

# 4GSR Photon Beam Clearance Issue

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## ID Beam Parameters & Orbit Interlock Tolerance

※ Parameters for typical IDs

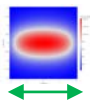
ID	Gap (mm)	$\lambda_u$ (mm)	L (m)	B [x/y] (T)	K [x/y/ $\perp$ ]	Max. Power density (kW/mrad <sup>2</sup> )	Max. Divergence (mrad)
IVU20	5	20	3	0.8867	1.6558	142	$\pm 0.2$ (H)
EPU98	15	98	3.6	H: 0/1.2020	0/11/11	45	$\pm 1.5$ (H)
				V: 0.8015/0	7.335/0/7.335	30	$\pm 1.0$ (V)
				C: 0.6667/0.6675	6.1/6.108/8.633	12	$\pm 0.8$ (H,V)

※ Orbit interlock condition of e-BPMs for the ID

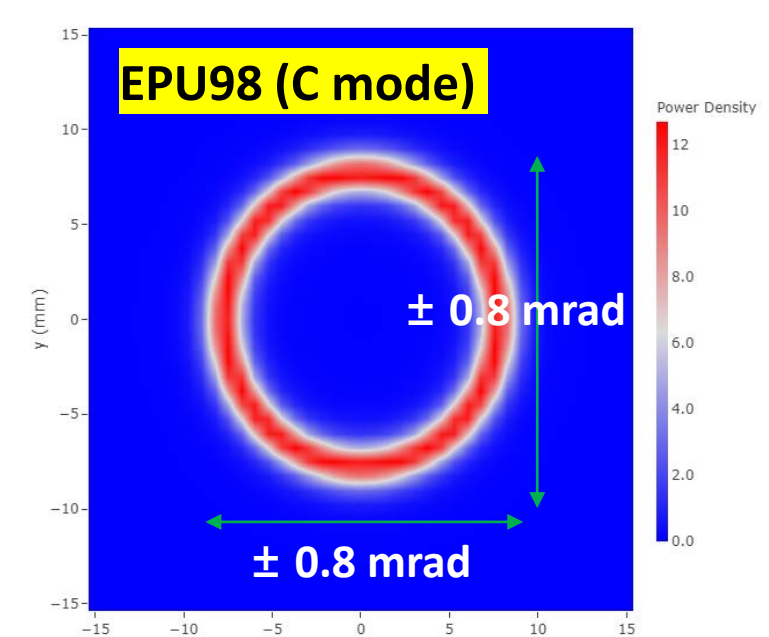
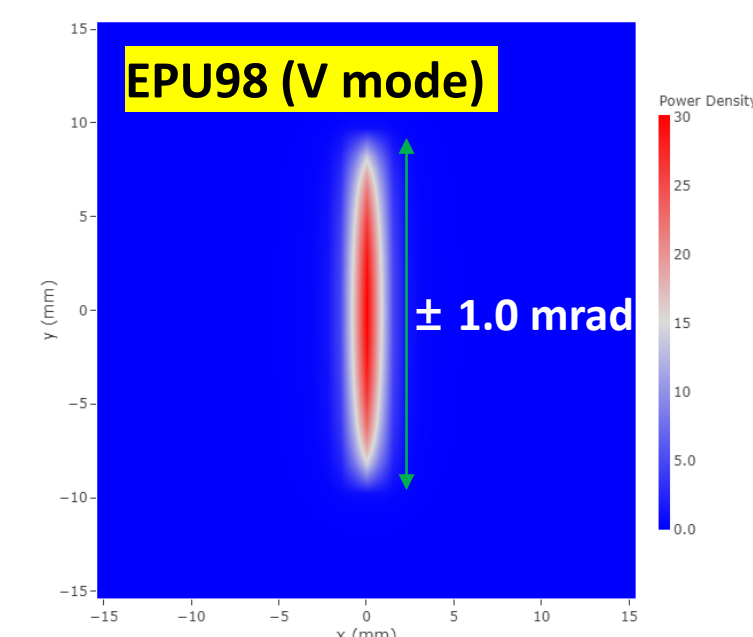
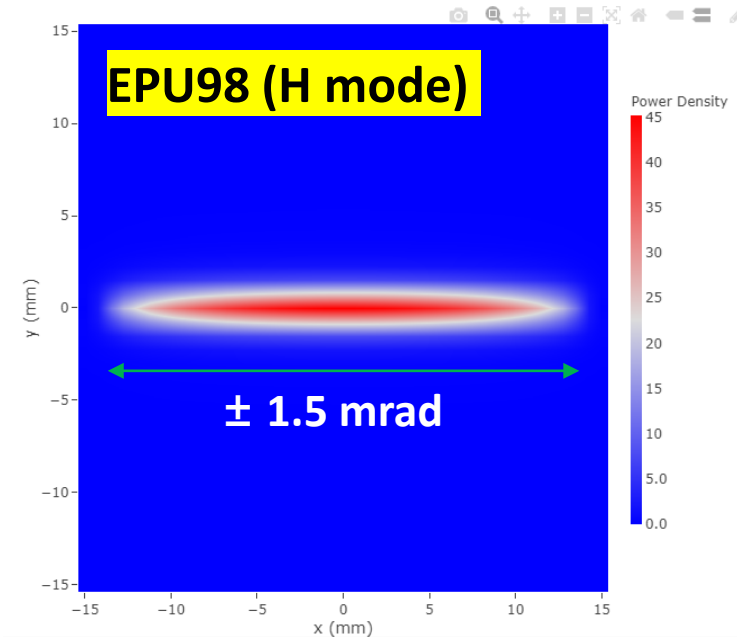
- $\pm 0.1$  mrad  $\pm 400$   $\mu$ m offset (Rms orbit error  $\sim 150$   $\mu$ m)

