SiD Collaboration

One Piece End Door Design Concept plus Forward Equipment Interfaces

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SiD Engineering Team

Engineers	Physicists
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– FNAL	
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• Walter Jaskierny	
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– RAL	
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Introductory Remarks

- SiD Engineering meetings began on July 25, 2007
  - Work presented today comprises a multi organizational effort
  - Work is very preliminary
    - Represents a first look at building an end door
  - Manpower is increasing
    - Organizational responsibilities are solidifying
- Physical dimensions are very fluid
  - Dimensions WILL CHANGE
- Precise design requirements are somewhat vague

End Door Design Philosophy

- Initial Phase Design Goals
  - One piece end door
  - Maintain magnetic field uniformity requirements in tracking region
  - 5mm maximum axial mechanical deflection due to magnetic pressure
  - Begin fringe field investigations
    - Determine requirements
  - Maintain ability to replace muon chambers (RPC baseline)
    - Off beamline
  - Determine appropriate design codes and standards

End Door Design Philosophy

- Second Phase Design Goals
  - End door extraction
    - 2 meters in Z (collision area)
    - Up to 6 meters in Z (maintenance area)
      - Assumed to be a very rare ocurrance
  - Provide mechanical support for HCal and ECal
  - Maximize RPC coverage
  - Mechanical connection to barrel
    - Presently considering hydraulically driven taper pins
  - PacMan Shielding
    - Determine Interfaces
    - Determine design requirements
      - Technical
      - Access issues
      - Push-pull
  - Push-pull considerations
  - Transportation to site
    - Weights and physical sizes
  - Cost

