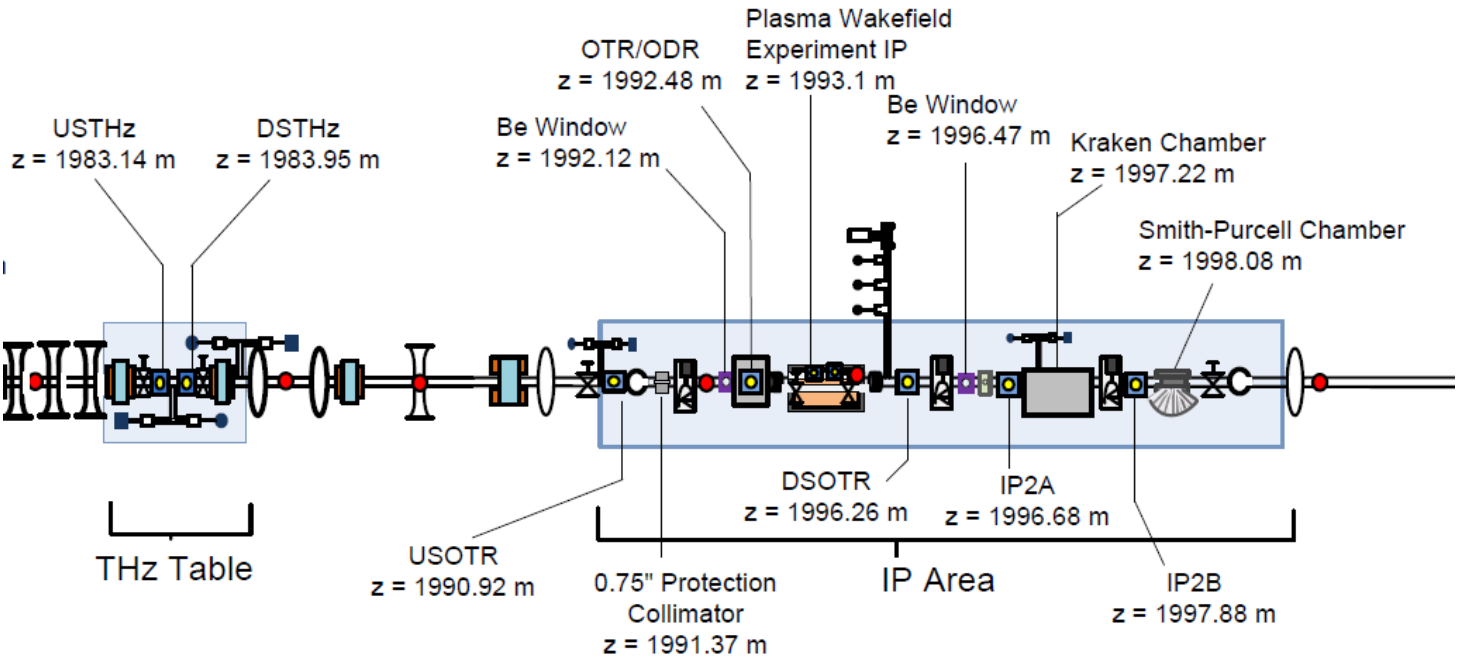
The Kraken Chamber 2.0

Christine Clarke, 9th October 2013



The “Kraken” is a massive multi-port vacuum chamber for use by experimenters on the second “IP” table. At this location the beam can be focused to a small spot.

The chamber was designed in collaboration with E-201 (FACET users in UCLA) and was installed in January 2013.

The current hardware set up inside the Kraken includes Newport stages for alignment of dielectric fibers.

The contents can be modified to suit other “samples” or hardware.

