

Instrumentation for HINS-Project X at Meson

Define measurement requirements (*IQA*) – *What do you want to know and where do you want to know it?*

1. Beam Position
2. Beam Transfer Efficiency
 - beam currents along line
3. Beam Energy
 - energy spread?
4. Transverse beam size and emittance
 - Transverse focusing and slits? Best to have both.
5. Longitudinal beam size
 - Is beam blow-up an issue? Probably
6. Halo measurements
 - Non-Gaussian tails

Measurements

- Beam Position
 - Stripline BPMs embedded in solenoids
 - One in every solenoids? Every other?
 - Standard button BPMs in diagnostics line
 - BPMs in MEBT/Chopper?
- Beam Transfer Efficiency
 - Measure beam currents – Toroids
 - One in LEBT
 - One at RFQ output
 - Three in diagnostics line
 - How do we measure beam transfer efficiency in chopper?
 - Instrument beam dumps as (segmented?) Faraday cups?

Measurements

- Beam Energy, Energy Spread
 - Need calibrated spectrometer + toroids to do this
 - Slit before spectrometer helps define beam source position
 - Reduces beam width effects on energy measurement
 - Downstream wire scanner to measure energy spread
 - **Only measure at end of beamline?**
- Transverse Beam Size and Emittance
 - Single wire scanner gives a measure of beam size but needs many pulses
 - Do we need single pulse measurements?
 - Need safety protocol to prevent damage to superconducting cavities?
 - Quad focusing and single wire scanner can measure transverse emittance
 - Single vertical and horizontal slit and single wire scanner can measure transverse emittance
 - This is the preferred method when space charge effects are present
 - **Advanced diagnostics with laser profile monitor – need H⁻**
 - **Where do we need measurements? Only in diagnostics line?**

Measurements

- Longitudinal Profiles
 - Longitudinal Bunch Shape Monitor (BPM)
 - “Feschenko” monitor in Linac and HINS, scanning wire
 - Water cooled 20 GHz fast Faraday cup
 - From SNS
 - Stops beam
 - Any longitudinal measurement should be as close as possible to end of acceleration beamline output to minimize space charge longitudinal beam blow-up
 - Need space before spectrometer magnet
 - Only measure at end of beamline?
 - Advanced diagnostics with laser profile monitor – need H⁻

