

Frank Zimmermann  
for the WP4 coordinators

EuCARD - WP4 Meeting, RAL, 13 April '10

# accelerator landscape

major events in 2009-13

LHC turn on & first physics results

FAIR & XFEL construction

major LHC upgrade (LINAC4)

decisions on LHC upgrades

decision on future Linear Collider

FLASH & CTF-3 exploitation

*a truly exciting time*



# ACCNET



## Accelerator Science Networks



### Coordination & Management

coordinated by

Walter Scandale, IN2P3 ; Alessandro Variola, LAL ;  
Peter Spiller, GSI ; Frank Zimmermann, CERN



### EUROLUMI

*accelerators & colliders  
performance*

coordinated by

Frank Zimmermann, CERN  
Ezio Todesco, CERN



### RFTECH

*sc & nc rf technologies*

coordinated by

Jean-Marie de Conto, UJF  
Mariusz Grecki, DESY  
Wolfgang Weingarten, CERN

## **AccNet Motivation**

**“The two legs of accelerator technology (magnets and acceleration) need significant progress and a reduction of their development time (now decades).**

**The challenges are beyond what a single lab can do. An optimal use of public resources and a minimum ecological impact will be more and more important. New ideas are needed.**

**ACCNET networks offer a platform for listening and discussing accelerator R&D issues across specialties and beyond daily occupations, to favor the emergence of creative ideas.”**



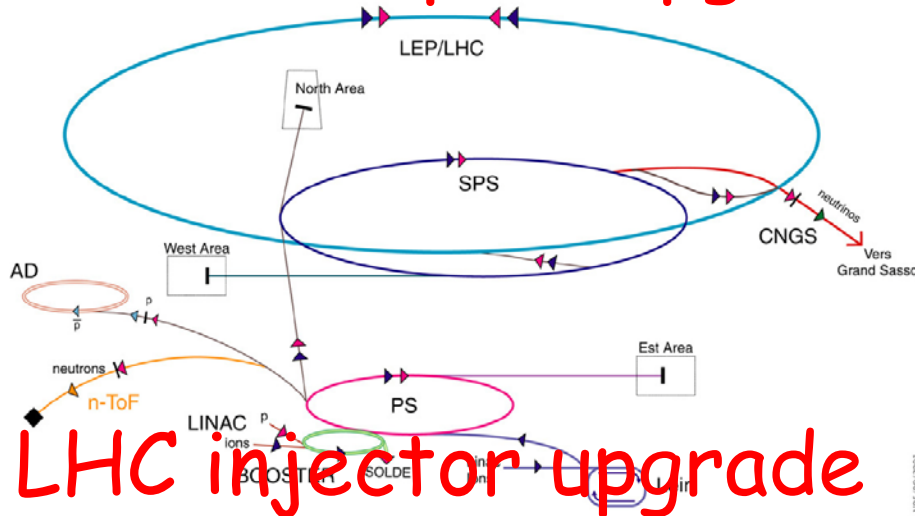
# EUROLUMI

brings together experts in beam dynamics, magnets, collimation & RF

FAIR



CERN complex upgrade



LHC injector upgrade

▶ p (proton)      ▶ (antiproton)  
 ▶ ion            ▶ proton/antiproton conversion  
 ▶ neutrons      ▶ neutrons

AD Antiproton Decelerator      LHC Large Hadron Collider  
 PS Proton Synchrotron          n-ToF Neutrons Time of Flight  
 SPS Super Proton Synchrotron      CNGS Cern Neutrinos Grand Sasso

## LHC phase-2 upgrade paths for IP1 & 5

**early separation (ES)** J.-P. Koutchouk

stronger triplet magnets

small-angle crab cavity

**full crab crossing (FCC)** L. Evans, W. Scandale, F. Zimmermann

stronger triplet magnets

small-angle crab cavity

LHC IR & beam parameter upgrade

**large Piwinski angle (LPA)**

wire compensator

**low emittance (LE)** R. Garoby

- ultimate beam (1.75x10<sup>11</sup> p/s/bunch, 25 ns spacing)
- early-separation dipole inside detectors,  $\beta^* \sim 10$  cm
- hardware inside LHC IR CMS detector
- hardware on crab cavities, off- $\beta$  beat
- ultimate LHC beam (1.7x10<sup>11</sup> p/s/bunch, 25 ns spacing)
- $\beta^* \sim 10$  cm
- crab cavity with 0% transverse voltage
- hardware on crab cavities, off- $\beta$  beat
- 50 ns spacing, longer & more intense bunches (5x10<sup>11</sup> p/s/bunch)
- $\beta^* \sim 25$  cm, no elements inside detectors
- long-range beam-beam wire compensation
- ultimate LHC beam (1.7x10<sup>11</sup> p/s/bunch, 25 ns spacing)
- $\beta^* \sim 10$  cm
- smaller transverse emittance
- novel operating regime for hadron colliders, beam generation
- constraint on new injectors, off- $\beta$  beat

