NEWSLETTER
July 2010
Issue 4

DITANET

Special Interest News:

- DITANET Prize Announced
- Second Topical Workshop

Individual Highlights

DITANET – helping to define improved early stage training standards

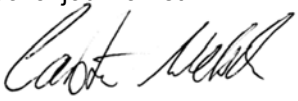
Within DITANET training is mainly through cutting edge research projects in beam diagnostics techniques for present and future particle accelerators. Being a strongly interdisciplinary research field, beam instrumentation is perfectly suited for providing a broad training in a number of expert topics in parallel. All network partners provide extensive local training to their Marie Curie Fellows. As most trainees are early stage researchers at the beginning of their careers, this is mostly realized in the frame of structured PhD programs and in collaboration with partners from different sectors.

In addition, DITANET organizes network-wide events, such as schools, topical workshops, and conferences which have to be attended by all network trainees, but are also open to the wider diagnostics community. Whilst most of this training targets scientific areas in beam instrumentation, some also address the so-called 'complementary skills'. This is part of our effort to improve on career development and employability amongst our trainees and is in line with realising PhD training as part of the professional career of a researcher, rather than a continuation of student life.

During 2003 a survey of 299 Marie Curie Fellows reported that 89% of fellows wished to receive training in complementary skills with 82% deeming that this would raise their employability status. The best way to acquire these skills was considered to be through dedicated training workshops. DITANET recently offered such a week-long training to all its trainees. The course was considered extremely beneficial by all participants and also helped in creating and strengthening links between trainees.

DITANET training standards are now already well-established and will clearly impact on future training across partner universities and disciplines. Our ideas were recently presented at a Learning and Teaching conference in Liverpool, UK and were very well received by a broad audience. This novel approach to postgraduate training, together with the very close links to industry partners, makes DITANET a 'research project in itself', as stated by a European University Association representative during the network's kick-off meeting.

Such changes in early stage training require learning and adjustment from both trainees and supervisors and are essential in ensuring that the next generation of researchers remains competitive in the international job market.



Carsten P. Welsch, Coordinator

DITANET Prize 2011

Applications are now invited for the DITANET Prize 2011. The Network will award a 1,000 € cash prize for an outstanding contribution to the field of beam instrumentation for particle accelerators by a researcher in the first 5 years of their professional career. The deadline for applications is **31/10/2010**

Full information on the application process can be found on the DITANET web site.

www.liv.ac.uk/ditanet

Recent Events

The Cockcroft Institute of Accelerator Science and Technology

Second DITANET Topical Workshop
Longitudinal Beam Profile Measurements
12th/13th July 2010

The exact determination of the time structure of ever shorter bunches in accelerators and light sources like the X-FEL, the ILC or CLIC is of high importance for the successful operation of these next-generation machines. It is also a key to the optimization of existing scientific infrastructures.
The measurement of the time structure poses a number of challenges to the beam diagnostics system: The monitors should be non-destructive, easy to maintain and provide time resolutions down to the femto second regime.
The DITANET consortium organized a two day workshop at the Cockcroft Institute, UK, on July 12th-13th 2010. The workshop brought together more than 20 experts from the world-wide beam diagnostics community to provide a forum for knowledge exchange, a review of the state of the art, and discuss future developments and challenges. Participants discussed the use of electro-optic techniques, coherent diffraction radiation, streak camera technology and rf deflectors to characterize the longitudinal beam structure in a range of particle accelerators, such as the LHC and CTF3, third and fourth generation light sources, as well as the US facilities SPEAR3 and ALS.

Further information:

http://indico.cern.ch/conferenceDisplay.py?confId=93401

News from DITANET Partners

Royal Holloway University of London

Royal Holloway University of London, UK *(N. Joshi)*

Several questions will still remain unanswered by the results from the quest of Large Hadron Collider (LHC) for Higgs bosons and new physics in the TeV energy range. Many of those questions could be answered by lepton-antilepton collisions, in which all quanta from electro-weak interactions would be produced with equal probability. To explore lepton collision events in TeV region, a Compact LInear Collider (CLIC) scheme is proposed at CERN. CLIC will be able to accelerate and collide electrons and positrons, with 3 TeV centre of mass energy. Its design is based on the 'two beam acceleration technique', and will require ultra low beam emittance with high beam stability. To achieve these parameters, it is essential to know the position and dynamics of the beam at various positions along acceleration path. As an ESR project within DITANET, RHUL is conducting a study of a Radio Frequency (RF) cavity Beam Position Monitor

Continued...

Design and simulation of a high resolution cavity beam position monitor system for single bunch (Continued)...

