DEELS 2018

Wednesday, April 18, 2018 - Thursday, April 19, 2018

Diamond Light Source

Book of Abstracts

Contents

DEELS / 19

Welcome

DEELS / 10

Status of the standard electron beam diagnostics of the EU-XFEL

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All electron beamlines of the EU-XFEL were supplied this year. The electron diagnostics supported the commissioning of the last beamline. In this contribution new results of the diagnostics will be shown. In addition recent problems will be discussed.

DEELS / 14

Bunch-by-Bunch Processing on MicroTCA at Diamond

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At Diamond we have been developing the control system for our multi-bunch feedback system for more than a decade, adding increasingly more functionality. Until recently the digital signal processing was limited by our use of the ageing Libera TMBF platform, but starting in 2016 we have been migrating to a platform based on MicroTCA and commercial off the shelf hardware.

The new hardware provides the ability to capture and process large amounts of
data: one second's worth of bunch by bunch data can be captured and transferred for offline processing in little more than a second. Also there is a lot of unused FPGA capability which will be used for implementation of future high speed processing.

The DLS MBF processor currently provides the ability to perform detailed experiments on individual bunches or selected groups of bunches, and provides live detailed statistics of the motion of each bunch. Future work will include the ability to replay prepared data to facilitate prototype experiments. We also plan to implement a method to measure tune spectra relative to the tune, which should reduce the impact of slow tune variations.

DEELS / 18

Status of Diagnostics Activities at the Karlsruhe Research Accelerator

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The Karlsruhe Research Accelerator (KARA) as a test facility provides an excellent environment for the development and benchmarking of new diagnostics. Examples of recent developments are the ultra-wideband readout electronics for ps-fast detectors, KAPTURE, and an ultra-fast line-camera with up to 10 Megaframes per second and continuous data streaming for optical and electro-optical bunch diagnostics , KALYPSO. With this ability for turn-by-turn readout, recent systematic and comprehensive investigations of the so-called micro-bunching instability were feasible. This is complemented by using commercial equipment such as our bunch-by-bunch feedback and low-level RF (LLRF) systems to enable characterization of these diagnostic tools in our short-bunch, low-alpha operation mode. This presentation will give an overview of the current status and outlook also in the context of KARA being part of the ARIES framework and possible opportunities for transnational access for similar investigations.

DEELS / **1**

BLDs system status at ESRF

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The ESRF-EBS new BLDs are commissioned and operational and an application to visualize the whole situation of the losses around the storage ring has been developed. Slow data are stored during normal operation at 1 Hz in order to correlate the losses with events happening around the machines such as vacuum problems or insertion devices motion. Fast average data are stored during the injection at a 4Hz in order to provide the loss per each injection shot all around the machine.

DEELS / **7**

Resonant Spin Depolarisation at DLS

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We are investigating a range of approaches to make Resonant Spin Depolarisaton (RSD) compatible with user beam operation at DLS. To improve the reliability of loss measurements, we depolarise only one half of the bunch train, and use the loss rate in the other half to normalise. We use specifically designed array of four scinitillators placed around the beam pipe after the collimators to maximise the rate of beam loss events, thus minimising statistical error. Finally, we are investigating the polarisation and de-polarisation with simulations.

DEELS / **6**

New dose and beam loss monitors for SOLEIL

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Soleil is currently working of two new monitors:

- Dose monitors based on RadFET sensors: preliminary tests and developement of dedicated read-out electronics will be presented.
- Loss Monitors: preliminary tests with scintillators or cerenkov radiator and calibration results will be presented.

DEELS / 23

Fibre BLMs at Diamond Light Source

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In order to improve coverage of beam loss measurements, we have been investigating the use of a fibre based time of flight measurement.
A prototype system has been installed, with fibres installed across cells one and two, starting just downstream of the injection kicker magnets. The fibres are positioned in the beam plane horizontally, one fibre in board and one out board. Sensors are installed at the upstream and downstream ends.
Initial measurements show that the system can detect injection losses and losses due to RF trips.

