Optical Diagnostic Results of MERIT Experiment at CERN

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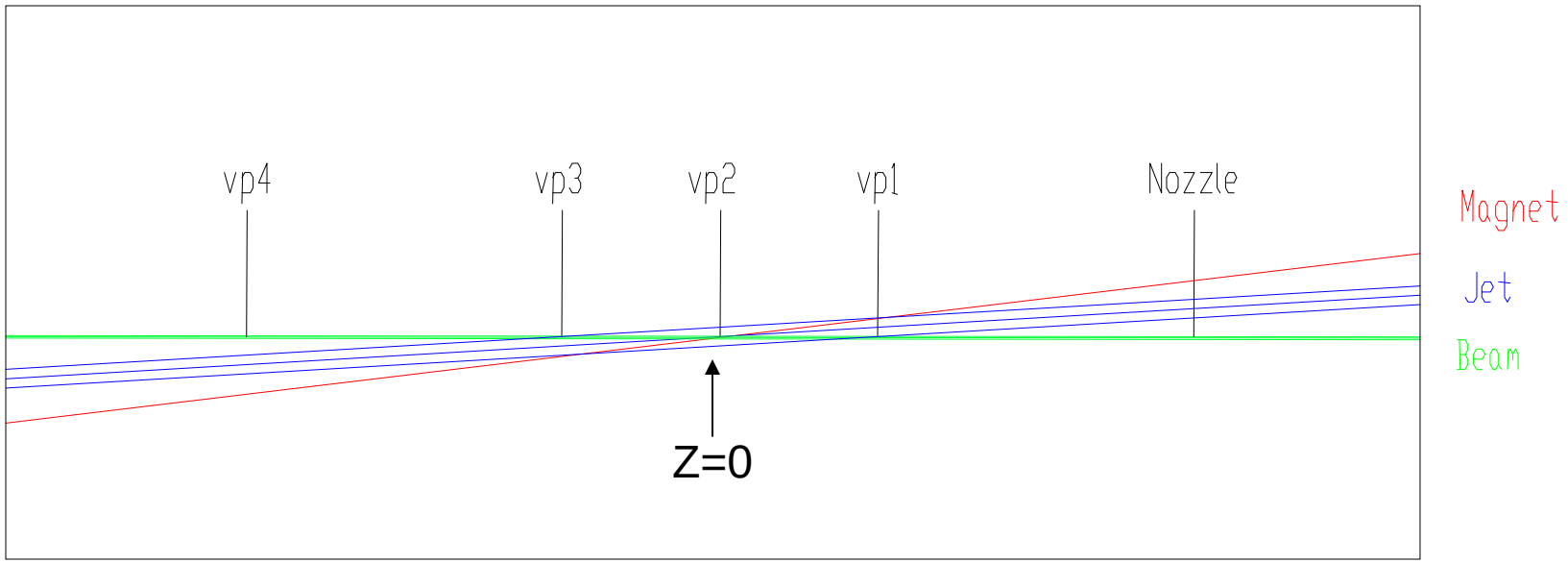
Optics Configuration with respect to Beam

Total 360 of beam shots performed.

Images for 260 beam shots are collected.

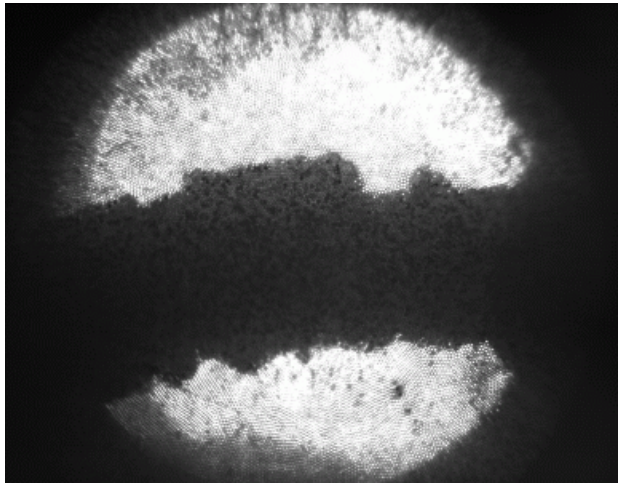
MERIT beam shot summary website,

http://www.hep.princeton.edu/~mcdonald/mumu/target/hkirk/MERIT_Beam_Program_110607.pdf

