Energy deposition of 24 GeV/c protons in gravity affected mercury jet

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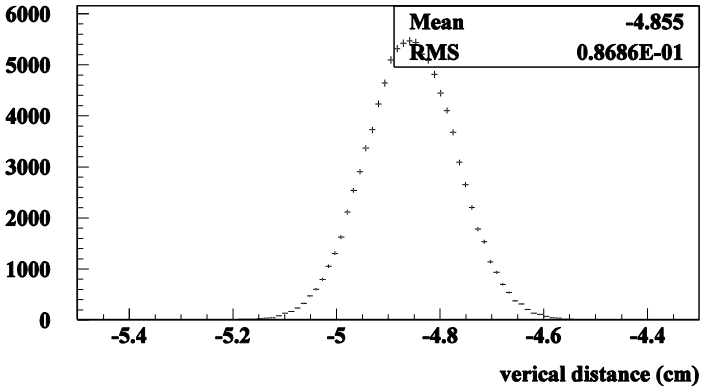
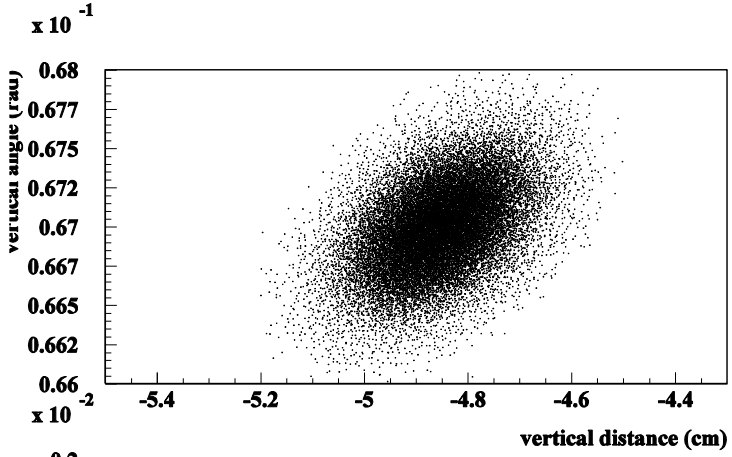
April 1, 2009

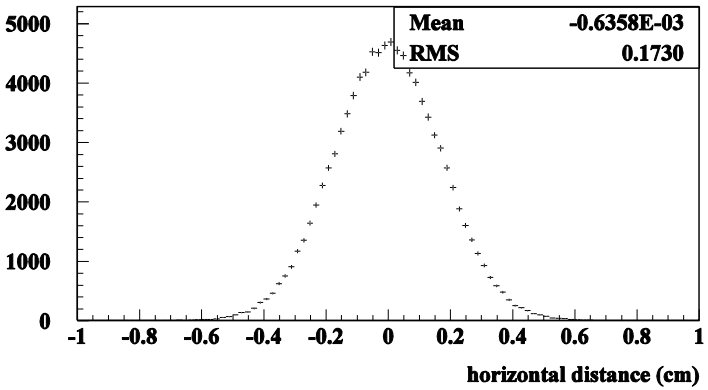
Beam simulation model

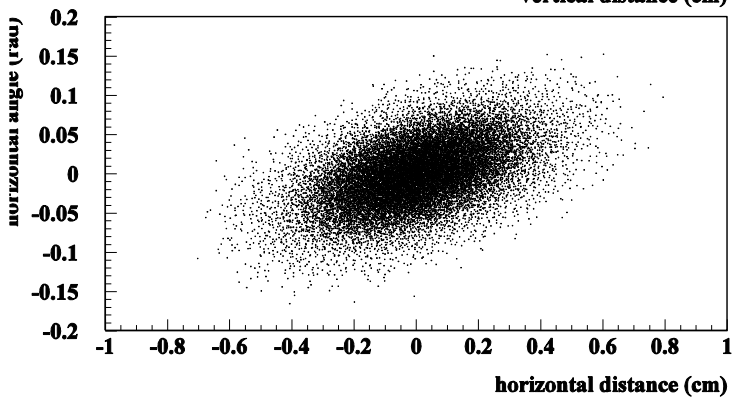
- Simulation starts at HG-WUP using beam parameters from MERIT Data Analysis(latest update : 07Oct08), including dispersion term.
- If there is vacuum only between WUP and center of target horizontal and vertical beam parameters very close to Ilias results. Real MC provides slightly larger sigmas due to interaction with beam windows and air.

