

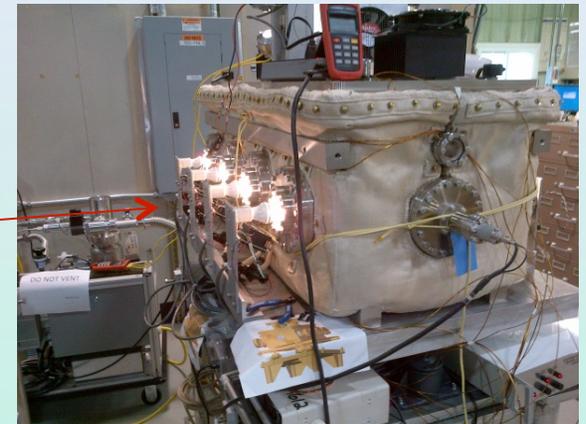
Instrumentation Update for RUN-14

RHIC	Stochastic Cooling 56MHz Cavity E-Lens (talks: S. White, today; X. Gu, today, P. Thieberger, tomorrow) Transverse and longitudinal bunch-by-bunch dampers (talk: K. Mernick, today) New Bunch-by-bunch diagnostics Polarimetry Spin flipper/RHIC BPM million turn capabilities IPM status Abort kicker R&D
AGS	e-IPM update (talk: R. Connolly, tomorrow)
Booster	BLM and BPM
Linac	Laser Profile Monitor
EBIS	Laser Ion Source (LION)
Future Projects	ERL (talk: D. Kayran, tomorrow) CeC PoP (talk: V. Litvinenko, today) Gatling Gun (talk: J. Skaritka & E. Wang, tomorrow) LEReC (talks: A. Fedotov, tomorrow; R. Hulsart, tomorrow) BLIP Raster Upgrade

Stochastic Cooling

Kickers

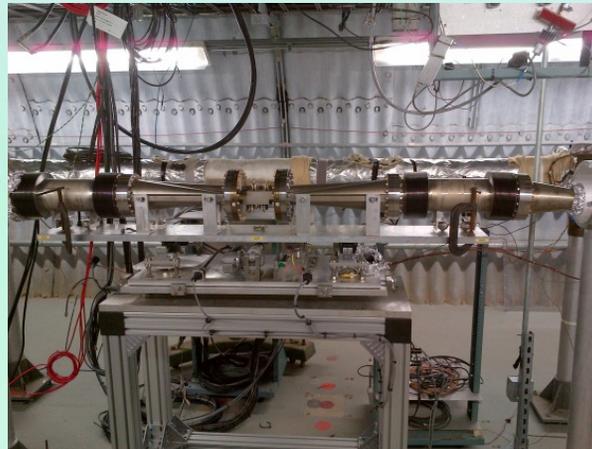
- two new longitudinal kickers - 3 tanks each, 16 cavities per tank (sector 4 blue & sector 11 yellow)
- new cavity tuning system using lamps with variable intensity
- status: to be installed



longitudinal kicker with lamp heaters on test stand

Longitudinal pick-ups

- new pick up in sector 1
- new tunnel port to existing pick-up in sector 2 (shorter signal path)
- status: done



