

# *Modernising the ILL Sample Environment Suite*

*May 26, 2008*

Eddy Lelièvre-Berna

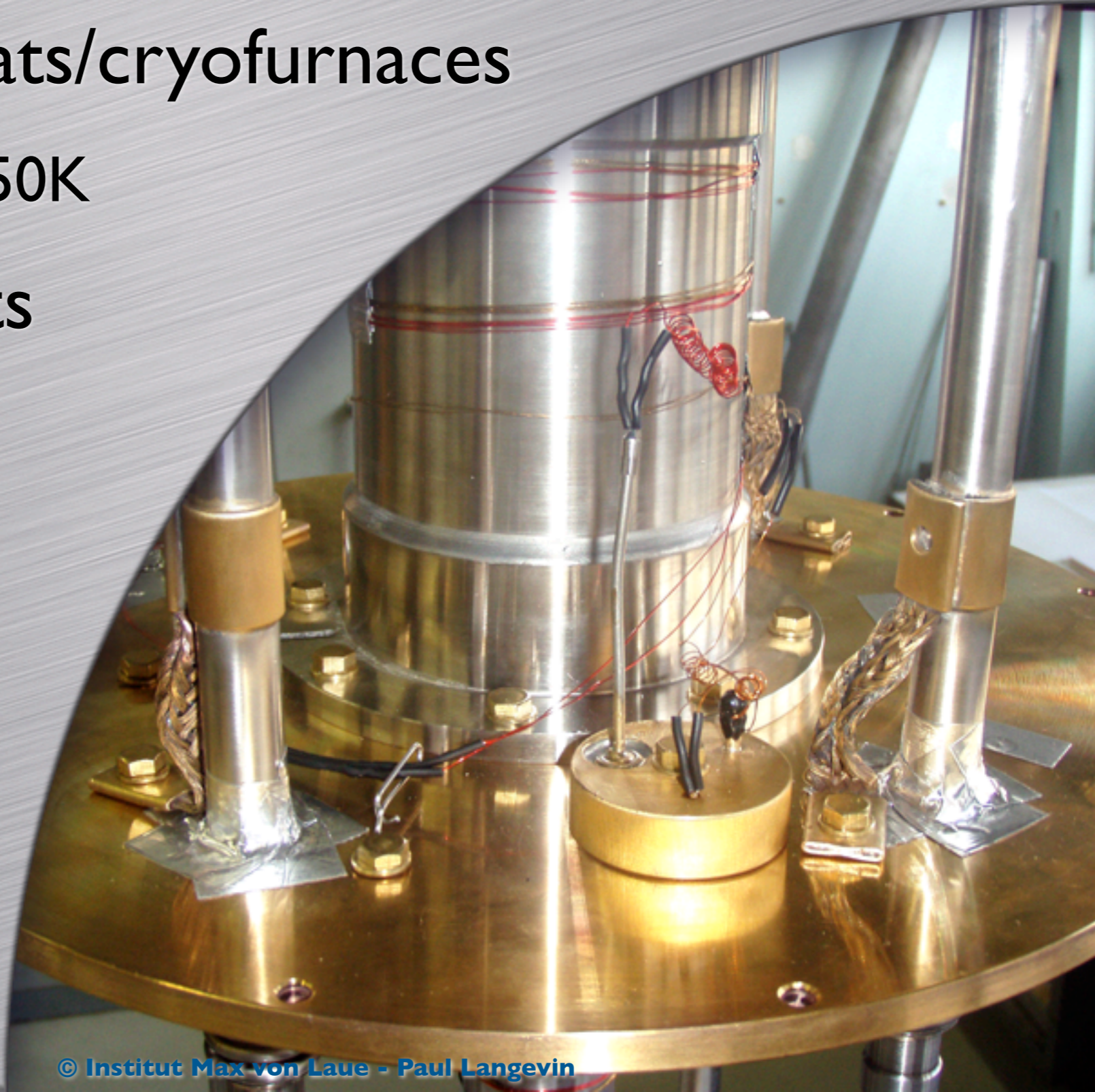
[lelievre@ill.eu](mailto:lelievre@ill.eu)



**SANE**  
NEUTRON ENVIRONMENT

<http://www.ill.eu/sane>

- 70 Orange cryostats/cryofurnaces
  - 1.5 - 320K / 1.5 - 550K
- 2 dilution cryostats
  - 15mK - 320K
- 7 dilution inserts
  - 35/40mK - 320K
- 2  $^3\text{He}$  fridges
  - 0.35 - 320K



- **Cernox CX1050 thermometers**
  - covers the range [1.4,320K], less sensitive to heat and shocks, low magnetic field dependence
  - 220 are calibrated, almost 50% of the cryostats modified, one calibration curve per sensor
- **Lakeshore 340 temperature controllers**
  - store 40 calibration curves max., more complex to tune/use, only 50W available (up to 250W needed), incompatible with C+Pt100...
  - 30 units ordered, about 10 installed, sensor auto-identification being designed with PIC microcontroller

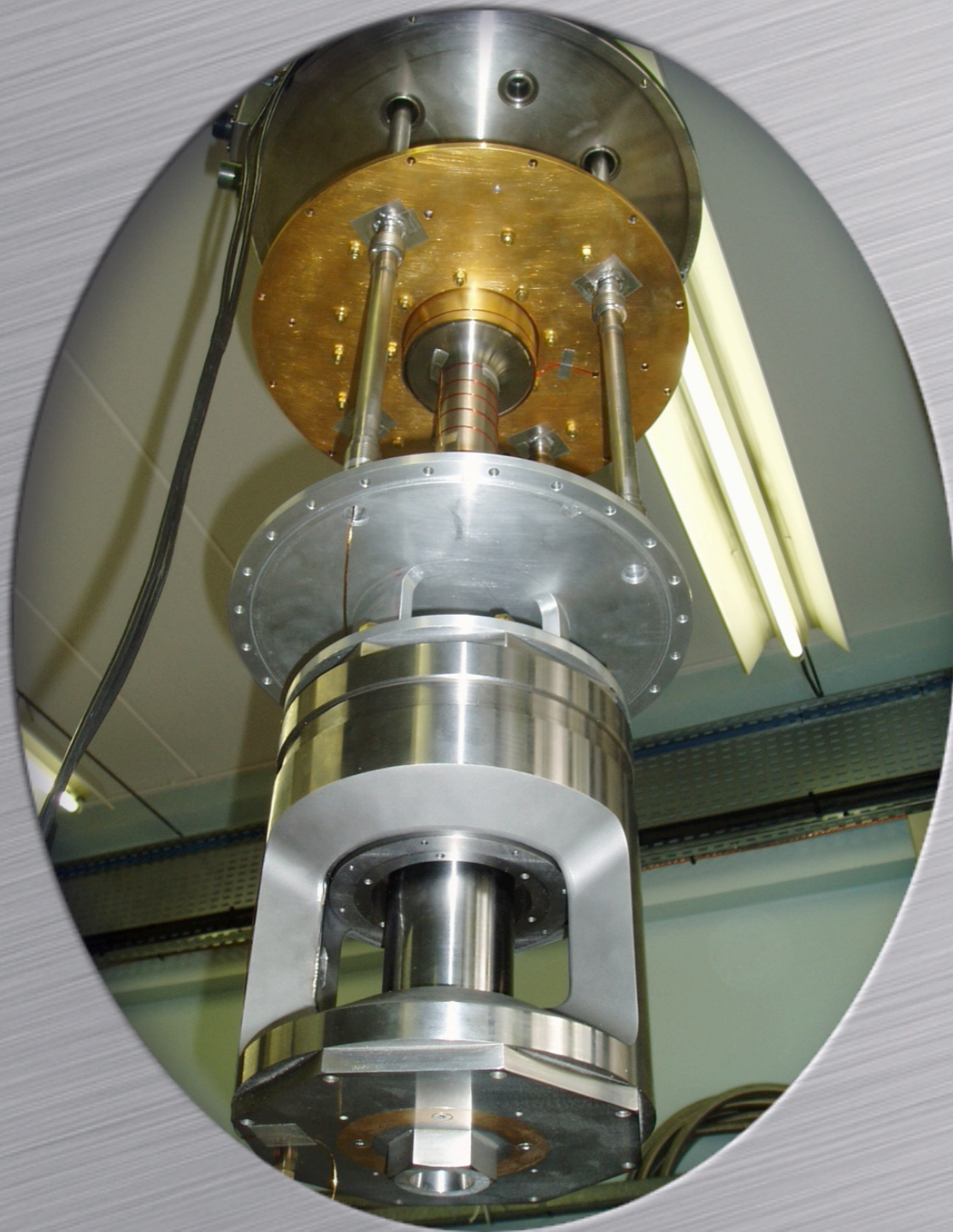
- **Cryogen level monitors**

- ILL, OIS, and Cryomagnetics sensors
- limits, alarm for magnets, fully programmable, autonomous, based on commercial up-to-date parts
- available this month

