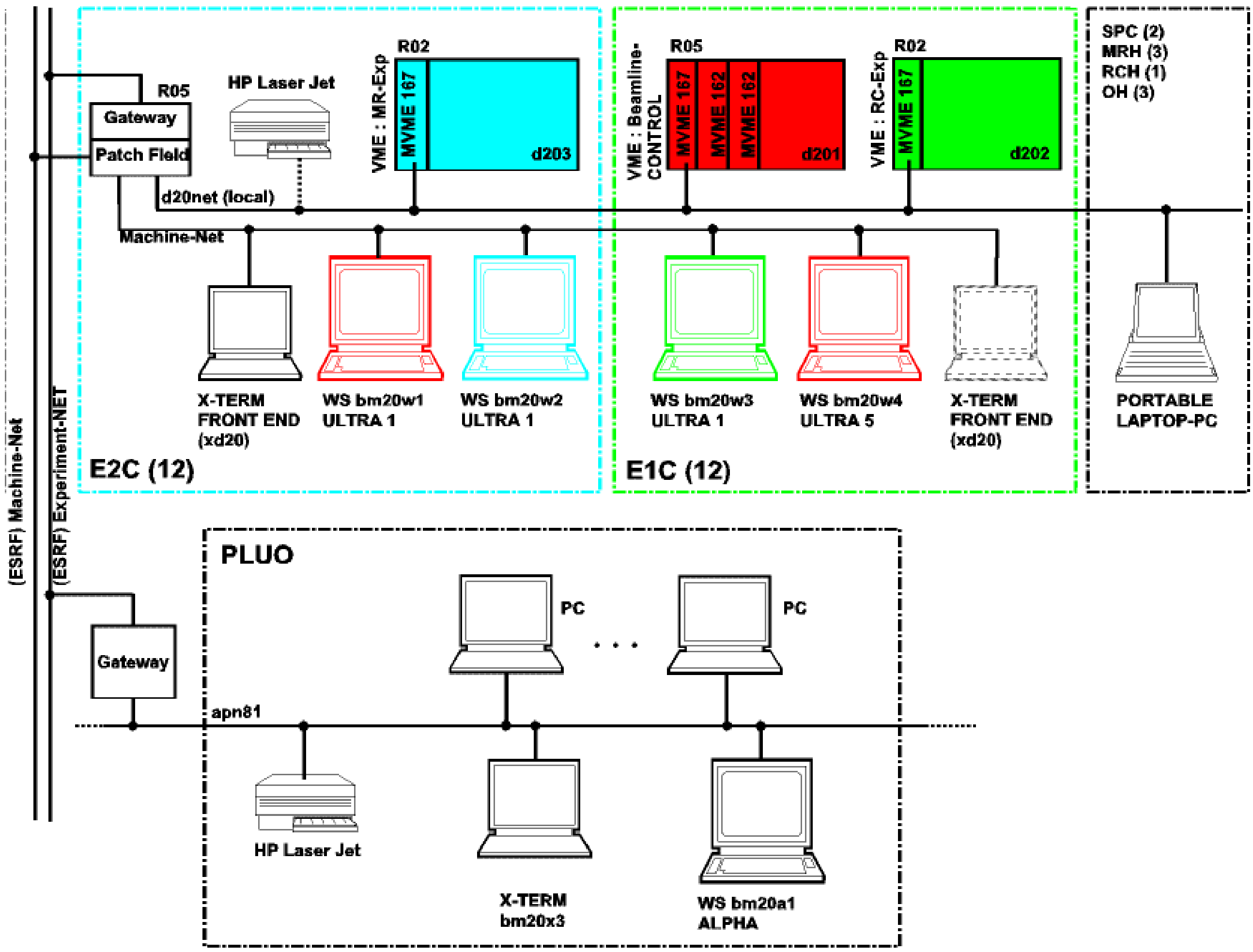
Developments basing on TACO at ROBL (CRG)

1. A short overview about the beamline BM20 (ROBL)
2. Technical equipment used for beamline instrumentation
3. Compatibility to the ESRF or What about a 'standard' beamline?
4. How did we integrate ROBL specific equipment?
5. ROBL specific Device Servers
6. Some examples of ROBL specific applications basing on TACO
7. The application 'xatros' (threads and TACO)
8. What functionality did we really use from the TACO system and what is still missed?
9. Summary

