

WIR SCHAFFEN WISSEN – HEUTE FÜR MORGEN

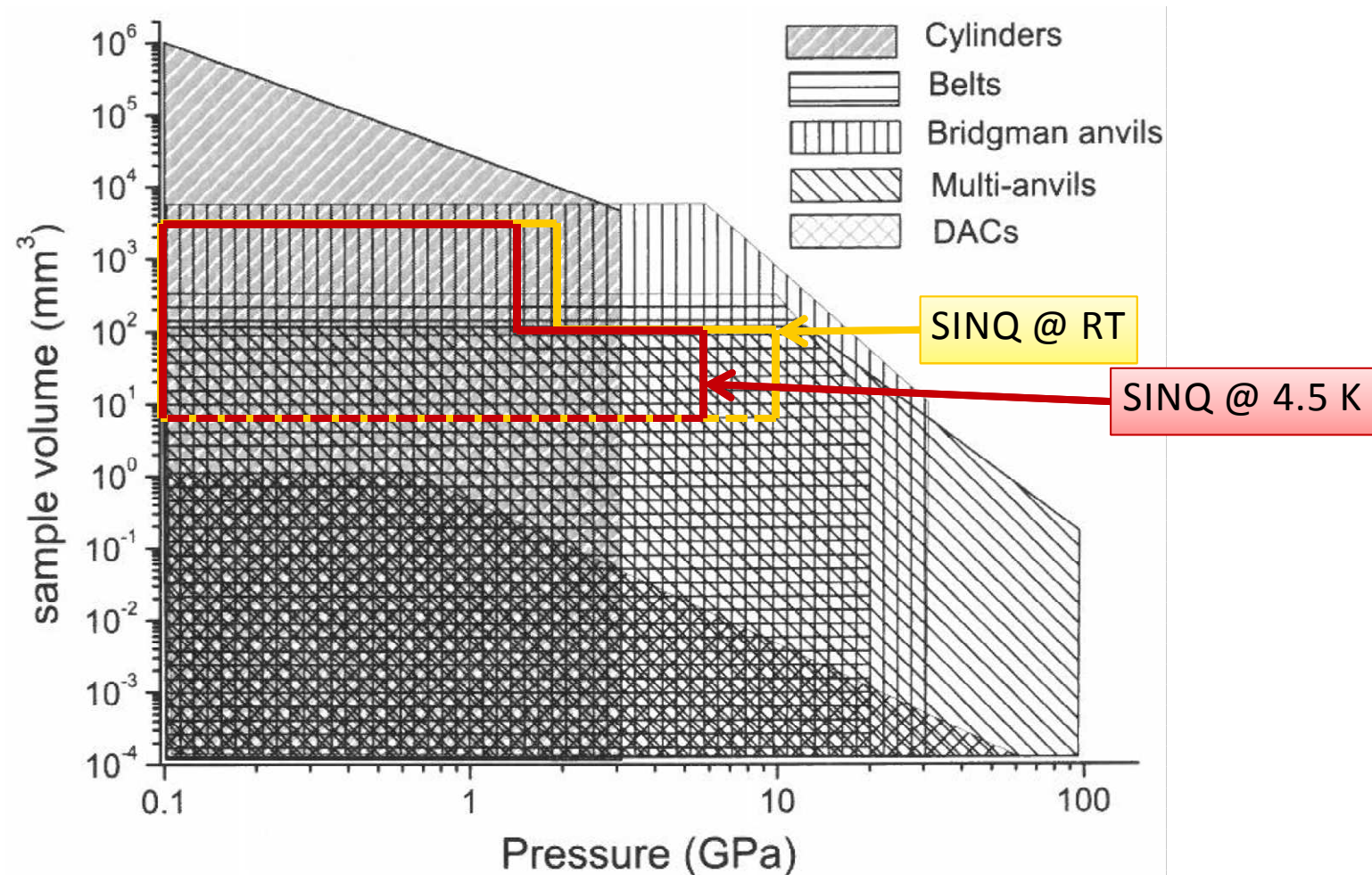


# Neutron pressure cells at SINQ, PSI

[jonathan.white@psi.ch](mailto:jonathan.white@psi.ch)

