FACET-II | Facility for Advanced Accelerator Experimental Tests

Picnic Basket, Probe Lines and Laser Diagnostics

October 26-29, 2020

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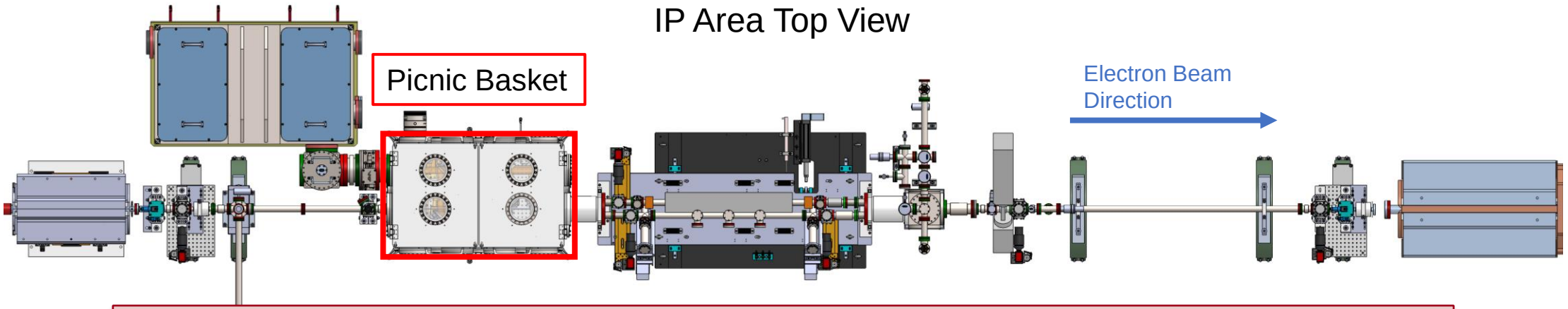
U.S. DEPARTMENT OF ENERGY
Office of Science

University of Colorado Boulder

SLAC NATIONAL ACCELERATOR LABORATORY

Main Picnic Basket Configurations



The picnic basket lets us switch between different experimental configurations remotely

Configuration	Description
1	• Setup for PWFA experiments using the lithium oven or bypass line • Optics for the main ionizing laser and the E324 probe beam
2	• Setup for experiments that require targets – gas jets or solid • Imaging and shadowgraphy setups for the gas jets
3	• Setup for SFQED experiments • The holed mirror is swapped out and the large SFQED stage inserted

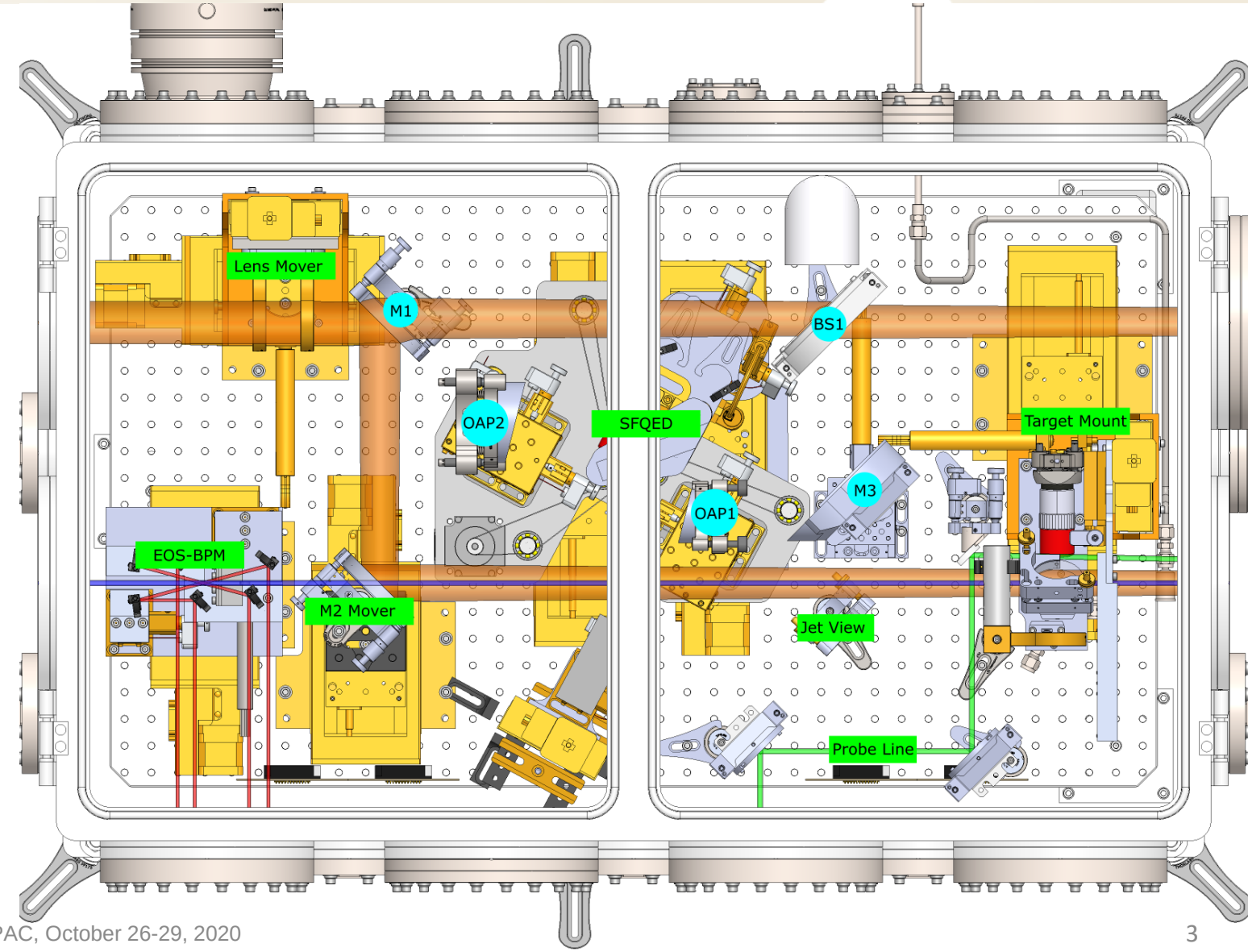
Additional variations on these configurations will exist when running experiments – to be detailed by the users.

Picnic Basket Overview and Major Assemblies

The picnic basket is filled with 7 major assemblies:

1. Lens Mover: switches/removes main laser optic
2. EOS-BPM: Electro-optic sampling beam position monitor
   - Measures longitudinal profile and time resolved beam position
3. M2 Mover:
4. SFQED: E320 experimental apparatus
5. Target Mount: Switches between different gas and solid targets
   - 3 gas jets and a wide range of solid targets
6. Jet View:
7. Probe Line:

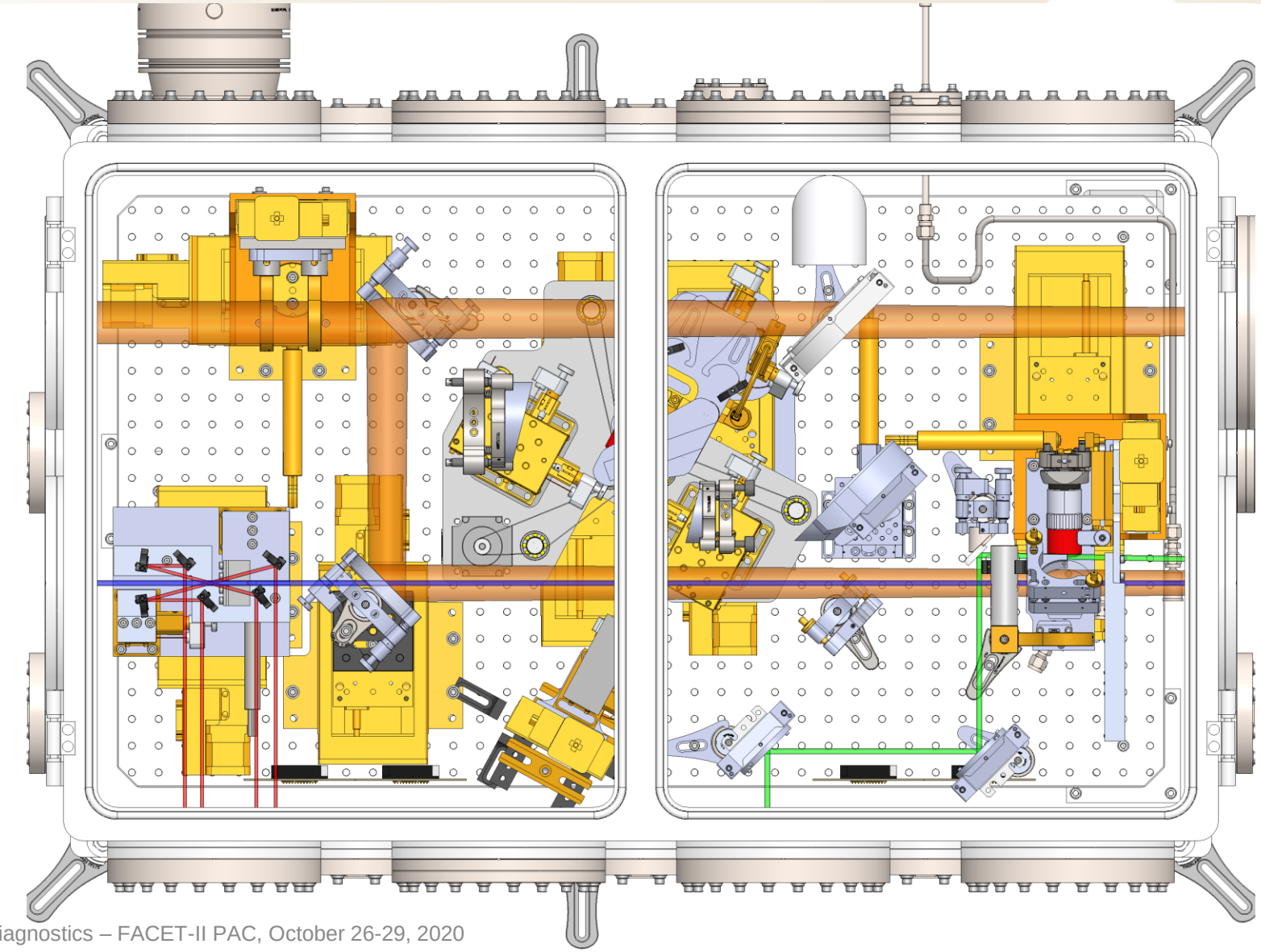
In addition, there is a steering mirror M1.



Configuration 1

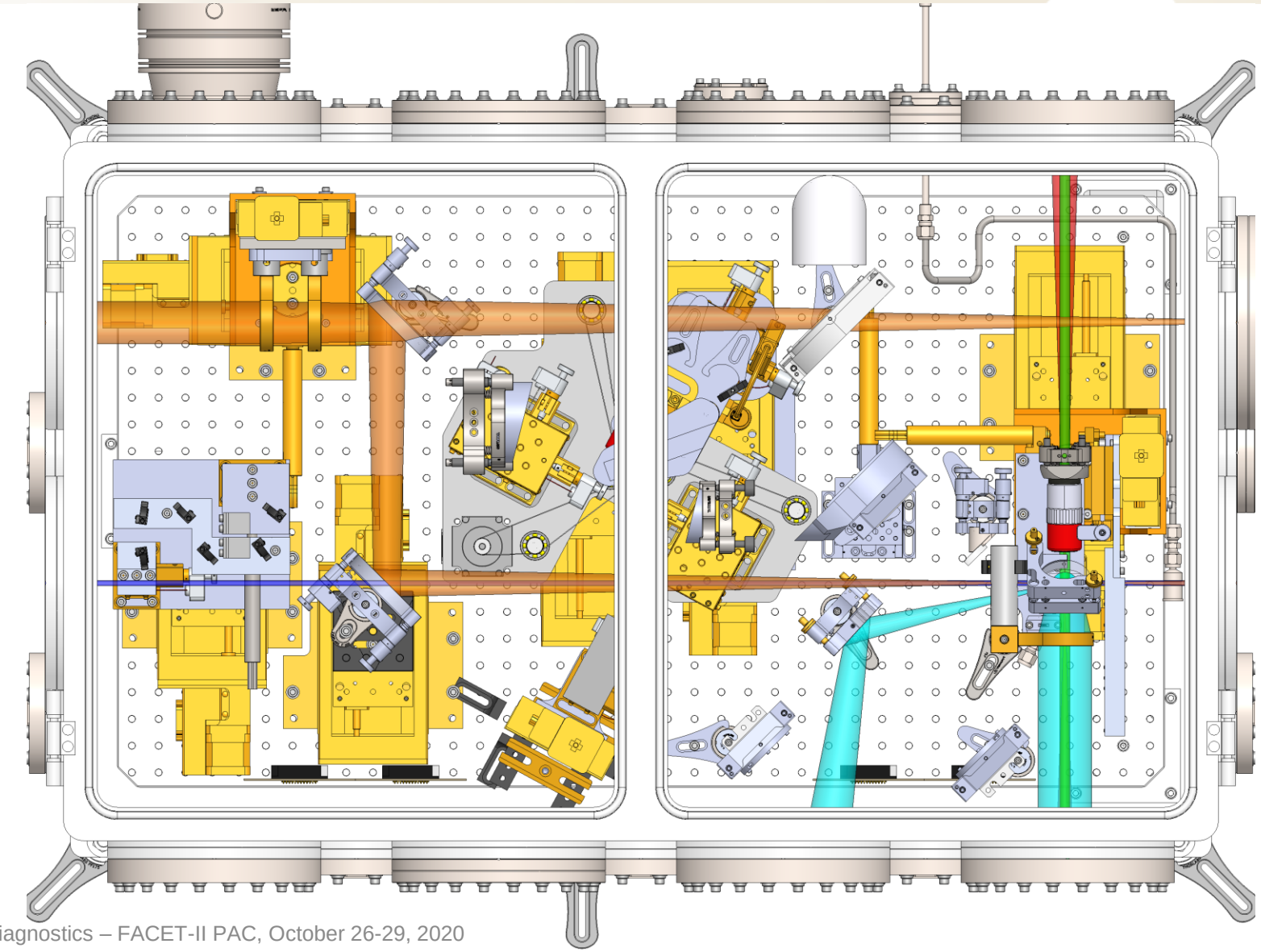
Lens A on mover in compressor

- Electron beam
- Main laser
- Probe laser
- Side ionization laser
- MO image relay
- Gas jet image relay