+  
 medical accelerators  
 +  
 plasma acceleration

# EUROLUMI themes

LHC IR upgrade: IR magnet technology; heat deposition & shielding; magnet lifetime; performance reach; ...

LHC beam parameter upgrade: beam generation, beam stability; beam-beam performance & compensation; crab cavities; luminosity leveling; machine protection; collimation upgrade; crab waists; intensity limits ...

FAIR: beam losses; space-charge effects; vacuum; aperture; ramping issues; ...

CERN complex upgrade: SPS electron-cloud mitigation; impedance effects; intensity limits; beam manipulation; PS booster upgrade ; SPL ; ...

LHC energy upgrade: beam dynamics, magnets, ...

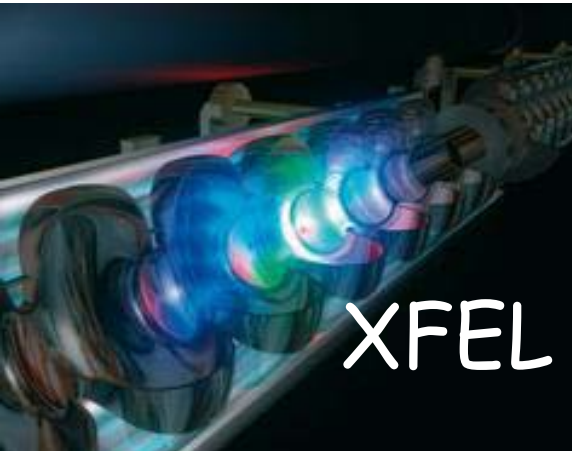
Applications for society: medical accelerators

Advanced techniques: plasma acceleration, crystal tools

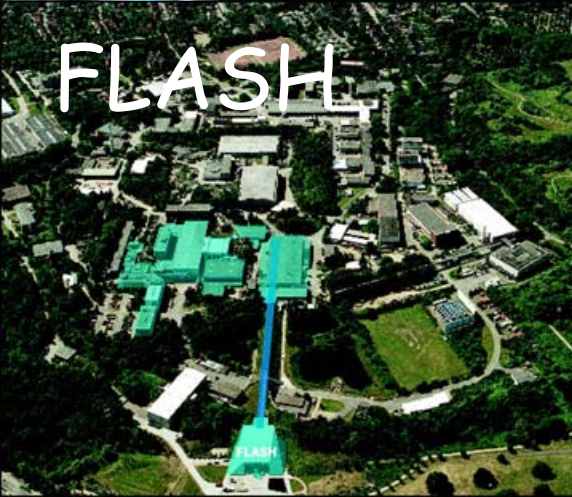


# RFTECH

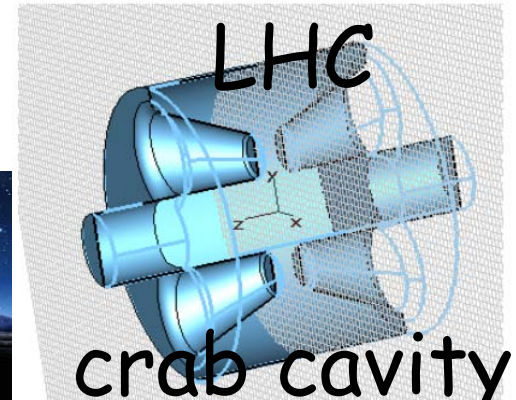
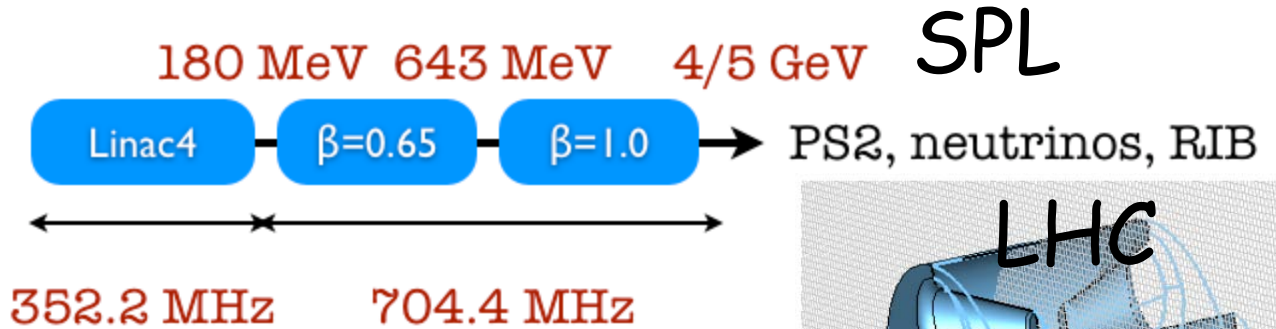
brings together RF experts from different labs, proton & electron accelerators, CLIC and ILC, ... ; encompasses all aspects of RF technology, e.g. klystron development, RF power distribution system, cavity design, and low-level RF system, for linear accelerators, storage rings, and associated research infrastructures, including transversely deflecting (crab) cavities and financial aspects such as costing tools