The technical equipment used for the beamline instrumentation

- 4 Sun workstations, two in each of the two control cabins, one of them is used as server system (bm20w1)
- one system in each cabin is applied to control the optics hutch and the safety systems, the second is used for performing the experiments
- 3 VME-crates with CPUs from Motorola (MVME167 and MVME162) and standard modules supported by the ESRF
  - One of the VME-crates contains two auxiliary CPUs (support of four beam position monitors (BPM)
  - one VME-System controls the devices in the optics hutch, the two others are each attached to one of the experiments



- PCs and the ALPHA workstation (EXAFSPAK) are applied to data analysis and are in principle not used for controlling of experiments

Compatibility to the ESRF or What about a 'standard' beamline instrumentation?

- VME modules:100 % compatible

Module type	*Number*	*Connections*
IBAM-3	4	About 30 serial lines
VPAP	8	~40 of about 75 motors
CC133	2	7 incremental encoders
ICV196	3	~75 digital I/O signals
ICV150	1	2 analogous input signals
ICV712	1	2 analogous output signals
VCT6	2	2 timers, 3 counters, 1 frequency generator
CAENV560	2	22 counters

(not included: BPMs, vacuum subsystem, ventilation subsystem)

- OS-9 and device drivers: 100 % compatible

- Device Servers: about 70 % are used from the ESRF

  7 Device Servers are ROBL-specific and have been developed at ROBL using TACO technologies

  2 Servers in the VME-system have been developed at ROBL using the ONC+/RPC standard

- Applications: about 50 % are standard applications of the ESRF
  - spec^{tm} is used at ROBL
  - OSF/Motif based applications written in C/C++ and basing on TACO libraries

How did we integrate ROBL specific equipment by benefiting from TACO?

(ROBL-specific equiment means: The device is specific but can be controlled by connections to the standard VME modules mentioned before).

Three cases (CRG beamline!):

1. new applications are required (ventilation subsystem, specialized measurements)
2. spec^{tm} is used but the devices are not supported (DCM, BOX, MCA ORTEC926)
3. A standard application of the ESRF is used but does not support a ROBL-specific device (vacuum application - turbo pump TCP380)

In all of the three cases we can benefit from TACO and the Device Server concepts.

1. extensive use of database entries to configure the applications
ROBL-specific applications (C/C++,OSF/MOTIF,TACO):
using TACO for the communication between the application and the Device Servers even running in different VME-systems
2. and 3.:
use a given functionality of a <u>Device Server as a 'logical device'</u>
Integration of new devices into given applications can be performed by using Device Servers which offer the same logical interface as already supported Device Servers do even though the implementation inside the Device Server may be very different. (Hereby generalizing similar devices.)

The most important ROBL-specific Device Servers:

- Double Crystal Monochromator (DCM)
- Glove Box motors (BOX)
- Multichannel Analyzer MCA (ORTEC926)
- Turbo pump (TCP380)

Quick-EXAFS (QEXAFS and the subprocess qexafsReadOut)

