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RTBT Collimators Re-Visisted

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Introduction

In the view of the aperture limitation near the vacuum window in the target region, this limited aperture reduce the horizontal acceptance to 272 and vertical acceptance to 625 pi mm mrad for 200 pi mm mrad ring emittance. This aperture limitation was created to shadow the part of the vacuum window which is not cooled by the target group. The RTBT collimators were re-visited. There are two collimators which are located after Q19 and Q22. The collimator which is after Q22 is already manufactured and no design changes are possible only location can be changed. The second collimator has been designed (drawings are ready) but not ordered yet. This note explores the possibility if the collimator acceptance can be made similar to the near vacuum window in the target region.

Present Configuration

As is stand the acceptance of these collimator are 400 mm mrad and beam with emittance of 240 mm mrad in case of one kicker failure can pass through them without scrapping. [1]. Figure 1 and 2 show the different envelopes of the beam traversing both collimators. The requirements of these collimator is to have an aperture of 400 pi mm mrad to clear the nominal beam even in the event that one out of fourteen extraction kickers fails

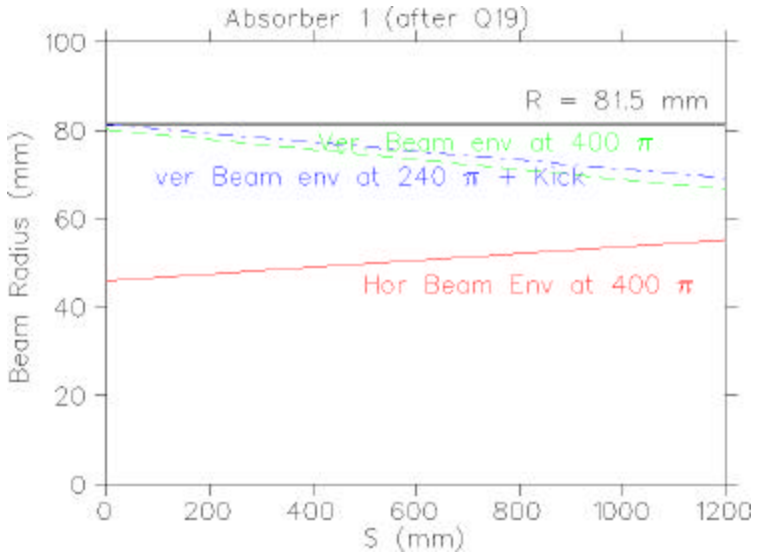

Figure 1: Beam envelop along the RTBT collimator 1 (after Q19) The horizontal and vertical beam envelops are shown at nominal 400 pi mm mrad and vertical beam envelop are at 240 pi mm mrad after misfire of kicker number eight.

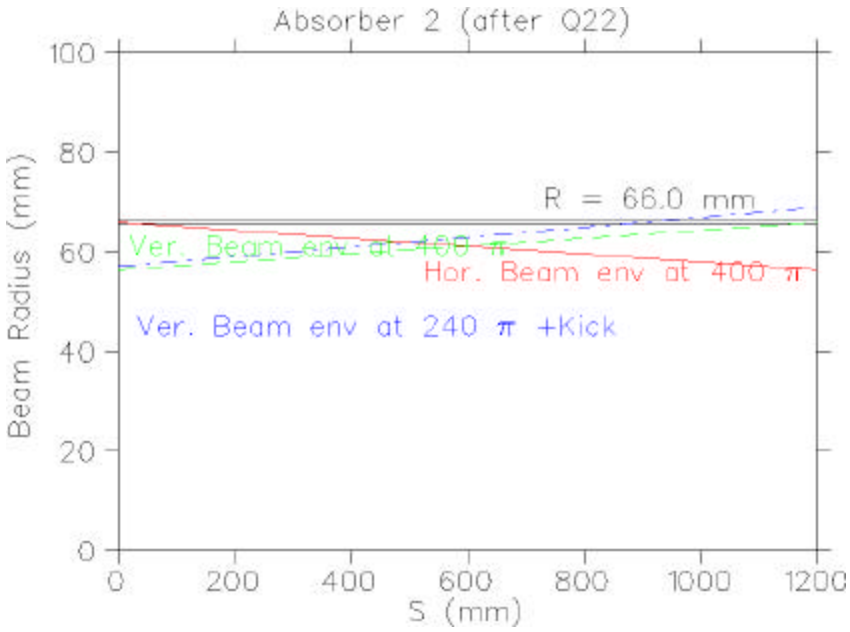

Figure 2: Beam envelop along the RTBT collimator 1 (after Q22) The horizontal and vertical beam envelops are shown at nominal 400 pi mm mrad and vertical beam envelop are at 240 pi mm mrad after misfire of kicker number eight.

Table I shows the technical specifications of the two collimators in RTBT.

