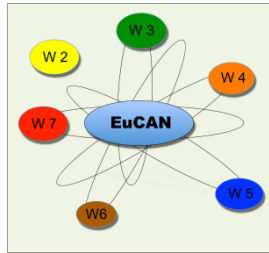




WP5 Extreme Beams & WP1 EuCAN



Frank Zimmermann
EuCARD-2 Annual Meeting
DESY, 17 May 2014

with input from Kurt Aulenbacher, Marica Biagini,
Mohamad Eshraqi, and Giuliano Franchetti



XBEAM network



**XBEAM helps pushing all accelerator frontiers:
luminosity, energy, beam power, beam intensity, and
polarization**

**luminosity: x10-100 (1000) higher than present state of
the art**

beam power: x10 higher

beam intensity: x10 higher

polarization: $\geq 60\%$ (p), $\geq 30\%$ (e^+), $\geq 80-90\%$ (e^-)

XBEAM structure



Task 5.1. Coordination and Communication

coordinated by F. Zimmermann (CERN), G. Franchetti (GSI)

Task 5.2. Extreme colliders (XCOLL)

coord: F. Zimmermann (CERN), M. Biagini (INFN-LNF)

Task 5.3. Extreme performance rings (XRING)

coord: G. Franchetti (GSI), J. Struckmeier (GSI)

Task 5.4. Extreme SC linacs (XLINAC)

coordinated by M. Eshraqi (ESS)

Task 5.5. Extreme polarization (XPOL)

coordinated by K. Aulenbacher (JGU Mainz)

WP5.1

Coordination and Communication

F. Zimmermann (CERN)

& G. Franchetti (GSI)

early WP5 achievements

web site created: <http://cern.ch/xbeam>

mailing lists created & 'filled':

eucard2-wp5-coordinators@cern.ch

eucard2-wp5.*-info@cern.ch

dissemination effort (invited talks)

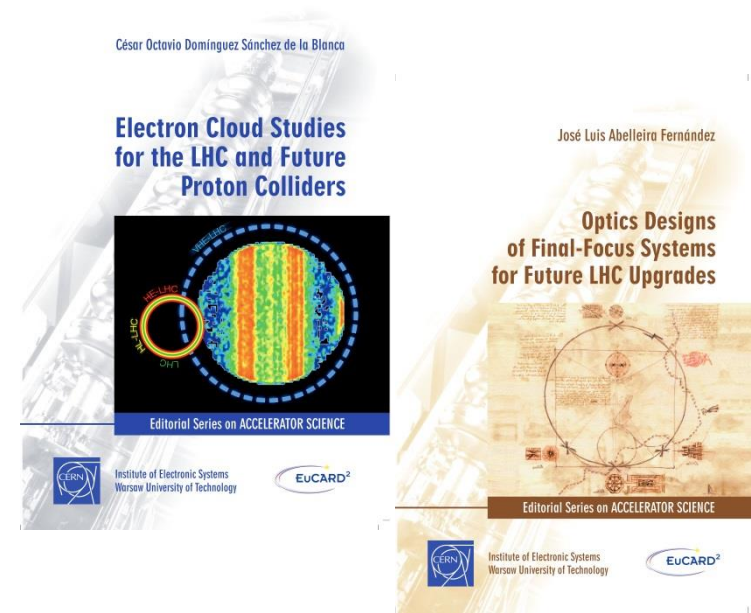
- F. Zimmermann, [LHC & Future High-Energy Frontier Circular Colliders](#), ISHP 2013, **Beijing/China**, 12 August 2013
- F. Zimmermann, [LHC & Future High-Energy Frontier Circular Colliders](#), CINVESTAV Merida/**Mexico** 5 September 2013
- K. Aulenbacher, [Electron Beam Polarimetry at ERL's](#), ERL2013 workshop, BINP, **Novosibirsk, Russia**, September 2013
- F. Zimmermann, [Future High Energy Circular Colliders](#), **DESY Hamburg**, 11 October 2013
- J.B. Rosenzweig (UCLA), [The Birth of the 5th Generation Light Source](#), ATS Seminar, CERN, 22 November 2013
- F. Zimmermann, [Zukünftige Beschleunigerprojekte am CERN](#), KfB Annual Meeting, **Darmstadt/Germany**, 29 November 2013
- F. Zimmermann, [CERN Future Circular Collider Study](#), **Beijing/China**, 16 December 2013
- F. Zimmermann, [The Next-Generation Particle Accelerator](#), IoP Joint HEPP & APP Meeting, Royal Holloway, U. London, **UK**, 9 April 2014

more dissemination effort (articles)

