

EuCARD-2

Enhanced European Coordination for Accelerator Research & Development

Newsletter

Accelerating News Issue 8

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[HiL](#)
[TIA](#)
[EuC](#)
[EuC²](#)
[Acc](#)

NEWS

[From the editors](#)
[EuCARD wrap-up and beyond](#)
[Concluding the TIARA Preparatory Phase](#)
[From the FP7 HiLumi Design Study towards the High Luminosity LHC](#)
[E-learning: a new training opportunity for European accelerator science](#)
[Towards energy efficient particle accelerators](#)
[A versatile test cryostat for low beta superconducting cavities](#)
[Synergies for testing Superconducting RF cavities](#)

EVENTS

4-15 December 2013 **LCS 2013** - 8th International Accelerator School for Linear Colliders
Antalya, Turkey

16-20 December 2013 **HEP 2013** - 5th International Workshop on High Energy Physics in the LCH Era
Valparaíso, Chile

6 January - 14 March 2014
JUAS school - Joint Universitites Accelerator

Issue 8: Winter 2013

Acc From the editors

by Mathilde Chaudron (CERN), Livia Lapadatescu (CERN), Agnes Szeberenyi (CERN), Celine Tanguy (CEA)

In this winter issue, we are celebrating this year's amazing highlights: Nobel Prize in physics for the Higgs, Prince of Asturias Award, the end of EuCARD, the start of EuCARD-2, the conclusion of the preparatory phase of TIARA and HL-LHC entering a new phase - from design study to approved project. We are happy to announce that Accelerating News has been assigned an ISSN Number and is now listed in the catalogue of the Swiss National Library.

In addition to this year's highlights, we report on TIARA's recommendations for promoting accelerator science in Europe, energy efficiency of particle accelerators, the design of a test cryostat for low beta superconducting cavities and quality assessment during SRF cavity production.

In the headlines are engaging stories on plasma wakefield, compact particle accelerators, 13.5 Tesla magnets, concept of a very large hadron collider and improvements in proton therapy.

Amongst the upcoming events, we invite you to the CLIC2014 Workshop and the Future Circular Collider Kick-off meeting.

We hope you enjoy this issue. Please [contact us](#) with any news or events that you would like added to future issues.

[Read more >>](#)

Keywords: editors; introduction



Photo: Higgs, François Englert / Sergio Bertolucci, Associate de Investigación del CERN, participando en un momento celebratorio en la Facultad de Ciencias de la Universidad de Córdoba. Foto © Iván Martínez / FPA

We wish all Accelerating News readers a very happy festive period and plenty of success for 2014.

Image credit: Ivan Martinez (FPA)

EuC EuCARD wrap-up and beyond

by Agnes Szeberenyi (CERN) and Livia Lapadatescu (CERN)

The **EuCARD** project was launched to join forces to improve the performance of European accelerator infrastructures. After 4 years of running, the project lived up to the expectations and achieved most of its ambitious goals. The work in EuCARD has been organized around scientific networks, transnational activities and joint research activities.

The Accelerating News newsletter, the series of scientific [monographs](#) on accelerator sciences and the roadmaps towards novel frontier accelerators are just a few examples of the outcomes of networking activities under the umbrella of the project. During the lifetime of the project, an out-of-contract networking activity has been successfully launched on laser



Some key project figures.
Image credit: EuCARD.

School
Archamps, France

20-31 January 2014

[USPAS](#) - US Particle
Accelerator School
Knoxville, US

3-7 February 2014

[CLIC 2014](#) - Workshop on
Accelerator, Detector and
Physics studies
Geneva, Switzerland

10-14 February 2014

[ICTR-PHE 2014](#) -
International Conference
on Translational
Research in Radio-
Oncology and Physics for
Health in Europe
Geneva, Switzerland

12-15 February 2014

[FCC Study Kickoff
meeting](#)
Geneva, Switzerland

25-30 May 2014

[CAARI 2014](#) - 23rd
International Conference
on the Application of
Accelerators in Research
and Industry
San Antonio, US

02-06 June 2014

[TIPP 2014](#) - Technology
and Instrumentation in
Particle Physics
Amsterdam, Netherlands

15-20 June 2014

[IPAC'14](#) - International
Particle Accelerator
Conference
Dresden, Germany

24-28 August 2014

[ECRIS'14](#) - 21st
International Workshop
on ECR ion sources
Nizhny Novgorod, Russia

25-29 August 2014

[FEL'14](#) - Free Electron
Laser Conference
Basel, Switzerland

1-5 September 2014

[LINAC'14](#) - 27th Linear

plasma acceleration, contributing and supporting the [AWAKE collaboration](#), which has gained relevant momentum since then. Two test facilities were open in EuCARD to transnational access: [HiRadMat@SPS](#) and [MICE@STFC](#). The EC funding of these TA was mostly dedicated to the support of the new users' visits and research in the facilities.

