HIGHLIGHTS FROM THE 2010 BEAM INSTRUMENTATION WORKSHOP*

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Abstract

The 14th Beam Instrumentation Workshop (BIW10) was hosted by the Los Alamos National Laboratory (LANL) and was held in the La Fonda Hotel in downtown Santa Fe, NM, USA from May 3 – 6, 2010. At BIW10, there were a record amount of participants including 177 registered attendees, 92 poster presentations, and 22 companies represented. The oral presentations included 3 tutorials, 8 invited, 10 contributed, a Faraday Cup Award, 2 Vendor Technical, and 1 Special. This oral presentation provides an overview of beam instrumentation areas of interest, which were discussed during the workshop. From a selection of the BIW10 presented papers, a number of technical highlights will also be described. Finally, this oral presentation will briefly discuss the BIW10 Thursday afternoon tour that took place at the Los Alamos Neutron Science Center (LANSCE).

INTRODUCTION

A BIW was held in Santa Fe, NM on May 3 – 6, 2010. LANL sponsored the workshop and the venue was the La Fonda Hotel. Fig. 1 shows the picture of all of the BIW10 participants. As in previous beam instrumentation workshops, BIW10 continued to offer a small size, no parallel presentations or sessions, various types of oral presentations, a Tuesday afternoon poster paper session, a Wednesday evening banquet, and a Thursday afternoon LANSCE tour.

Figure 1: The BIW10 participants pictured on the La Terraza portal of the La Fonda Hotel.

BIW INFORMATION

As Table 1 indicates, BIW10 was held in a location near the primary sponsor of LANL. Recent years have shown there has been increased participation from technical contributors and vendors from all over the world. This increase in participants not only included individuals from the United States but also included individuals from European and Asian countries.

Table 1: Recent BIW Information

Year	Primary Sponsor	Location	Participants
2010	LANL	La Fonda Hotel, Santa Fe	177
2008	LBNL	Granlibakken Conf. Cntr., Lake Tahoe	115
2006	FNAL	On site, Batavia	119
2004	ORNL	Marriott Hotel, Knoxville	120

Table 2 shows a number of recent BIW oral and poster presentations. For BIW10, the tutorial oral presentations each consisted of 75-minute presentation and a 15-minute Question and Answer (Q&A) session. Also, the invited and contributed oral presentations each consisted of a 35- and 20-minute presentation and 10-minute Q&A session. BIW10 also included 20-minute special presentation and vendor technical oral presentations.

Table 2: BIW Publishing Statistics

Year	Tutorial Oral	Invited Oral	Contributed Oral	Poster	Discussion Session
2010	3	8	10	92	Working Lunch
2008	3	8	7	53	Yes, 4 - 6
2006	3	7	7	40	Yes, 4 - 6
2004	3	2	12	37	Yes, 4 - 6

BIW10 did not offer the traditional series of discussion sessions, but included a Tuesday working lunch so that participants could share their own personal experiences. Several topics were discussed including types of cables that are effected less by radioactivity (Fig. 2).

BIW10 published the proceedings in two locations, the more dynamic content was published and continues to be maintained by LANL at http://www.lanl.gov/conferences/biw10/ and the static content is published in the web site maintained by the Joint Accelerator Conferences Website (JACoW) at http://accelconf.web.cern.ch/AccelConf.

BIW10 also provided 1 & ½ day period for 22 vendors to show their products and discuss technical topics with other workshop participants. Fig. 3 and 4 show these vendors and participants in various technical discussions.

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Figure 2: The LANL narrator, Rod McCrady, leading the working lunch discussion session.

Figure 3: BIW10 participants gather and discuss the technical topics during the Monday Vendor Reception.

Figure 4: Several BIW10 participants discuss the presentation of Barrie Gilbert (right, foreground), an Analog Devices Inc. designer and employee.

INITIAL ORAL PRESENTATIONS

During BIW10 initial session, the initial two presentations were from the then Accelerator and Engineering Directorate (ADE) leader, Scott Gibbs, and the then Accelerator & Operations Division leader, Kevin Jones. Scott presented an overview presentation of how accelerators contribute to LANL titled "Accelerators at Los Alamos Today" and Kevin presented LANL's future accelerator facility Matter-Radiation Interactions in Extreme (MaRIE) in "Looking Beyond LANSCE: The MaRIE Facility" [1,2]. Fig. 5 shows Kevin Jones explaining the MaRIE facility to the audience.

Figure 5: One of the two Keynote presenters, Kevin Jones, discusses the future LANL MaRIE facility.