Beam distribution at HG-WUP, 10Tp, 14 GeV/c

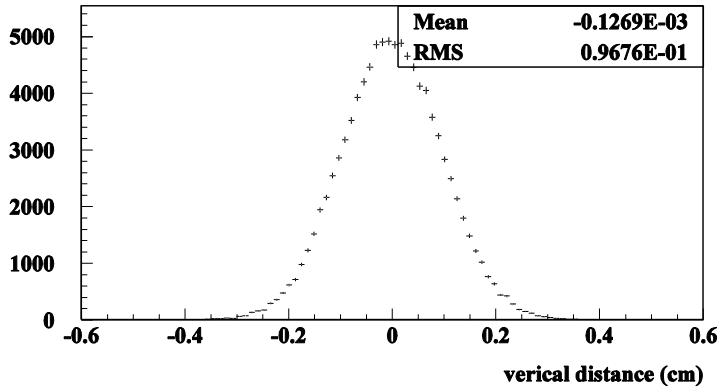


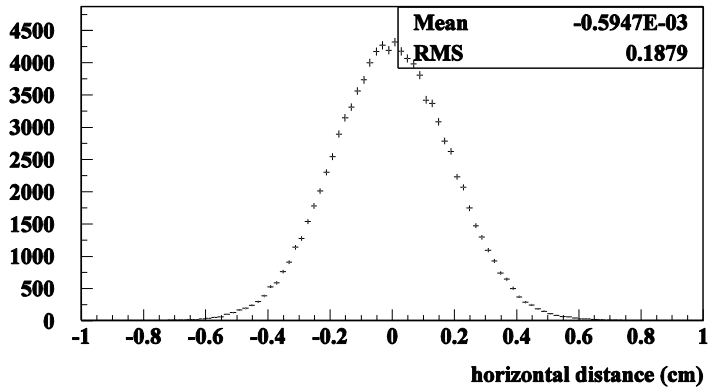


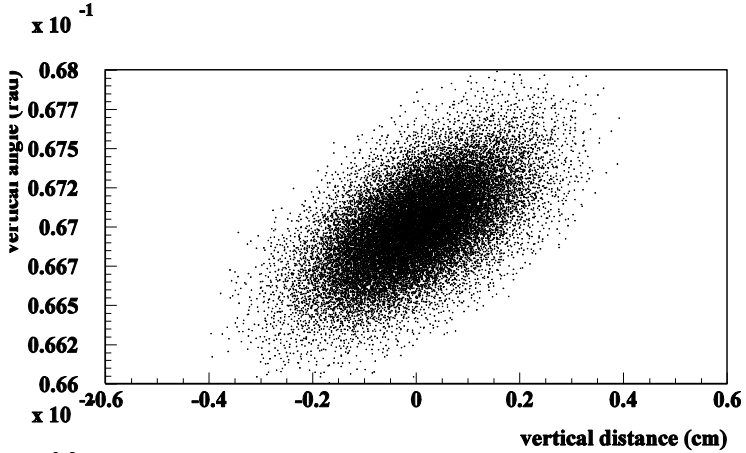


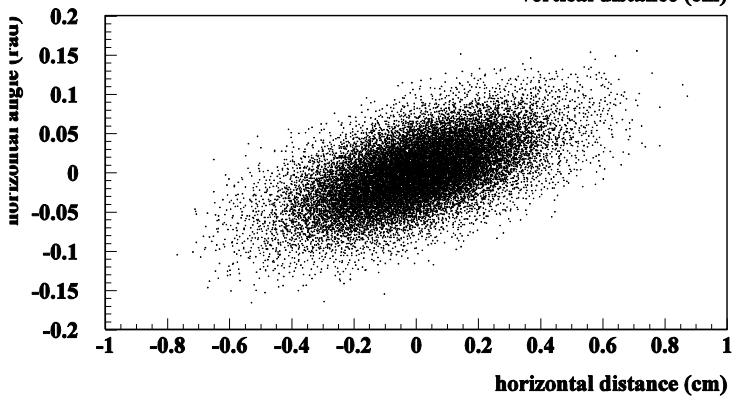


Beam distribution at center of target, 10Tp, 14 GeV/c (vacuum only)



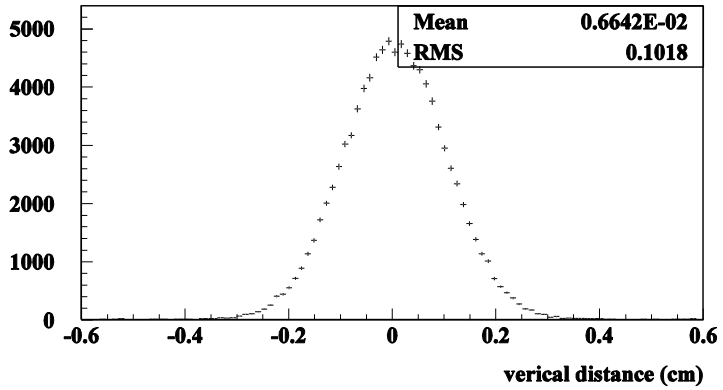


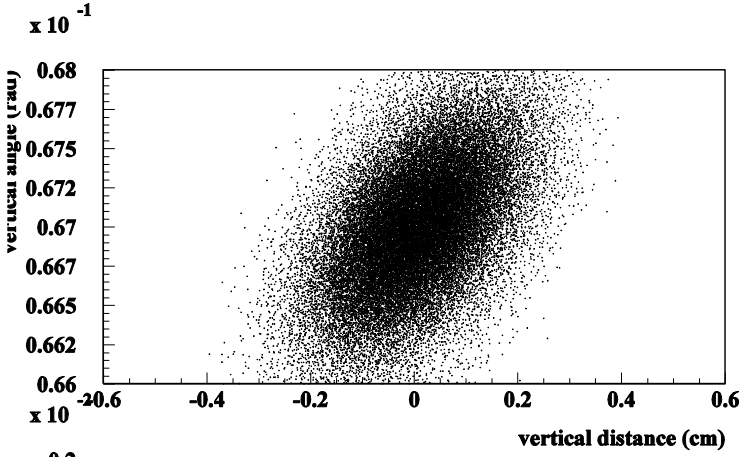


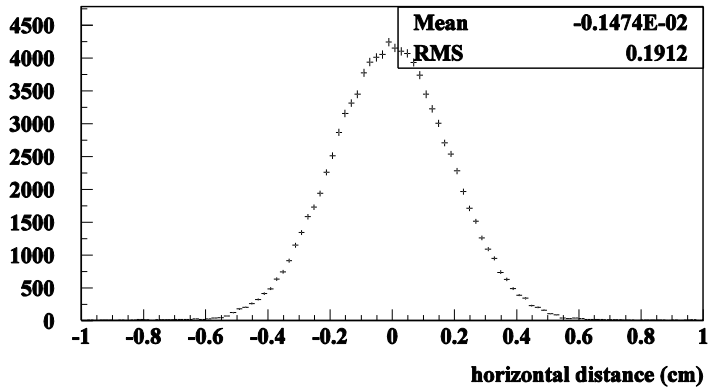


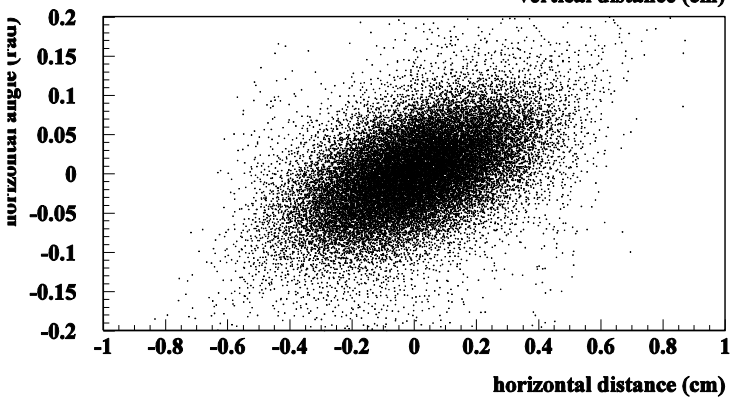
Ilias table (October 11, 2008): sigma_h = 0.1883 cm, sigma_v=0.09695 cm

Beam distribution at center of target 10Tp, 14 GeV/c (beam windows and air included)



