

SCARLET

Systems & Infrastructure



Overview

- Data Infrastructure
- Control Systems
- Vacuum Beamline
- Large Optic Mounts



Data Infrastructure



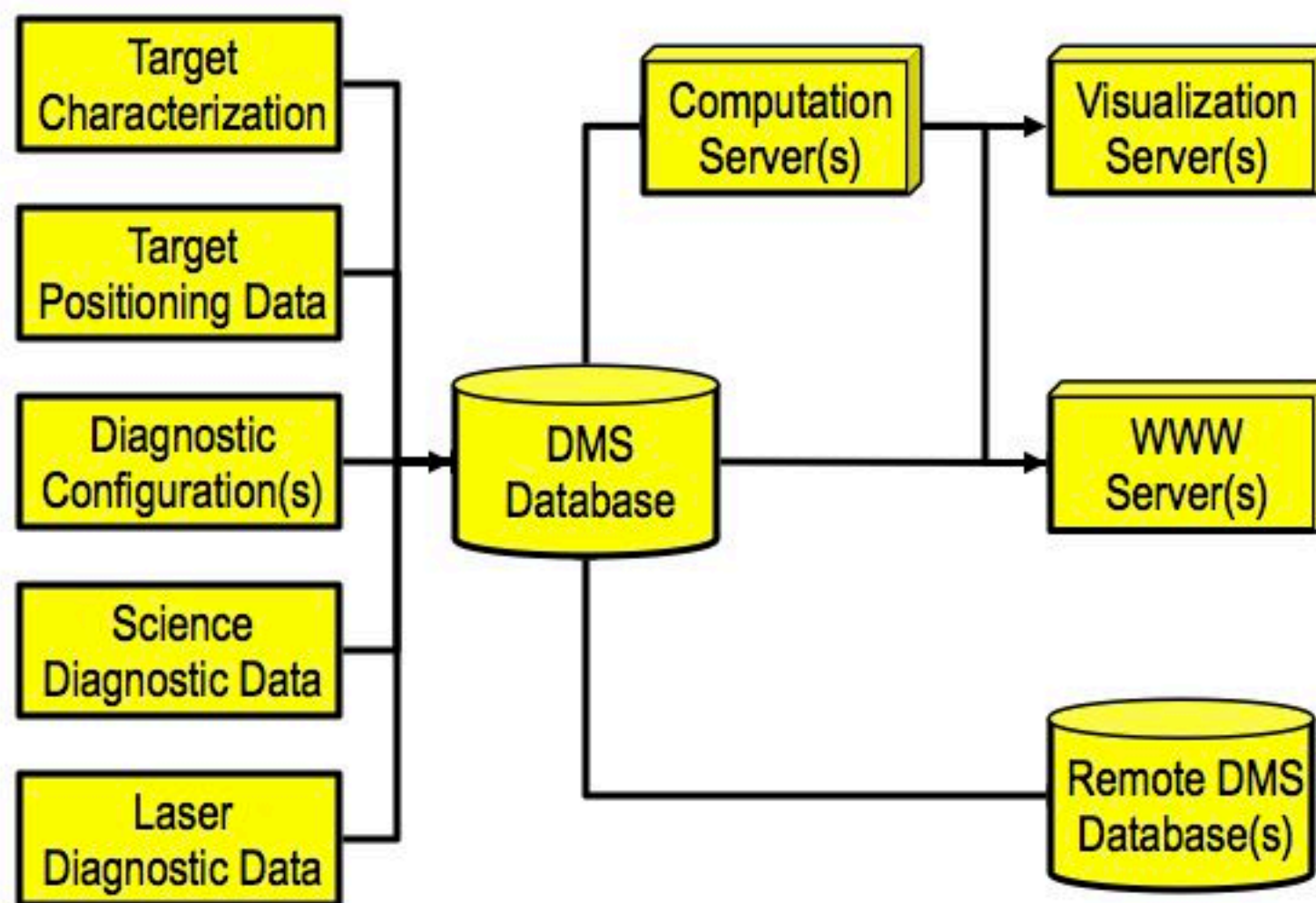
Infrastructure Goals

- Store any and all relevant data
- Robust & Reliable
- COTS & Open Source
- Client/Server (publish/subscribe model)
- 'Bursty' data handling



