WBS1& 2 SBS Magnet and Infrastructure

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WBS 1& 2 FY14 Scope of Work

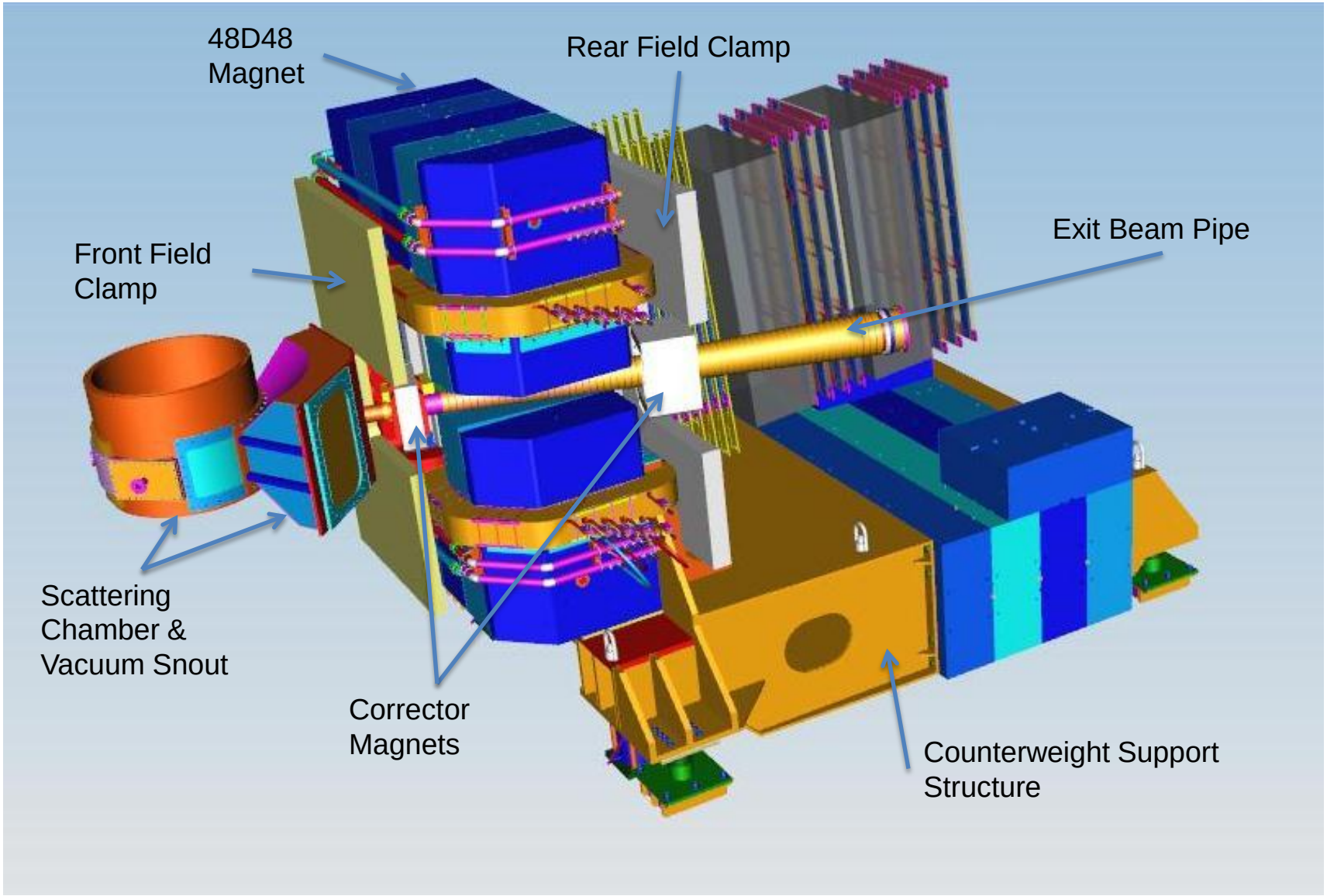
WBS 1

- Magnet Yoke Modifications
- Procure New Coils
- Magnet Assembly and Test
- Procure Support Structure/Magnet Platform
- Design and Procure Vacuum Chamber Snout
- Engineering of Exit Beam Pipe and Shielding
- Design and Procure Front Field Clamp
- Installation and Test of Power Supply
- Design Detector Supports
- Develop Installation Plan

WBS 2

- Design Rear Field Clamp
- Design of Electronics Hut and Shielding

SBS


48D48
Magnet
Rear Field Clamp
Front Field
Clamp
Exit Beam Pipe
Scattering
Chamber &
Vacuum Snout
Corrector
Magnets
Counterweight Support
Structure

Kinematics of SBS

•SBS Program is defined by three experiments, each with multiple configurations of equipment. Each configuration has been modeled and the required layout of the Hall has been determined.