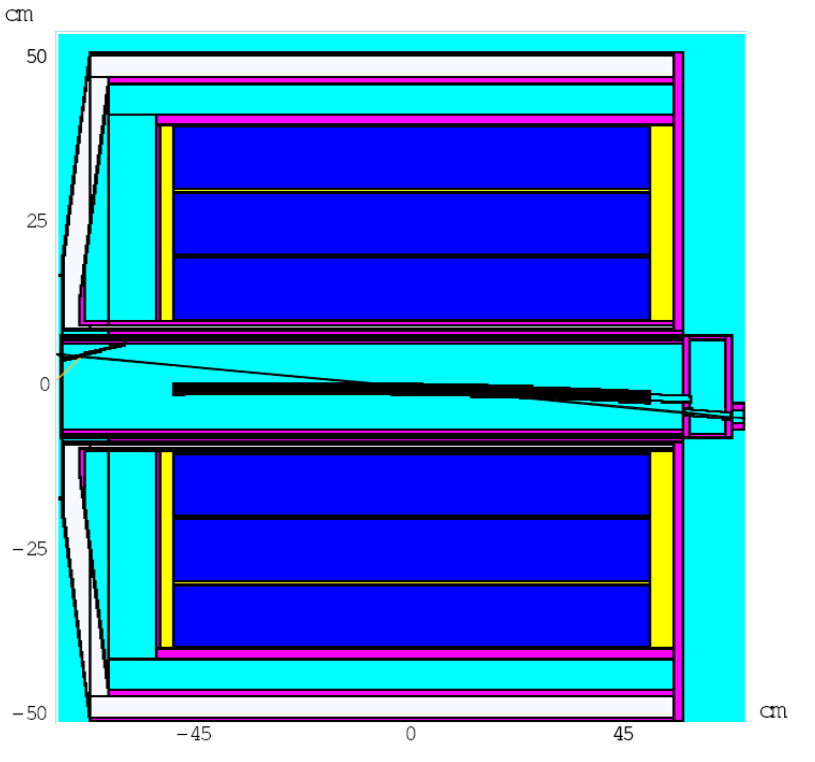


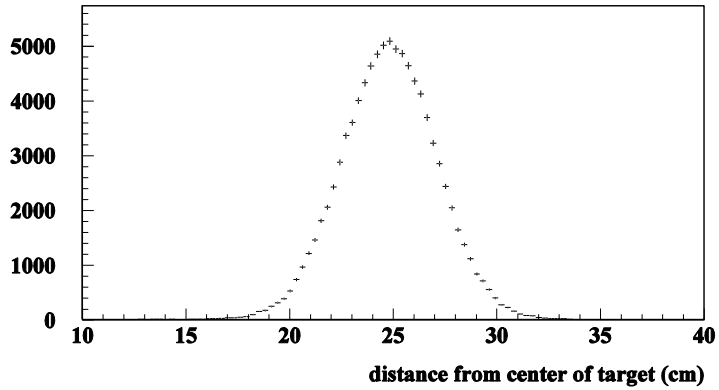


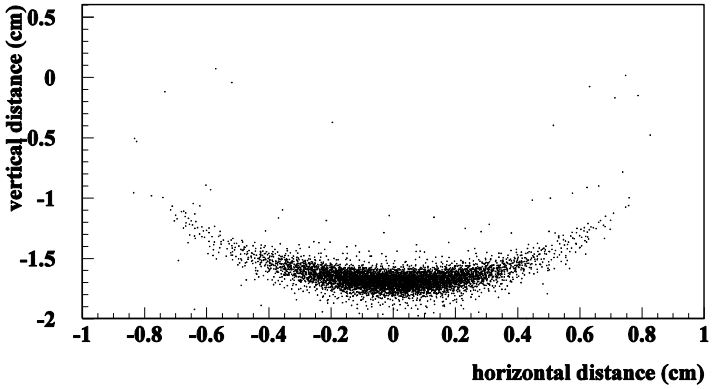


Ilias table (October 11, 2008): sigma_h = 0.1883 cm,sigma_v=0.09695 cm

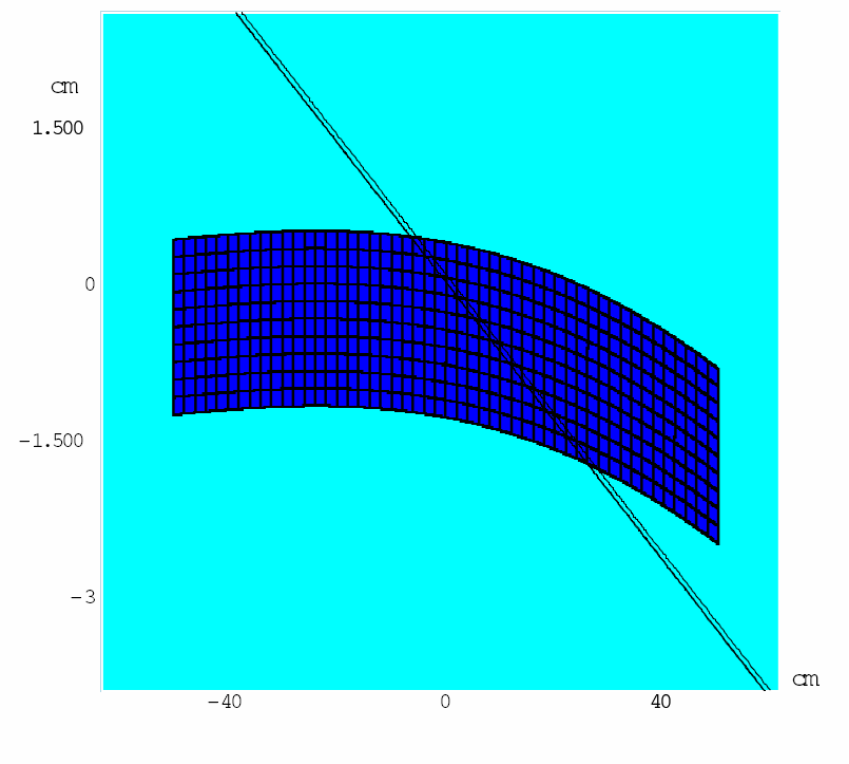
Distribution of beam entrance point to round target (r=0.84 cm), 10Tp, 14 GeV/c

