ILC also challenges electronics

To fulfil the detailed requirements of the ILC, each device from the particle source has to be controlled with high precision, stability and reproducibility. At Warsaw, Poland, a team of engineers works closely with particle physicists on electronics and photonics to develop electronic systems, instrumentation and microprocessors for cavity RF controls at the highest performance and for the lowest cost. This group motivates and encourages young researchers to join them by organising regular symposiums.

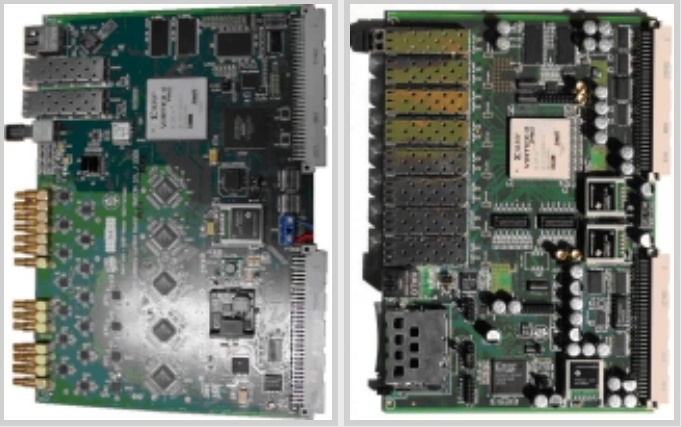
XFEL-ILC Warsaw group during WILGA07 Symposium

Some Warsaw group members in Tesla Test Facility control room. From left to right: prof K.Jablonska (Polish Synchrotron Radiation Society), prof R.S. Romaniuk (group leader), W.Jalmuzna, W.Cichalewski and T.Czarski (researchers and Ph.D.students)

"We mainly produce knowledge," says Ryszard S. Romaniuk, head of the group, at Warsaw University of Technology. The team's main task is to create advanced products consisting, in terms of time spent, of 80 percent non-material values - the software - and only 20 percent strictly material values - the hardware. Specialised in electronics and photonics, they are university engineers who are used to working for various projects, traditionally at DESY in ZEUS, a HERA experiment (and more recently on Flash and XFEL) and also on LHC experiments like CMS. They belonged to the former TESLA collaboration and now joined the Tesla Technology Collaboration (TTC).

For the ILC, their area of study concerns different aspects of RF cavity controls. Controlling RF cavity quality implies a lot of complex electronic algorithms, which take into account signals from different origins, processing and producing a feedback response to correct the anomalies. Under the European Community-Research Infrastructure "CARE SRF Joint Research Activity" (more about CARE), the Warsaw group joins the cavity RF studies and develops solutions for controlling RF guns, superconducting cavities, and electron beam feedback, not to mention also monitoring beam quality and beam position monitors. They also work on radiation immunity of the front-end electronics of sub-components in the ILC linac. Closely collaborating with two other universities in Poland (Lodz and Warsaw University) and Soltan Institute for Nuclear Studies, one of the widely recognised products of this group is the SIMCON - superconducting cavity SIMulator and CONtroller - hardware/software system. The versions 3.1 and 4.0 are now in operation in FLASH and ILC test sites.

Every aspect of RF cavity controls is challenging with the ILC: new methods of measurement, new material, new technology, more stability, more automation, and the list goes on. For example, the Warsaw group needs to develop very precise timing systems to ensure a picosecond synchronisation of all RF signals. They also plan to provide their expertise in microprocessors and software engineering to design intelligent electronic devices. This way, these could, for example, repair by themselves thanks to early diagnostics and detailed reports of errors. This Polish group shares its know-how by regularly sending engineers and students to other labs like DESY, CERN or even recently to Fermilab.



These two SIMCON (superconducting cavity SIMulator and CONtroller) electronic cards (version 3.1 left, version 4.0 right) are now in operation in FLASH and ILC test sites.

These pieces of hardware are particularly difficult to program and monitor. The complexity of the algorithm is at the scale of the ILC complexity. They are produced in a unique way, specially for the ILC project, but fortunately a lot of the solutions could be applied to other high energy projects. "We wish we could cooperate more with the ILC," says Romaniuk, "which means that we need an organisational background in Poland for financial supports and coordination of our efforts."

It also requires more manpower. To encourage young researchers and engineers to join the project, Polish universities organise twice a year a symposium on "photonics and electronics for accelerators and high energy physics experiments". It has been organised twice a year for ten years now. The young researchers work together in advanced applications of

photonics and electronics, particularly to apply difficult modelling methods and to implement and test components, devices and systems. The Symposium gathers more than 200 researchers each time, mainly from Poland but also from other countries. The most recent workshop was very successful and took place in May at Wilga, near Warsaw.

-- Perrine Royole-Degieux