# Detector concept


# Plenary introductory talk

IRENG07

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**Global Design Effort**

# Caveats

- The Detector Parameters have not been finalized.
- Little engineering effort been put into the design.
  - **But an Engineering Group has been established.**
- Share our current thoughts on the issues.
- Willing to be flexible but concerned about “boxing  ourselves into a corner”
- Looking forward to progress at this Workshop.

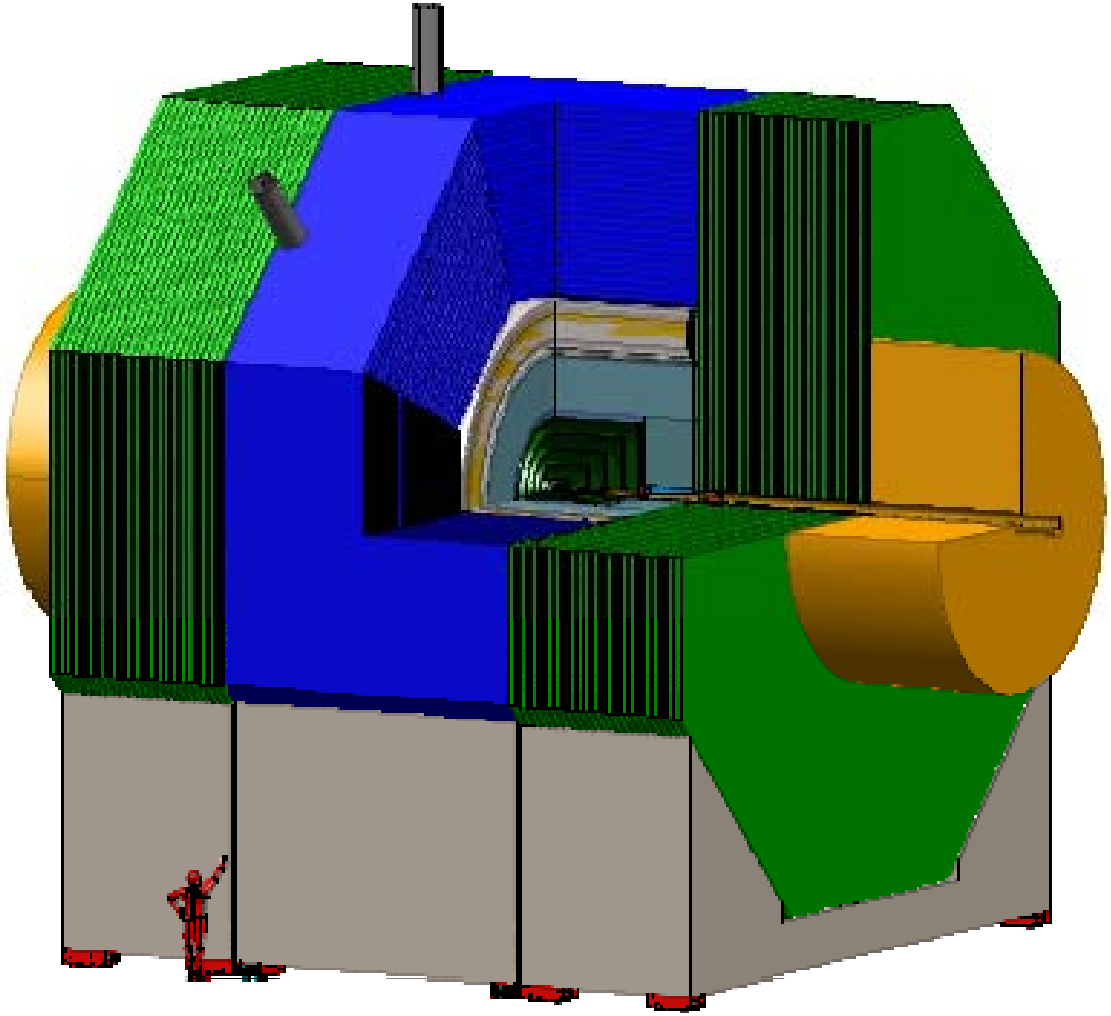
# SiD Engineering Team

| Engineers | Physicists |
|---|---|
| **ANL** | |
| • Victor Guarino | |
| **FNAL** | |
| • Bob Wands | Bill Cooper |
| • Joe Howell | |
| • Kurt Krempetz | |
| • Walter Jaskierny | |
| **SLAC** | |
| • Jim Krebs | Marty Breidenbach |
| • Marco Oriunno | Tom Markiewicz |
| • Wes Craddock | |
| **RAL** | |
| • Andy Nichols | Phil Burrows |

