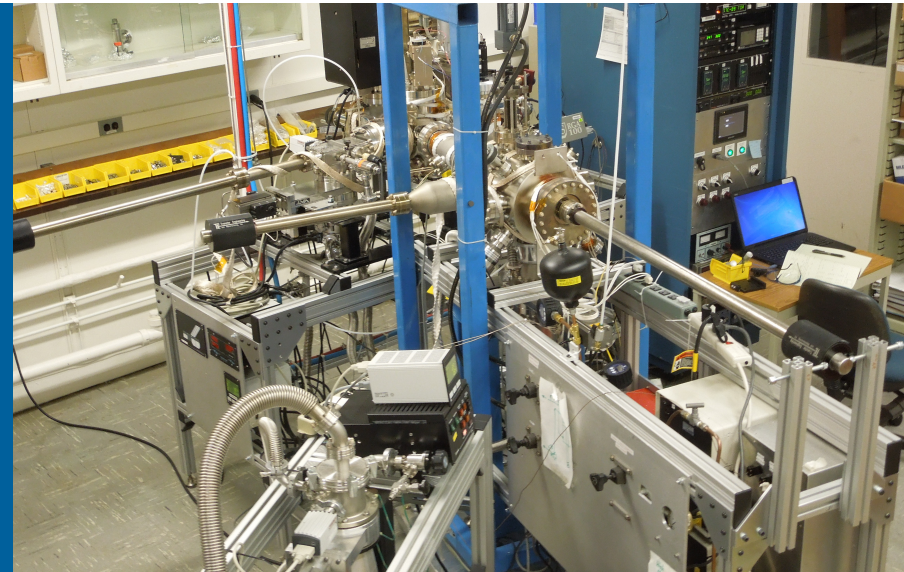


BLDG 366 FABRICATION FACILITY AND MACHINE SHOP



BOB WAGNER
Detector R&D Group Leader

KEN WOOD
Building 366 Manager

ALLEN ZHAO
Mechanical Group Leader

BUILDING 366 FABRICATION FACILITY OVERVIEW

Rapid prototyping, Experiment (sub)Detector Development & Construction, Experimental Support

- Fabrication Facility and Machine Shop is staffed and managed by HEP Division Mechanical Support Group
- **History of constructing major detector systems for HEPD:** CDF E-M Calorimeter and Pre-Shower, Proton Decay (Soudan), ZEUS Calorimeter, ATLAS TileCal, MINOS near detector, DES F8 Mirror Handler
- **Frequent (rapid) prototyping for experimental development:** NOvA plane assembly, protoDUNE CPAs, Mu2e Cosmic Ray Veto installation, Mu2e Field Mapping System, NEXT-100 High Pressure Xenon TPC
- Facility is subject to frequent reconfiguration to accommodate needs of HEPD experiments and lab support. Examples:
 - g-2 MRI magnet for NMR calibration
 - Clean room for Physics Division SRF/HWR development; and cryostat
 - NOvA calorimeter gluing machine, assembly fixturing, 52'x52' prototype
 - Small room(s): ZEUS EM & HAC, Resistive Plate Chambers, Columnar Recombination for Dark Matter Detection, NEXT-100

FABRICATION FACILITY CURRENT PROJECTS (PARTIAL)

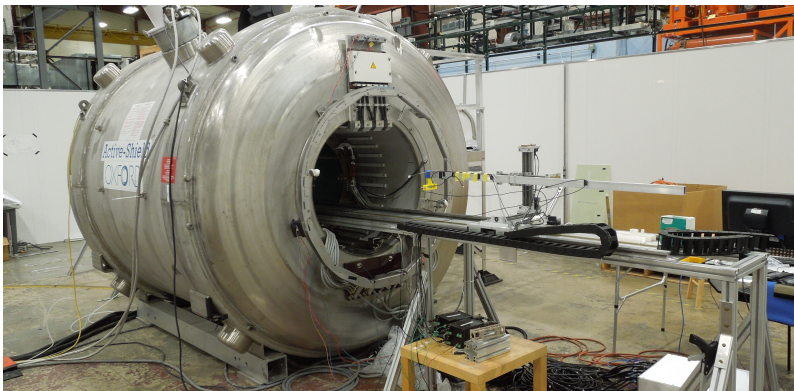
Prototyping, Experimental Support, Machine Shop



Mu2e CRV Installation Prototyping



Mu2e Magnetic Field Mapper Fabrication and Testing



g-2 MRI Magnet – NMR calibration
MCP photodetector magnetic effect studies



Bldg 366 Machine Shop – Design and fabrication for
HEPD experimental support

SAFETY CONSIDERATIONS COMMON TO WHOLE OF BUILDING 366

People entering building may encounter variety of potential hazards
Building manager controls access and hazard communication
Building access is via badge RFID only

▪ Safety Considerations

- Crane operation: hard hat, safety glasses, steel-toed shoes in lift area, crane and sling inspection each use, crane operator certification, barricades, badge access to building
- Forklift usage: hard hat as needed, safety glasses, operator certification, barricades, badge access to building
- Power and hand tool usage: safety glasses, cut resistant gloves as needed, barriers as needed
- Compressed gas cylinders: chained storage, separation of flammable or oxidizers, training, badge access to building, safety glasses as needed
- Electrical hazards: badge access to building, barricades, certification, shielded connections
- Laser usage: barricades, signage, laser safety glasses, badge access to building, operating permits as required