- Frank Zimmermann and Mathilde Chaudron, “[Exploring the accelerator frontiers](#)”, **Accelerating News #7, Autumn 2013**
- Michael Benedikt and Frank Zimmermann, “[CERN prepares for Future Circular Collider Study](#),” **Accelerating News #9, Spring 2014**
- Michael Benedikt and Frank Zimmermann, “[The Future Circular Collider study](#),” **CERN Courier, April 2014**

more dissemination effort (monographs)

- César Octavio Domínguez Sánchez De La Blanca “**Electron Cloud Studies for the LHC and Future Proton Colliders,**” **EuCARD(-2) Monograph No. 23**
- José Luis Abelleira Fernández, “**Optics Designs of Final-Focus Systems for Future LHC Upgrades,**” **EuCARD(-2) Monograph No. 24**



XBEAM steering events

- **1st XBEAM Steering Meeting**, CERN, 14 June 2013
 - **WP5 XBEAM status**, 2nd EuCARD-2 steering meeting, CERN, 11 September 2013
 - **WP5 XBEAM status**, 3rd EuCARD-2 steering meeting, Daresbury, 12 December 2013
 - **WP5 XBEAM status**, 4th EuCARD-2 steering meeting, CERN, 19 March 2014
- **2nd XBEAM Steering Meeting**, DESY, 19 May 2014

WP5.2

Extreme Colliders (XCOLL)

F. Zimmermann (CERN)
& M. Biagini (INFN-LNF)

XCOLL workshops so far

[TLEP6 workshop](#), CERN, 16-18 Oct. 2013

[SuperKEKB commissioning workshop](#), KEK, 11-13
Nov. 2013

[LHC-CC13 LHC crab-cavity workshop](#), CERN, 9-10
December 2013

[LHeC workshop](#), 20-21 January 2014

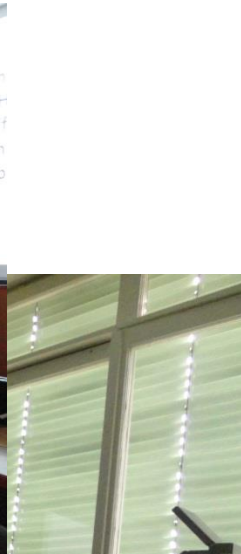
[“Future Circular Colliders Study Kickoff”](#), CERN,
12-15 Feb 2014

[Impedance 2014](#), Erice, Italy, 23-29 April 2014

TLEP6, 16-18 October 2013, 84

participants (USA: 5, Asia: 11, Mexico: 3, Europe: 66)

participation by CERN Director of Research Sergio Bertolucci, CERN Director of Accelerators & Technology Frederick Bordry, and former CERN DG Herwig Schopper



 <http://tlep.web.cern.ch/>
6th TLEP Workshop
@CERN
16-18 October 2013

TLEP Steering Committee

- Roy Aleksan - CEA-Saclay
- Patrizia Azzi - INFN/LPG
- Alain Blondel - Univ. Geneva
- John Ellis - Kings College London
- Patrick Janot - CERN-PH
- Markus Klute - MIT
- Mike Koratzinos - Univ. Geneva
- Jorg Wenninger - DESY-DE
- Martin Zanetti - INFN-IT
- Frank Zimmermann - CERN-DE

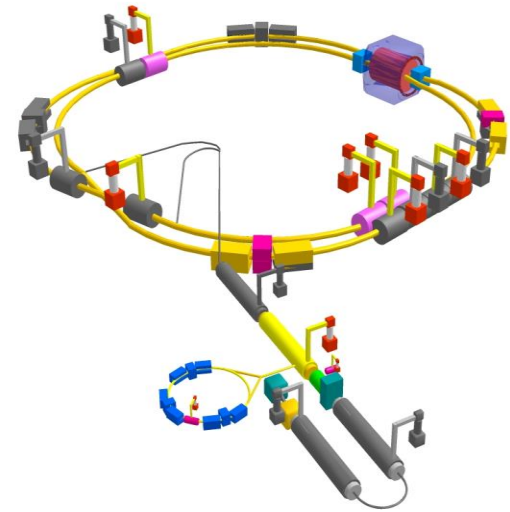
Registration link:
<https://indico.cern.ch/conferenceDisplay.py?confId=327713>

