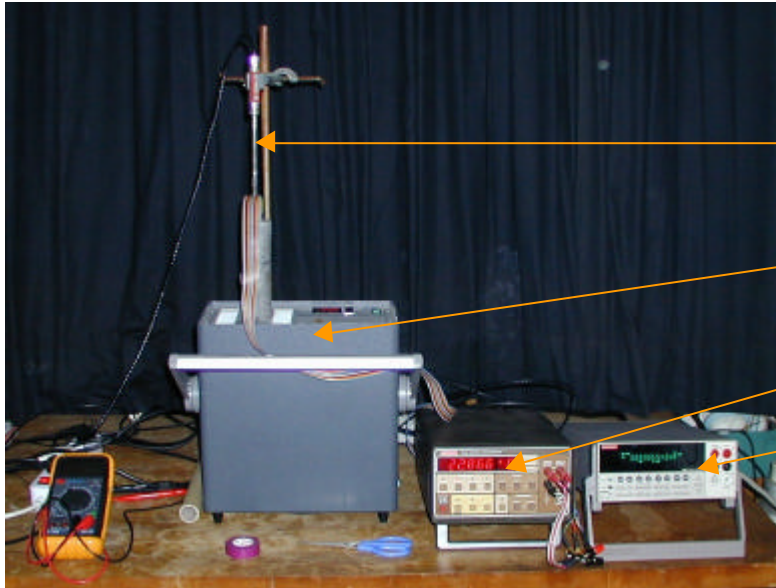


## Calibration facilities and sensor development:

There are two set-ups available: (A) with fluoroinert bath; (B) Dry process calibrator



### Instrumentation:

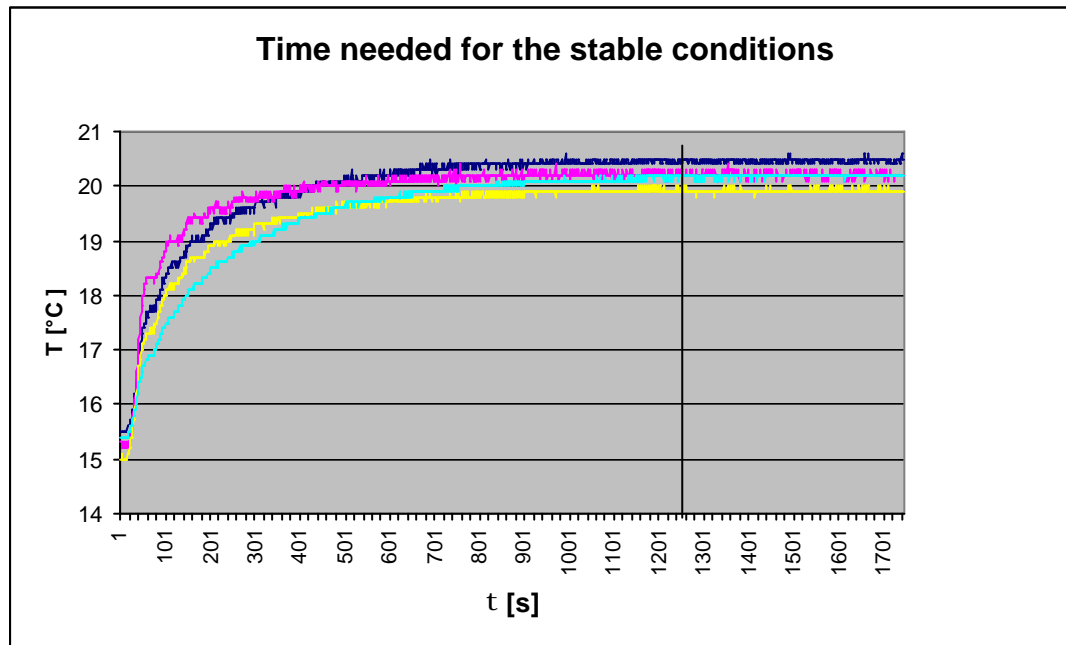
- Platinum Resistance Thermometer TINSLEY [ $25\Omega$ ; accuracy  $\pm 0.005$  K]
- ASL Metal Block Calibrator B140
- Digital Multimeter Keithley, 195 A
- Multimeter Keithley, Model 2000 with scanner card