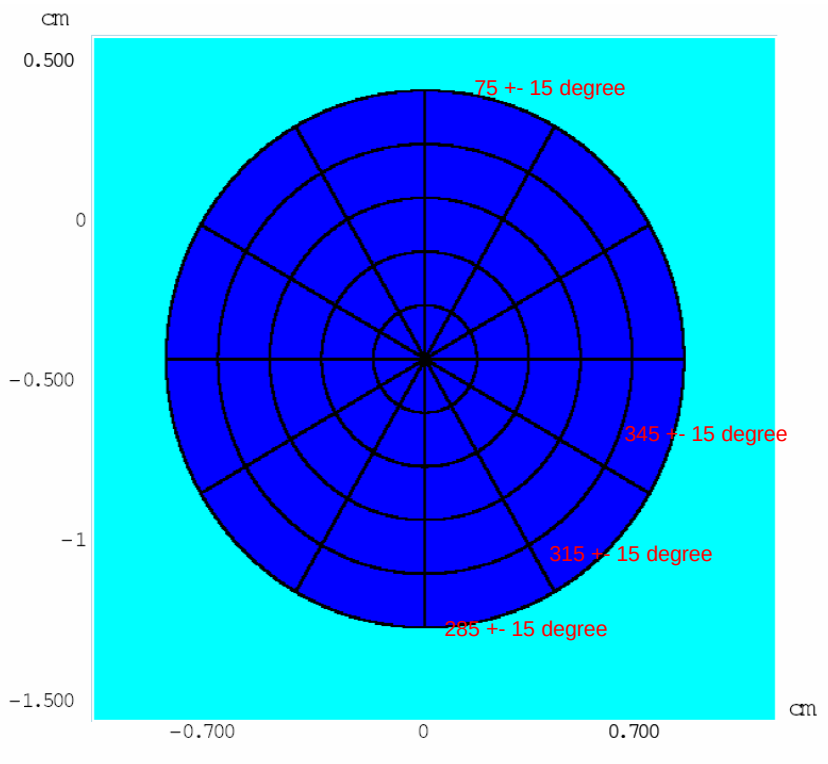




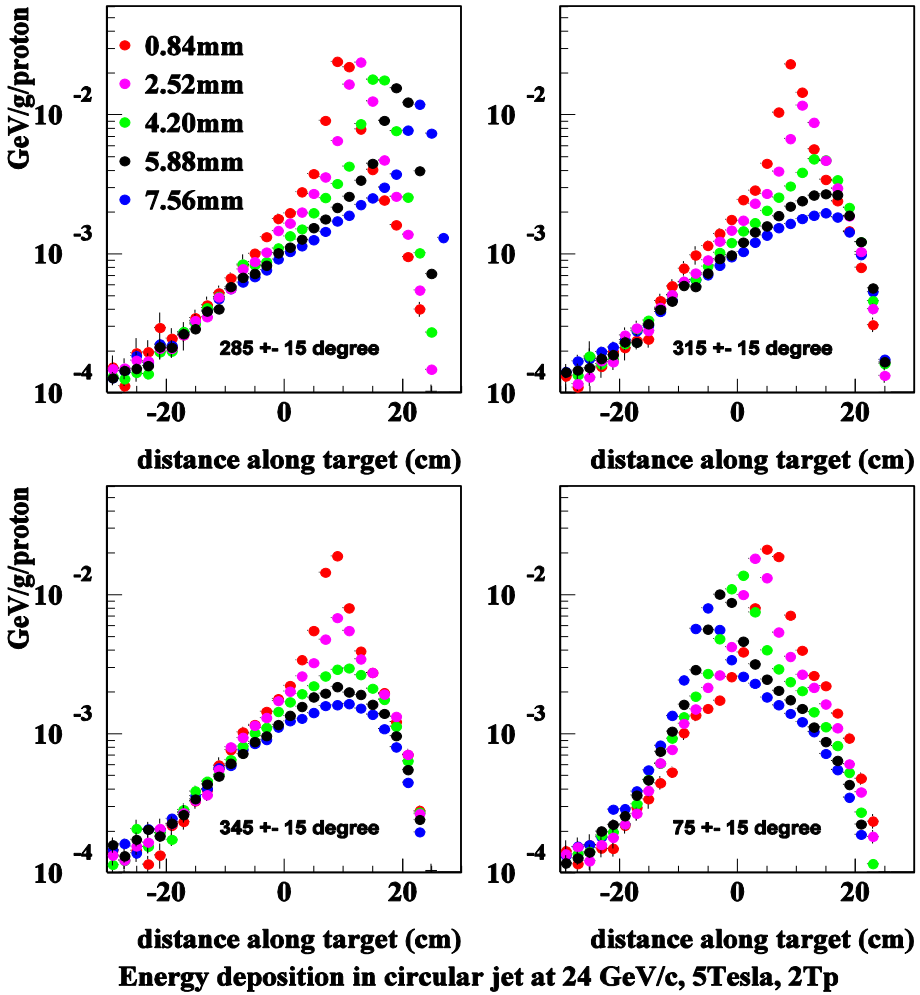


Round gravity affected jet
r=0.84 cm at 5 Tesla, reduced density

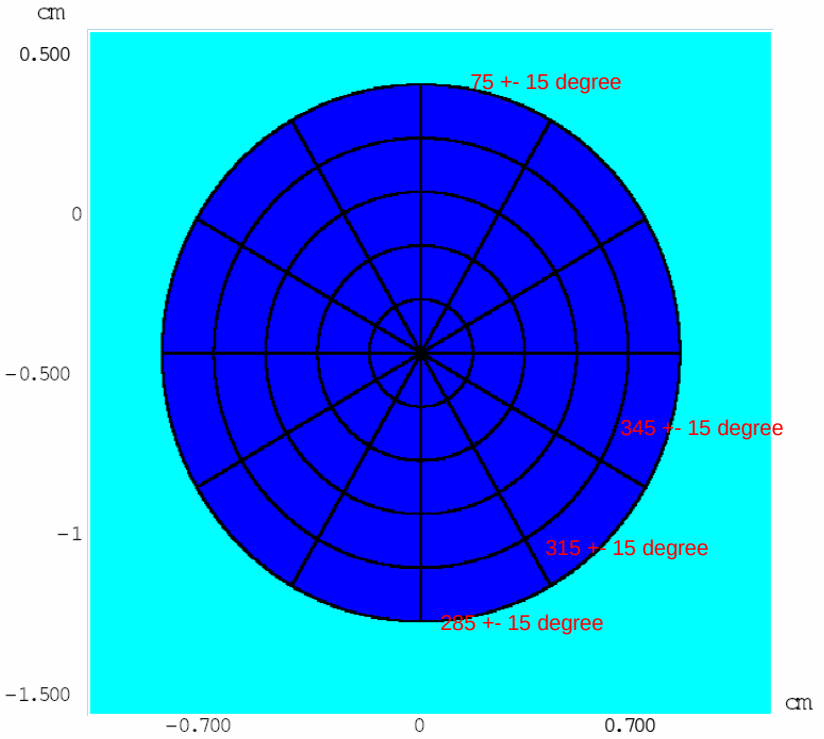




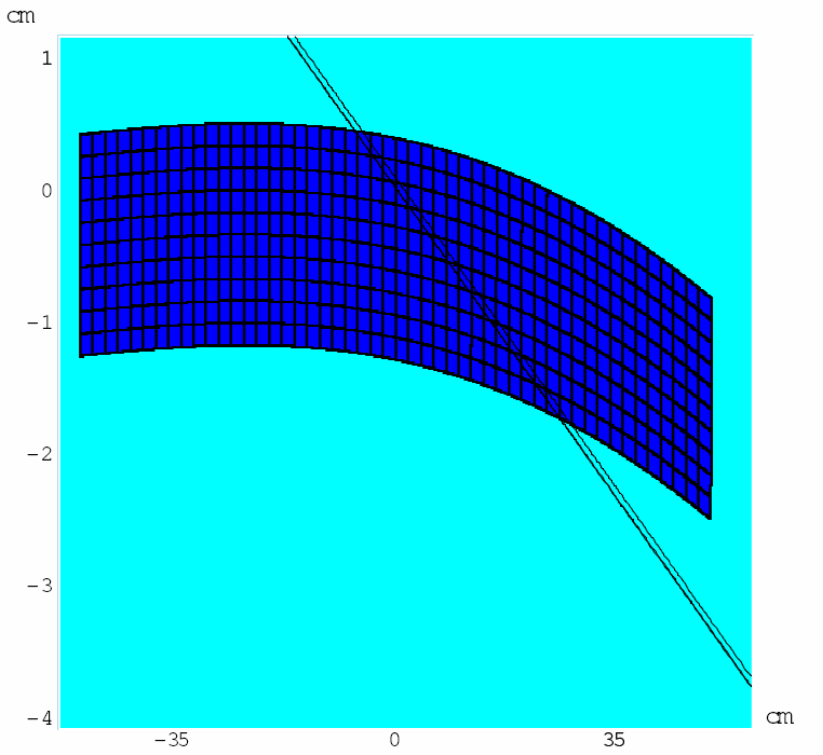
Energy deposition density in round gravity affected jet at 5 Tesla, r=8.4 cm, reduced density (4.77 g/cc)

