Status of NSLS-II

F. Willeke, BNL
DESY, April 6, 2009

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Outline

- Requirements
- Lattice Design
- Building
- Injector
- Storage Ring Subsystems
- Organization
- Status and Milestones
- Summary

NSLS-II Accelerator Design Goals

Average Spectral Brightness

of 2-10 keV photons: $B \geq 10^{21}\ mm^{-2}\ mrad^{-2} s^{-1}\ (0.1\%BW)^{-1}$

Spectral Flux Density : $\Phi_{max} \geq 10^{15}\ s^{-1}$ (0.1%BW)-1 @ 2 keV.

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NSLS-II Accelerator Design Goals

Beam Energy:	**E = 3 GeV**
Quasi constant, high Beam Current:	**I = 500 mA, ΔI / I = 1%**
horizontal Beam Emittance:	ε_x **= 0.6 nm (ultimate design goal)**
vertical Beam Emittance:	ε_y **= ~ 8 pm** (*diffraction limited @12keV)*
Moderate Beam Energy Spread:	**ΔE / E = 0.1% (RMS)**
High Orbital Stability:	**Δz, Δz' = 10% · σ_z, σ_z'**
Large Space for Insertion Devices:	**L_{ID} = 226 m (28.5%),**

with bending magnet sources included

space for at least **58 beam lines**

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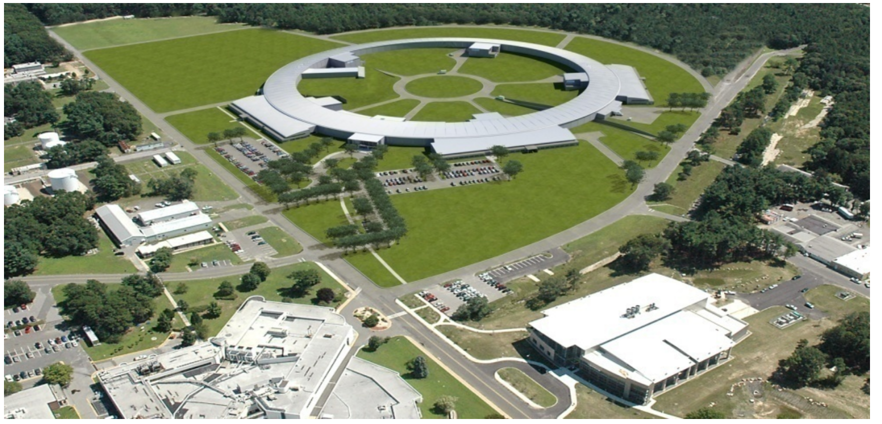
NSLS-II Accelerator Design Goals, continued



Beam Lifetime:	τ	**≥ 3 h**
Stable Beam Current in time:	**$\Delta I(t) / I(t=0)$**	**≤1%**
Small Bunch-to Bunch Current Variation:	**$\Delta I_{bunch\text{-}to\text{-}bunch} / I$**	**≤20%**
residual beam oscillations due to injection:	**$\Delta z, \Delta z'$ = 10% ·**	σ_z, σ_z'
Injection Frequency	**1Hz-0.016 Hz**	

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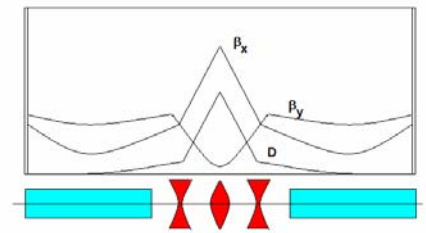
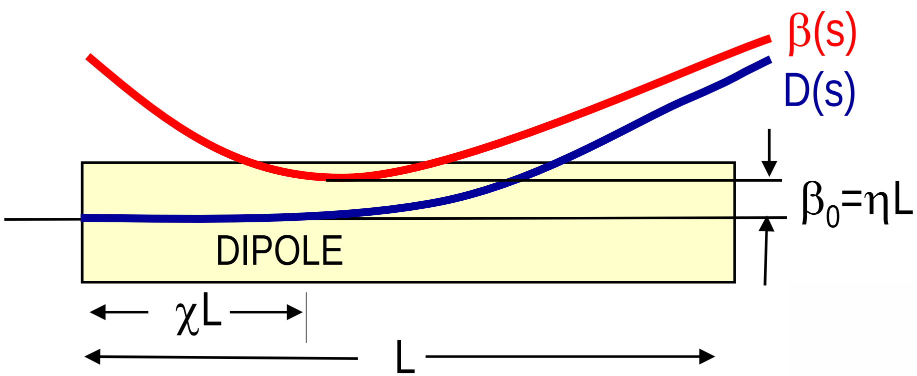
Basic Lattice Design Strategy

Double Bend Achromat ➔ effective low emittance lattice



Minimum Emittance



Minimum (bare lattice) Emittance for
$\chi=3/8$ and $\eta\approx0.1$
Note: emittance depends on bend angle $\theta=L/\rho$ and on γ and η but not explicitly on L and β_0

$$\varepsilon_{xe}(\eta) := \frac{C_q\cdot\gamma^2\cdot\theta^3}{J_x}\cdot\left(\frac{1}{320\cdot\eta}+\frac{1}{3}\cdot\eta\right) \qquad \varepsilon_{min} = \frac{C_q\cdot\gamma^2\cdot\theta^3}{J_x\cdot\sqrt{240}}$$

- The weaker the dipole field, the easier to reach minimum emittance with good D.A. (moderate chromaticity and sextupole strength) 60 dipoles➔ minimum emittance 1nm
- The weaker the dipole field, the less radiation losses P ~1/ρ, the easier to reduce emittance by increasing damping with damping wigglers $\varepsilon \sim (P\cdot(1+P_{DW}/P))^{-1}$
- The weaker the dipole field, the smaller the energy spread
- The weaker the dipole field, the more important other effects (IBS) on emittance
- The weaker the dipole, the lass space for insertion devices

NSLS-II Accelerator Design Features

Large Circumference

30 cells, Super periodicity of 15

Robust DBA lattice, weak bending field

Damper Wigglers reduce emittance by factor 2 (4)

Dynamic Aperture for 3hr life time with Touschek effect

Superconducting RF, low impedance, excellent beam loading properties for lsrge beam currents

Injector for full energy Top-Off Injection

C = 792 m

B=0.4 Tesla ; $\rho = 25$ m

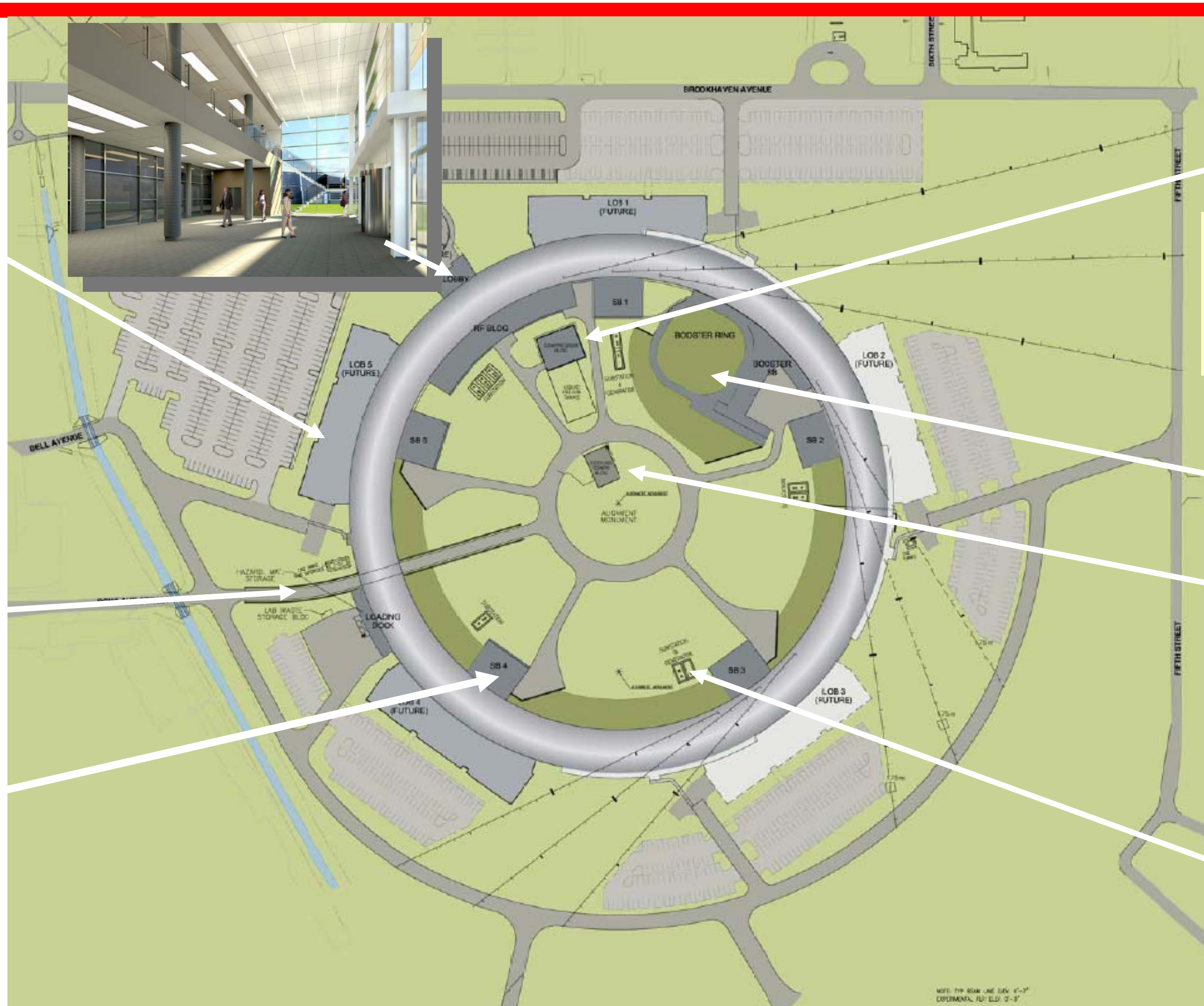
B=1.8Tesla, L=21m (56m)

DA > 15mm x 2mm(errors+ID)

I = 500mA

Inj Frequency= 1/minute

Light Source Foot Print



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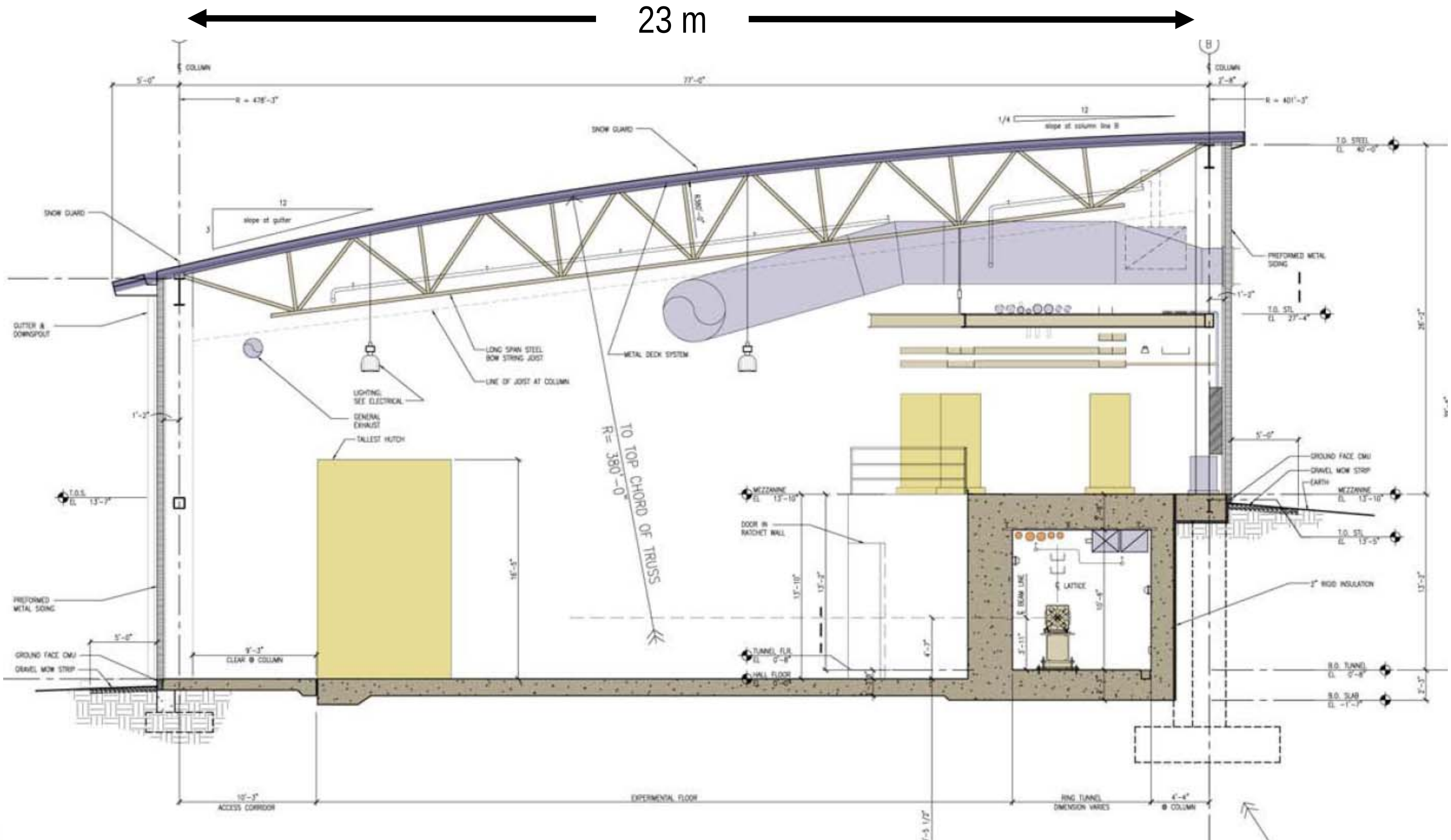
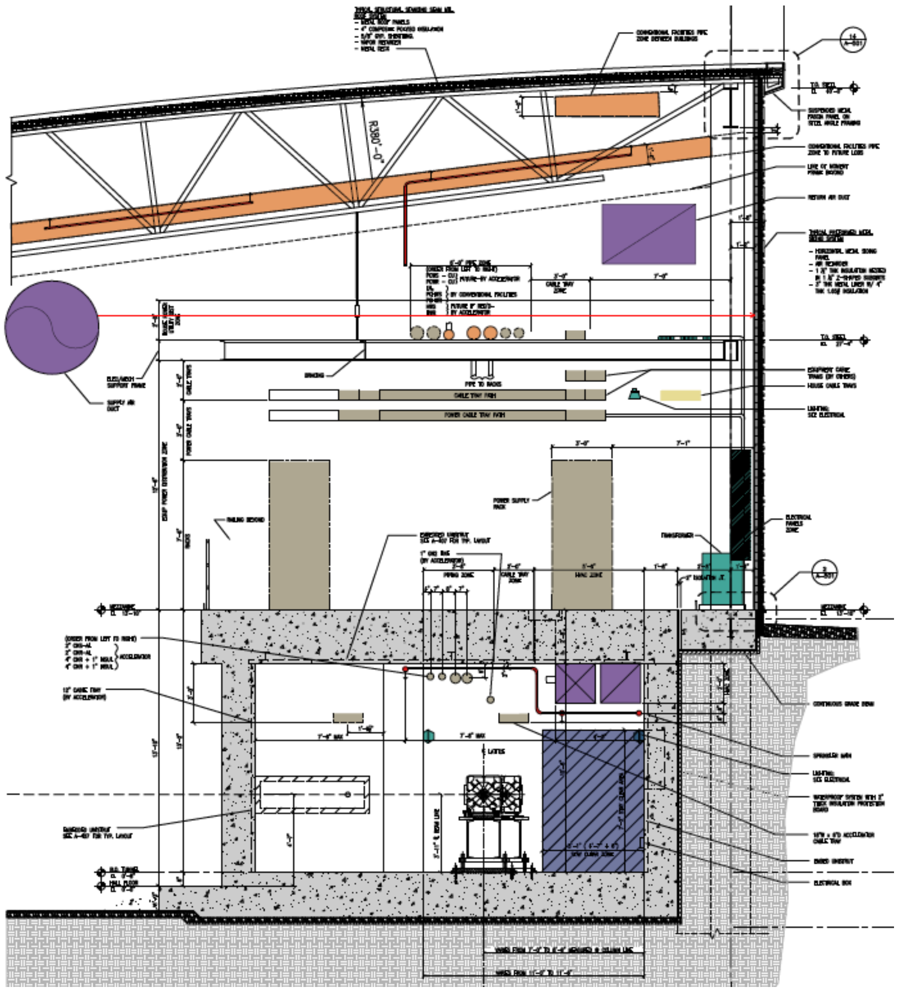
Ring Building Cross Section





Mezzanine

Ps and Electronic Racks

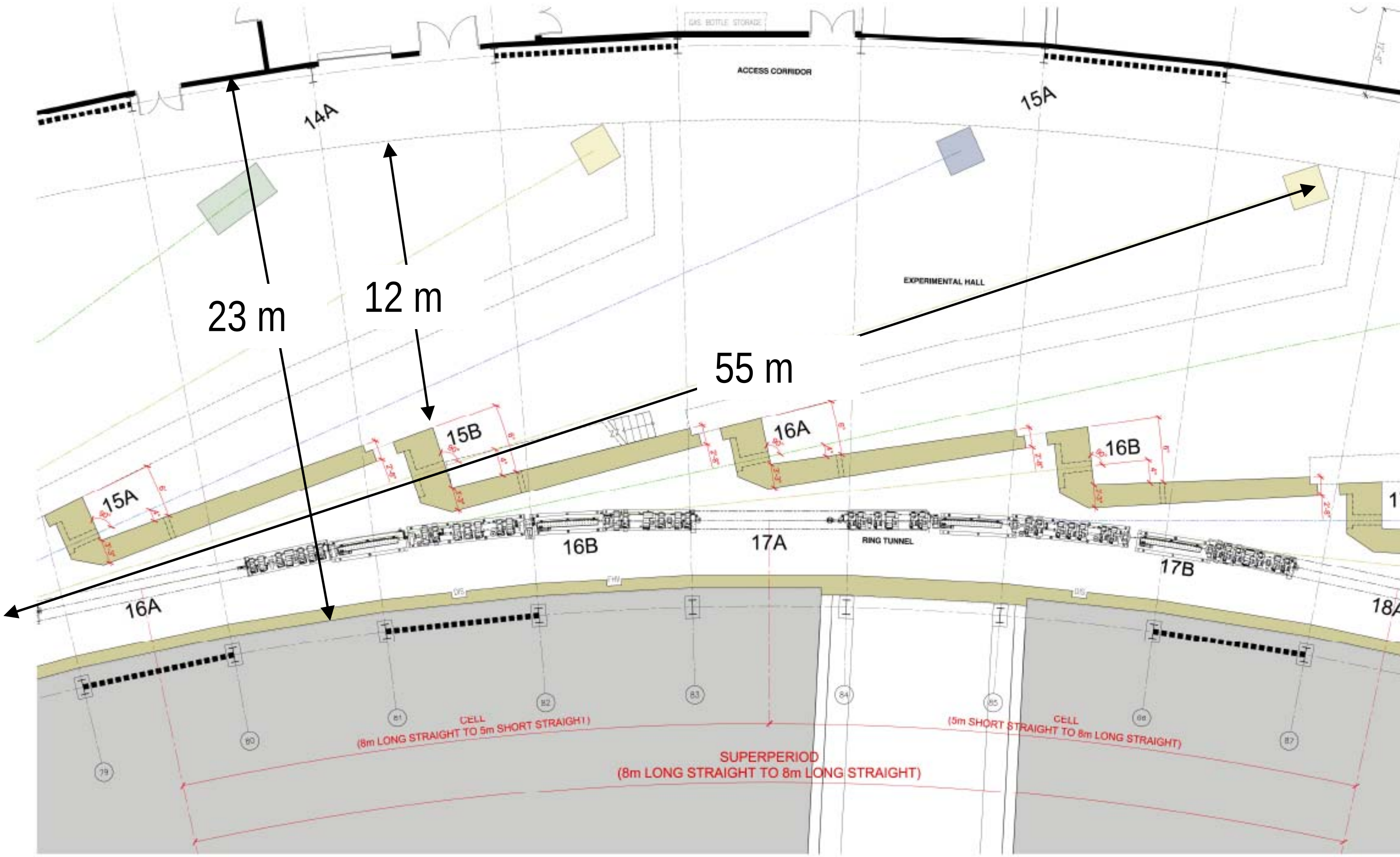
Pulser and cryo equipment

Electrical utilities

Tunnel

Beam height	1.2m (EF 1.4m)
Tunnel height	3.2m
Tunnel width	592cm -363 cm
Stay Clear	154 cm
Floor	85 cm concrete

