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A Recycler Collimator Design in Reduced Coordinates – RR613:RR621

Bruce C. Brown

Recycler Collimation Meeting

29 July 2015

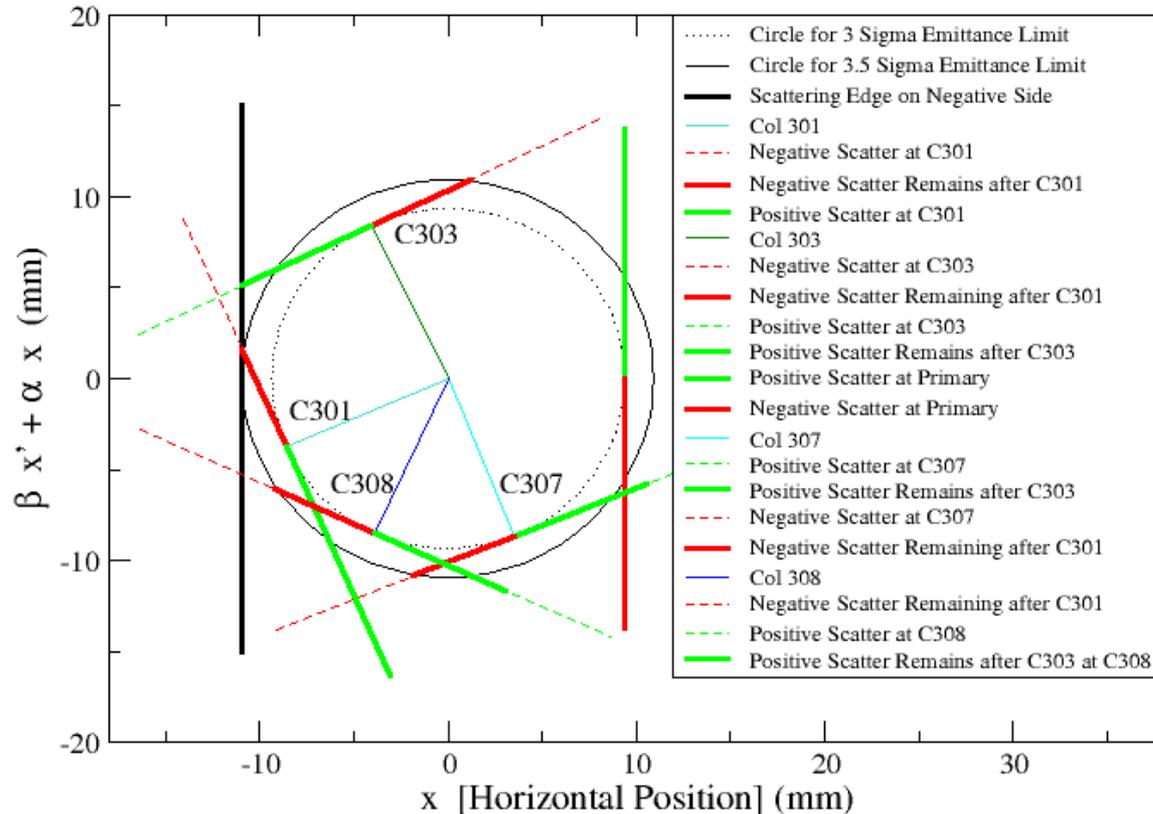
Design of Primary/Secondary Collimators: Reduced Coord.