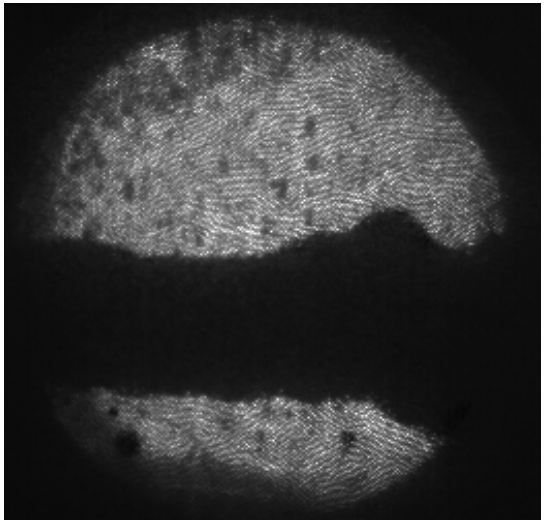


Observation : Interaction of Hg Jet with 14 GeV Beam, Animation

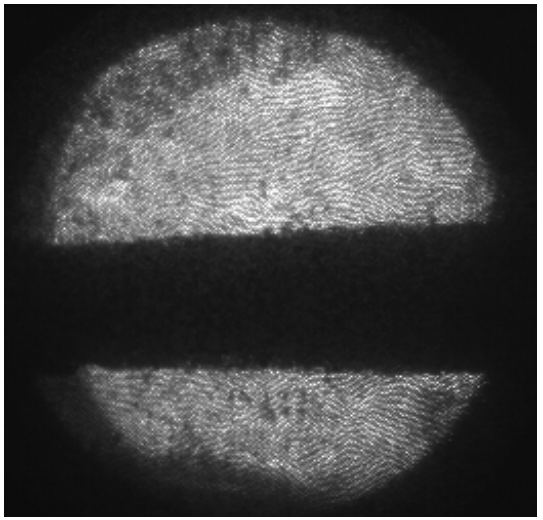
0T, 8TP



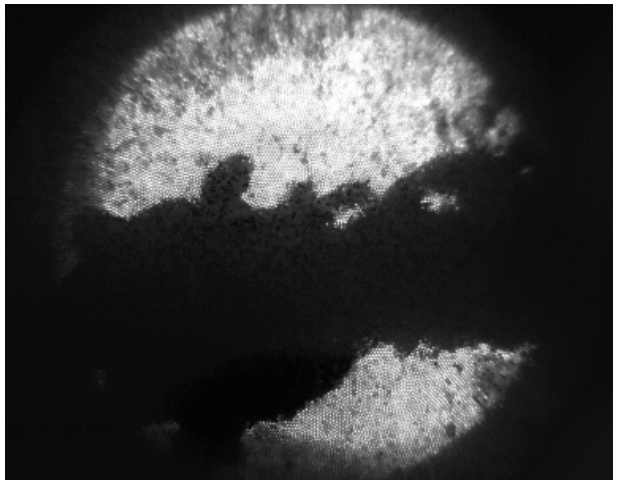
5T, 16TP



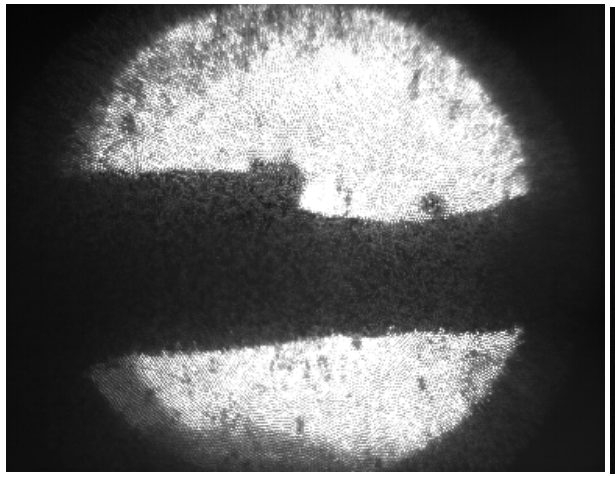
10T, 12TP



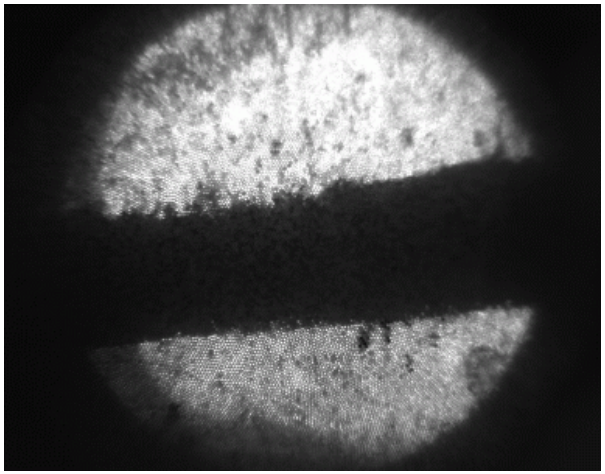
0T, 4TP



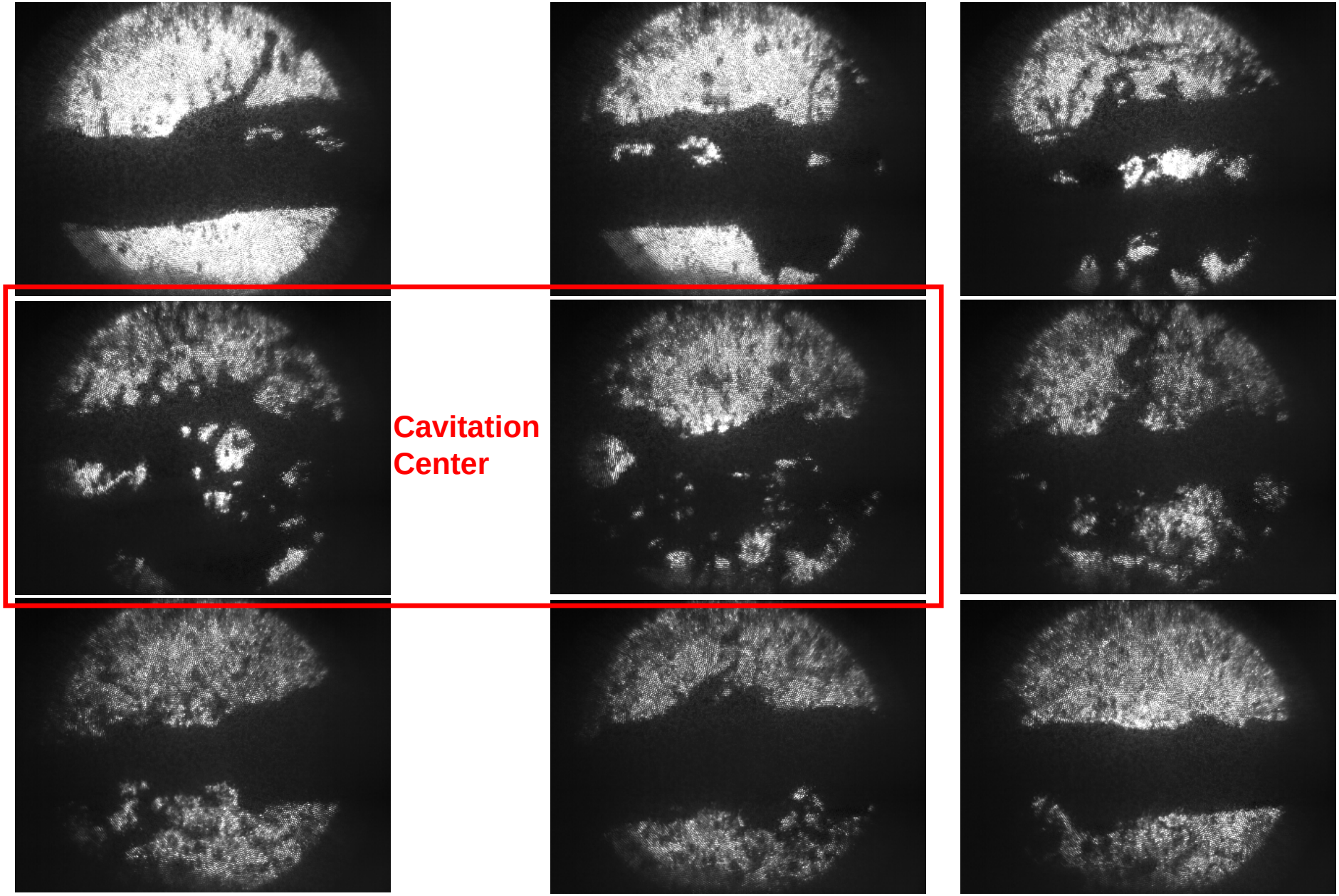
5T, 16TP



10T, 20TP

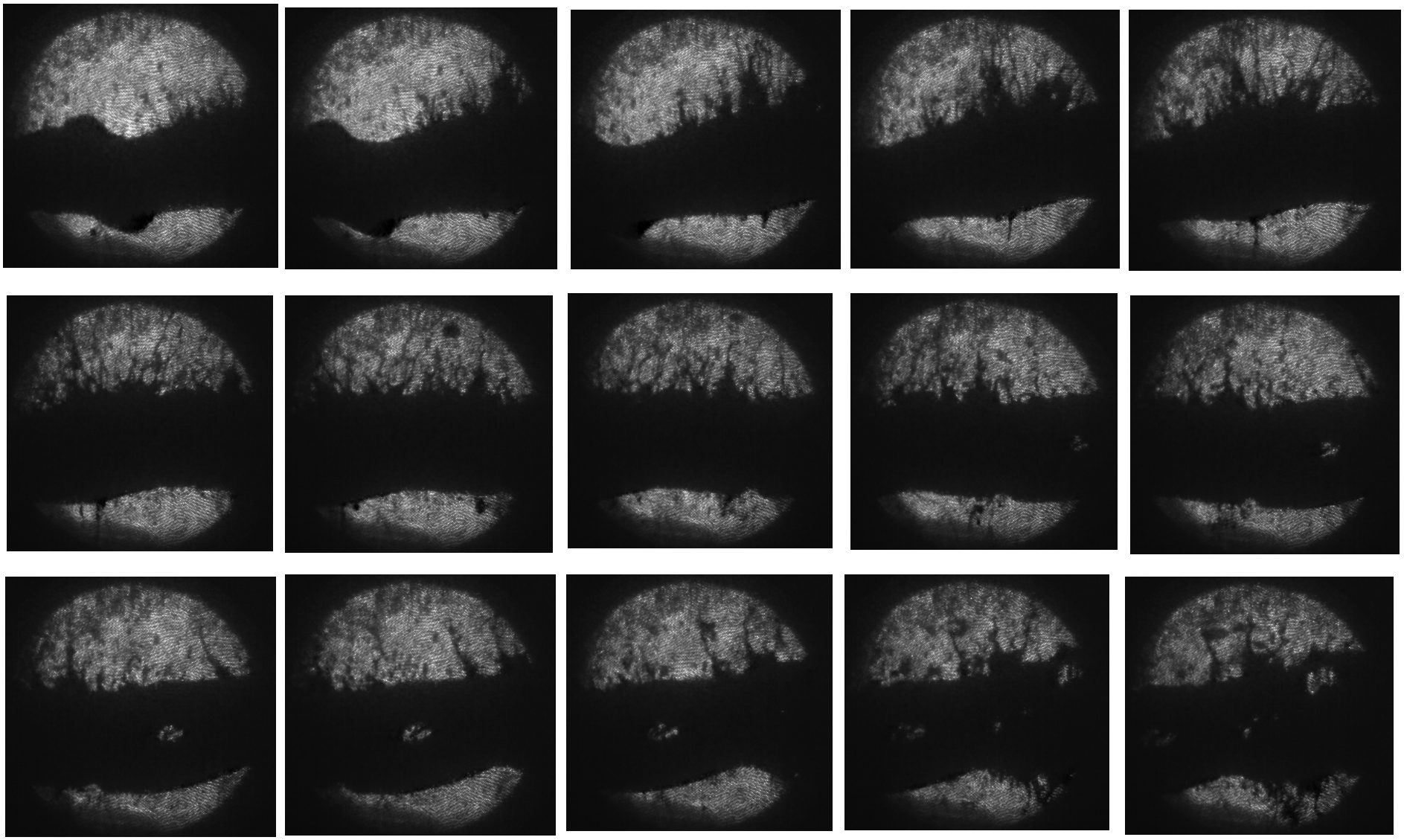


Cavitation Example 1 5T, 16TP, 14GeV



Cavitation Example 2 (1)

5T, 16TP, 14GeV



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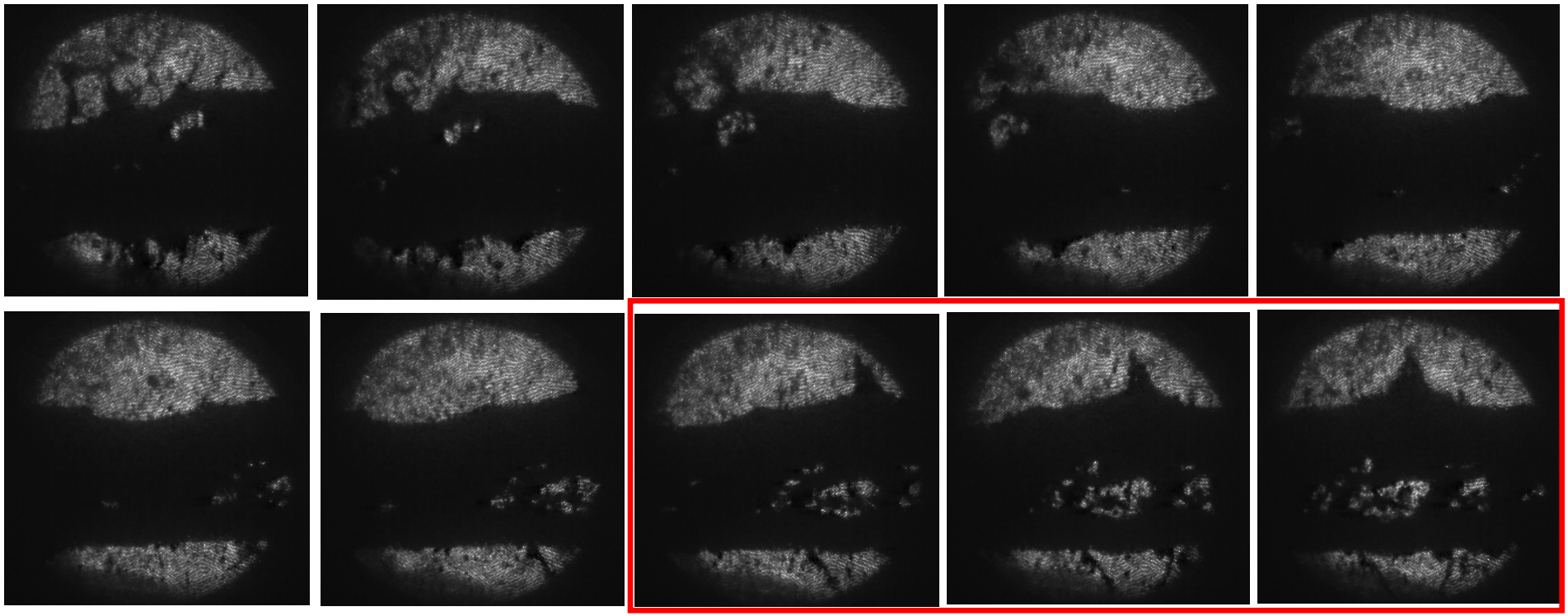
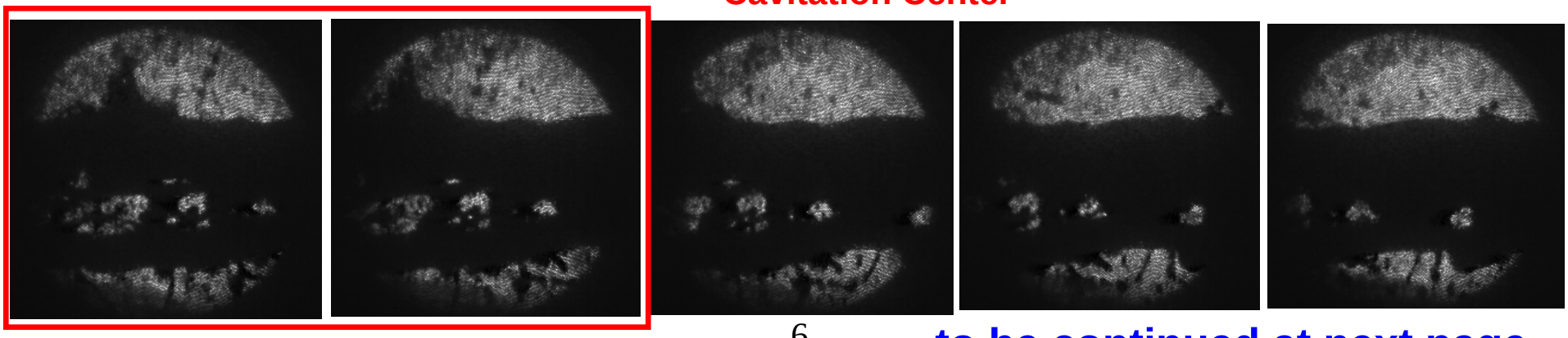
Cavitation Example 2 (2)



Cavitation Center



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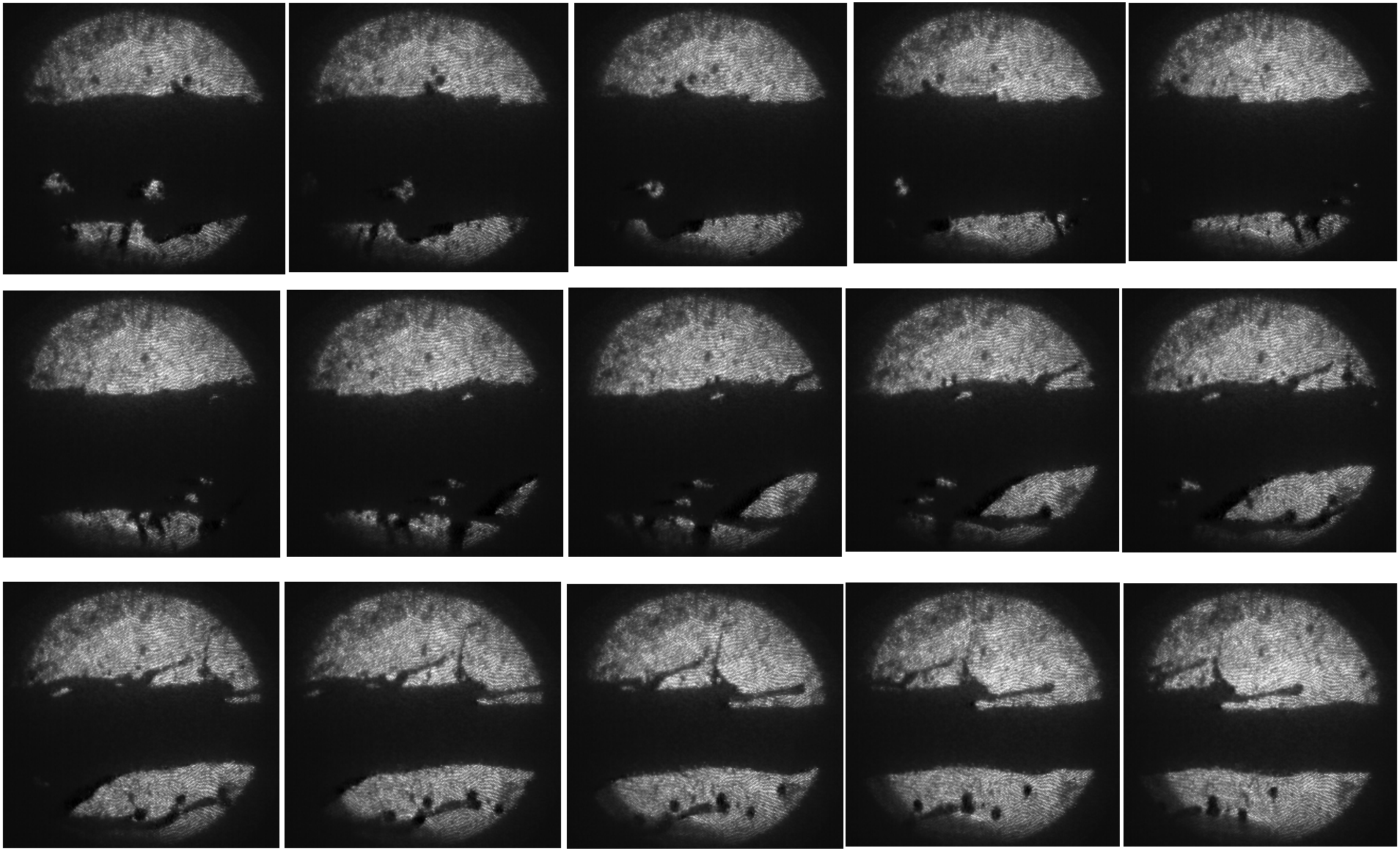
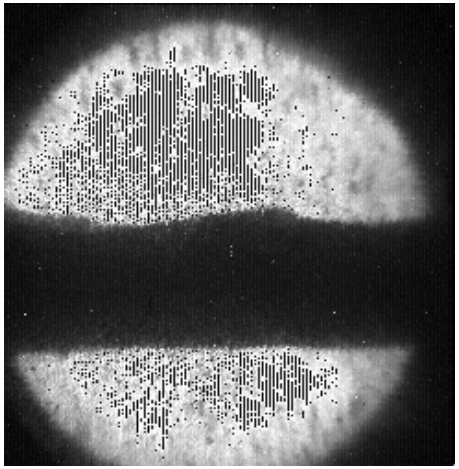
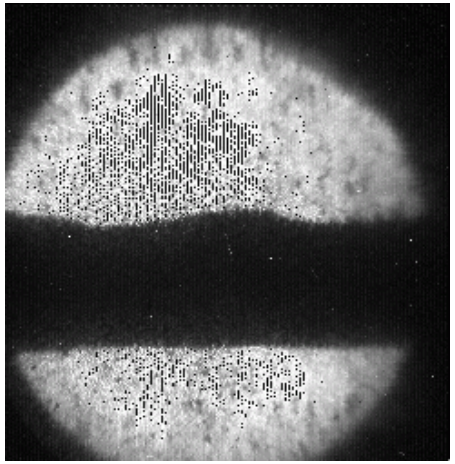
Cavitation Example 2 (3)

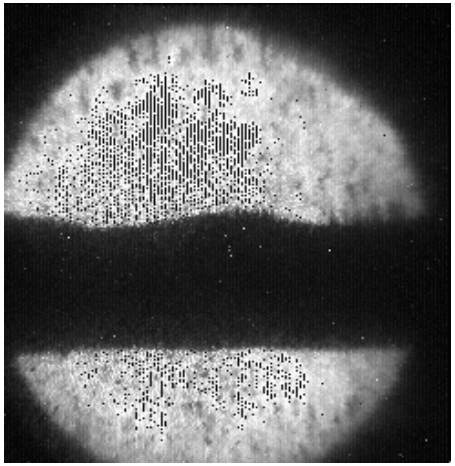


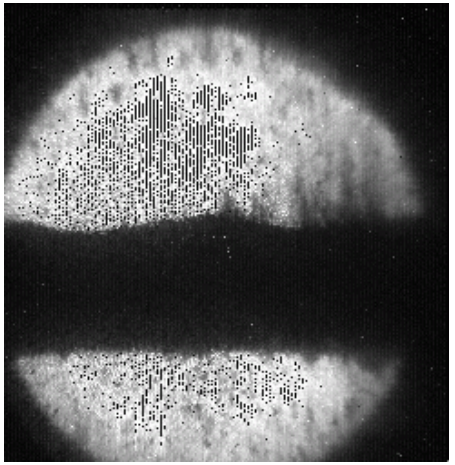
Observation : Velocity of Splash with Interaction of 24GeV Beam

