Beam dynamics activities for ESS-Bilbao DTL

DTL with H^+

Aritz Leonardo, Ibon Bustinduy

presented by Zunbeltz Izaola

13rd September 2011

Why I am here?

- María and Jon. Born on 17th of August.
- Julen. Born on 3rd of September.

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Both mothers and babys are fine.

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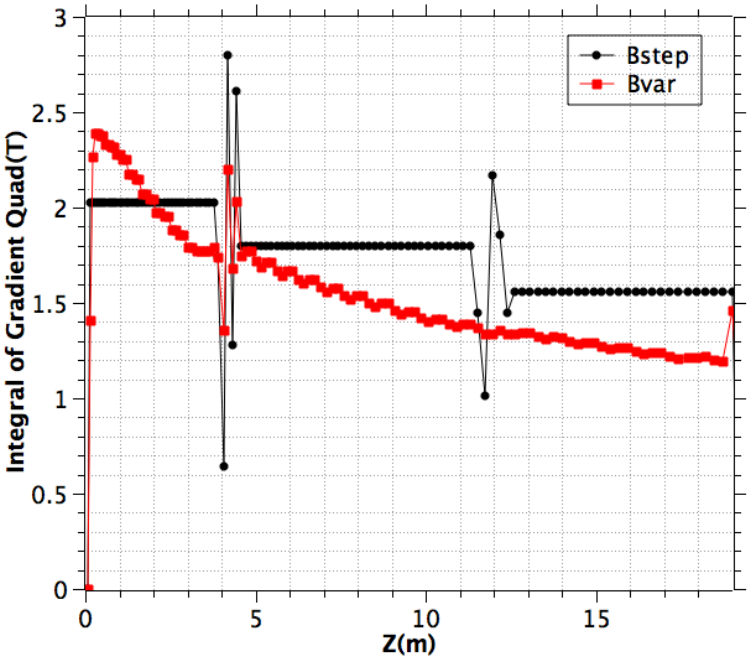
Both mothers and babys are fine.
Parents are very busy!

Acknowledgements

- Alessandra Lombardi
- Jean-Baptiste Lallement
- Margarita Tudela
- Michele Comunian

DTL layouts



BVAR-CERN FFDD layout with decaying magnetic gradients. (A. Lombardi, J. Stovall,. . .)

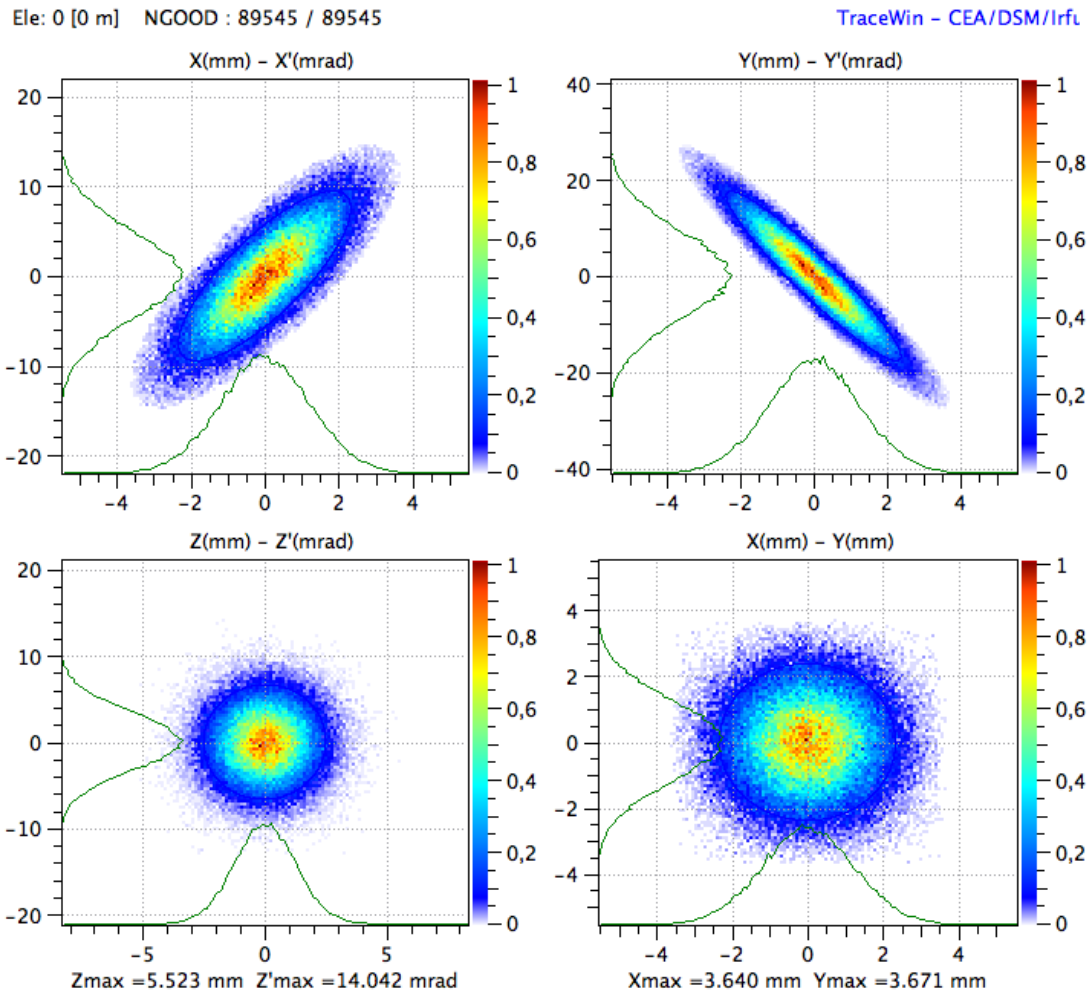
BSTEP FFDD layout with an identical mechanical design from LINAC4 but with constant B that varies from tank to tank.