Data Infrastructure

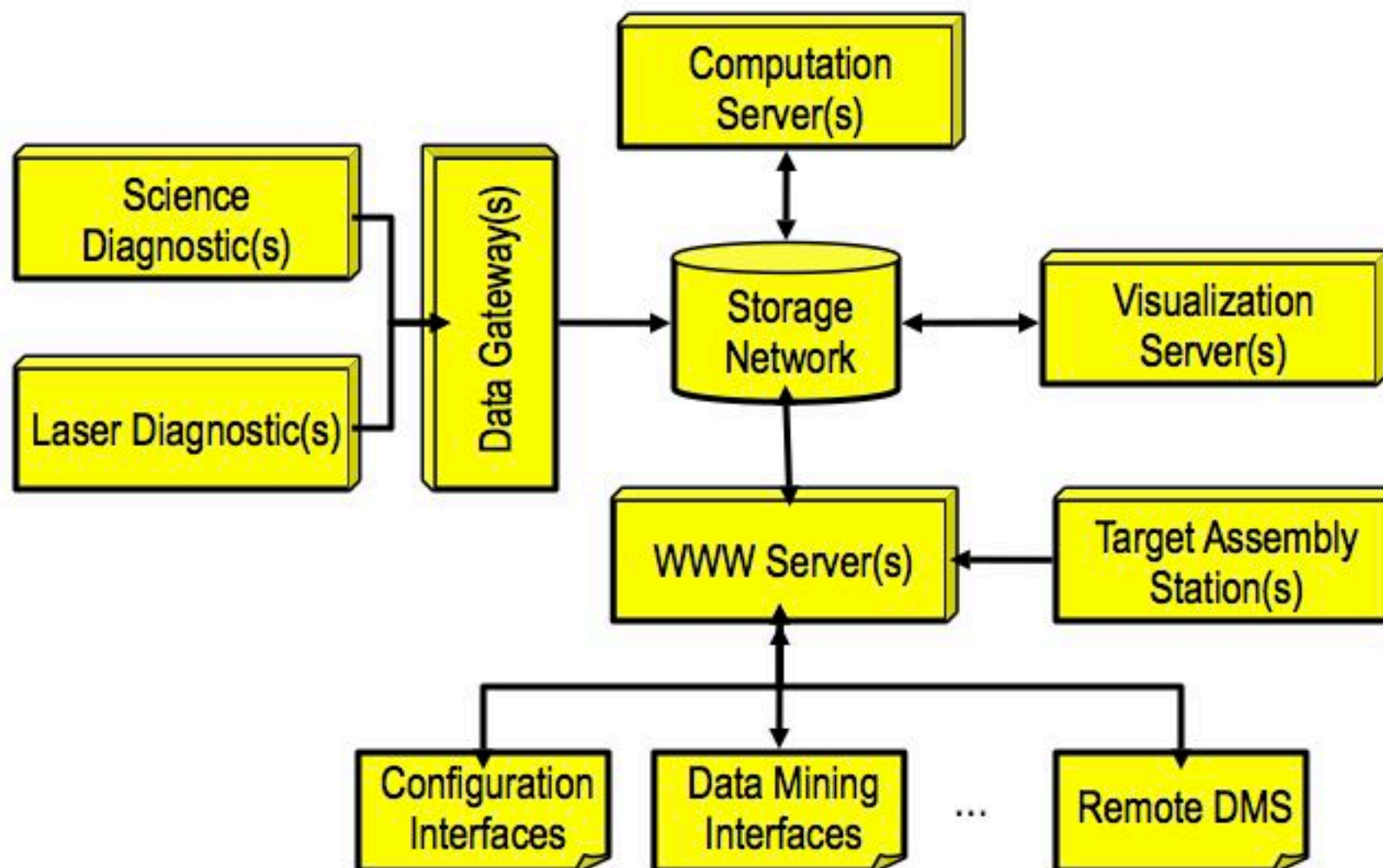
DMS Data Flow





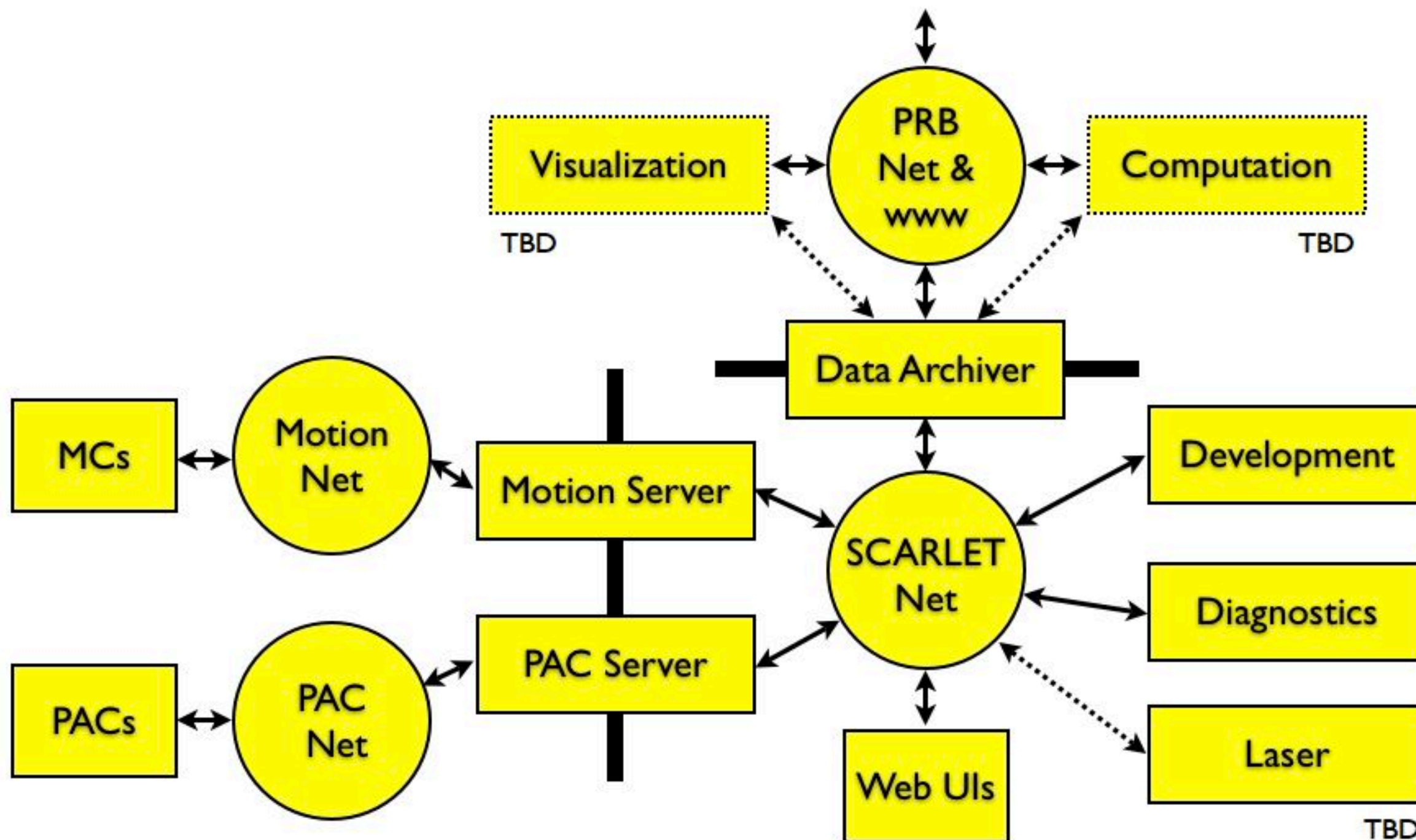
Data Infrastructure

DMS Architecture





Data Infrastructure



TBD
ca 7-2011



Infrastructure Status

- Comm Protocols - done
- Data Archiver - done
- Authentication & ACL - done
- PAC Server - done
- Motion Server - done
- Cameras Module - in progress
- Oscilloscopes Module - in progress
- LabVIEW Module - in progress
- Web UIs - in progress (PAC, Motion)

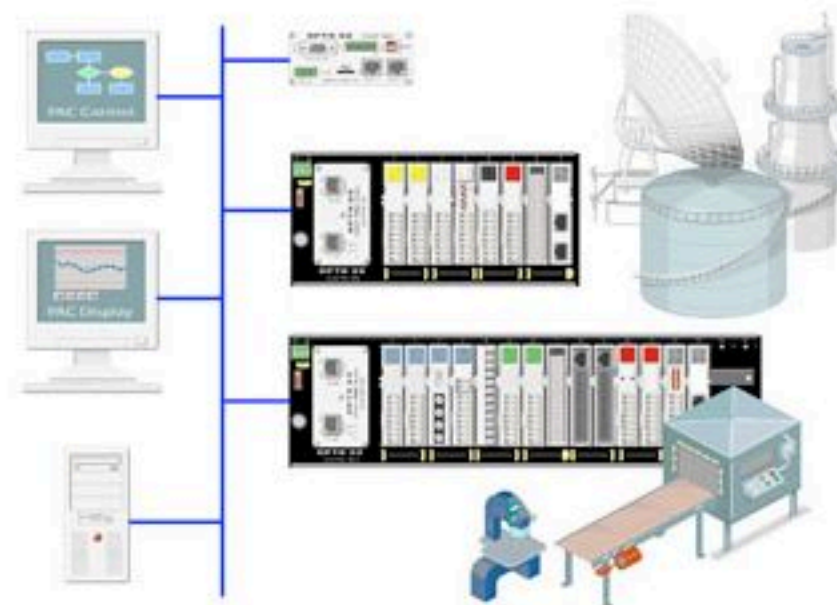


Control Systems



Automation Controls

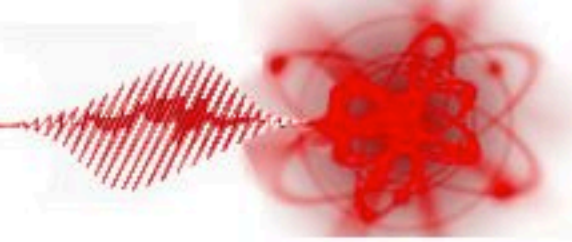
- High-reliability - 24x7x365 operation
- Distributed, extensible, networked
- Hardware/Software solution





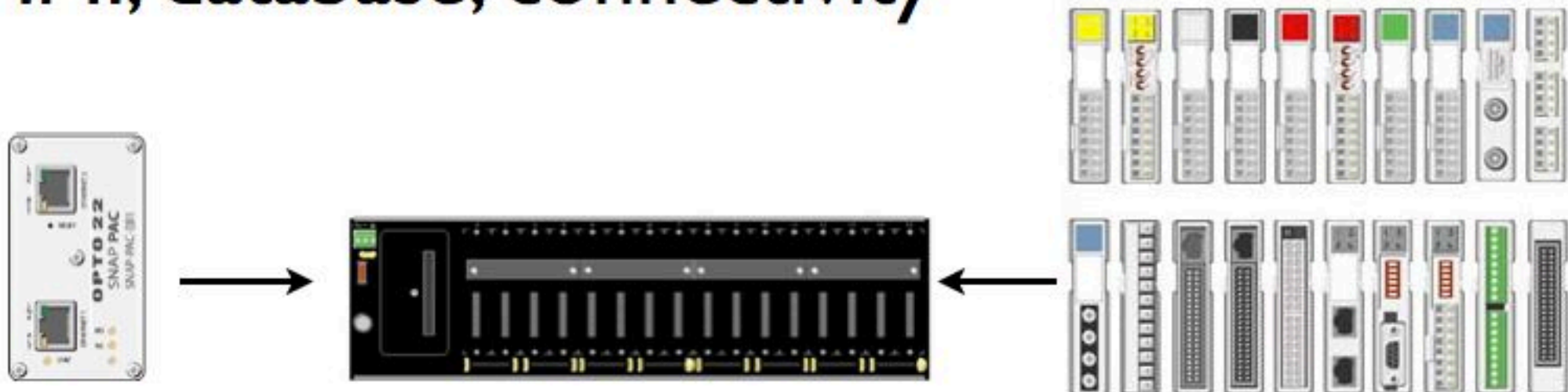
Automation Functions

- Primary:
 - Physical access control (Key fobs)
 - Parameter monitoring (press., temp., hum.)
 - Vacuum system sequencing
 - Safety interlocks & monitoring
- Secondary:
 - User Interface (depreciated)



