

Picnic Basket Configurations and Upgrades

2023 FACET-II User Meeting

Robert Ariniello / Project Scientist / AARD

October 17-19, 2023



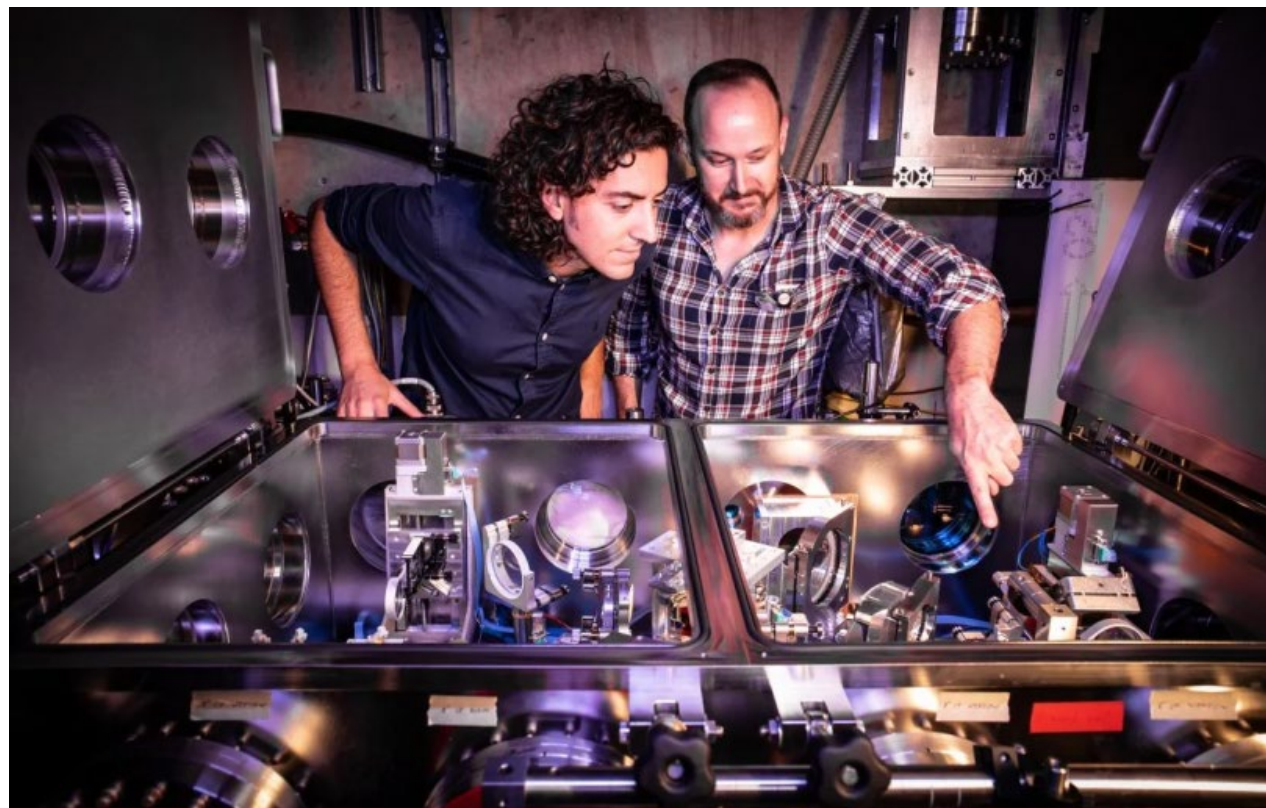
FACET-II

Facility for Advanced
Accelerator Experimental Tests

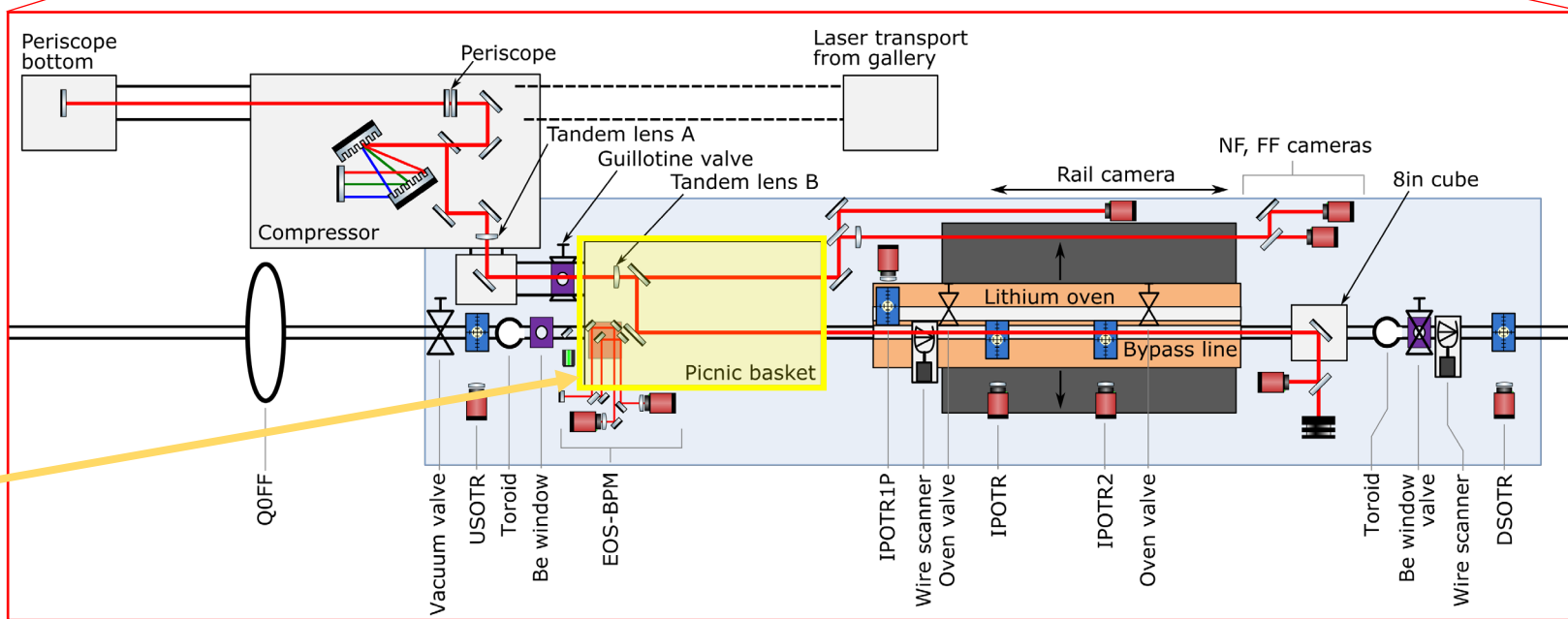
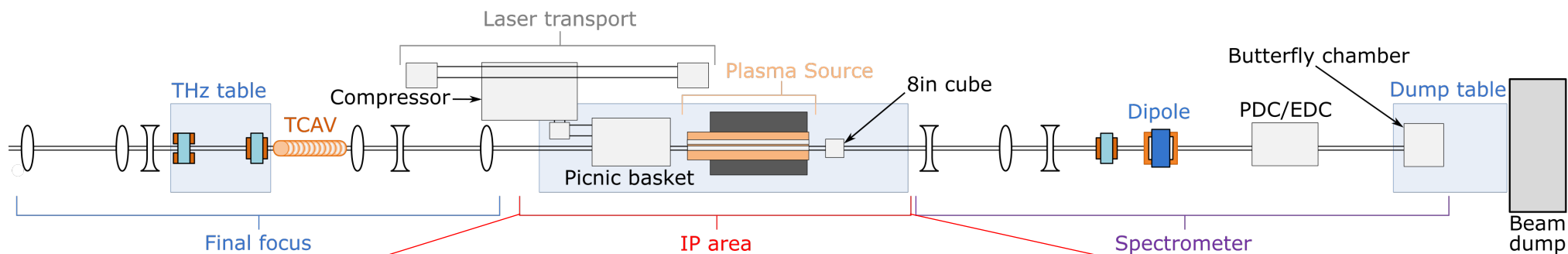


Outline

- Location of the picnic basket in the experimental area
- Picnic basket configurations:
