

Energy-Phase Rotation with a proton absorber

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- **Front End for the Neutrino Factory-IDS**
 - Beam loss and control
- **Add Chicane + Proton absorber**
 - Chicane removes high-energy particles
 - Proton Absorber removes low energy
- **Need to rematch bunching and phase rotation**
 - compensate for energy loss in absorber

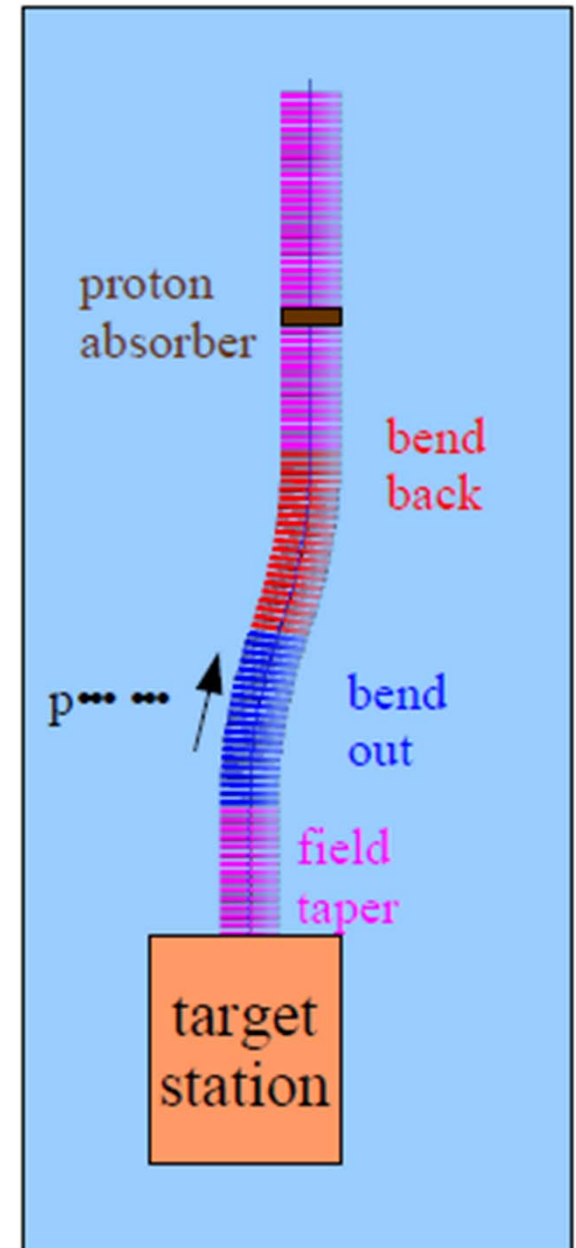
Chicane, Absorber geometry

➤ Chicane:

- bend out
 - $L=5\text{m}, \theta=12.5^\circ$
- bend back
 - $L=5\text{m}, \theta=-12.5^\circ$
 - centroid displacement of 1.1m
- composed of displaced, tilted $B=1.5\text{T}$ coils
 - $\sim 0.25\text{m}$ segments

