Optical Diagnostic Results of Hg Jet Target and Post-Simulation

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Talk Outline & Introduction

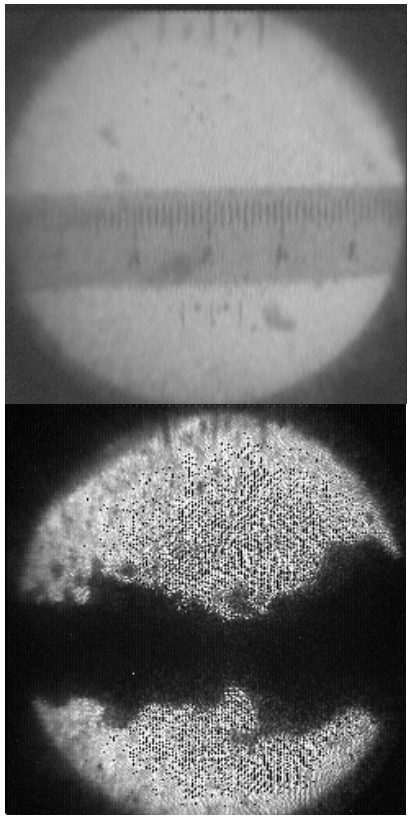
- Introduction : Aim of work
  - Understand the optical diagnostic results from experiment
  - Post-simulate with the experimentally observed results
  - Learn the characteristics of high power Hg target through the comparison of numerical calculation of theory with experimental results

- Experimental Results
  - Hg jet behavior in parallel B field: Jet height, Surface stabilization, Jet trajectory
  - Extent of jet disruption with beam intensity and beam energy
  - Response of filamentation on jet surface in crossing B field

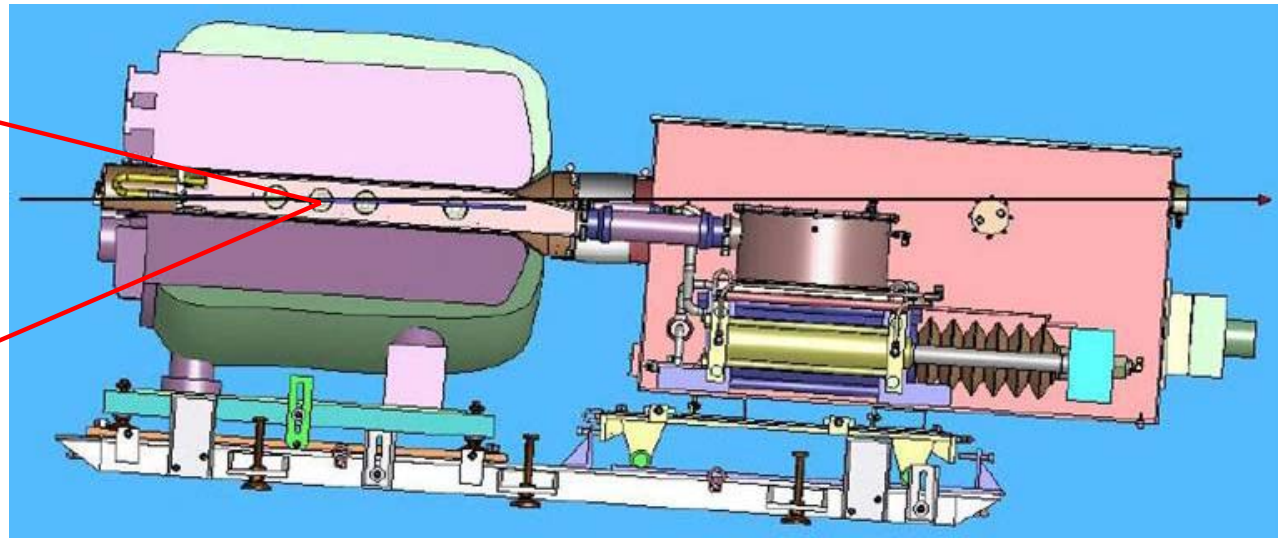
- Post-Simulation Status
  - Beam spot size from optics (I. Efthymiopoulos, CERN)
  - Distribution of energy deopsition to Hg target (S. Striganov, FNAL)

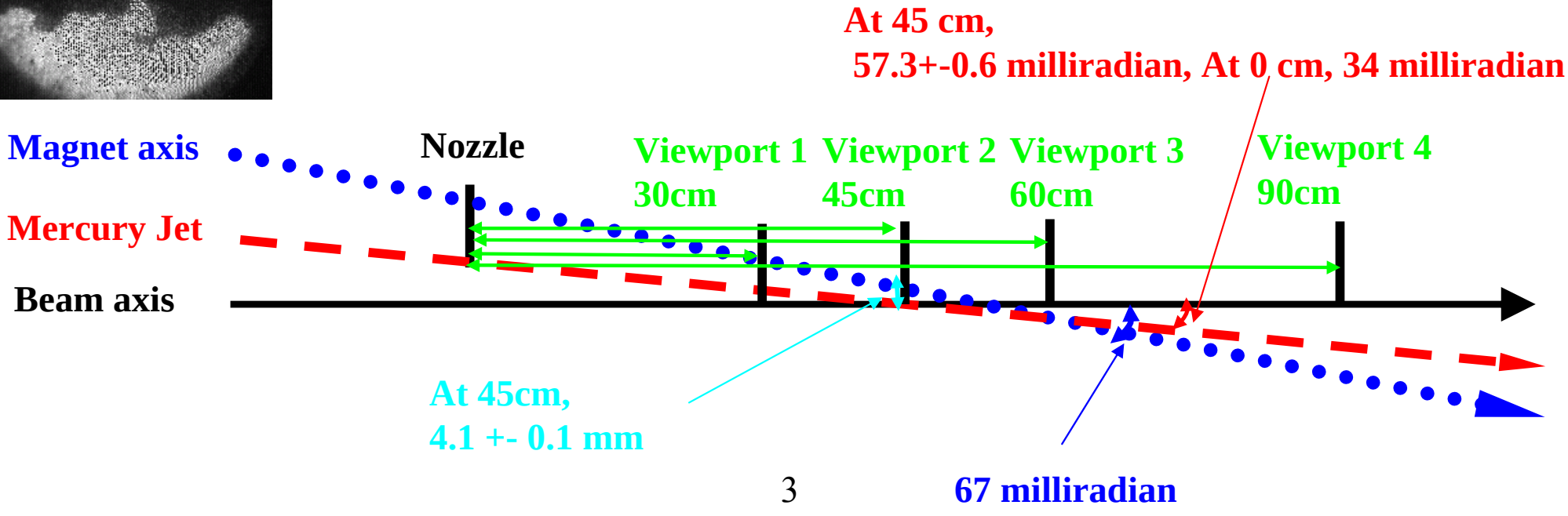
- Future Work
  - Beam interacting MHD simulation (R. Samulyak, SBU)
  - Compare with experimental results and make discussion

