Mechanical Operation and Maintenance Vacuum Group

AES-MOM Vacuum Group UHV support and services

- **APS**
- **Argonne National Laboratory**
- **National Laboratories**

The AES-MOM Vacuum Group at Argonne National Laboratory delivers engineering support to the Advanced Photon source, beamline users, Argonne and its sister laboratories. The Vacuum Group has been at Argonne since the APS was being built. The group has aided in design and manufacture of the APS and many other accelerator systems. The continued focus is the maintenance and upgrade of the APS by utilizing new UHV technology and practices.

The Vacuum Group also pursues R&D activities for future accelerator and beamline components. All new UHV designs need to be tested and that is where this group comes in. We have the facilities and knowledge to aid in the design and completion of UHV systems.

AES-MOM Vacuum Group - Who we are

Staff

- **George Goeppner** – Group Leader
- **Joe Gagliano** – Section Leader
- **John Hoyt** - Engineer
- **Try Leng Kruy** – Engineer
- **Mark Martens** – Chief Technician
- **John Zientek** - Engineer

Technicians

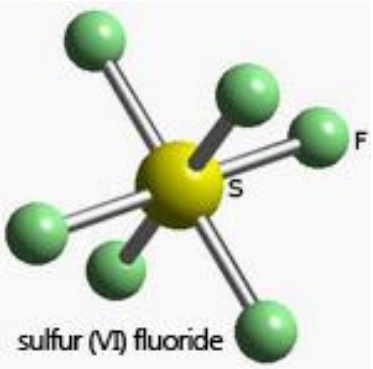
- **Scott Abbeduto**
- **Jack Burke**
- **Cheri Giacomi**
- **Guy Harris**
- **Kevin Knoerzer**
- **Aaron Lopez**
- **Raul Mascote**
- **Wayne Michalek**
- **Russ Otto**
- **Cristen Sarne (CJ)**
- **Robert Wilson**

AES-MOM Vacuum Group – What we do

- **Provide support for all APS vacuum related equipment**
  - Linac, Par, Booster, Storage Ring and Front Ends
- **Provide support for all pneumatic related systems**
  - Gate valves, safety shutters, photon shutters and beamline pneumatic doors
- **Provide support to the USER community**
  - USER Beamlines (vacuum and pneumatic systems)
- **Unique fabrication capabilities in building 382**
  - Aqueous cleaning, robotic welding, inspection of components, vacuum leak checking, high temperature vacuum oven, assembly of critical components, vacuum testing and vacuum certification

Sulfur Hexafluoride (SF_6) System for LINAC

- Sulfur Hexafluoride (SF_6) as a dielectric
- Decomposition of SF_6 is due to extreme arcing and moisture
- Assumed responsibility for the SF_6 system in 1997
- “Out of gas” condition and pressure switch failures caused many hours of down time

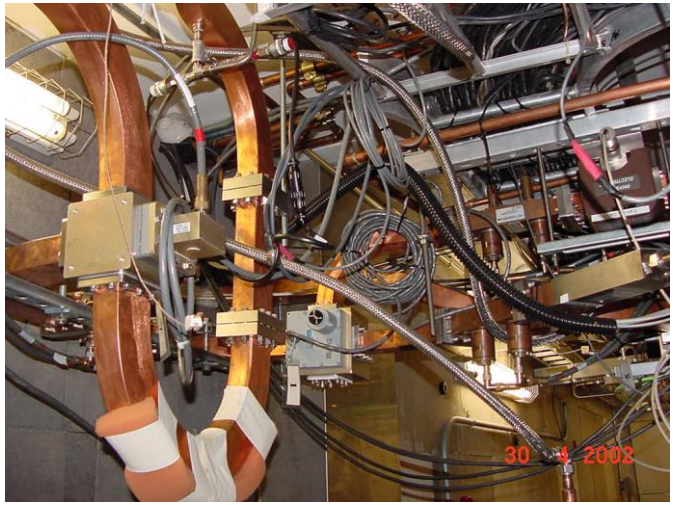


SF_6 Molecule

SF_6 Linac Waveguide

- **A control system developed by the Vacuum Group and has been in operation since fall of 1998**
  - Currently, the SF_6 gas that is removed from the Linac waveguide is expelled into the atmosphere
- **New SF_6 Control System**
  - Developed and currently being tested in building 382
  - Will reclaim more the 98% of this green house gas
  - Automated testing of SF_6 for "SO_2" contamination