The joint research activities had the lion's share in EuCARD. The highlights of these activities include: development of an innovative Nb3Sn magnet with a high-temperature superconducting YBCO insert for the first time in Europe; a smart collimator and cryocatcher, two-beam acceleration RF technologies, the active mechanical stabilization of magnets to a fraction of nanometer, ultra-precise beam monitoring, 20 fs scale synchronization and novel high gradient RF cavities for proton linacs, etc.

As EuCARD finished on 31st July, [EuCARD-2](#) will build upon the success of [EuCARD](#) and push it into an even more innovative regime.

[Read more >>](#)

Keywords: [EuCARD](#), [EuCARD-2](#), [summary](#)

Concluding the TIARA Preparatory Phase

by Celine Tanguy (CEA)

Almost 3 years since the TIARA Kickoff meeting, the TIARA participants met in Daresbury to review the progress within the Work Packages (WPs) and finalise the last deliverables.

The organisational Work Packages provided details about the Infrastructure Need and Resource Comparison ([WP3](#)), the final plan of the collaborative R&D Program ([WP4](#)) and the results of the survey of market needs for trained personnel and recommendations for promoting accelerator science and technology ([WP5](#)).

From the technical Work Packages, the following achievements were highlighted (among others): ultralow (world record) vertical emittance at the Swiss Light Source ([WP6](#)), multi-MegaWatt RF systems for the Ionisation Cooling Test Facility ([WP7](#)), new C-band structures at SPARC and overview of C-band technology at other international projects ([WP8](#)), design of innovative multi-MegaWatt Irradiation Facility for complex target testing ([WP9](#)).

On this occasion, an overview of R&D Infrastructures and Accelerator Programmes in UK was given, as well as Industrial Engagement in UK Accelerator R&D. Status of the on-going work toward 14 TeV operation of LHC and R&D for High Luminosity Upgrade was also showcased.

[Governing Council](#) meetings, including the [Steering Committee](#) members, were also organised, in particular to pursue discussion toward the TIARA implementation.

[Read more >>](#)

Keywords: [TIARA](#), [Daresbury](#), [concluding meeting](#)

From the FP7 HiLumi Design Study towards the High Luminosity LHC

by Agnes Szeberenyi (CERN) and Livia Lapadatescu (CERN)

To mark the approval of the High Luminosity LHC Programme



The final general meeting of the TIARA Preparatory Phase was hosted by STFC at Daresbury Laboratory on November 25-28.

Image credit:TIARA.

Accelerator Conference
Geneva, Switzerland

15-19 September 2014
IBIC'14 - 3rd International
Beam Instrumentation
Conference
Monterey, US

13-17 October 2014
PCaPAC'14 - 10th
International Workshop
on Personal Computers
and Particle Accelerator
Controls
Karlsruhe, Germany

IN THE HEADLINES

From Nobelprize.org
October 2013
[The Nobel Prize in
Physics 2013 to Peter
Higgs, François Englert](#)

**From Fundación
Príncipe de Asturias**
October 2013
[Prince of Asturias Award
for Technical and
Scientific Research 2013:
Peter Higgs, François
Englert and CERN](#)

From CERN Updates
October 2013
[New beam dump for a
veteran accelerator](#)

From Symmetry
October 2013
[Why particle physics
matters](#)

From CERN Courier
October 2013
[To the terascale: catching
the plasma wakefield](#)

From Phys.org
November 2013
[Charged particles can be
accelerated using light,
leading the way for more
compact particle
accelerators](#)

From Nature
November 2013
[Physicists plan to build a
bigger LHC](#)

by the CERN Council in June 2013, the **3rd Joint HiLumi LHC-LARP Annual Meeting** was held in conjunction with the HL-LHC kick-off.

The event took place at the Daresbury Laboratory in the UK between 11-15 November 2013, with an outstanding attendance of more than 160 scientists from all over the world, including Japan, Russia and the US. Directors of major accelerator laboratories were present as invited prominent speakers.