SBS FF Kinematic Settings

G_E^n 09016 Polarized He3

Q^2 [GeV^2]	θ_{BB} [deg]	d_{BB} [m]	θ_{48D48} [deg]	d_{48D48} [m]	d_{HCAL} [m]
1.46	40.0	1.50	39.4	2.8	17
3.68	34.0	1.50	29.9	2.8	17
6.77	34.0	1.50	22.2	2.8	17
10.18	34.0	1.50	17.5	2.8	17

G_E^p 07109 Hydrogen

Experimental Points 40cm Hydrogen

Q^2 [GeV^2]	$\theta_{electronarm}$ [deg]	θ_{48D48} [deg]	d_{48D48} [m]	$d_{electronarm}$ [m]	d_{HCAL} [m]
5.0	26.1	28.2	1.6	4.2	6.8
8.0	26.7	22.1	1.6	3.7	6.8
12.0	29.0	16.9	1.6	3	6.8

G_M^n 09019 Hydrogen/Deuterium

Experimental Points 10cm Deuterium

Q^2 [GeV^2]	θ_{BB} [deg]	θ_{BB} [m]	θ_{48D48} [deg]	d_{48D48} [m]	d_{HCAL} [m]
3.5	32.5	1.55	31.1	2.0	7.2
4.5	41.9	1.55	24.7	1.8	7.0
6.0	64.3	1.55	15.6	1.6	6.8
8.5	46.5	1.55	16.2	1.8	11
10.0	33.3	2.1	17.9	2.25	13
12.0	44.2	1.55	13.3	2.1	14
13.5	33.0	1.55	14.9	3.1	17

Calibration Points: 10cm Deuterium

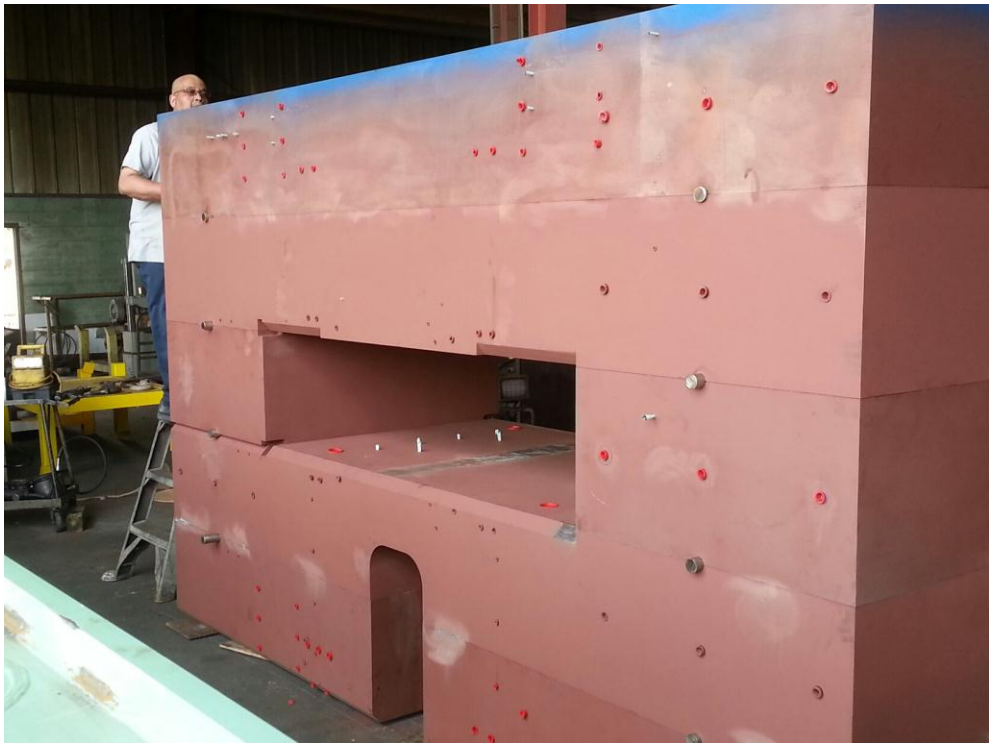
Q^2 [GeV^2]	θ_{HRS} [deg]	θ_{48D48} [deg]	d_{48D48} [m]	d_{HCAL} [m]
3.5	34.1	31.1	3.0	17.
3.5	30.9	31.1	3.0	17.
6.0	69.1	15.6	3.0	17.
6.0	65.9	15.6	3.0	17.
6.0	62.7	15.6	3.0	17.
6.0	59.5	15.6	3.0	17.