Experimental FLoor



Accelerator Physics

Challenges:

0.5 nm/8pm emittances + large beam current ($N_{eb}=10^{10}$)

➔ Touschek limited lifetime

τ= 3h requires DA: 15 mm x 2 mm @ $\Delta p/p=3\%$

High Orbital Stability: $\Delta y_{co}=0.3\ \mu m$ @ $\beta=1m$ @ 500mA

Tight Tolerances 30μm alignment tolerances

Safety for Beam lines during Top-Off

Low Impedance Design

Good Dynamic Aperture with many ID and DW

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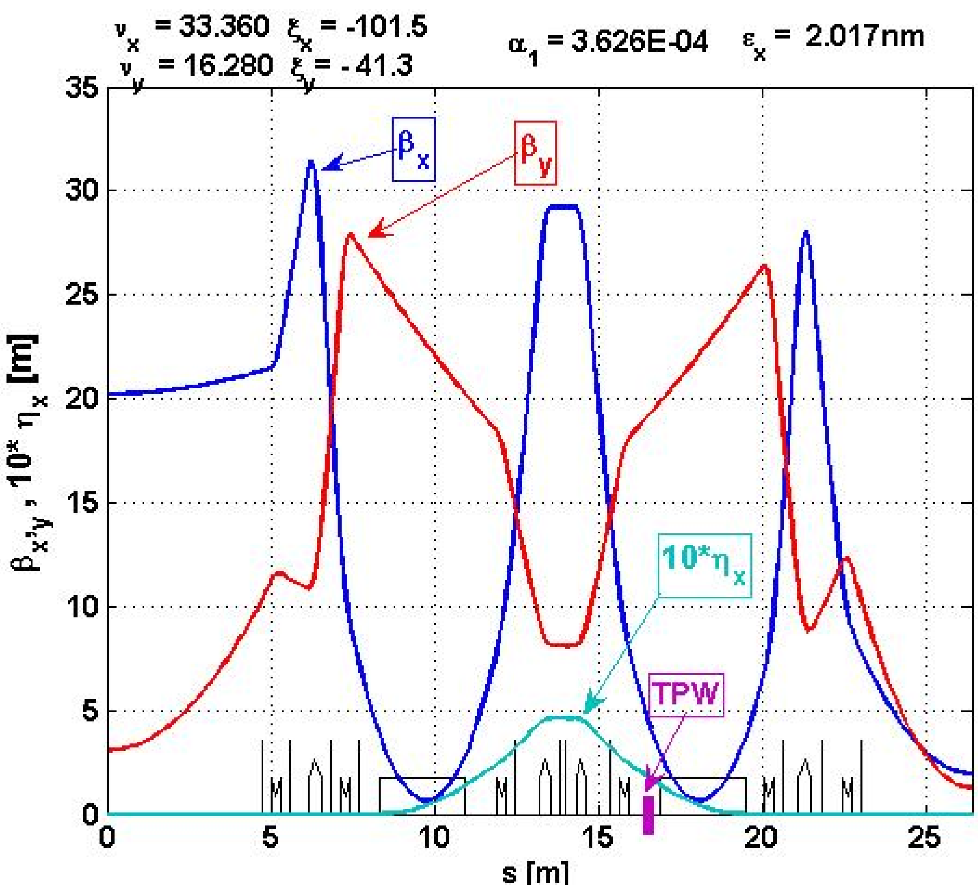
Lattice Functions for One Cell



Long ID

Dispersion Region

Short ID

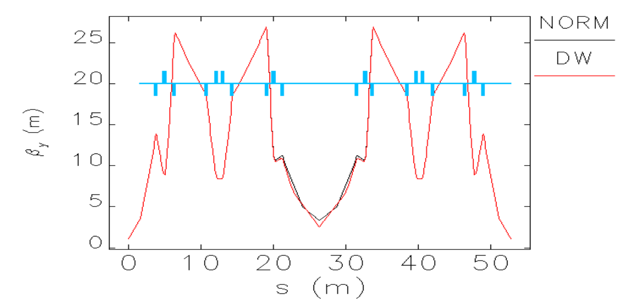
DBA 30, 15 fold symmetry

2 Alternating Straights 6.3m, 9.3m

3 Quadrupole Triplets

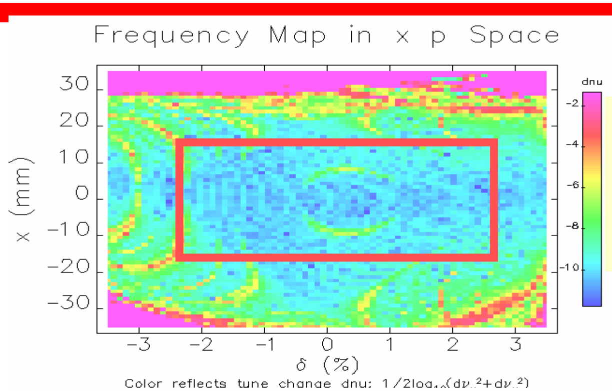
2 (3) chromatic sextupole families

7 sextupole families for nonlinear optimization

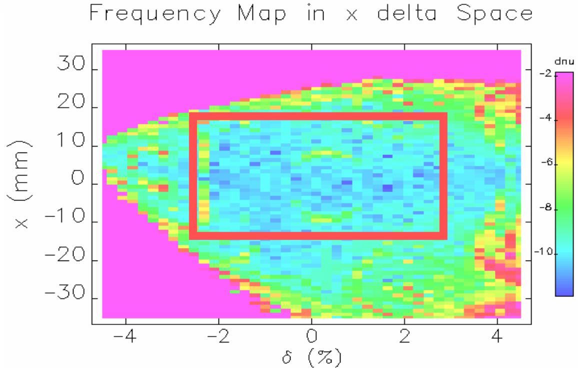


DW integration

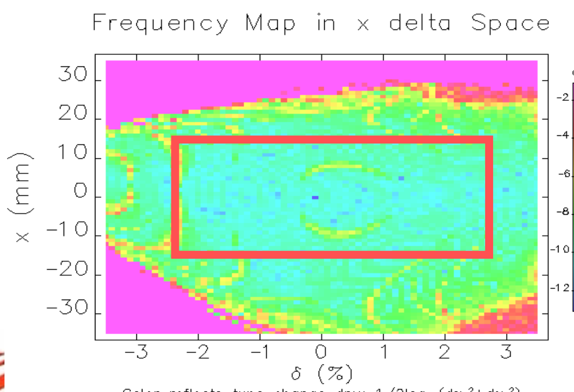
Dynamic Aperture with Multipole Errors



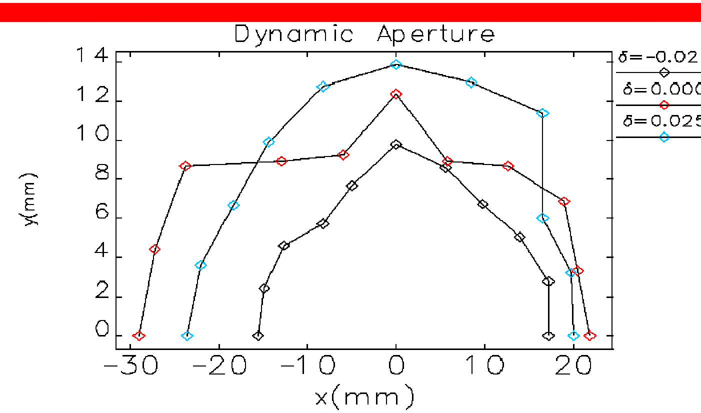
Without Field Errors



With regular Field Errors



With high precision Field Errors



DA small @ -0.25% $\Delta p/p$

Systematically studied, well understood

Introduction of high precision Q+S magnets in center of achromat

r = 30 mm	regular [1E-4]	High Precision [1E-4]
B_2^6	1	1
B_2^{10}	3.3	0.5
B_2^{14}	3.5	0.1
B_3^9	1	0.5
B_3^{15}	1	0.5
B_3^{21}	4	0.5

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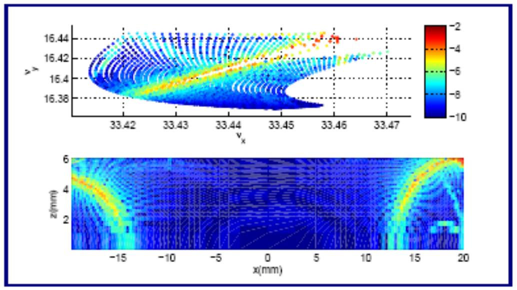
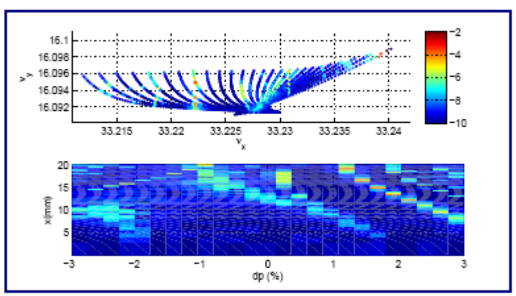
Dynamic Aperture with Insertion Devices

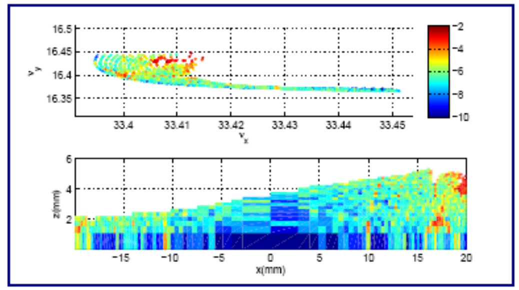
Frequency Map Simulation (RADIA kick map used)
basis lattice with well compensated chromaticity and tune shifts



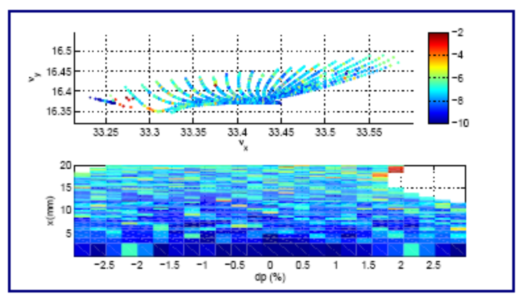
Bare lattice. (Res. is: $6\nu_x - 4\nu_y = 135$).



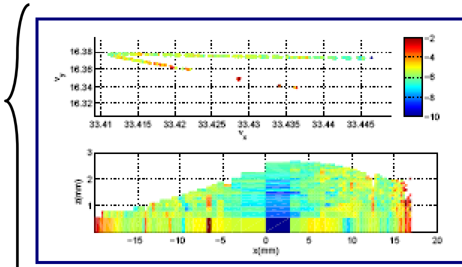
Add DW

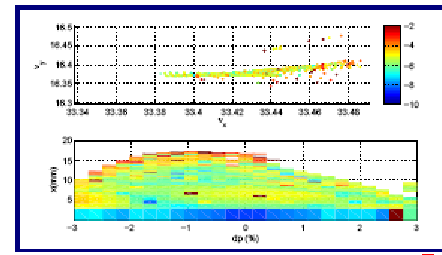


With DWs.



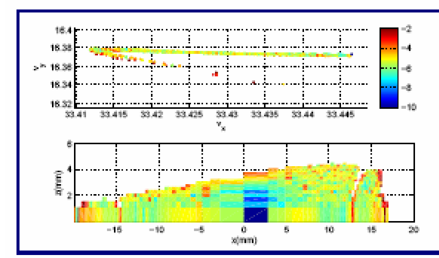
add IVU and imperfections

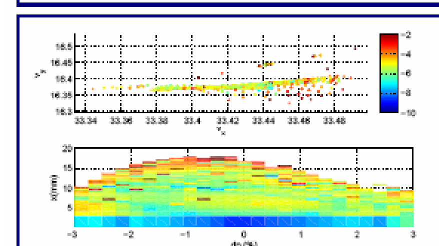




10 IVUs.

Add EPU's





Effect of DW is mainly linear Optics Distortion

Can be well integrated (requires 3-f symmetric installation)

Top Off Safety Study

Goal: Understand what limiting apertures and additional measures have to be

Modeled accelerator components with/without magnetic field defect

Collaborations with LBL, SLAC

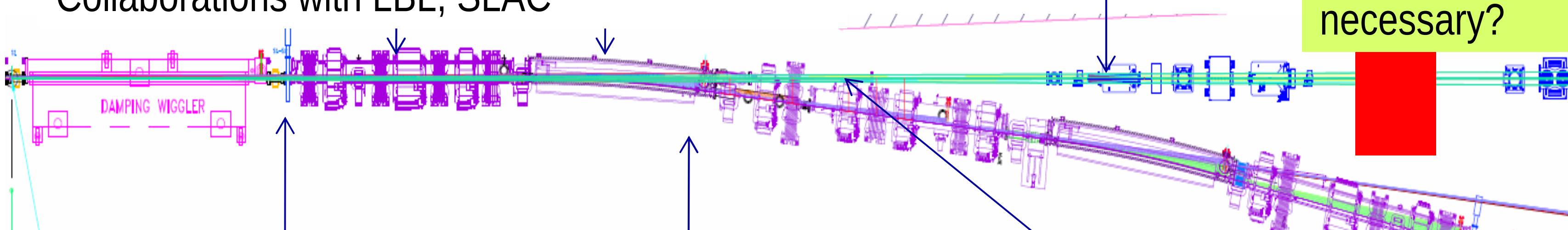
Fixed Mask

8.84mm, half aperture

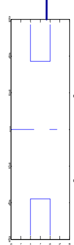
Safety Shutter

13.54mm, half aperture

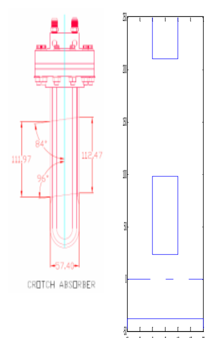
Sweeper magnet necessary?

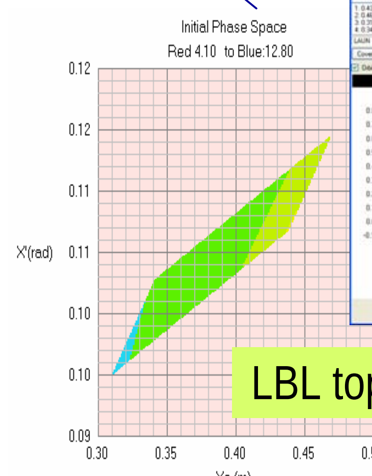


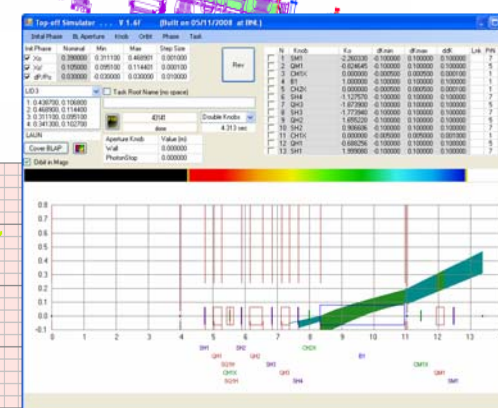
MIDPOINT OF LONG STRAIGHT



Stick Absorber







LBL top off back tracking code

Injector

Both LINAC and Booster

Are planned to be turn-key

Procurements provided by industry

-Final Design

-Manufacturing

-Installation

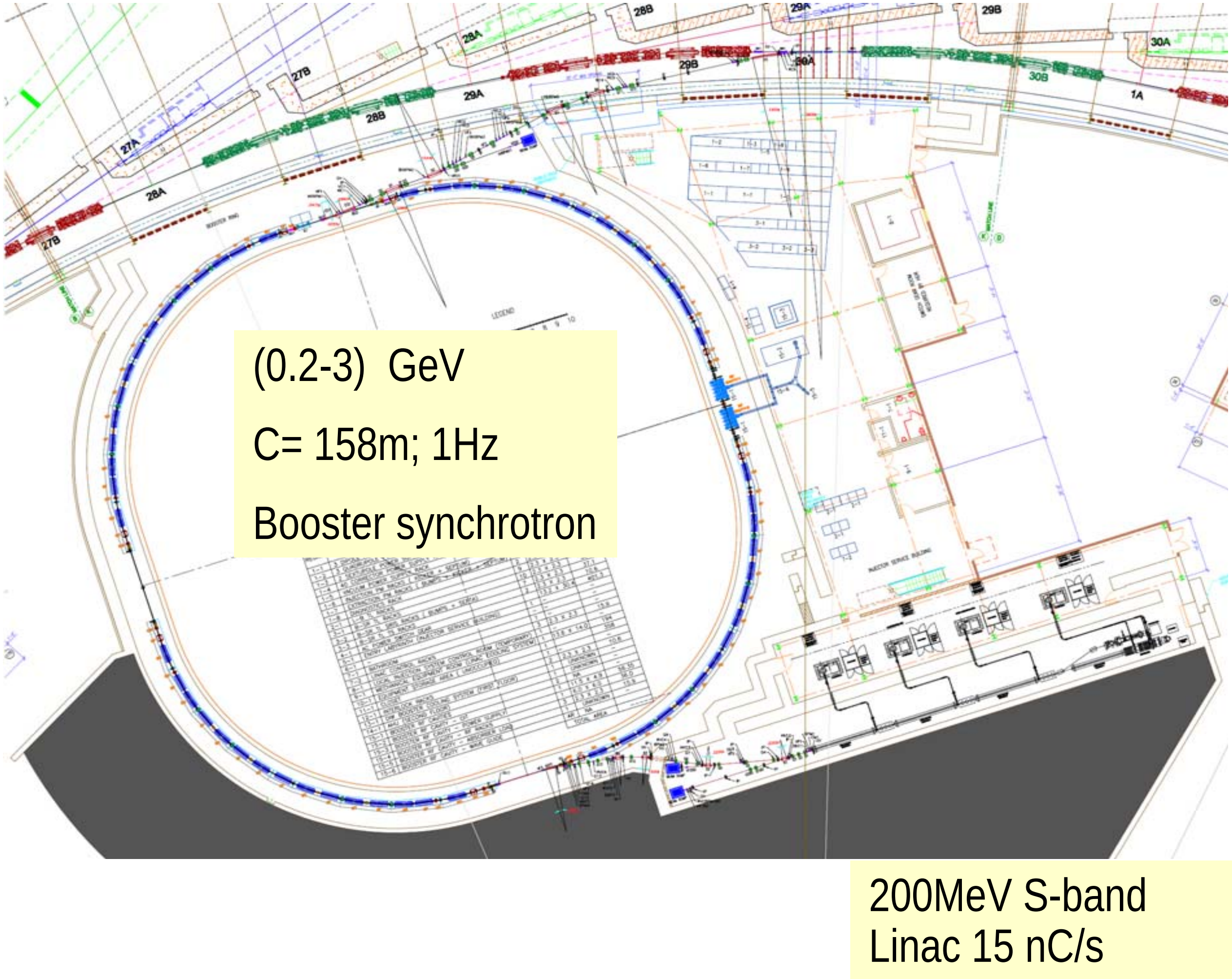
-Testing and Commissioning

Bids to be opened within the next few month and orders to be placed

Nov.'09 and Febr. '10.