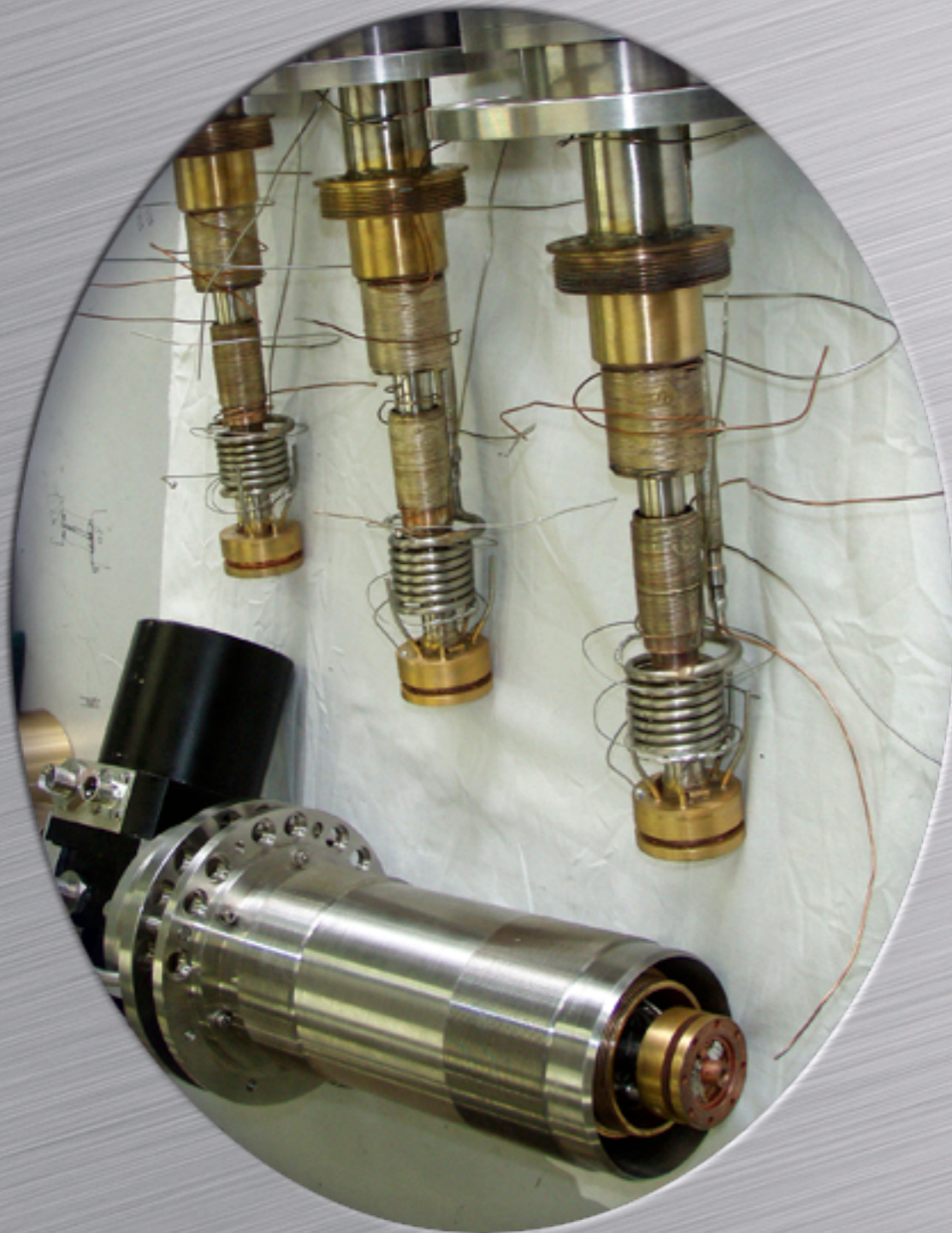
- **Cold-valve controllers**

- auto-adaptative PID, displays true mbar, fully programmable, autonomous, based on commercial up-to-date parts
- available this month





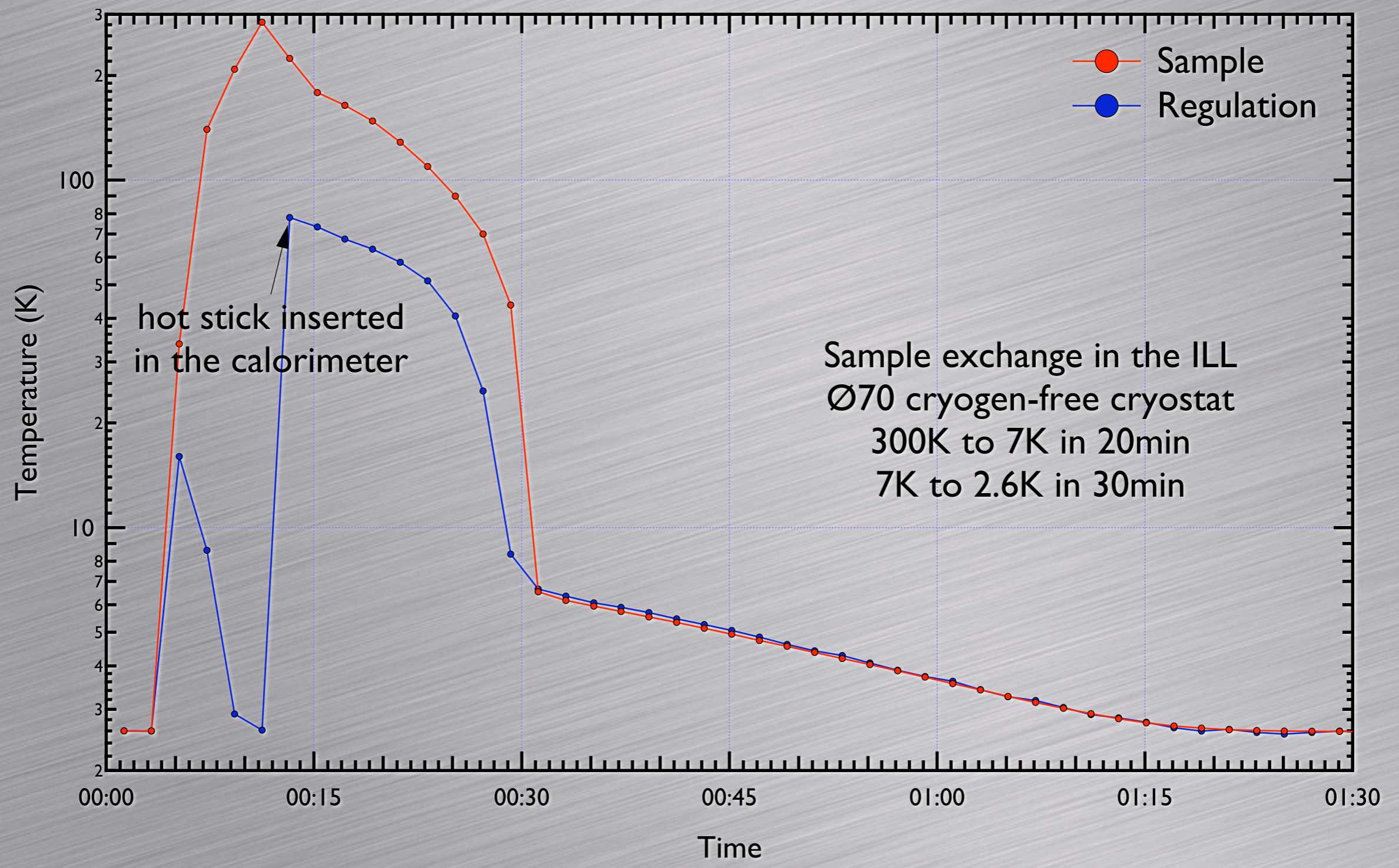
- Cryogen-free cryostat (Paris-Edinburgh press)
- 3K - 320K
- 3h cooling time with the transfer of liquid N<sub>2</sub>
- Ø3 x 0.6mm / 100kbar
- Ø6 x 0.6mm / 50kbar
- bottom-loading
- now available with special mounting system