SuperKEKB commissioning workshop, KEK, 11-13 November 2013, 68 participants (Europe: 7, USA: 8, Japan: 51, China: 1, Russia: 2)

beam commissioning
will start in early 2015

- $\beta_y^* = 300 \mu\text{m}$ (TLEP: 1 mm)
- lifetime 5 min (TLEP: ~15min)
- $\varepsilon_y/\varepsilon_x = 0.25\%$! (TLEP: 0.2%)
- off momentum acceptance ($\pm 1.5\%$, TLEP: $\pm 2\%$)
- e^+ production rate ($2.5 \times 10^{12}/\text{s}$, TLEP: $< 1 \times 10^{11}/\text{s}$)



sponsored by ICFA

co-sponsored by EuCARD-2 XBEAM Extreme Beams



SuperKEKB commissioning workshop, KEK 11-13 November 2013



LHC-CC13, 6th LHC crab cavity workshop, CERN, 9-11 Dec. 2013, 63 participants (USA: 15, Japan: 3, Europe: 45)



main objectives:

1. Compact cavity RF test results and performance validation
2. Cryomodule and RF system development for SM18, SPS tests & LHC
3. Preparation for SPS beam tests and future roadmap

LHeC workshop, 20-21 January '14,

Chavannes-de-Bogis - 109 participants

(USA: 14, Asia: 4, Africa: 3, Latin America: 2, CERN: 48, Europe: 37)

- launch of IAC & Coordination Group
- physics case & detector design
- new ideas (FFAG, CSR, p-beam cooling)
- CERN Test Facility (applications, layout)
- collaboration & ERLs: plans around the world
- future needs and integration in FCC

participation by CERN Directors Frederick Bordry & Sergio Bertolucci + former CERN DG Herwig Schopper

<http://cern.ch/lhec-event/lhec-workshop/cern.ch>

Workshop on the LHeC

Electron-proton and electron-ion collisions at the LHC

20-21 January 2014
Chavannes-de-Bogis, Switzerland



International Advisory Committee

Guido Alardelli (Rome)
Sergio Bertolucci (CERN)
Frederick Bordry (CERN)
Angelo Bressi (Milano)
Herwig Schopper (ILRP Beijing)
Andrew Hudson (Jefferson Lab)
Young Kee Kim (Chicago) and Fermilab
Victor A. Malveira (JINR, Dubna)
Shin-ichi Kubo (Tokai)
Laurinda Stazi (Rome)
Leonid Zaklin (EPFL, Lausanne)
Herwig Schopper (CERN) - Chair
Jürgen Schwandt (CERN)
Achille Sotchi (IL, Chosay)

Working Group Convenors

Physics and Detector
Nesce Anagnostou (Santiago de Compostela)
Olaf Behne (DESY)
Diane Medley (Yale University)
Alexandra Palani (Biology)
Accelerator and FEL Technology
Alex Rogoz (Jefferson Lab)
Eli Jovan (CERN)
Daniel Schulte (CERN)

Organizing Committee

Sergio Bertolucci (CERN)
Frederick Bordry (CERN)
Oliver Brüning (CERN)
Laure Harvey (CERN)
Max Klein (Liverpool)

Future Circular Collider Study

CDR and cost review for the next ESU (2018)