Magnet Modifications

- SBS will utilize the BNL 48D48 Dipole magnet.
- 48D48 is 1.2 meters long dipole with gap of 47cm x 122cm, designed to operate at current of 4000 A.
- SBS requires modification of the Yoke to allow beam line clearance and purchase of new coils to operate at maximum current of 2000A.

Status of November 2013 review: magnet pieces were delivered in Aug, 2013.

Magnet Modifications



- Magnet Yoke pieces have been machined and delivered.
- New assembly hardware was purchased to complete initial assembly of yoke.
- Preassembly completed by machining vendor.

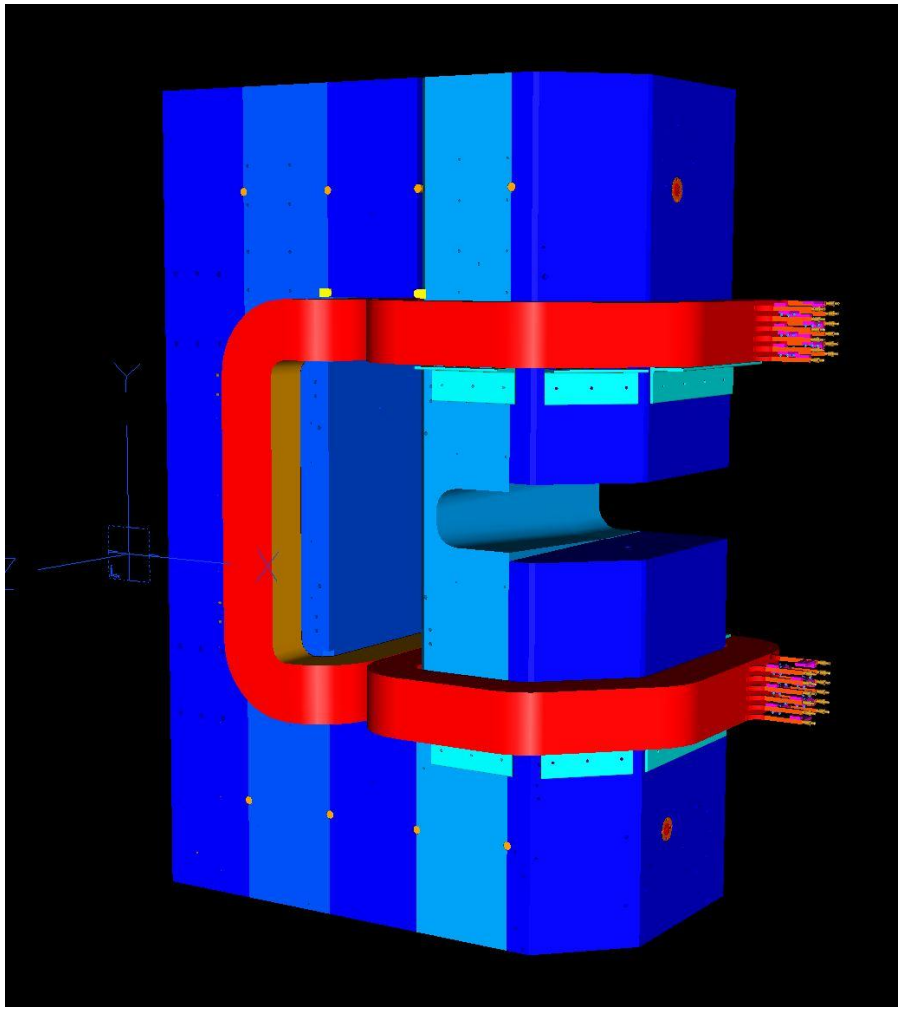
SBS Power Supply

•Experiments require 2200A, 638kW supply.

•Power Supply delivered to Hall A.

•Installation and acceptance test scheduled for January 2015 during Hall A Access period.

SBS Coils



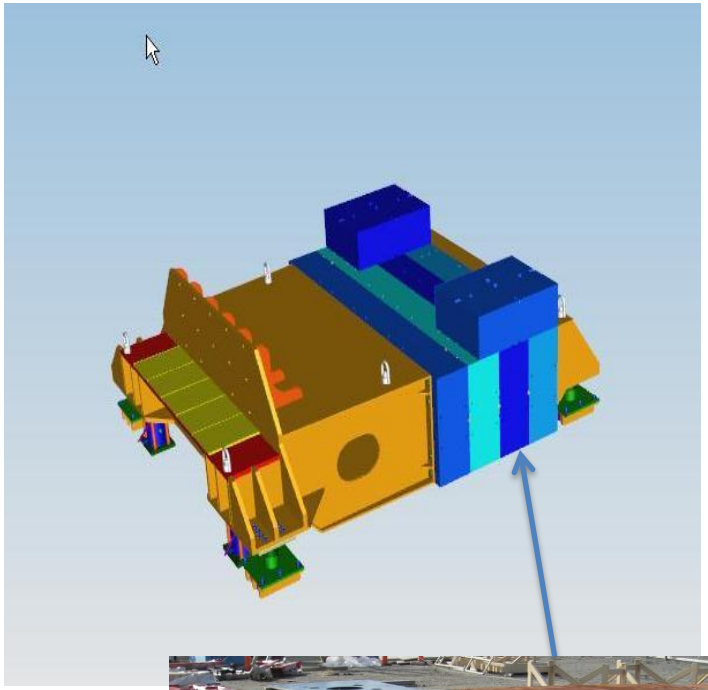
•New racetrack coils allow ease of rotation of magnet and clearance of beam pipe.
•New saddle coils allow close proximity of detectors to magnet.
•Max current of 2000A, water-cooled conductor, dT < 5C at 100GPM.

