Optimization of target parameters

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OUTLINE

- Model description
- Yield with current pbar target
- Cylindrical target – yield dependence on radius, length, material, beam size

Model description
(same as used by Valery Lebedev for pbar yield)

Production of positive pion with momentum 3.1095+-2% was simulated using MARS.

Pion coordinates were translated the longitudinal coordinate at which second order moments $\langle x\theta_x \rangle = \langle y\theta_y \rangle = 0$.

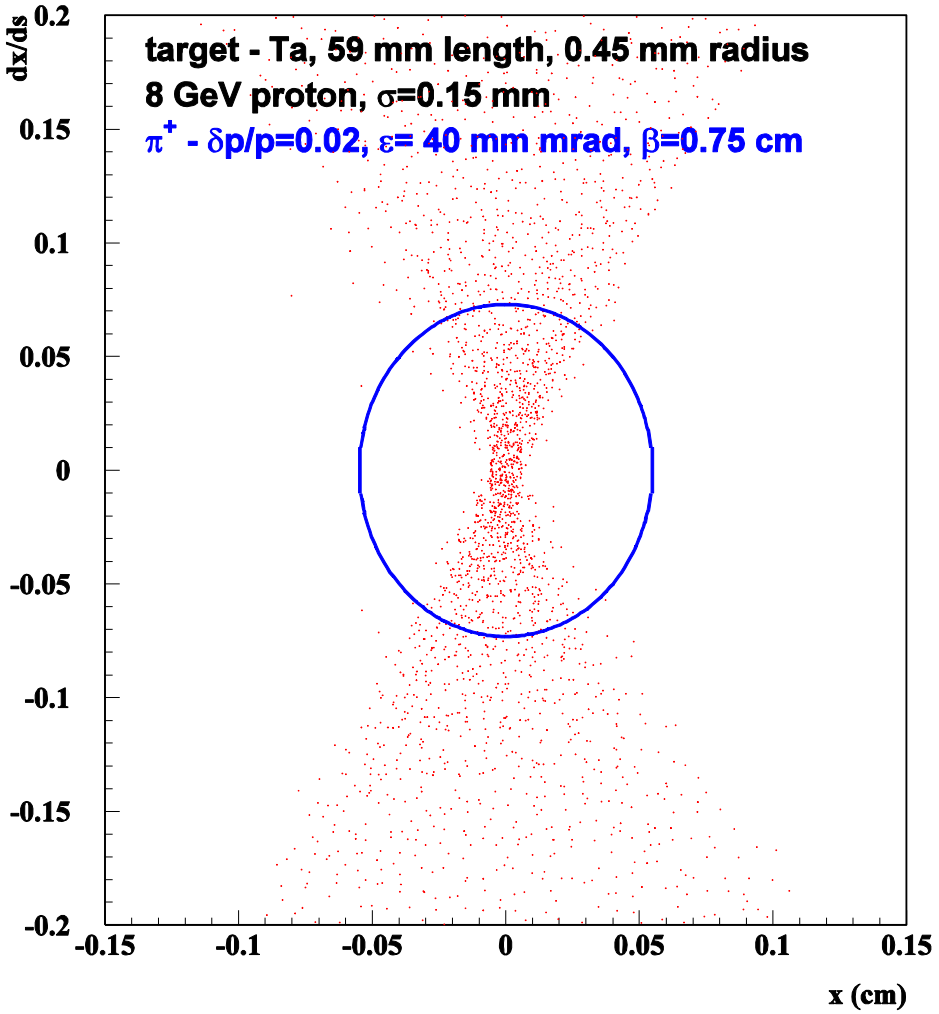
Pion within phase space determined by

$$\frac{x^2}{\beta} + x'\beta + \frac{y^2}{\beta} + y'\beta \leq \varepsilon$$

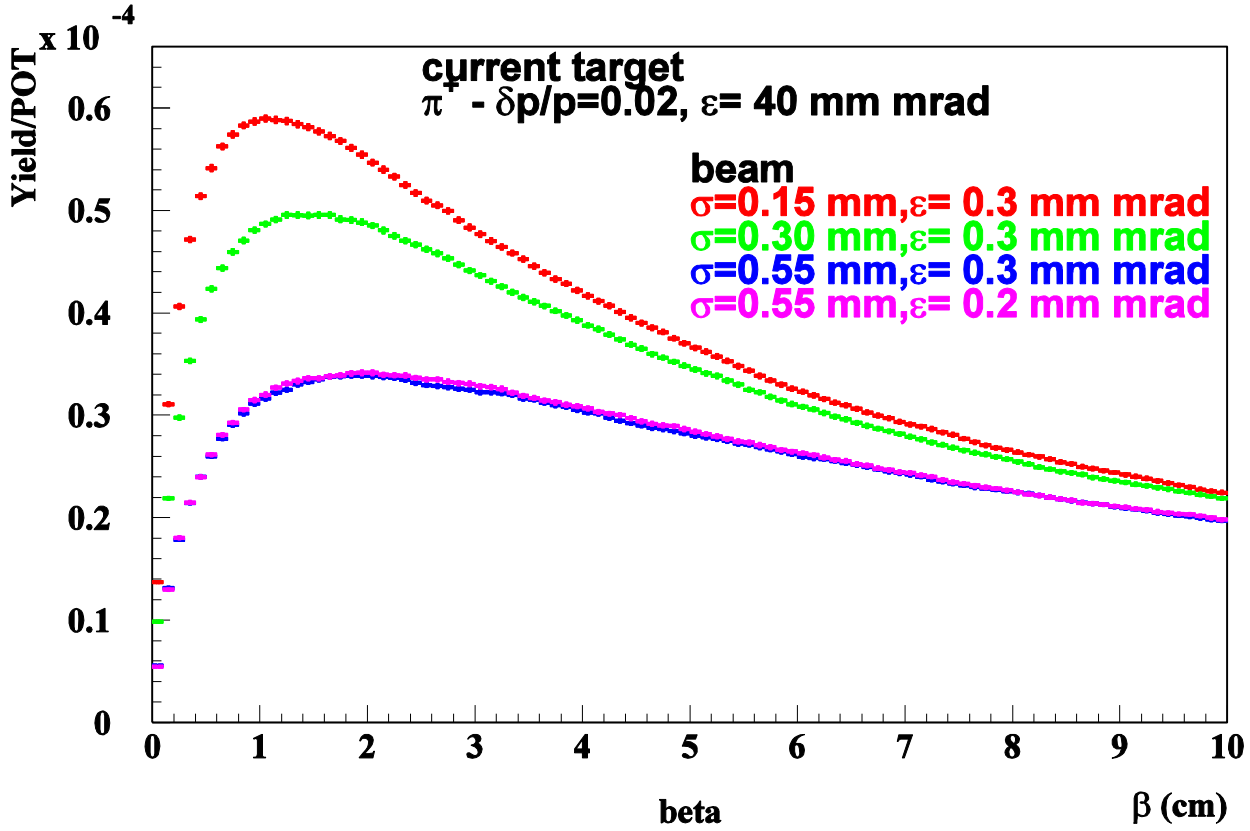
are considered to be accepted to the ring.

Proton beam rms emittance - 0.3mm mrad (17 π mm mrad 95% normalized emittance) and rms beam size - 0.15-0.55 mm (from Valery).

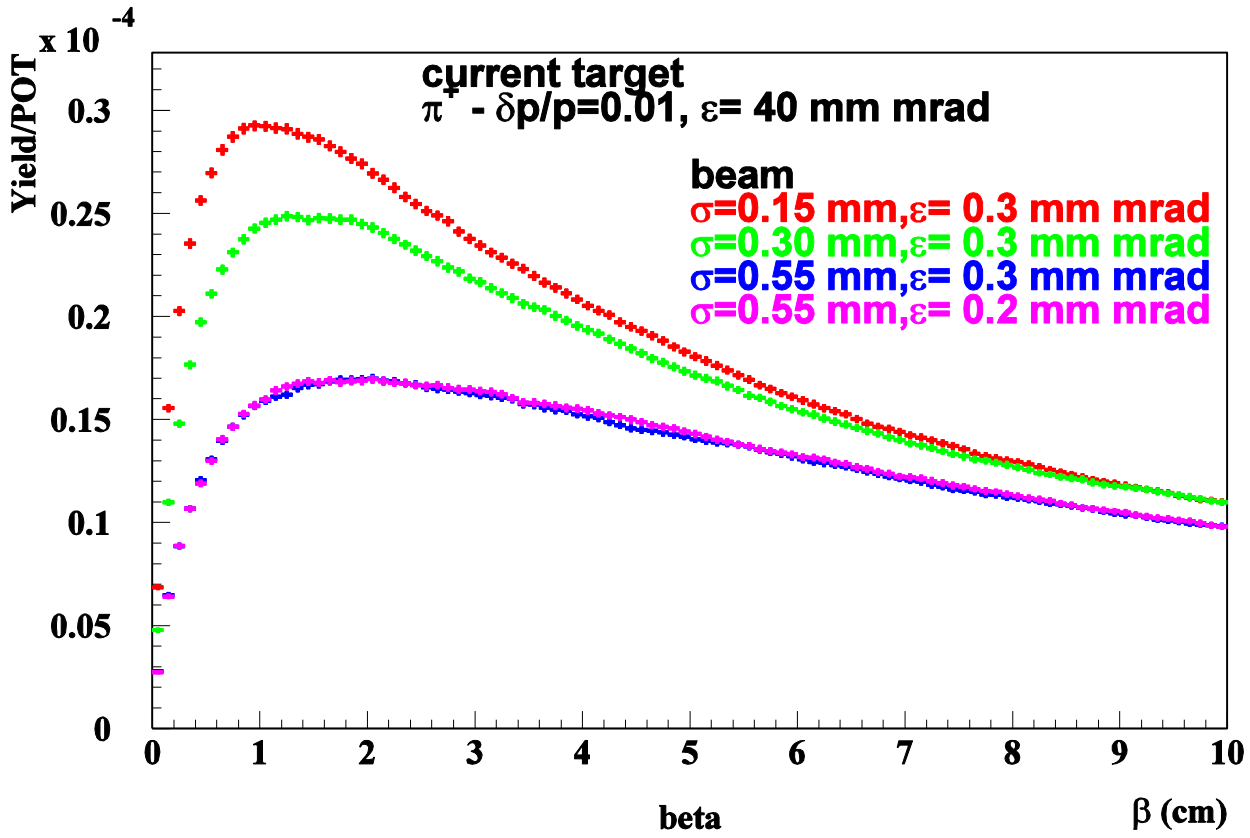
Pion acceptance ε=40 mm mrad (from Velery).



