Recycler RF Report

John Marriner

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Collaborators

- Brian Chase*
- Keith Meisner
- Chandra Bhat
- Joe Dey
- Jim Steimel
- Hyejoo Kang†

Recycler RF Issues

- RF "State" Definition & Interaction with the Recycler sequencer.
  - Enhancement of commands including the "cogging through 0 problem"
  - Adding hand-shaking hooks for the sequencer
- Rationalization of process and definition of the goals of each "state."
- Defining requirements for waveform
  - Low level analog improvements
  - High level linear and non-linear distortion
  - Gap monitor linear distortion.

RF State Specification

RF Operations in the Recycler

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1. Initialization

1.1. Narrative

Turns off all rf and initializes the AA marker to the *pbar* value. This sequence is intended to be used primarily when there is no beam in the machine. It should not be required for normal operation but may be used to recover from off-normal situations.

1.2. Parameters

None.

1.3. Actions

1.3.1. Set amplitude=0 to all channels.

1.3.2. Load 0 waveforms to all channels.

1.3.3. Set cogging offsets to nominal positions for all channels, *viz.*,

1.3.3.1.1. Channel 0=576

1.3.3.1.2. Channel 1=121

1.3.3.1.3. Channel 2=36

1.3.3.1.4. Channel 3=169

1.3.3.1.5. Channel 4=328

1.3.3.1.6. Channel 5=see below

1.3.3.1.7. Channel 6=376

1.3.3.1.8. Channel 7=528

1.3.4. Cog channel 5 (AA marker) to standard pbar value=178.

2. Initialize protons

Initializes the RF for proton mode. This state should follow the general initialization (state 1).

2.1. Parameters

None.

2.2. Actions

2.2.1. Cog channel 5 (AA marker) to standard value for protons=121.8.

1. Create Gap in Cooled Beam

1.1. Narrative

Starting with a coasting beam in the machine, this sequence places a standard size gap in the beam. This sequence is intended to be used when no other r.f. is on: following initialization (state 1 or 2) or close gap (state 4).

1.2. Parameters

None.

1.3. Actions

1.3.1. Amplitude channel 6 = 0.

1.3.2. Amplitude channel 7 = 0.

1.3.3. Load standard (-) barrier waveform to channel 6.

1.3.4. Load standard (+) barrier waveform to channel 7.

1.3.5. Cog channel 6 to bucket 576 (fast).

1.3.6. Cog channel 7 to 528 (fast).

1.3.7. Channel 6&7 amplitude->1.0 in 20 sec

2. Remove Gap in Cooled Beam

2.1. Narrative

Removes the gap from the cooled beam. Intended to be used when no other rf is present.

2.2. Parameters

None

2.3. Actions

2.3.1. Channel 6&7->0 in 20 sec.

2.3.2. Load 0 waveform to channel 6.

2.3.3. Load 0 waveform to channel 7.

2.3.4. Cog channel 6 to 376 (fast).

2.3.5. Cog channel 7 to 528 (fast).

3. Squeeze Cooled Beam for Injection

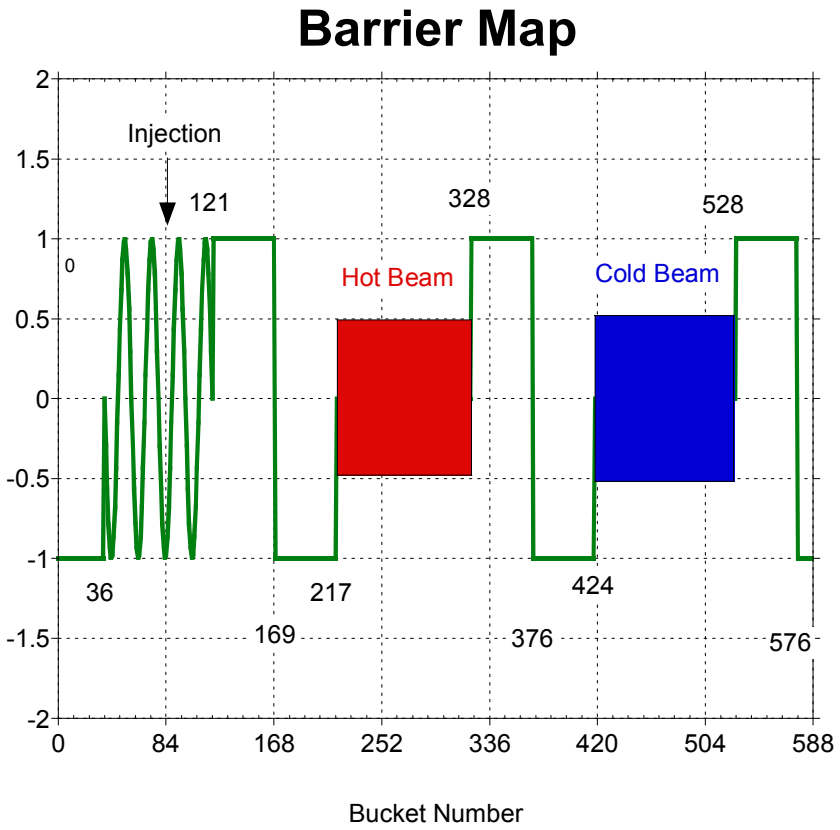
3.1. Narrative

Squeezes the cooled beam to the standard value to allow for injection of a new pulse of beam from the Accumulator. Intended to be issued after state 3.

3.2. Parameters

None

Standard Barrier Positions



Issues

- Adiabaticity of various processes.
  - Simulations
  - Experiments
- Waveform requirements (have specified <1% distortion based on "seat-of-the-pants" argument augmented by realism for now).
- Low, broadband synchrotron frequency & susceptibility to emittance growth from, *e.g.*, the MI ramp.
- Coherent instabilities?

Future Plans

- Develop and implement emittance measurement based on bunch length.
- Develop and implement timing measurements including measurement of dipole and quadrupole oscillations.
- Measure emittance growth with protons and antiprotons.
- Test longitudinal broad-band feedback based on Steimel technology.