X Ray Transport, Optics, and Diagnostics Overview

Photon Systems Breakout

Lehman Review

July 10, 2007

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Outline of XTOD Presentations

- Today
  - 4:30 Overview – Bionta
- Tomorrow
  - 8:00 New Plan – Donn McMhonn
  - 8:30 Mirrors
    - Mike Pivovaroff
    - Tom McCarville
  - 9:30 XTOD Detectors – Bionta

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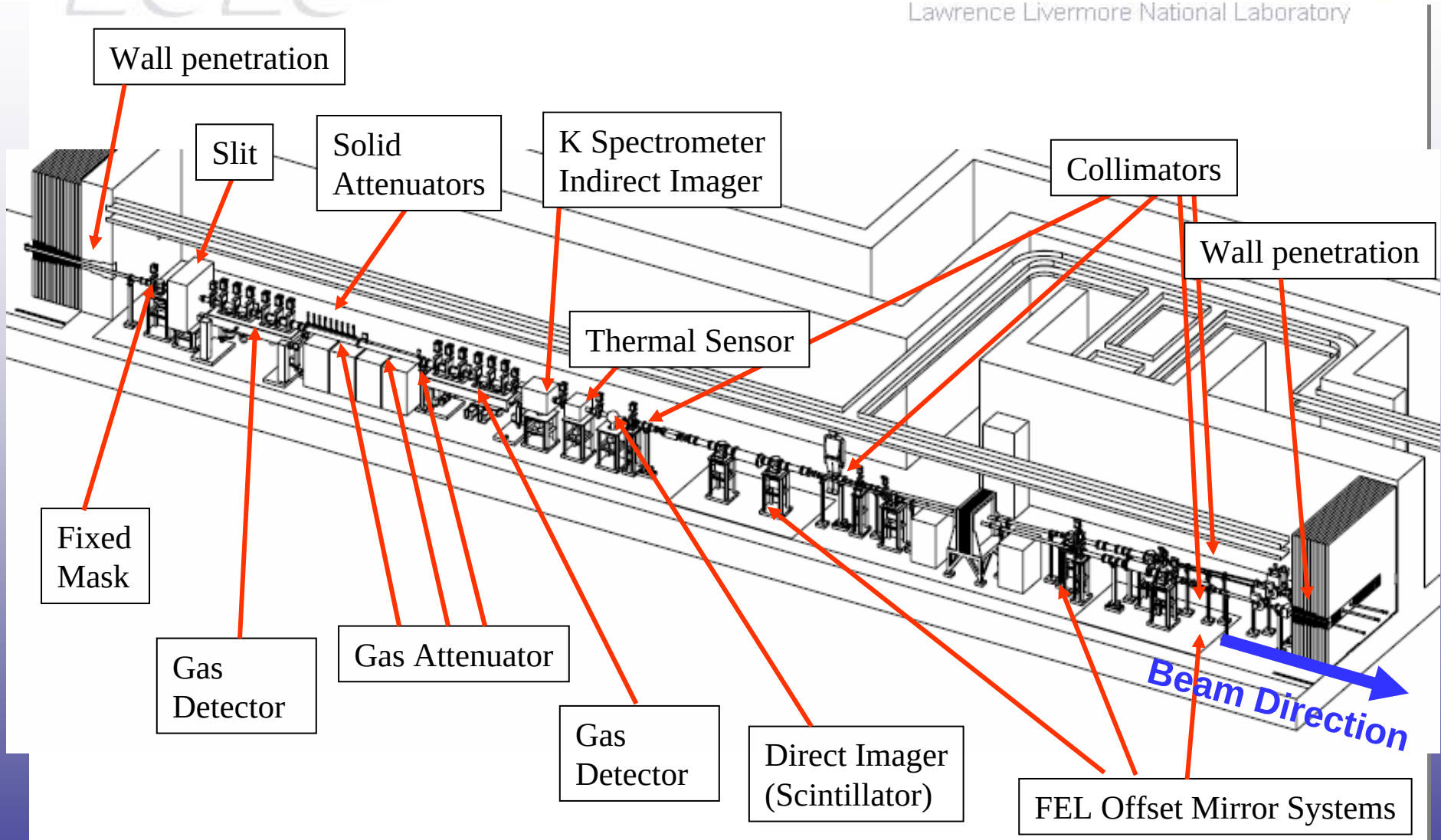
XTOD Scope: Front End Enclosure (FEE)



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Effects of Continuing Resolution

- Procurements delayed
  - Prototypes
    - Gas detector
    - Direct imager
    - Total Energy
  - Final articles
    - Fixed Mask
    - Slit
    - Attenuator
- Procurements postponed
  - X-Ray Tunnel Transport Hardware
- Results of post procurement activities has delayed design efforts for
  - Gas detector
  - Direct imager
  - Total Energy
  - K Spectrometer
  - Indirect Imager
  - SOMS
  - HOMS
- Shift in schedule requires additional funding in FY09 and FY10

Compressed procurement time forces us to purchase commercial items after PDR instead of waiting for FDR

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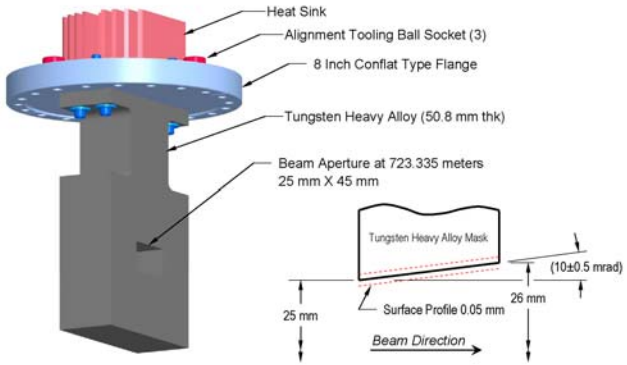
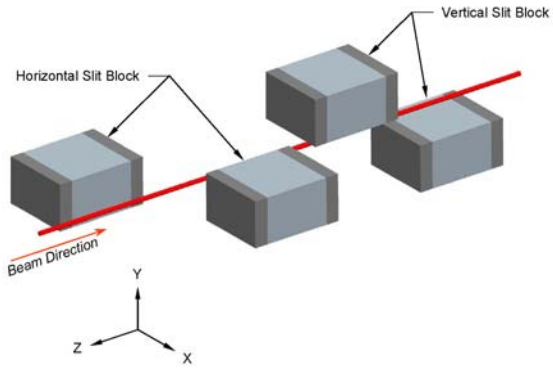
Slit and Fixed Mask are on order