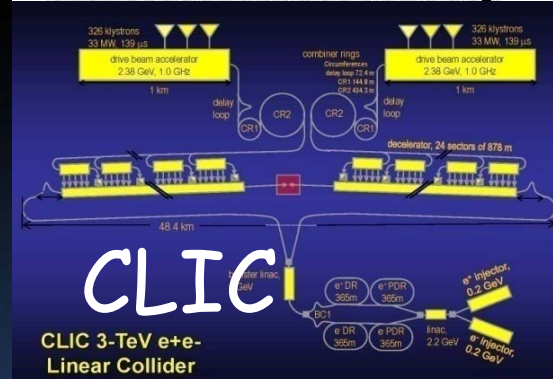
XFEL



FLASH



ILC



# RFTECH themes

low level RF: maintain RF phase (0.03 dg) & amplitude (0.03%); minimize power; built-in diagnostics; reliability; operability; reproducibility; maintainability; good understanding; development of LLRF costing tools based on SysML model; ...

cavity design: maximize gradient; minimize breakdown; optimize efficiency; minimize cost; minimize impedance; accelerating cavities; coupler design; PETS; compact crab cavities; ....

high power RF: power distribution system; design integration; costing tools; ...

SRF test infrastructures: establish multi-purpose state-of-the art network of equipment for R&D and test of SRF cavities and cryo-modules within 2 years; future projects - required equipment - project descriptions