※ Power density profile @ 10 m from the ID center

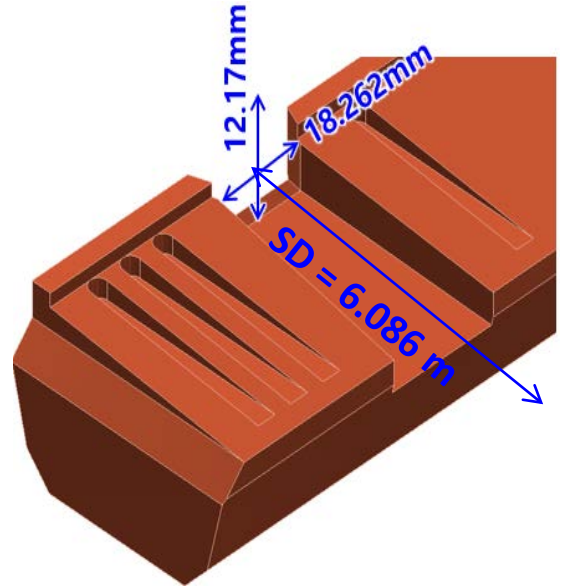
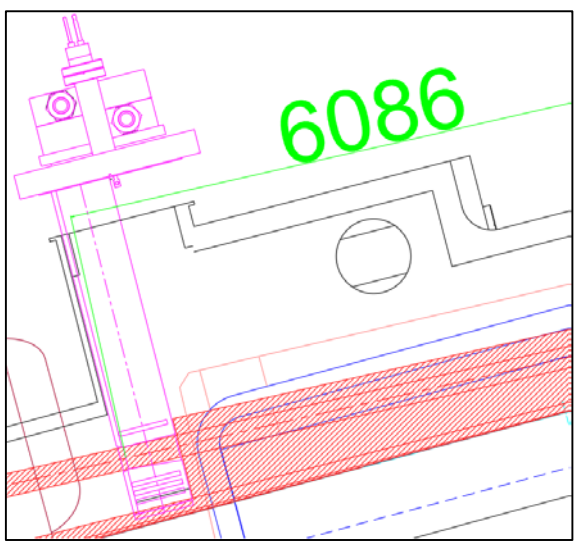
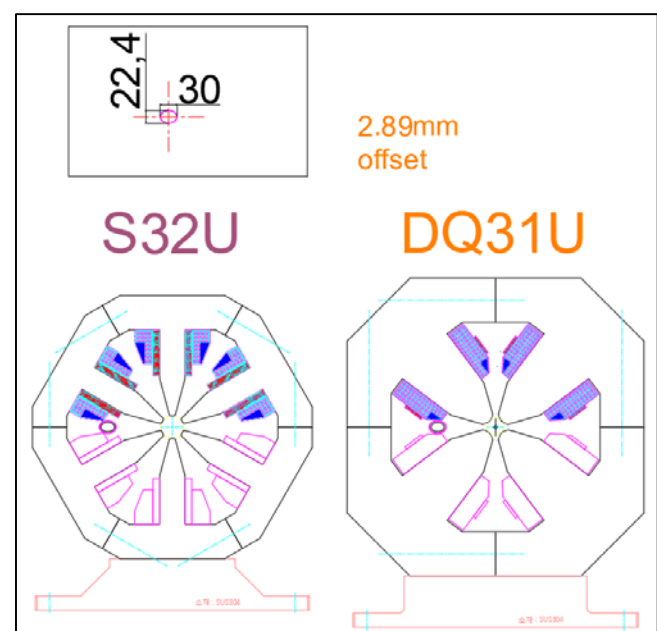
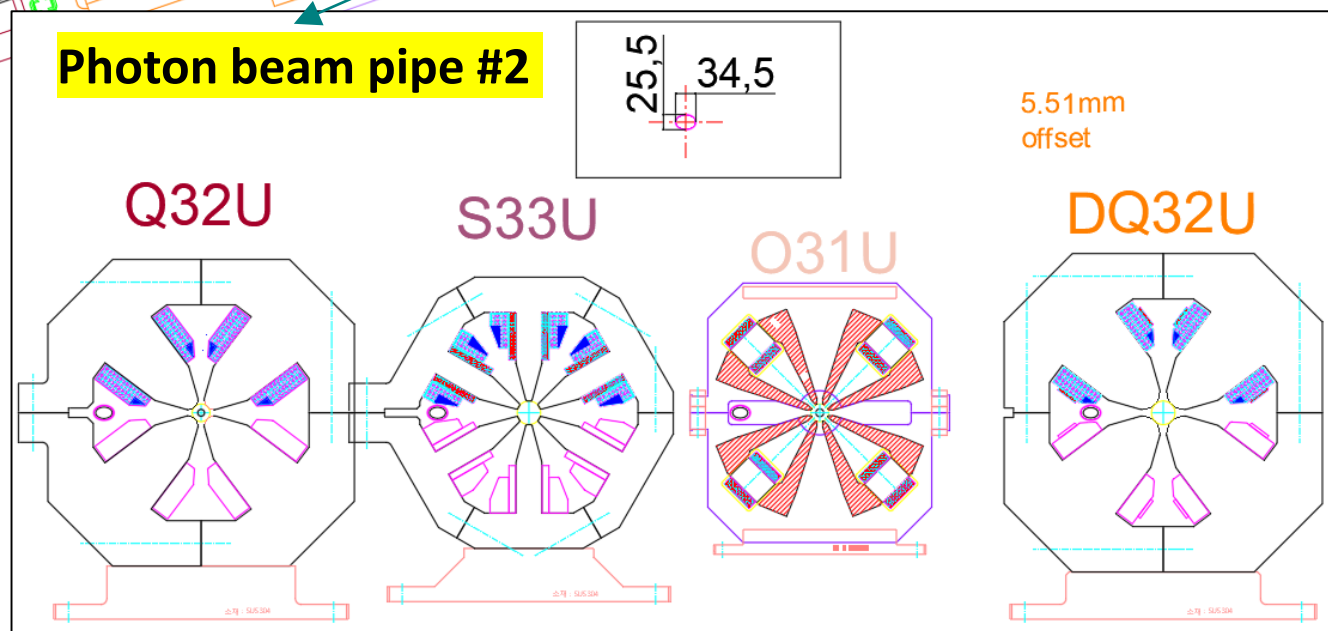
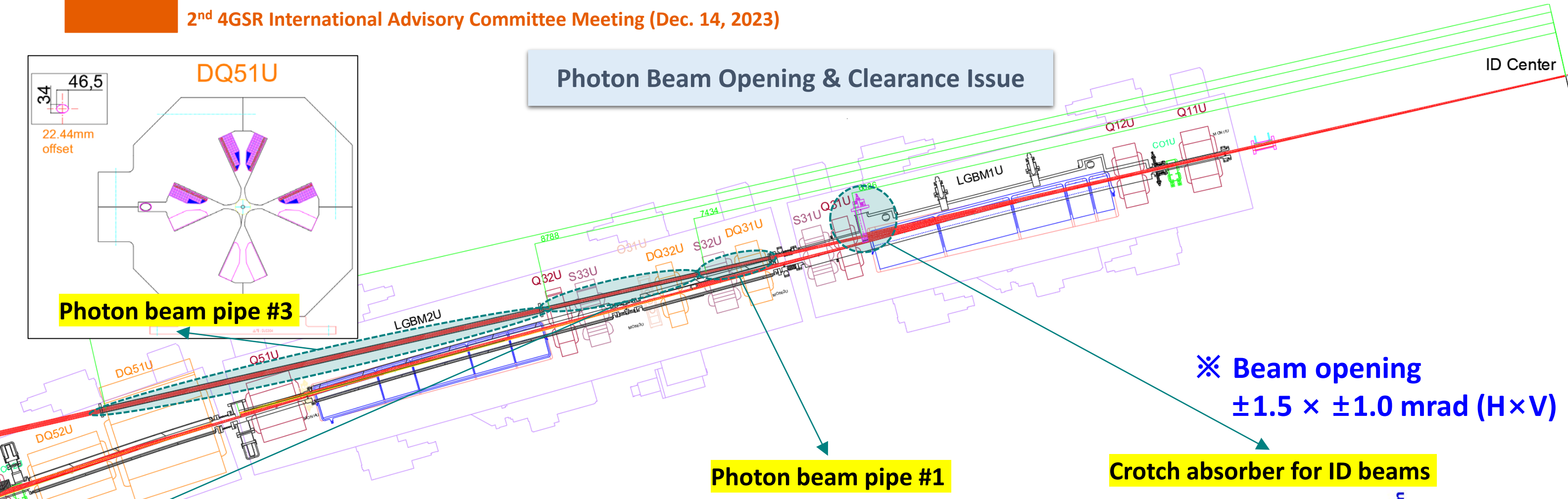
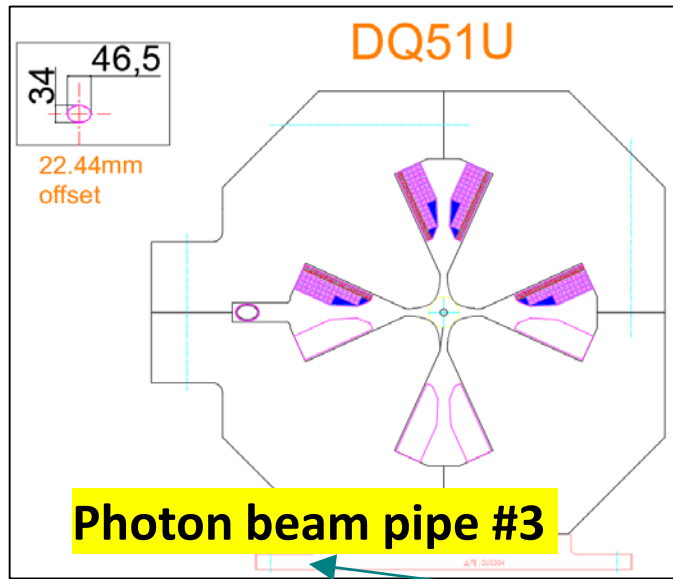
IVU20



