*6th International Workshop on Sample Environment at Neutron Scattering Facilities*
*Herrsching, September 29th to 1st of October, 2010*

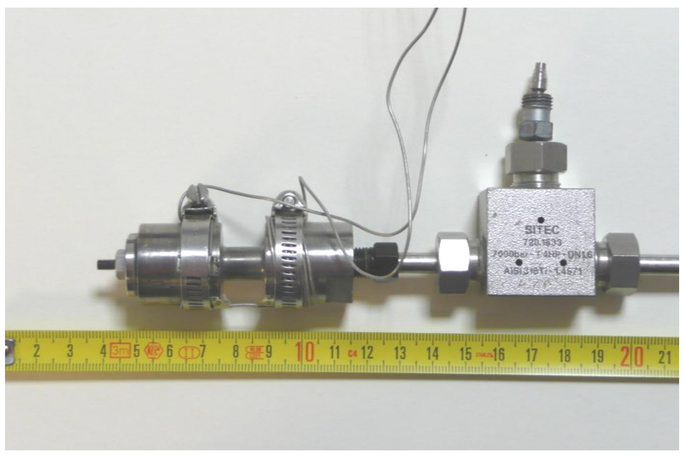
*Laboratoire Léon Brillouin - Sample Environment Group -*

# *High pressure activity at the Laboratoire Léon Brillouin*

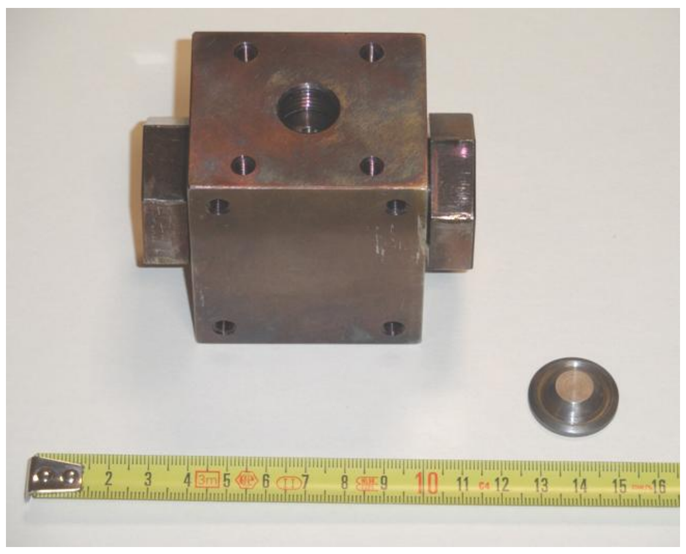
## *Here, from low pressures up to 25kbar*
## *Recent pressure cell developments*

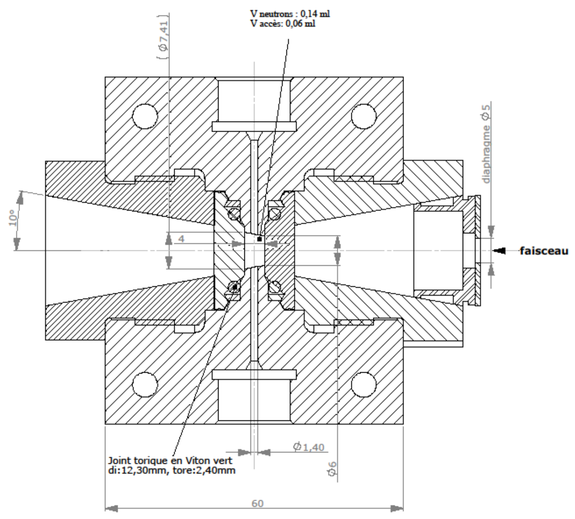
SANS cells:

Niobium pure $d_{in}$: 7mm; $d_{out}$:10mm; $P_{max}$: 400bar



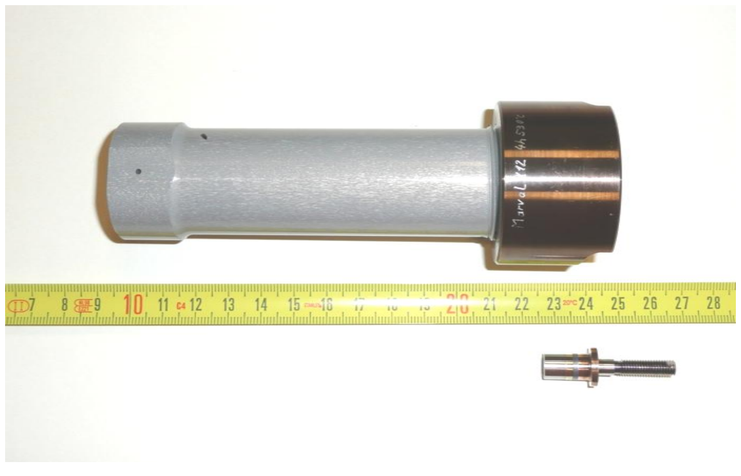

Window material:
Niobium pure: 3kbar
Aluminium 2017A T4: 4,5kbar
Aluminium 7049A T651: 6,5kbar






