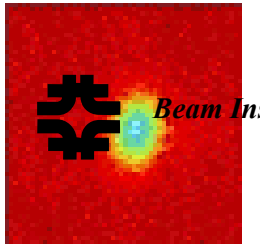

Instrumentation for Run II, etc.

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DOE Fermilab Review

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Run II Instrumentation Motivators

- Tevatron orbit, tune, and coupling control
- Transverse and longitudinal emittance preservation
- Instabilities and bunch head-tail concerns
- “DC” beam diagnosis and prevention
- Operational performance analysis, trending, and documentation
- Recycler Ring commissioning and integration
- Real-time operational tuning and monitoring

Tevatron - Orbit, Tune, Chromaticity, Coupling

- Tevatron Global BPM system
  - Can't see pbars and does not provide sufficiently accurate measurement of coalesced beam for "real-time" orbit measurement during Collider operation
  - Forces utilization of dedicated studies time with trains of 53MHz beam bunches for orbit smoothing/maintenance purposes
  - Requirements document by Tevatron Dept. for new Global BPM system is nearly complete (J. Steimel et al.)
  - Will always face problem of interfering signals due to near simultaneous passage of p's and pbar's at many locations
  - Recent improvements to present system include more critical analysis of available data, better-focused maintenance, and removal of p/pbar direction switching box (M. Olson, F. DeJongh)
- Improved real-time, bunch-by-bunch tune and chromaticity measurement hardware and software development underway (C.Y. Tan)
- New Schottky monitor installed in Tevatron during January shutdown (R. Pasquinelli et al.)

Emittance preservation

- Transverse
  - Beam Line Tuners are operational in Tevatron, MI, and Recycler to automate injection steering
  - Flying wire systems are baseline emittance monitor, but useable in Collider during store due to beam loss
  - Synchrotron light monitor is only “on-line” transverse profile monitor available during stores (but insufficient light at 150 GeV!)
  - Design of IPM for Tevatron to permit turn-by-turn profile measurements for transverse injection matching is in progress (A. Jansson et al.)
  - Improved multi-wire profile monitors installed in A1 and in design for P1 MI-TeV transfer lines
  - Beam Line BPMs, esp. A1/P1 lines, need commissioning attention
- Longitudinal
  - Tevatron and MI Sampled Bunch Displays (bunch length monitor) receiving considerable analysis and calibration attention (A. Tollestrup, S. Pordes, J. Crisp, R. Flora, et al.)

Instabilities and Bunch Head-tail Motion

- Head-tail motion and chromaticity measurement hardware and software development underway (P. Ivanov, V. Scarpine et al.)
- RF beam loading compensation and longitudinal damper systems both operational and in design (W. Foster, J. Steimel, W. Schappert et al.)
- Tevatron Lambertson magnet impedance measurements underway (J. Crisp)

"DC" Beam Diagnosis and Prevention

- Request for higher resolution data from Tevatron DC beam current transformer
- Efforts underway to install gated PMTs to observe flying wire signals between bunches
- Tevatron Electron Lens system has served as valuable diagnostic for this problem

Performance Logging, Analysis, and, Trending

- Considerable effort over the last year has gone into:
  - SDA (Sequenced Data Acquisition) software and infrastructure
  - Data logging and retrieval tools
  - Recognizing that instrumentation data, e.g. emittance measurements, cannot always be taken at face value
  - Correlated collection and analysis of accelerator instrumentation data
  - Building better utilities, data analysis, and physics into “front-end” instrumentation software
- Machine physicist “ownership” of instrumentation systems and data remains the crucial factor to leverage maximum benefit from existing and new beam instrumentation

Recycler Ring Commissioning and Integration

- Recycler Ring BPM system
  - Requirements for new system have been specified
  - Technical design review has been completed
  - Final design/prototyping and initial testing/fabrication is underway
  - Expect system installation/commissioning early/mid-summer (will require ~ 5 days RR/MI tunnel access)
- Electron cooling effort has received active beam instrumentation support (B. Chase, A. Semenov)
- New Schottky monitor installed during January shutdown (Pasquinelli et al.)
- Flying wires for Recycler were constructed and installed during January shutdown, but had to be removed due to vacuum problems; investigation continues
- Gated integrators for Recycler bunch intensity measurements are in construction

Real-time Operational Tuning and Monitoring

- Continued maintenance of all baseline instrumentation systems throughout complex
- Updated integrator electronics for beam current signals
- Software upgrades and maintenance for numerous systems, both in-house software and commercial software packages
- Development of new instrumentation, e.g. optical transition radiation based instruments

Non-Run II Instrumentation Commitments

- NUMI -
  - New beamline and target Beam Position Monitor system (some development activity in progress using MiniBooNE beam)
  - New beamline and target Beam Loss Monitor system
  - New requirements that feed down into Main Injector, e.g. batch-by-batch position monitoring with extraction 'abort' capability
  - Suffering from lack of instrumentation engineering & technician resources
- Switchyard 120 -
  - Diverse collection of BPM, BLM, profile, and intensity monitoring systems in MI-TeV P1 transfer line, MI-Pbar P2 transfer line, Main Ring F-sector remnant P3 transfer line, and Switchyard
    - Most exist, in a fashion, but last used and maintained during Main Ring or fixed target operations of the past
    - Must be revived and integrated with current Control System
    - Not all systems are suited for slow spill
  - New QXR spill regulator system to be designed/commissioned
  - Low priority activity, nevertheless requires real, non-negligible resources