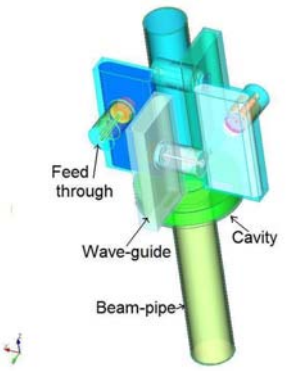
Royal Holloway University of London, UK *(N. Joshi)*

(BPM) system for the CLIC main LINAC.

The figure to the right shows a simulation model of the cavity BPM structure. A cylindrical cavity is a hollow conducting cylinder of certain radius and length, with both ends enclosed by conducting plates with a hole for the beam passage.

When a bunch of charged particles passes through the resonant cavity, it induces an electromagnetic field over various resonance modes. The amplitude of power coupled in the dipole mode is dependent on the position offset from the electromagnetic centre, which is also the cavity centre. The phase of the coupled field gives a direction of the offset from the centre. The power induced in the dipole mode is then coupled into a waveguide. This field is finally extracted to a coaxial line using a feed though. The extracted RF signal, which is in the GHz range, is down-converted to an Intermediate frequency (IF, in GHz range) signal, using a frequency mixer and a Local Oscillator (LO, in GHz range). This IF signal, after appropriate filtering, is finally digitized for further processing.

CLIC is still in its conceptual design phase and will have challenging beam parameters. To gather the essential fundamental knowledge about BPM system design and their operation with relatively simple bunch pattern, we participated in a BPM system design project for the DIAMOND light source at RAL, UK. A cavity BPM structure is designed and simulated using various 3D electromagnetic simulation software [1]. It is planned to use the 13th harmonic (6.495 GHz) of the RF system as a LO to down-convert the BPM signal. To achieve this IF frequency, the dipole frequency should be optimized at 6.4970 GHz. A BPM structure, including the cavity and a beam-pipe made of copper, is simulated using the Eigenmode solver Omega3P. The simulation showed the monopole and dipole modes of resonance with frequencies of 4.4030 and 6.4737 GHz, having an internal Q of 6266 and 7687 respectively. The required dipole frequency is obtained from simulation of an IF of 20 MHz, the full model including waveguide and feed through. A frequency separation of ~5 MHz is obtained by using asymmetric slots in X and Y directions. Detailed electromagnetic simulation showed good beam coupling between coupled ports and isolation better than 20 dB between X and Y ports. The monopole signal was suppressed better to better than 120 dB. From the wakefield simulation, for current Q values and a bunch repetition frequency of 500 kHz, the amplitude spill-over is less than 5%. It can be overcome by signal subtraction. Similar cavities, with such high monopole suppression, have already achieved a position resolution of ~50 nm. At present, the cavity is being fabricated.



Omega3P model of RF cavity BPM

CLIC will have a ~1.5 A beam, which is composed of 312 bunches with 0.5 ns separation. To reduce the effect of a voltage spill over between consecutive bunches, the overall *Q* of a cavity should be considerably reduced. CLIC has a requirement for the BPM resolution of 50 nm, over 20 MHz bandwidth. With our experience on relatively simple bunch patterns, we are now determining the optimum parameters, like frequency and *Q*, of a BPM system for CLIC. We will investigate into the full BPM structure through electromagnetic simulations after that.

References:

[1] A. Morgan et al. “Simulation of a cavity BPM for high resolution single pass beam position measurements”, *BIW, LANL, 2010.*

News from DITANET Partners (Continued)

CNA/University of Seville, Spain *(Z.A. Haidar, A. Bocci, M. Alvarez and J.G. Camacho)*

A new external line has been mounted in the cyclotron installed at the "Centro Nacional de Aceleradores" in Seville (CNA) in order to test two non interceptive beam transversal profile monitors (BTPMs). The equipment has been developed by the "Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas" (CIEMAT) in Madrid. The BTPMs are two fluorescence profile monitors (FPMs) designed and built for non-interceptive beam transverse profilers required for the "International Fusion Materials Irradiation Facility" IFMIF. One prototype is based on a commercial linear array multi-anode PMT (Photo Multiplier Tube - a 32 channel linear array *H7260* from *Hamamatsu Photonics*), whereas the other is a Custom Designed Intensified CID camera (ICID), both developed by CIEMAT. We performed, for the first time, a measurement with a deuteron beam in the cyclotron of the CNA, as well as first tests using BTPM devices, for measuring the profile of 9 MeV deuteron beams, injected at different currents from 400 nA to 40 μA.