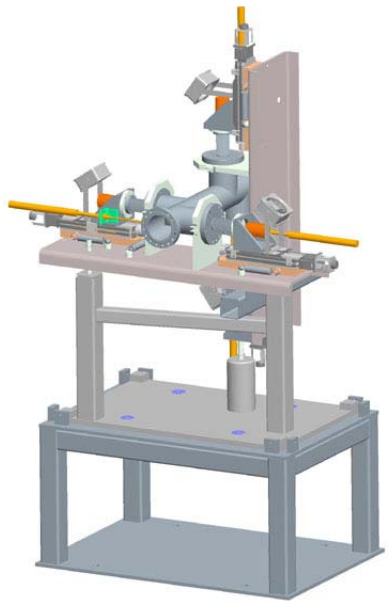
Fixed Mask



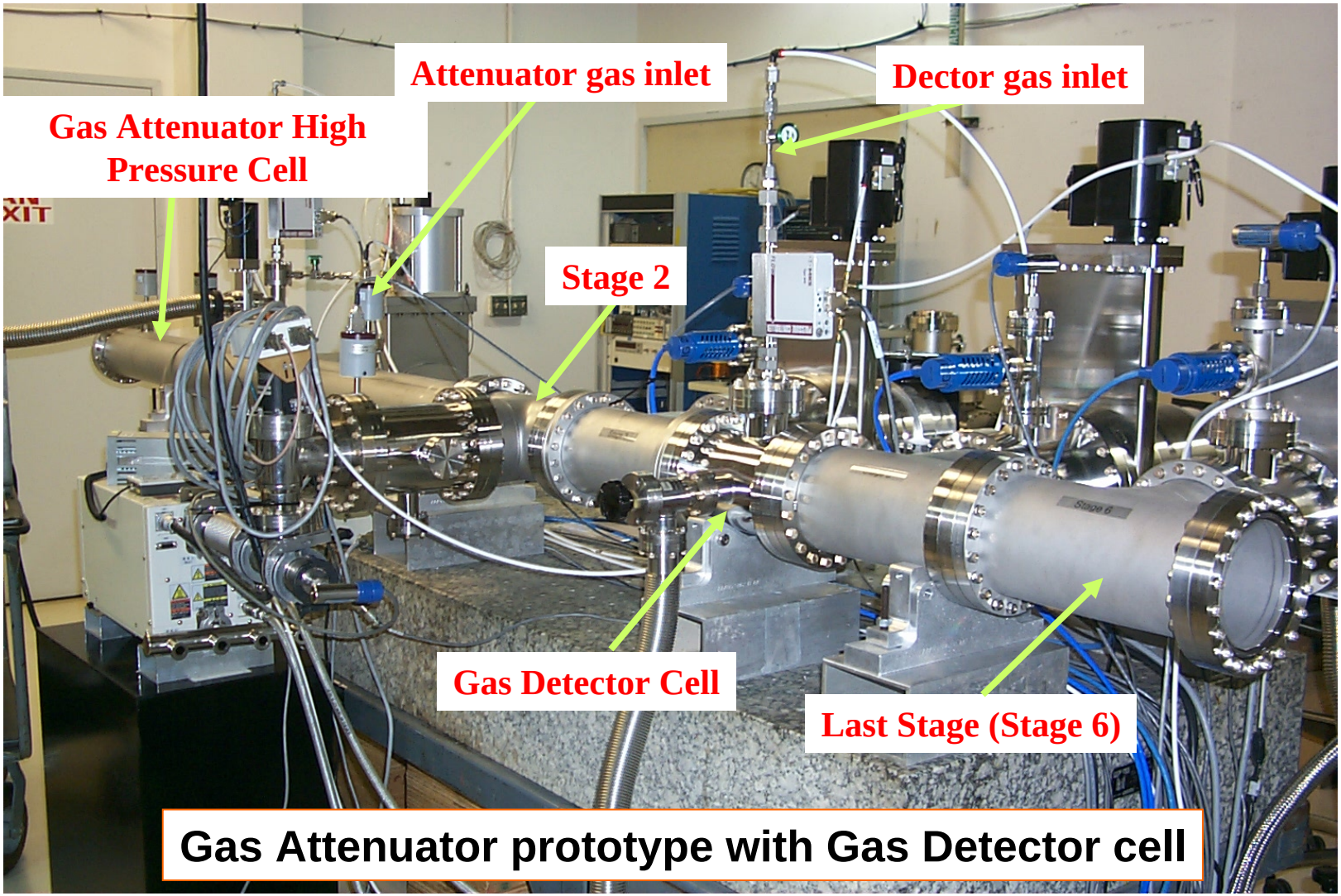
Slit



Status Fixed Mask and Slit:
PRD done
SCR done
PDR done
ESD done
FDR done
In Purchase / Fabrication



Attenuator is on order



Gas Attenuator prototype with Gas Detector cell

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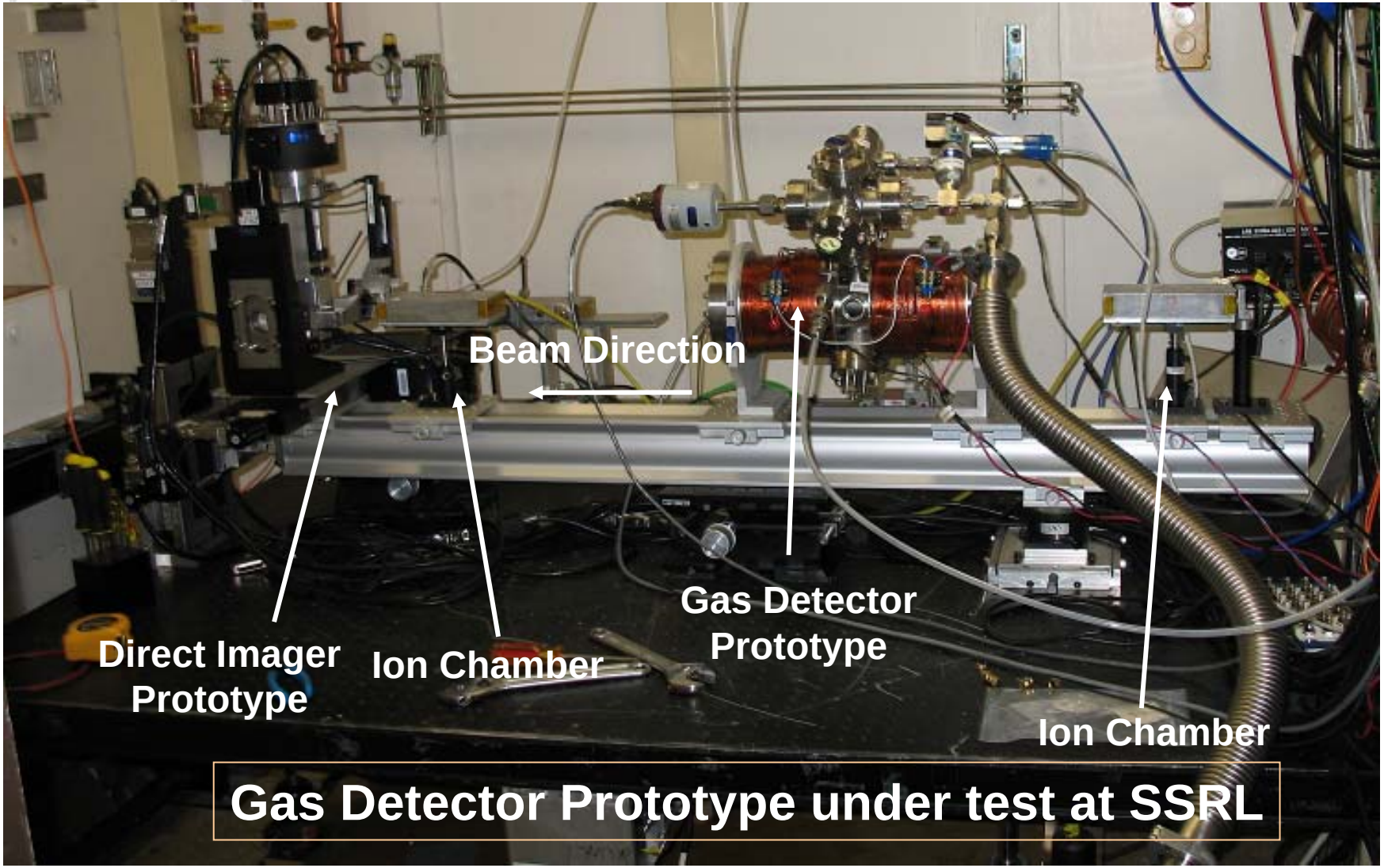
Gas Detector in Final Design



Gas Detector Prototype under test at SSRL

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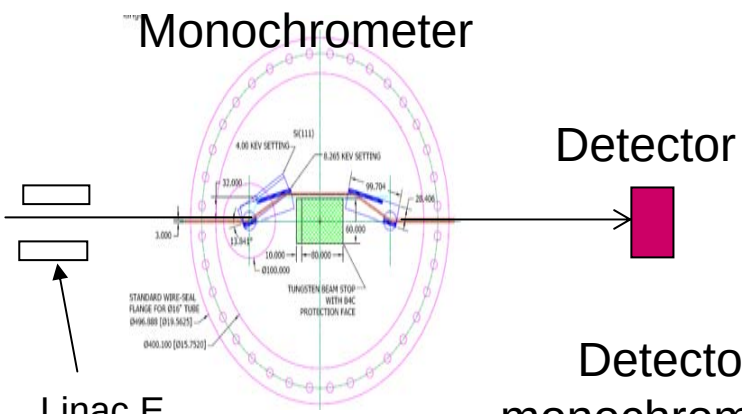
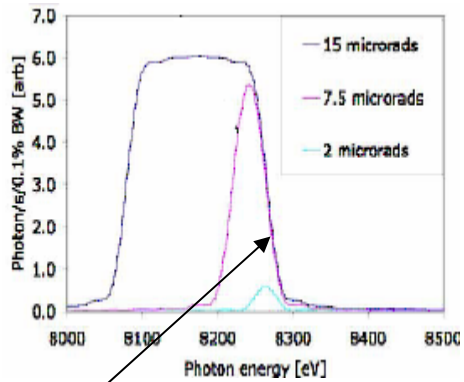
Channel-cut Si Monochrometer (used to measure undulator relative *K at 8 keV*) in conceptual design