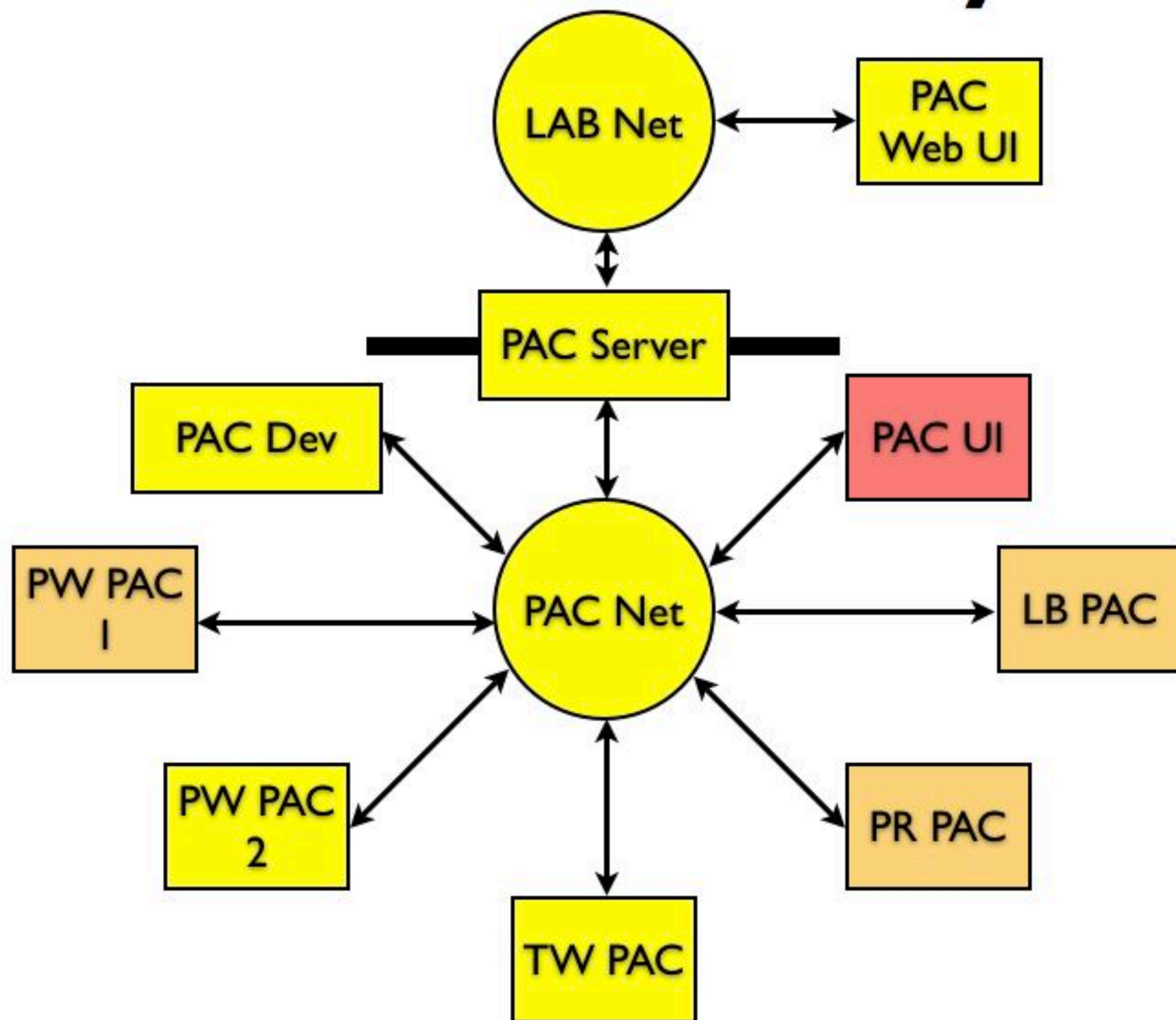
Opto22 SNAP-PAC

- Modular: roll to requirements
 - Controller
 - I/O (Serial, Analog, Digital, Relay, LV, HV, ...)
- Expandable
- Software suite: development, management, HMI, database, connectivity





PAC Layout



Valve control outputs
Gate valve state inputs
Air pressure gauges
Vacuum pressure readings
Turbo control & monitoring
Temperature readings
Humidity readings
RFID readers



PAC Hardware

- Extension of the 40TW PAC
- Field wire PW PACs



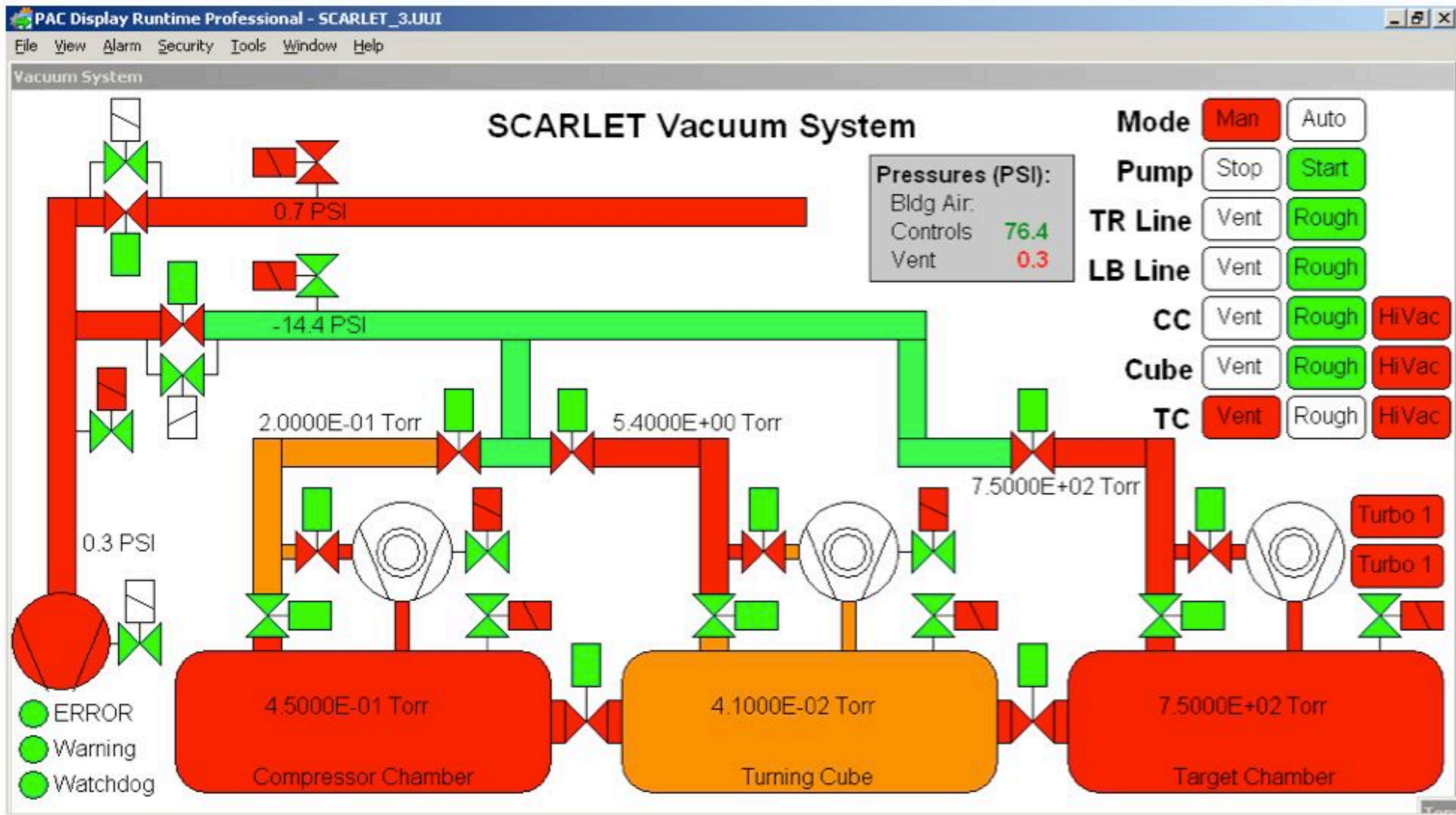


Vac. System Sequencing

- One house roughing pump
- Limited vent air supply - slow regen
- Operations restrictions:
 - Rough one chamber at a time
 - Vent one chamber at a time
 - Limit turbo backing line pressure rise
- Target Load-Lock Chamber (future)



