

Recycler Beam Line Tuner Operation

Duane C. Voy

A Recycler Ring Beam Position Monitor (BPM) has been installed into the ring to support Beam Line Tuner (BLT) operation. This BLT is hardware and software identical to each of the ring BPM subsystems but is operationally independent and dedicated to BLT functions. No special BLT processing is provided by the front-end. The BLT simply collects and returns turn-by-turn position and intensity data to ACNet where an application program performs BLT calculations at the console level. The position pickups used by the BLT are **VP602** and **HP603**.

The BLT is configured for operation with **2.5 MHz bunched proton and antiproton** injection into the Recycler. Additionally, the BLT provides periodic flash measurements (~200 Hz) of the 2.5 MHz bunched proton beam for diagnostics and ‘comfort displays’.

For a detailed description of the triggered measurement and data readout operations of the BPM/BLT system or to learn how to sample other beam flavors see “Event Driven Data Acquisition for the Recycler Ring BPM Front-end” (Beams-doc-800). A summary of the most important configuration parameters follows.

BLT measurement configuration is accomplished through Acquisition Specifications made available via ACNet device R:BLTACQ. Three of the sixteen available specifications are used in the system:

- 1 – **Repetitive Flash,**
- 2 – **Main Injector Protons to Recycler** and
- 3 – **Main Injector Antiprotons to Recycler.**

The field values of the three acquisition specifications are loaded into the front-end by ACNet at boot time and are treated as if they are constants. The engineering and diagnostics application program described below may be used to modify or add acquisition specifications.

Acquisition Specifications

Event Index 1 - Repetitive Flash:

<code>_enable</code>	<code>kAcquisitionOn</code>
<code>_measurement</code>	<code>kRepetitive</code>
<code>_beamMode</code>	<code>kProton</code>
<code>_beamType</code>	<code>kInjectExtract</code>
<code>_measurementType</code>	<code>k2_5MHzEnsemble</code>
<code>_armEvent</code>	<code>kArmAutomatic</code>
<code>_triggerEvent</code>	<code>kTriggerPeriodic</code>
<code>_pretriggerEnable</code>	<code>kPretriggerDelayOff</code>
<code>_triggerDelay</code>	<code>0</code>
<code>_globalDelay</code>	<code>0</code>
<code>_intensityThreshold</code>	<code>0.0</code>
<code>_timeout</code>	<code>2</code>

Event Index 2 - Main Injector Protons to Recycler:

<code>_enable</code>	<code>kAcquisitionOn</code>
<code>_measurement</code>	<code>kOneShotTurnByTurn</code>
<code>_beamMode</code>	<code>kProton</code>
<code>_beamType</code>	<code>kInjectExtract</code>
<code>_measurementType</code>	<code>k2_5MHzEnsemble</code>
<code>_armEvent</code>	<code>0xE2</code>
<code>_triggerEvent</code>	<code>0xA2</code>
<code>_pretriggerEnable</code>	<code>kPretriggerDelayOn</code>
<code>_triggerDelay</code>	<code>0</code>
<code>_globalDelay</code>	<code>0</code>
<code>_intensityThreshold</code>	<code>0.0</code>
<code>_timeout</code>	<code>240</code>

Event Index 3 - Main Injector Pbars to Recycler:

<code>_enable</code>	<code>kAcquisitionOn</code>
<code>_measurement</code>	<code>kOneShotTurnByTurn</code>
<code>_beamMode</code>	<code>kAntiproton</code>
<code>_beamType</code>	<code>kInjectExtract</code>
<code>_measurementType</code>	<code>k2_5MHzEnsemble</code>
<code>_armEvent</code>	<code>0xE0</code>
<code>_triggerEvent</code>	<code>0xA0</code>
<code>_pretriggerEnable</code>	<code>kPretriggerDelayOn</code>
<code>_triggerDelay</code>	<code>0</code>
<code>_globalDelay</code>	<code>0</code>
<code>_intensityThreshold</code>	<code>0.0</code>
<code>_timeout</code>	<code>240</code>

BLT readout configuration is accomplished through Readout Specifications made available via ACNet device R:BLTTBS for turn-by-turn data, and R:BLTBFS for repetitive flash data.. The readout specification of interest for BLT operation is the turn-by-turn specification. Readout specifications cannot be loaded at boot time because they

contain measurement dependent information. Set the readout specification immediately prior to reading measurement data to assure data integrity.

Valid readout specification field values for R:BLTTBS are listed below. Position and intensity data are available by reading the R:BLTTBV ACNet device.

<code>_eventIndex</code>	2 or 3
<code>_dataType</code>	kBunchedData
<code>_beginTurn</code>	1 . . 2048
<code>_numTurns</code>	1 . . 1024
<code>_channel</code>	0 or 1

Channel #0 contains VP602 data and channel #1 contains HP603 data. Note that the sum of the `_beginTurn` and `_numTurns` field values may not exceed 2048.

The Recycler BPM engineering and diagnostics application program (R33) has been enhanced to support operation of the BLT front-end. It is possible to manipulate the BLT timing and scaling engineering parameters with R33, and acquisition specifications may be modified or added with the program.

End.