There are 2 vendors for the booster

And 4 vendors for the LINAC



NSLS-II INJECTOR

LINAC Parameters

Energy	200MeV
Frequency	S-Band
Charge	15nC
ΔE/E	<1%

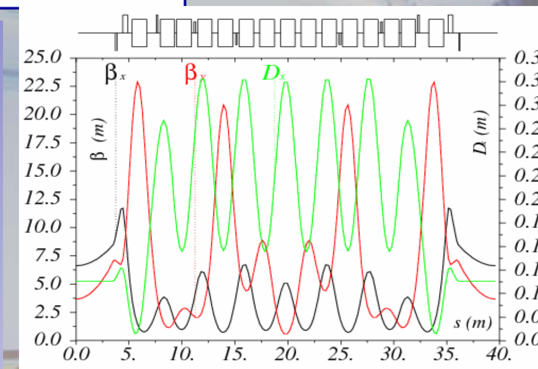
3 sectors
Thermionic Gun
Subharmonic Buncher

Booster Parameters

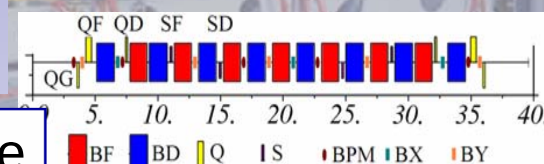
Circumference	158m
Injection Energy	200Mev
Extraction Energy	3GeV
Cycle Frequency	1Hz
Charge	10-15nC @20-30mA

Similar
to Australian LightSource Booster

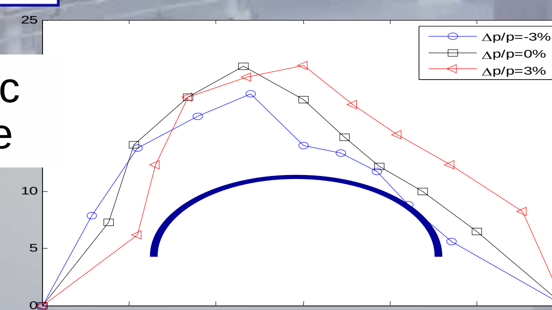
Booster Lattice



Structure



Dynamic aperture



Dipole physical aperture

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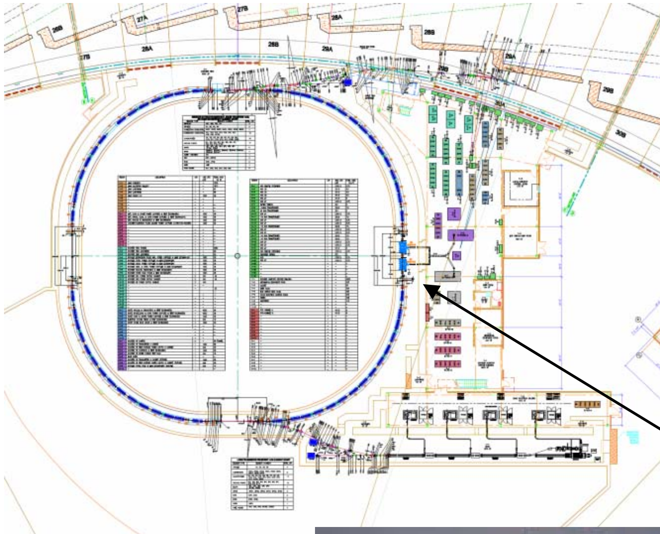
Injector RF



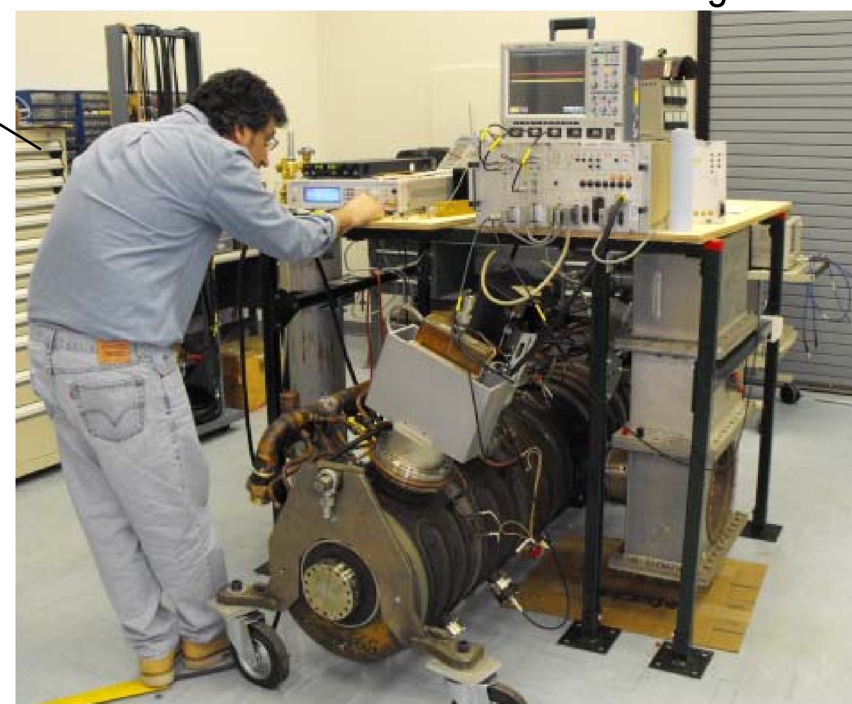
RF System provided by NSLS-II

Based on 1 PETRA 7-cell cavity

80kW IOT

Started to work on coupler and cavity control

Thanks to DESY Directorate and Colleagues!

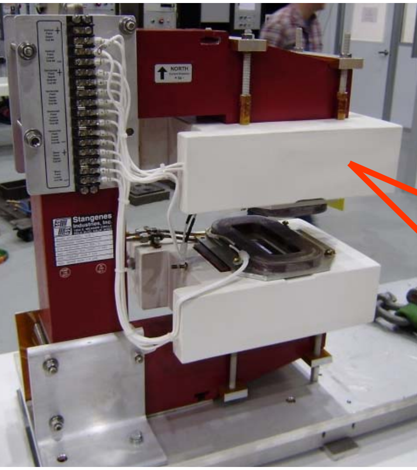


Commercial

80 kW

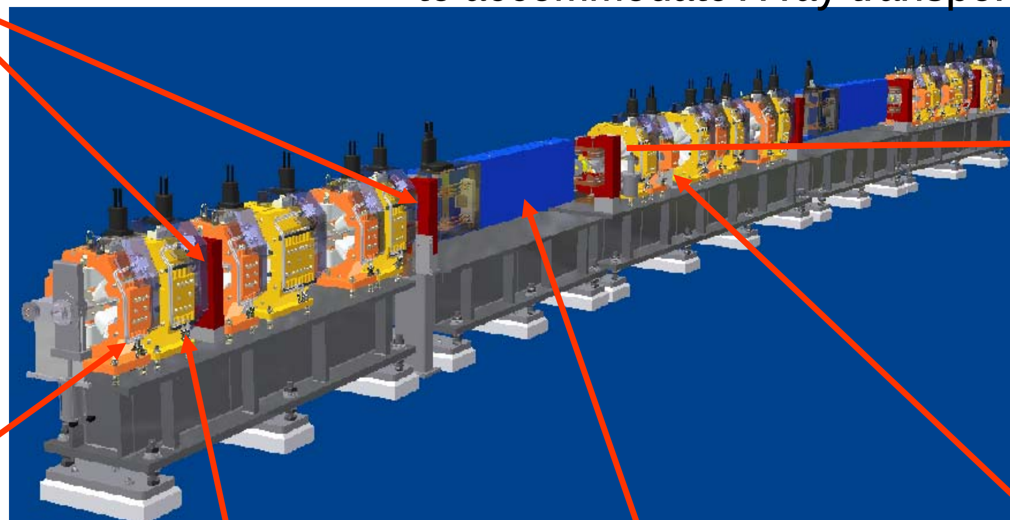
IOT Amplifier

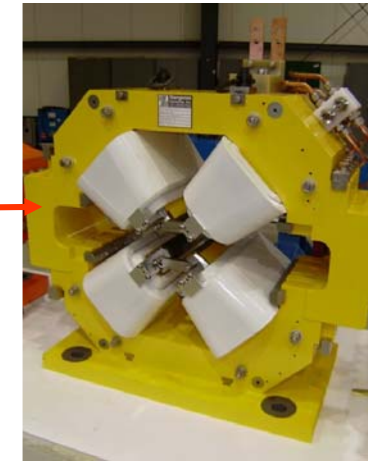
Storage Ring Magnet

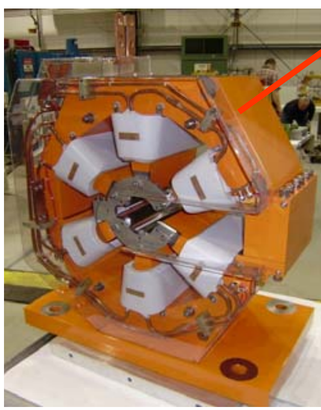


Correctors

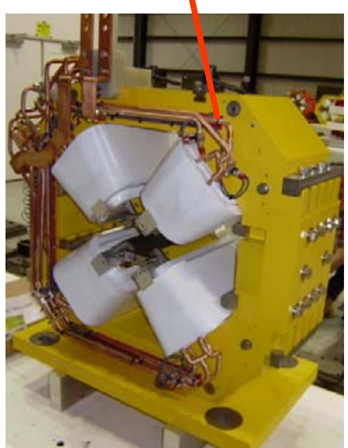
Wide Quadrupoles & Sextupoles
to accommodate X-ray transport.



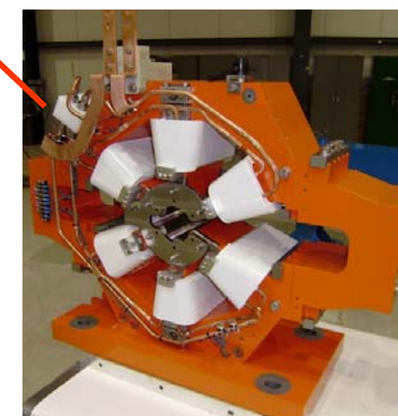




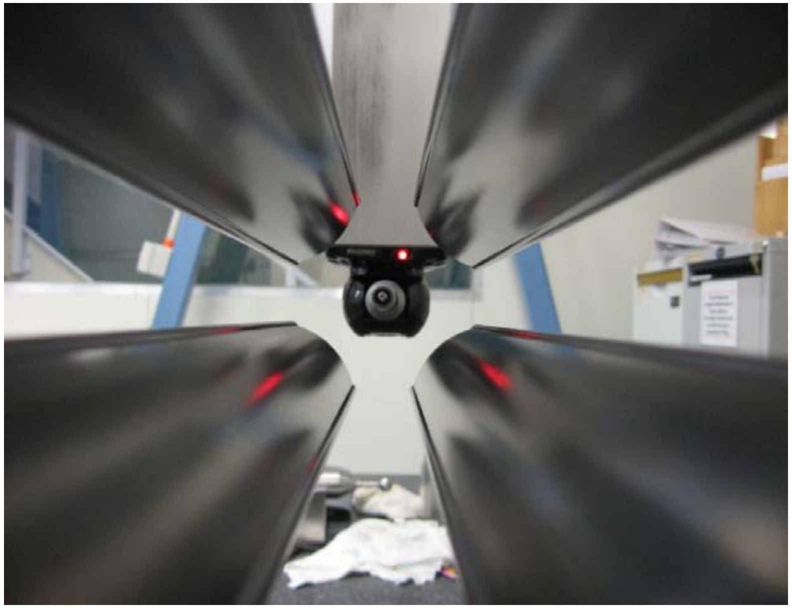
Regular Quadrupoles
&Sextupoles



Dipoles



Prototype Production



Completed Yoke of the 90mm Quadrupole magnet

Novel Magnetic Design using “root” and “end” chamfering to suppress high order systematic multipoles

12-20 poles, (18,30 poles)

High Demands on Field Quality

ΔB/B < 10-4 @25mm

Protoypes of all magnets built in industry

Manufacturing methods tested at 3 vendors:

- Laser cut of laminations and subsequent high precision machining of stacked yokes
- Laser cut of laminations and subsequent high precision wire EDM of stacked yokes
- Stamping of laminations and subsequent high precision wire EDM of stacked yokes

→

Manufacturing Methods will meet the requirements

All magnets meet the high

Field quality specs

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Advanced Measurements Capability

- New 30mm rotating coil
- State of the Art NSLS II production measurements coil (9 bucking coils)
- Precision of Harmonics 2 10^{-6} @ r = 25mm
- Very Flexible, Can be used for any magnet and multipole

Magnet Alignment

<u>Requirement:</u>

30μm magnet to magnet; 100μm girder to girder

<u>Method:</u>

Use temperature stab. clean room $\Delta T=1°C$ (like tunnel)

Measure magnetic center with stretched wire with RF in static field ➔ achieve 5μm precision

Move magnets into position automatically

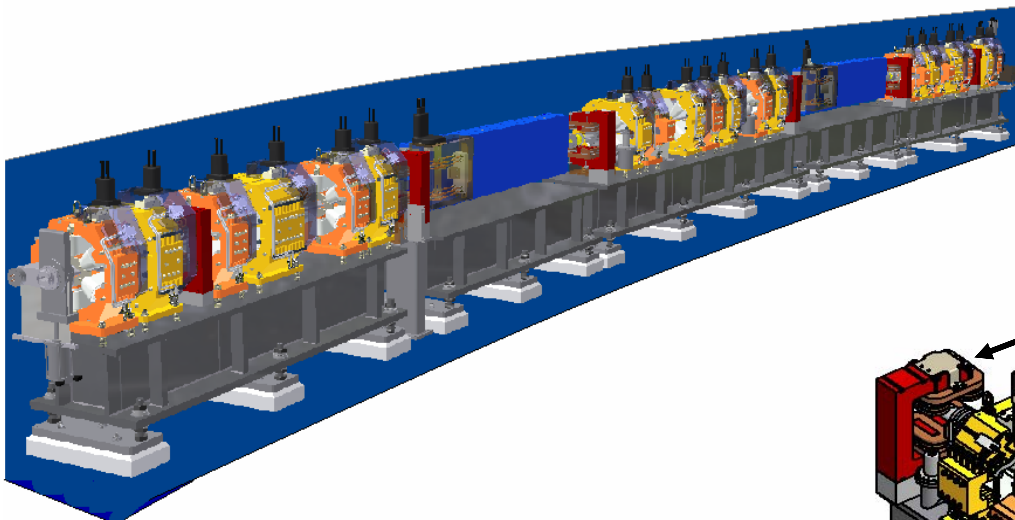
Tighten Support bolts Manually

Characterise Girder Surface with inclinometers

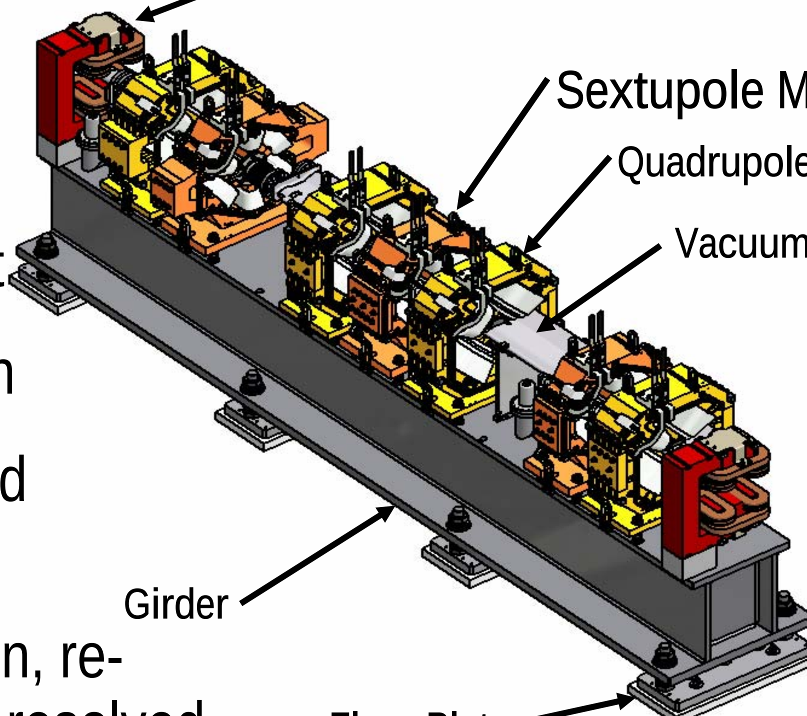
Reproduce girder surface in Tunnel

Plan to assemble 2 girders per week (45 weeks)

Support system



Low vibration design carried out, prototyped, tested



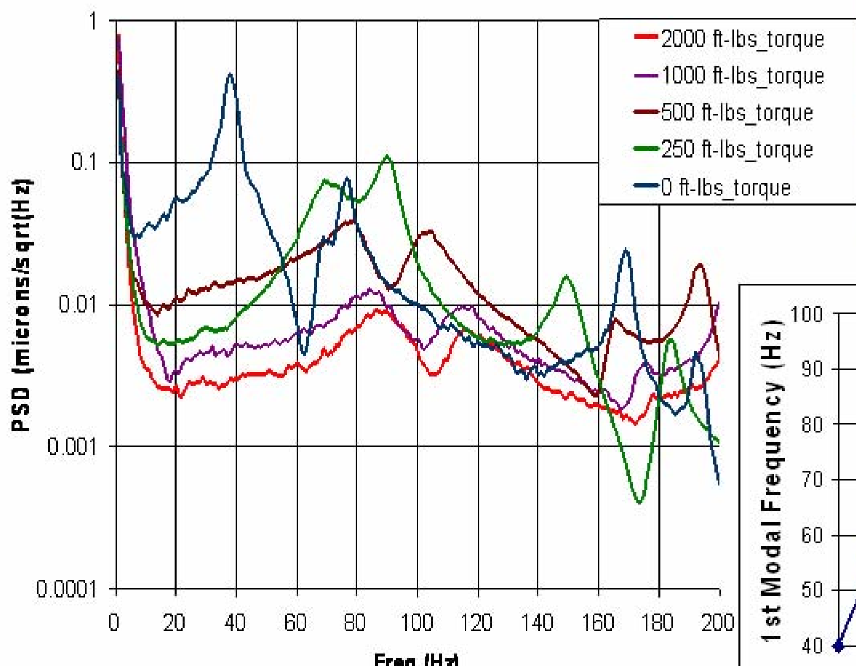
- Designed for 1.2m beam height
- Vibration studies confirm design
- Reproducibility after thermal and mechanical cycling tested
- Issues with transport, installation, re-establishing alignment precision resolved

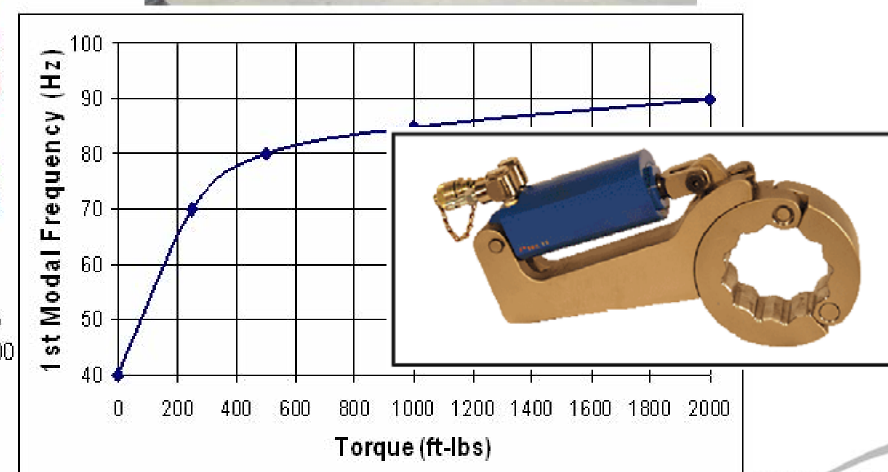
Magnet Support R&D

- Mechanical resonances > 30Hz confirmed

➔ But need large torque to tighten bolts

- Procedures for transport of equipped girders and reestablishment of girder shaped in place and tested





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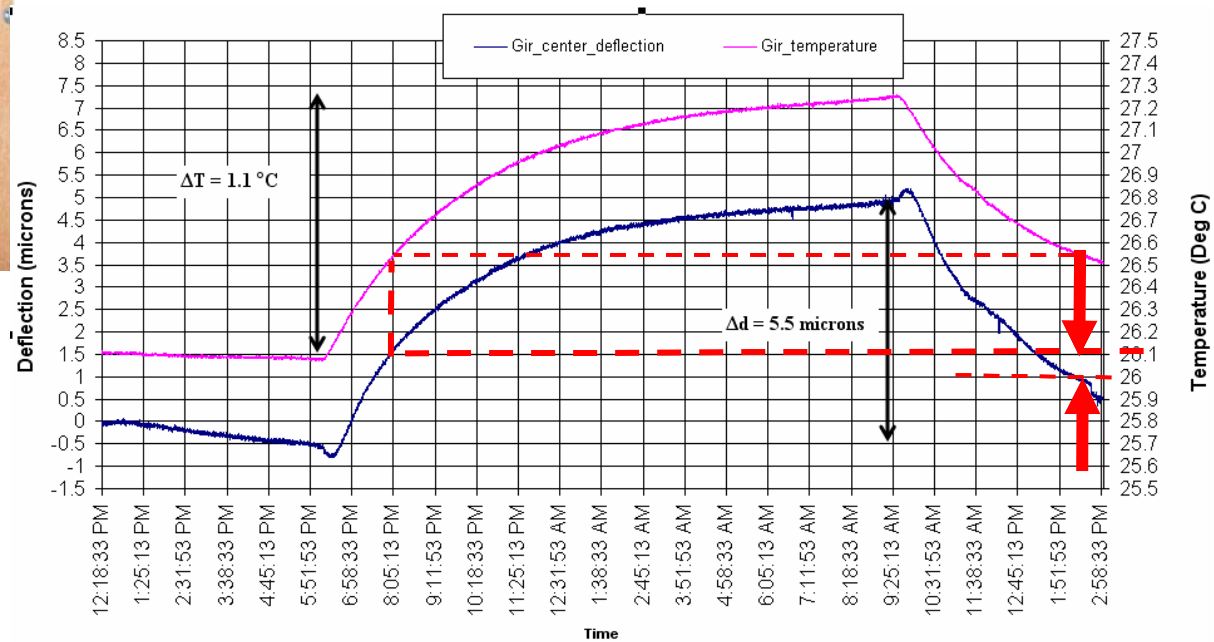
Girder R&D: Behavior under Temperature Changes