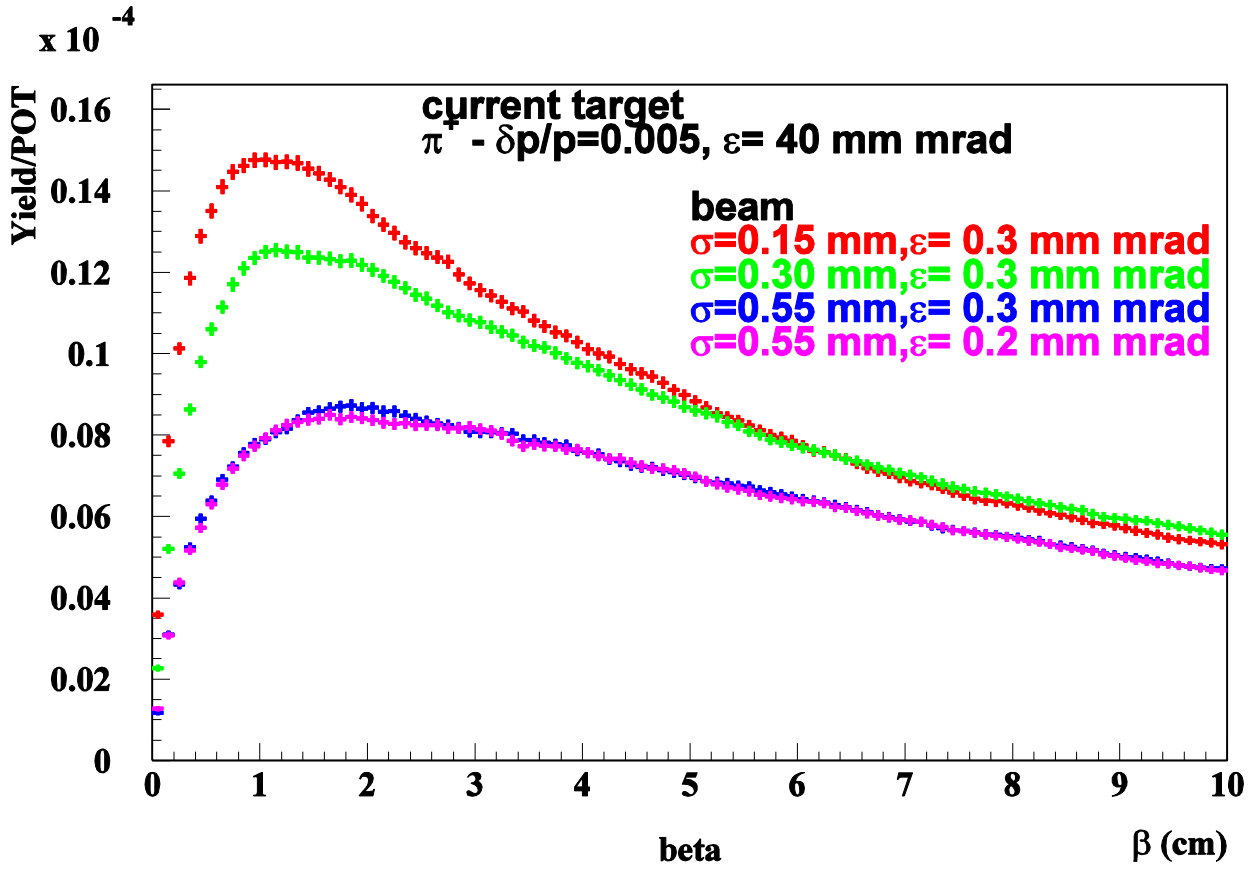
Dependence of pion yield on beta function for current pbar target (Δp/p=0.02)



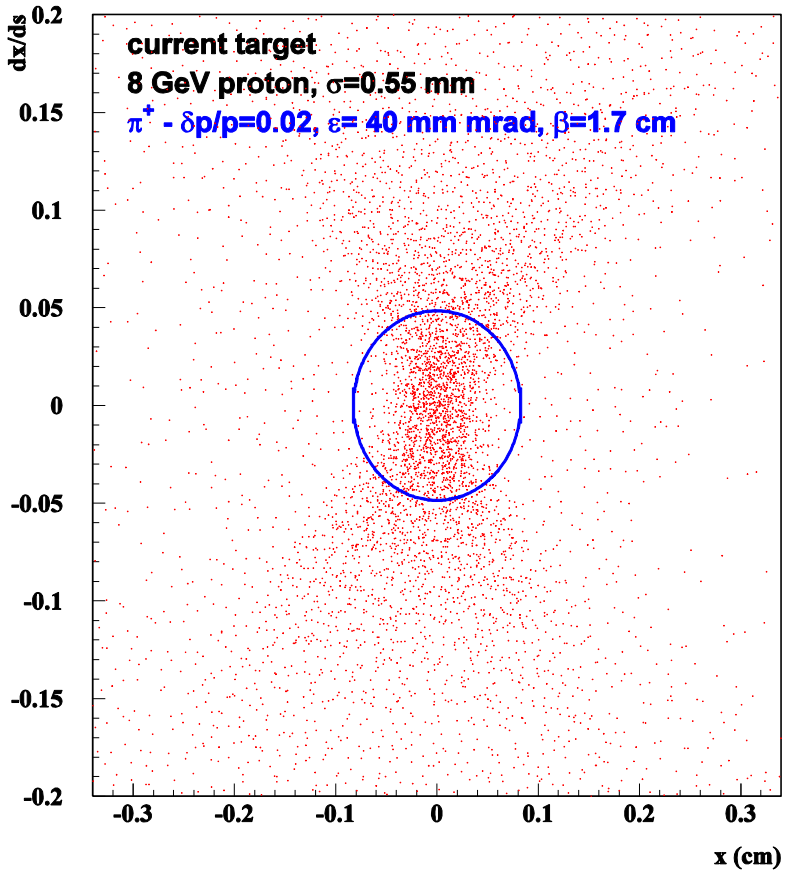
Dependence of pion yield on beta function for current pbar target (Δp/p=0.01)

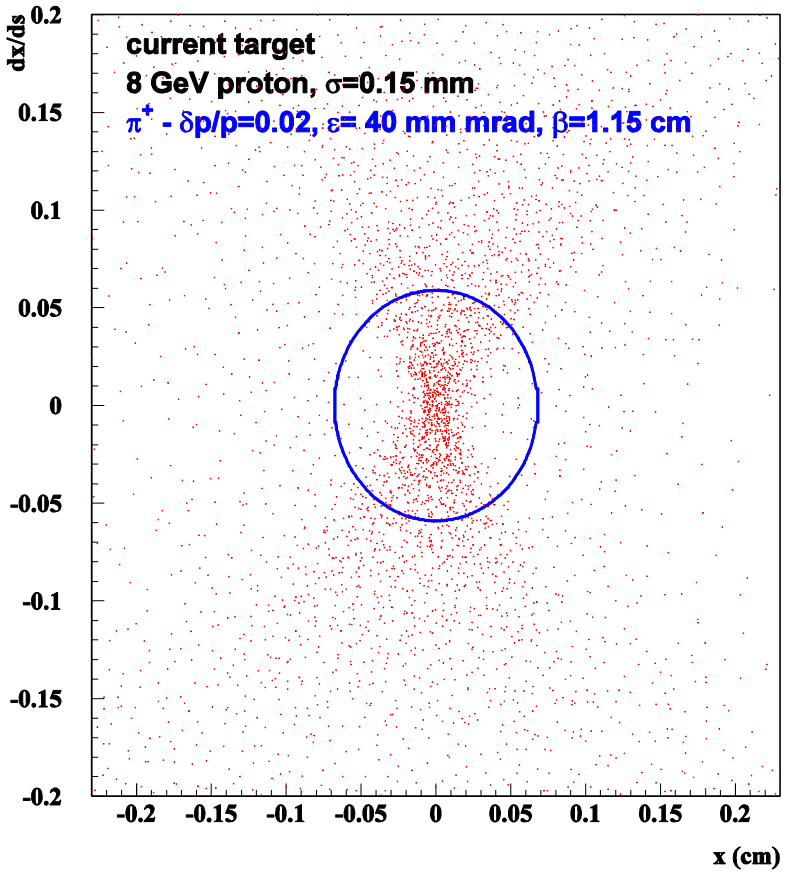


Dependence of pion yield on beta function for current pbar target (Δp/p=0.005)

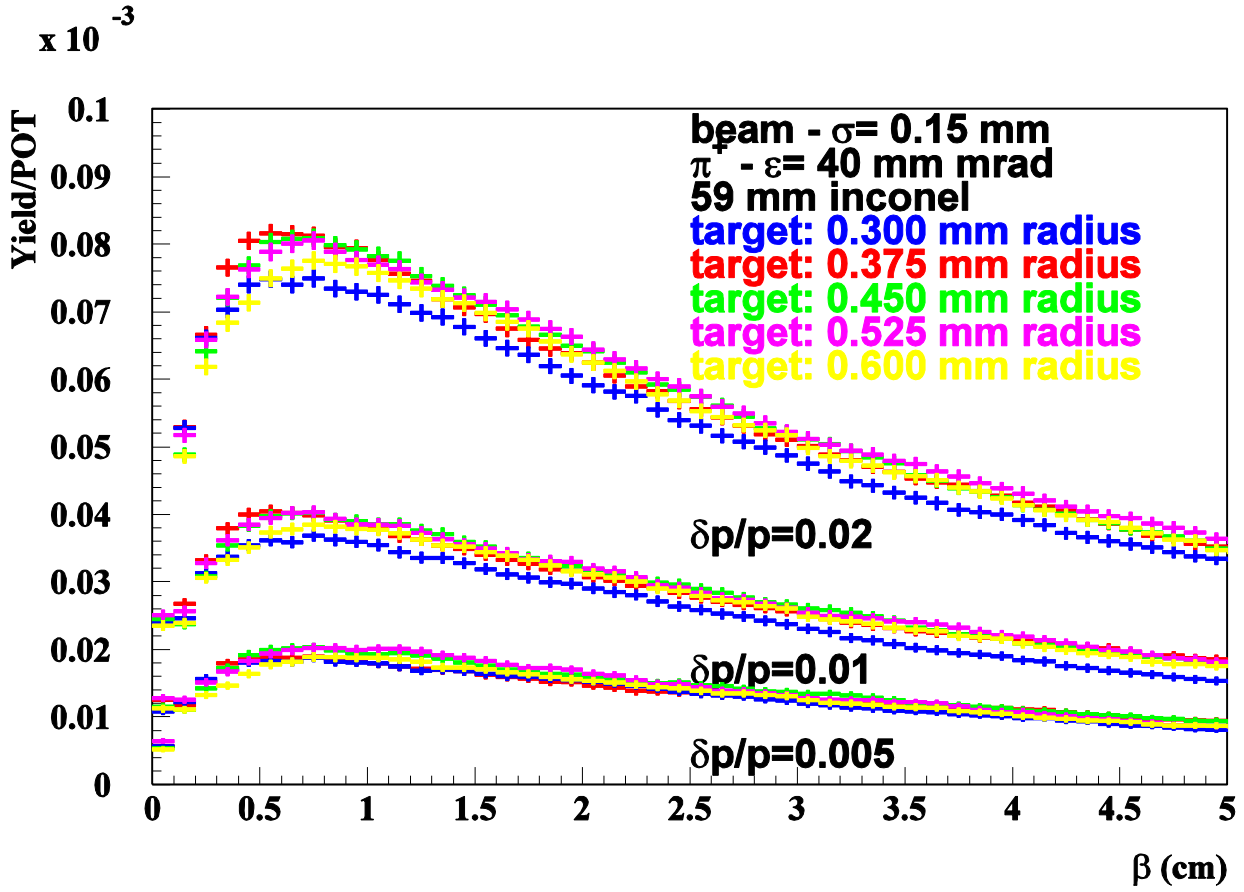


Pion phase space distribution for current pbar target – dependence on proton beam size.

