IFJ PAN Kraków

ELQA Activities

Jaromir Ludwin
Division of Scientific Equipment and Infrastructure Construction
The Institute

- Established in Krakow in 1955
- First cyclotron built in 1958 (14.5 MeV deuterons and 29 MeV alpha particles)

The Institute

- Currently one of the biggest institutes of the Polish Academy of Sciences
- Conducting research in fields of
  - Particle physics
  - Nuclear and strong interaction physics
  - Condensed matter physics
  - Bio-physics
- Two special divisions
  - **Cyclotron Centre Bronowice** (hadron therapy centre – 250 MeV proton beam, 2 gantries, ocular radiotherapy facility)
  - **Division of Scientific Equipment and Infrastructure Construction** (cryogenic infrastructure, mechanical workshop, design office)
Examples of our projects
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Qualification tests of superconducting components of the accelerator E-XFEL (2010 – 2015)

103 x Current Lead

Cold magnet

840 x Cavity

103 x Cryomodule
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Wendelstein 7-X Stellarator assembly (2007 – 2012)

- Preparation and installation of 120 systems supplying superconducting coils.
- Completing of 220 splices of superconducting cables.
- Manufacturing of 30 sets of mechanical elements for polychromators.
- Verification calculations (FEM) of the designed equipment for the assembly, storage and transport of external module tanks.
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ITER – design and prototype works (2010 – 2024)

2010-2013: FEM calculations of ITER infrastructure elements
- static analyses for nonlinear effects (buckling) and fatigue
- dynamic analysis for seismic loads.

2013-2024: Radial Neutron Camera (RNC)
- Thermo-hydraulic design and analysis (detector cooling system)
- Electromagnetic analyses (dynamic loads and electromagnetic shields)
- Design of RNC components (adjustable collimators and rotary detectors)
- CAD design support

2014-2016: High Resolution Neutron Spectrometer (HRNS)
- Coordination of the engineering part of the project
- Leading role in CAD design
- Thermo-hydraulic design and analysis - detector cooling system
- Electromagnetic analysis – detector shielding system against the influence of magnetic field
RF installations
- S-tub installations
- LLRF installations
- Local protection system installations
- RF power distribution installations

Power converter installations
- Klystrons Modulators for RFQ and DTL
- Klystron Modulators for Medium / High Beta
- Power converters for magnets

RF Cryomodule Tests
- Preparation and execution of qualification tests of 30 cryomodules
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Many projects done in collaboration with scientific divisions of the Institute

STUMM (IFMIF-DONES) in collaboration with Department of Radiation Transport Physics

Building of 2nd prototype and installation of two Cherenkov telescopes in Czech Republic – collaboration with Department of Gamma-Ray Astrophysics

T2K (ND280 detector upgrade) – collaboration with Department of Cosmic Ray Research and Neutrino Studies

IFJ PAN contribution
- Design and manufacturing
- 4 full-size modular frames
- 36 supports for MicroMegas
History of CERN – IFJ PAN
ELQA collaboration
First Collaboration Agreement between CERN and IFJ PAN related to ELQA activities signed on 2003 (left photo) and updated in 2005 (right photo)

Source: A. Kotarba
IFJ PAN ELQA Team at CERN – Arc Interconnection Verification

Source: A. Kotarba
Partial Arc Qualification

Source: A. Kotarba
First TP2 - TP4 tests

Source: A. Kotarba
First TP4 tests

Source: A. Kotarba
Equipment used during LHC assembly and early HC

Source: A. Kotarba
Line-N Factory

Source: A. Kotarba
Summary of the collaboration

We have been working together since the beginning of the LHC, during:

- LHC assembly
- Hardware commissioning
- Recovery after 2008 incident
- Long Shutdowns 1 and 2
- Technical stops

ELQA hardware and software are our basic tools, which we (Institute and CERN) have created on our own. This provides the tightest possible feedback loop between user and developer.
Maintenance of the TP4 measurement system
Maintenance of TP4 system

Hardware
- General hardware maintenance
- Upgrade of gain/phase analyser (EoL of currently used device)

Software
- Universal test and measurement application
- ELQA database optimisation
- Full implementation of local TFM
- Upgrade of MIC QHR application
- ELQA test plan web application
- Additional PXI based monitoring applications
Hardware

- Initial system check
- Removal of all devices and cleaning
- Upgrade of power distribution box and check of grounding system
- Preparation of fasteners for new and relocated devices
- Replacement of all connectors
- Retightening of all screws
- Replacement of broken cables
- Design and production of new PCBs for external TFM reference and TFM isolation amplifier
TP4 instruments rearrangement

- 24 VDC to 230 VAC converter
- Power supply for the TP4 crate
- TP4 Crate (multiplexers and reference resistors)
- PXI computer with two DMM cards
- Powertek amplifier (output +/- 12V, 700 mA RMS, 1A peak)
- Agilent 6643A DC Power Supply (0-35V, 0-6.0A)
- Powertek GP102 gain phase analyser with dual analysis channels and generator
TP4 instruments rearrangement

- Space for new device (2U)
- Agilent 6643A DC Power Supply (0-35V, 0-6.0A)
- Power supply for the TP4 crate
- TP4 Crate (multiplexers and reference resistors)
- PSM1700 gain phase analyser with dual analysis channels and generator
- PXI computer with two DMM cards
- Powertek amplifier (output +/-12V, 700 mA RMS, 1A peak)
- 24 VDC to 230 VAC converter
Replacement of all connectors

Harting pins after few thousand mating cycles
Conclusions

• There is a huge record of fruitful collaboration between CERN and IFJ PAN, in particular in the field of Electrical Quality Assurance.

• TP4 maintenance project started with a significant delay, but we are catching up with the schedule.

• Our experts are working on many projects, ranging from accelerator technology to fusion.

• We are really good at building and testing.