- Transform Coordinates from x, x' to $x, \beta x' + \alpha x$
OR y, y' to $y, \beta y' + \alpha y$
- Identify Primary Collimator and Calculate Scattering
- Use 3 sigma boundary for scattering and 3.5 sigma for secondary collimators
- Follow scattered particles
(phase advance in clockwise direction)
- Secondary Collimators at negative or positive extreme

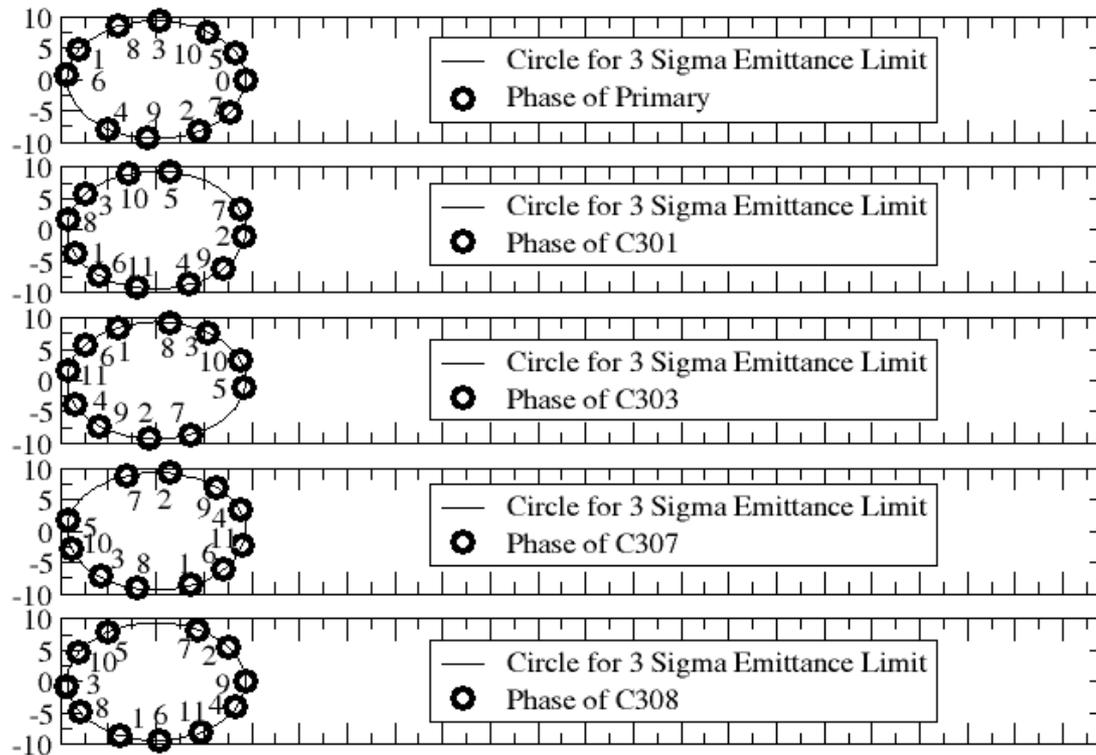
Main Injector Collimation – First Turn Capture

Main Injector Collimation in Normalized Coordinates

First Turn Response to Horizontal Scatter at HPC230



Main Injector Collimation – MultiTurn Capture



Design of Primary/Secondary Collimators: Reduced Coord.

Recycler Collimator Design Strategy #1

- Tickle the beam lightly with primary collimator (small beta)
- Place one or more secondary collimators at arbitrary places to collect scattered protons on subsequent turns
- Uncaptured protons will scatter again one or more times in next 20 turns.
- Hope that primary and secondary collimators are limiting apertures in both planes

Design of Primary/Secondary Collimators: Reduced Coord.