Temperature Cycling and Reproducibility Tests



Result:

Reproducibility after 1 °C Temperature Change : ~0.5 μm

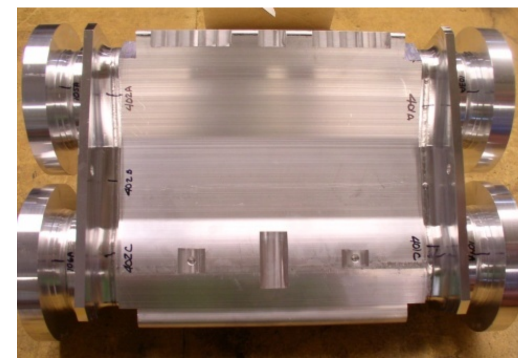
Vacuum System

Vacuum System Based on extruded Aluminum,

Glidcop absorbers take synchr. Radiation load

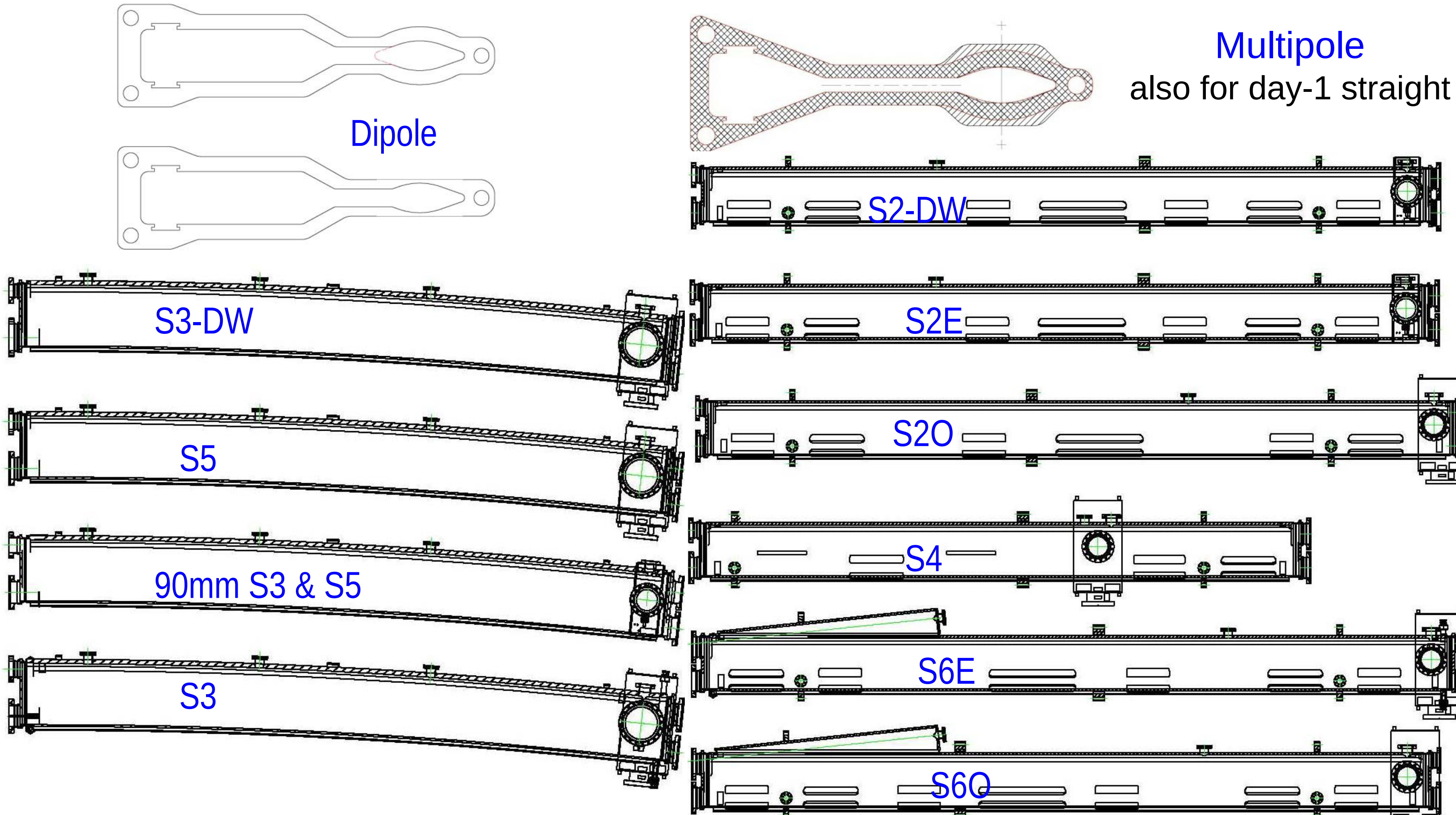
NSLS-II Prototype

- Vacuum chamber design
  - Well advanced
  - Manufacturing techniques verified: extrusions, machining, welding, conditioning
  - prototype chamber completed
  - Tests in progress
  - NEG-pumping strips support structure designed
  - BPM Integration developed and optimized
-

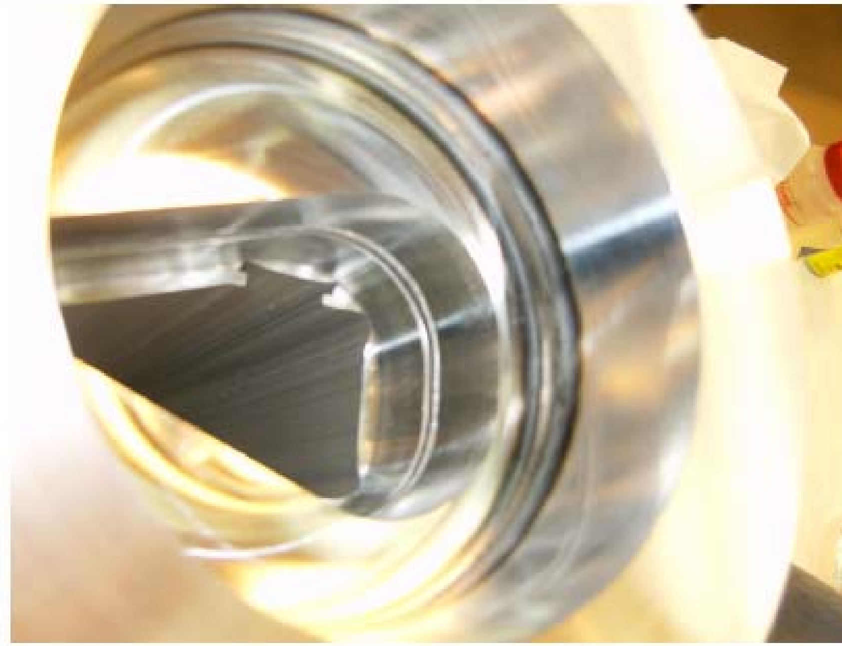


- **Shielded bellow designs** developed, impedance models generated and evaluated

Aluminum Chamber



Precision Welding on NSLS-II Test Chambers performed at ANL



Welding Tests very satisfactory!

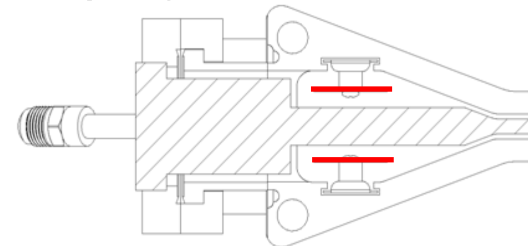
Dipole Chamber Bending

Bending Process under Control

NEG Strips and Carriers

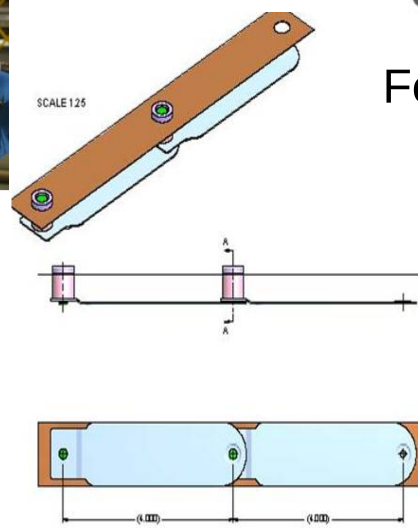
2 NEG strips in each Al chamber as main distributed pumping – total ~ 1,200m

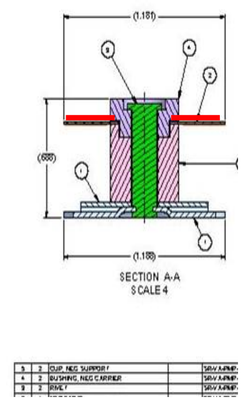
- Riveted mounting every 10 cm
  - w/ ceramic insulators and carrier plates
- Fully tested in prototype chambers
- Modified carriers for BPM TE modes?



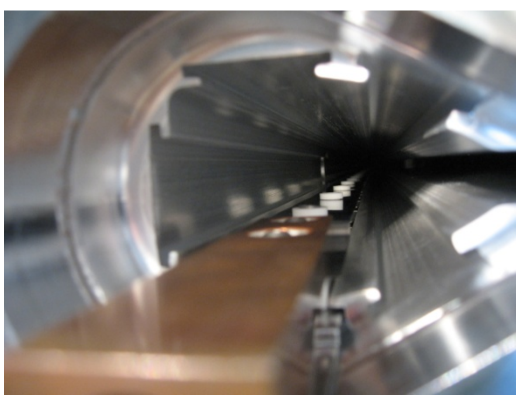
NEG strips in antechamber

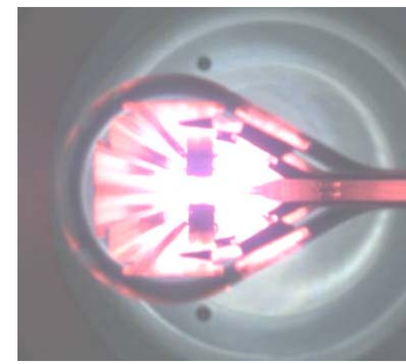
Feedthru





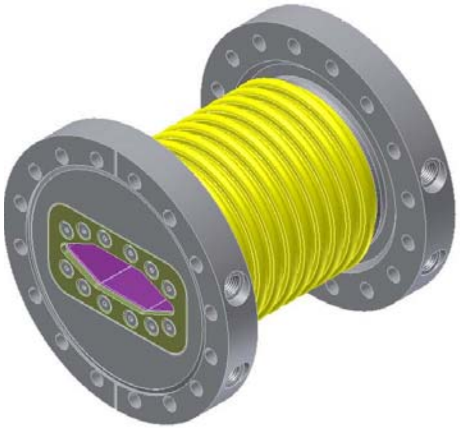
Carriers





30min activation @ 450^{0}C with 70 A thru NEG strips

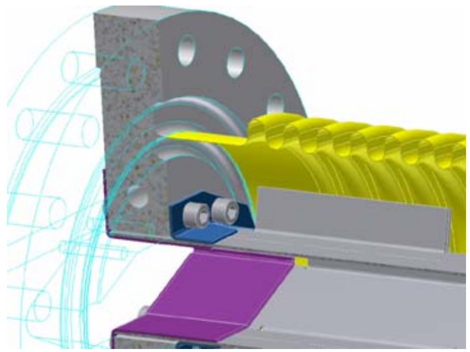
Shielded Bellow

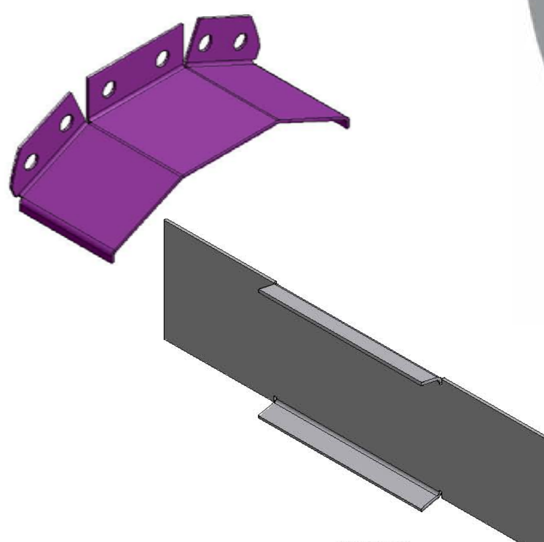


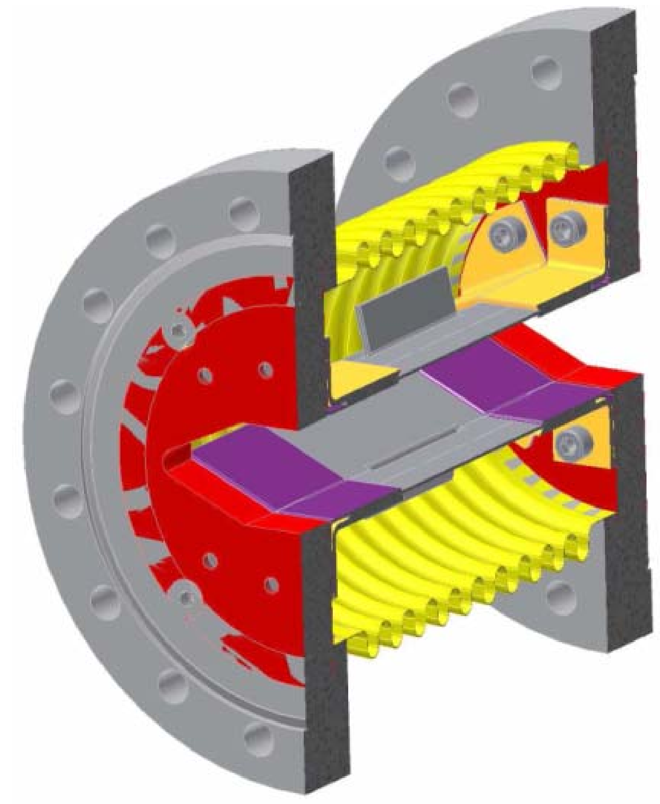
Hydro-formed
Bellow

Flanges with
cooling Channels

Novel Approach with
outside Finger clamped
both ends







Diagnostic System

Monitor	Location					
	SR	BTS	Booster	LTB	Linac	Gun
Wall Current Monitor						3
Fast Current Transformer			1	1	2	
Integrating Current Transformer		1		2		
Fluorescent Screen	1 (3 position)	6	6	7	3	
Energy Slit		1		1		
Bunch Cleaner			1			
RF BPM – Single Pass		7		7	3*	
RF BPM – TBT & Stored Beam	180		20			
ID RF BPM	2 or 3 per ID					
Photon BPMs	1 per ID					
DC Current Transformer	1		1			
Fill Pattern Monitor Stripline	1					
Tune Monitor Stripline	1		1			
Emittance Monitor (3PW source)	1					
Pinhole Camera (BM source)	1					
Optical Ports for visible radiation	1		1			
FireWire Camera	1		1			
Streak-camera	1					
Transverse Feedback Systems (Striplines & RF Amplifiers)	1 H & 1 V					
Beam Oscillations Monitor	1					
P-i-n Diode Loss Monitors	60					
Scintillator Loss Monitors	10					
Beam Scrapers (X & Y)	2 sets					

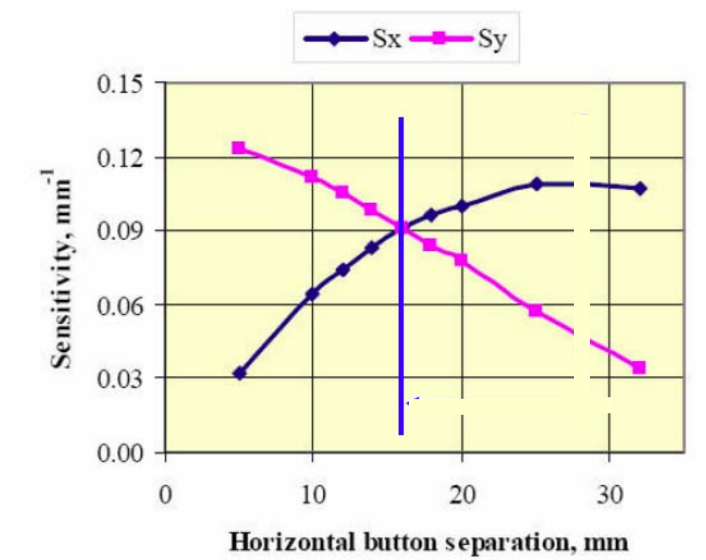
BPM System

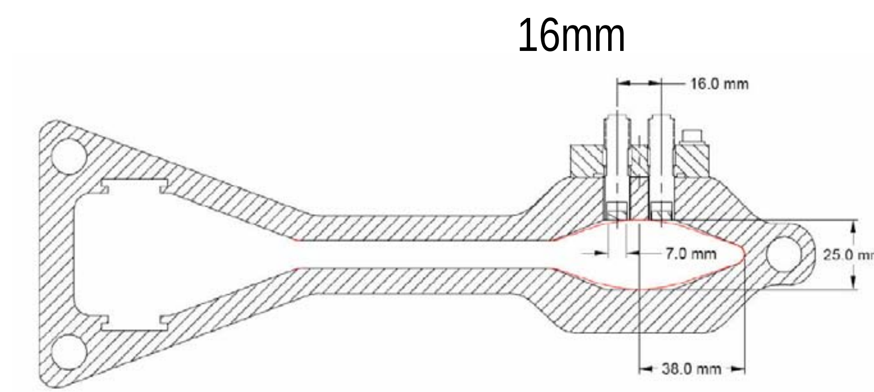
Button like BPM Antennas

Optimized for equal sensitivity in both planes

Single flange with 2 buttons

➔ in-house development





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BPM Electronics

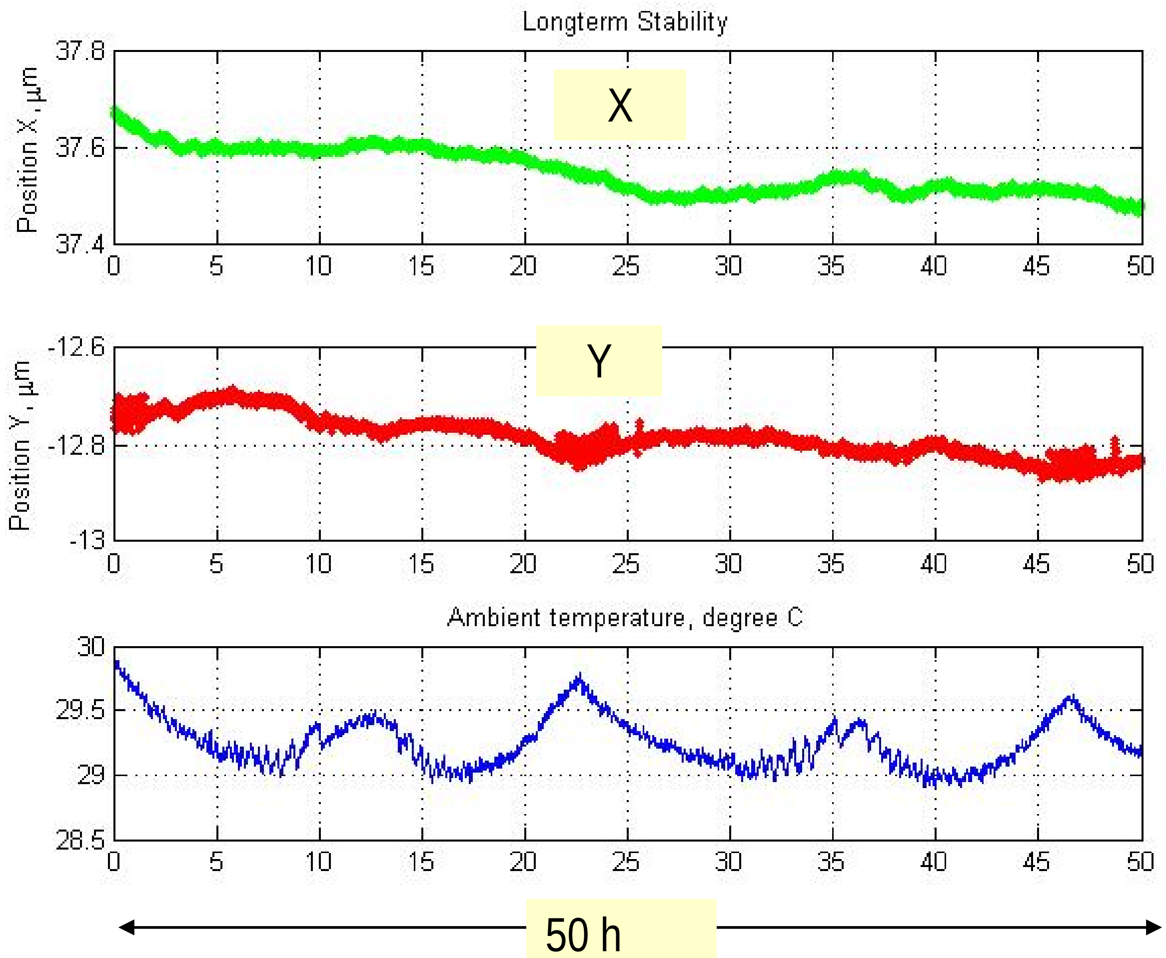
BPM Electronics :