BCTE-INFN FODO 62 permanent quadrupoles with constant $G = 54\,\mathrm{T\,m^{-1}}$ (Michele Comunian)

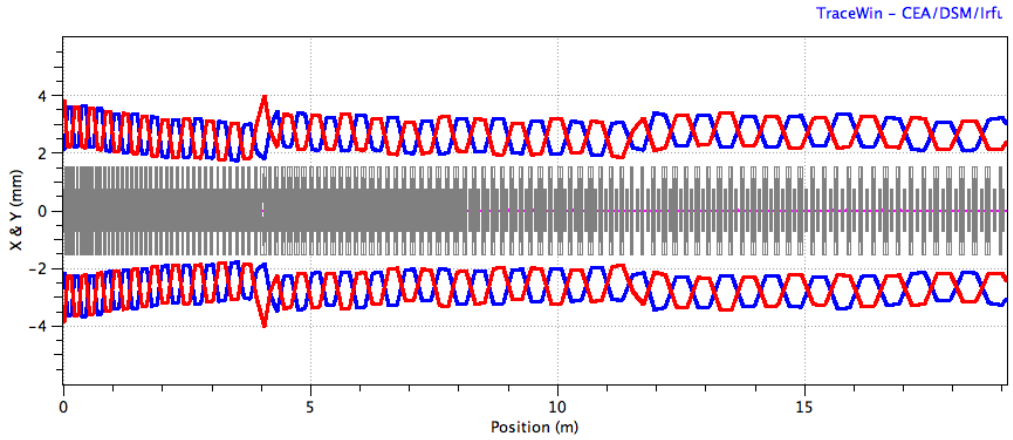
Initial Beam parameters

- 90000 particles in a Gaussian distribution
- RMS Normalised Emittance (π mm mrad)

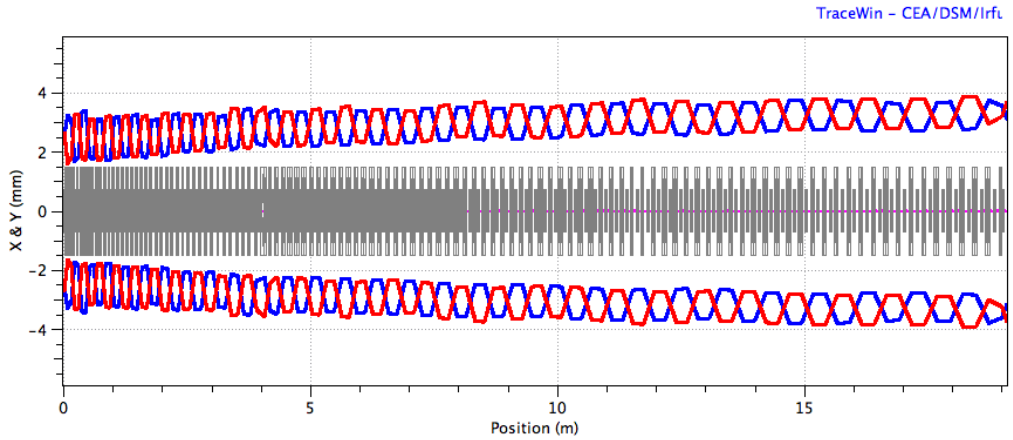
$\epsilon_{xx'}$	0.2667828
$\epsilon_{yy'}$	0.267178
$\epsilon_{zz'}$	0.3362703