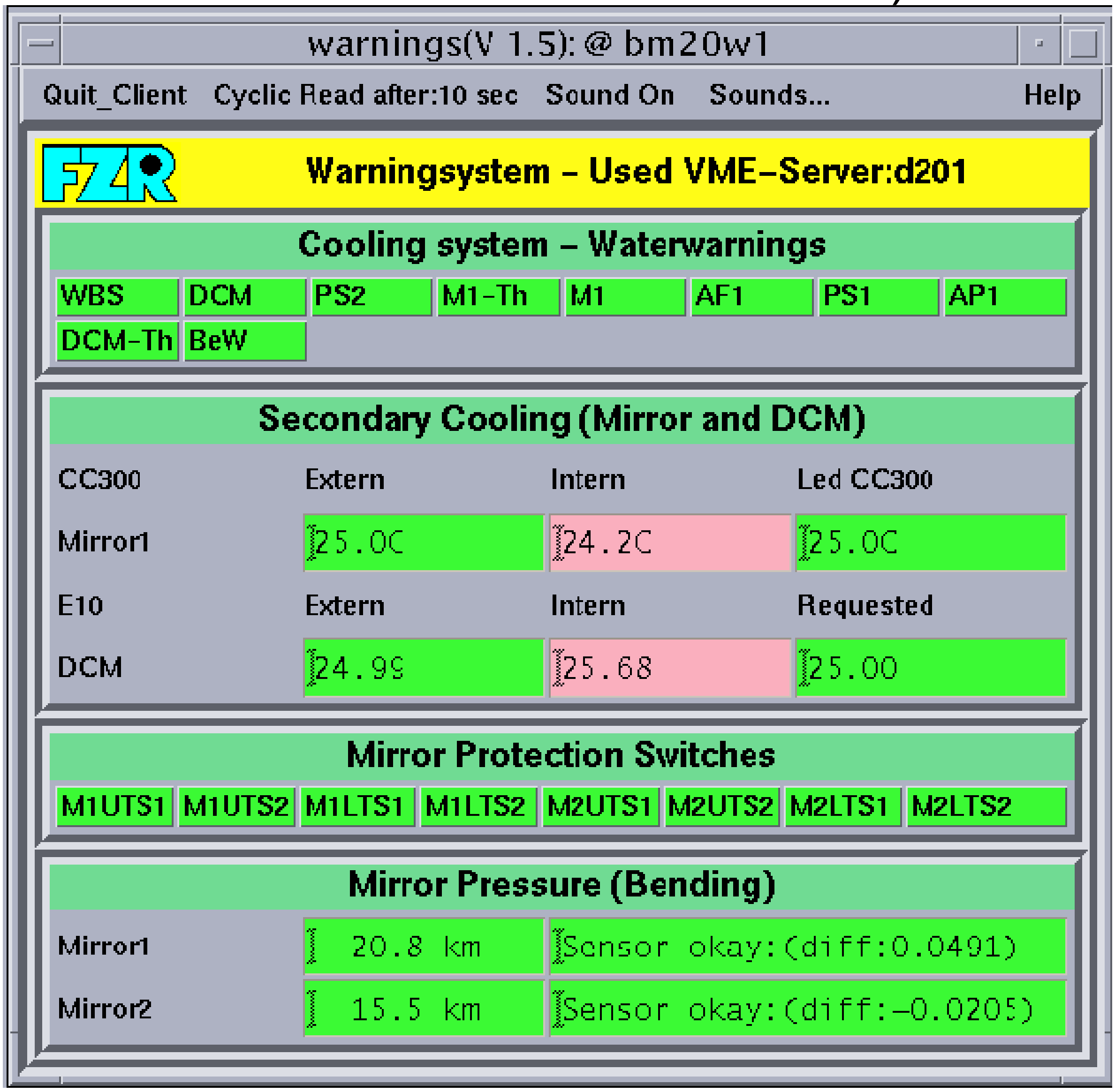
The Device Server ORTEC926

- The Multi Channel Buffer MCB ORTEC926 had been bought as a PC-based stand-alone system. It is a NIM module with a printer port connection to a PC and comprises also a software solution.
- The MCB is both used in the Materials Research Hutch as at the Radiochemistry's experimental station.
- The task was to integrate this stand-alone solution into the spec^{tm} based environment and to use the **mca-macros for spec** written by the ESRF and to visualize the measured data by the application **mcatcl** (also developed at the ERSF).
- The solution was to connect the MCB ORTEC926 via it's printer port to a VME module and to write a device server which supplies nearly the same interface as the MCA Device Servers of the ESRF (DSUG146/ESRF) which can be configured in spec.

The Device Server TCP380

- ROBL uses a turbo pump at its DCM while a measurement is running.
- The turbo pump is controlled by a TCP380 controller.
- To enable the visualization of the pump's status a Device Server TCP380 has been developed which fits to the logical interface of a Perkin Device Server (DSUG122/ESRF). This way the pump can be configured for the vacuum application of the ESRF which is used for all other vacuum related subsystems.

The warnings application at ROBL (using both TACO based and ONC+/RPC-based client/server communication)



- uses a specialized icv196_rpc_server based on the ONC+/RPC toolkit to show the status of signals connected to the VME module ICV196
- uses the SerialLine Device Server of the ESRF to get the information of the two used thermostates
- Uses the Icvadc and Icvdac Device Servers of the ESRF to check the bending radius of both mirrors
- interrogates at pre-selectable time intervals and warns optically and acoustically (if enabled)