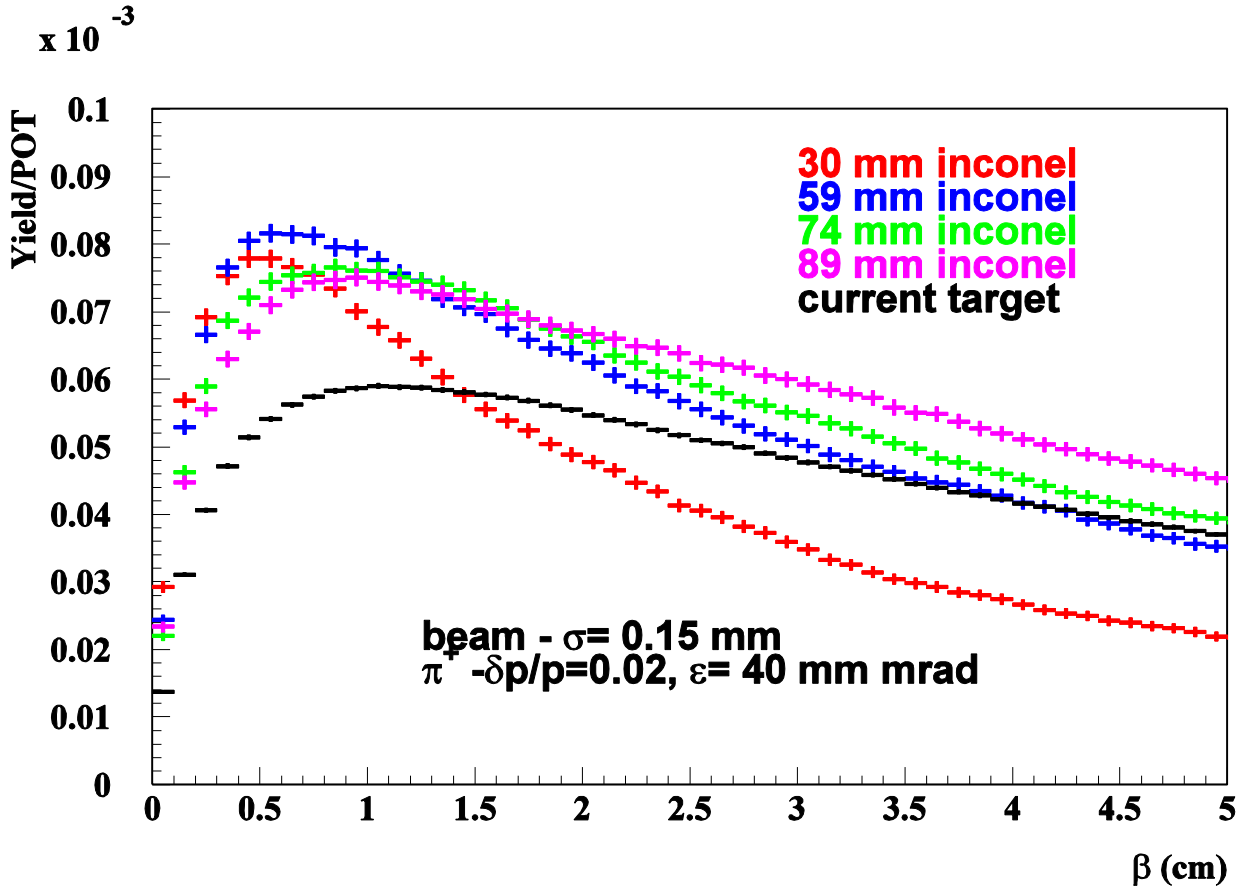




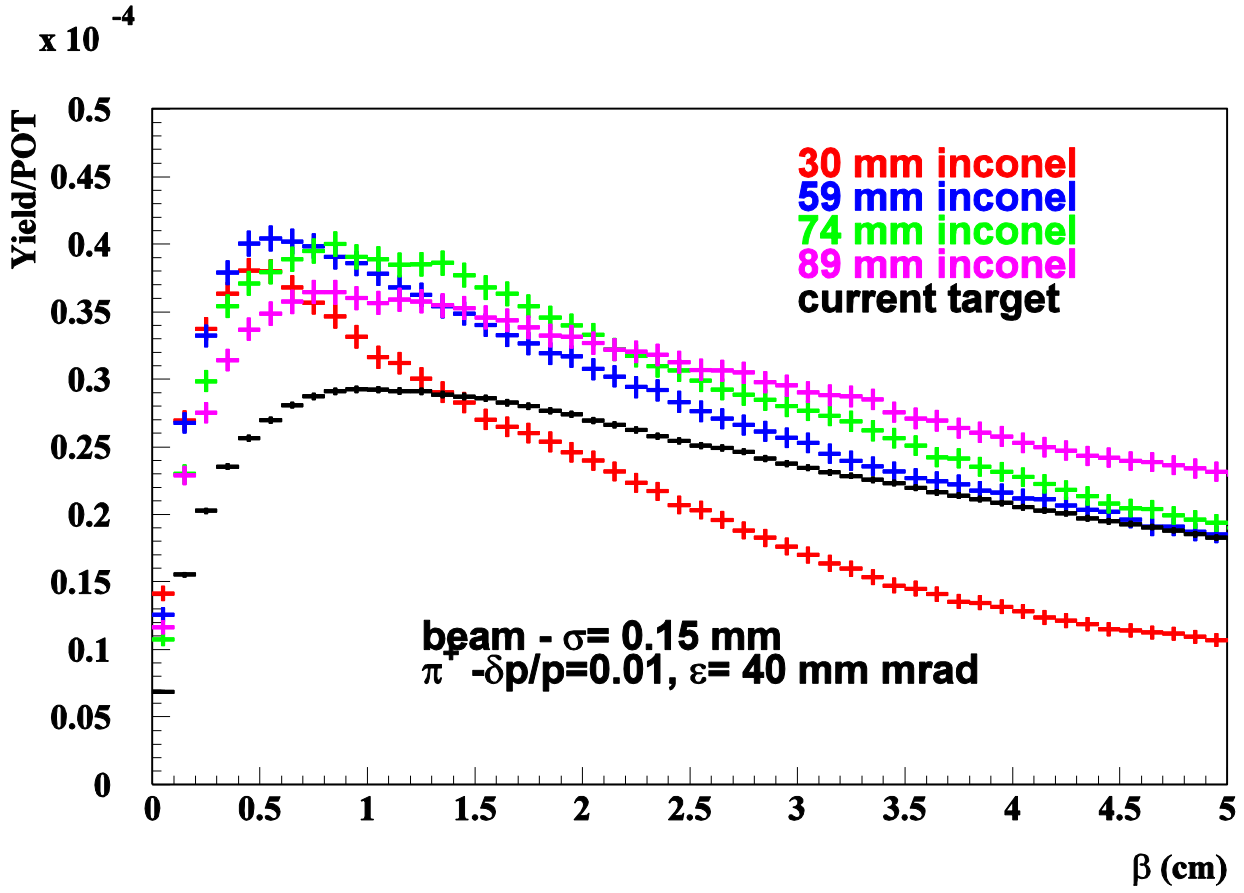
Dependence of pion yield on beta function for different target radius – 59 mm inconel



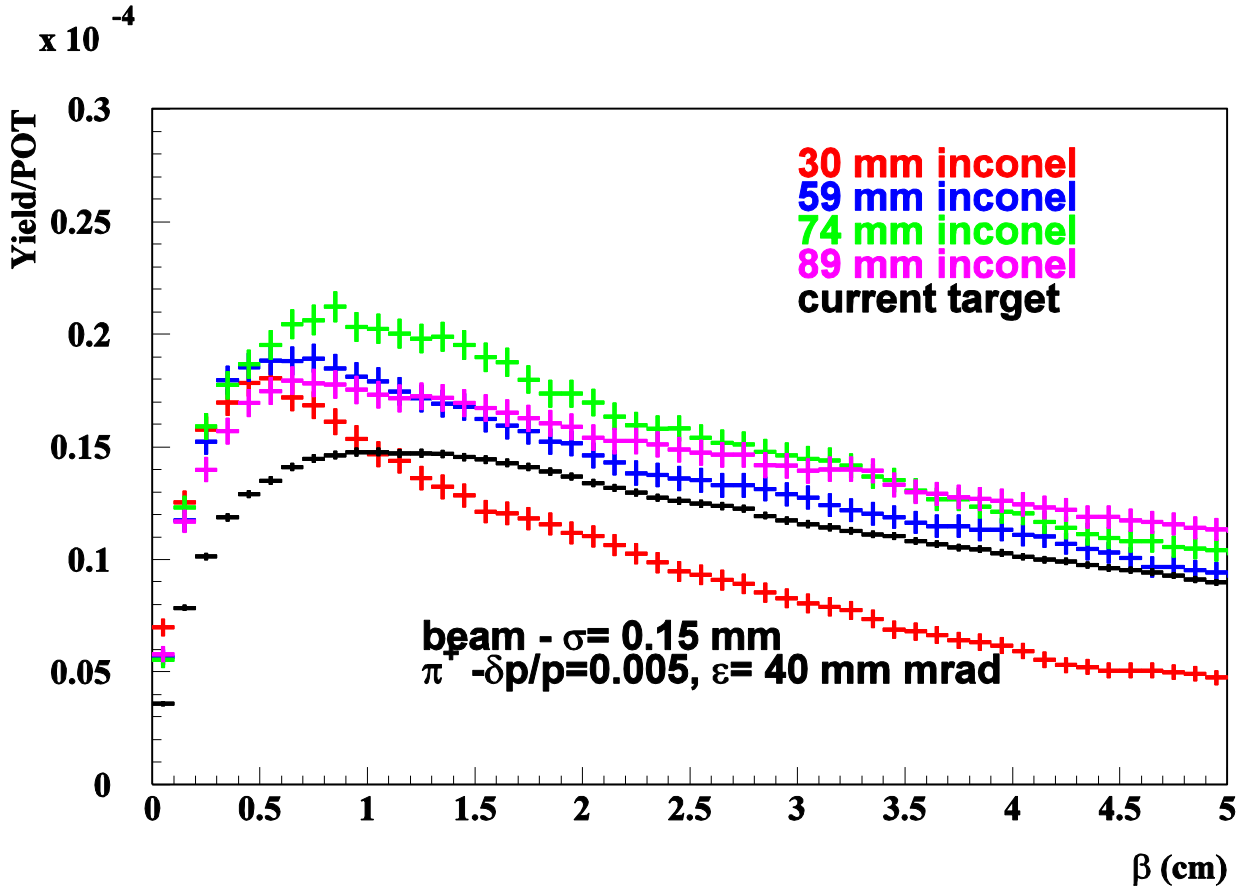
Dependence of pion yield on beta function for different target length ($\Delta p/p=0.02$).