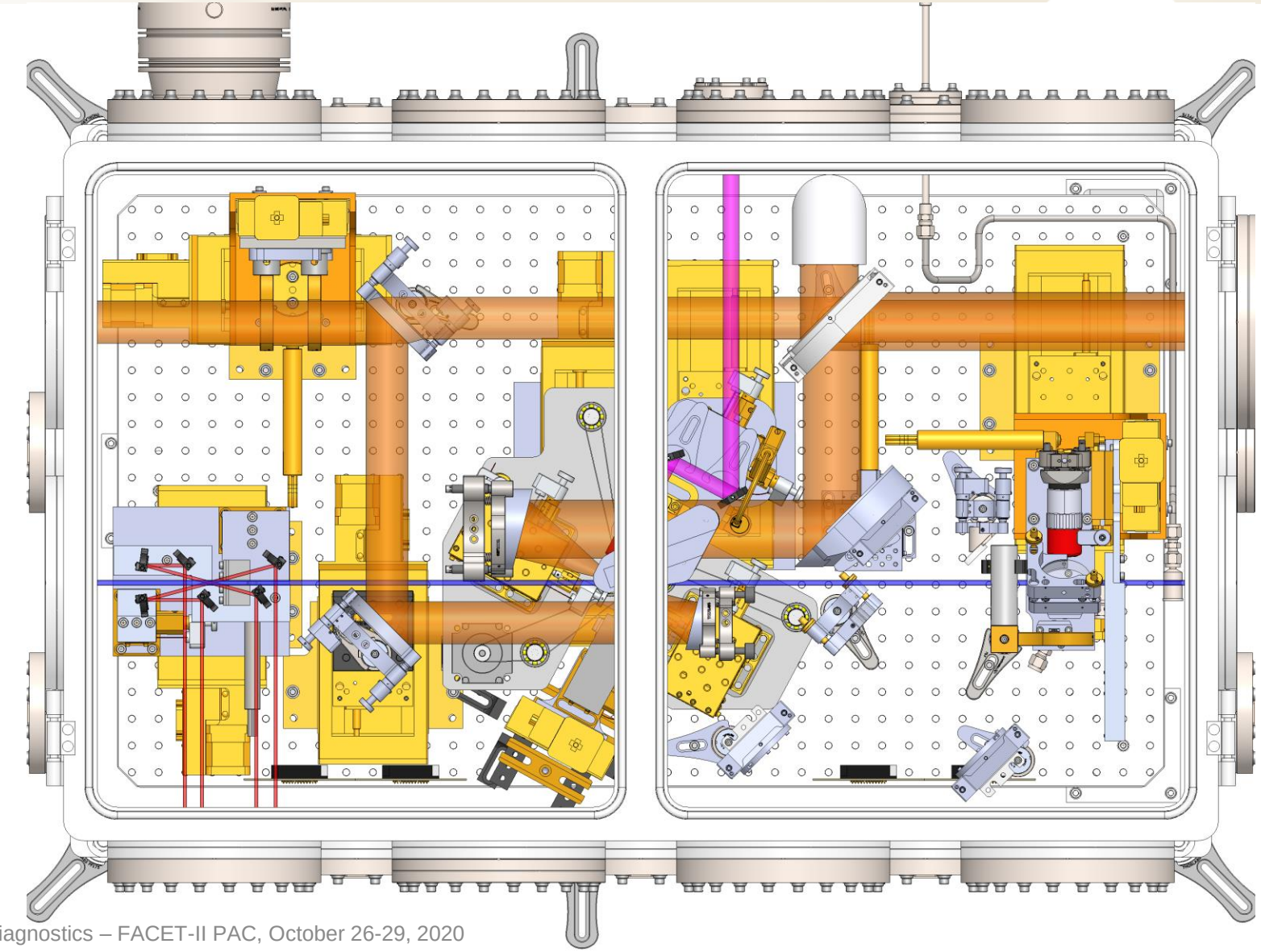
Configuration 2

- Electron beam
- Main laser
- Probe laser
- Side ionization laser
- MO image relay
- Gas jet image relay



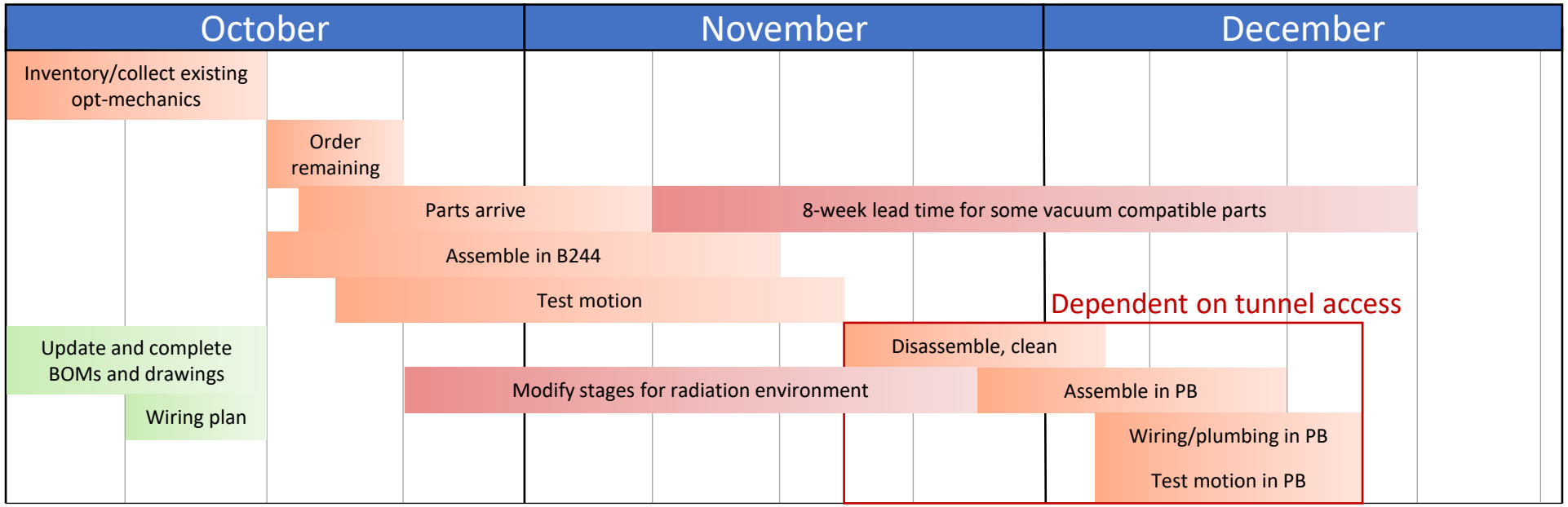
Configuration 3

- Electron beam
- Main laser
- Probe laser
- Side ionization laser
- MO image relay
- Gas jet image relay