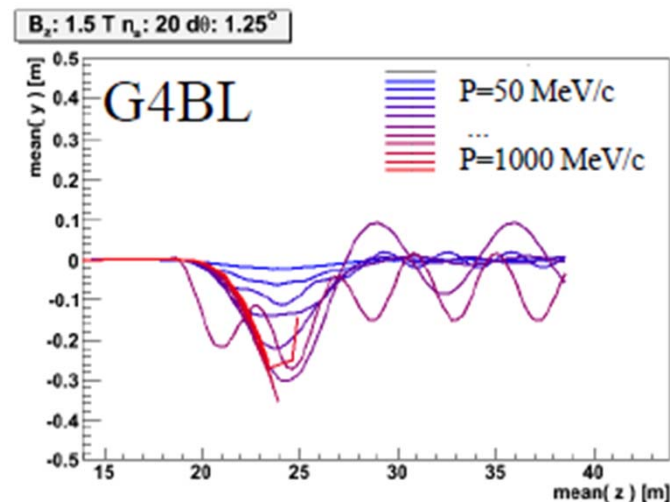
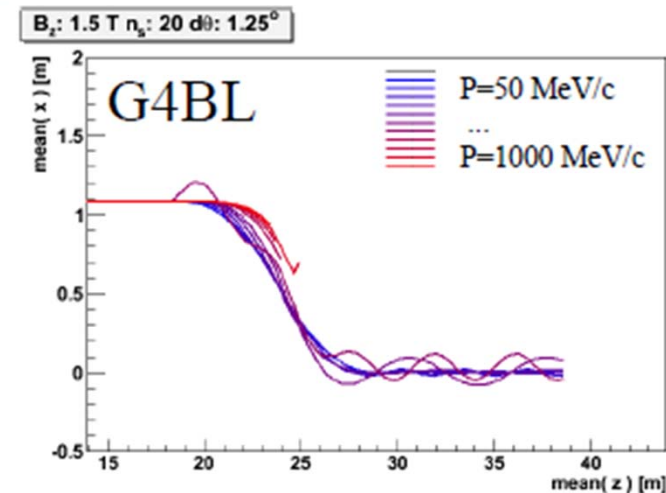
➤ Absorber:

- 10cm Be
 - $\sim 30\text{MeV}$ energy loss



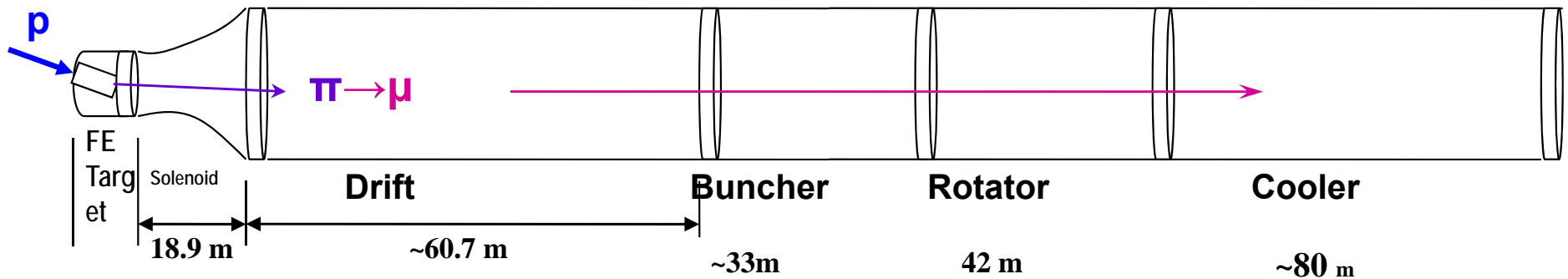
➤ Chicane effect:

- $P > \sim 500 \text{ MeV}/c$ are lost
- $P < \sim 500 \text{ MeV}$ pass through
 - displaced by $\sim 1.1 \text{ m}$
- Nominal Path length increased by only 8cm
 - orbits perturbed



➤ absorber effect

- removes low energy particles
 - designed to remove protons
- distorts energy distribution
 - energy phase-rotation distorted; must be rematched