## TOF cell:

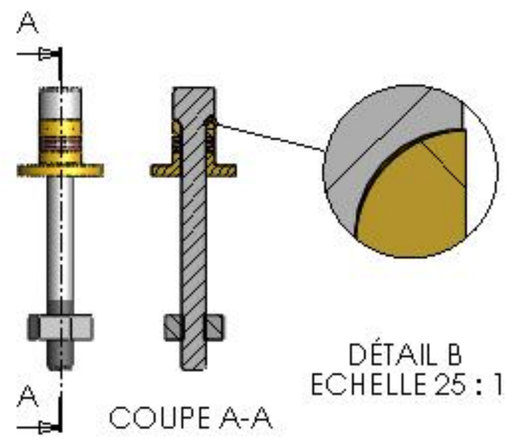
Aluminium 7049A T651 $d_{in}$: 8mm; $d_{out}$: 31,5mm; insert 6mm; $P_{max}$: 6,5kbar

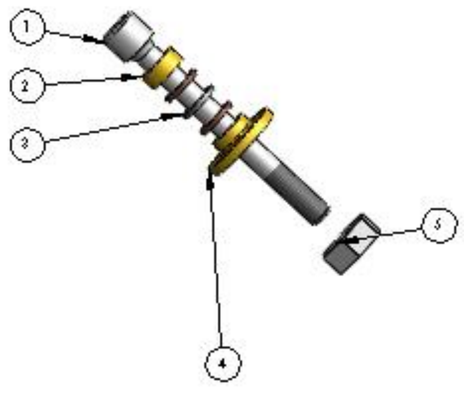


High pressure generators:
Handdriven hydraulic systems: 7kbar
Hydraulic pump driven inert gas system: 10kbar
Mc Whan type cells: 25kbar

At the LLB the Bridgman type seal is wildly used because of its reliability and easy to use capacity. Instead of using for the soft layer seal a metal like lead or indium an elastomer O-ring seal could also be used if there isn't any extrusion space between the sealing parts. The O-ring seal was successfully used up to 6kbar for liquids at ambient temperature when the gap width is lower than 0,005mm (0.0002"). For pressures higher than 3kbar it is recommended to add anti-extrusion discs in front and behind the soft seal to limit the extrusion, therefore we use annealed copper. For the first seal between the Bridgman head and the soft layer we use marine brass (CuAl9Ni3Fe2, DIN 17672 W.N. 2.0966; Company: Le Bronze Industriel designation: TM). For the second seal in front of the locking bolt we use beryllium copper (CuBe2, C17200 TF00). Beryllium copper is widely used due to it's high strength, the low temperature ductility, the immunity to hydrogen embrittlement and the fact to be non-magnetic even in the cold-formed condition. The material is chosen in function of its deformation ability. What has to be noticed is that the standard heat treatment with the solution-annealed temper and the age hardening gives elongations between 3 to 10%. Therefore we ask the inspection certificate to choose the right material with an elongation between 8-10%.
In general the sealing material for the first seal should have a minimum elongation of 20%, a yield strength of 300MPa and a tensile strength of 600MPa. Depending of the maximum pressure the tensile strength should mount up to 1000MPa in relation with a high elongation (10-15%) and a good work hardenability. At least to have good low temperature tightness, especially for gases, all materials should have nearly the same coefficient of thermal expansion. This is reached by choosing the alloys from the same base material.

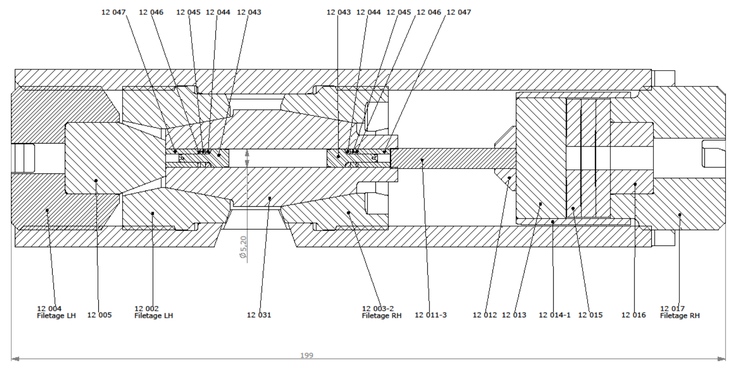
## LLB Bridgman Seal:




Diffraction cells:
CuBe2 25HT $d_{in}$: 5,2 or 5,7mm; $d_{out}$:27mm; $P_{max}$: 25kbar
TiZr Zero Scattering Alloy $d_{in}$: 5,2 or 5,7mm; $d_{out}$:24,5mm; $P_{max}$: 18kbar

This Mc Whan type HP cell is also entering into a standard 50mm cryostat




Aluminium 7049A T651 $d_{in}$: 12mm; $d_{out}$: 48mm; $P_{max}$: 6,5kbar

## JRA NMI3 FP7 pressure cell:

Beryllium copper CuBe2, alloy 25 HT: $d_{in}$: 6mm; $d_{out}$: 18mm; $P_{max}$: 8kbar