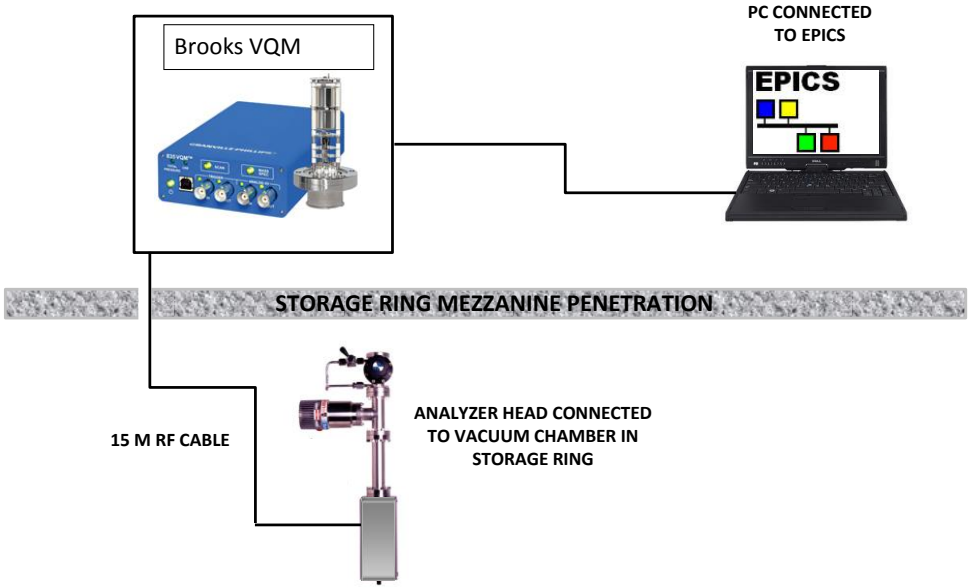
Linac Stage 3 SF_6 Switching Waveguide



Thermionic RF Gun SF_6 Switching Waveguide

Storage Ring Residual Gas Analyzer (RGA)

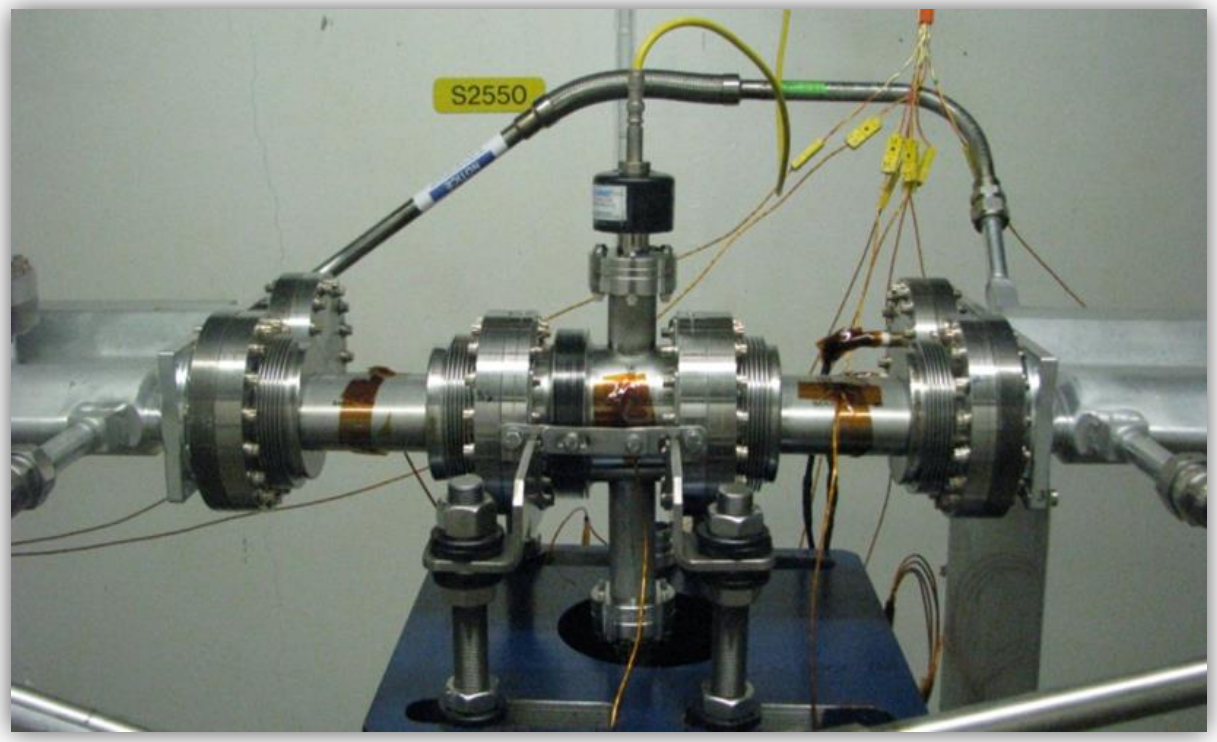
- **Storage Ring RGA systems**
  - Original system was Spectra
  - No longer supported by vendor
  - Current system is Brooks 835 VQM