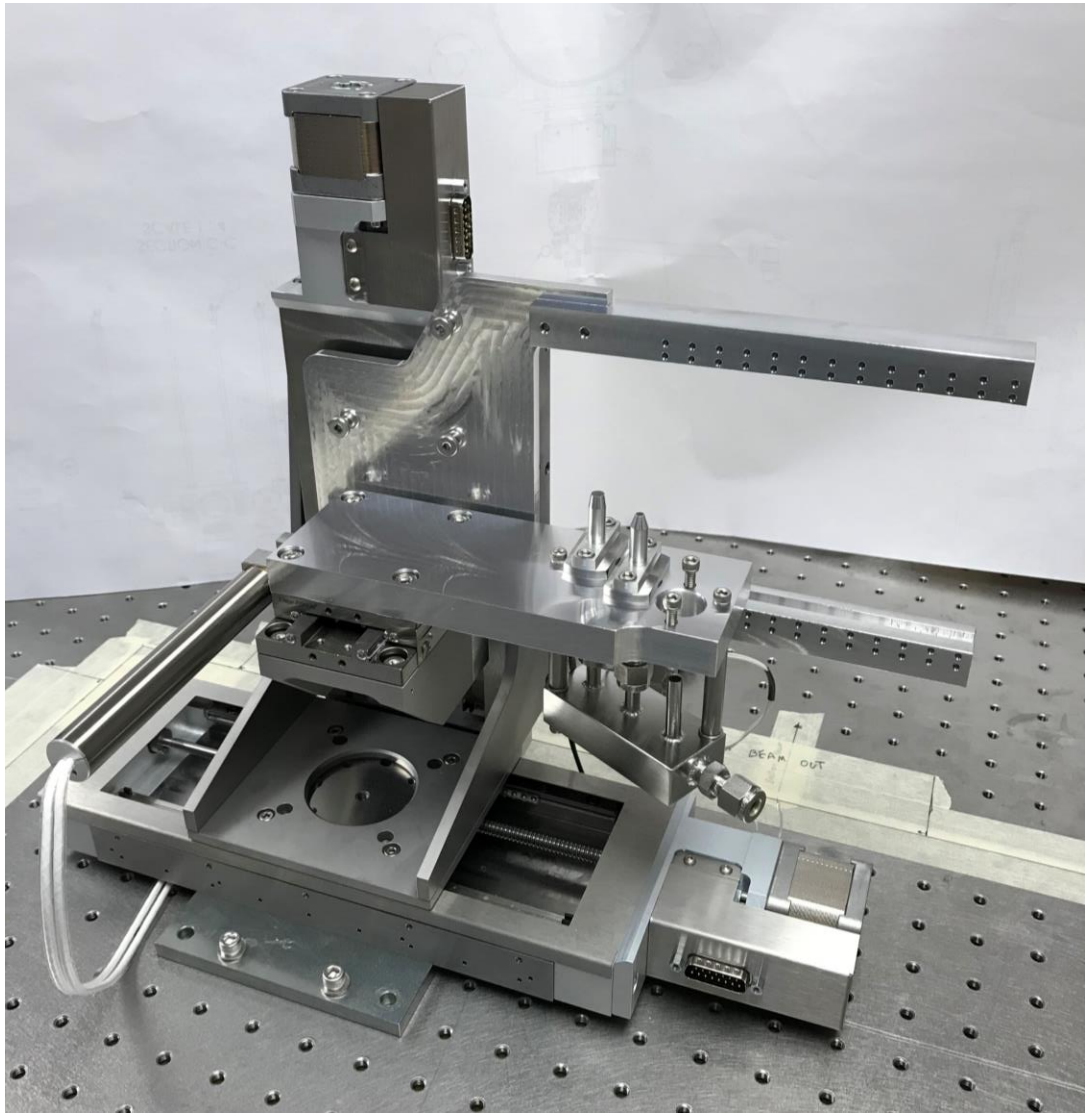
Status and Timeline

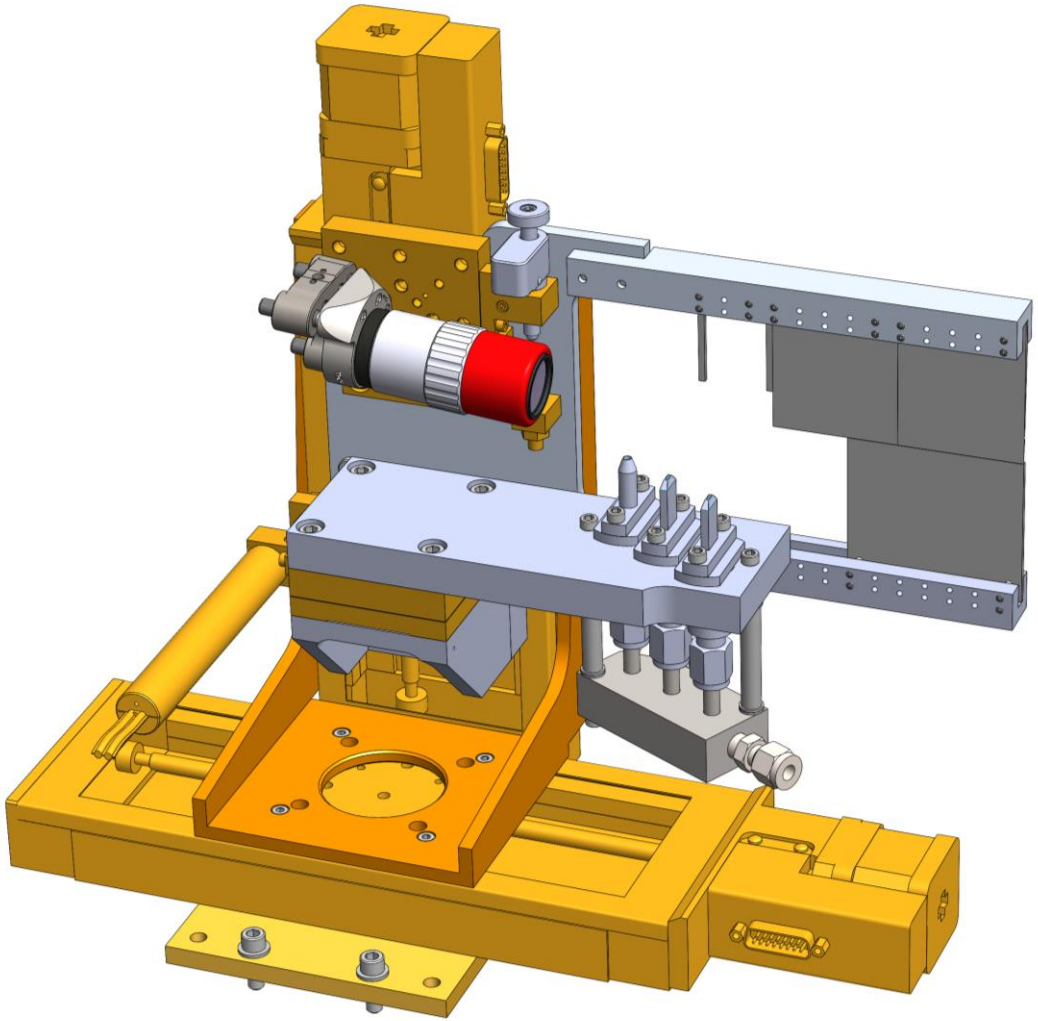
- Work completed to date:
  - Completed bill of materials and installation drawings for all sub-assemblies
  - Inventoried existing parts at SLAC to determine what components still needed to be ordered
  - Ordered or requested quotes for remaining components
- Currently building up the assembly outside of the accelerator in B244 to test clearances and movement.



Experimental hardware planned to be fully installed in the PB mid to late December.

Target Mount (E305, E308, E315) Assembled





Probelines & External Diagnostics – Courtesy Henrik Ekerfelt

4 probelines & corresponding diagnostics

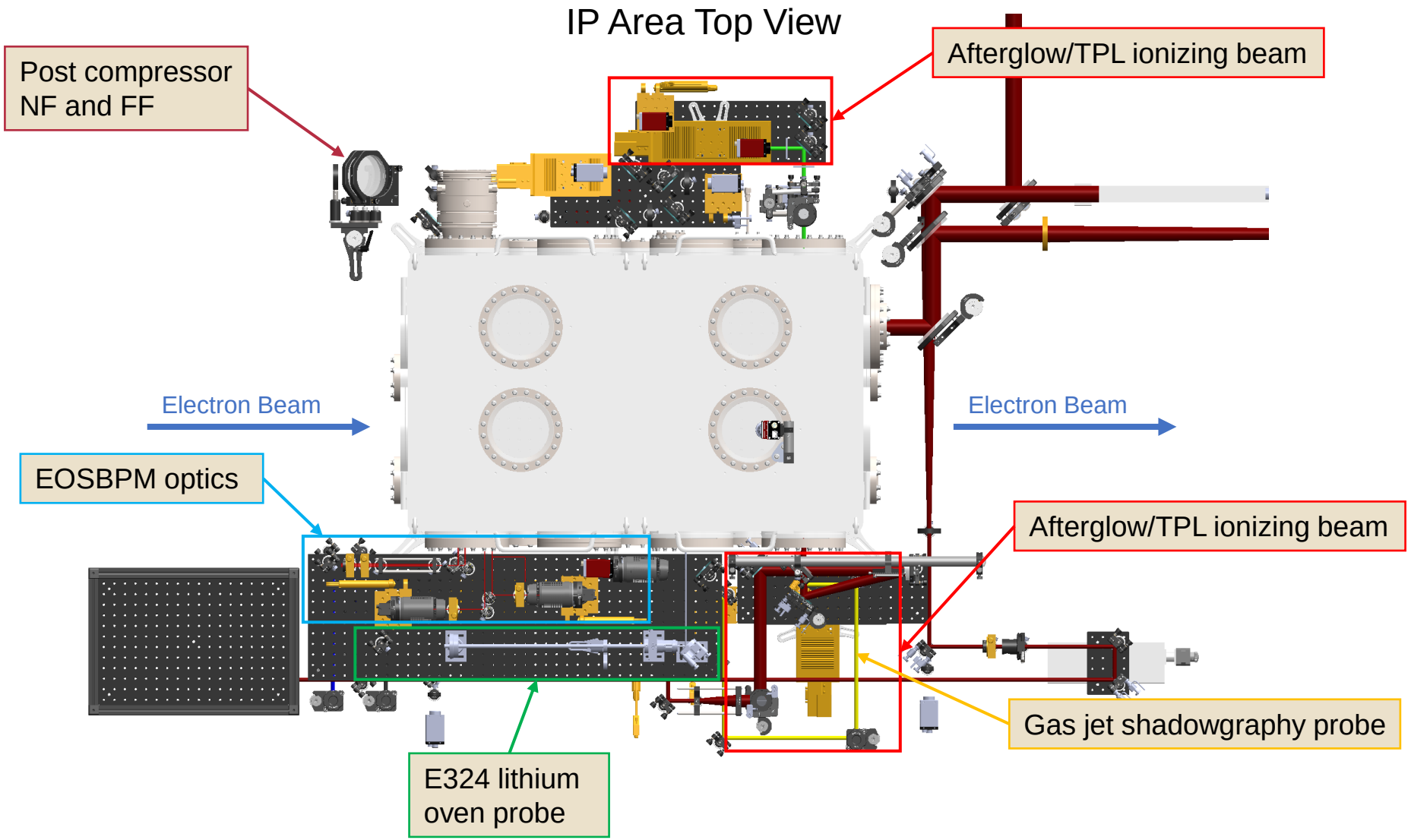
- EOSBPM
- E324 lithium oven probe
- Afterglow/TPL ionizing beam
- Gas jet shadowgraphy probe

