

ACEOLE

Marie Curie Initial Training Network

Data Acquisition, Electronics and Optoelectronics for LH
Experiments

MILESTONES AND DELIVERABLES

(as defined in **Annex I**, the *Description of Work*, appended to the Grant Agreement)

OVERVIEW

- History
- Grant Agreement
- Initial Training Network
- ACEOLE research work packages
- ACEOLE deliverables and milestones
- Training
- Working together

HISTORY

of Marie Curie training projects at CERN (1/2)

- A variety of Marie Curie actions at CERN
 - Coordinated by CERN Marie Curie Steering Committee (MCSC)
 - 6 Early Stage Training Projects
 - 8 Other Marie Curie actions (RTN, Cofunding, individual fellowships.....)
 - 89 Researchers
 - 2M € training budget (not including living costs etc)
- Two FP6 forerunners to ACEOLE:
 - MITELCO (Microelectronics, Telecommunication & Controls Developments for expts)
 - » Feb 2005 - Jan 2009
 - » 11 ESTs over 4 years
 - ELACCO (Electronics, Acquisition & Controls Developments for Physics Experiments)
 - » Jun 2006 - May 2010
 - » 13 ESTs over 4 years

HISTORY

of Marie Curie training projects at CERN (2/2)

- FP7 Initial Training Networks (ITN)
 - 1st call for proposals 2006
 - Major differences with FP6
 - Network with at least 3 partners
 - Partners in at least 3 countries
 - Researcher mobility (mandatory)
 - Involvement of industry (mandatory)
- CERN coordinates 3 ITNs (ACEOLE, MCPAD, PARTNER)
 - **ACEOLE** (Data Acquisition, Electronics and Optoelectronics for LH C Experiments)
 - » Proposals (submitted May 07 & Sept 07; Kick-off today)
 - » 4-year project
 - » Oct 2008 - Sep. 2012
 - » 17 Researchers + 12 Visiting Scientists

ACEOLE PROGRAM OF WORK

- Grant Agreement, Annex I “Description of Work”:

» <http://indico.cern.ch/conferenceDisplay.py?confId=39638>

- Contractual commitment;
- Commission insisted on “Description of Work” identical to approved proposal (Sept. 2007);
- May need to review and update?

INITIAL TRAINING NETWORK (ITN)

- Initial Research Training

- Early Stage Researchers (ESR) experience < 4 yr
- Experienced Researchers (ER) 4 yr < experience < 5 yr
- Visiting Scientists (VS) experience > 5 yr

- ACEOLE = Monosite ITN

- CERN (the grant recipient and coordinator)
- + 9 Associated Partners

- General ITN Objectives

- International mobility
- Intersectorial experience (academia + industry)
- Complementary skills (language, communication & management, IPR issues etc.)
- Dissemination of results (workshops etc)

RESEARCH WORK PACKAGES

(integrated into CERN's approved R&D programme)

(S)LHC Subsystem	W.P. No.	Work Package (Research Training Theme)	N°. ESR	N°. ER
Detector	1	Pixel detector systems for particle tracking (and imaging).	1	1
Electronics & Optoelectronics readout system	2	Radiation-hard ASIC building blocks for detector data readout.	1	-
	3	Radiation & magnetic field tolerant power management systems for front-end on-detector electronics .	1	-
	4	Radiation-hard, non-magnetic optical transmission systems for data transfer, timing & trigger distribution, & control functions.	3	2
Data acquisition	5	Data acquisition and high level triggering systems.	6	2
		TOTALS =>	12	5

W.P.1 TASKS & DELIVERABLES (Annex I, B.2.1)

Work package number	1	Start date or starting event:	Month n
Work package title	Development of pixel detectors		
Leader	Michael Campbell		
Person-months	54		
Associated Partners	PANalytical, VTT Espoo		
Objectives	Develop techniques to assemble low cost, low mass, moderate to large area pixel detectors for photon counting X-ray imaging systems and particle tracking at the SLHC.		
Description of work	<ol style="list-style-type: none"> 1. Development of experiments for tiling large areas with existing pixel detector tiles. 2. Study and evaluate tiling solutions for assembling moderate to large area pixel arrays. 		
Deliverables	<p>D11 Report on low cost bump bonding solutions and design of test components</p> <p>D12 Report on the full evaluation programme</p> <p>D13. Report on tiling solutions suitable for HEP and materials analysis</p> <p>D14. Documentation and conference paper on tiling solutions attempted and conclusions</p>		

W.P.2 TASKS & DELIVERABLES (Annex I, B.2.1)

Work package number	2	Start date or starting event:	Month n
Work package title	ASIC building blocks for SLHC		
Leader	Paulo Moreira		
Person-months	36		
Associated Partners	INESC Porto		
Objectives	Develop radiation-tolerant ASIC building blocks in 130nm CMOS technology for detector upgrades at the SLHC.		
Description of work	<ol style="list-style-type: none"> 1. Establish functional and performance specifications of selected building block(s); 2. Design, fabricate and laboratory test prototype; irradiation testing. 2. Design, fabricate, test final version and carry out system-level integration tests. 		
Deliverables	<p>D21. Sign-off specification document for ASIC (IP block)</p> <p>D22 Completion of testing and irradiation of prototype ASIC with conference report or journal publication</p> <p>D23 Complete testing/irradiation of final ASIC and system-level integration test. Final conference report and/or journal publication</p>		