$\pm 0.2$  mrad



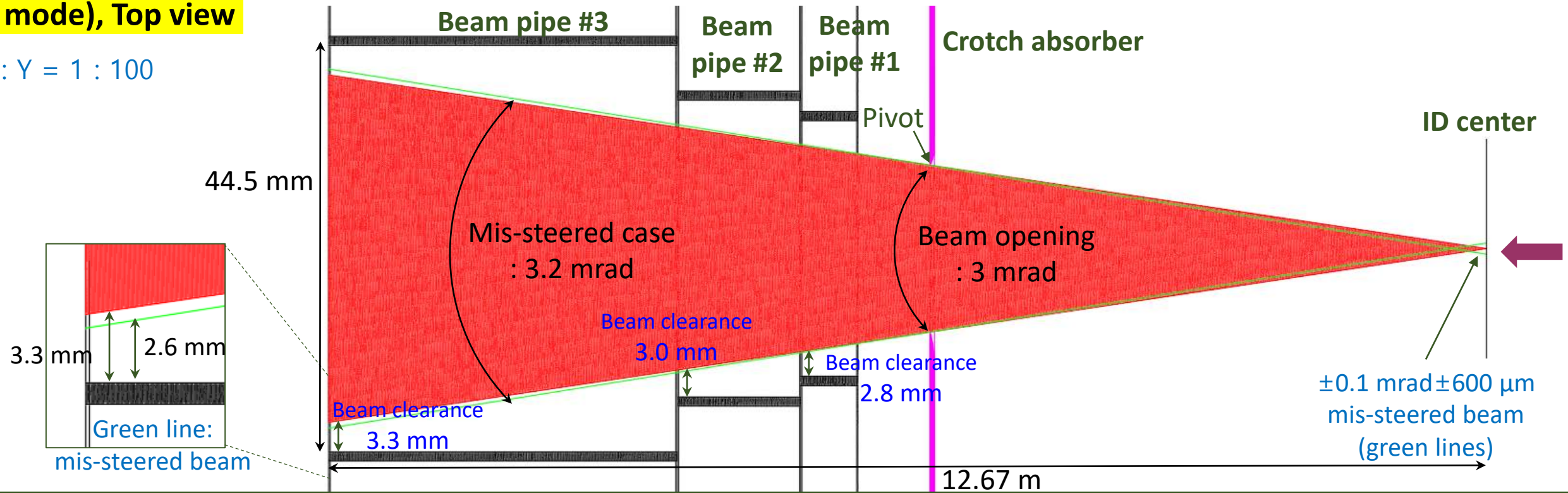
Photon Beam Opening & Clearance Issue



Photon Beam Opening & Clearance Issue

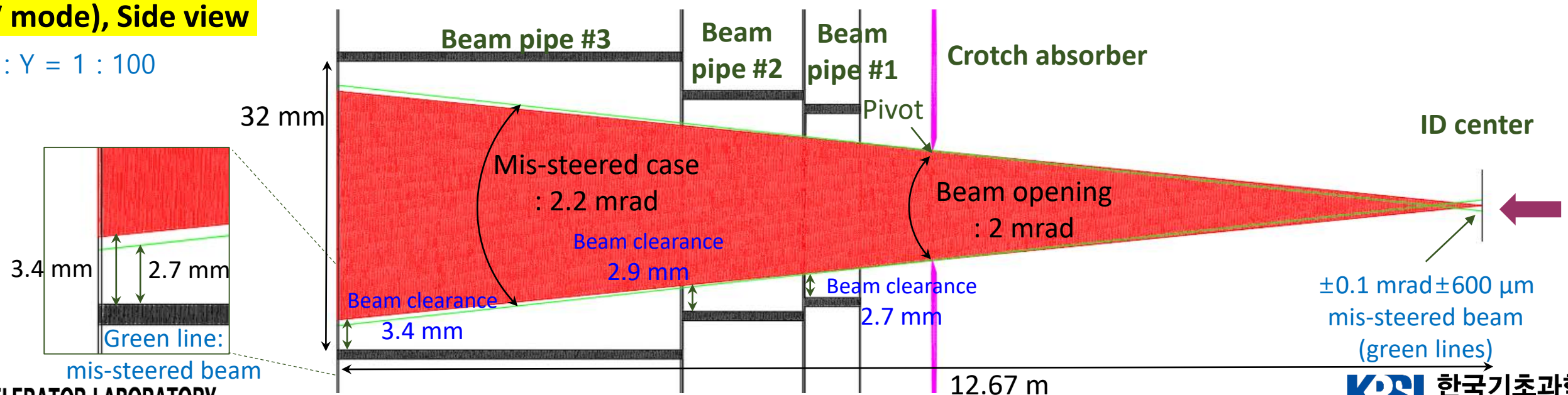
**EPU98 (H mode), Top view**

※ Scale X : Y = 1 : 100



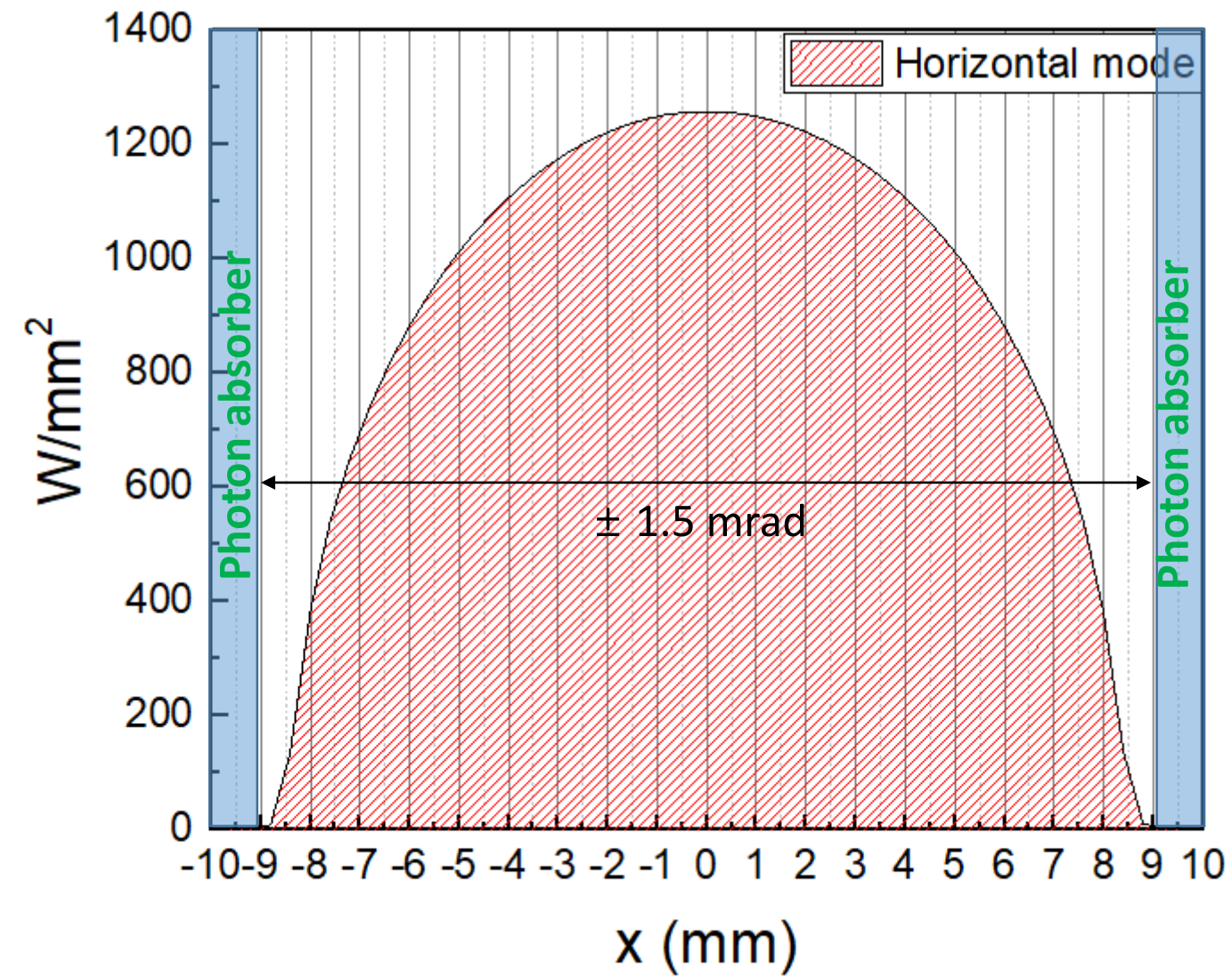
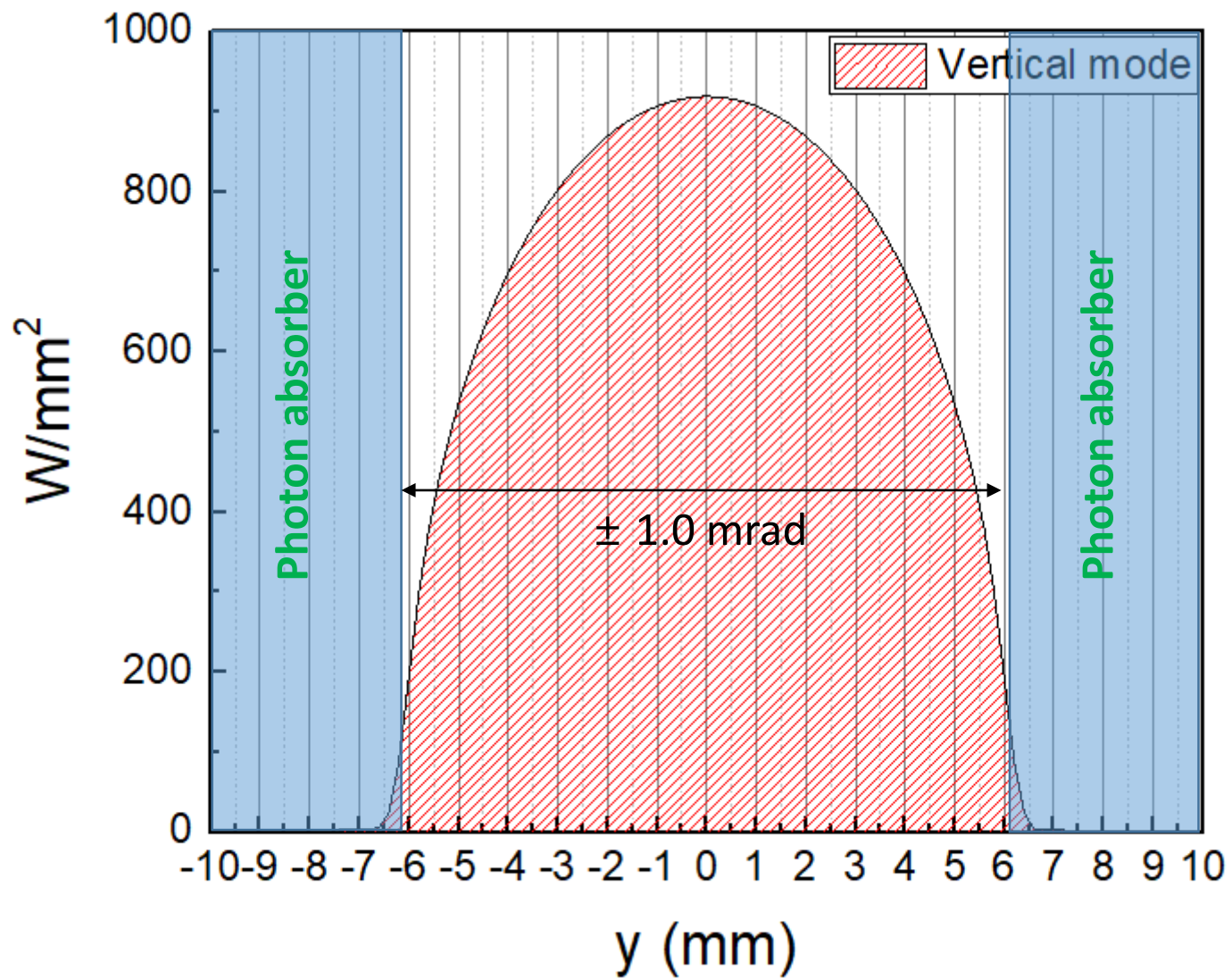
**EPU98 (V mode), Side view**

※ Scale X : Y = 1 : 100