Vacuum System



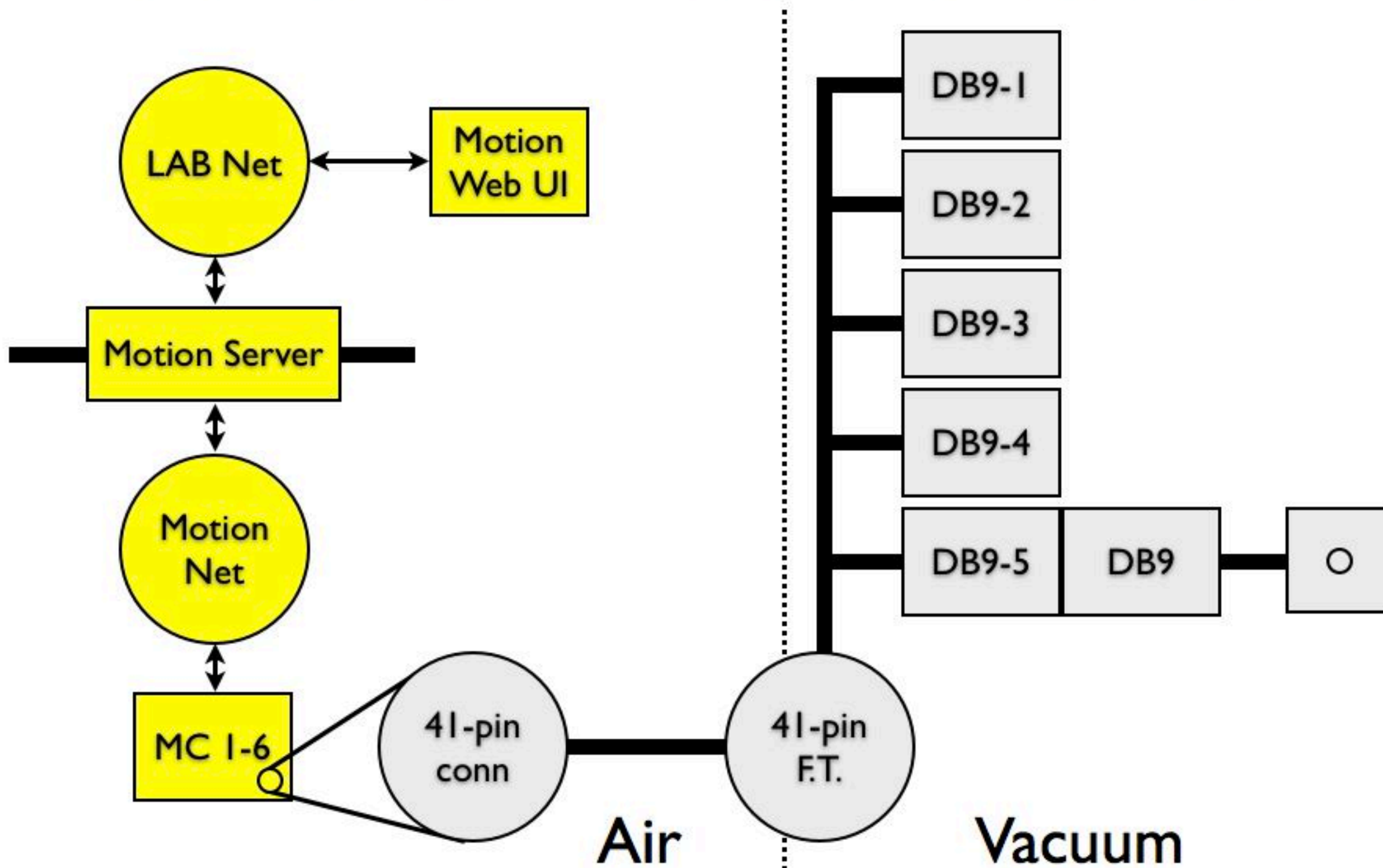


Motion Control

- Cost is a major concern
- Stage-level modularity
- Position encoder option
- Current shutdown



Motion Control Arch.





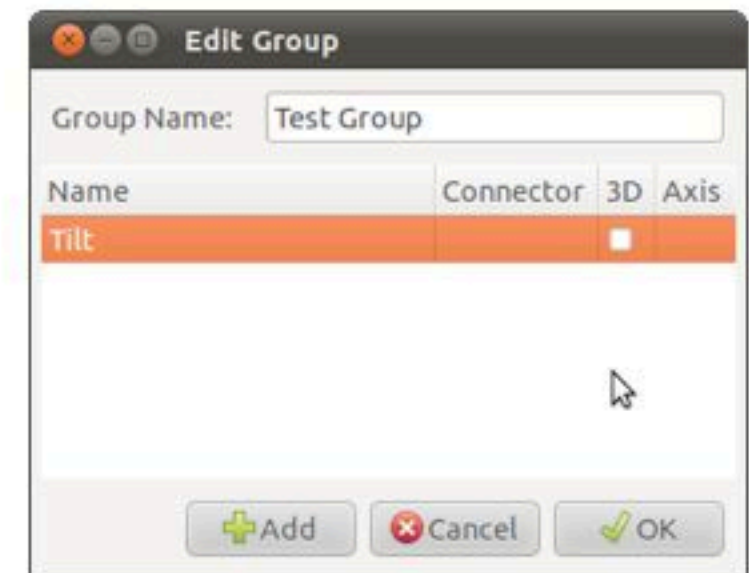
Motion S/W Features

- Grouping
- Access controls
- Multiple clients & Lockouts
- Intuitive interface
- Analog user input



Motion Control S/W

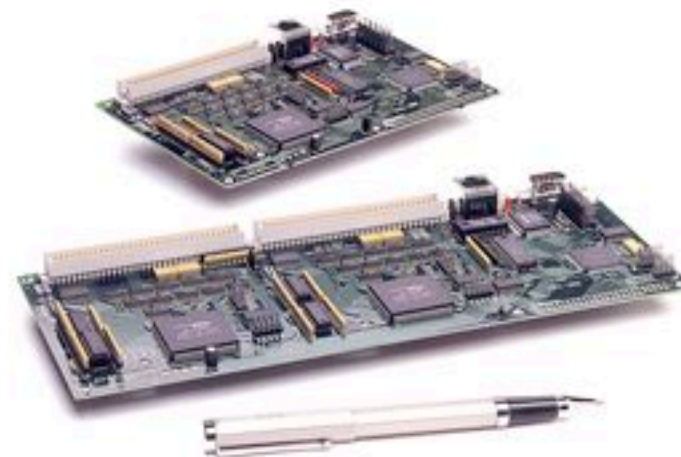
- Server & Communication - done
- Databases (grouping & access) - done
- User Interfaces - in progress
- Analog input - done





Motion Control H/W

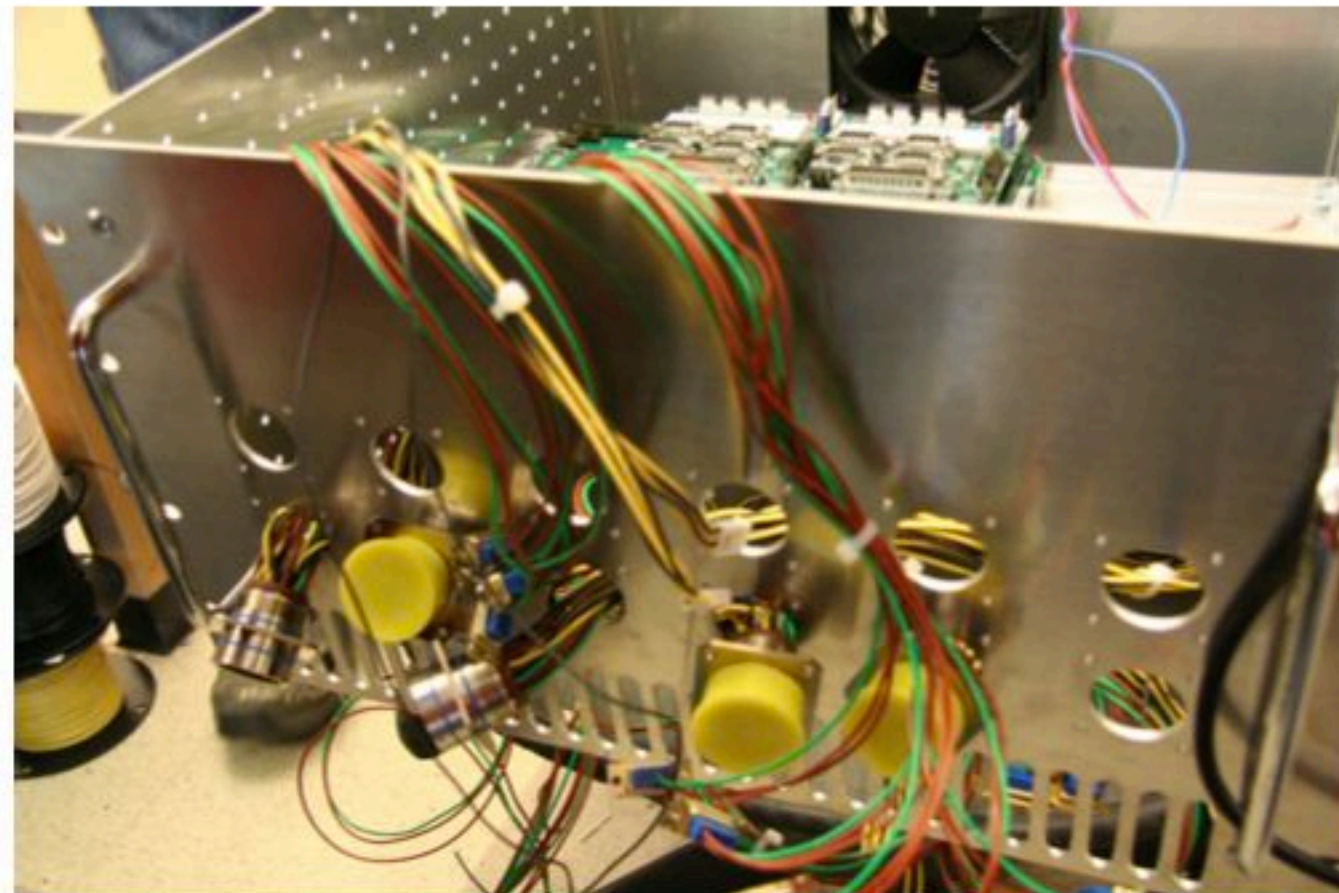
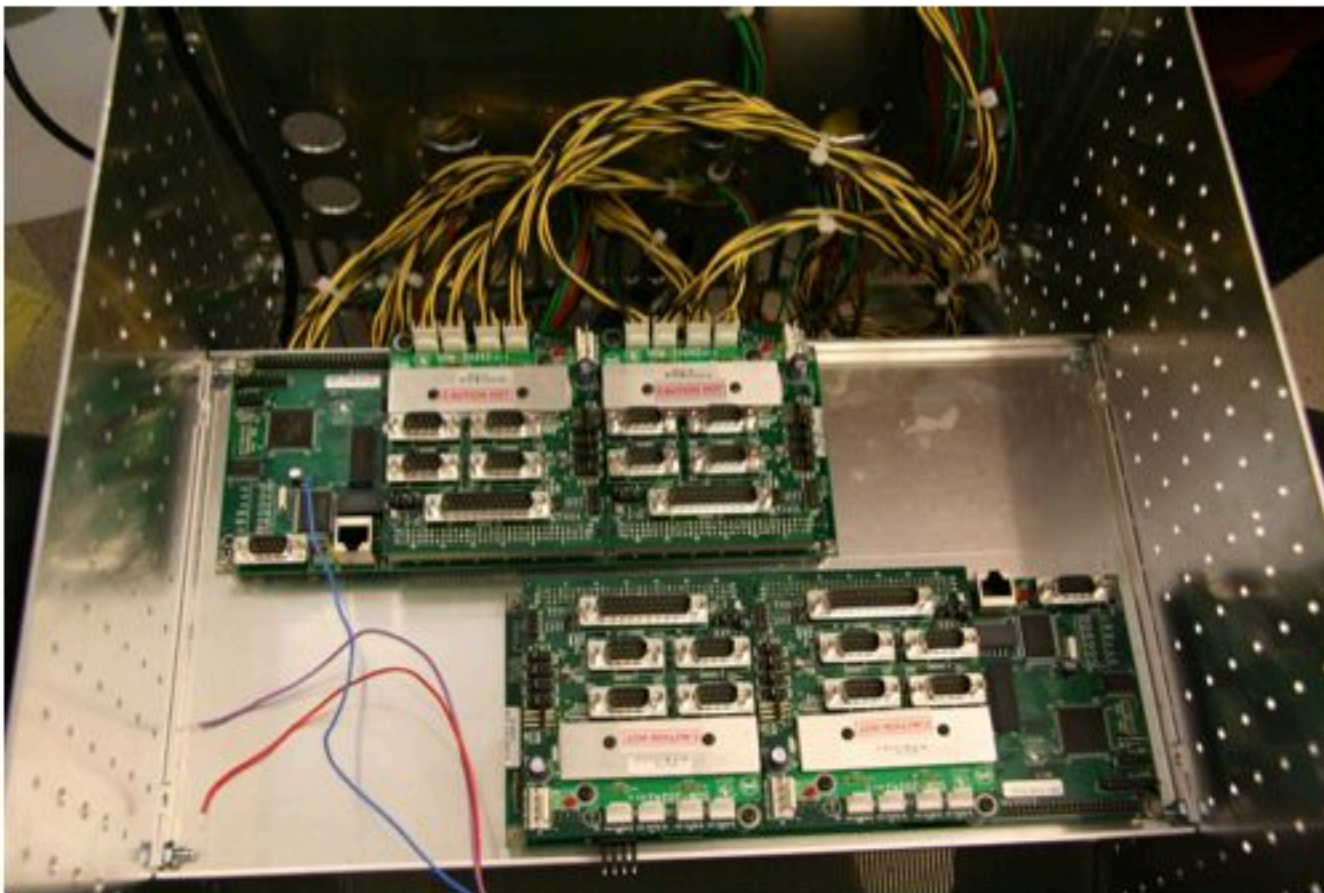
- Galil DMC-2813 8-Channel Controller
Encoder inputs
Ethernet + RS232 control
2 x drive cards
- Galil SDM-20242 Step Motor Drive Card
4 step motor drivers per





