



# Overview of the “Modernisation of Sample Environment” Project

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# Temp. controller/sensors

- The ILL standard sensors are C, Pt100
  - Carbon, Pt100 sensors have a common calibration curve (e.g. C0, PT0)
  - there is an overlap in the [20,50K] range
- Problem: carbon probes are not identical and not reliable
  - +140mK variation at 4K seen on std sensors
  - +1 K variation above 20K after 20 years !
- We must replace the carbon probes !

# Temp. controller/sensors

- The ILLSEC temperature controller:
  - sometimes resets itself at low temperature, leading to instabilities
  - can unexpectedly outputs a full heating current
  - cannot be repaired (unavailable parts)
- We must replace the ILLSEC !
  - several commercial units have been tested (Air Liquide BT500, Eurotherm system (ILL-SCI), LakeShore LK340, Oxford Instruments ITC503).

# Temp. controller/sensors

- New ILL sensors: Cernox CX1050
  - covers the range [1.4,320K]
  - less sensitive to heat and shocks
  - pre-calibrated units are expensive...
- New ILL temperature controller: LK340
  - already used at HMI, ISIS, PSI, JAEA,...
  - stores a maximum of 40 calibration curves
  - does not provide all ILLSEC functions

# Temp. controller/sensors

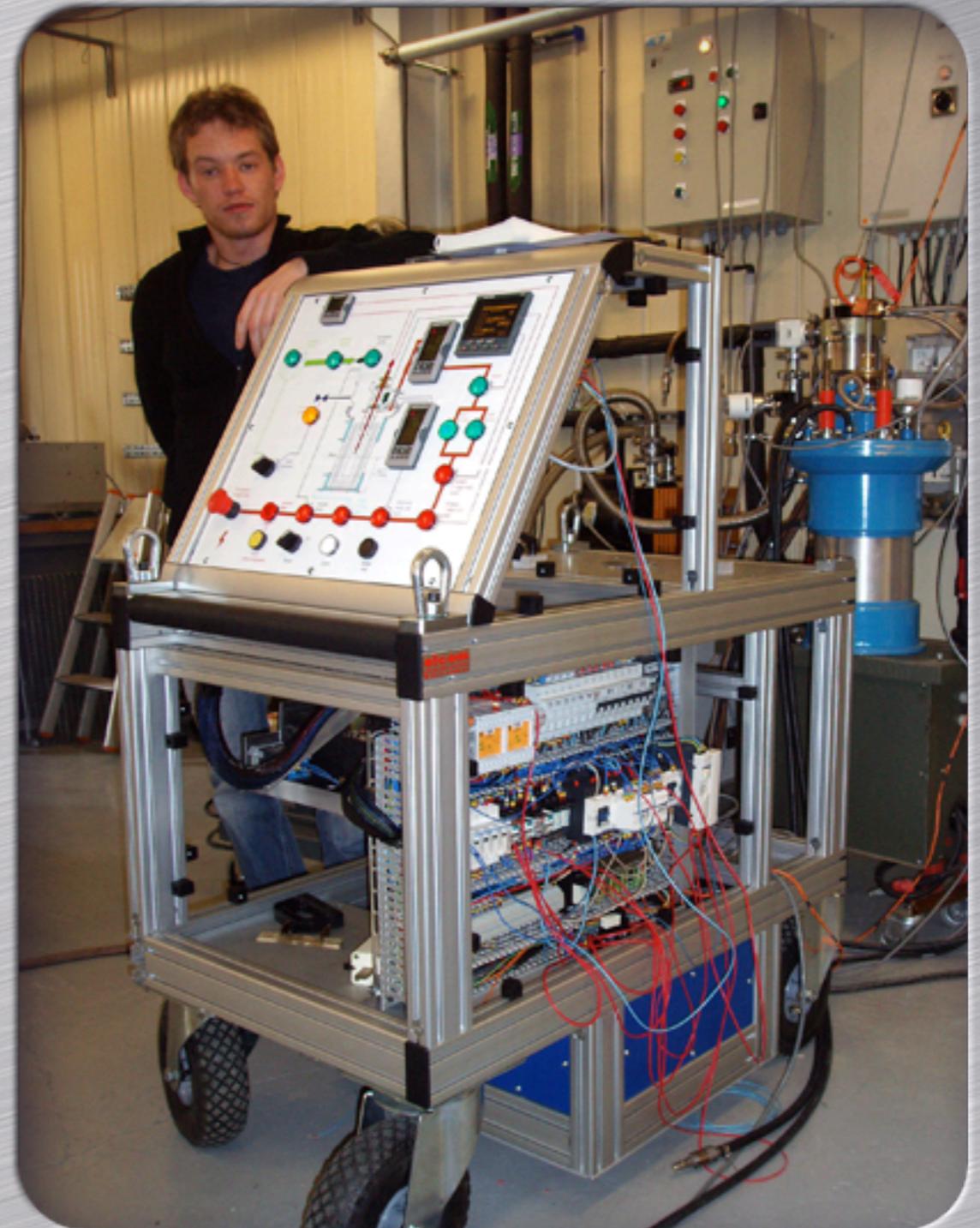
- We install 40 new sensors per year.  
( $\approx 30\text{k€}/\text{year}$ )
- So we will purchase non-calibrated Cernox (cost / 3) and have built our own calibrator ( $\approx 28\text{k€}$ ) - see poster



