Requirements for the Stability of MEBT and HEBT Quadrupoles

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Figures 1 and 2, show the Trace3d out put fore the MEBT and HEBT. To determine the power supply stability, quadrupoles gradients of each quadrupole were changed at one time and recorded the maximum mismatch factor (either in x or y planes). Based on the mismatch factor emittance growth of whole line was calculated. The acceptable emittance growth in the line was the measure of the power supply stability.

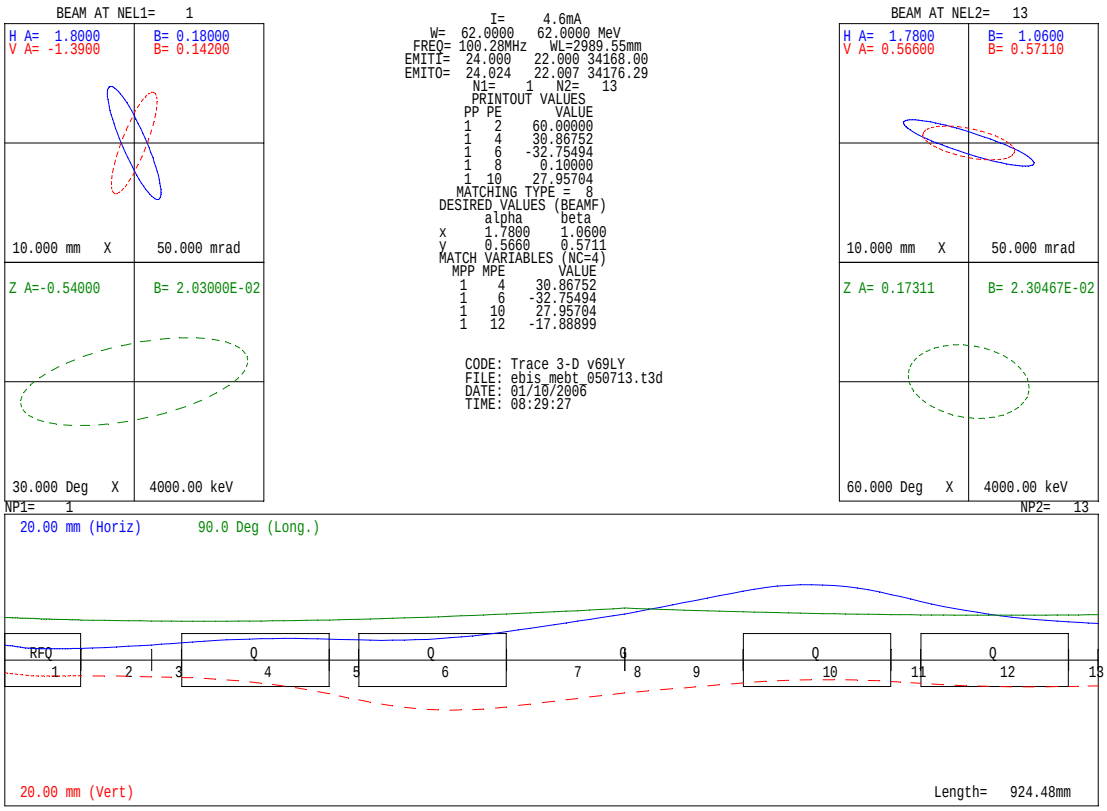

Figure 1: Trace 3d out put for the MEBT in case of Au^{32}. The first element shown in the figure is the last cell of the RFQ to provide the symmetric beam into the MEBT.

