

HIGHLIGHTS FROM DIPAC2011

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Abstract

The 10th European Workshop on Beam Diagnostics and Instrumentation for Particle Accelerators (DIPAC2011) was hosted by Deutsches Elektronen Synchrotron (DESY) and took place on board of the museum freighter Cap San Diego at the port in the city centre of Hamburg, Germany. The talks and poster sessions were held in the former cargo holds of the Cap San Diego which created a quite exciting atmosphere for such a workshop. This unusual venue and a very interesting program stimulated a record number of participants to join: 294 registered participants, 21 industrial exhibitor booths, 194 posters, 13 invited and 17 contributed talks and a visit of DESY formed a lively 3½ days program with so many very high quality contributions that it becomes quite unfair to select only a few in this summary.

DIPAC, BIW AND IBIC

This 10th DIPAC was also the last one in the DIPAC series which started 1993 in Montreux. A short and informal summary of all DIPACs were given by A. Peters, HIT, at the close-out of this workshop. Remarkable details of each DIPAC and the increase of participants (see Tab. 1) were highlighted by him. The largely grow of participants shows the increasing importance of beam diagnostics around the world. This was one of the reasons that the recent BIW, DIPAC and Asian beam instrumentation committees had decided about some important changes of the following beam diagnostic workshops: BIW and DIPAC will be merged into a truly International Beam Instrumentation Conference which will circle around the three regions Asia, America and Europe. After some international discussions and voting within the committees a common name was created: **IBIC**: The following schedule was fixed:

- 2011 - Last DIPAC in Hamburg, Germany
- 2012 (May) - Last BIW in Newport News, USA
- 2012 (Sept) - 1st IBIC in Tsukuba, Japan
- 2013 (May) - 2nd IBIC in Oxford, UK
- 2014 - 3rd IBIC in USA
- 2015 - 4th IBIC in Asia,
- 2016 - 5th IBIC in Europe, etc.

Table 1: Summary of DIPACs

Year	Location	Institute	Participants
1993	Montreux, CH	CERN	100
1995	Travemünde, D	DESY	100
1997	Frascati, I	INFN	130
1999	Chester, UK	CLRC DL	100
2001	Grenoble, F	ESRF	150

2003	Mainz, D	GSI	130
2005	Lyon, F	CERN	150
2007	Mestre, I	ELETTRA	190
2009	Basel, CH	PSI	210
2011	Hamburg, D	DESY	294

THE VENUE

The unusual venue of DIPAC2011 was well accepted by the participants. Many of them visited the Cap San Diego (<http://www.capsandiego.de/>) from its bridge down to the machine room. Lively discussions took place nearly everywhere, on different decks as well as in various open rooms. The speaker could also be seen and heard from the decks above the auditorium due to a large winch shaft. This strongly integrates the industry exhibition with 21 booths on the two decks above the auditorium into the workshop. Although the city centre of Hamburg and all hotels were in walking distance, almost all participants remain on board during the breaks because of the exciting atmosphere and due to the coffee and lunch served on three decks. Three more cargo rooms were prepared to host the poster sessions, providing plenty of space for more than 100 posters per day.

THE PROGRAM

DIPAC2011 extended the program to three full days plus a half-day visit of DESY at the fourth day. Registration was possible at the evening before the first day joined by a welcome drink with (sponsored) Hors d'Oeuvre which was very well visited. Part of the program was also a happy hour and a farewell-cocktail on board on the following evenings. These (sponsored) events were very well honoured by the participants since this created an informal forum for additional discussions between the colleagues.

The workshop banquet took place at the historic brewery “Gröninger” in the vicinity of the Cap San Diego. Its rustic ambience and the famous local beer contributed to a relaxed atmosphere which enabled another informal “networking” between participants.

A visit of DESY with guided tours to the accelerator facilities completed the workshop on the fourth day. The tour provided a comprehensive overview of the past, recent and future accelerators and experiments at DESY and their adjacent instrumentation for beam diagnostics.

The scientific program of DIPAC2011 was divided into different topical blocks where one or two invited talks were accompanied by contributed talks of the same topic. The idea behind such blocks was that the invited talk should give an overview of the topic while the contributed

talks presented most recent developments within this topic. The program committee was able to form topical blocks entitled: “Introduction and Close-out”, “News”, “BPMs”, “Machine Commissioning”, “Electronics”, “Optical Diagnostic” and “Current Monitors”. The block “News” was filled with selected contributed talks of recent news of topics which were not part of the other blocks. Each block was finished by a discussion session of 20 minutes where remaining questions of that topic were discussed in the auditorium.