 - Laser integration for plasma formation
 - E300
 - E301
 - E305
 - Targets: gas jets and solid targets
 - E305
 - E308
 - E332
 - E336
 - Laser/electron beam collisions (SFQED)
 - E320
 - Diagnostics
 - EOS-BPM
 - E324
- Current status of the hardware
- Planned upgrades



Overview of the IP area and location of the picnic basket



PICNIC BASKET

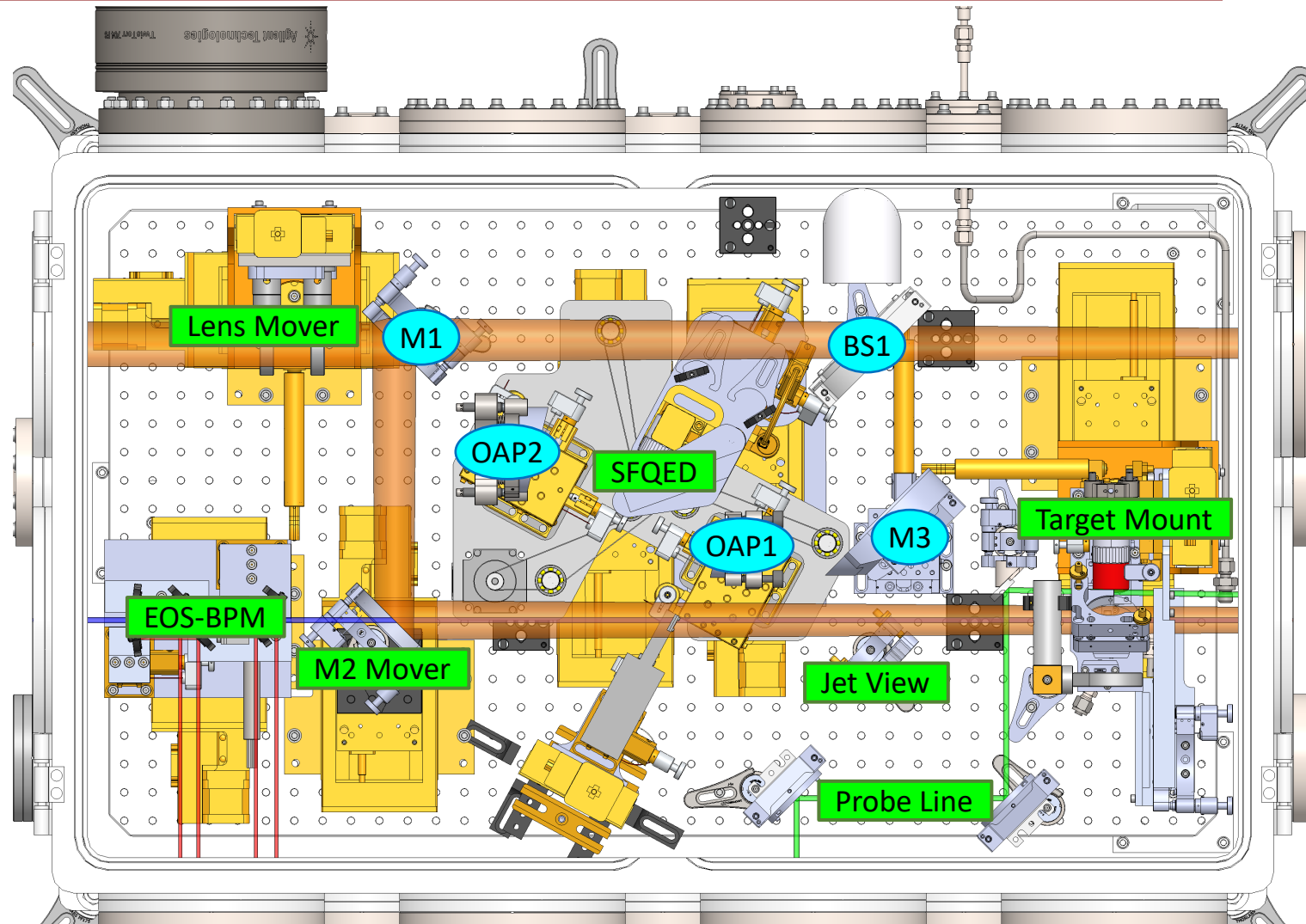
The picnic basket is the primary experimental chamber in the beamline