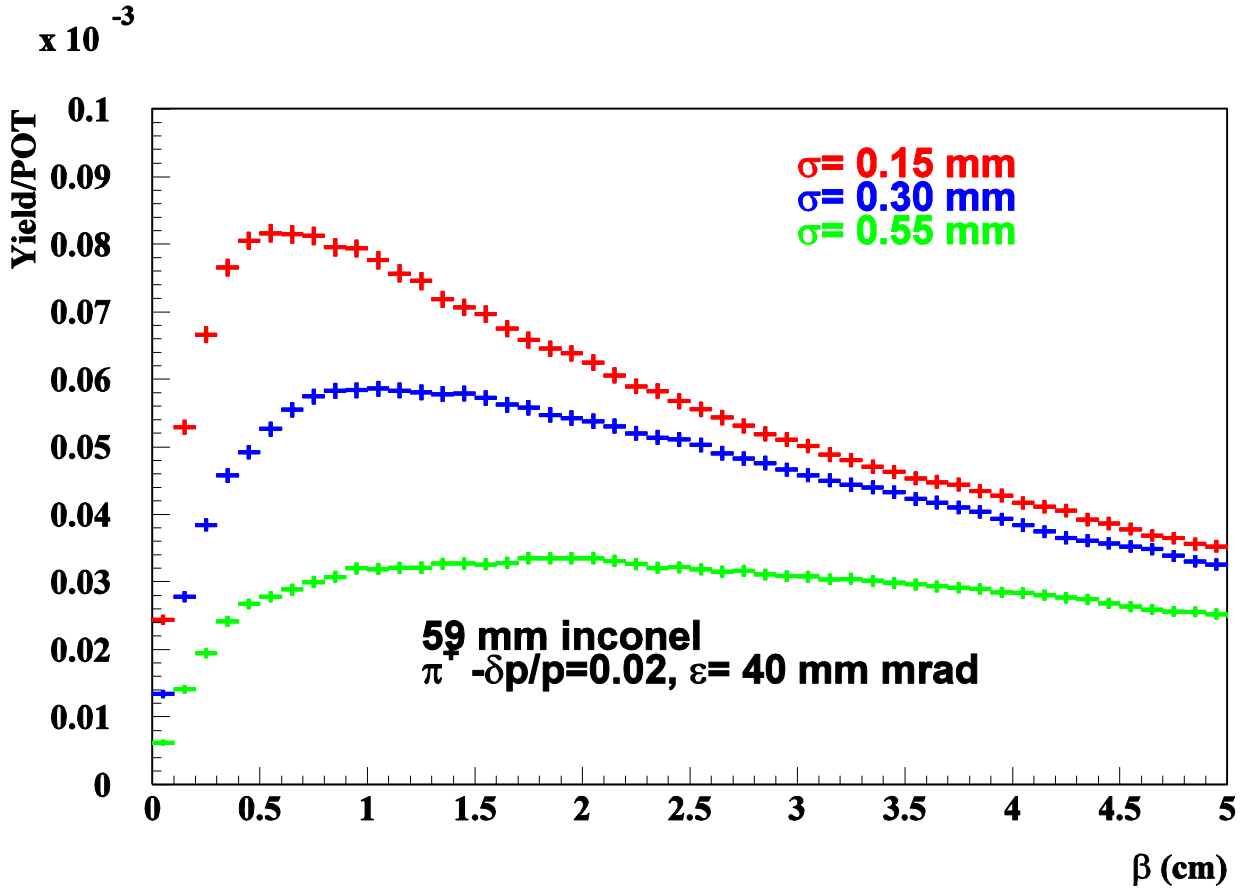
Dependence of pion yield on beta function for different target length ($\Delta p/p=0.01$).



Dependence of pion yield on beta function for different target length ($\Delta p/p=0.005$).



Dependence of pion yield on beta function for different proton beam sizes ($\Delta p/p=0.02$). Target radius = 3 σ_{proton}



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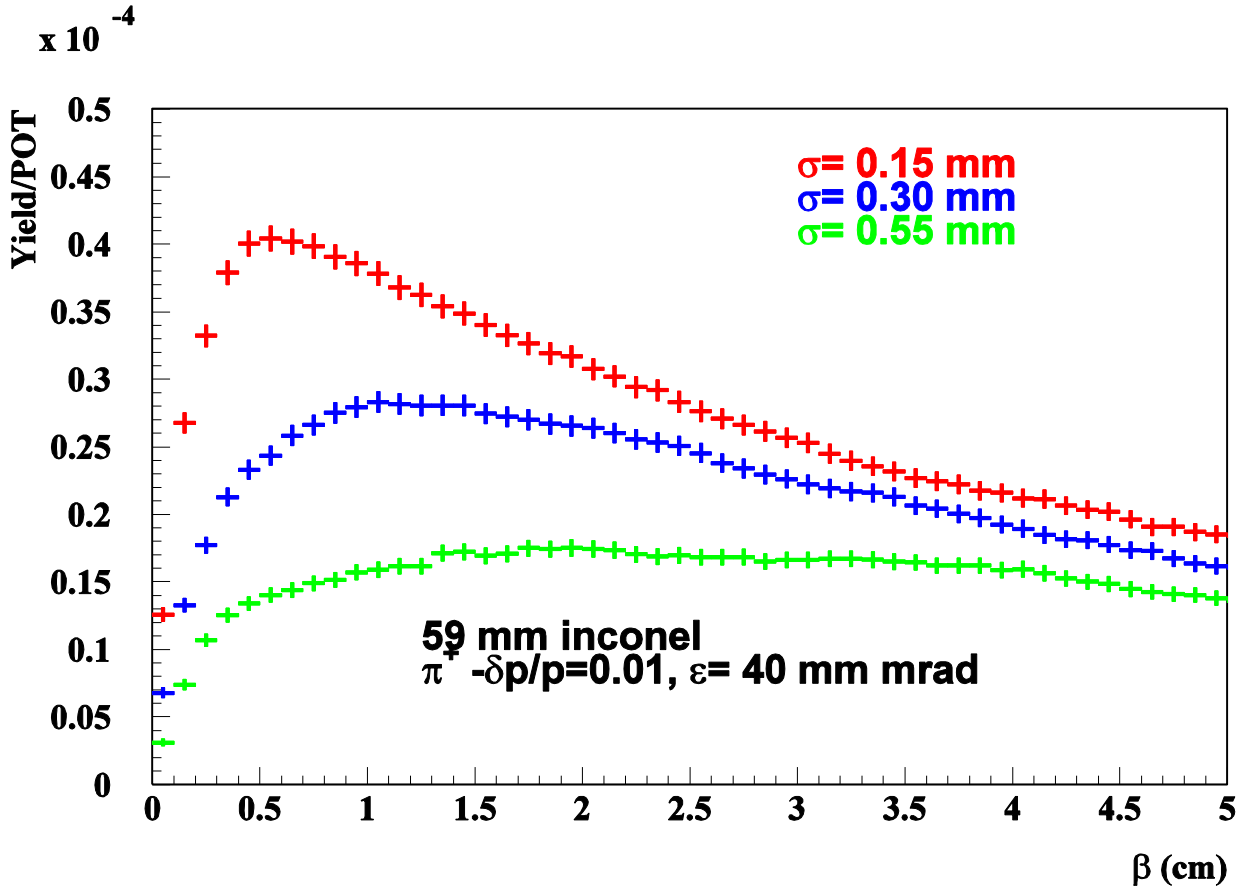