Motion Control H/W

- Controller Boxes - in progress
- Vacuum Harnesses - in progress
- Air Harnesses - not started

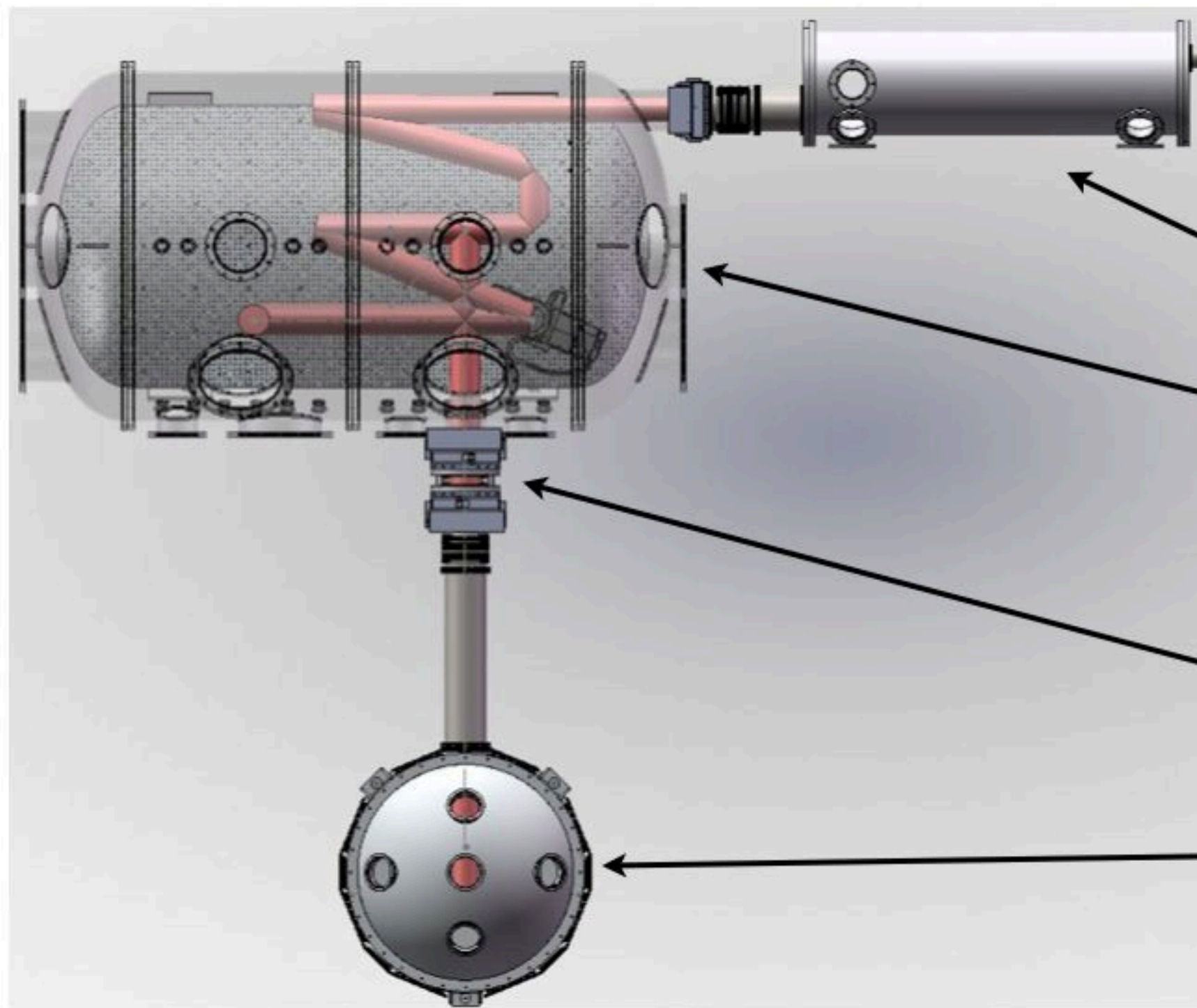




Vacuum Beamline



Vacuum Beamline



Beam
(~10' Beam tube not shown)

Fold Chamber (FC)

Compressor
Chamber (CC)

Pellicle Chamber (PC)

Target Chamber (TC)