W.P.3 TASKS & DELIVERABLES (Annex I, B.2.1)

Work package number	3	Start date or starting event:	Month n
Work package title	On-detector Power Management schemes		
Leader	Jan Kaplon		
Person-months	36		
Associated Partners	AGH Krakow		
Objectives	Develop radiation-tolerant ASIC components compatible with efficient power management in SLHC detectors and evaluate them in system level demonstrators.		
Description of work	<ol style="list-style-type: none"> 1. Design, prototype and lab characterization of selected rad-tolerant ASIC block. 2. Evaluate its performance in the radiation environment expected at SLHC trackers. 3. Integrate ASIC block into full ATLAS tracker demonstrator ASIC. 4. Participate in preliminary system tests using the full ATLAS tracker ASIC. 		
Deliverables	<p>D31 Deliver proto detector module using shunt regulator</p> <p>D32 Report or conference paper on performance of shunt regulator in the prototype detector module</p> <p>D33 Delivery of full ATLAS SCT readout chip</p> <p>D34 Report/conf. paper on test results of detector module incorporating the shunt regulator.</p>		

W.P.4 TASKS & DELIVERABLES (Annex I, B.2.1)

Work package number	4	Start date or starting event:	Month n
Work package title	Optical transmission systems for SLHC experiments		
Leader	Francois Vasey		
Person-months	126		
Associated Partners	INESC Porto, SCK.CEN, UCL, VTT Oulu		
Objectives	Develop radiation-tolerant, low-mass, non-magnetic, high-density, multi-Gigabit/sec optical interconnect solutions for massively parallel data transmission, global clock and trigger distribution, control and monitoring functions in SLHC experiments.		
Description of work	<p>4.1. Architecture studies, evaluation of PON networks for application in SLHC experiments.</p> <p>4.2. Characterization of semiconductor lasers (standalone and embedded in optical package).</p> <p>4.3. Radiation resistance and reliability; test setups, measurements, analysis, ageing.</p> <p>4.4. Electro-optical & environmental characterization of optical packages.</p>		
Deliverables	<p>D411 Report on extendibility of PON concept to HEP</p> <p>D412 Conference report on demonstration of PON protocol for HEP application</p> <p>D413 Documentation on hard, soft and firmware, system test results</p> <p>D421 Report on laser electrical impedance measurements and models</p> <p>D422 Report on proposed matching networks, recommendations to designers and experimental results</p> <p>D431 Report on analysis of high fluence test data and proposed methodology</p> <p>D432 Conference report on irradiation tests</p> <p>D433 Conference report on irradiation and reliability tests</p> <p>D441 Report on environmental, EMI and thermal impedance testing</p> <p>D442 Conference report with comparisons between different module types</p> <p>D443 Documentation on hard, soft and firmware, system test results</p>		

W.P.5 TASKS & DELIVERABLES (Annex I, B.2.1)

Work package number	5	Start date or starting event:	Month n
Work package title	Data Acquisition for (S)LHC experiments		
Leader	Niko Neufeld		
Person-months	240		
Associated Partners	Force10, INFN-LNL		
Objectives	Profiling & performance optimization of DAQ networks of the LHC experiments; fault tolerance for the DAQ systems. Evaluation of multi-Gigabit/s technology for DAQ in SLHC		
Description of work	<ol style="list-style-type: none"> 1. Network ramp-up to full production size; techniques for profiling network performance; optimization of the routed network. 2. Include fault handling in the DAQ systems in order to achieve high data taking efficiency. 3. Optimise the networked data storage system for data reliability and storage virtualization. 4. Studies for DAQ upgrades for SLHC experiments: tracking of networking technology and an R&D effort on constructing an event collection system with multi-Gbps links. 		
Deliverables	D51 & D52 Intermediate report/conference papers on network optimization / data storage systems / fault tolerance in run control / design of DAQ for future SLHC upgrade. D53 Prepare final report/conference papers		

W.P.6 - DISSEMINATION OF RESULTS; TRANSFER OF KNOWLEDGE (Annex I, B.2.3)

Work package number	6	Start date or starting event:	Month 0
Work package title	Workshops, training courses, dissemination of results & transfer of knowledge		
Leader	ACEOLE Coordinator + Management Committee (+ Researchers)		
Person-months	15 (visiting scientists)		
Associated Partners	AGH Krakow, Force10, INESC Porto, INFN-LNL, PANalytical, SCK.CEN, UCL, VTT		
Objectives	Promote transfer of knowledge, contribute to S&T & complementary training, and dissemination of results.		
Description of work	<ol style="list-style-type: none"> 1. Visiting scientists' contributions to the research work. 2. Plan, prepare and deliver dedicated training courses (by visiting scientists) 3. Organize workshops to promote training and dissemination of results 		
Deliverables	<ol style="list-style-type: none"> 1. Training courses and seminars at CERN as defined in table 8 in section 2.3.2. 2. Three workshops on electronics & optoelectronics (Sept 2009, 2010, 2011) 3. Three DAQ workshops (at CERN and/or in association with CHEP) 4. (Opto)electronics & DAQ sessions at IEEE-NSS (2011) & a project wrap-up workshop. 		