3.8TP, 10T V = 24 m/s

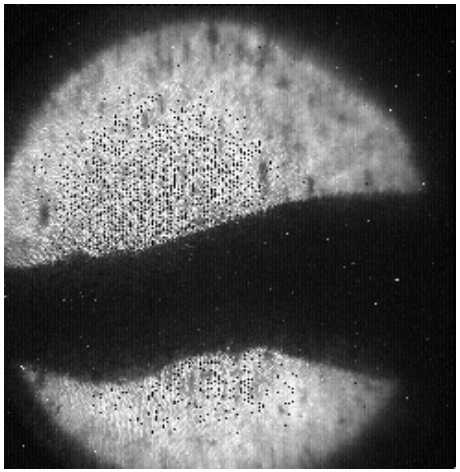

t=0

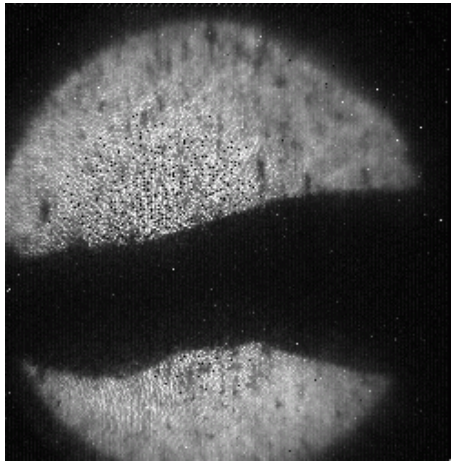

t=0.150 ms

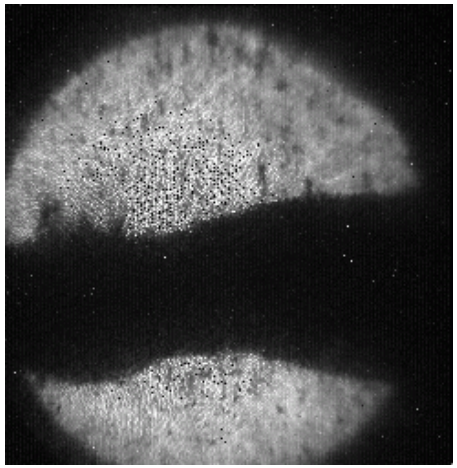

t=0.175 ms

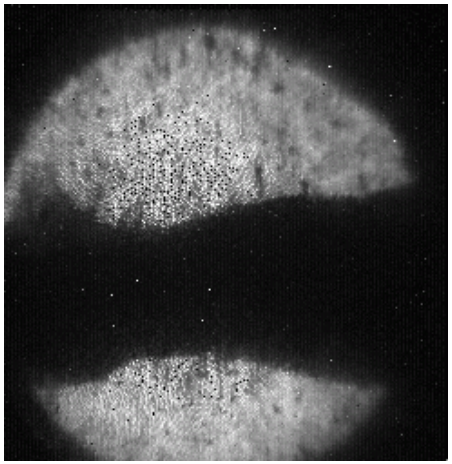

t=0.375 ms

6TP, 5T V = 47 m/s


t=0

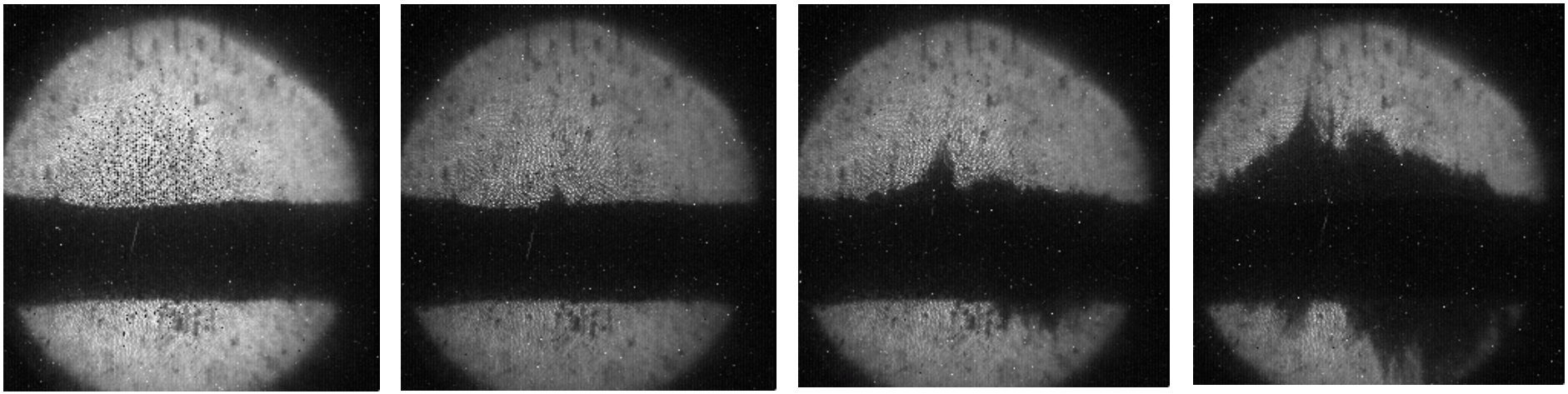

t=0.050 ms


t=0.175 ms


t=0.375 ms

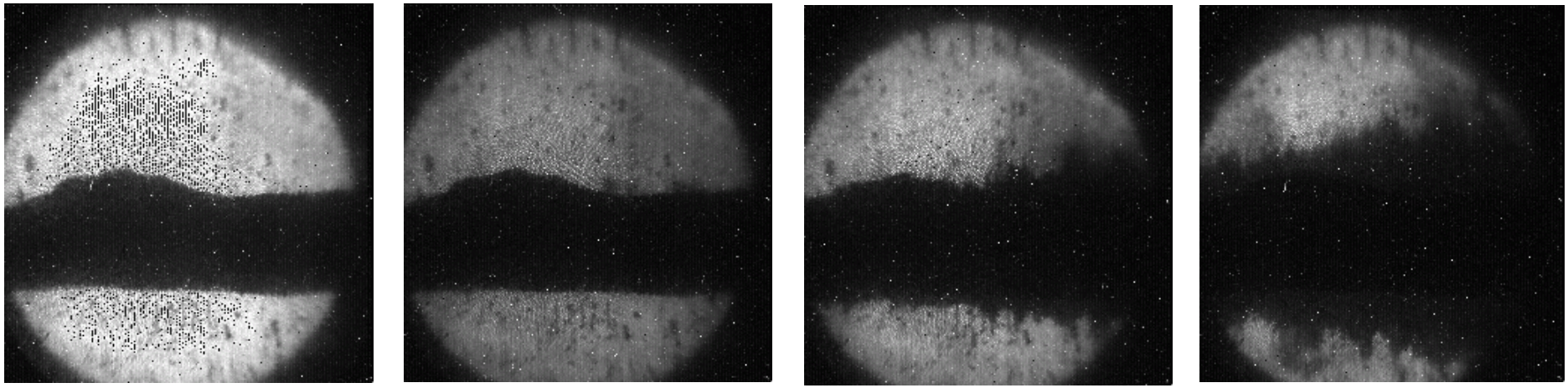
Observation : Velocity of Splash, with Interaction of 24GeV Beam