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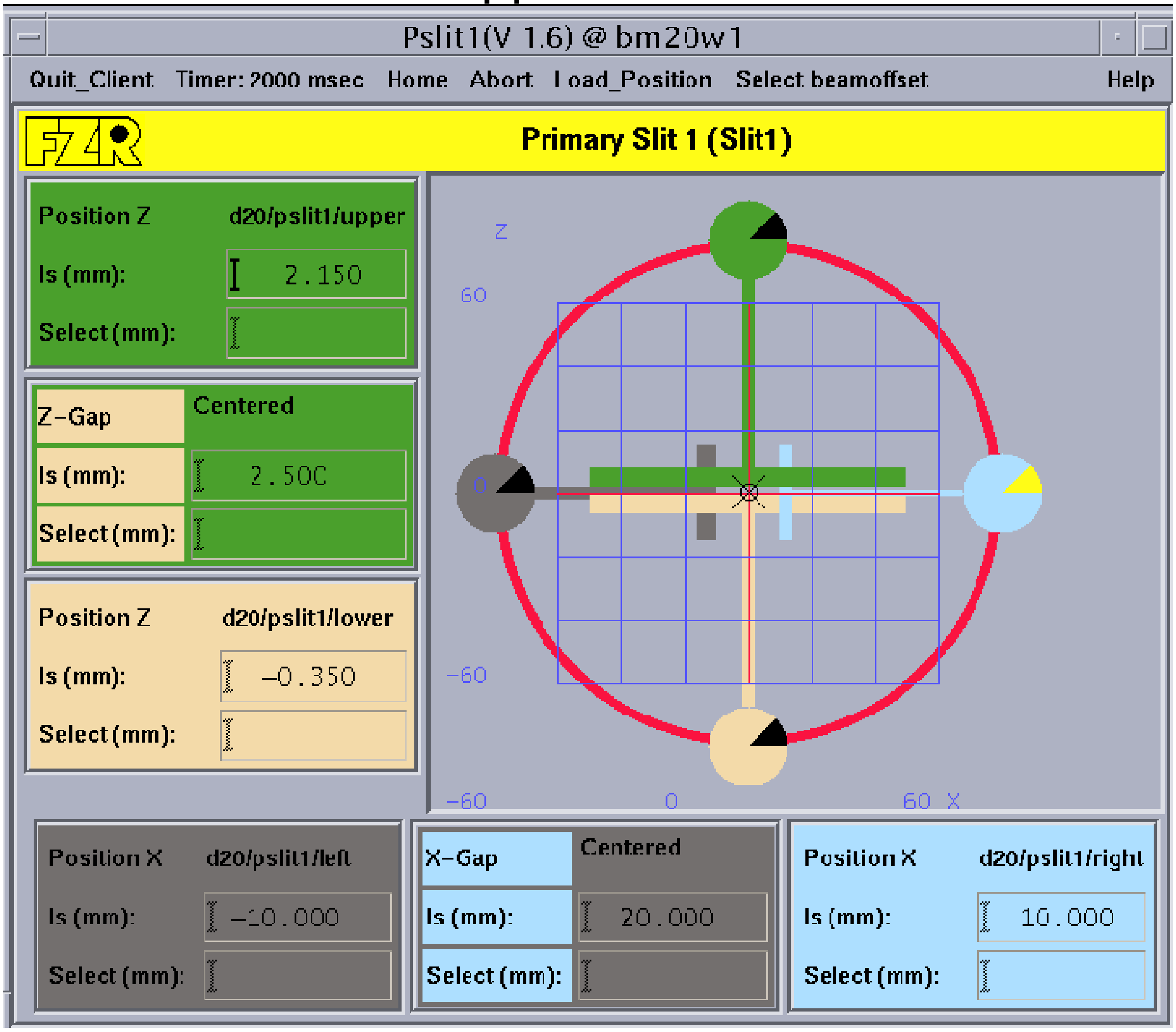
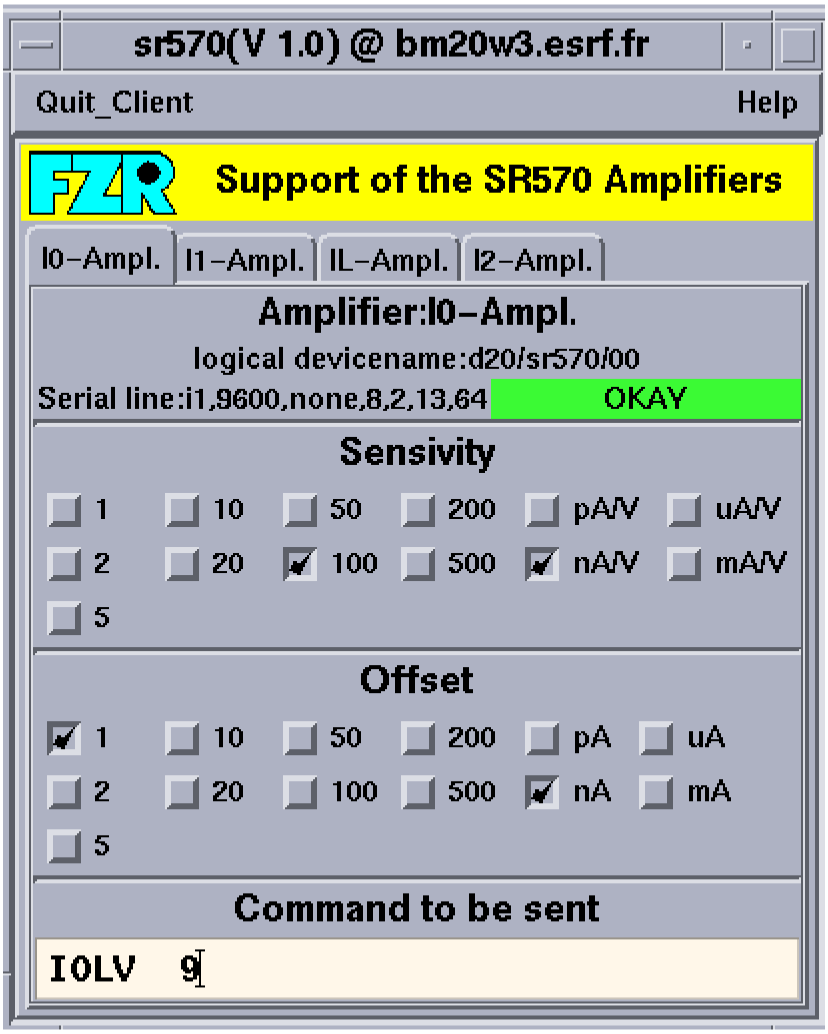
The Slit Application of ROBL



