NEWSLETTER
January 2011
Issue 6

DITANET

Special Interest Articles:

- **Last call for registration to DITANET School**
- LHC: Let there be light !
- Research News from GSI

Individual Highlights:

Schools, Workshops and Conferences

2011 will be a busy year for the DITANET Consortium:The network's broad training program will show all its facets during this calendar year.

The exciting series of events will start with an international school on beam diagnostics in Stockholm, Sweden **7th to 11th March** (more details below), before the network will organize a number of Topical Workshops across Europe during the year.

Following the very successful examples of the first workshops on "low energy, low intensity beam diagnostics" that took place in Germany in November 2009 and on "longitudinal beam profile measurements" in the UK in July 2010, details about a workshop on "novel detection techniques" that will be organized by US/CNA in Seville, Spain on **7./8. November** will be posted on our web site shortly. Additional workshops, covering the whole range of research topics that are addressed by the network partners, are in the planning stage.

The consortium will also organize an international conference on beam diagnostics. This 3-day event will be held between **9th to 11th November** with US/CNA as local organizer. It will bring the wider beam diagnostics community together to critically discuss the present state-of-the-art in our field, give all DITANET trainees the opportunity to present their research outcomes and serve as an ideal opportunity to discuss potential future collaboration and research challenges.

Keynote speakers from leading accelerator laboratories, universities and the industry sector will be invited to present an comprehensive overview of our field and hopefully trigger many interesting discussions.

I look forward to meeting you soon at one of our upcoming events !

Carsten P. Welsch, Coordinator

DITANET School: REGISTER NOW !

The **registration dead line** for our advanced school on beam diagnostics is approaching quickly and there are only **few places left** !

The school will take place in Stockholm, Sweden from **7th to 11th March 2011** and will cover all aspects of modern beam diagnostics for particle accelerators.

Fundamental diagnostic techniques will first be introduced before dedicated instrumentation for most different accelerator types, from low energy rings and medical accelerator to colliders and light sources, will be presented in detail.

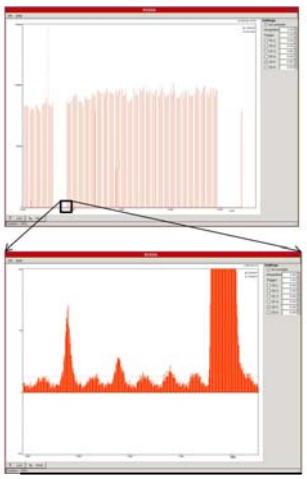
All details can be found at:

www.liv.ac.uk/ditanet

News from DITANET Partners

CERN, Switzerland *(A. Jeff)*

Installation of the Longitudinal Density Monitor



Measured longitudinal density profile in the LHC.

A prototype of the Longitudinal Density Monitor (LDM) for the Large Hadron Collider was installed in October 2010 and has been taking data with both protons and heavy ions.

The LDM, which is being developed at CERN by DITANET trainee Adam Jeff, is a single-photon-counting system attached to the LHC synchrotron-radiation telescope. A small proportion of the synchrotron light is directed to an avalanche photo-diode (APD) and the arrival time of individual photons is recorded in a time-to-digital converter. Built up as a histogram over thousands of turns, the photon arrivals make up a longitudinal profile of the LHC beam.

One of the major challenges is the large dynamic range which is required both in time and in intensity. The target resolution of 50 ps over the LHC's 89 μs revolution, equivalent to a precision of 15 cm around the 27 km ring, leads to a rather large result set. Similarly, measuring debunched beam and satellites among the much brighter peaks of full LHC bunches requires a large dynamic range in intensity. The target dynamic range of $1{:}3{\cdot}10^5$ will have to wait for phase 2 of the LDM, which will involve installation of a second APD with an ultra-fast optical gate to block light from the bunches.

However, on-line correction for the APD's deadtime and afterpulsing have already allowed a dynamic range of 10^4 to be achieved.