Mercury Intense Target Experiment : October 22, 2007 ~ November 11, 2007

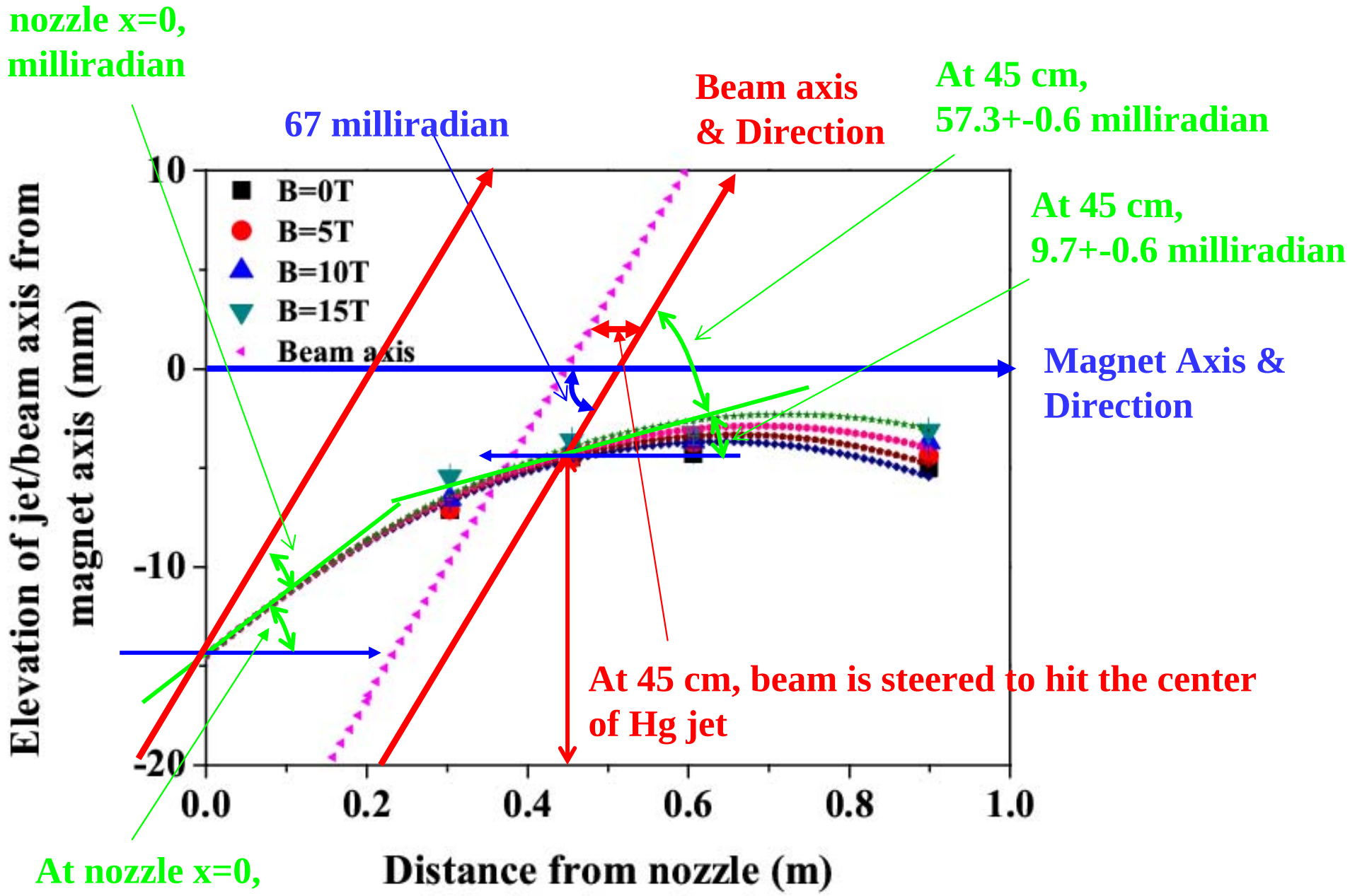


Installation of key components for MERIT experiment



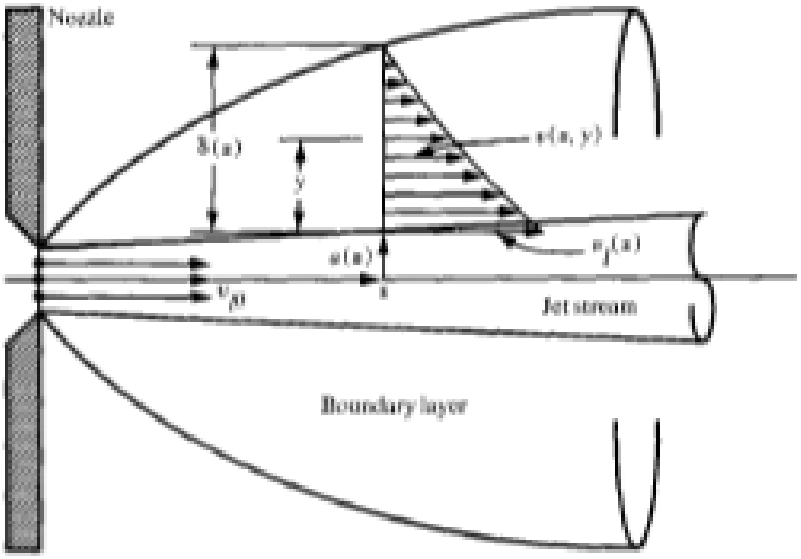


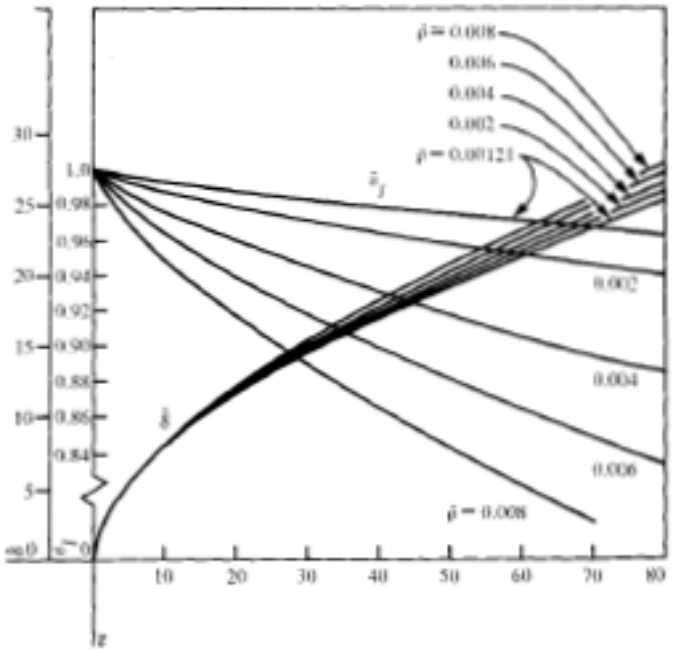
Influence of Magnetic Field and Gravity to Jet Trajectory

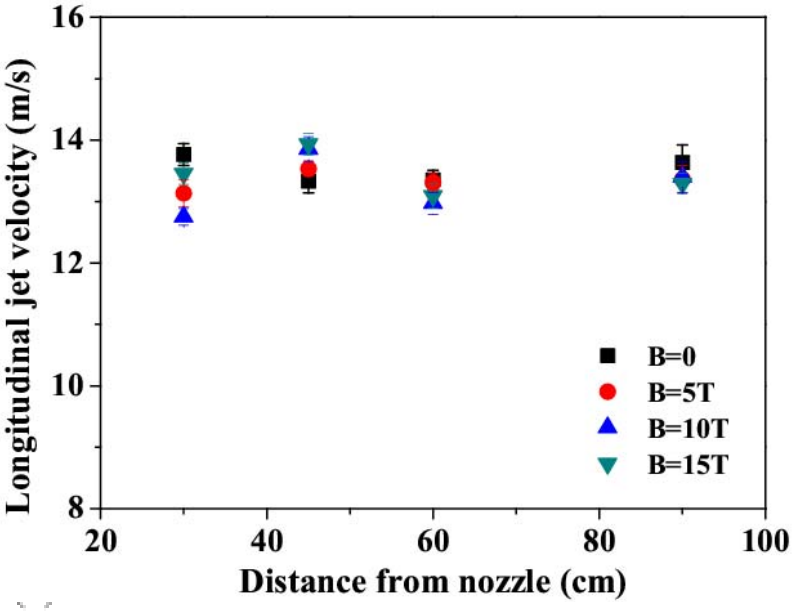


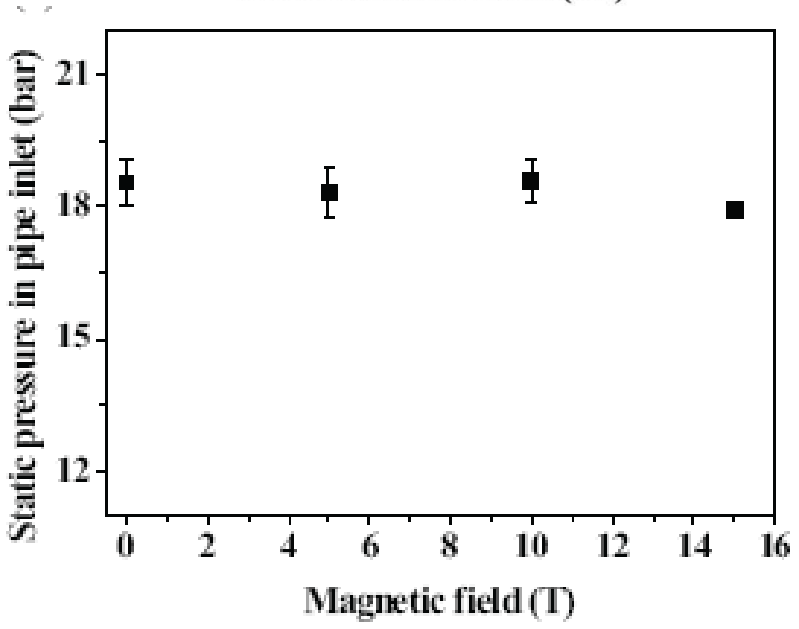
Longitudinal Hg Jet Stream Velocity along Distance from Nozzle