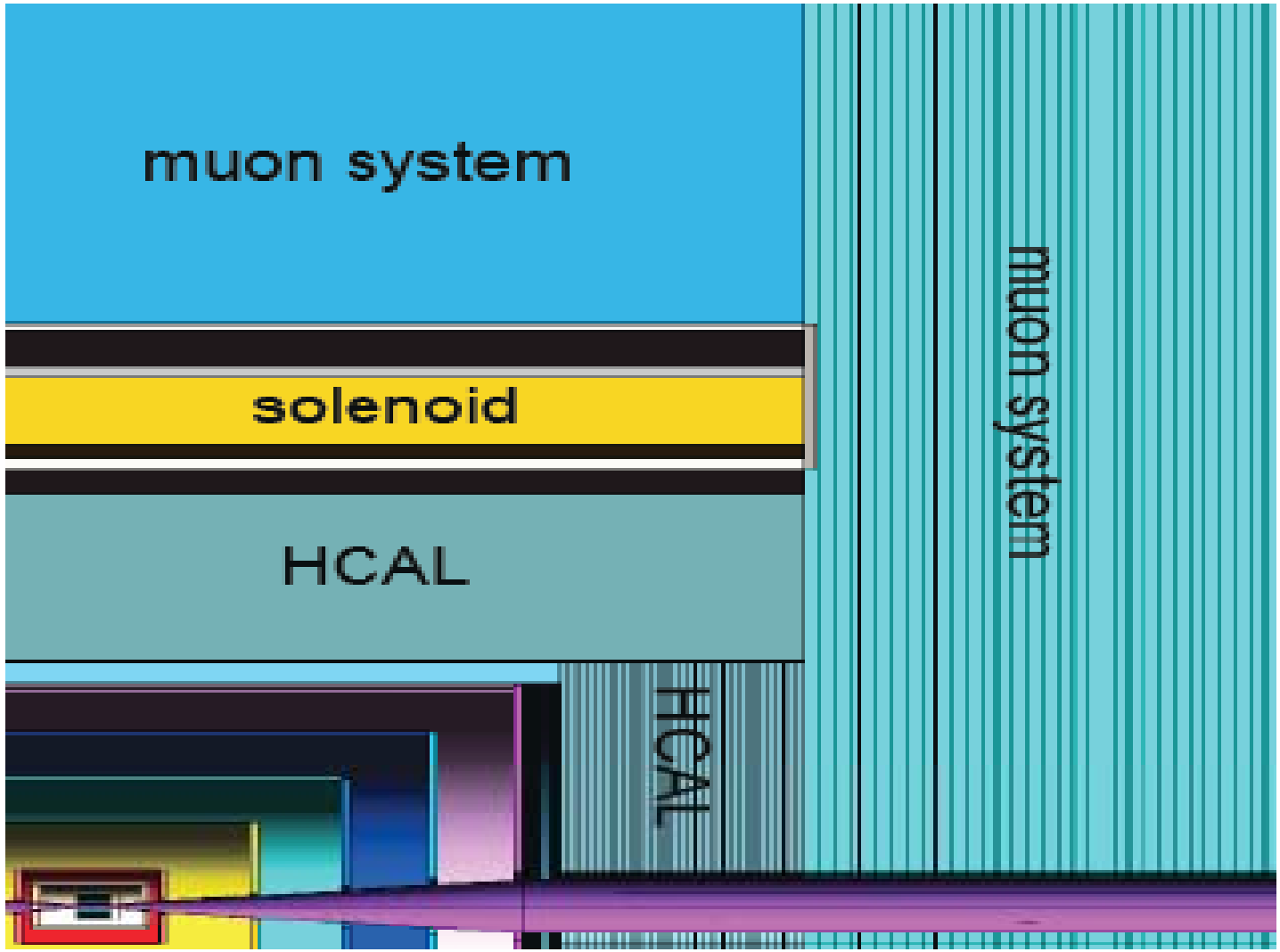
# General parameters

- Detector parameters
  - **12mX12mX12m**
  - **10,000 tonnes not including Pacman (another 2000 tonnes)**
  - **5 Tesla 5m clear bore Superconducting Magnet**
  - **Return Flux**
    - Design goal; magnet field 1m outside the iron
      < 100 G
  - **Baseline Design for L*=3.664m**

