

Summary Instrumentation & Controls WG

Wim Blokland

Jim Patrick

Manfred Wendt

Project X Collaboration Meeting

September 12, 2009

Collaboration Opportunities on Project X Beam Instrumentation

Manfred Wendt (ORNL)

- Detailed requirements and specifications for beam instrumentation systems have NOT yet been established. Need:
 - Requirements derived from beam dynamics and operations aspects
 - Define monitor technologies, e.g. button vs. cavity-style BPM (SRF)
 - Exact location / layout / space / # of beam detector components.
 - Standardization of electronics hard- & software (e.g. VME/VXS, TCA, ...)
- Potential Collaborations
 - Laser-based, non-invasive beam diagnostics – **Formal collaboration** (MoU) with LBNL, J. Byrd.
 - MEBT emittance monitor, e.g. multewire/slit apparatus.
 - LEBT emittance diagnostics, e.g. *Allison* scanner.
 - **Collaboration on a e-beam scanner for non-invasive beam profile monitoring of high intensity proton beams (SNS)**
 - Collaboration of a high power version of a fast *Faraday* cup as invasive longitudinal beam profile monitor.

Experience on SNS Beam Instrumentation Collaborations

Willem Blokland (ORNL)

From the perspective of the Beam Instrumentation Group

- Time-line (CD2 and up)
 - Changes in budget, requirements, merging of designs
 - Built-up of SNS, construction, Division groups
- Setup of division groups with clear responsibilities:
 - Controls/Physics/ Instrumentation and each was allowed to determine their own development environment but tight together through the CA protocol
- Documents: (Do your documentation from the start!)
 - Design Document
 - System Brochure
 - Interface Control Document
 - Acceptance Test
 - Traveler

- Count on changes:
 - Budget (close to CD4 budgets are tight!)
 - Specifications
 - People
- Collaboration:
 - Work with other labs and meet other people in your field
 - Need very good communication (meet in person) and Reviews to catch issues
 - Define work scope very well and document
 - Count on changes
 - Can be a lot of fun

HINS as a Beam Diagnostics Test Facility

Vic Scarpine (FNAL)

- HINS (High Intensity Neutrino Source) is a Linac Injector R&D facility
 - Potential exists to operate HINS as a low-energy, high-intensity H- test facility during Project X R&D phase
 - Development of Fermilab projects as well as facility for external collaborators
 - Potential projects:
 - **Beam diagnostics R&D**
 - Beam chopper R&D
 - Low-energy material studies
- Maximum set – R&D
Emittance station – slit-collector/laser slit
Bunch length – wire and/or laserwire
Bunch profile – laserwire
Beam Diagnostics R&D section

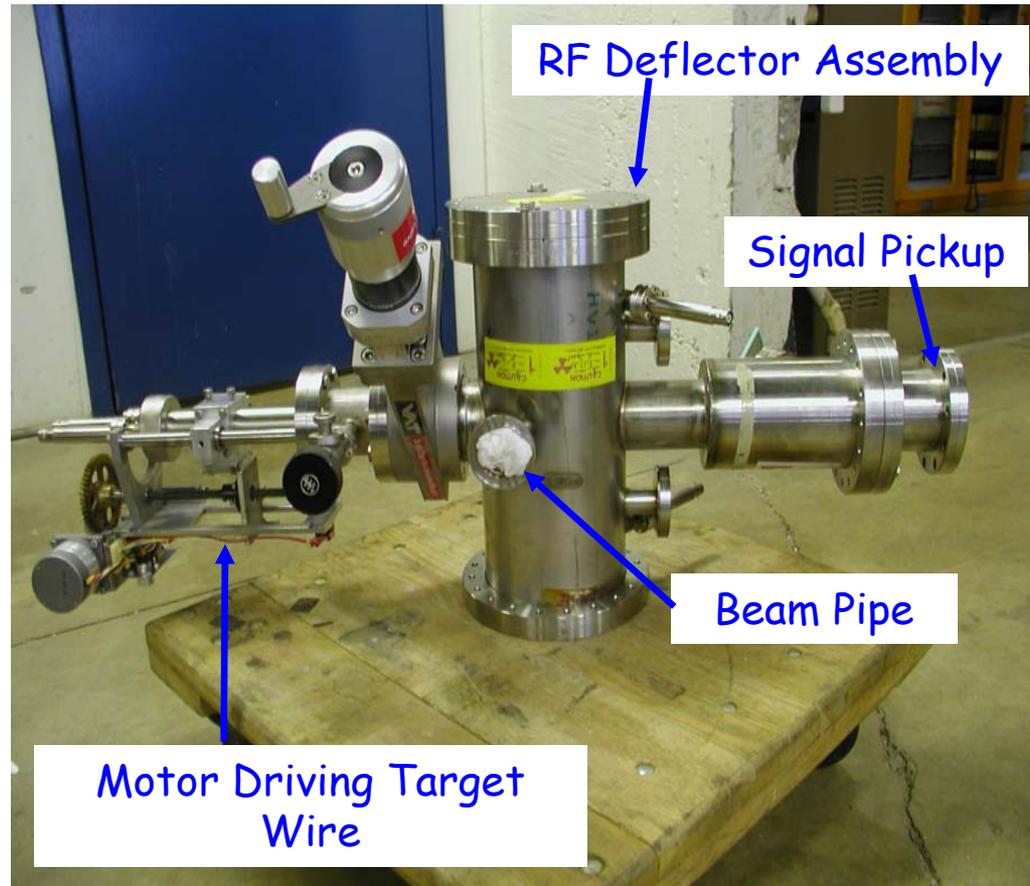
Bunch Shape Monitor for HINS

Wai-Ming Tam (FNAL)

Progress on 400MeV Bunch Shape Monitor for HINS that can be used for ProjectX

Preliminary study on its RF deflector shows that it is possible to use it for the HINS Linac Front End.

