

ESM, MIS-STEERED SYNCHROTRON RAY TRACE, HORIZONTAL
SCALE: X:Z=1:10

E	PD-ESM-RAYT-0001	A
SHEET SIZE	DRAWING/PART NUMBER	REVISION
ESH&Q RISK LEVEL A-1	SHEET 8 OF 9	



DETAIL T
SCALE 4:1

DETAIL S
SCALE 4:1

DETAIL R
SCALE 4:1

DETAIL P
SCALE 4:1

DETAIL N
SCALE 4:1

⇦ Beam Direction

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