A COMPARISON OF FRONT-END DESIGN REQUIREMENTS

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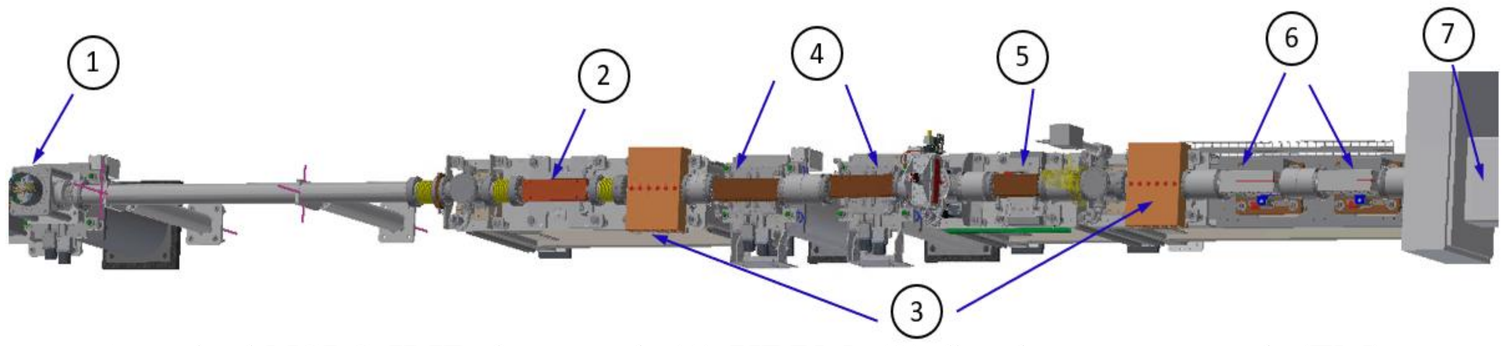
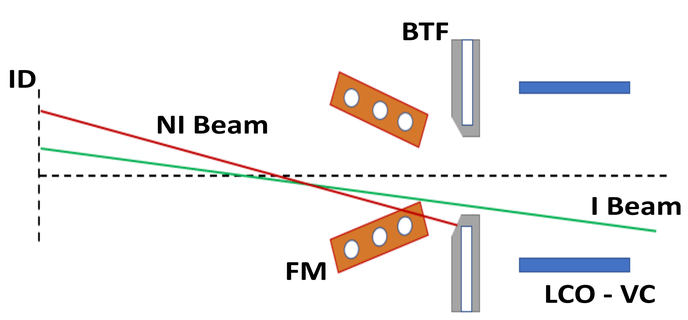
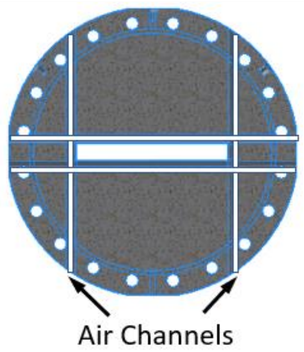
INTRODUCTION

Front end design criteria of different light sources are compared for the purpose of simplifying the designs of future front ends at NSLS-II, with a focus on the source definitions for photon and bremsstrahlung fans, and thermal fatigue designs criteria.



A typical NSLS-II ID front end; (1) XBPM, (2) fixed aperture mask (FM), (3) lead collimators (LCO), XY slits, (5) photon shutter (PS), (6) safety shutters (SS), and (7) ratchet wall collimator (RCO).





Burn-through flanges are used at NSLS-II to ensure that lead-collimator vacuum chambers are protected for large e-beam deviations.