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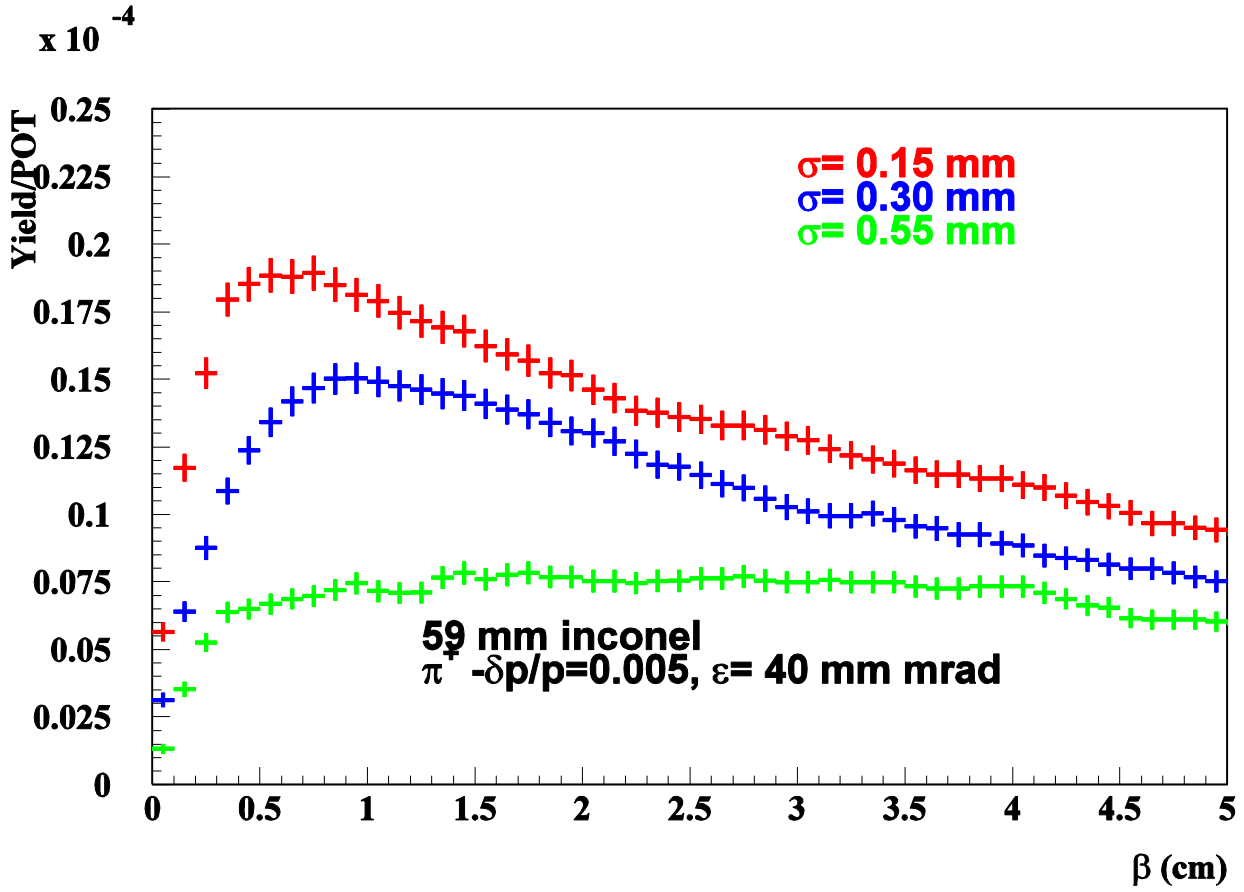
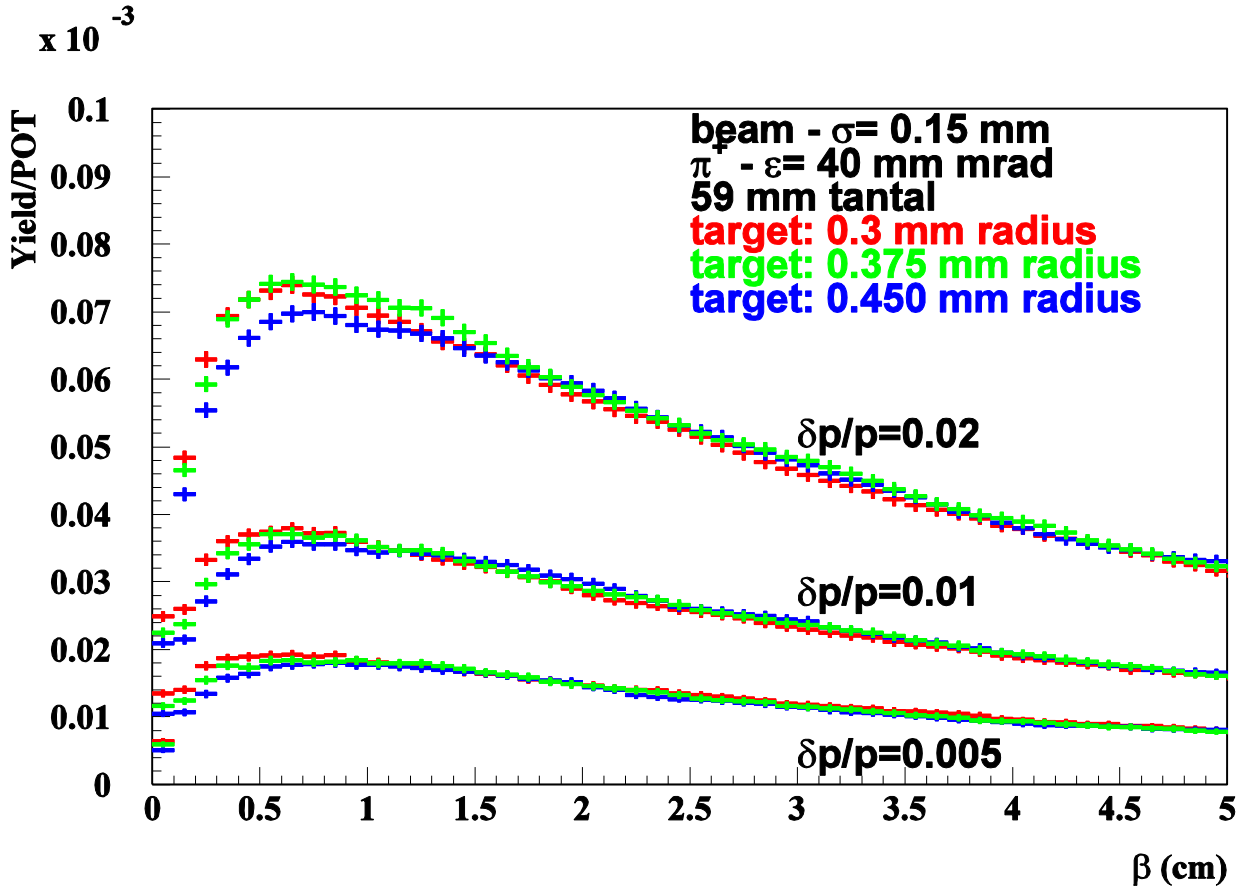
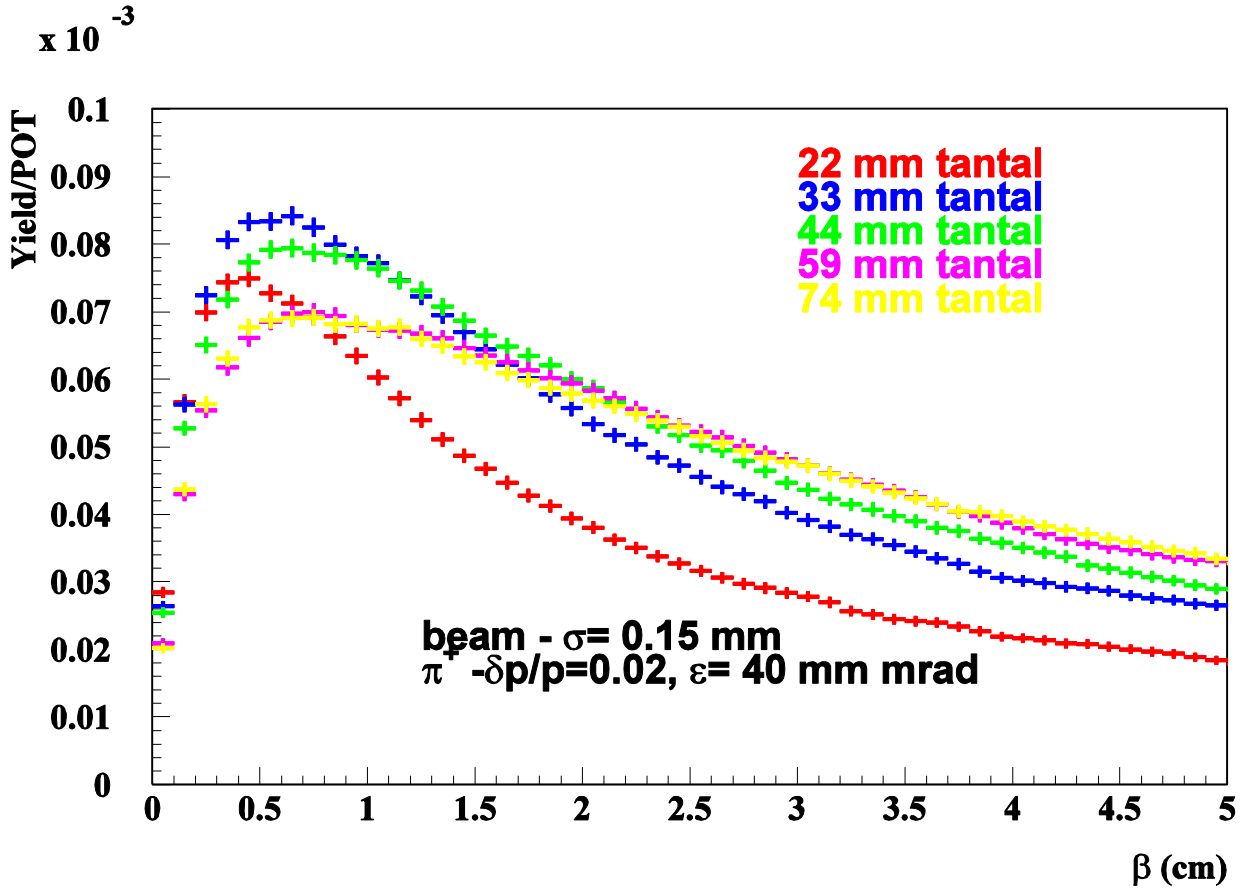


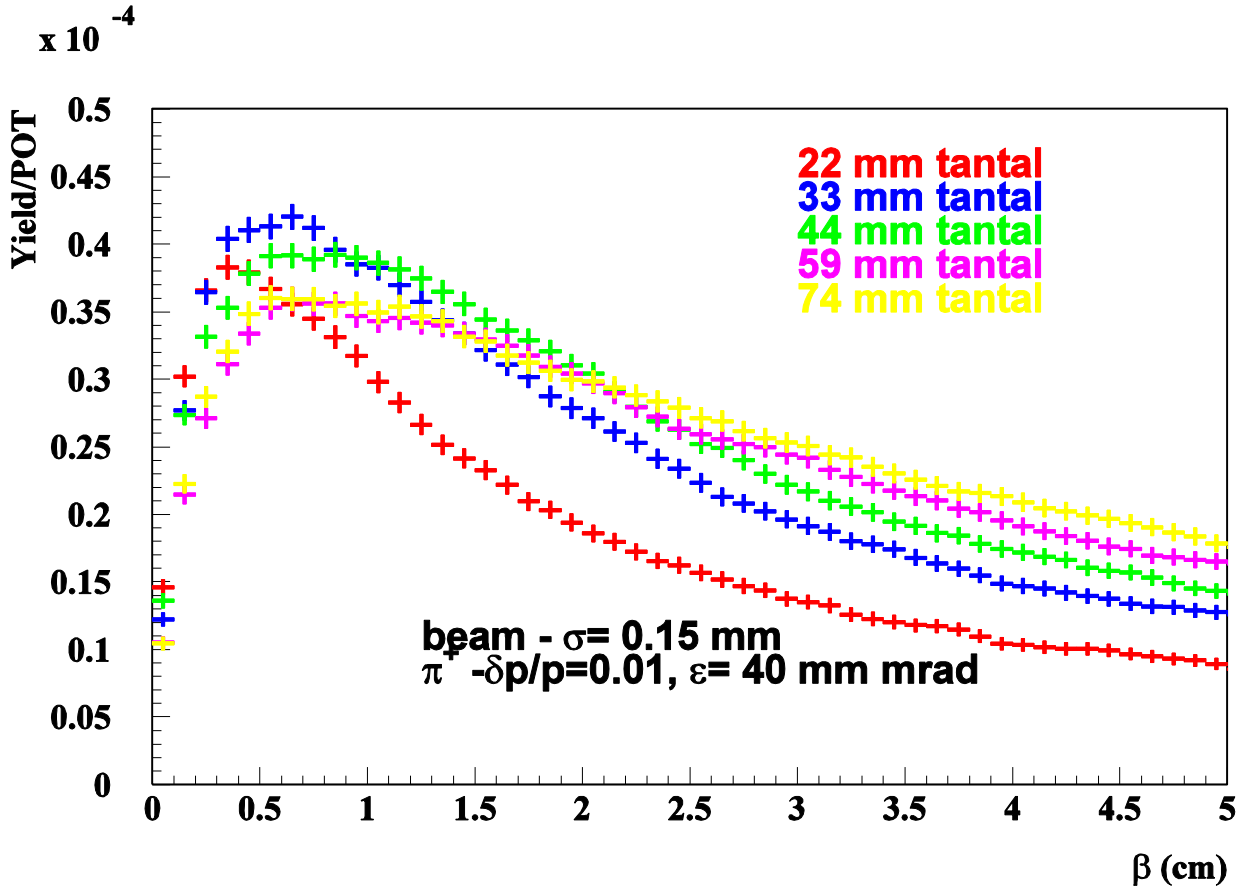
Dependence of pion yield on beta function for different target radius – 59 mm tantal



Dependence of pion yield on beta function for different target length ($\Delta p/p=0.02$).