Oct' 2016

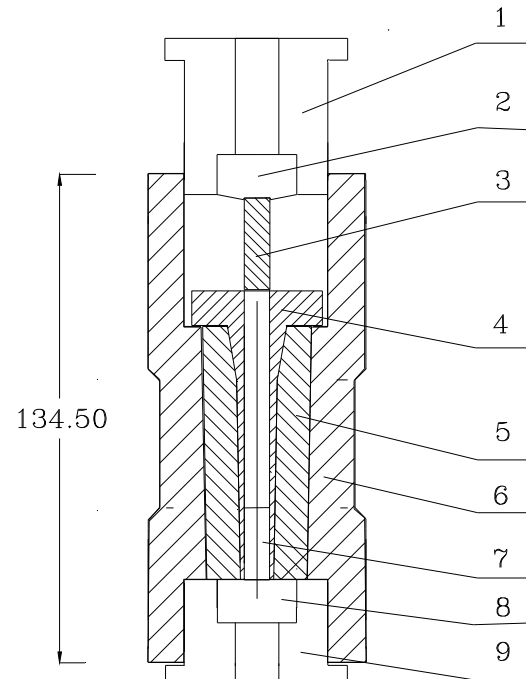
# Neutron Pressure Cells @ SINQ



S. Klotz, "Techniques in high pressure neutron scattering", 1<sup>st</sup> Ed., CRC Press, (2013)

## Standard clamp cells - I

**12 kbar** cell for inelastic neutron scattering / single crystal wide-angle diffraction



1,9.-Nuts, steel

2,8.-Pistons support, steel

3,7.-Pistons, steel and WC

4.-Insert1, hard steel

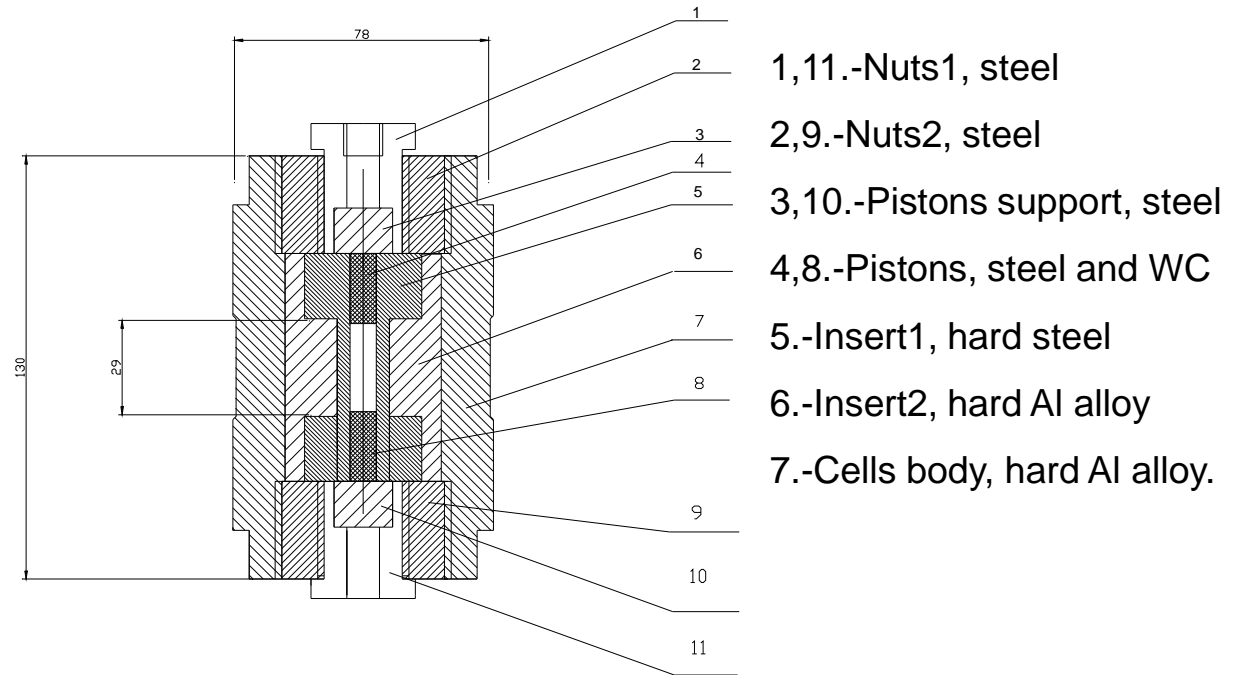
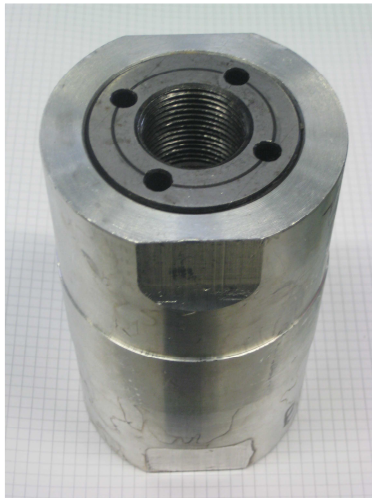
5.-Insert2, hard Al alloy