Sector 1 Longitudinal pick-up with horizontal motion stage

microwave link circuitry with 16GHz upgrade

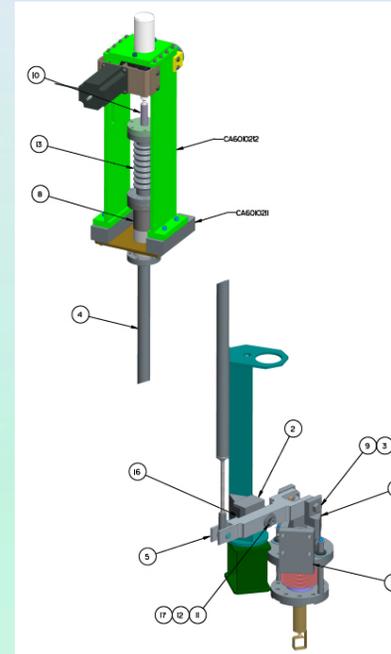
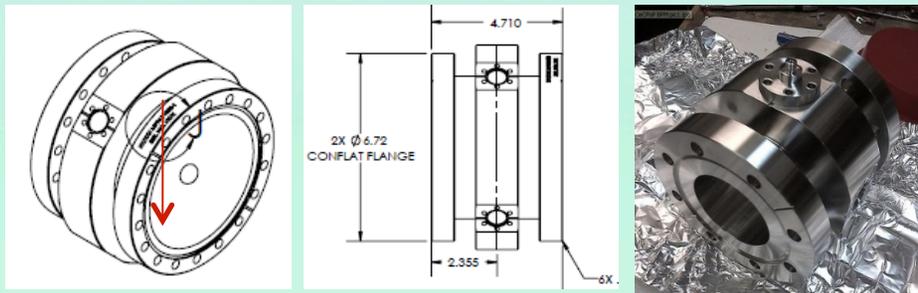
Microwave link

- changed local oscillator from 10MHz to 16GHz to improve performance



New 56 MHz Cavity

- installation at IR4, infrastructure in 1004D trailer
- motion controls
(tuner – coarse & fine, fundamental damper)
- replacement of sector 3 DX BPM strip line with
(short) button BPM



56MHz motion control at the VTF



- new infrared detectors (shown at right)
- impact on AC Dipoles / AC quadrupole
 - removed the AC dipoles & AC quadrupole for 56MHz installation
 - will re-install AC Dipoles (only) after 56MHz installation with shifted position due to space constraints
 - (will retune cap banks in the tunnel for the Au beams)

56MHz IR detector



B Sheehy & P. Ziminski

Electron Lenses

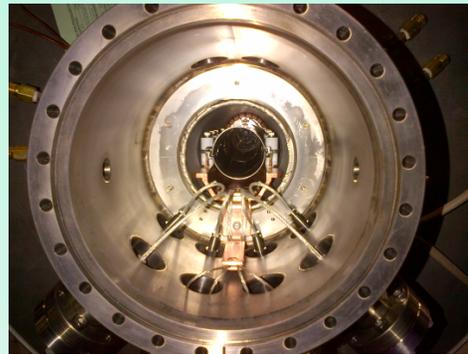
initial beam commissioning using EBIS SC solenoid (during run-13) shutdown:

- EBIS SC solenoid removed, new solenoids positioned
- Blue & Yellow E-Lens solenoids magnet measurements completed
- effort now underway to install both E-lens, guns, collectors and all peripheral equipment
- subsystem and system hi-pots completed
- pre-beam system testing ongoing