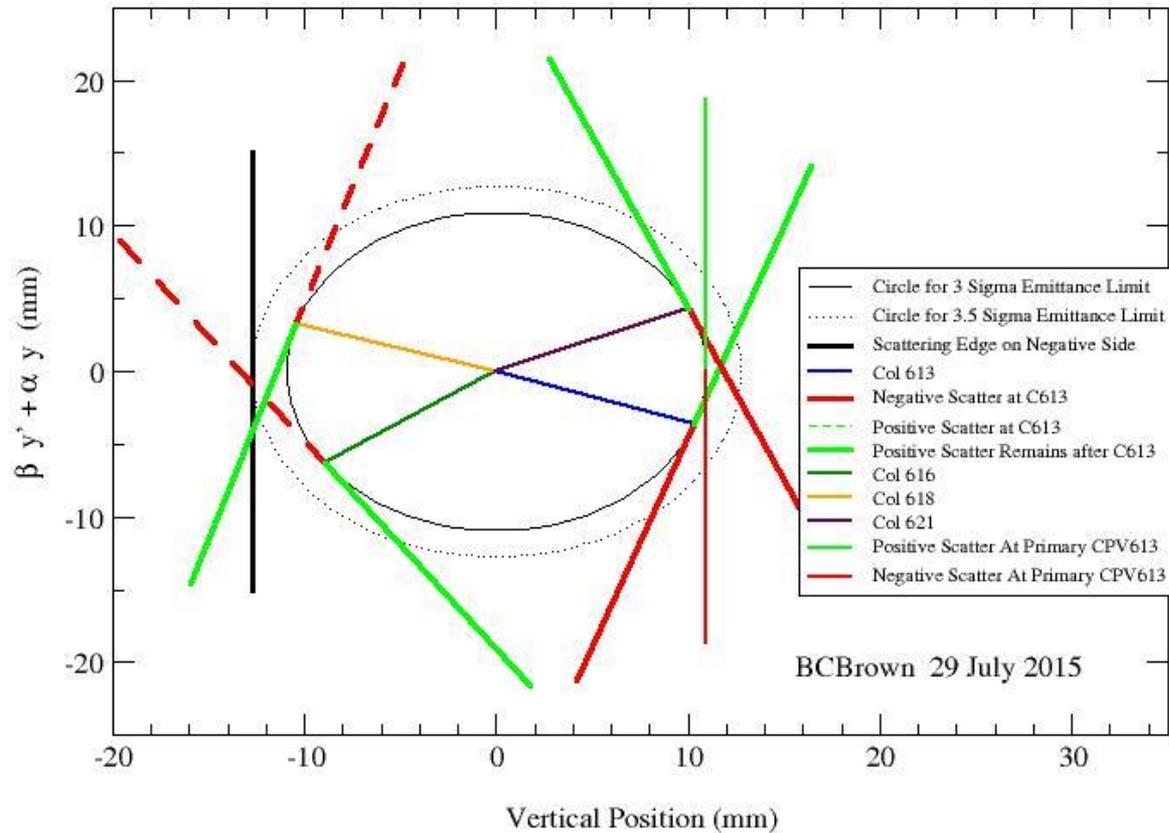
Recycler Collimator Design Strategy #2

- Hit the halo hard with primary (at large beta)
- Place secondary collimators at appropriate phases to collect halo in next few cells
- Uncaptured protons will scatter again one or more times in next 20 turns.
- With primary in vertical plane, horizontal effects will be studied in simulations. Need to capture from at least one edge for each slip stacked beam. [Will we use different time bumps when there is only one beam?]
- Hope that primary and secondary collimators are limiting apertures in both planes