•Procured racetrack coils. Vendor has delivered 8 of 11 coils, last shipment expected Nov 7th.
• Saddle coil procured separately. Saddle coil contract is in the award process.

Magnet Assembly and Test

- Acceptance testing completed for magnet yoke assembly.
- Acceptance tests completed on coils as received.
- Magnet assembled with existing saddle coil from BNL and a fraction of new racetrack coils.
- Commissioning test limited by power supply and coil availability.
- Completed commissioning test of magnet at 200A.
- Scaled results are in agreement with simulations.

SBS Support Structure



- GEp experiment configurations require a short distance between target and SBS Magnet.
- Support of SBS is limited by HRS links and pivot location.
- Resulted in a counterweight support system with magnet loaded on edge of frame.
- Engineering review of structure completed.
- Using 2nd yoke pieces from BNL as counterweight, only frame to be fabricated .
- Counterweight block modifications are completed and stored at vendor's facility.
- Support Frame in fabrication, delivery in January 2015.

•Structure rolls on 2" surfaced floor plates, using hydraulic cylinders for lift. and Hilman rollers - Rollers are existing in-house.

•Floor plate drawings are ready for procurement.

•Detector supports to be integrated into frame design.

Exit Beam Pipe & Correctors

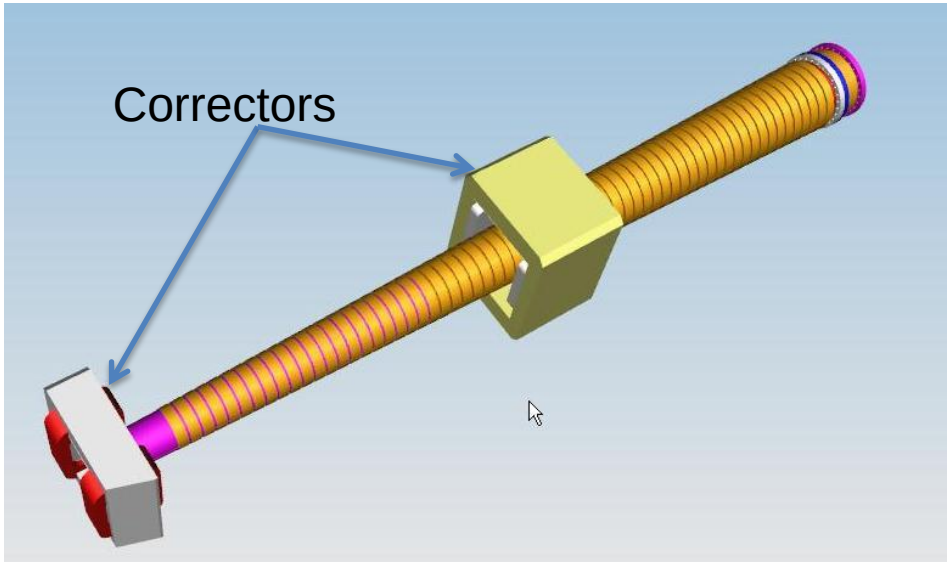
•SBS experiments require magnet to change position and angle in 16 different combinations.

•Utilizing layers of shielding and two iron dipole magnets to reduce field in beam line.

•Design allows sections of pipe and shielding to be changed for different configurations.

•Using same 2 Correction magnets in all configurations. Correction magnets are adjustable by powering coils individually.

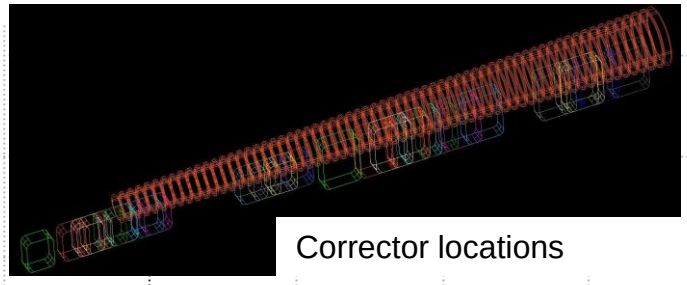
•Preliminary drawings completed.