Blue E-Lens 12-17-13



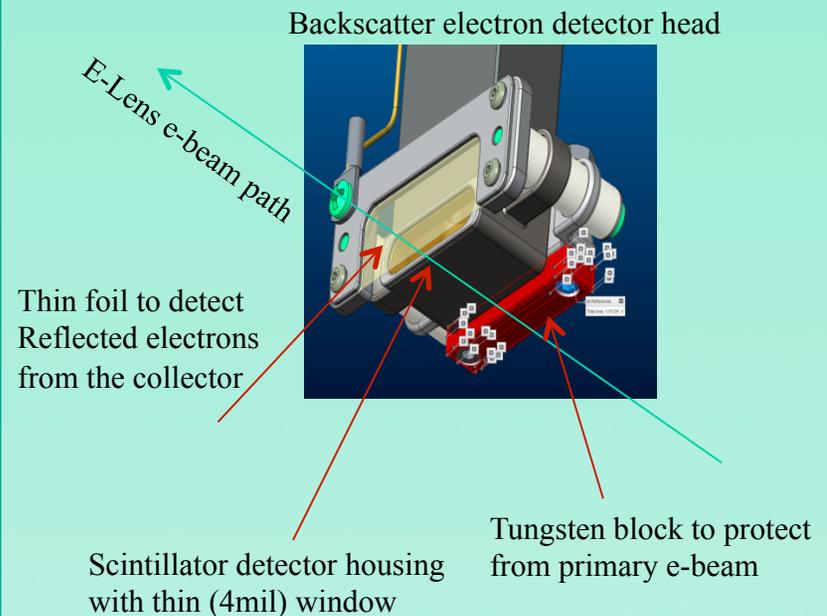
Yellow E-Lens 12-17-13



Blue E-Lens BPM and drift tube signal cables to feedthroughs

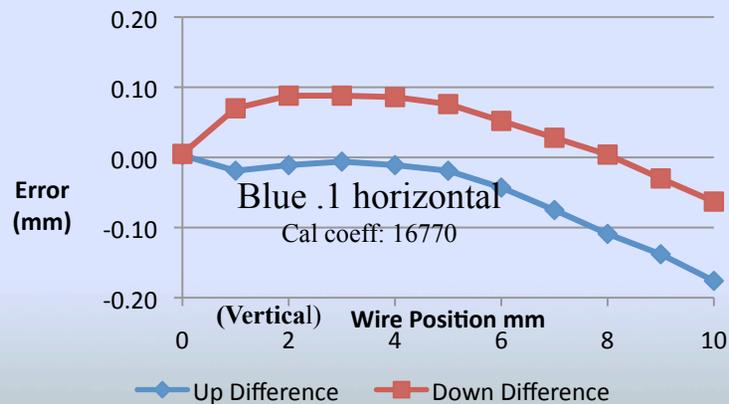
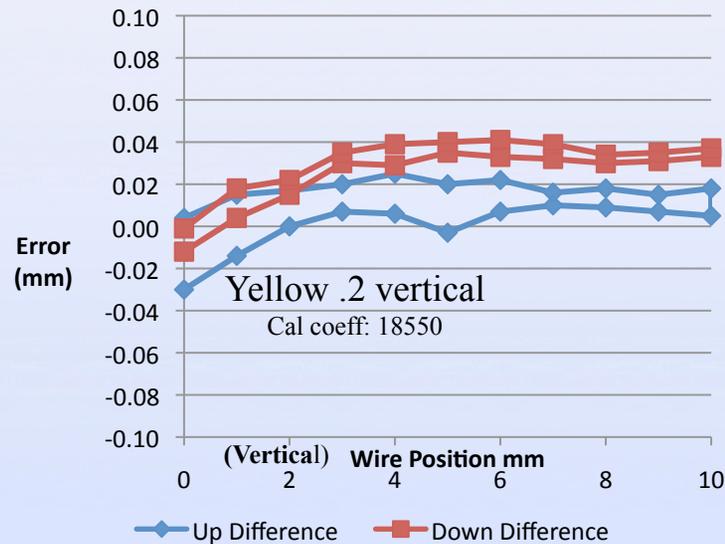
Backscattered Electron Detector

Peter Thieberger 15:15 Friday



Electron Lens BPMs

E-Lens BPM wire scan results



- Tests with wire scanner revealed that crosstalk between planes can be reduced by rotating BPM device.
 - Conclusion: crosstalk measured with beam last year is likely due to rotation of the BPM.
- Tests with wire scanner revealed that different calibration coefficients are required for different BPM units, and for each plane.
 - Conclusion: mechanical assembly variations in striplines are the cause.

Transverse and Longitudinal bunch-by-bunch Dampers

- see K. Mernick's talk today on new transverse damper system being installed in sector 5
- see K. Mernick's talk (RHIC retreat, 2013) on longitudinal bunch-by-bunch damper in yellow sector 1. Shutdown: removed and repaired - all feedthroughs and stand-offs were replaced and reinstalled

