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# EuCARD

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Combination of Collaborative Project and Coordination and Support Action

## PROJECT INTERIM REPORT

# WORK PACKAGE INTERIM ACTIVITY REPORT FOR SEMESTER 3

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<b>Work Package:</b>	WP4: AccNet
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### 1. PUBLISHABLE SUMMARY

During the third semester, AccNet has made excellent progress in connecting the European and worldwide accelerator communities, fulfilling its role as catalyser between various institutes and entities, with a special emphasis on accelerator performance and RF technologies. AccNet highlights during the reporting period included the launch of a new network on proton-driven plasma acceleration, the exploration of a possible second new network on medical accelerators, and the preparation of four high-impact AccNet workshops on a higher-energy LHC, LHC crab cavities, crystal collimation, and RF technologies, respectively, in the fourth quarter of 2010.

AccNet also co-sponsored the conferences "MIXDES2010" in June 2010. An AccNet General Steering Meetings took place in April 2010. The AccNet web site at LAL and the AccNet mailing lists were continually updated. The lists of contact persons from all participating institutes for both networks have been expanded. Man power and budget plans were updated. AccNet dissemination & outreach activities comprised a seminar talk at KEK. About 20 new EuCARD AccNet documents testify to the success of the network. These include 8 conference papers.

In summary, AccNet has made an impact on the most relevant topics, in particular it is further pushing the crab-cavity program for the LHC, helped revising the LHC upgrade strategy, and supported the first looks at a higher-energy LHC. AccNet has also operated highly cost efficiently. During the semester, 10 visitors or conference/workshop participants were supported, including 9 students.

All AccNet success indicators are positive; EuroLumi is giving significant input to the LHC luminosity and energy upgrade; RFTech is organizing the RF community; AccNet is breaking new grounds on plasma acceleration, crystal collimation, and medical accelerators.

## 2. WORK PROGRESS AND ACHIEVEMENTS DURING THE PERIOD

### 2.1. WP4: ACCELATOR NETWORKS (ACCNET)

#### 2.1.1. Task WP4.1: Coordination and communication

##### **Objectives**

Throughout the programme, this task represents AccNet in EuCARD and the outside. It also communicates achievements.

##### **Progress**

At the First Annual EuCARD meeting at RAL/UK on 14 April and at the 5<sup>th</sup> meeting of the EuCARD Steering Committee on 12 October the status and plans of AccNet were reported.

A general AccNet Steering Meeting was organized on 13 April, at RAL/UK.

During this semester AccNet prepared the launch of a new network on plasma wake field acceleration (PWAN) due to start in October, and it is exploring the scientific scope plus candidate participants for a fourth network, on medical accelerators.

Presentations featuring results of AccNet studies were given at various occasions during this period, e.g. at the KEK Accelerator Seminar, at the MixDes Conference, to several LHC experiments, and to various scientific bodies and committees (e.g. LHCC, LHC Upgrade Task Force).

Several future AccNet mini-workshops have been prepared, on a higher-energy LHC (HE-LHC), crystal collimation, LHC crab cavities, and RF technologies, respectively.

The AccNet web site was continually updated and expanded. Budget and manpower plans were also updated and adjusted. Lists of EuroLumi and RFTech contact persons at participating institutes, and pertinent mailing lists were maintained.

##### **Contractual milestones and deliverables**

There were no official deliverables for this reporting period. The AccNet web site (D 4.1.1.) created in the first semester was continually updated. A general AccNet Steering meeting was organized in April 2010.

