EuCARD-2

Enhanced European Coordination for Accelerator Research & Development

Milestone Report

1st XCOLL topical workshop

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MILESTONE REPORT

1ST XCOLL TOPICAL WORKSHOP(S)

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Abstract:

This milestone report summarizes two topical workshops organized by EuCARD-2 Task 5.2 “Extreme Colliders” (XCOLL) in the fall of 2013. Both workshops were held at CERN, with strong European and international participation. The TLEP6 workshop discussed the parameters and key issues (e.g. beamstrahlung, polarization) for a future large high-energy circular e^+e^- collider, and prepared the future work within a new organizational structure called “Future Circular Colliders” (FCC). The workshop LHC-CC13 was devoted to the SRF crab-cavity development for the High-Luminosity upgrade of the LHC, including results obtained so far from cavity prototypes based on three different types of design, the plan for RF tests in CERN SM18 and beam tests in the SPS, cryo-module development, and strategy for down selection.

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Delivery Slip

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1. WORKSHOP SUMMARY

In 2013, the following two topical workshops were organized by EuCARD-2 Task 5.2 "Extreme Colliders" (XCOLL):

1. From 16 to 18 October 2013, 84 accelerator experts and particle physicists attended a TLEP workshop at CERN. ("TLEP6"). While most of the participants (66) came from Europe there also were significant contingents from the US (5), from Asia (11), and from Mexico (3).The TLEP6 workshop reviewed the design parameters of TLEP – a proposed future high-energy high-luminosity e^+e^- collider in a new 80-100 km tunnel – with particular emphasis on emittance choice and beamstrahlung effects, where a new approach featuring from Novosibirsk and detailed beam-beam simulations at Brookhaven deserve to be mentioned. Other workshop highlight topics included first looks at TLEP impedance, on the vacuum system, and on synchrotron-radiation shielding on polarization. Another important element of TLEP6 was the particle-physics case and the preparation of the 5-year design study on Future Circular Colliders (FCC) which will be launched in February 2014. A prominent TLPE6 participant was Prof. Herwig Schopper, ex-Director General of CERN and instrumental in the approval, construction and success of LEP. Another key participant, Prof. Sergio Bertolucci, CERN's Director of Research and Computing, gave an enthusiastic presentation, where he stressed that the "FCC" could well be the long term future of CERN, offering frontier machines for precision (using lepton machines) and energy (using hadron accelerator), and much more (e-p and ions).

2." LHC-CC13" – A workshop on LHC crab cavities, at CERN from 9 to 11 December 2013. LHC-CC13 was organized jointly with US-LARP and LHC HiLumi. The 63 participants included 15 from the United States, 3 from Japan, and 45 from Europe. LHC-CC13 reviewed the test results from 3 different prototype SC compact cavities and developed a plan for future performance validation and final down selection by the end of 2016 or early 2017. It also discussed the R&D on cryo-module and RF system required for test without beam in CERN building SM18,and later beam tests in the SPS as well as for the final implementation in the LHC. Lastly, it prepared for SPS beam test, foreseen to start in 2017, and established a future roadmap.

2. BASIC DETAILS ABOUT THE WORKSHOPS

Type of activity	Topical Workshop
Title	TLEP6 Workshop on a Future Circular e+e- Collider in an 80-100 km tunnel
Date	16-18 October 2013
Place	CERN
Type of audience	Scientific community, Policy Makers
Size of audience	84 participants (Europe: 65, USA: 5, Asia: 10, Mexico: 4)
Countries Addressed[1]	CERN (21), Switzerland (7), France (13), Italy (11), Denmark (1), United Kingdom (3), Spain (3), Germany (4), Greece (1), Sweden (1), Poland (1), Russia (2), Japan (1), China (2), Korea (1), USA (5), Mexico (4), India (4)
Link	http://indico.cern.ch/conferenceDisplay.py?confId=257713
Partners involved	Mexican funding agency CONACyT, CERN Directorate, FCC Study Coordination, IHEP Beijing (China partner), Fermilab, BINP (Russia partner)

Type of activity	Topical Workshop
Title	LHC-CC13 Workshop on LHC Crab Cavities
Date	9-11 December 2013
Place	CERN
Type of audience	Scientific community, Industry, Policy Makers
Size of audience	63 (Europe: 45, US: 15, Japan 3)
Countries Addressed[2]	CERN (37), Switzerland (2), France (1), Italy (1), United Kingdom (4), USA (15), Japan (3)
Link	http://indico.cern.ch/conferenceDisplay.py?confId=269322
Partners involved	US-LARP (US EuCARD-2 partner), Niowave (US company), LHC HiLumi project, Cockcroft Institute (UK EuCARD-2/HiLumi partner), KEK (Japan HiLumi partner)