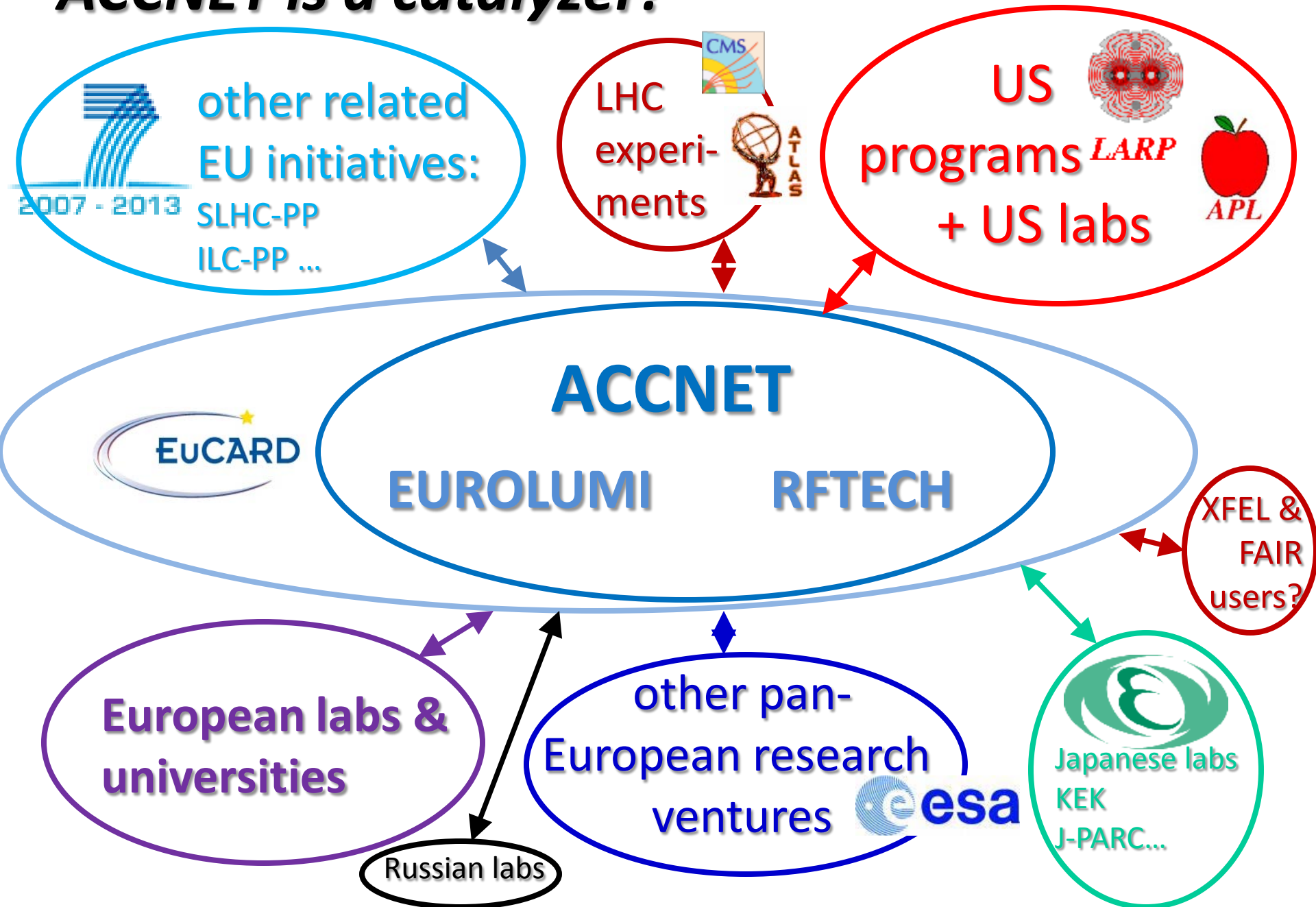
# ACCNET tools



- ❑ **annual workshops**
- ❑ **topical meetings and mini-workshops**
- ❑ **capability of inviting or exchanging experts over periods of typically a week to a month**
- ❑ **exploratory studies & collaborations**
- ❑ **opportunities for students**
- ❑ **unique place of discussion with users**

→ *exchange of ideas and expertise aimed identifying the most promising strategies and technologies*

# ACCNET is a catalyzer!



The participation is open inside and outside the consortium. A large number of institutes participate in ACCNET activities.



# work organization

- ***1 major workshop for EUROLUMI per year***
- ***1 major workshop for RFTECH per year***
- possibility of additional ***topical mini-workshops***
- possibility of ***joint EUROLUMI+RFTECH mini-workshops*** on topics of common interest (either by machine [SPL, LHC+injector RF upgrade, LHC crab cavities, GSI rf systems]; or by topic [RF phase and amplitude jitter, timing stabilization, beam loading compensation, flat bunches, controlled noise injection,...])
- ***1 ACCNET steering meeting / year***  
(ACCNET+EUROLUMI+RFTECH coordinators)



# first ACCNET meeting: 04.12.2008





# AccNet 1<sup>st</sup>-year achievements

- (invited) **talks** at **PAC 2009, EPS HEP2009 & LLRF09** conferences
- **AccNet workshop on LHC crab cavities**, LHC-CC09, September 2009
- **AccNet-EuroLumi workshop on anti-e-cloud coatings**, AEC'09, Oct '09
- **AccNet web site at LAL**
- **AccNet mailing lists**
- **contact persons** from all participating institutes for both networks
- **man power and budget plans**
- scope expansion to **plasma acceleration and medical accelerators**
- **AccNet-EuroLumi mini-Workshop on Crystal Collimation**, Nov. '09
- **AccNet-EuroLumi working meeting on proton driven plasma acceleration**, PPA'09, Dec. 2009
- **AccNet Co-Sponsored Workshop on "Physics for Health in Europe"**, Feb. 2010

# AccNet publications

## AccNet dissemination

- two **articles in 2<sup>nd</sup> EuCARD newsletter** (on LHC-CC09 + AccNet & on concept of proton plasma acceleration)
- one **article in CERN Courier** Feb. 2010 (on PPA'09 workshop)
- two **seminar talks** at DESY and University of Heidelberg
- CERN **Academic Training lecture series on LHC upgrade**
- presentations at **ATLAS upgrade week** and to **LHCC**
- presentations at **Chamonix'2010 LHC Performance Workshop** and to **LHC Upgrade Task Force**