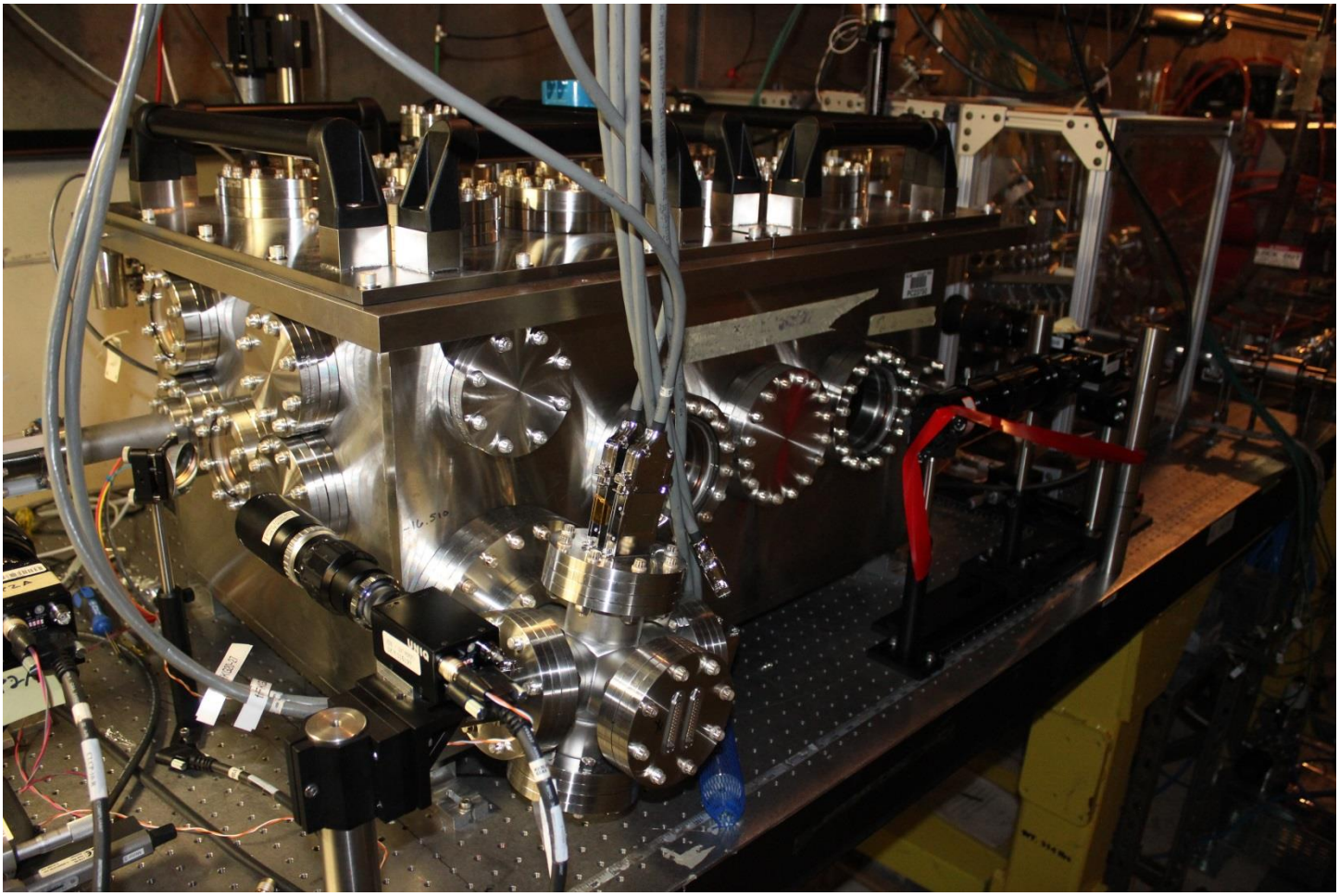


Figure 1: The Kraken Chamber.

Drawings and Model

Drawings of the Kraken chamber and its contents can be found on the FACET website in the Images folder.

https://portal.slac.stanford.edu/sites/ard_public/facet/FACET%20Images/Forms/Thumbnails.aspx?RootFolder=%2fsites%2fard_public%2ffacet%2fFACET Images%2fKraken Sample Chamber&Folder

If the drawing you require does not exist, please send an email to cclarke@slac.stanford.edu with your request.

The Solid Edge Model can also be downloaded from the Images folder. Solid Edge (v20) is required.