More testing will be carried out.



Longitudinal Laser Wire for Project X/HINS

John Byrd (LBNL)

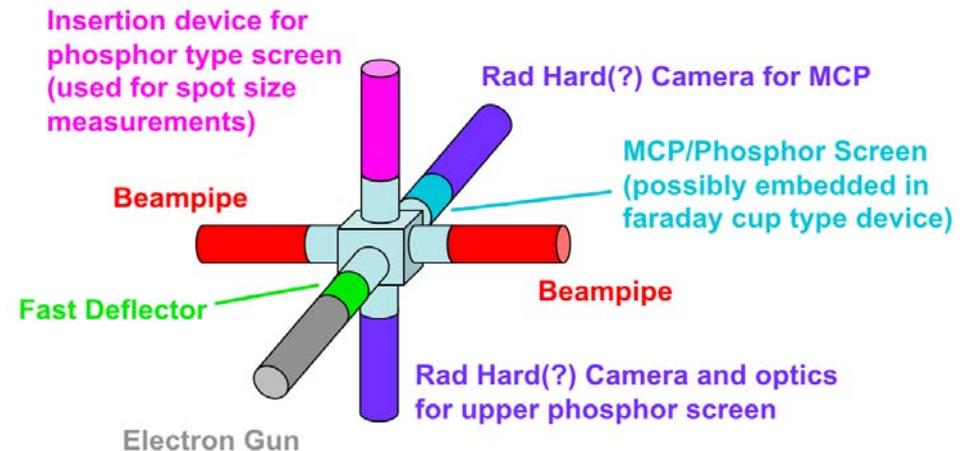
- Collaboration between LBNL and FNAL on laser wire diagnostics started in August 2009.
- Goals
 - Understand minimum laser pulse energy and rep rate (i.e. power) for acceptable S/N: Study frequency dependence of backgrounds & Explore lock-in techniques
 - Understand maximum laser pulse energy and laser peak power that can be transmitted over 50-100m of fiber.
 - Determine measurement bandwidth (fast scanning with mirror)
 - Explore techniques for measuring tails (modulation)
- Schedule
 - Oct 09, determine laser power capabilities over fiber
 - Nov 09, visit SNS for background study
 - Dec. 09, determine expected S/N for HINS.
 - Jan 09, deliver report.

E-Beam Scanner R&D

Randy Thurman-Keup (FNAL)

- Measure the transverse profile of a high intensity beam with electrons
- Progress: purchase of E-gun and design

Parameter	SNS	PX (MI)
Design Beam Intensity	1.4E14	2E14
Ring Length (μs)	1	11
Charge density (particles / cm)	5.4E9	0.6E9
RMS Bunch Length (ns)	---	1.5
Transverse Beam Size	~ few cms	~1 mm
Peak Charge Density (particles / cm)	5.4E9	4E9



ProjectX Controls

Jim Patrick (FNAL)

- Goals, e.g. unified control system for the entire accelerator complex
- Base core on the evolving ACNET experience, with EPICS support “underneath”
 - To simplify test and integration of products from collaborators
- Development of EDM screens (graphics console look and feel)
 - Can access ACNET and EPICS devices
 - Many examples shown, as EPICS EDM, ACNET graphics console, and as web browser embedded ACNET graphics console
- HINS / NML as R&D test bed
 - Evolve software framework (the “right” way is still discussed)
 - Test new hardware, e.g. VXS, xTCA
 - Try out new ideas...

xTCA for Physics Standards

Ray Larsen (SLAC)

- Adapt high availability xTCA hardware standard for physics use.
 - Active participation in the PIGMG committee.
 - Open source standard of the telecommunication industry.
- Presentation with many technical details of the current xTCA PIGMG standard
 - ATCA, MTCA, interfaces, form factors, timing & clock signals, etc.
- Examples of accelerator applications
 - DESY-XFEL / FLASH:
LLRF system based on ATCA
Plans for a 12 ch. 16-bit 125 MSPS digitizer on MTCA (2-wide AMC)
 - SLAC:
Collaboration with DESY on controls upgrade (MTCA based).
Upgrade 80 (out of 240) RF stations (LLRF, slow and fast interlocks).

Project X Timing

Greg Vogel (FNAL)

- Details on the current Fermilab multi-level timing system
 - TCLK – high level machine coordination
 - Beam Sync Clocks – machine specific bunch level timing
 - Machine State data – MDAT, ethernet
- Project X clock system requirements and upgrades
 - Details on a XCLK / ACLK system
 - Keep TCLK for legacy equipment (MI, RR, etc.)
 - RCS beam sync clock to synchronize Linac and RCS
 - RR beam sync clock to synchronize RCS and Recycler
 - ACLK/XCLK will be source by a new time line generator, and will have many upgraded features with respect to TCLK

Charge Summary

- Discussion/potential modifications to ICD-1 and ICD-2
 - Many requirements not finished so exact impact is not defined
 - Shorter Linac: less instrumentation but a new booster-> different style instrument e.g. BPM
 - Controls: Additional RCS beam sync clock
- Discuss potential modifications to the existing RD&D
 - Collaboration with SNS on ES/Emittance/FC/Laser
- Establish goals and work plan for FY2010
 - Schedule on longitudinal LW proposed by LBNL
 - Provisional distribution of responsibility: TBA (SNS/LBNL)
- Identify any issues related to the above that need resolution
 - Physics requirements but we understand this will take time