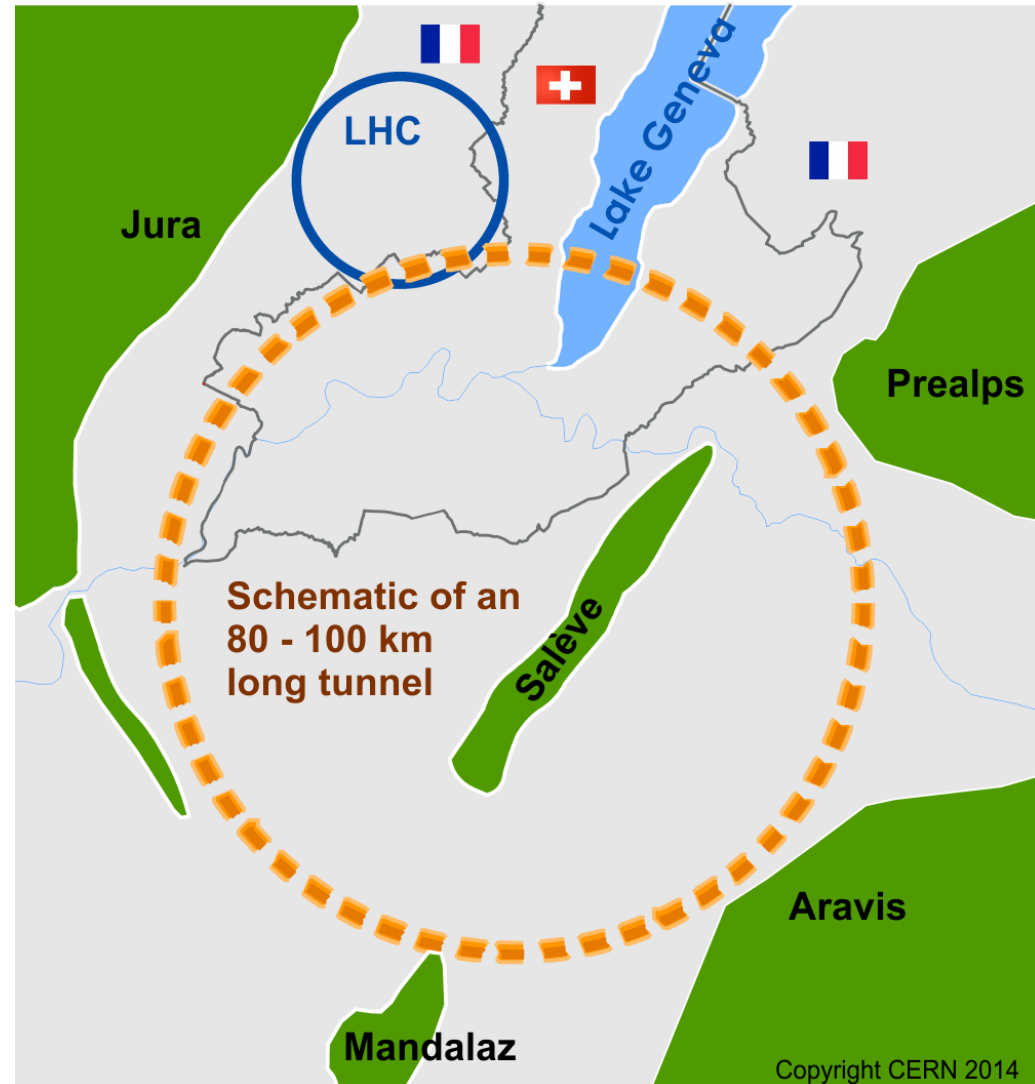
Forming an international collaboration to study:

- pp -collider (*FCC-hh*) →
defining infrastructure

~16 T \Rightarrow 100 TeV pp in 100 km

~20 T \Rightarrow 100 TeV pp in 80 km

- e^+e^- collider (*FCC-ee*) as potential intermediate step
- $p-e$ (*FCC-he*) option
- 80-100 km infrastructure in Geneva area



Kick-Off meeting for Future Circular Collider study (FCC)



U. Geneva, 12-15 February 2014

341 registered participants

(Americas: 37, Asia: 19, Africa: 1, CERN: 140, Europe: 144)

- all FCC aspects
- refined study scope
- schedule, WBS, milestones
- path towards international collaboration

Kick-off Meeting of the Future Circular Colliders Design Study

12 - 15 February 2014, University of Geneva / Switzerland

upcoming XCOLL workshops

[MulCoPim14](#), Valencia, Spain, 17-19 Sept. 2014

6th Int'l Conf., "[Charged & Neutral Particles Channeling Phenomena - Channeling 2014](#)" Italy, 5-10 Oct. 2014

[High Luminosity Circular \$e^+e^-\$ Colliders – Higgs Factory \(HF2014\)](#), Beijing, China, 9-12 Oct. 2014

High Luminosity Circular e^+e^- Colliders – Higgs Factory (HF2014), Beijing, 9-12.10. 2014

International Organizing Committee (IOC)

Michael Benedikt (CERN)
Marica Biagini (INFN-LNF)
Alain Blodet (U. of Geneva)
Alex Chao (SLAC)
Swapan Chattopadhyay (Cockcroft Inst.)
Weiren Chou (Fermilab, Co-Chair)
Jie Gao (IHEP)
Stuart Henderson (Fermilab)
Andrew Hutton (JLab)
Eugene Levichev (BINP)
Xinchou Lou (IHEP)
Katsunobu Oide (KEK)
Qing Qin (IHEP, Co-Chair)
Dave Rice (Cornell U.)
John Seeman (SLAC)
Chuanxiang Tang (Tsinghua U.)
Jorg Wenninger (CERN)
Frank Zimmermann (CERN)