Commercial Available

Electronics

Qualified in meeting

0.3μm stability requirement



RF Button Heating Issue

Direct Heating

New design incorporates

a Boron Nitride heat sink

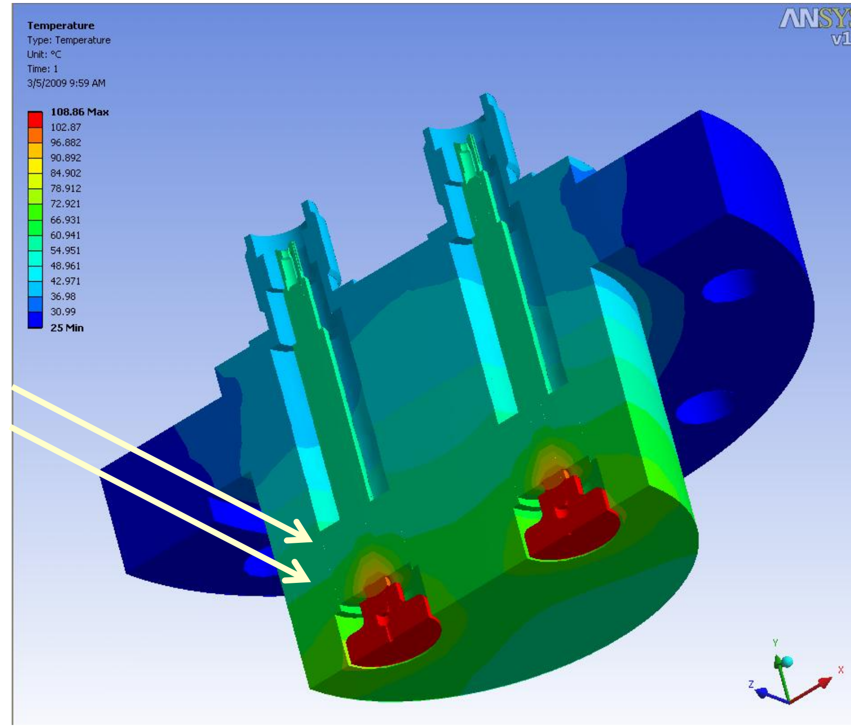
washer on the ambient side

of the glass seal.

8 watts per button temperature
➔ maximum value of 109 ºC.

Washer

Seal

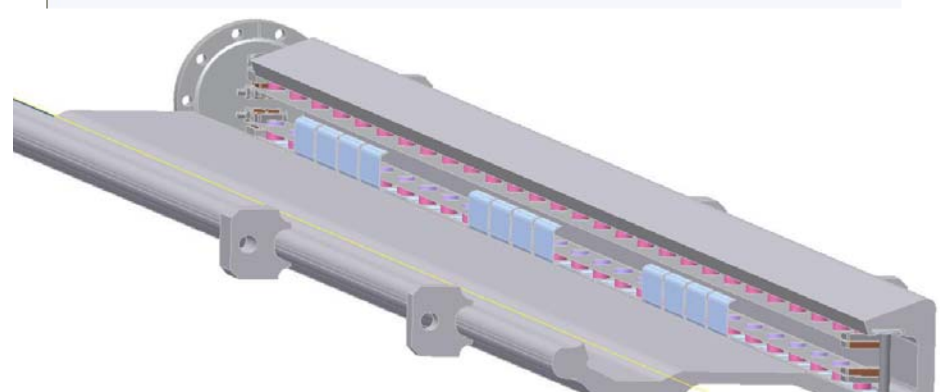


Trapped Mode in BPM Chamber

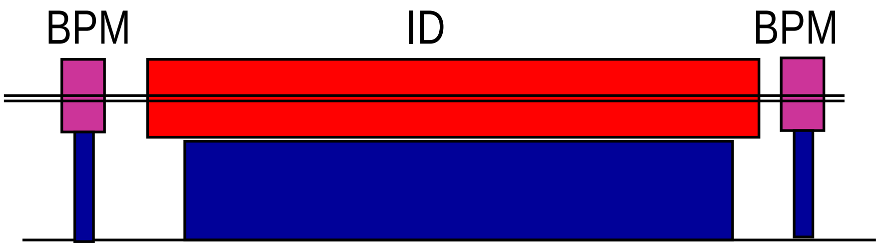
(ROGUE Mode)

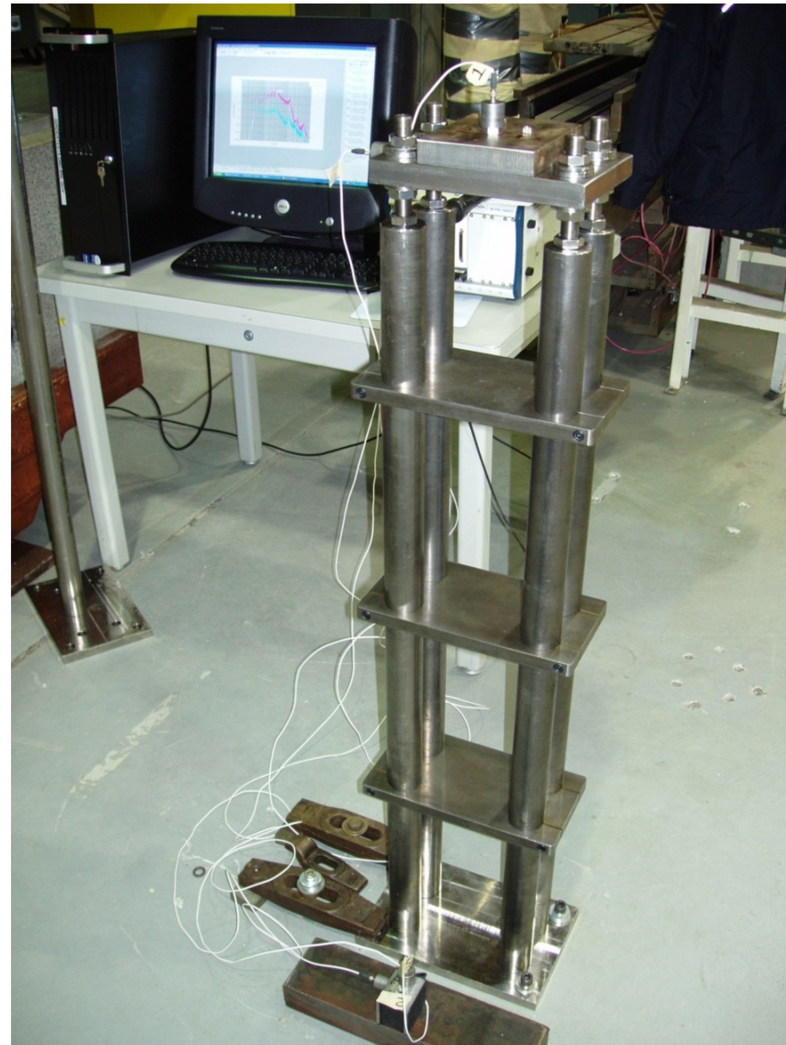
Frequency shifted from 500MHz

By RF Shielding



INVAR High Stability BPM Stand





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Storage Ring RF

Requirements

	Baseline Capability with 2 RF Cavity Systems Required Voltage 3.3 MV		Fully Build-out Capability with 4 RF Cavity Systems Required Voltage 5 MV	
	#	P(kW)	#	P(kW)
Dipole	60	144	60	144
Damping wiggler	3 (21 m)	259	8 (56m)	517
Cryogenic-PMU	3	76	6	127
EPU	2	33	4	66
Additional devices	~7	120	~10	200
TOTAL		529		1003
Available RF Power		540		1080

RF Stability Requirements

	$\Delta\varphi$ (deg)	$d\delta$ ($x10^{-4}$)
Centroid jitter due to Residual dispersion (ID's)	0.81	3
Vertical Divergence (from momentum jitter)	2.4	9
Dipole, TPW (position stability due to momentum jitter)	0.27	1
Timing experiments (5% of 15ps bunch @>500Hz)	0.14	0.5

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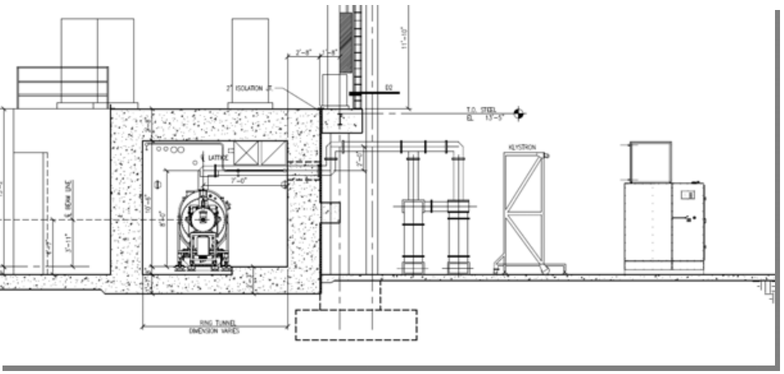
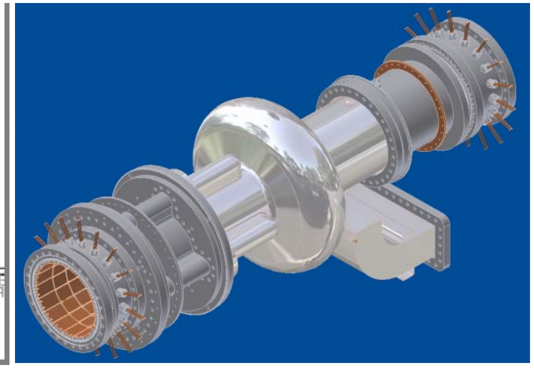
Storage Ring RF System

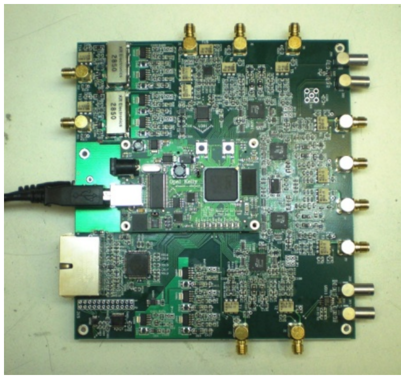


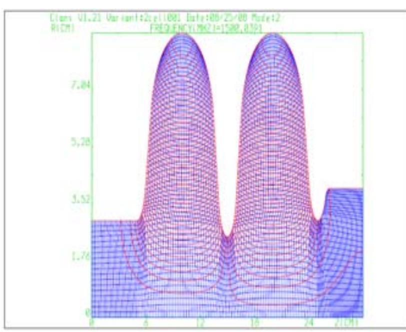


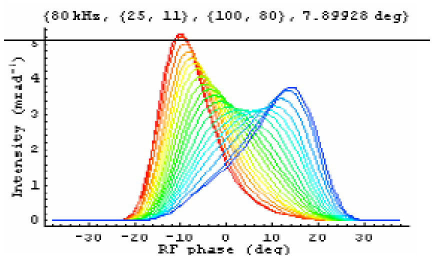
- Storage Ring RF: CESR-B or KEK-B **single cell 500 MHz sc. cavity**
- Three possible vendors for turn-key cavity module
- **Turn-key RF transmitter** system defined and specified,
- **Demanding LLRF system for beam stability requirements**

  -FPGA based control module, designed, prototype fabricated, tests performed

  -Extensive LLRF modeling in progress, optimize control algorithm to satisfy high demands on RF phase stability of 0.5 °
- S.C. 3rd Harmonic Bunch Lengthening Cavity







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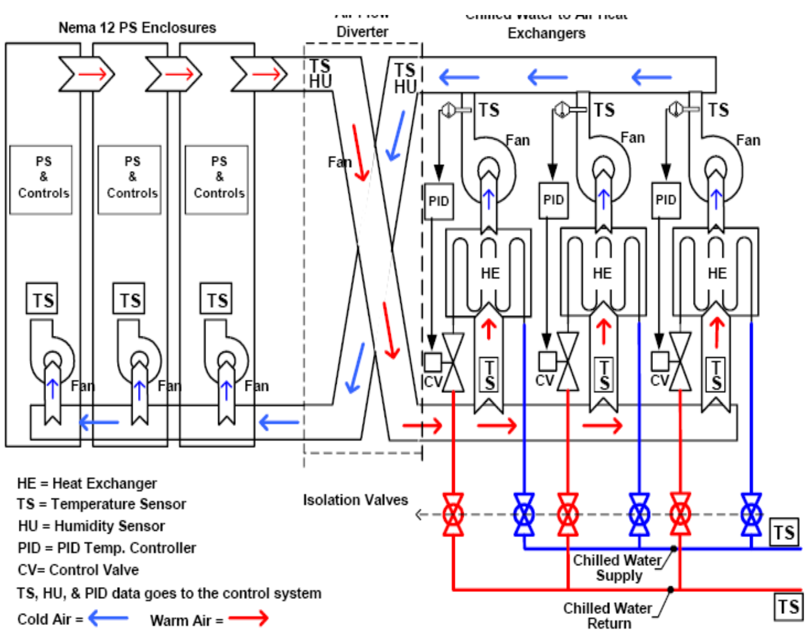
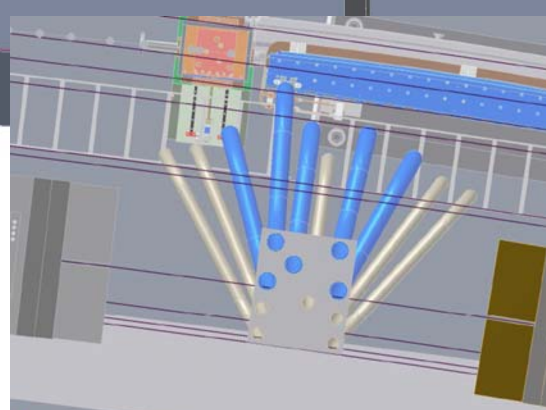
PS System

- Main Dipole Thyristor Bridges
- Quadrupoles, sextupoles:
- Switched mode with individual DC input
- Design for high availability:

Closed air cooled racks



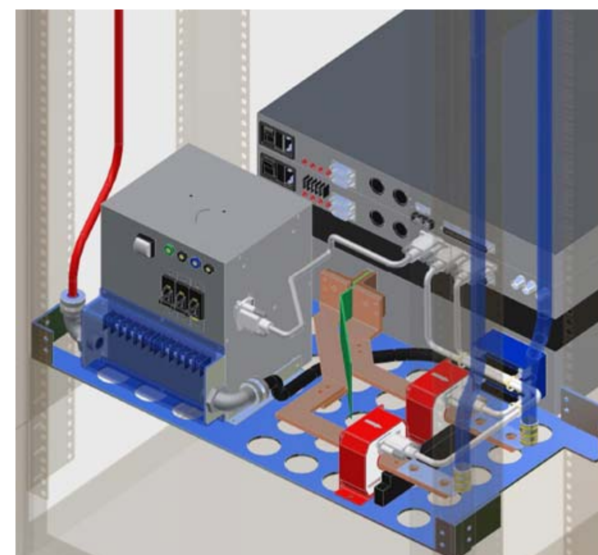
Layout of equipment on tunnel mezzanine



Detailed 3-D CAD models of PS equipment inside the racks

and

Rack Layout on Mezzanine (tunnel roof) incl. cable trays, cable conduits, AC distribution



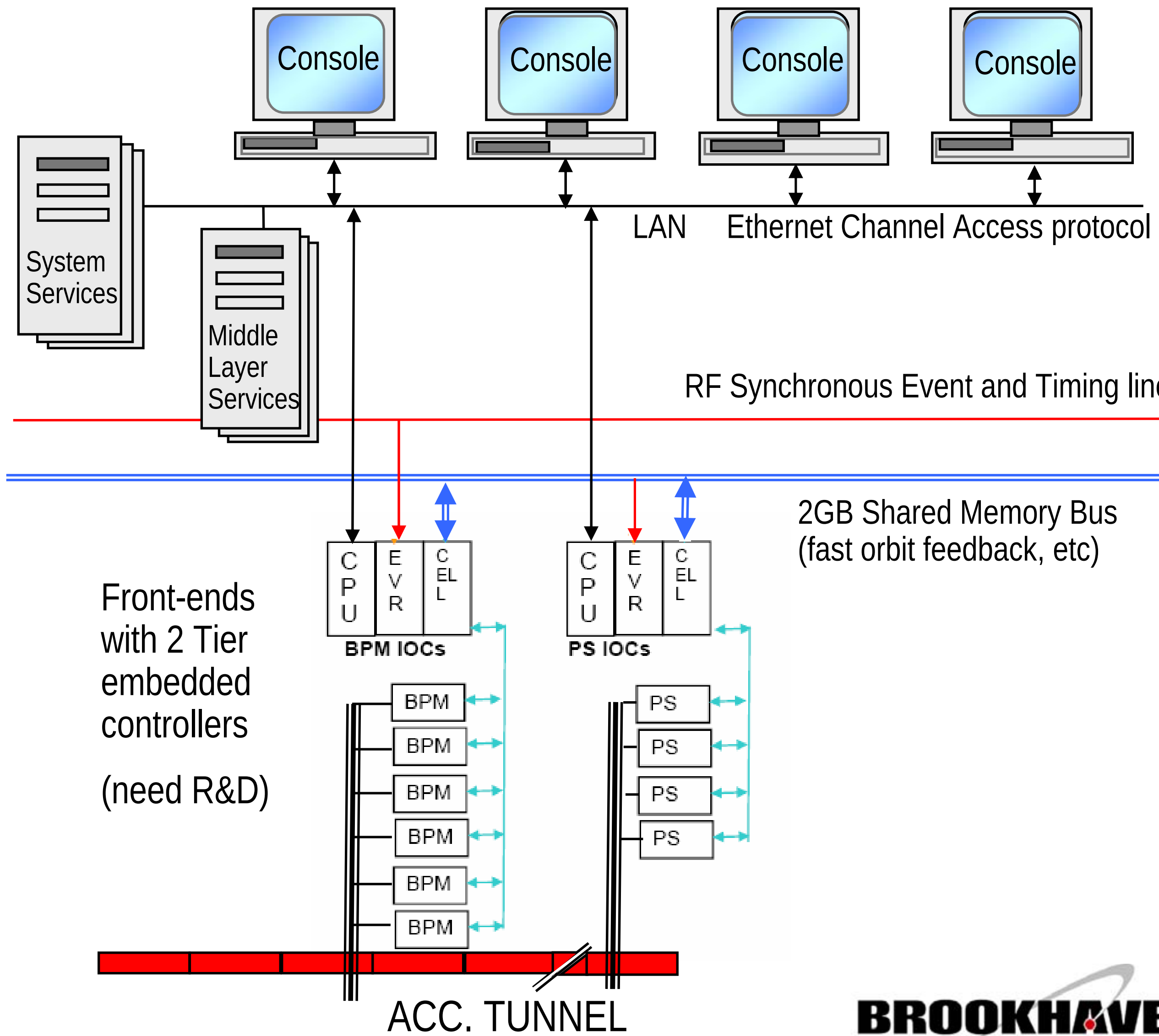
Control System

<u>Work accomplished so far:</u>

- System needs assessed (data flows, timing requirements, data access needs…)
- Systems architecture developed
- R&D items identified and R&D strategies developed
- Concept for high applications developed
- Plans for RDB developed

<u>Next Steps</u>

- Start R&D work
- Carry out preliminary design



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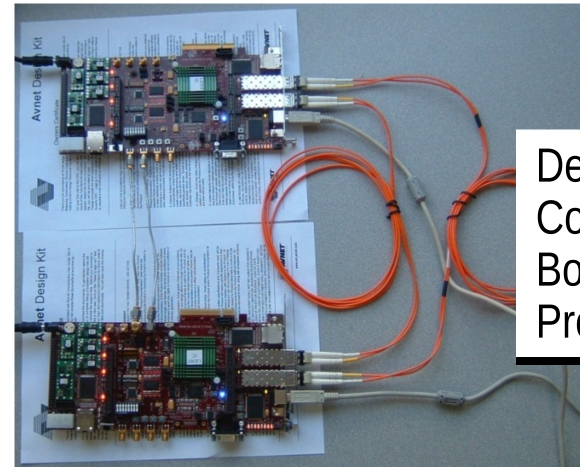
Control System

Efforts concentrated on three areas:



Device Controller Board Prototype

- **Controls Architecture Development**
  development is the embedded device controller - standard EPICS and control system studio collaborative set of operator applications being developed at DESY and SNS.

