PAUL SCHERRER INSTITUT

SEA -
a Modular Sample Environment Control System

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Contents

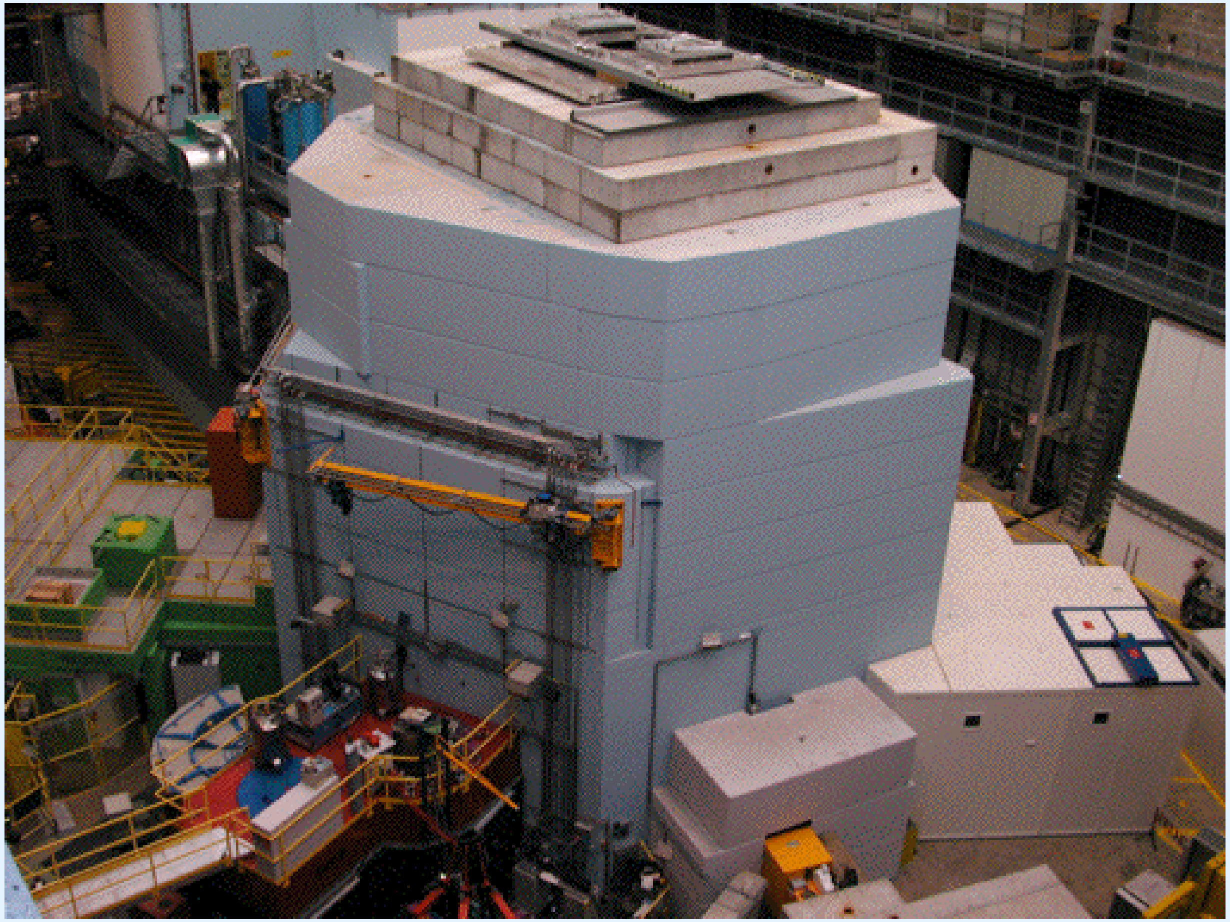
- SEA
  "Sample Environment Application"
  "Sample Environment Automation"

- SINQ, the Swiss spallation neutron source
- Sample Environment at SINQ
- The software SEA

SINQ

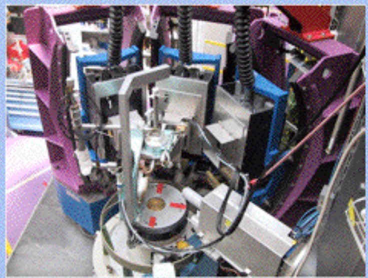
- SINQ is a spallation neutron source at the Paul Scherrer Institute in Switzerland