Linac E variation and measurement

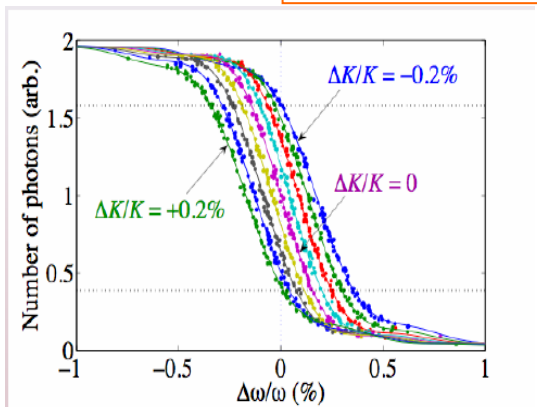
Detector monochrometer measures intensity at a single point



Two undulator spontaneous spectrum. Falloff of high energy tail is independent of aperture

Status K Spectrometer: PRD

Use linac E variation and measurement to obtain other points along curve



Two undulator spontaneous high energy falloff has highest slope when *ΔK/K=0*.

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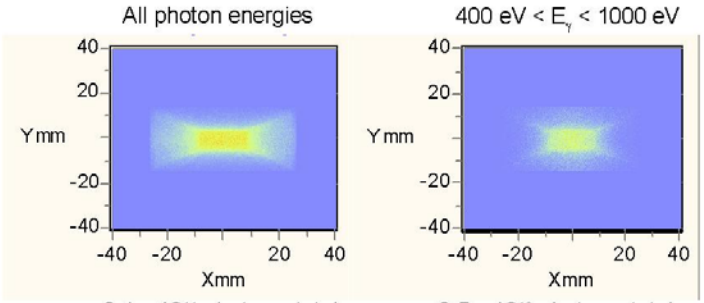
Low energy spectrometer becomes Indirect imager to find spontaneous core at 826 eV

Raw soft spontaneous

Figure 3: Spontaneous Fluence at Direct Imager:
Soft X-Ray FEL Setting, 0.79 nC

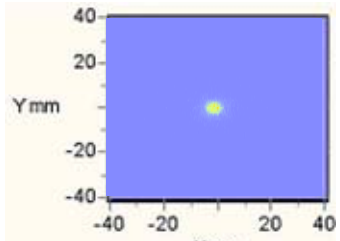


2.1 x 10^{11} photons, total
3.8 x 10^{-4} J, total
9.1 x 10^{-5} J/cm^2, center

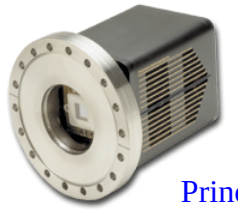
2.5 x 10^{10} photons, total
3.1 x 10^{-6} J, total
7.8 x 10^{-7} J/cm^2, center

After reflection

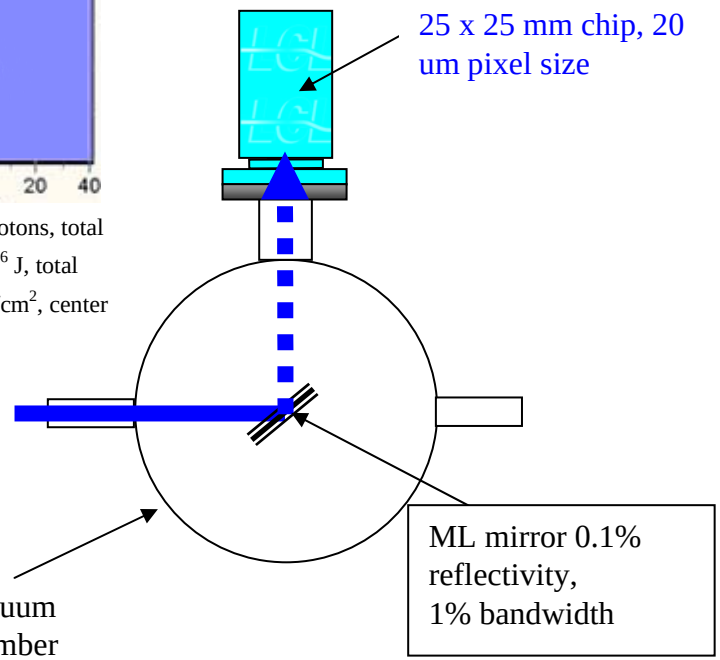
840 eV < E_γ < 860 eV
$h\nu_1$ = 844.6 eV
effective bandwidth = 5.5*10^{-3}



2 x 10^{10} photons, total
2.6 x 10^{-6} J, total
7.8 x 10^{-7} J/cm^2, center



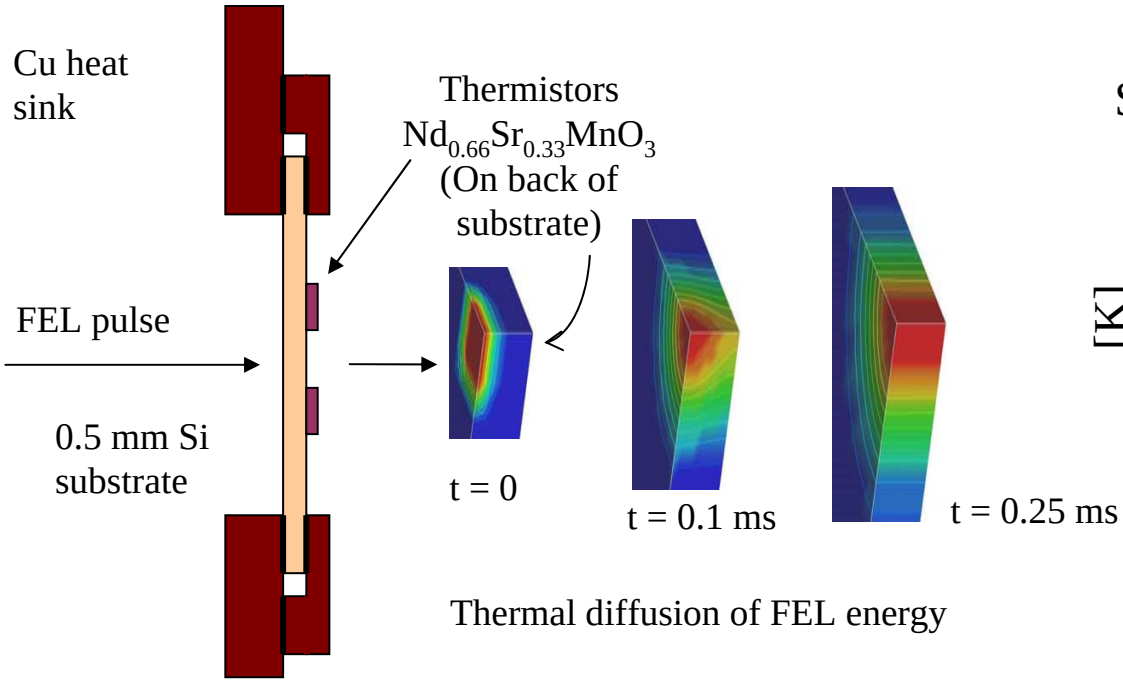
Princeton Instruments back illuminated CCD camera
25 x 25 mm chip, 20 um pixel size