Picnic basket configurations and main 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
3. M2 Mover
4. SFQED
E320 experimental apparatus
5. Target Mount
Switches between different targets
6. Jet View
7. Probe Line
E324 laser probe

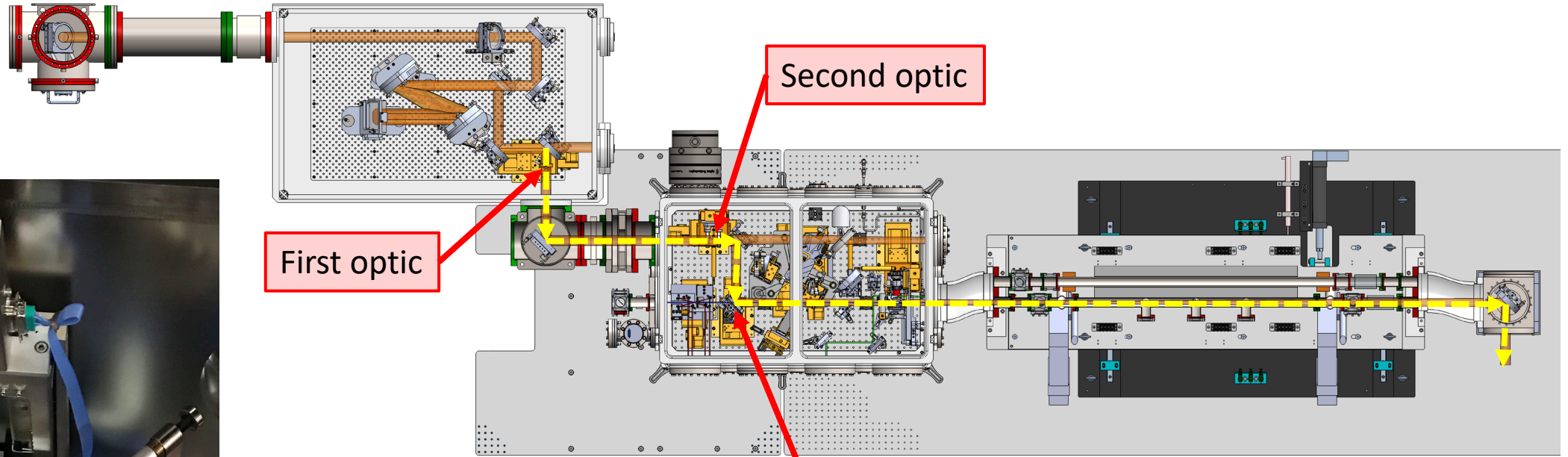
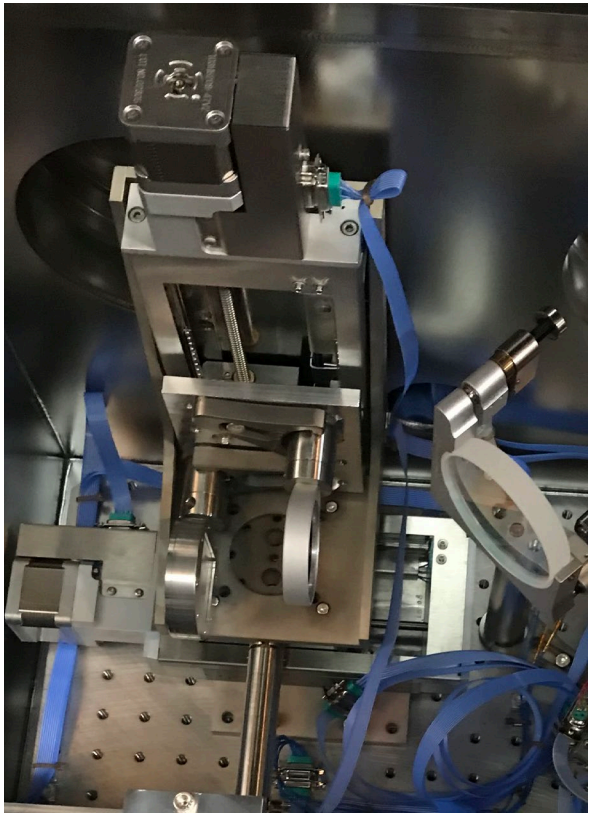
In addition, there is a steering mirror M1



