A Metrology Beamline At NSLS-II

April 23, 2018

At-wavelength metrology around the complex

From Denny's spreadsheet:

Facility	Beamline	Source	Energy range	White beam option?	When available?	Fraction available for metrology
APS*	1-BM	BM	6-28 keV	Yes	Now	0.50
ALS	5.3.1	BM	2.1-13 keV	No	Now	0.25
ALS	6.3.2	BM	0.025-1.3 keV	No	Now	0.75
ALS	11.3.2	BM	0.05-1.0 keV	No	Now	1.00
ALS	12.0.1	undulator	0.092 keV (fixed)	No	Now	0.75
SSRL	8-1BM	BM	0.015-0.185 keV	No	Closed (according to website)	
SSRL	16-1BM	BM	Soft x-ray range (mono)		Future, should be operating in FY19	1.00
SSRL	16-2BM	BM	Tender/hard x-ray range (mono)		Future, should be operating in FY19	1.00
NSLS-II	5-BM	BM	2-17 keV	Yes	FY21?	1.00

Dedicated to EUV optics

Total of 0.75 FTE beamlines for hard x-ray metrology

* APS will also have a fraction of a ID line temporarily as part of APS-U

NSLS-II Metrology beamline estimate

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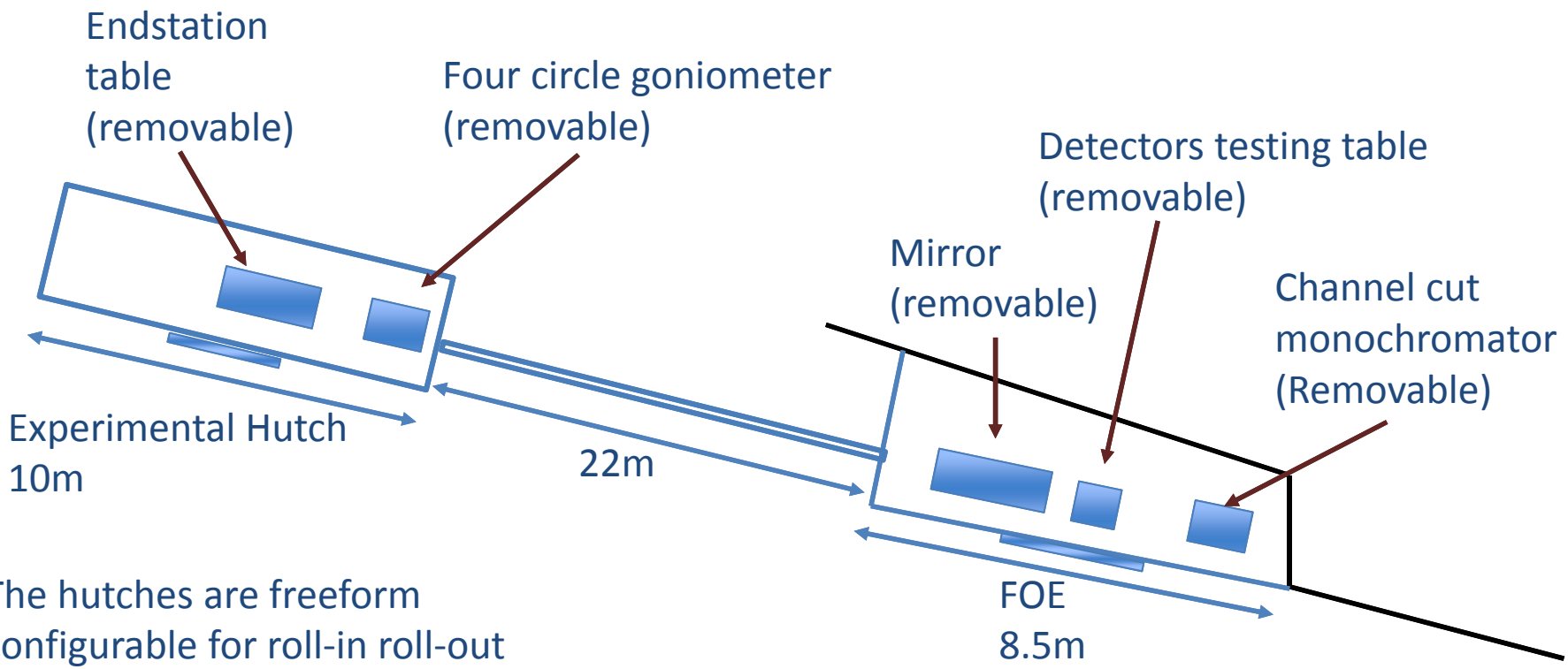
- Determined that only a long (60m) white beam beamline would offer capabilities for testing optics and X-Ray detectors.
- Scope was organized into minimum to enable a metrology program and scope that would give enhanced capabilities.
- Estimate produced using the NSLS II estimating tool, using the NSLS II standard WBS for beamline construction. Ensures that nothing in the construction sequence is overlooked and gives a resource loaded schedule that captures the full cost including labor, M&S and overheads
- In many respects this beamline is similar to the recently completed set of BDN beamlines and benefits directly from cloning (no design effort) some systems.

Metrology beamline layout (5-BM)



The hutches are freeform configurable for roll-in roll-out experiments, including Refractive lenses, Zone plate and MLL testing, large mirror systems and monochromators

$5.3 M for bare minimum (empty hutches)
$6 M hutches equipped as shown

A Joint metrology beamline at NSLS-II?

- For relatively little cost, could build a white beam flexible beamline for at-wavelength metrology and detector testing at NSLS-II
- Questions to address:
  - Is there sufficient need for such a capability?
  - What modes of access should be available?
  - How to fund construction costs
    - Cost share between the 5 light sources and BES?
    - Other partners?
  - How to fund operations costs?

Minimum scenario ($5.3M)

- Three pole wiggler
  - Three pole wiggler system constructed as spare but not measured
- Front end (white beam)
  - Clone of CMS beamline frontend (only top level drawing required)
  - Terminating in dual Be Windows (PPS)
- Hutches
  - QAS copy FOE, 10m x 3m Experimental hutch
  - Integrated white beam stop (PPS)
  - Shielded beam pipe
- Utilities
  - DI water for Be Windows and integrated beam stops
  - PCW for racks and general cooling
  - Compressed Air
  - Electrical infrastructure similar to QAS
- PPS
  - Doors, labyrinths, Be Windows, integrated beam stops, reach-backs to the accelerator & frontend
- EPS
  - Be Windows, general IO
- Controls
  - Network and timing fiber, CAT 6 distributed in hutches
  - General hutch cameras
  - IOCs and work stations for basic general control

Middle of the road scenario ($5.85M)

- Minimum scenario plus experimental equipment
  - All experimental equipment reused from stored equipment in 742
  - All equipment mounted in such a way that it can be rolled out of the beamline for test on large or specialist equipment
- Channel cut monochromator (upgrade to direct drive (QAS design))
  - Controls & EPS
  - Turbo and Ion pumps for fast vacuum pump-out.
- Mirror tank X26 (two features in new substrate)
  - Plane mirror stripe (Rh over Pt) & Toroidal stripe (Rh over Pt)
  - Controls & EPS
  - Turbo and Ion pumps for fast vacuum pump-out.
- Removable vacuum pipes (HV ~10^{-4} mbar)
- Experimental table (five axis) (reused)
  - Stages (X, Y, Z)
  - Controls
- 4 Circle Huber (reused)
  - Controls
- Basic controls