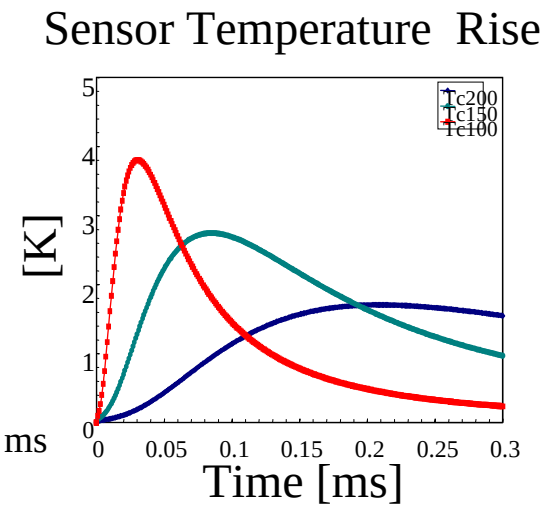
Status Indirect Imager:
PRD in progress

Total Energy (Thermal) Sensor in Final Design

Measures FEL energy deposition through temperature rise



Thermal diffusion of FEL energy



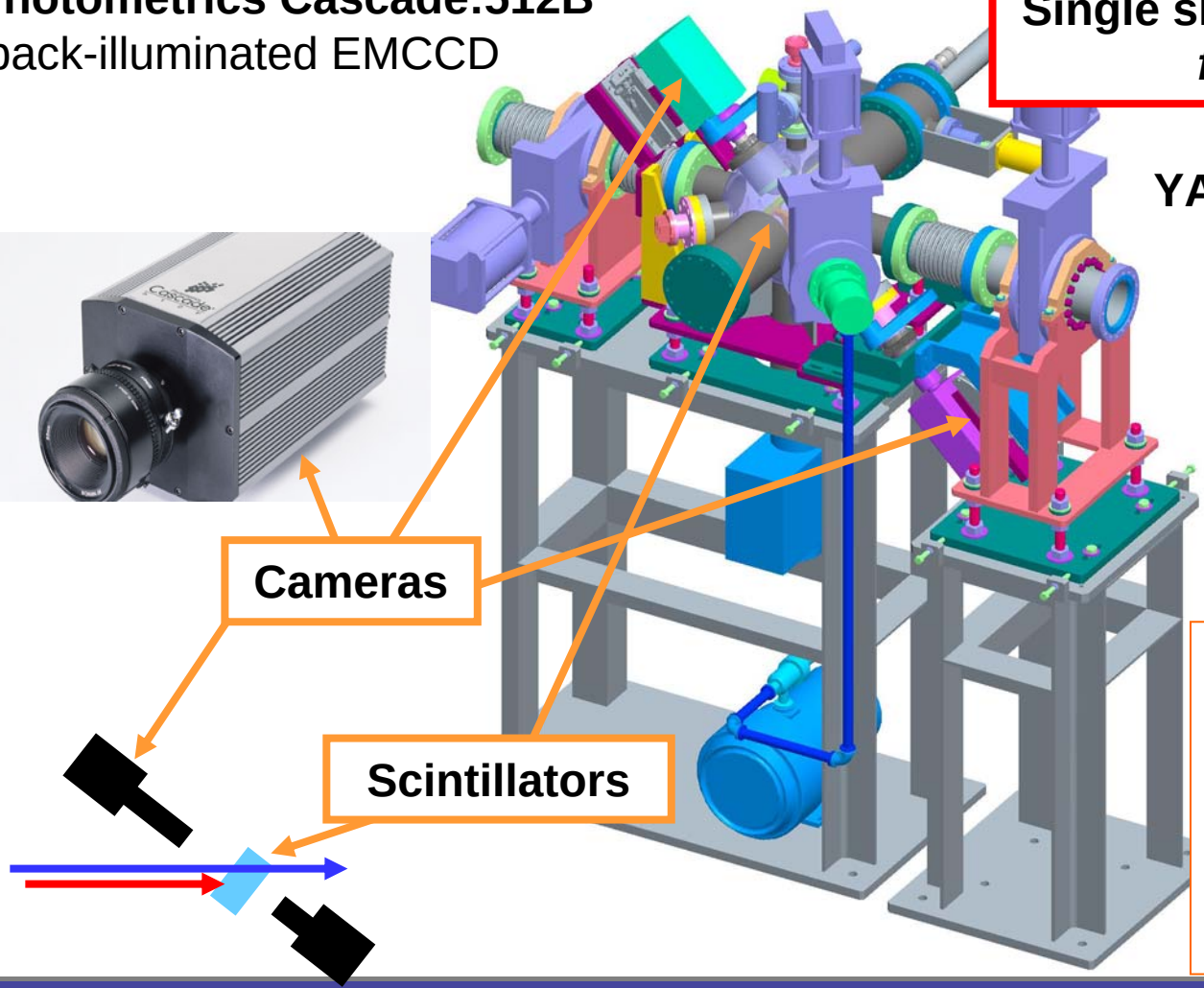
Status Total Energy:
PRD done
SCR done
Prototype
PDR done
in Final Design

Direct Imager provides Images of Spontaneous and (attenuated) FEL

Photometrics Cascade:512B
back-illuminated EMCCD

Single shot measurement of *f(x,y), x, y ,u*

YAG::Ce Scintillators



Status Direct Imager:
Prototypes in progress
PRD done
SCR done
PDR done
in Final Design

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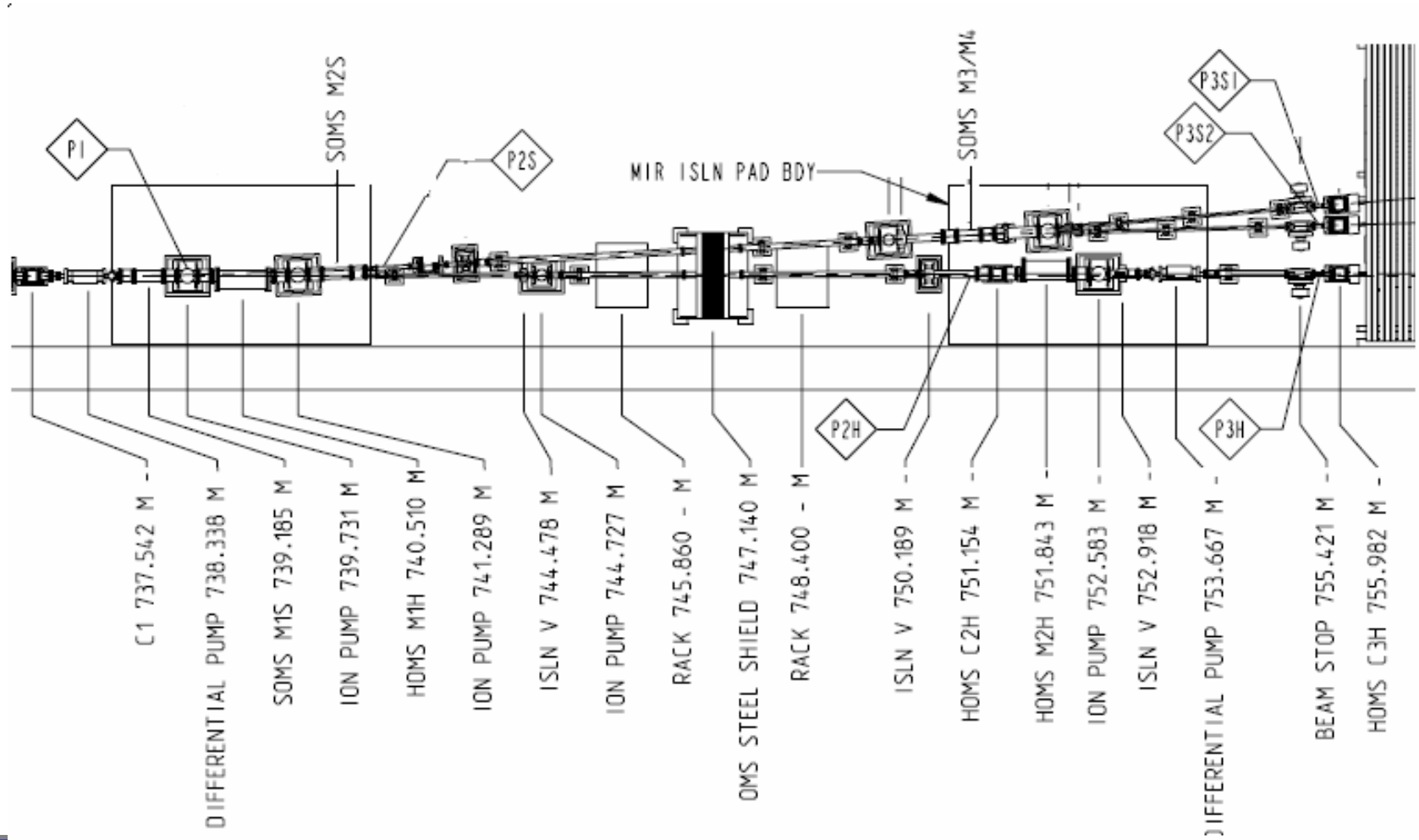
FEL Offset Mirror Systems