##### **Planning, deviations and corrective actions**

Task on schedule	√	Ahead of schedule		Minor delay		Significant delay	
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##### **Estimate of use of resources**

Partner	Personnel					Material				
	++	+	=	-	--	++	+	=	-	--
CERN			*					*		
CNRS			*					*		

**Plans for next semester**

- Representation of AccNet at the Second EuCARD Annual Meeting with status report and highlight talks in spring 2011
- Third general AccNet Steering Meeting in spring 2010
- Dissemination of AccNet results, e.g. in the EuCARD Newsletter and general presentations or seminars
- Representation of AccNet, including report on status & plans, at EuCARD Steering Meetings

**2.1.2. Task WP4.2: EUROLUMI****Objectives**

The objective of EuroLumi is bringing together experts in beam dynamics, magnets, collimation, RF, and accelerator applications to improve the performance of existing accelerators and prepare upgrades of these as well as new facilities. In particular, EuroLumi is preparing the upgrade of the Large Hadron Collider (LHC), the FAIR complex at GSI, and the rejuvenation of the CERN injector complex. Interim EuroLumi has encouraged and supported new initiatives on proton driven plasma acceleration and on medical accelerators, giving birth (or semi-birth) to two new networks within AccNet.

**Progress**

A number of high-impact mini-workshops were being prepared, among which the first AccNet workshop on a Higher-Energy LHC (HE-LHC), the fourth workshop on LHC crab cavities, an annual workshop on crystal collimation, and the second RFTech Annual workshop. A written proposal for a first demonstration experiment on proton-driven plasma acceleration using the beam from the CERN SPS or PS was being finalized. AccNet supported the MixDes 2010 conference.

AccNet-EuroLumi supported or organized a number of exchanges of scientists and joint studies. The Mexican doctoral student H. Maury (CINVESTAV/Merida) arrived at CERN for a one-year visit, to perform electron-cloud simulations for the various LHC upgrade scenarios, the present LHC, and the SPS. The Mexican master student B. Yee (CINVESTAV/Mexico City) was supported by a two-month stay, modelling the effect of LHC crab-cavity failures in view of machine protection. The US-LARP physicist C. Bhat (FNAL) studied the generation & stability of intense, long and/or flat bunches in LHC, SPS and PS. US-LARP physicist R. Calaga (BNL) pushed forward the LHC crab cavities and organized the international collaboration.

The AccNet-EuroLumi web site was continually updated and expanded.

**Contractual milestones and deliverables**

There were no official deliverables for this reporting period. The EuroLumi web site (D 4.2.1.) created in the first semester was continually updated. Instead of a single Annual EuroLumi workshop, 3 EuroLumi topical workshops will be organized during the last three

months of the year. The first of these is the workshop on a higher-energy LHC with about 55 participants scheduled in October.

**Planning, deviations and corrective actions**

Task on schedule	√	Ahead of schedule		Minor delay		Significant delay	
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**Estimate of use of resources**

Partner	Personnel					Material				
	++	+	=	-	--	++	+	=	-	--
CERN			*					*		

**Plans for next two semesters**

- AccNet(-EuroLumi) co-sponsors Channeling conference, Ferrara, October 2010
- Workshop on LHC energy upgrade, addressing physics case, magnets, superconductors, synchrotron radiation, cryogenics and vacuum, beam dynamics, and injectors, in October 2010
- Crystal collimation mini-workshop in October 2010
- Workshop on LHC crab cavities, in December 2010
- Brainstorming meetings and mini-workshop on medical accelerators
- Continued or repeated visits by C. Bhat (FNAL, LARP), H. Maury (CINVESTAV) and, possibly, B. Yee (CINVESTAV) to work on topics related to the LHC luminosity upgrade
- Workshop on plasma acceleration in spring 2011 (within the frame of the new network PWAN)
- Mini workshop on advanced collimator technologies in fall 2011
- Workshop on optics design, IRs, RF, injection, extraction and collective effects for the High-Luminosity and High-Energy LHC.

**2.1.3. Task WP4.3: RFTECH**

The objective of RFTech is bringing together RF experts from different laboratories, proton & electron accelerators, ILC, CLIC, FAIR, etc. to exchange ideas and promote innovation on all aspects of RF technology, e.g. klystron development, RF power distribution system, cavity design, and low-level RF system, for linear accelerators, storage rings, and associated research infrastructures, including transversely deflecting (crab) cavities and financial aspects such as costing tools.

