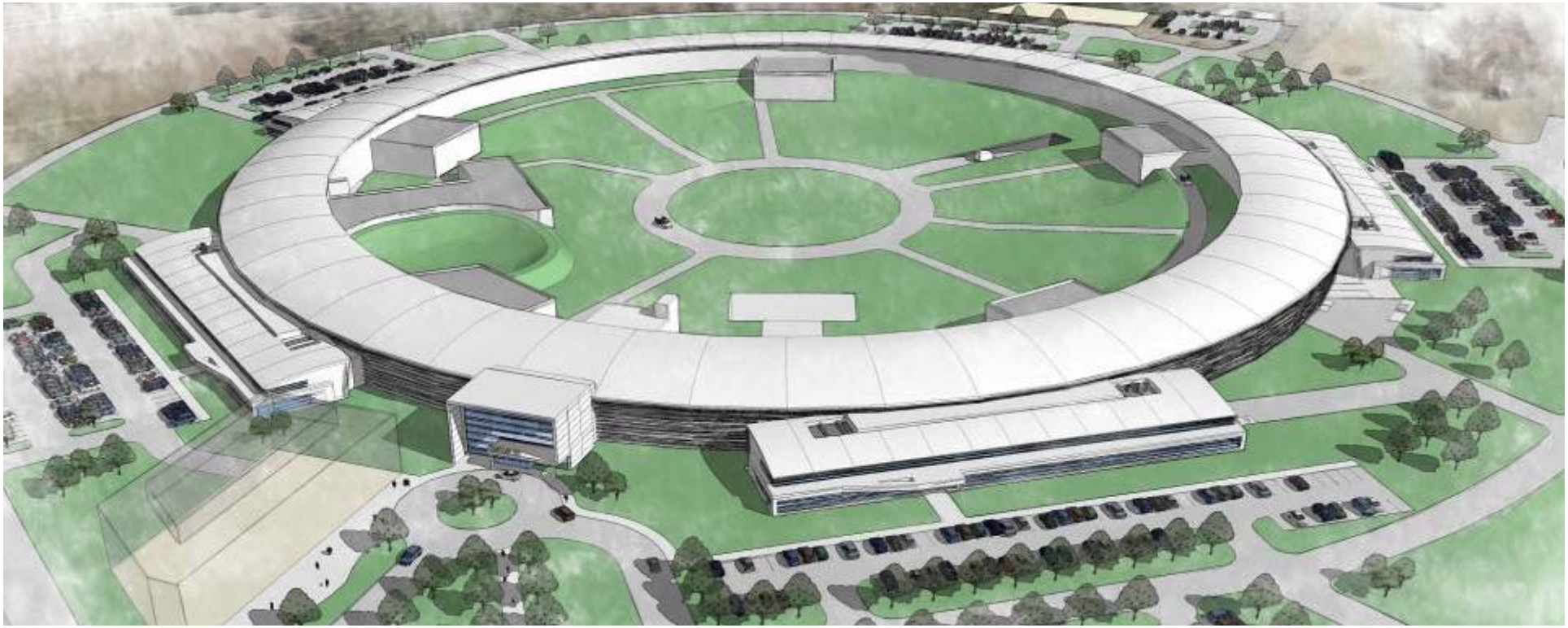
NSLS-II Project Update



Steve Dierker
Associate Laboratory Director for Light Sources
NSLS-II Project Director
Experimental Facilities Advisory Committee
October 4, 2007

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Project Scope

Accelerator Systems
- Storage Ring (~ ½ mile in circumference)
- Linac and Booster Injection System

Conventional Facilities
- Improvements to Land
- Ring Building w/ Operations Center and service buildings (~ 326k gsf)
- Laboratory/Office Buildings (LOBs) to house beamline staff & users (~68k gsf)
- Reuse of existing NSLS office/lab space for NSLS-II staff
- Sustainable design (LEEDS certification)

Experimental Facilities
- Initial suite of 6 insertion device beamlines and instruments
- Capable of hosting at least 58 beamlines

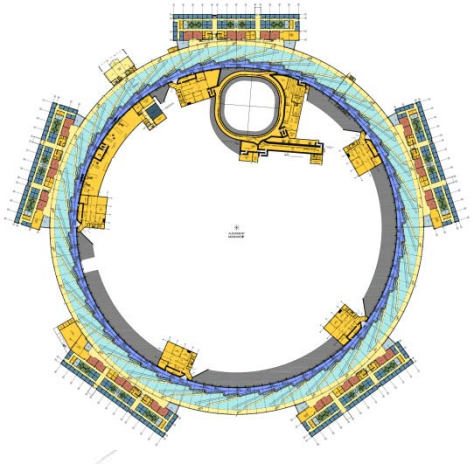
R&D
- Advanced optics for achieving 1 nm and 0.1 meV
- Nanopositioning
- Advanced insertion devices

Storage Ring

- Very Broad Spectral coverage
  - Far-IR through very hard x-rays
- Very high Brightness from 10 eV to 20 keV
  - > 10^{21} p/s/0.1%/mm^2/mrad^2 from ~ 2 keV to ~ 10 keV
- Very high Flux from 10 eV to 20 keV
  - > 5x10^{15} ph/s/0.1%bw from ~ 500 eV to ~ 10 keV
- Very small beam size
  - σ_y = 2.6 μm, σ_x = 28 μm
  - σ'_y = 3.2 μrad, σ'_x = 19 μrad
- Top-off Operation
  - Current stability better than 1%
- 27 straight sections available for insertion device beamlines
- 31 BM or Three Pole Wiggler ports available for beamlines