In the following I’ve selected some highlights out of this blocks although there were many more highlights and extreme high quality presentations, posters and reports also from other topics. Sorry for not touching them all.

Introduction and Close-out

Since DESY was the host of DIPAC2011, the director of the accelerator department of DESY, R. Brinkmann, was invited to present the accelerator projects at DESY as the first talk. He closed the loop from the Nano-Cosmos with the infinite small elementary particles over the Condensed Matter with infinite complex structures to the Universe with infinite large dimensions. He showed that DESY is involved in all of these topics due to its research on HERA and LHC, its modern light sources FLASH, XFEL and PETRAIII and on astrophysics with IceCube and CTA.

The two following talks summarised comprehensively modern electron beam diagnostics (H. Loos, SLAC) and photon diagnostic (M. Gensch, HZDR) for x-ray FELs. Both together gave a good stimulus due to their experienced overviews over requirements on instruments and diagnostics for recent and future accelerators. This was finally completed by the close-out talk of J. Wenninger, CERN, who stressed the importance of (the existing!) reliable and well understood diagnostic systems at LHC. He concludes that the LHC can only be operated **efficiently** with excellent diagnostics and **safely** with a high performance and failsafe beam loss system.

News

The program committee selected four contributed talks out of the 200 abstracts to be presented in the “News” session and not covered by other blocks. These talks spanned different topics: X-ray BPMs, Emittance and Energy measurements at Wakefield Accelerators, Halo Monitoring and Bunch-Compression Gymnastics.

My favourite in this block was the talk of Ch. Bloomer from DIAMOND presenting a new type of x-ray BPM. He presented the design and first measurements of a backscatter x-ray BPM with an aperture in order to allow the user light pass through the center. Since the majority of the halo photons that would strike the foil are still <1keV the remaining thermal problems were solved by a shallow-angle copper wedge with a hole in the centre of the aperture. After solving some light reflection issues, they were able to measure the beam position of the x-ray beam successfully. This type of monitor has several advantages: Compared to standard vane XBPMs this

monitor provides far more information regarding the photon beam distribution and helps to overcome undulator-gap dependent effects.

Beam Position Monitoring (BPMs)

As usual in almost all DIPACs, the BPM topic incorporated the major amount of abstracts; at DIPAC2011 we received more than 40 papers of that topic. M. Wendt, FERMILAB gave a very nice ‘Overview of Recent Trends and Developments for BPM Systems’ while the two following talks concentrated of Cavity BPM Systems (A. Lyapin, JAI and R. de Monte, ELETTRA). Since the ‘90th, the record resolution of Cavity BPMs was improved from 25 nm at SLAC-FFTB down to 8.7 nm with the C-Band ILC IP-BPM (KEK) at ATF.

Out of so many contributions I’ve selected my personal highlight as “Embedded Collimator Beam Position Monitors” and “Electromagnetic Simulations of an Embedded BPM in Collimator Jaws” by C. Boccard et al., CERN. These posters presented the idea of having embedded BPM buttons in collimator jaws. Wire measurements on a test bench showed the expected behavior of the signals which were also successfully compared with real beam measurements as well as simulations with CST Studio. A final test in the SPS shows that the buttons worked well even in the presence of strong beam loss. They conclude that embedded BPM will be an advanced feature of next generation collimators for LHC. One should be able to center the jaws with a resolution below 1µm.

Machine Commissioning

T. Toyama, KEK, J-PARC, gave an excellent overview about the ‘Beam Instrumentation in J-Parc’. These kinds of very high intensity machines can suffer from the impedance of the BPMs, driving longitudinal microwave instabilities. The newly designed and installed electrostatic BPMs have a large capacitance which reduces its longitudinal impedance. This was carefully simulated and measured so that no longitudinal instability was observed in the MR. The inevitable transversal instabilities were successfully combated by a transverse bunch-by-bunch feedback system.

The talk of U. Irso, CELLS, highlighted the importance of working, reliable and calibrated ‘Diagnostics during the ALBA Storage Ring Commissioning’. He concluded that the diagnostics components at ALBA eased an efficient commissioning. Since this is a very important part of our job in beam instrumentation and diagnostics, I like to highlight that again.

Another part of our job is to ensure a safe and reliable operation of the accelerator. The talk of L. Fröhlich, ELETTRA, ‘Instrumentation for Machine Protection at FERMI@ELETTRA’ highlighted the importance of Machine Protection equipment even at relatively low average current machines. The use of various types of BLMs and online dosimeters is important to keep

radiation induced faults and activation as low as possible. The importance of Machine Protection Systems (MPS) was also documented by ≈ 20 MPS and BLM related contributions including the interesting talk of C. Zamantzas, CERN, about ‘Designing Electronics for the use in Radiation Environments’.