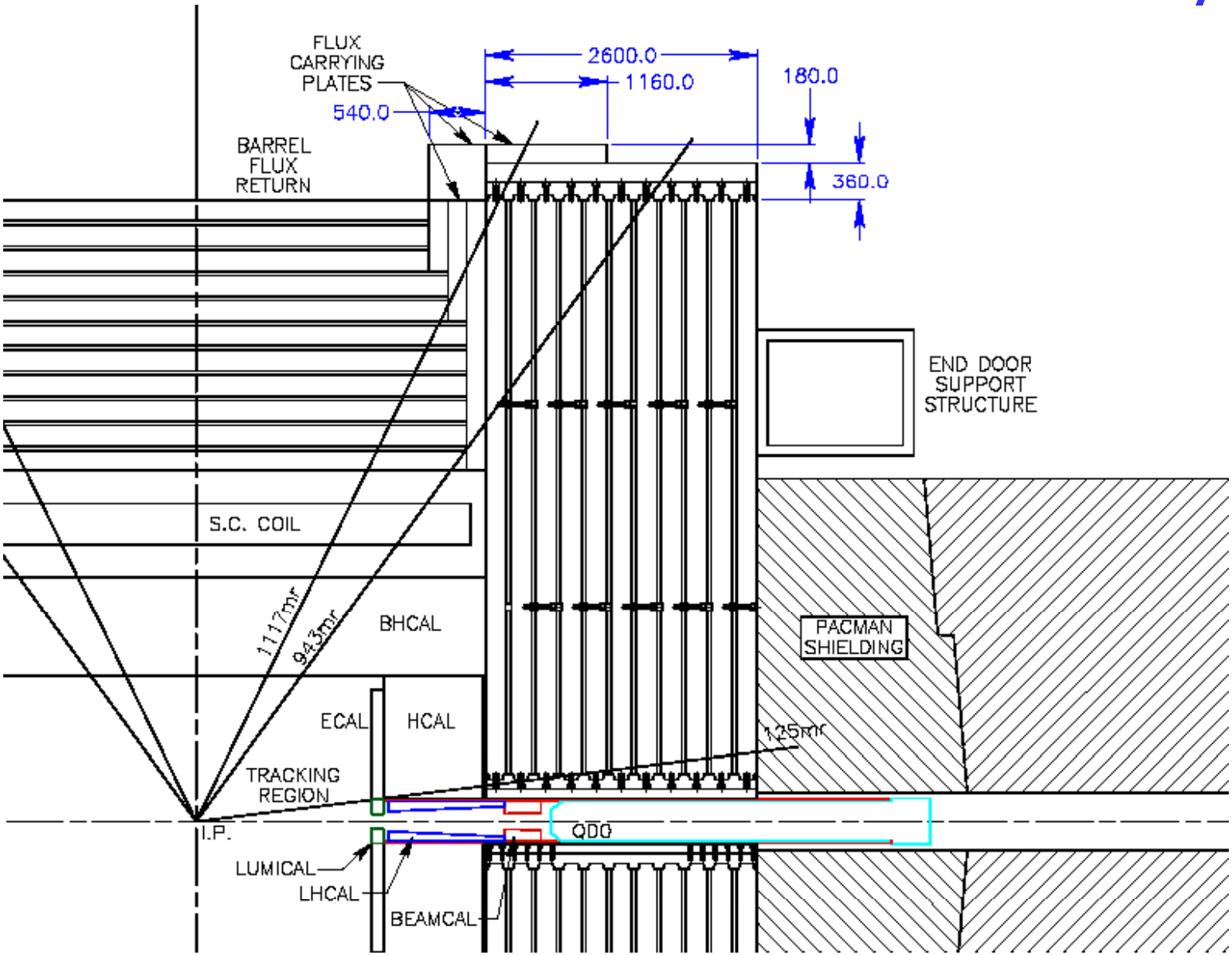
End Door Design Comments

- Dimensional constraints
  - Outer radial dimensions driven by barrel flux return design and fringe field considerations
  - Inner radial dimensions driven by forward support tube assembly
  - Z Thickness driven by:
    - Magnetic fringe field requirements
    - Muon detection requirements
- Present concept
  - Eleven 200mm thick steel plates with ten 40mm nominal gaps for detector planes
- Machined steel surfaces will be used
  - On mating surfaces transverse to the direction of the magnetic flux
  - To minimize the effects of dimensional tolerance stack-up
- Pre-assembly at fabricator's plant