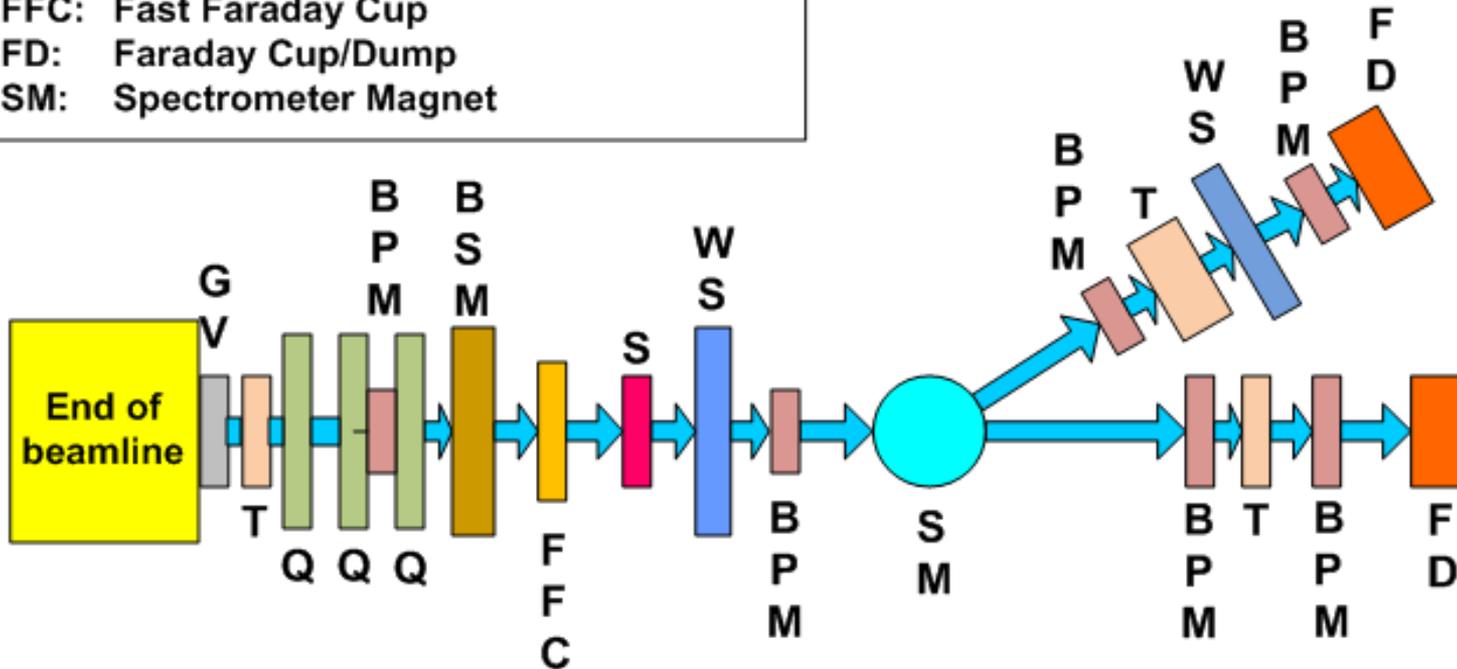
Measurements

- Beam Halo Measurements
 - Where to measure halo (if at all)?
 - Can the wire scanner be made sensitive enough to see halo?
 - Advanced diagnostics with vibrating wire from Bergoz
- What measurements need to be made in MEBT/chopper region?
 - How will you diagnose chopper and make it operational?
 - Right now there is no space in lattice to add diagnostics