DEELS / 15

Short Report on SLS 2.0 Photon BPM Workshop

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SLS 2.0 is the upgrade project of the Swiss Light Source (SLS) at the Paul Scherrer Institut in Villigen, Switzerland. It aims to reduce the natural emittance by a factor of ~ 40 by replacing the triple bend achromat with a 7-bend achromat structure. The issues of stability and reproducibility of this higher brightness and more coherent photon beam was recently addressed in an internal photon beam position monitor (BPM) workshop. Based on the present experience, a wish list for SLS 2.0 photon BPMs was composed and options for White beam and pink beam photon BPMs were discussed. This talk summarizes the (preliminary) outcome of this workshop.

DEELS / 2

Characterisation of ESRF-EBS BPM blocks

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In order to check the quality of the BPM blocks that will be installed in the ESRF-EBS we have developed a RF characterization bench, which simply measures the transmission between each of the 4 buttons. Every BPM block is measured at least twice: first when they arrive from the manufacturer, and later after being assembled on a girder, with 2 out of 10 of these BPMs also having undergone NEG coating. Thanks to these measurements we were able to detect some dimensional out-of-tolerance BPM blocks and also (more surprisingly) the presence of metallic dust, films or slivers in some of them. This characterization will also possibly be used in determining a first rough value for the BPM block's electric offset, so to minimize these offset at the time of early commissioning when beam-based alignment techniques are not yet possible.

DEELS / 21

BPM button leaks at ESRF-EBS

Author: Friederike Ewald[None]

The 1500 BPM-buttons for ESRF-EBS had suffered from un-expected UHV leakage problems that are now clearly identified as bulk defects in the steel used for BPM body. These defects were identified with the help of X-ray computed tomography (CT) performed at two ESRF beamlines dedicated to this technique. The CT scans allowed to correlate the existence of small (<10um) but long (>10mm) channels in the steel with the BPM button leaks. All 1500 BPM buttons were screened, and risky buttons could then be sorted out. This reduced the occurrence of leaks but not fully suppressed them, mainly due to the resolution of the CT scans limited to a minimum of 2 um. Therefore a non-destructive UHV leak-test for the buttons was developed at the ESRF and is now applied to each of the BPM buttons.

DEELS / 5

Integration of a novel BPM system within the global orbit feedback environment of Elettra

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A new-concept BPM was developed to prove the usefulness of pilot tone technique in channels equalization, thermal drift compensation and self-calibration.
It ran successfully not only during various machine shifts, but also during a user dedicated beamtime shift for more than 10 hours, behaving in a transparent way for all the control systems and users. The equivalent RMS noise (10 kHz data rate) for the pilot tone position was less than 200 nm on a 20 mm vacuum chamber radius.
Two main steps led to this important result: firstly, the development of a novel RF front end that adds the pilot tone to the signals originated by the beam, secondly, the realisation of an FPGA-based double digital receiver that demodulates both beam and pilot amplitudes, calculating the compensated X and Y positions.

We successfully tested our system as a drop-in substitute for Libera Electron systems, by placing our front end inside the machine tunnel, connected on one side to the button BPMs of a section normally used by a Libera, and on the other side to the digital receiver. We also demonstrated seamless communication via Ethernet interface with the global orbit feedback and Tango control systems.

DEELS / 11

Frequency Hunting application for beam noise detection at ALBA

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Due to recent unknown noise problems in ALBA beam position, a new python application has been developed in order to catch and track particular frequency components along the runs. Such application takes the BPMs 10kHz data from the Fast Archiver at a given periodicity, analyzes the BPMs spectrum and stores the tracked components into a log file for later off-line analysis. We will present how the application has been developed, some useful examples of its capabilities and possible improvements for a deeper investigation of noise sources at ALBA.

DEELS / 4

An X-ray imager for beamline survey

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In one of the long straight sections of SOLEIL is installed a pair of canted undulators for the ANATOMIX and NANOSCOPIUM beamlines. Since the upstream undulator radiation can potentially damage the downstram undulator magnets, an accurate survey of the respective alignement of the two devices is mandatory. An XBPM was initially installed for this purpose. But for redundance and further analysis, an X-ray analysis was then installed just downstream the XBPM. We present the commissioning of this new device together with its first results in operation.