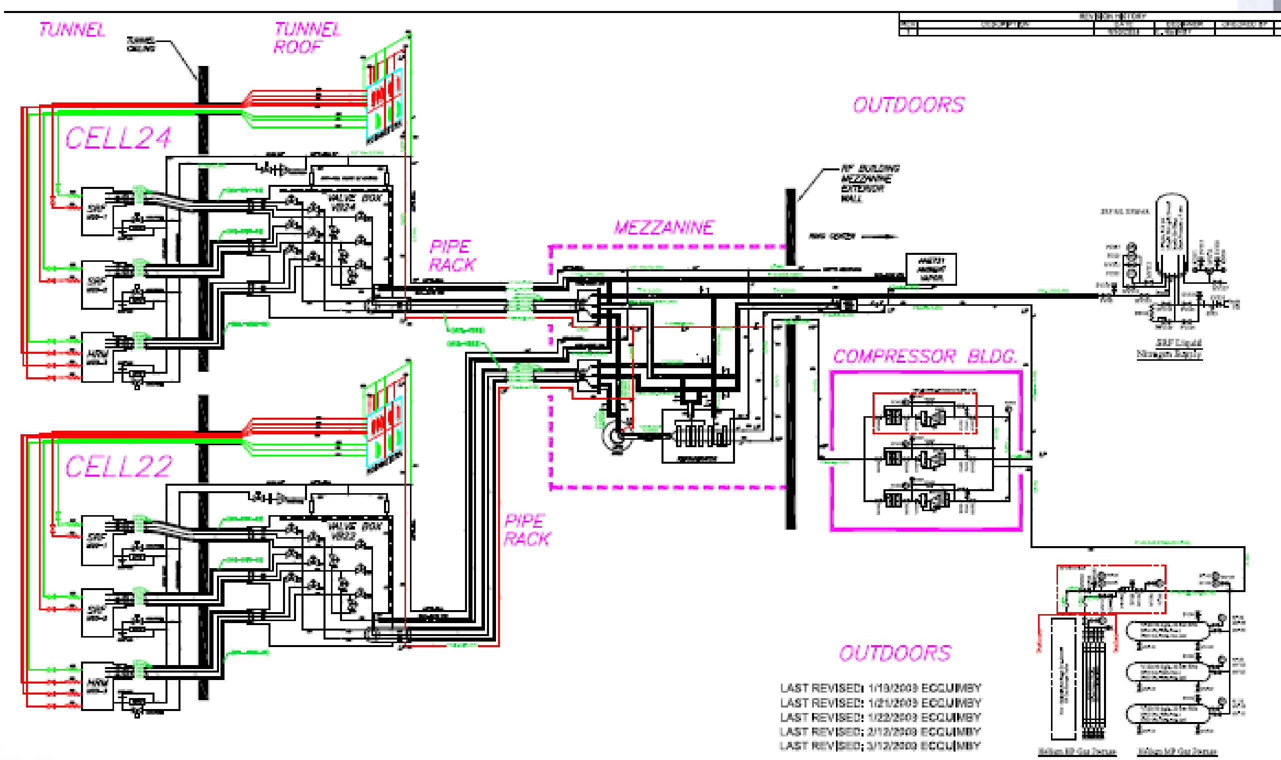
- **Relational Database Development**
  Development/formatting of configuration tools, scripting tools, web-based reports and machine files: **Integrate Asset Management and Controls Database**

- **High Level Application Platform**
  online model running tracy 2 is operational with a lattice derived from an elegant desk As it runs under EPICS all of the channel access clients work on it including the XAL tools and the matlab middle layer toolkit and SDDS for that matter.
  open-source protocol (DDS)is examined whether suitable for the high level application architecture.

Cryogenic Systems

900 W @ 4.5 K liquid Helium Refrigerator

System Design Completed based on vendor supplied components



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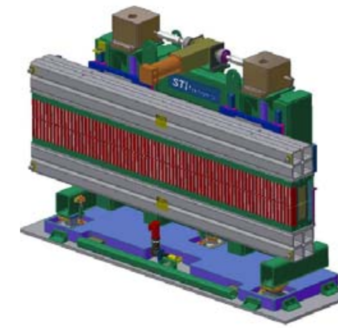
NSLS-II Insertion Device Plan

Name	U20	U19	U45	U100	DW-1.8T	SCW	3PW
Type	IVU	CPMU	EPU	EPU	PMW	SCW	PMW
Photon energy range	Hard x-ray (1.9-20keV)	Hard x-ray (1.5-20keV)	Soft x-ray (180eV-7keV)	VUV (8eV-4keV)	Broad band (<10eV-100keV)	Very hard x-ray (<10eV-200keV)	Broad band (<10eV-100keV)
Type of straight section	6.6m	6.6m	9.3m	89.3m	9.3m	6.6m	near 2nd Dipole
Period length (mm)	20	19	45	100	90	60	-
Total undulator length (m)	**3.0**	3.0	**4.0**	4.0	**7.0**	1.0	0.25
Number of periods	148	158	89	40	75	17	0.5
Magnetic gap (mm)	**5**	5	**10**	10	**12.5**	15	35 (32)
Peak magnetic field strength B (T)	1.03	1.21	0.68(Heli) 1.03 (Lin)	1.50	1.80	3.50	1.14
K	1.81 (eff)	2.03 (eff)	2.80 (eff) 4.53 (eff)	14.01	15.2(eff)	19.61	-
hν fundamental, eV	1832.8	1469.7	183.1	8.6			
hν critical, keV					10.7	21.0	6.8
Total power (kW)	8.02	11.18	12.09	25.64	64.40	34.89	0.34
G(K)	0.97785	0.9818	0.9959	0.9996	0.9997	0.9998	-
On-axis power density (kW/mrad^2)	62.33	77.86	40.03	26.33	55.30	25.60	0.28

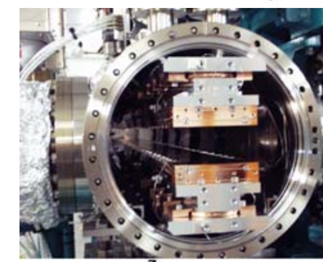
Insertion Devices

* Magnetic design and tracking studies have been almost completed for all the devices.

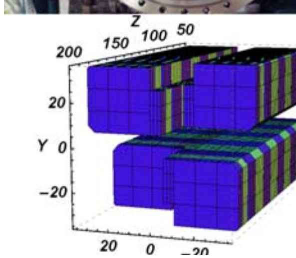
* Mechanical / Electrical designs will be conventional and contracted out to the industry for DW and EPU



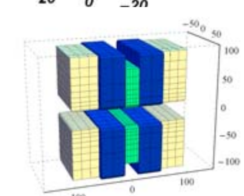
Damping Wigglers: Final magnetic design is completed , mechanical and electrical design will be contracted in FY08



IVU: Design based on NSLS-II X25 device

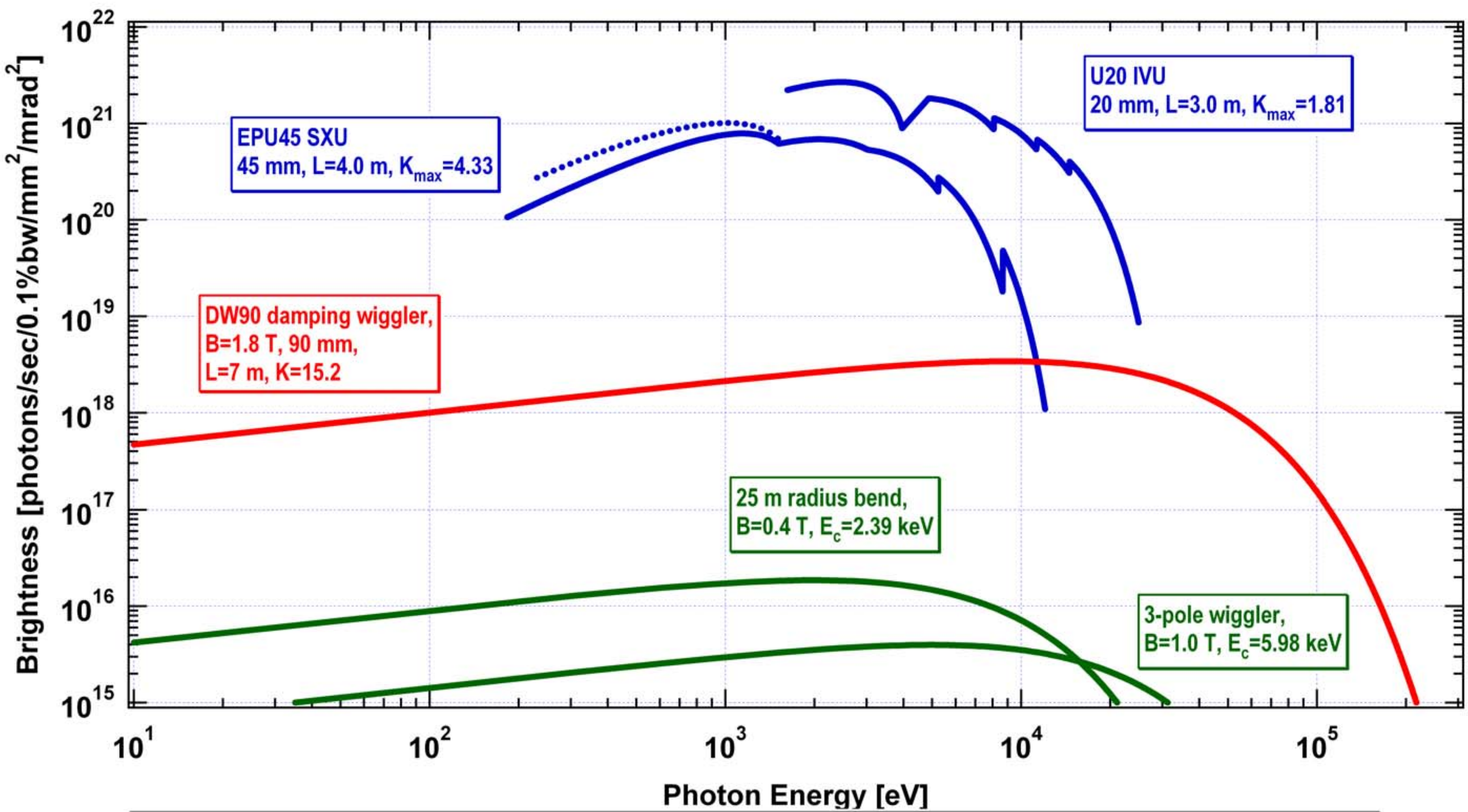


EPU: Apple Design



3PW: Design + 1 Device for diagnostic purpose is in the baseline budget.

Brightness



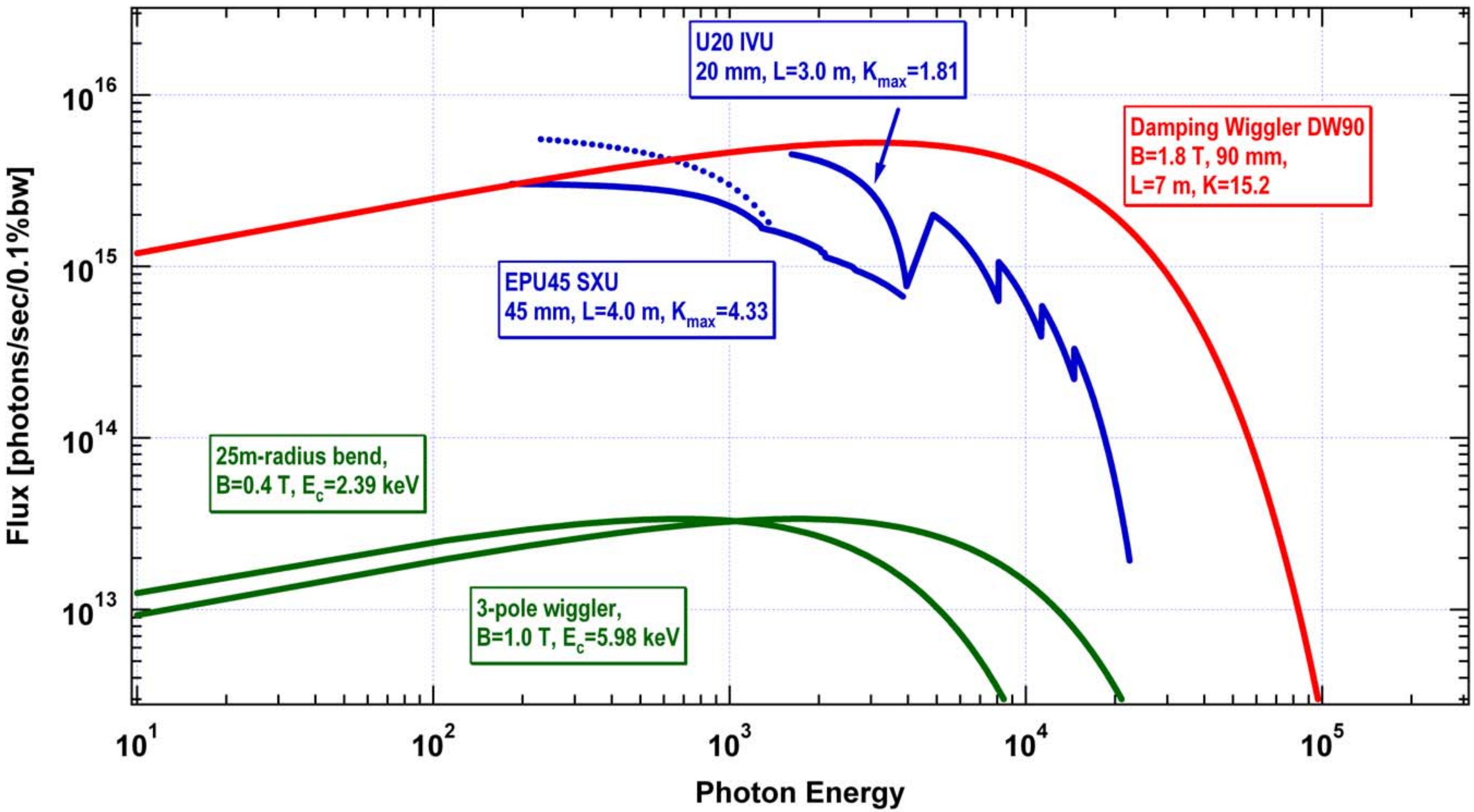
Ring parameters: 3.0 GeV, 0.5 A, ε_h=0.5 nm, ε_v=0.008 nm, energy spread=0.001

Straight section parameters: low-β: β_h=2.02 m, β_v=1.06 m; high-β: β_h=20.8 m, β_v=2.94 m; $\alpha_h=\alpha_v=\eta_h=\eta_v=\eta'_h=\eta'_v=0$

Bend magnet parameters: β_h=0.65 m, β_v=25.1 m, α_h=0.032, α_v=-0.044, η_h=0.04 m, η'_h=0.056, $\eta_v=\eta'_v=0$

3-pole wiggler parameters: β_h=3.87 m, β_v=35.2 m, α_h=2.01, α_v=-1.56, η_h=0.168 m, η'_h=-0.105, $\eta_v=\eta'_v=0$

Flux



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Straight section parameters: low-β: β_h=2.02 m, β_v=1.06 m; high-β: β_h=20.8 m, β_v=2.94 m; $\alpha_h=\alpha_v=\eta_h=\eta_v=\eta'_h=\eta'_v=0$

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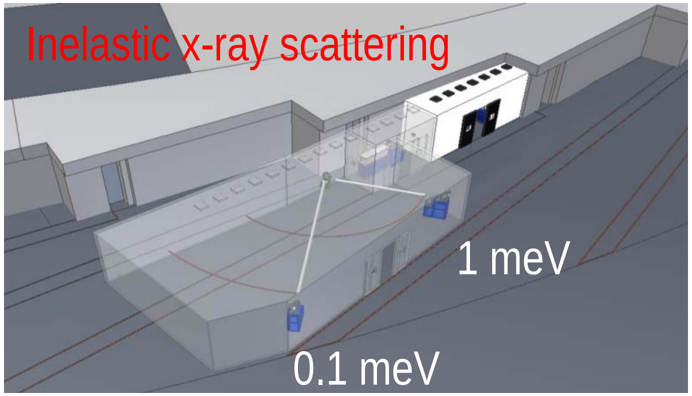
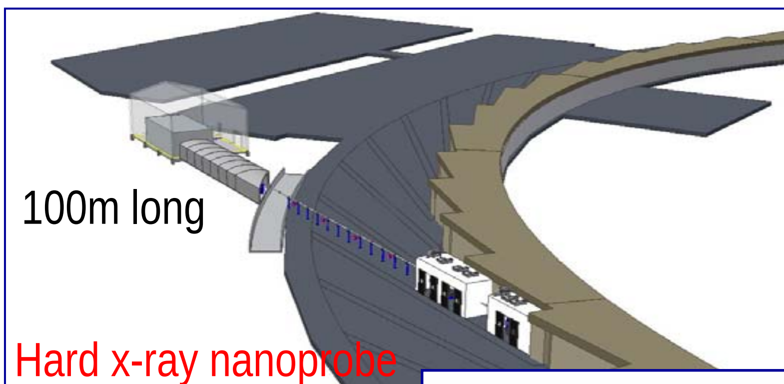
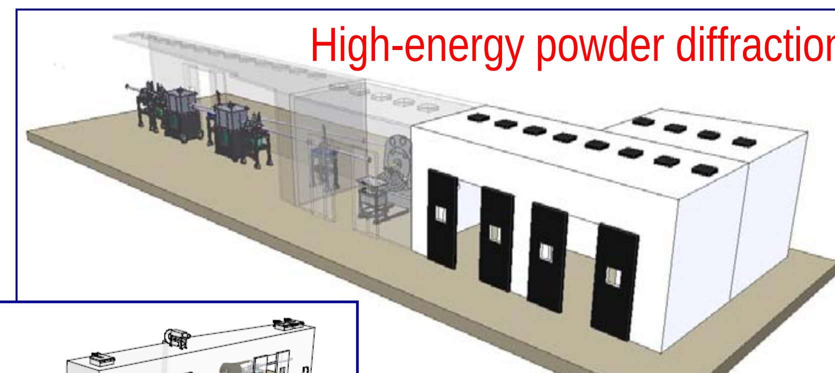
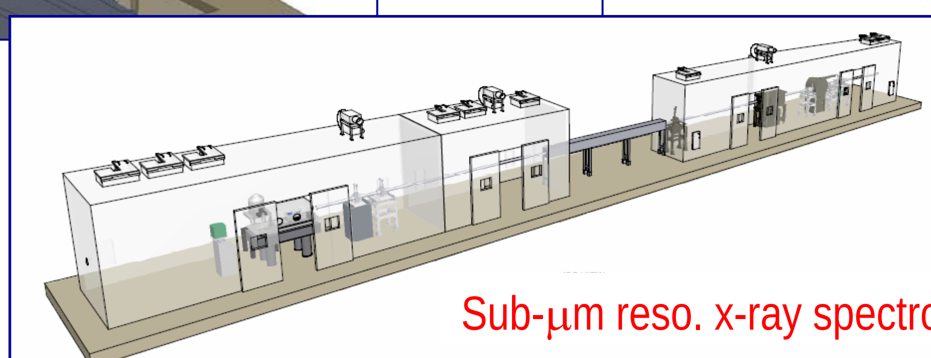
Six Project Beamlines at NSLS-II



