Common R&D projects for the LHC upgrade and plans for irradiation facilities

Outline:

- PH common R&D projects
- Working Group on future irradiation facilities at CERN
- Outlook

PH common R&D

PH department, "White Paper Theme 3", common R&D projects:

"9 (10) work packages in which a strategic role for CERN has been identified and which concern the development of specific expertise relevant for future projects. Priority has been given to common projects and coordination frameworks, where several experiments will profit from the development"

- Approved by CERN Council in June 2007
- Covers period 2008-2011
- Total 7.9 MCHF materials, 56 FTE of Fellows/Associates/students
- + staff resources, imbedded in the PH personnel plan

Common R&D work packages for LHC upgrade

- **Microelectronics & Optoelectronics**
  - 3 work packages
- **Detectors**
  - 4 work packages
- **Data analysis, simulation and computing**
  - 2 work packages

For more detailed information:

http://ph-dep.web.cern.ch/ph-dep/InfoCommunication/News/070717.html (July 2007)

Faculty meetings 15/11/2007, 25/4/2008

http://ph-dep.web.cern.ch/ph-dep/InfoCommunication/FacultyMeeting.html

3 WP's on Microelectronics & Optoelectronics

WP1: **Radiation-hard microelectronics technologies and common building blocks** ➔ see talk of A. Marchioro

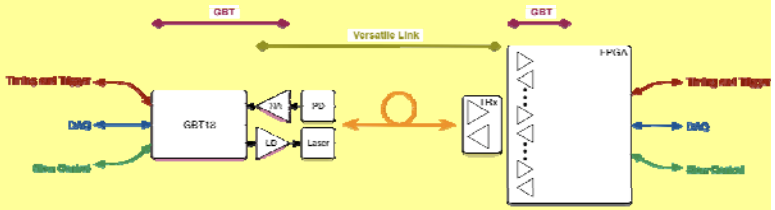
WP2: **On-detector power management** ➔ see talk of M. Weber

The work of WP2 is mostly carried out in the framework of the SLHC-PP project (EU-FP7), in collaboration with 6 institutes

3 WP's on Microelectronics & Optoelectronics

WP3: **Radiation-hard optical link for experiments**

- Project with a micoelectronics and an optoelectronics component.
- Common versatile optical link solution:
  - Transfer of data, timing/trigger/fast-control, controls
  - Increased bandwidth for more data transfer capacity
  - Higher radiation hardness
  - Low material



In close collaboration with ATLAS/CMS optoelectronics working group

4 WP's on detector technologies

WP4: **Radiation Hard Semiconductor Detectors**

- Continued participation in RD50, integration into LHC tracker upgrades

Initial work program:

1. **Silicon material studies (mainly strip like detectors)**
   - Materials (MCZ, FZ, EPI, DOFZ, …), detector structures (n-in-n, n-in-p, p-in-n), thickness (50 to 300 μm)
2. **New detector concepts (mainly pixel like detectors)**
   - n-in-p versus n-in-n planar pixels; 3D detectors; evaluation of thin sensors with integrated electronics
3. **Build up test equipment and other infrastructure for common use**

4 WP's on detector technologies

WP5: **Micropattern Gas Detectors**

- Participation in technology developments and contribution to setting up a MPGD collaboration framework (see tomorrow's LHCC presentation)

CERN work plan elements in interest of LHC upgrade:

- Development of large area MPGD
- Characterisation studies (high rate, stability,…)
- MPGD simulation software
- Common test beam infrastructure

WP6: **Interconnect Technology and Quality Assurance**

- Explore technologies for interconnects and hybridisation
- Quality assurance methodology (assembly+QA facility)

4 WP's on detector technologies

WP7: **Facilities and Component Analysis for Detector R&D**

- Upgrades of irradiation facilities;
- Radiation hardness studies on materials

Principal WP7 work plan:

- New GIF++ facility
- Upgrade of proton and mixed-field irradiation facilities at PS T7

- Ageing of gas detectors for LHC/SLHC (mostly RPC gas circulation studies at GIF)
- Reference ageing laboratory
- Component analysis and materials data base

Irradiation Facilities

Working group on future CERN irradiation facilities

http://irradiation-facilities.web.cern.ch/irradiation-facilities/

- Interdepartmental WG
- Made a broad survey of the requirements
- **Preliminary conclusions:**
  - Upgrade of proton and mixed-field facility at PS East Hall
  - Fast proton extraction facility at SPS (mainly for collimator studies)
  - GIF++ facility at the SPS
- Implementation studies and resources estimates ongoing

2 WPs' on data analysis, simulation and computing

WP8: **Parallelization of Software Frameworks to exploit Multi-core Processors**

- Adapt and optimise existing software frameworks in the LHC experiments to run on multi-core processors

Work plan:

- Investigate current and future multi-core architectures
- Analyze performance of LHC physics application software on multi-core architectures
- Develop Solutions to parallelize LHC physics software

Workshop on WP8/WP9 subjects, April 2008:
http://indico.cern.ch/conferenceDisplay.py?confId=28823

2 WPs' on data analysis, simulation and computing

WP9: **Portable Analysis using Virtualization Technology**

- Development of "Virtual Appliances" to provide a complete data analysis environment specialized for each of the LHC experiments

Work plan:

- Evaluation of the available virtualization technologies
- Collect requirements from experiments and confront them with available technologies
- Deployment of a read-only distributed file system
- Provide prototypes of data analysis virtual appliances for at least 2 experiments

…… common projects in mechanical engineering

"Preliminary"

Ongoing survey among the PH mechanical engineers, with the aim of identifying interest areas and potential common projects. Principal subjects:

- **Materials studies (structural and thermal materials)**
- **Cooling for upgraded detectors**
  - R&D on cooling justified by experience with the current systems
  - **Plans to organise 2 cooling events:**
    - Oct/Nov 2008: 1-day forum at CERN, open to all experiments. Presentations on LHC experience and new ideas.
    - Feb/Mar 2009: 2-3 day cooling workshop on cooling systems, thermal management and materials for cooling systems.
- **Reverse engineering and scenarios for maintenance/replacement interventions**

SLHC-PP project, WP5

“Radiation protection and safety issues for accelerator and experiments”

WP coordinator: Thomas Otto, SC/RP

- **Experiment radiation &activation**
  - Simulations for activation and radiation
  - Validation with measurements at LHC
  - Optimization of forward region design, exposure during maintenance and repair
- **Accelerator radiation &activation**
  - Simulations for activation and radiation in critical regions
  - Evaluation of doses to materials and equipment
  - Minimize consequences for equipment and beam operation
- **Impact study**
  - Dose rates in areas of SLHC access
  - Environmental impact
  - Estimates related to radioactive waste

Participants: CERN, CTU, GSI, PSI, USFD

Outlook

- PH department has started common R&D activities in 2008 in close collaboration with the experiments and with *participation from several (many) labs*.
- Important to keep the common R&D in line with the upgrade plans (technically and time-wise!)
- In addition to the current common R&D, funded through White Paper Theme 3, there are possibilities of additional common R&D projects