The picnic basket lets us switch between different experimental configurations remotely

Laser integration for laser ionized plasma sources

E300
E301
E305



Two optics movers:

Upstream holed mirror

- Support up to 2 optics in the compressor with transverse alignment
- Support up to 2 optics in the picnic basket with full 3D alignment

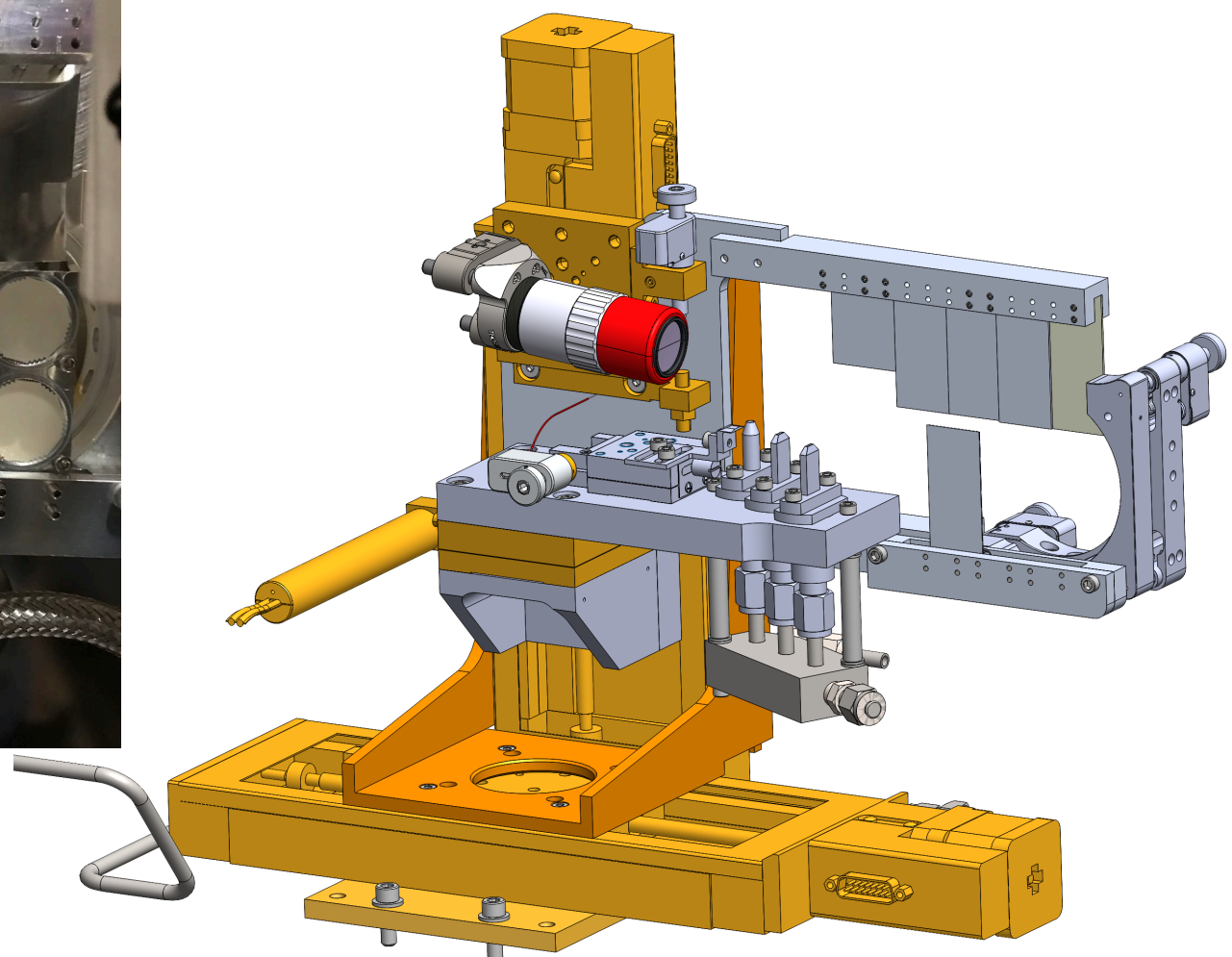
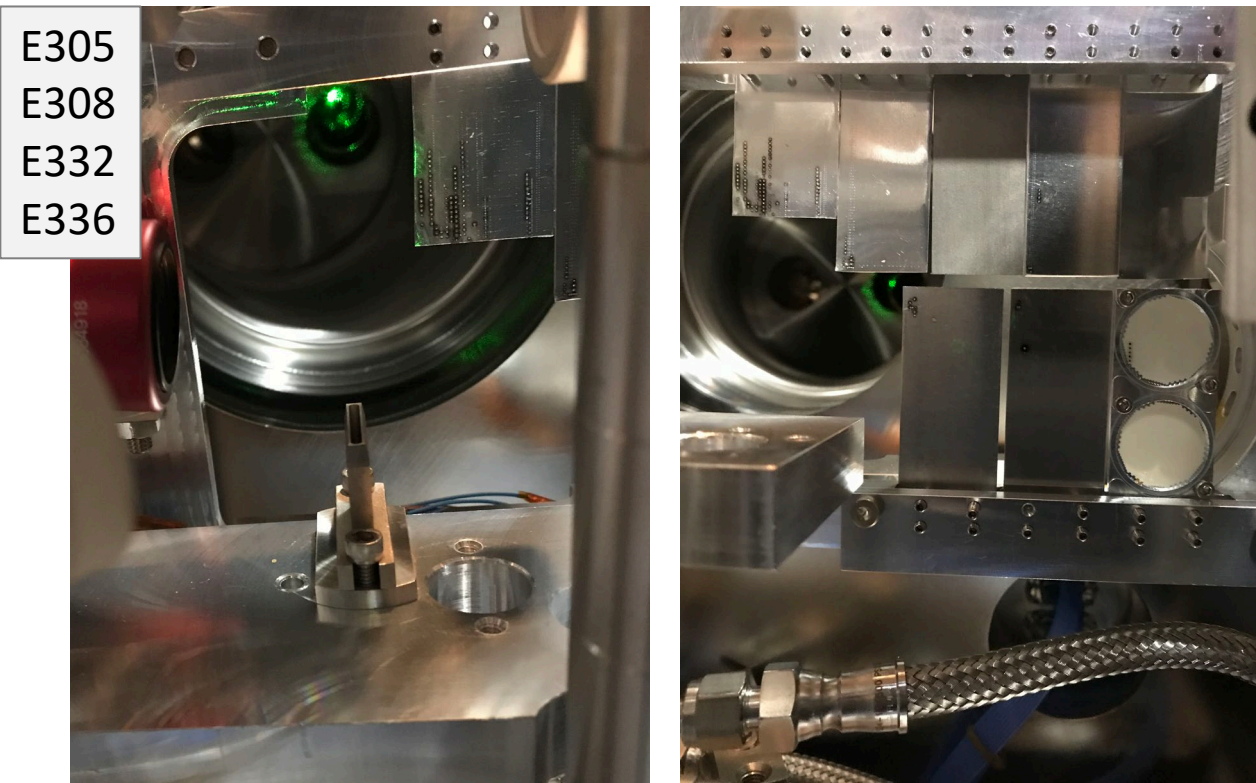
Up stream holed mirror

