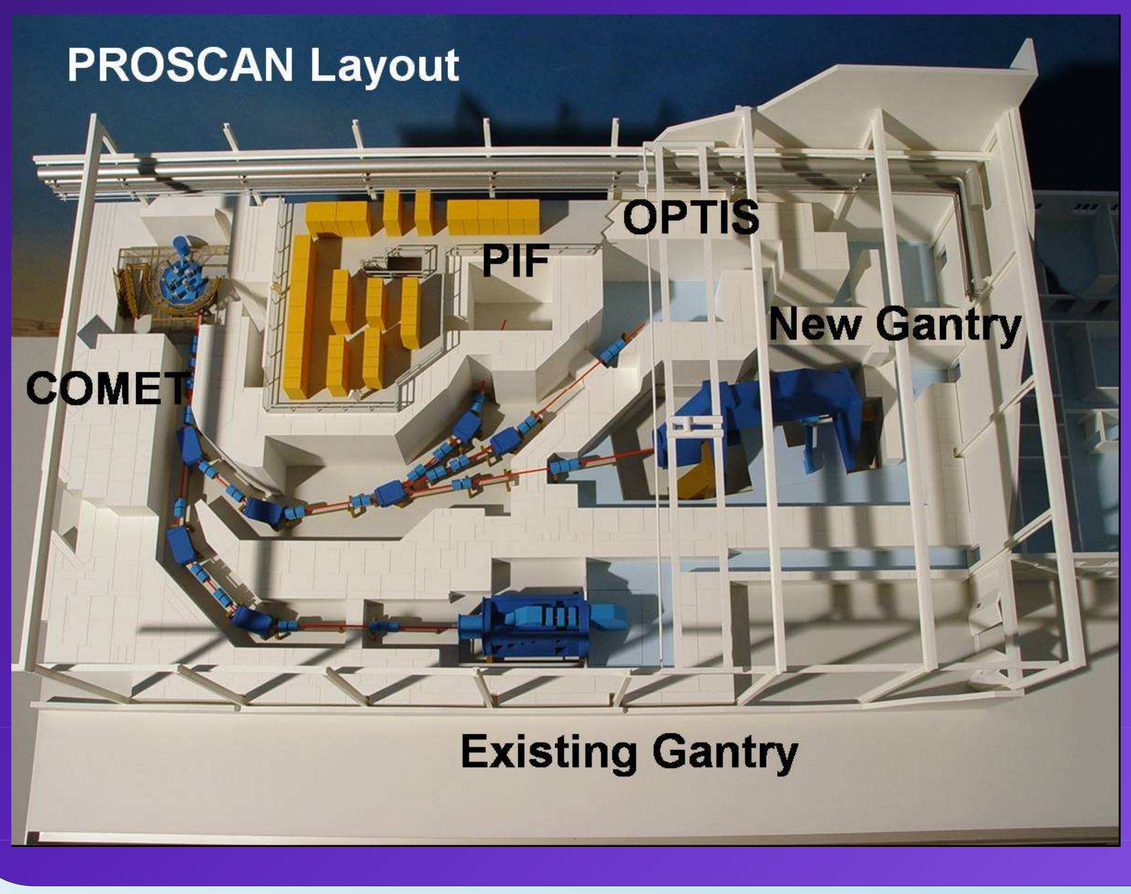
# Upgrading the PROSCAN Control System to EPICS: a success story

*D.Anicic, M.Gasche, H.Lutz, T.Korhonen, A.C.Mezger , Paul Scherrer Institut, Villigen, Switzerland*

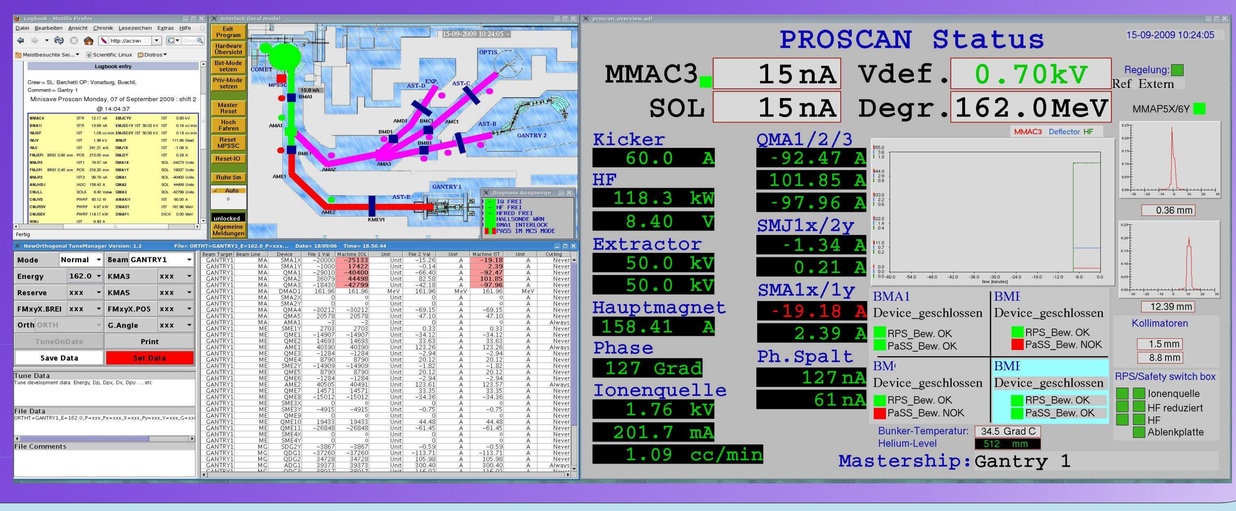
At the Paul Scherrer Institute the High Intensity Proton Accelerator (HIPA) as well as the new biomedical facility (PROSCAN) use an in-house developed control system called ACS. The SLS and future XFEL on the other hand use EPICS. In view of the standardization of software and hardware equipment, the decision was made to replace the ACS system with EPICS. Two years ago we started the migration of the PROSCAN control system, which has already from the beginning been built with a high degree of hardware standardization, using VME components only. The migration was finished at the end of last year, but we did not perform the definitive switch over due to time constraints coming from the patient treatment. In the coming years we also expect to migrate the ACS control system of the high intensity proton accelerator to EPICS, taking advantage of the work and experience we gained with the PROSCAN migration. We will present here the goals that have been followed and the way we have proceeded for the very successful migration of the PROSCAN control system.