- 1.8K cryogen-free cryostats
- $T_{\min} = 1.9\text{K}$  for 1 week (1.5K for 1h possible)
- 2h30 to reach 1.9K from RT
- 1h30 to heat to 300K
- available on D9 and D15
- to be tested on D10 in June
- D19 unit still in construction



- **Ø50, Cryomech PT405**
  - covers the range [3.6,320K]
  - low vibrations, 36k€
  - perfectible design
- **Ø70, SHI SRDK-408D2**
  - covers the range [2.6,320K]
  - quite powerful (1W @ 4.2K)
  - less but still expensive (29k€)





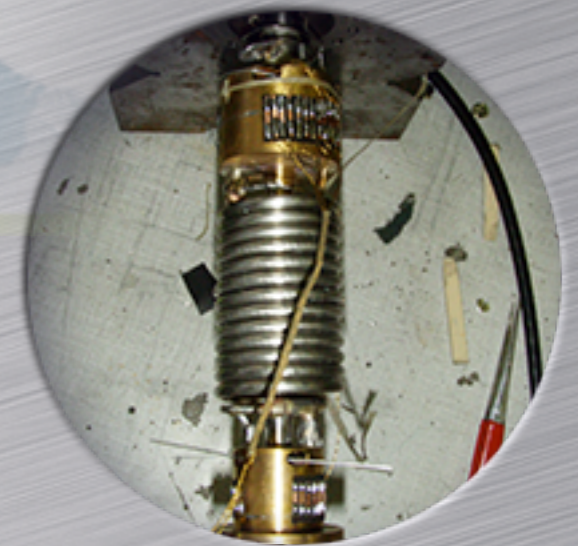
## Dilution Cryostats

95ILDIL80	15mK - 300K	Ø80 x 60
121ILDIL20 (D10)	120mK - 300K	Ø10 x 15
144ILDIL80	35mK - 300K	Ø80 x 105

## Dilution Inserts

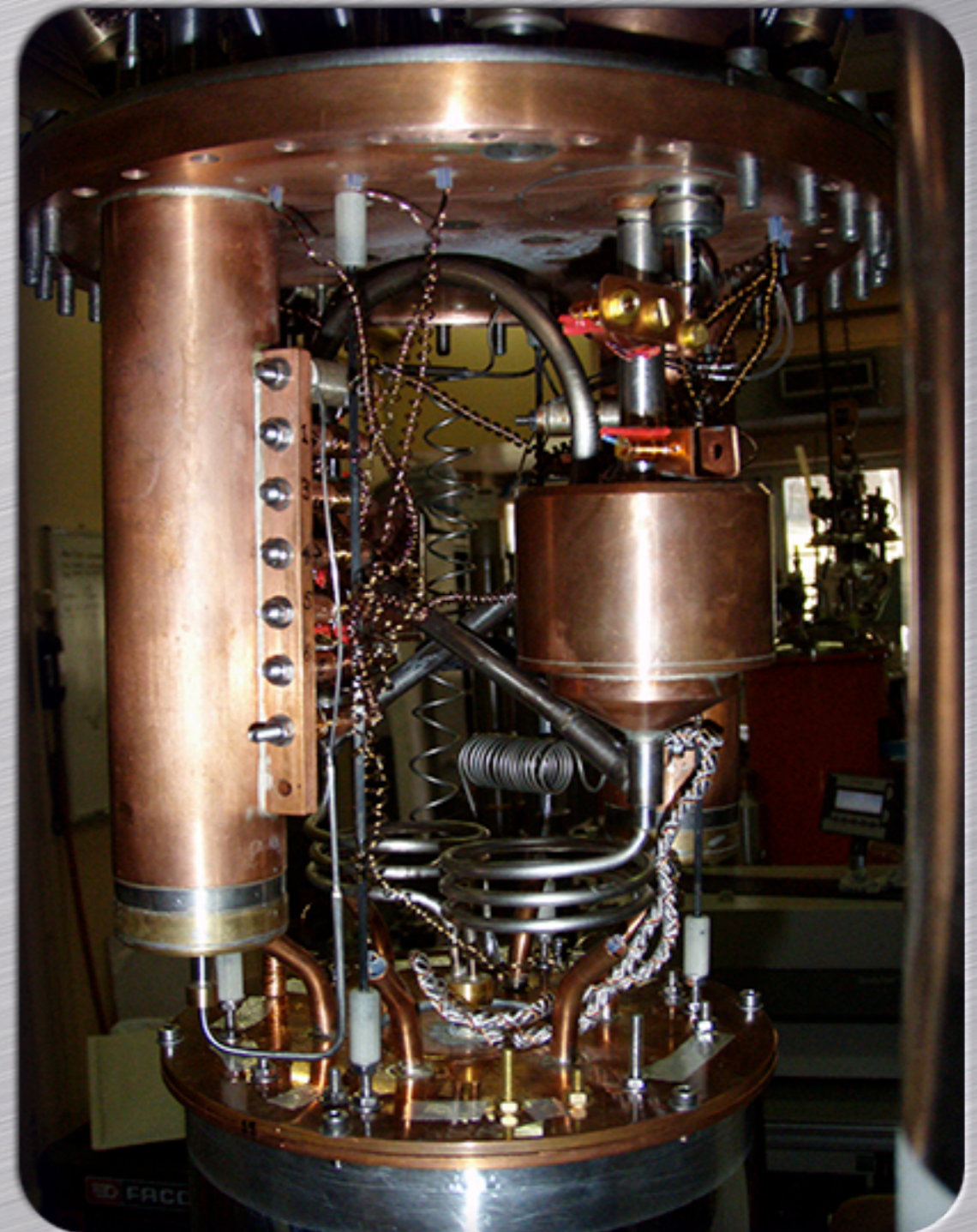
502	50mK - 300K	Ø42 x 70
504	50mK - 300K	Ø30 x 110
162ILDIL20 (15T)	30mK - 300K	Ø20 x 180
165ILDIL32 (10T)	40mK - 300K	Ø32 x 100
178ILDIL36 (5-6T)	40mK - 300K	Ø36 x 70
179ILDIL36 (OC)	40mK - 300K	Ø36 x 70

} **NEW**



## ● TritonDR

- Collaboration with Oxford Instruments
- $T_{\min} = 35\text{mK}$
- $T_{\max} = 700\text{mK}$
- 1 week without trouble
- remains quite slow for experiments requiring temperature changes
- new version coming...