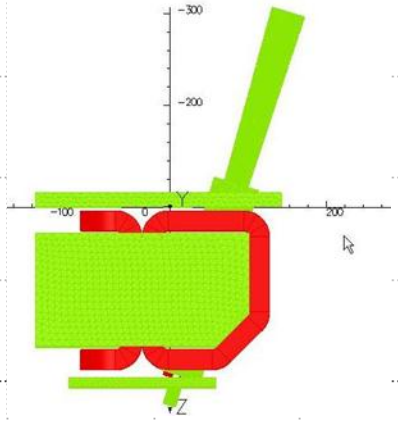
- Verifying beam pipe and corrector configurations in Tosca before starting procurement process, analysis 30% complete.

Exit Beam Pipe & Correctors

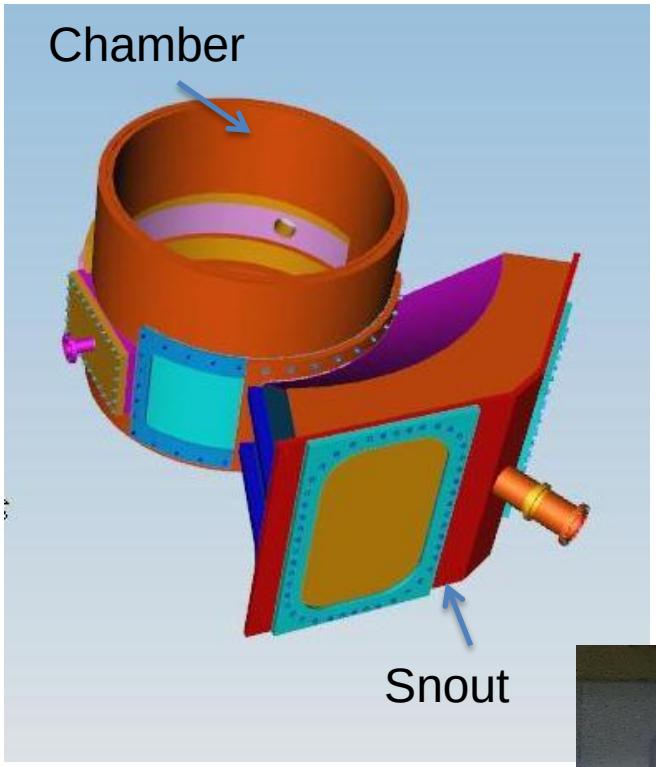
- GEp experiment, 16.9 degree & 1.6 m from target configuration
- Requires Integral < 1000 G-cm
- Integral = -230 G-cm