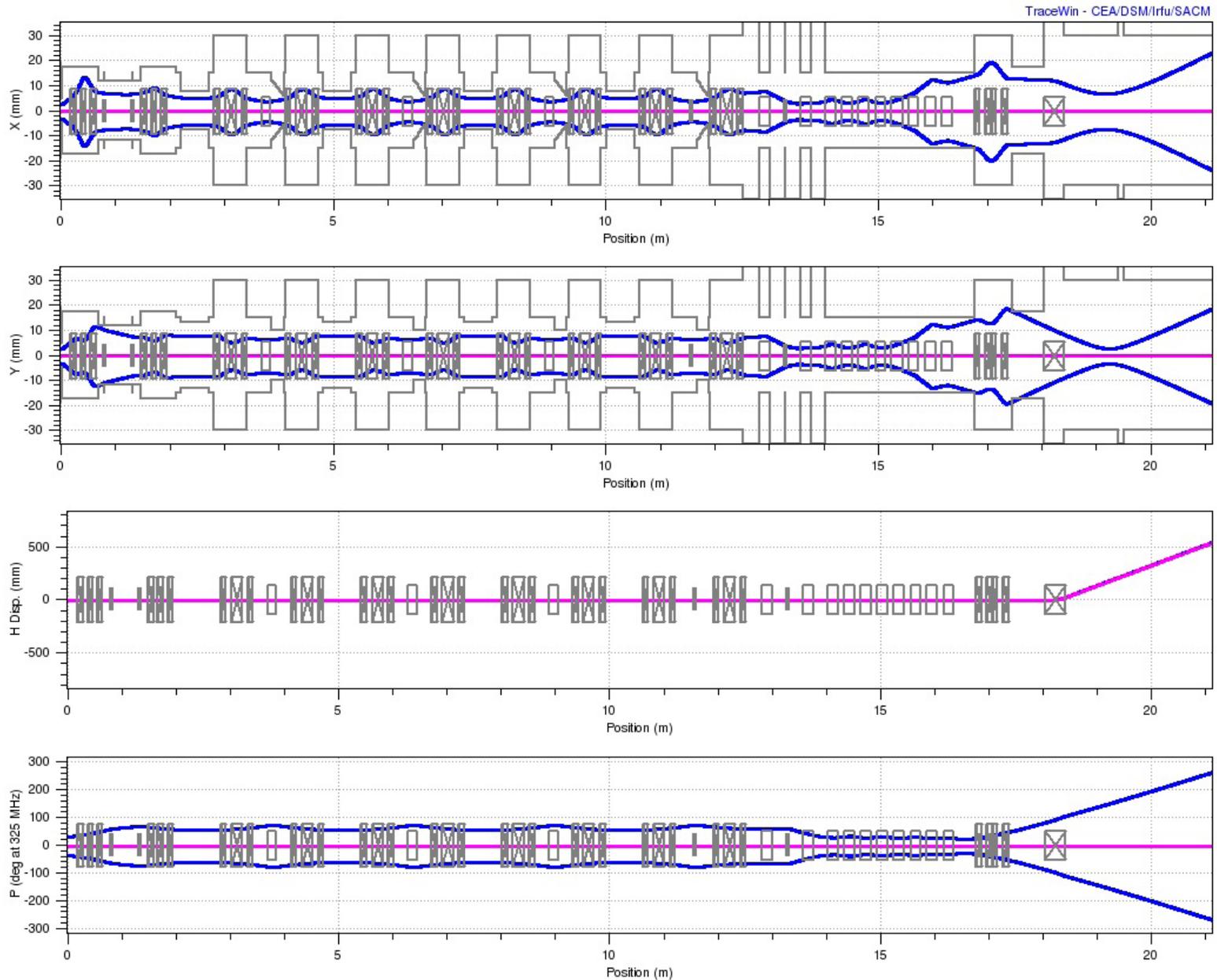
Basic Diagnostics

T: Toroid
GV: Gate Value
Q: Quadrupole
BPM: Beam Position Monitor
WS: Wire Scanner
S: Horz and Vert Slits
BSM: Bunch Shape Monitor (Longitudinal)
FFC: Fast Faraday Cup
FD: Faraday Cup/Dump
SM: Spectrometer Magnet