Dependence of pion yield on beta function for different target length ($\Delta p/p=0.01$).



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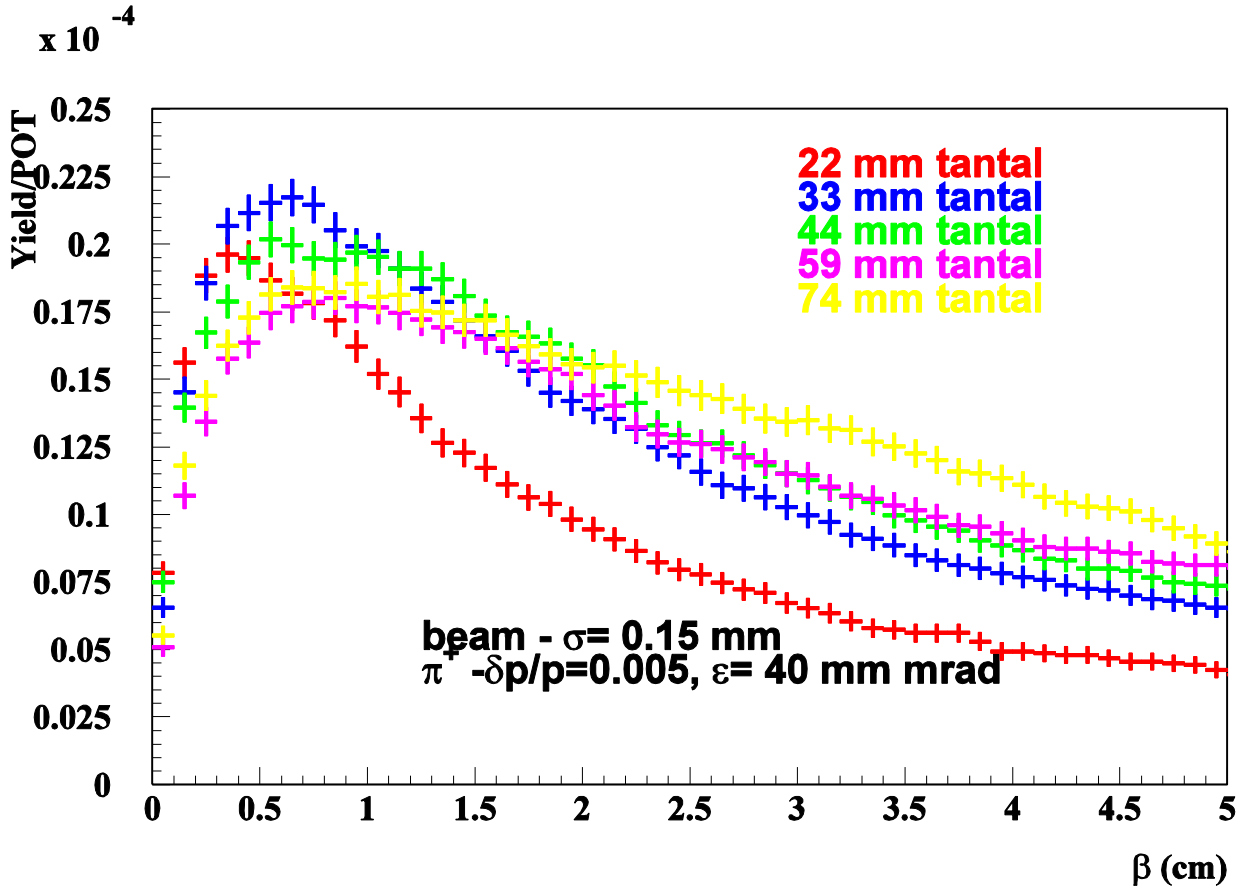
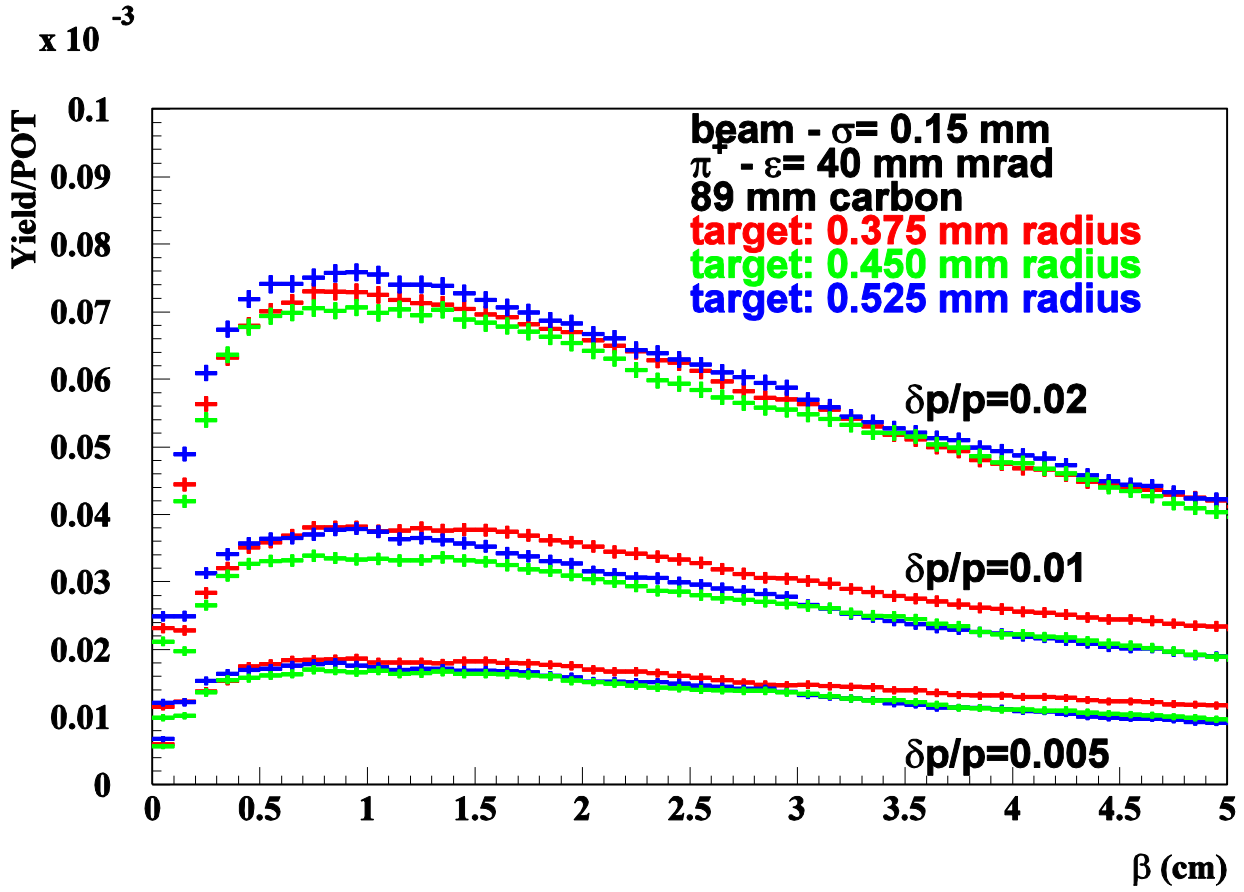
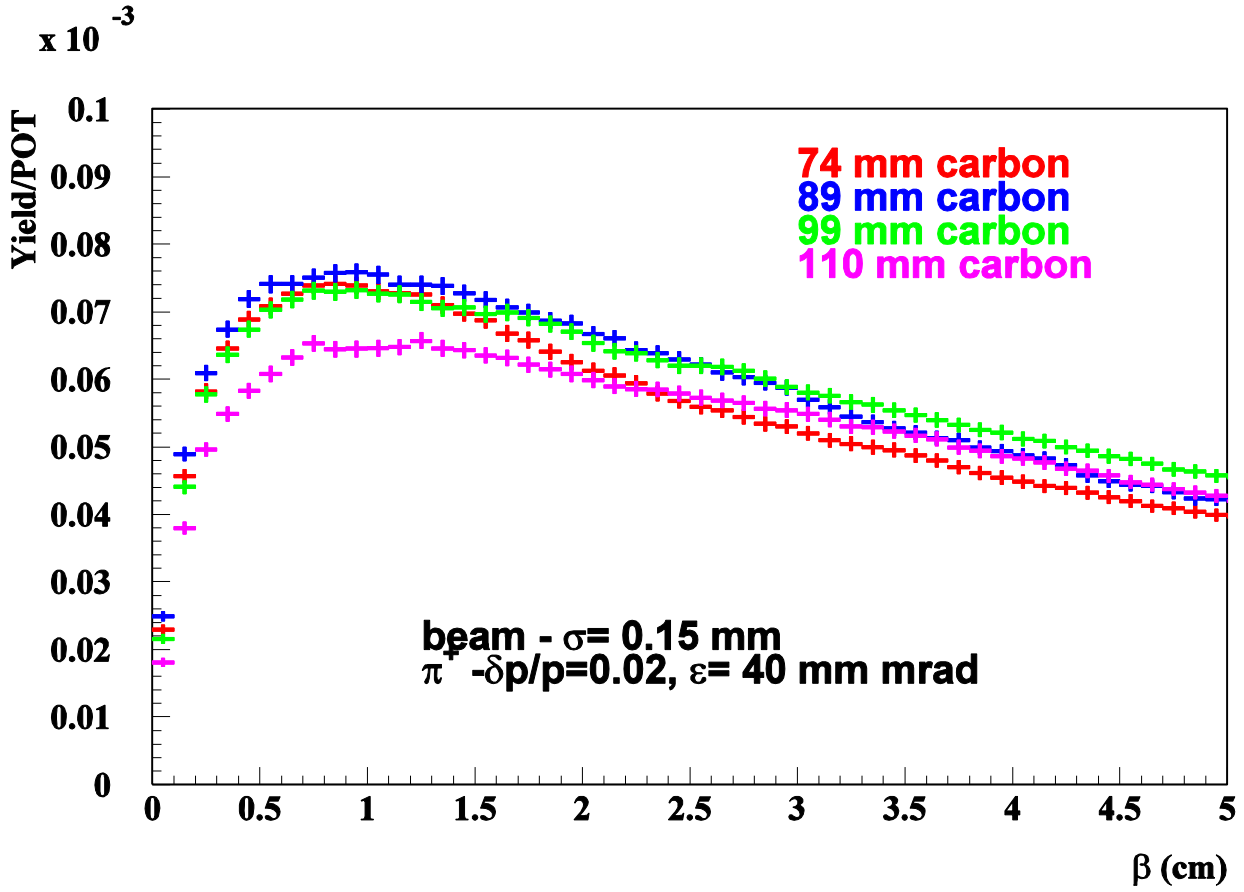