10TP, 10T V = 54 m/s



t=0 t=0.075 ms t=0.175 ms t=0.375 ms

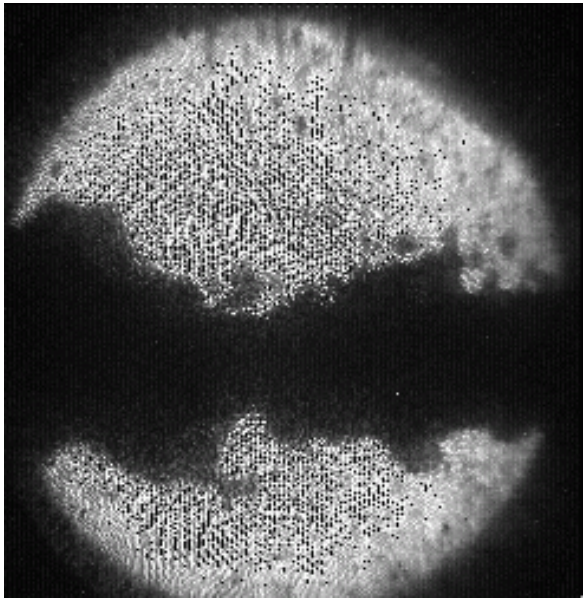
20TP, 10T V = 65 m/s



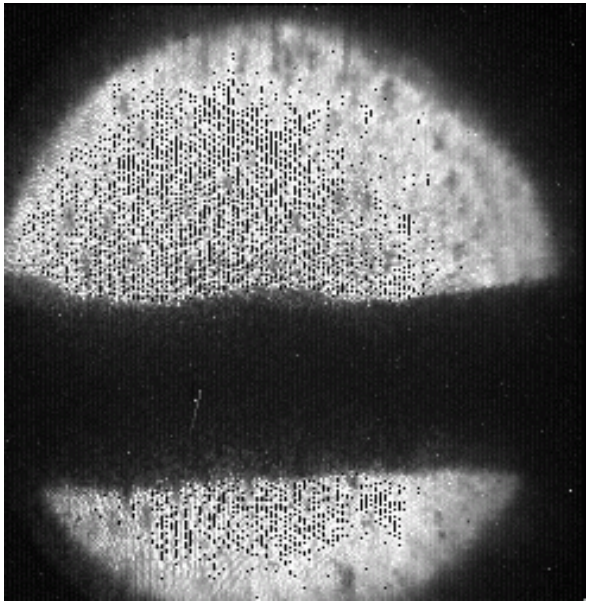
t=0 t=0.050 ms t=0.175 ms t=0.375 ms

Observation : Hg Jet Movement In Magnetic Field, V=15m/s

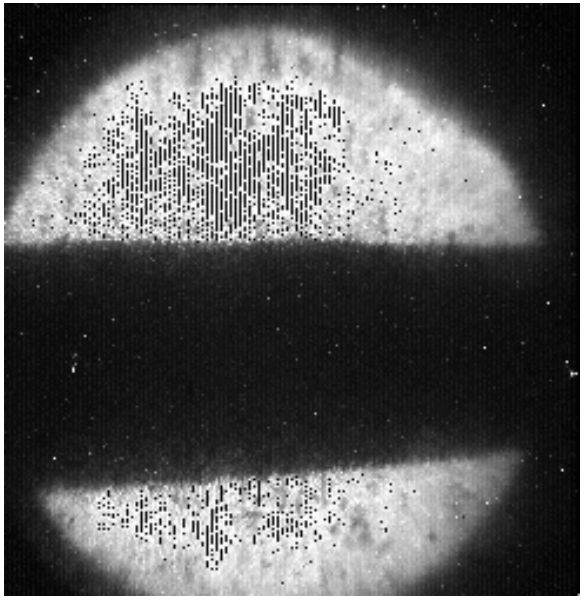
0.4T



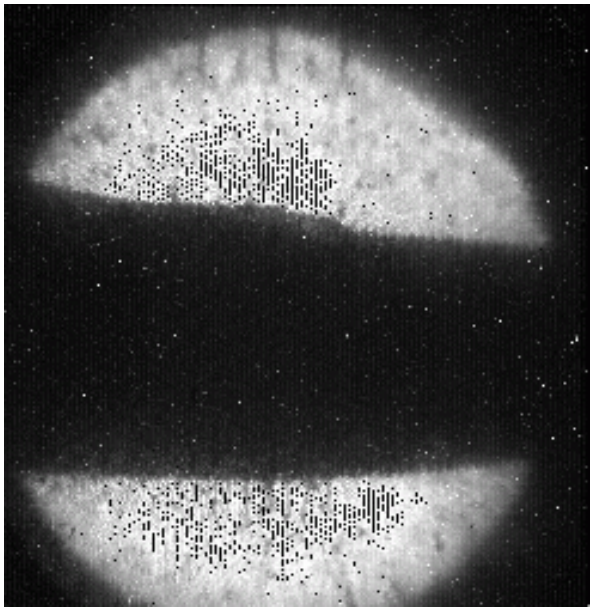
5T



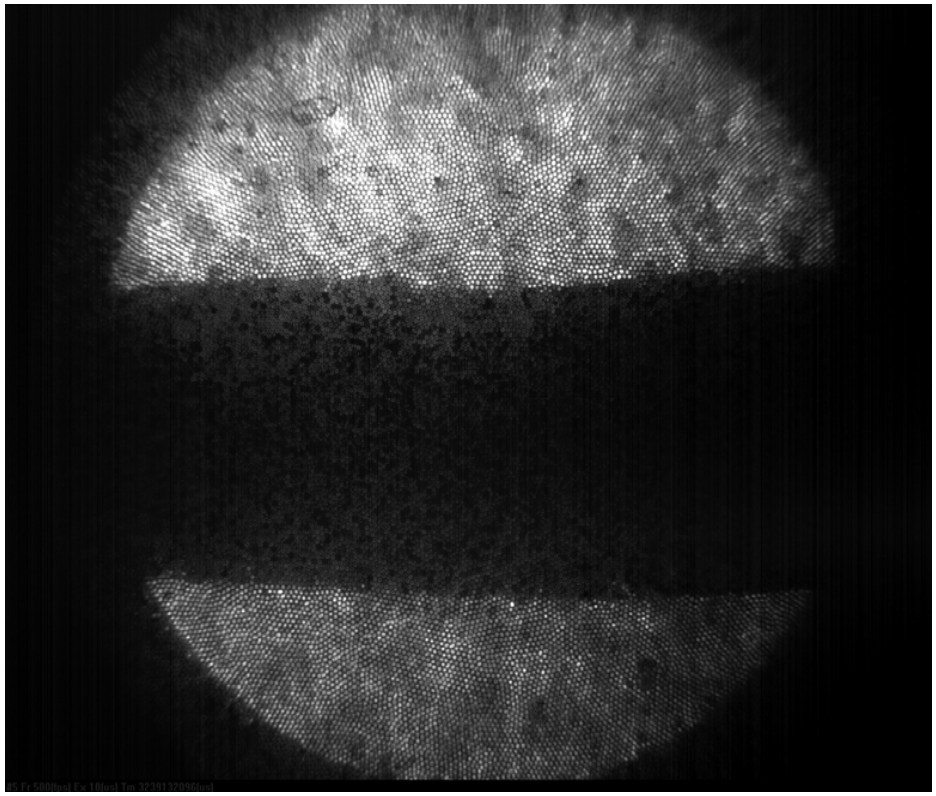
10T

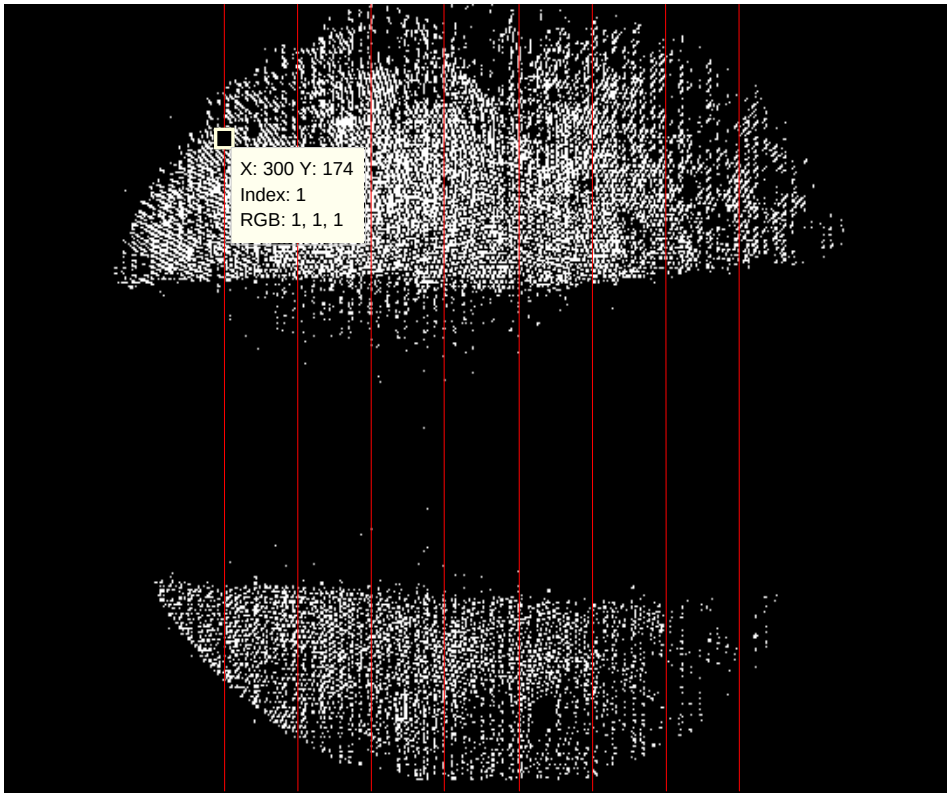


15T



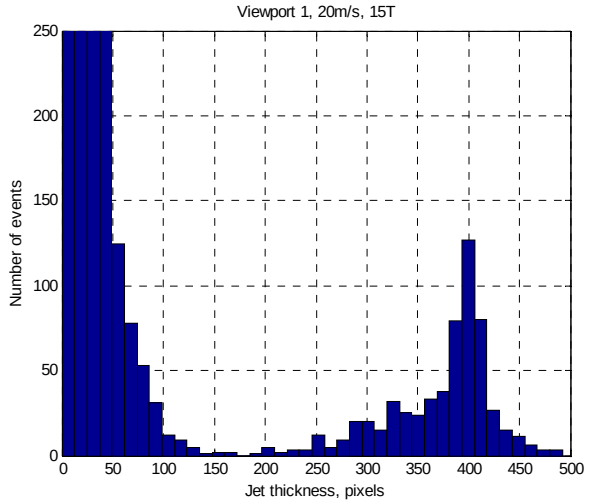
TIF Image Processing For Analysis

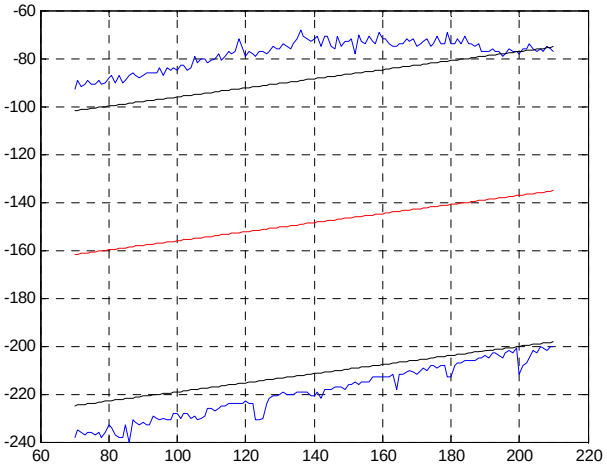


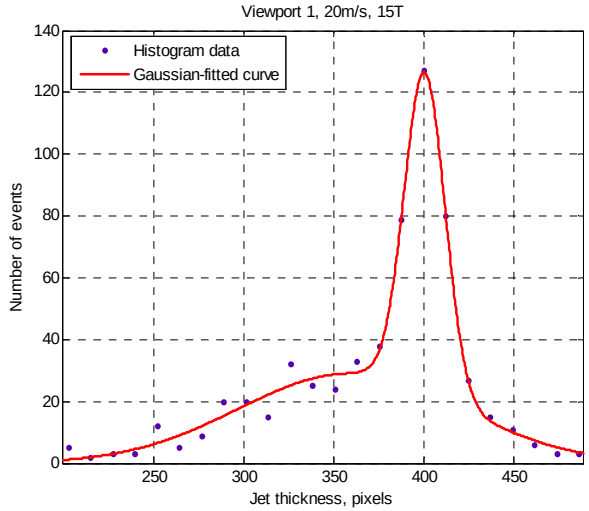


Jet Size Distribution and Gaussian Fitted Curve

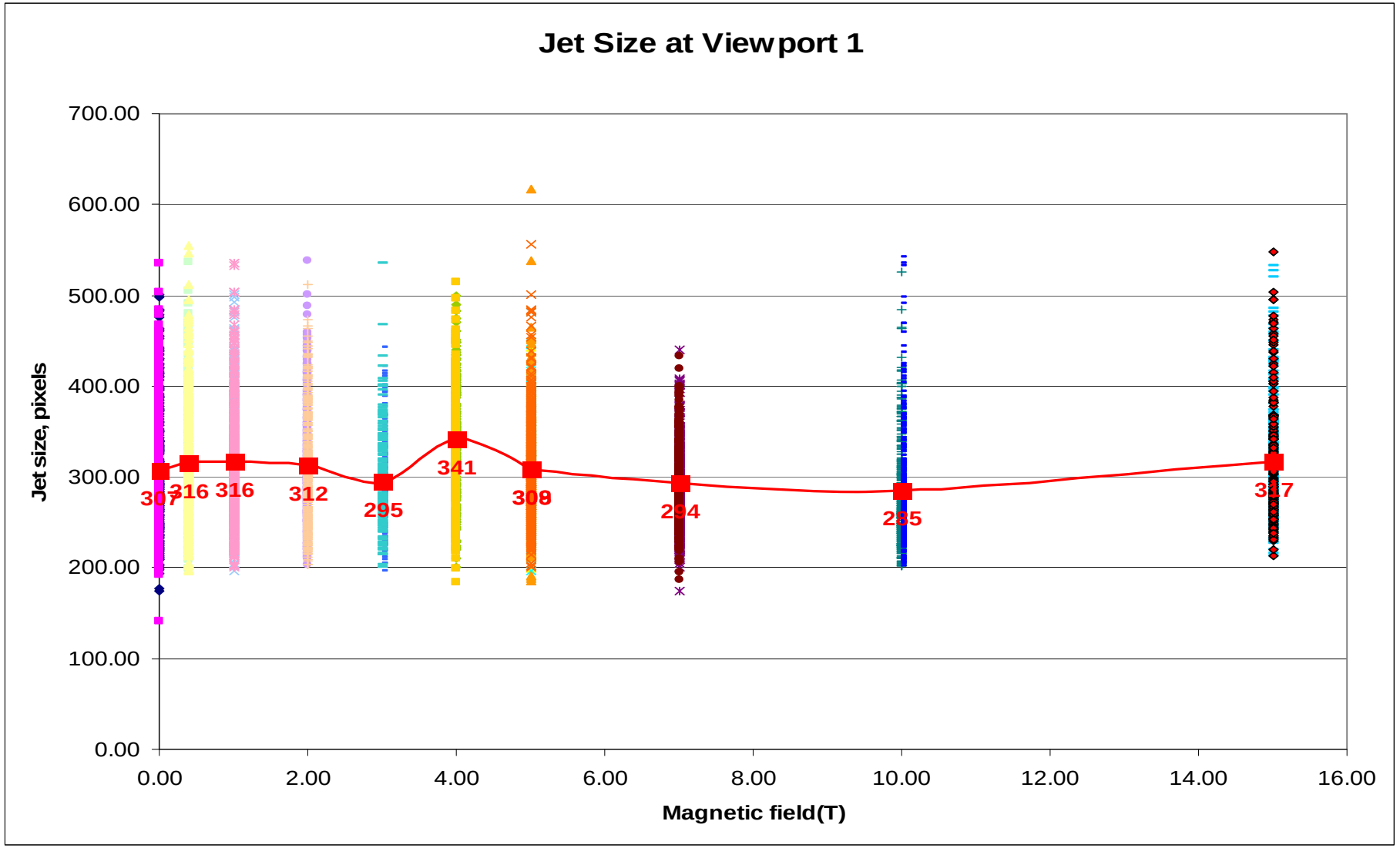
$$f(x) = A1 \times e^{-((x-B1)/C1)^2} + A2 \times e^{-((x-B2)/C2)^2}$$