## Horizontal Field

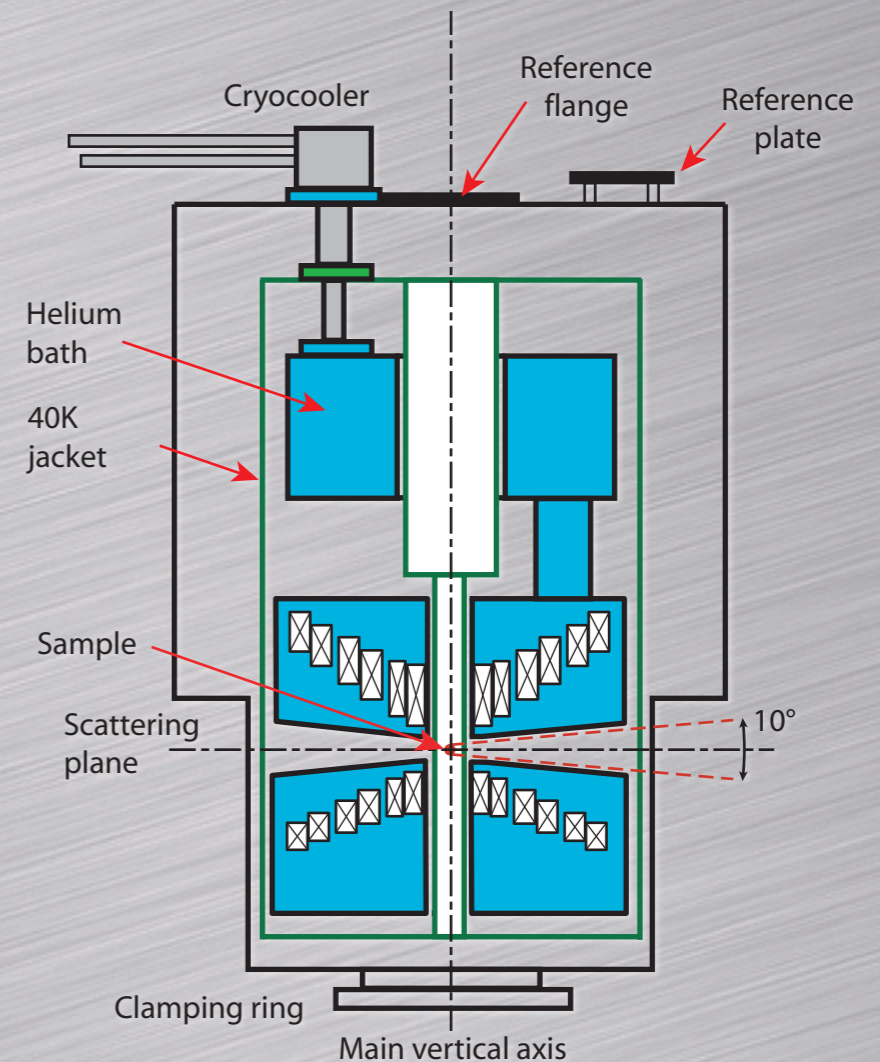
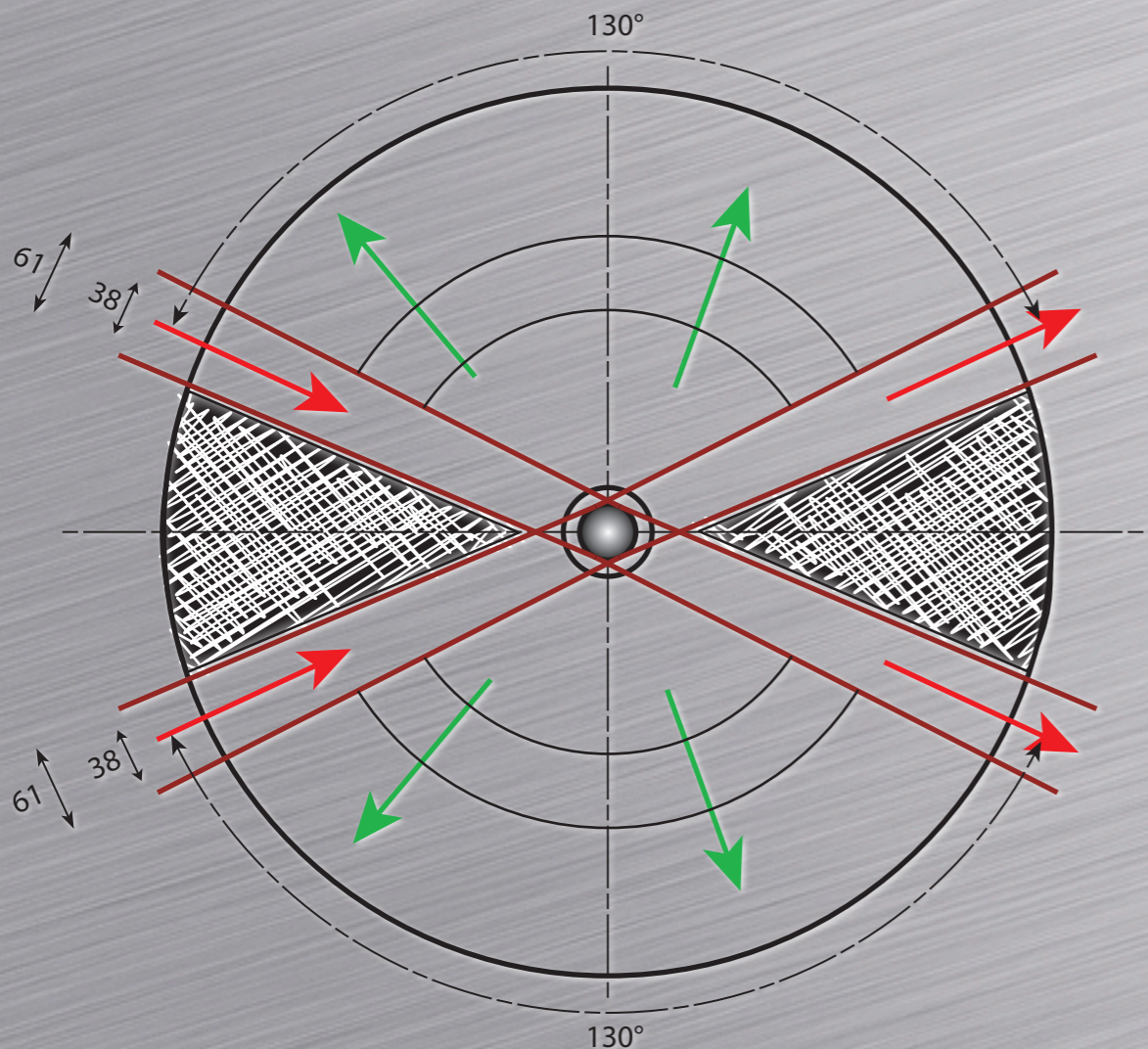
2.0T	40mK - 320K	Ø280, 4x40°	1998
3.8T	40mK - 320K	Ø600, 2x160°	1999
4.6T	1.5 - 320K	Ø436, 10°	1978
7.0T (ESRF)	1.5 - 320K	?	?

## Vertical Field

2.5T (asym.)	40mK - 320K	Ø286, -5/+5°	1995
5T (sym.)	40mK - 320K	Ø560	1986
6T (asym. CNRS)	40mK - 320K	Ø388	1994
6T (sym., D2B)	1.5 - 320K	Ø365	2006
10T (asym., D3)	40mK - 650K	Ø512, -25/+5°	1999
12T (asym., CEA)	40mK - 320K	Ø560, -3/+10°	1994
15T (sym.)	20mK - 320K	Ø588, -2/+2°	2004