Longitudinal bunch-by-bunch damper & ARTUS 2 + 2 meter long assembly in Sector 1



RHIC IPM status

replaced Blue Sector 1 Horizontal MCP

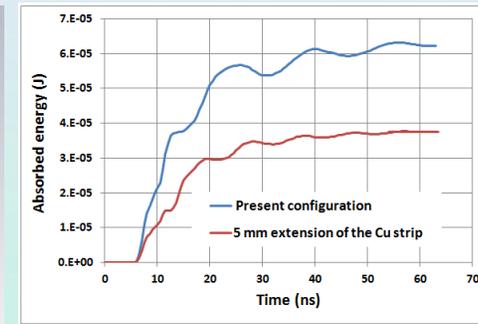
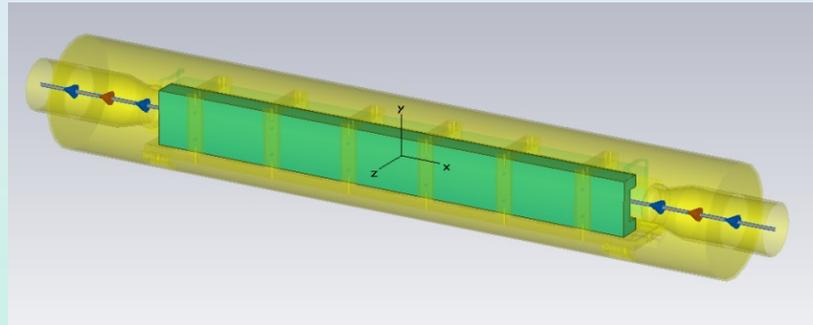
New Bunch-by-Bunch Diagnostics

RUN-13	hardware	RUN-14
Bunch-by-Bunch Beam Phase (for longitudinal damper)	LLRF platform	same
Bunch-by-Bunch Coherence	(data from new daughtercards from 10 Hz feedback, Zynq-based FPGA)	same
Bunch-by-Bunch Beam Loss	adapted ML510 (spares from 10 Hz feedback)	same
Bunch-by-Bunch Luminosity (at PHENIX)	adapted ML510 (same board)	same at PHENIX new for STAR
Bunch-by-Bunch Beam Position (at dump for abort kicker studies, either blue or yellow - not both)	1 Zynq development board (from RHIC BPM upgrade R&D)	2 new dedicated assemblies (Zynq)
	LLRF platform	Bunch-by-Bunch Beam Position (for transverse damper)

RHIC Abort Kicker

multi-group effort (experimental and theoretical) to understand performance limits at high beam currents

Microwave Studio
Simulations
(P. Thieberger)



CERN Low Sensitivity BLMs

- **purpose is to more accurately characterize loss pattern at the dump**
 - RHIC ion chamber BLMs saturate during beam dump (70nC/rad)
 - will install 2 new evacuated secondary emission pick-ups, courtesy of CERN (7.6pC/rad)
 - signals to be processed by standard RHIC BLM electronics



CERN BLMs detectors



CERN BLMs internal secondary emission electrodes



Existing loss monitors at the dump

- **no beam dump related quenches expected with gold beams during run-14**

Polarimetry

R&D related to fiber breaks in RHIC during run-12 and run-13

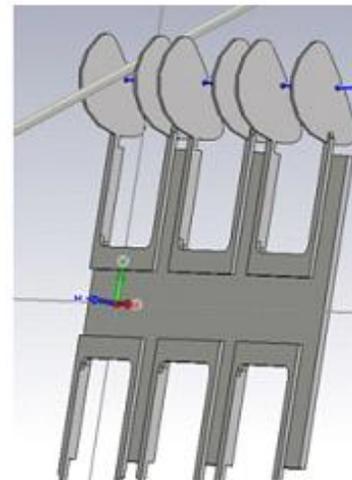


- Target video spectral analysis (T. Tsang)
data from run-13 with various narrowband optical filters analyzed
preliminary conclusion – dynamics in core and wings not same
plan: continued R&D using additional spectrometer
reference: “Light spectra of RHIC targets”, T. Tsang

<http://www.cadops.bnl.gov/AP/spinmeeting.htm>

hed

- New target holders
(J. Kewisch, G. Mahler)
modeling using Microwave Studio
see presentation by Jorg, Friday