Beam envelope



BSTEP



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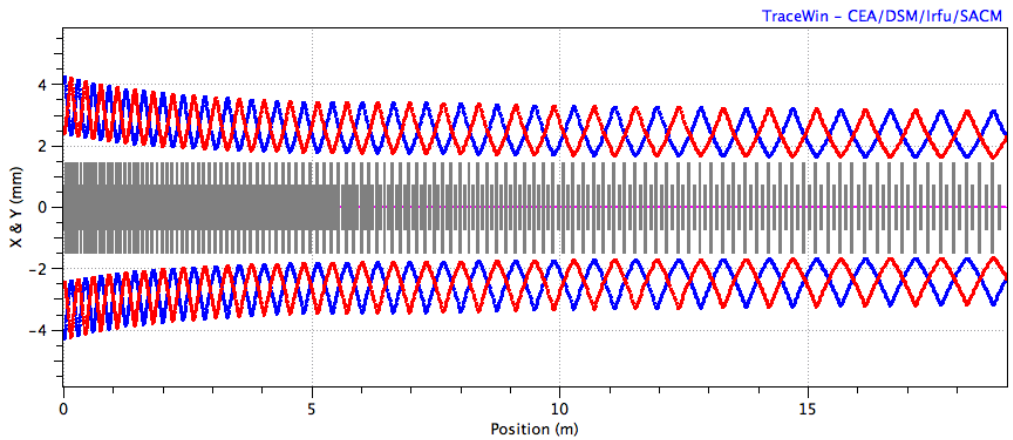
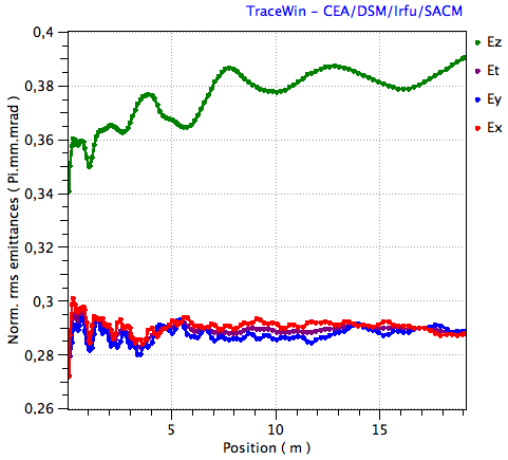
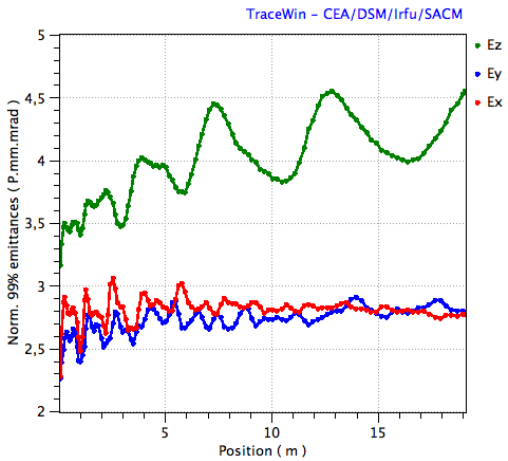


BCTE

Emittances

BSTEP





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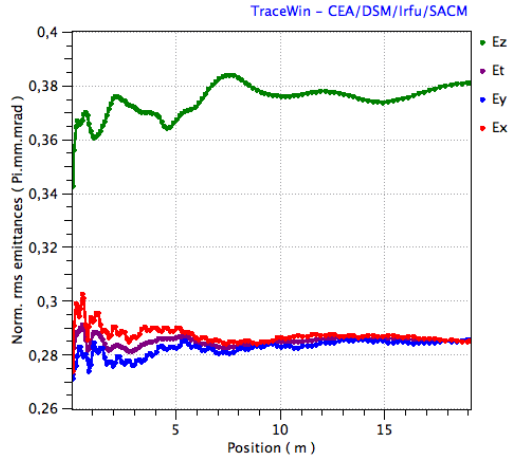