# High magnetic fields

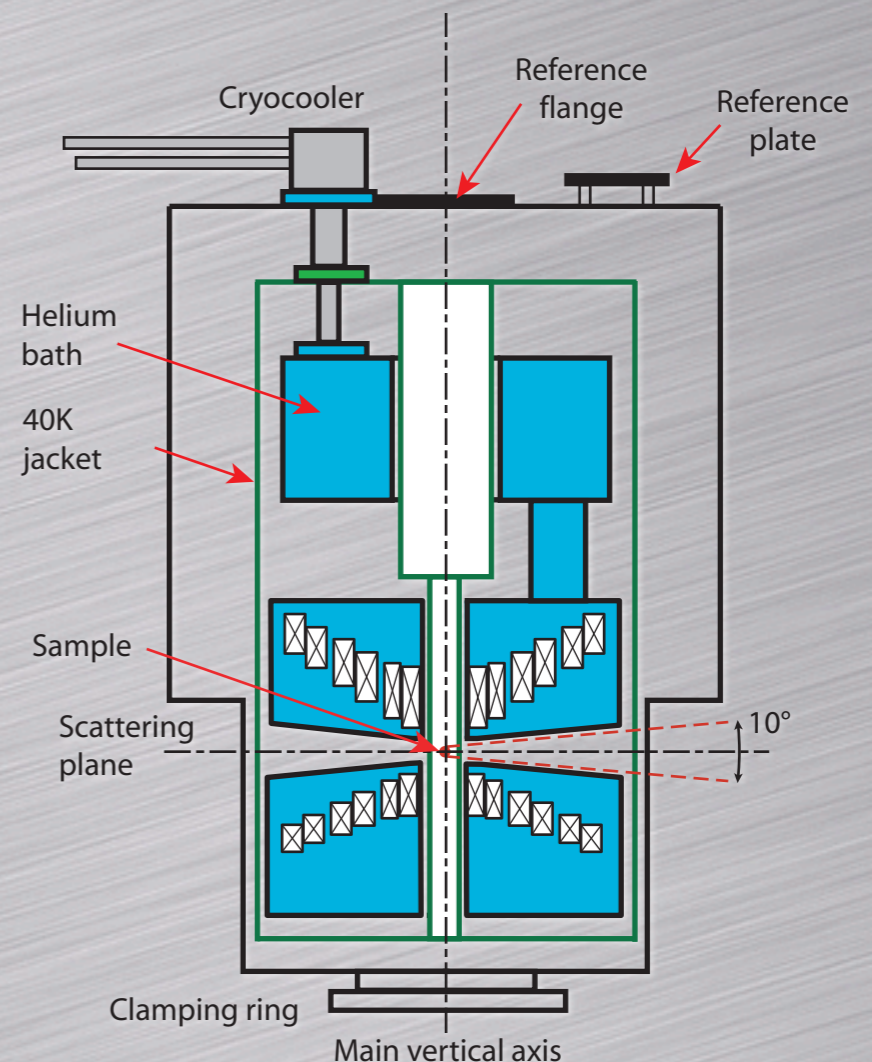
10T asymmetric vertical magnet ordered:  
 | 30° horizontal opening access to Ø38 sample,  
 ±5° vertical access to 30mm height sample  
 including 1mm for Cd plates on all slides



## New magnet for reflectometry...

- for ADAM, D17...
- vertical field
- symmetric or asymmetric
- $\pm 20^\circ$  horizontal access (in/out)
- $\pm 5^\circ$  vertical access (in/out)
- $20 \times 20 \times 1 \text{ mm}^3$  sample ( $\text{Ø}25$ )
- $\text{Ø}400\text{mm}$  and  $400\text{kg}$  max
- 3% field homogeneity

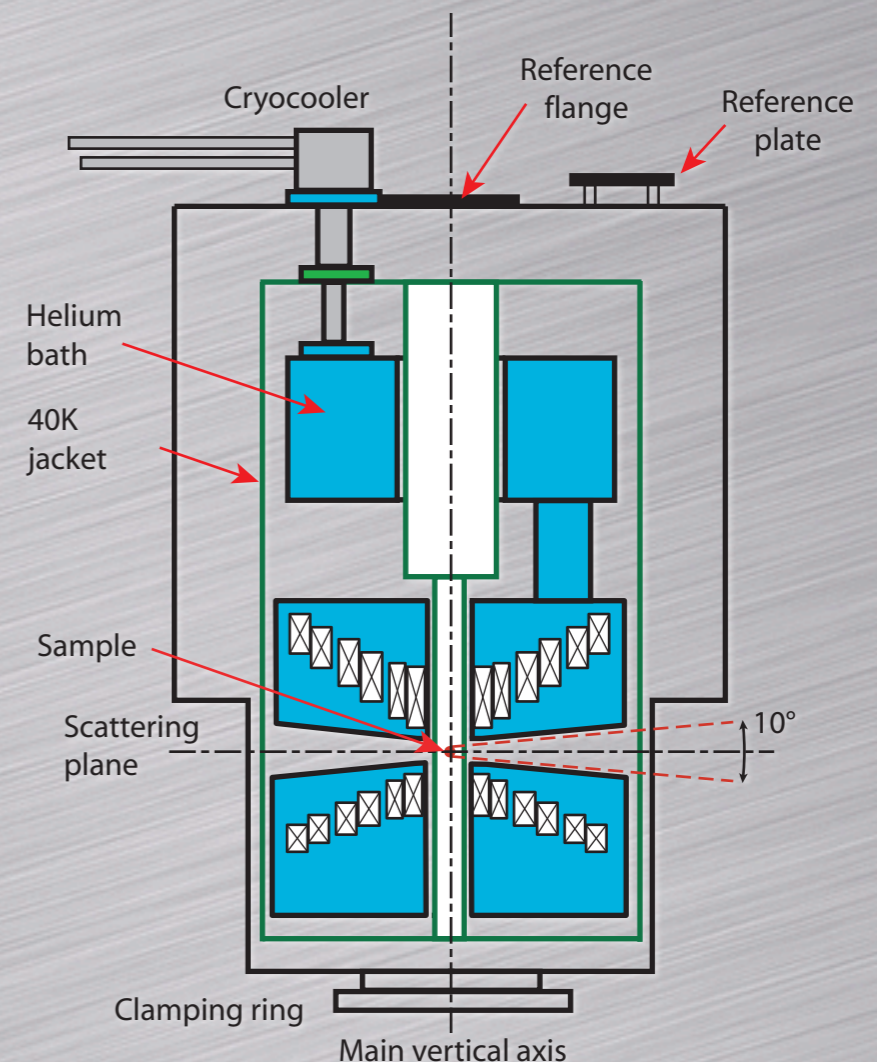
*Budget from:  
ADAM CRG, Sweden, ILL*



## New magnet for SANS...

- for D11, D22, D33...
- horizontal field (symmetric)
- +10T @ 4.2K, +11T @ 2.2K
- $\pm 15^\circ$  access for B // beam
- $\pm 7.5^\circ$  access for B perp. beam
- $\varnothing 22\text{mm}$  sample space
- 0.5% field homogeneity
- $10^\circ$  maximum tilt at nominal field