DEELS / 16

Source Feedback From X-rays (SOFFOX)

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Beamline detectors operating in the 100-1000Hz regime are becoming more common, and the X-ray beam stability demanded by beamlines is also thus of comparable bandwidths. In order to maintain

the positional stability of a focussed X-ray beam at the beamline sample-point at bandwidths of up to ~500Hz, it is proposed to introduce a feedback system that makes adjustments to the X-ray source point (the electron beam) at these bandwidths, using X-ray beam position monitors as the feedback input.

Presently, it is extremely difficult for beamlines to correct beam motion at these frequencies with conventional beamline feedback, using optical components (monochromator, mirrors, etc) to steer the X-ray beam. Simply the mass of these components make them difficult to move and manipulate at >100Hz. The existing electron beam feedback, the "fast orbit feedback", is less effective above about 200Hz, and in any case, this feedback knows nothing of the X-ray beam stability on the beamline itself.

Thus, it is proposed to develop a new system, monitoring the X-ray beam position on the beamline and making adjustments to the electron beam at ~500Hz, in order to improve the X-ray beam stability.

9

Visit to Control Room and Instrumentation Area

DEELS / 12

Preliminary results from a wide-band 500MSps digitizer prototype

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One of the frontiers that novel beam diagnostics and readout electronics will explore in the future is bunch-by-bunch information. Both for the electron synchrotrons and for the high repetition rate LINACs, bunch-by-bunch beam information will be useful to better understand and control the machine. As a first step to explore this field, I-Tech prototyped a 500MSps digitizer which features 4 input channels with large dynamic range and wide bandwidth. The ADC sampling is controlled through a PLL which is locked to an external reference signal. In this contribution the measurements and characterizations achieved with a single-channel prototype are presented.

DEELS / 17

Overview of SESAME Diagnostics and Recent Work

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SESAME is a 2.5 GeV 3rd generation Synchrotron Light Source in Allan, Jordan. The commissioning of the Storage Ring has been done in spring 2017. The storage ring is equipped with 64 BPMs ,3 fluorescent screens, FCT, DCCT, 4 BLMs, 2 Bunch by Bunch kickers and one Synchrotron Radiation Monitor. This talk gives an overview of the Diagnostics elements and our experience during the commissioning. In addition, current problems, solutions and upgrades will be discussed.

DEELS / 22

Diagnostics X-ray Beamline at Diamond Light Source

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Fourth generation light sources operate with low emittance to provide more brilliant beams for user experiments. These machines have set the bar for non-invasive transverse beam size measurement on the micron and sub-micron scales. It has been identified within the community that this spatial resolution is at the limit of most diagnostic instrumentation, and systems which more closely resemble dedicated X-ray beamlines may be necessary. Here we describe the small-scale X-ray diagnostics beamline being developed at Diamond Light Source, with an emphasis on investigating X-ray imaging and interferometry.

DEELS / 13

Coronagraph based halo monitor development for bERLinPro

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Beam halo induced by space charge force and scattering of trapped ions is one of the critical issues for linac based high power machines such as bERLinPro. In order to suppress uncontrolled beam losses, the coronagraph based halo monitor was designed and optimized to measure the beam halo which has ~ 10^−4 contrast to the beam core. The beam test was performed in BESSY-II. In this presentation, we will present the design and experimental criterion and experimental results.

DEELS / 3

Momentum Compaction Measurement using Synchrotron Radiation

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The momentum compaction factor of a storage ring can be obtained by measuring how the beam energy changes with the RF frequency. Direct measurement of the beam energy can be difficult, long or even not possible in some machines such as ESRF. Since the energy spectrum of the synchrotron radiation depends on the beam energy, it is indeed possible to relate the variation of the beam energy with a variation of the produced synchrotron radiation flux. In this contribution, we will present how we obtain a measurement of the momentum compaction using this dependence.

DEELS / 24

General Discussion

DEELS / 20

Close and DEELS 2019 announcement