Also, during the first day of presentations, the Faraday Cup Award was given to the co-recipients' of Kirsten Elaine Hacker of DESY and Florian Loehl of the Cornell University's CLASSE facility for their contribution "Femtosecond Resolution Beam Arrival Time Monitor" [3].

ADDITIONAL ORAL PRESENTATIONS

Three instructive tutorial orals were presented during BIW10, including Barrie Gilbert of Analog Devices, Inc. gave the presentation about logarithmic amplifiers, Mark Gulley of LANL gave the presentation about tuning a beam line, and Alezander Zhukov of Oak Ridge National Laboratory and the Spalation Neutron Source (SNS) gave the presentation about Beam Loss Monitors [4,5,6].

Additional invited and contributed orals were presented during the BIW10 workshop including Rhodri Jones of CERN providing an update of the Linear Hadron Collider and a description of "the incident" [7].

Alezander Aleksandrov of ORNL/SNS gave an oral presentation and discussed the beam operational instruments and how they were used to quickly commission the SNS facility (Fig. 7) [8]. Sasha further discussed how these instruments were presently being improved by increasing their dynamic range (Fig. 8).

Daniela Leitner of LBNL and the Facility for Rare Ion Beams (FRIB) presented an oral paper in which she describes what beam instrumentation are needed for an Electron Cyclotron Resonance (ECR) ion source [9]. The ECR source is capable of providing multiple species and charge state plasma sources, a good match for a heavy ion beam facility. Fig. 9 shows the mass-to-charge ratio of a typical FRIB ECR ion source. Fig. 10 shows how extracted beam transverse distributions from an ECR source are very complicated.

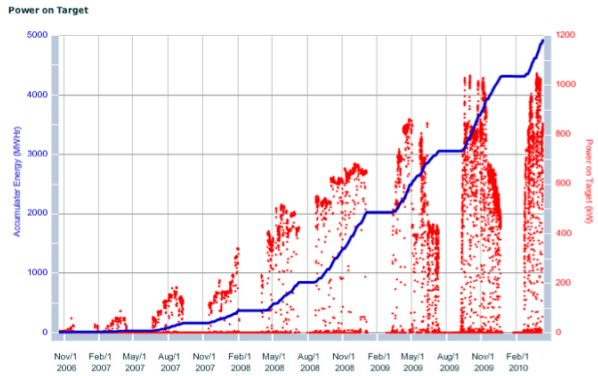

Figure 6: Within an approximate 1-year period, SNS increased its on-target beam current.

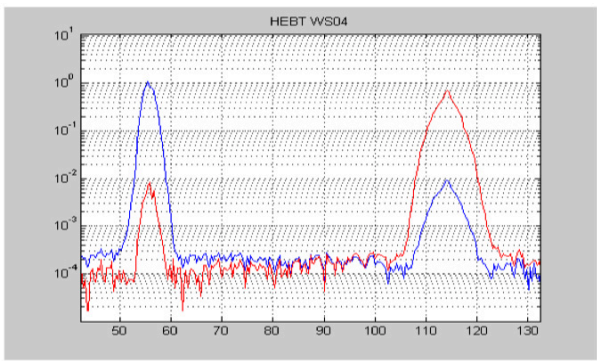

Figure 7: During a single wire scan, there was coupling between the wire scanner horizontal (red trace) and vertical (blue trace) wires. This coupling is being eliminated, thereby increasing the wire scans dynamic range.

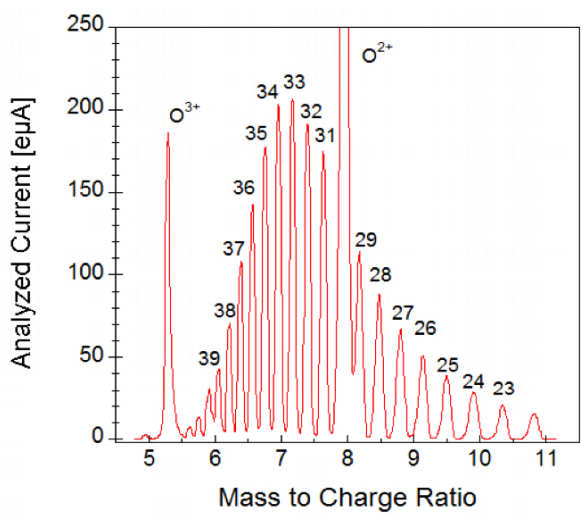

Figure 8: A variety of ECR ion source analyzed species provided to FRIB.