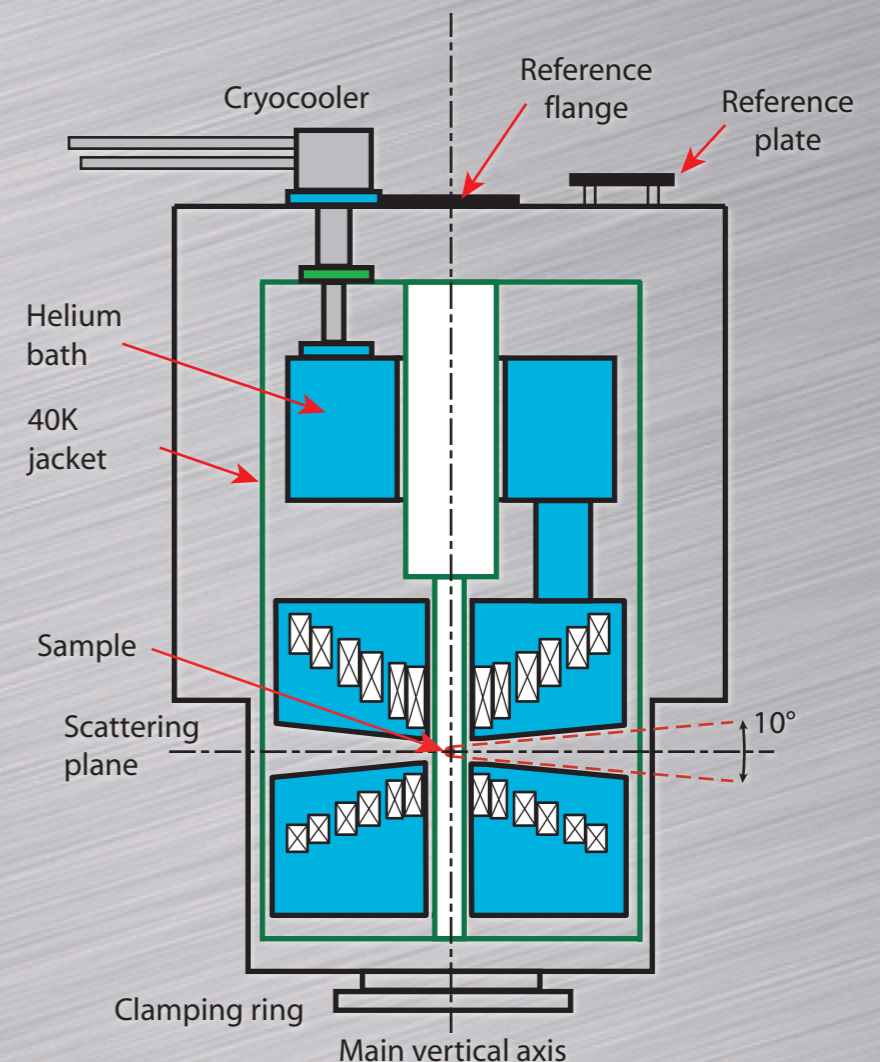
*Budget from:  
ILL Millennium Project*



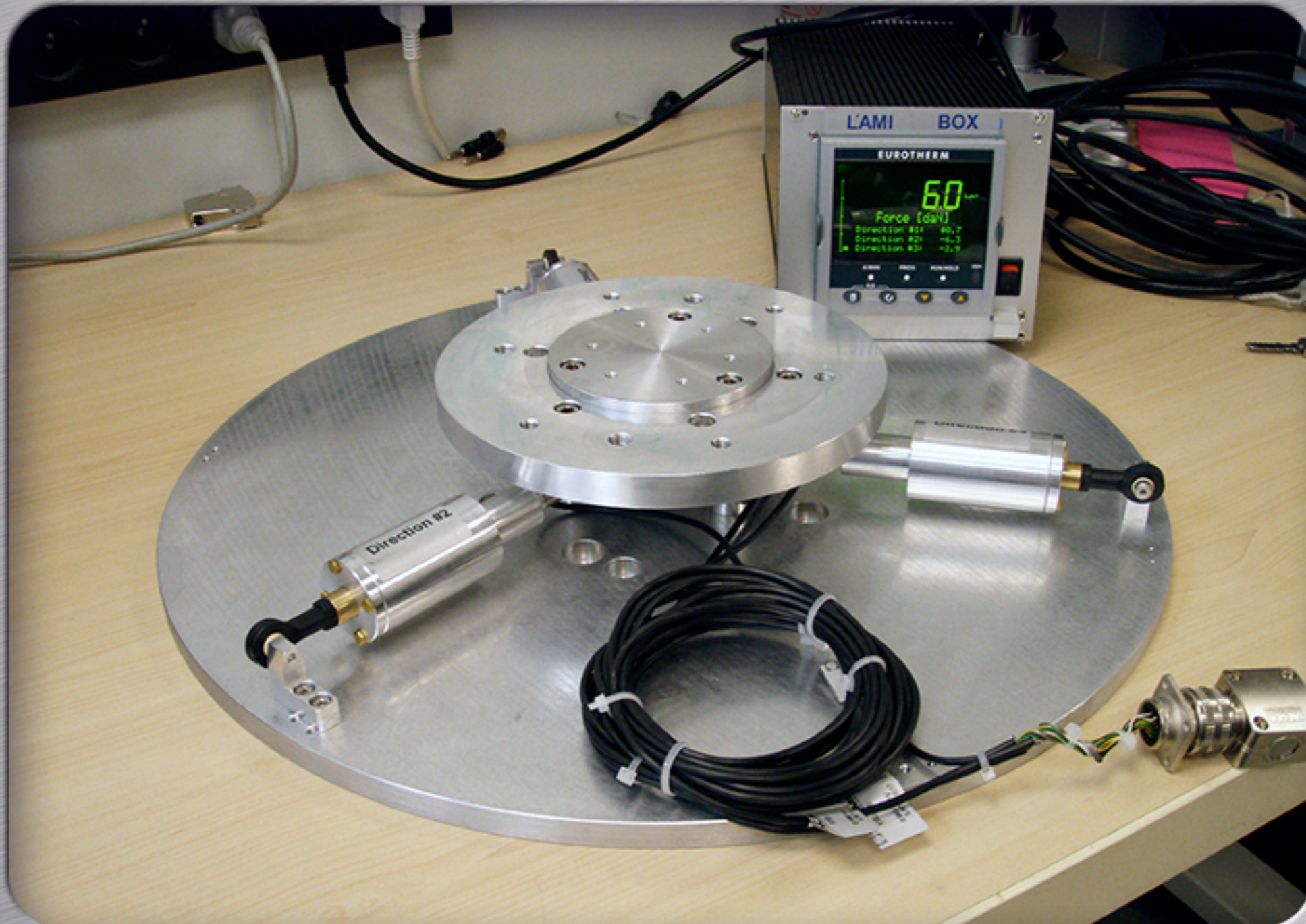
## New magnet for TOF...

- for IN5...
- vertical field (asymmetric ?)
- $\pm 3^\circ$  incident access
- $\pm 20^\circ$  outgoing access
- $\varnothing 38$  sample space
- $\varnothing 800\text{mm}$  max
- 1% field homogeneity
- Tests planned with 2.5T, 5T, 10T...