  - It is a continuous source → instrumentation as on a reactor source



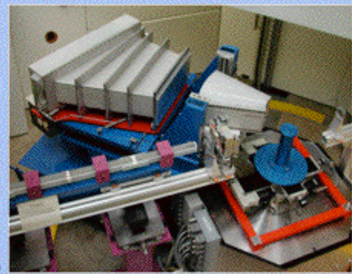
SINQ instruments

TRICS
Single crystal diffractometer
Thermal neutrons

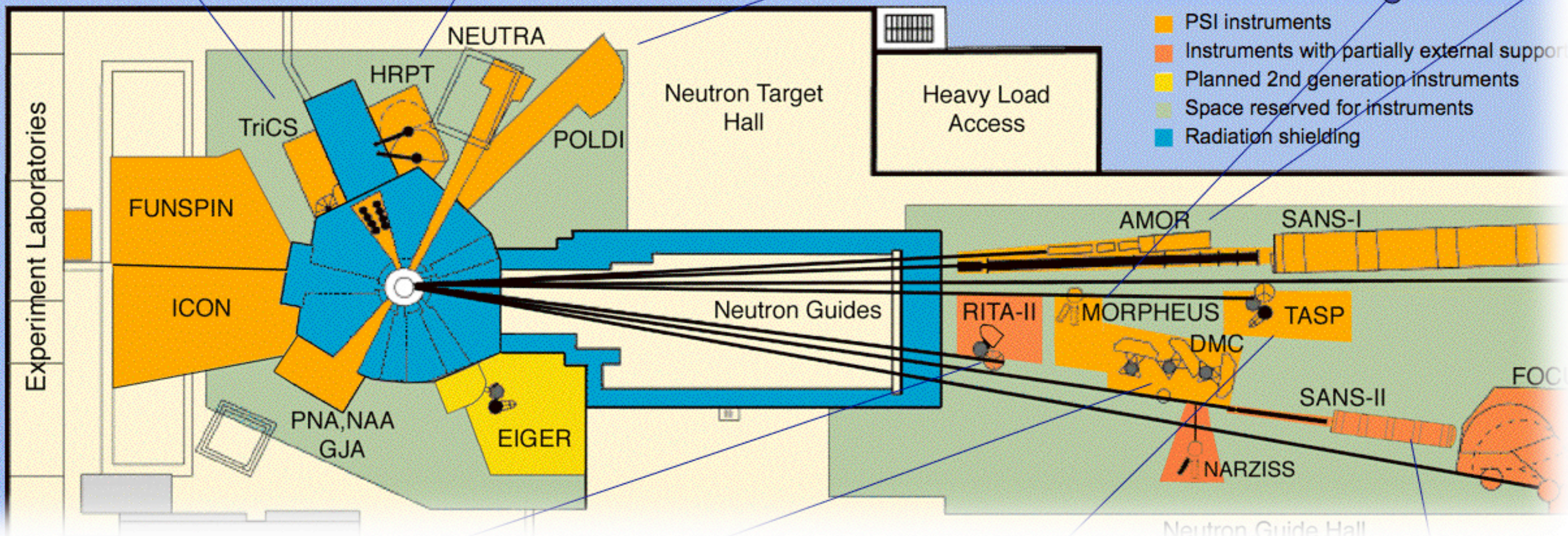


HRPT
Powder diffractometer
Thermal neutrons

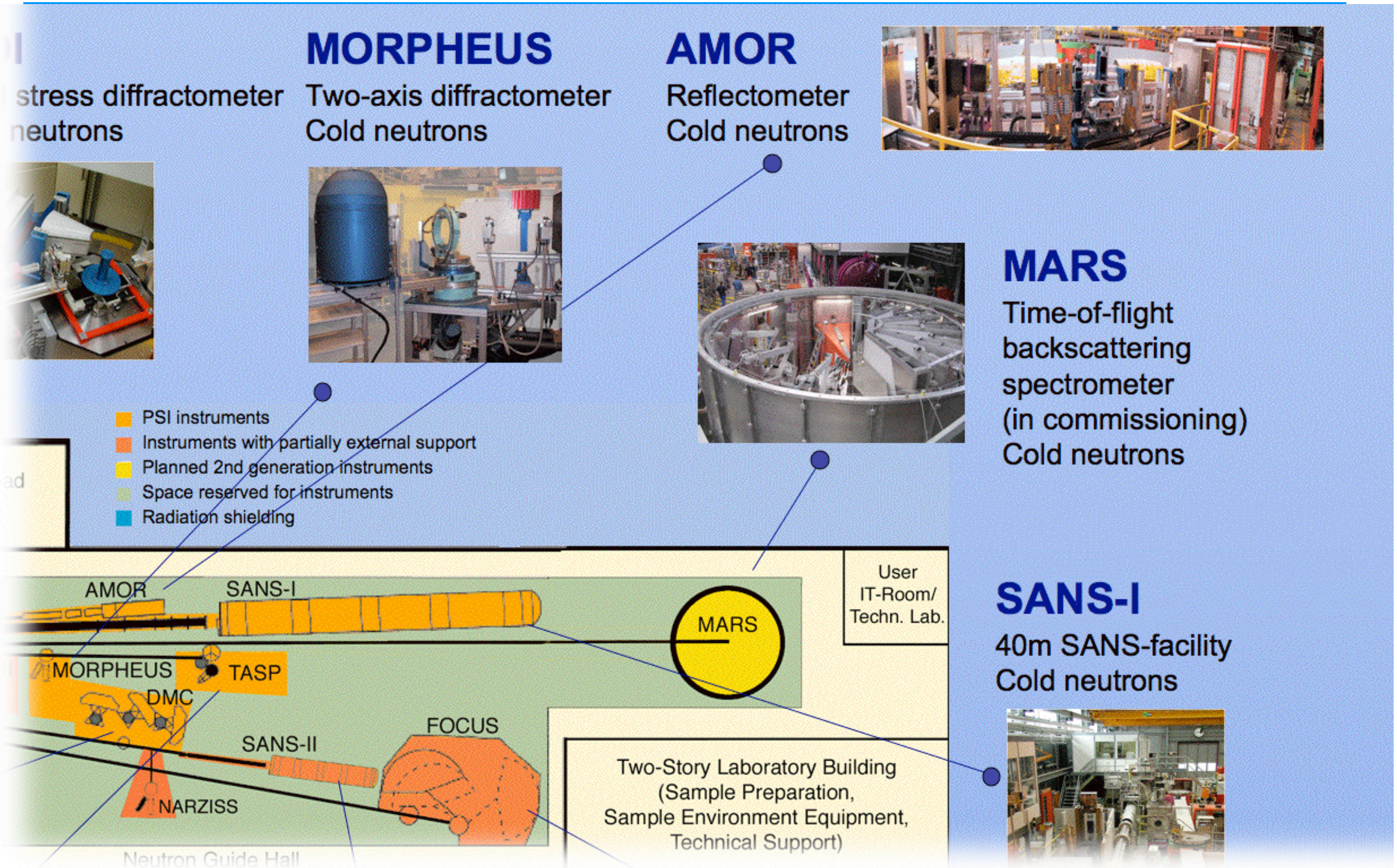
POLDI
Residual stress diffractometer
Thermal neutrons



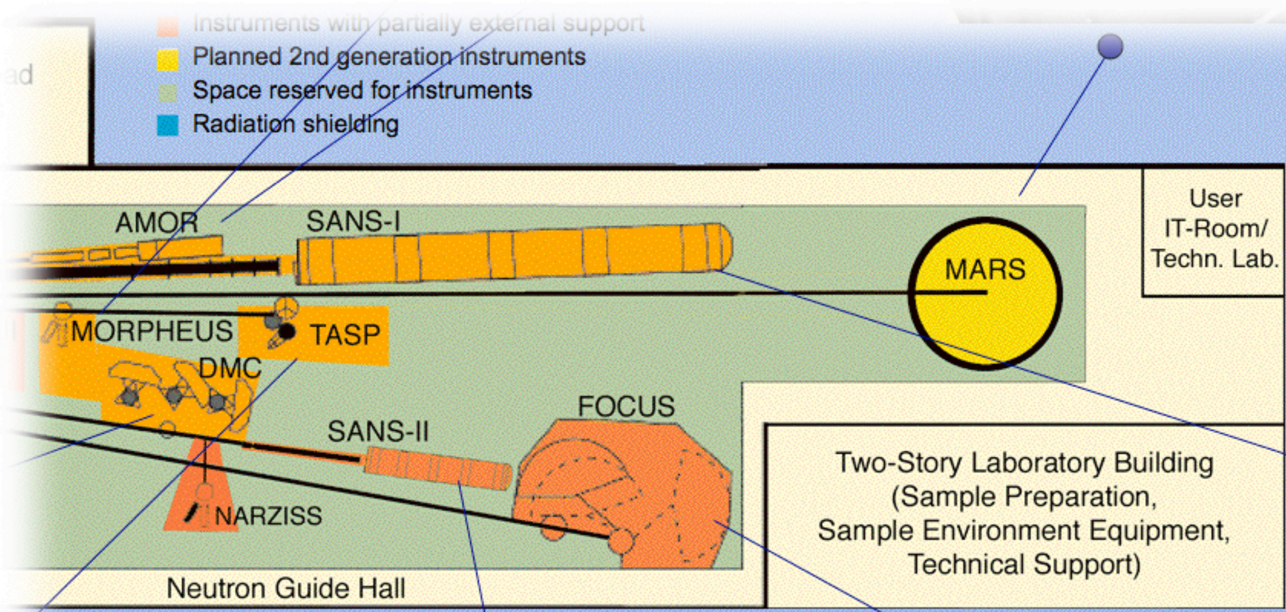
MORPH
Two-axis diff
Cold neutron



SINQ instruments



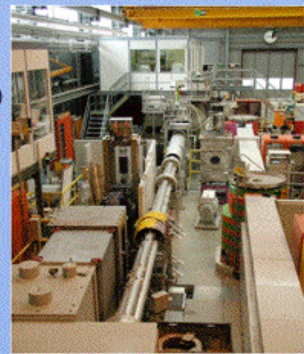
SINQ instruments



Cold neutrons

SANS-I

40m SANS-facility
Cold neutrons



spectrometer
zed neutrons

SANS-II (*)