SOMS and HOMS reflect horizontally



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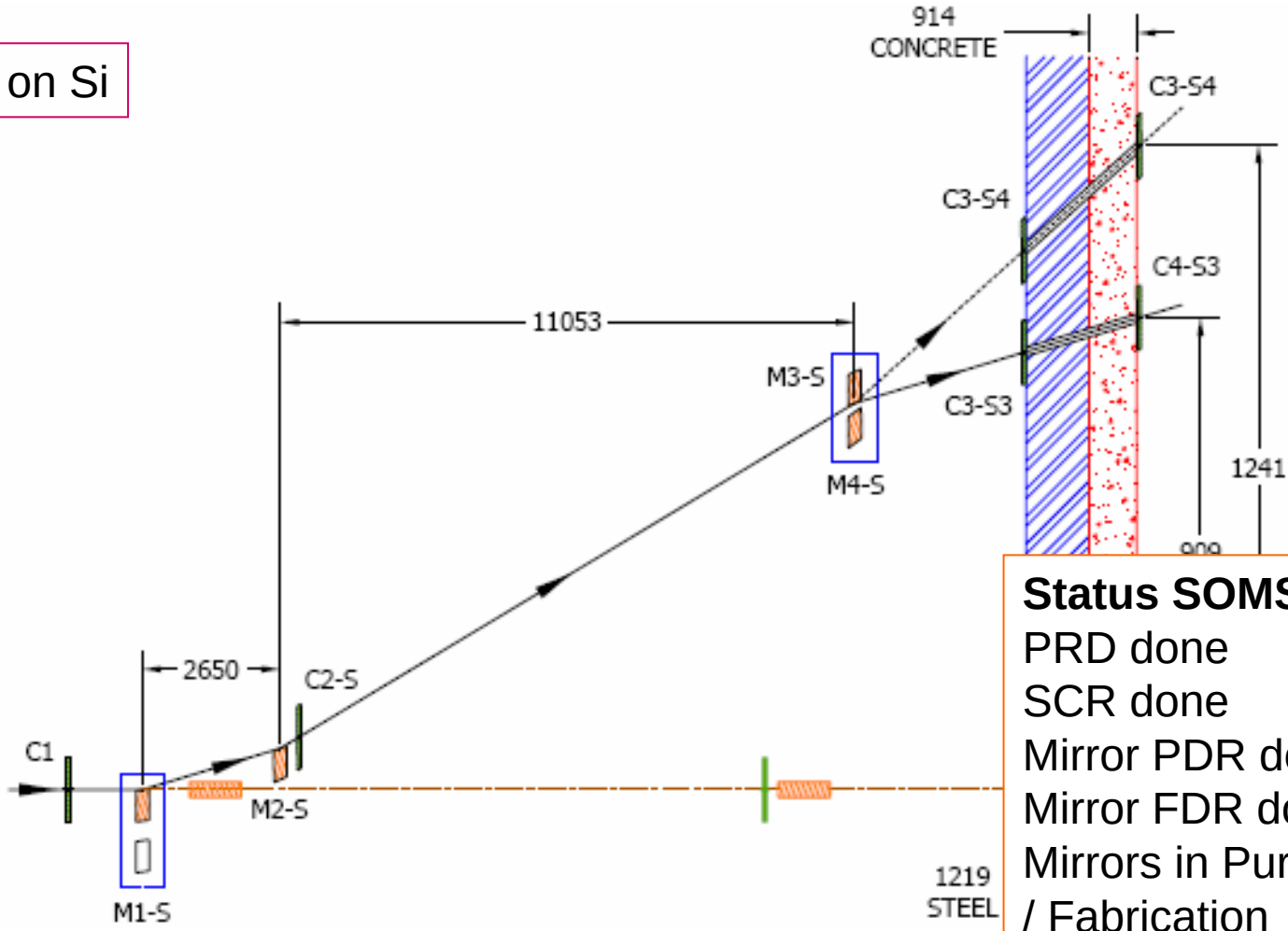
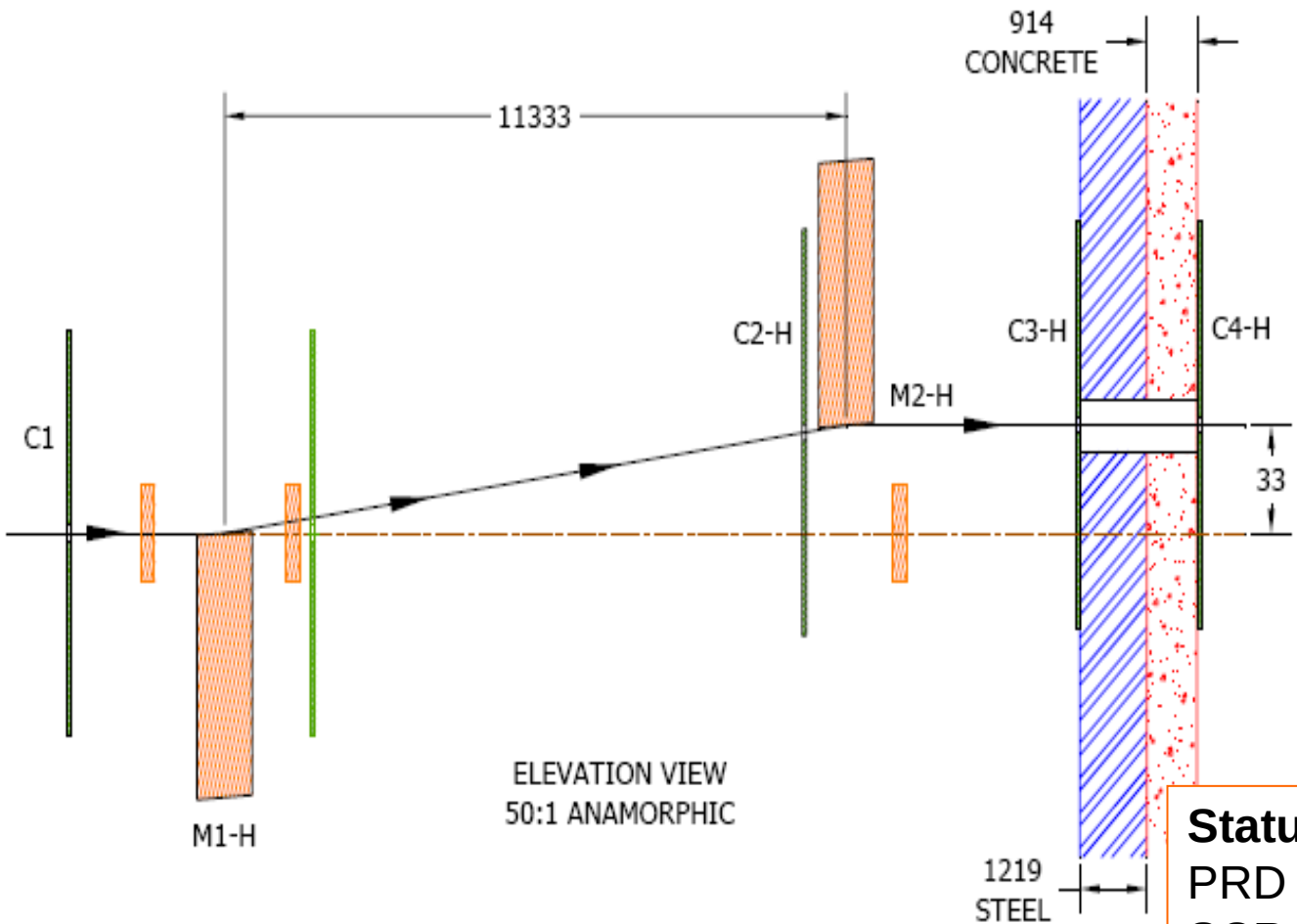
Soft X-Ray Offset Mirror System (SOMS):