CST model



Spin Flipper

- planned studies during gold run-14
 - verify bump closure quality (better than 50dB) with gold beams
 - test new controls firmware and/or algorithms and check Jorg's optimizer routine
 - test for system reliability and repeatability to prepare for routine operations
- data acquisition
 - test BPM data acquisition and analysis methods (using 1024, 2048, 4096-turn capabilities) using multiple data sets of all of the BPMs combined to reduce errors
 - million turn BPM data (memory expansion card technology merged into standard DSP code)
- other hardware modifications:
 - spin flipper 2 HV feed through repaired, all chassis modified to minimize HV breakdown
 - new spare XMC AC dipole controller daughter cards
 - voltage divider was upgraded to isolate the power ground return paths



Spin Flipper development chassis



Spin Flipper daughter card with memory and heat sink



Spin Flipper bare daughter card, each card controls one AC dipole

courtesy P. Oddo

Injector Upgrades - AGS

e-IPM update R. Connolly's talk

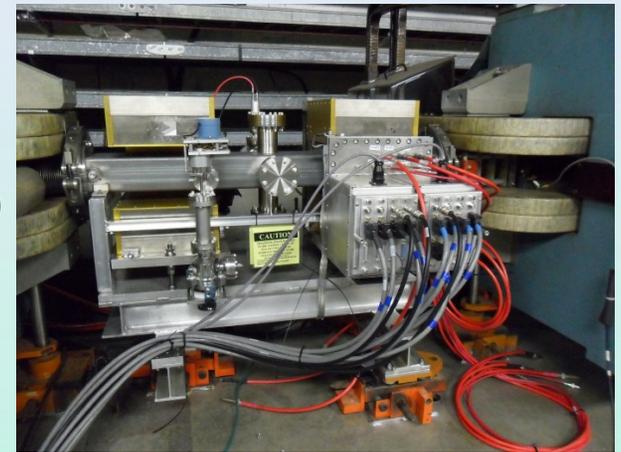
will remove D5 H e-IPM assembly

(to install back leg windings around permanent magnet)

preparing for D15 V e-IPM installation:

tunnel electronics fabrication and testing is underway

house electronics should be ready during the run



AGS D5 IPM installed with MCPs & electronics

J7 Plunging Stripping Foil

- inner is OK and is typically used for operations.

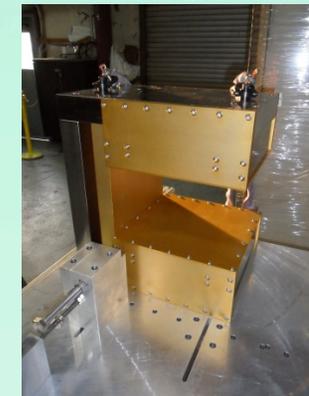
- outer was repaired (back-up)

F5 Jump target ready if needed, was tested late last run

C15 Polarimeter – detector and grid modifications were made, new sources ordered, planning for installation in March

AGS BPMs - 3 BPMs to be repaired (in tunnel) by the start of the run

new cables - G10 kicker and A3 PUE to fast scopes, & CT normalized signal from 911B to 929



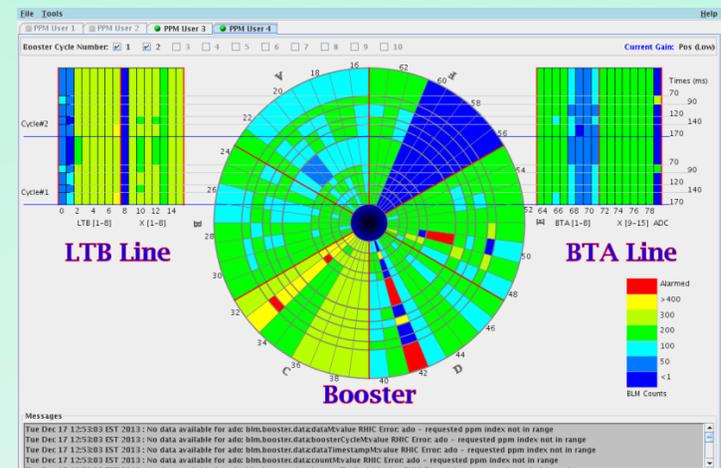
AGS D5 IPM permanent magnet showing back leg