Electronics

Beside C. Zamantzas’s talk there were two further talks in the Electronics block (A Boccardi CERN, and P. Gessler, DESY), both about modern Crate systems. A. Boccardi summarized the main players in this field, like VME, PCIE, VXS and xTCA. He pointed out, that new developments in that field were driven by the need to have high bandwidth communication between the boards. Therefore P. Gessler preferred clearly the xTCA standard which offers beside a high speed point-to-point connection also an increased availability by redundant power (and fan) and by a well-defined remote management. He concludes that μ TCA and the newly defined MTCA.4 are good platforms for large installations in industry and science.

Optical Methods

Optical methods for beam diagnostics are widely used in nearly all kind of machines. More than 30 contributions were dealing with the measurement of transversal beam parameters (e.g. size, emittance) with optical methods like OTR, IPM, BIF, SR and screens. A hot topic on DIPAC2011 was the effect of coherent Optical Transition Radiation (COTR) which destroys an OTR image of the beam completely. This was pointed out already in the introduction talk of H. Loos and summarised in the beginning of this block by S. Welsch, DESY. All VUV- and X-FELs suffer nowadays from this effect. Therefore some solutions were discussed by various talks and posters: L.G. Sukhikh presented results of measurement on backward OTR in extreme ultraviolet region (EUV) where no coherent effects are expected due to the shorter wavelength. Clear and reproducible radiation was observed; therefore he claimed that “with this method beam profile diagnostics seems to be realistic”.

Another solution discussed was to use scintillating screens and a lot of studies of various screen parameters were presented in two talks (B. Walasek-Höhne, GSI and O.I. Meshkov, BINP) and many posters. It became clear, that scintillating screens worked quite well at not too intense beams and larger beam dimensions but also that those are limited in resolution to some ten microns by various effects, e.g. grain size (phosphor) or internal optical reflections (crystals). Minjie Yan (University Hamburg) showed in her poster beam size measurements with different tilts of LYSO- and BGO-screen showing that an optimum tilt exists for each observation geometry. Surprisingly, placing the camera normal to the beam (typical configuration for beam size measurements), shows the worst resolution among the three geometries.

In the same paper it was discussed that COTR will take place on every surface, therefore also on scintillation

screens. This and residual synchrotron light disturbs the image as well. It was shown that looking only to the relative long decay of a LuAG screen after 100 ns with a gated camera can remove effectively the COTR so that a clean beam image could be observed.

Current Monitors

The current monitor block was introduced by a rich overview talk of D. Belohrad, CERN, presenting the “State of the Art Beam Current Measurements”. There was an additional bunch of very interesting and high quality contributions ranging from fC to A measurements. I like to point out a poster presented by K.B. Scheidt, ESRF, which demonstrates clearly an improved stability and much less noisy beam current measurement by using the sum of all available BPM sum signals. In a low bandwidth application (0.05 – 1 Hz) this allows a much faster response time for the calculation of very long lifetimes (≈ 100 hrs) than with usual PCTs.

ACKNOWLEDGMENT

Let me take now this opportunity to acknowledge the hard work of the international Program Committee who formed this interesting scientific program with exciting topics and brilliant speakers. Also I’ve received from the committee some very useful and important hints concerning organization issues.

My special thanks are going to our colleagues from Japan who all did the travel to Hamburg although the devastating earthquake that had occurred two months before had had strong impact to their personal relationships and institutes.

And I would like to thank JACoW and the Editors of the proceedings for their enthusiasm to place online an almost full set of talks and reports just at the end of the workshop and for their professional finalization of the proceedings.

I hope that all participants had enjoyed the service and catering on board as much as I did. The crew of the Cap San Diego and the “Hamburger Gastmahl” were always comprehend partners and they provided a service exceeding my expectations. Thanks a lot for this wonderful hospitality.

Finally, I’d like to thank many colleagues of DESY, especially the Local Organizing Committee and the Workshop Staff for their fantastic support! The unusual venue brought quite some extra load to them, but all were enthusiastic in preparing and running DIPAC2011 on board of the Cap San Diego and they were sad to disassemble the setup. Hey, you did a really, really good job!!!

Now, let’s have a farewell to DIPAC and let us welcome IBIC.

REFERENCES

Proceedings of the 10th European Workshop on Beam Diagnostics and Instrumentation for Particle Accelerators, DIPAC2011, Hamburg, Germany, May 16th–18th, 2011, <http://adweb.desy.de/mpy/DIPAC2011>