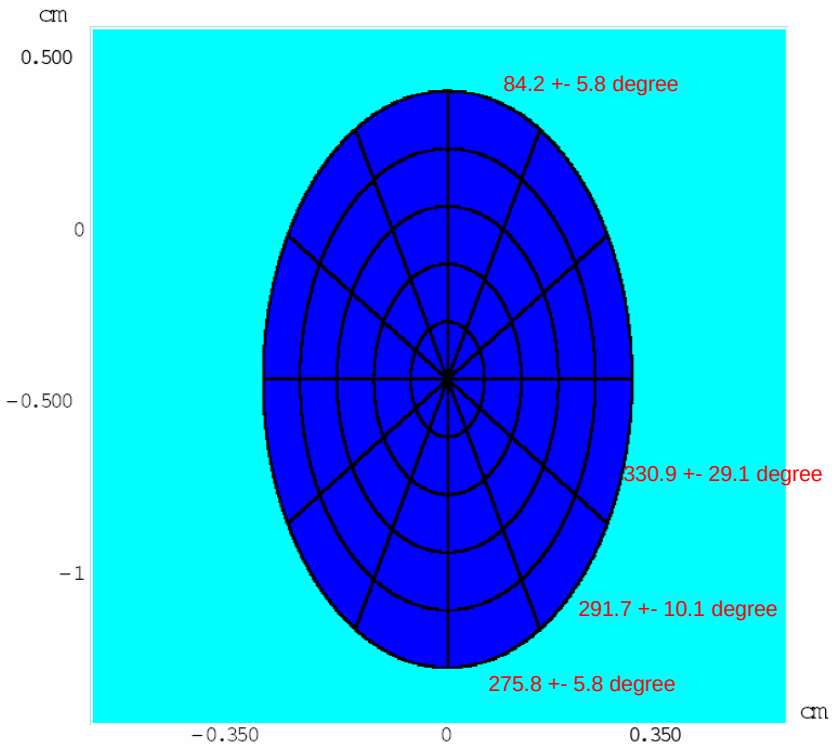


Energy deposition in circular jet at 24 GeV/c, 5Tesla, 2Tp

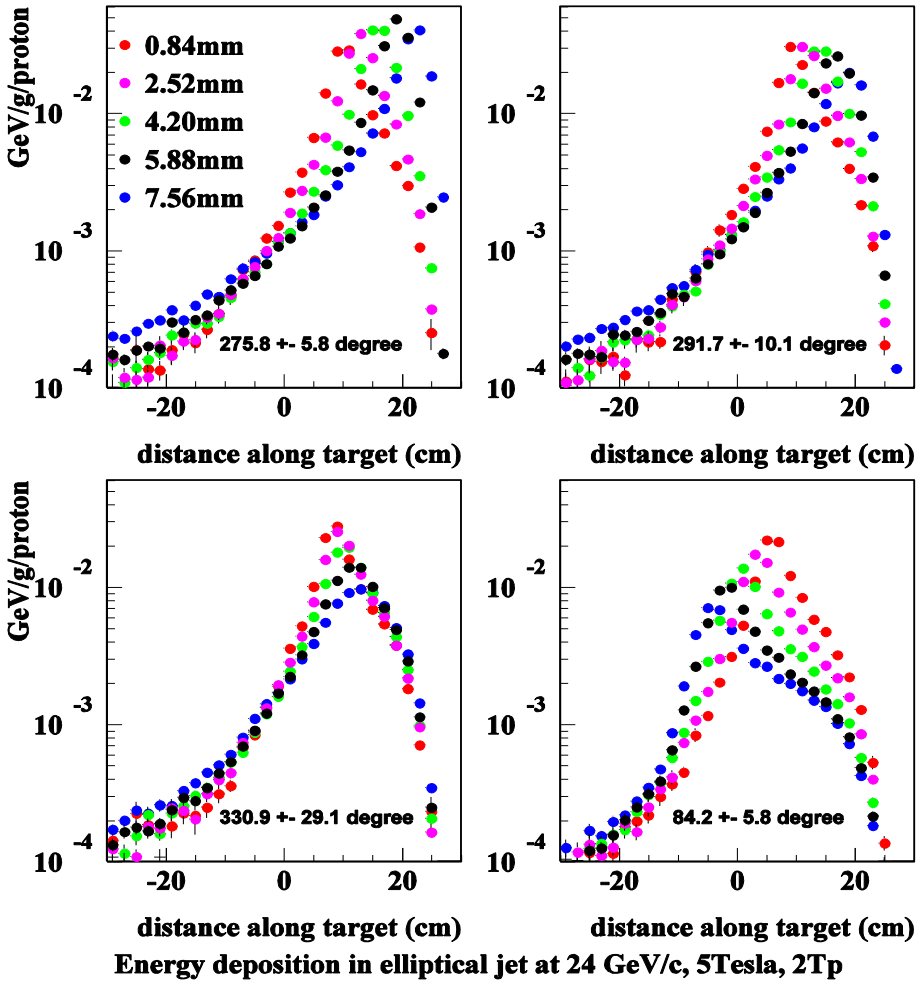


Elliptic gravity affected jet, r_v=0.84 cm, r_h=0.3 cm at 5 Tesla

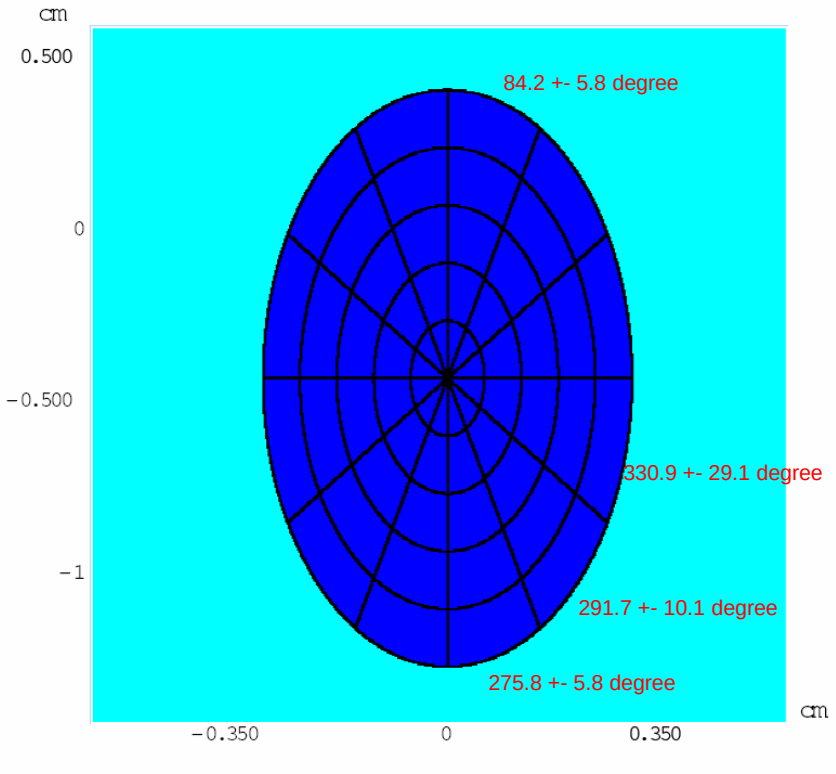




Energy deposition density in elliptic gravity affected jet, r_v=0.84 cm, r_h=0.3 cm at 5 Tesla, normal density (13.546 g/cc)