Design Parameters

- 3 GeV, 500 mA, top-off injection
- Circumference 791.5 m
- 30 cell, Double Bend Achromat
  - 15 long straights (8.6 m)
  - 15 short straights (6.6 m)
- Novel design features:
  - damping wigglers
  - soft bend magnets
  - three pole wigglers
  - large gap IR dipoles
- Ultra-low emittance
  - ε_x, ε_y = 0.5, 0.008 nm-rad
  - Diffraction limited in vertical at 10 keV
- Pulse Length (rms) ~ 15 psec



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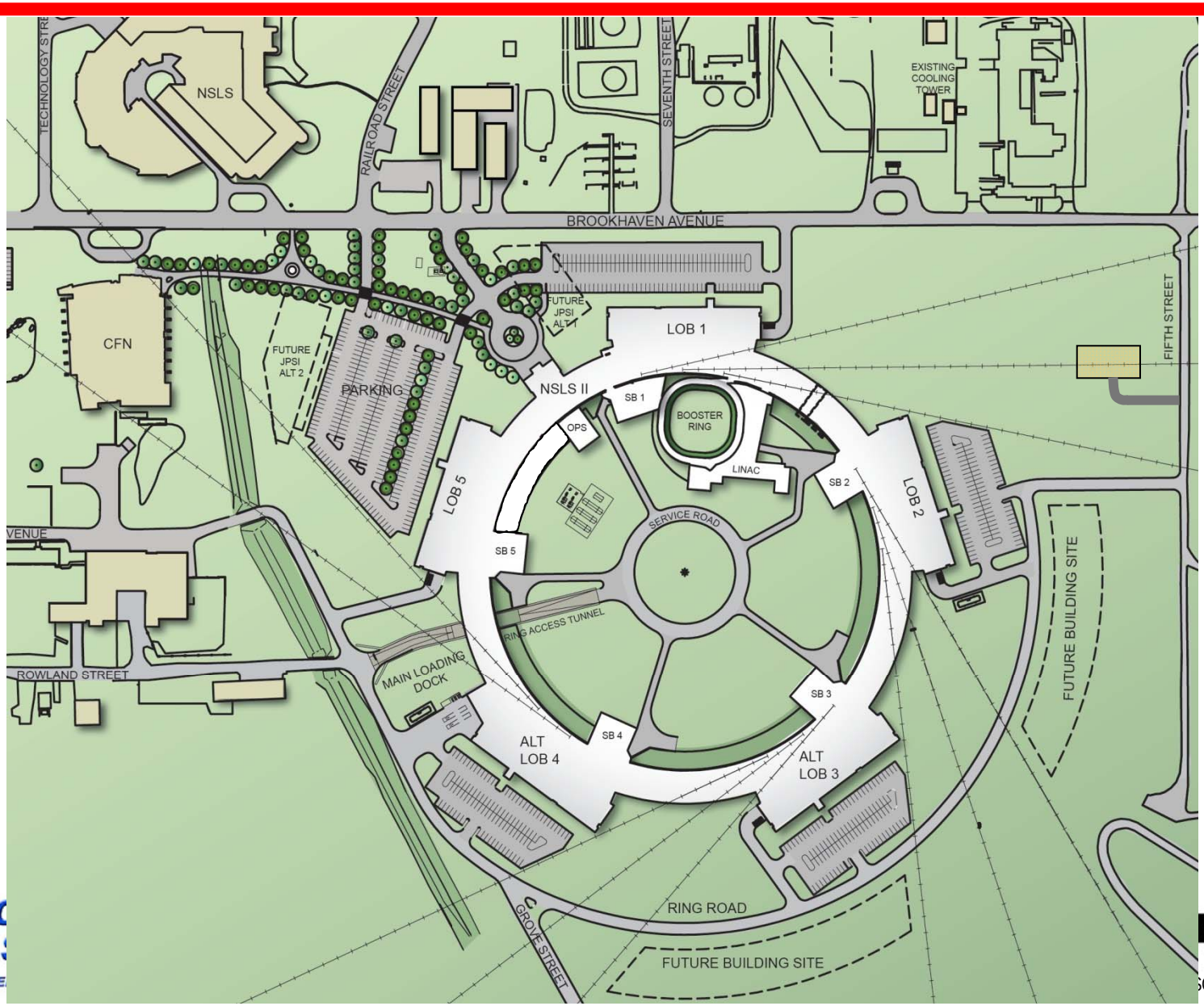
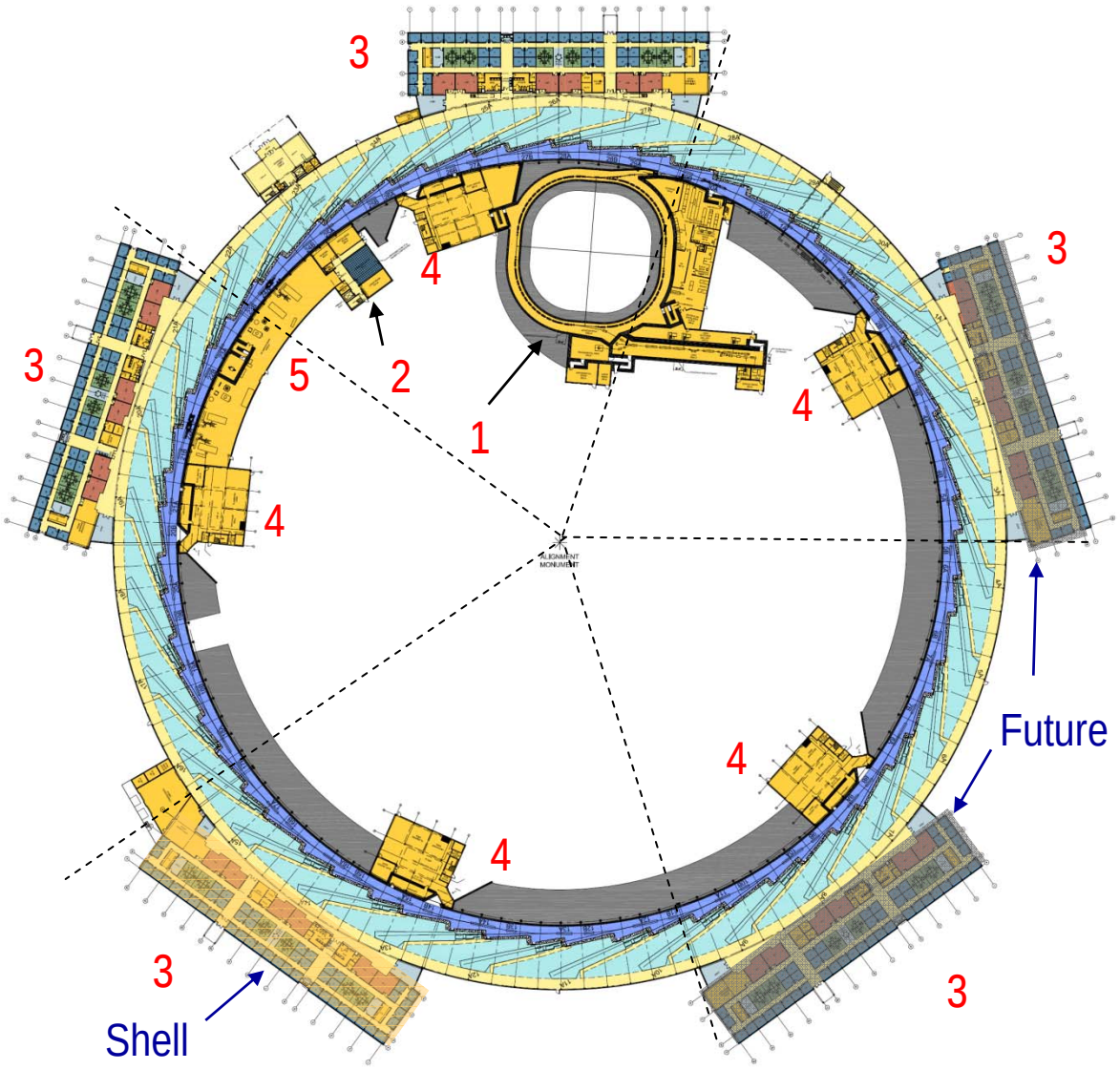
Site Plan