*Budget from:  
ILL Millennium Project*



# High magnetic fields



Easy measurement of the magnetic forces



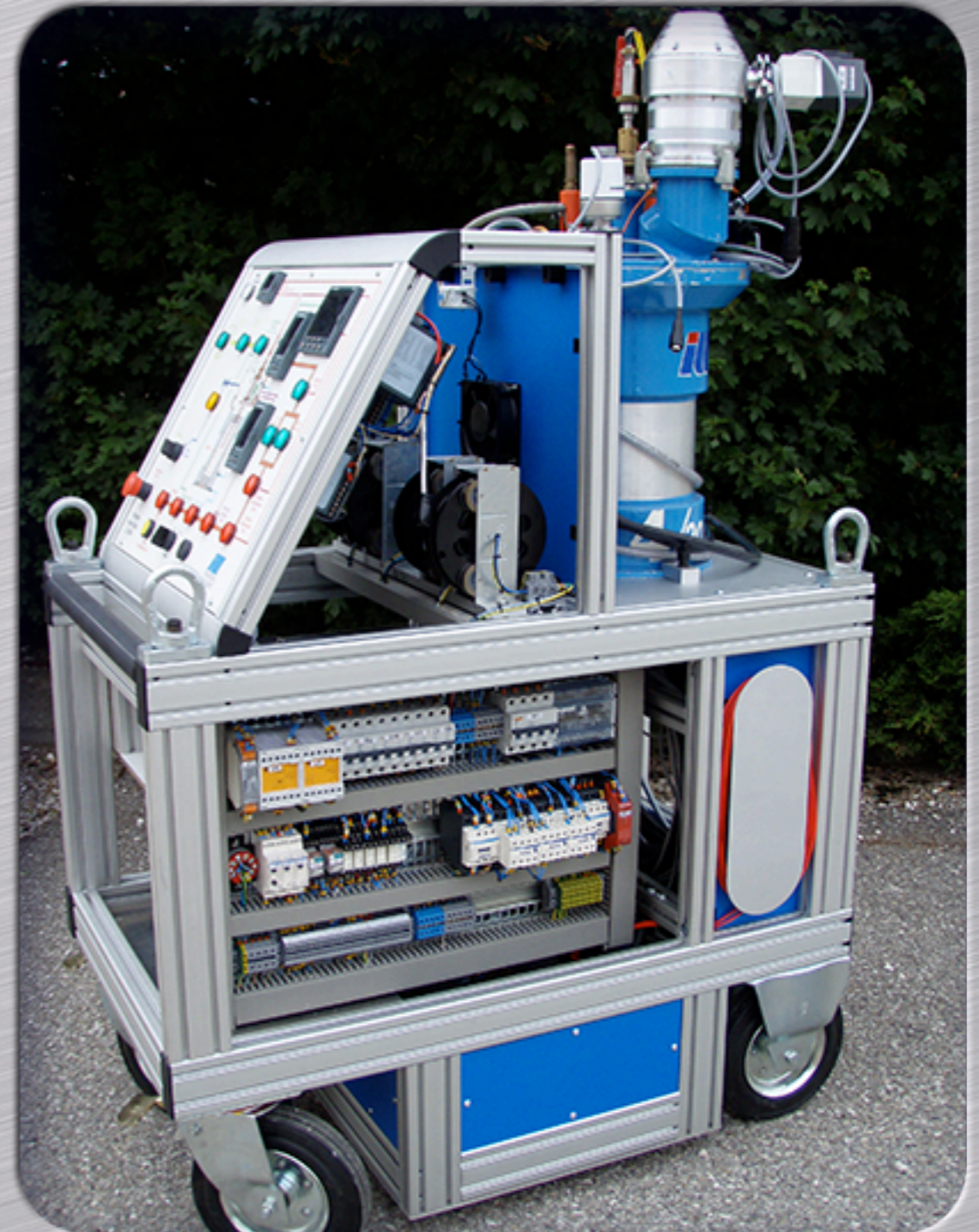
## 19 Furnaces available

250°C	thermocox	A5 - AG3	Ø10 x 50 mm
450°C	thermocox	A5 - AG3	Ø60 x 50 mm
1000°C	V or Nb screens	Al, V or Nb, sapphire	Ø15-45 x 50mm
1100°C	V or Nb screens	Al, V or Nb	Ø15 x 50 mm
1250°C	Nb screen + hole	Al, Nb, sapphire	Ø30 x 30mm
1400°C	Nb screens	Al, Nb	Ø35 x 40 mm
1600°C	Nb screens	Al, Nb	Ø35 x 50mm
1650°C	mirrors	Al or nothing	Ø10 x 10mm

- Compact furnace for Eulerian cradles
  - $T_{\max} = 1100\text{K}$
  - 1h to reach 500K from RT
  - +30' to reach 1100K
  - 30' to cool down to 650K
  - 30' to replace the heater
  - available on D9
  - copy planned for D10



- 6 new power-racks
  - easier to use, safer
  - automatic control
  - fixation of the furnace
  - monitoring / diagnostics
  - Ethernet remote control
- **+3000K ?**
  - levitation technique...



Gas pressure cells available: 2.5 to 10kbar

2.5kbar @ 300K	2.5kbar @ 1.5K	16mm Al 7049T6	Ø15 x 30mm
5kbar @ 300K	4.7kbar @ 1.5K	32mm Al 7049T6	Ø15 x 30mm
5kbar @ 300K	4.7kbar @ 1.5K	15mm TiZr	Ø7 x 30mm
5kbar @ 300K	4.7kbar @ 1.5K	6mm CuBe	Ø6 x 25mm
5kbar @ 300K	3kbar @ 500K	7mm CuBe	Ø5 x 25mm
10kbar @ 300K	≈8kbar @ 1.5K	10mm Steel	Ø5 x 30mm
10kbar @ 300K	≈8kbar @ 1.5K	≈30mm TiZr	Ø5 x 10mm

## Clamps available: 10 to 30kbar

10kbar @ 300K	7kbar @ 1.5K	12mm TiZr	Ø6 x 20mm	Fc75
10kbar @ 300K	7kbar @ 1.5K	8mm CuBe	Ø6 x 20mm	Fc75
10kbar @ 300K	7kbar @ 1.5K	6mm Steel	Ø6 x 20mm	Fc75
15kbar @ 300K	12kbar @ 1.5K	9mm CuBe	Ø5 x 20mm	Fc75
20kbar @ 300K	17kbar @ 1.5K	25mm Al <sub>2</sub> O <sub>3</sub>	Ø4 x 5mm	Fc84/Fc87
30kbar @ 300K	25kbar @ 1.5K	25mm Al <sub>2</sub> O <sub>3</sub>	Ø3 x 5mm	Fc84/Fc87

- Second 100kbar Paris-Edinburgh press ordered
- new gas handling controller with CNRS patented valve on track...

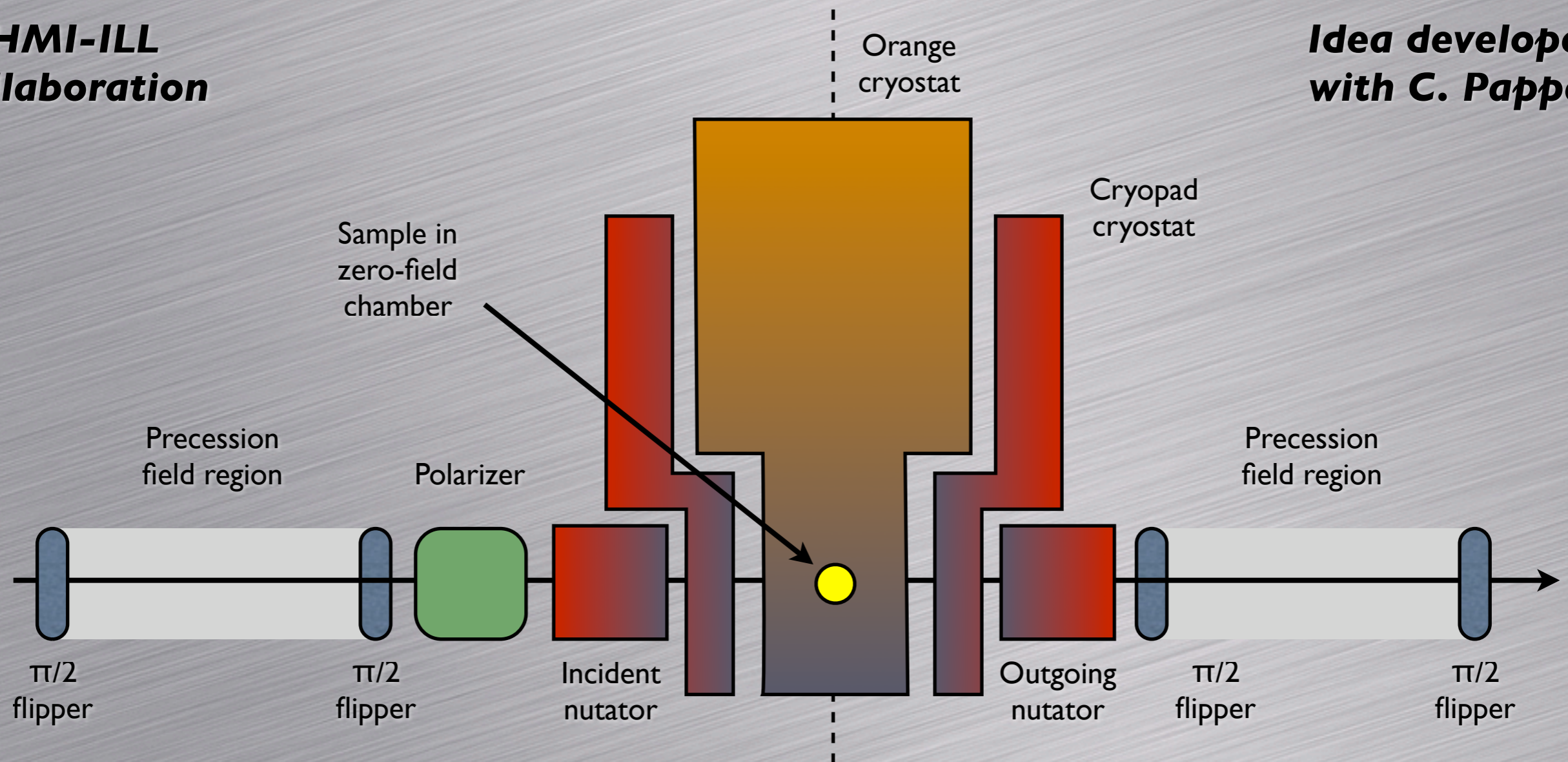


# Polarimetric Spin-Echo

The multifaceted dynamics of antiferromagnets require more than the conventional neutron spin echo set-up ...