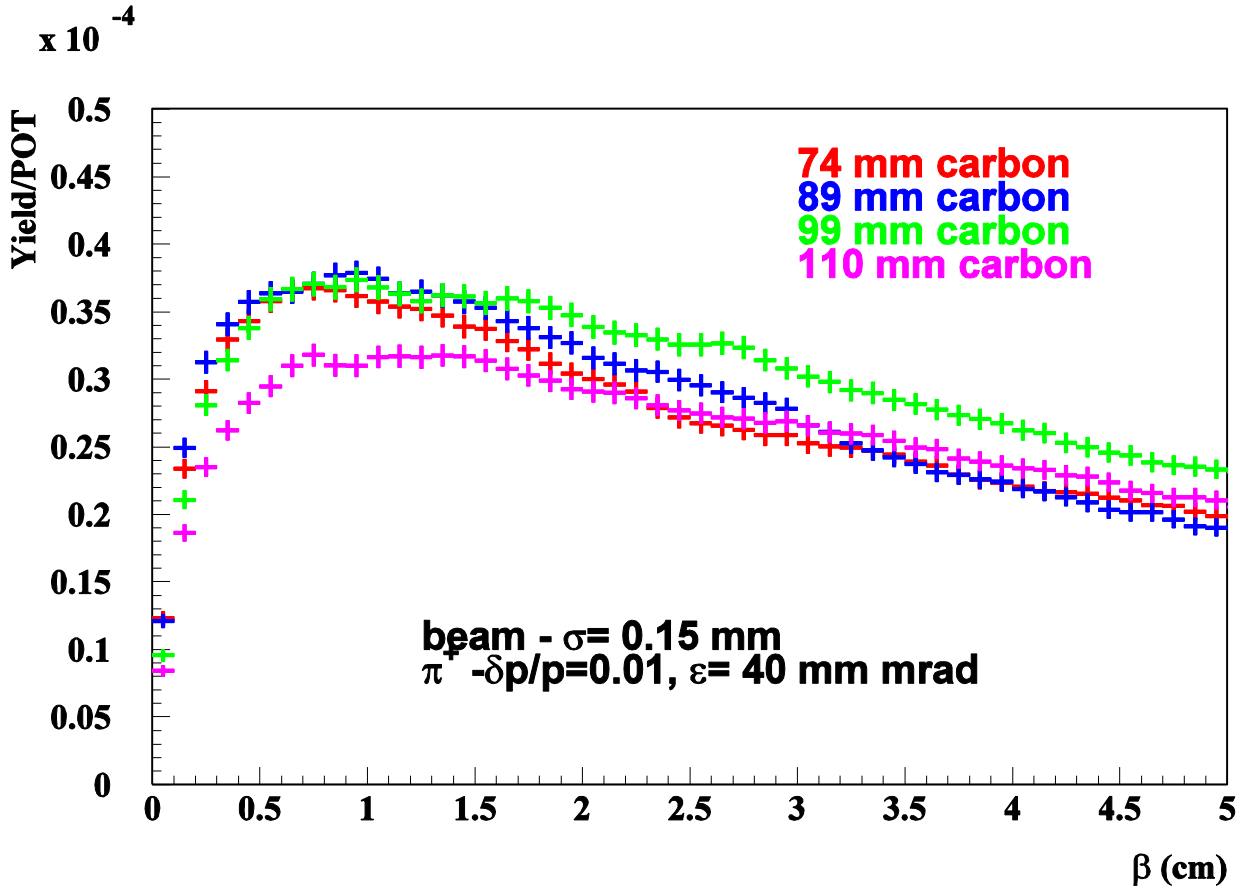
Dependence of pion yield on beta function for different target radius – 89 mm carbon (3.52 g/cm^3)



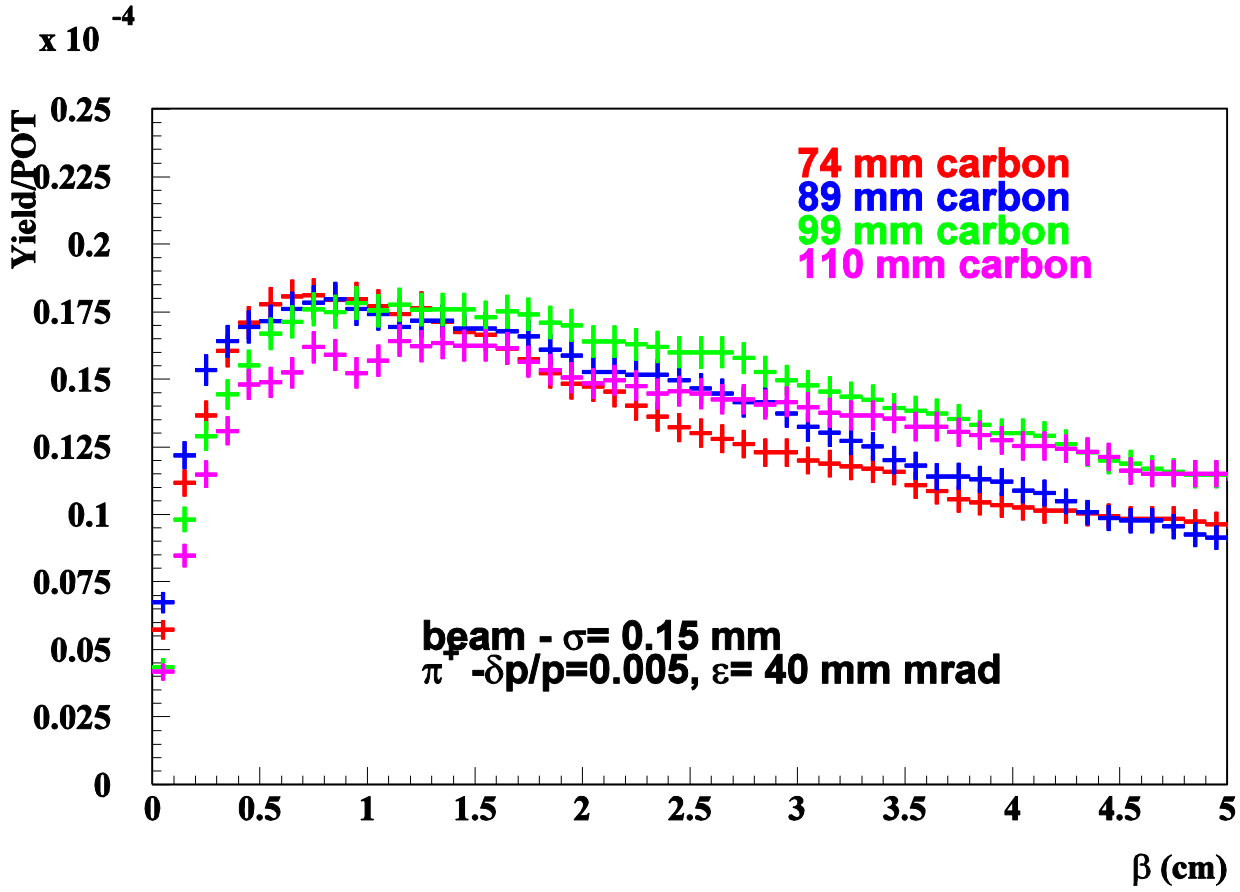
Dependence of pion yield on beta function for different target length ($\Delta p/p=0.02$).



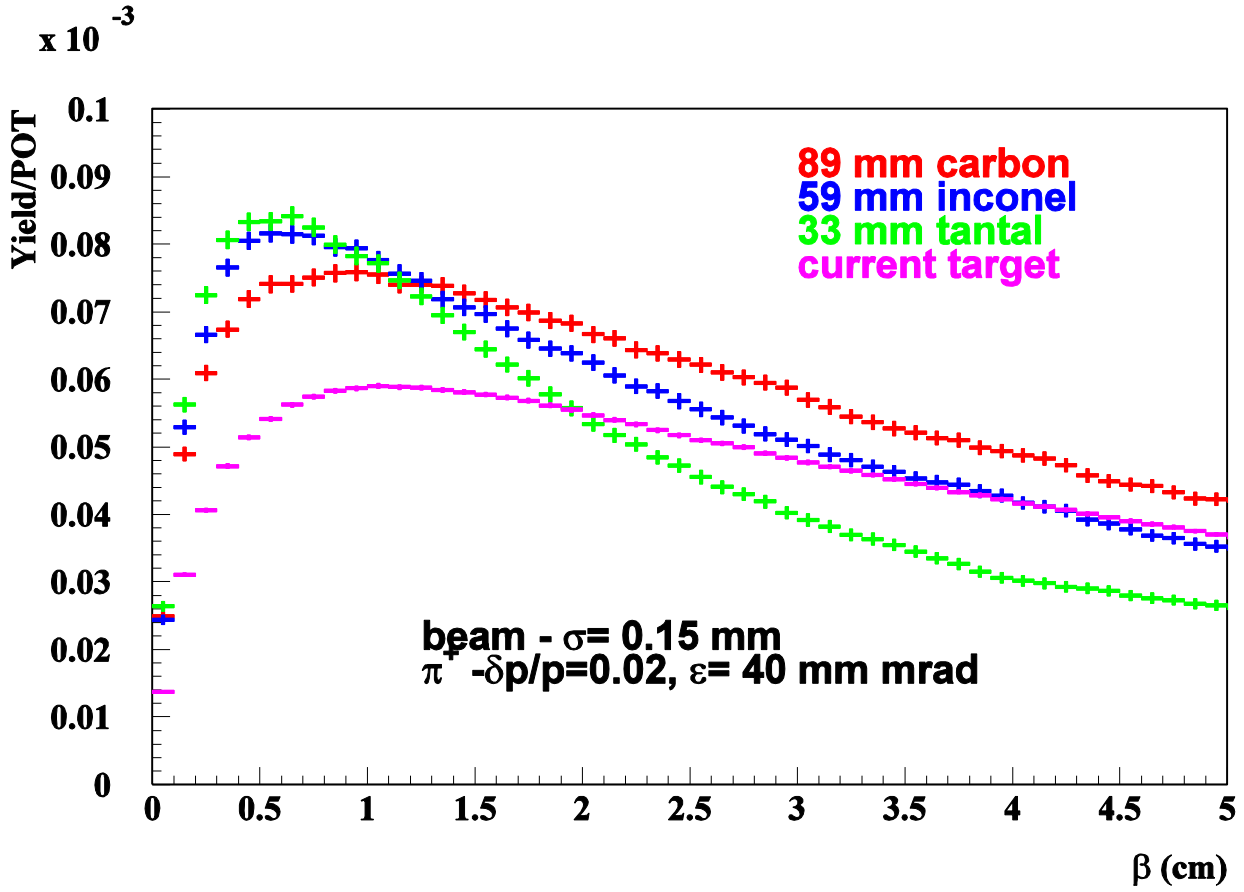
Dependence of pion yield on beta function for different target length ($\Delta p/p=0.01$).