## 19 Furnaces

250°C	thermococox	A5 - AG3	Ø10 x 50 mm
450°C	thermococox	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

- New power-bay
  - easier to use, safer
  - automatic control
  - fixation of the furnace
  - monitoring / diagnostics planned in new software
  - see poster
- New furnaces...?



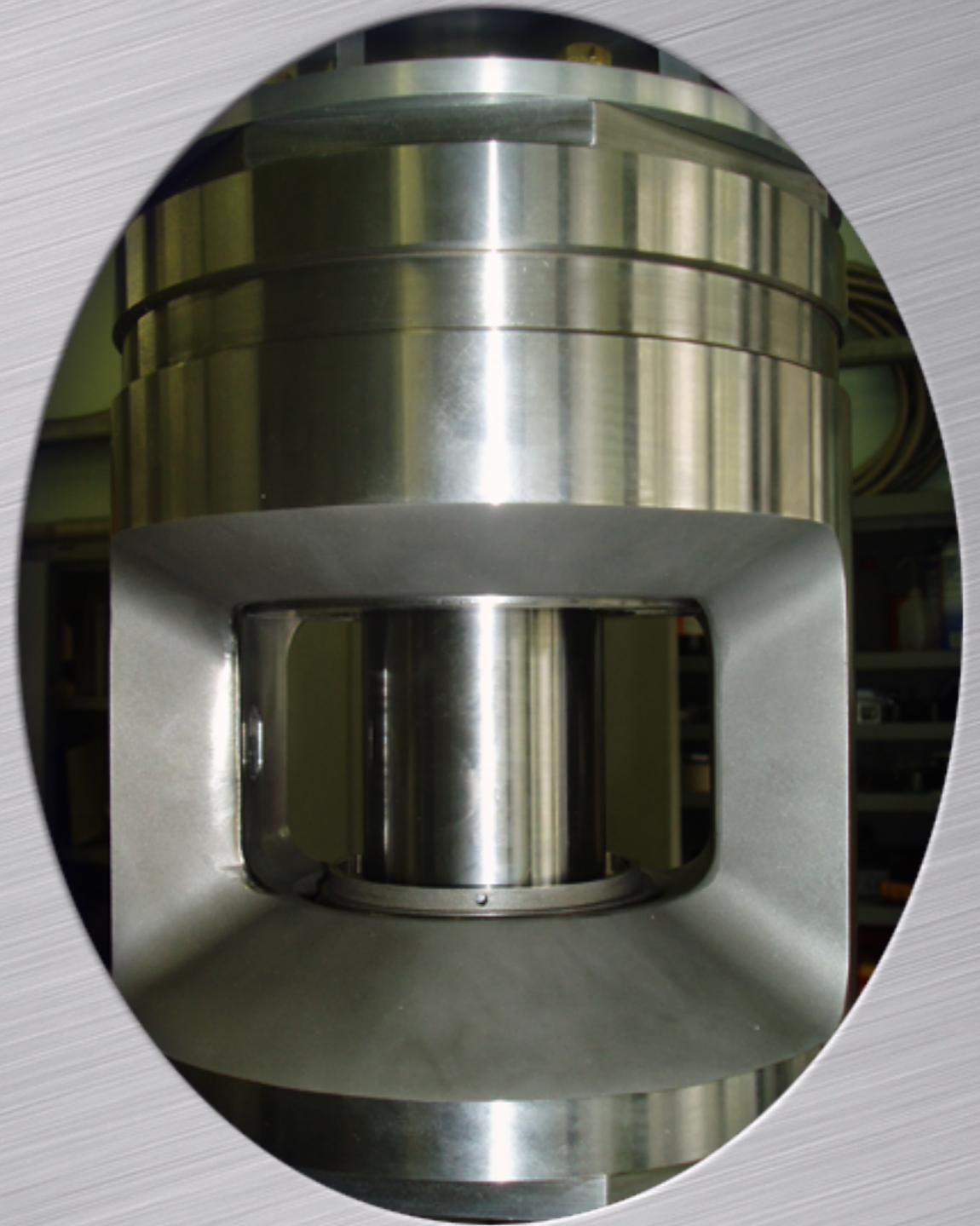