Storage Ring RGA Configuration

Storage Ring - BNL Bellows Test

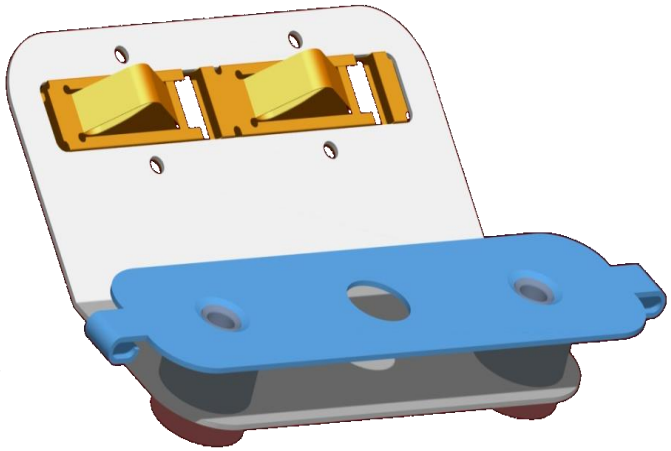
- **BNL Bellows Test at APS – NSLS II**
  - BNL bellows installed into Sector 25 - April 2010
  - Successful testing concluded in April 2012



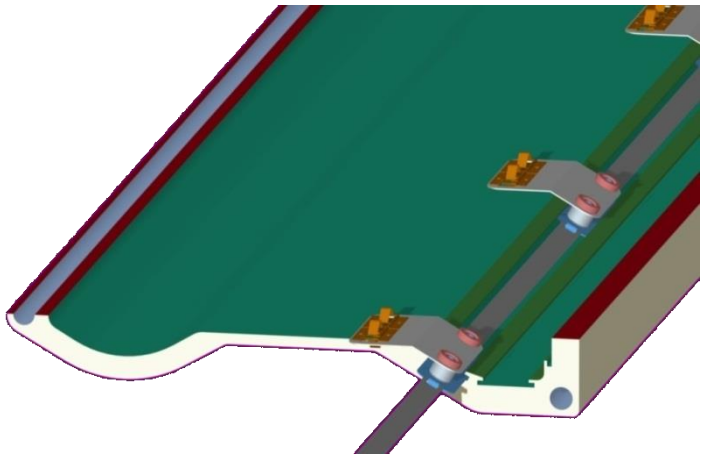
BNL Bellows Test Setup at Sector 25

Storage Ring - Diagnostic Snubbers

- **Diagnostic Snubbers**
  - In FY10, designed, prototyped and installed Snubbers
  - Snubber design significantly reduced and/or eliminated transverse electric modes (TE)
  - Effectively alters the geometry of the vacuum chamber by periodically shorting the high field region in the small gap
  - At present, 13 sectors are installed with Snubbers
  - Installation is ongoing