Recycler Collimator Design – CPV613 and following

Recycler Collimation (proposed) in Normalized Coordinates

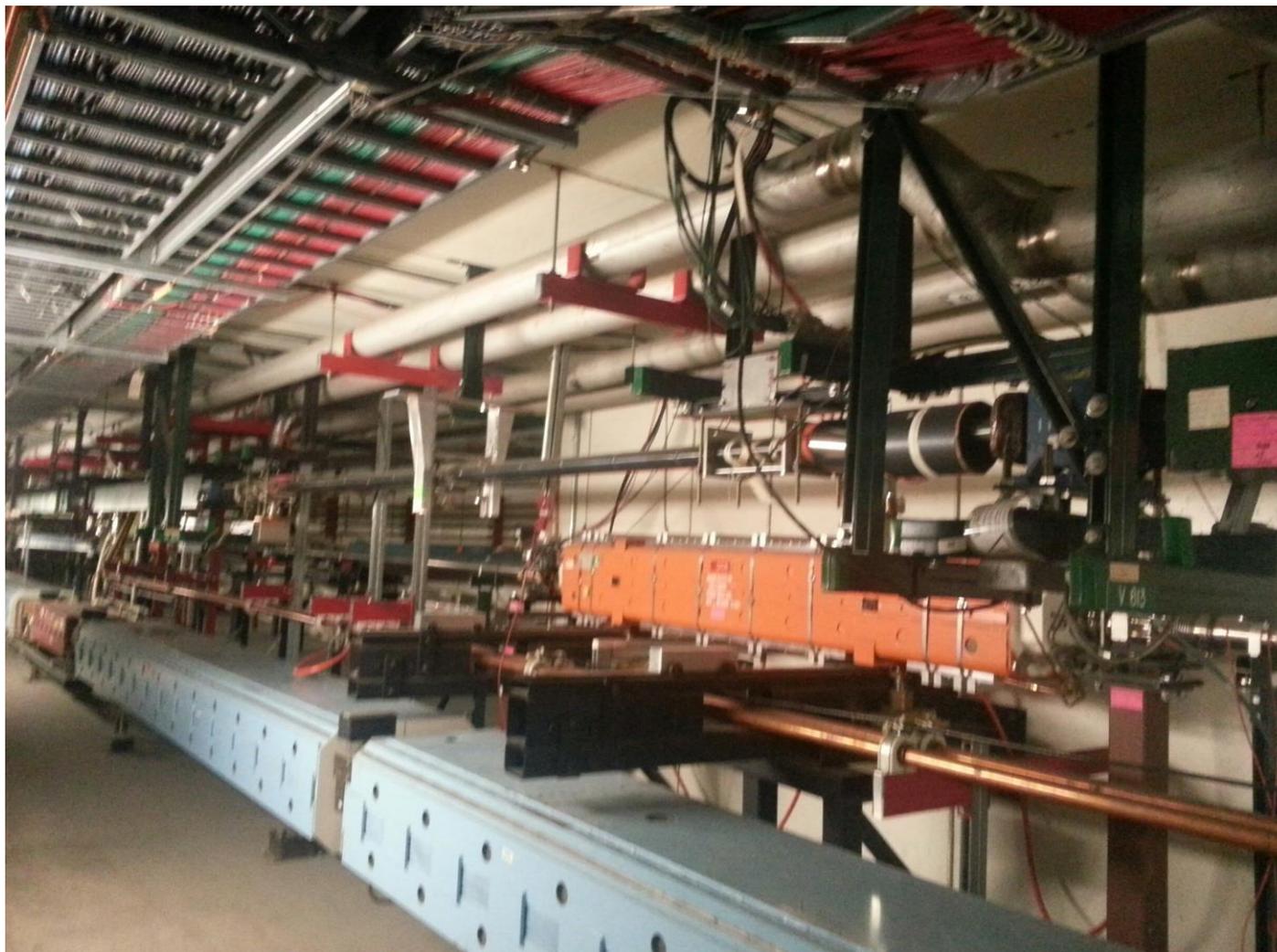
First Turn Response to a Vertical Scatter at CPV613