- Inelastic x-ray scattering
- Hard x-ray nanoprobe
- Coherent hard x-ray scattering
- Soft x-ray scattering/polarization
- X-ray powder diffraction
- Sub-µm resolution x-ray spectroscopy







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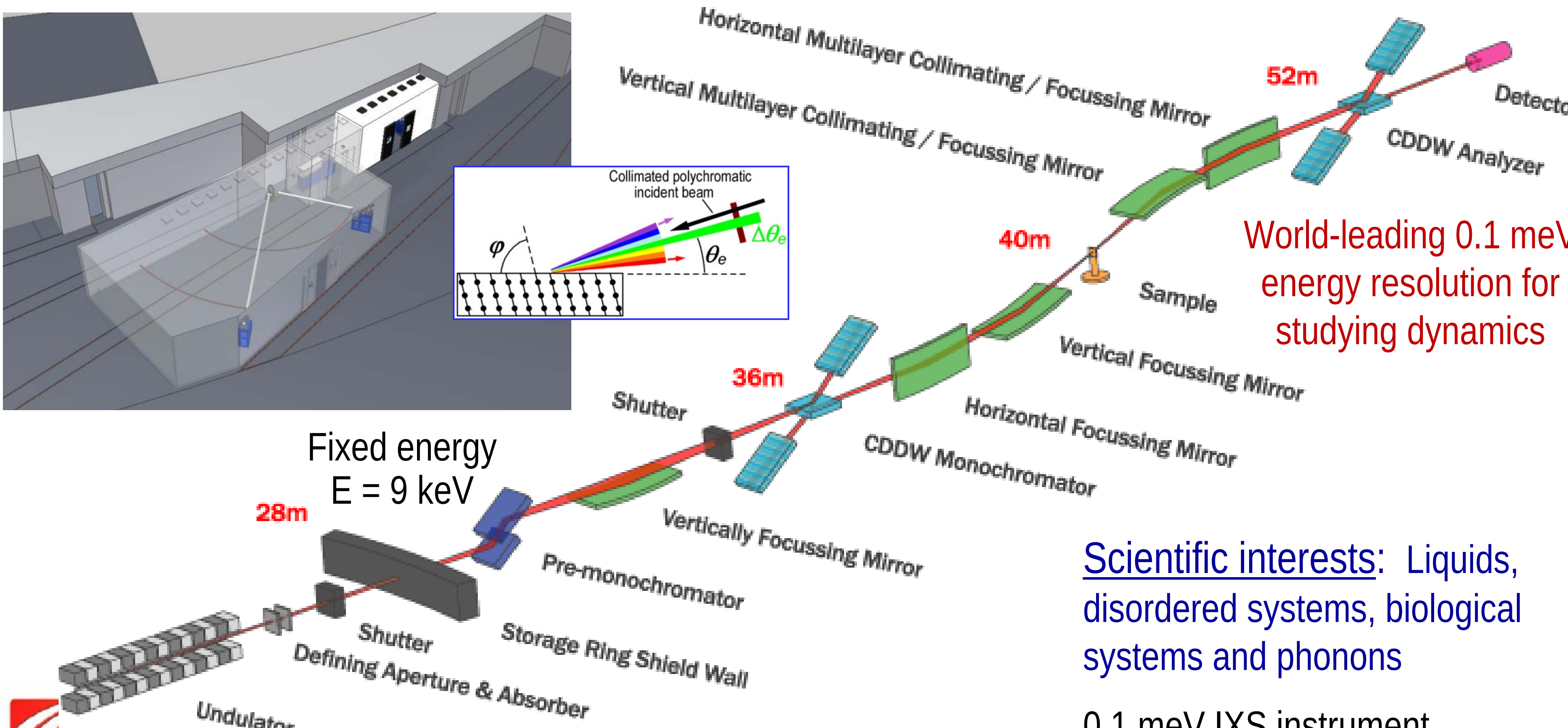
Inelastic X-ray Scattering

<u>BAT members</u>

C. Burns (WMU) – Spokesperson; S-H. Chen (MIT); A. Cunsolo (APS, ANL); M. Krisch (ESRF); H-K. Mao (CIW); T. Scopigno (U. Rome); S. Shapiro (CMPMSD, BNL); Y. Shvyd'ko (APS, ANL); J. Hill (BNL)



Fixed energy
E = 9 keV

World-leading 0.1 meV energy resolution for studying dynamics

<u>Scientific interests</u>: Liquids, disordered systems, biological systems and phonons

0.1 meV IXS instrument

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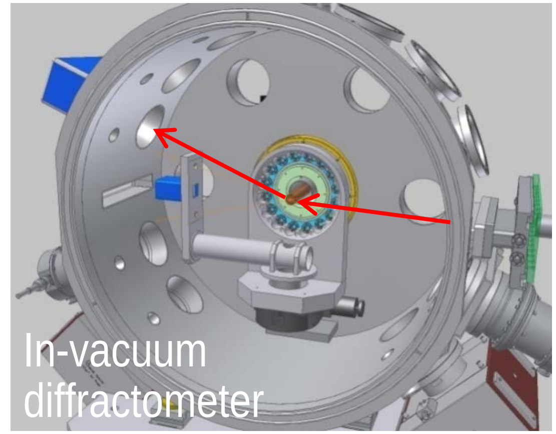
Coherent Soft X-ray Scattering & Polarization

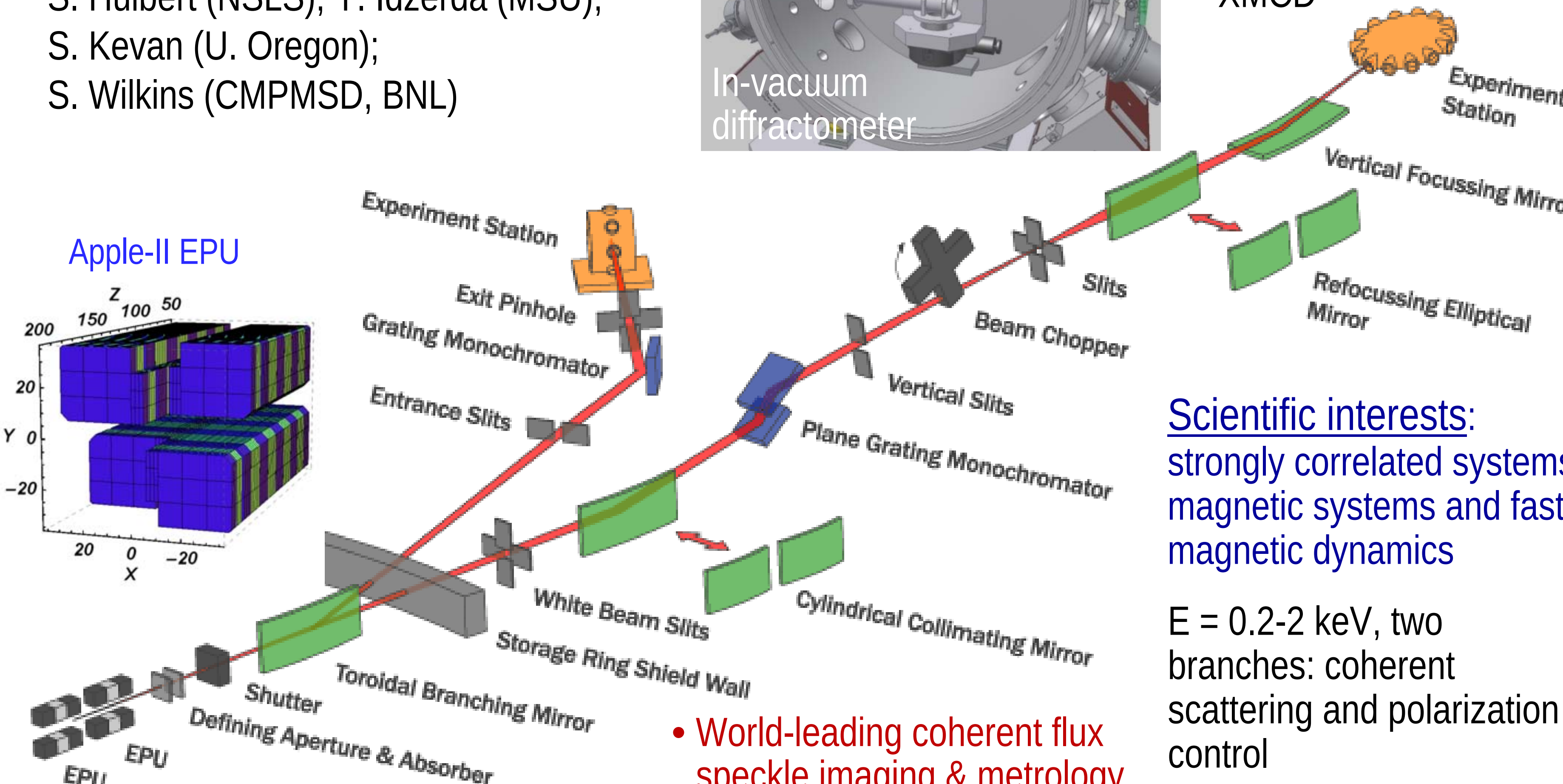
<u>BAT members</u>

C. Sanchez-Hanke (BNL) – Spokesperson;
H. Ade (NCSU); D. Arena (NSLS);
S. Hulbert (NSLS); Y. Idzerda (MSU);
S. Kevan (U. Oregon);
S. Wilkins (CMPMSD, BNL)



Fast (1 kHz) circular polarization switching by beam chopper and focusing optics for XMCD

Apple-II EPU



<u>Scientific interests</u>:
strongly correlated systems, magnetic systems and fast magnetic dynamics

E = 0.2-2 keV, two branches: coherent scattering and polarization control

- World-leading coherent flux speckle imaging & metrology

Coherent Soft X-ray Scattering & Polarization

<u>BAT members</u>

C. Sanchez-Hanke (BNL) – Spokesperson;
H. Ade (NCSU); D. Arena (NSLS);
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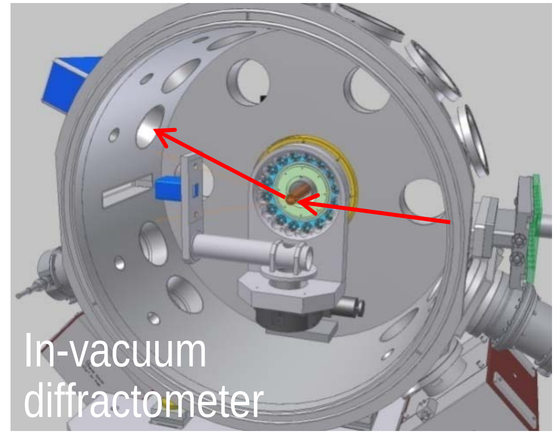

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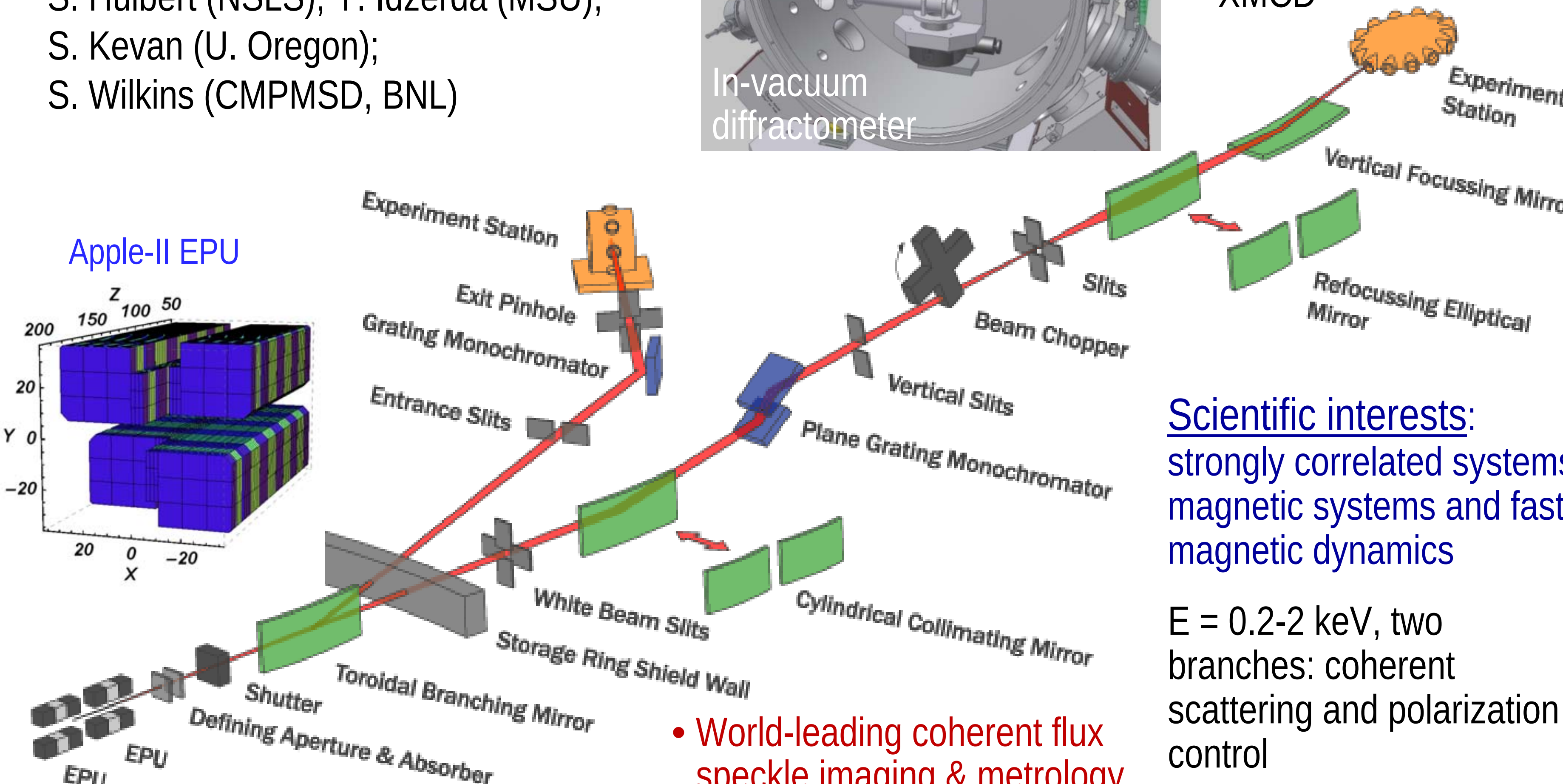


<u>Scientific interests</u>: strongly correlated systems, magnetic systems and fast magnetic dynamics

E = 0.2-2 keV, two branches: coherent scattering and polarization control

- World-leading coherent flux speckle imaging & metrology

X-ray Powder Diffraction

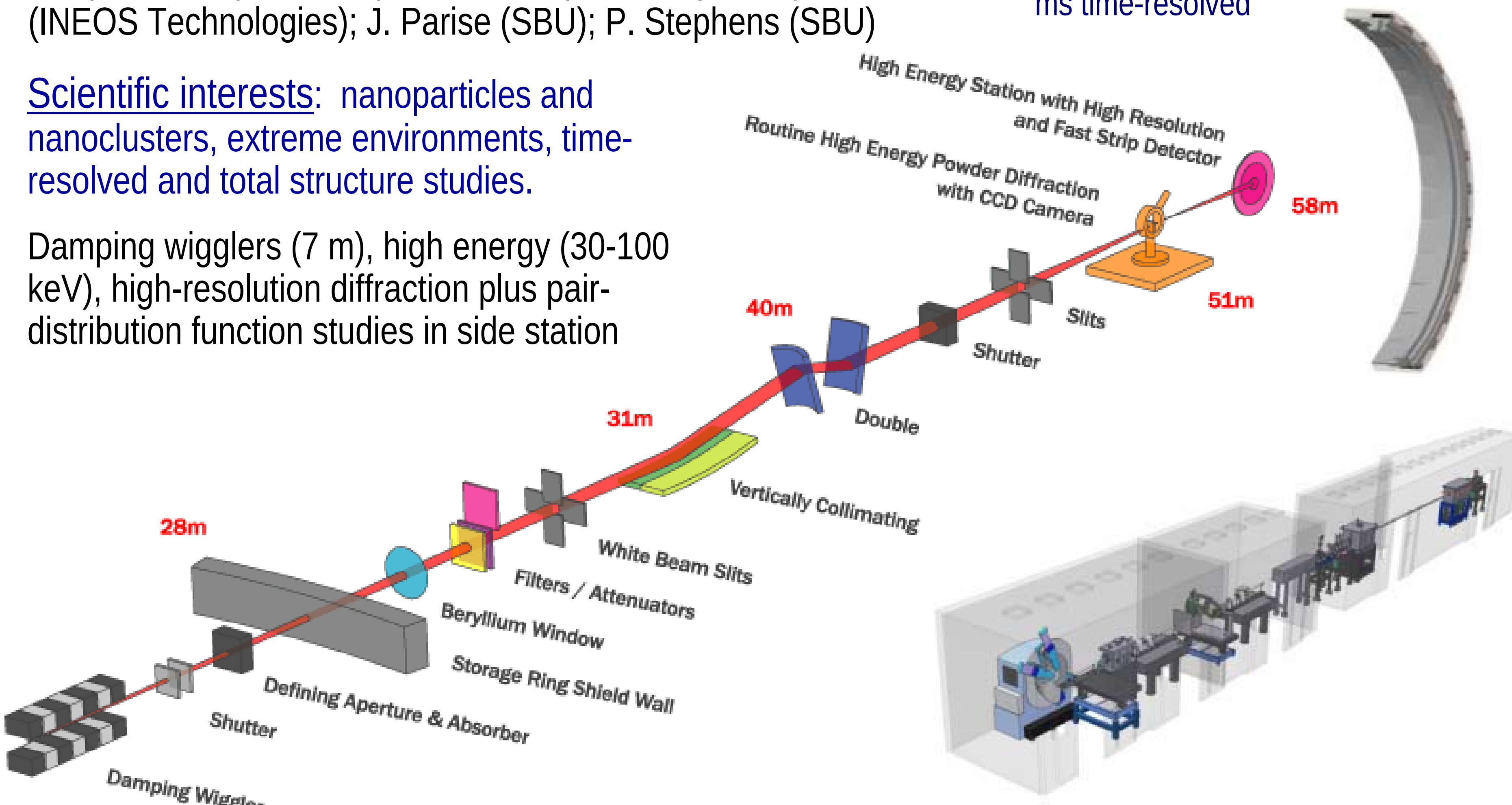
<u>BAT members</u>

S. Billinge (Columbia/BNL) – Spokesperson; P. Chupas (APS, ANL); L. Ehm (SBU/BNL); J. Hanson (Chemistry, BNL); J. Kaduk (INEOS Technologies); J. Parise (SBU); P. Stephens (SBU)

<u>Scientific interests</u>: nanoparticles and nanoclusters, extreme environments, time-resolved and total structure studies.