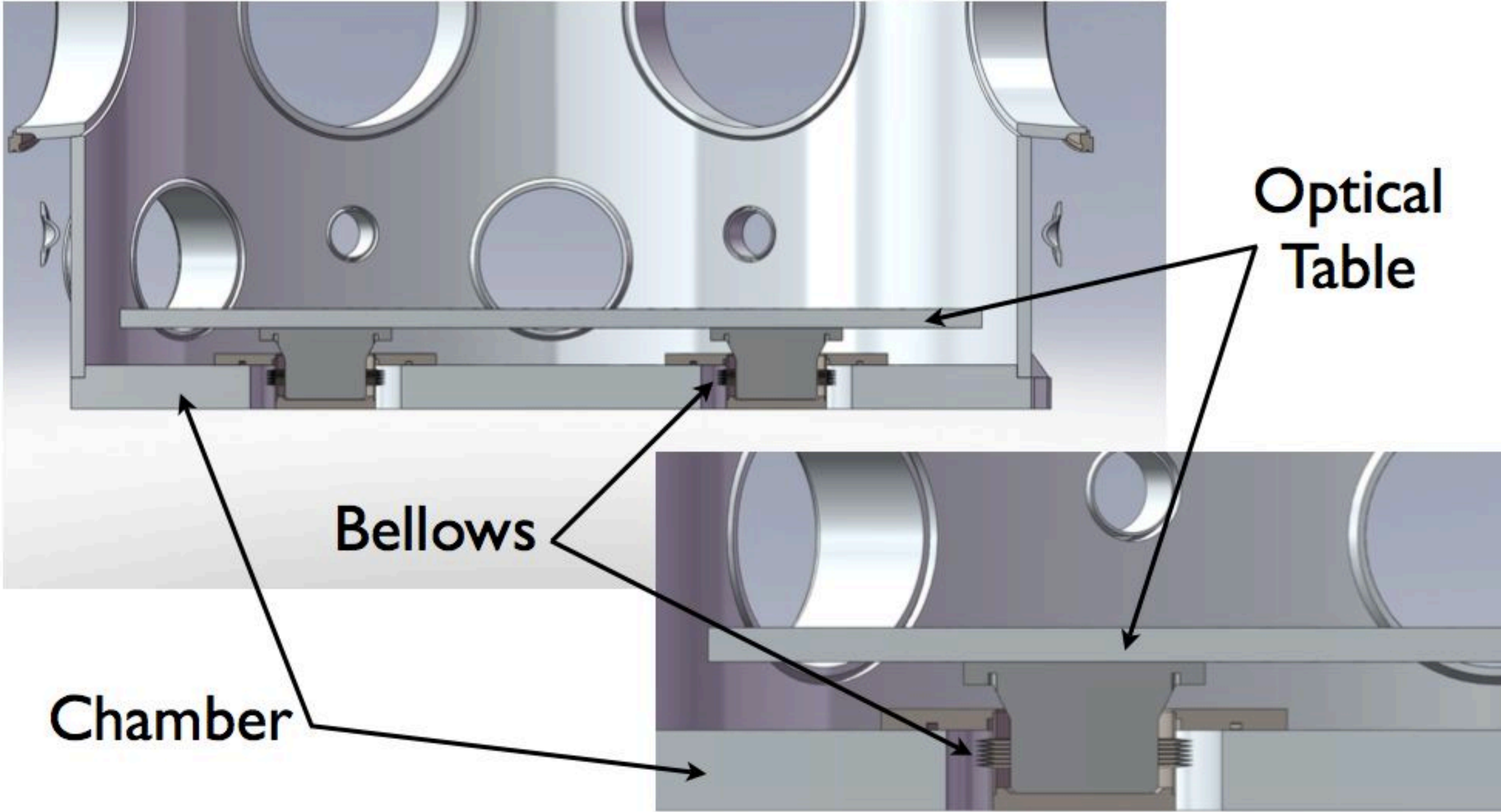


Fold Chamber

- Path length adder for image relay/telescope
- Replace flat w/deformable mirror in future
- $\varnothing 20'' \times 6'$ cylinder
- $\leq 10^{-6}$ Torr, 500 l/s turbo pump
- Decouple optics from chamber

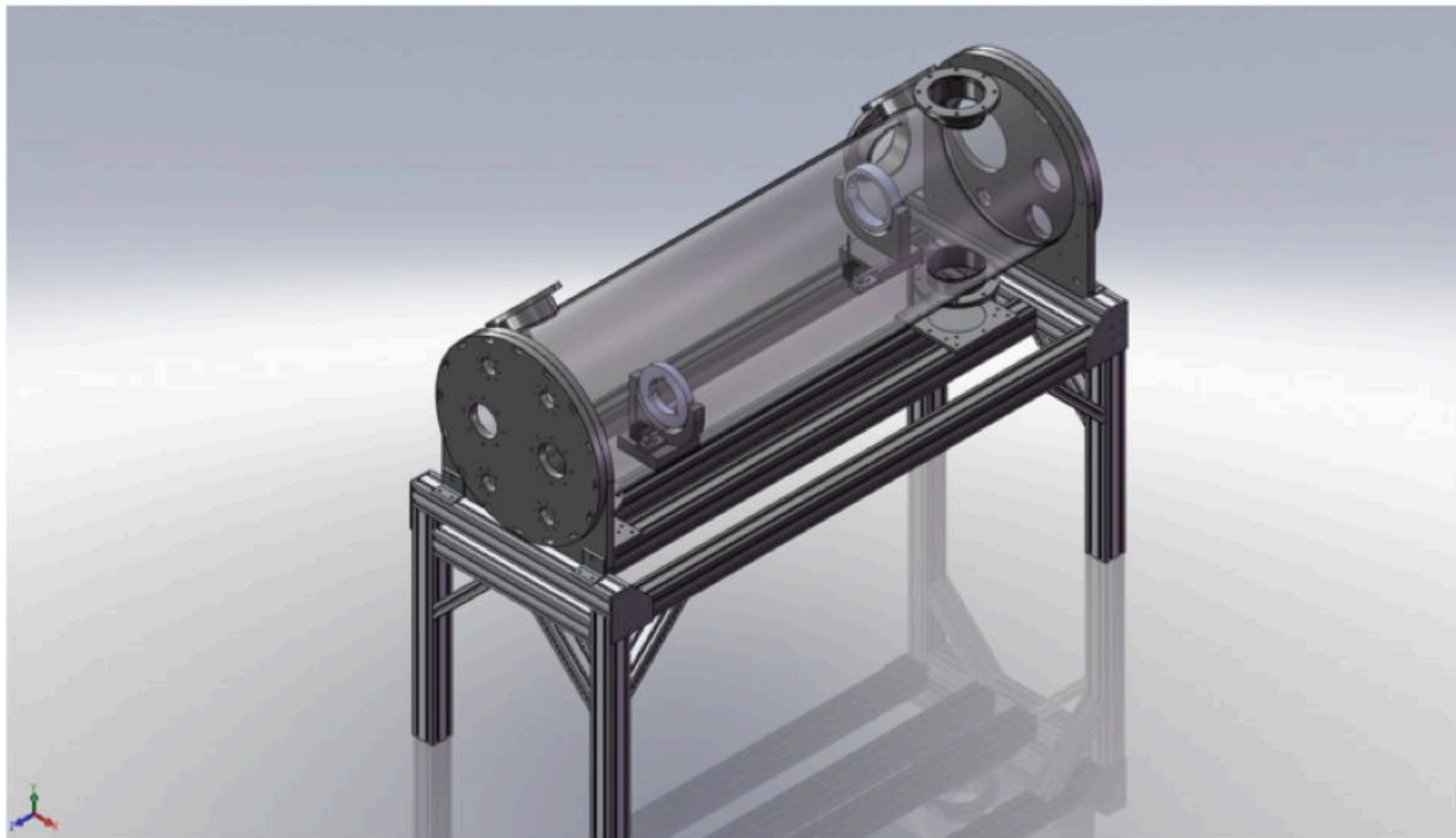


Decoupling





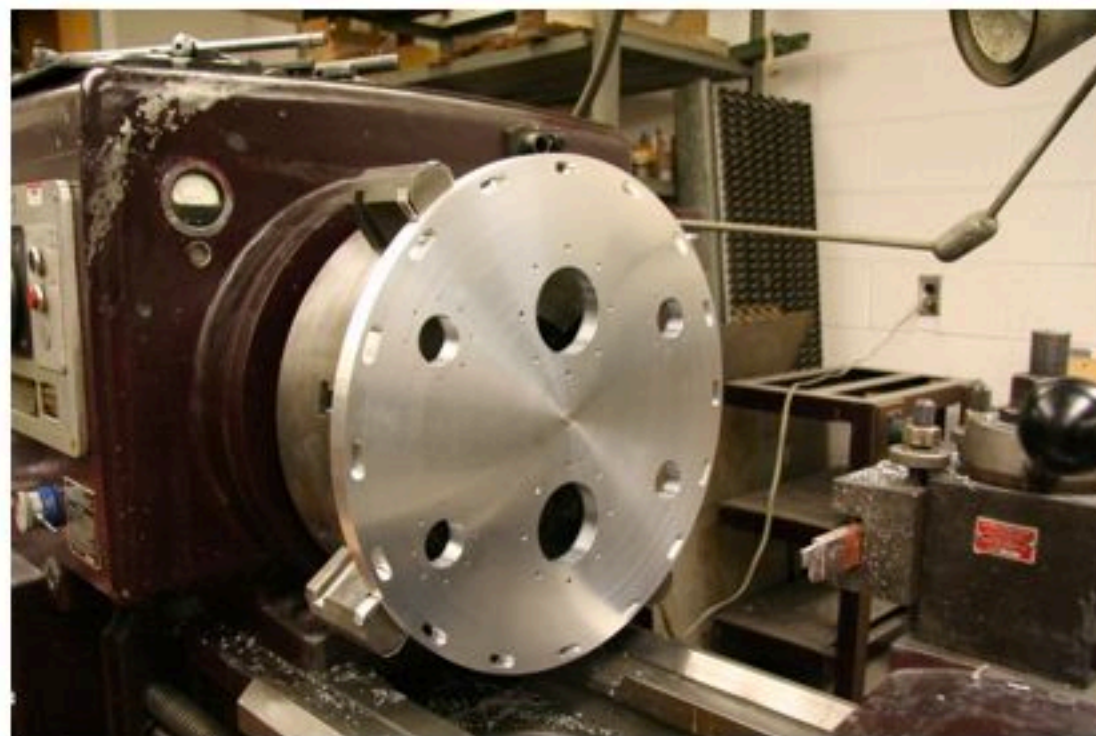
Fold Chamber





Fold Chamber

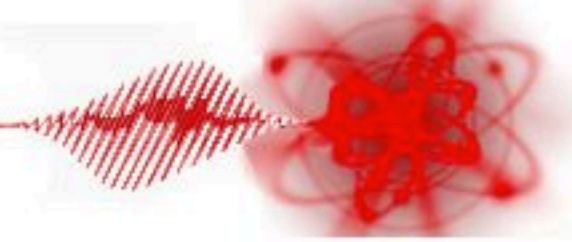
- Parts in fab, ~40% complete
- Planned completion end-Jul
- Decoupling bellows in leak-check (Lesker)