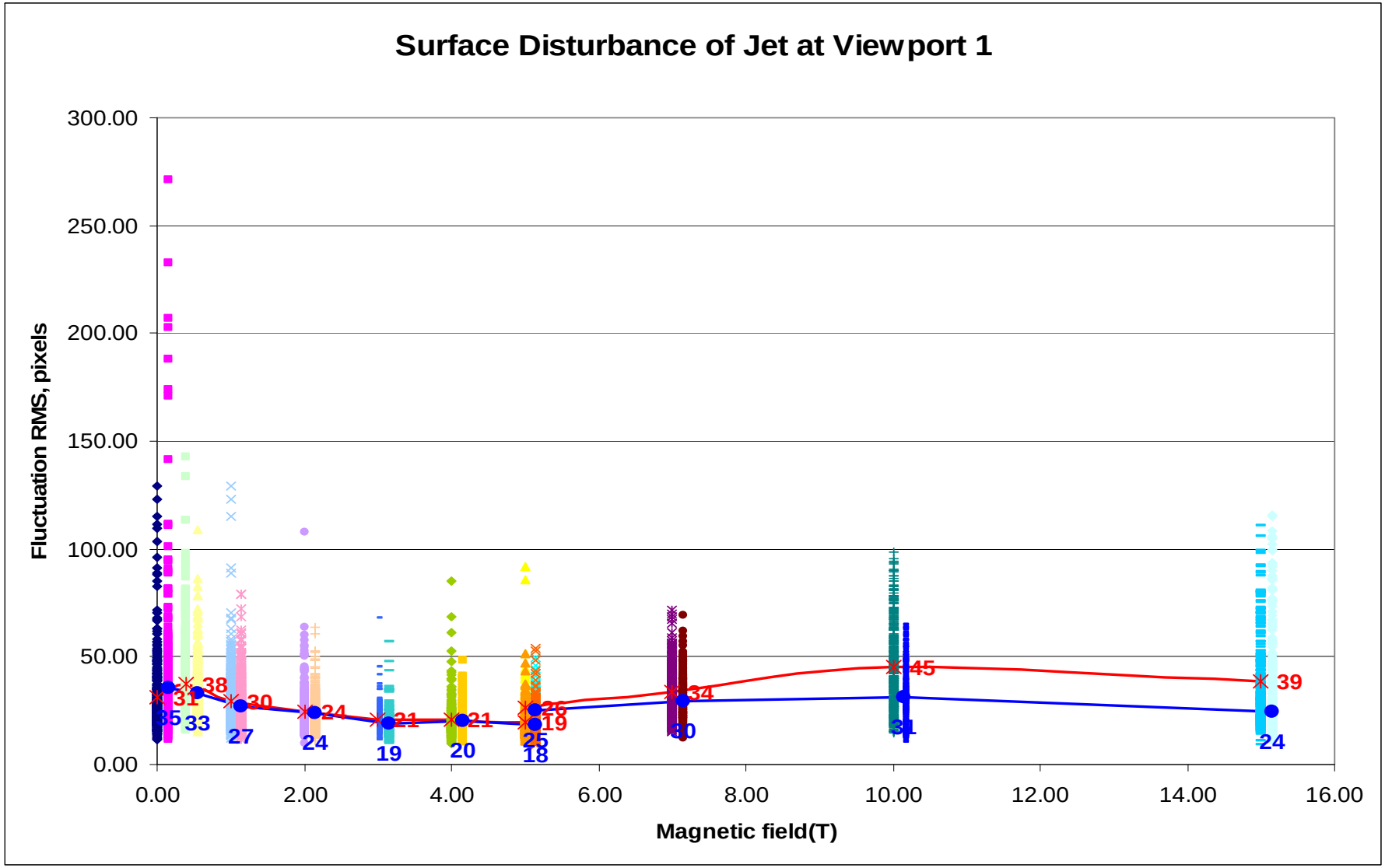




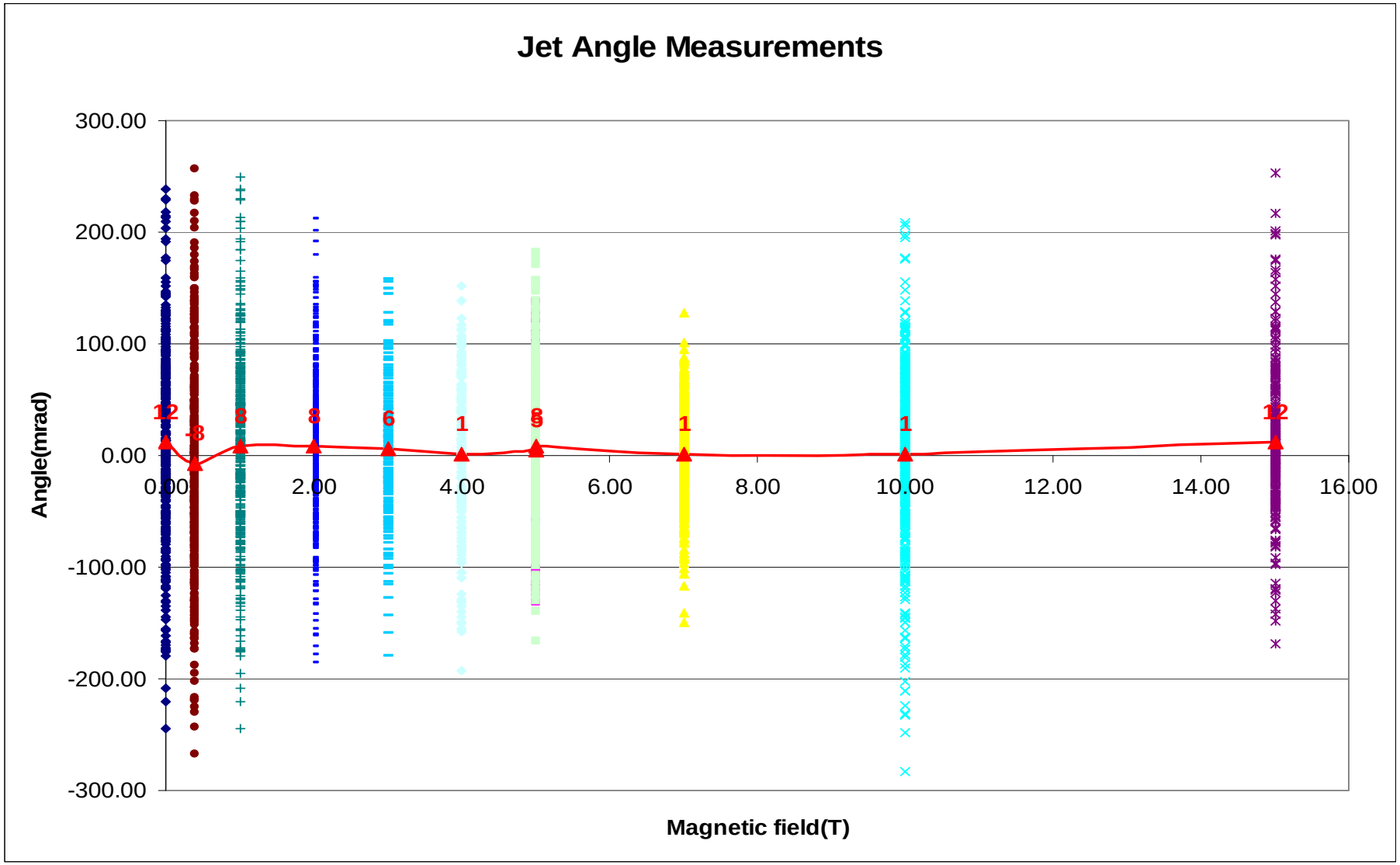
Hg Jet Size, Viewport 1



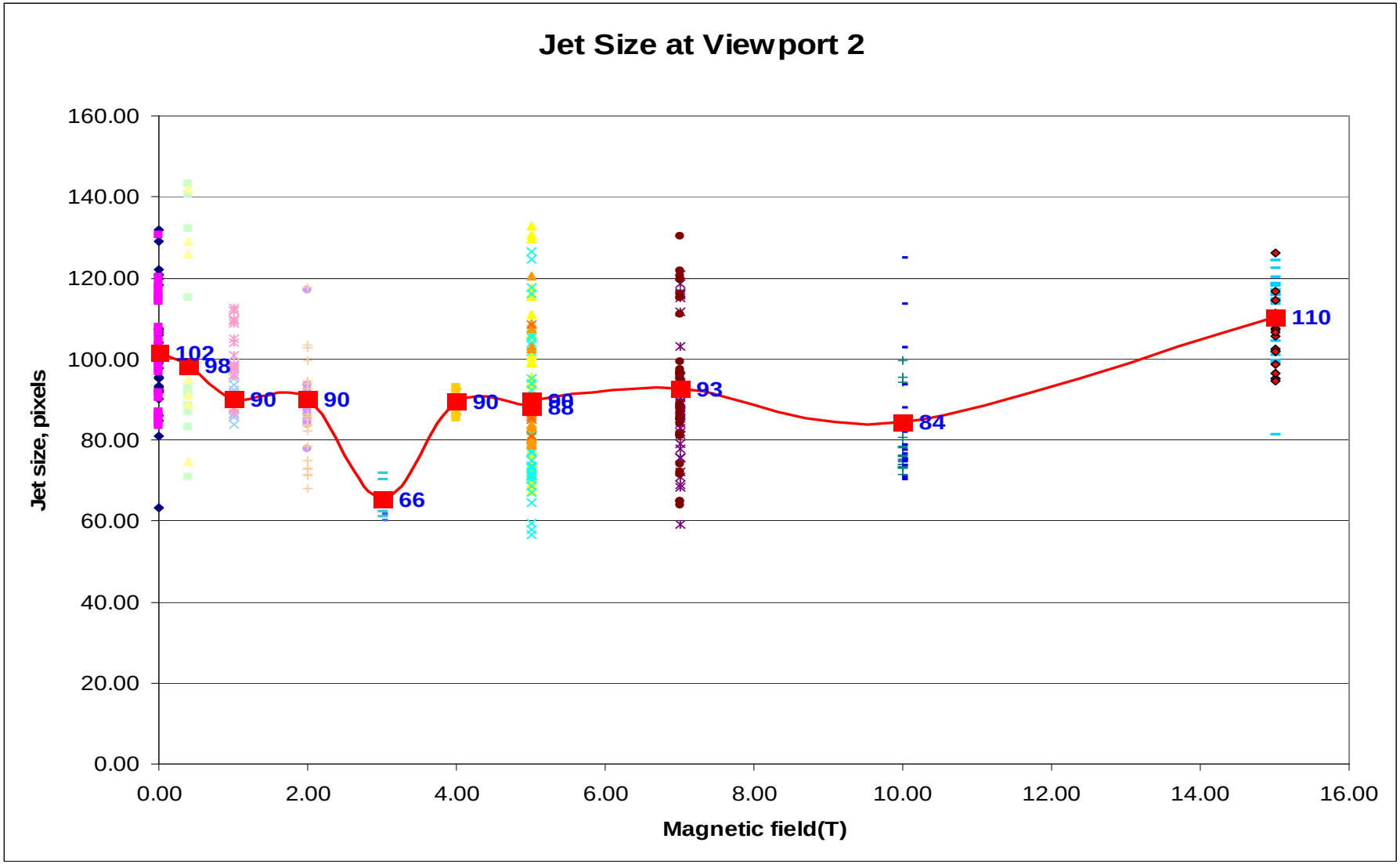
Hg Jet Surface Movement, Viewport 1



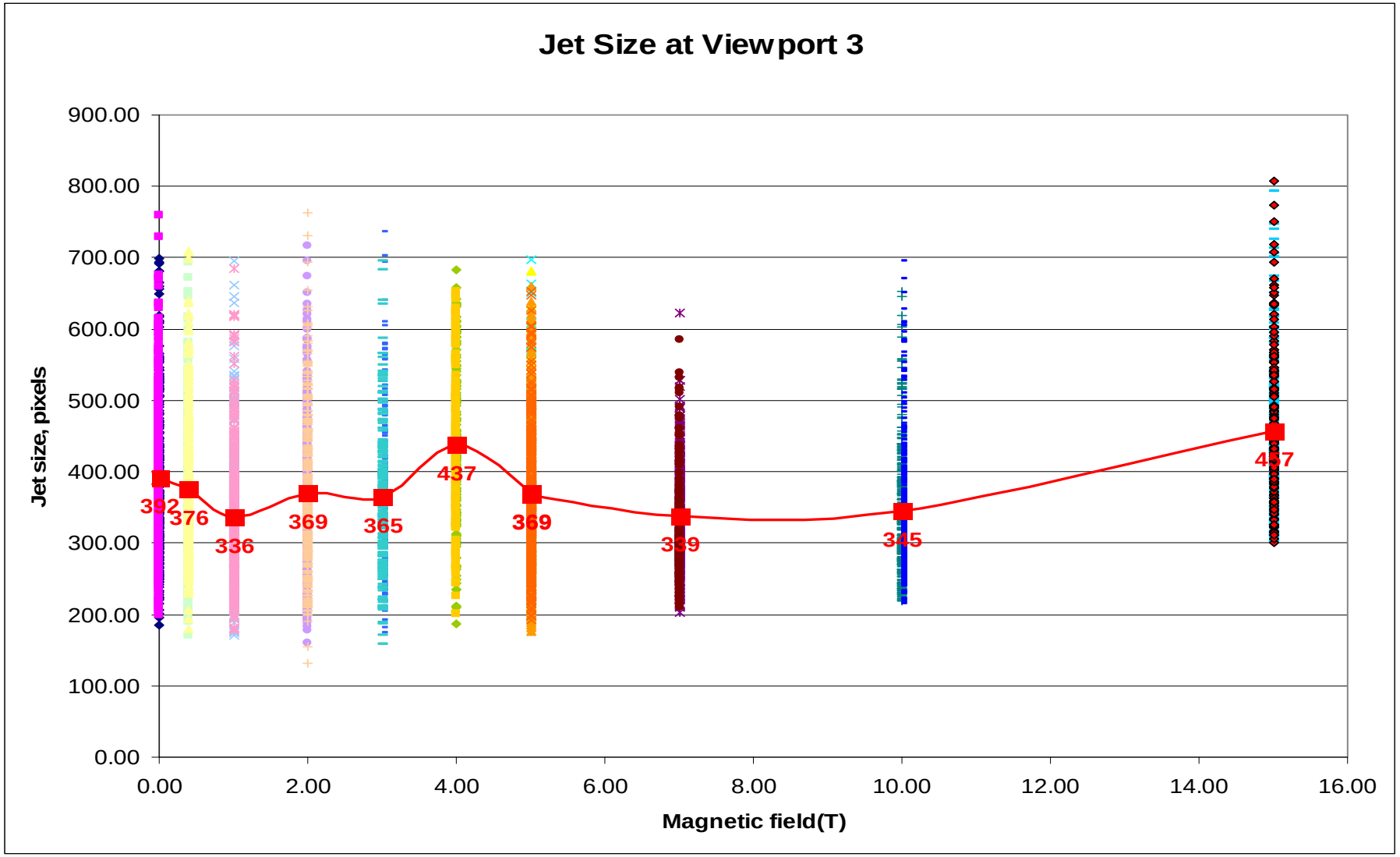
Hg Jet Angle Measurement, Viewport 1