Dependence of pion yield on beta function for different target length ($\Delta p/p=0.005$).



Dependence of pion yield on beta function for different material ($\Delta p/p=0.02$).



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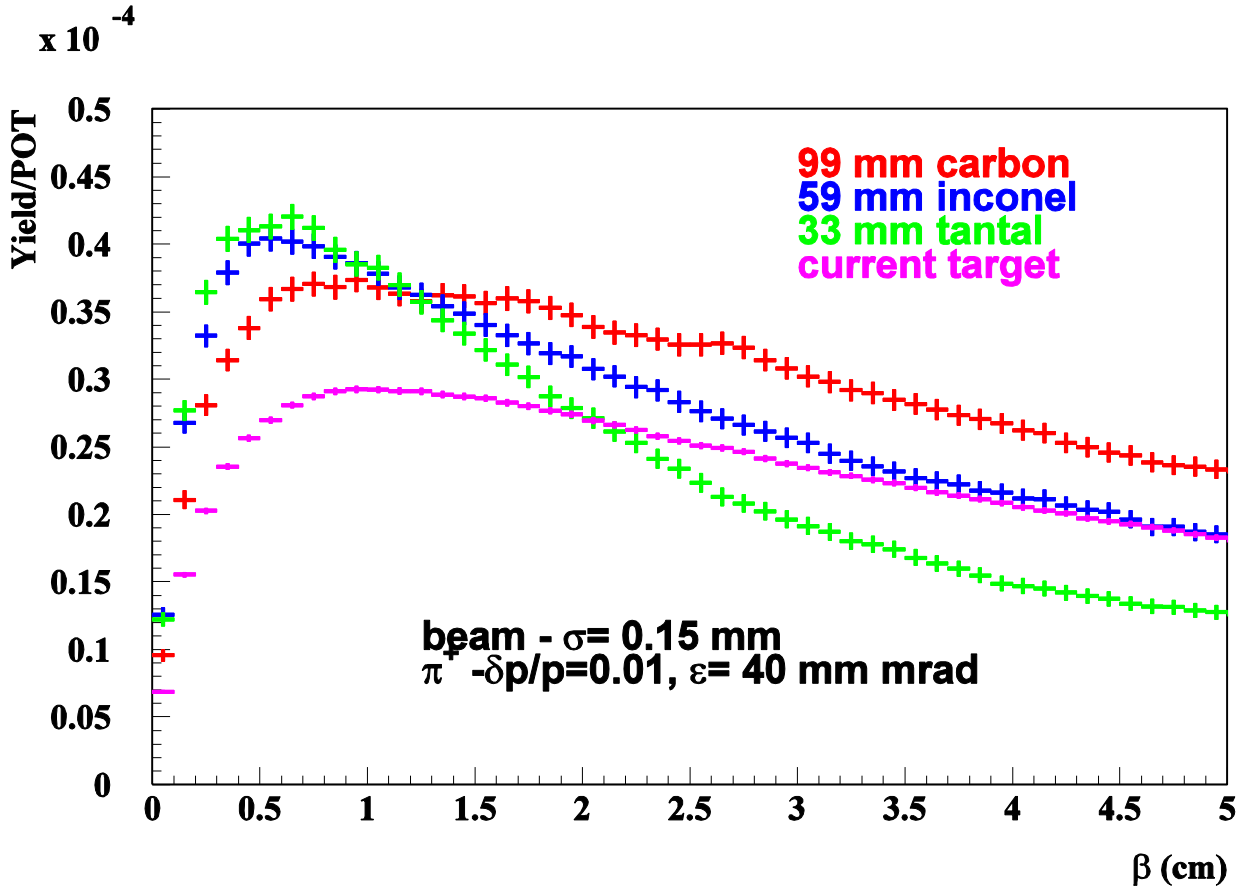
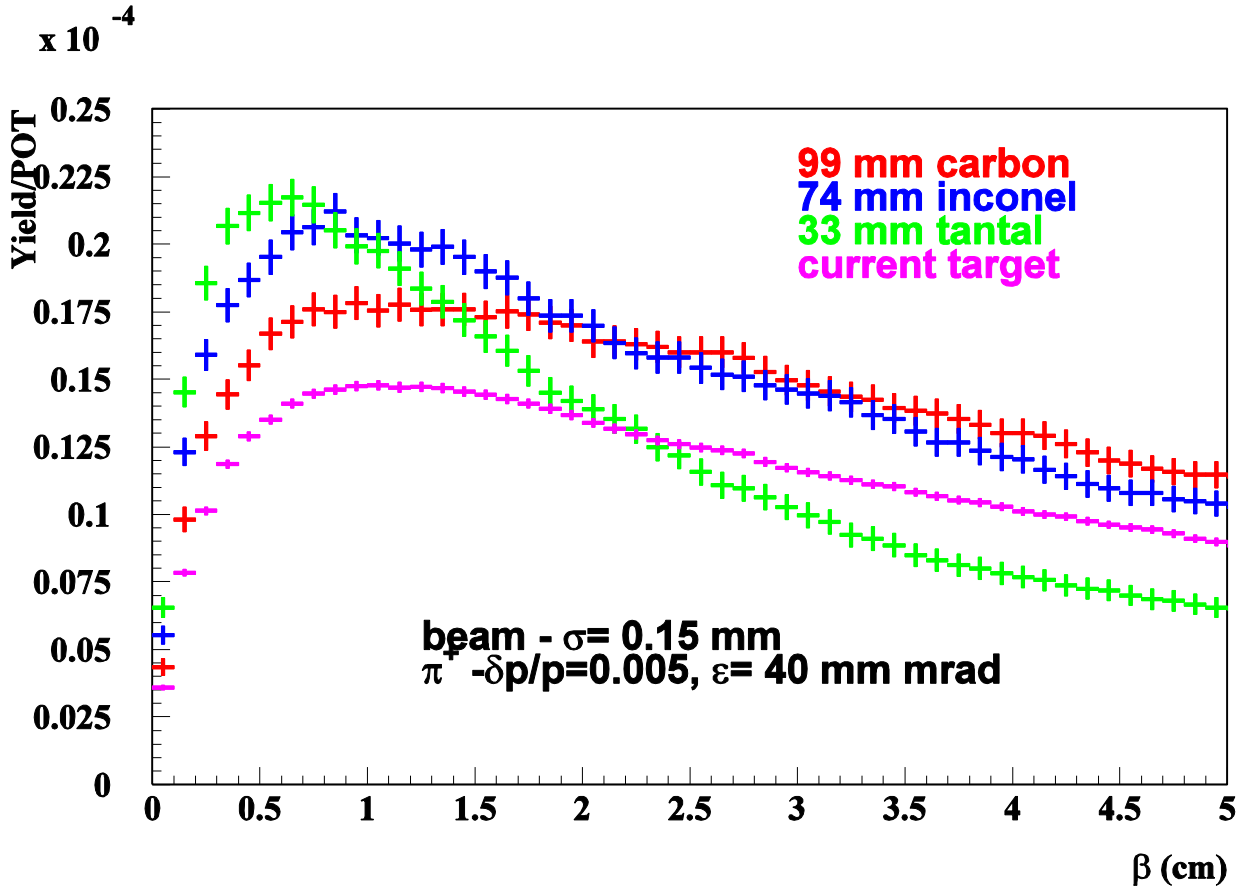
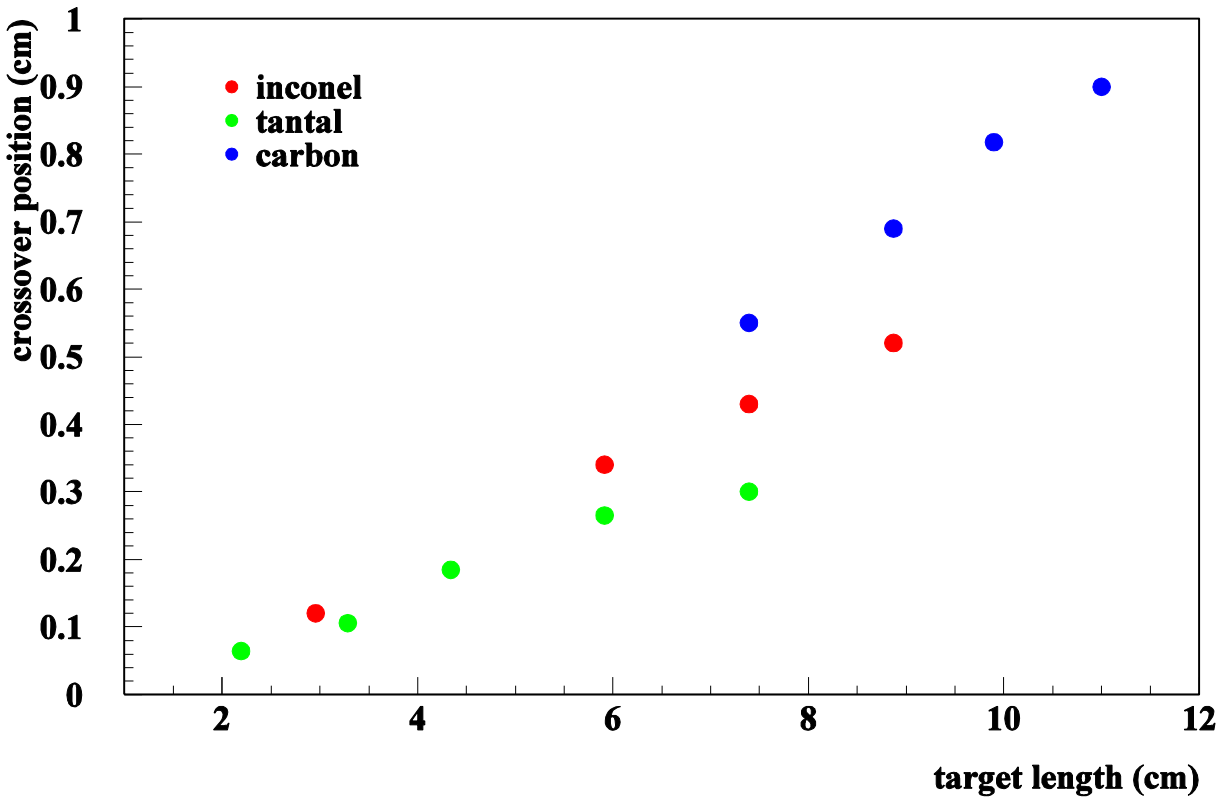


Dependence of pion yield on beta function for different material ($\Delta p/p=0.005$).



Dependence of waist position on the target length



CONCLUSIONS

1. Pion yield dependence on beta-function at the target for pion acceptance of 40 mm mrad was simulated for different setups.

2. Yield from current pbar target rises on about 70% with decreasing proton beam rms from 0.55 to 0.15 mm.

3. Yield could be increased on about 40% in comparison with current pbar target by using simple cylinder with radius about 2.5 proton beam rms and thickness 0.3-0.5 interaction length. Dependence on target material is rather week.