# General parameters with pacman's



# Sub-Systems



# Sub-System Parameters-Barrel

| BARREL | Baseline Technology | Inner radius | Outer radius | Z max | Weight (tonnes) |
|---|---|---|---|---|---|
| Vertex detector | Pixel | 1.4 | 6.1 | 6.25 | <.001 |
| Tracker SiD | Silicon strips | 20.0 | 126.5 | ± 167.9 | .1 |
| EM calorimeter | Silicon/W | 127.0 | 140.0 | ±180.0 | 65 |
| Hadron calorimeter | RPCs/SS | 141.0 | 250.0 | ± 277.2 | 380 |
| Solenoid | 5 Tesla | 250.0 | 330.0 | ± 277.0 | 220 |
| Muon chambers | RPCs/Fe | 333.0 | 645.0 | ± 277.0 | 3050 |

# Sub-System Parameters-Forward

| SiD FORWARD | Baseline Technology | Inner Z | Outer Z | Outer radius | Weight (tonnes) |
|---|---|---|---|---|---|
| Vertex detector | Pixel | 71.9 | 172.0 | 71.0 | <.001 |
| Tracker | Silicon strips | 26.7 | 165.4 | 126.5 | .05 |
| EM calorimeter | Silicon/W | 168.0 | 182.0 | 127.0 | 20 |
| Hadron calorimeter | RPCs/SS | 182.0 | 277.0 | 140.7 | 75 |
| Muon chambers | RPCs/Fe | 277.5 | 589.5 | 645.0 | 4000 |
| LumCal | Silicon/W | 170.0 | 183.0 | 19.0 | .35 |
| GamCal | Silicon/W | | | | .3 |
| BeamCal | Silicon/W | 321.0 | 334.0 | 18.0 | .15 |

# General Safety Issues

- Radiation
  - **Self Shielding Detector**
- Fire Safety
  - **No Flammable Gases**
  - **Halogen-free Cables**
  - **Smoke Sensor in all sub detectors**
- Seismic Safety
  - **Looking for guidance; Site dependent**
- ODH Issues
  - **Looking for guidance**

# Assembly- Possible Surface Scenario

- Solenoid tested to full field on surface
- Other Sub-systems are also constructed and tested on surface.
- Defines a surface building
  - **Roughly 24mX24mX24m**
  - **500 tonnes crane (smaller hoists should also be available)**

# Assembly-Possible Underground Scenarios

- Underground area is defined by Detector Maintenance and planned Upgrades and Repairs
- Access to Underground
  - **No disassembly**
    - Shaft 15m- 4100 tonnes lowered
  - **Some disassembly**
    - Shaft 9m- 500 tonnes lowered

