MICE Required "Stay Clear"

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1 introduction

The envelope of tracks that will propagate through cooling lattices are studied in order to define the required "stay clear" near the focus coils, assuming that the beam envelope is bountded at 21 cm by the RF irises.

Some time ago

(http://hep04.phys.iit.edu/cooldemo/pc/pc24/pc24_zisman_bsc.pdf)

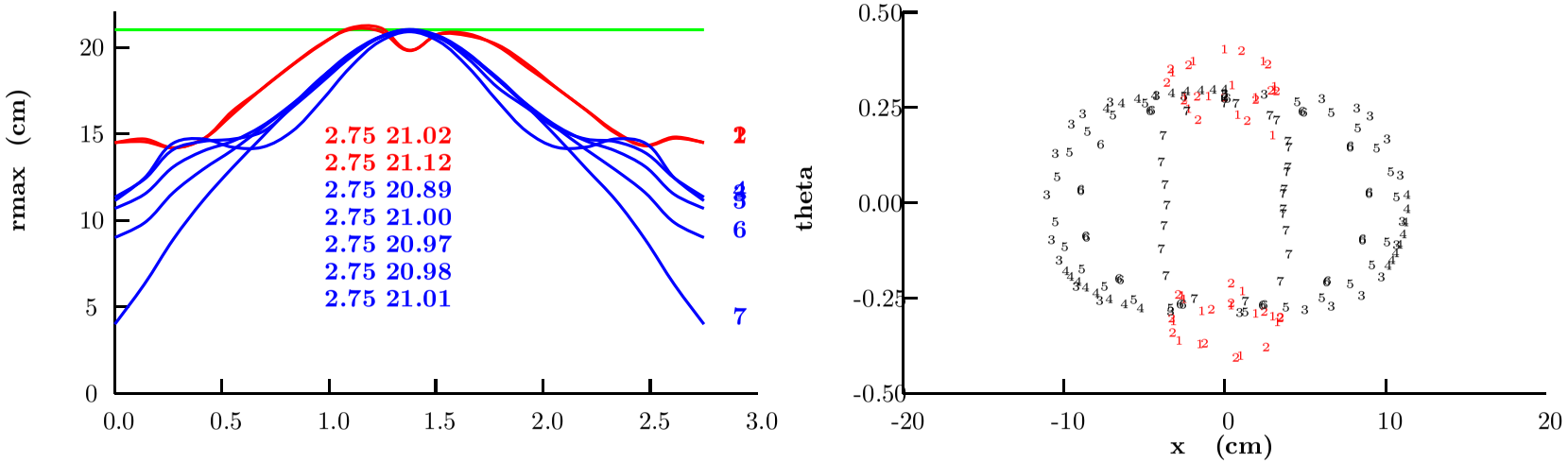
, I determined such an envelope by generating 100,000 random tracks and sending them down a series of cells (without RF or material), and obseving the envelope of remaining tracks in a final cell. Despite the relatively large statistics, the method fails to explore the bounds of the envelope, especially for tracks at the edges of the momentum acceptance.

In this note, I use a method that getts closer to the real bound, and which gives more information. One track is intoduced at each of a number of momentum, and tracked down many (typically 50) cells. Maximum amplitudes at differing relative position in each cell are determined. If the envelope is below the 21 cm cut-off, defined by the rf irises, then the initial transverse momentum is increased until the envelope just meets this constraint.

Using this method, one finds that the highest amplitude tracks are often traped in islands, and it was not clear that such tracks would in fact be cooled. However, it was found, in a separate study, that such tracks are cooled becuase, with synchrotron motion, they do not remain within their islands for long. Their average cooling rate may be less, but they do cool and are thus regarded as useful tracks and included in the definition of the stay clear envelope.