Diagnostic Snubber Carrier

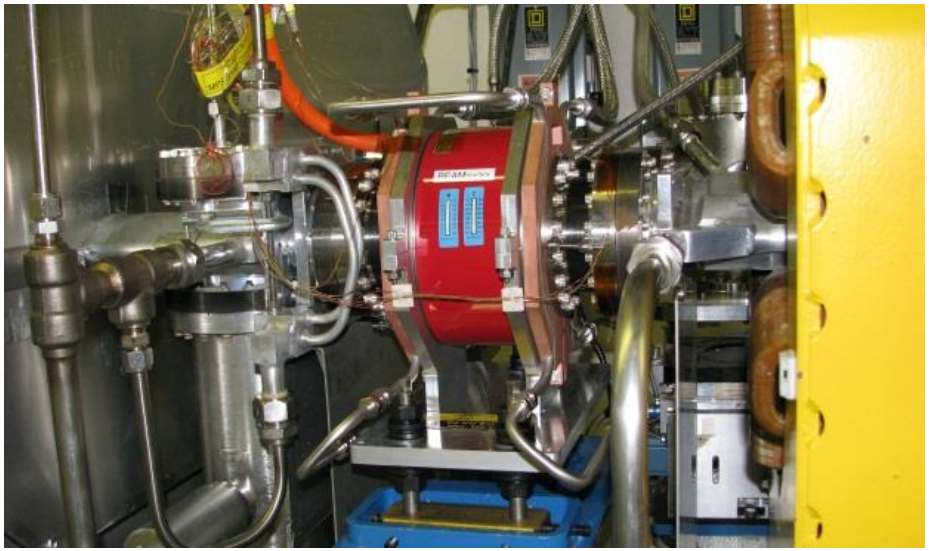


Diagnostic Snubber Carriers and Connecting Links

Storage Ring Current Monitor

- New DCCT Current Monitor installed in Sector 36 during September 2012

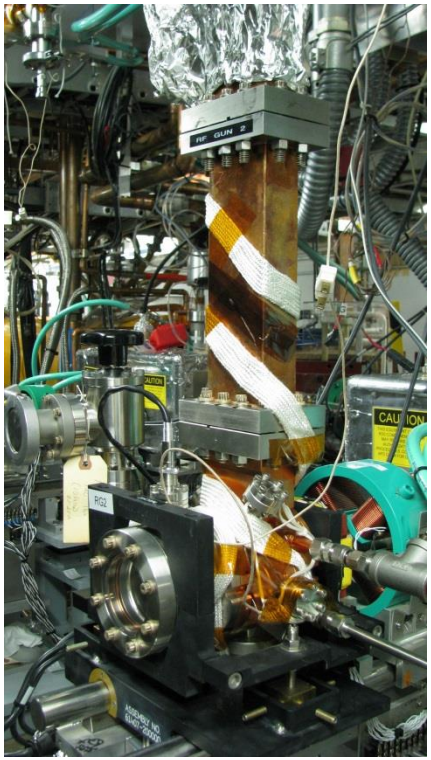
Size Comparison – New and Old



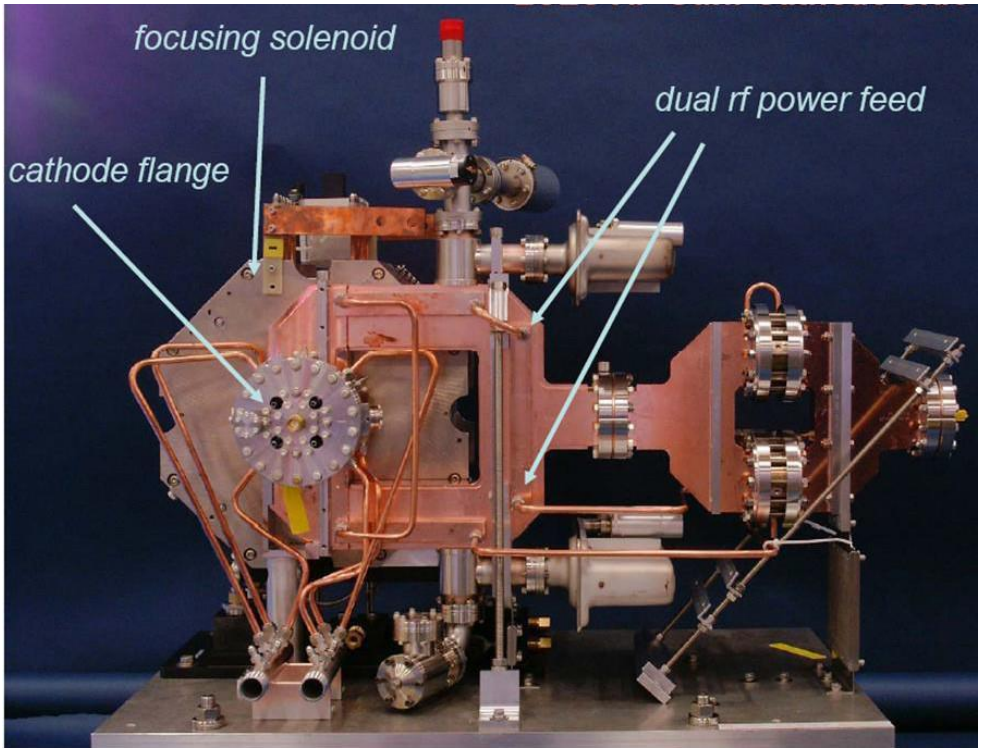
DCCT Installed in Sector 36

Linac Thermionic RF Guns - PC Gun - BBC Gun - T Cavity

- **Continue to give support on the LINAC Thermionic RF Guns, Ballistic Bunch Compression Gun (BBC), Photo Cathode Gun (PC) and the Deflecting T-Cavity**



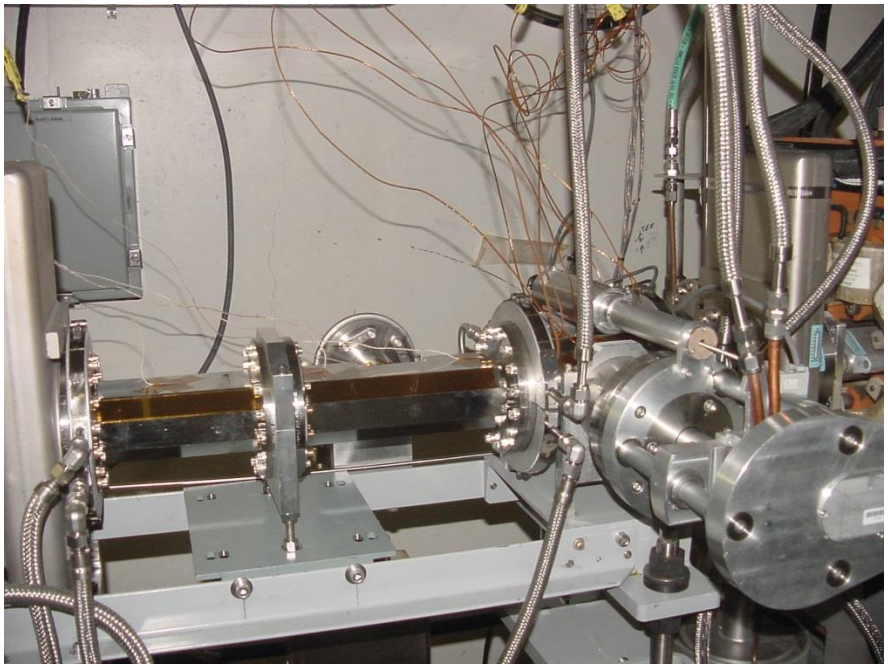
Generation III RF Gun



New Photo Cathode Gun

Sector 37 Scraper

- **Continued support on the Sector 37 Scraper design, fabrication and installation**
  - Currently working on a new scraper design with ASD Physics and AES-MED personnel



Scraper Installed at Sector 37

Superconducting Undulator

Front End Pneumatics

- **Responsible for the design, fabrication, installation and commissioning of pneumatic components for all new front ends**

New Front End Pneumatic Cylinders at 23 ID

Pneumatic Door Upgrade for APS Beamline Stations

- **Responsible for maintaining beamline pneumatic doors**
  - Existing design has more than 80 pneumatic connections
  - Existing design extremely difficult to troubleshoot
- **Designed and fabricated new pneumatic control box**
  - New pneumatic control box uses state of the art components currently used on new front ends

