| ESRF | **Experiment title:** Compression of Neon to above 500 GPa in a toroidal-DAC | **Experiment number**: HC-3681 |
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| **Beamline**: ID27 | **Date of experiment**: from: 06/07/2018 to 10/07/2018 | **Date of report**: 13/03/2020 |
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## Report:

The aim of this proposal was to qualify Ne as the pressure medium for the TPa range. Essentially to show that: a 5 µm diameter sample of Ne could be loaded in a toroidal diamond anvil cell; Ne can be compressed up to 500 GPa; Ne can be quantified as a good hydrostatic pressure transmitting medium by measuring the deviatoric stress from the analysis of the diffraction line-width.
We have developped the toroidal anvil design. By FIB machining, a double stage type anvil is sculpted in a single crystal diamond anvil. Pressure up to 600 GPa had so been achieved on gold (ReportME-1380) and up to 450 GPa on Al. However, compressing a gas like Neon is much more difficult since any misalignment of the two anvils or of the gasket hole can lead to an instability of the sample under pressure.

Two toroidal-DACS with culets of 20 µm and 25 µm respectively were prepared.
The sample of the 20 µm culet was 4.5 µm in diameter at 150 GPa and the signal to background ratio was then too deteriorated to make further measurement on the volume of Ne.
The diameter of the sample on the 25 µm was 12 µm at so to optimize the diffraction signal of the Ne sample. Unfortunately, it was unstable above 80 GPa.

It has been very difficult to find a compromise between a small enough sample for stability under pressure and a large enough for good XRD signal to background ratio. With the EB-ESRF, an X-ray focus below 2 µm and a new detector pixel sensitive detector with high dynamic, this compromise will be much easier to achieve.