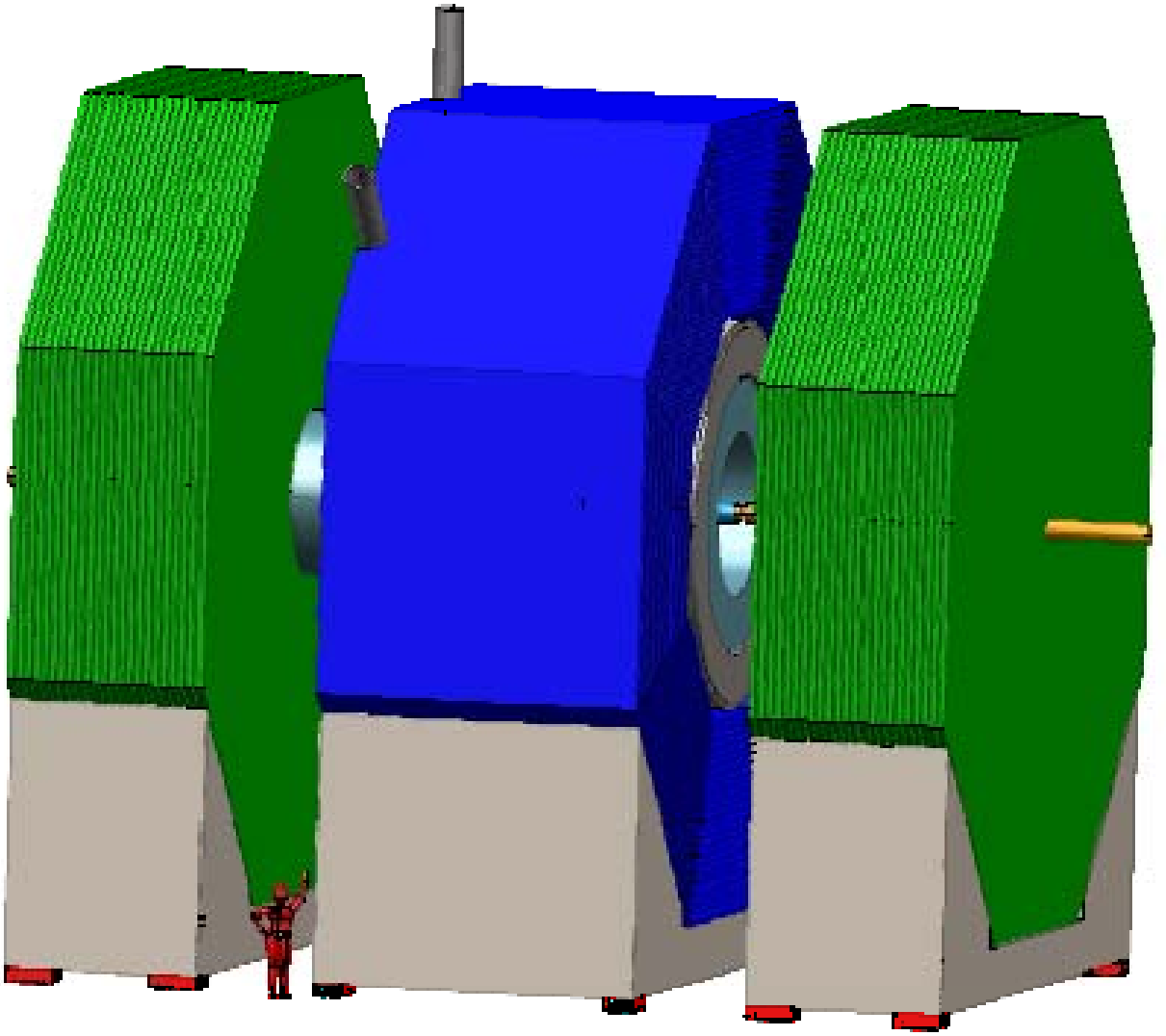
# Alignment

- Positioning accuracy needed for detector after it was moved to IP in push-pull operation
  - **1 to 2mm**
- Final/fine adjustment done by a positioning system not yet designed.
  - **Positions**
    - Vertex Detector
    - Beam pipe
    - LumCal,GamCal and BeamCal
    - QDO

# Possible Opening procedures

- on beamline
  - **Need to access Electronics→ End caps open 2m**
    - Roughly 16m total
  - **Small Crane system (~5tons)**
  - **Time Duration → 20hrs**
    - Power down magnet-4hrs
    - Open End Caps- 4hrs
    - Perform work- 4hrs
    - Close End Caps- 4hrs
    - Power up magnet- 4hrs