**Progress**

RFTech supported the attendance to the MIXDES 2010 (MIXed DESign of integrated circuits and systems) conference held in Wroclaw (Poland) from 24 to 26 June 2010. The “xTCA” part of the conference was organized by Dr Makowski (Lodz University), a member of the RFTech network, and by Dr Simrock (ITER). This session was devoted to the development of instrumentation applied in High Energy Physic, where hardware should be characterized by

high reliability, availability and serviceability, and several standards (MTCA, ATCA or AMC) are under development, profiting from high-speed serial interfaces. The xTCA objectives are to simplify the applications of MTCA and ATCA hardware in high energy physics.

French “Grand Emprunt”: Thanks to the RFTech network and after fruitful exchanges with CERN, a proposal was prepared for an EQUIPEX label (“EQuipement d’EXcellence”) and LABEX label (“LABoratoire d’EXcellence”) on the LHC crab-cavity development. The submission of the EQUIPEX was done in September. The LABEX document is under preparation (to be completed by end of October).

The next RFTech workshop will held at PSI Villigen (Switzerland) on 2-3 December 2010. The preliminary scientific program focuses on RF cavity and couplers design (crab cavity design, SC/NC cavity development, power couplers), Superconducting RF (RF control, piezo control of detuning, infrastructures), Low-level and high-power RF systems (new electronics for LLRF, klystrons, solid state amplifiers), costing tools and reliability.

#### **Contractual milestones and deliverables**

There were no official deliverables for this reporting period. The RFTech web site (D 4.3.1.) created in the first semester was continually updated. The Annual REFtech workshop was organized in March 2010.

#### **Planning, deviations and corrective actions**

Task on schedule	√	Ahead of schedule		Minor delay		Significant delay	
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#### **Estimate of use of resources**

<i>Partner</i>	<i>Personnel</i>					<i>Material</i>				
	++	+	=	-	--	++	+	=	-	--
CERN			*					*		
DESY			*					*		
UJF				*					*	

**Comments:** EU funding is shared between CERN, DESY and UJF. The first workshop has been organized by DESY, and as a result the use of resources is presently lower for UJF. Financial support for MIXDES2010 as well as for the RFTech workshop at PSI will be provided by UJF.

#### **Plans for next two semesters**

- Second RFTech Annual Meeting at PSI, end of 2010
- AccNet(-RFTech) co-sponsors MIXDES conference, Gliwice, June 2011
- Third RFTech Annual Meeting in 2011

### 3. ANNEXES

#### 3.1. EVENTS

AccNet events held during this semester are listed on the AccNet web site <http://accnet.lal.in2p3.fr/Tasks/Workshops/index.php>.