8 external diagnostics

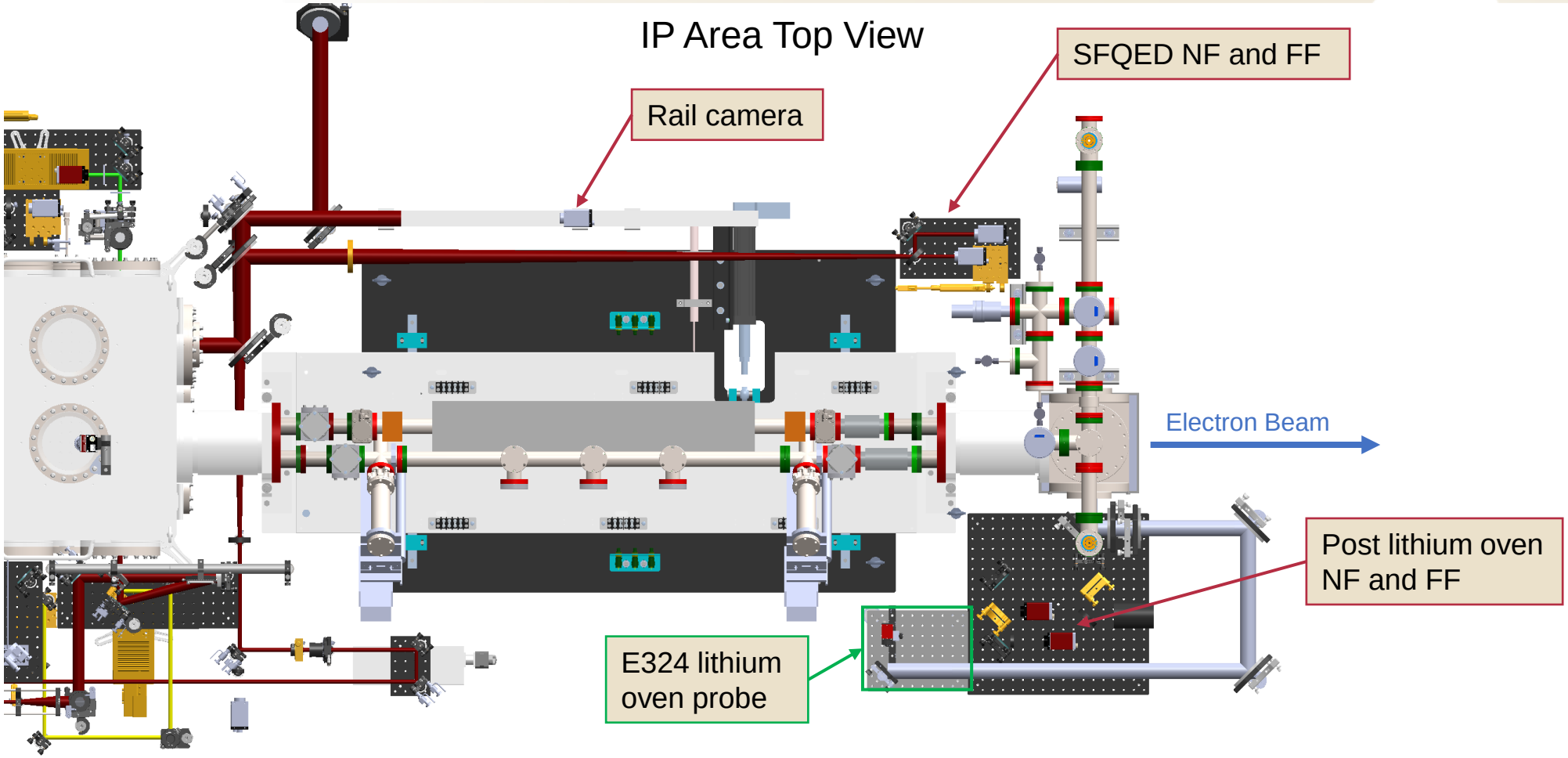
- Probe alignment
- Rail camera
- Near- and far-field for main laser after the compressor
- Near- and far-field for main laser after the lithium oven
- Gas jet top- and upstream-views
- SFQED Focus setup
- SFQED Near and far field

First version of all diagnostics are implemented in CAD.
Mechanical designs >90% complete.
Optical designs are >80% complete.

Top View Probe/Diagnostic Layout



Top View Probe/Diagnostic Layout



The probe lines and different diagnostics all fit in the experimental area.

Timeline and Status

- Finish remaining design work in the next two weeks
- Parts lists are up to date with current design
- Inventory of existing parts – next two weeks
- Missing parts are being ordered – next two to three weeks

- Assemble sub breadboards in B244 where possible
- Final decision on assembly order needs to be made

Thank You!