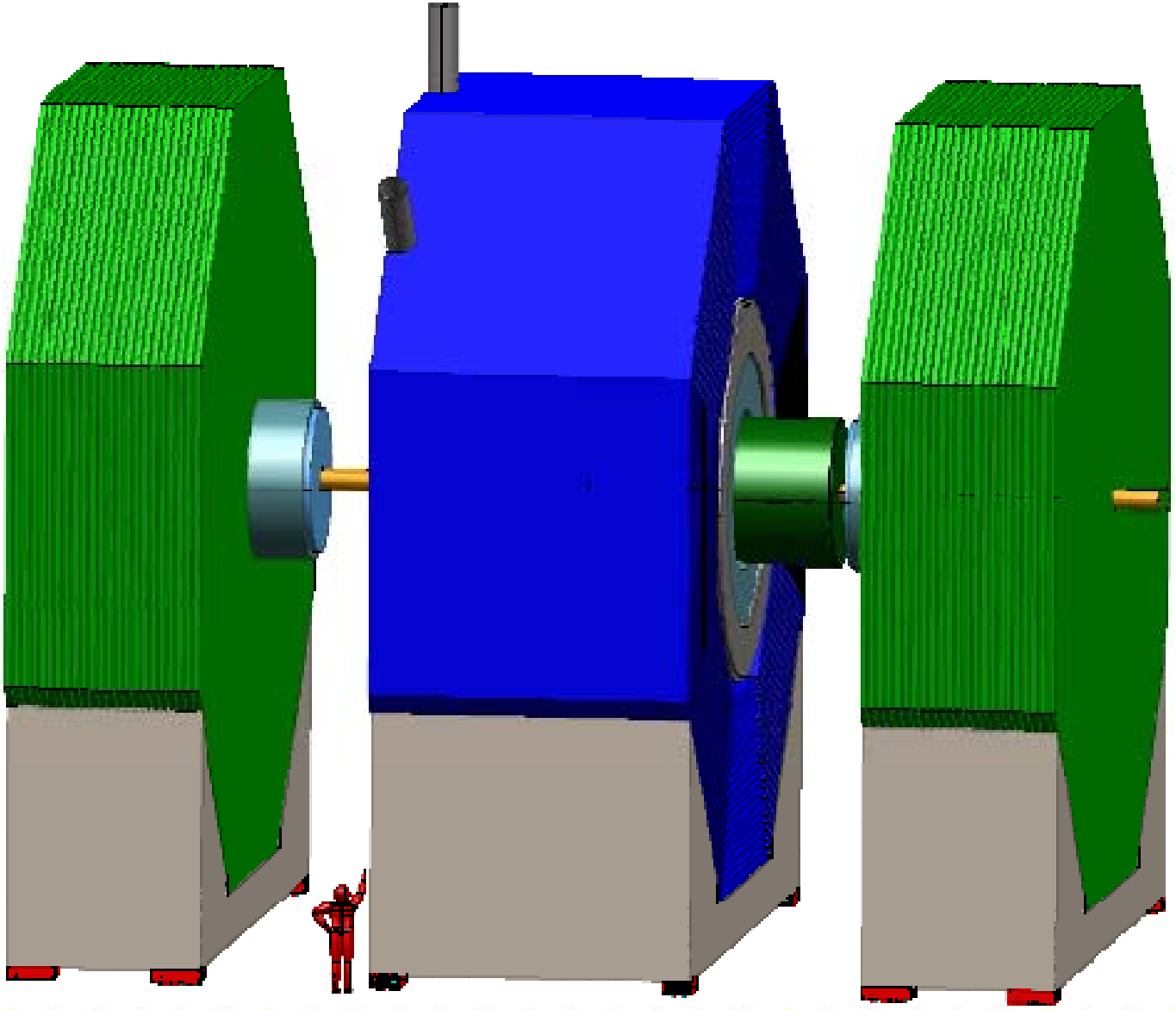
# Opening procedures-On Beamline
# 2m End Cap Opening