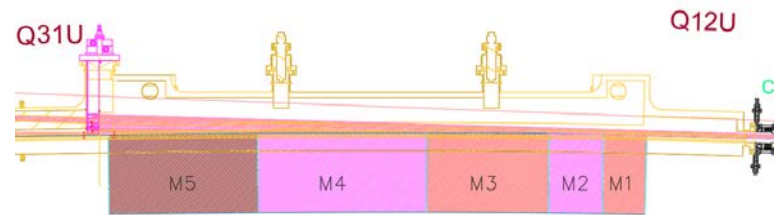
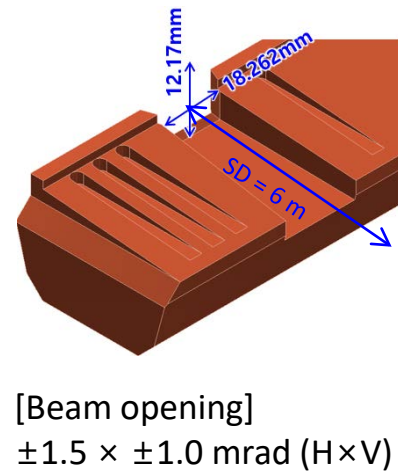
### EPU98 Power Density @ the Crotch Absorber

※ Source distance = 6.1 m

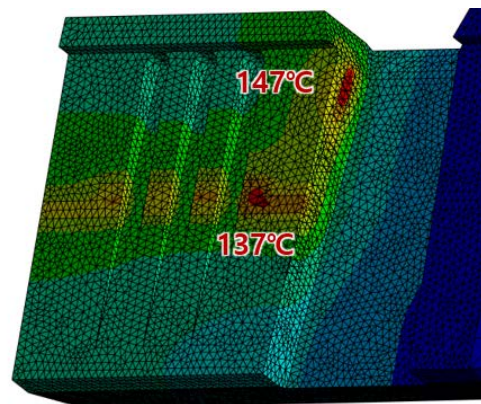
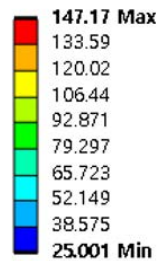


# Thermo-mechanical Analysis

## Crotch absorber (for the ID beamline)

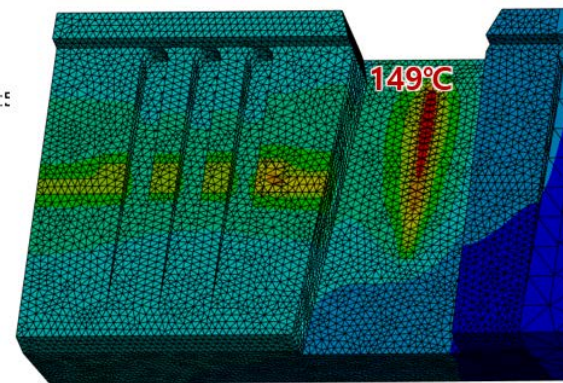
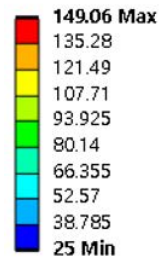