## EuCARD AccNet documents

- about 20 in total, including
  - **2 journal articles**
  - **9 conference presentations**
  - **1 PhD thesis**
  - **1 master thesis**

# AccNet deliverables

D.4.1.1 - Continually updated **AccNet web site**

<http://accnet.lal.in2p3.fr/> )

D.4.2.1 - A continually updated **EuroLumi web site**

(<http://accnet.lal.in2p3.fr/Tasks/Eurolumi/> )

D.4.3.1 - A continually updated **RFTech web site**

(<http://accnet.lal.in2p3.fr/Tasks/Rftech/> )

The AccNet web sites are documented in a **report**

<https://edms.cern.ch/file/1001866/4/EuCARD-Del-D4.1.1-D4.2.1-D4.3.1-1001866-v3.0.pdf>

The completed deliverables are publicly available from the web link

<http://cern.ch/EuCARD/about/results/deliverables/> .



# AccNet milestones

## M.4.1.1

- 1<sup>st</sup> **RFTech videoconference steering meeting** 30 March
- **general AccNet Steering meeting** during the 2nd EuCARD Steering Committee meeting in November 2009 at Frascati.

## M4.2.1:

- Instead of a general annual EuroLumi workshop, **4 topical mini-workshops** have been organized and supported during this first year (high efficiency of topical workshops; minimum interference with LHC consolidation and re-commissioning): **LHC-CC09, AEC'09, CrystalCollimation'09, PPA'09**
- **first major EuroLumi workshop in fall 2010**

## M4.3.1:

- Annual **RFTECH workshop was held on 29 March 2010**

# AccNet expenses

per diem for **Mexican CINVESTAV visitor** H. Maury (2 months)

travel support of **CCAB member** Georg Hoffstaetter  
for LHC-CC09

travel support of **expert** David Seebacher for AEC'09

travel support for **crystal experts** (A. Taratin, S. Dabagov)

moderate **support for** LHC-CC09 and AEC'09 **workshops**

**travel expenses** for 4 persons (DESY, WUT) attending **LLRF'09**

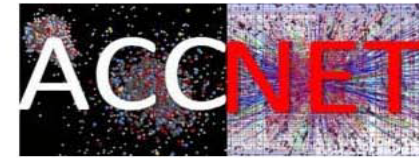
travel costs for **2<sup>nd</sup> SC mtg** and **EuCARD annual meeting**

**others ?**

# AccNet web site



**Accelerator Science  
Networks**  
EuroLumi and RFTech



Coordinated by [W. Scandale](#)

*AccNet is a Networking Activity (WP4) in the framework of [EuCARD](#)*

[A. Variola](#) and [F. Zimmermann](#) (*Coordinated Accelerator R&D in Europe*)

<a href="#">Main Objectives</a>	<a href="#">Network Structure</a>	<a href="#">Activity Reports</a>	<a href="#">WP4 Collaboration Workspace</a>	<a href="#">Job Opportunities</a>	<a href="#">Workshops</a>	<a href="#">Literature and Presentations</a>	<a href="#">Links</a>
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Notice: this site is under construction. Please accept our apologies for its incompleteness and yet missing information.

created & maintained  
by Bernard Mouton,  
Serge Du, J. Yuan, and  
Alessandro Variola (LAL)

**AccNet is composed of two sub tasks**

<a href="#">EuroLumi</a>	<a href="#">RFTech</a>
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updated by  
Frank Zimmermann  
(CERN)

## Hot News

- 9-10 November 2009 EuCARD-AccNet-EuroLumi mini-Workshop on Crystal Collimation, at CERN - **NEW!**
- 2-4 February 2010 AccNet Co-Sponsored Workshop on "Physics for Health in Europe", CERN - **NEW!**
- spring 2010 topical workshop on plasma acceleration - **NEW!**
- spring or fall 2010 AccNet-EuroLumi workshop on LHC upgrade paths - **NEW!**

*AccNet Articles in EuCARD Newsletter no 2 (September 2009):*

[Start by probing the crab cavities](#)  
[Breaking news for Proton "Surfatrons"](#)