NSLS
RAILROAD STREET
SEVENTH STREET
EXISTING COOLING TOWER
BROOKHAVEN AVENUE
CFN
FUTURE JPSI ALT 2
PARKING
FUTURE JPSI ALT 1
LOB 1
FIFTH STREET
NSLS II
SB 1
BOOSTER RING
OPS
LINAC
SB 2
LOB 2
LOB 5
SERVICE ROAD
SB 5
RING ACCESS TUNNEL
FUTURE BUILDING SITE
ROWLAND STREET
MAIN LOADING DOCK
SB 3
SB 4
ALT LOB 4
ALT LOB 3
RING ROAD
GROVE STREET
FUTURE BUILDING SITE

Floor Plan

NSLS-II Floor Plan

1. Booster/LINAC
2. Operations Center
3. LOB – Lab Office Buildings (3 base scope, 2 more future)
4. Service Buildings (5)
5. RF Area



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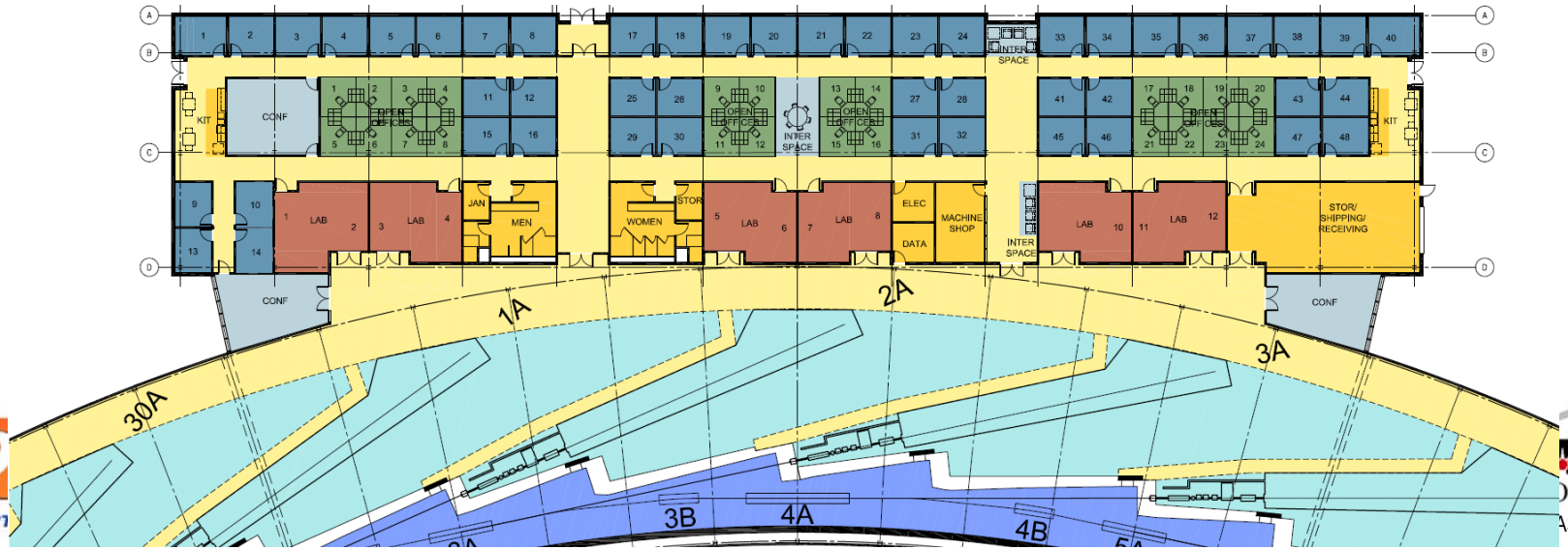
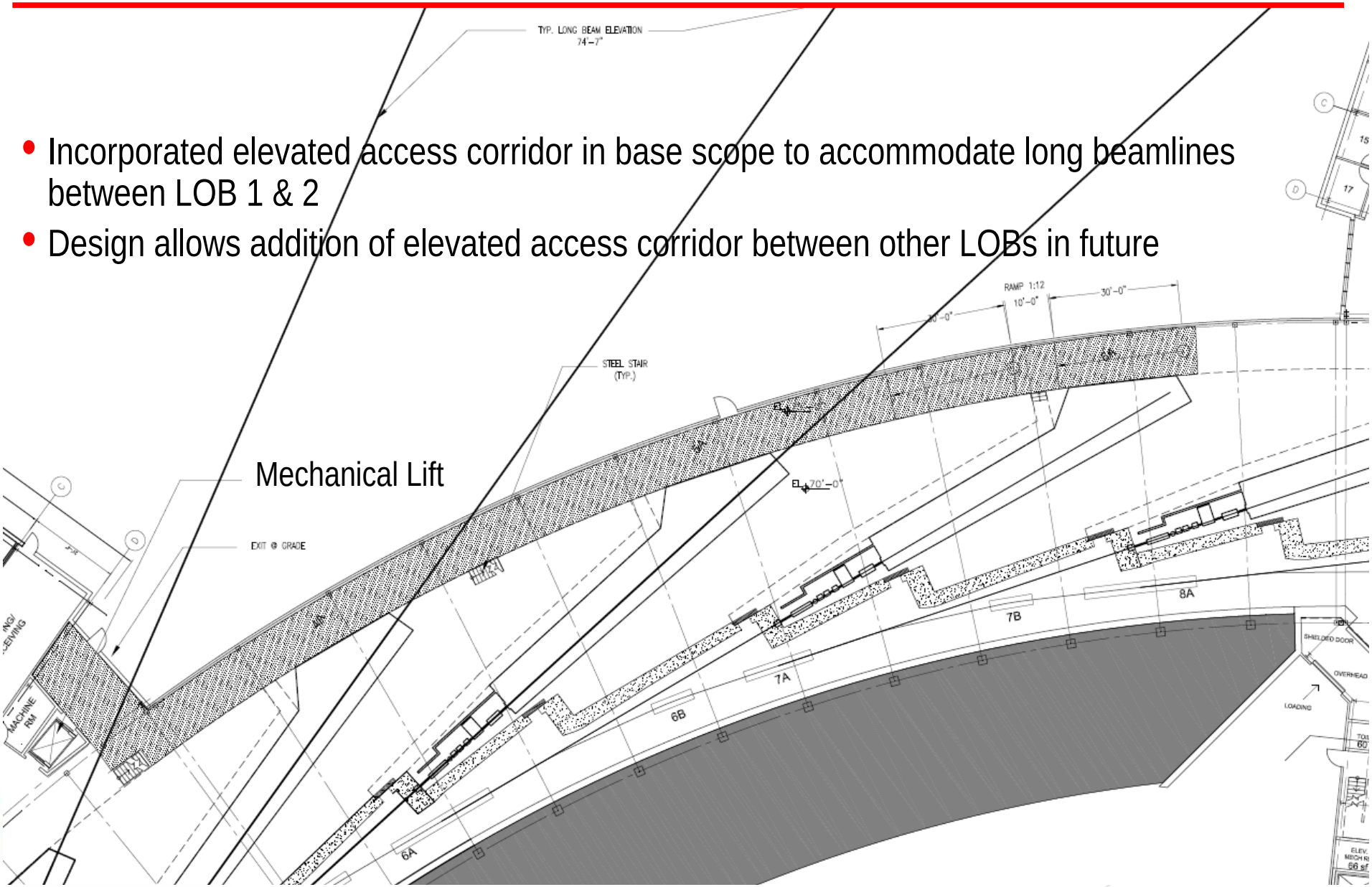
Laboratory Office Buildings

- Three in base scope (22,800 sf each) – Each serves six sectors
  - 72 offices w/ conference space, interaction areas, lavs, showers
  - 6 labs – optimized for shared use
  - Shipping/Receiving/Storage area & chemical storage area
  - Future addition of 2 more LOB's as facilities builds out
- Egress provided for personnel and large items at each LOB
  - Loading area with exterior roll-up door
  - Double-door from each lab onto the experimental floor
  - Rolling access to all beamline areas



Elevated Access Corridor

- Incorporated elevated access corridor in base scope to accommodate long beamlines between LOB 1 & 2
- Design allows addition of elevated access corridor between other LOBs in future



Stability Dependent on Conventional Facilities

- Stability goals driven by conventional facility design
  - Stability of storage ring tunnel floor
    - Vibration < 25 nm rms from PSD from 4-50hz (vertical)
  - Stability of experimental floor
    - Vibration level of ~ 25 nm rms (vertical) from PSD from 4-50hz for general floor area
    - Vibration level for 1 nm resolution beam lines requires further definition but appears achievable with proper correlation
  - Thermal stability of storage ring tunnel environment
    - +/- 0.1^{0} C
  - Thermal stability of experimental floor
    - +/- 0.5^{0} C