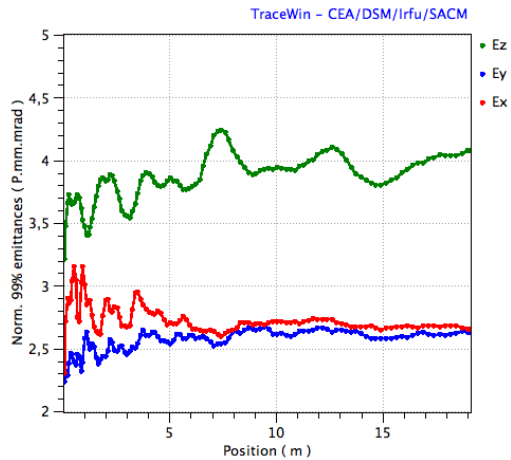

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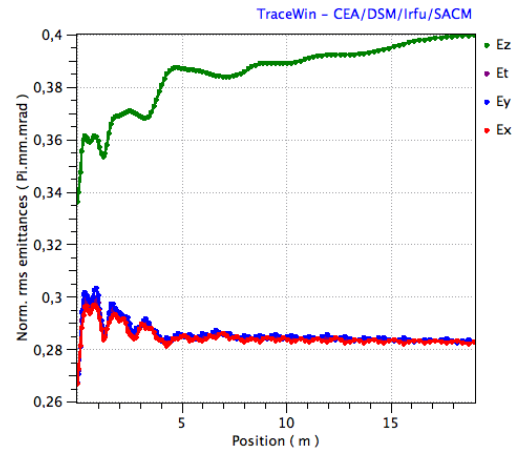
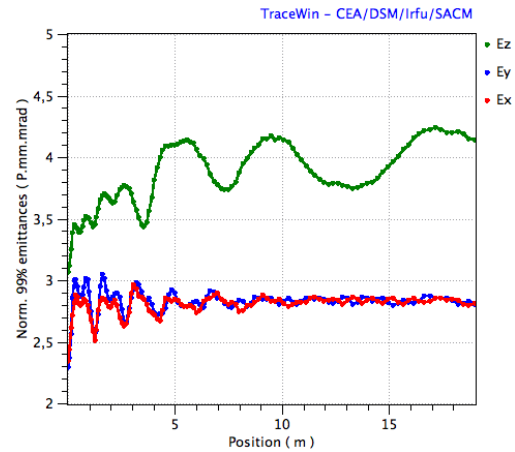
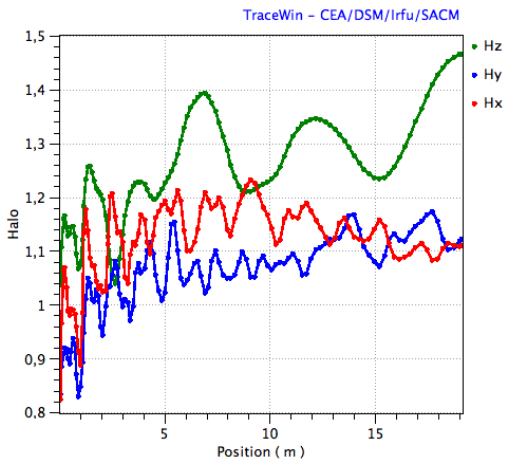




Halo

$$H_i = \frac{\sqrt{3\langle q_i^4\rangle\langle p_i^4\rangle + 9\langle q_i^2 p_i^2\rangle^2 - 12\langle q_i p_i^3\rangle\langle q_i^3 p_i\rangle}}{2\langle q_i^2\rangle\langle p_i^2\rangle - 2\langle q_i p_i\rangle^2} - 2.$$

BSTEP



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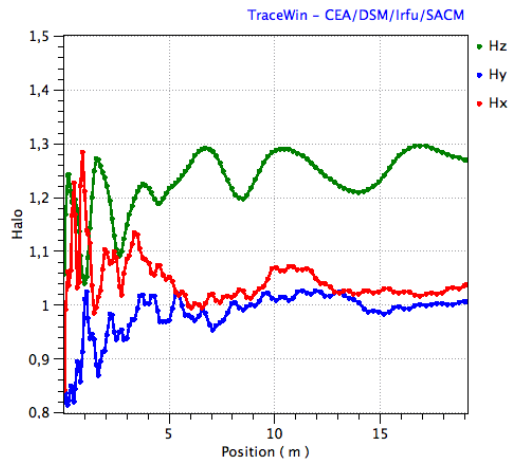