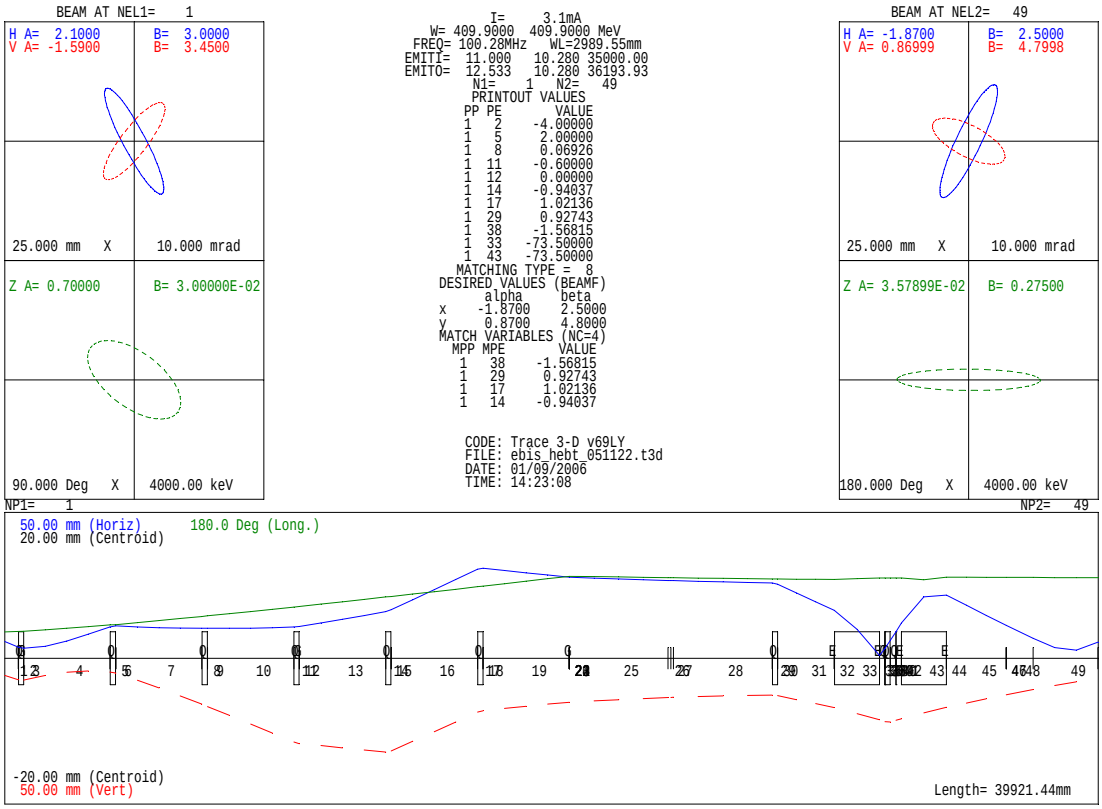

Figure 2: Trace3d output for HEBT in case of mismatch injection into the booster of Au^{32}.

Table 1 lists the results for MEBT and HEBT for mismatch injection into the booster with Au^{32} for change in gradient of ± 1%. The MMF factor was calculated at the entrance of the booster inflector in case of HEBT and at entrance of the IH Linac in case of MEBT.

Table 1: Mismatch factor for MEBT and HEBT for ±1% changed in the quadrupole gradients in case of Au^{32}.

Quadrupole Gradient (T/m)	Change in %	MMF (maximum in x or y)
MEBT		
30.8554	±1	0.038
-35.01241	±1	0.164
29.38225	±1	0.130
-13.11687	±1	0.028
HEBT		
-4.0	±1	0.016
2.0	±1	0.021
0.06926	±1	0.004
-0.600	±1	0.042
-0.94037	±1	0.081
1.02136	±1	0.071
0.92743	±1	0.080
-1.56815	±1	0.054

If the PS has stability of 0.01%

MMF for the MEBT
$= 0.01*SQRT(0.038^2 + 0.164^2 + 0.130^2 + 0.028^2) = 0.0021$

Emittance growth MEBT

= 0.42 %

MMF for the HEBT
$= 0.01*SQRT(0.016^2 + 0.021^2 + 0.004^2 + 0.042^2 + 0.081^2 + 0.071^2 + 0.080^2 + 0.054^2) = 0.0018$

Emitance growth gor the HEBT
= 0.36%

Recommendation: stability 0.01%, if this stability cost too much then we can have 0.05%

Note: SNS HEBT PS stability was 0.01%