Boundary layer induced by a jet emerging from a nozzle



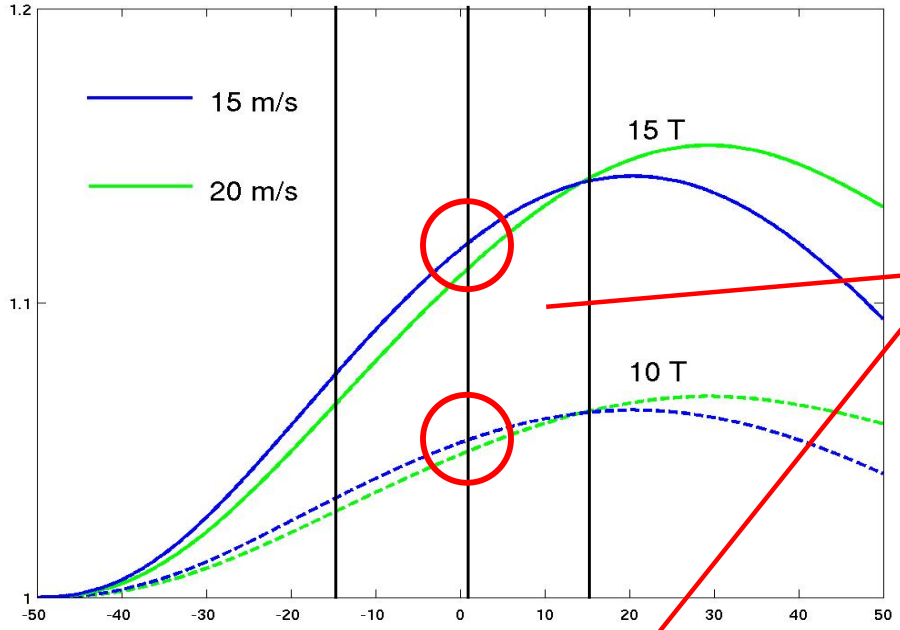


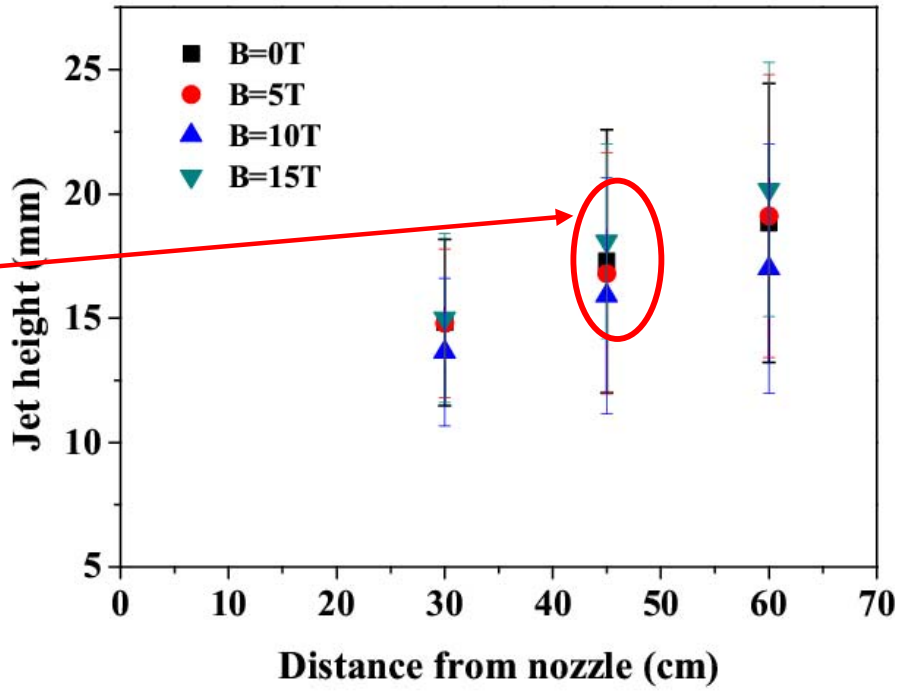


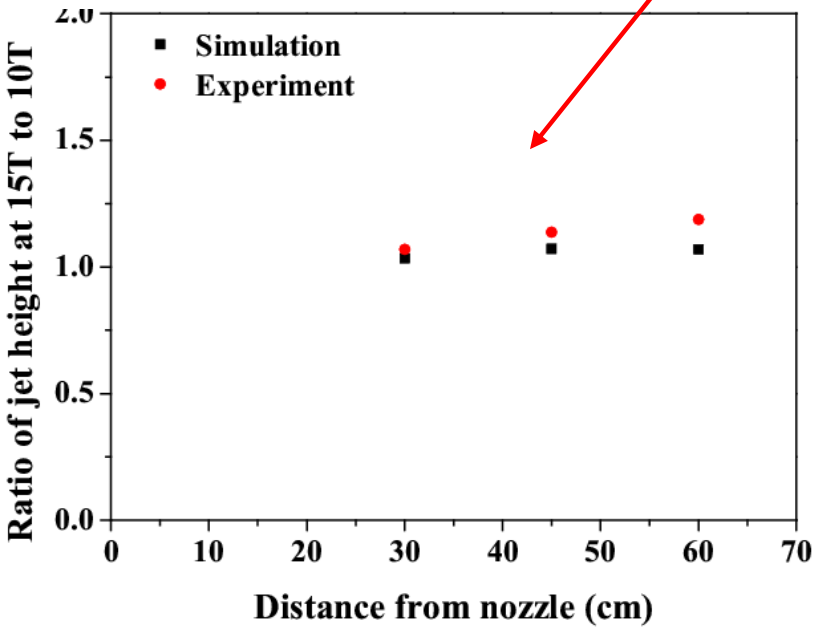


Hg Jet Height vs. Magnetic Field and Distance from Nozzle

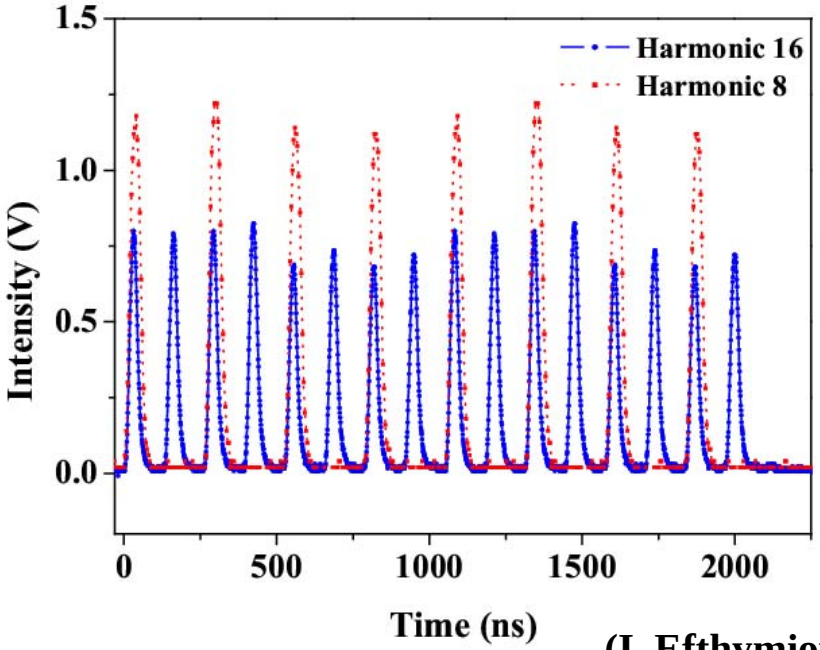
Jet distortion vp1 vp2 vp3 (R. Samulyak, 2008)



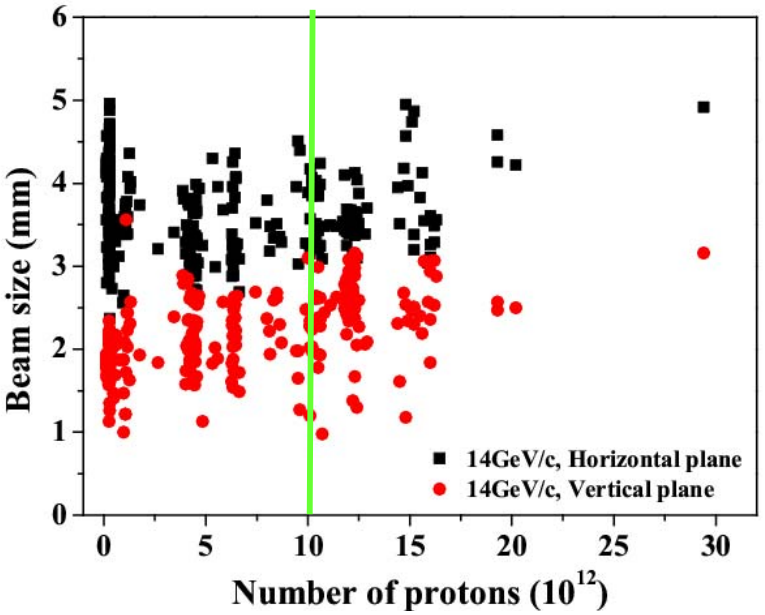




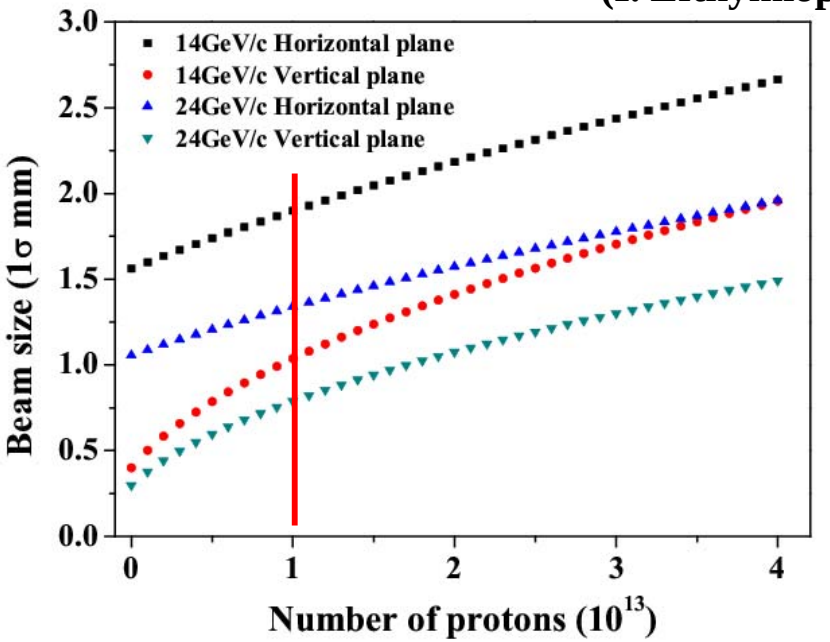
Beam Pulse Structure and Beam Size from Optics and Camera



(G. Skoro, 2008)



(I. Efthymiopoulos, 2008)



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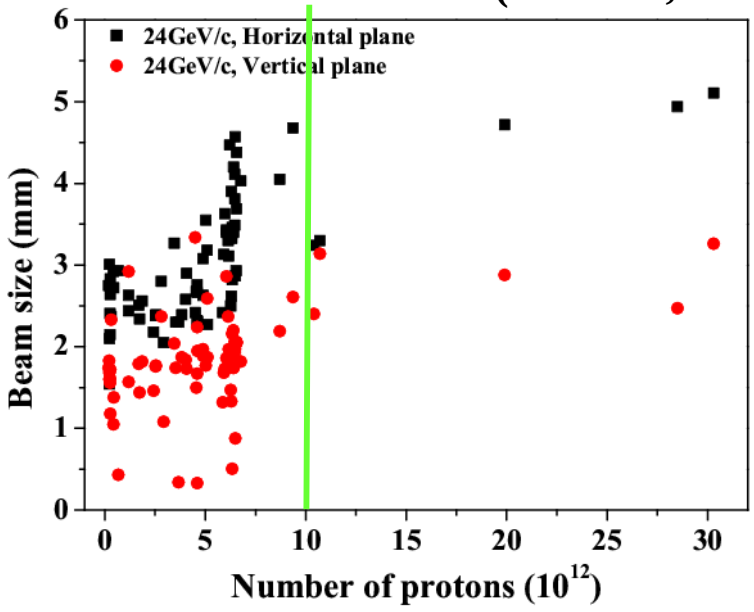
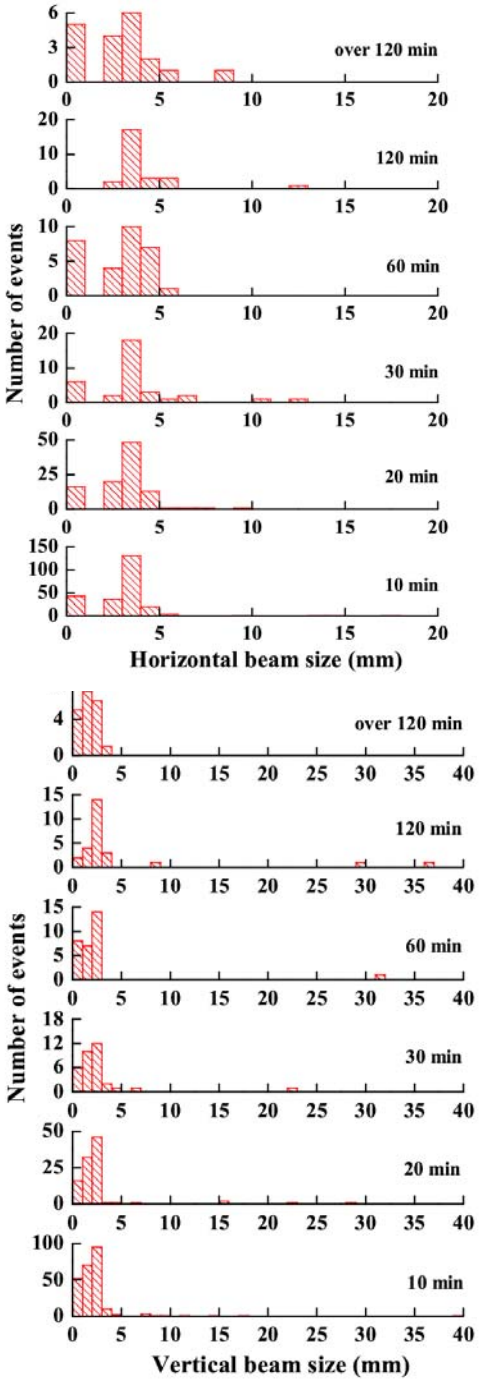