## Proscan facility = medical proton therapy system




### Features

- **COMET**: Cyclotron with a superconducting main magnet, fixed Energy of 250 MeV and an intensity of up to 1 μA.
- Degrader is used to vary the Energy from 70 to 230 MeV.
- 4 beam lines: 2 Gantries, 1 eye treatment facility, 1 experimental area.
- Beam lines and Energy (Degrader) are reconfigured by the user through a beam allocator and gateway **(BALL)**. **R**un **P**ermit **S**ystem gets reconfigured through BALL .




### Factsheet of Proscan ACS control system

ACS is a control system with a very similar basic architecture to EPICS and was developed over more then 15 years with 4-5 people following the technical trends:

- PowerPC's in VME (LYNX-OS), VME modules, PLC's
- Message based UDP communication from high level application to IOC (hardware data is considered as a real-time database). No IOC applications.
- IOC configuration data as well as Backend configuration data generated from Oracle Database.
- Naming Convention with an Object oriented approach (Device, Attribute, Conversion level)
- Name discovery by Applications: Application can request device names, attributes with wild cards from a Core Database.
- Data increment function implemented at IOC level.
- PLC connectivity. With vacuum and proprietary cyclotron control.
- High level status bit interpretation.
- Implementation of latest MEDM. The connectivity offered in the file medmCdev.c is used for this.

### How did we proceed ?

- No changes allowed in ACS during the migration.
- Power-PC's can boot Lynx-OS or VxWorks in order to switch in 15 minutes from ACS to EPICS.
- Workstations can boot by switching from one Harddisk to another in order to use the new applications and datafiles.
- Use a channel access naming convention adapted to the existing naming convention scheme, in order to simplify the operational aspects and the migration of existing applications (i.e. for device + attribute + conversion use the channel name (device:attribute:conversion)
- No IOC applications, just do I/O.
- Convert the existing high level applications (Scans, Beam allocator and Gateway, Run time permission, …) to channel access with or without wrapper routine approach.
- Modify the existing MEDM screens for channel access (by use of a converter)
- Use existing EPICS drivers and implement some new EPICS drivers (PLC's, …) and records (ex: status bit interpretation)
- Create the necessary template and substitution files. Totally about 44000 record created through 66 templates)
- Put all information in the Oracle database.
- Write a channel access pv viewer (Java) getting all the channels from the oracle database and display them with their values for fast diagnostics.

**Due to the patient therapy time constraints, only small timeslots could be allocated for tests on the facility itself:**

**⇒Use of test hardware and soft IOC's for first tests**

### Factsheet of Proscan EPICS control system

EPICS is a widely used control system toolkit. The implementation of this toolkit in PROSCAN is based on following principles:

- Use an appropriate channel naming convention.
- No IOC applications, just do I/O.
- Only high level applications.
- Use MEDM as synoptic data display.
- 13 new EPICS drivers (PLC's, …) , 3 new records (statusString, BitmapIn, setclr) and 4 genSubs.
- Device incrementing is used only by individual applications like the knob box and beam centering. These applications use increment through get and put.
- Gateway in IOC for Run Permit System access for non migrated User application.
- Use ACS archiving through Channel Access in order to safeguard the long term availability of the current and future data.

### What did we learn

The way to upgrade a system to EPICS depends on its architecture:

- An architecture with clients communicating with IOC's can be migrated to EPICS without major problems, it is just hard work.
- To limit the work to be done, wrapper functions and gateways could provide a solution.
- HIPA will have to replace many old components (CAMAC) before being migrated to EPICS. Meanwhile new hardware using EPICS can be integrated through a gateway.

**The EPICS system is now fully functional and an appropriate moment fitting the biomedical treatment has to be found to make a definitive switch to the EPICS environment.**