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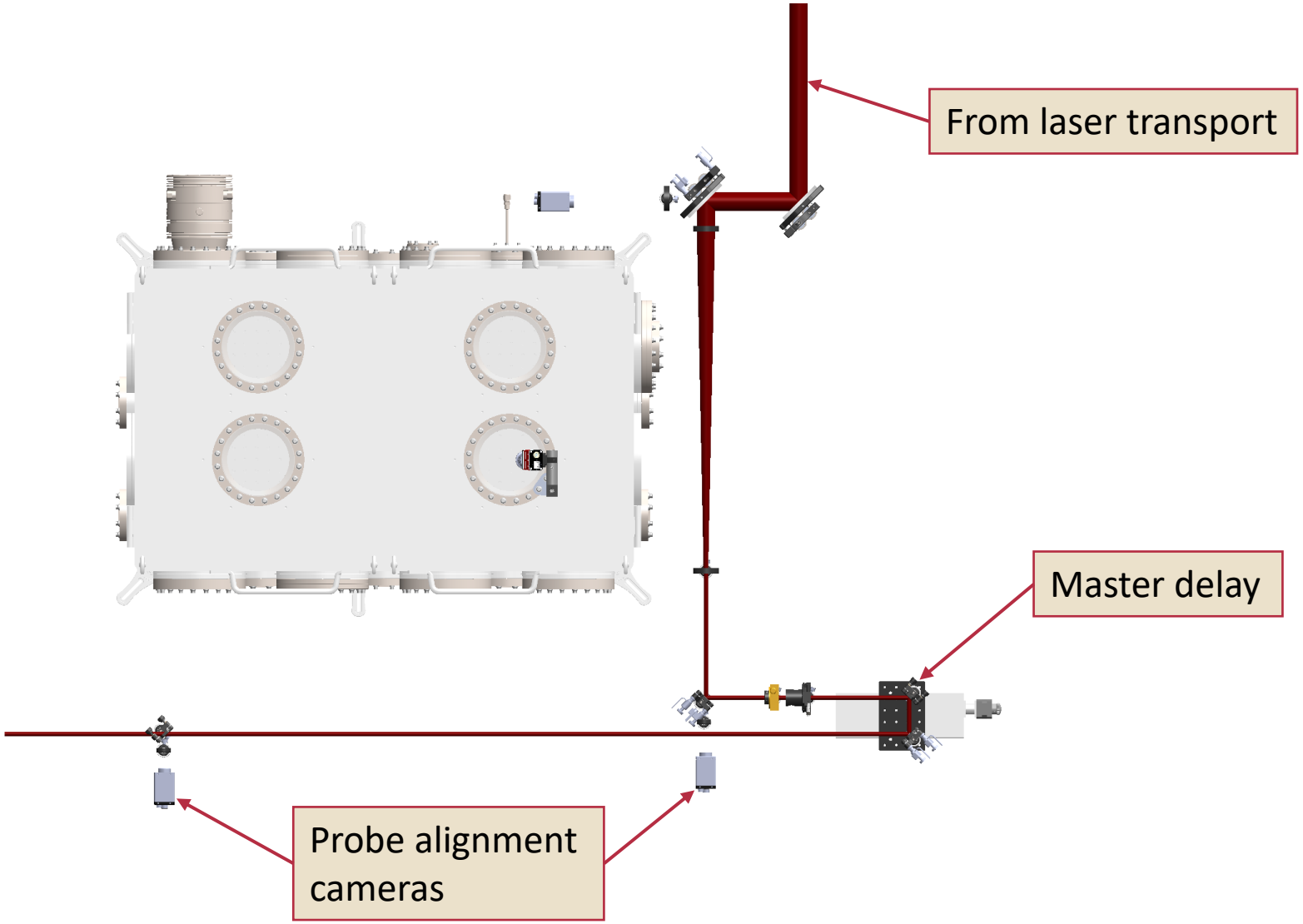
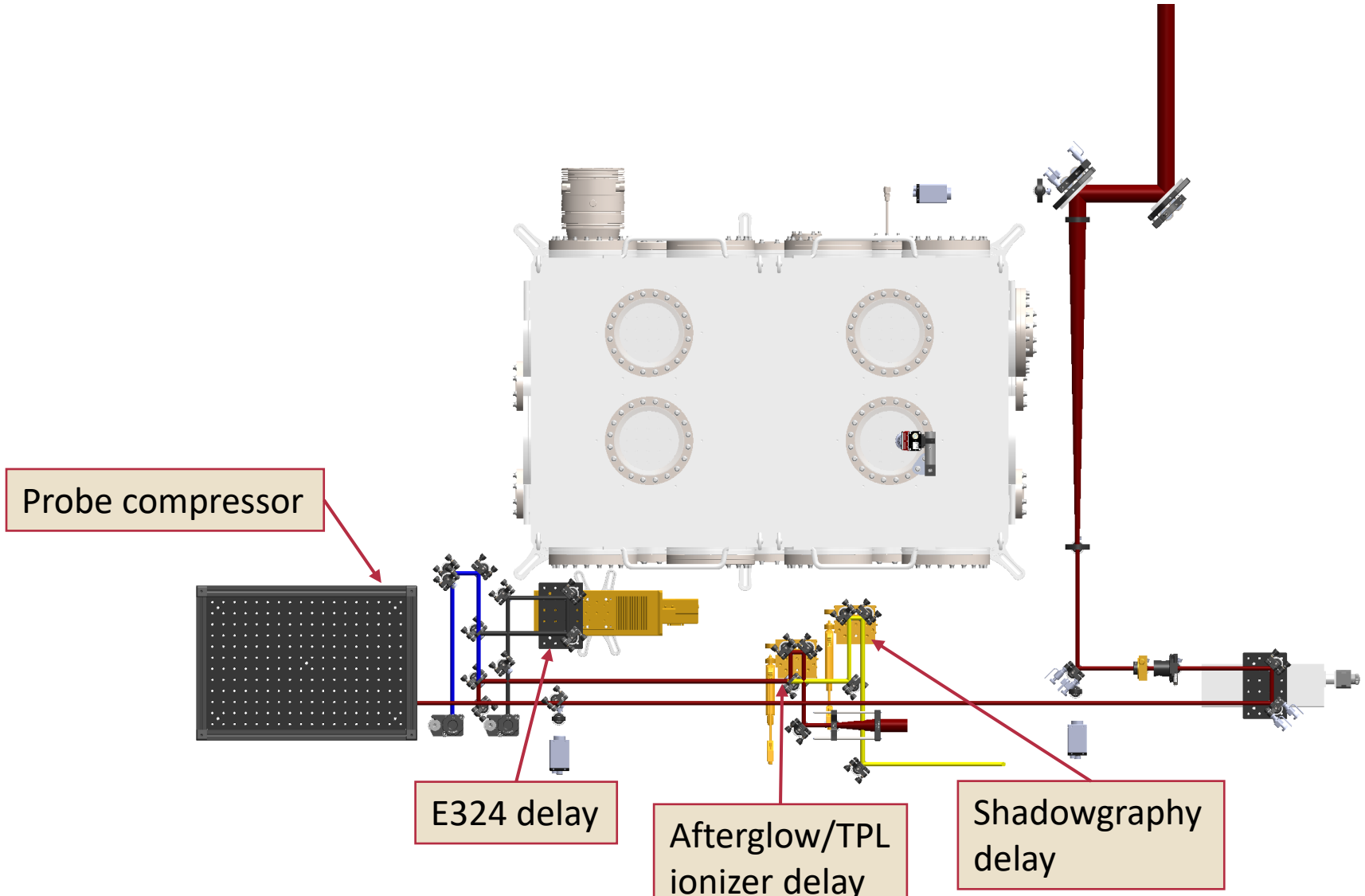
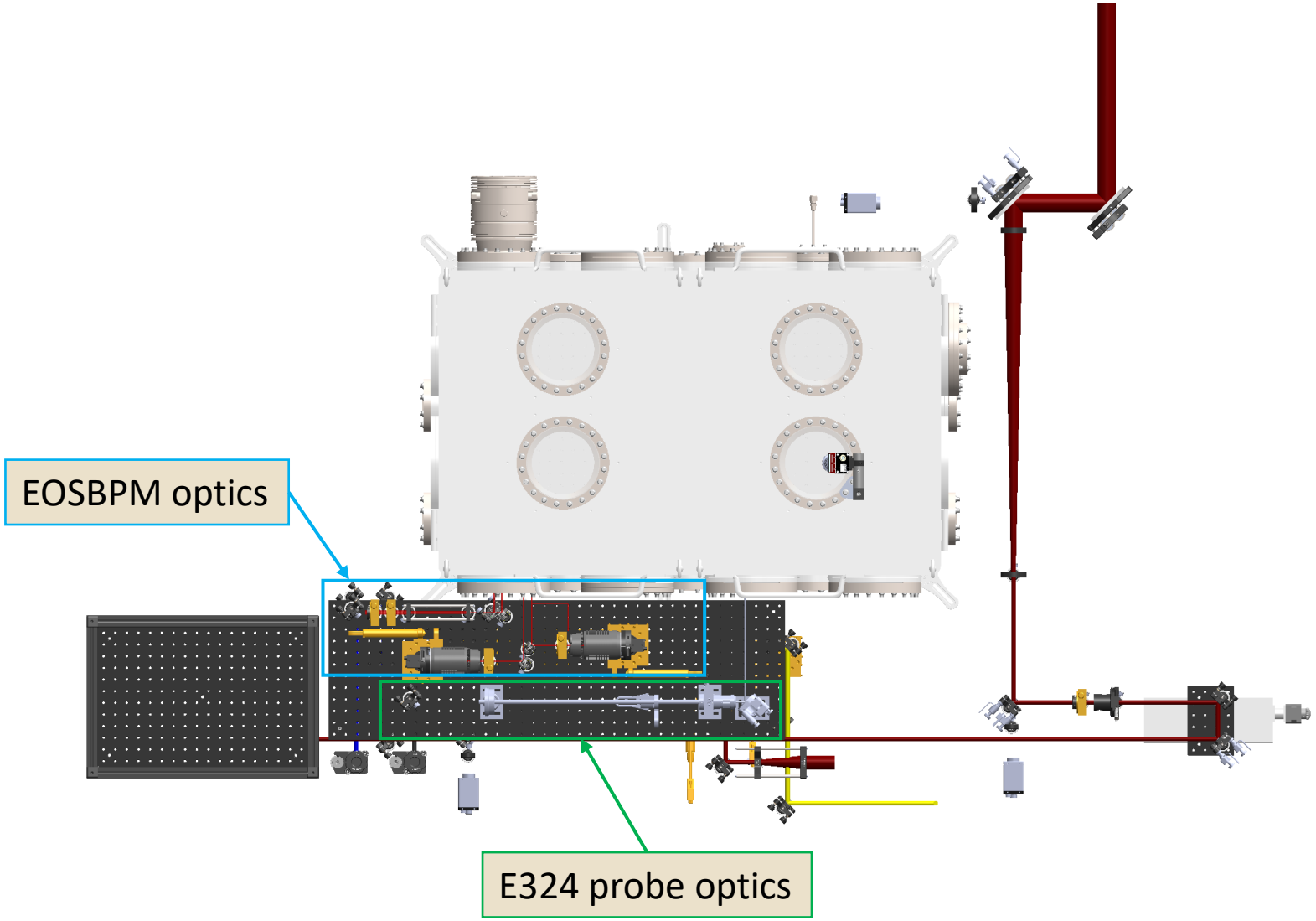
Incoming probeline from laser transport