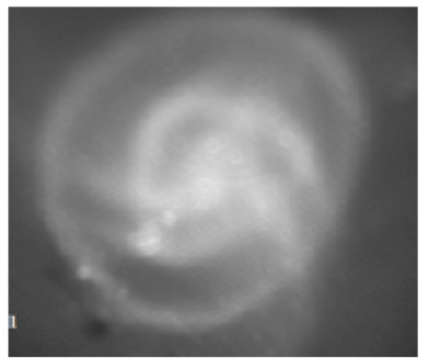

Figure 9: This graphic of a viewscreen shows the two-dimensional shape of multi-species extracted beams 1 m downstream.

David Douglas of TJNAF discussed Energy Recovery Linacs (ERLs) and describes how an efficient ERL also has unique features, such as the beam does not have time to reach equilibrium – like a linac [10]. Due to the beam's high power, controlling the beam's halo is necessary. Furthermore, since the beam's transverse distribution is not always linear, the beam's rms width is not a good description of its transverse extent. Therefore, having beam instrumentation that measures the beam's actual transverse distribution is also necessary. David also described how one sets the cavities to accelerate the beam during without increasing space charge effects, and after the beam initiates FEL lasing, the beam is then deaccelerated using the same-but-reset cavities (Fig. 11).

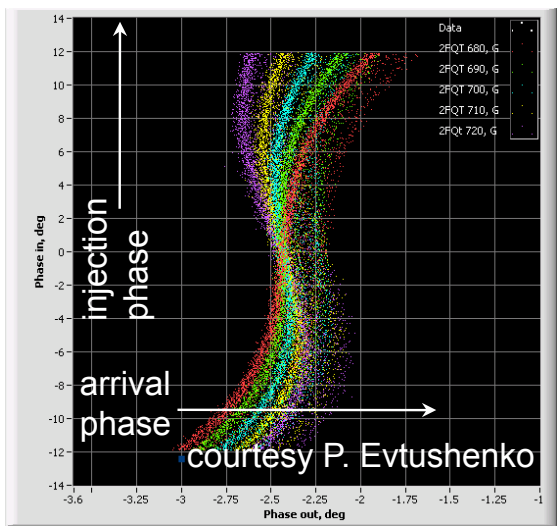

Figure 10: The ERL acceleration cavities are first set to accelerate beam in such a way so as to minimize beam space charge effects.

Guenther Rehm of the Diamond Light Source reported how Diamond personnel acquire tune measurements by injecting the beam into the Ring with a beam whose position is sinusoidally disturbed a shorter distance than the beam's width [11]. This process results in a continually updated tune measurement that is invisible to

the users. The beam position detection is accomplished using a digital I/Q detector and the known sinusoidal disturbance. Fig. 12 shows the individual horizontal and vertical bunches moving a short distance than its width.

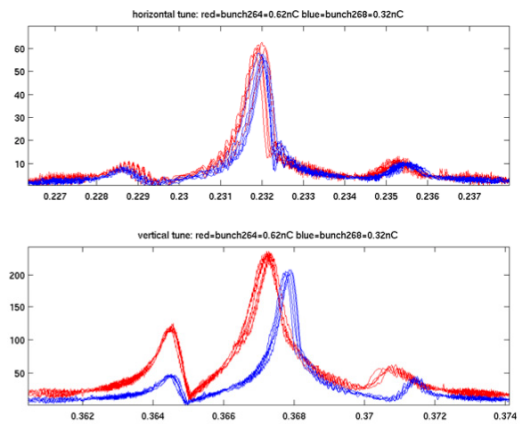

Figure 11: Horizontal (red) and vertical (blue) tune measurements of the sinusoidally disturbed beam for the Diamond Light Source ring.

Fig. 13 shows the measured and modelled response matrix from 24 different correct responses.

Ralph Fiorito of the University of Maryland and Carsten Welch of University of Liverpool reported on a digital micro-mirror array that has been successfully used to experimentally acquire beam halos [12]. Ralph's oral presentation discusses how this technique is accomplished using the multi-pixel micro-mirror array (Fig. 14).

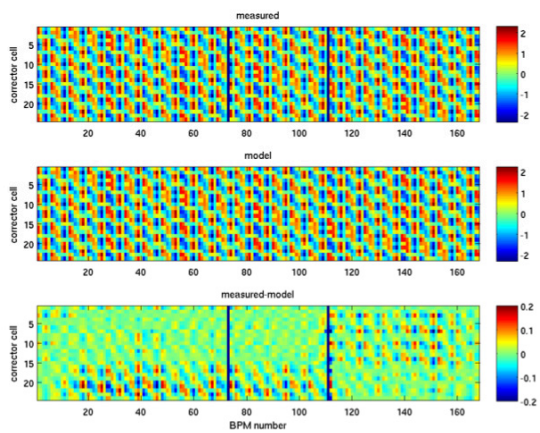

Figure 12: Using this injected moving beam bunch techniques, typical Diamond Light Source measured (top), modelled (middle), and resultant corrector response matrices (bottom) are graphically displayed.