Interlocked e-Beam Deviations

Facility	ID front end		BM front end	
	Position ± (mm)	Angle ± (mrad)	Position ± (mm)	Angle ± (mrad)
NSLS-II	0.5	0.25	GE	GE
ALS-U	1.0	0.2	1.0	0.2
APS-U	1.5 (H) 1.0 (V)		GE	GE
CLS	2.5 (H) 1.6 (V)		1.6 (V) 2.5 (H)	
DLS	1.0		2 (H) 4 (V)	3(H) 0.5(V)
ESRF	1.0		3 (H) 2 (V)	
HEPS		0.1		0.1
Soleil	0.8		0.5	0.5
SSRF		0.5 (H) 0.2 (V)	5 (H) 2 (V)	
TPS	1.0 (H) 0.2 (V)		GE	

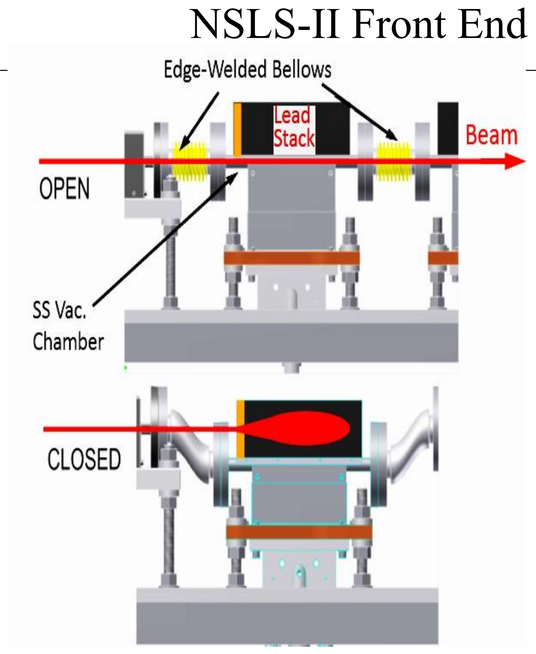
GE: Geometric Envelope

H: Horizontal
V: Vertical

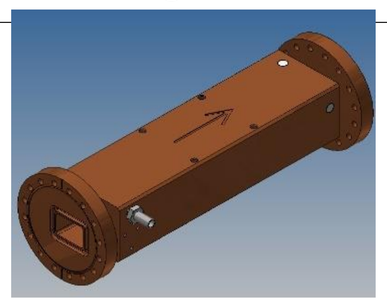
Maximum Allowable Values of Temperature, von Mises Stress and Plastic Strain

Facility	Copper Alloys		
	OFHC Cu	Glidcop	CuCrZr
NSLS-II		300 ºC + T_{amb}	300 ºC + T_{amb}
ALS-U	300 ºC 300 MPa	400 ºC 430 MPa	
APS-U	200 ºC	375 ºC	250 ºC
CLS	150 ºC	300 ºC	200 ºC
DLS	400 ºC $\varepsilon_p <$ 0.5%	400 ºC $\varepsilon_p <$ 0.5%	
ESRF-EBS	200 ºC	200 ºC	250 ºC 280 MPa
HEPS		400 ºC	
SOLEIL	0.75 σ_{yield}	0.75 σ_{yield}	
SSRF	150 ºC 340 MPa	300 ºC 400 MPa	
TPS	150 ºC	300 ºC	200 ºC

NSLS-II Front End Component Designs



Out-of-Vacuum Safety Shutter



CuCrZr High Power Mask

CuCrZr Air-Cooled Mask

CONCLUSION

Un-interlocked e-beam deviations for PPS components (LCO, RCO and SS), and expanded source locations for the photon and bremsstrahlung fans have resulted in more conservative but elaborate designs at NSLS-II. The new design for EPS components (FM, PS and XY slits), based on CuCrZr bodies with integrated flanges, has been adopted at several facilities. A comparison of thermal design criteria for the three copper alloys (OFHC Cu, Glidcop and CuCrZr) shows a wide range in maximum allowable values of temperature and stress.

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REFERENCES

[1] L. Doom et al., “Front-end design of national Synchrotron Light Source II”, *MEDSI2010*, Oxford, England.

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