Robert Wilson - Upgraded Pneumatic Door Box

Existing Pneumatic Door Box

Building 382 – "UHV Vacuum Factory"

- **Complete fabrication facility**
  - Inspection
  - Aqueous cleaning
  - Baking of vacuum components
  - Welding
  - Assembly and testing

- **Precision advanced arc welding systems**
  - Multi-axis contouring, integrating all welding parameters for a given weld path

Building 382 – “Vacuum Factory”

Aqueous Cleaning

Inspection

Building 382 – "UHV Vacuum Factory"

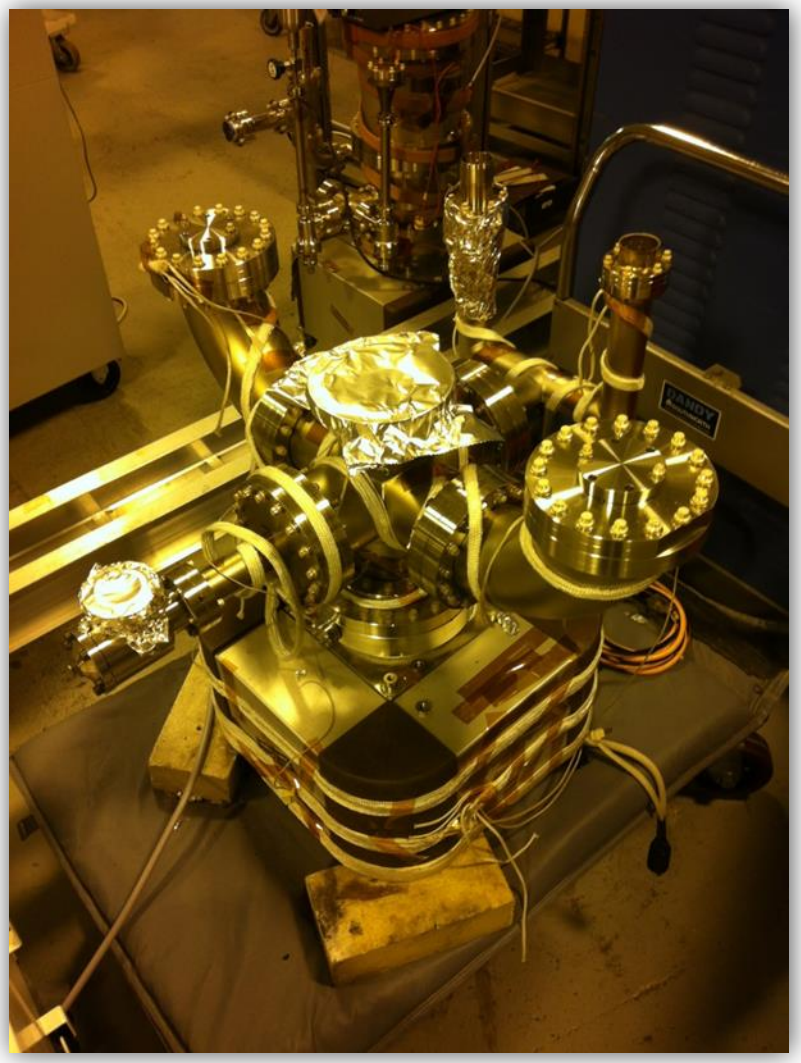
Vacuum Oven

Vacuum Chamber Testing and Certification

Alternate Aluminum Gasket supplier for ANL Storage Ring

Gasket Sizes

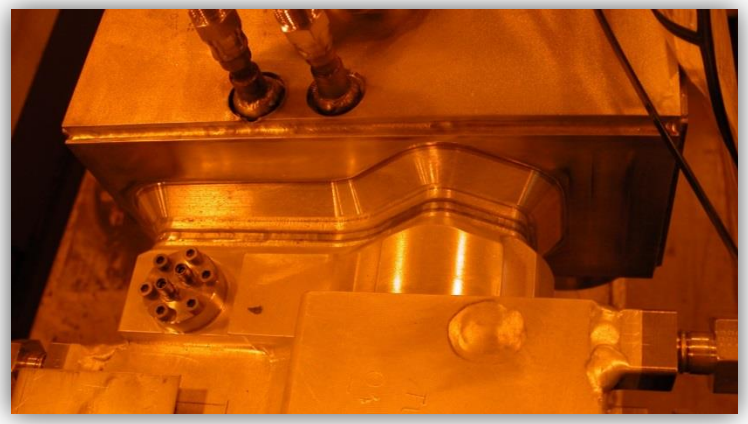
- 2.75”
- 4.5”
- 6”
- 8”
- 12”