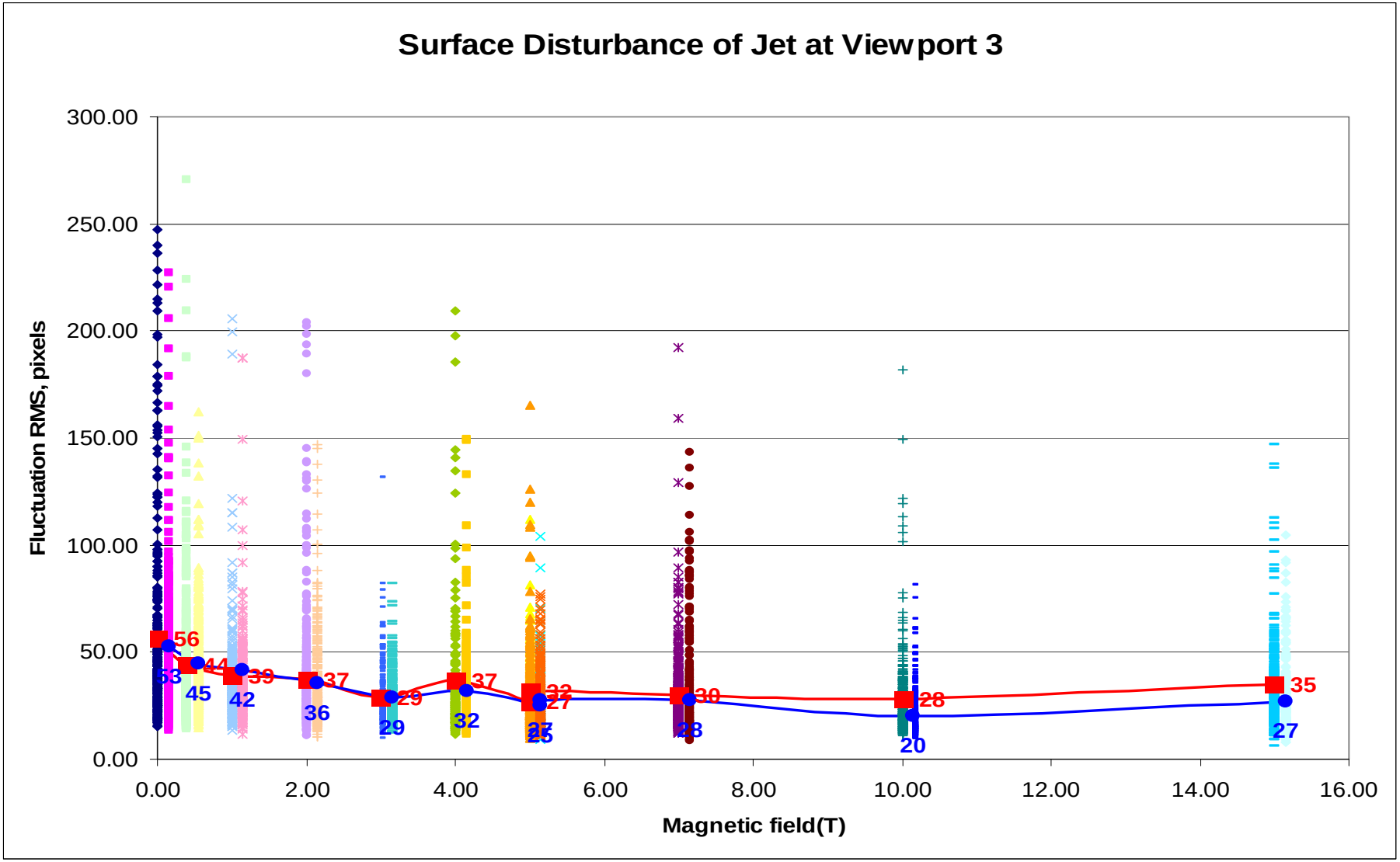
Hg Jet Size, Viewport 2



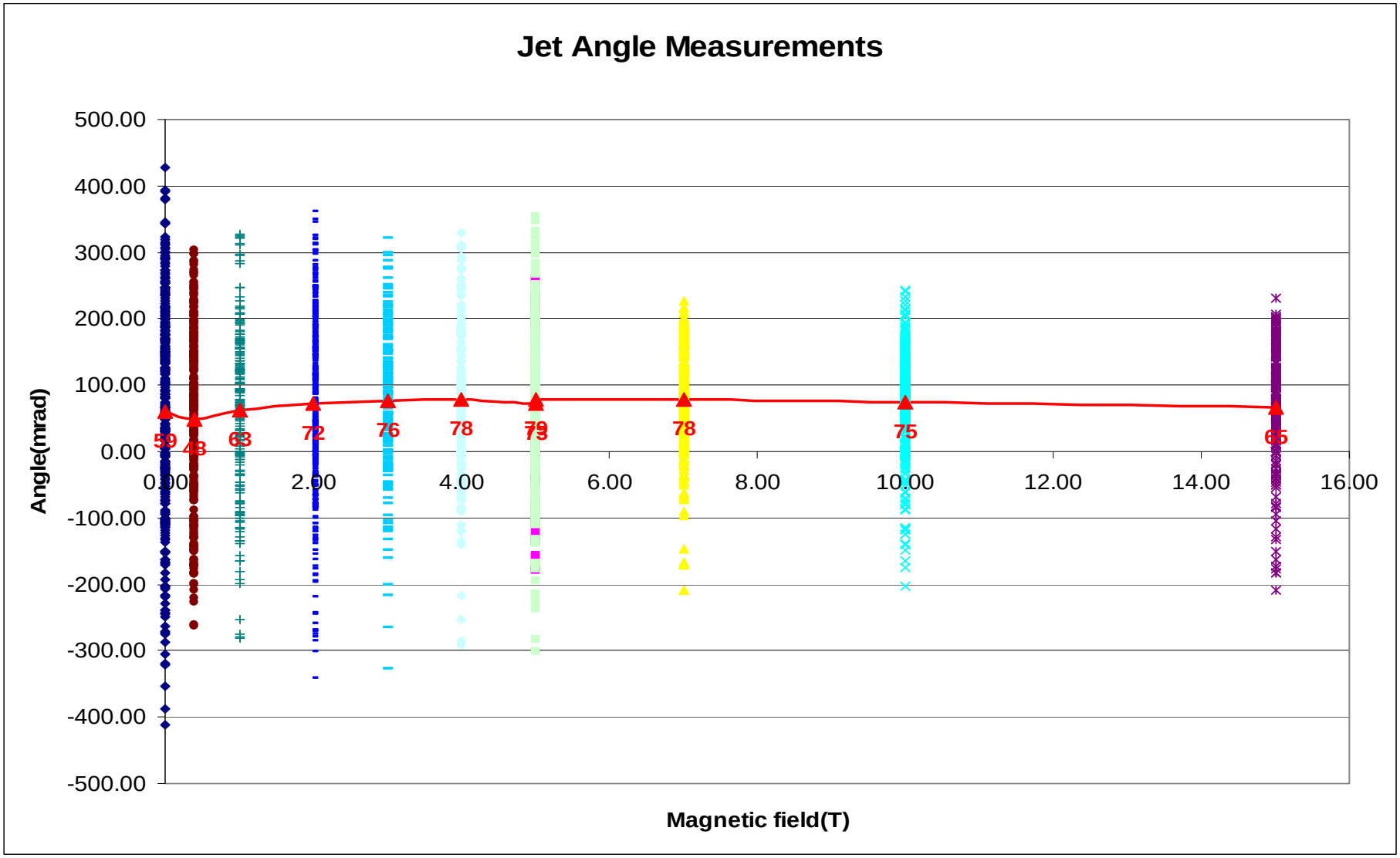
Hg Jet Size, Viewport 3



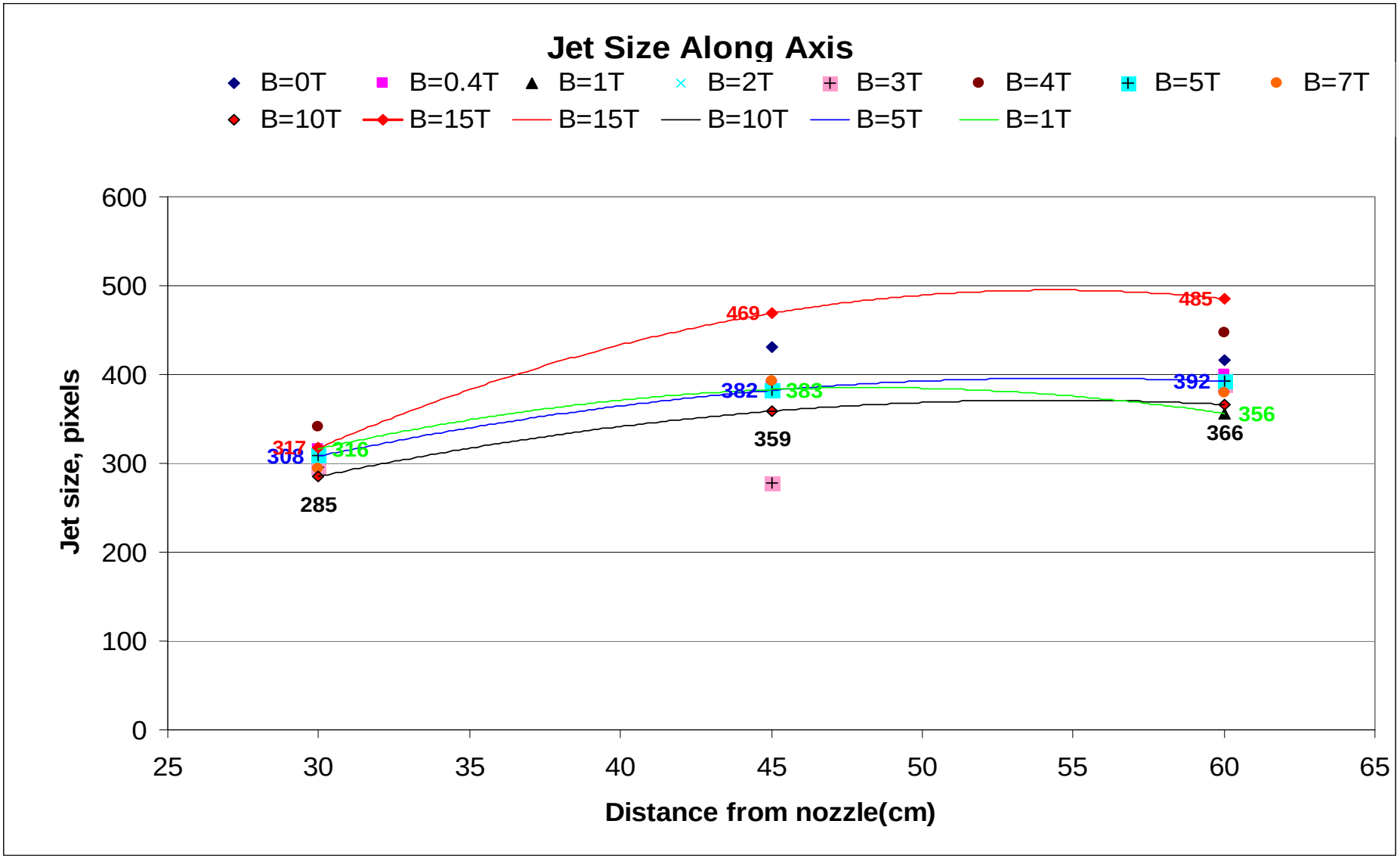
Hg Jet Surface Movement, Viewport 3



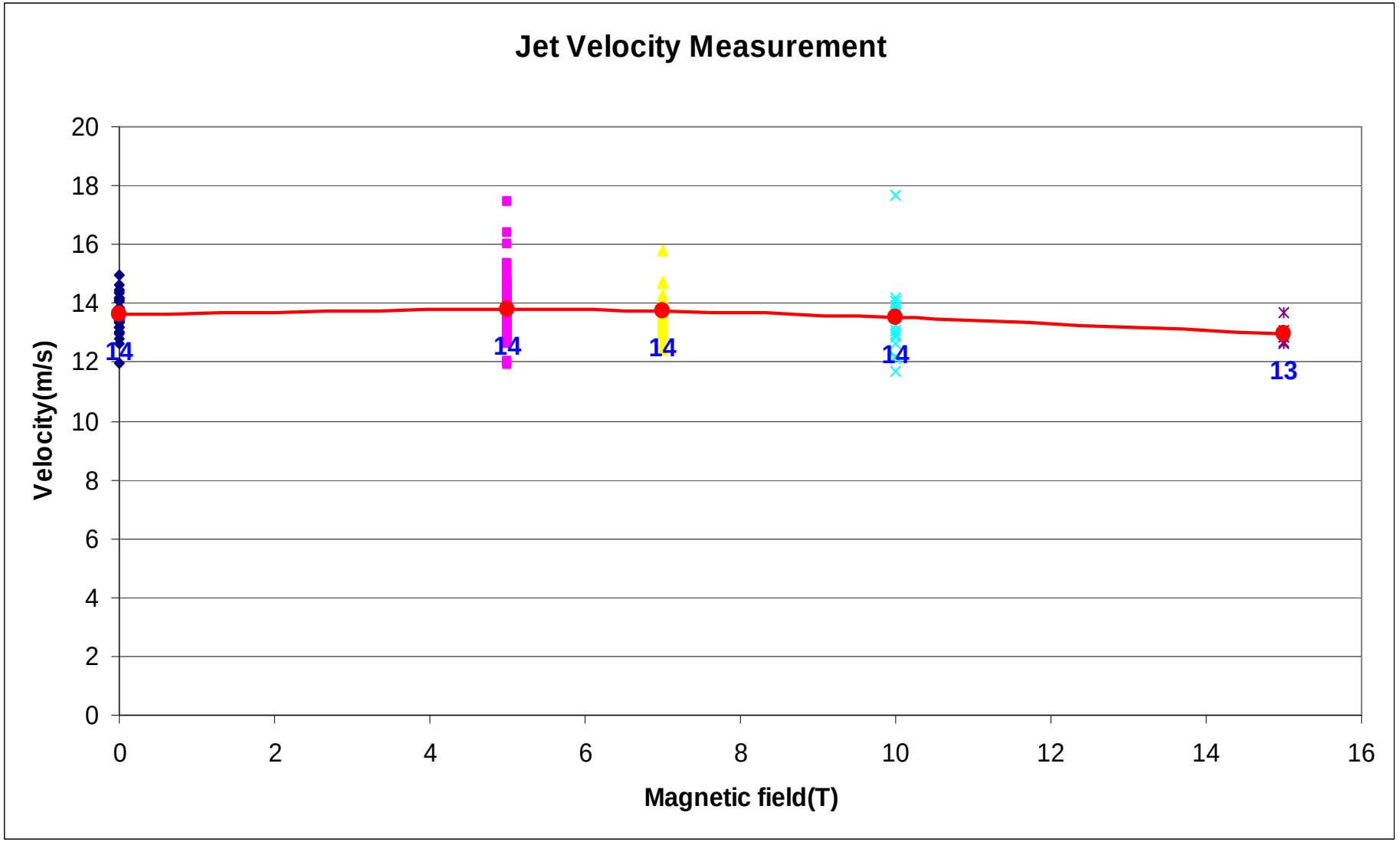