Energy deposition in elliptical jet at 24 GeV/c, 5Tesla, 2Tp

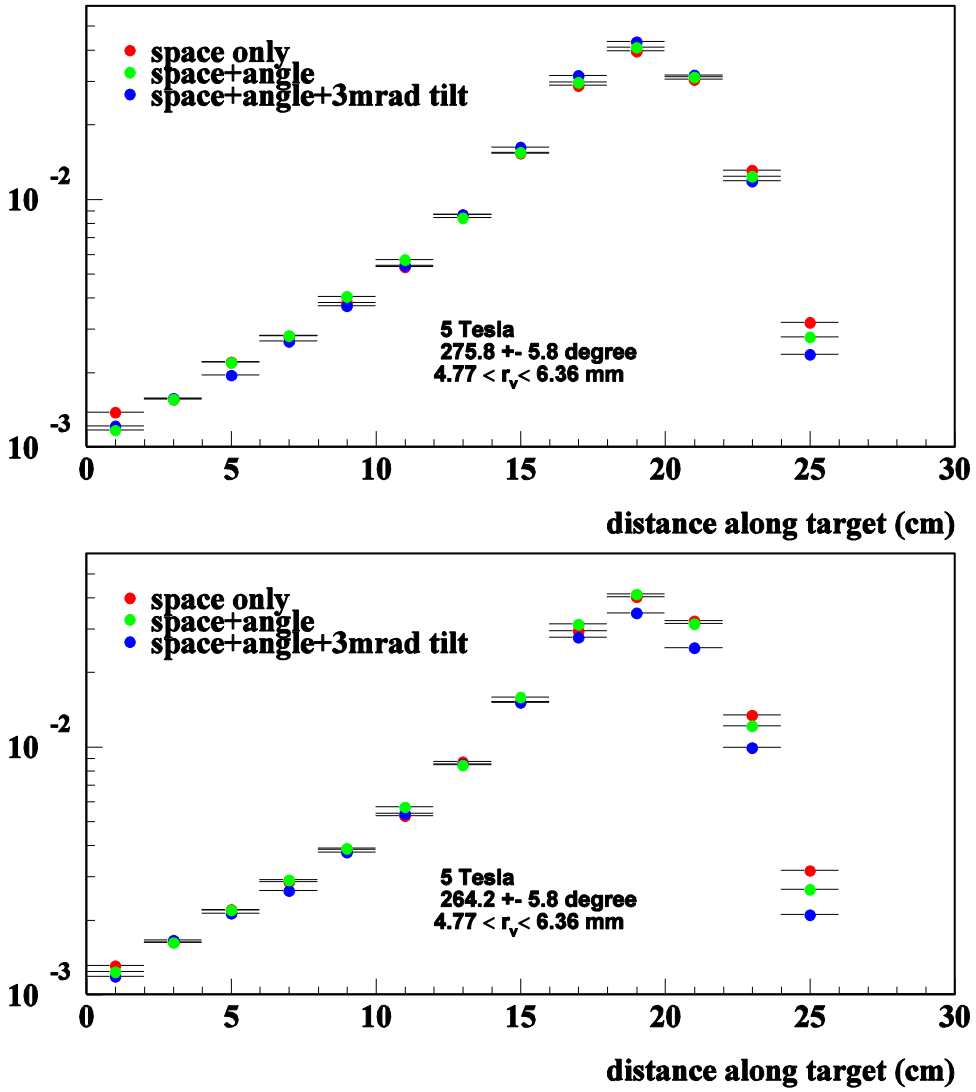


How energy deposition depends on beam parameters?

Three beam setup scenarios:

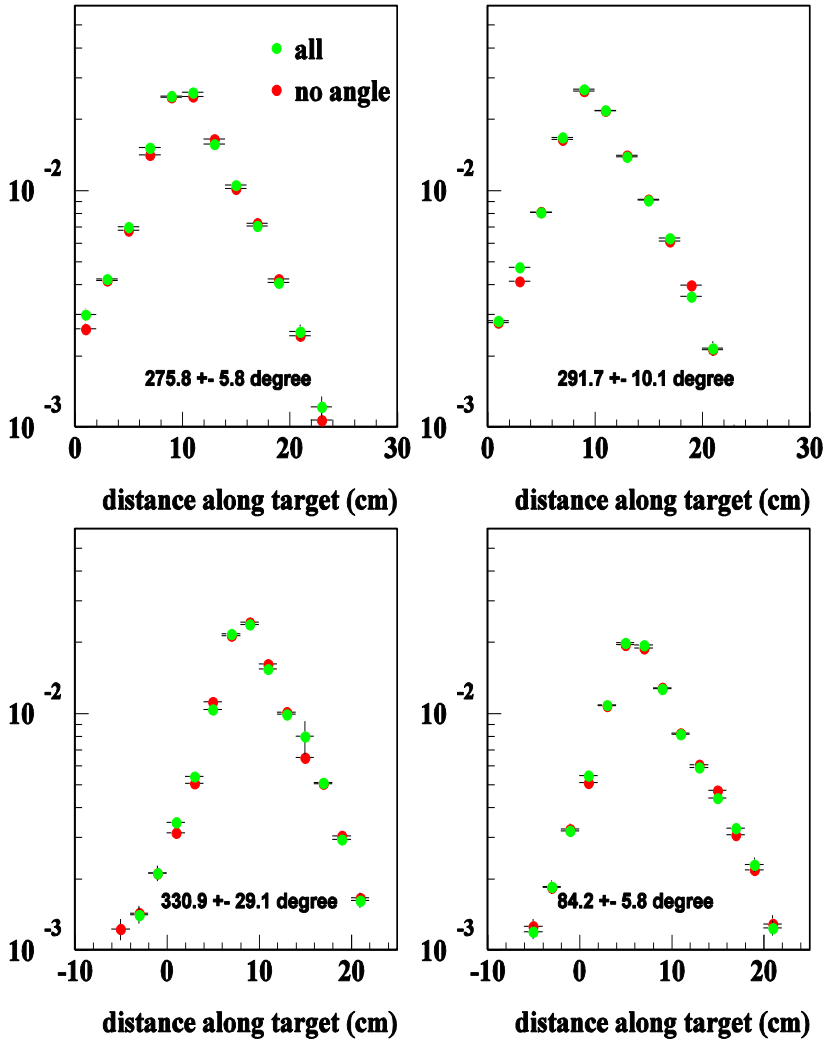
- Only vertical&horizontal divergence. Ilias sigmas at target center.
- Vertical&horizontal and angular divergences. Ilias parameters at HG-WUP.
- Same as 2 plus 3 mrad horizontal beam tilt

Maximum of energy deposition density has weak dependence on angular beam distribution

