Pion/muon capture for the Neutrino Factory

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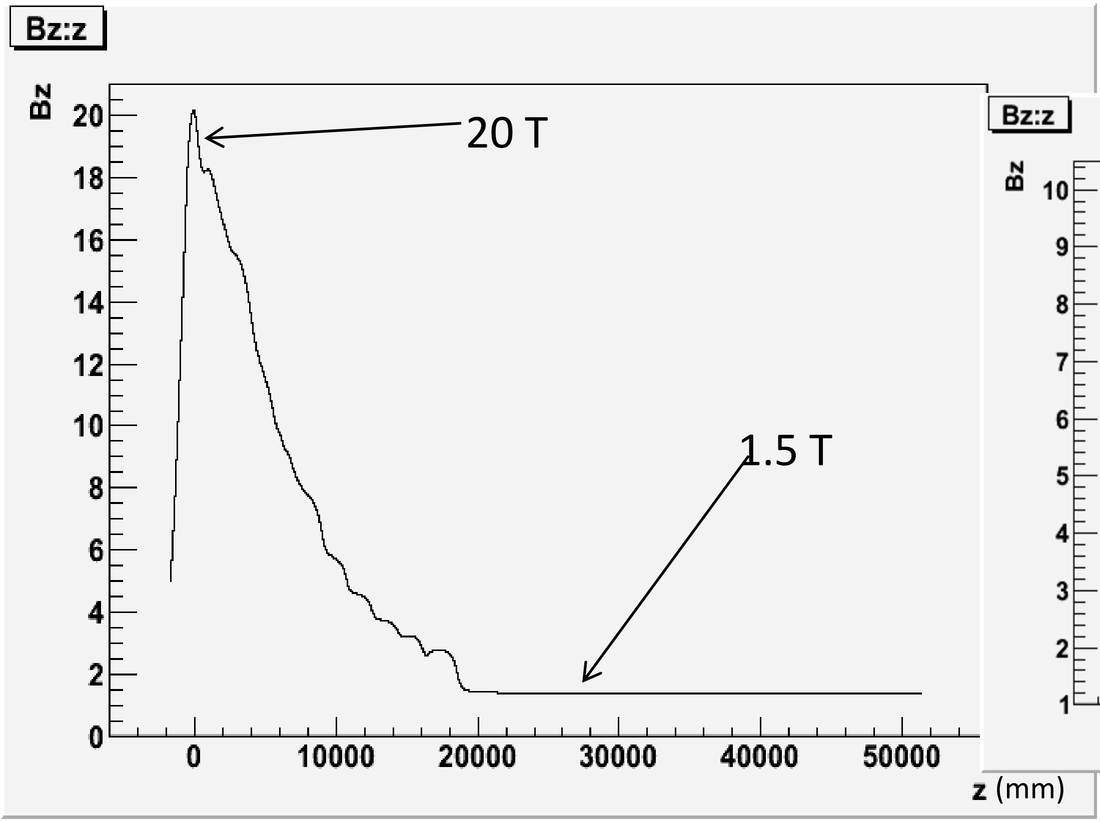
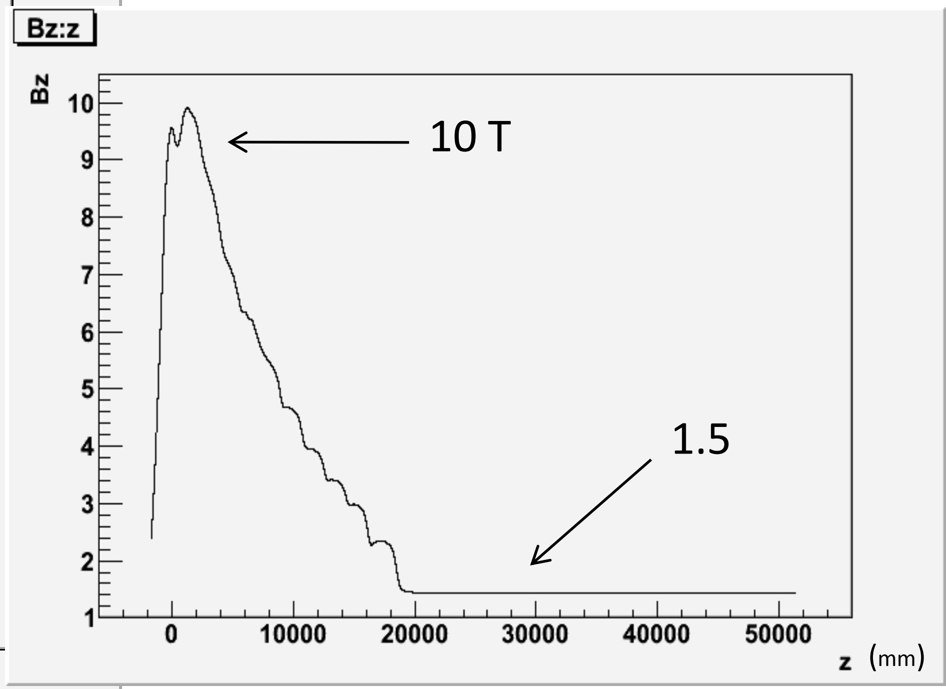
Target and beam