## Gas pressure cells

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

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

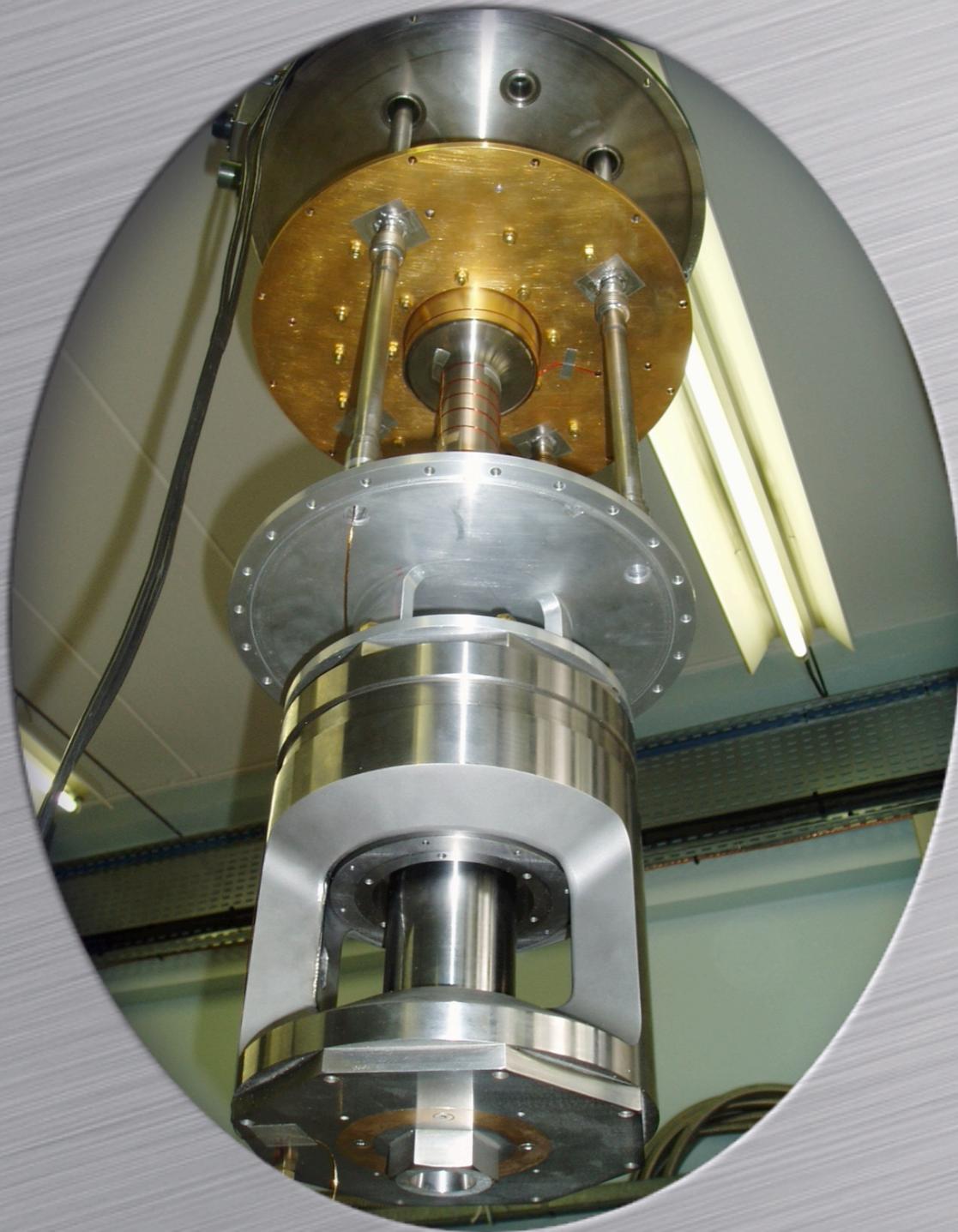
- Paris-Edinburgh cell
  - $\text{Ø}3 \times 0.6\text{mm} < 100\text{kbar}$
  - $\text{Ø}6 \times 0.6\text{mm} < 50\text{kbar}$
- New gas handling systems with CNRS valve (very high stability)...?