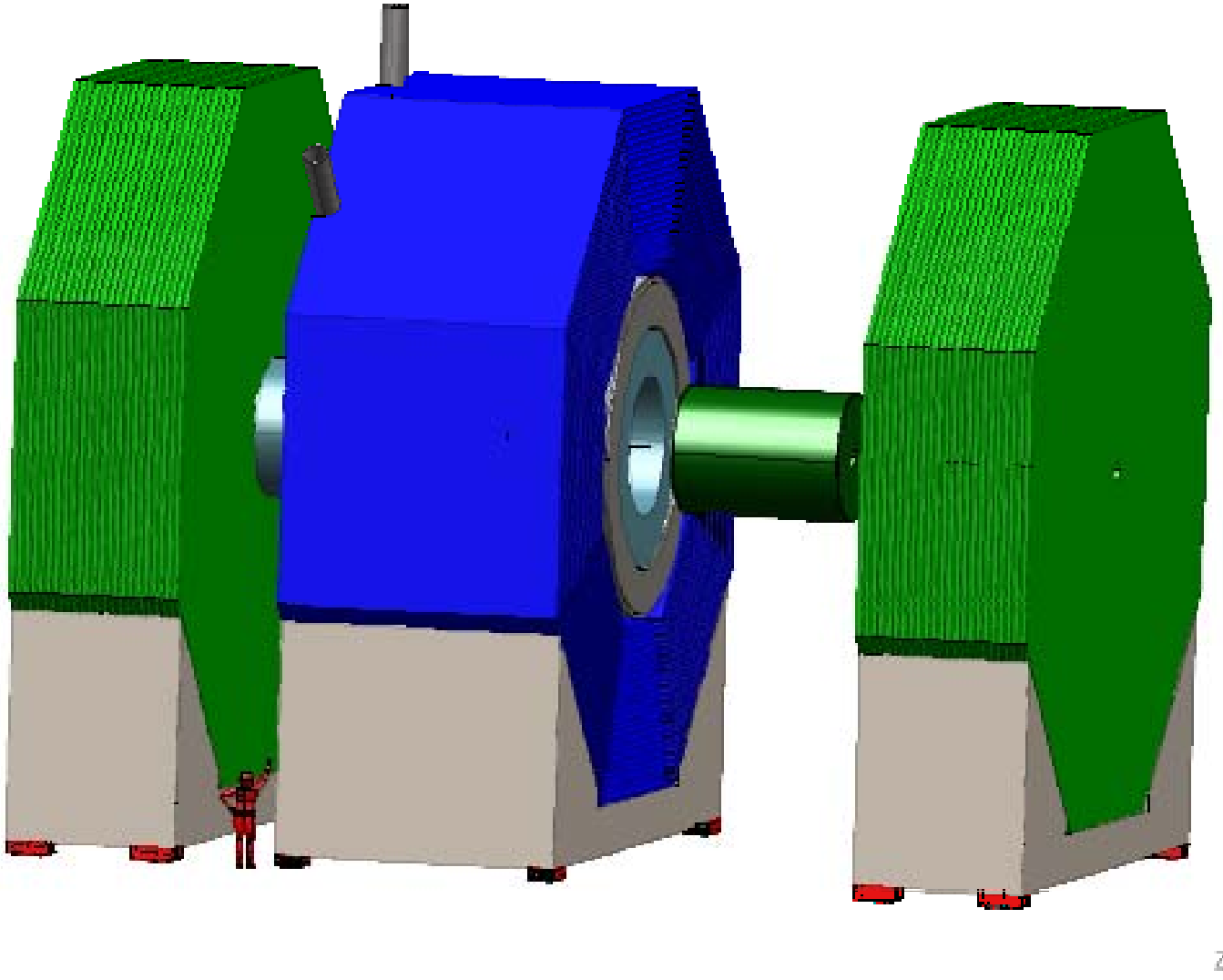
# Possible Opening procedures

- off beamline
  - **Detector Motion→ End caps open 2m**
    - Frequently for Electronics maintenance
  - **Detector Motion→ End caps open 3m**
    - Possible every 6 months for Vertex and Tracker maintenance
    - Possible every few years for Vertex Detector replacement
    - Time Duration for Opening or Closing→ about 1 week
  - **Detector Motion→ End caps open 6m**
    - Possible every 5 years for Upgrades
      - Tracker Detector System
      - ECal Silicon Detectors
      - HCal RPC's
      - Muon RPC's
  - **Crane System for above scenarios (~25 tons plus another smaller hoist)**

# Opening procedures-Off Beamline
# 3m End Cap Opening



# Opening procedures-Off Beamline
# 6m End Cap Opening



# Possible Opening procedures

- For Major Issues
  - **Solenoid Repair**
  - **Absorber Plates Replacement**
- Under Shaft
  - **Safety issues maybe a problem**
- off beam position
  - **Crane System (~500 tons plus others smaller hoists)**
  - **Approximately twice the floor area**

# Preference for Stability of Underground Hall

- Settlement of Floor
  - **<1-2 mm/Detector Exchange**
- Temperature
  - **21 Degrees C**
  - **Plus or minus 1 Degrees C variation with time**
  - **Plus or minus 3 Degrees C at different hall locations**
- Dewpoint
  - **< 12 Degrees C or 56% relative humidity**

# Services & connections

- Most systems are envisioned to be directly connected to detector and travel with it
  - **solenoid power supply**
  - **dump resistors (Water Cooled~3mx3mx3m)**
  - **electronic racks (~70 racks)**

# Services & Connections to Detector

| Utility | Mode | Estimate | Provide | N conduits@ Diameter |
|---|---|---|---|---|
| AC Power | 480 VAC 3φ | 430 KW | 750 KW | 3@10 cm |
| UPS Power | 480 VAC 3φ | 15 KW | 30 KW | 1@5 cm |
| LCW | | 350 lpm | 500 lpm | 2@10 cm |
| Chilled Water | | 244 lpm | 500 lpm | 2@10 cm |
| Instrument Air | ~1 MPa | ~100 lpm | ~200 lpm | 2@5 cm |
| Fiber Optics | 72 fiber cables | 3 | 5 | 5@1 cm |
| Helium | Quadraxial flex | | | 1@10 cm |
| | | | | |
| Total | | | | ~0.1 $m^2$ |

# Summary

- Additional Workshop Talks Planned
  - **Bob Wands-Field Mapping Calculations**
  - **Marco Oriunno- Platform Issues**
  - **Bill Cooper- SiD Beam Pipe Concepts**
  - **Jim Krebs- End Cap Concepts**
  - **Marty Breidenbach- Assembly Schemes**
  - **Wes Craddock-Water Cooled Dump Resistor**

- Questions?????