Some Activities Since Last EFAC Meeting

- Finalized Lattice Design & Footprint — May 4
- SC Mini-Review — May 22
- Project Advisory Committee (PAC) — May 24-25
- Kick off cost estimate for CD-2 — June
- CD-1 ESAAB — June 13
- CD-1 Approval — July 12
- Held User Workshop — July 17-18
- WBS Level 2 Cost Estimate Meetings — July/August
- Internal Cost and Schedule Review — Aug 30
- Held seven Accelerator Technical Design Reviews — Aug/Sep
  - Storage Ring Magnets, Vacuum Systems, Front Ends
  - Instrumentation and Diagnostics
  - Insertion Devices
  - Power Supplies
  - Control Systems
  - Accelerator Physics
  - Interlock Systems
- Conventional Facilities 90% Title I Submission — Sep 7
- Comprehensive Project Design Review — Sep 11-13
- SC Mini-review of Cost/Schedule Baseline — Sep 28
- BSA-EVMS Certification Review — Oct 1-5

NSLS-II User Workshop

First Day Session

- Described conceptual design and status of project
- Highlight talks on physical and life sciences and user access models
- Described process for beamline development at NSLS-II
- Described Joint Photon Sciences Institute
- Described plans for transitioning from NSLS to NSLS-II
- Discussions at reception and dinner

- > 450 Attendees
- OSTP: John Marburger
- DOE: Pat Dehmer (BES), Pedro Montano (BES), Susan Gregurick (BER)
- NIH: Charles Edmonds (NIGMS), Alan McLaughlin (NIBIB), Michael Marron (NCRR), Amy Swain (NCRR)
- NSF: Guebre Tessema

NSLS-II User Workshop

2nd Day Breakout Sessions

Technique-based Sessions

- Hard x-ray Nanoprobe
- Soft Coherent Scattering and Imaging
- Powder Diffraction
- Macromolecular Crystallography
- Liquid Interfaces
- Inelastic X-ray Scattering
- Hard Coherent and XPCS/SAXS
- XAFS
- Bio-SAXS
- Photoemission Spectroscopy

Science-based Sessions

- Life Sciences
- Catalysis
- Environmental Science
- High-Pressure
- Strongly Correlated Electrons
- Magnetism
- Radiometry and Metrology
- Soft Condensed Matter

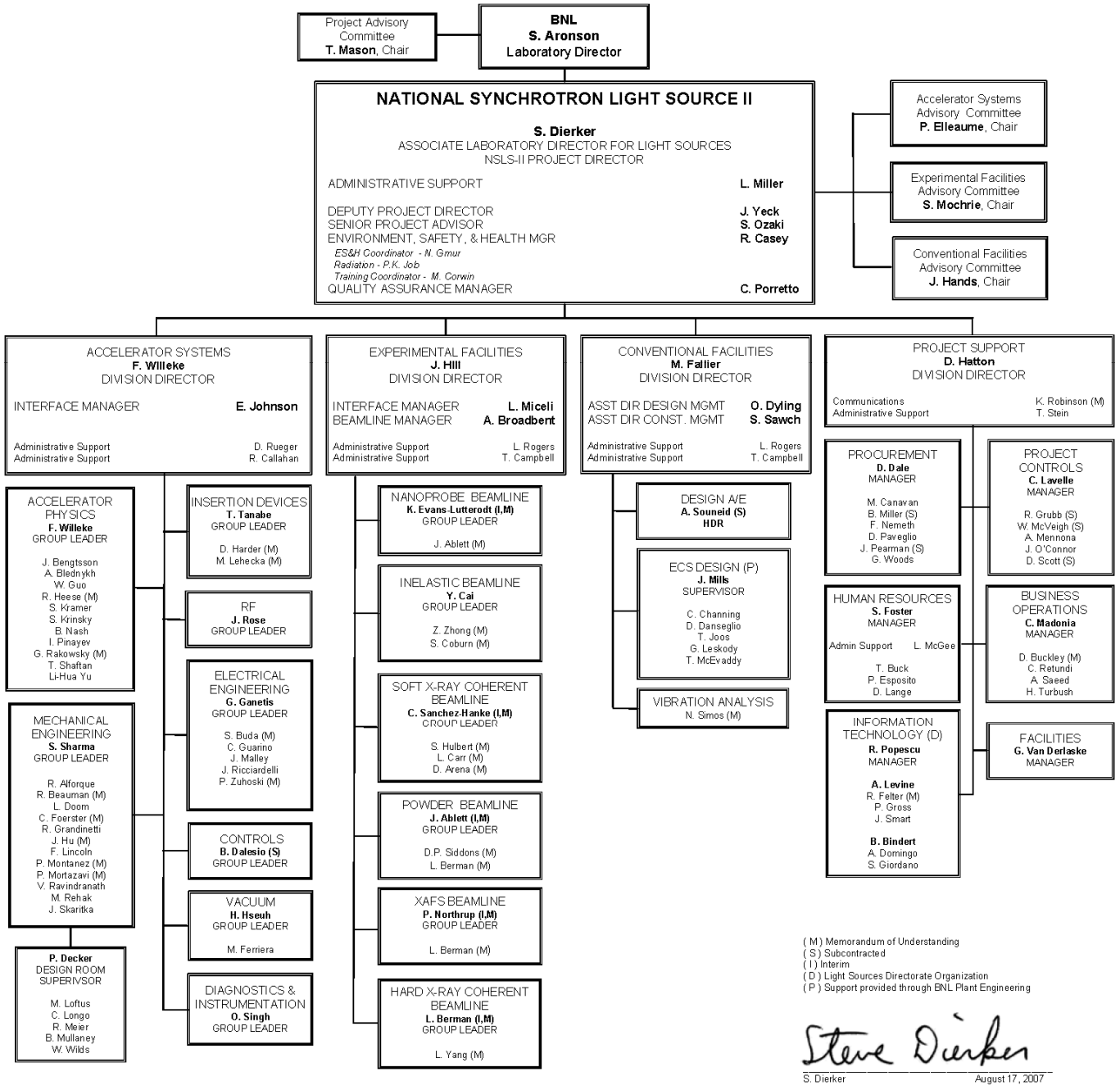
Some Upcoming Events

• Experimental Facilities Advisory Committee (EFAC)	Oct 4-5
• Post material for CD-2 EIR Review	Oct 5-19
• Accelerator Systems Advisory Committee (ASAC)	Oct 8-9
• DOE CD-2 Review and External Independent Review	Nov 6-9
• Project Advisory Committee (PAC)	Nov 20