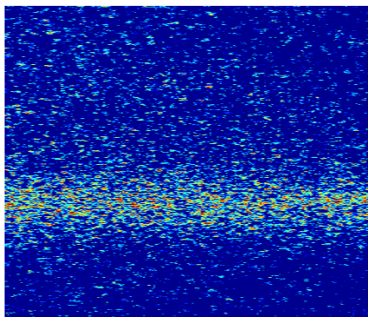
Recently the Basic Nuclear Physics Group of CNA participated in a meeting at GSI for a collaboration framework between the INFN, CEA, LPC, GSI and ESA. This collaboration is dedicated to an experimental campaign named FIRST: "Fragmentation of Ions Relevant for Space and Therapy". This project aims for an extensive study of nuclear reactions for hadron-therapy and space applications. The ER Alessio Bocci and the ESR Ziad Abou Haidar, at CNA, will be involved in the improvement of the experimental setup as well as in future measurements. In particular, the work will focus on setting up the Music IV detector at GSI, the front-end electronics, and a system of Flash ADC.

Concerning Medical Applications, collaboration between the CNA and the Institute of Experimental and Applied Physics of the Czech Technical University in Prague, and the University of Granada (Spain) is being negotiated in order to join efforts in the project of the dose measurement of IMRT (Intensity Modulated Radio-Therapy). The idea is to use pixelized tracking detectors with their related electronics. Such detectors have been tested in the 3 MV tandem accelerator in May 2010, showing promising performances.

Within collaboration with the University of Sao Paulo, experimental data analysis of proton reactions based on fragment identification and cross section measurements using silicon detectors was undertaken. The experiment was performed in Lisbon in October 2009. The conclusion of the experimental analysis and theoretical calculations show us a very interesting physical case that needs to be investigated more precisely and more deeply.

For this matter, the ESR Ziad Abou Haidar is now preparing a proposal and a protocol for an experiment of which he will be the spokesperson in order to measure the elastic scattering of protons, at low energies, against Ni target to study spin-orbit potential from a microscopic point of view.

This experimental data does not exist in literature, and the proton interaction, studied in a fundamental basis is a subject of interest for several areas such as Nuclear Astrophysics.



Transverse beam profile measured for the first time in the cyclotron

Experimental setup

New to the Network

Abdul Haneefa

Abdul graduated in Physics from the Government College Malappuram, University of Calicut in 2006, gaining a Masters in Radiation Physics at the Department of Physics, University Of Calicut, India in 2008. As an integral part of this course, Abdul trained at the Regional Cancer Centre, Kerala, India where he was exposed to medical linear accelerators, dosimetry and quality assurance in cancer therapy.

Following his Masters, Abdul undertook a radiological safety course at Bhabha Atomic Research Centre (BARC), India qualifying as a Radiation Safety Officer (Level III). From March 2009 onwards he worked as a medical physicist/radiation safety officer at the International Cancer Centre in India. Here his duties were to calibrate and measure the medical radiation therapy machines including teletherapy cobalt, medical LINAC and brachytherapy.

In March 2010, Abdul joined the Nuclear Physics Department of IFIN-HH, Romania as a DITANET Trainee, where he is working to develop a new type of detector for particle accelerators. This project entitled 'Zero-Time Detector Development for Future Particle Accelerators' aims at studying the composition of heavy ion beams.

Fairoja Cheenicode

Fairoja completed her first degree in physics in 2006 and pursued her Masters in Physics at the University of Calicut, India in 2008. Here, Fairoja chose to specialise in quantum field theory and astrophysics with a strong focus also on solid state and nuclear physics.

During her Masters she presented several seminars and carried out two projects at IIA (Indian Institute of astrophysics- Bangalore, India) on data analysis using IDL (Interactive Data Language) in radio astronomy and solar optical telescopes and its instrumentation in solar astronomy. Additionally, she realized a small computational project based on microprocessors and microcontrollers at the University of Calicut, India. With a strong interest in the field of experimental physics, Fairoja entered the DITANET programme as a trainee in May 2010 joining IFIN-HH, Romania where she will work on the development of 'Electronics for Zero Time Detectors'.

New to the Network (Continued)

Tomasz Cybulski

Tomasz studied medical physics and dosimetry at the AGH University of Science and Technology in Krakow, Poland. His Master's thesis dealt with TL dosimetry for mixed fields of ionizing radiation of photons and charged particles. His experimental work was conducted at both The Institute of Nuclear Physics in Krakow, Poland and the Joint Institute for Nuclear Research, Dubna, Russia. He investigated the properties of thermo-luminescent detectors, part of the international MATROSHKA project on the International Space Station. The irradiation with heavy ion beams was conducted at JINR.

After graduating in 2006 he started his work in the industry sector with Synektik Sp. z o.o., Warszawa, Poland where he worked as a dosimetrist in the quality assurance of X-ray diagnostic medical devices. He was also responsible for the development of measurement methods and procedures.