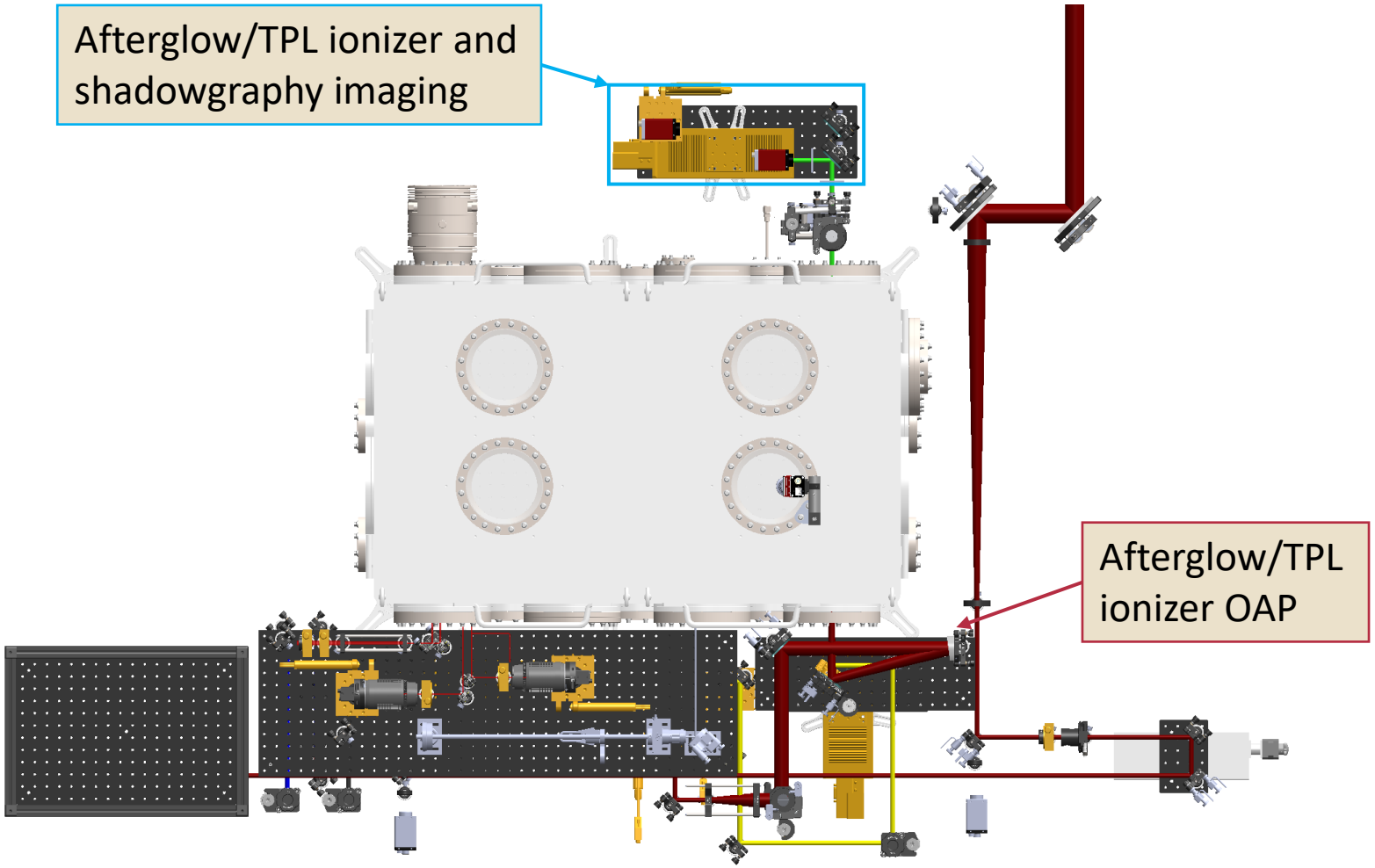
After compression, split into 4 arms with individual delays



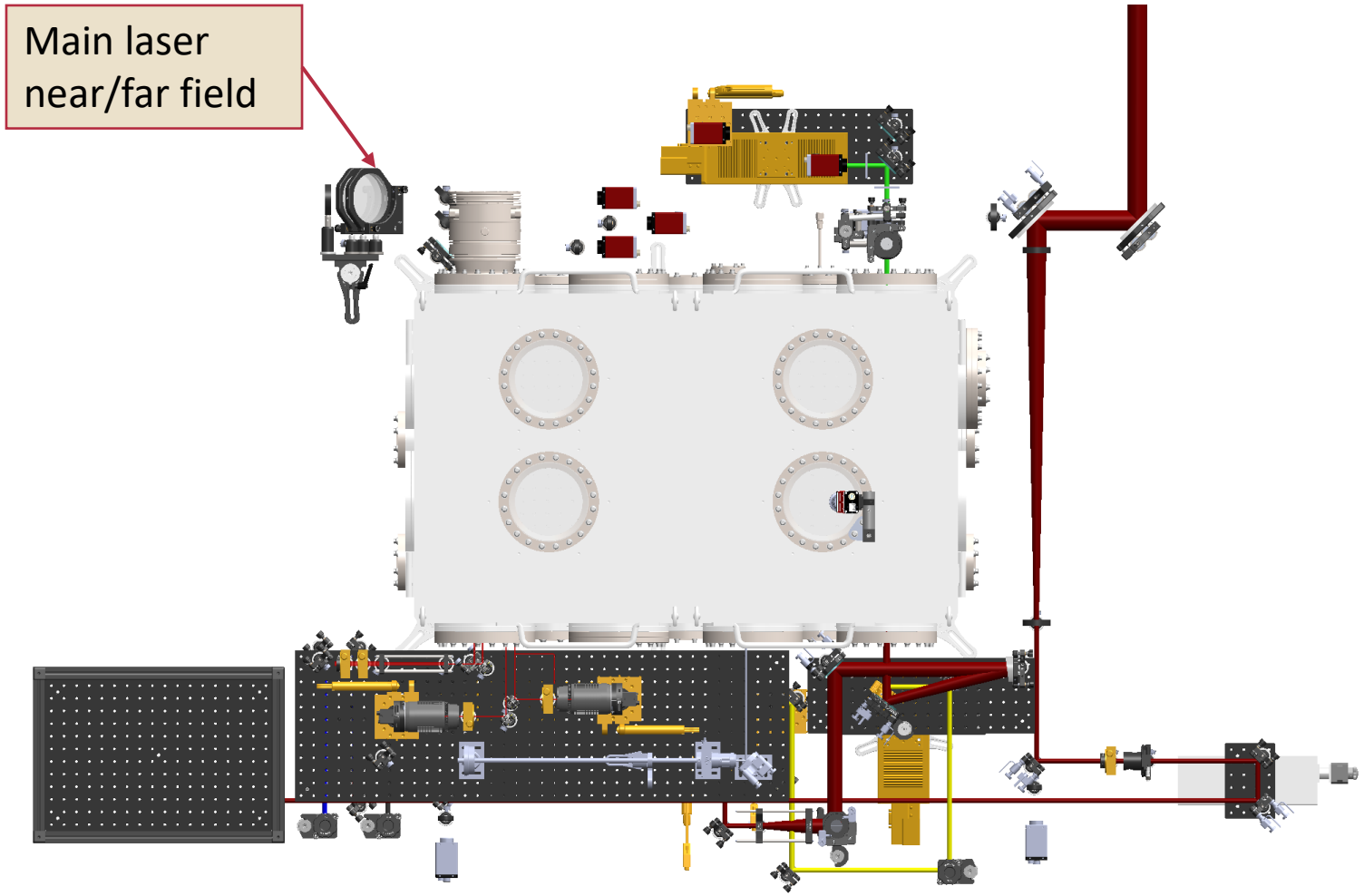
EOSBPM and E324 optics are located on the next level up