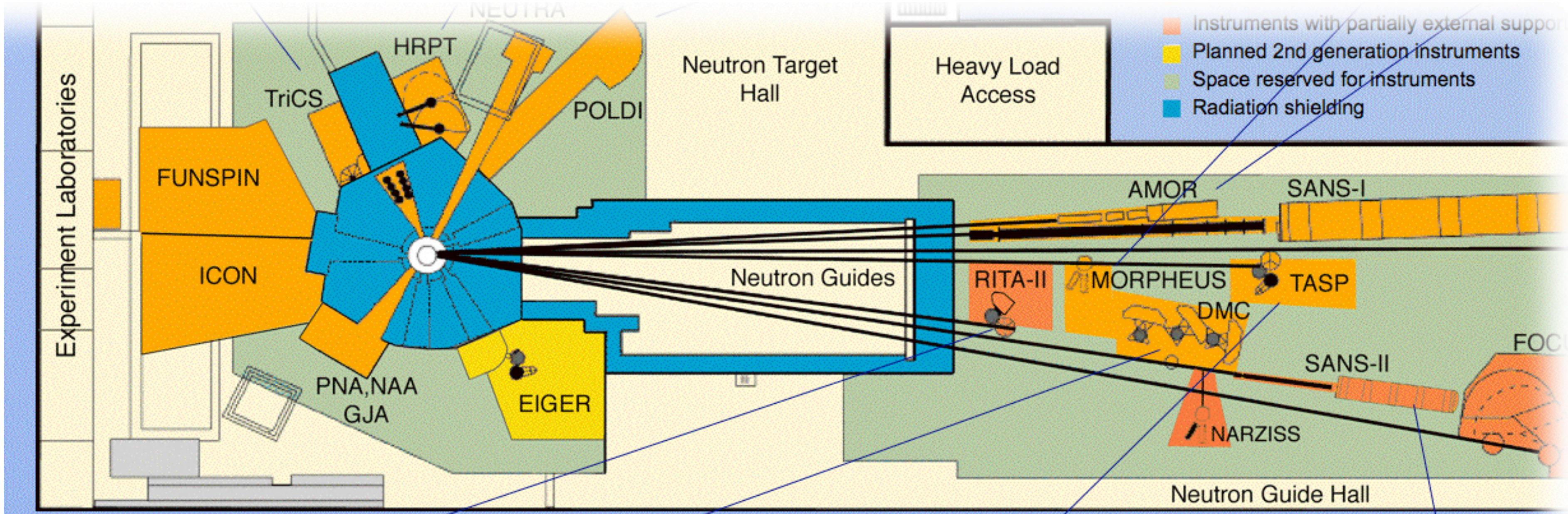
12m SANS-facility
Cold neutrons

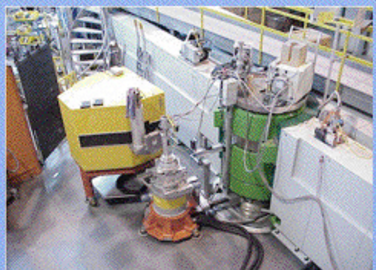
FOCUS (*)

Time-of-flight spectrometer
Cold neutrons

(*) RITA-II and SANS-II are operated in cooperation with *Risø National Laboratory, Denmark*, FOCUS in cooperation with the *Saarland University, Germany*.

SINQ instruments



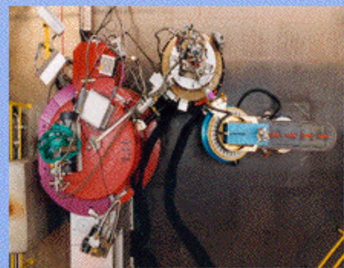


RITA-II (*)

Triple-axis spectrometer
Cold neutrons

DMC

Powder diffractometer
Cold neutrons



TASP

Triple-axis spectrometer
Cold polarized neutrons

SANS-II (*)

12m SANS-facility
Cold neutrons

Sample Environment at SINQ

- A large zoo of neutron scattering instruments

Sample Environment at SINQ

- A large zoo of neutron scattering instruments
- An even larger zoo of sample environment devices

Sample Environment Devices at SINQ

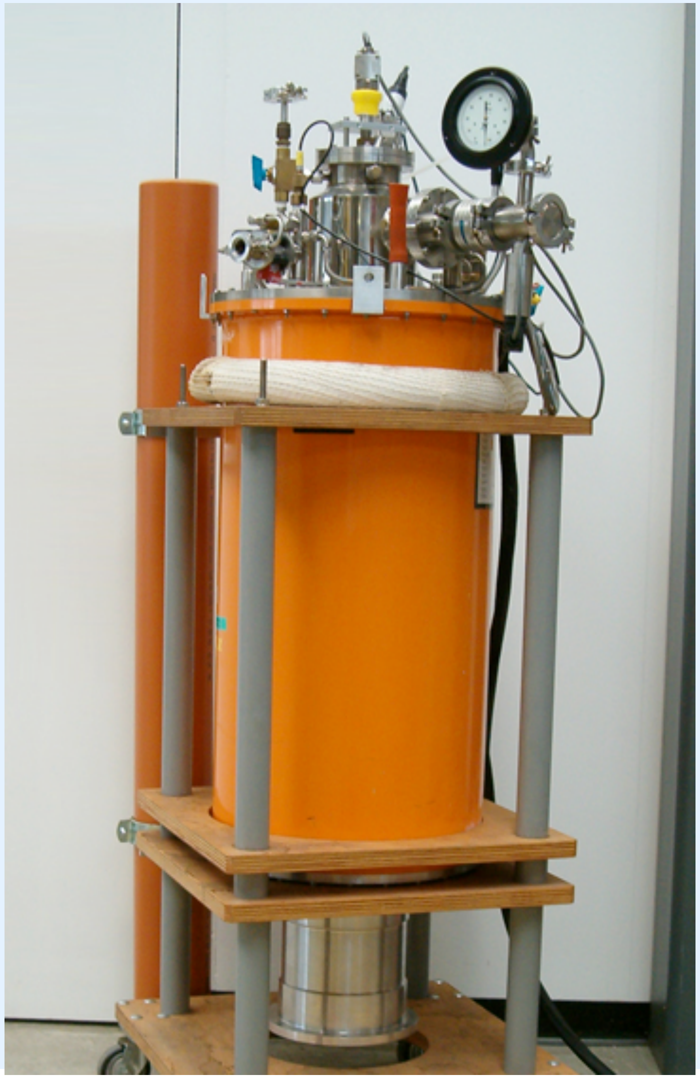
Closed Cycle Refrigerators
(bottom loading)

- 10 “10 K” systems (2 of them with hot stage up to 475 K)
- 3 “4 K” systems (1 with hot stage up to 700 K)

Sample Environment Devices at SINQ

Orange Cryostats

- 3x 50 mm Orange cryostat
- 2x 70 mm Orange cryostat
- 1x 70 mm Cryo-Furnace
- 2x 100 mm Orange cryostat



Sample Environment Devices at SINQ

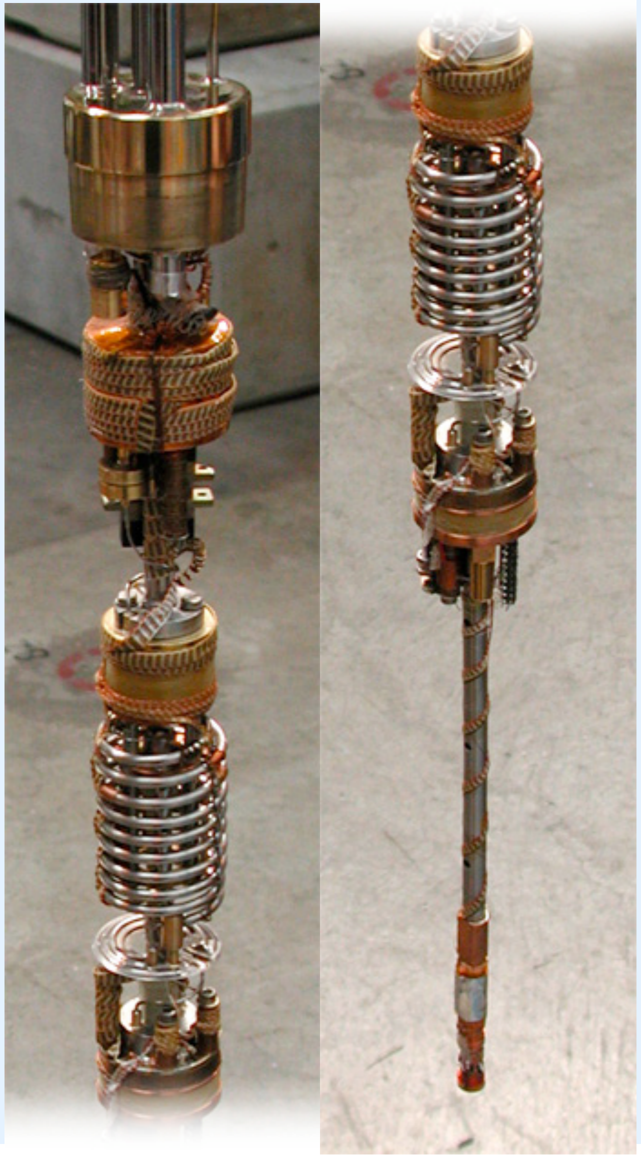
Cryomagnets

- 1.8 Tesla horizontal
- 4 Tesla vertical
- 9 Tesla vertical
- 11 Tesla horizontal (SANS)
- 14.9 Tesla vertical

Sample Environment Devices at SINQ

2 Dilution Inserts (from Oxford Instruments)

- New one has a weak link as option
- is long enough to fit in most of our cryomagnets:
  - 15 Tesla vertical
  - 11 Tesla horizontal
  - 9 Tesla vertical
  - 2 Tesla horizontal