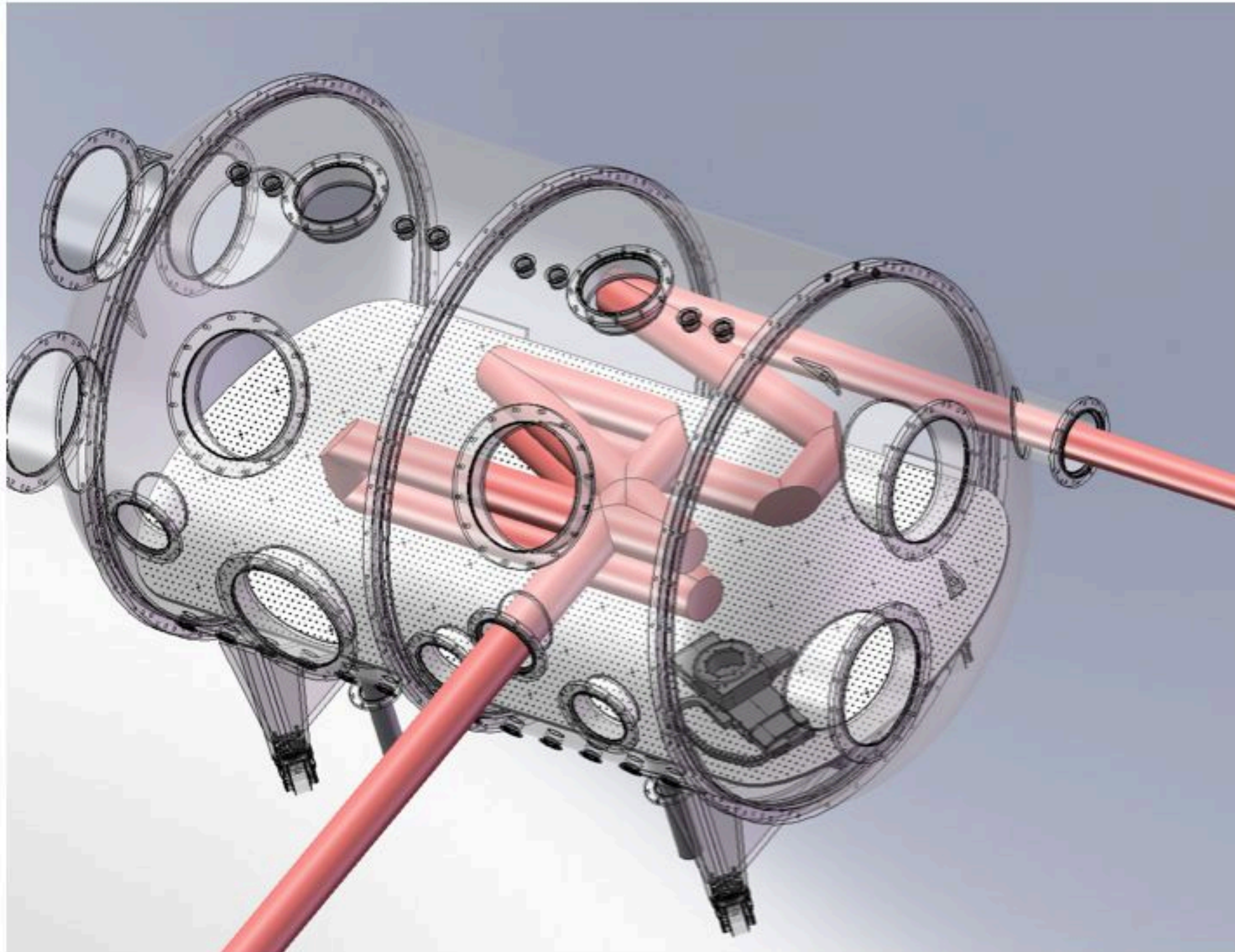


Compressor Chamber

- Compressor & in-vacuum diagnostics
- $\varnothing 6' \times 9'$ cylinder, domed ends
- $\leq 10^{-6}$ Torr, dual 1000 l/s turbo pumps
- Decouple optics table from chamber
- Fit through halls & doors of PRB



Compressor Chamber





Compressor Chamber



Jun 3



Jun 17



Jun 17



Compressor Chamber

- In leak check, ship date 20 Jul (AtlasUHV)
- Optics table in fab (Yarde)
- Optics table structure in fab (Physics Shop)
- Decoupling bellows in leak-check (Lesker)



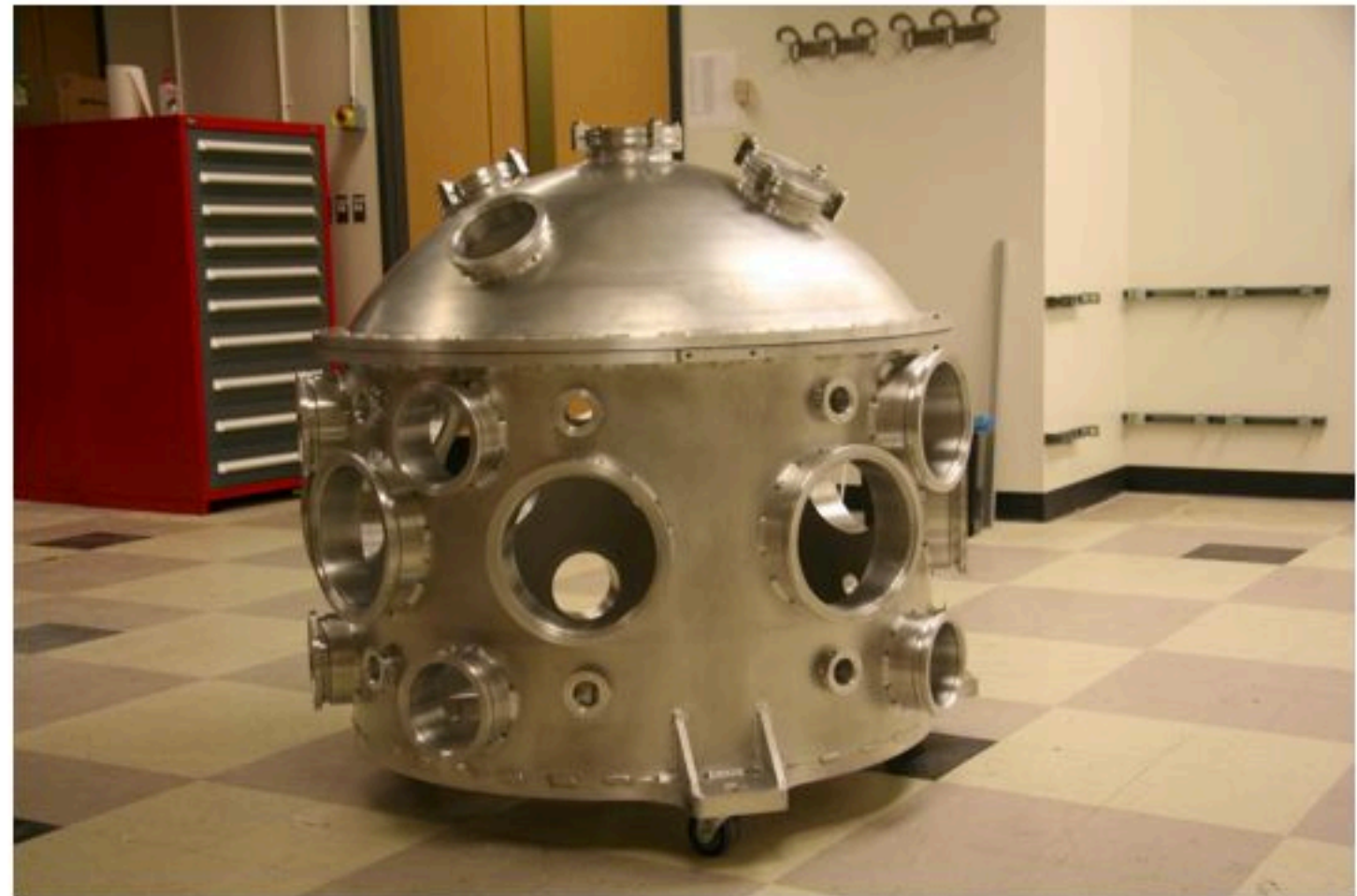
Pellicle Chamber

- Vacuum barrier between TC and CC
- Balanced pumping mandatory
- Pellicle change w/o beamline disassembly
- Gates/valves synchronized & interlocked
- $\leq 10^{-3}$ Torr until gates open, then $\leq 10^{-6}$ Torr
- CAD modeling nearing completion



Target Chamber

- $\varnothing 42'' \times 30''$
- $\leq 10^{-6}$ Torr, dual 700 l/s turbo pumps
- + Cryopump?