- Overlap the laser beam with the electron beam

Plus: Steering mirrors and laser diagnostics

Support for two or three optics at a time – all remotely adjustable

Solid targets and gas jets



Flexible target mount for solid targets and gas jets

- 4 degrees of freedom for solid targets
- Up to 3 different gas jet nozzles

A wide variety of targets and gas jets can be installed simultaneously

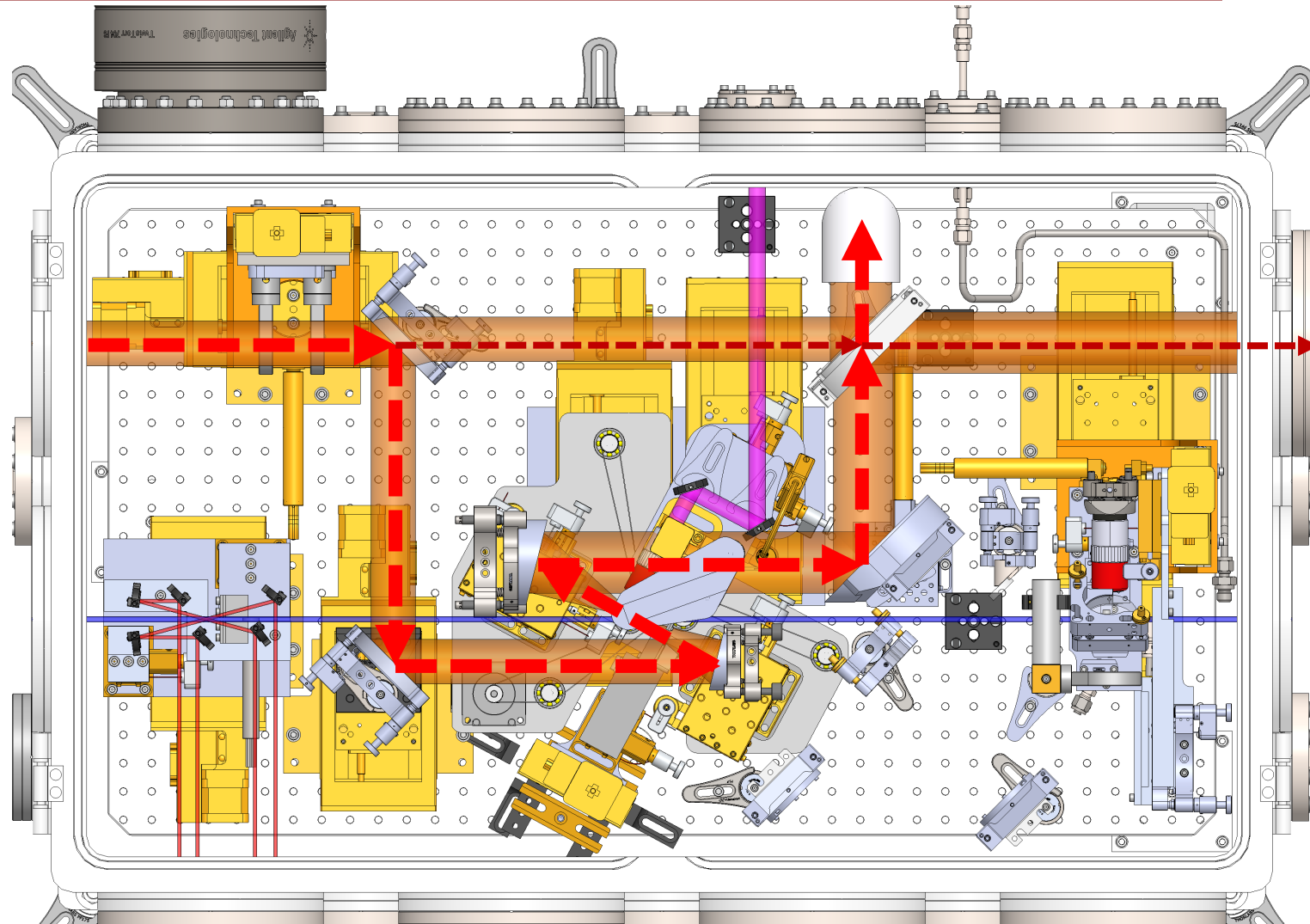
Colliding the laser with the electron beam - SFQED