HINS Diagnostics Line
V 1.0
May 19, 2010



MEBT – 10 ma

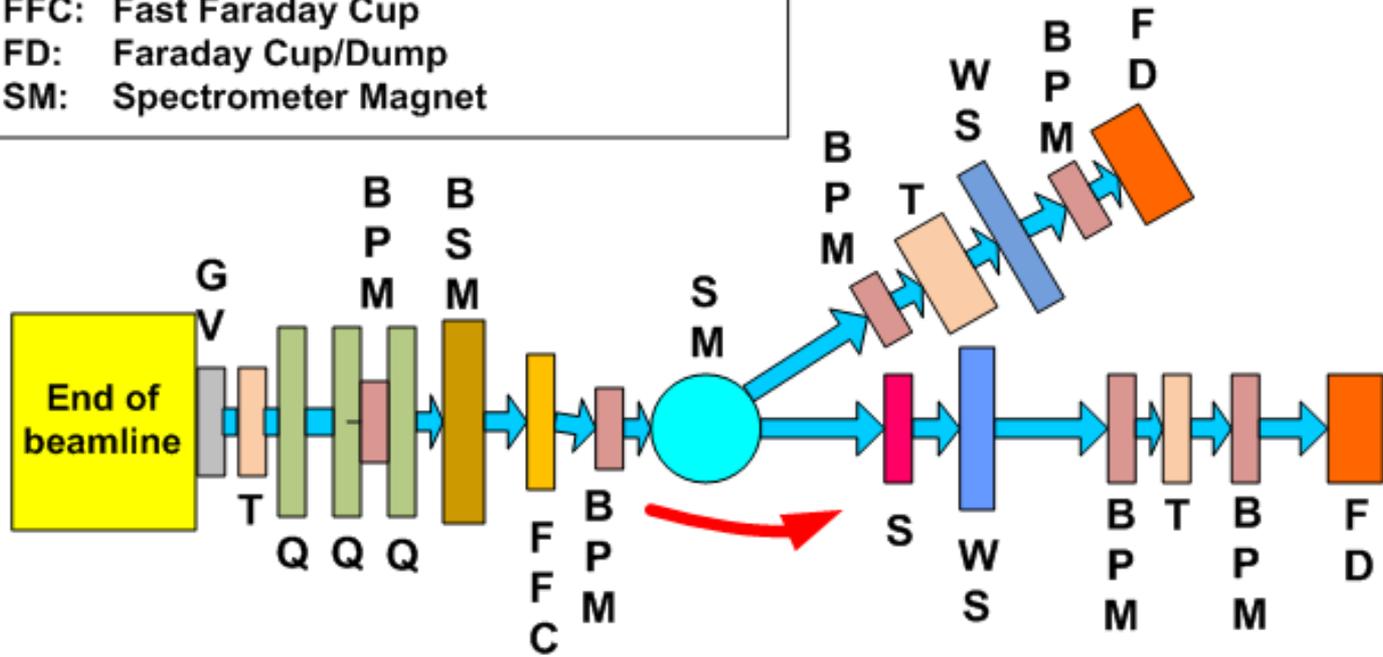


Basic Diagnostics - v2

Move slit and wire scanner after spectrometer magnet to save space

- T: Toroid
- GV: Gate Value
- Q: Quadrupole
- BPM: Beam Position Monitor
- WS: Wire Scanner
- S: Horz and Vert Slits
- BSM: Bunch Shape Monitor (Longitudinal)
- FFC: Fast Faraday Cup
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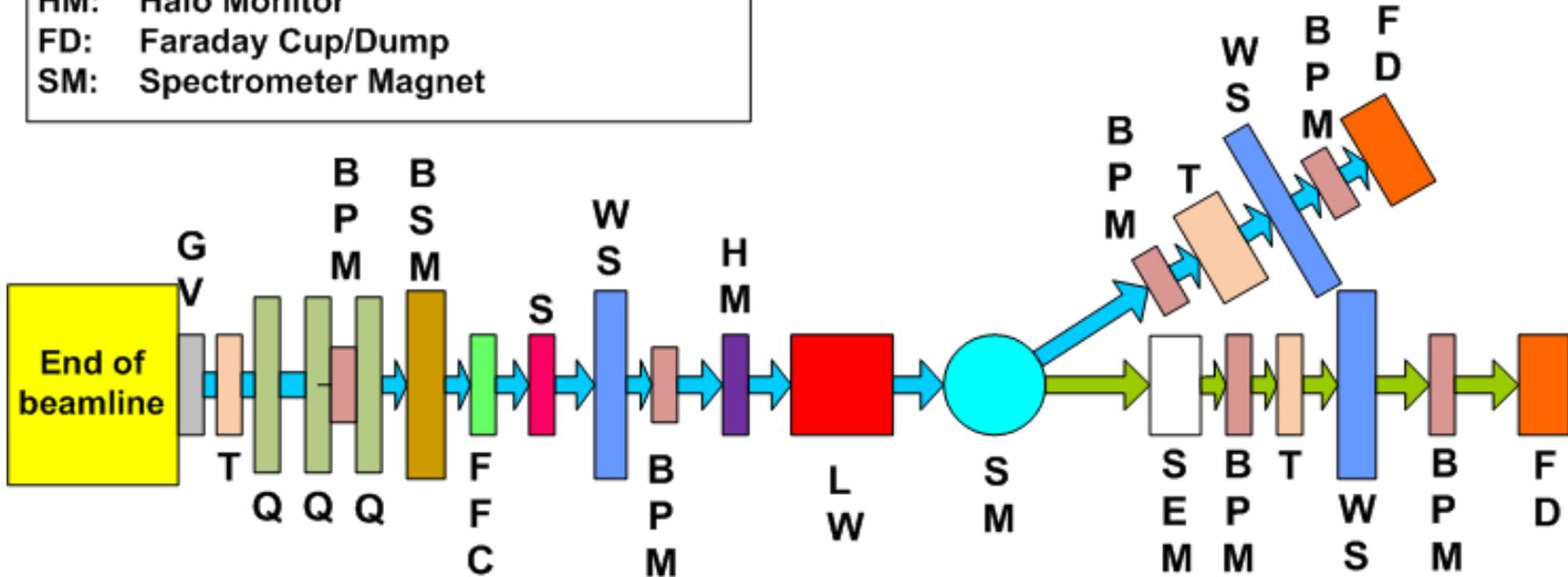
Advanced Diagnostics

Need laser wire and halo monitor before spectrometer magnet

T: Toroid
GV: Gate Value
Q: Quadrupole
LW: Laser Wire
SEM: Secondary Emission Monitor
BPM: Beam Position Monitor
WS: Wire Scanner
S: Horz and Vert Slits
BSM: Bunch Shape Monitor (Longitudinal)
FFC: Fast Faraday Cup
HM: Halo Monitor
FD: Faraday Cup/Dump
SM: Spectrometer Magnet

Advanced HINS Diagnostics Line
 V 1.0
 May 19, 2010

 H^- Beam
 H^0 Beam or H^- Beam



Random Questions/Thoughts

1. Need measurement requirements defined
 - This probably depends on beamline configuration
2. What are the HINS-ProjectX beamline scenarios?
 - Will one set of instruments fit all options?
3. What's available to beg, borrow or steal?
4. What do we build/buy?
5. Need a time-frame/schedule
 - If there are new instruments required then we need to know by when