Local Organizing Committee (LOC)

Huiping Geng (IHEP)
Yinghua Jia (IHEP)
Shuzhen Liu (IHEP)
Qian Pan (IHEP)
Tongzhou Xu (IHEP, Chair)
Shan Zeng (IHEP)
Ning Zhao (IHEP)

HF2014



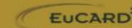
55th ICFA Advanced Beam Dynamics Workshop on High Luminosity Circular e^+e^- Colliders – Higgs Factory



Topics

Parameters
Optics
Interaction region and machine-detector interface
Synchrotron radiation and shielding
Superconducting RF
Injectors and injection
Orbit stability and beam instability
Polarization
Instrumentation and control
"Green" Higgs factory

October 9-12, 2014
Hotel Wanda Realm
Beijing, China



[Http://hf2014.ihep.ac.cn](http://hf2014.ihep.ac.cn)

Email: hf2014@ihep.ac.cn

Registration Deadline: August 31, 2014

WP5.3

Extreme Performance Rings (XRING)

G. Franchetti (GSI)
& J. Struckmeier (GSI)

XRING workshop so far

"Beam Dynamics meets Magnets" , Darmstadt,
2-4 December 2013

upcoming XRING workshops

SC Collaboration Meeting 2014, CERN, 20-21 May
2014

"Beam Dynamics meets Magnets #2", PSI,
Switzerland, 1-4 December 2014

Space Charge 2015, UK, Oxford, April 2015

beam dynamics meets magnets", Darmstadt 2-4 December 2013, 84 participants (Japan: 3, USA: 2, Europe: 79)

beam Dynamics *meets* Magnets

1st XBEAM-XRING Workshop

2-4 December 2013
Darmstadt, Germany

Chair G. Franchetti
Workshop Secretary I. De Caluwe

International Advisory Committee

P. Fabricatore	INFN	O. Boine-Frankenheim	TUD/GSI
E. Fischer	GSI	S. Machida	RAL
H.G. Khodzhibagiyev	JINR	K. Ohmi	KEK
S. Russenschuck	CERN	F. Schmidt	CERN
C. Spencer	SLAC	F. Zimmermann	CERN

TOPICS

Magnet field mapping	Nonlinear dynamics
Multipole measurements	Emittance growth
Magnetic field in elliptical chambers	Beam loss
3D vs. 2D description	Space charge
Magnet design	Lattice modeling
Mathematical models	Tracking and multipoles



"beam dynamics meets magnets", Darmstadtium, 2-4 December 2013

WP5.4

Extreme Linacs (XLINAC)

M. Eshraqi (ESS)

XLINAC workshop so far

[Commissioning of Proton Linacs](#), ESS, Sweden,
8-9 April 2014

upcoming XLINAC workshops

Linac High-Power Couplers, 2014-15

second XLINAC workshop on Commissioning of
High-Power Linacs, 2014-15

Beam Dynamics Issues of High Power Linacs, CERN,
2014/15?

“beam commissioning of proton linacs”

Lund, 8-9 April 2014



commissioning plan, diagnostics, schedule, objectives, knowledge exchange, collaboration & synergies between laboratories
attended by 31 experts from major European laboratories (ESS, CERN, CEA, DESY, GANIL, INFN LNL, INFN LNS, ISA Århus University, Max IV Lab., PSI, RAL; Sweden:18 persons, rest of Europe:12) & ORNL/SNS US (1 pers.)

WP5.5

Extreme Polarization (XPOL)

K. Aulenbacher (JGU Mainz)

XPOL workshop so far

[Spin Optimization at Lepton Accelerators,](#)

Mainz, 12-13 February 2014

upcoming XPOL workshops

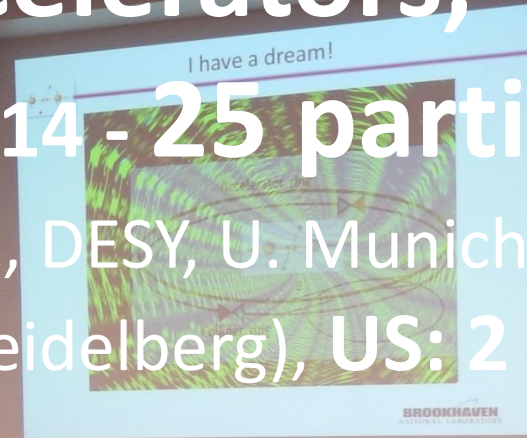
Polarization for high energy colliders - satellite workshop to XCOLL workshop on LHeC or FCC