### DAQ system used to monitor data from

- Reference thermometer TINSLEY
- Individual NTC sensors

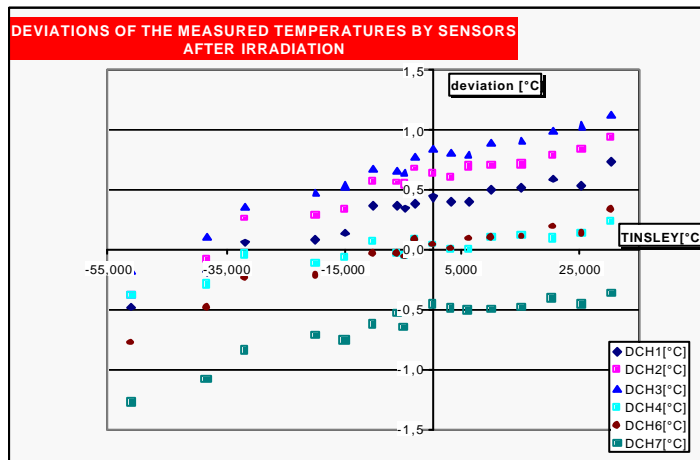
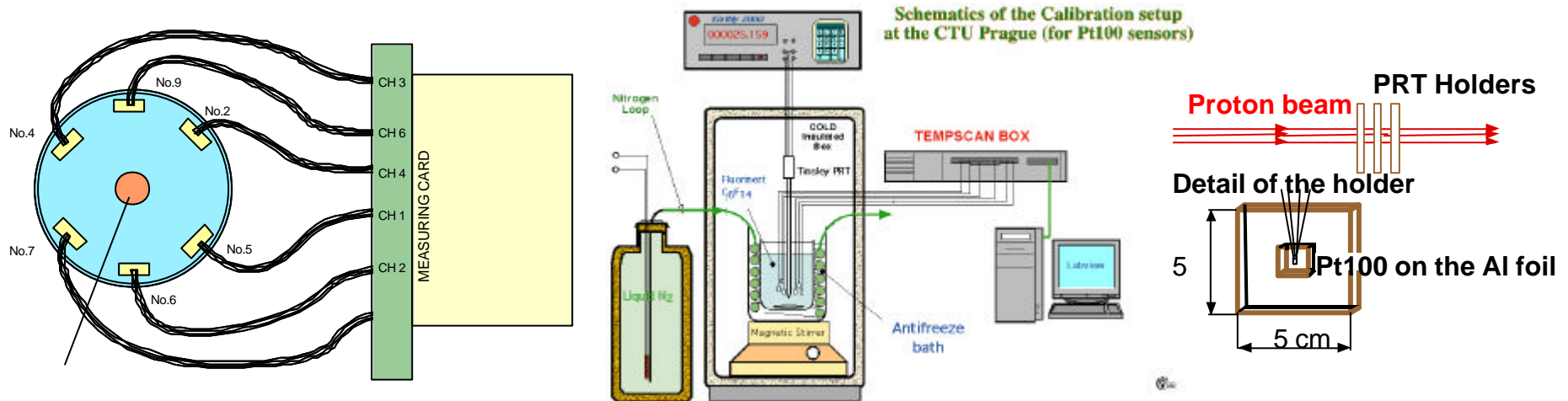
## Stability of the ASL calibrator is better than $\pm 0.03$ K



- Average time to achieve stable conditions at given set-point within the range from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  is less than 15 minutes
- **sensors with individual fit can be calibrated up to the accuracy of  $\pm 0.05$  K**
- **Overall general fit used for sensors can result in temperature deviation up to  $\pm 0.4$  K**

- Special temperature probes have been developed and used measurements at CERN
- Studies of the side effects on sensors are conducted (heat sinks for leads, influence of convection and radiation, etc.)

- Evaluation of irradiation effect on the Pt 100 sensor behavior have been determined



- Irradiation doses used:  
**9.7E12 +/-12 1.3E14 +/-9% and 9.7E14 +/-7% [p/cm2]**  
 (irradiation did not significantly influence the accuracy of the sensors; similar conclusion announced later by Wuppertal concerning the NTC sensors)
- The graph displays the absolute deviations of the non-calibrated sensor temperature readings from the correct values of temperature measured by the reference PRT TINSLEY within the investigated temperature range from -55 °C to +30°C.

- **Calibration facilities and procedures were verified during several calibration measurements with Pt100, Pt1000 and NTC sensors**
- **Facilities for pressure sensor calibration are also available**
  - Precise micro-manometer (0-600 mm H<sub>2</sub>O),
  - Rosemount Pressure Transmeter E1151 (0-2500 mm H<sub>2</sub>O),
  - Pressure transducer Druck PDCW 32 (0-3.5 bar]
- **Facilities for flow-meters calibration /liquid phase/ available**