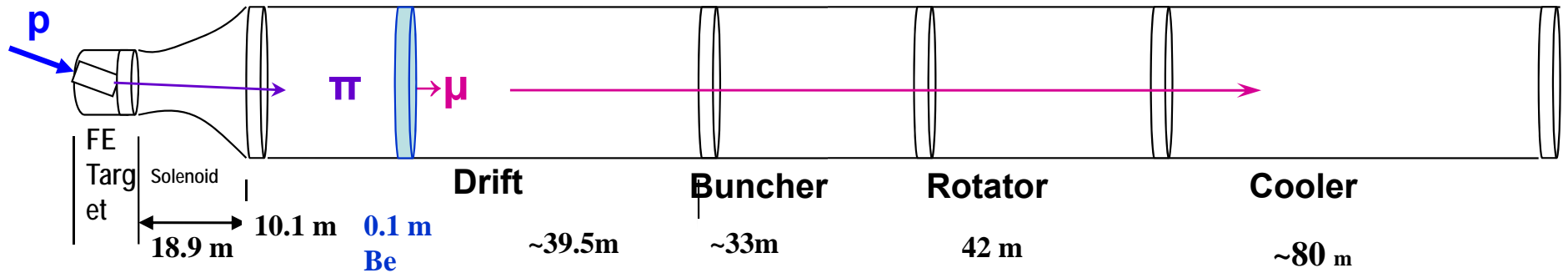
➤ IDS setup

- particle 1-233 MeV/c
- particle 2-154 MeV/c
- Drift
- Bunch N=10
- Rotate N=10.05
- Cool -201.25 MHz

➤ with absorber

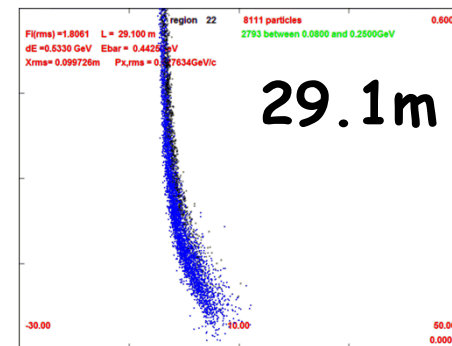
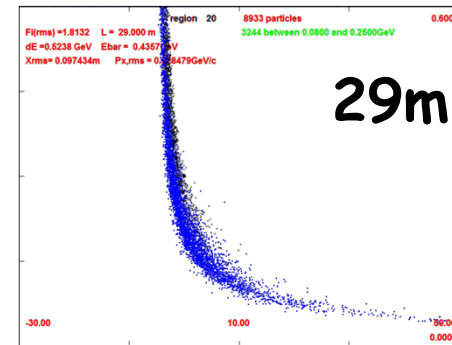
- particle 1-270 MeV/c
- particle 2-185 MeV/c
- absorber at 29m
 - 10cm Be
 - particle 1-237 MeV/c
 - particle 2-144 MeV/c
- Bunch N=10
- Rotate N=10.04
- Cool -201.25 MHz
 - $p_{ref}=230$ MeV/c