# AccNet EuroLumi institutes & contacts

Institute	Name	Institute	Name
<a href="#"><u>BNL</u></a>	Calaga Rama	<a href="#"><u>GSI</u></a>	Boine-Frankenheim Oliver
	Drees Angelika	<a href="#"><u>INFN-LNF</u></a>	Biagini Marica
	Fischer Wolfram		Palumbo Luigi
	Peggs Steve		Spataro Bruno
<a href="#"><u>CERN</u></a>	Bottura Luca	<a href="#"><u>INFN-NA</u></a>	Vaccaro Vittorio
	Todesco Ezio	<a href="#"><u>KEK</u></a>	Ohmi Kazuhito
	Zimmermann Frank	<a href="#"><u>LBNL</u></a>	Furman Miguel
<a href="#"><u>CI</u></a>	Chattopadhyay Swapan	<a href="#"><u>MPP</u></a>	Caldwell Allen
<a href="#"><u>CNRS-LAL</u></a>	Mouton Bernard		Xia Guoxing
	Scandale Walter	<a href="#"><u>TEMF</u></a> <a href="#"><u>Darmstadt</u></a>	Mueller Wolfgang
	Variola Alessandro		Weiland Thomas
<a href="#"><u>CNRS-LPSC</u></a>	Baylac Maud	<a href="#"><u>TUBE</u></a>	Bruns Warner
<a href="#"><u>CSIC - IFIC</u></a>	Faus Golfe Angeles		Henke Heino
<a href="#"><u>DESY</u></a>	Mais Helmut	<a href="#"><u>UJF</u></a>	De Conto Jean-Marie
<a href="#"><u>FNAL</u></a>	Bhat Chandra	<a href="#"><u>UOM</u></a>	Sammur Nicholas
	Sen Tanaji	<a href="#"><u>UPSA</u></a>	Ekelof Tord
	Shiltsev Vladimir	<a href="#"><u>USAN</u></a>	Petracca Stefania
	Valishev Alexander		



# AccNet RFTech institutes & contacts

Institute	Name
<a href="#">BESSY Berlin</a>	Knobloch Jens
<a href="#">BNL</a>	Ben-Zvi Ilan
	Calaga Rama
<a href="#">CEA-DSM</a>	Chel Stéphane
	Daël Antoine
	Devanz Guillaume
<a href="#">CERN</a>	Duperrier Romuald
	Angoletta Maria Elena
	Brunner Olivier
	Calatroni Sergio
	Capatina Ofelia
	Chiaveri Enrico
	Garoby Roland
	Hofle Wolfgang
	Jensen Erk
	Junginger Tobias
	Montesinos Eric
	Ruber Roger
	Vretenar Maurizio
Vullierme Bruno	
Weingarten Wolfgang	
<a href="#">CI</a>	McIntosh Peter
<a href="#">CNRS-IPNO</a>	Bousson Sébastien
	Gardès Daniel
	Gassot Hui Min
	Olry Guillaume
<a href="#">CNRS-LAL</a>	Mouton Bernard
	Variola Alessandro
<a href="#">Darmstadt University-IKP</a>	Eichhorn Ralf

Institute	Name
<a href="#">WUT</a>	Czuba Krzysztof
<a href="#">DESY</a>	Elsen Eckhard
	Grecki Mariusz
	Nietubyc Robert
	Proch Dieter
	Simrock Stefan
<a href="#">ESRF</a>	Jacob Jorn
<a href="#">FZD</a>	Teichert Jochen
<a href="#">Goettingen University</a>	Quadt Arnulf
<a href="#">GSI</a>	Huelsmann Peter
<a href="#">IFJ PAN</a>	Wierba Wojchiech
<a href="#">INFN-LNF</a>	Ghigo Andrea
<a href="#">INFN-Milano</a>	Pagani Carlo
<a href="#">INFN-Roma</a>	Tazzari Sergio
<a href="#">Institute for Nuclear Studies, Swierk</a>	Wronka Slawomir
<a href="#">Karlsruhe University?</a>	Ustinov Alexey?
<a href="#">LPNHEP (IN2P3 Jussieu)</a>	Augustin Jean-Eudes
	Debu Pascal
<a href="#">Rostock University</a>	Glock Hans-Walter
	van Rienen Ursula
<a href="#">Royal Holloway</a>	Molloy Stephen
<a href="#">TEMF Darmstadt</a>	Mueller Wolfgang
	Weiland Thomas
<a href="#">TUL</a>	Makowski Dariusz
	Napierski Andrzej
	Smage Bogna
<a href="#">UFJ and LPSC</a>	De Conto Jean-Marie
<a href="#">Wuppertal University</a>	Mueller Guenter

# EuroLumi exchanges & joint studies

Mexican summer student Humberto Maury (CINVESTAV)

- **e-cloud simulations for LHC upgrade scenarios**

US-LARP physicist Chandra Bhat (FNAL)

- **generation & stability of long flat bunches for LHC**

US-LARP physicist Rama Calaga (BNL)

- **LHC crab cavities**

Austrian physicist David Seebacher (TU Graz & U. Vienna)

- **impedance of anti-e-cloud coatings**

US expert Georg Hoffstaetter

- **LHC crab cavities**

German experts Allen Caldwell, Guoxing Xia (MPI Munich)

- **proton-driven plasma acceleration**

Russian and European experts A. Taratin (JINR Dubna), S.