▪ Work Control Documents

- Building 366 Daily Operations (46245.2)



MU2E CRV INSTALLATION AND LIGHT LEAK CHECKING

Development fixturing for CRV module handling and installation, develop methodology for module light leak checking

▪ Safety Considerations

- Crane operation: hard hat, safety glasses, steel-toed shoes in lift area, crane and sling inspection each use, crane operator certification, barricades, badge access to building
- Floor bolt installation: Safety glasses, dust masks, vacuum collection of dust, face shield as needed, tool inspection
- Hand tool usage: cut resistant gloves, safety glasses, tool inspection
- DC Voltage (<100): Safety glasses, LOTO as needed, enclosed connections or commercial shielded connectors
- Work at Elevation: Guard railed lifts or scaffolds

▪ Work Control Documents

- Mu2e Experiment CRV Prototype Work (52673.3)
- Mu2e Experiment CRV Module Light Leak Test (53283.0)
- Building 366 Daily Operations (46245.2)



MU2E MAGNETIC FIELD MAPPER FABRICATION & TESTING

Development of mechanical support and motion control of field mapper; integration of field mapper systems and testing

▪ Safety Considerations

- Pinch hazard: shield potential pinch points, warning labels
- Rotating mechanical arm: warning barrier
- Work at elevation < 6': Platform for above ground work

▪ Work Control Documents

- Mu2e Experiment Field Mapper Prototype Work (53119.1)
- Building 366 Daily Operations (46245.2)



MACHINE SHOP

Fabrication of detector and experimental components for HEPD

▪ Safety Considerations

- Powered Machine Tools: machine guarding, safety glasses, certification for machine usage, training, machine inspection
- Abrasive grinding: machine guarding, safety glasses, certification, training, machine inspection
- Crush hazard: machine guarding, certification, training
- Hand tool usage: safety glasses, cut resistant gloves as needed, tool inspection
- Sharps hazard: cut resistant gloves, safety glasses, certification tool inspection
- Crane or forklift operation: hard hat, steel-toed shoes, safety glasses, barricades, operator certification, crane/sling inspection
- Material Handling: safety glasses and shoes, training, use of lifting equipment

▪ Work Control Documents

- Building 366 Daily Operations (46245.2)

- **Recent independent review of shops at Argonne cited Ken Wood and Frank Skrzecz for having best organized shop with clear and safe process protocols that had been seen at any national lab.**



FABRICATION FACILITY SAFETY RECORD

- 0 reportable injuries since Facility inception in early 1980s
- 1 safety incident since inception (Bldg 369, early 2000s)
 - Physicist foot trapped when vertical stack of MINOS detectors shifted
 - **Response:**
 - Remove shifted detectors to free foot. No injury
 - Restack detectors horizontally to prevent unanticipated movement

FABRICATION FACILITY AND MACHINE SHOP SAFETY PROTOCOLS (1)

- Building access is Badge RFID controlled 24/7
 - Machine shop and MRI magnet room doors closed and locked during off-hours
- Visitor access is by permission of Ken Wood, Building Manager
- All personnel (HEP and Visitors) must follow entrance requirements
 - No open-toed shoes; steel-toed shoes for handling material > 50lbs.
 - Hard hats if in vicinity of crane operation
 - Respect barricades, barriers, warning signs
 - Safety glasses required in machine shop and as needed for other work in building
 - Certification and permission required for machine tool usage
 - Other requirements or PPE dependent on nature of work and/or hazards present
- Work Control Document 46245 covers Building 366 Daily Operations
 - Includes Skill of Worker Proficiency (ANL-804) for each of main facility personnel
 - Covers tasks performed for each of main facility personnel

FABRICATION FACILITY AND MACHINE SHOP SAFETY PROTOCOLS (2)

- In addition to WCD, work is discussed, planned, and prioritized at weekly meeting of Mechanical Support Group plus anyone working or having jobs in building
 - Begins with safety share and discussion relevant to our work, seasonal concerns, or home safety
 - Milestones achieved in near past and tasks for moving forward on each project
 - Equipment problems and/or needs discussed
 - Schedule for week by agreement
- Major work performed by Mechanical Support Group covered by WCDs and includes thorough pre-job briefing(s) and post-job briefing(s)
 - Frequently jobs concern how to carry out fabrication, installation, etc safely, e.g. CVR installation prototyping
 - Engineered work checks drawings
 - Check list of task steps to verify correct and safe completion
 - Approval for next task or declaring task complete
- 100% compliant with building safety protocols, personnel training, and equipment safety requirements

FABRICATION FACILITY AND MACHINE SHOP SAFETY PROTOCOLS (3)

- A challenge to safe work operation in the building is coordination of fabrication and testing of equipment and/or detectors with scientists, engineers, technicians, and students beyond HEPD that spans other lab divisions, other national laboratories, and universities throughout the U.S. and abroad. Mitigation:
 - Training through HSE online, classroom, and hands-on training as appropriate
 - Supervision by Building Manager and/or HEP qualified personnel
 - Involvement of all stakeholders in WCD development and sign-off
 - Safety review visits by collaborators outside of HEPD.
Example: review of safety practices for Mu2e work in 366 by Fermilab Mu2e safety group.
 - Hazards communication
 - Attendance at weekly Mechanical Group planning meeting