E320

Assembly to focus the laser into the incoming beam

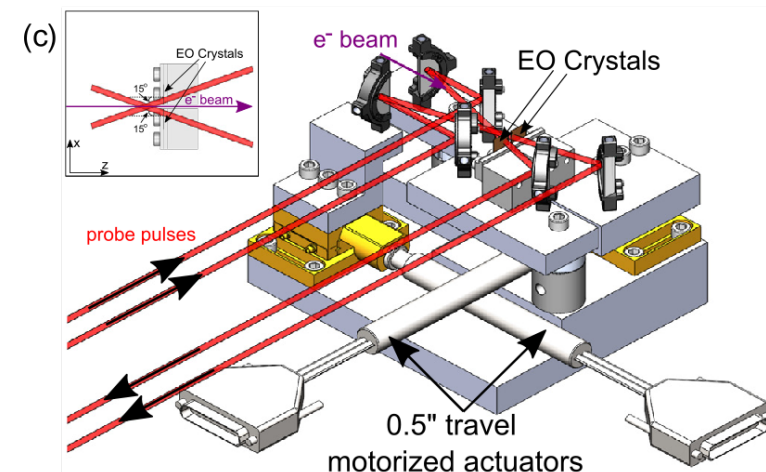
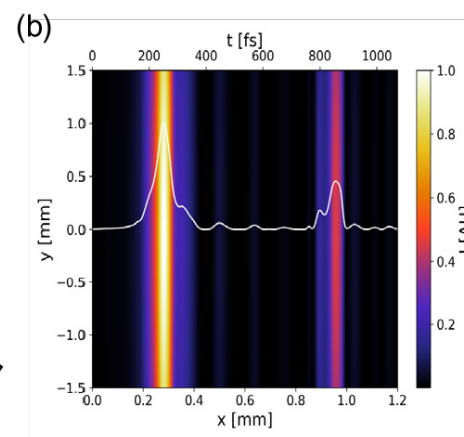
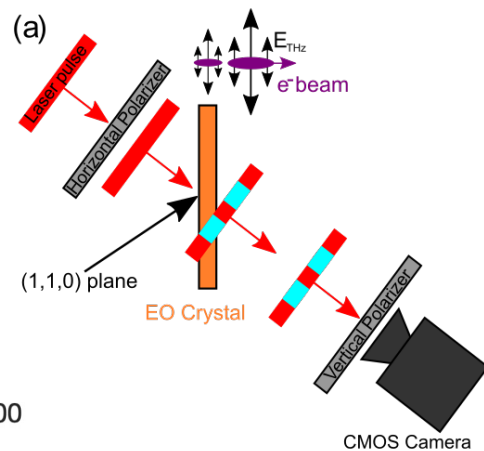
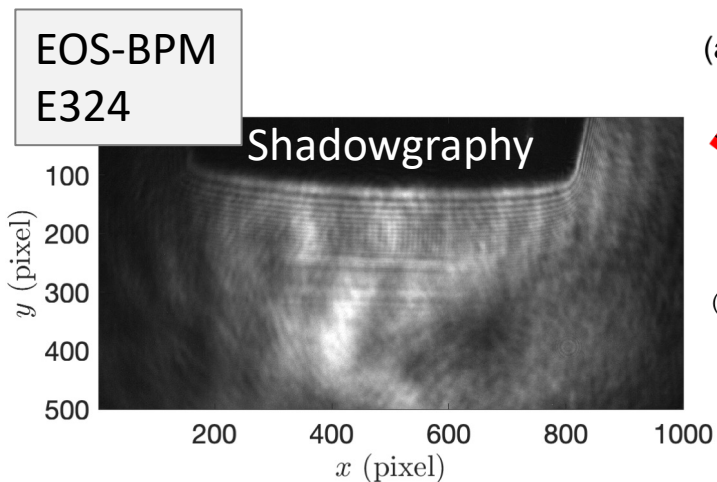
- First OAP focuses the beam
- Second OAP recollimates
- 5D of freedom for both OAPs
- Focus diagnostics setup
- Interferometer for OAP alignment
- Main laser beam dump

Can be removed for compatibility with other experiments

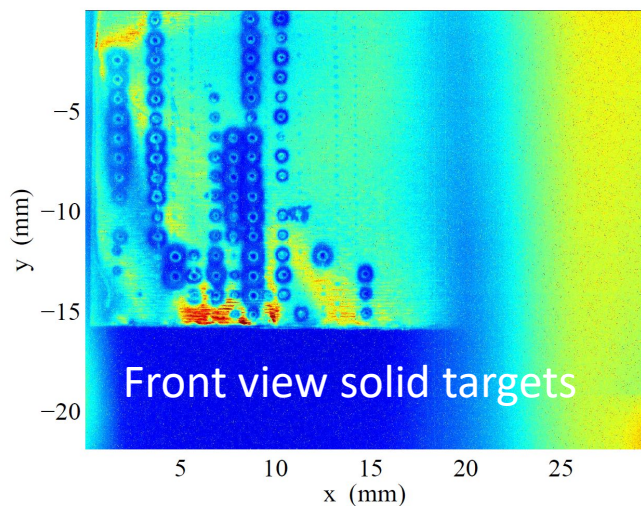


Full remote alignment/optimization of the laser focusing (collisions last week!)