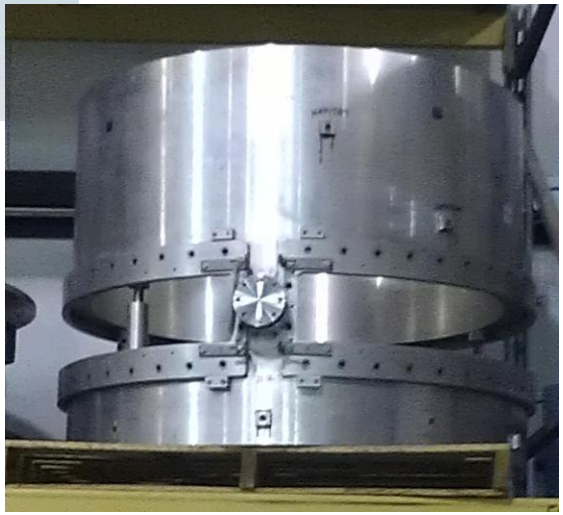
Corrector locations



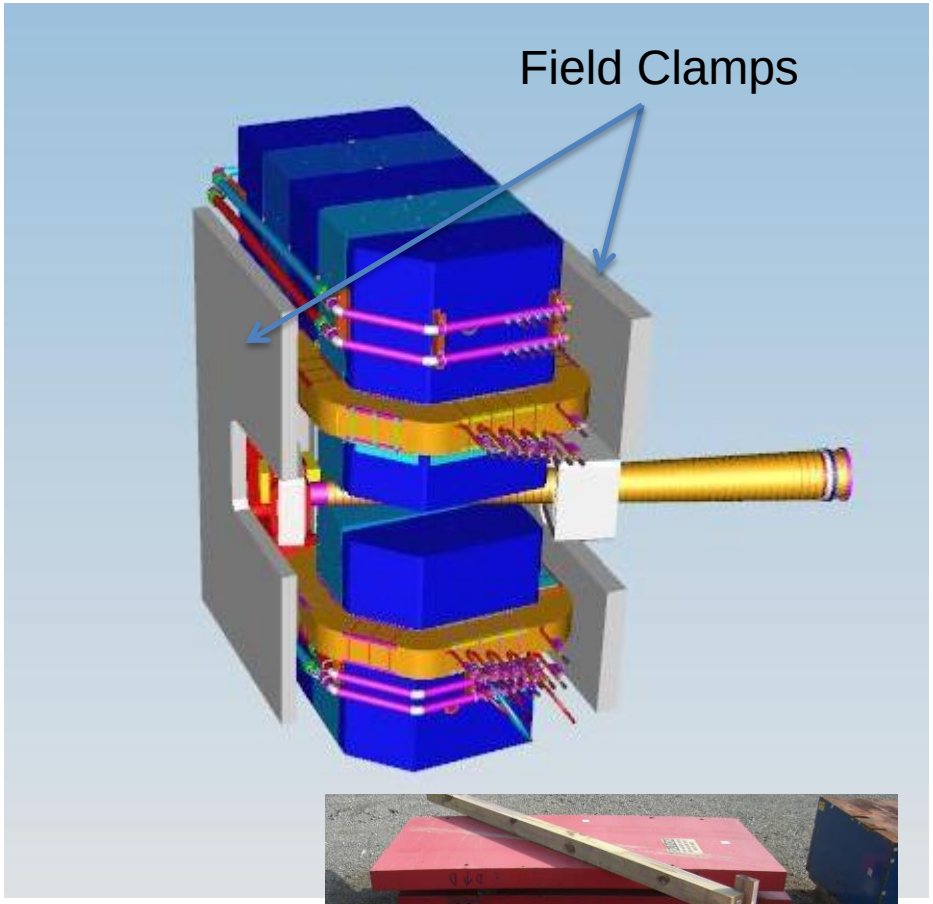
Vacuum Chamber



- Utilizing existing scattering chamber.
- Vacuum snout is in fabrication, delivery February 2015.
- Vacuum windows are designed, testing in March 2015.



Field Clamps & Pole Shims



- Front field clamps needed to limit target field, less than 40 G.
- Rear field clamps needed to limit detector field.
- Field clamp supports designed for adjustability.

- Design of SBS field clamps is complete.
- Front field clamp to be fabricated from existing steel material received from BNL.
- Rear field clamp to be purchased in FY15. (WBS 2)

- Preliminary analysis of pole shims , evaluating use of existing material, 25% complete.(WBS 2)