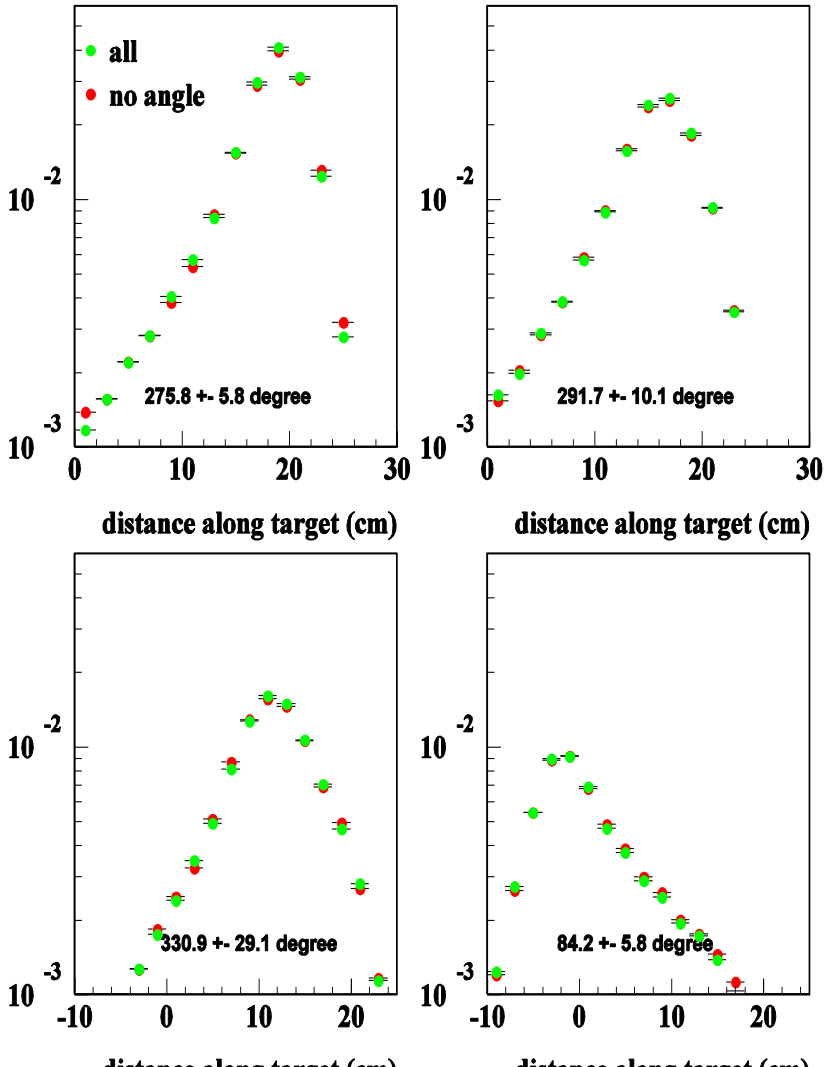


Energy deposition in elliptical mercury jet at 24 GeV/c (gravity curved), 10Tp

How energy deposition depends on beam parameters?

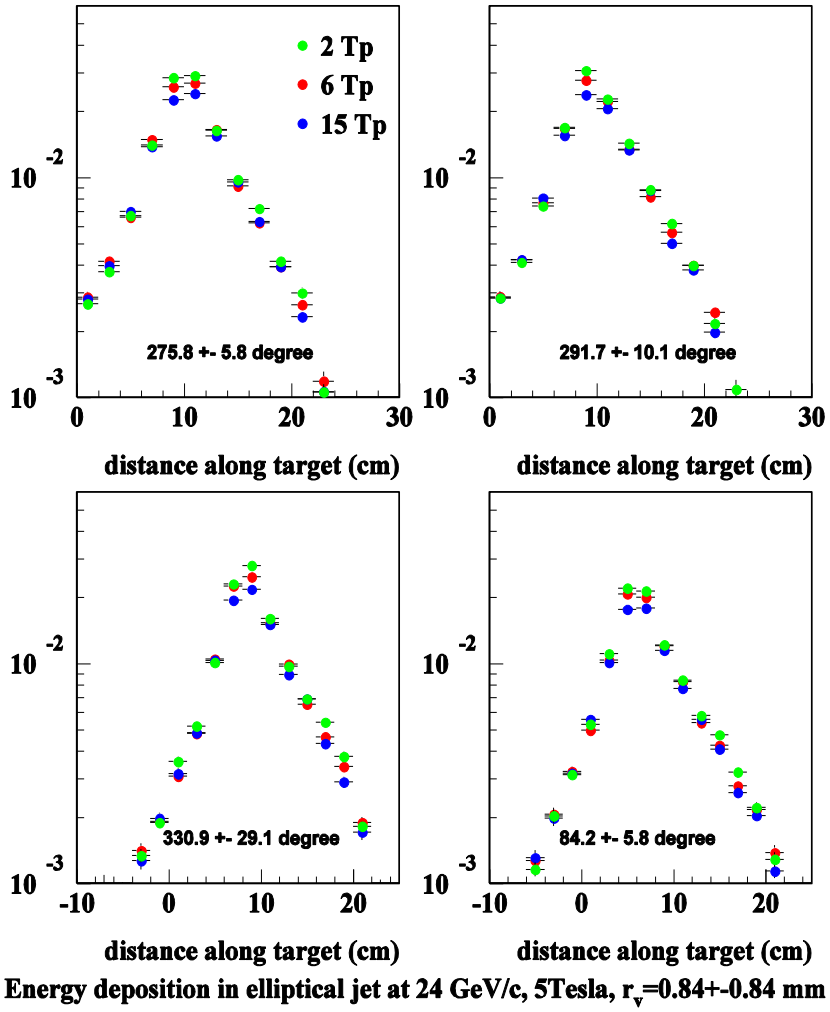


Energy deposition in elliptical jet at 24 GeV/c, 5Tesla, r_v=0.84+-0.84 mm

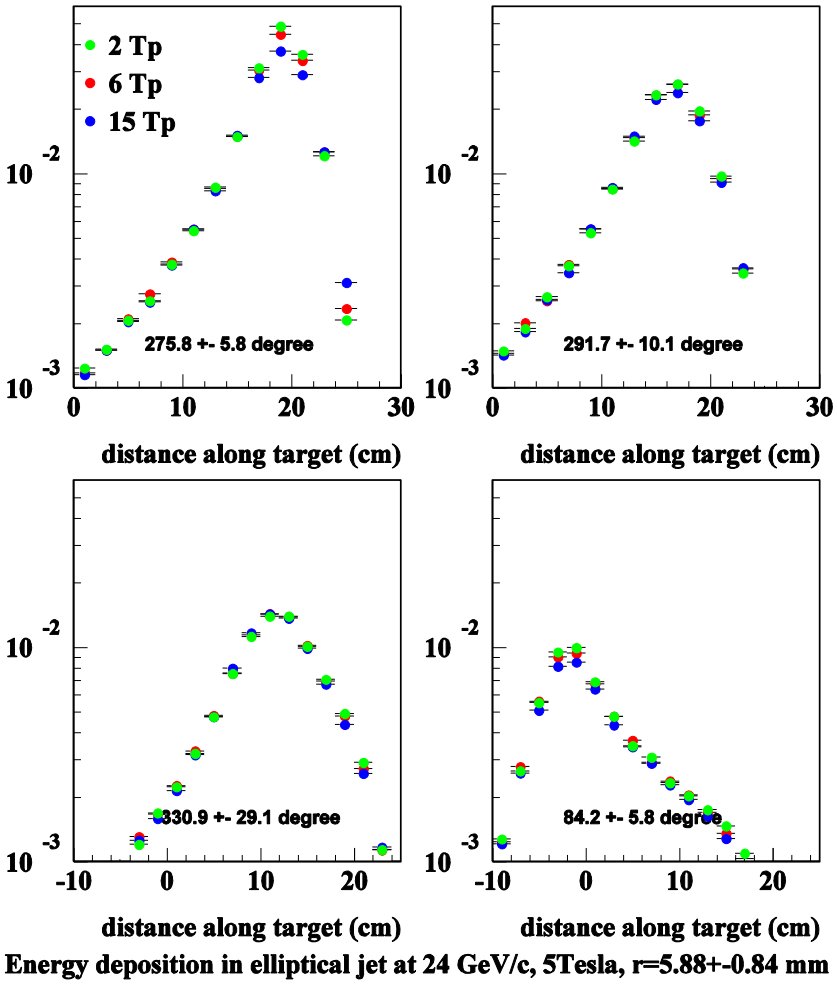


Energy deposition in elliptical jet at 24 GeV/c, 5Tesla, r_v=5.88+-0.84 mm

Energy deposition density in elliptic gravity affected jet, r_v=0.84 cm, r_h=0.3 cm at 5 Tesla, normal density (13.546 g/cc)