- Mercury target cyl
- L=30 cm
- R=0.5 cm
- Centered at z=0
- Rotated 100mRad
- 10 GeV beam energy
- 67mRad

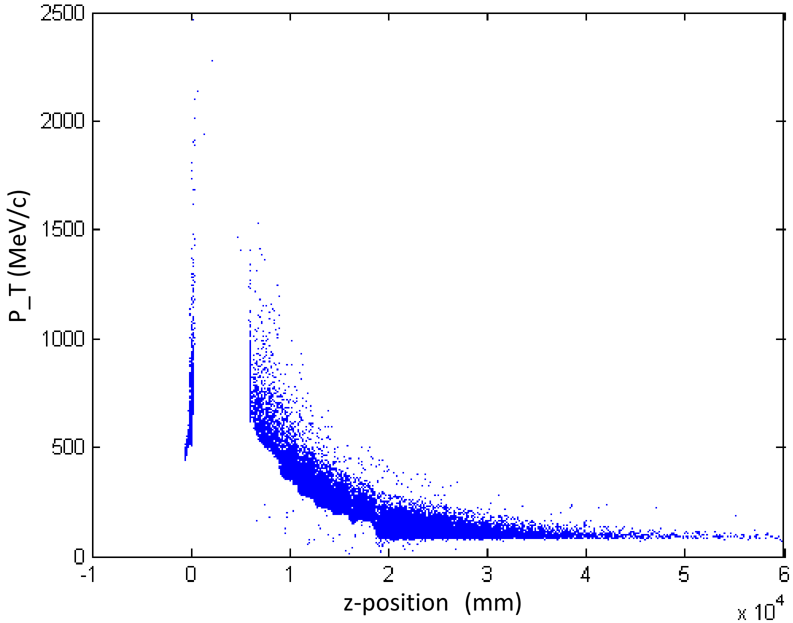
Number of particles from 100000 protons on target				
Magnetic field tapered off from:	**20 T - 1.5 T**	**10 T – 1.5 T**	**10 T – 2 T**	**30 T – 1.5 T**
No. Muons	179070	165289	176188	177612
No. Pions	27453	18444	21480	32847
No. Kaons	8	8	12	19
Sum	**206531**	**183741**	**197680**	**210478**