6.-Cells body, hard Al alloy.

- $T$  down to 1.5 K (then 8 kbar max  $P$ )
- Outer diameter = 55 mm
- Inner diameter (for sample) = 7.4 mm
- Weight = 1.6 kg

## Standard clamp cells - II

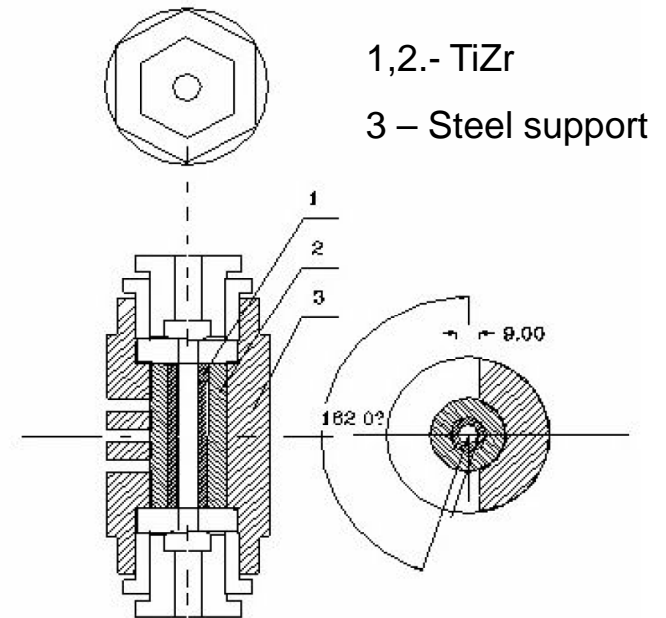
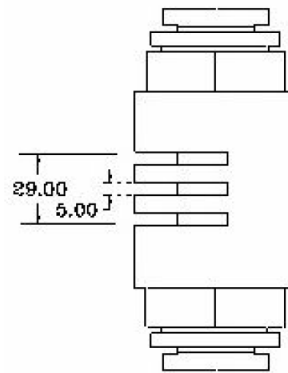
**17 kbar** cell for inelastic neutron scattering / single crystal wide-angle diffraction



- $T$  down to 1.5 K (then 15 kbar max  $P$ )
- Outer diameter = 78 mm
- Inner diameter (for sample) = 7.8 mm
- Weight = 2.6kg