Existing Stages

4" linear travel stage: http://search.newport.com/?x2=sku&q2=UTS100PPV6
2" linear travel stage: http://search.newport.com/?q=*&x2=sku&q2=UTS50PPV6
1" linear travel stage: http://search.newport.com/?x2=sku&q2=MFA-CCV6
5 axis stage: http://search.newport.com/?q=*&x2=sku&q2=9082-V
Actuators: http://search.newport.com/?q=TRA6PPV6
Tip/tilt Newport 561-TILT http://search.newport.com/?q=*&x2=sku&q2=561-TILT
Rotary Stage: http://search.newport.com/?x2=sku&q2=URS50BPP

The typical assembly for positioning dielectric structures in 2013 used the 4" travel in x and the 2" travel in y (z is the direction of the beam). The 5 axis stage usually has four axes motorized to give us yaw and roll (+- 6 degrees yaw with moderate roll).

The url that follows shows the configuration that was typical in 2012.

https://portal.slac.stanford.edu/sites/ard_public/facet/FACET%20Images/Kraken%20Sample%20Chamber/krakenStages.pdf

A 2" motor was also used to move a mirror into and out of the beam.

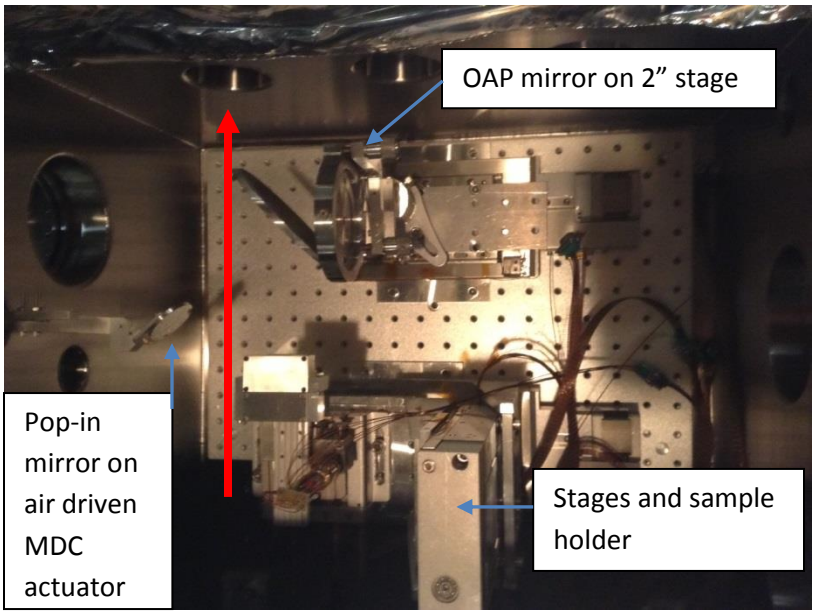


Figure 2: Photograph of contents of Kraken for E-201. The red arrow shows the beam path.

Vacuum

For easy sample change-over, we have an o-ring seal on the chamber.

The stages in the Kraken are rated for 10^{-4} Pa ($7.5e^{-7}$ Torr).

We use turbo pumps and ion pumps on this chamber.

Typically, we can pump down to $1e^{-6}$ Torr in 2.5 hours. After 12 hours, the pressure is below $3e^{-7}$ Torr.

