Recycler Beam Line Tuner Front-end Operation

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

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 (~100 Hz) of the 2.5 MHz bunched antiproton beam for diagnostics and 'comfort' displays. The position pickups used by the BLT are **VP602** and **HP603**.

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 measurements are configured 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 three acquisition specifications (see tables below for specification values) are loaded into the BLT front-end by ACNet at boot time and are treated as if they are constants. This means that once loaded they remain active and the BLT front-end will make the specified measurements, without intervention, each time the specified arm/trigger conditions are met. The engineering and diagnostics application program mentioned below may be used to modify or add additional acquisition specifications.

Acquisition Specifications

Event Index 1 - Repetitive Flash:

_enable	**kAcquisitionOn**
_measurement	**kRepetitiveSingleGate**
_beamMode	**kAntiproton**
_beamType	**kInjectExtract**
_measurementType	**k2_5MHzEnsemble**
_armEvent	**kArmAutomatic**
_triggerEvent	**kTriggerPeriodic**
_pretriggerEnable	**kPretriggerDelayOff**
_triggerDelay	**100**
_globalDelay	**0**
_intensityThreshold	**0.0**
_timeout	**2**

Event Index 2 - Main Injector Protons to Recycler:

_enable	**kAcquisitionOn**
_measurement	**kOneShotMultipleGate**
_beamMode	**kProton**
_beamType	**kInjectExtract**
_measurementType	**k2_5MHzEnsemble**
_armEvent	**0xE2**
_triggerEvent	**0xA2**
_pretriggerEnable	**kPretriggerDelayOn**
_triggerDelay	**0**
_globalDelay	**0**
_intensityThreshold	**0.0**
_timeout	**5**

Event Index 3 - Main Injector Pbars to Recycler:

_enable	**kAcquisitionOn**
_measurement	**kOneShotMultipleGate**
_beamMode	**kAntiproton**
_beamType	**kInjectExtract**
_measurementType	**k2_5MHzEnsemble**
_armEvent	**0xE0**
_triggerEvent	**0xA0**
_pretriggerEnable	**kPretriggerDelayOn**
_triggerDelay	**0**
_globalDelay	**0**
_intensityThreshold	**0.0**
_timeout	**5**

Data readout configuration is accomplished through the 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 R:BLTTBS turn-by-turn specification. Readout specifications cannot be loaded at boot

time because they contain measurement dependent information. Set the readout specification[1] immediately prior to reading measurement data to assure data correctness.

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

_eventIndex	**2 or 3**
_dataType	**kBunchedData**
_beginTurn	**1..2048**
_numTurns	**1..1024**
_channel	**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 R25 has been enhanced to support operation of the BLT front-end. It is possible to manipulate the BLT timing and scaling parameters, and acquisition specifications may be modified or added with the program.

End.

[1] The protocol for data readout described in “Event Driven Data Acquisition for the Recycler Ring BPM Front-end” (Beams-doc-800) must be followed to assure that the expected data are received.