#### 3.2. PUBLICATIONS AND DOCUMENTS IN THIS SEMESTER

<b>WP 4.1:</b> (written before this semester: 10)
F. Zimmermann, EuCARD WP4 Accelerator Networks, Report at 5th EuCARD Steering Committee Meeting Malta, 11 October 2010
F. Zimmermann, LHC Beyond 2020, KEK Accelerator Seminar, Kobayashi Hall, 14 July 2010
F. Zimmermann, Machine Plans for Upgrades - SLHC-type Luminosities - Issues and Solutions, CMS Upgrade Week, CERN, 29 April 2010
A. Caldwell, Proton Driven Plasma Wakefield Acceleration, AccNet Highlight Talk at First Annual EuCARD Meeting, RAL, UK, 14 April 2010
R. Calaga, LHC Crab Cavities, AccNet Highlight Talk at First Annual EuCARD Meeting, RAL, UK, 14 April 2010
F. Zimmermann, Report from EuCARD WP4 - Accelerator Networks, First Annual EuCARD Meeting, RAL, UK, 14 April 2010
F. Zimmermann, AccNet, First Annual AccNet Meeting, RAL, UK, 13 April 2010
<b>WP 4.2:</b> (written before this semester: 18)
B. Yee Rendon, Manual of Crab-Cavity Analysis Tools, September 2010
B. Yee Rendon, Crab Cavity Voltage Calculation, September 2010
B. Yee Rendon, Setting Up Simulations of Failure Scenarios for a Crab Cavity in the Nominal LHC, September 2010
B. Yee Rendon, Setting up Simulations of Failure Scenarios for a Crab Cavity in the Nominal LHC, Accelerator Seminar, CERN, 22 September 2010
K. Ohmi, Beam-Beam Studies for the High-Luminosity and High-Energy LHC Plus Related Issues for KEKB, Accelerator Seminar CERN, 24 August 2010
J. Gajda, R. Romaniuk, Development of laser technology in Poland
F. Zimmermann, Summary of the LHC-CC09 Crab-Cavity Advisory Board Meeting
R. Calaga, F. Zimmermann et al, Summary of the 3rd LHC Crab Cavity Workshop (LHC-CC09)
H. Maury Cuna, Study of the Heat Load due to the Electron Cloud in the LHC and in Higher-Luminosity LHC Extensions (English version), Master Thesis U. Merida, August 2009
<b>WP 4.3:</b> (published before this semester: 3)
T. Kozak, D. Makowski, AMC radiation monitoring module for ATCA/ $\mu$ TCA based Low



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Level RF Control System, Proceedings of MIXDES 2010 Conference, pages 125-128.
K. Czuba, M. Ladno, AMC Timing receiver and clock synthesizer module for the LLRF system, Proceedings of MIXDES 2010 Conference, pages 129-132.
J. Wychowaniak, D. Makowski, P. Predki, A. Napieralski, Application for management and monitoring of xTCS software, Proceedings of MIXDES 2010 Conference, pages 133-138.
P. Perek, D. Makowski, P. Predki, A. Napieralski, ATCA carrier board with dedicated IPMI controller, Proceedings of MIXDES 2010 Conference, pages 139-143.
S. Bou Habid, K. Czuba, W. Jalmuna, T. Jezynski, Design of eight channel ADC card for GHz signal conversion, Proceedings of MIXDES 2010 Conference, pages 144-147.
A. Piotrowski, D. Makowski, PCIExpress hot-plug mechanism in linux-based ATCA control systems. Proceedings of MIXDES 2010 Conference, pages 1148-151.
K. Prygoda, T. Pozniak, D. Makowski, T. Kozak, M. Wisniewski, A. Napieralski, M. Grecki, Power supply unit for ATCA-based piezo compensation system, Proceedings of MIXDES 2010 Conference, pages 152-156.
M. Grecki, Sub-LSB DAC resolution enhancement applied to LLRF control, Proceedings of MIXDES 2010 Conference, pages 157.
P. Drabik, K. Pozniak, Object oriented programming environment for reconfigurable applications implemented in FPGA chips
L. Dymanowski, K. Lewandowski, M. Linczuk, A project of universal computing platform - cluster of floating point DSP processors (Projekt uniwersalnej platformy obliczeniowej - klastra zmiennoprzecinkowych procesorów DSP)
K. Pozniak, T. Stanislawski, W. Zabolotny, W. Koehler, F. Stephan, S. Simrock, Indirect method of measuring changes of EM field in RF-gun cavity for XFEL accelerator (Pośrednia metoda pomiaru zmian pola we wnętrzu działa elektronowego akceleratora XFEL)
T. Stanislawski, T. Czarski, K. Pozniak, R. Romaniuk, Conditioning of complex envelope signal from FLASH accelerator cavities (Kondycjonowanie sygnału obwiedni zespolonej z wnętrza akceleratora FLASH)
J. Glowka, M. Macias, K. Czuba, K. Pozniak, R. Romaniuk, Stanowisko testowe z miedzianą strukturą typu TESLA (Test stand with copper TESLA structure)
R. Romaniuk, Photonics and Web Engineering: WILGA 2009