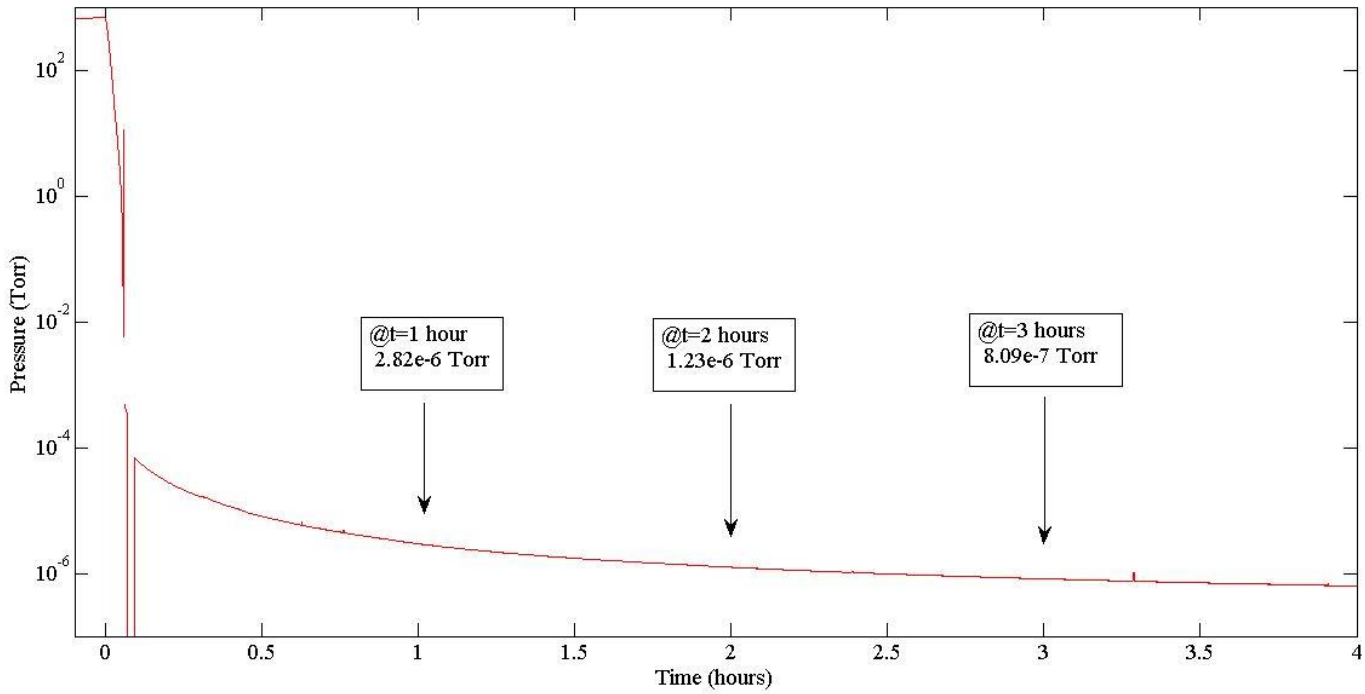


Figure 3: Pump down plot from atmosphere of Kraken with Agilent TPS with New Generation Turbomolecular Pump Turbo-V 81-M.

Alignment

Alignment of samples such as dielectric fibers or slabs is critical. Often there is a small aperture ~100µm for the beam. For alignment purposes we have profile monitor screens that can be inserted into the beam upstream and downstream of the chamber. The beam trajectory can be marked. When the beam is off, a laser can be put on the beam trajectory and samples aligned.

We recommend that an OTR screen or phosphor screen is incorporated on your sample holder. OTR foils can be ordered through Lebow Company http://www.lebowcompany.com/ and we typically find that 10um titanium is the minimum thickness for a foil that can be used with a focused beam. Diameter 7mm (holder 11mm). Spares are encouraged.

Beam Size Tuning

Part of the experimental set up needs to include an OTR screen for beam spot size tuning if this is an important parameter for you. Otherwise, we cannot measure the spot size at the exact location of your samples. We will however have the capability to measure spot size upstream and downstream of the chamber with OTRs and wirescanners.

The beam size can be tuned anywhere and then the waist shifted to a location in the Kraken chamber (you need to provide a distance for where you want the waist relative to the centre of the chamber). We call the waist location the “IP” (Interaction Point).

Limitations of the FF quadrupole power supplies determine the minimum betas we can achieve at any given location. Near the E-200 IP (for the plasma studies) we can get down to BetaX/Y=0.018/0.18 (round beam). As you move away from the E-200 IP the minimum achievable betas grow; at the Kraken chamber the best we can do is 0.03/0.3. Once the waists are at a given location, we have waist knobs that shift the waist while holding the betas at the waist constant. These waist knobs can do fine (~cm) adjustment.

Breadboard

The breadboard is standard from Thorlabs and cut to size. The hole pattern is 1” spacing and the thread is for ¼”-20 bolts.

There are spare breadboards to mount things outside of the tunnel and check everything is correct allowing a quick swap on an access to the tunnel. The breadboards fit inside the chamber on kinematic mounts.