EXAMPLE OF TIMESCALE & MILESTONES

(see Fig. 1 and Table 5 of Annex I for all WPs; *May need updating*)

Theme number	Del. no.	Titles of the Research Training Themes and description of deliverables and milestones	Nature	Dissemination level	Delivery date (month)
1		Development of pixel detectors			
	D11	Report on low cost bump bonding solutions and design of test components	R	Public	10
	M11	Low cost bumping test structure design	O	Restricted	16
	D12	Report on the full evaluation programme	R	Public	18
	W1n	Organize a workshop on pixel detectors (Medipix collaboration related)		n.a.	12, 24,36
	D13	Report on tiling solutions suitable for HEP and materials analysis	R	Public	12
	M12	Design of various tiling solutions	O	Restricted	24
	D14	Documentation and conference paper on tiling solutions attempted and conclusions	R	Public	36

TRAINING

- Hands-on research training complemented by formal training:
- Individual training allowances (600 €/month)
- CERN Training Programmes
 - » Academic Training
 - » CERN Seminars
 - » CERN Computing School
 - » Technical Training
- International Conferences
 - » TWEPP, CHEP, IEEE NSS-MIC, IEEE Real-Time.....
- Training during secondment
 - » Up to 30% of contract duration
- Complementary Training
 - » CERN Management and Communication courses
 - » Other external training courses

Training by Visiting Scientists (Annex I, Table 8)

Associated Partner	Visiting Scientist	Visit length (months)	W.P.	Training topic	No. training hours
AGH Krakow	Senior Physicist (W. Dabrowski)	1	3	Architectures, performance requirements and limitations to implementing front-end electronics for silicon tracking detectors at the SLHC and/or other relevant topics	10
INESC Porto	Senior Engineer (H. Salgado)	2	4.2	Optical sources (laser diodes, EOM, EAM); Device characterization & fibre optic measurement techniques. Extraction of laser diode parameters. S-parameters/ network analyzer measurements.	6
INESC Porto	Senior Engineer (J. Machado da Silva)	1	2	Redundancy & DFT & BIST techniques of RF, analogue & mixed-signal ASICs; Dynamic characterization of A/D converters.	6
LNL Legnaro	Senior App.Physicist (G. Maron)	3	5	Control and monitoring of large and widely distributed systems.	15
PANalytical	Senior Engineer (J. Bethke)	1	1	Principles and techniques of x-ray materials analysis using diffraction and fluorescence.	10
SCK.CEN	Senior Engineers (M.Van Uffelen+P.Leroux)	1 + 1	4.3	Reliability and radiation-tolerance qualification of optoelectronics components for extremely high dose applications	8
UCL	Senior Engineer (I. Darwazeh)	1	2 + 4.1	Network architecture, traffic, switching; Optical networks & topologies, Optical network standards, WDM networks & technologies. Communications circuits and ASIC design.	10
UCL	Senior Engineer (J. Mitchell)	1	4.1	Core & access optical networks, Multiplexing technologies, transmission technologies, switching technologies, Devices & implementation, Network performance & measurements, optical networks for radio applications.	10
VTT Oulu	Senior Engineer (P Karioja)	2	4.4	Photonic packaging and integration.	8
VTT Espoo	Senior Research Engineer (I. Suni)	1	1	High-density array interconnect technology, Heterogeneous integration by direct silicon wafer bonding	3

WORKING TOGETHER (1/2)

- ACEOLE partners
 - Pre-existing relationships and/or collaborations
 - CERN services tailored to support international collaborations
- EU funding covers People:
 - Researcher salaries + social conditions
 - Training & Mobility
 - ITN Management
 - Organization of workshops, conferences
 - » *See Seamus' presentation*
 - **It does not cover research project costs**
 - » That's why ACEOLE research projects have been integrated into CERN's approved R&D programme

WORKING TOGETHER (2/2)

Supervisory Board

(Kick-off + 6 months, then ~ once per year)

- Approve and oversee implementation of training programme for scientific, technical and complementary skills;
Co-ordination of the network-wide training activities;
- Monitor/evaluate overall progress of research training program;

Management Committee

(At least twice per year)

- Overall management of research programme;
- Implement training activities with associated partners;
- Management & follow-up progress of the individual projects;
- Organization network-wide training (courses, workshops, etc);
- Overview integration of Researchers into research team(s);
- Review of the Personal Career Development Plans;
- Dissemination of best practice and project results.

Sharing information

- Use of SharePoint tool (www.cern.ch/aceole)
>> Robert's presentation

Deliverables

1. Annual S&T and management/financial reports
2. Prepare workshops & training events