## Standard clamp cells - III

Workhorse **15 kbar** cell for neutron powder diffraction



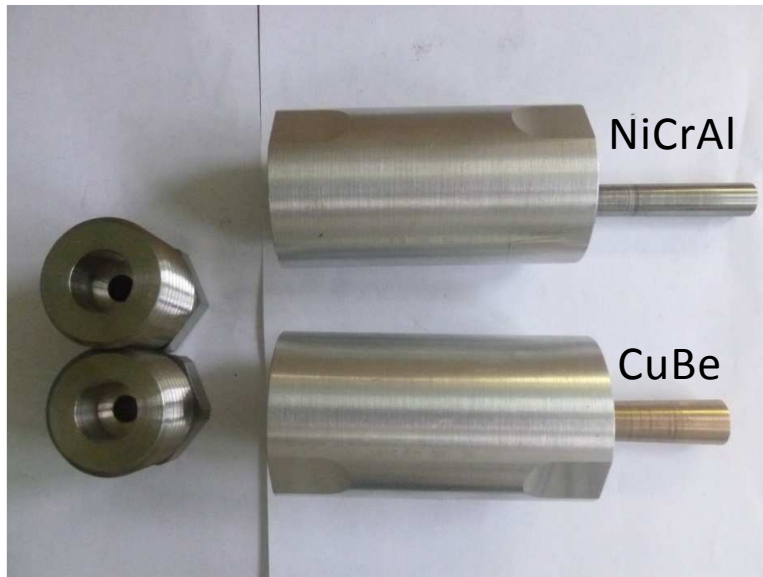
- $T$  down to 1.5 K (then 12-14 kbar max  $P$ ).
- Outer diameter = 78 mm
- Inner diameter (for sample) = 8 mm
- TiZr 'null-scattering' alloy

# Nonmagnetic Clamp Cells

**10 kbar** cells for inelastic neutron scattering+diffraction,

Al outer - CuBe/NiCrAl inner

Cell with CuBe insert ok for SANS



- $T$  down to 1.5 K (then 7-8 kbar max  $P$ ).
- Outer diameter = 46 mm  $\rightarrow$  fits 9T vertical and 7T horizontal field magnets.
- Inner diameter (for sample) = 8 mm
- Each weighs 0.6 kg.