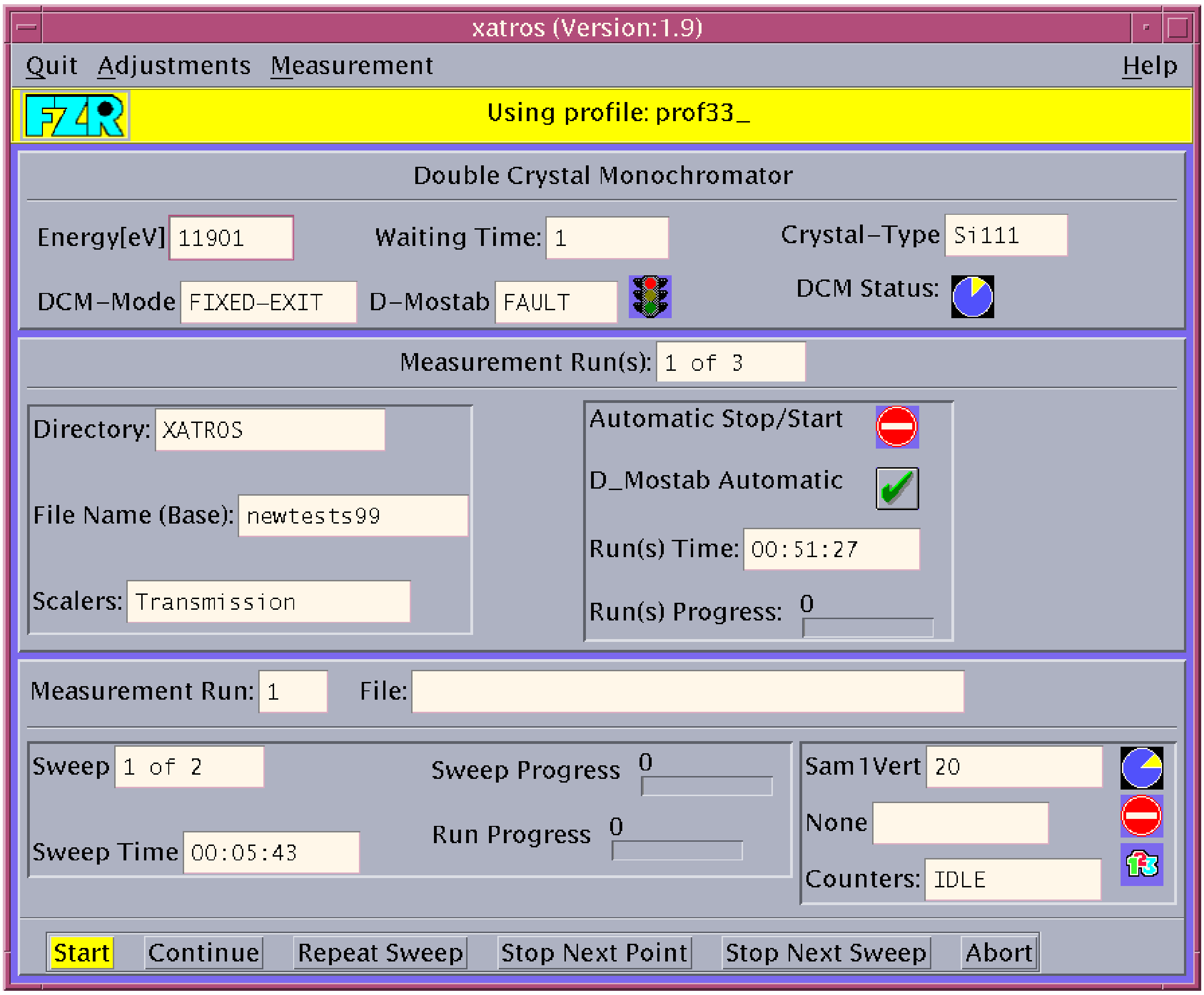
- One application for 4 slit systems configured by an extensive use of TACO database entries
- benefits from distributed Device Server concepts
- Uses Vpap Device Serves of the ESRF
- Uses VCT6 Device Servers and CAENV560 Device Servers of the ESRF to perform measurements while moving gaps (both translation of the gap of a given size and changing the gaps size are possible)