Temperature  
Type: Temperature  
Unit: °C  
Time: 1 s  
2023-08-15 오전 10:43



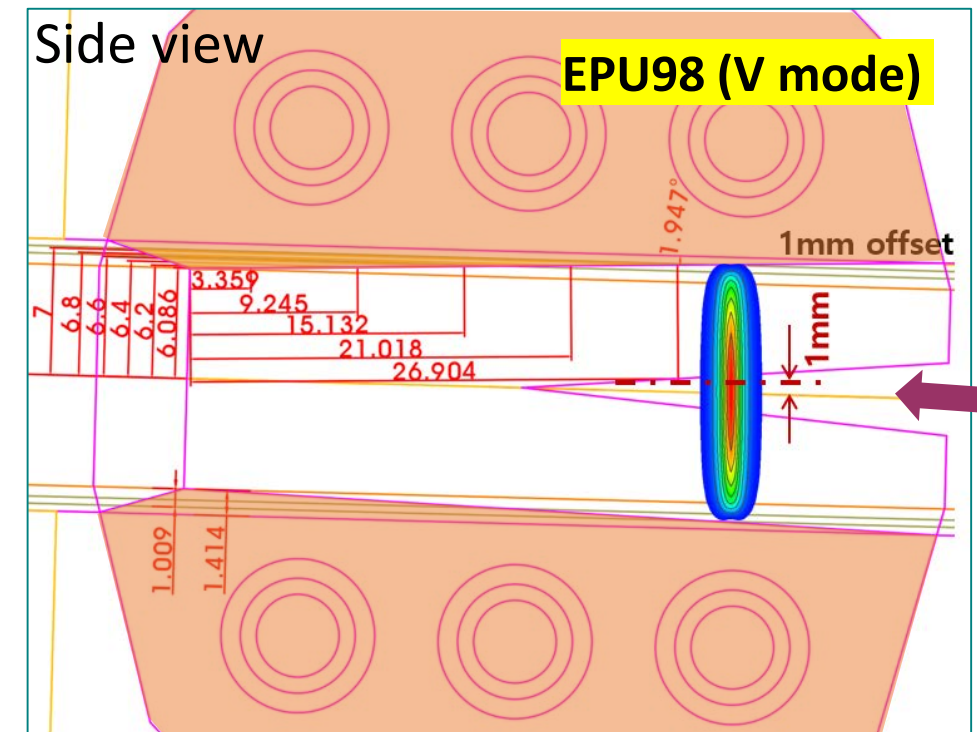
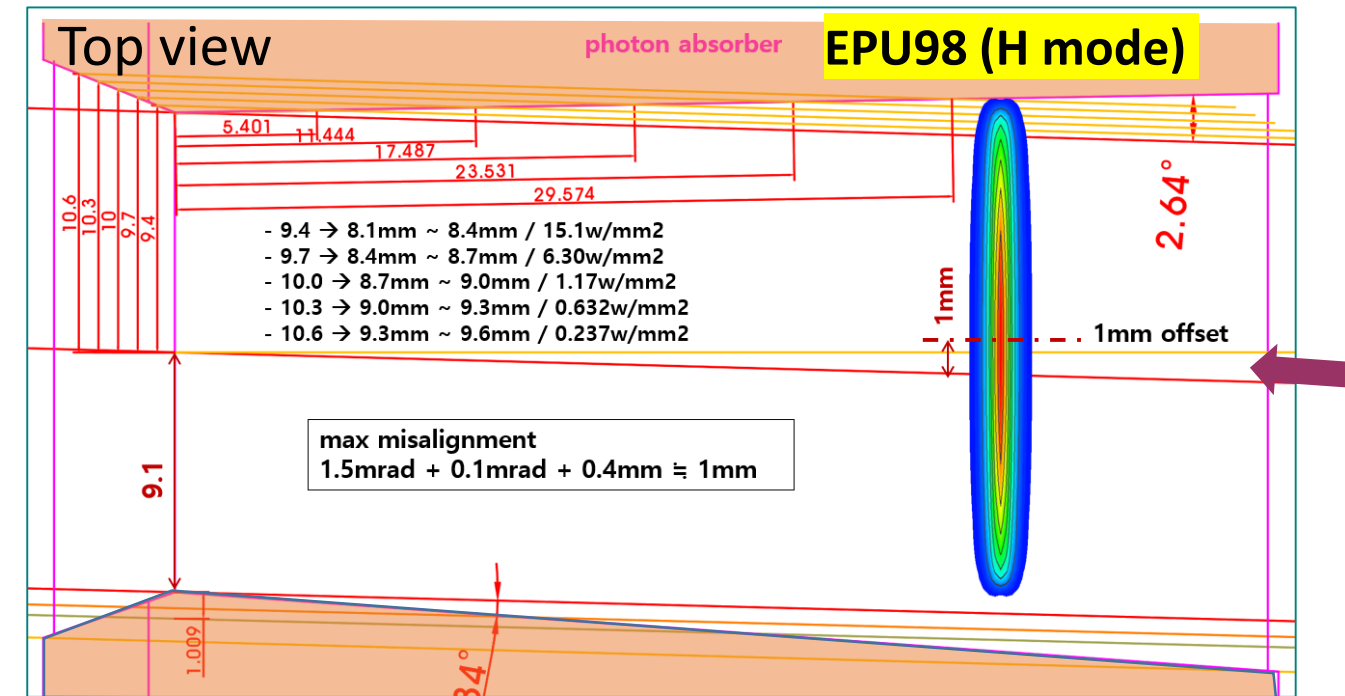
[Max. Temperature for EPU98 (Hor. mode)]