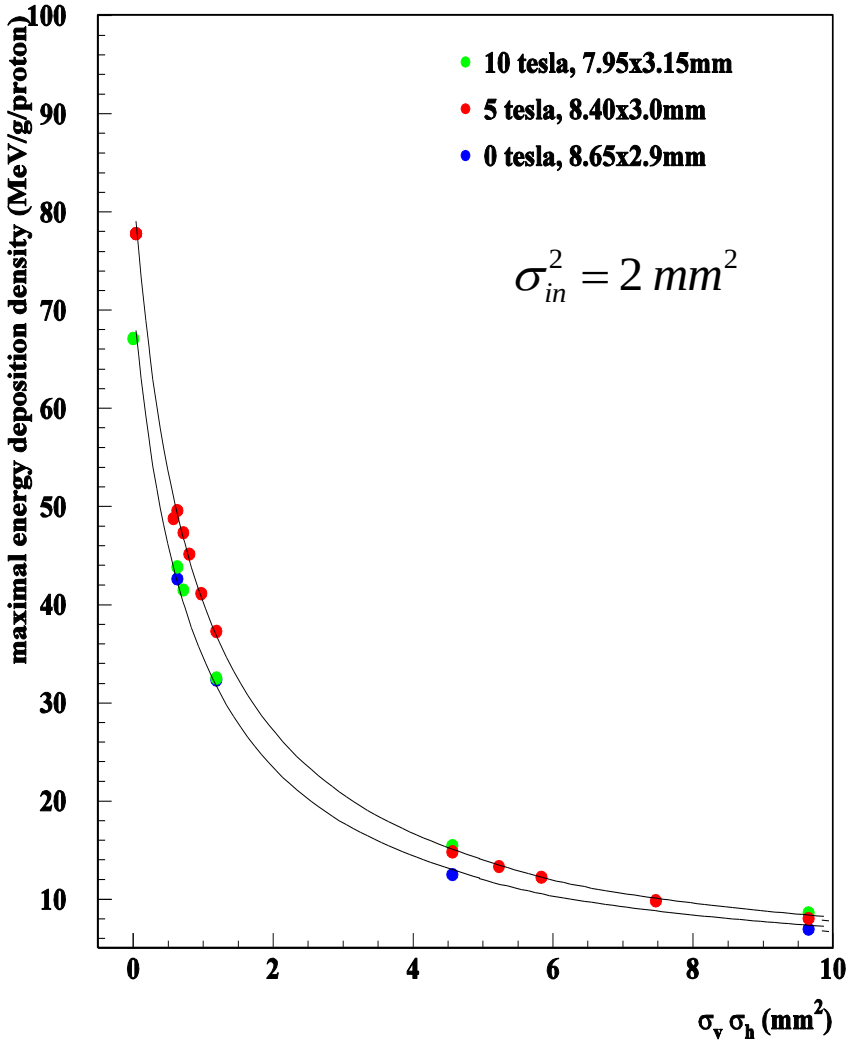
Energy deposition in elliptical jet at 24 GeV/c, 5Tesla, r_v=0.84+-0.84 mm



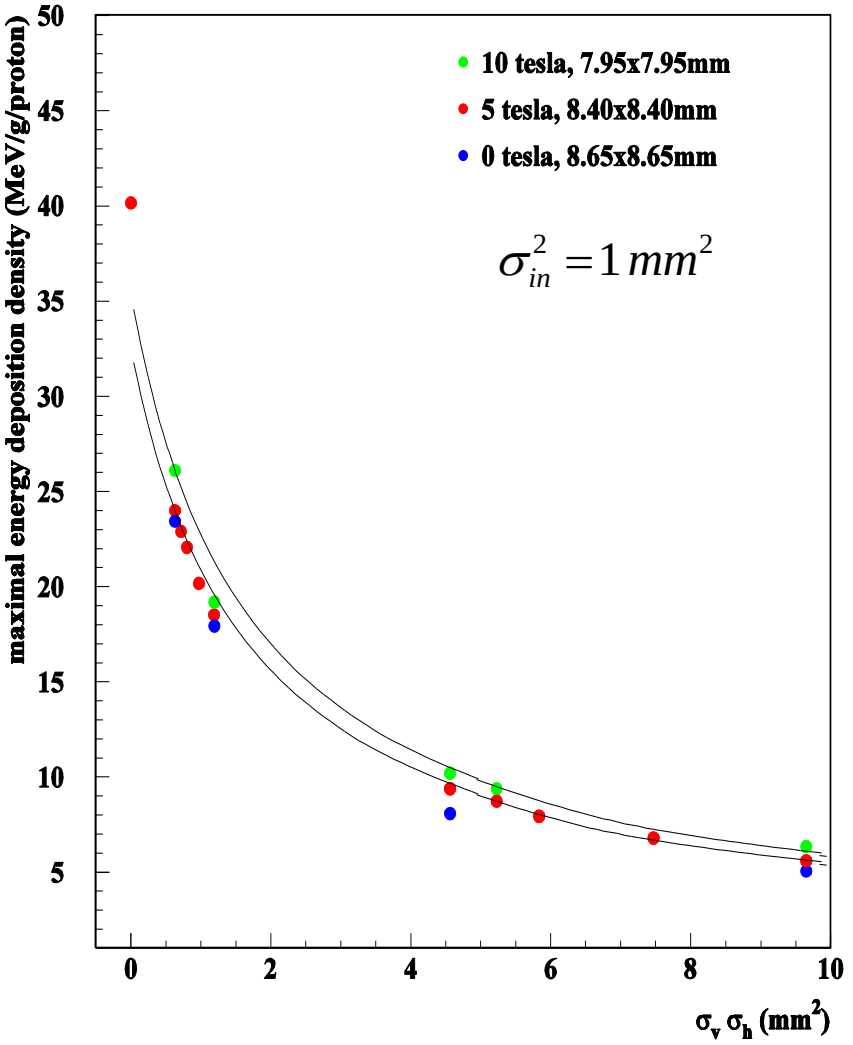
Energy deposition in elliptical jet at 24 GeV/c, 5Tesla, r=5.88+-0.84 mm

How energy deposition density depends on beam size?

$$\frac{1}{\sqrt{(\sigma_{in}^2+\sigma_v^2)(\sigma_{in}^2+\sigma_h^2)}} \approx \frac{1}{\sqrt{(\sigma_{in}^2+s/1.84)(\sigma_{in}^2+1.84s)}}, s=\sigma_v\sigma_h, \sigma_h \approx 1.84\sigma_v$$



Gravity affected elliptical jet, 24 GeV/c



Gravity affected circular jet, 24 GeV/c