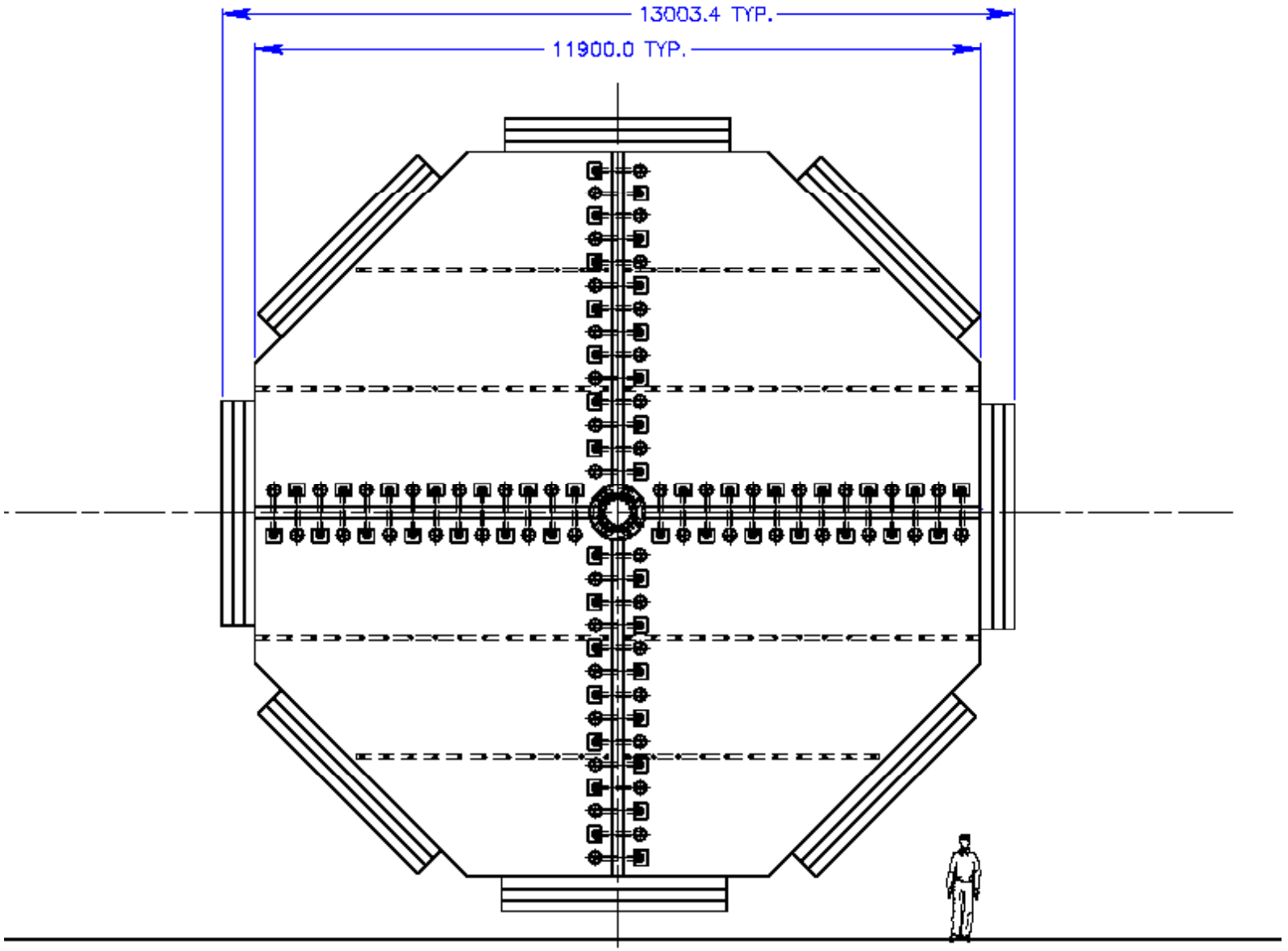
End Door Interface Considerations

- Inner Support Tube
  - Provides structural support for
    - LumiCal
    - LHCal
    - BeamCal
    - QD0
  - Fixed Z location
    - End door exhibits 2 meters relative Z motion when opened on beamline
  - Alignment issues before, during, and after end door extraction
- Ecal and Hcal
  - Structural supports
  - Alignment issues. End door deflection due to magnetic pressure – how is this interface affected?
- Provide clearance of services for all of above
  - QD0 service cryostat
- Barrel flux return
  - Connection of end door to barrel
  - Routing of barrel detector services
- PacMan shielding