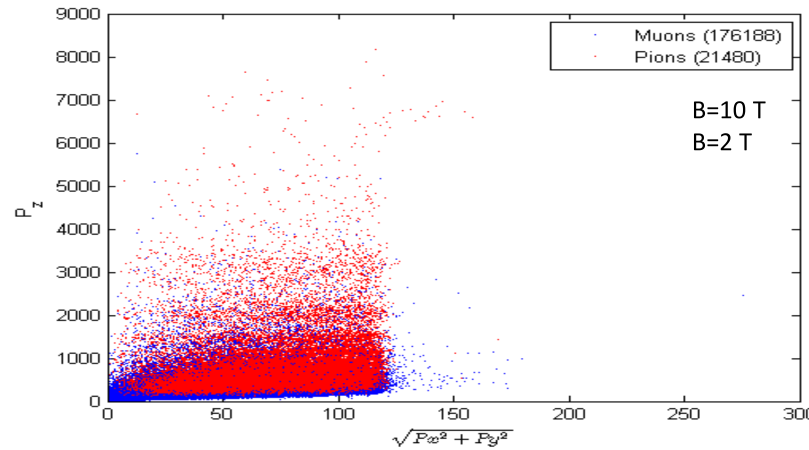


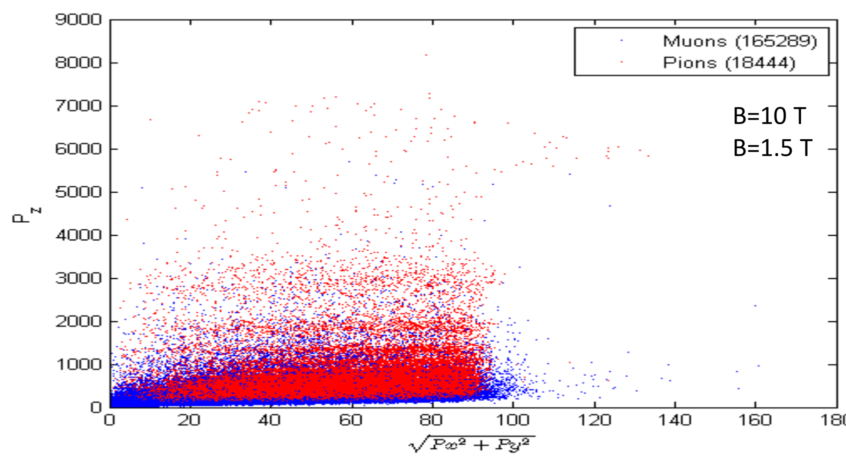


- High B-field around target increase No. of captured pions/muons (and helps to lower the deposited energy from charged particles in the SC-solenoid)
- Transverse momentum acceptance is proportional to: **B x r**
- We have a very large longitudinal momentum spread, and therefore time spread

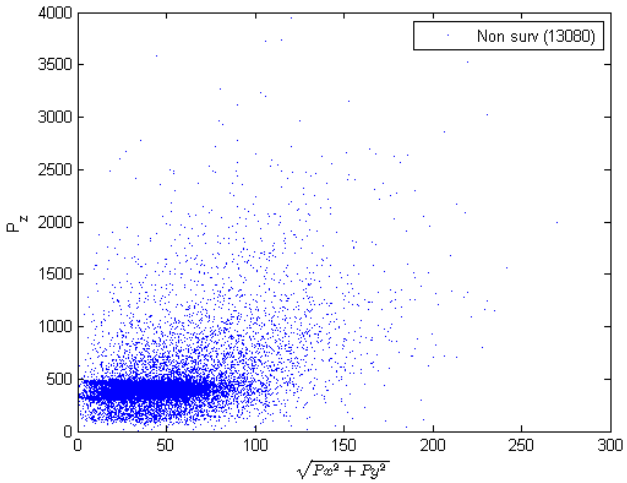
Loss of pions (20 T)