Beam Size from Camera Monitor As a Function of Measured Time



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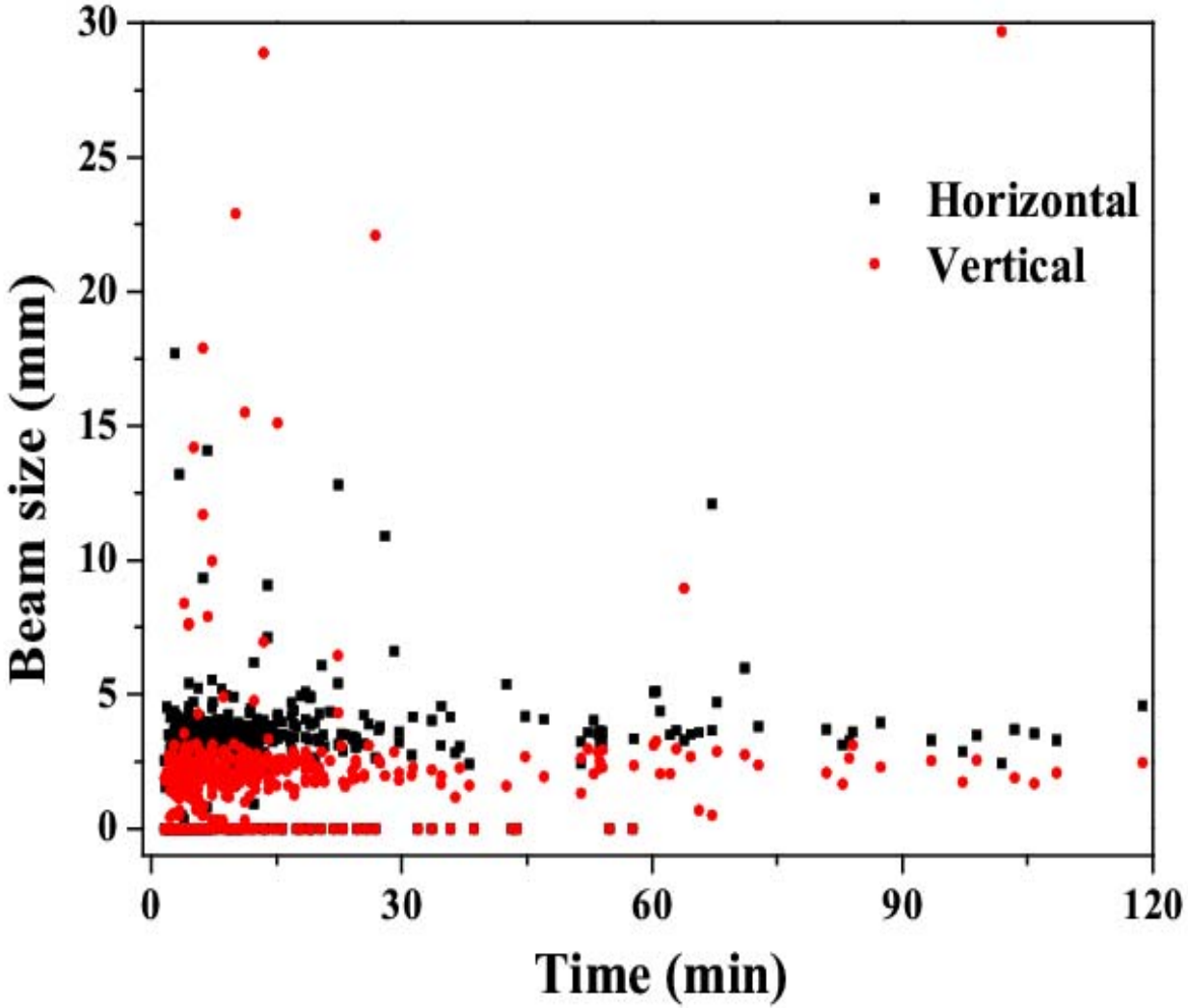
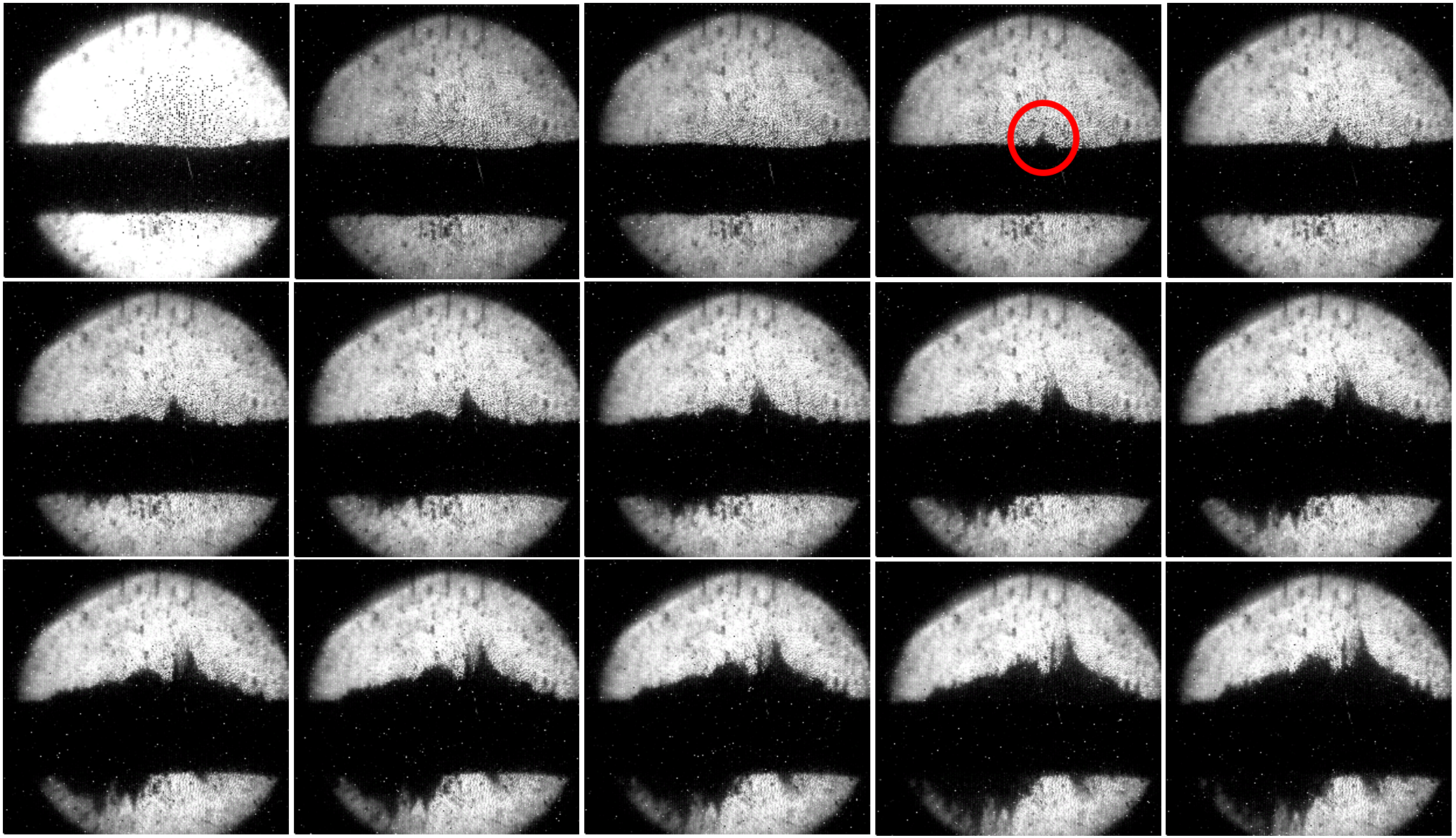
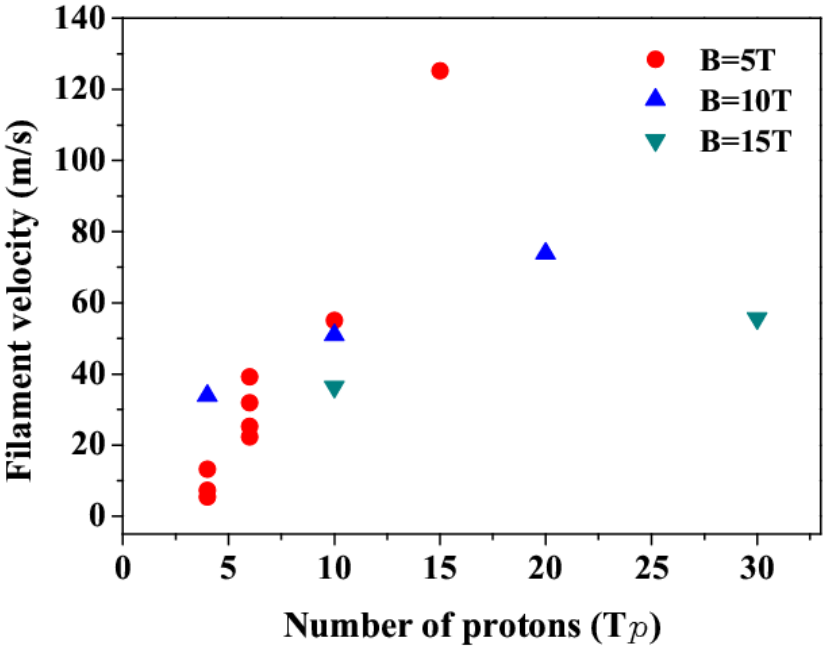
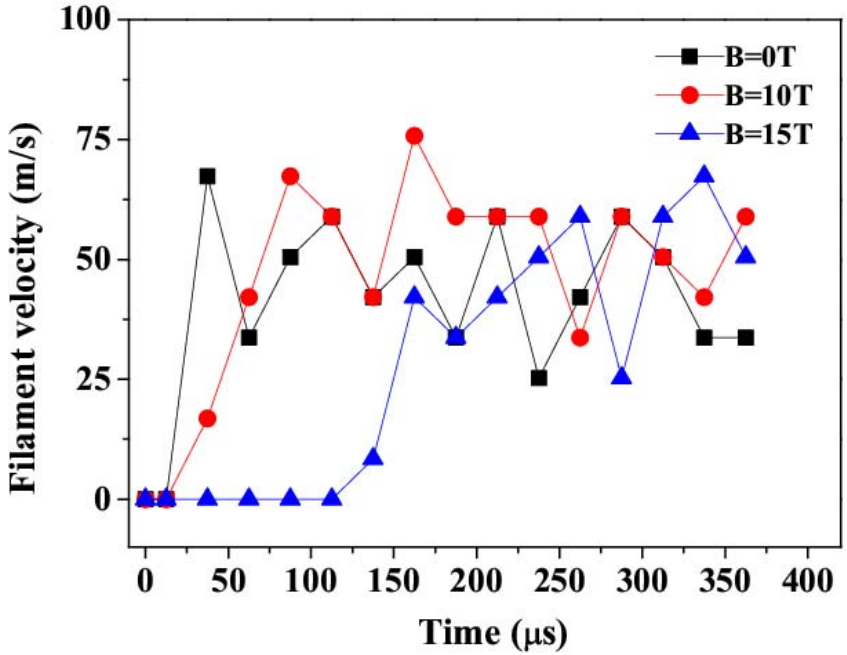