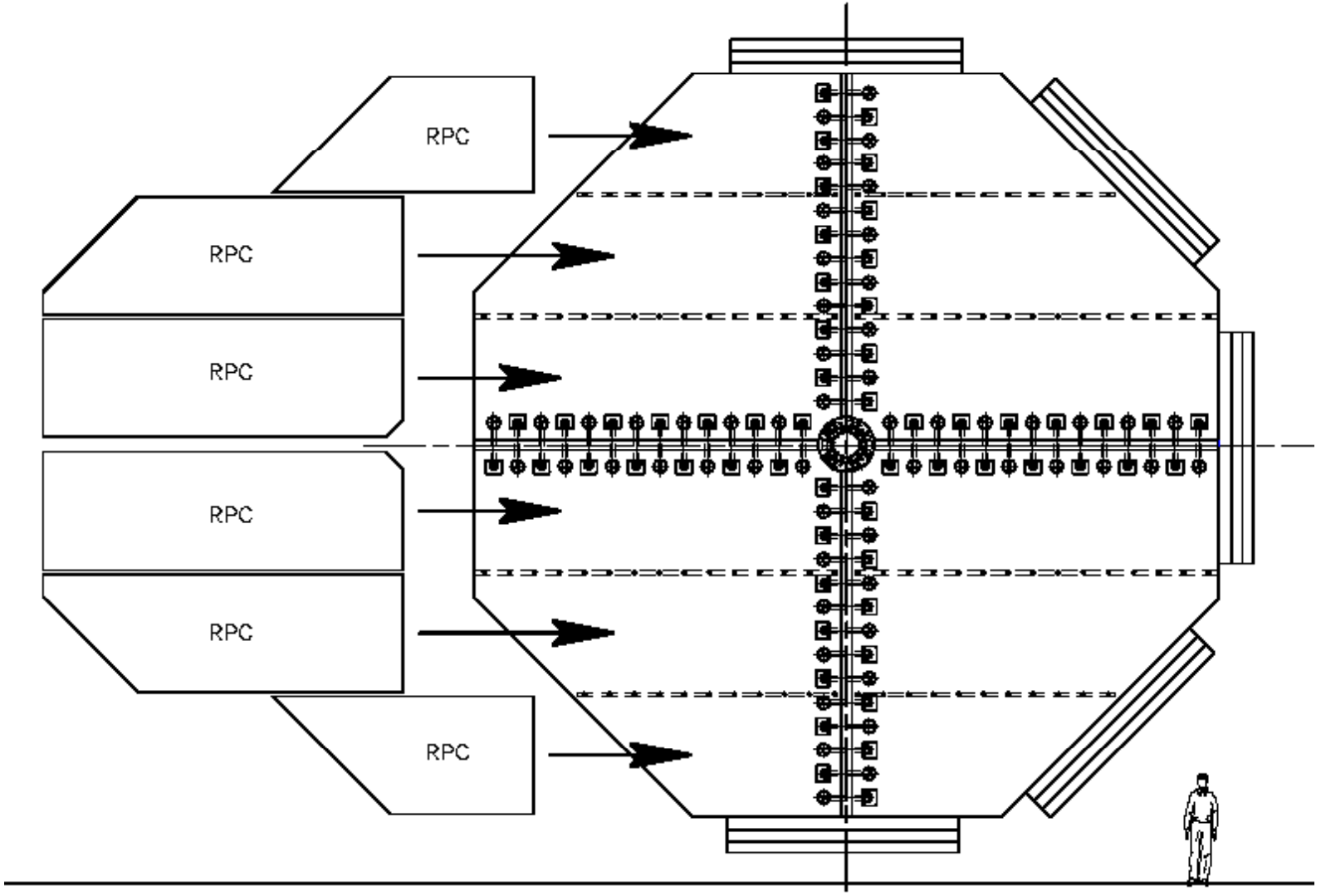
Elevation View of Detector Geometry



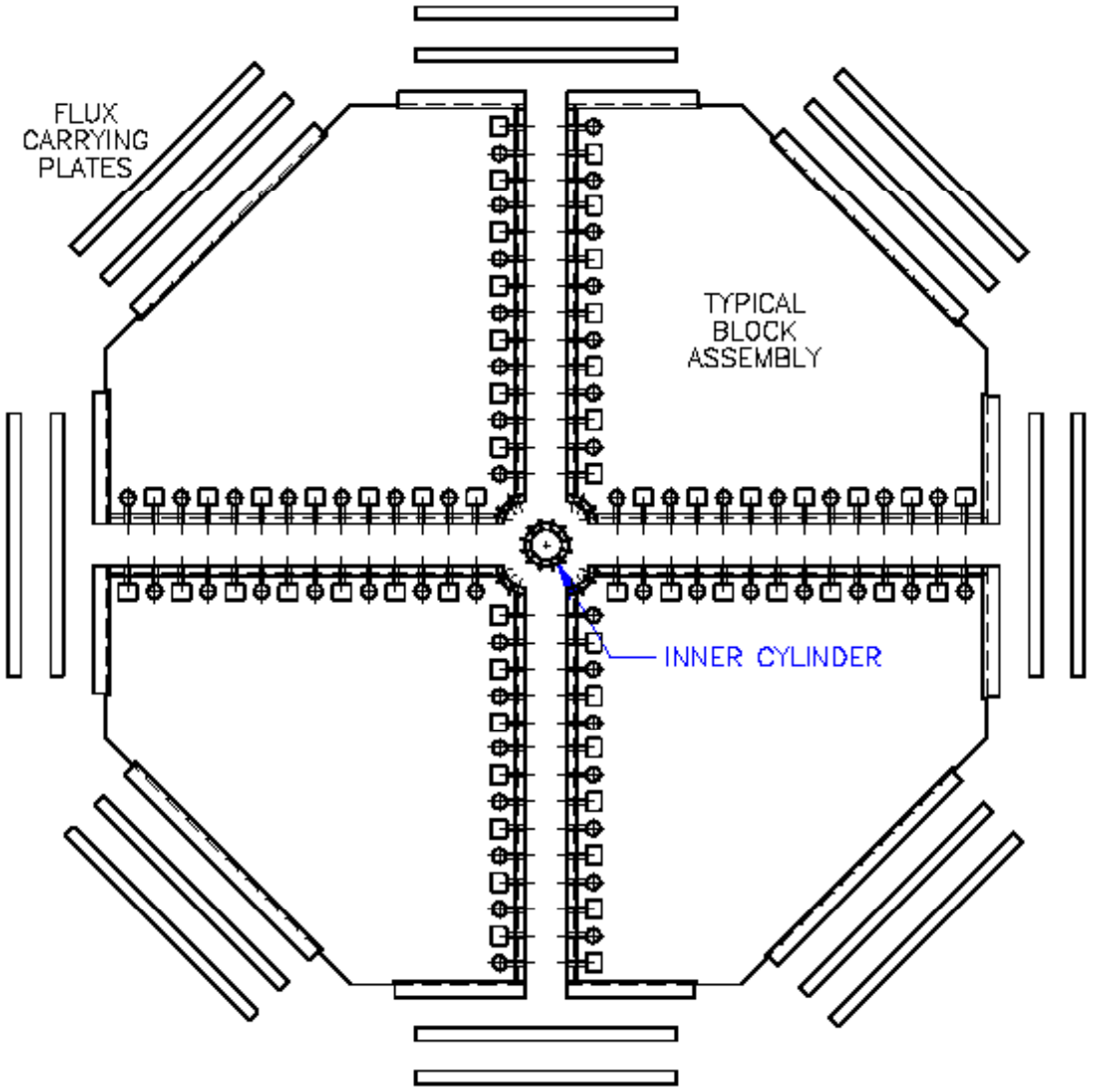