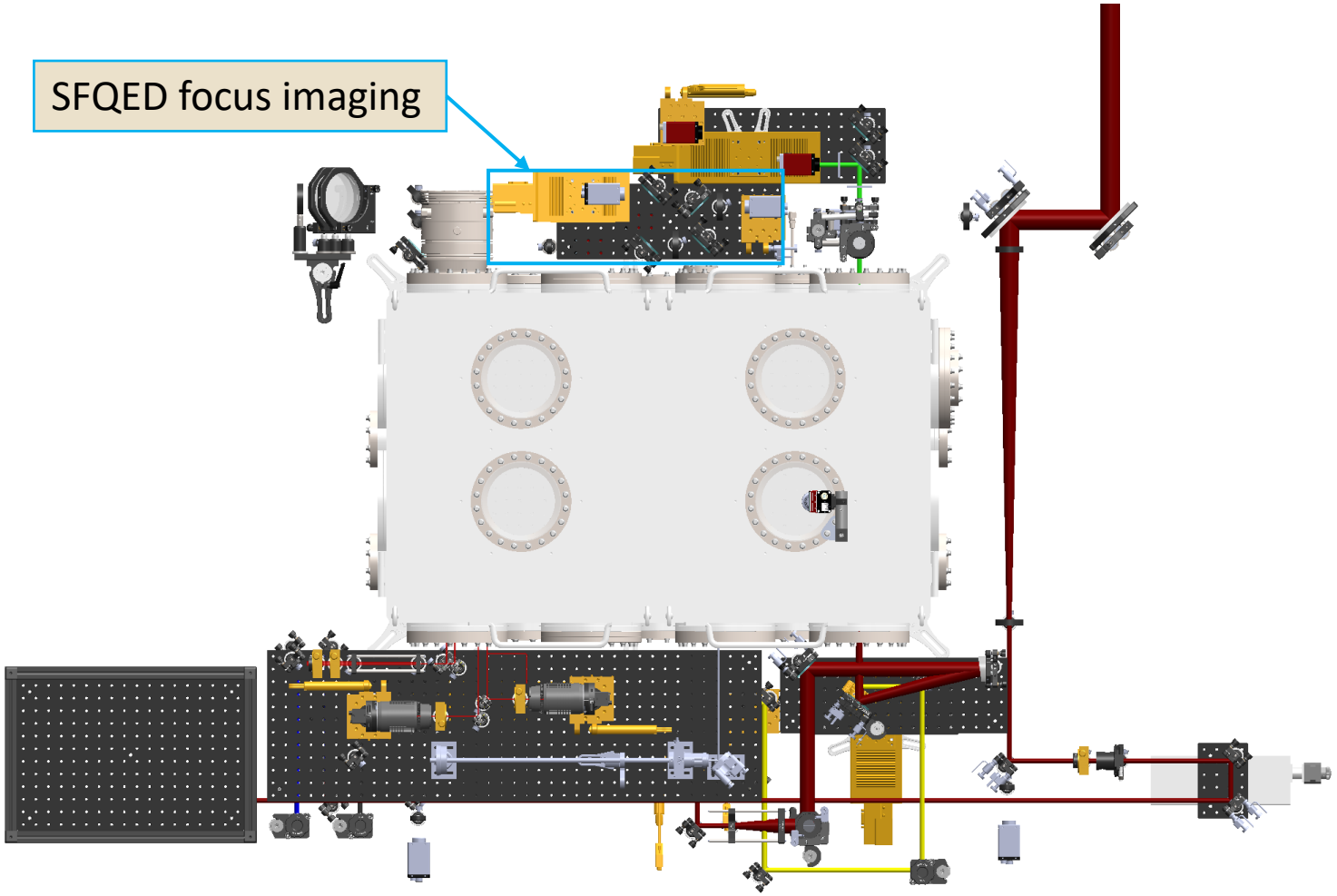
Afterglow and shadowgraphy imaging of gas jets



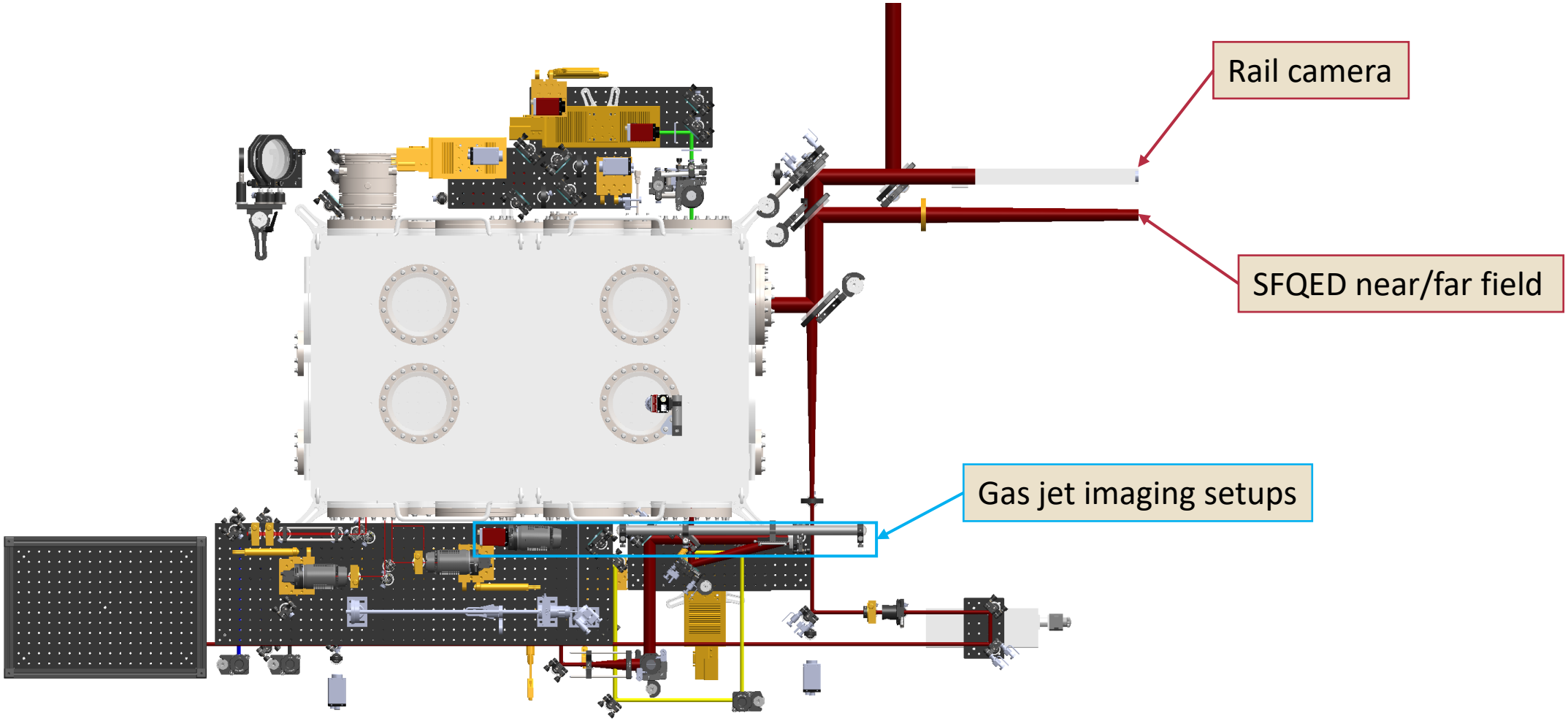
Near- and far-field of the main laser after the compressor



E320 focus diagnostics above the compressor diagnostics



E320 near-, far-field and rail camera. Gas jet imaging cameras



With Li-oven and 8in cube showing near-, far-field and rail