The sr570 application to control the amplifiers of the ion chambers



- uses a SerialLine Device Server of the ESRF to change the offset and / or the sensivity of four amplifiers
- uses register cards

The main window of xatros
(X-ray acquisition tool from Rossendorf)



- Xatros is an application which is used for all types of measurements performed at the experimental station of the radiochemistry (XANES, EXAFS and Quick-EXAFS (under construction))
- GUI-based (OSF/Motif, X11) application written in both C (GUI builder) and C++ using threads and TACO
- imports 20 logical devices from two VME-crates and even uses the multi TACO control system access
- uses three new database domains

The application xatros (threads and TACO)

- Visualization of the status of all supported devices independently from the user and without disturbing his interactions

- starting one thread for each device (19 threads) to show the most important information (even in more than one window)

- adaptive time intervals (interrogate the Device Servers more often if the device is in use, more rarely if it is in a passive status)

- the TACO libraries seem to be MT-safe and even stable for long times (xatros operates more than 1 day without any crash)

- the OSF/Motif (X11) libraries are not MT-safe (causes a lot of problems)

What functionality do we really use from the TACO system and what is still missed?

Relativly simple functionality of TACO has been used

Only synchronous mode

No Security restrictions

- DSAPI:
  - dev_import(), dev_free()
  - dev_putget()
  - dev_rpc_protocol(), dev_rpc_timeout()
  - dev_xdrfree()
  - dev_error_str()