The beam core is allowed to reflect to another location, while the beam halo is digitally acquired and displayed using a lower resolution digitizer. The two images are then digitally assembled (Fig. 15).

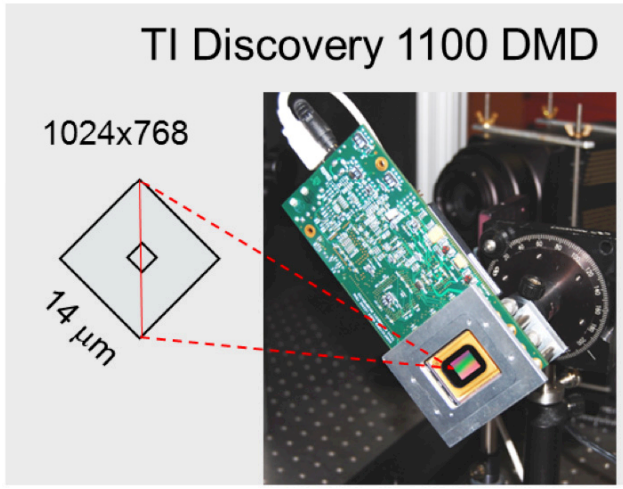

Figure 13: The Texas Instruments digital micro-mirror array transmits the transverse beam distribution without the beam core, i.e., the beam halo.

There were many interesting poster papers presented at BIW10 but due to a lack of space in this paper, only some of the beam profile measurement papers will be listed within the References Section, including 2 papers about beam induced fluorescence profile monitors, 2 papers about laser wire H^- beam profile measurements, 2 papers about residual gas ionization beam profile monitors, and a paper describing various image properties of inorganic scintillators [13, 14, 15, 16, 17, 18, 19].

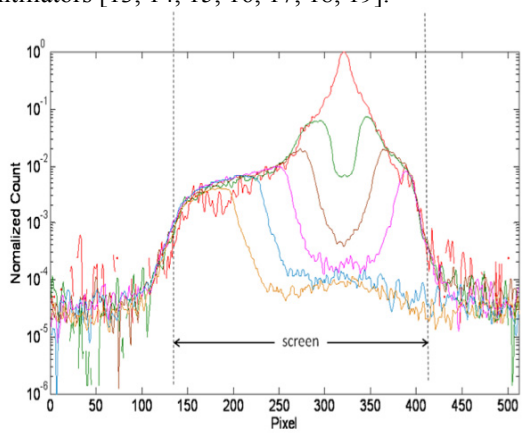

Figure 14: This graphic shows a transverse projected distribution of the beam core and halo (distribution edges) using a digital micro-mirror array.

LANSCE FACILITY TOUR

On Thursday afternoon, a tour of the Los Alamos National Science Center (LANSCE) was provided to a subset of BIW10 participants. After a brief overall description of the facility, the participants observed the injector area, the drift tube linac, and transition region, and coupled cavity linac that accelerates the beam from 760 keV to 800 MeV. They also saw the facility control room, the klystron-tube area, and the Switchyard area (Fig. 16). Finally, they saw the Lujan Center where all of the neutron-related experiments take place.

Figure 15: LANL guide Thomas Spickermann is explaining the Switchyard area to individuals taking the LANSCE facility tour.

SUMMARY

As in previous DIPACs, BIW10 showed an increase in beam instrumentation interest, i.e., the beam instrumentation field is growing. There were a wide variety of oral presentations, included oral presentations about atypical facilities, e.g., ERL's or ECR Ion Sources. Approximately 50% increase in poster presentations from previous years, and a large participation in vendor and exhibitors, e.g., 1 & ½ days were provided for vendor displays and further fellow-participant discussions.

All of the presentations, both oral and poster, are now published on 2 web sites. LANL's web site, http://www.lanl.gov/conferences/biw10/, includes videos and embedded movies, and the JACoW web site, http://accelconf.web.cern.ch/AccelConf, includes archival information, such as papers.

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[2] K. Jones, "Looking Beyond LANSCE – the MaRIE facility", BIW10, Santa Fe, NM, May 2010, MOKNB02; http://www.lanl.gov/conferences/biw10/preprints/MOKNB02_talk_av.pdf.

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[4] B. Gilbert, "Fundamentals of Logarithmic Amplifiers and Recent Advances", BIW10, Santa Fe, NM, May 2010, MOCNB01; http://www.lanl.gov/conferences/biw10/preprints/TUTNB01_talk.pdf, and associated movie.

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