Storage rings for measuring the electric dipole moments of protons, deuterons and electrons

XPOL workshop “Spin Optimization at Lepton Accelerators,” U. Mainz,

12-13 February 2014 - 25 participants

Germany: 23 (Mainz, DESY, U. Munich, U. Bonn, U. Hamburg, U. Heidelberg), US: 2 (BNL)



- spin generation, spin transport
- accurate measurement of spin vector
- contributions from universities
- milestones accomplished & road ahead
- challenges for linear & circular machines

WP5 XBEAM

Milestones & Deliverables



deliverables :

1. Preliminary strategies, optimization, limitations, paths & parameters for
 - future hadron & lepton colliders;
 - future high-performance hadron rings;
 - future high-power high-current SC linacs; and
 - future polarized beams

[month 36]

2. Strategy for

- future extreme beam facilities

[month 48]

none at the moment

milestones :



Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
MS29	1st XCOLL topical workshop	19	12	Web site
MS30	1st XRING topical workshop	12	11	Web site
MS31	1st XLINAC topical workshop		12	Web site
MS32	1st XPOL topical workshop	16	12	Web site
MS33	2nd XCOLL topical workshop	19	24	Web site
MS34	2nd XRING topical workshop	12	24	Web site
MS35	2nd XLINAC topical workshop	27	24	Web site
MS36	2nd XPOL topical workshop	16	24	Web site
MS37	3rd XCOLL topical workshop	19	36	Web site
MS38	3rd XRING topical workshop	12	36	Web site
MS39	3rd XLINAC topical workshop	27	36	Web site
MS40	3rd XPOL topical workshop	16	36	Web site

≥1 workshop per task in year 1

**accomplished:
6 workshops for XCOLL
1 workshop for XRING
1 workshop for XLINAC
1 workshop for XPOL**

**planned for next year:
3 workshops for XCOLL
2 workshops for XRING
2 workshops for XLINAC
1-2 workshops for XPOL**

WP5 XBEAM MS reports

EuCARD2-Mil-MS29

EuCARD2-Mil-MS30

EuCARD2-Mil-MS31

EuCARD2-Mil-MS32



Europe
Seventh Framework Programme



1ST



Document

Due date

Report release

Work package

Lead beneficiary

Document

Abstract:

This milestone is titled "Extreme Light Laboratory (ELL) parameters for circular e⁺e⁻ colliders". The purpose of this milestone is to communicate the results of the first crab-cavity tests in the context of the down stream

Grant Agreement



Europe
Seventh Framework Programme



1st

Document

Due date

Report release

Work package

Lead beneficiary

Document

Abstract:

The milestone is titled "Extreme Light Laboratory (ELL) parameters for circular e⁺e⁻ colliders". The purpose of this milestone is to communicate the results of the first crab-cavity tests in the context of the down stream

Grant Agreement



Europe
Seventh Framework Programme



1st

Document

Due date

Report release

Work package

Lead beneficiary

Document

Abstract:

The milestone is titled "Extreme Light Laboratory (ELL) parameters for circular e⁺e⁻ colliders". The purpose of this milestone is to communicate the results of the first crab-cavity tests in the context of the down stream

Grant Agreement



Grant Agreement No: 312453

EuCARD-2

European Coordination for Accelerator Research and Development
Seventh Framework Programme, Capacities Specific Programme, Research Infrastructures,
Combination of Collaborative Project and Coordination and Support Action