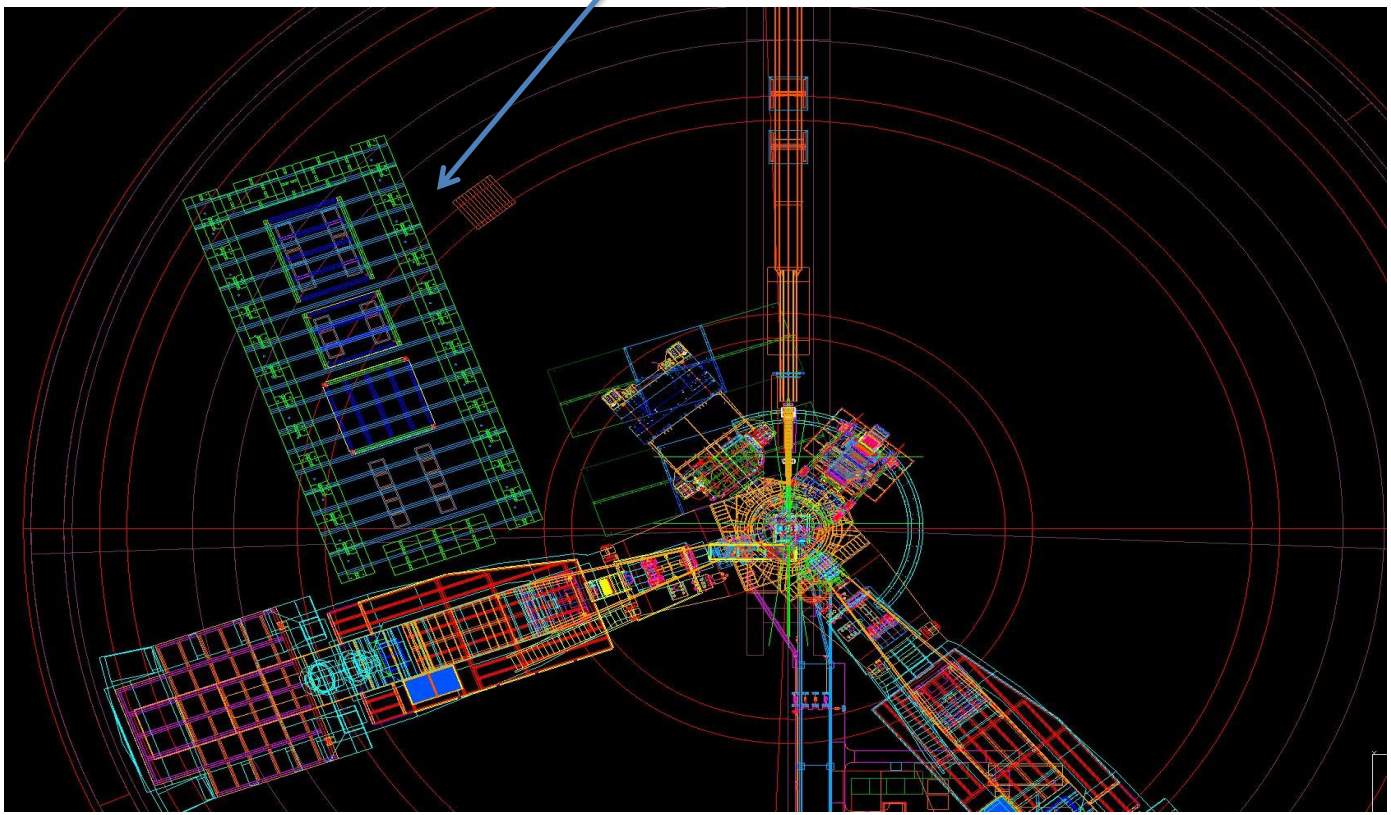
Detector Supports

- Counterweight support structure designed to support magnet and detectors.
- GRINCH - designed mirror mounts and structural parts, 90% complete.
- Engineering review of HCal is scheduled for December 2014.
- Design of SBS Detector frames and mounting brackets to begin January 2015 including :
  - HCal elevation stand
  - GEM support frame

  and engineering review of Coordinate Detector and ECal.

Electronics Hut & Shielding

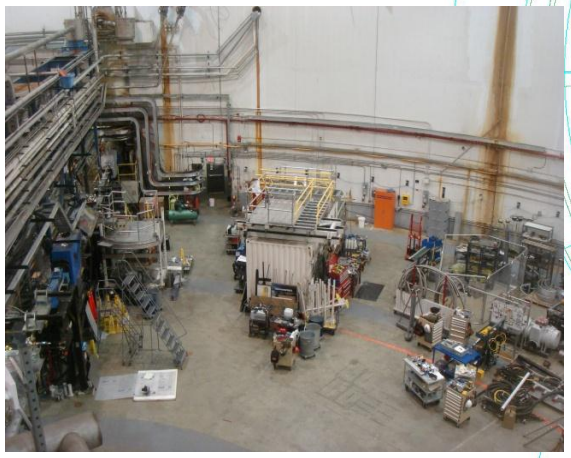
Started design and Hall layout of Electronics Hut, 10% complete.
(WBS 2)