Sample Environment Devices at SINQ

Clamp pressure cells

- 8 kbar (for inelastic NS)
- 9 kbar (for elastic NS)
- 15 kbar (for elastic NS)
- 30 kbar (small single crystal)

New: Paris-Edinburgh pressure cell (no picture)

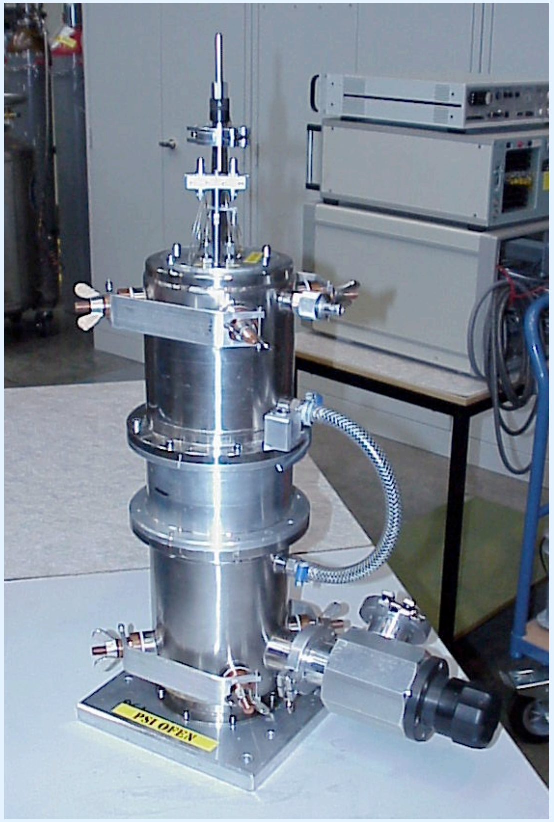
- 100 kbar

  to used also in a closed cycle cryostat of ILL design

Sample Environment Devices at SINQ

Furnaces

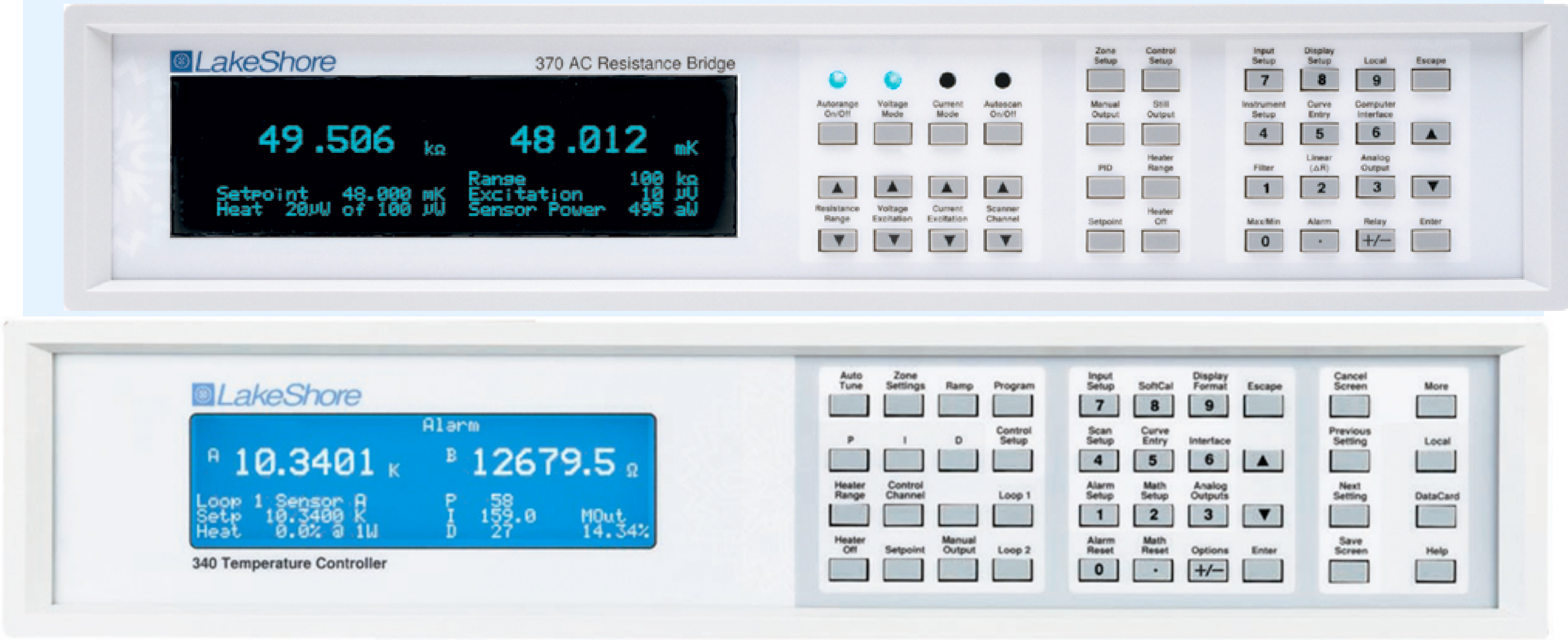
- 700 K
- 1400 K
- 1800 K



Sample Environment Controllers at SINQ

Sample environment electronics at SINQ:

- LakeShore 340 temperature controller, 370 AC Resistance Bridge



Sample Environment Controllers at SINQ

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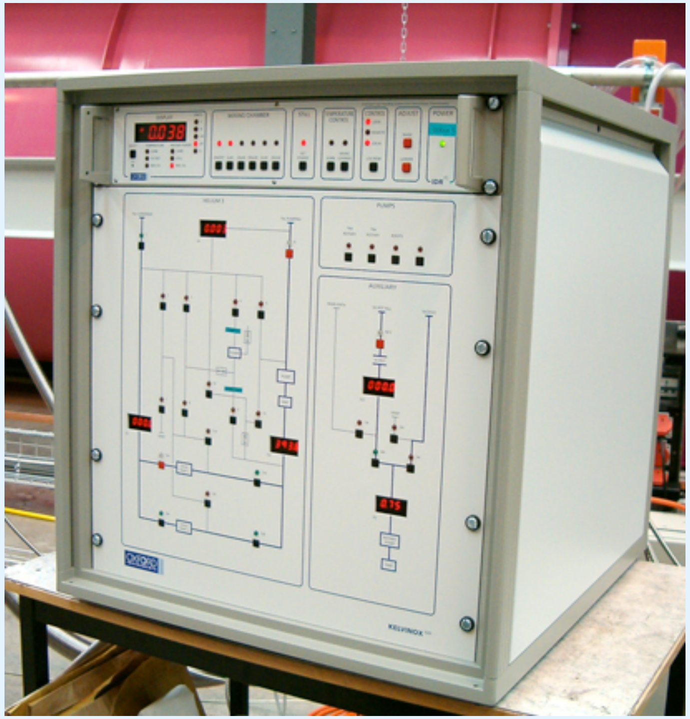
- „Intelligent“ controllers (ILM, IPS, ITC, IGH) from Oxford Instruments