Vacuum Cleaning

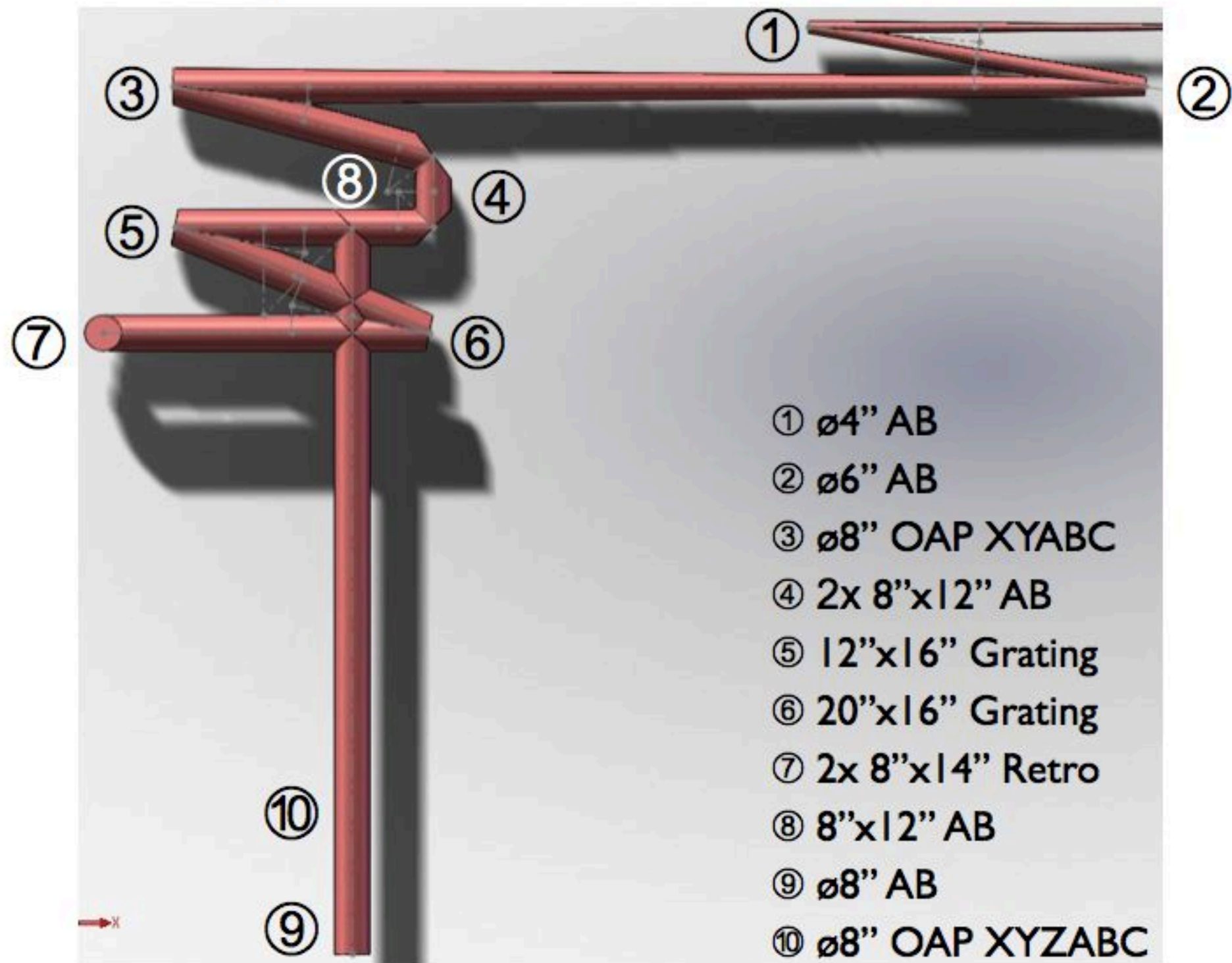
- Mill: Citriclean & abrasive surface prep
- Machined: soap & water, Simple Green
- Final clean: acetone, methanol, & DI water
- Assembled beamline bakeout @ 100°C,
 $10^{-1} \leq 10$ Torr (Ar?), 4-5 days



Large Optic Mounts



Compressor Beamline





Requirements

- Rotational (Roll, Pitch, Yaw) Range: $\geq \pm 1^\circ$
Resolution: ≤ 1 arcsec ($5\mu\text{rad}$) / step
- Linear (XYZ) Range: $\geq \pm 1$ cm
Resolution: $\leq 1\mu\text{m}$ / step
- Large Grating 40kg
Retro mirror 20kg
Fold mirror 0.3kg
- Vacuum compatible to $\leq 10^{-6}$ Torr



Challenges

- Combination of:
Large, heavy optics
Minute adjustments
Stability, repeatability
Vacuum compatible
- No COTS $\Rightarrow$ Custom $\Rightarrow$ \$\$\$\$\$\$



Kinematic Mounts

- Two-parts: holder & base
- Three contact points
- Spring-loaded
- Two or three adjustors
- High adjustor loads
- Scaling





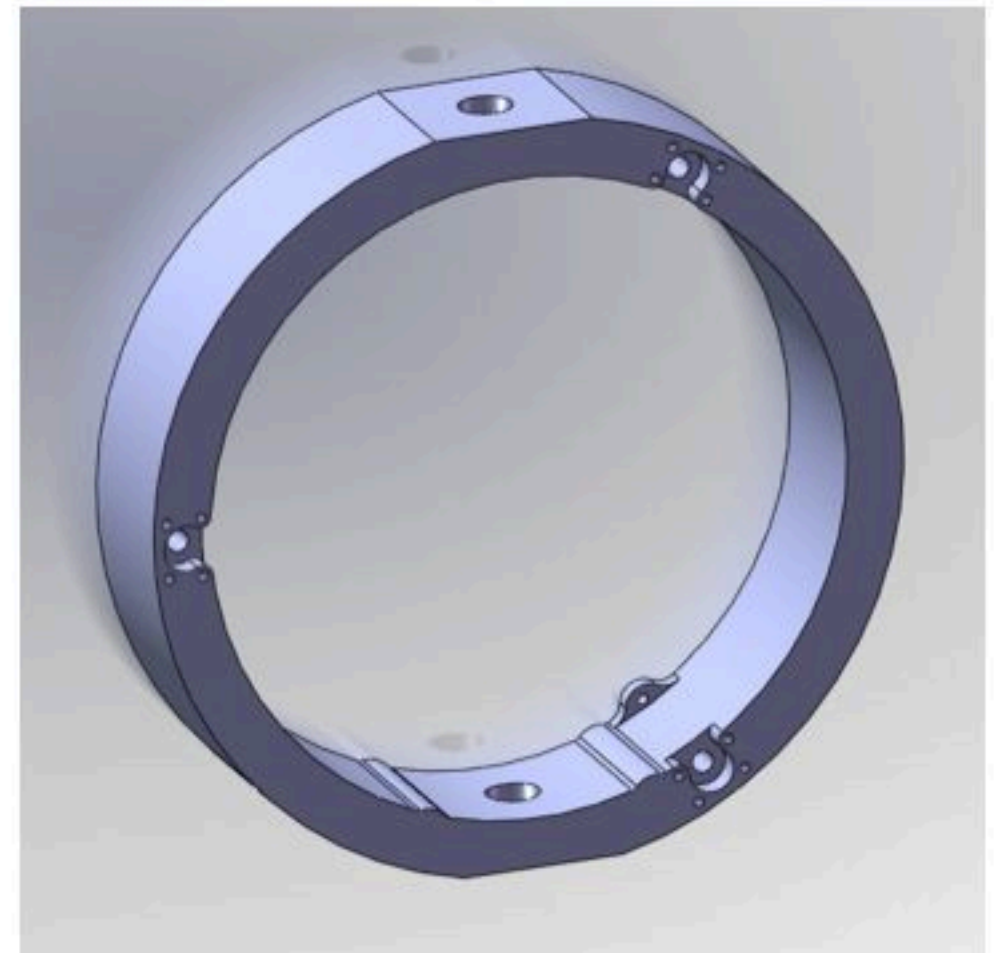
Mount Types

- 3 x Circular ($\varnothing 4''$, $\varnothing 6''$, $\varnothing 8''$) Optics w/AB
- 2 x Circular ($\varnothing 8''$) w/XYZABC
 - RAL OAP stage
- 5 x Rectangular Optics w/AB
- 2 x Grating Mounts
 - LLE Grating Mounts



HOLDERS

- Circular:
ø4", ø6", ø8"
- Rectilinear:
Frame & corner clamp





Grating Mount

- LLE Grating Design
- Working with PGL