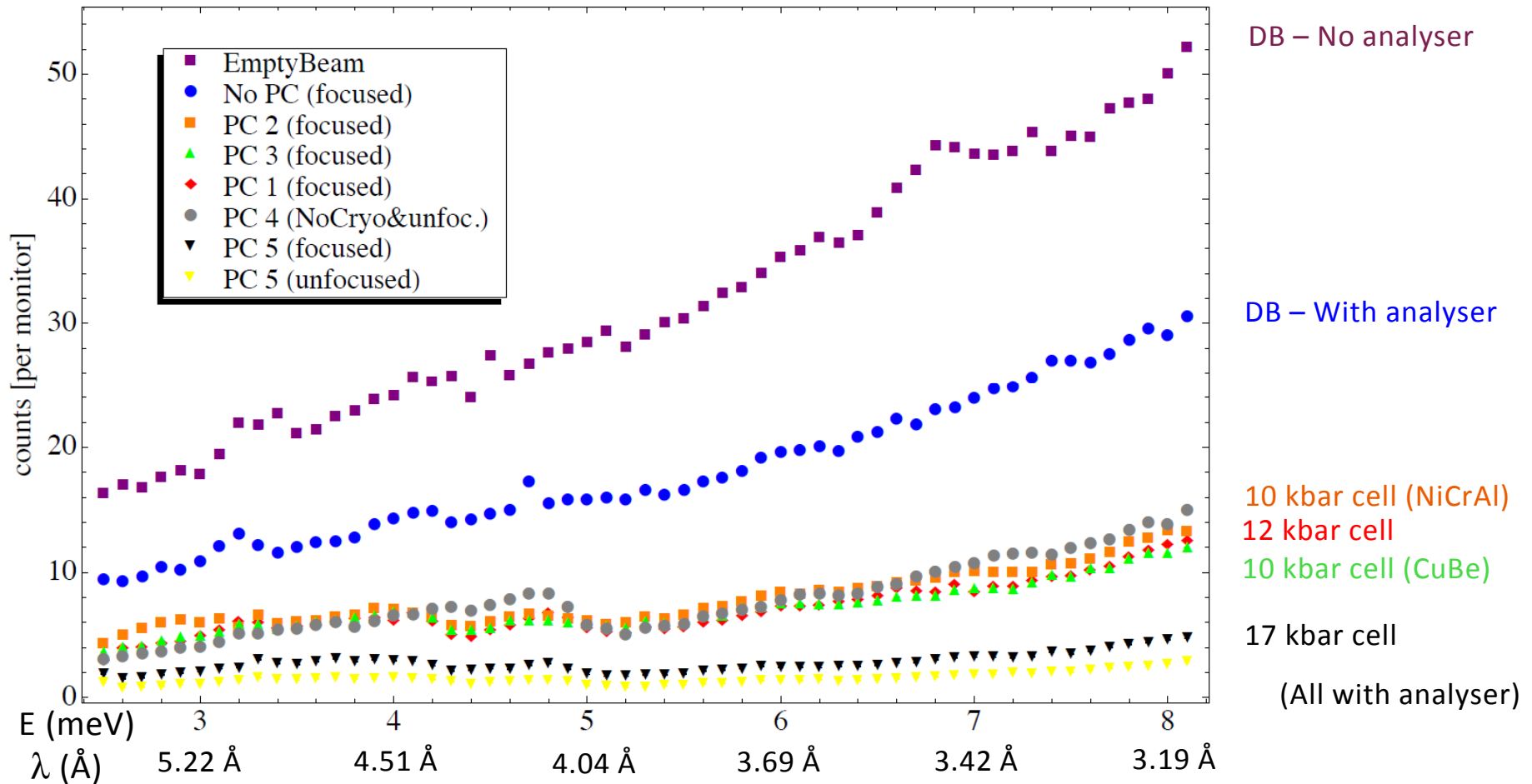
**10 kbar** cell for diffraction,

All TiZr



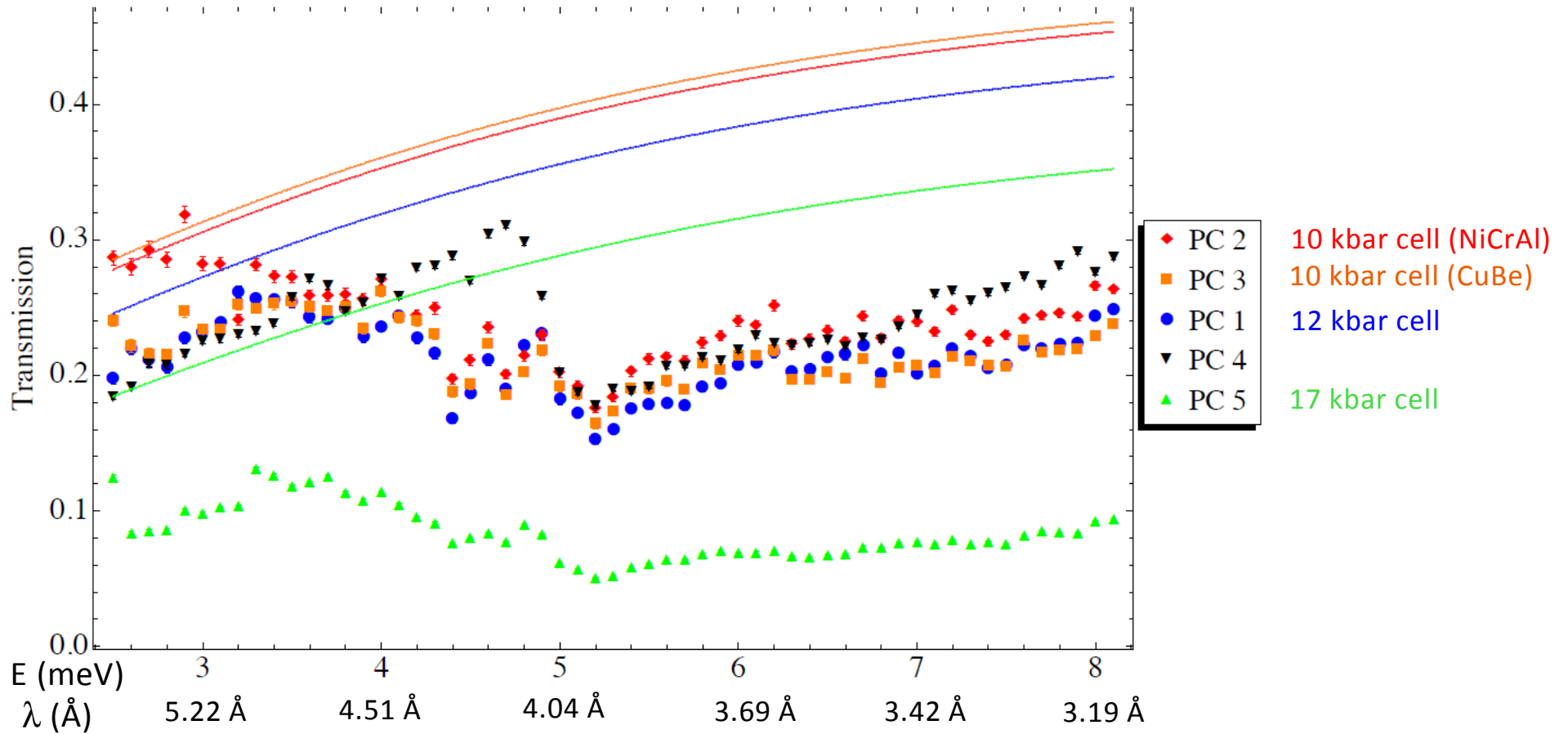
- $T$  down to 1.5 K.
- Outer diameter = 28 mm  $\rightarrow$  fits various magnets.
- Inner diameter = 6 mm.

# Transmission of spectroscopy cells (I)



Courtesy: S. Allenspach

# Transmission of spectroscopy cells (II)



Courtesy: S. Allenspach



7 kbar pressure ramPTMs – H-free!

- Mix of deuterated methanol and ethanol (4 parts methanol : 1 part ethanol)
- Various Fluorinerts of reducing stock – FC-75 and FC-77 no longer available
- Deuterated glycerol - \$\$\$