End Door Assembly



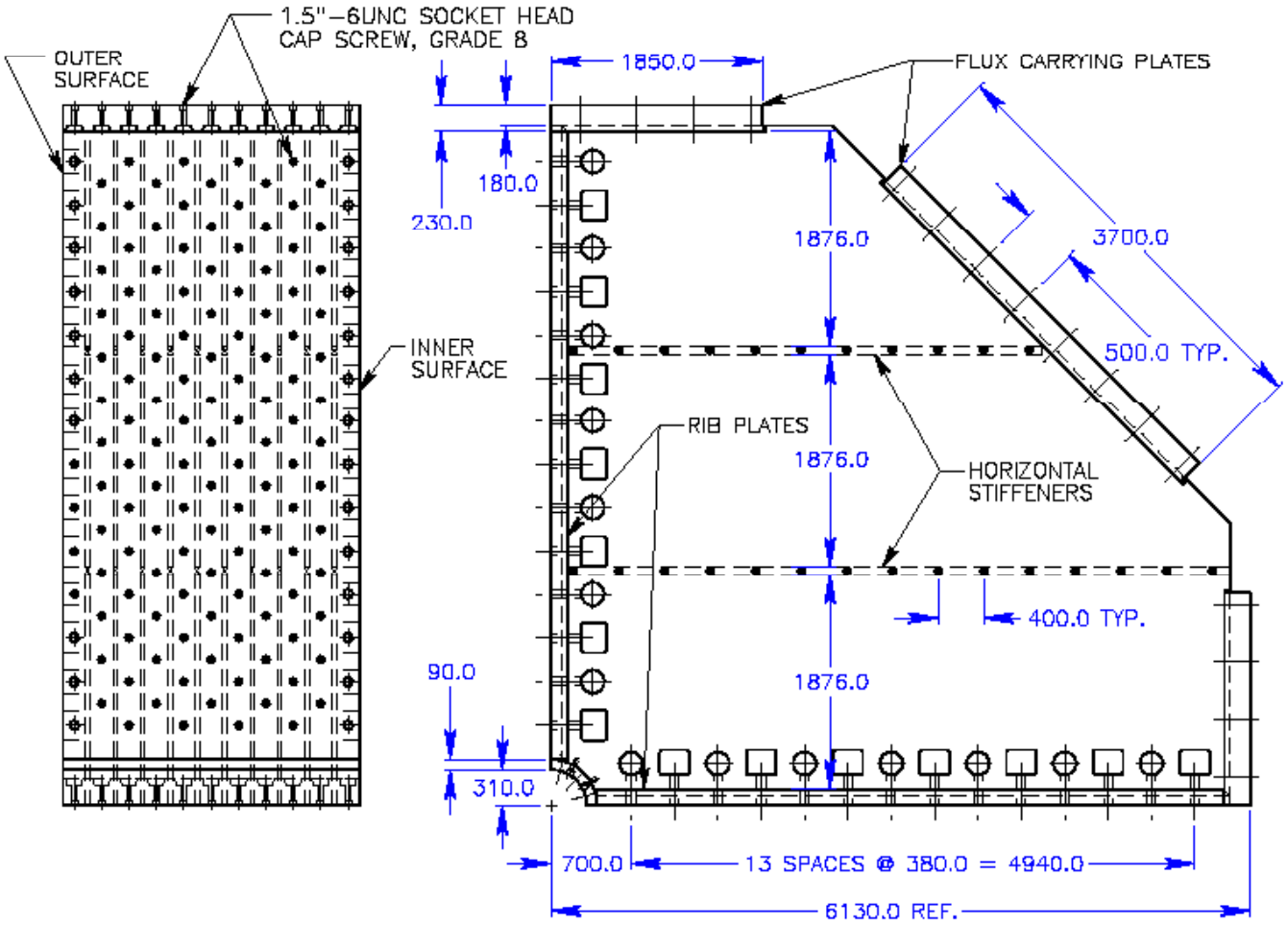
Muon Chamber Replacement (RPC Baseline)