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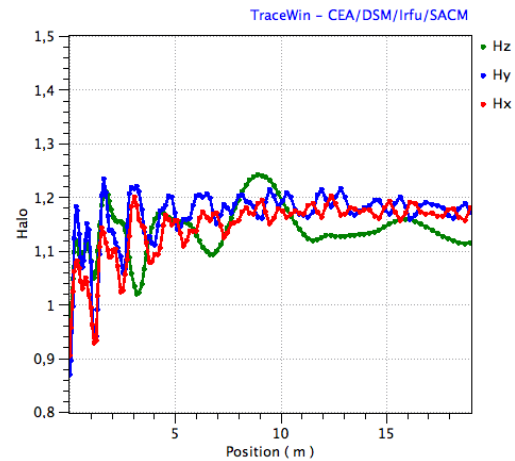
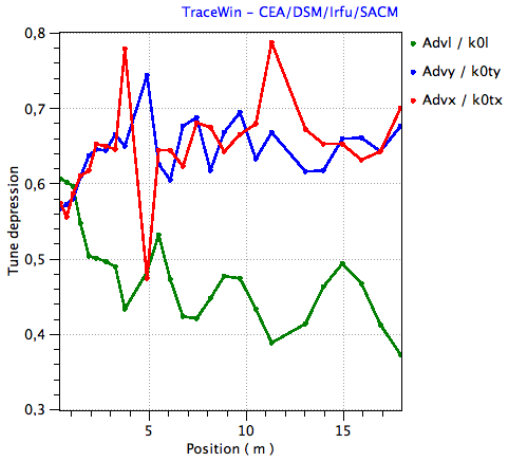
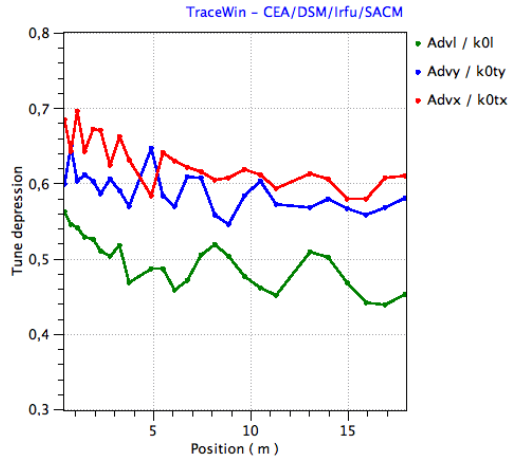


Tune depression

BSTEP



BVAR



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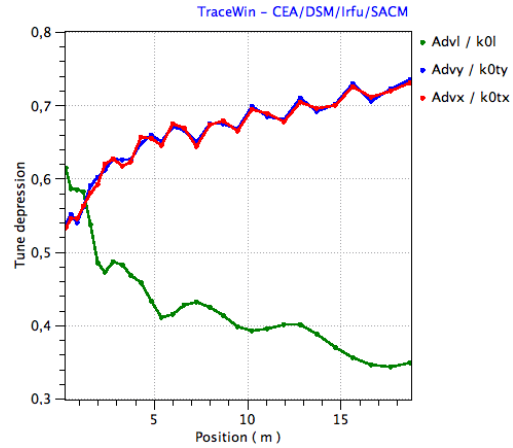
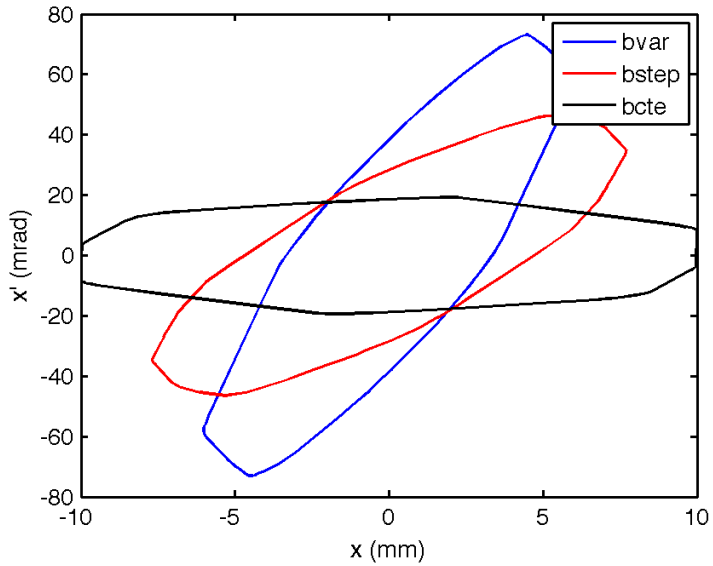
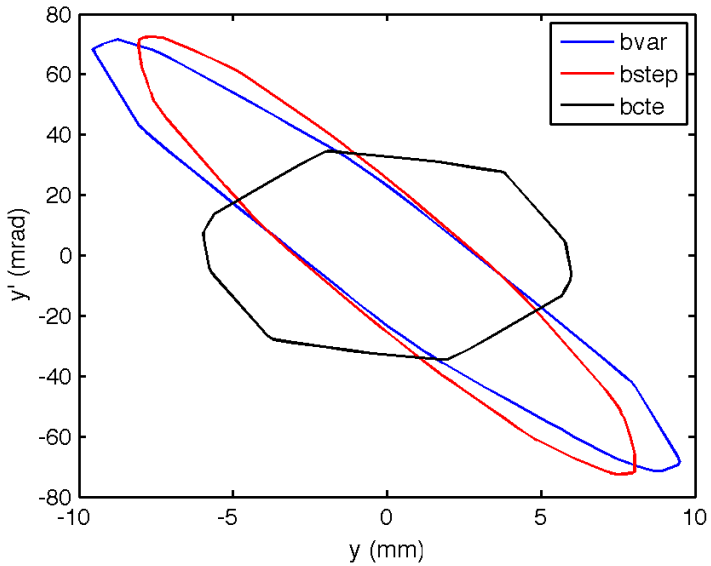