RR 613A – Primary Collimator



RR 613B S1 possibility



RR 614B



RR 615B



RR 616B S2 Possibility



RR 617B



RR 618B S3 Possibility



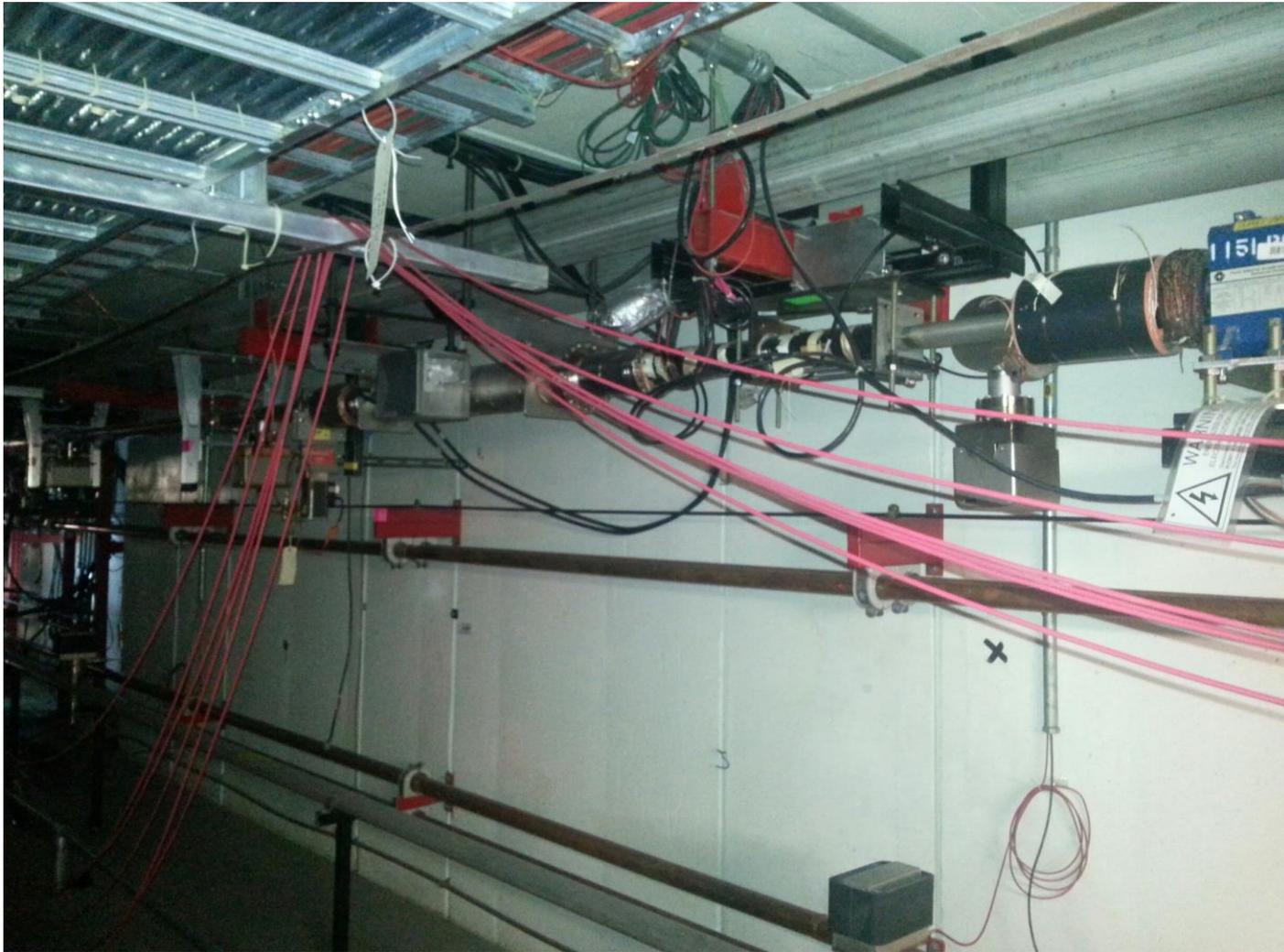
RR 619B



RR 620B



RR 621B S4 Possibility



Collimation Design Strategy

Next steps:

- Decide on expected proton annual loss => shielding demanded
- Mechanical Design for one secondary at some location
 - Motion required? Horizontal and Vertical, Pitch and Yaw
- Consider implications for water/bus systems
- Consider expectations for vacuum
- Orbit bump design and magnet requirements

Then:

- Make decisions to allow further design
- Prepare for review