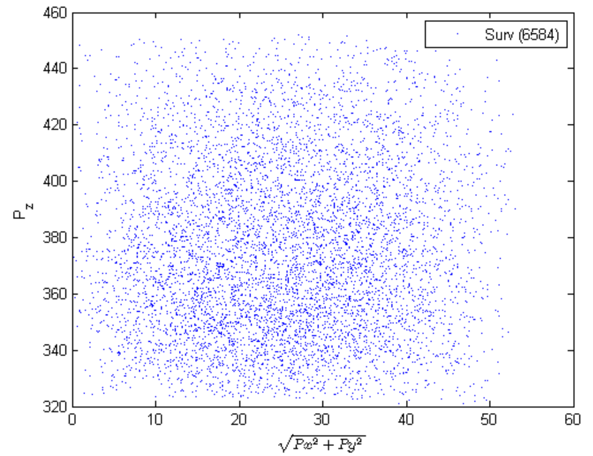




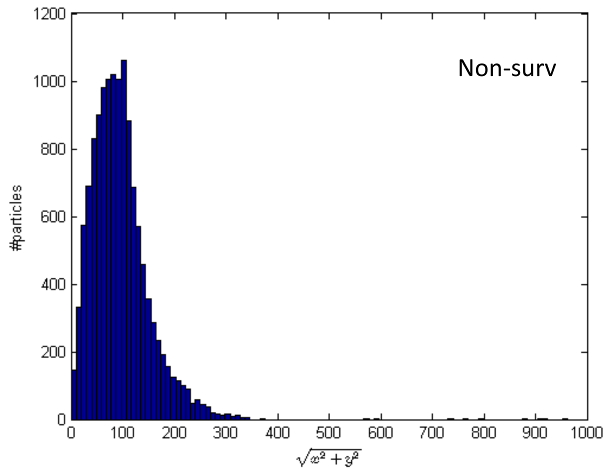


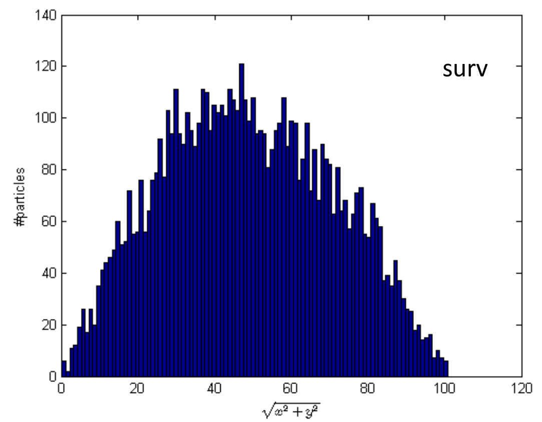
- What about other acceptance cuts?
- We need to see which particles survive through the front-end, and track them back to when they were in the pion/muon capture solenoids
- Because of physical limitations at the end of the front-end, the transversal momentum and the radial particle distribution are affected

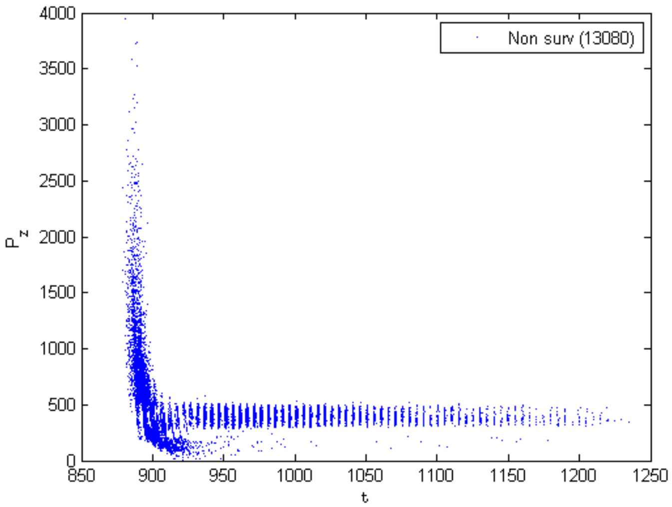


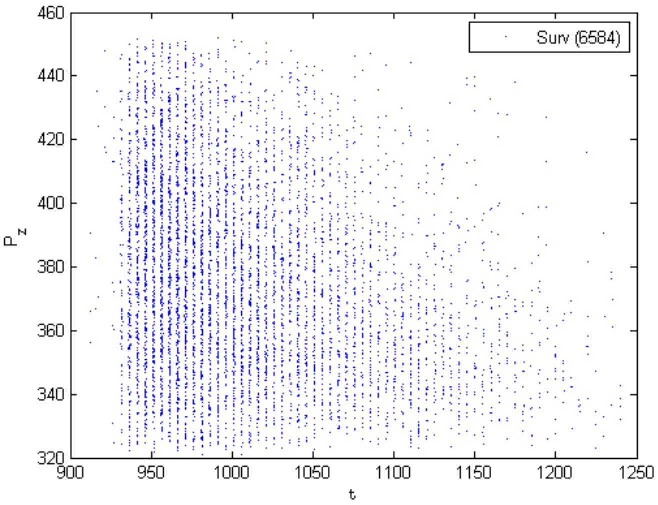


End of front-end









- Also the particles arriving too early, have a large momentum, which the the RF-system cannot accelerate/decelerate and will therefore be lost

- **With these cuts, one can find the particles that most likely will survive through the front-end**
- **Change the magnetic field and the geometry of the solenoids, to maximize the surviving particles**

Conclusions

- A higher magnetic field will increase the particle flux
- The acceptance calculations are important for checking if the increased particle flux populates the acceptance region

Further work

- Run the new and updated IDR lattice in G4BL to find the acceptance cuts
- Maximize the number of muons/pions in this acceptance range by changing the solenoid geometry and magnetic field
- Add shielding to the setup