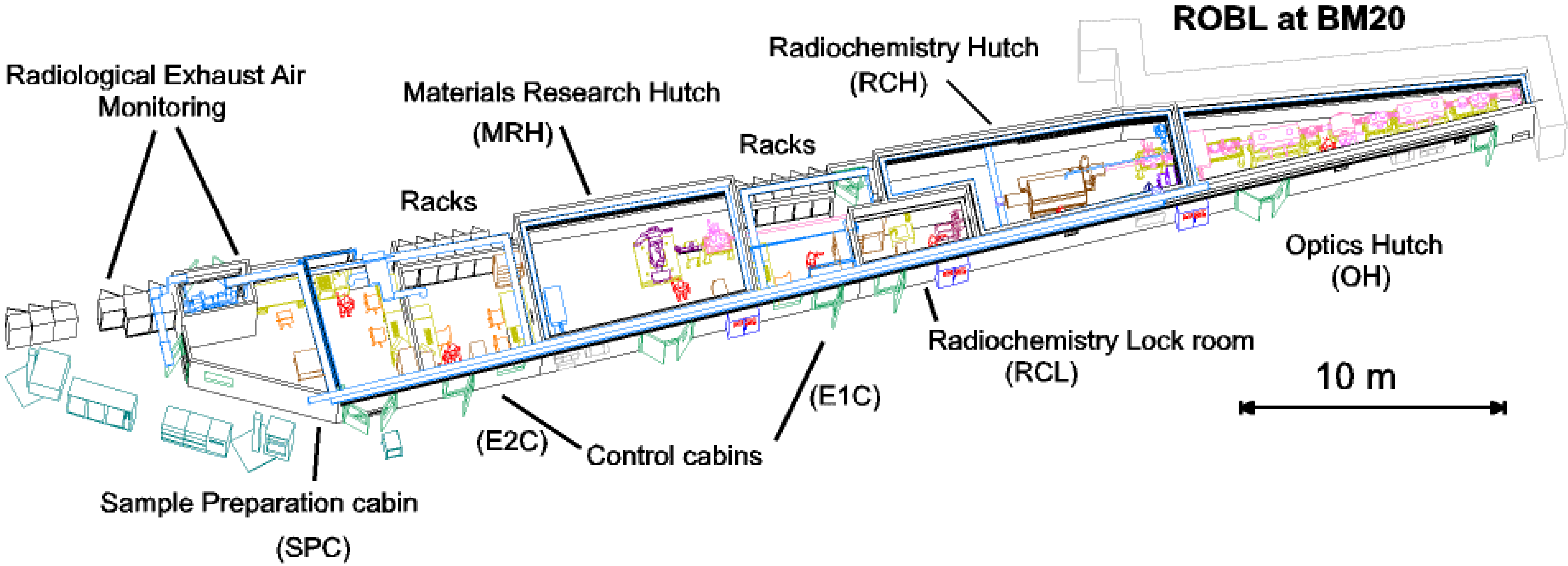
- XDR data types:
  - simple types
  - types of variable length arrays

- Database:
  - Extensively used both in applications and in Device Servers
  - 3 private Domains called PROF, REG and SCAL
  - applications have been configured by database entries
  - db_getressource(), db_putresource(), db_delresource()
  - db_getresdomainlist(), db_getresfamilylist(), db_getresmemberlist(), db_getresresolist(), db_getdsserverlist()

- Multi TACO control system access is used in two applications

- What is(was) still missed?
  - Events (now available, but to late for us and OS-9?)
  - Device Servers performing tasks in the background or a standard communication to sub-processes

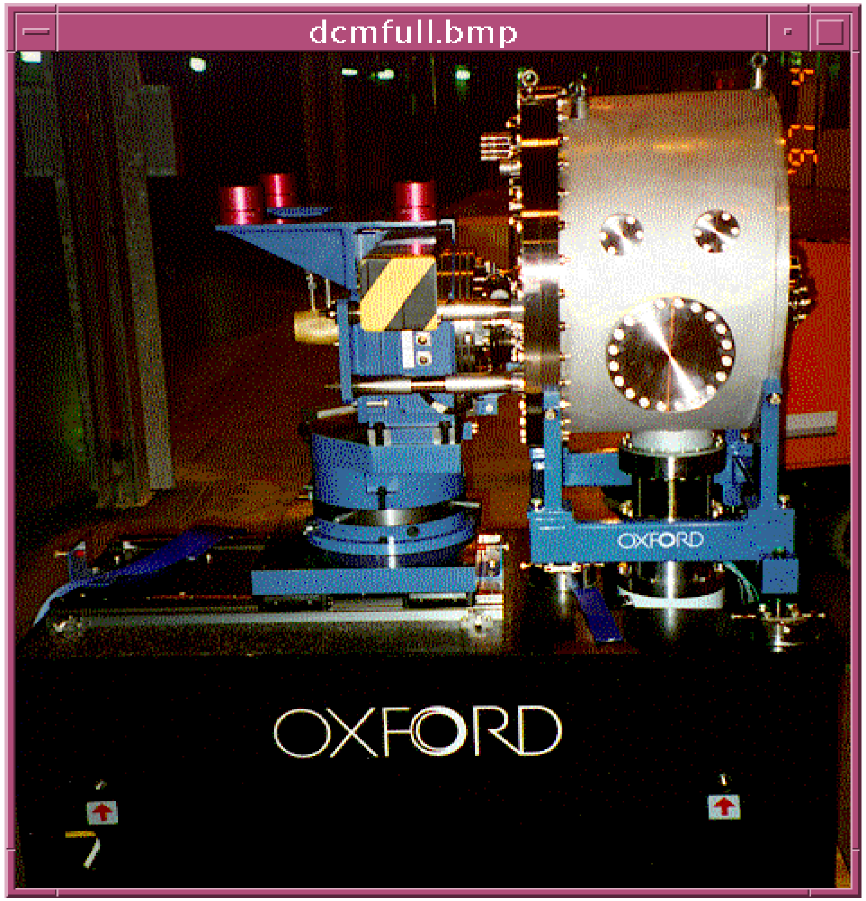
A short overview about the ROBL beamline (CRG)
(ROssendorf BeamLine)