Organization & Staffing

- Organization is well established
- Making good progress with staff additions
  - Ferdinand Willeke joined project full-time on August 1 to succeed Satoshi Ozaki as Director of Accelerator Systems Division
  - Interface Managers for ASD, CFD, and XFD all in place
  - Asst Director for Construction Management hired
  - Other recent hires:
    - QA Manager, IT Manager, many physicists, engineers, & designers (see org chart on next vg)
  - 26 open requisitions – many candidates identified; interviews ongoing

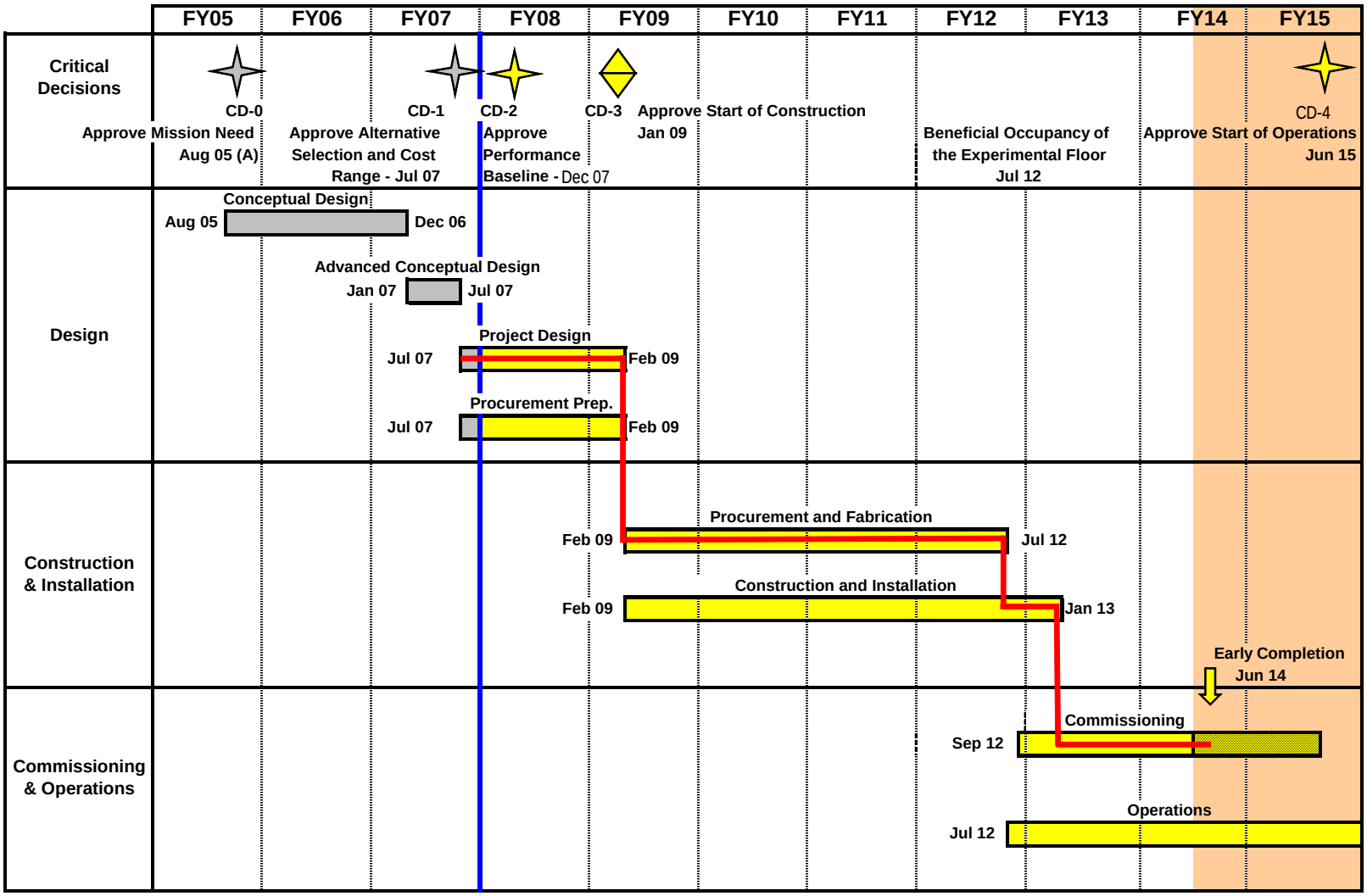
NSLS-II Project Organization



Project FTE Profiles

Category	*Total*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Project Management	235	42	45	42	42	40	18	6	0
R&D & Concept Design	73	19	19	18	17	0	0	0	0
Accelerator Systems	524	76	93	91	99	122	25	18	0
Experimental Facilities	129	17	25	25	24	20	14	4	0
Conventional Facilities	49	8	8	9	9	9	4	2	0
Pre-Operations	173	0	0	0	2	28	75	68	0
Total	1,183	162	190	185	193	219	136	98	0

Schedule Schematic



15 months total schedule contingency

CD-4 Criteria & Key Performance Parameters

Level 1B Milestone:To be granted upon receiving Beneficial Occupancy of the experimental floor in one pentant of the storage ring building

- Director of DOE-BES is approving authority
- Enables early operations funding

CD-4: To be granted upon meeting the following key performance parameters:

- Accelerator Facilities
  - Electron Energy = 3.0 GeV
  - Stored Current = 25 mA
- Conventional Faciliites
  - Building Area = 300,000 gross square feet
- Experimental Facilities
  - Beamlines installed and ready for commissioning with x-ray beam = 2
  - Additional beamlines procured = 4