Damping wigglers (7 m), high energy (30-100 keV), high-resolution diffraction plus pair-distribution function studies in side station

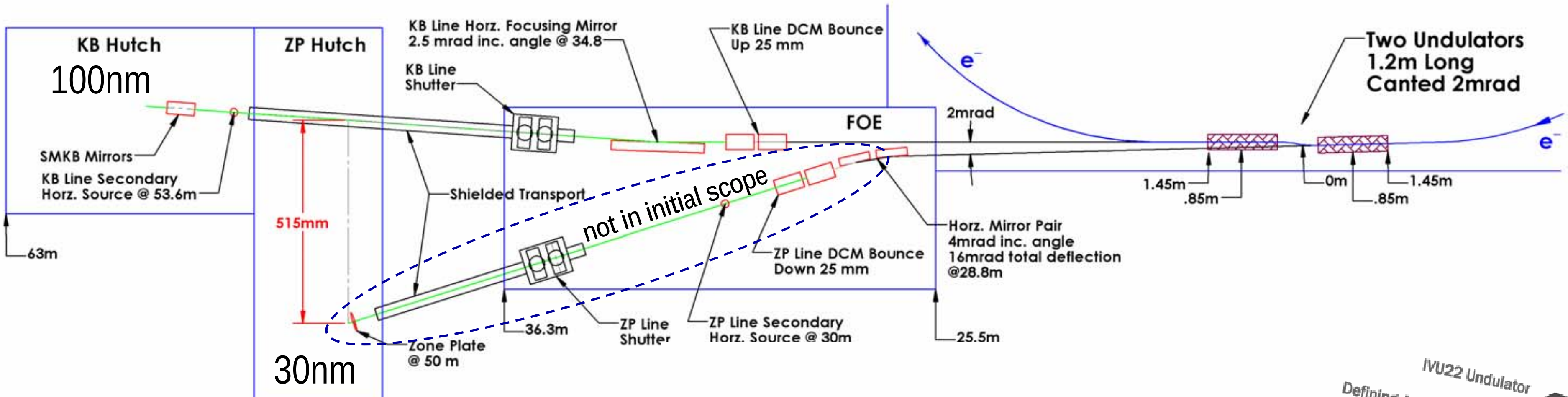
- Multi-crystal analyzer array for high-resolution
- 7000 element strip detector for ms time-resolved



Sub-micron Resolution X-ray Spectroscopy

BAT members

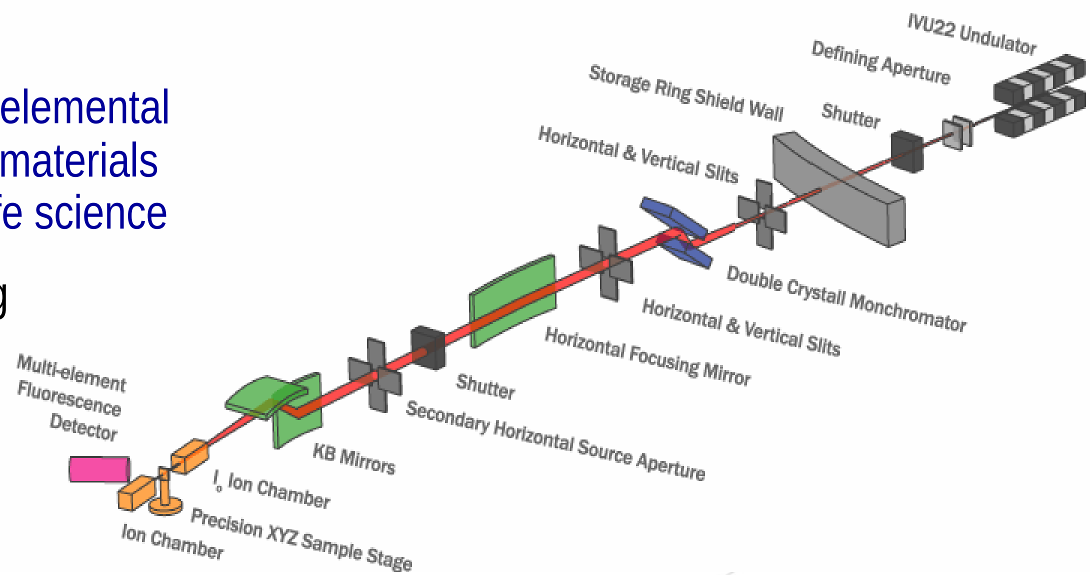
T. Lanzirotti (Chicago) – Spokesperson; S. Sutton (Chicago); S. Vogt (ANL); G. Woloschak (NU); M. Rivers (Chicago); P. Eng (Chicago); L. Miller (NSLS); J. Fitts (BNL); P. Northrup (BNL)



Scientific interests: submicron imaging of elemental distribution in chemical and energy science, materials science, earth and environmental science, life science

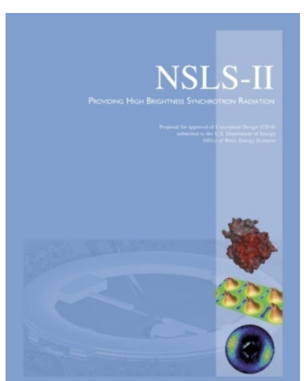
Undulator beamline 2 – 25 keV. Mostly using XRF imaging. KB 100 nm main branch and FZP 30 nm side branch (not in initial scope)

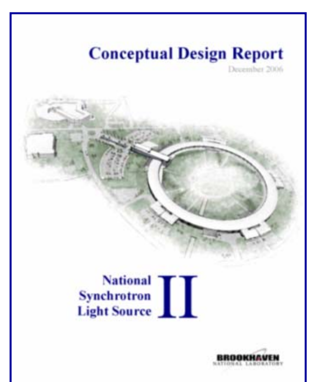
World-leading x-ray brightness in 100x100 nm^2 focal spot size

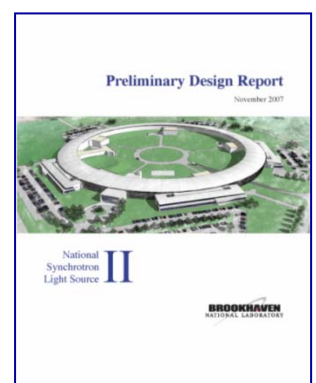


NSLS-II Key Milestones

Aug 2005	CD-0, Approve Mission Need	(Complete)
Jul 2007	CD-1, Approve Alternative Selection and Cost Range	(Complete)
Jan 2008	CD-2, Approve Performance Baseline	(Complete)
Dec 2008	CD-3, Approve Start of Construction	(Complete)
Feb 2009	Contract Award for Ring Building	
Aug 2009	Contract Award for Storage Ring Magnets	
Mar 2010	Contract Award for Booster System	
Feb 2011	1st Pentant of Ring Building Ready for Accelerator Installation	
Feb 2012	Beneficial Occupancy of Experimental Floor	
Oct 2013	Start Accelerator Commissioning	
Jun 2014	Early Project Completion; 1st Beam to Beamlines soon afterwards	
Jun 2015	CD-4, Approve Start of Operations	







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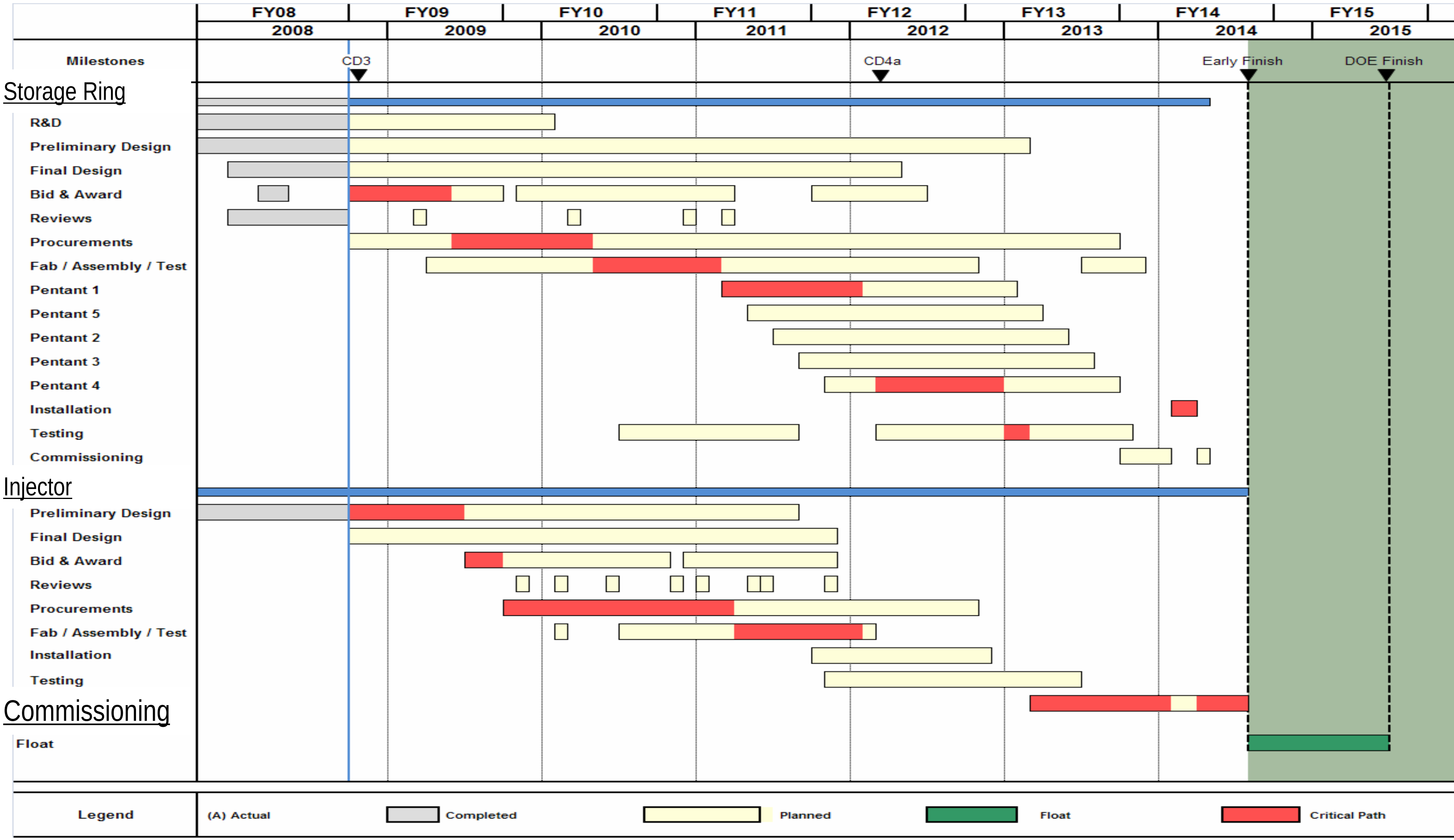
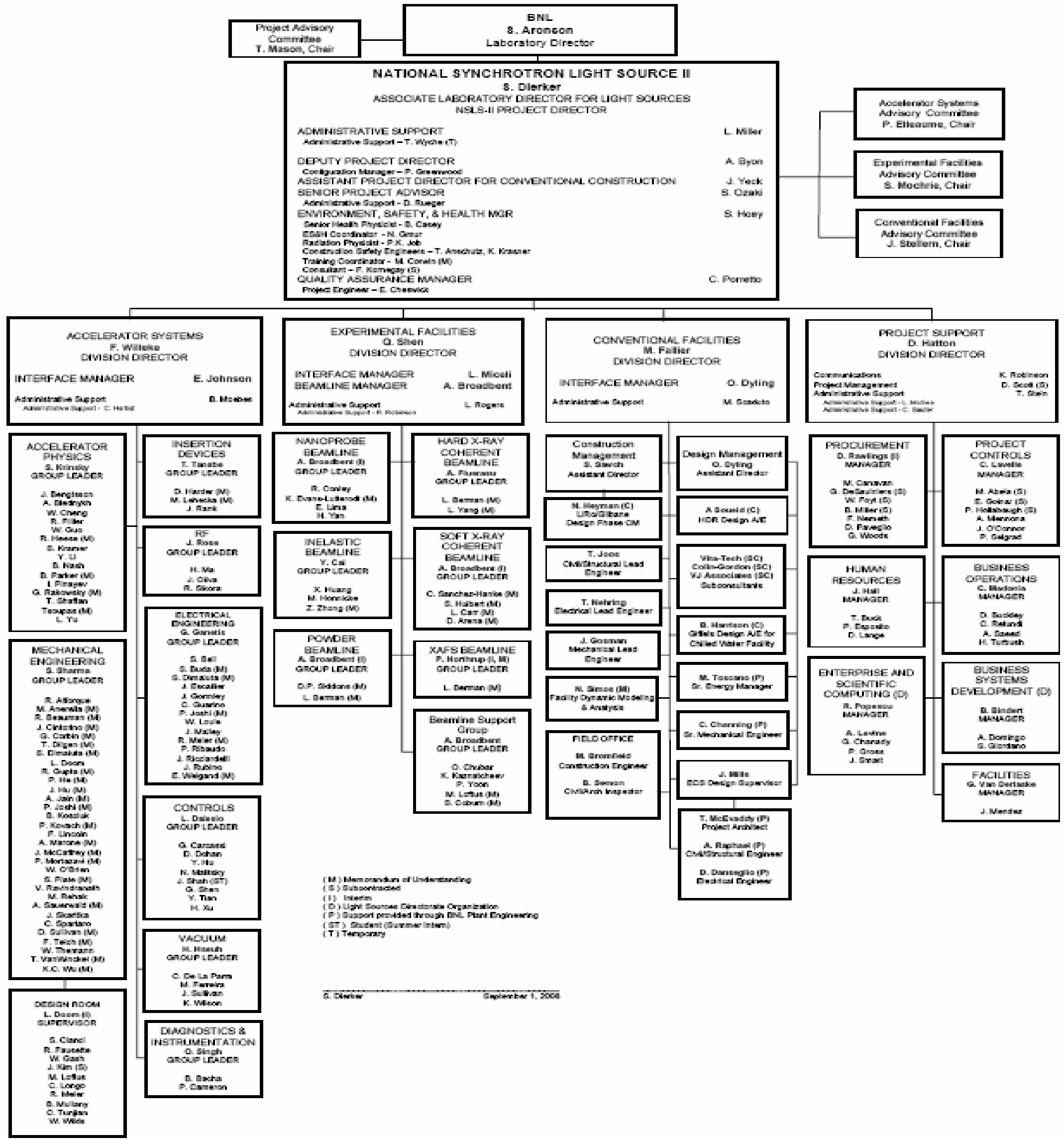
Accelerator Systems Schedule



Organization



ACCELERATOR SYSTEMS
F. Willeke
DIVISION DIRECTOR

INTERFACE MANAGER **E. Johnson**

Administrative Support B. Moebes
Administrative Support - C. Herbst





ACCELERATOR PHYSICS
S. Krinsky
GROUP LEADER
J. Bengtsson
A. Blednykh
W. Cheng
W. Guo
S. Kramer
Y. Li
B. Nash
B. Parker (M)
I. Pinayev
N. Tsoupas (M)
L. Yu

MECHANICAL ENGINEERING
S. Sharma
GROUP LEADER
R. Alforque
M. Anerella (M)
L. Doom
R. Gupta (M)
C. Yu
A. Jain (M)
B. Kosciuk
P. Kovach (M)
J. McCaffrey (M)
W. O'Brien
S. Plate (M)
V. Ravindranath
M. Rehak
R. Scheuerer (M)
J. Skaritka
C. Spataro
A. Stinikov
W. Themann
K.C. Wu (M)
C. Yu

TECHNICAL SUPPORT
F. Lincoln
NSLS-II LEAD
J. Sullivan
W. Themann

T. Dilgen (M)
SCMD LEAD
J. Cintorino (M)
G. Corbin (M)
P. He (M)
A. Sauerwald (M)
D. Sullivan (M)
F. Teich (M)
T. VanWinckel (M)

DESIGN ROOM
M. Loftus
SUPERVISOR
S. Cianci (JS)
J. Dang (JS)
R. Fausette
W. Gash
C. Longo
R. Meier
B. Mullany
L. Reffi
W. Wilds

ELECTRICAL ENGINEERING
G. Ganetis
GROUP LEADER

S. Buda (M)
J. Escallier
W. Louie
P. Joshi (M)
E. Orr (M)
J. Ricciardelli

ELECTRICAL DESIGNERS
J. Malley
SUPERVISOR

C. Guarino
S. Jarzabkowski
J. Rubino

ELECTRICAL TECHNICAL SUPPORT
P. Ribaudo
SUPERVISOR

S. Bell
S. Dimaiuta (M)
J. Gormley
R. Meier (M)
D. Oldham (M)
E. Weigand (M)

CONTROLS
L. Dalesio
GROUP LEADER

G. Carcassi
D. Chabot
M. Davidsaver
D. Dohan
D. Dudley
K. Ha
Y. Hu
N. Malitsky
R. Petkus
J. Shah
G. Shen
Y. Tian
H. Xu



INSERTION DEVICES
T. Tanabe
GROUP LEADER
J. Rank
D. Harder
O. Chubar (A)

RF
J. Rose
GROUP LEADER

J. Cupolo
Y. Kawashima
H. Ma
J. Oliva
R. Sikora

VACUUM
H. Hseuh
GROUP LEADER

M. Ferreira
P. Settepani
K. Wilson
S. DiStefano
C. De La Parra
J. Sullivan (A)

DIAGNOSTICS & INSTRUMENTATION
O. Singh
GROUP LEADER

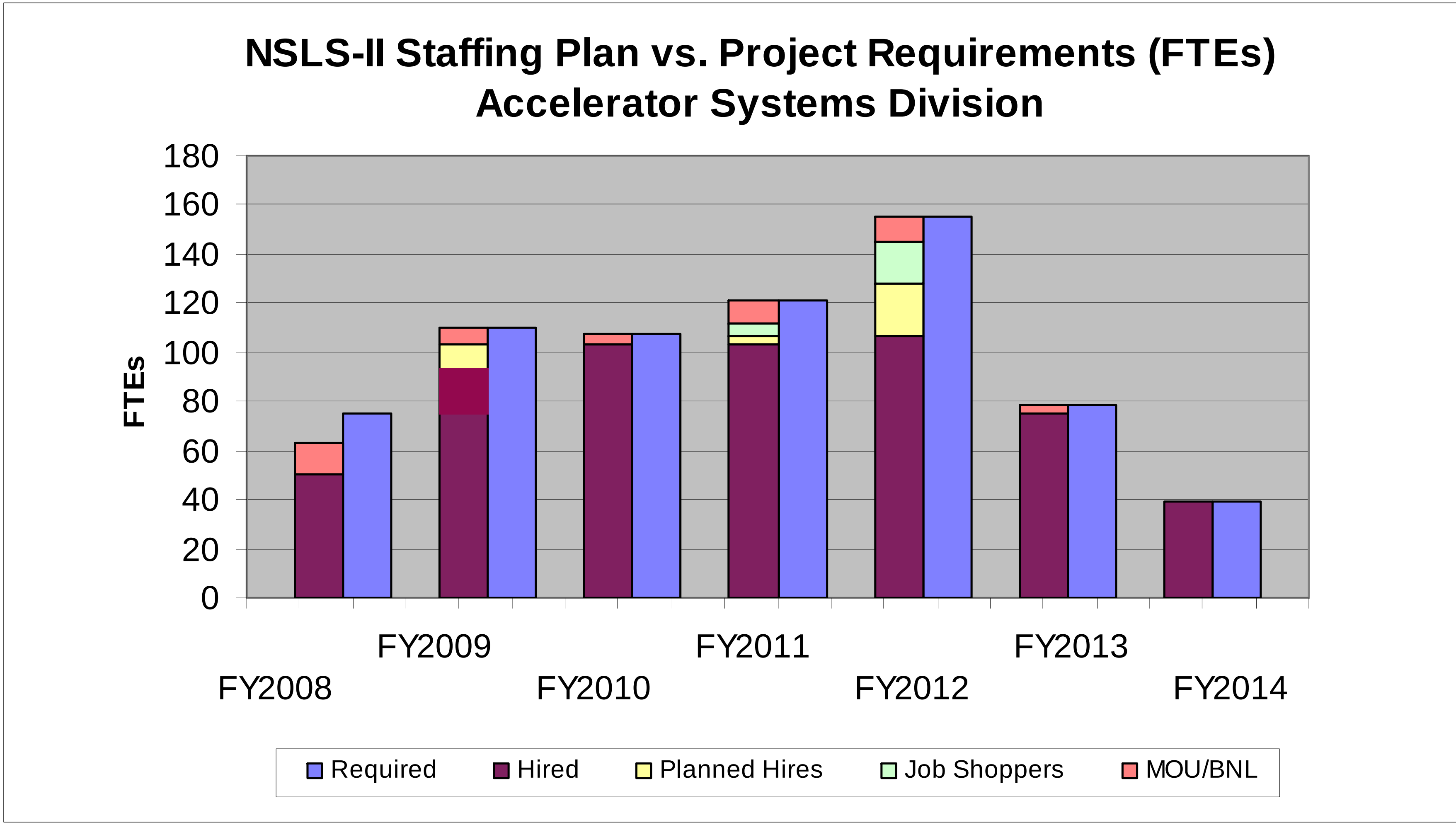
B. Bacha
P. Cameron
A. Della Penna
D. Padrazo

INJECTION SYSTEM
T. Shaftan
GROUP LEADER
R. Fliller
R. Heese
G. Wang
B. Singh

TASK FORCE
FAST ORBIT
FEEDBACK
Om Singh
Leader

TASK FORCE
BEAM
CONTAINMENT
S. Kramer
Leader


Staffing



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Summary

- NSLS-II made very fast progress from conceptual design phase to construction phase
- Civil Construction has started
- The technical progress of accelerator systems is very good and all critical designs have been performed
- Major Procurements of Technical Components has Started
- A strong management scheme is in place
- The funding prospects for the project are excellent