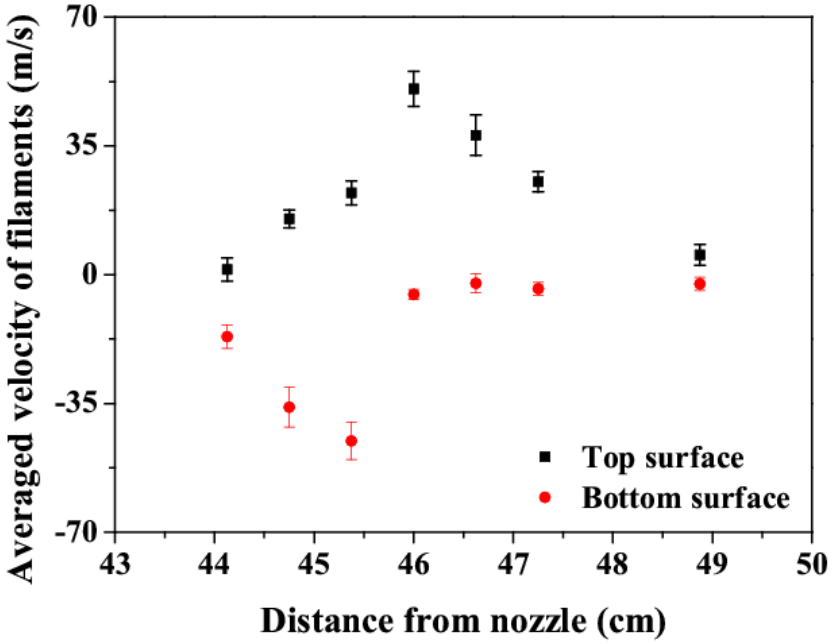
Investigation of Hg Jet Interacting with 24GeV 10Tp Beam in 10T Field