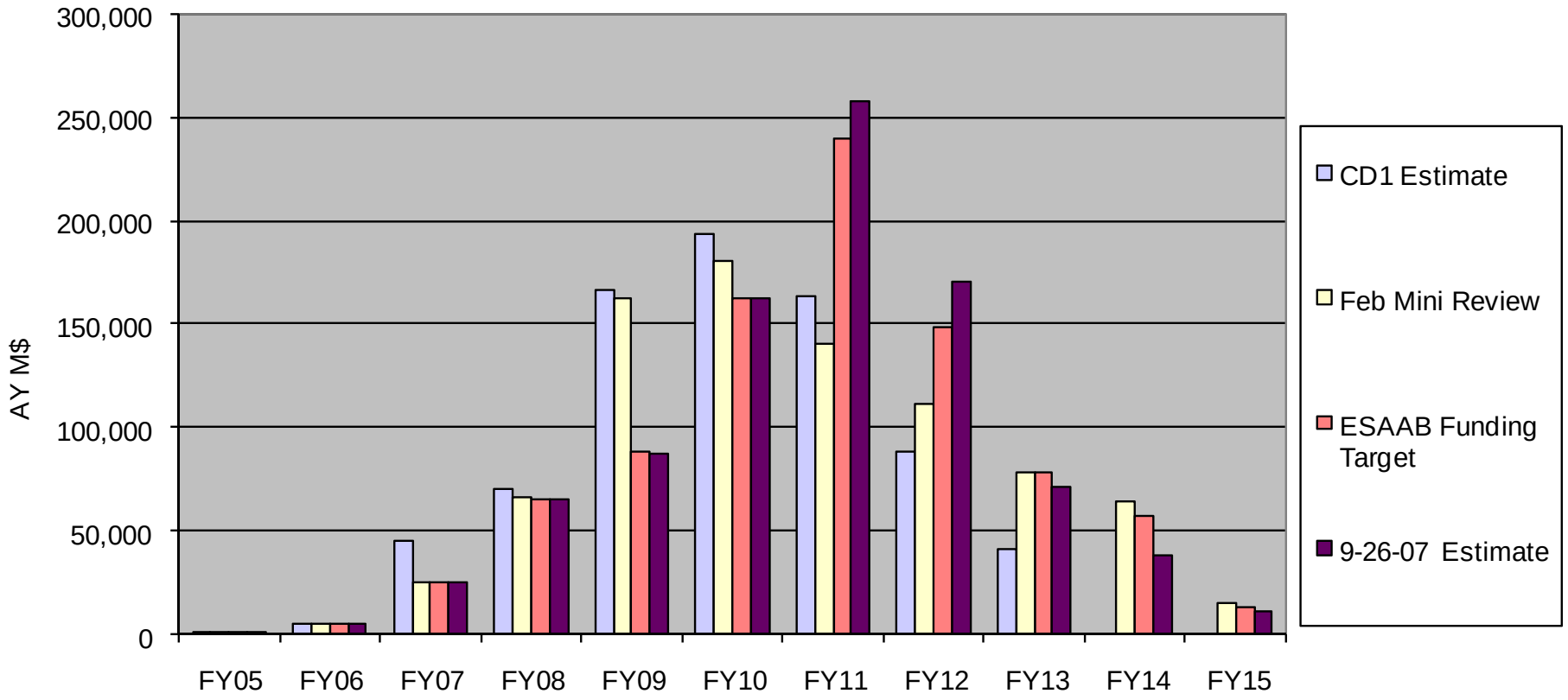
Commissioning and Transition to Operations

- Commissioning Schedule
  - Start Linac commissioning in Sep 2012
  - Start Storage Ring commissioning in Oct 2013
  - Beam available to beamlines on early finish date of June 2014
- Transition to Pre-Operations and to Operations
  - Start transitioning staff to pre-ops when experimental floor is available FY12
  - Start shifting staff to NSLS-II operations in FY13
  - Transition all staff to pre-ops or ops after early finish date