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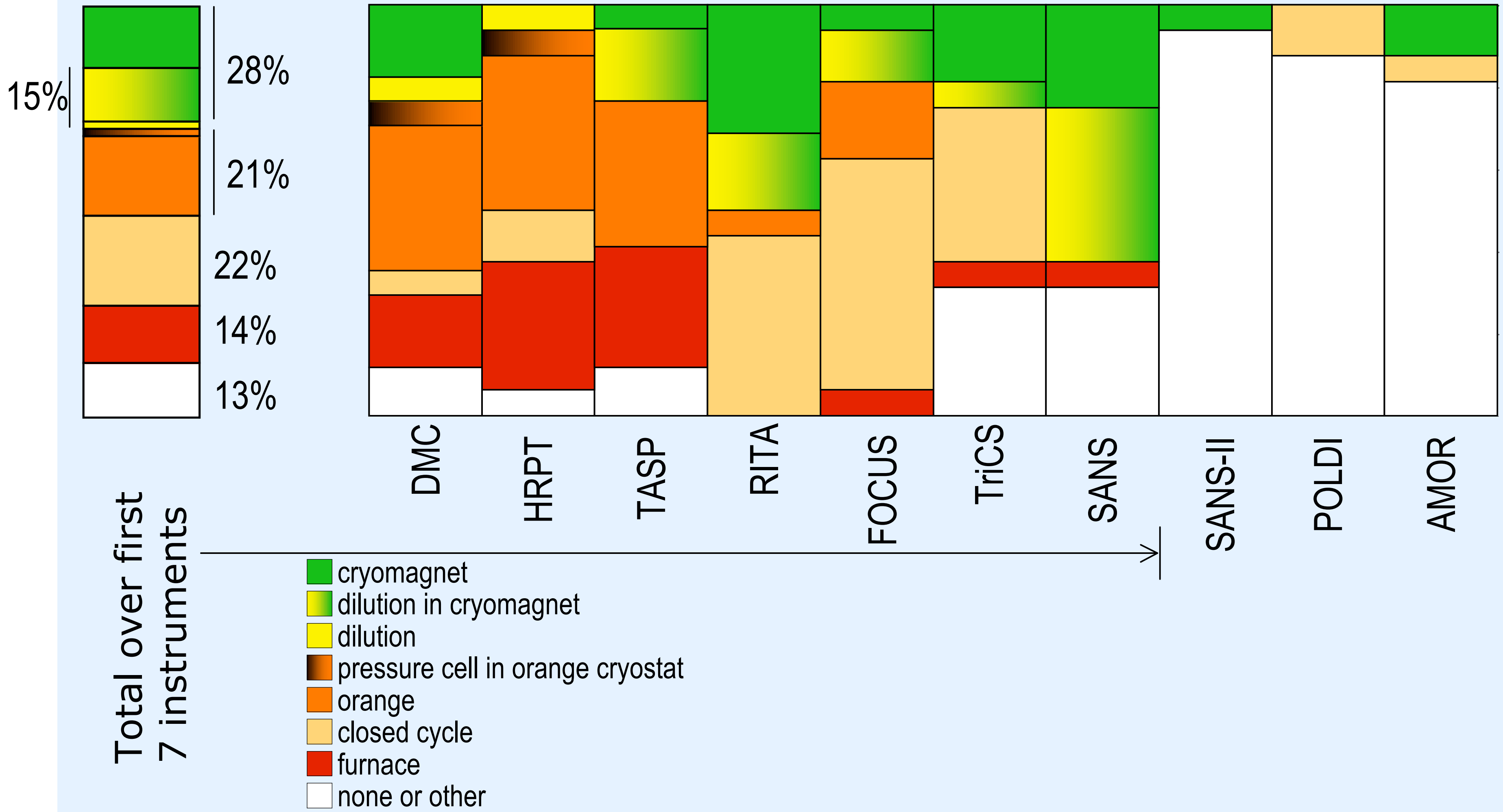
Sample Environment Controllers at SINQ

Sample environment electronics at SINQ:

- LakeShore 340 temperature controller, 370 AC Resistance Bridge
- „Intelligent“ controllers (ILM, IPS, ITC, IGH) from Oxford Instruments
- Eurotherm (for furnaces and needle valve control)
- American magnetics level meters
- + several unique controllers

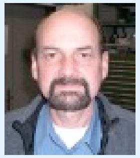
Usage of Sample Environment at SINQ

Percentage of SE device usage on SINQ instruments for the next 4 months

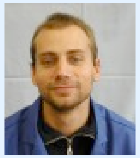


Sample Environment People at SINQ

People working for sample environment at SINQ

- Full time:
  - technicians:  *Walter Latscha*  *Stephan Fischer*
  - responsible, software:  *Markus Zolliker*

- Part time:
  - group leader:  *Ben van den Brandt*
  - some of the other 9 people from “Sample Environment and Polarized Targets” group

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Sample Environment Automation

Automation and Remote Control

Aims

- Monitoring (seeing what happened during the night/weekend)
- Control mechanisms not included in commercial hardware
- Control mechanisms combining different hardware
- Remote control

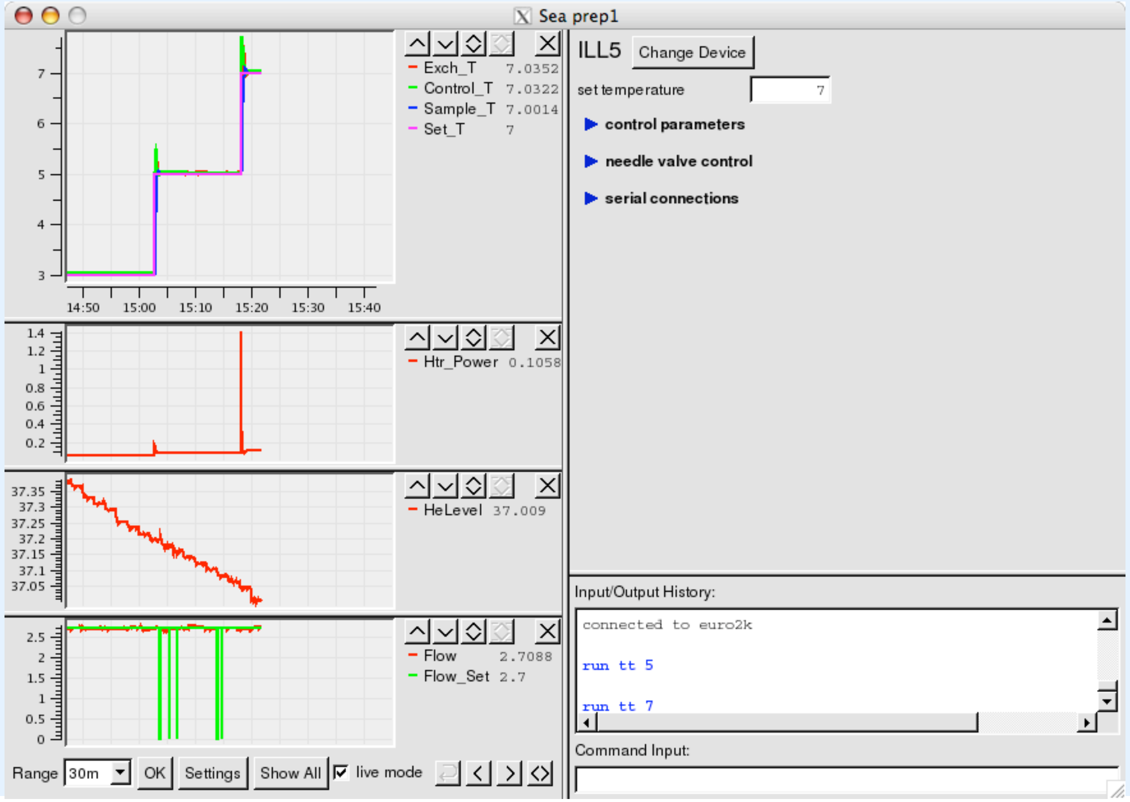
Sample Environment Control Software

Before 2006:

- separate control program (TECS) for the LakeShore 340 temperature controller
- some other devices were handled by the instrument control program

Now:

- all SE devices handled by SEA, our new sample environment software



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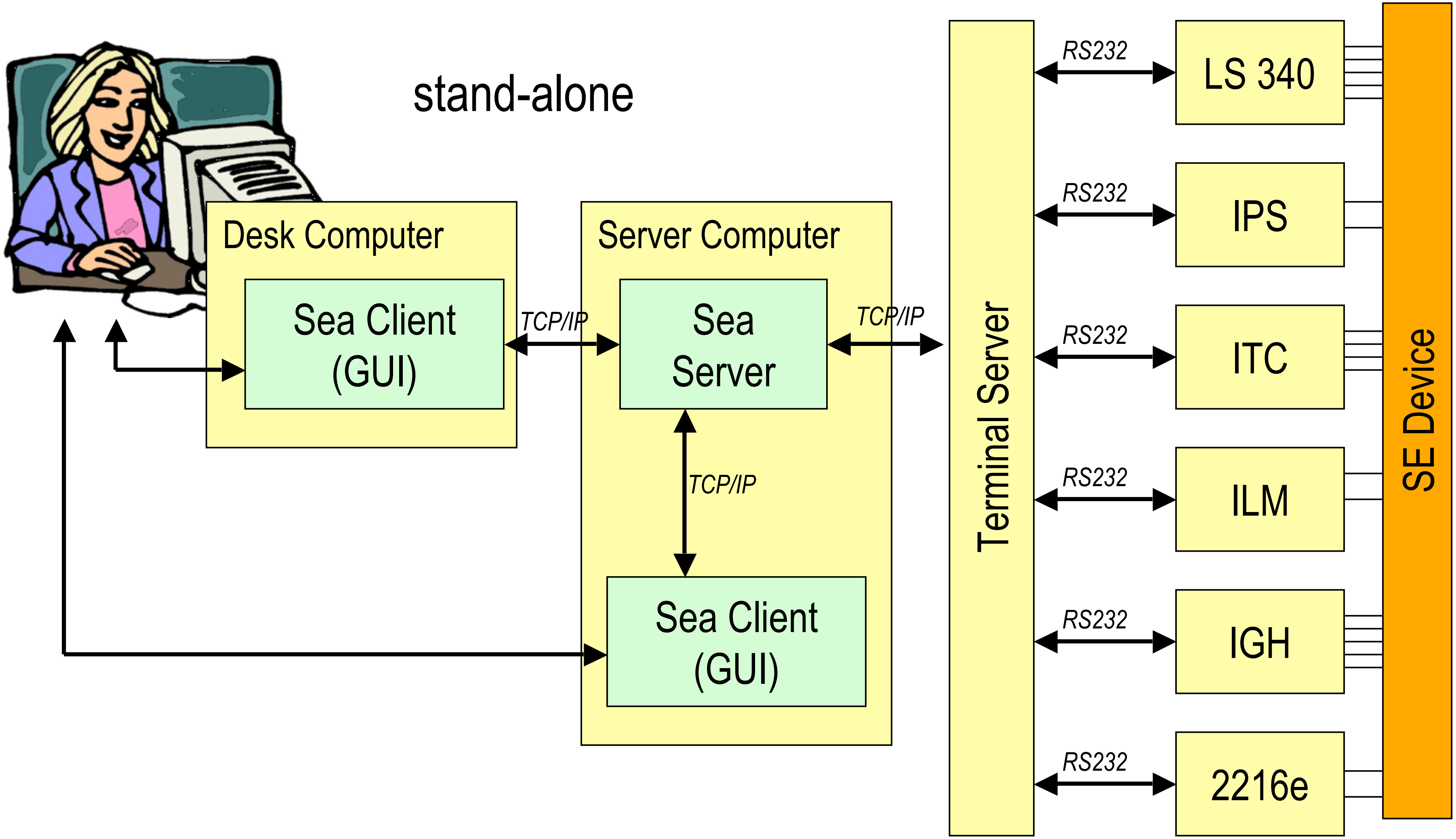
Sample Environment Control

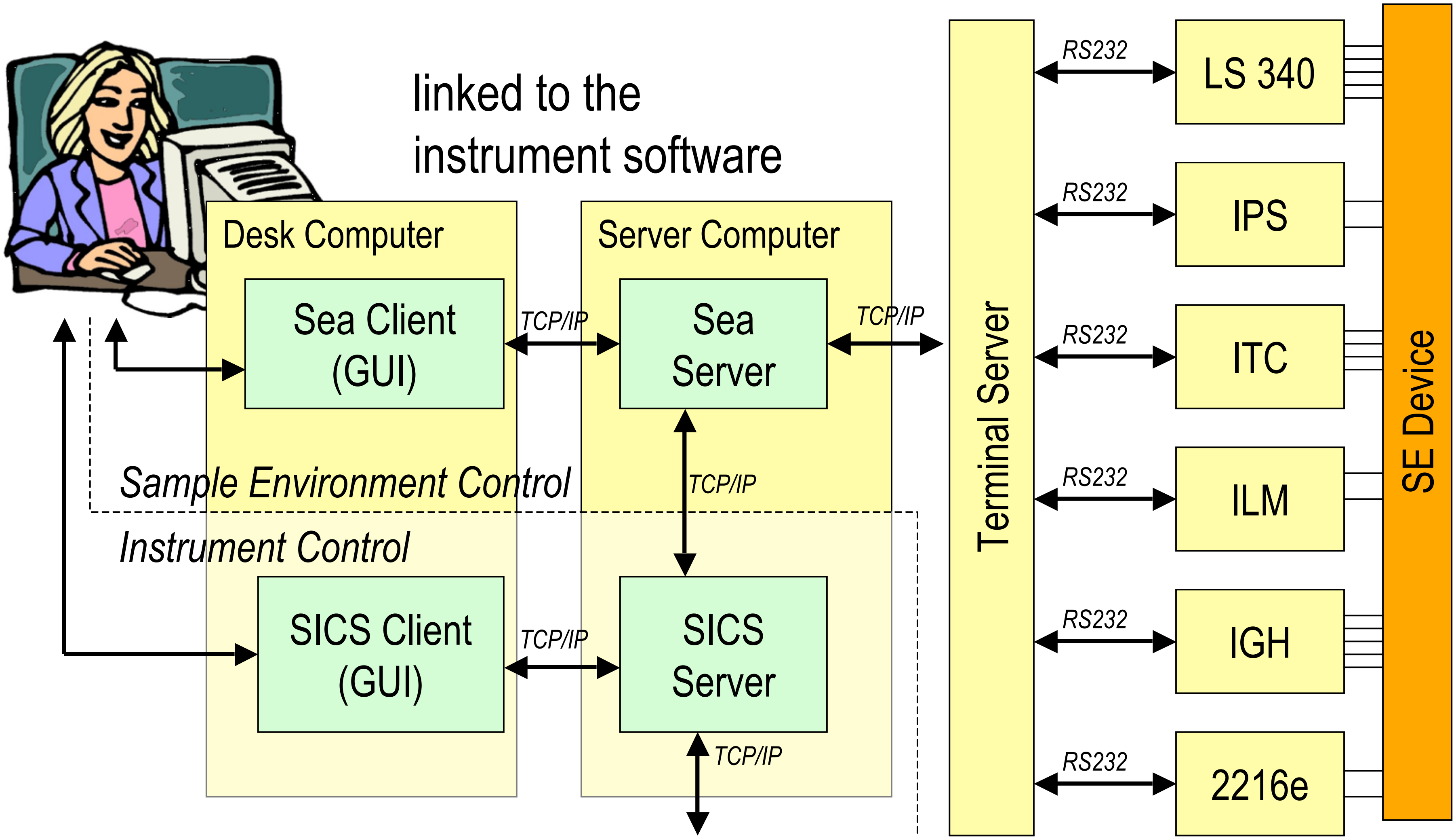
Features of SEA:

- Logging of all relevant variables at 5 sec interval, stored for at least one year
- Control logic not handled by the hardware: automatic needle valve control, correction for sample - heat exchanger difference.
- Charts for live display and for inspecting the history
- Graphical user interface for changing control parameters
- Command interface (commands can be used in an instrument batch file, or entered directly)

Sea Design


stand-alone
Desk Computer
Sea Client
(GUI)
TCP/IP
Server Computer
Sea
Server
TCP/IP
TCP/IP
Sea Client
(GUI)
Terminal Server
RS232
RS232
RS232
RS232
RS232
RS232
LS 340
IPS
ITC
ILM
IGH
2216e
SE Device

Sea Design


linked to the
instrument software
Desk Computer
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ITC
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ILM
RS232
IGH
RS232
2216e
SE Device
Sample Environment Control
TCP/IP
Instrument Control
SICS Client
(GUI)
TCP/IP
SICS
Server
TCP/IP

Implementation Details

SEA server

- Programming language: C
- Tcl is used as scripting language
- Runs on Linux, portable to Windows or Macintosh

SEA client

- Programming language: C++, Qt for GUI
- Runs on Linux and Macintosh, and Windows

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Design Advantages

- The server runs on standard Linux PCs (no special input/output cards)
- Computers may be at any distance from sample environment device
- The user interface can be used on any computer (experimental hall, office, home ...)
- The server program is based on the same software (SICS) as the instrument control (shared know how)
- Adding new drivers is relatively easy, and need only changes in the server software, not in the client software
- Adding a new device is done by adding a configuration script to the server. No change on the client is needed, as the GUI layout is stored on the server
- Based on open source software