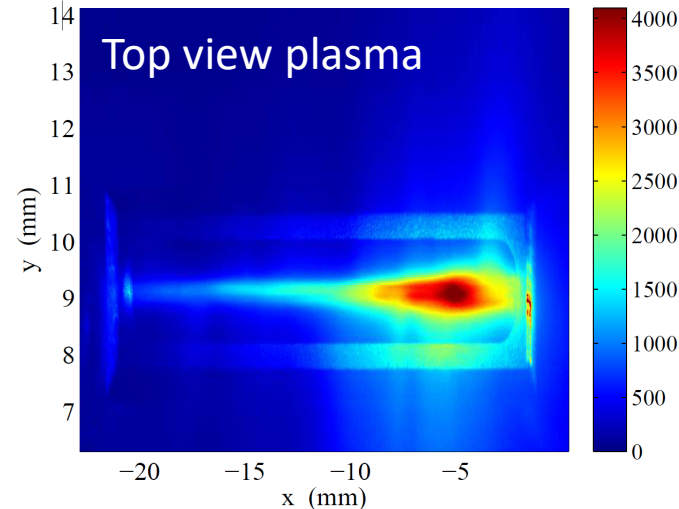
Diagnostics



Profile Monitor CAMR:LI20:208 13-Aug-2022 01:35:56



Profile Monitor CAMR:LI20:209 21-Aug-2022 03:10:42

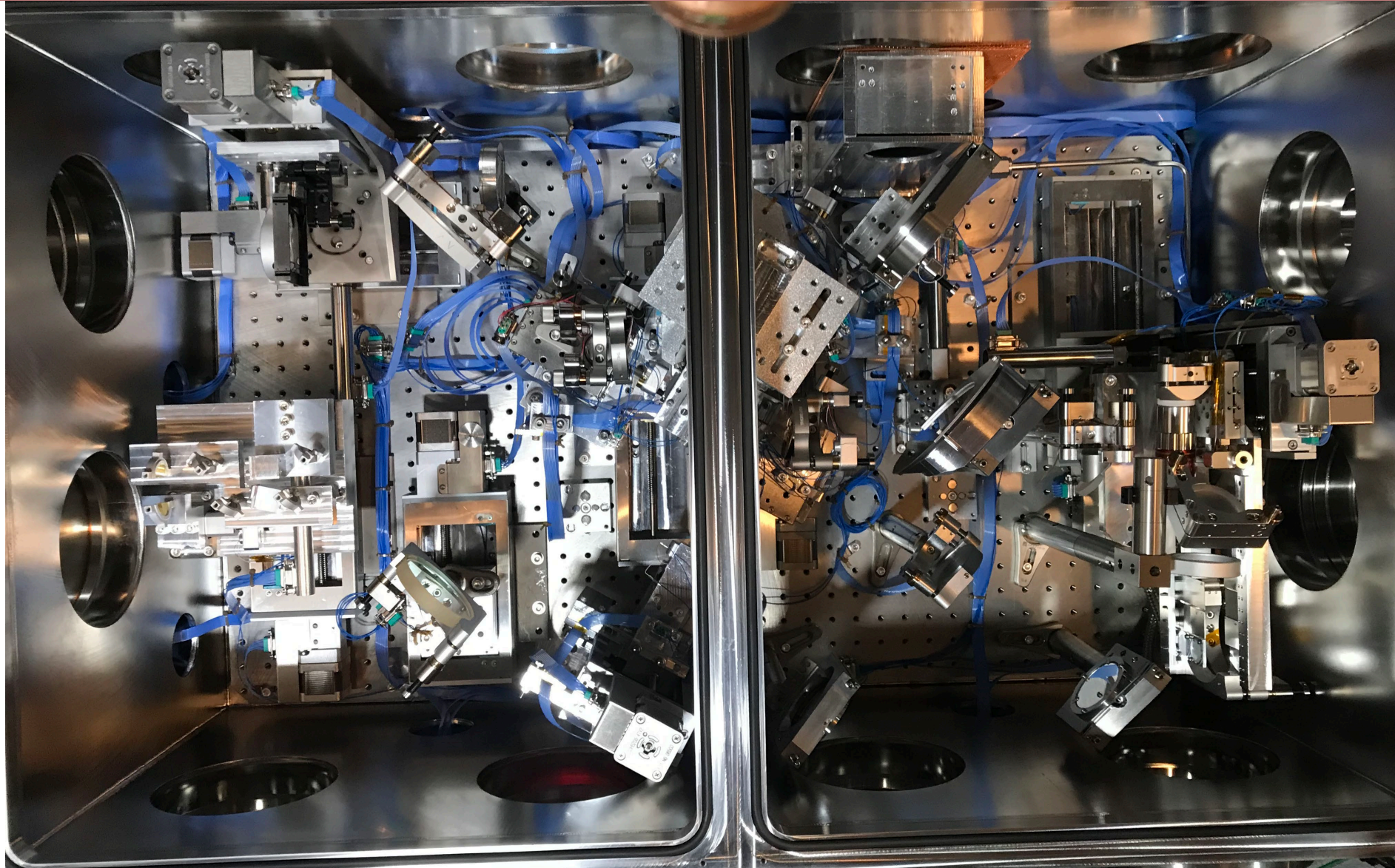


Chamber provides a variety of diagnostics

- EOS-BPM (see Chris's talk for details)
- Imaging of the targets/jets (front and top)
- High resolution shadowgraphy
- E324 laser probe of the downstream plasmas