B_4C on Si



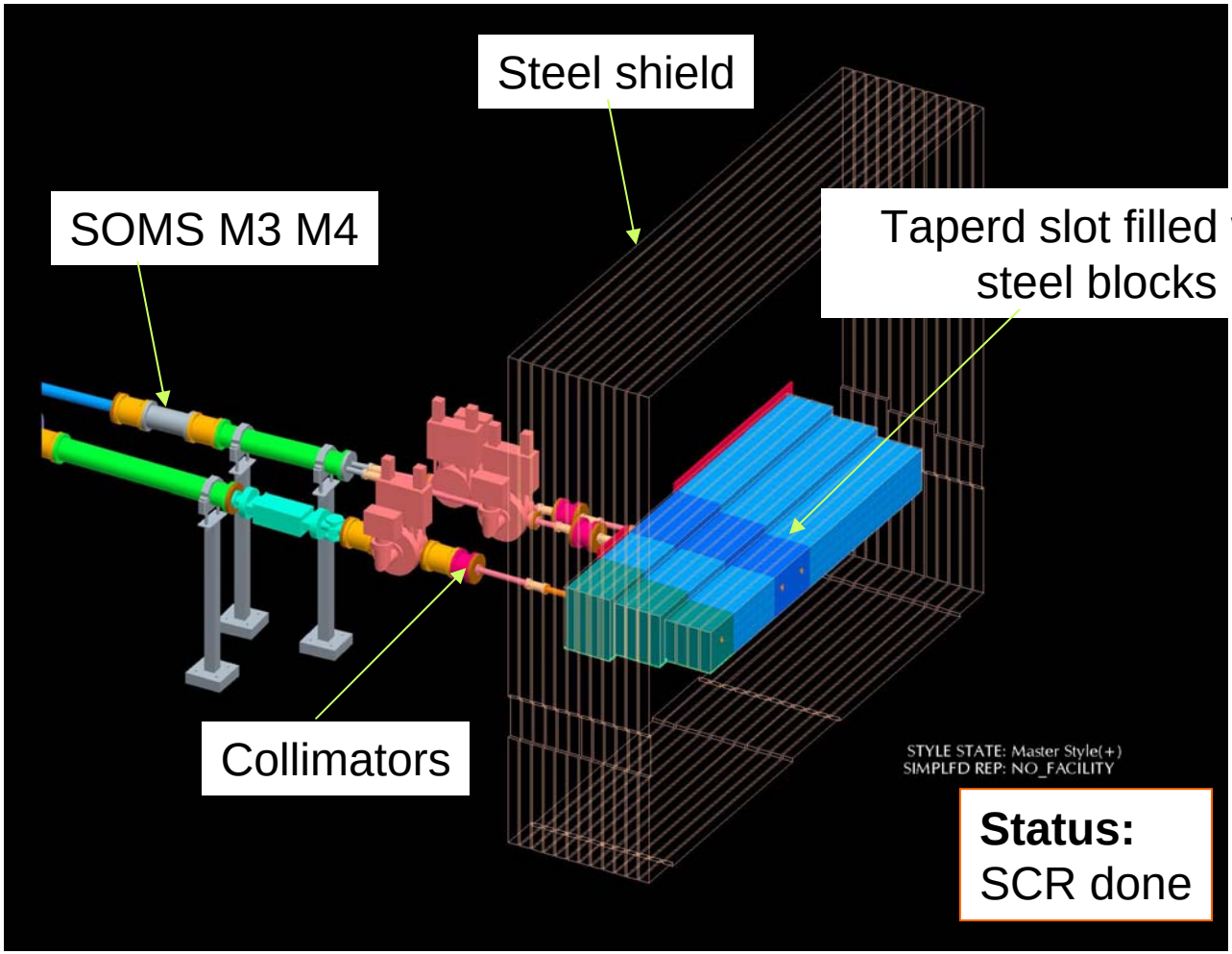
Status SOMS:
PRD done
SCR done
Mirror PDR done
Mirror FDR done
Mirrors in Purchase / Fabrication

Hard X-Ray Offset Mirror System (HOMS):



Status HOMS:
PRD draft
SCR 7/17

Wall penetration FEE to NEH



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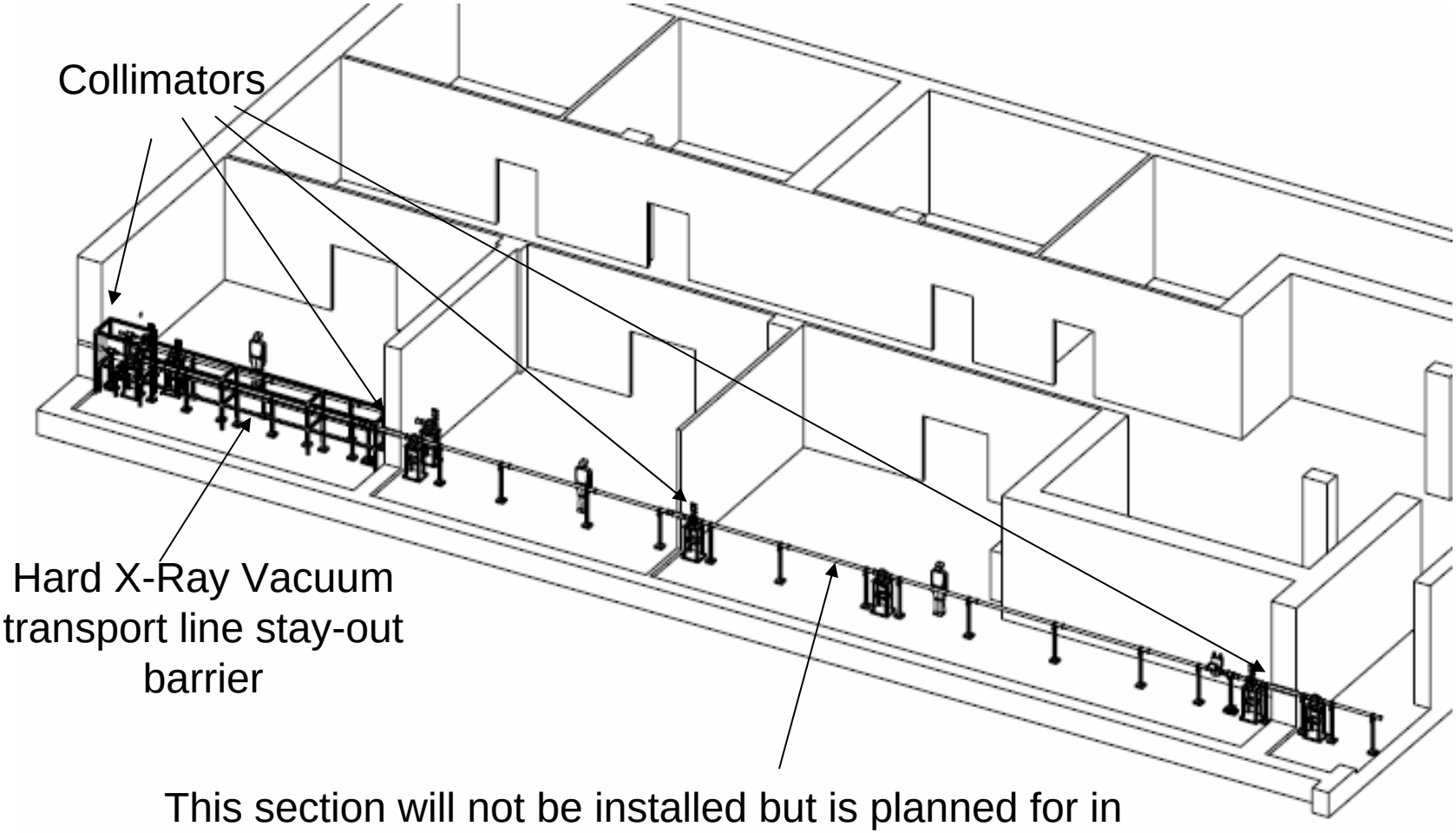
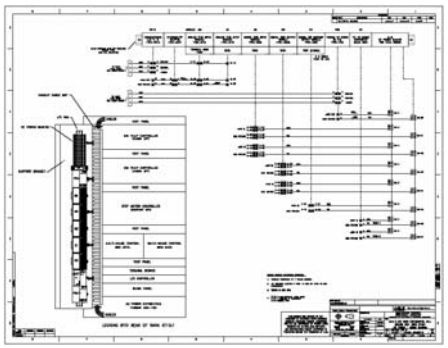
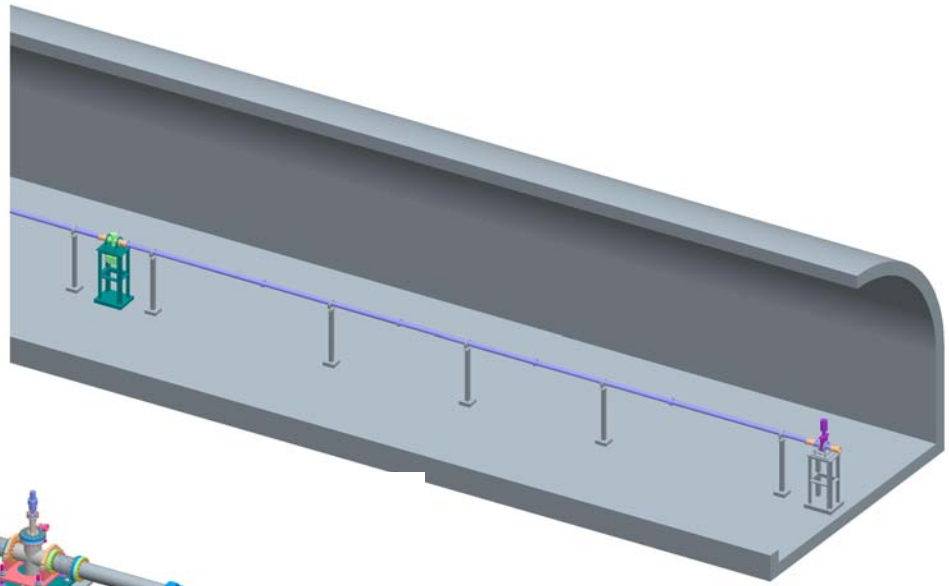
XTOD elements in Near Hall