Temperature  
Type: Temperature  
Unit: °C  
Time: 1 s  
2023-08-18 오후 4:5

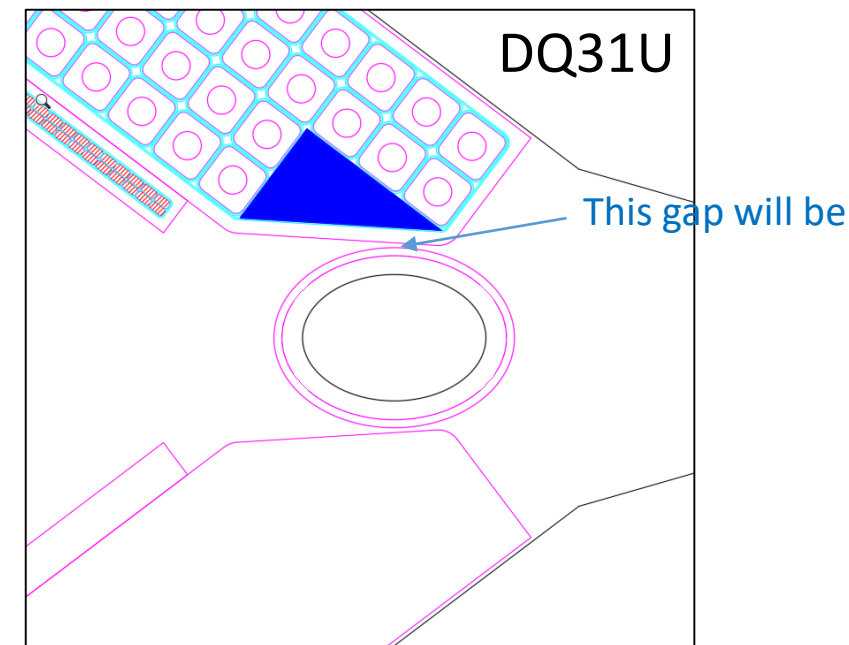
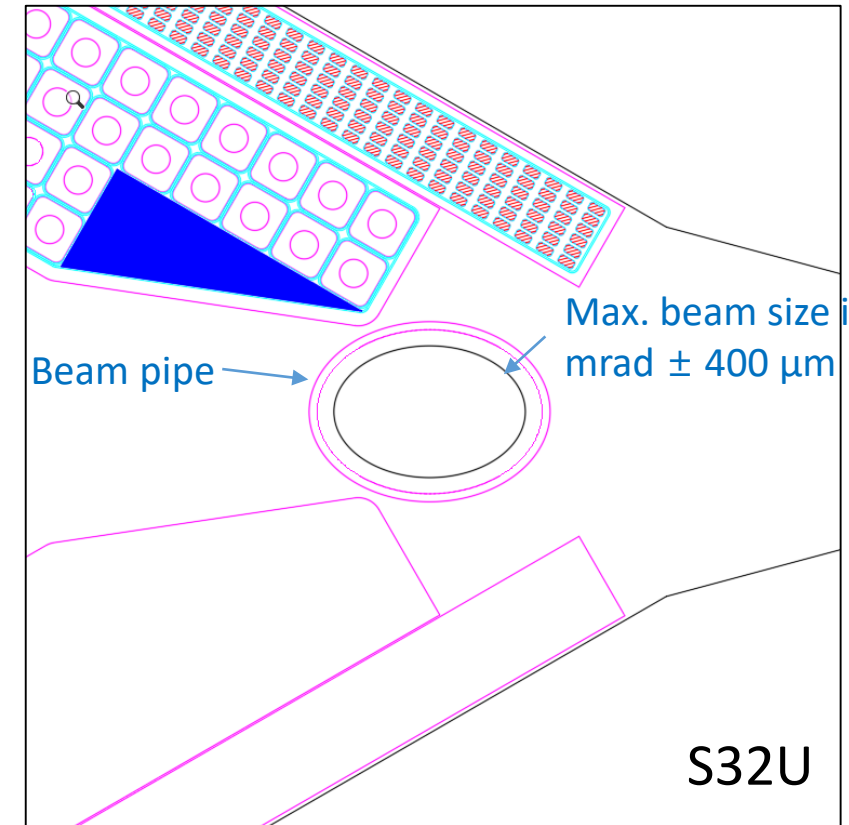
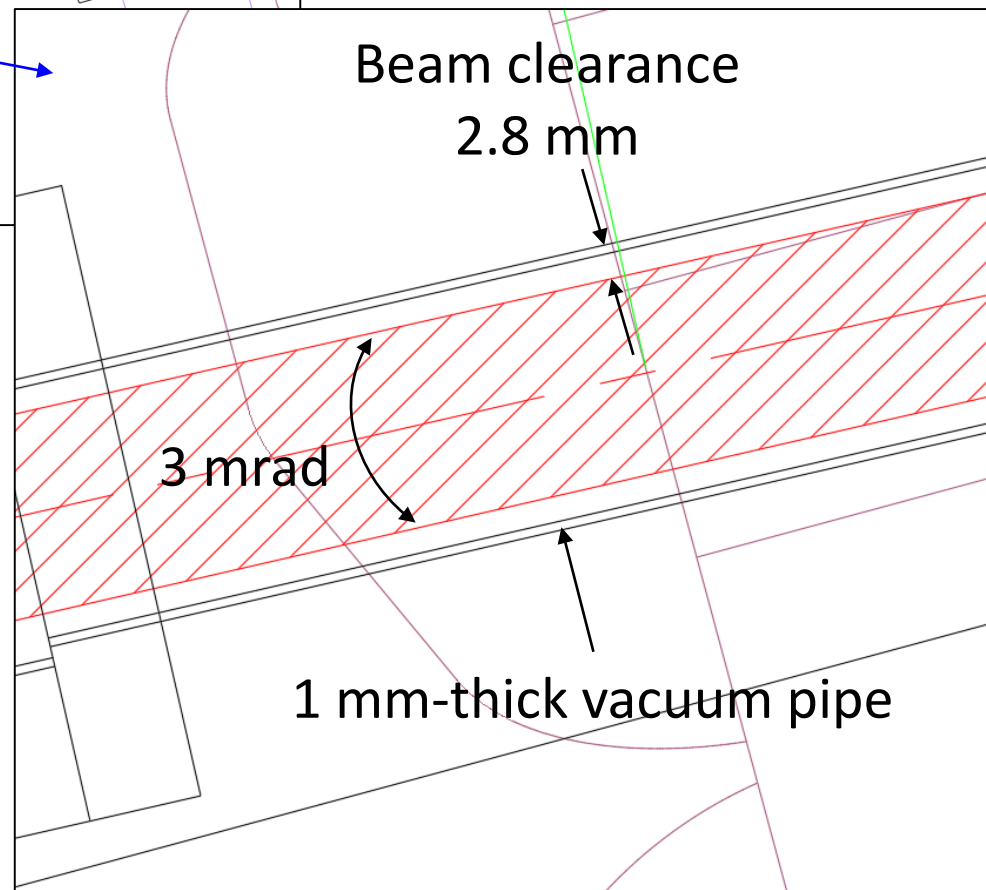
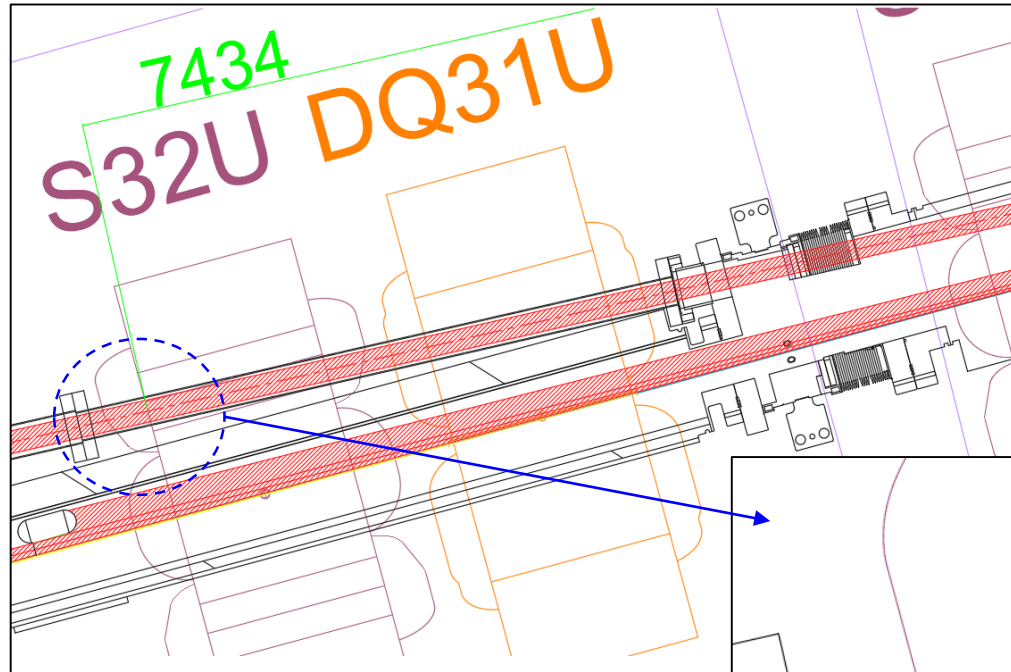


[Max. Temperature for EPU98 (Ver. mode)]