The image shown here demonstrates this large dynamic range. The upper part shows the whole LHC ring with 121 lead ion bunches. It is noted that the unprecedented energies of the LHC allow synchrotron light diagnostics not only with protons but even with lead ions !

Below is a zoom showing the very much smaller satellite bunches. The smallest peaks are spaced by 2.5 ns, corresponding to the RF period, while the slightly larger satellites are thought to be introduced in the LHC's injection chain.

GSI, Germany *(R. Singh, F. Kurian and P. Forck)*

Project Updates

GSI is a heavy ion accelerator facility, located in Darmstadt, Germany consisting of a linear accelerator, the SIS-18 synchrotron and the experimental storage ring.

There are two DITANET projects being undertaken at GSI presently, which will upgrade the systems in present facility and serve as a prototype for upcoming FAIR facility.

Tune measurement system (Rahul Singh): Tune is a global property of a synchrotron, and it has to be set appropriately to avoid beam losses. Tune diagnostics is an inherent part of any synchrotron.

News from DITANET Partners (continued…)

GSI, Germany *(R. Singh, F. Kurian and P. Forck)*
Project Updates

There are two DITANET projects being undertaken at GSI

A new digital tune, orbit and position measurement system (TOPOS) has been recently commissioned at the synchrotron SIS-18. The working principle of tune measurement is the following: First, a band limited noise exciter excites the beam; then a linear cut BPM measures the beam signal which is followed by a fast ADC and FPGA system which calculates the position of the beam; and finally an FFT is done over the position data to find the tune. All the above processes are done in real time, thus enabling the operators to use this system as an operational tool.

Recently the system has been used to observe the space charge effects on tune with increasing current [1], demonstrating the importance of this method for studying collective effects.

The tune measurement system is presently still under development, and investigations into the algorithms for position calculation, noise generator and noise level in the tune spectrum are going on.

Within the project, a novel stable, predict-able tune measurement system, which requires minimum beam excitation, shall be developed.

Low current measurement using a CCC (Febin Kurian):

The upcoming FAIR facility is designed to deliver high energy beams with unprecedented intensity of ion beams and anti-protons. Slow extraction, however, required especially for the production of rare isotopes, demands for an innovative, non-interceptive measurement of very low ion currents down to the order of nA.

A cryogenic current comparator is foreseen for this purpose because other beam current measurement devices do not offer the required low current resolution in the pA range. The development of an improved cryogenic current comparator unit is in progress at GSI in collaboration with FSU Jena and MPI-K Heidelberg.

Already back in the early 90's, GSI had developed a cryogenic current comparator that had demonstrate the capability of measuring currents well below 30nA. The first task of this project therefore is to re-commission the old system and perform prototype tests. The new improved unit shall be installed in FAIR as well as the Cryogenic Storage Ring at the MPI-K Heidelberg. The necessary replacement of the old components is in progress and a re-run of the system is expected by April 2011. In the meantime the development of an entirely new CCC unit is being brought forward in parallel to an upgrade of the DC SQUID control unit, which is the heart of the CCC system. The latter has now already been developed by FSU, Jena.

After extensive studies on the noise response, a new nano-crystalline material has been chosen for the toroidal magnetic field sensor. Simulation studies on the shielding factor of the magnetic shielding are expected to be finished in the first half of 2011.

References:

[1] R. Singh et al,

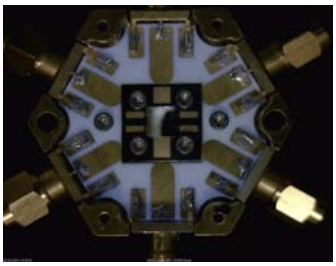
Observation of Space Charge Effects on Tune at SIS-18 with New Digital Base Band Tune Measurement System

Proc. HB2010, Morschach, Switzerland (2010)

News from DITANET Industry Partners

Diamond Detectors, United Kingdom *(K. Oliver)*

Project Updates



Diamond Detectors Ltd. is a subsidiary company set up by Element Six to manufacture innovative diamond radiation detectors, offering a range of fully packaged diamond radiation detectors and diamond plates as well as custom design services. The initial products developed in association with different Universities cover applications in high energy physics research such as the Large Hadron Collider (LHC) project at CERN, the new Facility for Antiproton and Ion Research (FAIR) at GSI in Germany as well as the Diamond Light Source (UK).