- Dabagov (INFN-LNF) – **crystal collimation**

# LHC-CC09 workshop

**LHC Crab Cavity Workshop,  
jointly organized by CERN,  
EuCARD-ACCNET, US-LARP,  
KEK, & Daresbury  
Lab/Cockcroft Institute  
CERN, 16-18 September 2009**



~50 participants, LHC Crab Cavity Advisory Board established





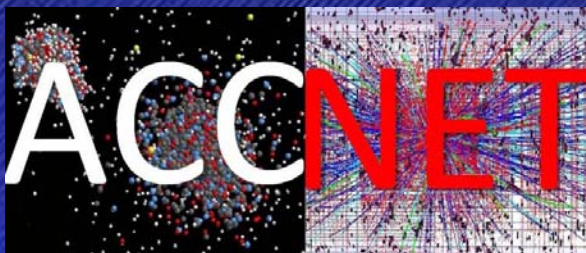
# AEC'09 workshop on Anti e-Cloud Coatings

<http://indico.cern.ch/conferenceDisplay.py?confId=62873>

organized by EuCARD-AccNet-EuroLumi



<http://eucard.web.cern.ch/EuCARD/index.html>



<http://accnet.lal.in2p3.fr/>



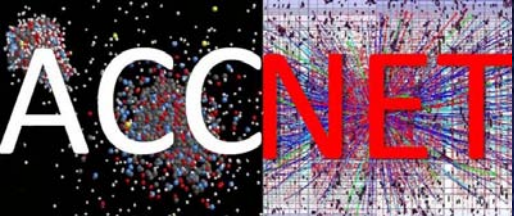
and SPS Upgrade Study Team

<http://paf-spsu.web.cern.ch/paf-spsu/>

*41 participants*







# AccNet mini-workshop on crystal collimation

9-10 November '09, ~20 participants

<http://indico.cern.ch/conferenceDisplay.py?confId=71773>

## topics:

SPS MDs: beam set up, detectors, data analysis,  
simulations, halo cleaning

Tevatron T980 for 2009-10

Tests and test beams: IHEP activities, crystal  
measurements, MVR, compact TPC at H8,  
nuclear interaction, RP2 status

Future of UA9





# AccNet workshop on *proton driven plasma acceleration* “PPA09”

17-18 December '09, 24 participants

CERN COURIER

<http://indico.cern.ch/conferenceDisplay.py?confId=74552>

Feb 24, 2010

**Workshop pushes proton-driven plasma wakefield acceleration**



# RFTech activities

joint organization of **LHC-CC09** together with EuroLumi

sLHC upgrade studies for Superconducting Proton Linac:

- established **contacts to European and worldwide experts on SRF**
- created **international working group on SRF cavities and accessories**

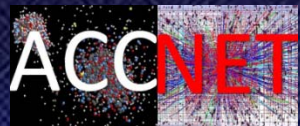
Members: CERN, CNRS-IPN-Orsay, CEA-Saclay (France), BNL (USA), TRIUMF (Canada), and University of Rostock (Germany)