- 43 Orange cryostats
  - 1.4 - 320K
- 18 cryofurnaces
  - 1.4 - 500K
- 7 dilution inserts
  - 15/40mK - 320K
- 2 dilution cryostats
  - 15mK - 320K



# Equipment/projects



- Cryogen-free cryostat (Paris-Edinburgh cell)
- 3K - 320K
- 3h cooling time with the transfer of LN<sub>2</sub>
- $\text{Ø}3 \times 0.6\text{mm} < 100\text{kbar}$
- $\text{Ø}6 \times 0.6\text{mm} < 50\text{kbar}$
- bottom-loading

# Equipment/projects



- New 1.8K cryogen-free cryostats for D9, D10, D15 and D19
- New cryo-free cryostat for IN13 ( $\text{Ø}70$ , 3K)
- New cryo-free cryostat for TOF ( $\text{Ø}70$ , 1.5K) ?
- ...?

# Equipment/projects

## 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
5.0T (sym.)	40mK - 320K	Ø560	1986
6.0T (asym. CNRS)	40mK - 320K	Ø388	1994
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

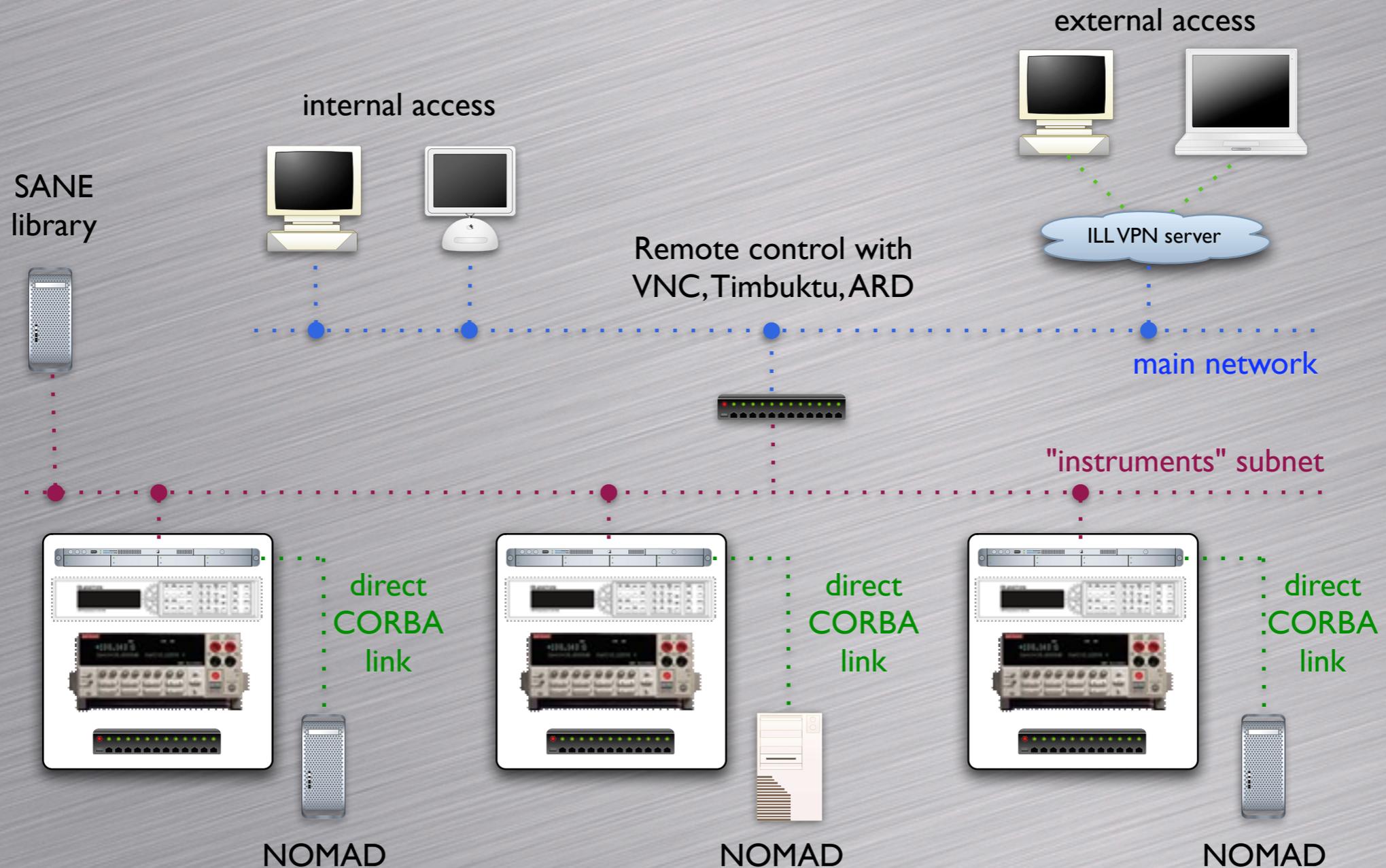
- Road map...
  - Vertical field magnet for D2B (6T - AS Scientific)
  - Vertical field magnet for TAS (10T - Oxford Inst.)
  - Horizontal field magnet for Reflectometry, SANS
  - Vertical field magnet for TOF
  - Vertical field magnet for Reflectometry, SANS
  - ...

- Desirable options for cryomagnets
  - dilution fridge insert (ILL design),
  - zero-boil-off: we can save 25k€ LHe per year and simplify the use (to be developed with CNRS),
  - self-shielded: the stray field is reduced by a factor  $\approx 50$  but the cost doubles. This option will be considered when absolutely necessary.
  - focusing supermirror at the entrance (two entrance windows in that case). The adoption of this option depends on the application.

# Equipment/projects

- Control - Monitoring - Integrated diagnostic
  - devices controlled in parallel (on beam + off beam)
  - automatic device recognition, cold valve control, etc
  - permanent monitoring, diagnostic, alarm management
  - reliability: network not required, same software used everywhere (scientists, technicians, SANE...)
  - quick integration of external equipment
  - help files, tutorials, remote access for LC and OHS
  - sample status in NOMAD (T, H, P, errors, etc), more ?

- Control - Monitoring - Integrated diagnostic



- Too many projects ?
- Today:
  - +1 electronician (expert in Eurotherm)
  - +1 technician expert in polarimetry and mechanics
  - +1 technician expert in cryogenics
  - + budget increase (Millennium Programme)
- Tomorrow ?