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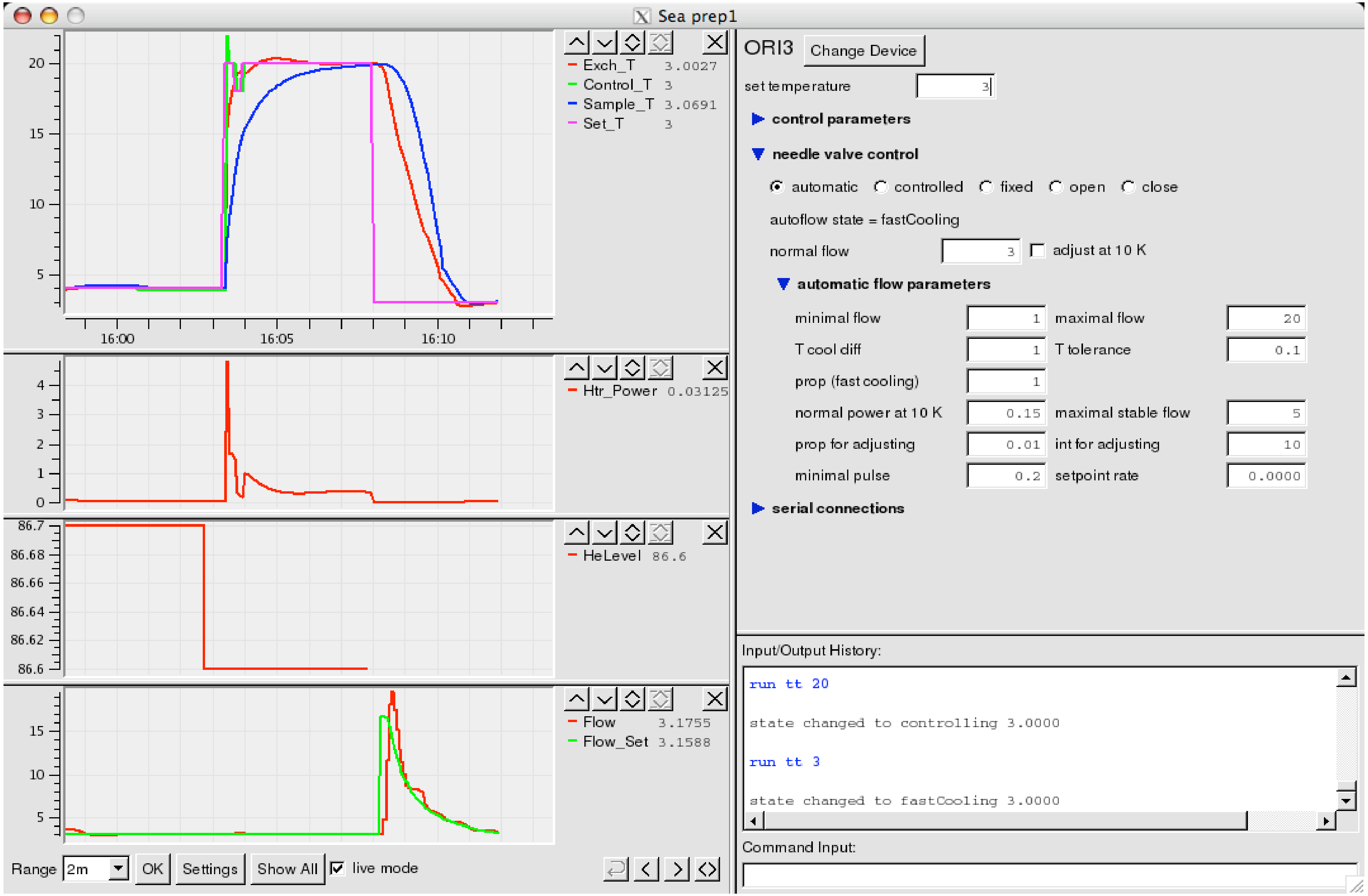
Design Drawbacks

- In the simplest configuration: SE Controllers need to have an RS232 interface
  However, other interfaces may also be realized
  - RS485: converters to RS232
  - GPIB: gpib controller (converter TCP/IP - GPIB)
- Drivers have to be programmed
  - In principle, it would be possible to make a connection to LabView using available drivers
  - This approach is not favored at SINQ, because it needs a Windows-PC in addition to the Linux-PC for instrument control

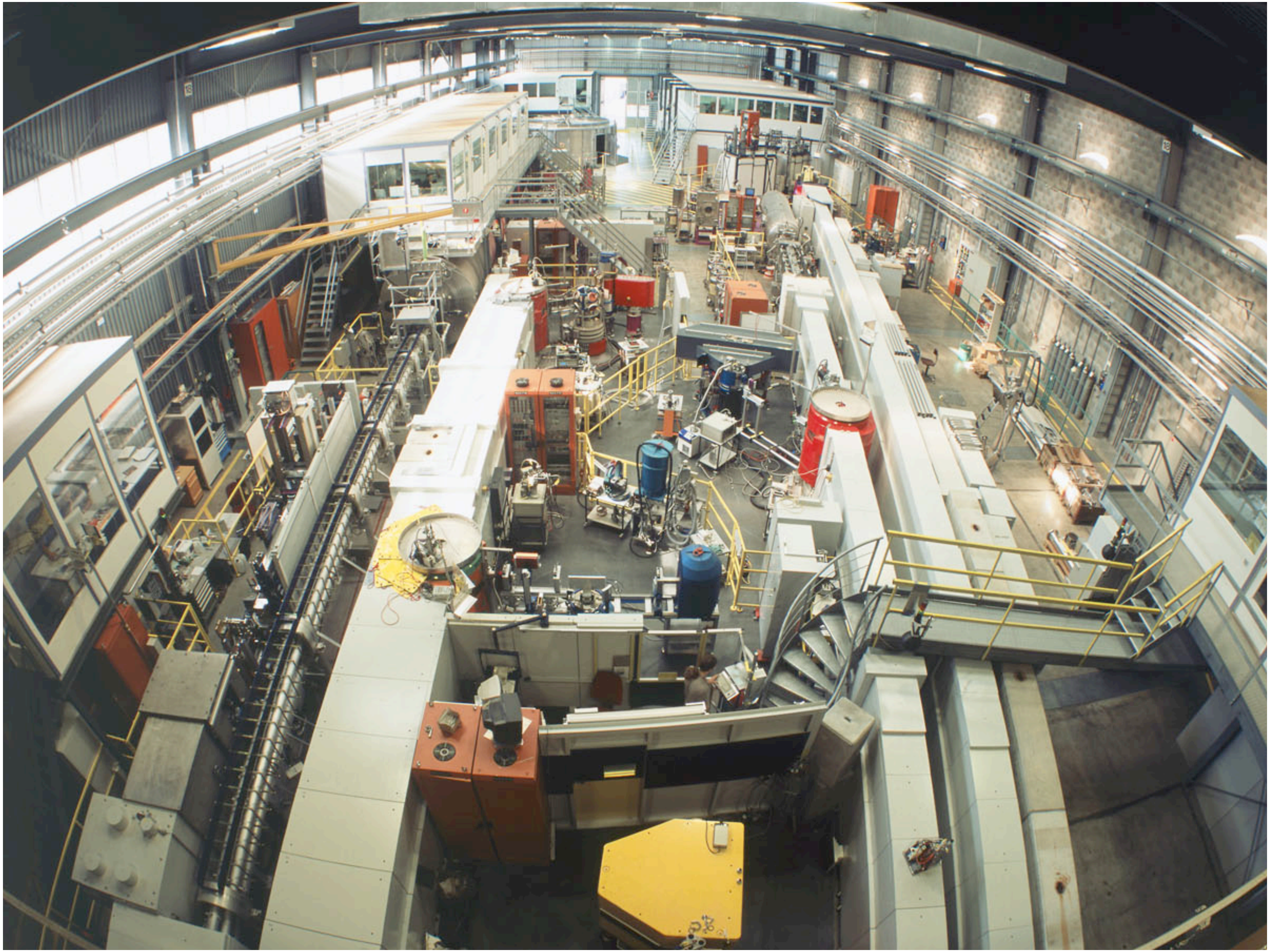
Sea Client (GUI)