[1] Country distribution of the attendees

[2] Country distribution of the attendees

Figure 1: The TLEP6 workshop poster. The poster was crafted by Mike Koratzinos from the University of Geneva. Japanese artist Kazuya Akimoto kindly agreed to the use of one of his works as the basis for the poster's backdrop

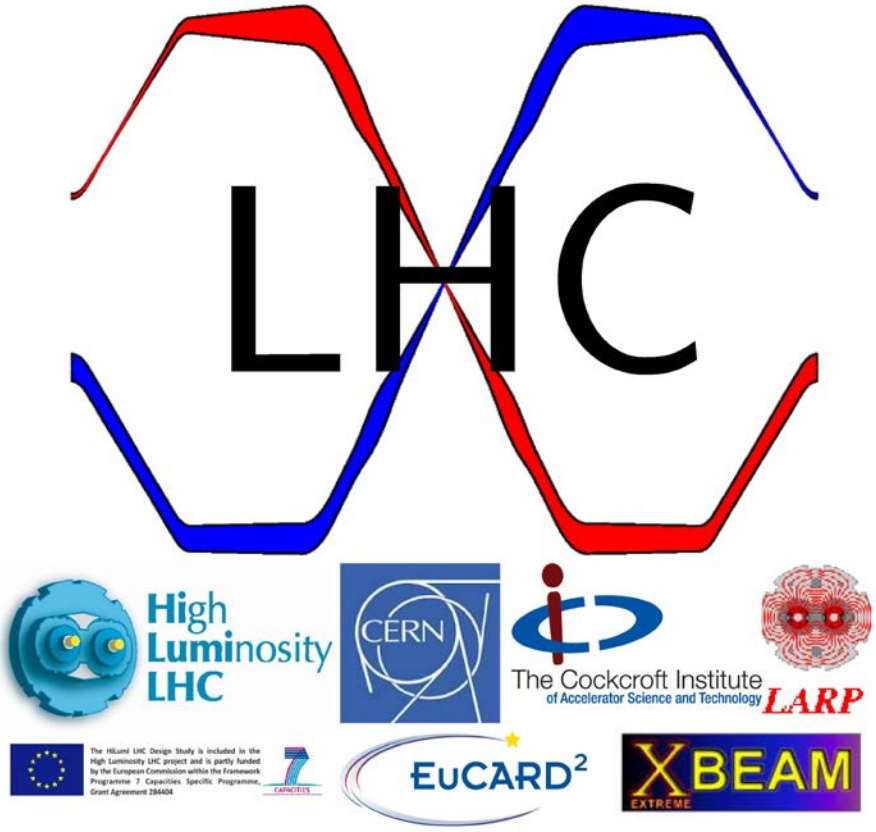

Figure 2: The LHC-CC13 workshop logo designed by Rama Calaga of CERN

2.1. MAJOR OUTCOMES

TLEP6:

- First design of vacuum system and first assessment of synchrotron-radiation effects including beam vacuum, magnets, water cooling, shielding and dedicated absorbers.
- Careful assessment of beam-beam effects at various centre-of-mass energies, including beamstrahlung, tune scans, and varying number of collisions points, with a revision of luminosity target values. Discussion of formulae used for describing beam lifetime limit due to beamstrahlung.
- Alternative parameters at the Z pole and W threshold, with much smaller emittance and crab-waist collisions.
- Schemes (wigglers, rotators, snakes, polarized sources) which could allow for polarized beams at Z pole and W threshold.
- Clarification of TLEP physics case
- Preparation for FCC kick-off meeting in February 2014

LHC-CC13:

- Review of test results from 3 different prototype SC compact cavities
- Plan for future performance validation and for the final down selection by the end of 2016 or early 2017. Minimum functional assemblies of all 3 designs will be fabricated for the SM18 RF tests and 2-3 cryo modules for beam tests in the SPS. A detailed list of down selection criteria, including weights, is to be established.
- Discussion on R&D for cryo module and on the RF system required for tests without beam in SM18,and with beam in the SPS
- Proposal of novel “crab kissing” scheme for luminosity levelling.
- Back-up solutions based on lower-harmonic (200 MHz) RF system and/or long-range beam-beam compensation.
- Plan for final implementation in the LHC and roadmap.

ANNEX: GLOSSARY

Acronym	Definition
FCC	Future Circular Colliders project at CERN, comprising both a 100-TeV hadron collider and TLEP. A 5-year FCC design study will be launched in February 2014. With a kick-off event at the University of Geneva.
RF	Radiofrequency
SC	Superconducting
SM18	CERN surface building in which cryogenic tests of SC magnets and SRF systems can be performed.
SRF	Superconducting radiofrequency (system)
TLEP	A proposed future high-energy high-luminosity e^+e^- collider in a new 80-100 km tunnel; see http://cern.ch/tlep □