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Beam Loss Monitors

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External Beamline & Instrumentation Independent Design Review

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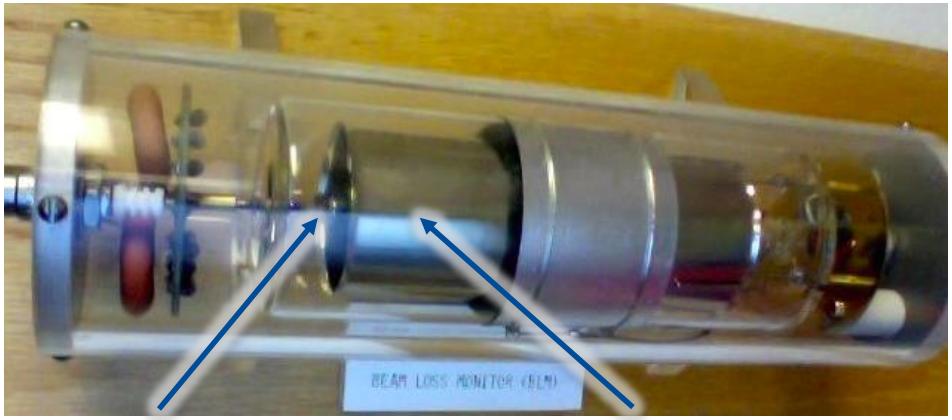
Outline

- M4 Line Beam Loss Monitors (BLM)
- M4 Line BLM Readout Electronics
- M4 Line BLM Installation Efforts
- Delivery Ring BLMs

M4 Line BLMs – Physical Detectors

- Physical detectors will be ionization chambers
- Sealed, Ar filled, concentric cylindrical electrodes



Electrodes ~100 mm length

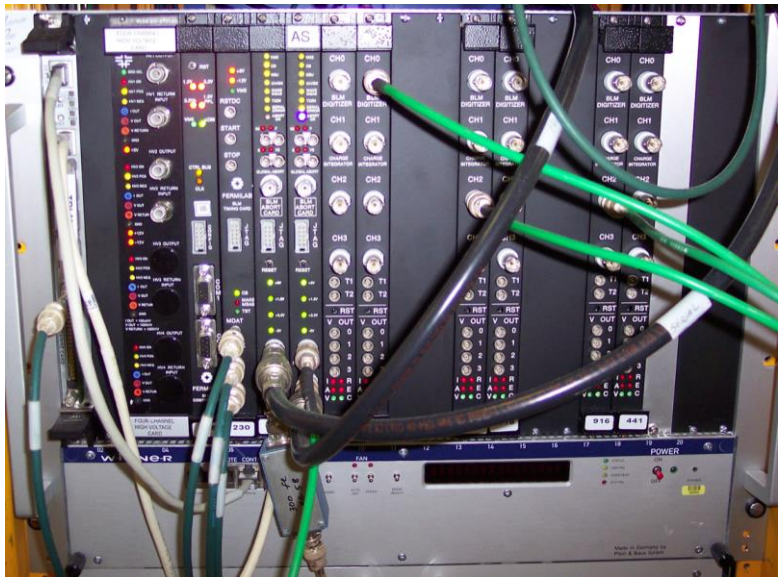
Inner Anode
~6 mm DIA

Outer Cathode
~40 mm DIA

- Sensitivity of 70 nC per Rad
- Require 30 loss monitors
  - Will be reused from the Tevatron

M4 Line BLMs – Readout Electronics

- VME based
  - 8 Digitizer Cards (4 ch / card)
  - Timing Card
  - Abort Card
  - Control Card
  - High Voltage Card
  - Crate Controller



- Filter Box
  - Ferrite core for common mode noise rejection
  - Additional capacitance to equalize time constants for all cables
- Electronics will be reused from the Tevatron
- One crate located in MC-1 will readout all 30 loss monitors

M4 Line BLMs – Readout Electronics

- Digitizer Card
  - Operates with a pair of alternating integrators
  - No deadtime
  - Single integration period is ~20 μs
  - Circular buffer contains 64k integration samples
  - Three additional variable length sums of the single integration samples
    - The sum lengths are specified by the user
  - The maximum integration rate is 720 Rad/s with a single ADC count corresponding to 11 mRad/s or 0.22 μRad in ~20 μs
  - Performs abort threshold comparison on single integration samples and all three sum length values

M4 Line BLMs – Readout Electronics

- Abort Card
  - Gets over-threshold information from Digitizer
  - Can mask off channels
  - Can require multiplicity
  - Can generate a digital abort signal for each summing length
- Timing Card
  - Takes TCLK, MDAT, BSCLK
    - TCLK and MDAT sent to Control Card
    - BSCLK used for AA marker to generate integration clock
      - Also has internal timing generator for transfer lines

M4 Line BLMs – Readout Electronics

- Control Card
  - Initializes other cards in crate based on information obtained from the VME crate processor
  - Reads loss data from Digitizer and stores in circular buffers for access by crate processor
  - Starts and stops integration based on TCLK events
  - Changes abort settings based on MDAT machine state

M4 Line BLMs - Effort

- Crate must be moved from Tevatron location and installed at MC-1
- Loss monitors must be installed in tunnel
- Cables must be terminated
- Filter box must be modified to reflect cable lengths
- ACNet devices must be created
- Possible minor modifications to readout software
- Application software must be adapted

Delivery Ring BLMs

- The delivery ring BLMs will be the exact same system as the M4 line
- 60 loss monitors are required
- 3 readout electronics crates are required
- These will be reused from the Tevatron
- Effort is similar to M4 line, but 2-3 times as much due to more systems

Summary

- System design is finished
- Low risk due to reuse of existing Tevatron loss monitor systems
- Needed modifications are minor