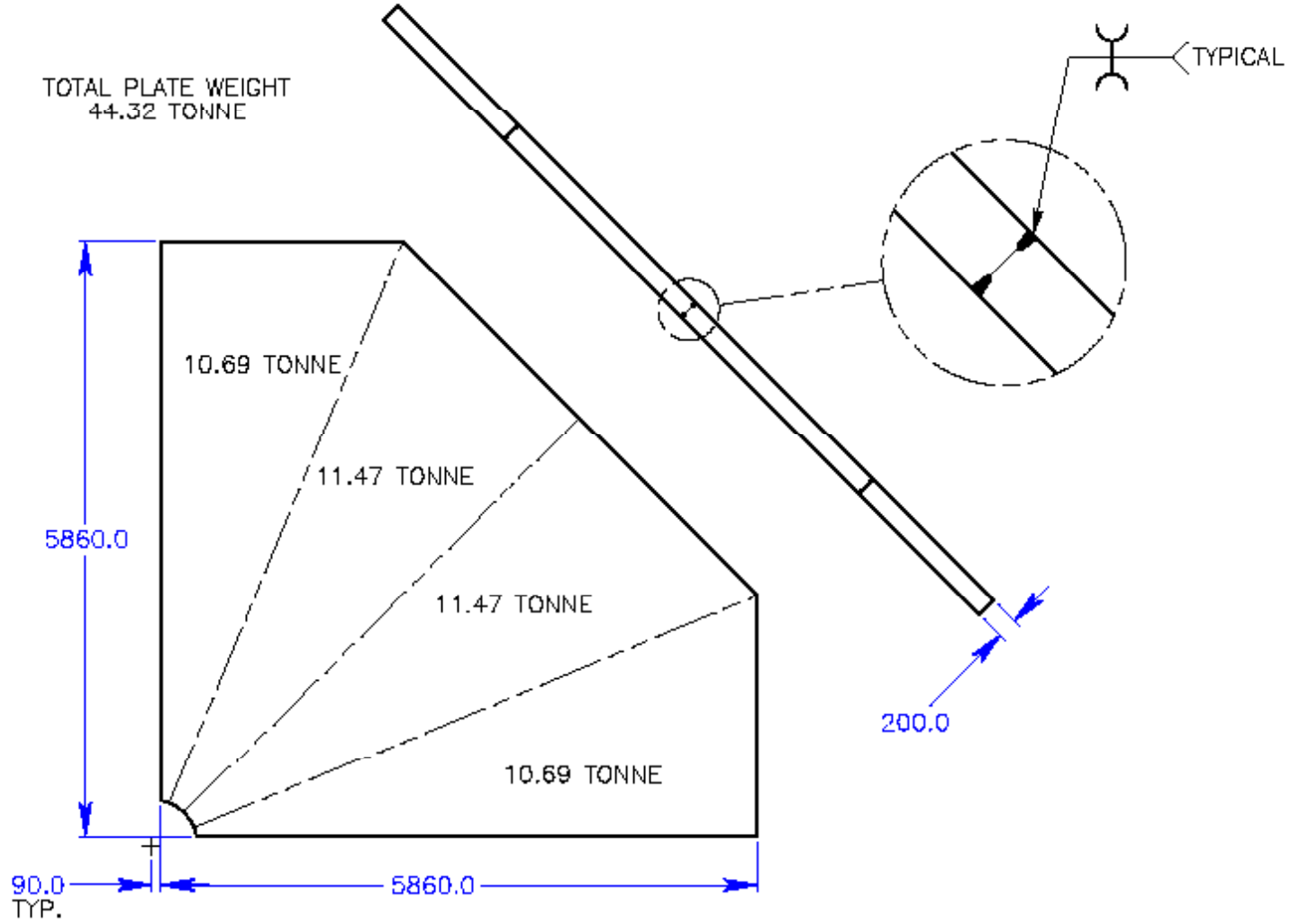
Exploded Assembly



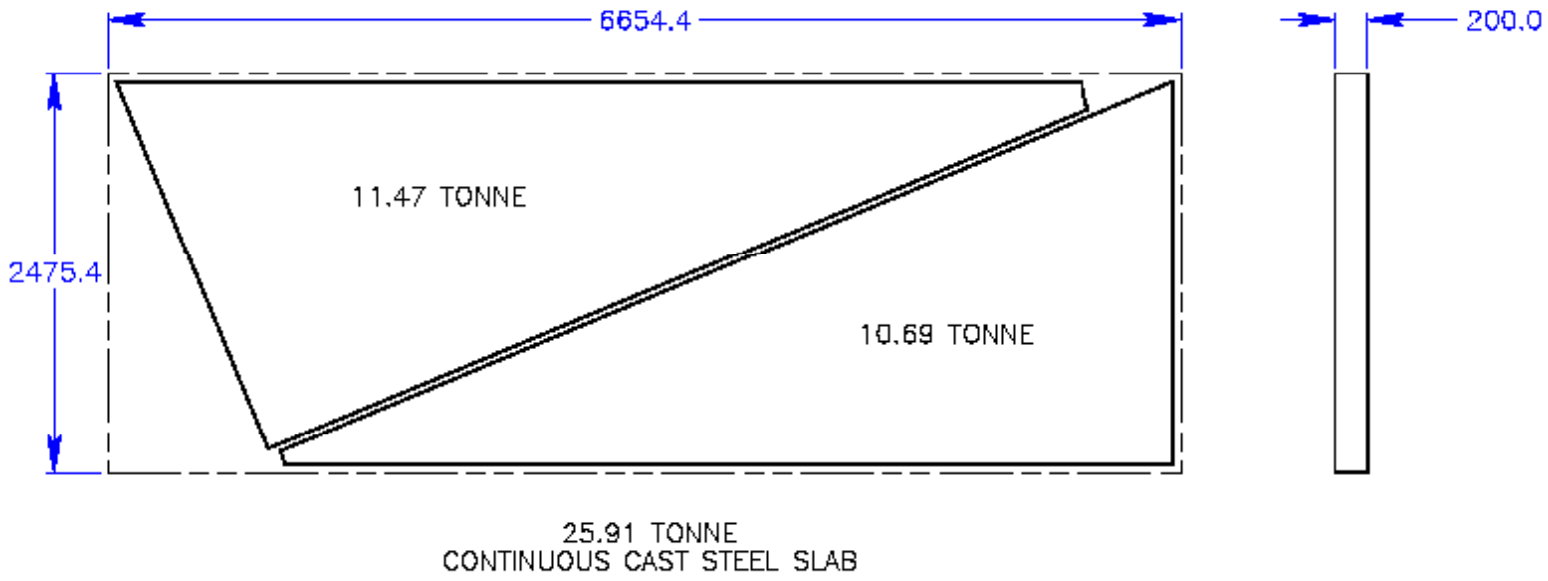
Typical Block Assembly (537 Tonne)