Courtesy J. Fite

Injector Upgrades – Booster BLMs

- **Loss Monitor Resurrection**
- **Booster loss monitor system was no longer delivering data due to failing hardware**
 - Since hardware interlocks were no longer used (connected), it was decided to make this system more like the AGS loss monitor
 - Monitoring only with software alarms
 - Most of the interlock hardware was removed
- **Failing Multibus crate was and beyond repair and replaced with standard VME crate**
 - Was last controller limiting booster to four users
- **Existing Datel data acquisition cards reused via new ADO**
 - Similar software interface to MADC
 - Alarming similar to AGS loss monitor manager
- **New Booster loss monitor application (BoosterBlmView)**
 - Controls Group working on functionality and testing.
- **Other efforts underway**
 - Need to make minor repairs in the B-BLM argon gas distribution system

BoosterBlmView application window

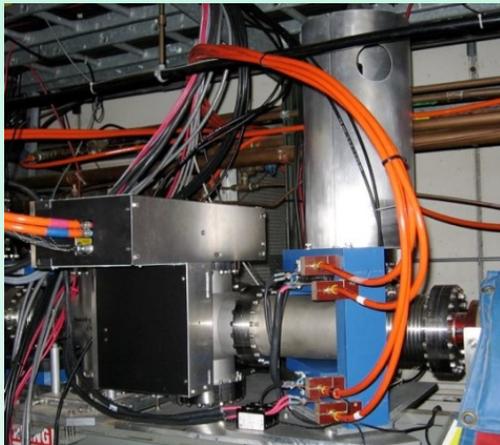


Injector Work – Booster BPMs

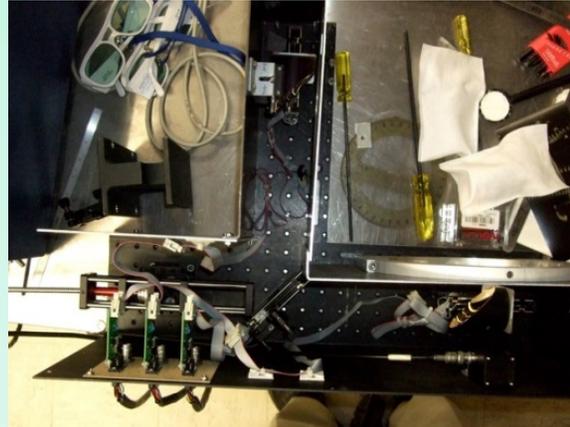
- “Dead-BPM” list reviewed, total of 5 BPMs added to orbit system
- The B4 PUE was found to be backwards since the original installation
 - Checked the cabling in the tunnel and the 914 rack against the documentation and found and fixed a cable swap in the rack. This PUE should be OK now.
- The A2 PUE was not working
 - No signal from the inside plate of the PUE.
 - Impedance matching transformer on the inside plate was faulty.
 - Impedance matching transformers on inside & outside plates were removed.
 - Connected a cable for the calibration loop that runs to the racks in 914.
 - Having the cal loop available outside the Booster ring will make future debugging easier.
- A reminder that the A2 & A8 signals are split and sent to the radial loop and orbit system.

Injector Upgrades – Linac LPM

- **installed new Quantel Ultra 50 Nd:YAG Q-switched laser**
 - 50mJ/pulse, 10ns long, 1064nm wavelength
 - Nd:YAG lasers wavelength is right at the peak of the ionization cross section
 - The fastest the laser can fire is 20Hz, so we fire one pulse/linac cycle (6.6Hz)
 - Fiber optic cable transports light to LPM, laser source in service building
- **installed motion stage used to scan laser across the beam**
- **installed new corrector magnet windings**