MILESTONE REPORT

1ST XPOL TOPICAL WORKSHOP: SPIN OPTIMIZATION AT LEPTON ACCELERATORS

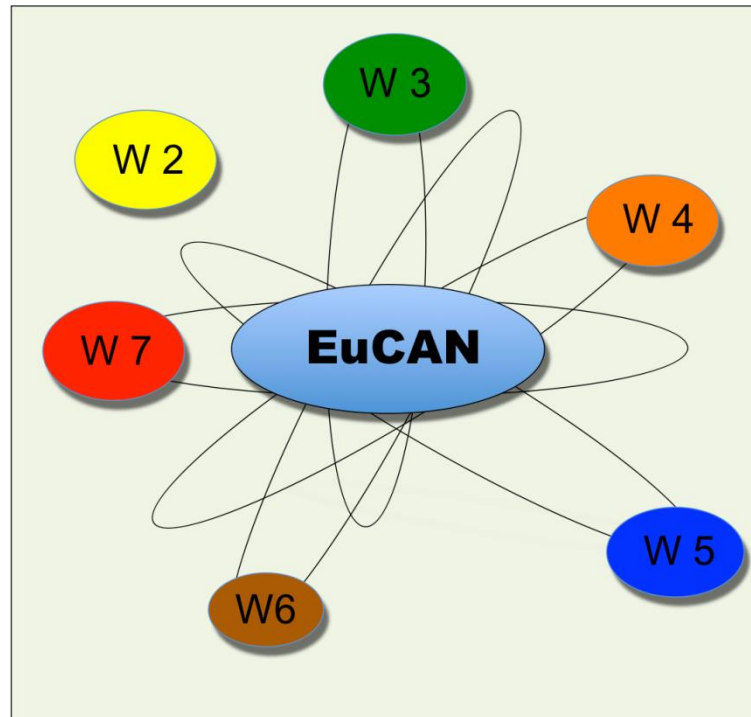
MILESTONE: MS32

Document identifier:	EuCARD2-Mil-MSx-Template-v0.1
Due date of milestone:	End of Month 31 03 14
Report release date:	dd/mm/yyyy
Work package:	WP5 extreme beams
Lead beneficiary:	JGU
Document status:	Draft [Final when fully approved]

Abstract:

The XPOL workshop, organized from 12-13 February 2014 at Mainz University, was devoted to the subject of "spin optimization" at lepton accelerators. This theme comprises spin generation, spin transport and the accurate measurement of all components of the spin vector.

WP1.4 EuCAN



WP1 EuCAN achievements

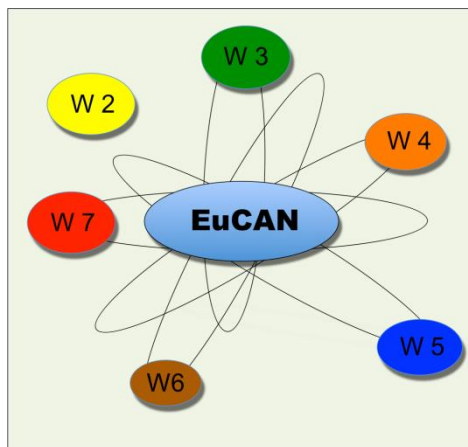
web site created: <http://cern.ch/eucan>

milestone

report

EuCARD2-Mil-MS4

CERN-ACC-2013-0263



EuCAN

Coordination of Accelerator Networks

Mandate:

- Coordinate the activities of the five accelerator networks within EuCARD-2
- Monitor work progress and budget of all networks, informing project management and participants and disseminating achievements
- Provide a platform for information exchange and collaboration between the accelerator networks via a common calendar and web page
- Serve as interface to other EuCARD-2 work packages and other similar national, European, international and American or Asian entities

EuCARD-2 Accelerator Networks

WP2: Catalysing Innovation (INNovation)

WP3: [Energy Efficiency \(EnEfficient\)](#)

WP4: [Accelerator Applications \(AccApplic\)](#)

WP5: [Extreme Beams \(XBEAM\)](#)

WP6: [Low Emittance Rings \(LOW-e-Ring\)](#)

WP7: Novel Accelerators (EuroNNAc2)

Events:

Early announcement: A EuCAN workshop "**universities meet laboratories**" is planned for 2014

EuCAN Task Description:

The EuCAN task coordinates and integrates the five accelerator networking activities in EuCARD-2, namely WP3: EnEfficient, WP4: AccApplic, WP5: XBEAM, WP6: LOW-e-RING and WP7: EuroNNAc2 to ensure consistency of the WP work according to the project plan. It stimulates and guides progress on novel and high-performance accelerators for various fields of science, as well as on their applications e.g. for medical treatments, helping the topical networks to lay the foundation for a new generation of advanced accelerator infrastructures in Europe.

Building on the success of the FP6 CARE project and FP7 EuCARD-AccNet networking work package, this task provides an interface between the individual accelerator networks, developing synergies and supporting collaboration and joint events. It provides a common calendar of events for all networks, creates and maintains web pages, and helps with dissemination and outreach activities (publications in newsletters, CERN Courier, journal articles and booklets, etc.; seminars, discussions, teaching activities). The EuCAN task is also an **interface to other EuCARD-2 work packages, and national and international organizations** like ECFA, ICFA, ILC, CLIC, MAP, ESA, US DOE, KEK in Japan, and industry.