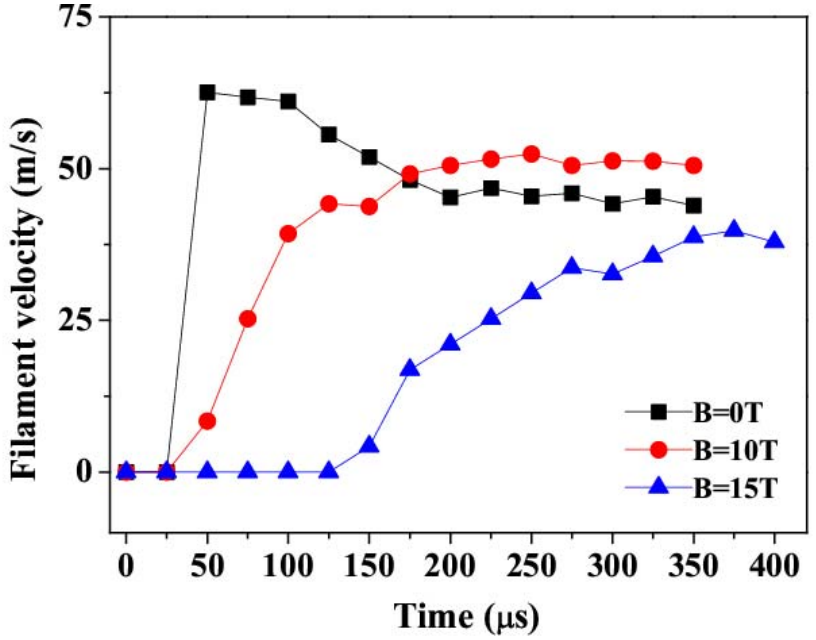


Velocity Distribution at Hg Jet Surface

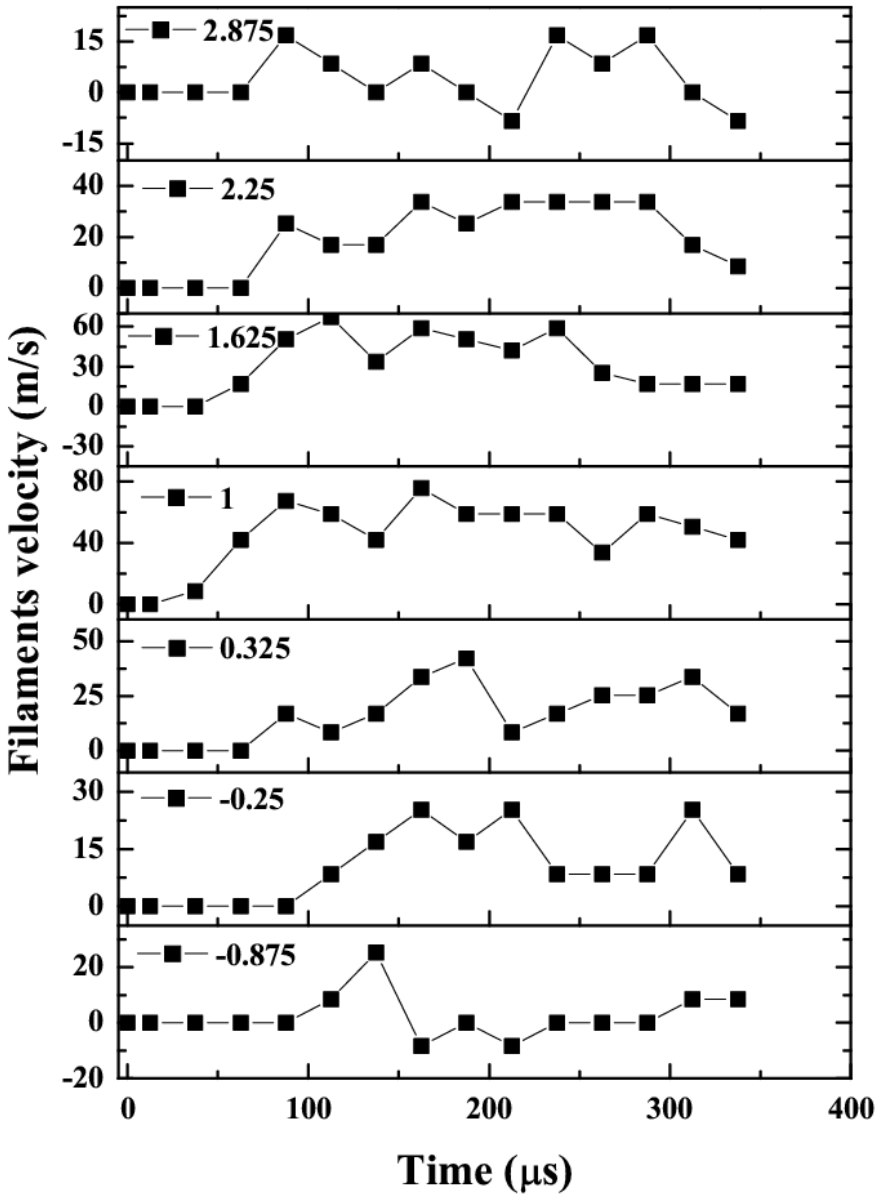


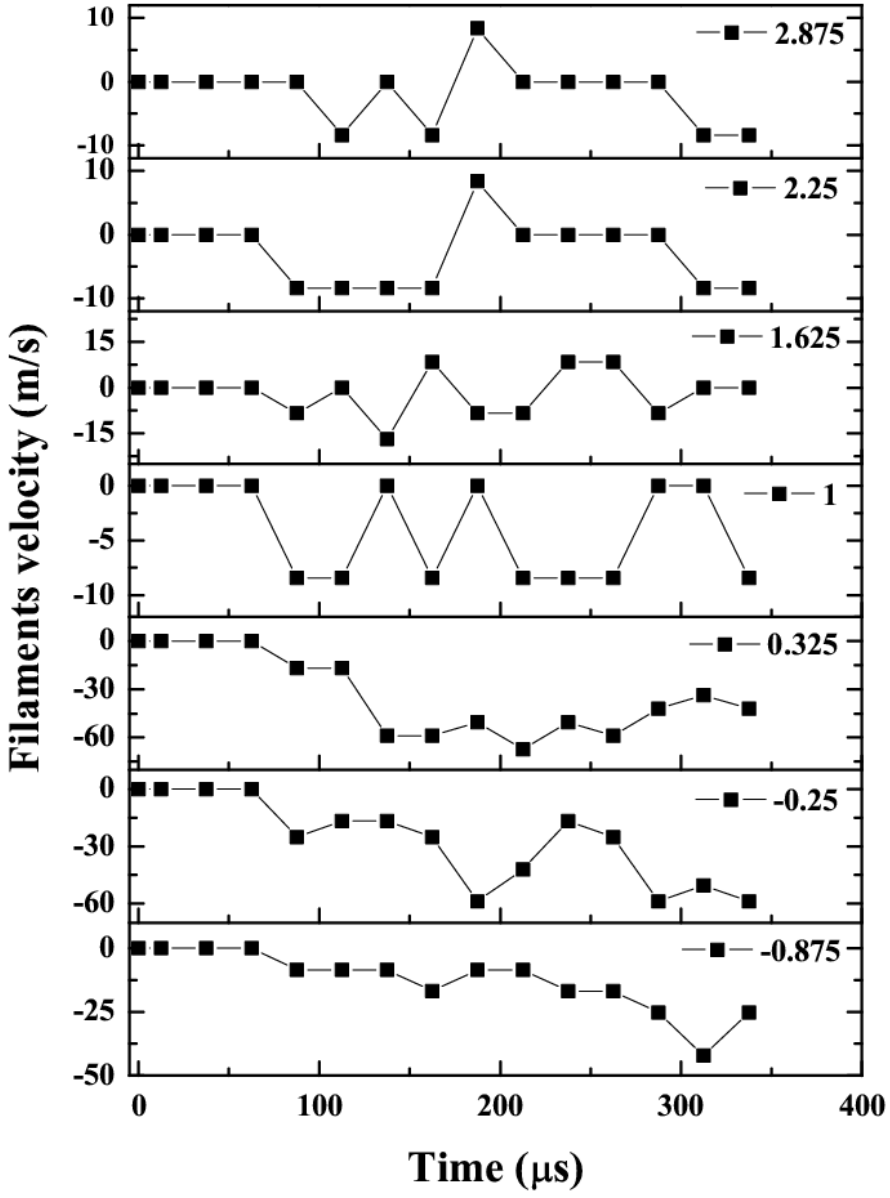






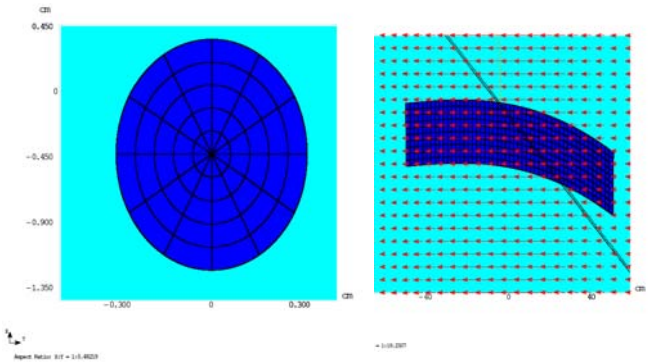
Time Response of Velocity at Hg Jet Surface

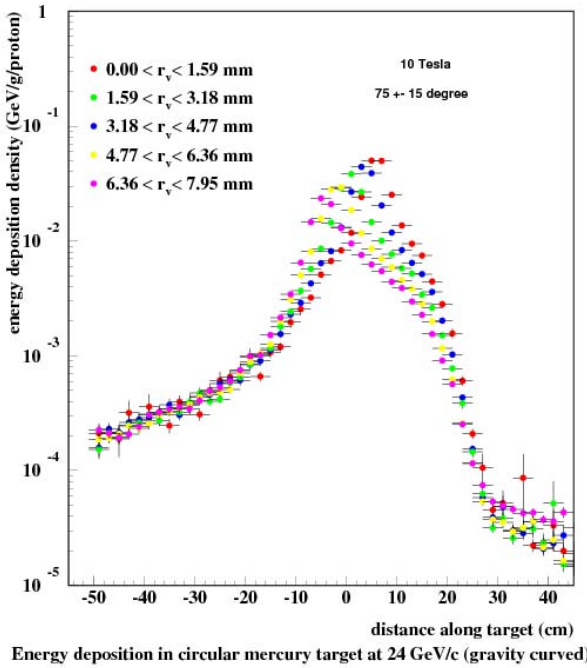




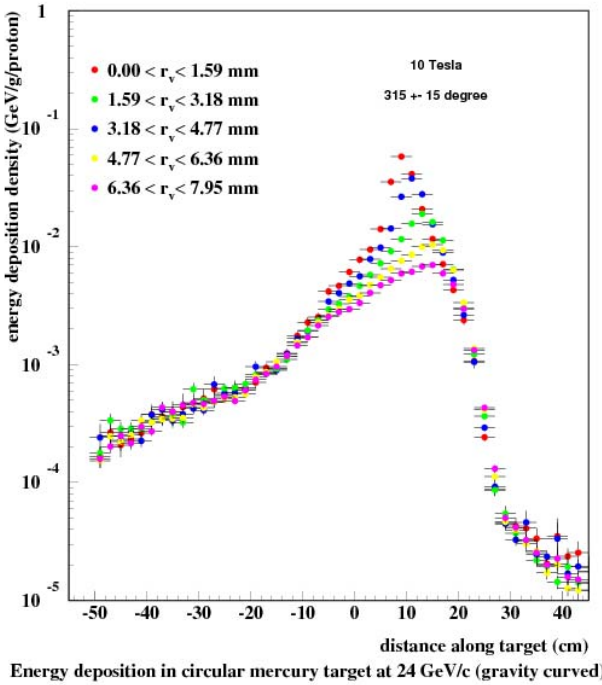
Energy Deposition to Hg Jet Target, Circular Curved Jet

(S. Striganov, 2008)





Energy deposition in circular mercury target at 24 GeV/c (gravity curved)



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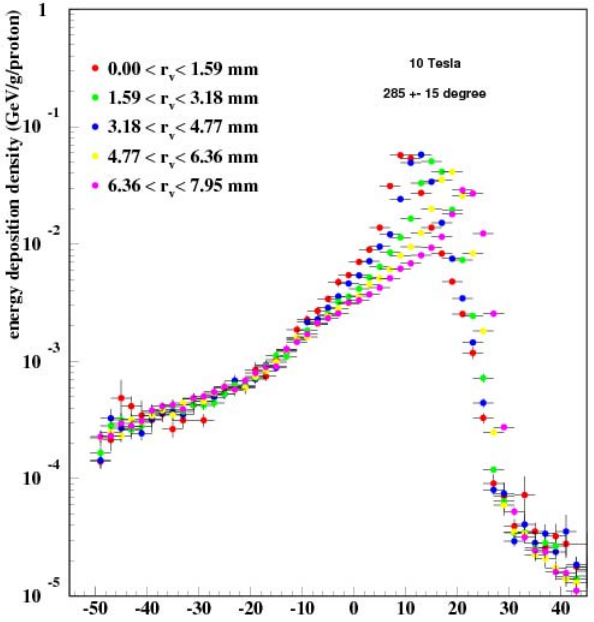

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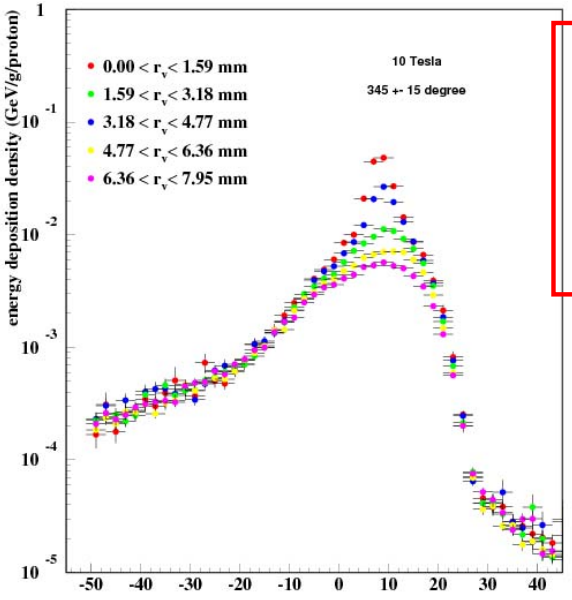

Energy deposition in circular mercury target at 24 GeV/c (gravity curved)

Max. energy deposition = 0.058 GeV/g/proton (92.8 J/g @ 10Tp)
@ z=9cm, r=-0.159cm, phi=315 degree.
Total energy deposition = 1.13 GeV/proton (1.8kJ @ 10 Tp)

radius=0.795 cm, density = 5.32g/cm^3

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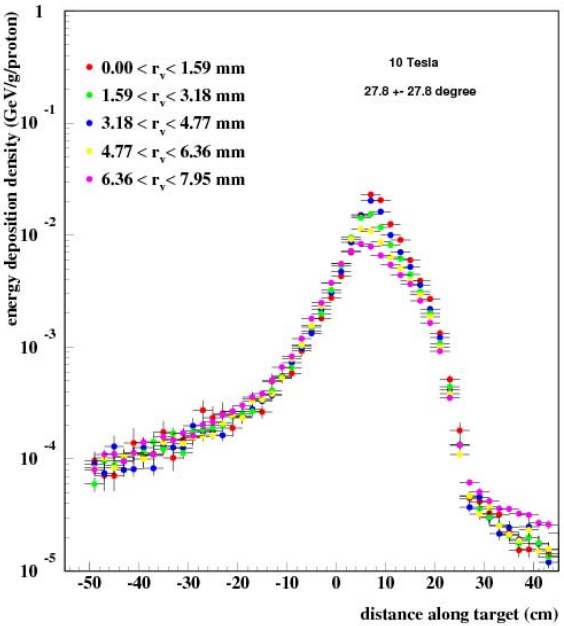
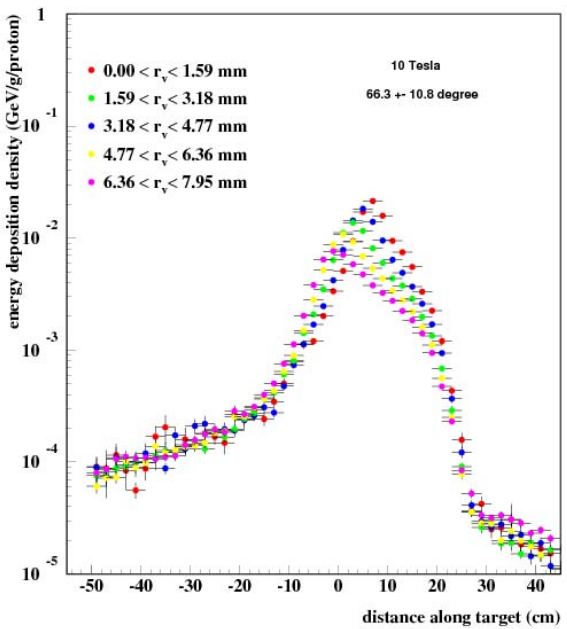