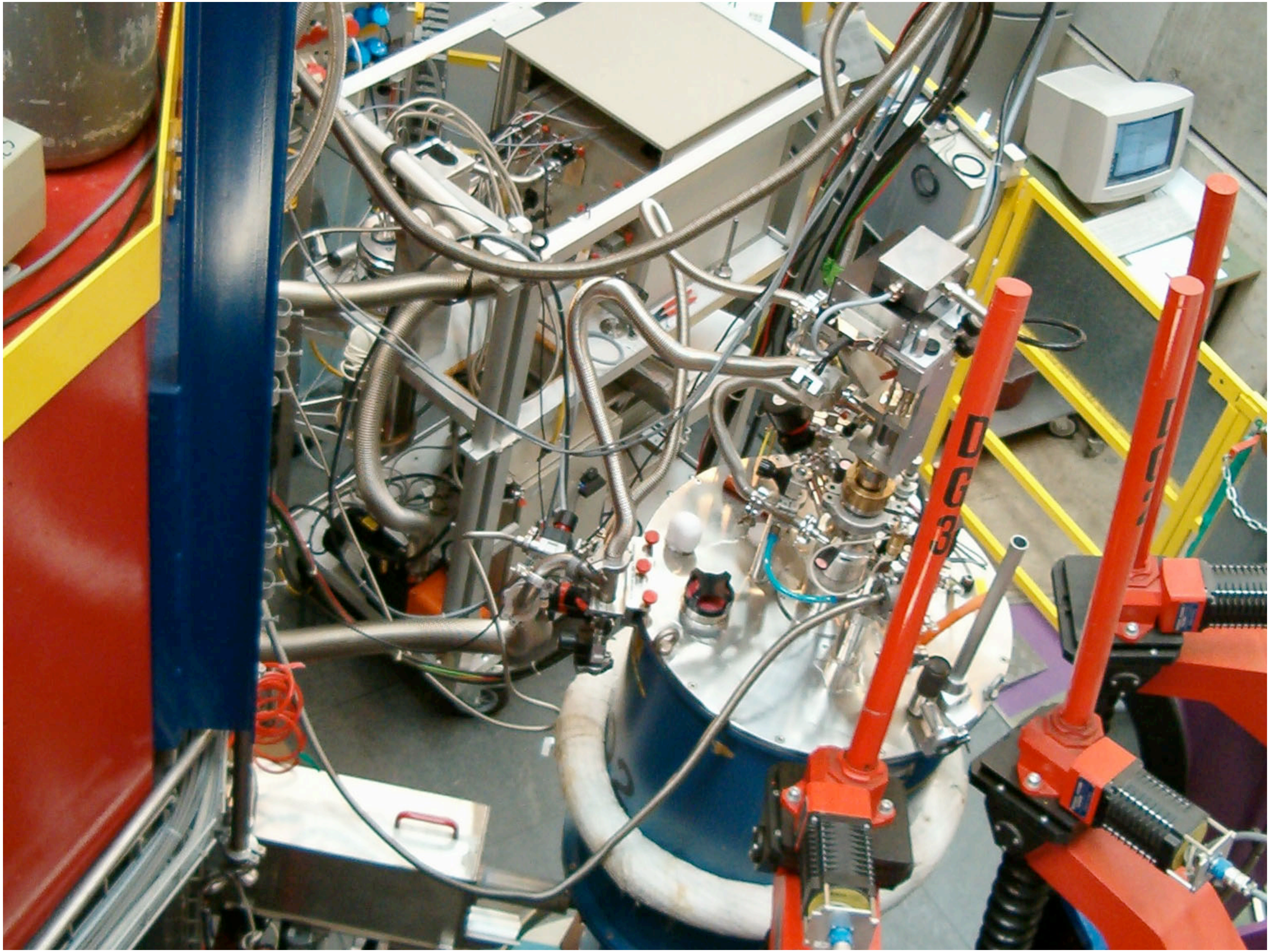


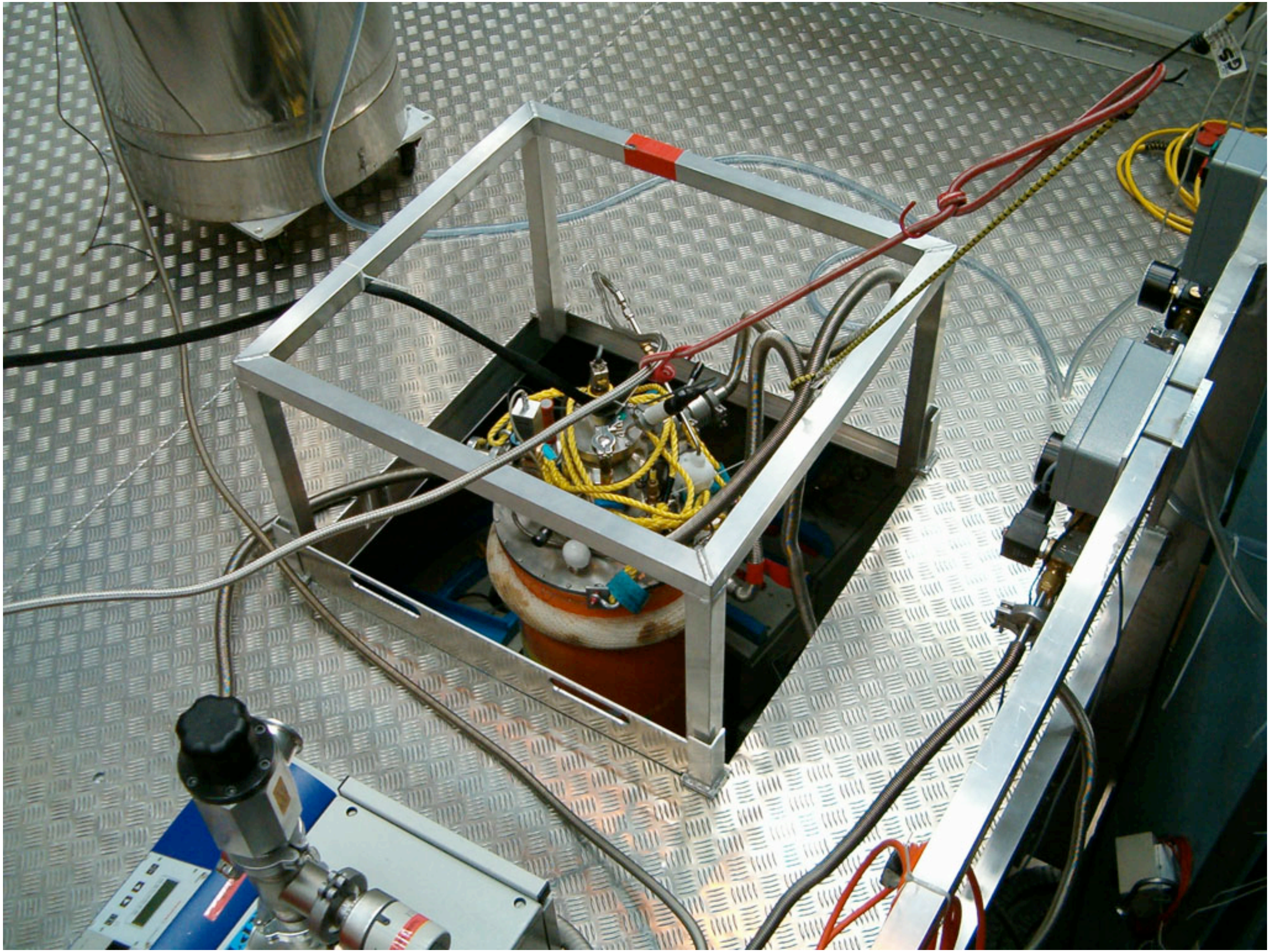
Conclusion

Automation and remote control is a must, especially when using complex sample environment devices.

This can be realized with a modular client server software like SEA.




DG3




RI3
LakeShore