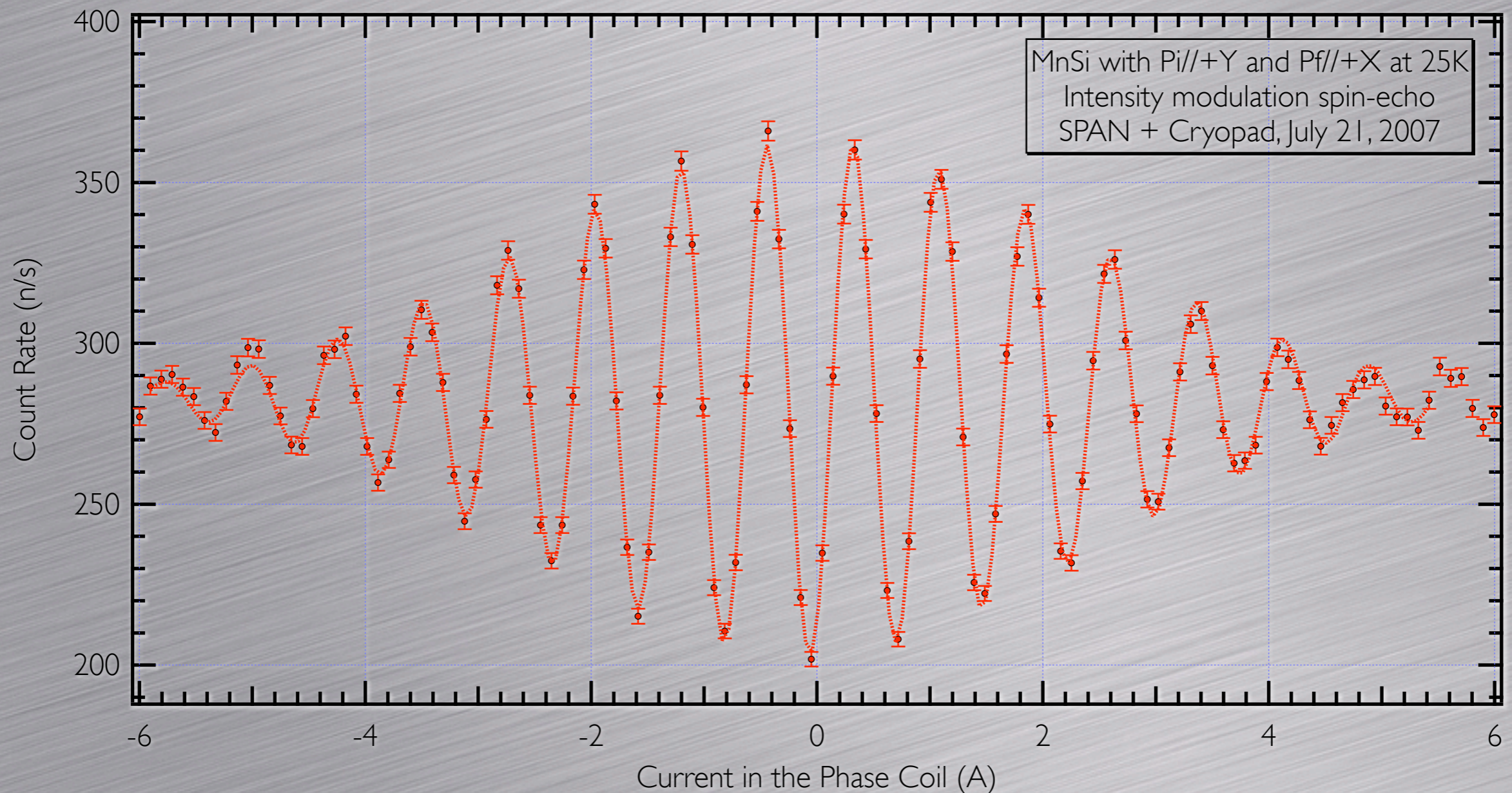
**HMI-ILL  
Collaboration**

**Idea developed  
with C. Pappas**



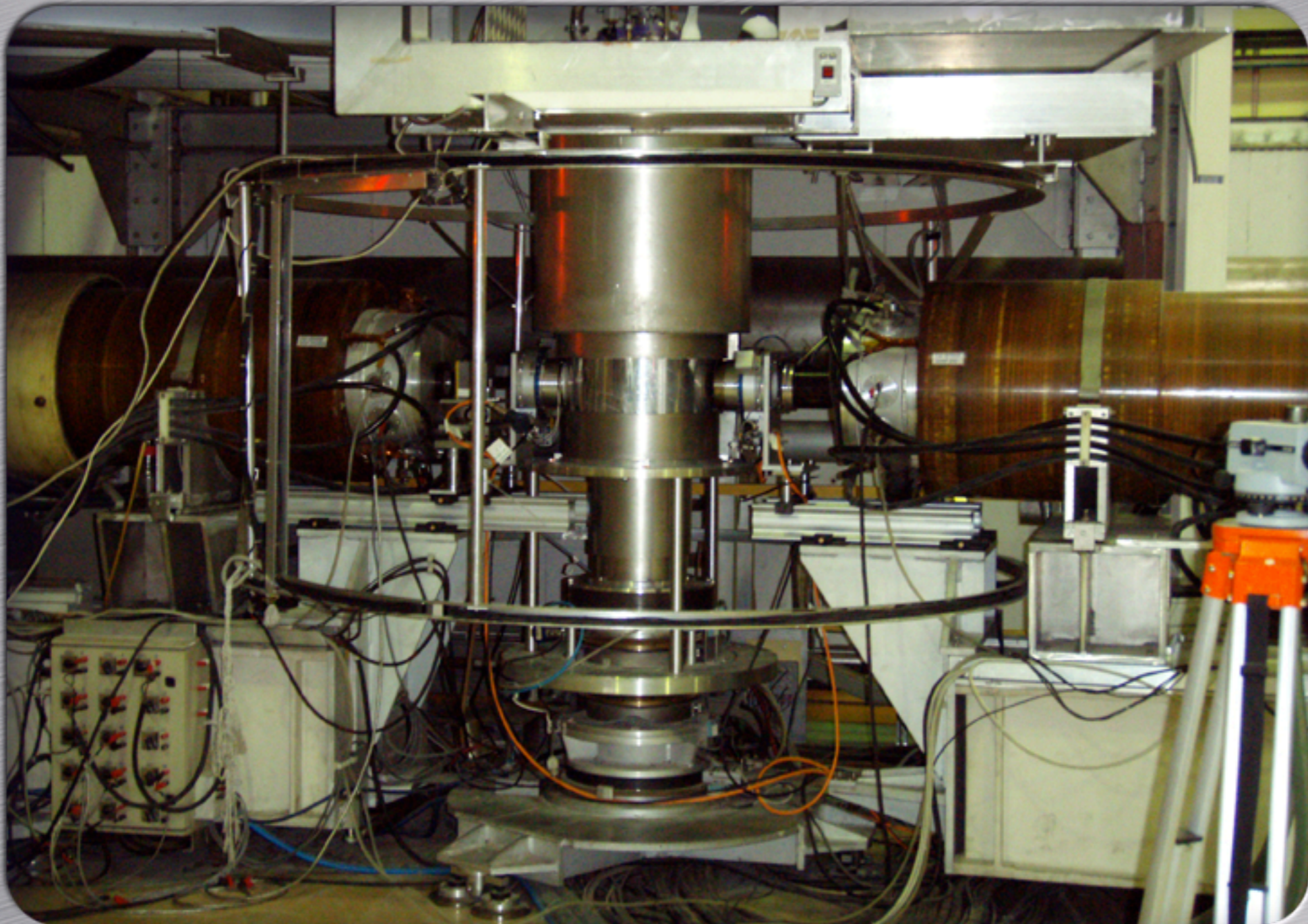
# Polarimetric Spin-Echo

Spin-echo group recorded on the helimagnetic peak of MnSi with perpendicular incident and scattered polarisation vectors





# *Polarimetric Spin-Echo*



Now available on IN15

- large superconducting Nb cylinder with RT chamber
- holds the largest spin filter cell ever (almost 2 litres)
- maintains  $^3\text{He}$  polarisation in the stray field of a magnet ( $T_1 = 131$  hours)
- fits large beams, i.e. 20 cm height and 7 cm width !





NEUTRONS  
FOR SCIENCE



*Thank you*