Energy deposition in elliptical mercury target at 24 GeV/c (gravity curved)



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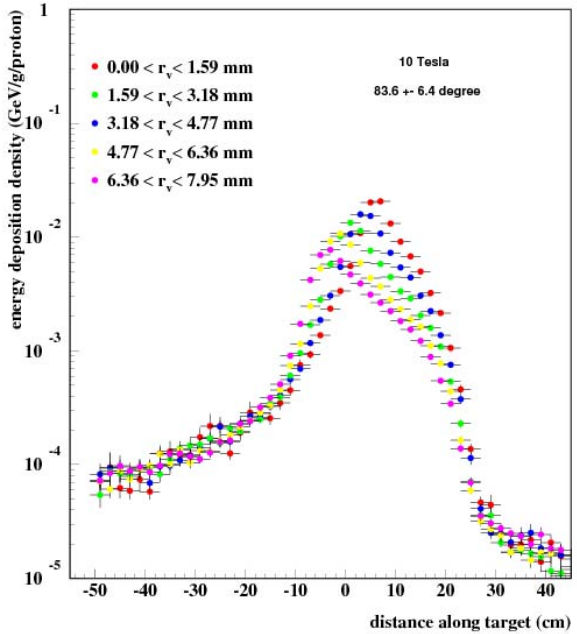

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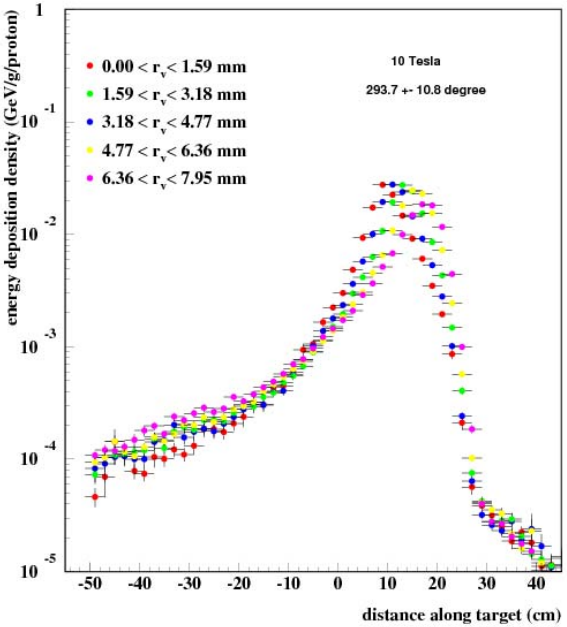

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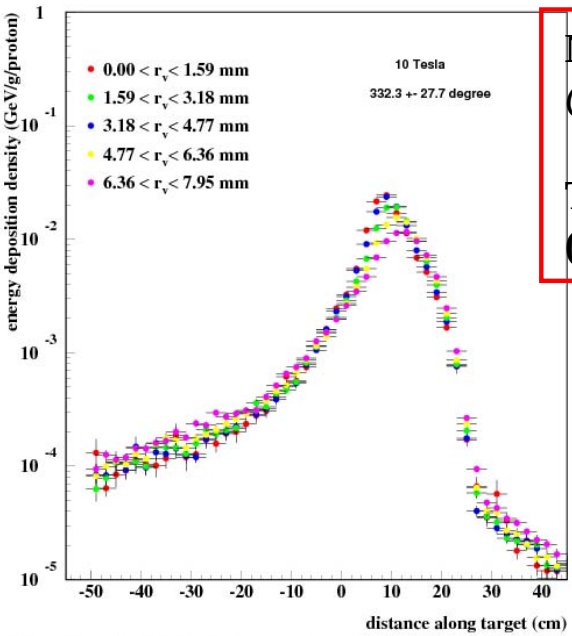

Energy deposition in elliptical mercury target at 24 GeV/c (gravity curved)

Max. energy deposition = 0.0398 GeV/g/proton @ z=19cm (63.7 J/g @ 10Tp), r=0.557cm, phi=263.6 degree.
Total energy deposition = 2.18 GeV/proton (3.5 kJ @ 10 Tp)

radius_vert=0.795 cm,
radius_horiz=0.315cm,
density = 13.54g/cm^3

Energy Deposition to Hg Jet Target, Circular Straight Jet

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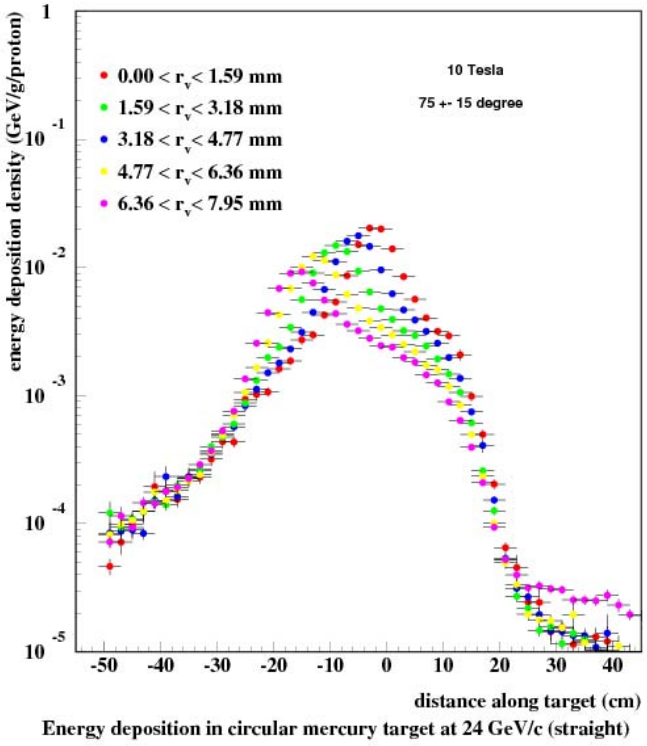
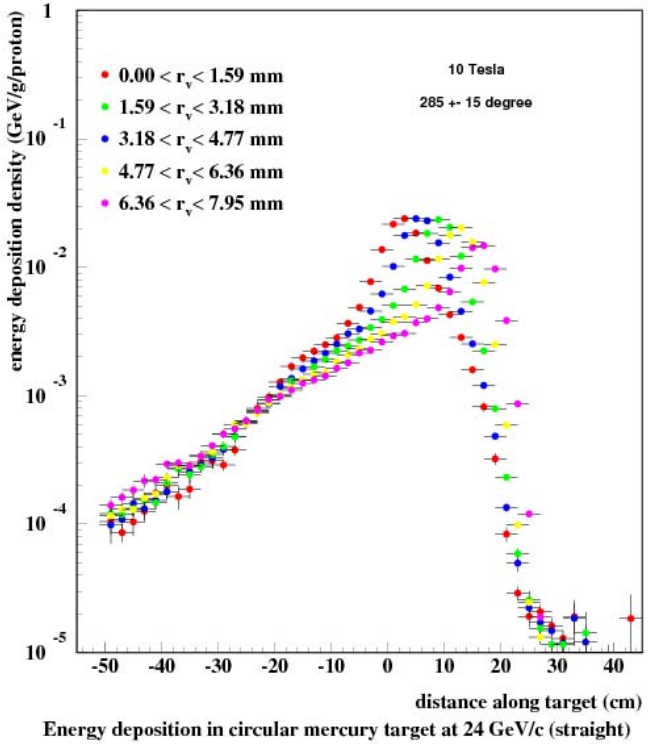


Energy deposition in circular mercury target at 24 GeV/c (straight)



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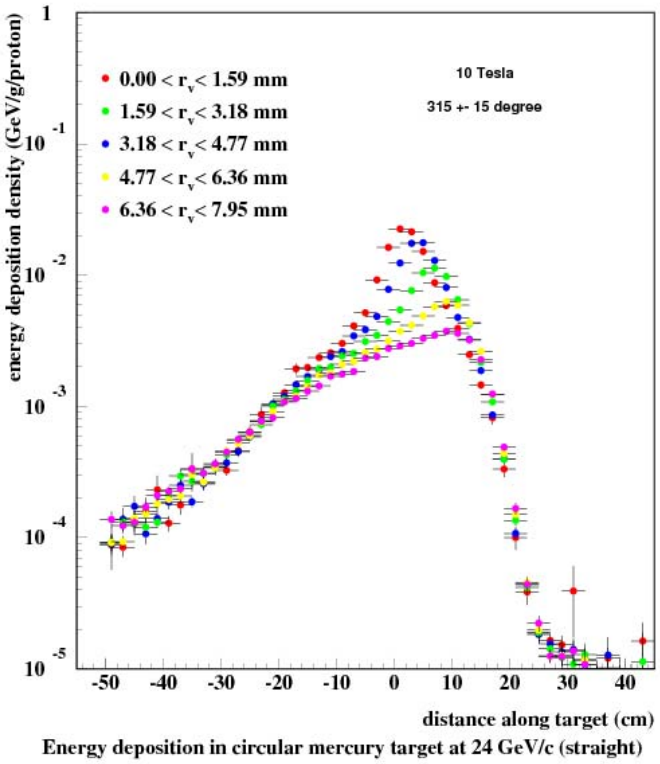