Gasket test apparatus

Precision Advanced Arc Welding Systems

- **Manual and Automated welding services**
  - Provide weld development
  - Provide welded components that meet or exceed Mil Spec requirements



- **Components fabricated using automated welding equipment**
  - All vacuum chambers for APS
  - All ID vacuum chambers for APS

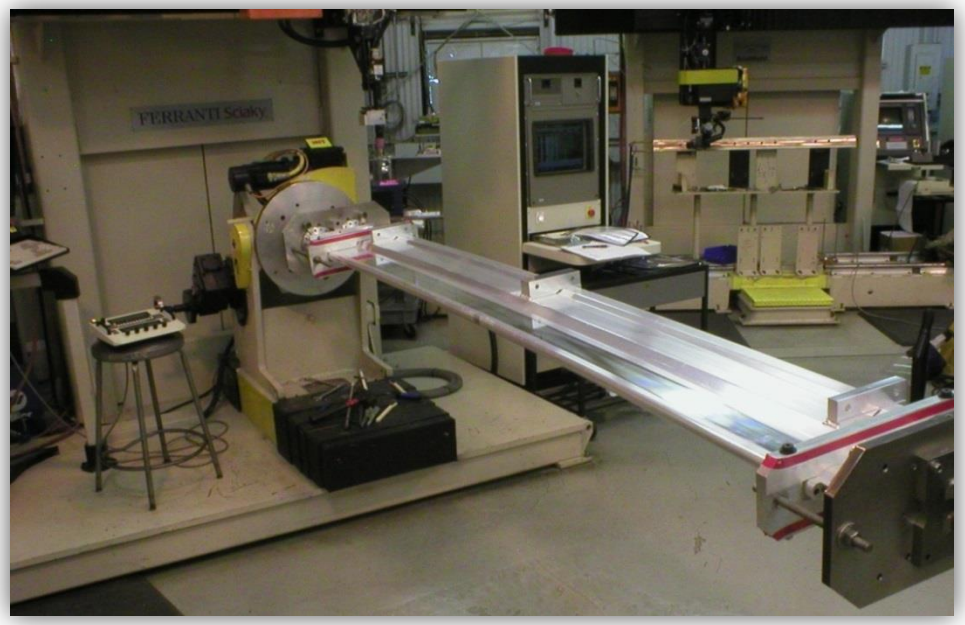
Components Fabricated at APS

- BESSY II chambers
- DESY FEL chambers
- SLS chambers
- ESRF chamber
- CLS chambers
- LBL chambers
- KEK chambers
- NSLSII storage ring chambers
- LCLS chambers

Fermi Numi Horn fabricated at Argonne using innovative welding methods to assemble and straighten the Numi Horn for Fermi lab Neutrino Experiment