Table I: RTBT Collimators parameters. Distance between upstream quadrupole and collimator are measured center to center

Collimator	RTBT1	RTBT2
Drift number after Quad	Q19	Q22
Quad to collimator distance [m]	1.9	2.89
Cross section	circular	circular
Radius of the reduce aperture [mm]	81.5	66.0
Length of the collimator [mm]	2972	2972
Length of aperture reduction [mm]	1200	1200
Acceptance [pi mm mrad]	400	400

New Proposed Configuration

The minimum aperture near vacuum window in the target region is 280 x 127 mm^2, and beta function 72 and 6.4 meters in horizontal and vertical direction respectively, which corresponds to acceptance of 272-pi mm mrad horizontally, and 625 pi mm mrad vertically for the ring emittance of 200 pi mm mrad in each plane. If the ring emittance doubles then one has to adjust the last doublets to produce the required size (200 x 70 mm^2) at the target. Therefore the ratio of window acceptance and ring emittance remain same at this place. But this bottleneck in aperture in the target region defines the

tolerance of the quadrupoles, dipoles and corrector upstream in the RTBT. To make collimator acceptance comparable to window acceptance we are proposing to reduce the horizontal acceptance of RTBT collimators to 300 pi mm mrad while requirement for vertical remain same namely 400 pi mm mrad and 240 pi mm mrad plus one kicker failure. Figure 3 and 4 show the different envelopes of the beam traversing both collimators. The requirements of these collimator is to have an aperture of 400 pi mm mrad to clear the nominal beam even in the event that one out of fourteen extraction kickers fail vertically and 300 pi mm mrad horizontally.

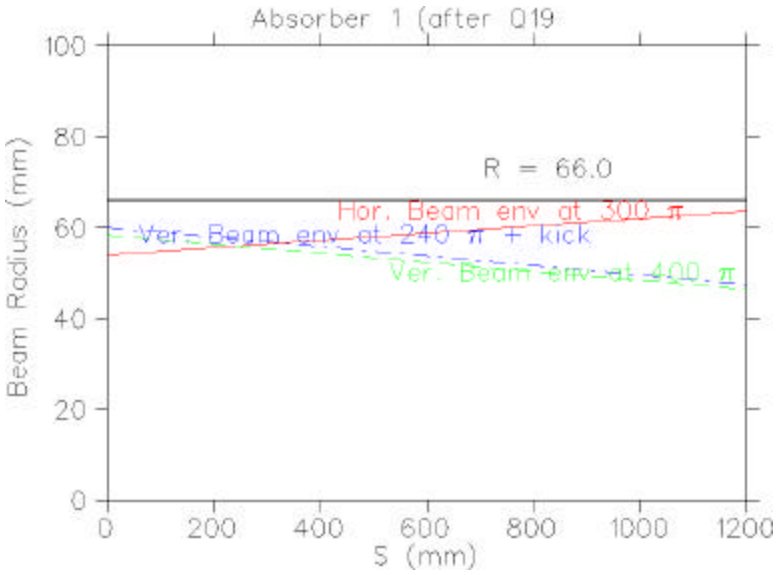

Figure 3: Beam envelop along the RTBT collimator 1 (after Q19) The horizontal beam envelops are shown at nominal 300 pi mm mrad and vertical beam envelop are at 400 pi mm mrad and 240 pi mm mrad after misfire of kicker number eight.

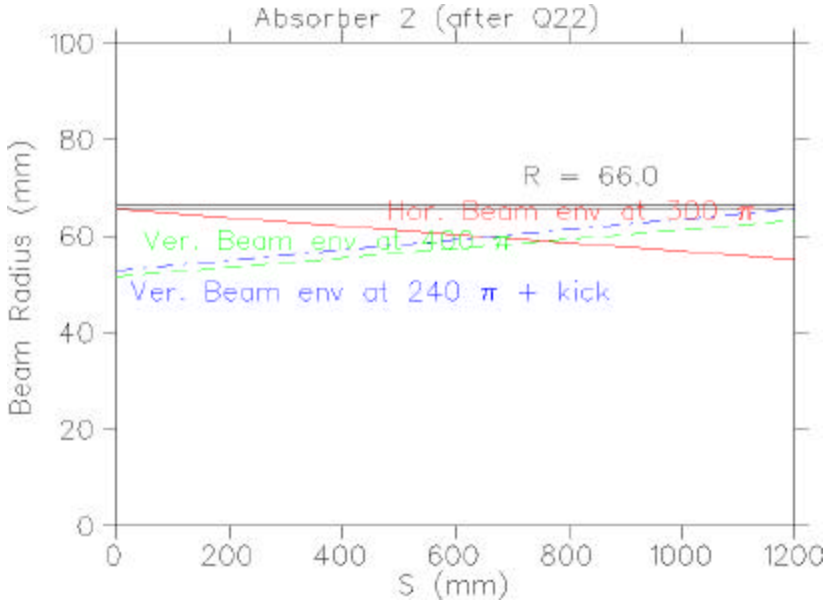

Figure 4: Beam envelop along the RTBT collimator 1 (after Q22) The horizontal beam envelops are shown at nominal 300 pi mm mrad and vertical beam envelop are at 400 pi mm mrad and 240 pi mm mrad after misfire of kicker number eight.

Table II show the technical specifications of the two proposed collimators in the RTBT.

Table II: RTBT Collimators parameters. Distance between upstream quadrupole and collimator are measured center to center

Collimator	RTBT1	RTBT2
Drift number after Quad	Q19	Q22
Quad to collimator distance [m]	3.89	2.15
Cross section	circular	circular
Radius of the reduce aperture [mm]	66.0	66.0
Length of the collimator [mm]	2972	2972
Length of aperture reduction [mm]	1200	1200
Vertical acceptance [pi mm mrad]	400	400
Horizontal acceptance [pi mm mrad]	300	300

In this new proposal the two collimator become identical this means no new drawing and the collimator after Q19 can be order without delay.

References

[1] N. Catalan-Lasheras and Deepak Raparia, " The Collimation system of the Ring to Target Transfer (RTBT) Line", BNL/SNS Technical Note 095, July and Appendix to Tech Note 095, October 12, 2001