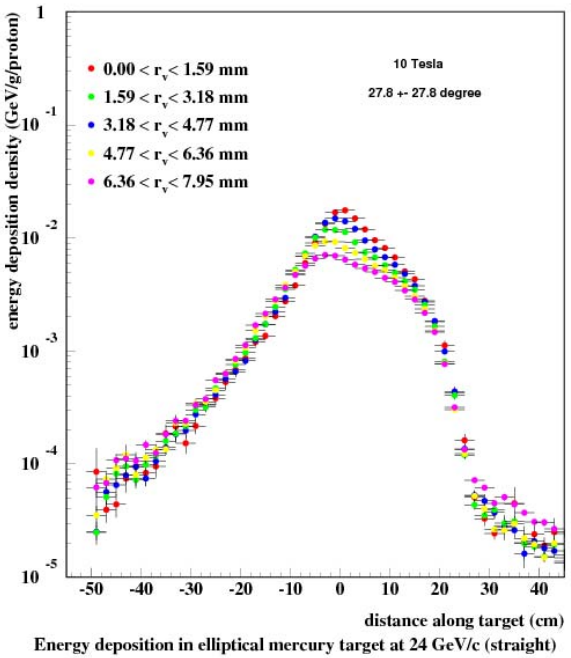
Energy deposition in circular mercury target at 24 GeV/c (straight)

Max. energy deposition = 0.0239 GeV/g/proton @ z=3cm (38.2 J/g @ 10 Tp), r=-0.159cm, phi=285 degree.
Total energy deposition = 1.07 GeV/proton (1.71 kJ @ 10 Tp)

radius=0.795 cm, density = 5.32g/cm^3

Energy Deposition to Hg Jet Target, Elliptical Straight Jet

(S. Striganov, 2008)



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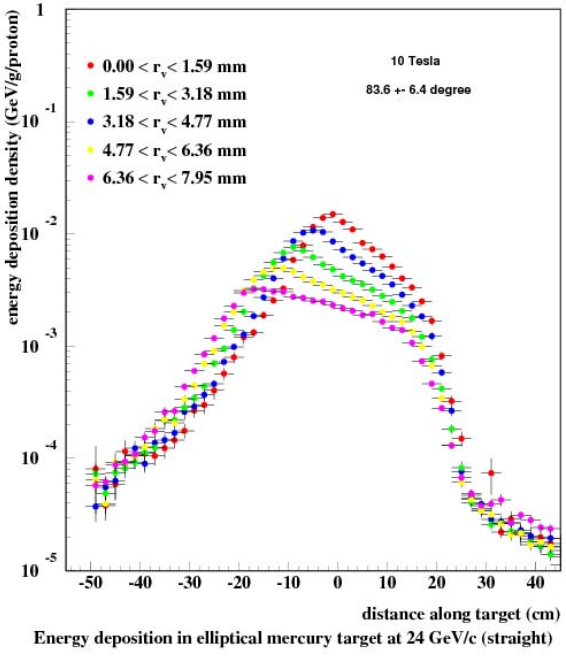

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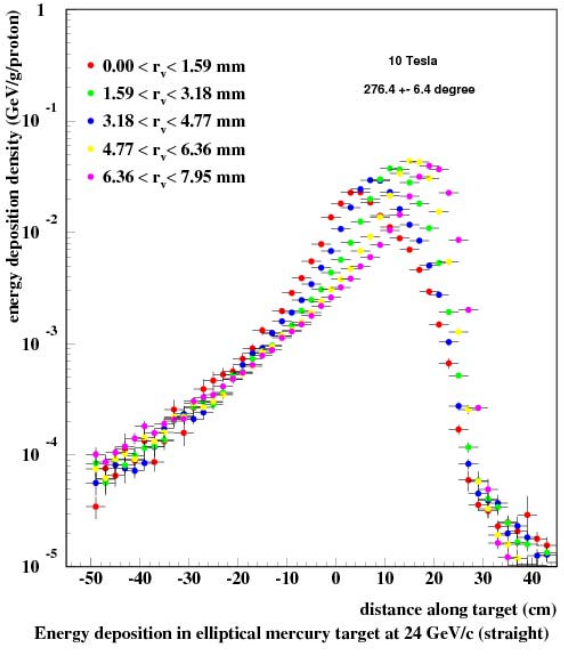

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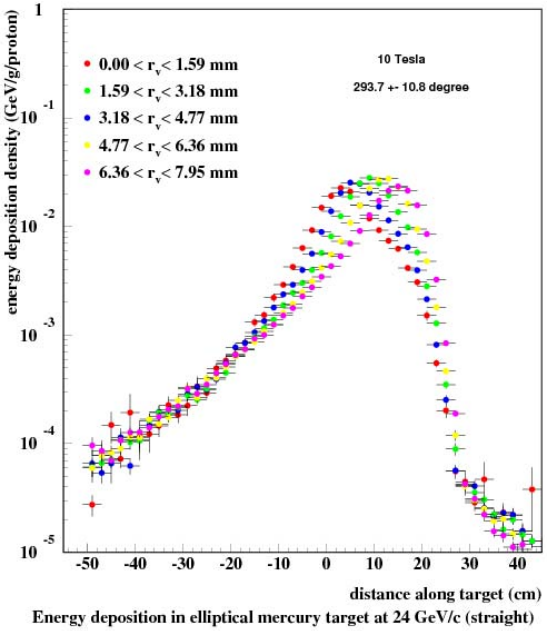

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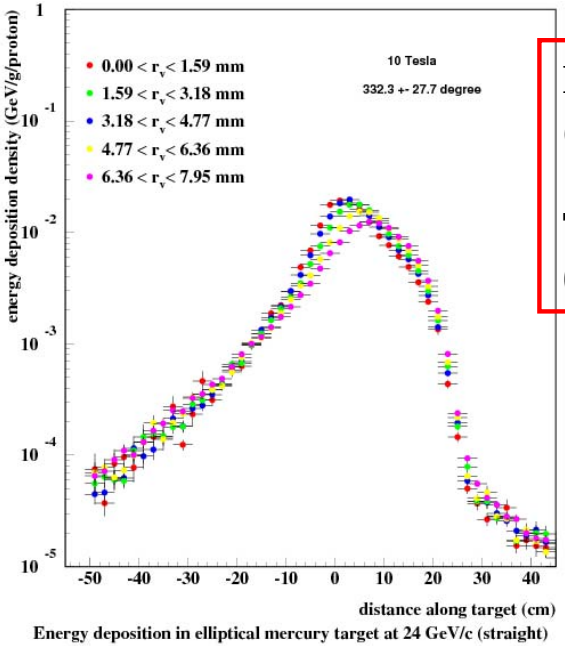

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Max. energy deposition = 0.045 GeV/g/proton @ z=15cm (72 J/g @ 10 Tp), r=0.557cm, phi=263.6 degree.
Total energy deposition = 2.37 GeV/proton (3.79 kJ @ 10 Tp)

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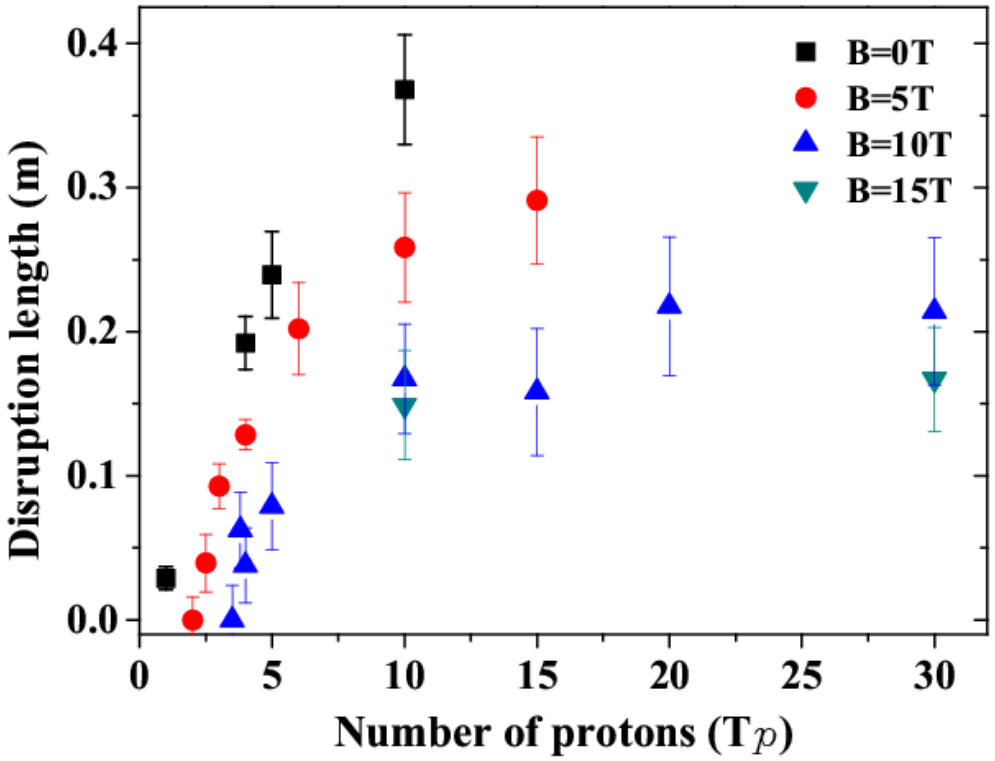
Extent of Disruption Length of Hg Jet Target



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Circular Curved Jet

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Conclusions and Future Work

1. **Hg jet behavior in B Field was investigated experimentally.**

2. **Beam size and length was investigated but needs to interpret the difference of results between optics and camera monitor.**

3. **Based on the observed data, the calculation of energy deposition to Hg jet was calculated with elliptical jet and circular jet, which will be an input to the calculation of Hg jet response to the interaction of proton beam.**

4. **Filaments velocity of Hg jet in 10T field with an interaction of 10Tp beam needs to be simulated and compared with the measured value.**

5. **Jet model needs to be discussed and established based on the comparison between post-simlation results and exmerimental results.**