Hg Jet Angle Measurement, Viewport 3



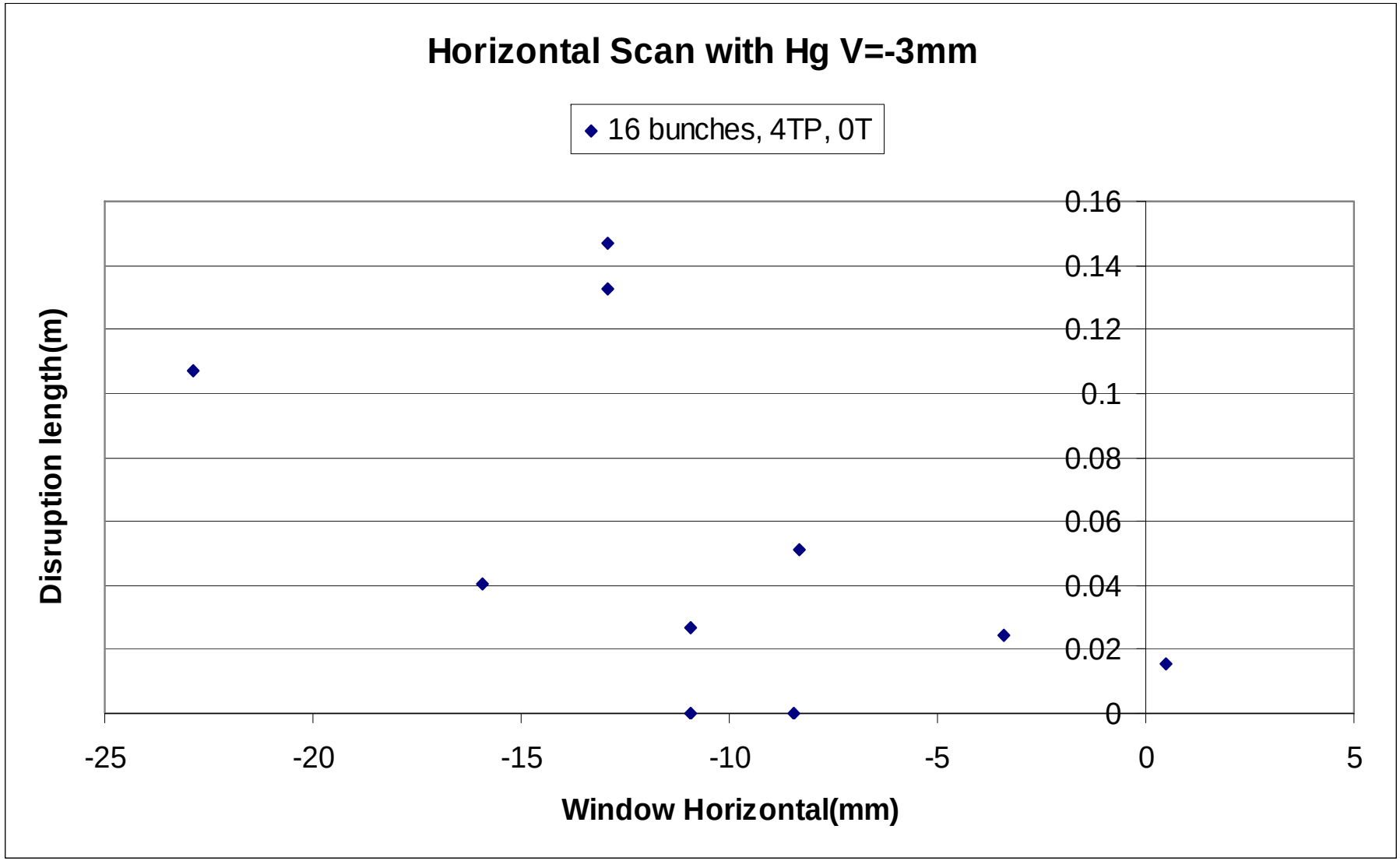
Hg Jet Size Along Magnet Axis



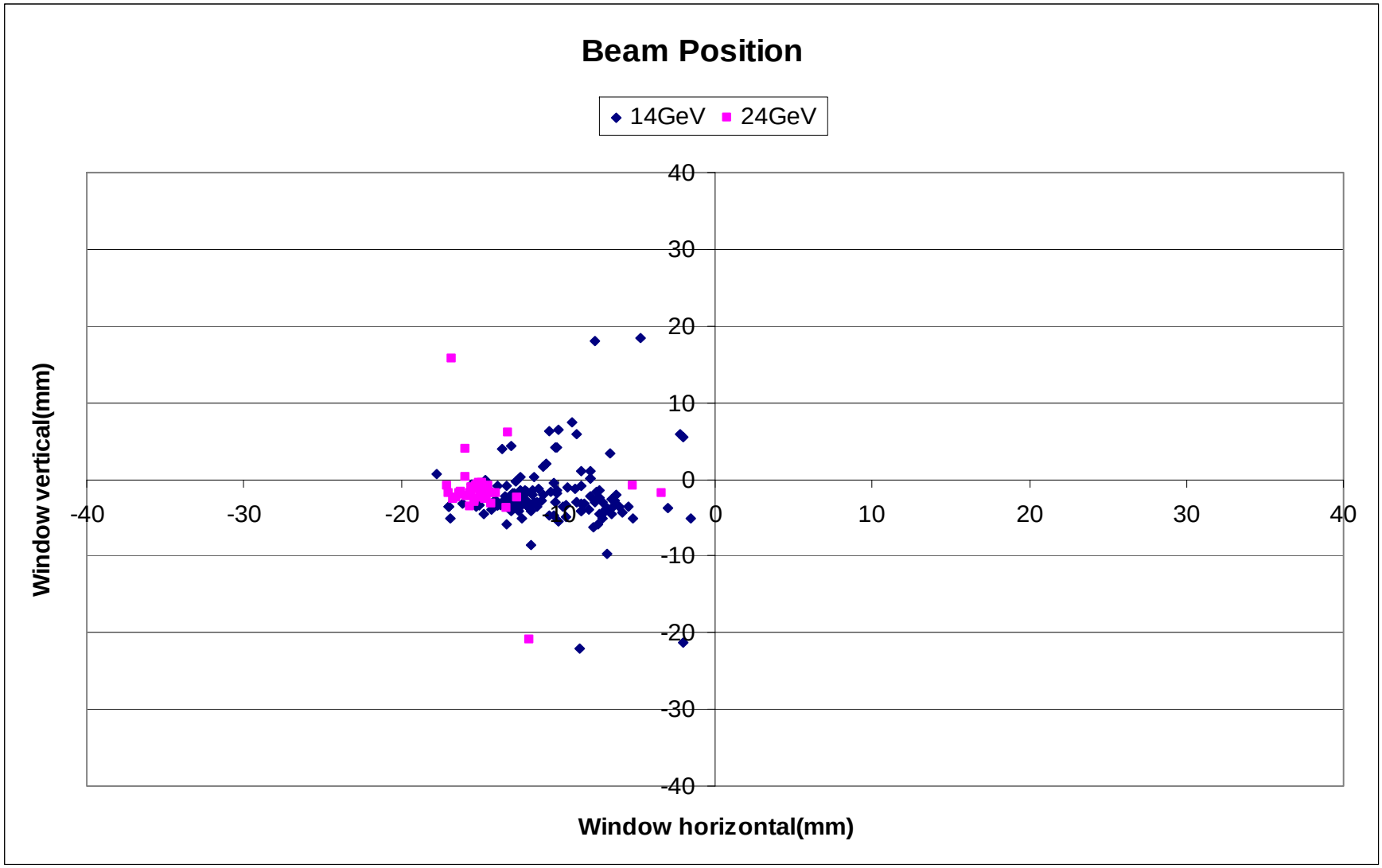
Hg Jet Velocity In Magnetic Field



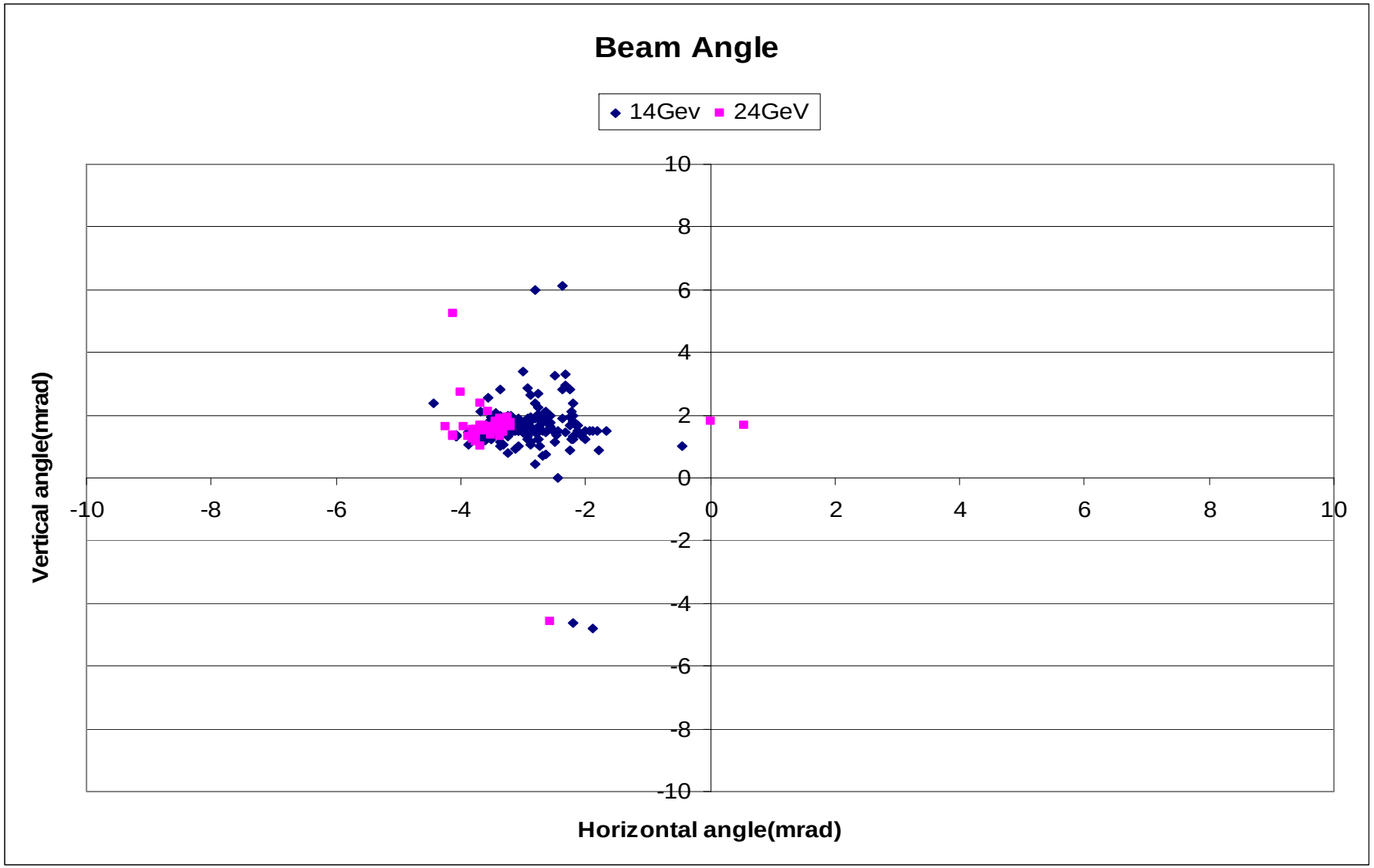
Horizontal Scan with Target In, 14GeV Program