Typical Block Plate

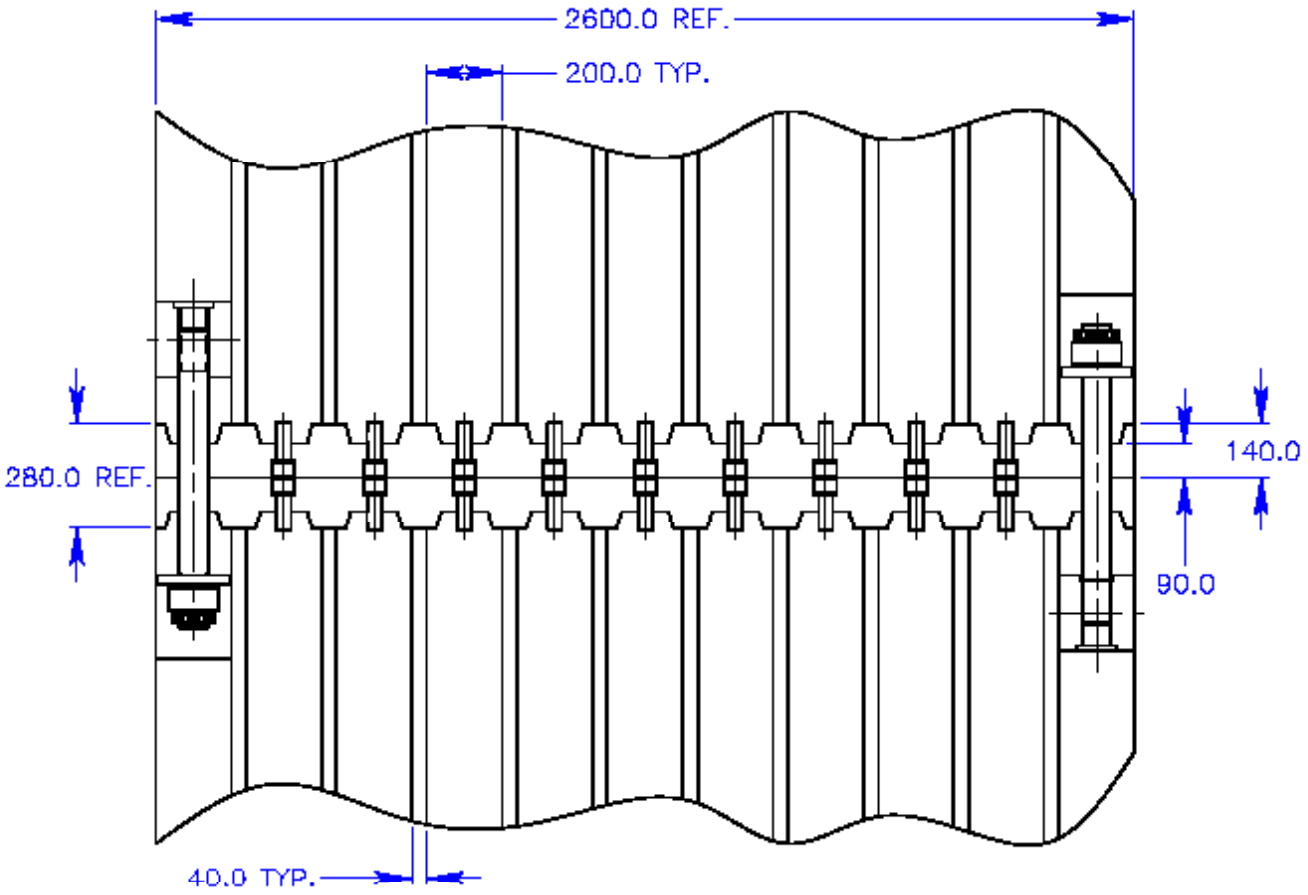


Continuous Cast Steel Slab

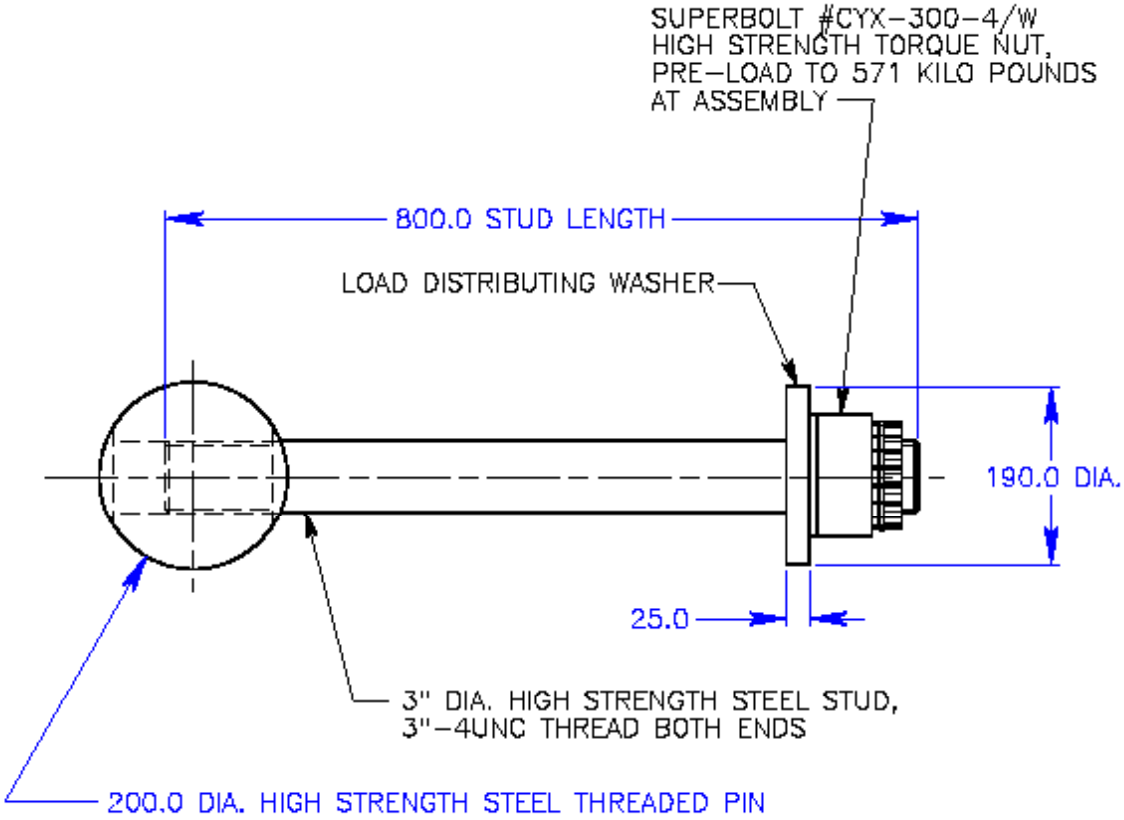


25.91 TONNE
CONTINUOUS CAST STEEL SLAB

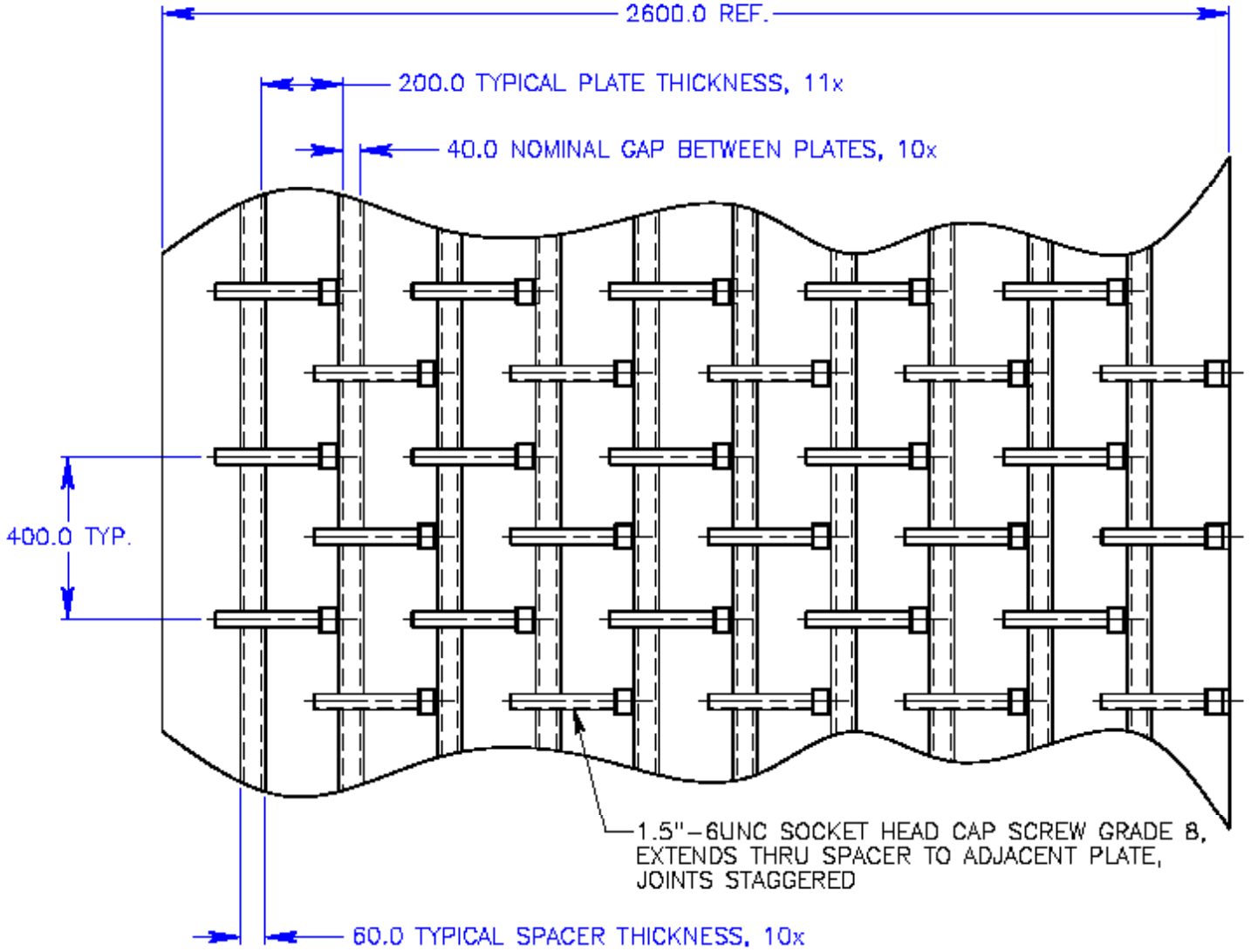
Block-to-Block Connection



Block-to-Block Fastener Assembly



End Door Plan View Cross Section thru Horizontal Spacers



PacMan Shielding

- A major component of the SiD "Self-Shielding" concept
- Extends in Z from outer surface of the end door to the wall (tunnel opening) of the experimental hall
  - Approximately 8.6 meters
- Extends radially 3 meters
  - 1 meter of steel (328 tonne minimum per side)
  - 2 meters of concrete (592 tonne minimum per side)
  - Minimize clearance to inner support tube assembly
- Configuration is probably detector specific
  - Movable components must allow 2 meter end door extraction
  - Movable components must allow disconnection and clearance of beam pipe during push-pull
    - PacMan must be supported from and travel with detector during push-pull

Conclusions

- A strong engineering team has been formed – and functioning
- We are evaluating and compiling design requirements
  - Technical performance requirements
  - Issues pertaining to fabrication, assembly, installation, and push-pull
  - Safety issues
- Need information from systems
  - i.e., Muon System
    - Thickness of steel absorber needed
    - Minimum preferred number of planes for any track
- We are evaluating and compiling information pertaining to the large steel fabricators
  - Four fabricators found thus far that can supply raw plates (continuous cast) of 27 tonne
- End door block design needs revising
  - 537 tonne is too heavy
    - Prefer assembly with 500 tonne capacity crane
- We are in the first chapter of a very long novel