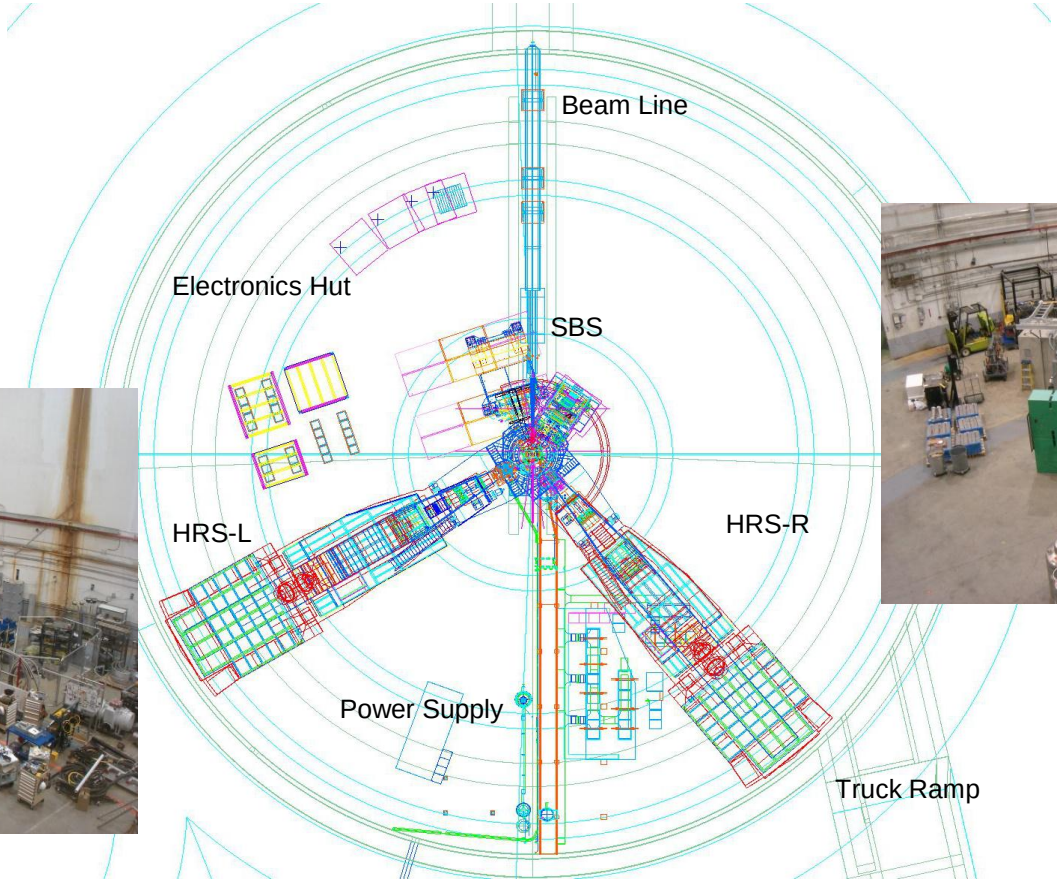


Hall A Installation Plan

- Developed detailed floor plan of Hall A, existing equipment and SBS experiment configurations.
- Modifying and relocating LCW and power utilities for SBS and future experiments as Hall access is available.

- Hall A is ~50 meter diameter with a 20 ton overhead crane capacity





SBS Program

Manpower

•Hall A Design/Engineering available resources – 3 designers, 2 engineers, 1 engineering associate, Hall Coordinator and 6 technicians

•In FY15, SBS Program requires 37 manweeks design, 17 manweeks engineering and 10 manweeks technicians.

•Sufficient resources to complete milestones in FY15.

Installation

- Assembly and installation of equipment in Hall A is dependent on Experiment schedule. Typical new installation takes 4-6 months.
- General interaction of SBS with other experiments or hall infrastructure is done under Hall operations.
- After program completion, installation is Hall operations.

SBS ESH &Q

Fully integrate ESH&Q into planning ,design, fabrication and installation

•Conducting design and safety reviews of major subsystems before fabrication and installation; such as engineering review of support structure & review of equipment supplied by Collaborators.

•Coordinating work of outside institutions to insure Jlab policies are followed; Collaborators present designs for review in weekly meetings.

•Utilizing Jlab screened vendors and requiring vendor's to have quality program in use.

As program progresses into fabrication and installation,

•Will perform hazard analysis and utilize Jlab safety system for all testing and commissioning activities; such as load testing, weld inspection, TOSPs, coil acceptance tests, pre-assembly and testing of magnet.

•Each SBS Experiment will be required to complete the Jlab Readiness Review process.

		Design and Engineering			Procurement/	Fabrication	Milestone	
	Activity	des	eng	early design finish	late proc/fab start	Duration		Complete
		mw	mw			mw		
1	Magnet yoke received						Aug-13	√
2	Magnet yoke modifications	6	2	4-Oct-13	13-Dec-13	18	Apr-14	√
3	New coils	2	2	13-Sep-13	19-Sep-13	28	Apr-14	Delivery Jun-15
4	Magnet assembly hardware	4	1	8-Nov-13	14-Feb-14	8	Jul-14	√
5	Assemble magnet (Testlab)	4	2	22-Nov-13	31-May-14	6	Jul-14	√
6	Commissioning tests of magnet (Testlab)		2		12-Sep-14	4	Sep-14	√
7	Power supply				11-Oct-13	12	Jan-14	√
8	Power supply test (Hall A)		1		15-Mar-14	4	Sep-14	Install Feb-15
9	Magnet support structure	8	3	13-Dec-13	25-Jan-14	24	Jul-14	Delivery Jan-15
10	Detector supports	22	8	30-Mar-15	15-Apr-15	10	Jun-15	40%
11	Field clamps and supports	6	3	2-Feb-15	2-Apr-15	8	Jun-15	80%
12	Beamline supports	4	1	28-Jan-15	15-Jun-15	10	Sep-15	20%
13	Shielded beampipe and vacuum chamber	6	3	19-Nov-14	2-Dec-14	16	Apr-15	70%
14	Beampipe correctors	4	2	18-Dec-14	12-Sep-14	16	Jan-15	50%
15	Pole inserts	2	1	12-Mar-15	5-May-15	4	Jun-15	20%
18	Electronic s Hut	6	2	24-May-15	1-July-15	12	Oct-15	10%

Summary

- **Magnet modifications and testing at lower current have been successfully completed.**
- **All WBS 1 items are either completed or in progress to be completed in FY15.**
- **Design and engineering of WBS 2 items has started.**
- **Sufficient resources are available to complete WBS 1 and WBS 2 items in FY15**