The Quadrant beam position monitor is suitable for a range of beam applications including X-ray synchrotron and charged particle beam lines. The low-Z diamond based detector is mounted over a hole on either a conventional PCB or on a diamond carrier substrate for thermal loads. Standard detector thickness options are 50,150,300 and 500 micron on a 4.5x4.5mm device, custom thickness and sizes available on request also available on electronic grade polycrystalline diamond for larger devices.

The advantages of single crystal diamond include

- Low X-ray absorption (Z=6)
- Radiation hard
- Excellent thermal and mechanical properties
- Compact, UHV compatible
- High positional resolution.
- Time resolution better than 1ns
- Homogenous
- Spectroscopic grade material, better than 1% energy resolution

For further information contact Kevin Oliver (CEO)

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diamonddetectors.com

New to the Network

Rui Pan

Rui graduated from Capital Normal University (CNU), Beijing, China in 2007 with a bachelor's degree in Optical Engineering. During his study he did two internships, one testing scintillators with cosmic ray at the Institute of High Energy Physics, Chinese Academy of Sciences, and the other testing aircraft engine turbine blades at the Institute of Aeronautical Materials in Beijing.
Following this he was very interested in the Terahertz field choosing to study for a master's degree in Optical Engineering, graduating from CNU in 2010. The Master's course specialized in the principles of optics, non-linear optical, advanced laser physics, and THz science and technology. His thesis focused on THz Time Domain Spectroscopy system and Thz fast imaging, including electro-optical detection techniques.

Rui entered the DITANET network in January 2011, and will work on the development of an electro-optical test set-up to measure longitudinal bunch lengths based at CERN, Switzerland.

Position Vacancies

Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH), Romania has a vacancy for a 12-15 months training contract available to either an Early Stage Researcher (ESR) or an Experienced Researcher (ER).

The successful applicant will work on the development of a 'Zero Time Detector' for future particle accelerators and be based in Romania and will have access to the broad training program the DITANET network provides.

Further information can be obtained by contacting the lead scientist Dr. Horia Petrascu, hpetr@nipne.ro.

Details on the Marie Curie eligibility rules and an outline of the project can be found on the DITANET web site:

http://www.liv.ac.uk/ditanet/projects/ifin-hh.html

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DITANET Events 2011	
March 7th – 11th	DITANET advanced School on Beam Diagnostics Stockholm, Sweden
March 10th	Meeting of the Steering Committee Stockholm, Sweden
March 11th	Meeting of the Supervisory Board Stockholm, Sweden
November 7th – 8th	Topical Workshop on Detector Technologies Seville, Spain
November 9th – 11th	DITANET Conference on Beam Diagnostics Seville, Spain
Other Interesting Events	
March 28th – April 1st	PAC Conference, New York City, USA
May 16th - 18th	DIPAC workshop, Hamburg, Germany
September 4th - 9th	IPAC Conference, San Sebastian, Spain

NOTICE BOARD

DEADLINE FOR THE NEXT NEWSLETTER
10th March 2011.

About DITANET

The development of novel Diagnostic Techniques for future particle Accelerators is the goal of the European Network (DITANET) which is installed within the Marie Curie ITN scheme. Several major research centers, leading universities, and partners from industry are developing beyond-state-of-the-art diagnostic techniques for future accelerator facilities, whilst jointly training students and young researchers within this unique European structure.

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