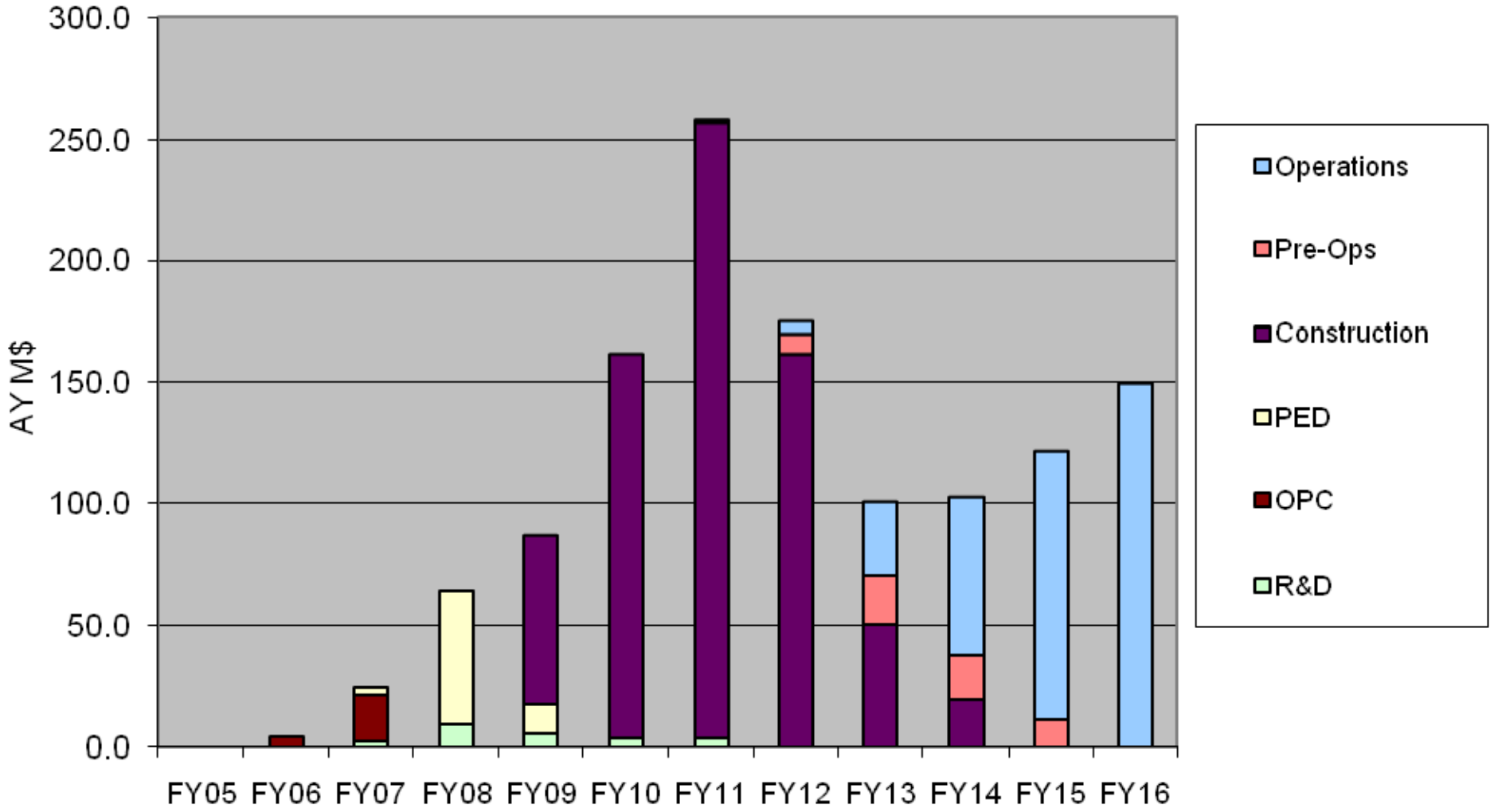
Current Cost Estimate $M

Project Management	$ 62
Accelerator Systems	250
Conventional Facilities	213
Experimental Facilities	80
Contingency (on TEC items above)	182
Total Estimated Costs (TEC)	787
R&D and Conceptual Design	51
Pre-Operations	56
Other Project Costs (OPC)	107
Total Project Costs (TPC)	$ 894

Funding Profile Evolution



Funding Target Profile w/ NSLS-II Ops



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Funding Target Profile and Current Cost Estimate

WBS Element ($ x 1000)	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	Total
Funding Target	1,000	4,800	25,000	65,000	88,000	164,500	254,400	170,800	71,000	37,800	11,500	893,800
1.0 NSLS-II	1,000	4,800	25,000	64,882	87,252	162,128	258,331	170,430	70,982	37,815	11,501	894,121
1.01 Project Management			250	11,487	12,285	10,732	11,566	10,505	4,306	1,240		62,371
1.02 R&D	1,000	4,800	22,000	9,790	5,743	3,909	3,561					50,803
1.03 Accelerator Systems			500	16,031	26,068	45,782	91,834	49,935	16,384	3,495		250,029
1.04 Experimental Facilities			250	3,836	5,694	7,867	13,806	36,889	11,072	940		80,354
1.05 Conventional Facilities			2,000	13,075	15,340	67,468	86,023	27,709	1,358	244		213,217
1.06 Pre Operations							734	7,881	19,671	17,769	9,501	55,556
Contingency			0	10,663	22,122	26,370	50,807	37,511	18,191	14,127	2,000	181,791

Estimates are fully burdened and escalated

Scope & Cost Reductions

Additional pre-CD-2 scope & cost reductions in order to accommodate funding profile in 09 &10 and maintain TPC < $900M

Area	Bottom Line Estimate
Accelerator Systems	$ 11.3 M
Conventional Facilities	$ 14.1 M
Experimental Facilities	$ 9.3 M
Total	$ 34.7 M

Scope Contingency

Area	Bottom Line Estimate
Accelerator Systems	$ 2.7 M
Conventional Facilities	$ 26.0 M
Experimental Facilities	$ 14.1 M
Total	$ 43.4 M

Total Scope Contingency equals 7% of TEC

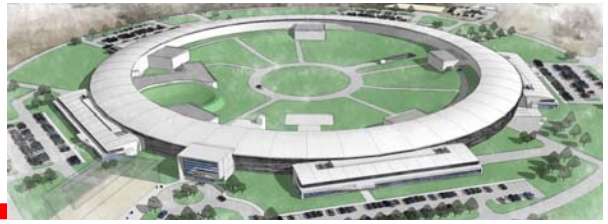
Potential Future Scope Additions

Area	Bottom Line Estimate
Accelerator Systems	$ 11.3 M
Conventional Facilities	$ 40.6 M
Experimental Facilities	$ 11.6 M
Total	$ 63.5 M

Issues

- Aggressive schedule for establishing the Performance Baseline
  - Preliminary design period shortened due to FY07 Continuing Resolution and lead time required for FY09 budget submission
  - Project baseline will be approved when the project is ~5% complete
- FY09 and FY10 funding constrain the technically limited plan. Work not on the critical path has been deferred.
- Some additional resource leveling is required and better staffing plans needed, especially for FY10
- Aggressive schedule for documenting preliminary design

Summary



- Conceptual design has matured into an exciting design, promising superlative experimental capabilities.
- Novel design w/ outstanding performance and flexibility from the far-IR to the very hard x-ray. A range of sources will be available to match the various scientific needs.
- Baseline scope meets performance and cost goals and provides substantial experimental capability
- Good progress at resolving design challenges
- Project Organization well developed to execute project
- Planning for transition from NSLS and reuse of experimental and conventional facilities from NSLS