Front End with Absorber

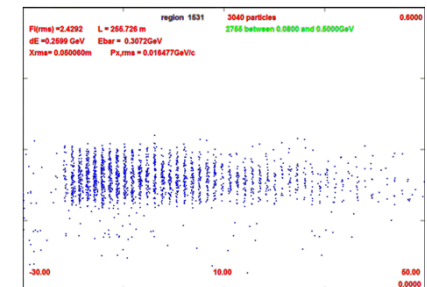
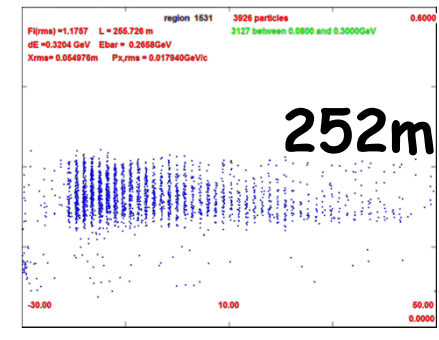
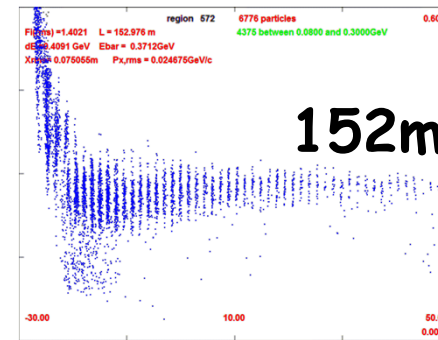
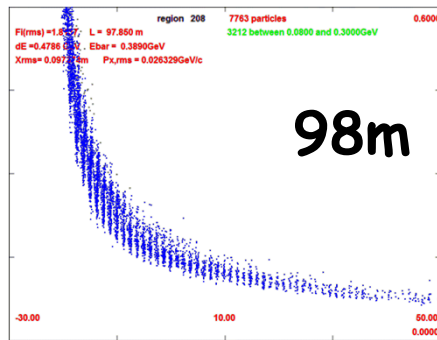
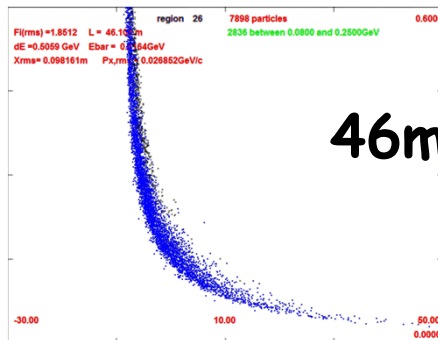
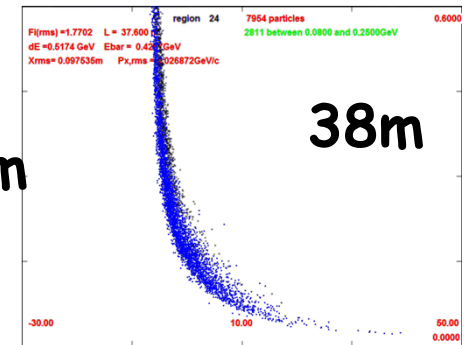
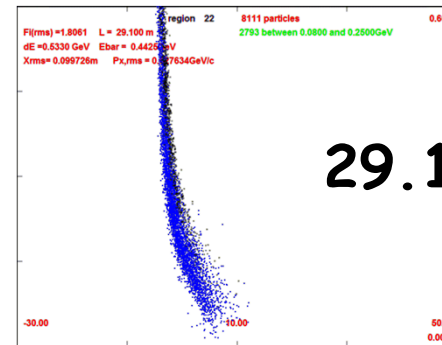
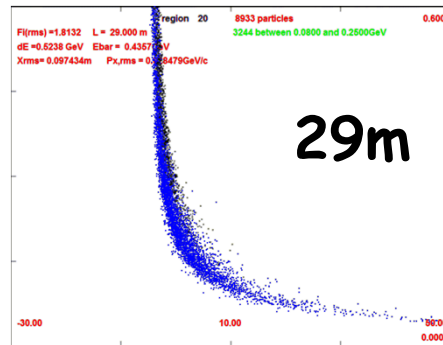
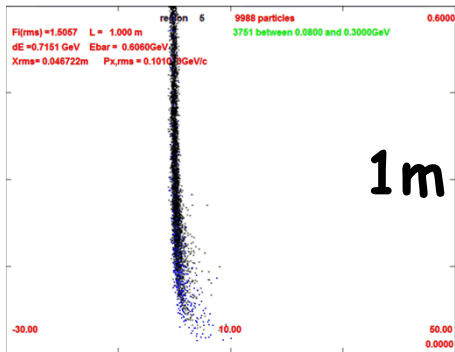