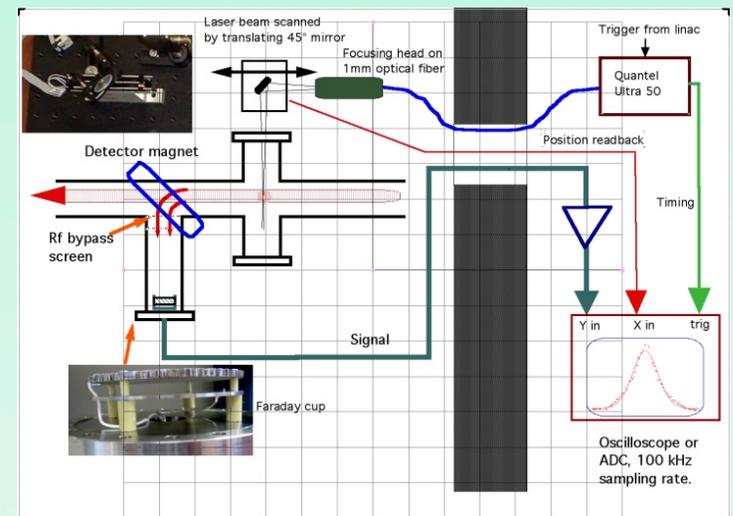


LPM installation in HEFT



Inside of the optical box showing the optical fiber launch and the 45°parabolic mirrors used for final focusing

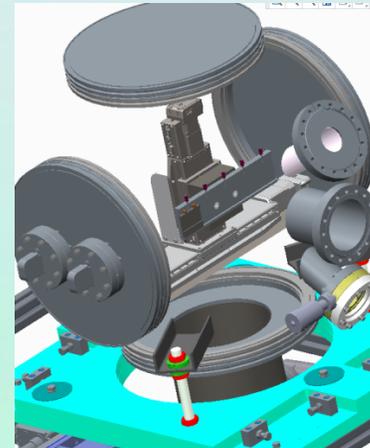
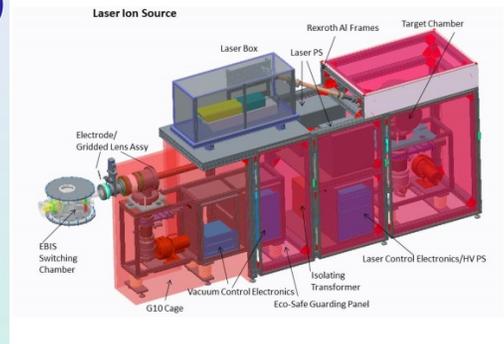
LPM Block Diagram



Courtesy R. Connolly et al

EBIS - Laser Ion Source (LION)

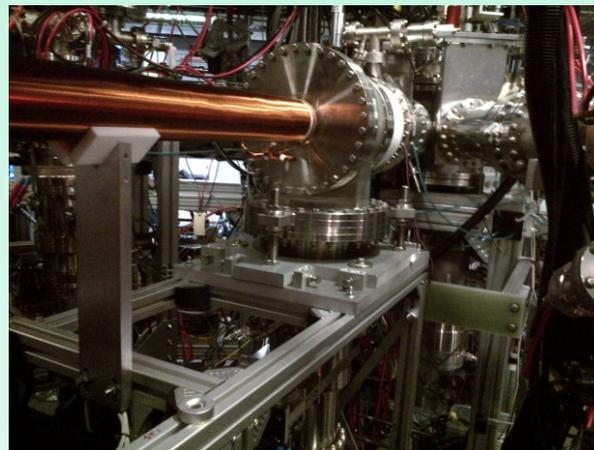
- LION structure was assembled in 919B
- target X-Y motion stage h/w & s/w development
- subsystems tested, platforms and grids hi-potted
- moved assembly to 930 EBIS
- effort towards completion is underway