Supporting diagnostics for the laser, electron beam, and targets in the chamber

Current status of the hardware installation



Current status of the hardware installation



Detailed design developed with users before installation

Fully installed and commissioned:

- Lens mover
- EOS-BPM
- M2 mover
- Jet view
- Probe line

SFQED

- Facility provided infrastructure for apparatus – all fully installed

Target mount

- Only running with a single gas jet instead of the designed 3
- A single jet has been sufficient – low priority to upgrade
- Have new gas jets on hand – need to design a new manifold

Detailed planning led to a straightforward and quick installation/commissioning

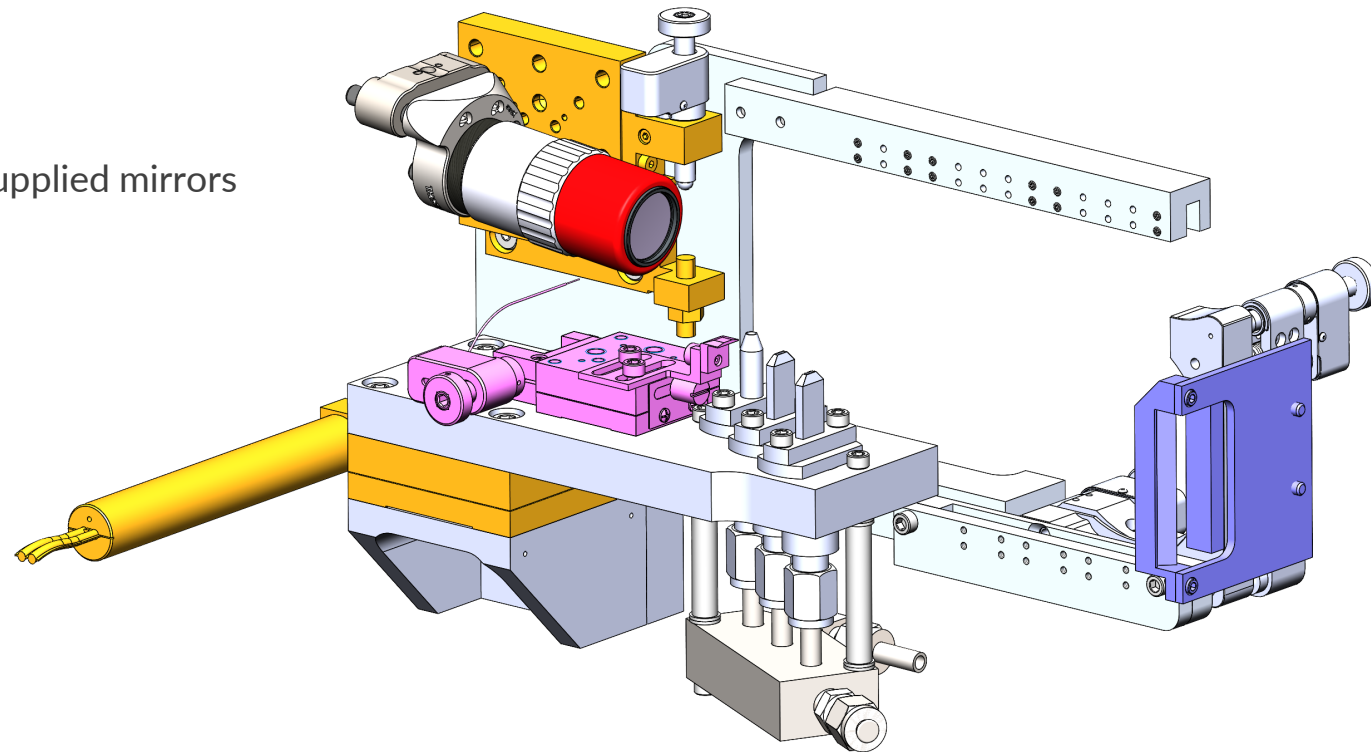
Planned upgrades

One upgrade installed

- Tip/tilt capability added to the target mount

Several more upgrades in the works

- **Tip/tilt measurement for the target mount**
 - In vacuum parts ready for installation, waiting for user supplied mirrors
- **Knife edge mover for the downramp injection**
 - Parts ready for installation
- New gas manifold to support 3 gas jets



Capabilities added as demanded by user requirements

Summary

The picnic basket can support many experiments simultaneously

- Has been used for E300, E305, E308, E320, E332, E336

Flexible setup allows us to support new experiments as needed

- Wide range of solid target and gas jets can be supported
- Flexible optical stages for both target interaction and downstream ionization

Careful planning meant that initially planned hardware is nearly all installed and commissioned

Upgrades installed as demanded by user requirements

- One upgrade already installed
 - Tip/tilt capability added to the target mount
- Several more upgrades in the works
 - Tip/tilt measurement for the target mount
 - Knife edge mover for the downramp injection

Picnic basket installation serves a wide range of user needs



Questions?

2023 FACET-II User Meeting

October 17-19, 2023