Support of Brookhaven National Lab NSLS II

Inspection and Inventory

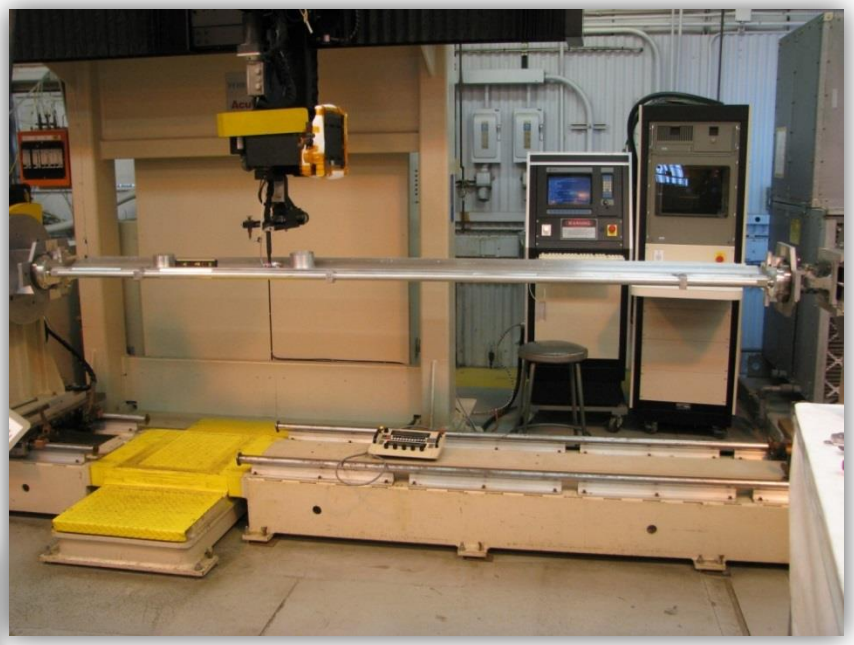


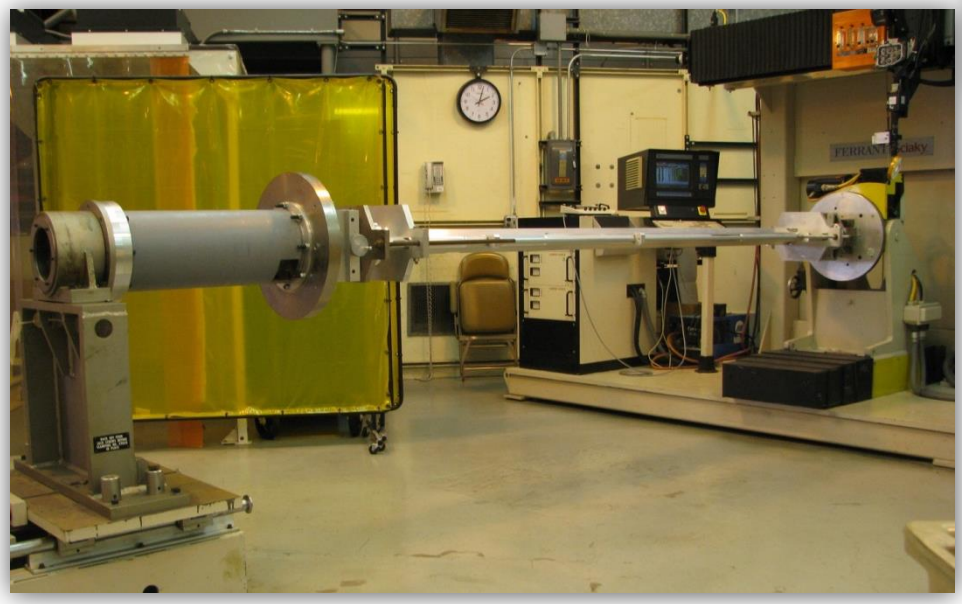
Welding

UHV Bake and Vacuum Certification

Precision Advanced Arc Welding Systems

NSLS II Chamber





APS and USER Support

- All AES-MOM vacuum services are available to all Argonne facilities
- Routine maintenance on all vacuum pumps and Leak Detectors
- Verify beamline vacuum status
- Provide leak check service
- Building 400 and 382 clean room
- Building 382 UHV services

MOM Ticket System and Tech Tuesday

- **Ticket system**
  - Support for mid-sized tasks that require less than 40 hours of support services are requested through a simple-to-use on-line request system.
  - http://www.aps.anl.gov/APS_Engineering_Support_Division/Mechanical_Operations_and_Maintenance/support/support.html

- **Tech Tuesday**
  - Jobs requiring only a few hours of support - On Tech Tuesdays technical assistance is provided for small, quick tasks on Tuesday afternoons during user beam operations - Tuesdays typically being maintenance days. Requests are submitted through a simple-to-use-line request system.
  - http://www.aps.anl.gov/APS_Engineering_Support_Division/Online_AES_Support/support_tt.html

Thank you

- George Goeppner
- Joe Gagliano
- Nick Sereno

Links

http://www.aps.anl.gov/APS_Engineering_Support_Division/Mechanical_Operations_and_Maintenance/