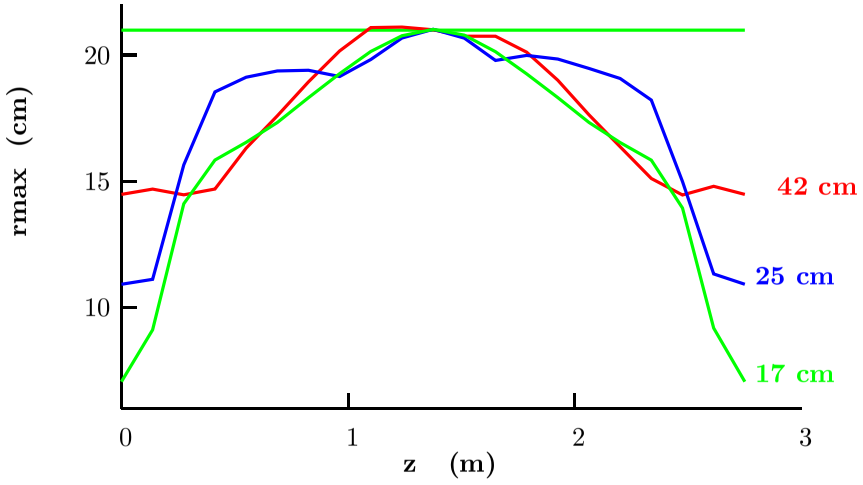
2 'Base Line' Case, beta=42 cm

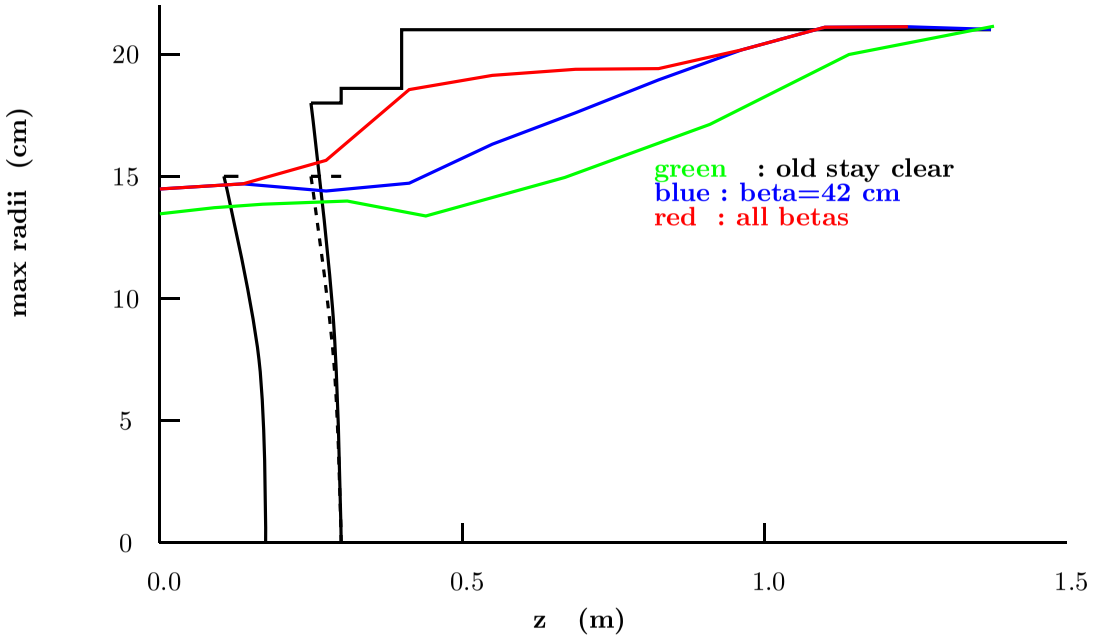
The following plots show the envelopes for a series of momenta, and the corresponding phase plots. The envelopes and phase points in red are those that lie in islands. the numbered momenta (1 to 7) correspond to .155, .17, .185, .2, .215, .23, and .245 MeV/c The currents were set for 0.2 MeV/c central momentum. From these momentum dependent envelopes, we determine an overall envelope corresponding to this particuar lattice current settings.



3 All Cases: betas= 42, 25 and 17 cm

This plot shows the envelopes when the currents are adjusted to give minimum betas of 42, 25 and 17 cm. It is seen that the 17 cm case does not contribute to the overall envelope. The same is true for smaller beta solutions.





(rad)	rad (cm)
.00001	14.48275
.13751	14.69298
.27501	15.65462
.41251	18.55021
.55001	19.13194
.68751	19.38077
.82501	19.40834
.96251	20.17549
1.10001	21.10166
1.23751	21.12177

4 Conclusion

The above figure give the maximum envelopes:

1) for the base line 42 cm beta lattice (blue)
2) for the maximum of all lattices (red)
3) for the old study of the base line 42 cm case as determined by running 100,000 gaussian tracks (green)
4) The current hardware outline (black)
5) The outline with a 15 (instead of 18) cm saftey window (black dashes)

The outlines of hardware are indicated in black. The dotted ouline is for a 15 cm saftey window.

The results for all betas are given in the table.

It is seen that the current method gives stay clears about 1 cm greater than the former method, and that the stayclear inluding lower betas is greater for distances greater than 14 cm from the absorber center.

It is seen that the current hardware does not constrain the aperture, and that a 15 cm saftey window would have a slight constraint on the 25 cm solution, but none on the baseline.