4. One optics hutch - two different experimental stations (alternatively used)
5. Materials research: structural identification and characterization of modifications of surfaces and interfaces produced by ion beam techniques (X-ray diffraction and reflectrometry)
6. Radiochemistry: Radioecological research for risk assessment and development of remediation strategies for areas contaminated by radionuclides (XANES, EXAFS)

- Special features: radionuclide laboratory->Radiochemistry safety systems

The Double Crystal Monochromator (DCM) and the DCM Device Server

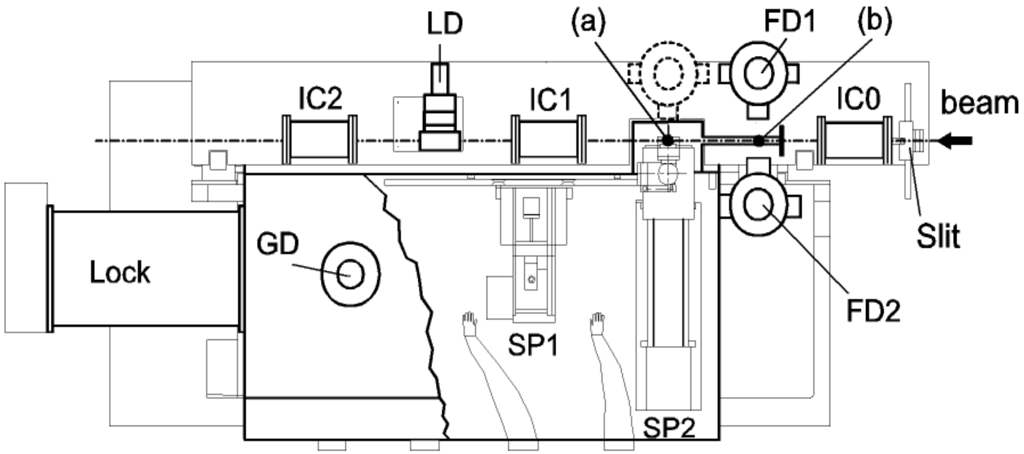


7. 12 motors/actuators controlled by 5 different types of controllers
8. 2 transducers (1 LVDT controller)
9. all controllers are intelligent controllers connected via 7 serial lines
10. IBAM-3 VME module in the VME crate d201 which controls the optical devices
11. generalization by implementing a <u>subset</u> of the VPAP Device Server interface (DSUG078/ESRF)
12. supplies the possibility to control the DCM by all applications using the supported subset of the VPAP Device Server functionality

- can be easily configured within spec^{tm} and also in other applications (xatros,...)

The Glove Box at ROBL's experimental station for Radiochemistry - the BOX Device Server

13. A highly specified equipment at ROBL
14. There are 16 motors controlled by either MICOS controllers or ORIEL controllers. They are used to change samples or to move detectors into an optimal position.
15. Generalization by implementing a subset of the VPAP Device Server interface (DSUG078/ESRF) similar to the DCM Device Server
16. Some of the motors use the same controller. Therefore they can be only moved sequentially. To prevent the applications from this task the BOX Device Server queues the actions in case of conflicts.


LD
(a)
FD1
(b)
IC2
IC1
IC0
beam
Slit
Lock
GD
FD2
SP1
SP2