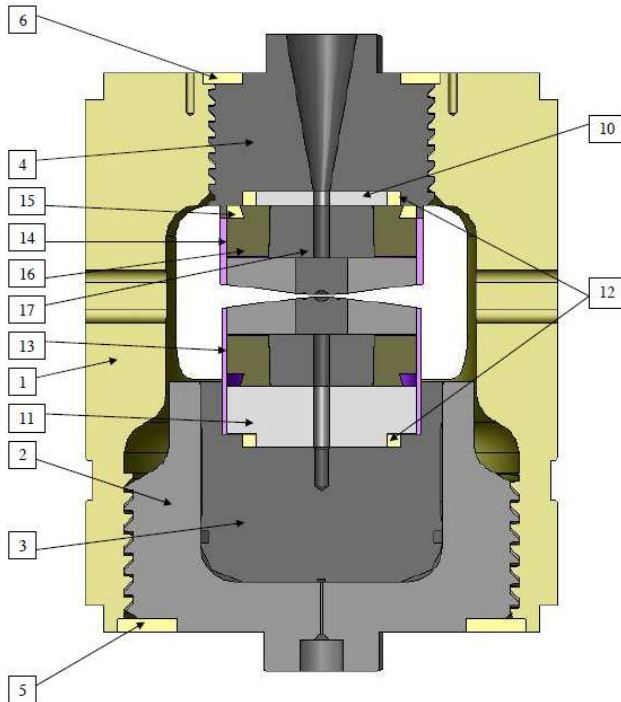
## Opposed anvil techniques

Neutron absorbing cBN anvils

TiZr or CuBe gaskets

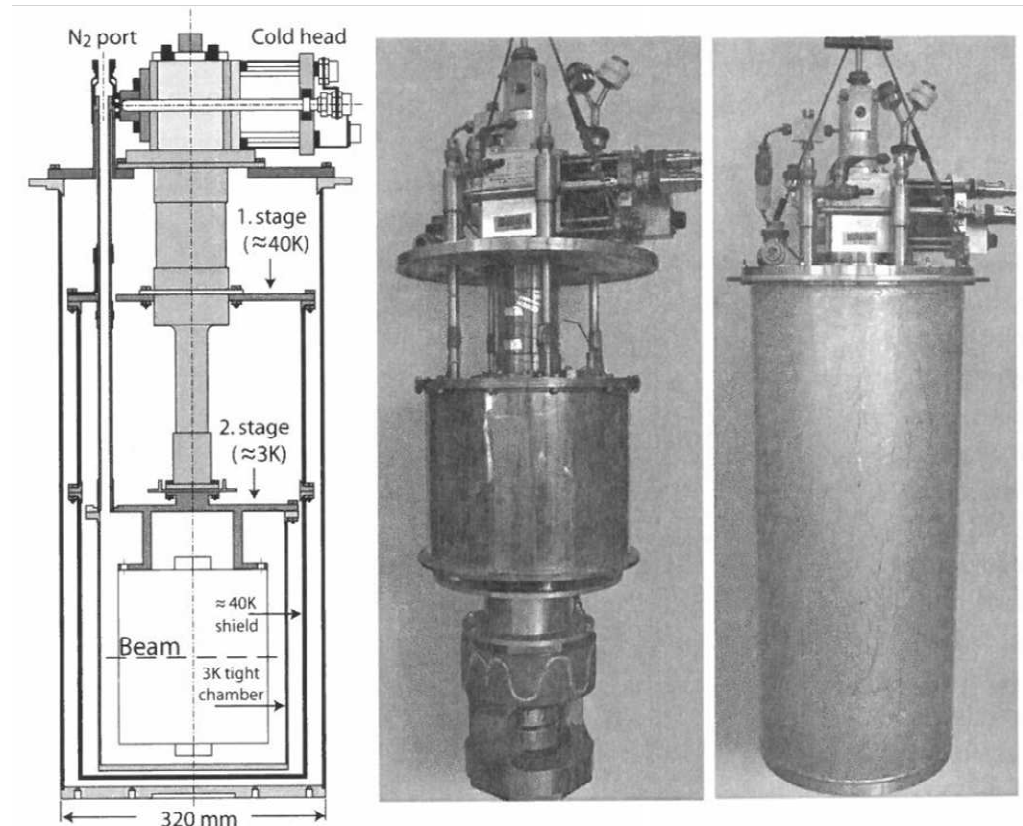
## Dedicated cryocooler

PE cell mass is 30kg



Druck auf Probe  
Kraft auf Probe  
Hydraulik, Pneumatik  
Probengröße  
Material Presse  
Material Stempel  
Material Gasket  
Druckmedium (Probe)  
Hersteller

max. 200 kbar (200'000 atm)  
max. 160 tn (1 Airbus A330-200)  
max. 2000 bar (Öl oder He-Gas)  
30 – 100 mm<sup>3</sup>  
hochlegierter Stahl (AW819)  
Bornitrid oder synth. Diamant  
Titan-Zirkon Legierung  
Methanol:Ethanol Gemisch, Fluoriniert  
M.G.63 (Frankreich) / Université Paris VI