This working group participated in several SPL collaboration meetings

<http://indico.cern.ch/conferenceDisplay.py?confId=63935>



# First Annual RFTech Meeting



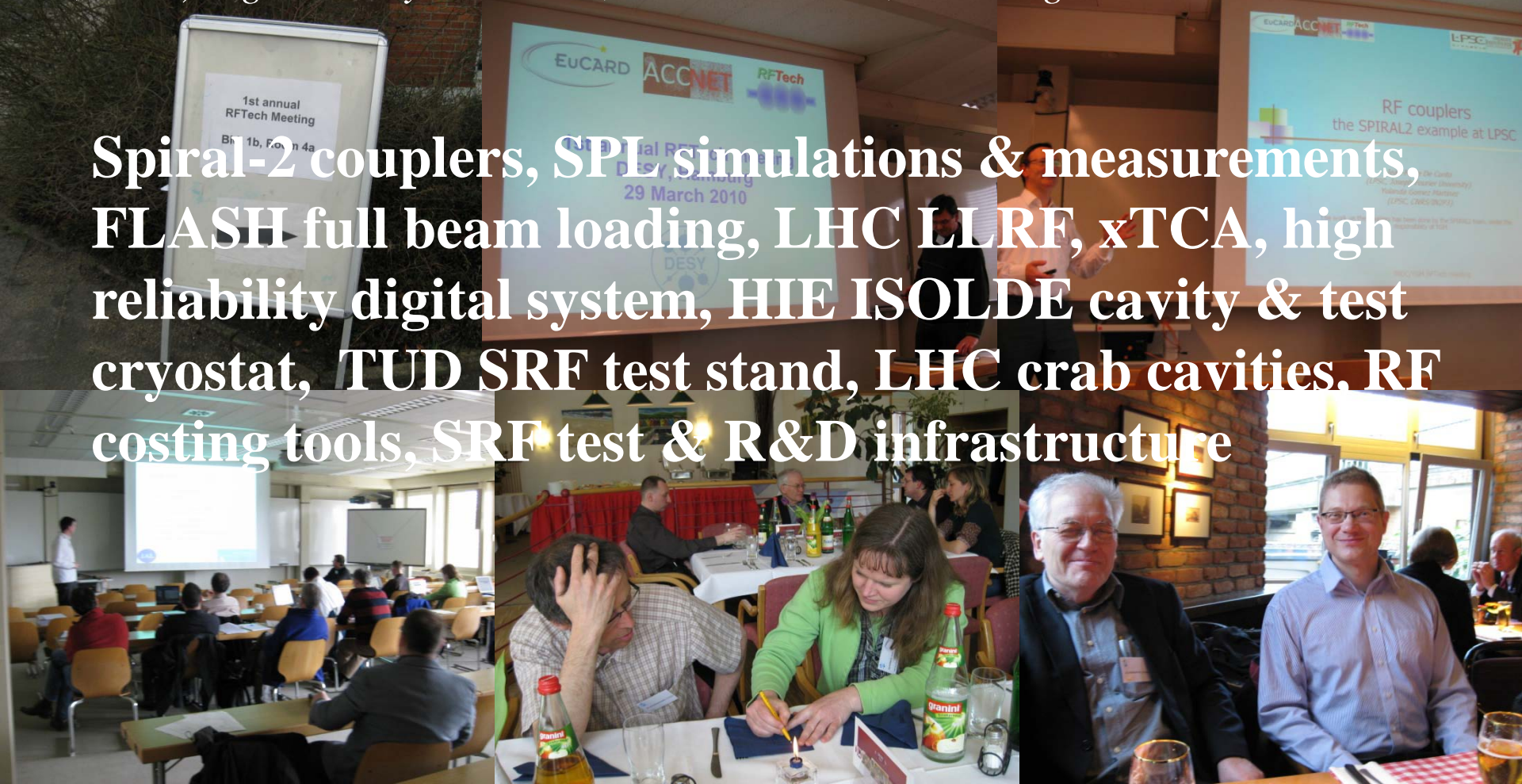
## DESY, 29 March 2010



<https://indico.desy.de/conferenceDisplay.py?confId=2831>

17 participants (DESY, CERN, TUD, UROS, ASTeC, LPSC, UFJ, ESS, U London, TUL, UG, SINS) organized by M. Grecki, J.-M. De Conto, W. Weingarten & DESY

Spiral-2 couplers, SPI simulations & measurements, FLASH full beam loading, LHC LLRF, xTCA, high reliability digital system, HIE ISOLDE cavity & test cryostat, TUD SRF test stand, LHC crab cavities, RF costing tools, SRF test & R&D infrastructure





# AccNet plans for 2010

## future AccNet workshops

- Topical workshop on **LHC energy upgrade**, Sept. or Oct. 2010
  - magnets for arcs and insertions, cryogenics, and vacuum pipe
- **“EuroLumi 2010”**, November or December 2010
  - LHC limitations, LHC luminosity upgrade, LHC energy upgrade, SPS upgrade, PS Booster upgrade, FAIR challenges
- Mini workshop on **LHC crab cavities**, end of 2010
- **Plasma acceleration** workshop
- **Crystal collimation** mini-workshop
- brainstorming meeting on **medical accelerators**

## major reviews of LHC upgrade scenarios

- beam parameters, magnet parameters, collimation limits
- luminosity evolution
- injector upgrade path
- energy upgrade
- intensity & luminosity limitations

comments, questions,  
proposals?