The first part of the event covered the kick-off of the HL-LHC project, advanced as a first priority for CERN in the years to come. Following the format of the previous annual meetings, the second part of the event focused on the progress in design and R&D of the FP7 HiLumi Design Study. Plenary and work package parallel sessions were organized and focused on the work of the Parameter and Lay-Out Committee, the collaboration with LARP, the achievements and reports from work packages. The outcomes and recommendations of the CERN Review of LHC & Injector Upgrade Plans Workshop (RLIUP) were also reported.

The 4th Joint HiLumi Annual Meeting is planned to take place in November 2014 at KEK, the High Energy Accelerator Research Organization in Japan.

[Read more >>](#)

Keywords: *HiLumi LHC, HL-LHC, RLIUP, US-LARP, Annual Meeting*



E-learning: a new training opportunity for European accelerator science

by Philip Burrows (JAI, University of Oxford)

Currently around 500 students each year commence master's and PhD courses related to accelerator science and technology. TIARA Work Package 5 (WP5) proposes measures to improve training access. For science and engineering undergraduates, and high-school students, we recommend setting up an e-learning course: 'Introduction to Accelerator Science and Technology'.

Based on the surveys on [education and training provision](#), and the [market needs for accelerator scientists and engineers](#), TIARA WP5 ("Education & Training") has issued its final report, which includes recommendations for promoting Accelerator Science and Technologies at a European level. Among these TIARA WP5 recommends improved support for students to participate in training programmes, including accelerator schools and lab-based internships. It is believed that a prestigious European fellowship scheme for master's and PhD students would help to improve the supply of trained personnel, as well as raise the profile of the field.

It is also recommended setting up an e-learning course ('Introduction to Accelerator Science and Technology') to open up training opportunities to European undergraduate science students, as well as a module suitable for high-school students and teachers. See the report '[Recommendations for promoting accelerator science and technology in Europe](#)' for full details.

[Read more >>](#)

Keywords: *TIARA, education, training, recommendations*



Group picture from the 3rd Joint HiLumi LHC-LARP Annual Meeting 2013. Image credit: HiLumi LHC.



An additional recommendation by TIARA WP5 is to set up a www portal for providing a comprehensive source of information on accelerator opportunities, namely job and internship vacancies, bursaries and fellowships, and research group and personnel expertise, as well as news on conferences, workshops and training schools and access to online training materials and resources. Image credit: Max Bradbury (JAI, University of Oxford).

From CERN Updates

November 2013

[Test magnet reaches 13.5 tesla – a new CERN record](#)

From Medical Physics

Web

November 2013

[Proton rescanning: which works best?](#)

EuC² Towards energy efficient particle accelerators

by Mike Seidel (PSI) with Mathilde Chaudron (CERN)

The **2nd Workshop on Energy for Sustainable Science at Research Infrastructures** was held the 23-25 October 2013 at CERN to discuss the challenges and potential solutions in energy efficiency. The workshop featured a talk from the **EnEfficient network**, the **EuCARD-2 Work Package 3**, which presented its plan to stimulate innovation in the energy efficiency of particle accelerators in the coming years.

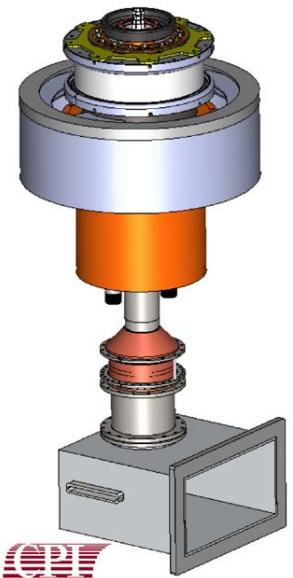
Scarcity of resources, along with rising energy costs and climate change are ever growing concerns for the next generation of large accelerator based facilities. Indeed, the much increased performance of proposed new facilities comes together with anticipated increased power consumption. The network EnEfficient builds on this recent consciousness that accelerators have to be sustainable over the long term and socially acceptable by reducing their environmental impact and their energy consumption. It aims to federate the initiatives of research institutions and universities towards an efficient utilization of electrical power in 5 different areas: heat recovery, efficiency of Radio Frequency (RF) power generation, virtual power plant (improved adaptation to varying supply situation on grid), energy storage systems and low power beam transport channels.