Mostly used for neutron powder diffraction

Single crystal option available

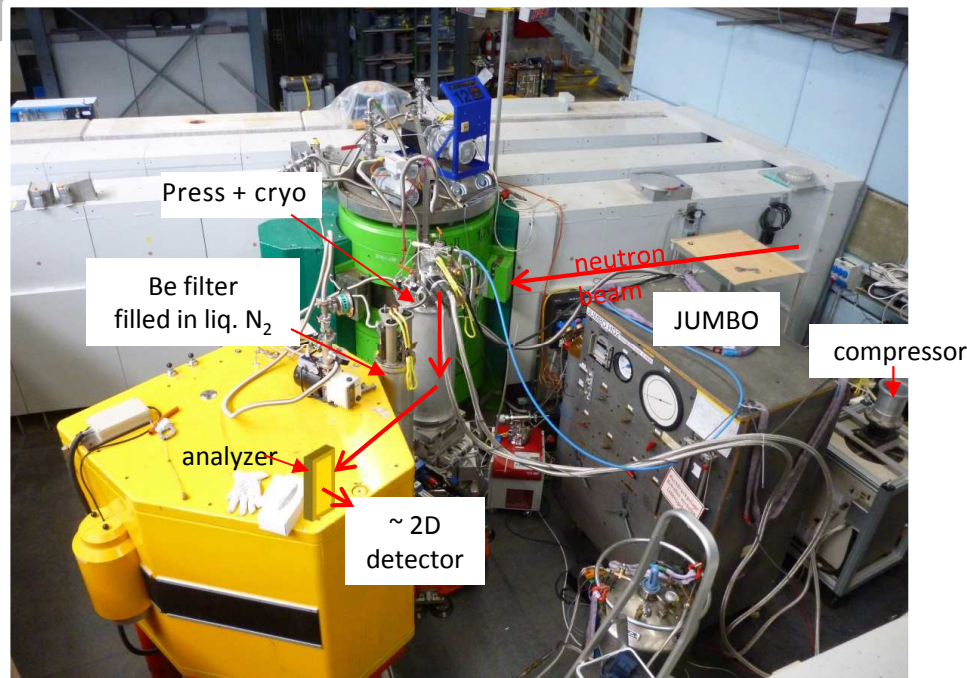
Sample volume: 30–100 mm<sup>3</sup>

# Paris-Edinburgh Press II

Low temperature mode

Sample  $P$  (He gas) up to 10 GPa

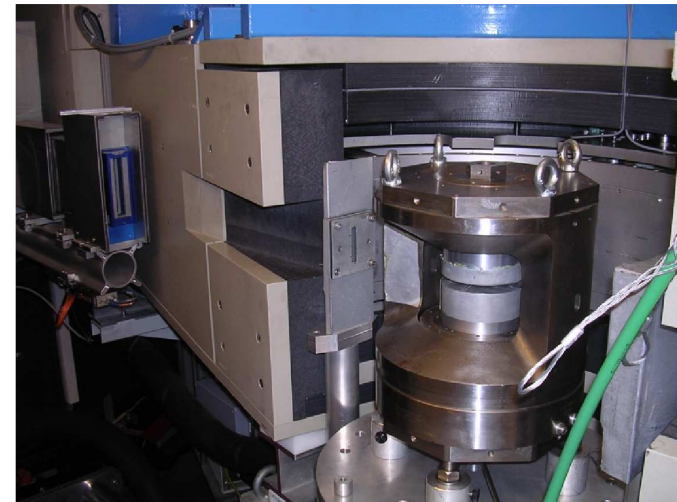
$T$  down to 4.5 K (max  $P$  = 5 GPa)



Single crystal mode @ RITA-II

Room temperature mode

Sample  $P$  (oil) up to 10 GPa



@ HRPT

# LNS Pressure People

Clamp cells for spectroscopy and  
single crystal diffraction  
Paris Edinburg Press

Jonathan WHITE



Clamp cells for powder diffraction

Denis CHEPTIAKOV



SQUID cell

Alun BIFFIN



New initiatives, gas cell (?), moral  
support..

Christian RÜEGG