Coordination duties include organizing *EuCAN internal steering meetings*, setting up proper reviewing, reporting to the project management and distributing information within EuCARD-2. The task also covers organising and supporting annual meetings dedicated to EuCARD-2 activity review and possible activity workshops or specialized working sessions, implying the attendance of invited participants from inside and outside the consortium. The *EuCAN membership consists of the coordinators of the five EuCARD-2 accelerator networks*.

EuCAN Deliverables:

D1.4.1) EuCAN web pages available: Continuously updated online resources to provide the accelerator networking work packages with information such as relevant events and publications (Task 1.4) [month 2]

D1.4.2) Key results of the five accelerator networks: A report on the main results from the accelerator networking work packages, namely WP3: EnEfficient, WP4: AccApplic, WP5: XBEAM, WP6: LOW-e-RING and WP7: EuroNNAc2. (Task 1.4) [month 48]

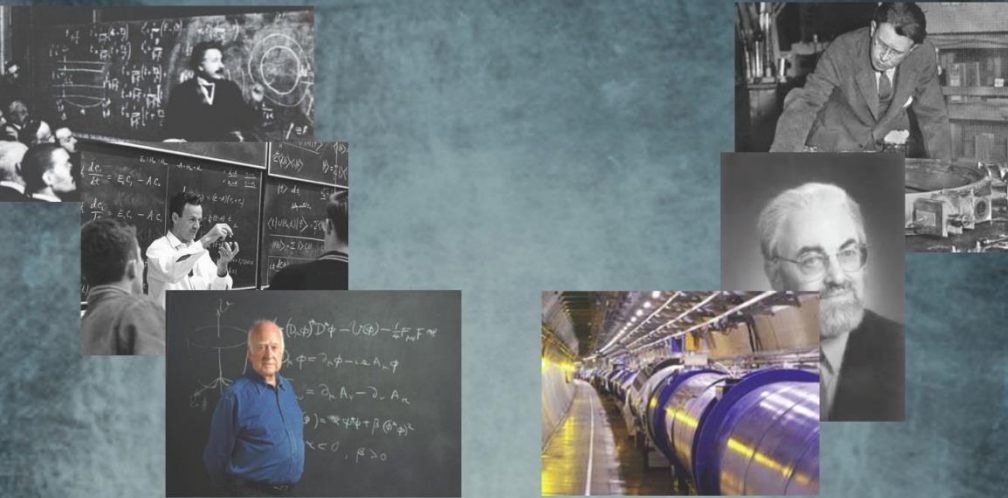
EuCAN WP1

deliverable

**key results of 5 accelerator networks
M18**

due rather soon

Universities **meet** Laboratories



EuCAN "Universities meet Labs" (EuCAN),
Frankfurt am Main,
29 Sept. - 2 Oct. 2014

Questions:

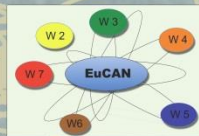
- 1) Is there a synergy between universities and laboratories ?
 - 2) Research ranking: universities and laboratories = different worlds ?
 - 3) Training in accelerator physics and technology.
 - 4) Attraction of young generation starts in universities, which role do laboratories play for attracting students ?
 - 5) Is "academic" always a bad word ?
 - 6) Are university accelerators a useful complement to large national and international laboratories?
- &**
preparation of EuCAN deliverable

1st EuCANN Meeting

Chair: F. Zimmermann, G. Franchetti

Local organization: O. Meusel, Secretary: T. Harji
30 Sept. - 2 Oct. 2014, Frankfurt am Main, Germany

<https://indico.gsi.de/conferenceDisplay.py?confId=2801>



International Advisory Committee

Ralph Assmann, DESY

Riccardo Bartolini, Oxford U

Rob Edgecock, HUD

Giuliano Franchetti, GSI

Yannis Papaphilippou, CERN

Mike Seidel, PSI

Marco Shippers, PSI

Jens Stadlmann, GSI

Topics

- 1) Is there a synergy between universities and laboratories ?
- 2) Research ranking: universities and laboratories = different worlds ?
- 3) Training in accelerator physics and technology.
- 4) Attraction of young generation starts in universities, which role do laboratories play for attracting students ?
- 5) Is "academic" always a bad word ?
- 6) Are university accelerators in a useful complementary to large national and international laboratories?