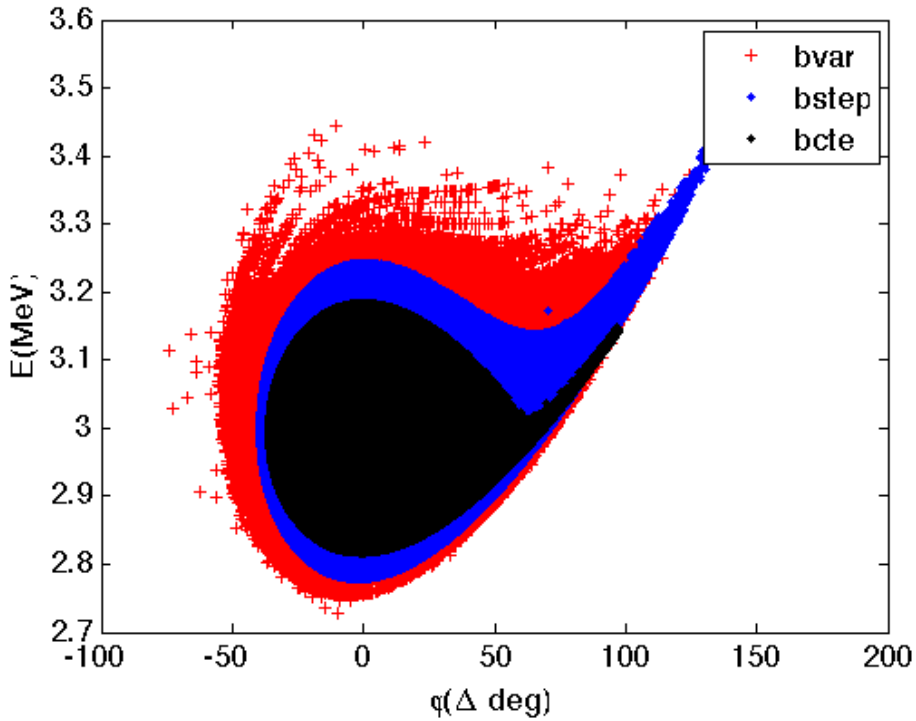
Transverse acceptance





	rms ϵ_x [π mm mrad]	rms ϵ_y [π mm mrad]	98%ϵ_x [π mm mrad]	98%ϵ_y [π mm mrad]
BSTEP	**3.5279**	**3.2291**	**17.6395**	**16.1457**
BVAR	3.2415	3.1887	16.2077	15.9434
BCTE	2.9772	2.9958	14.8860	14.9788

Longitudinal acceptance



	rms ϵ_l [π deg MeV]	95% ϵ_l [π deg MeV]
BSTEP	**2.7757**	**13.8787**
BVAR	2.3422	11.7110
BCTE	1.7292	8.6462

Conclusions

- BSTEP shows higher acceptance
- BVAR best overall
- Further work: Robustness study (underway)