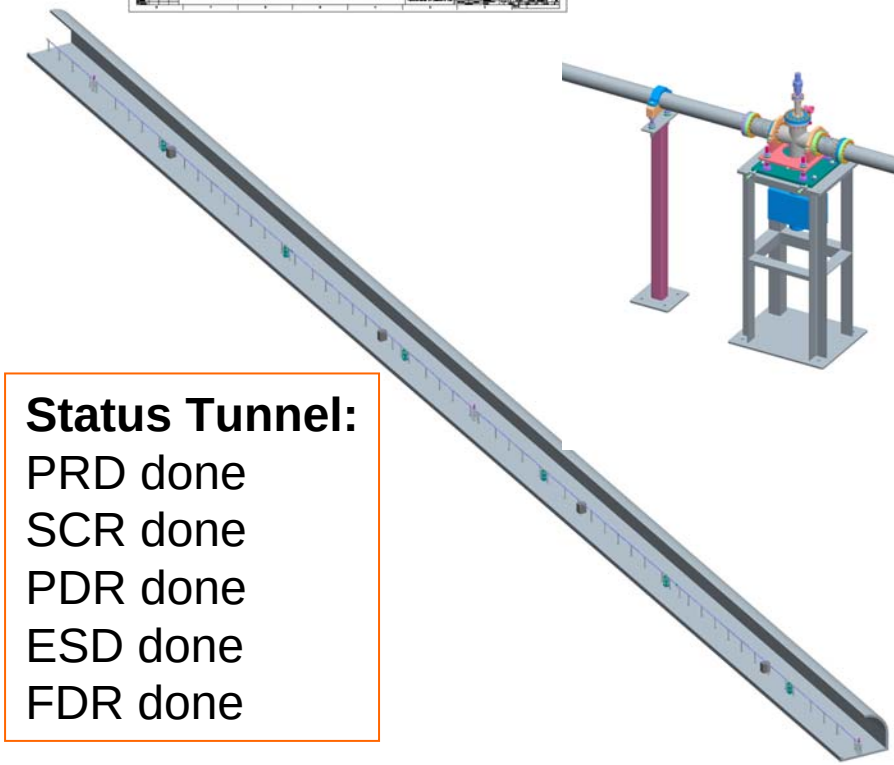


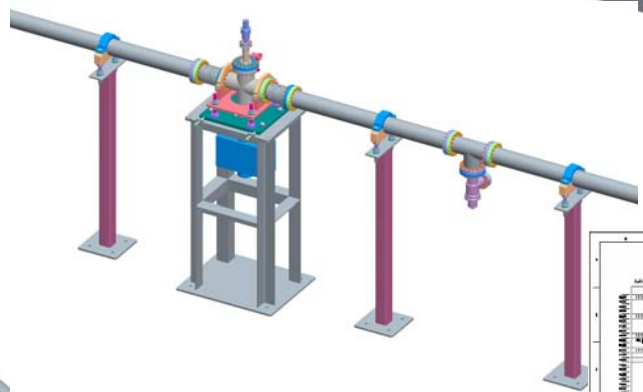
This section will not be installed but is planned for in case of delays in the installation of LUCI equipment