Tomasz joined the Quasar Group and DITANET on the 1st of June 2010 and is based at the Cockcroft Institute, UK. He is developing beam monitoring detectors for the Clatterbridge Center for Oncology working with hadron therapy for eye tumors. His research is also incorporating numerical studies of the beam line and design of beam detectors for intensity measurements and exact position of the beam.

Product News from Instrumentation Technologies

(DITANET Associate Partner)

Beam Diagnostics Experts Meet at the Libera Workshop

The latest Libera family member Libera Single Pass H – hadron phase & position processor

Instrumentation Technologies is hosting the 6th Libera Workshop - the annual Libera community gathering from 12th to 15th October in Solkan, Slovenia. The workshop will focus on applications using the Libera family of instruments, state-of-the-art instrumentation systems used for diagnostics and beam stabilisation at particle accelerators.

This year the workshop also focuses on beam stabilisation instrumentation for hadron accelerators, including the development of the hadron phase and position processor, part of collaboration in the FAIR project at GSI in Darmstadt, Germany. This instrument may be coupled with Libera LLRF, the digital RF stabilisation system, and Libera Sync, a very low-jitter clock distribution system. Practical examples of their use on accelerators and demonstration of the systems will be looked at.

The Libera Workshop is an opportunity to network with experts from the accelerator field and explore how to optimise the beam stability from injection to the end station. The participants learn about the use of Libera instruments at different accelerators around the world and get practical experience as well as intensive training.

Learn more about the instruments and the workshop at:

http://www.i-tech.si

Position Vacancies

PhD Position
Royal Holloway University of Lodon/Diamond Light Source

Royal Holloway University of London announce the immediate availability of a PhD studentship in accelerator physics at Diamond Light Source.

Diamond is a 3rd Generation Light Source built to provide a high intensity radiation beams from far infrared to X-ray region, and is the largest electron beam based facility in the UK. The diagnostic possibilities supplied by the intense light emitted from the beam are currently in very high demand by applied scientists from many research disciplines.

Its performance is limited by an onset of so-called "microbunch instabilities" which appear when the beam charge exceeds a certain threshold, and John Adams Institute at Royal Holloway is involved in a project to investigate the nature of the instabilities through the analysis of micro-wave radiation emitted by the electrons. The purpose is to understand the origin of the instabilities and develop a strategy for controlling them.

The PhD student would be working on diagnostics to monitor the nature of the emitted radiation, as well as developing mathematical tools to understand the physics of the generation of the light, and the project would involve a substantial amount of time working at Diamond, as well as with the accelerator physics academics at Royal Holloway.

Full information on this post can be found at: https://www.pp.rhul.ac.uk/twiki/bin/view/Public/JohnAdamsInstitute

Experienced Researcher Position
DESY/DITANET

DITANET have a vacancy for an Experienced Researcher based at DESY, Germany working on the project 'Resonant Diffraction Radiation from Inclined Targets as a Tool for Bunch Lengths Diagnostics'.

Full information on eligibility and the application procedure can be found on the DITANET web site and an overview of the project can be found at: http://www.liv.ac.uk/ditanet/projects/desy.html

If you wish to advertise a vacancy in this newsletter please contact the Project Manager.
g.p.wall@liv.ac.uk

DITANET

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Examples of Recent Publications/Presentations:

Publications:

A. Papparardo, L. Cosentino and P. Finocchiaro, 'An imaging technique for detection and absolute calibration of scintillation light'. Review of Scientific Instruments 81, 033308 (2010).

C. P. Welsch, 'DITANET - A European Training Network on beam Diagnostics for Particle Accelerators'. International Committee for future Accelerators Beam Dynamics Newsletter No. 51: Accelerator Science and Technology in the UK. S. Chattopadhyay and W. Chou (eds.) April 2010: 202.

Events 2010/2011:

DITANET Events 2010	
2010	
October 15th	DITANET Steering Committee Meeting, CERN
DITANET Events 2011	
March 7th-11th	3rd DITANET School on Beam Diagnostics Techniques
Other Interesting Events	
September 12th-17th	LINAC, Tsukuba, Japan
September 12th-17th	ECAART, Athens, Greece
May 16th-17th	DIPAC, Hamburg, Germany
September 4th-9th	IPAC, San Sebastian, Spain

NOTICE BOARD

DITANET: FINAL CONFERENCE
This event will take place in Seville, Spain during November 2011.

DEADLINE FOR THE NEXT NEWSLETTER
20th September 2010.

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.

This project is funded by the European Commission as part of the FP7 Marie Curie Actions under contract number PITN-GA-2008-215080.

PEOPLE

UNIVERSITY OF LIVERPOOL

The Cockcroft Institute of Accelerator Science and Technology

MARIE CURIE ACTIONS