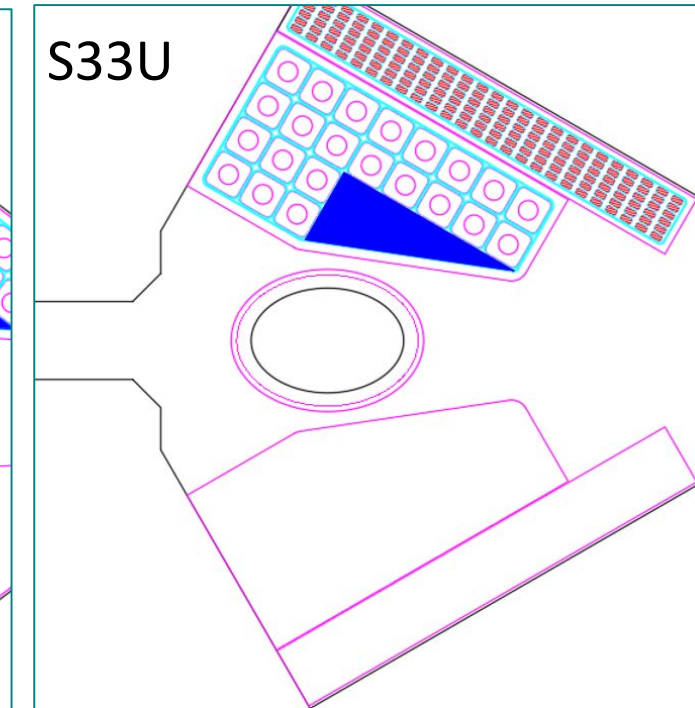
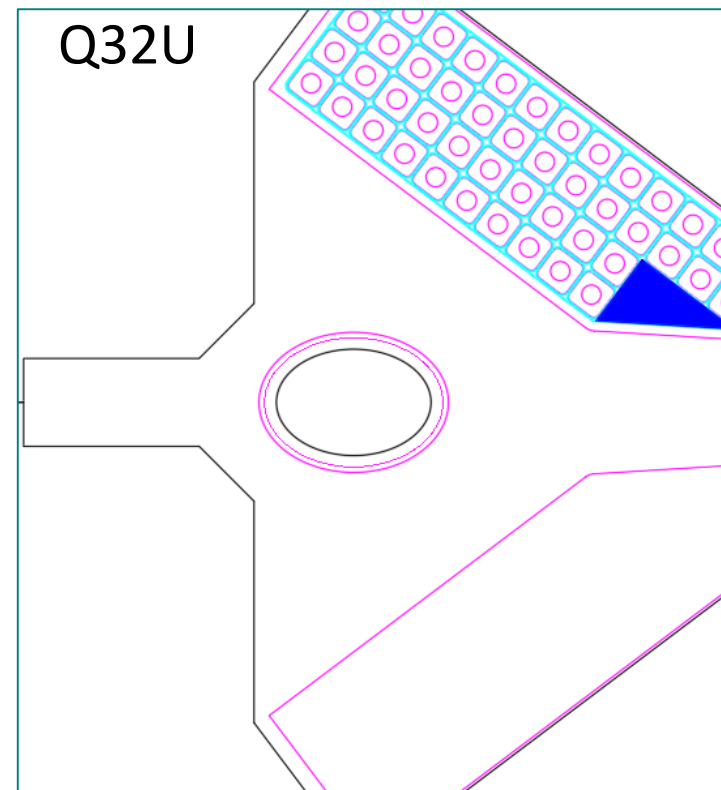
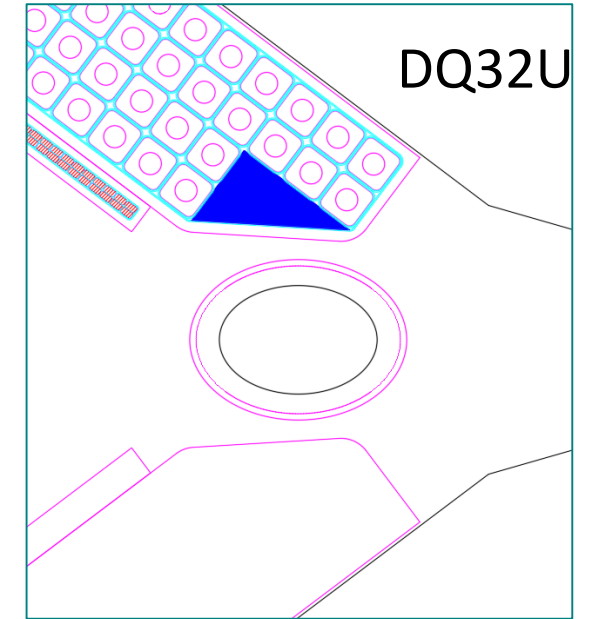
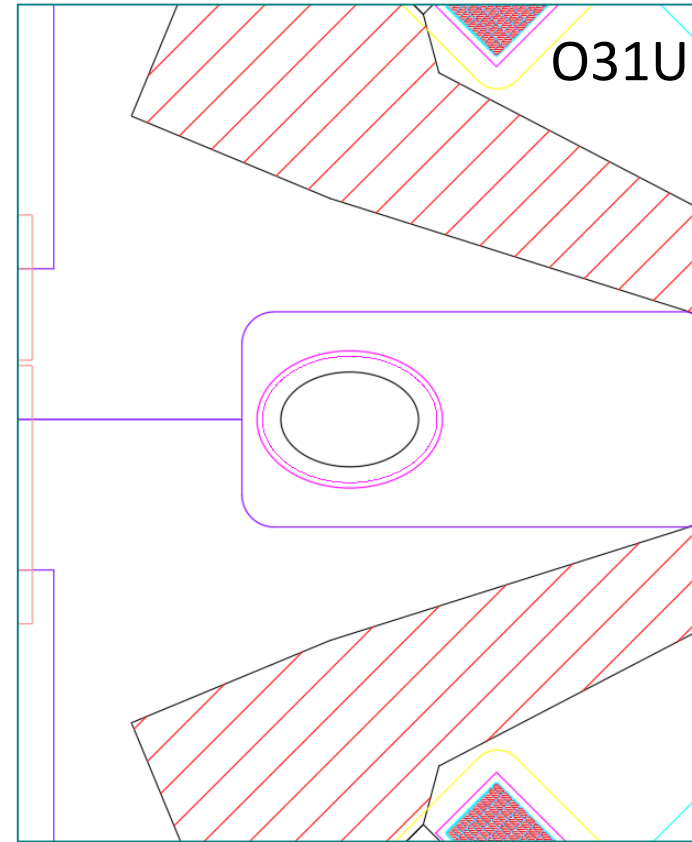
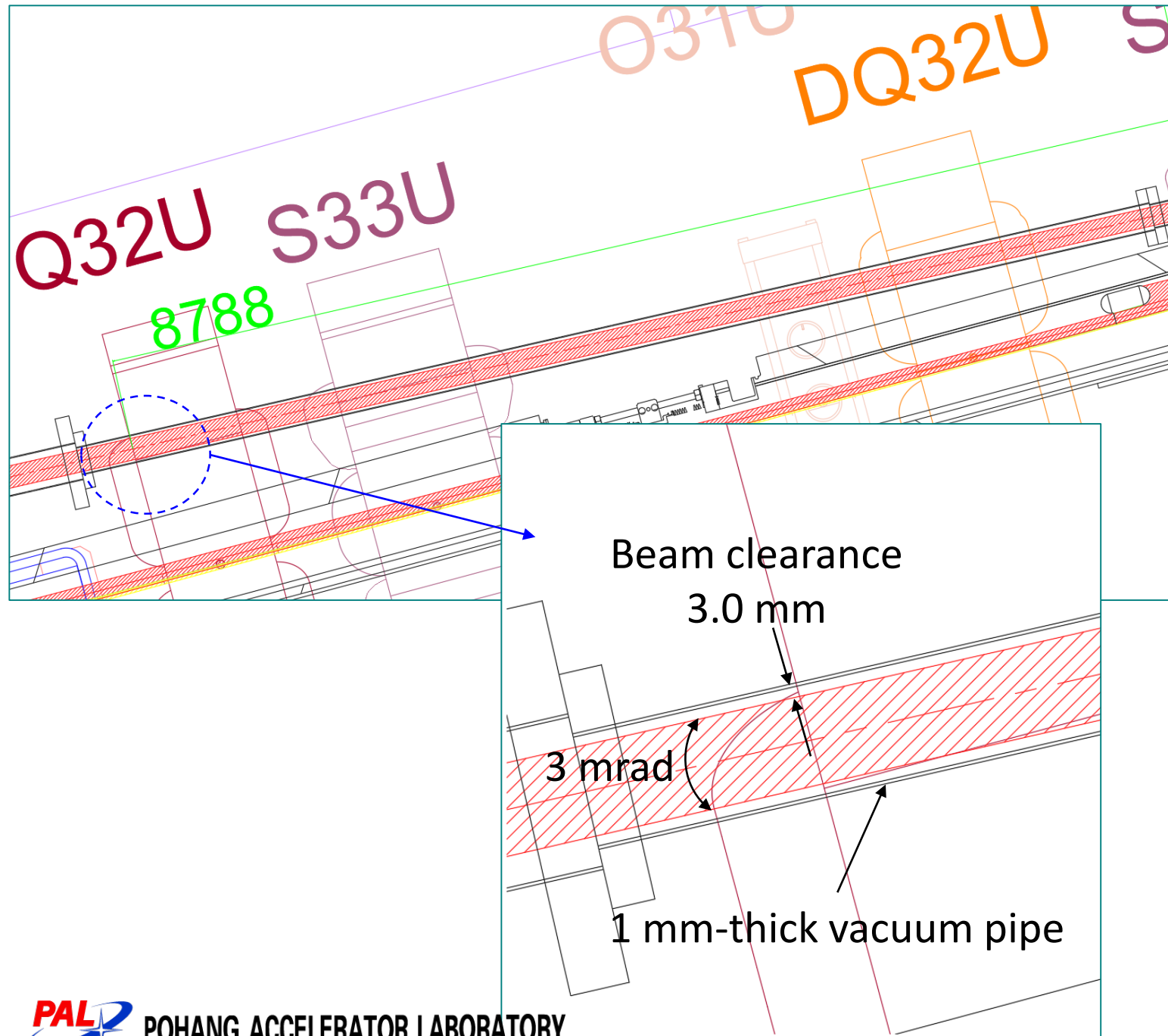
- Worst case mis-steering of ±0.1 mrad ± 400 μm