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- absorber at 29m
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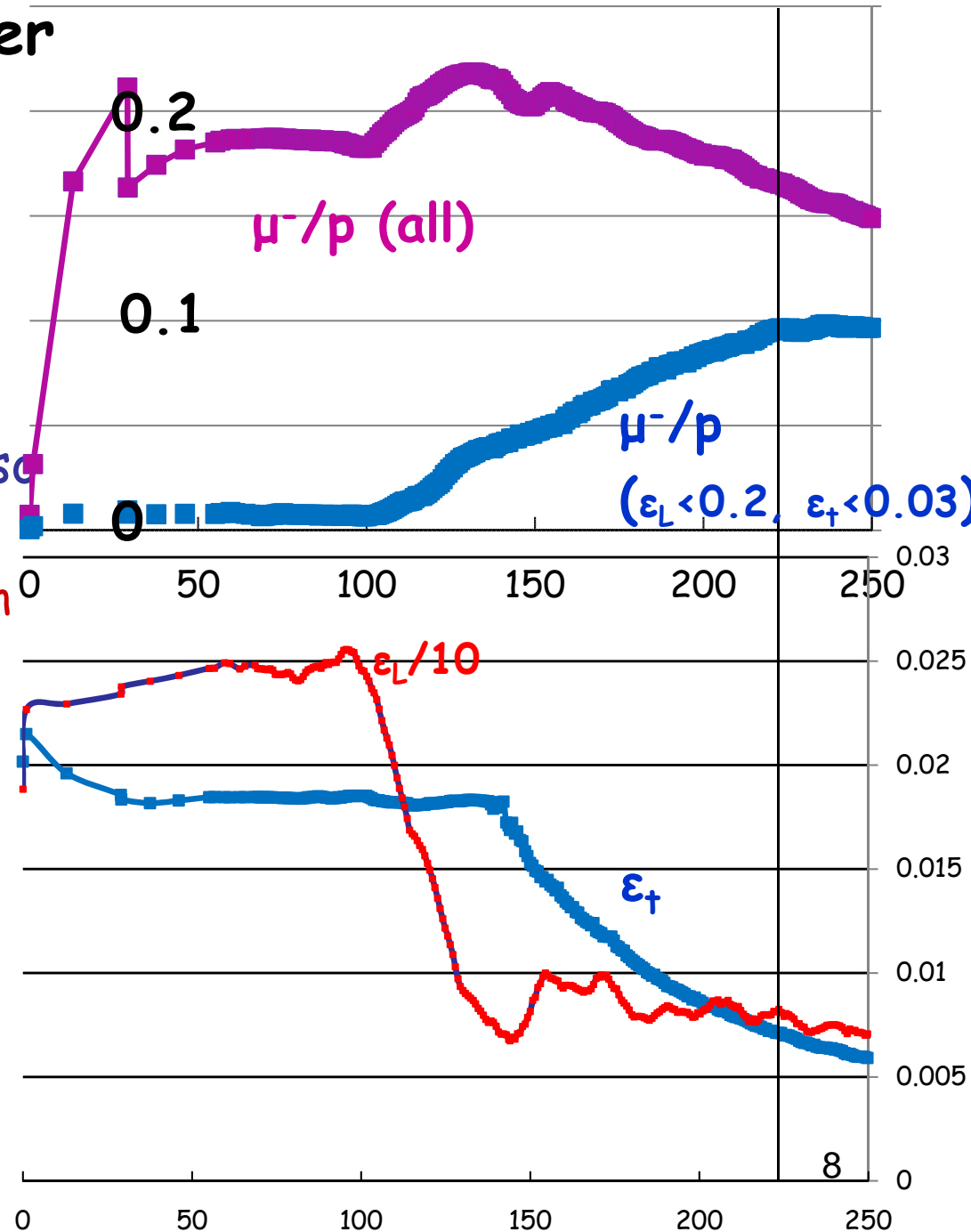


0.1m Be absorber



➤ Similar to without absorber

- ~10m shorter drift
- ~10% fewer μ 's within acceptance
- drop of ~20% intensity at absorber
- but longitudinal emittance also reduced
 - surviving μ 's are stretched in longitudinal phase space



- Procedure for rematching bunching/rotation with “proton” absorber is demonstrated
 - track reference particles with energy loss through system
- results similar to without absorber
 - ~10% fewer μ 's accepted
 - Losses reduced by some factor
- Chicane + Absorber Geometry needs to be defined and simulated
 - ~10–20% less μ/p (?)
 - Losses reduced/controlled by ?
- Is this version preferred?