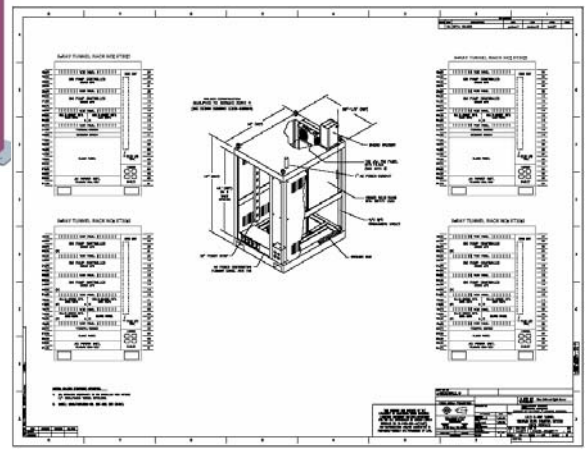
XTOD Tunnel Design Complete











Status Tunnel:
PRD done
SCR done
PDR done
ESD done
FDR done

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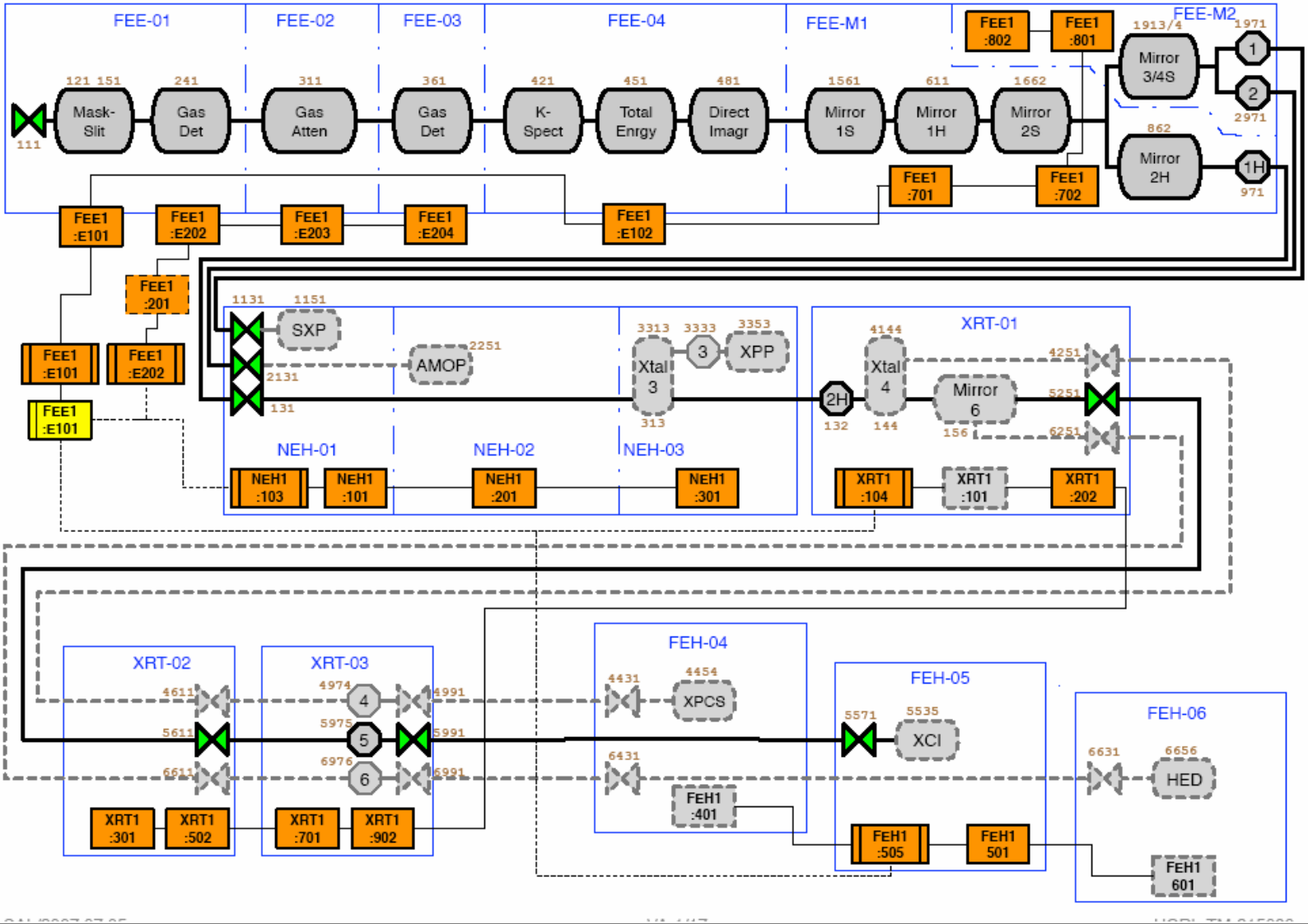
Integrated EPICS control system for XTOD has been designed



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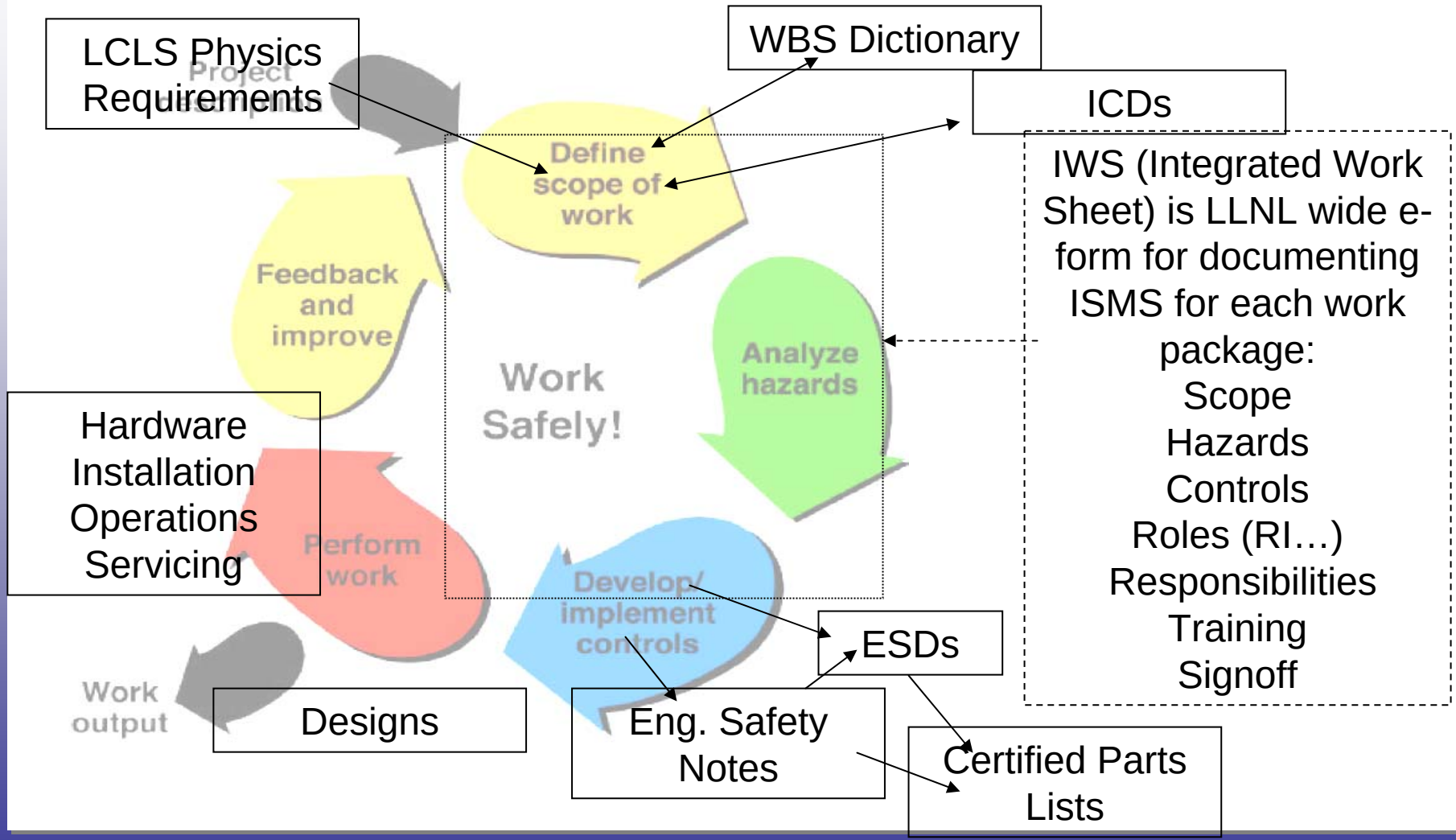
XTOD work flow follows ISMS practices for each WBS element



Integrated Safety Worksheets are being Developed for Each Task

IWS#	WAL	Title	RI	Alt-RI	Site 1	Site 2	Site 3
12599	B	Testing of Prototype Gas Attenuator Vacuum System	Kishiyama		132S/1571		
12662	B	LLNL Collaboration at Stanford LCLS: Off-Site Work	Bionta		SLAC		
12877	B	LCLS Optics testing at DESY lab, Hamburg Germany	Bionta		DESY		
12920	B	LCLS X-Ray Tunnel Vacuum Transport System	Bionta	Trent/McKernan	132S/Labs	SLAC	
13253	B	LCLS Solid Attenuator	Kishiyama		132S/1571	SLAC	
13321	C	LCLS Total Energy Monitor	Friedrich	Niedermayr	132S/various		
13453	B	LCLS Fixed Mask, and X-Ray Slit	Bionta	Trent	132S/1571	141/1145	SLAC
13474	B	B141 LCLS lab .01 version	Bionta	McKernan	141/1145		
13527	B	LCLS Gas Detector	Bionta	McMahon	132S/1571	141/1145	SLAC
1106	B	Electronics fabrication and assembly	Andreski		321		
13680	B	LCLS Direct Imager	Bionta	McMahon	132S/1571	141/1145	SLAC
14018	B	FEL Offset Mirror System	Bionta	McCarville	141/1145	SLAC	

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Summary

- FY07 was to be a year of design completion and procurement of all systems with most ready for shipping to SLAC for BO
- CR delayed procurements of prototypes and final designs by 3 to 6 months
- Delayed procurements have been let
  - Fixed mask, Slit, Attenuator, some Controls
- Accelerated some procurements to ease compressed schedule
  - SOMS Mirror, Direct imager, Thermal sensor, Controls
- Work flow follows the principle of ISM (development to install/commissioning)