LION target X-Y motion stage inside target chamber



LION view left side



LION downstream transport and switching chamber



LION view right side

R & D - ERL, CeC, LEReC, Gatling Gun

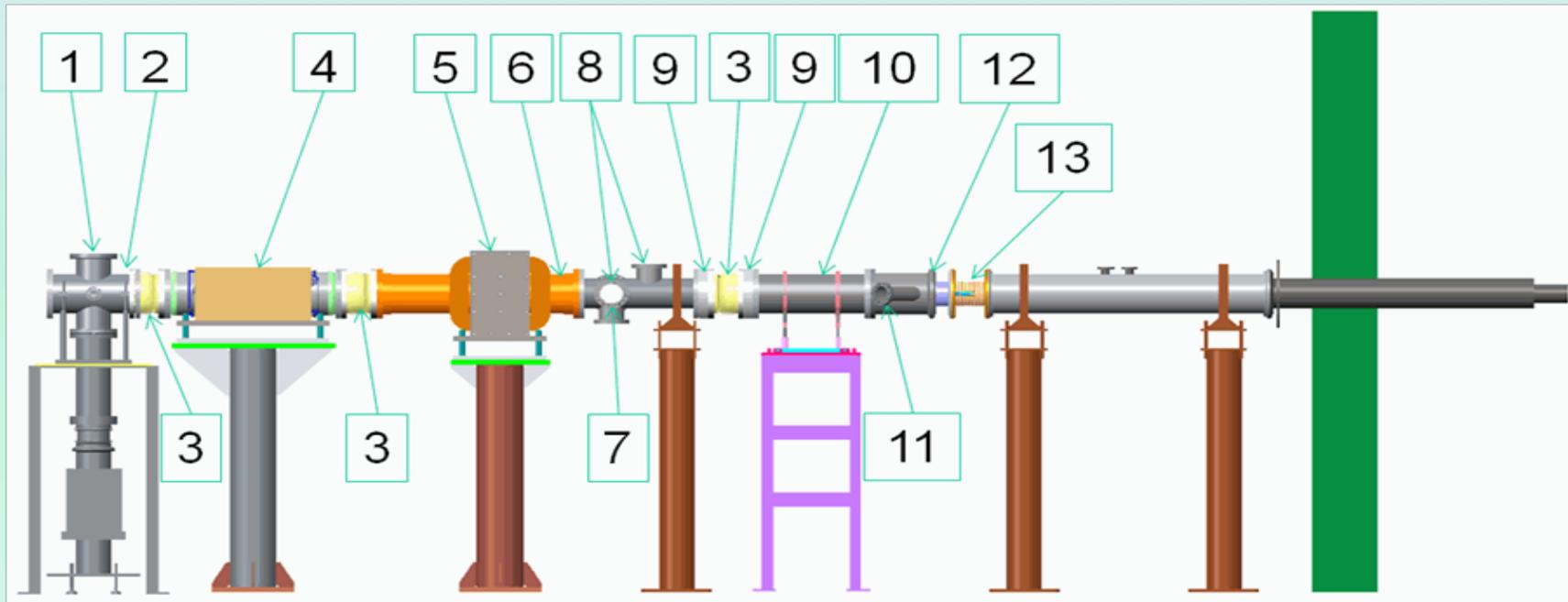
- **Energy Recovery Linac (talk: D. Kayran, Friday)**
 - first beams to straight beam line and dump planned mid-January, then work towards high-power (35mA) beam later this year
 - working on current monitoring strategy to meet RSC requirements
 - testing Libera and BNL BPM electronics with ERL BPM pick-up at ATF with live e-beams
- **Coherent electron Cooling (talk: V. Litvinenko, Thursday)**
 - phase-1 system being installed, first low power beams planned during run-14
- **LEReC (talks: A. Fedotov and R. Hulsart, Friday)**
 - preliminary design is underway with cost estimates
 - recent revisions include using the ERL 5-cell cavity and energy recovery
- **eRHIC Gatling Gun (J. Skaritka & E. Wang, Friday)**
 - first low-power beam tests at Stangenese (California) planned for late January
 - plan is to combine beam from 2 opposing cathodes using the combiner
 - gun will be shipped to BNL later this year for further testing in 905



CeC 500MHz cavities and gun

BLIP Raster Upgrade

project scope: design, fabricate, install and commission a BLIP Raster system with the components shown in the proposed beamline layout, including all required mechanical, electrical and software systems.



1. plunging harp
2. 6.50" collimator
3. aluminum bellows (3x)
4. raster magnet
5. steering magnet (existing but relocated)
6. 4.00" collimator

7. plunging harp (opposite side)
8. laser profile monitor
9. beam current transformers (2x)
10. beam position monitor
11. Viewport and electron suppressor
12. beryllium window (existing)
13. aluminum bellows (existing)

Courtesy R. Michnoff et al