As one of the networking activities a workshop on efficient RF generation will be organized in the spring of 2014. The picture shows the concept design of a multi-beam Inductive Output Tube (IOT). IOTs typically reach higher efficiency than traditional klystrons particularly where klystrons need to be operated below saturation. The utilization of this technology for the accelerator of the **European Spallation Source (ESS)** is presently being investigated which would result in electrical power savings of 3 MW. [European](#)

[Additional participants are sought and are welcome in all themes of the EnEfficient network.](#)

[Read more >>](#)

Keywords: EuCARD-2, energy efficiency, networks



Inductive Output Tube (IOT).
Image credit: CPI.

TIA A versatile test cryostat for low beta superconducting cavities

by Sébastien Bousson (CNRS/IN2P3/IPN Orsay), Hervé Saugnac (CNRS/IN2P3/IPN Orsay) and Sébastien Blivet (CNRS/IN2P3/IPN Orsay)

In **Work-Package 9 (WP9)** of the **TIARA-PP** project, the **IPN Orsay team (CNRS/IN2P3)** has raised the challenge of designing a versatile test cryostat capable to host almost all type of fully-equipped superconducting (SC) cavities, including the wide range of low beta structures.

In the process of developing a SC accelerating cavity, the integrated test of the fully dressed cavity (i.e. equipped with its RF power coupler and cold tuning system) in the nominal condition of RF power and temperature is a key step towards the validation of the expected performances of the accelerating structure. To perform this experiment, a specific cryostat is required, adapted to the geometry and configuration of the cavity to be tested.

This type of infrastructure already exists for elliptical-type SC



cavities, but not for the low beta structures due to difficulty of integrating the large variety of geometries, configurations and frequencies: quarter-wave or half-wave resonators, spoke or CH-type cavities, single-gap or multi-gap, frequencies ranging from 60 to 700 MHz...

As shown in Fig.1 with a spoke cavity or in Fig. 2 with a quarter-wave resonator, the chosen configuration of the cryostat is a top-loading, where the equipped cavity coming from the assembly in the clean room is suspended to the cryostat top-plate. The various openings located laterally or on the bottom closing plate of the cryostat allow to implement the power coupler and cold tuning system and give access to the cavity for the assembly process and to integrate the instruments. With a length of 2.7 m, a width of 1.5 m and a height of 3.4 m, the cryostat dimension is optimized to minimize the footprint in the test stand but sufficient enough to integrate a string of a SC cavity and a SC solenoid for specific tests.

[Read more >>](#)

Keywords: TIARA, low beta Superconducting Cavity, cryostat

Fig 1: Top-loading of the cryostat with a double spoke cavity.
Image credit: TIARA.



Fig 2: Cryostat integrating a quarter-wave resonator.
Image credit: TIARA.

Acc Synergies for testing Superconducting RF cavities

by Detlef Reschke (DESY)

Within the 36 month period of the [CRISP project](#) the main objective of WP4 is to upgrade and harmonize the SRF Accelerator Structures for ESS, ILC, LHC upgrade and the European XFEL. The activity supports an optimised surface treatment, the application of advanced test and preparation infrastructure as well as state-of-the-art diagnostics tools.

At CERN the SRF cavity test infrastructure is under upgrade to allow 2 Kelvin operation needed for the characterisation of a first cryomodule for the ESS and the CERN-SPL. The upgrade includes a new cryogenic transfer line between the cryoplant and RF test stand area with two horizontal cryomodule test places and four vertical RF test cryostats. Two of the vertical cryostats have been modified for 2K operation, which is necessary for the testing of the SPL cavities.

The industrial production of the series accelerator cavities for the European XFEL started successfully beginning of 2013. Until end October 2013, 164 series accelerator and ILC-HiGrade cavities for the European XFEL have been delivered to DESY. For many of the cavities that didn't pass the tests an additional treatment applying a chemical surface removal ("Buffered Chemical Polishing BCP") is under consideration. The development of advanced diagnostics like high resolution optical inspection and the experience of industrial cavity production and surface treatment will be extremely beneficial for any other European large scale SRF project such as ESS as well as for the preparation of the ILC.

[Read more >>](#)

Keywords: CRISP, SRF, European XFEL, cryomodule cavities



XFEL series cavity during incoming inspection at DESY.
Image credit: DESY.



Vertical test inserts equipped with XFEL superconducting accelerator series cavities.
Image credit: DESY.

LINKS

Accelerators for Society

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