### Photon Beam Pipe #1

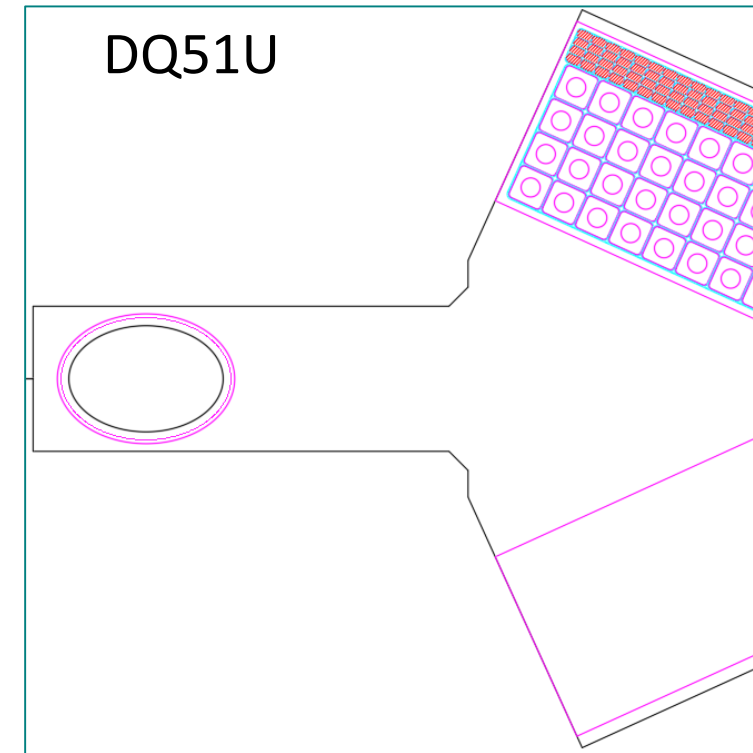
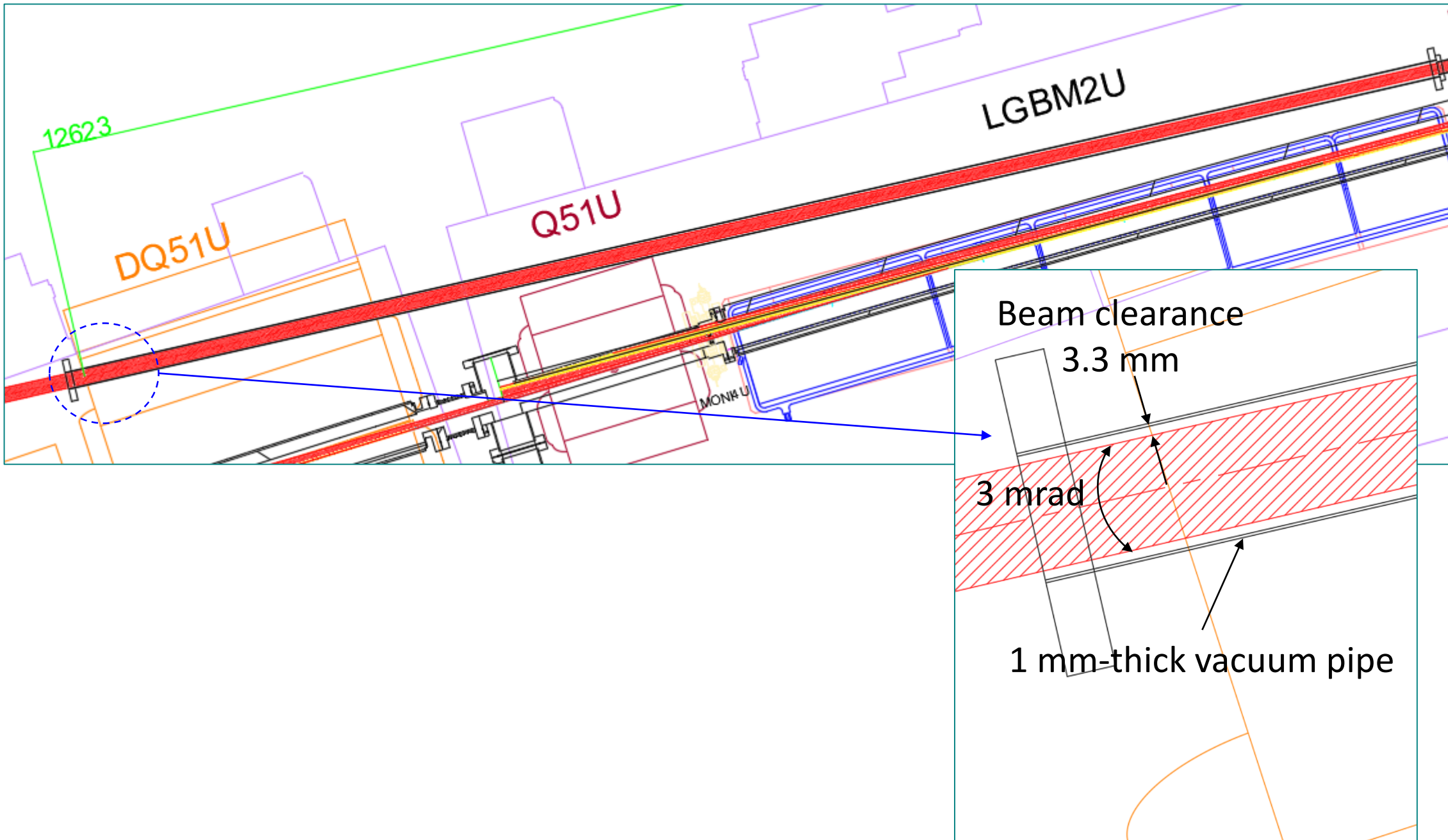


Photon Beam Pipe #2





Photon Beam Pipe #3



## Summary

- Beam opening of the crotch absorber for the ID beam is  **$\pm 1.5 \times \pm 1.0$  mrad (H×V)**
- Orbit interlock condition is decided after thermal analysis of the crotch absorber
  - **$\pm 0.1$  mrad angle &  $\pm 400$   $\mu$ m offset**
  - Maximum mis-steered beam has 1 mm transversal offset at the crotch absorber
  - Current crotch absorber design is reliable even with the worst-case heat load
- 3 different vacuum pipes with different aperture size will be installed for photon beam delivery
  - Photon beam pipe has elliptical aperture with 1 mm thickness
  - Vacuum pipes will be mounted on inside the magnets with appropriate spacers
- The minimum clearance between the chamber and the photon beam is 2.8 mm at “S32U” magnet
- The minimum clearance between the chamber and the magnet is 1.5 mm at “S32U” magnet and 2 mm for other magnets