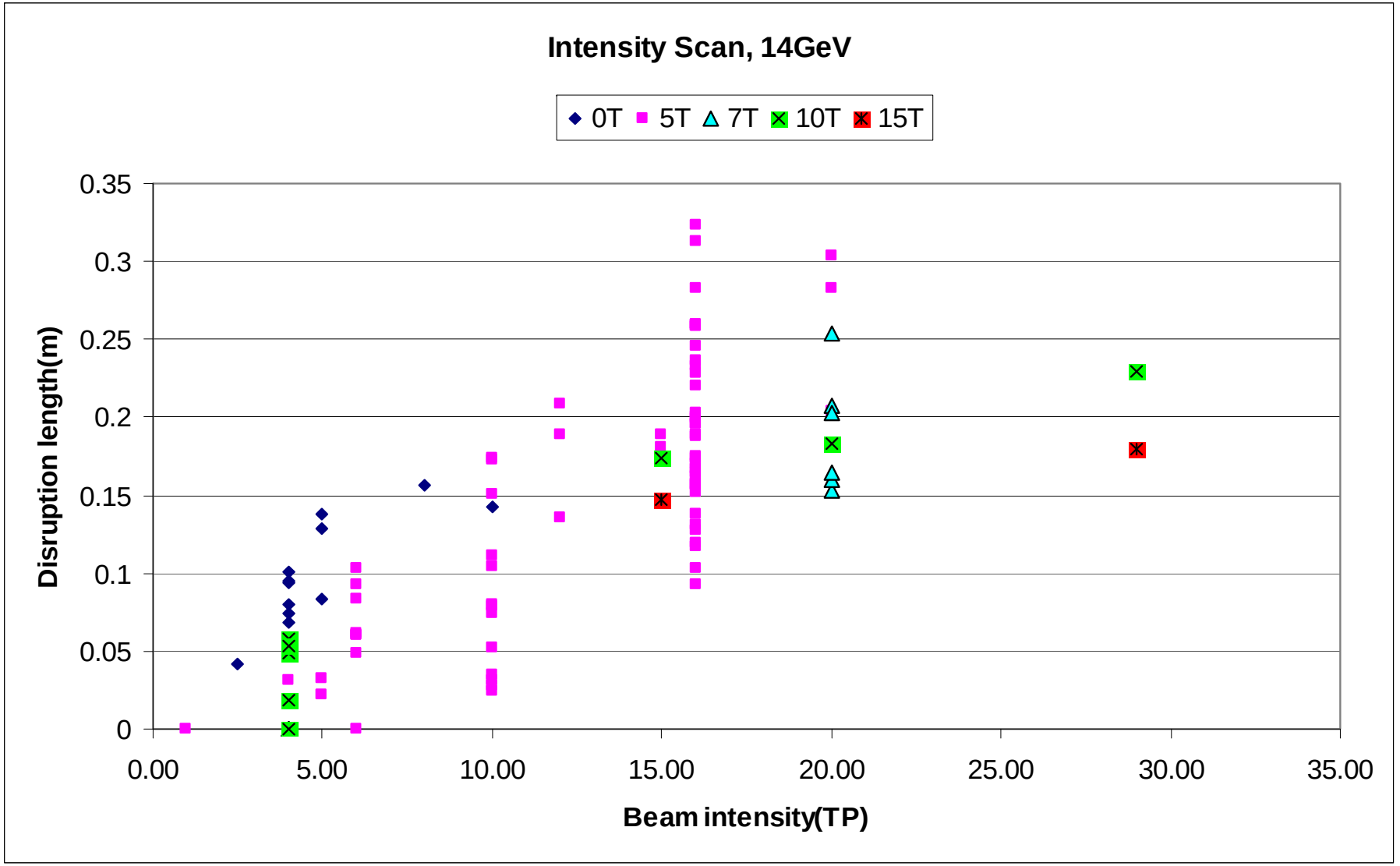
Beam Position with Target In



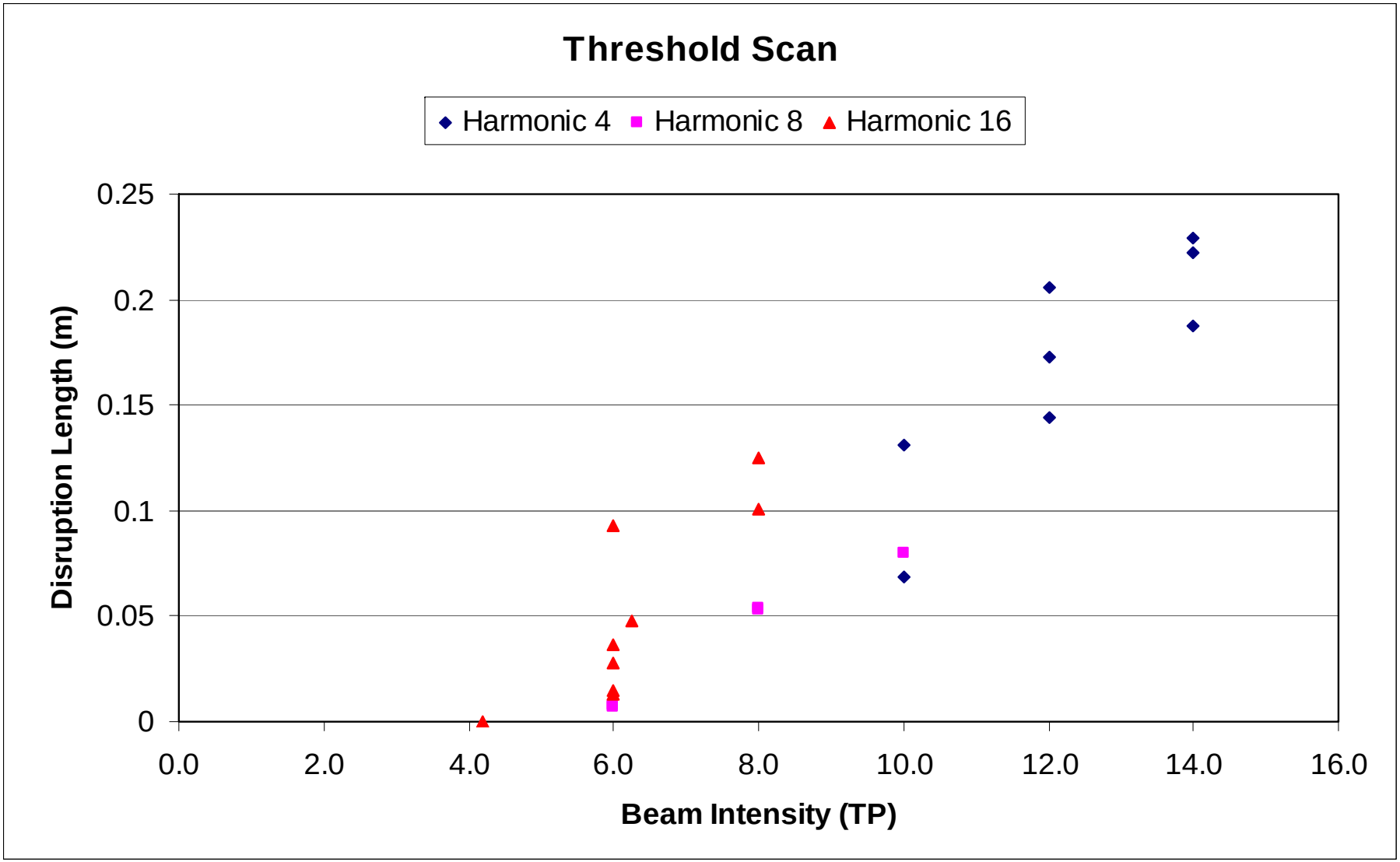
Beam Angle with Target In



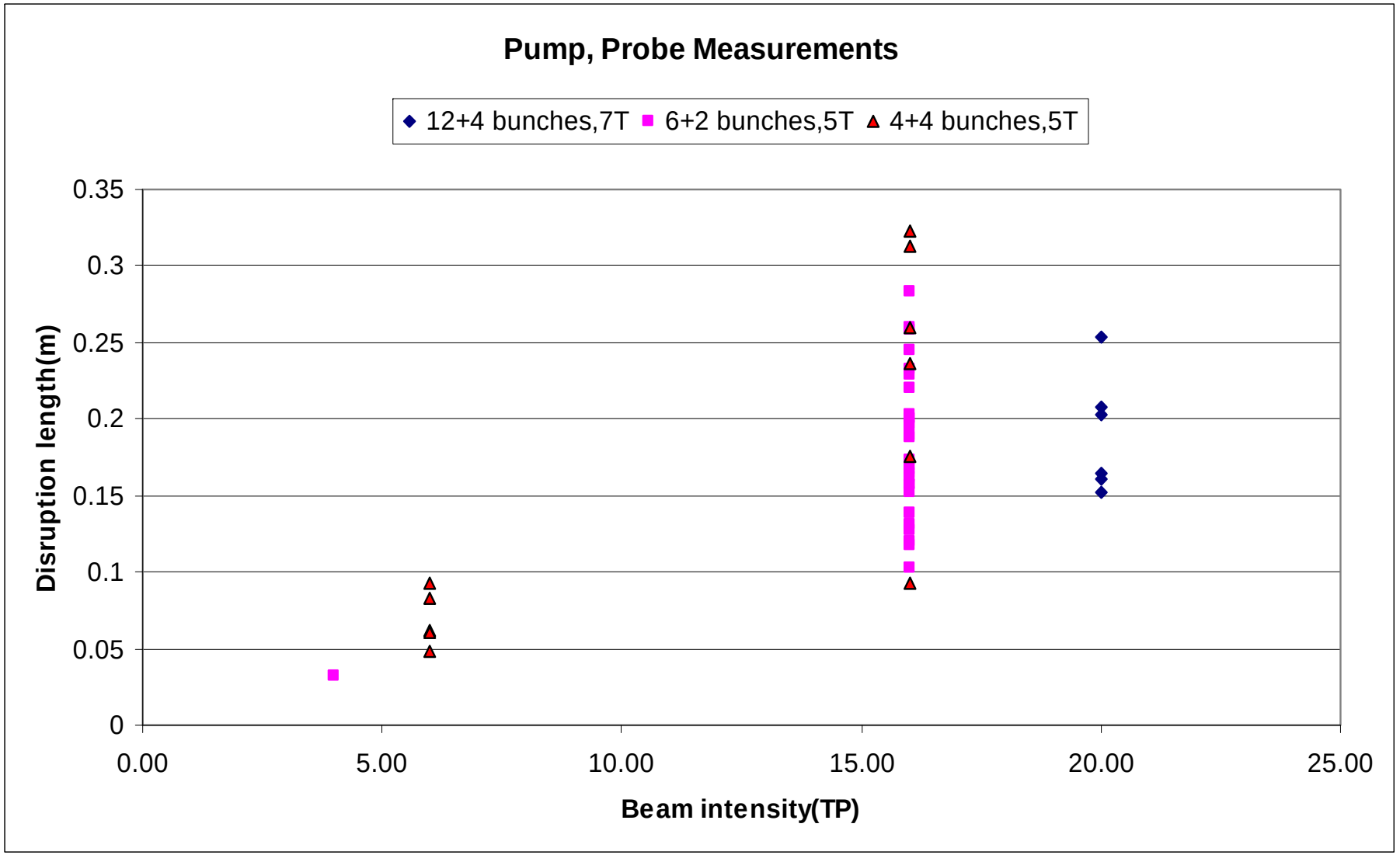
Intensity Scan, 14GeV Program



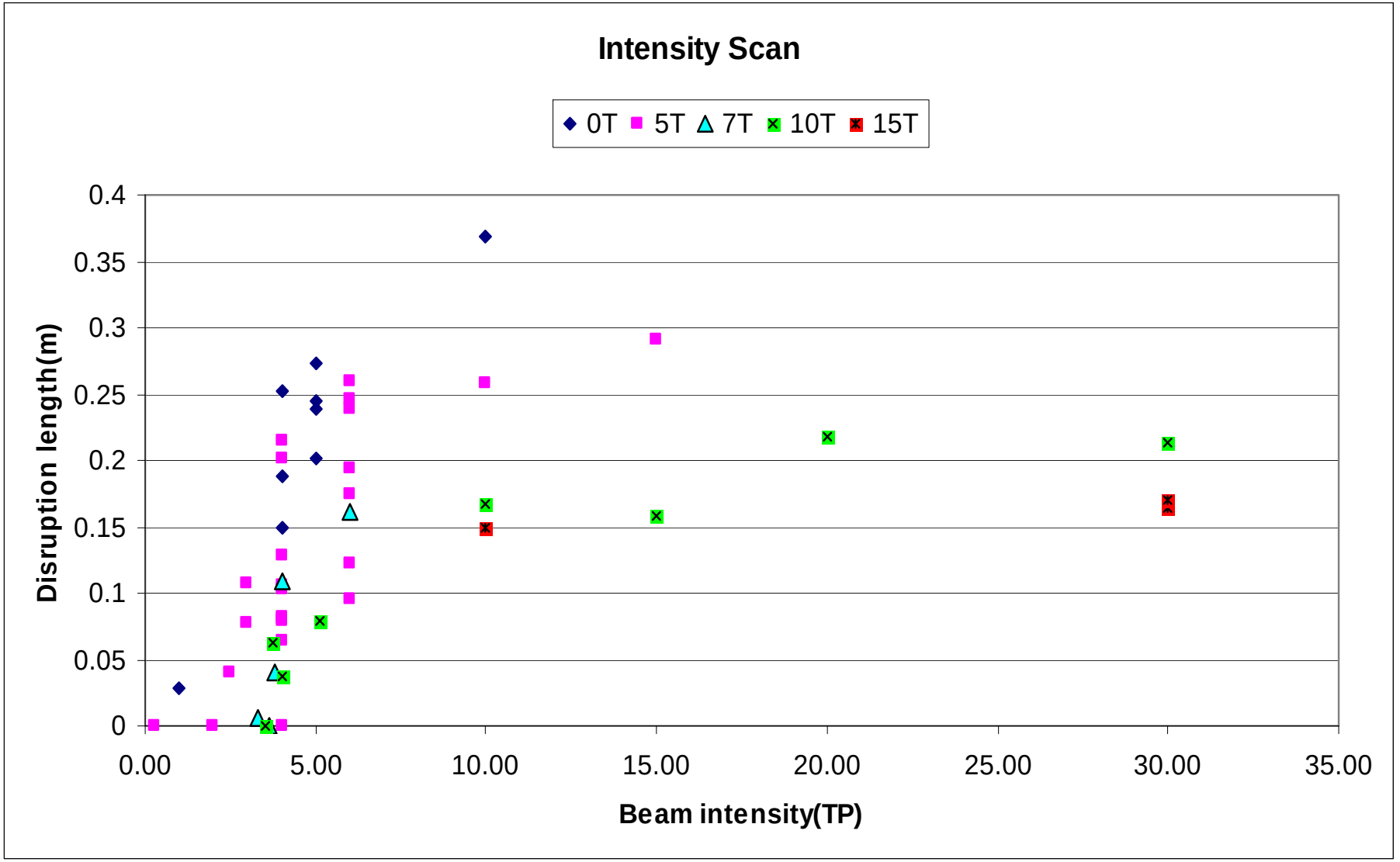
Threshold Scan, 14GeV Program



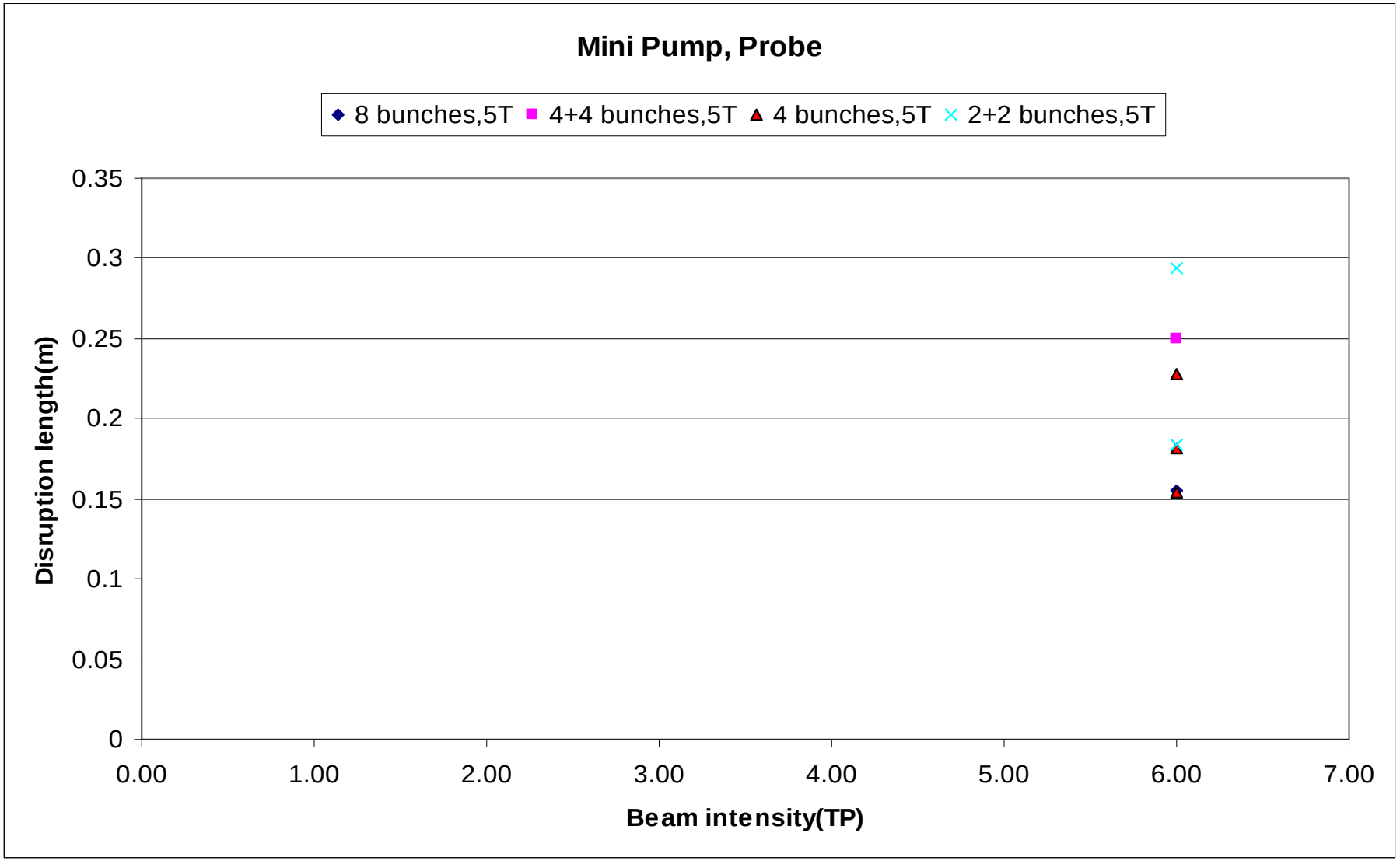
Pump/Probe Measurements, 14GeV



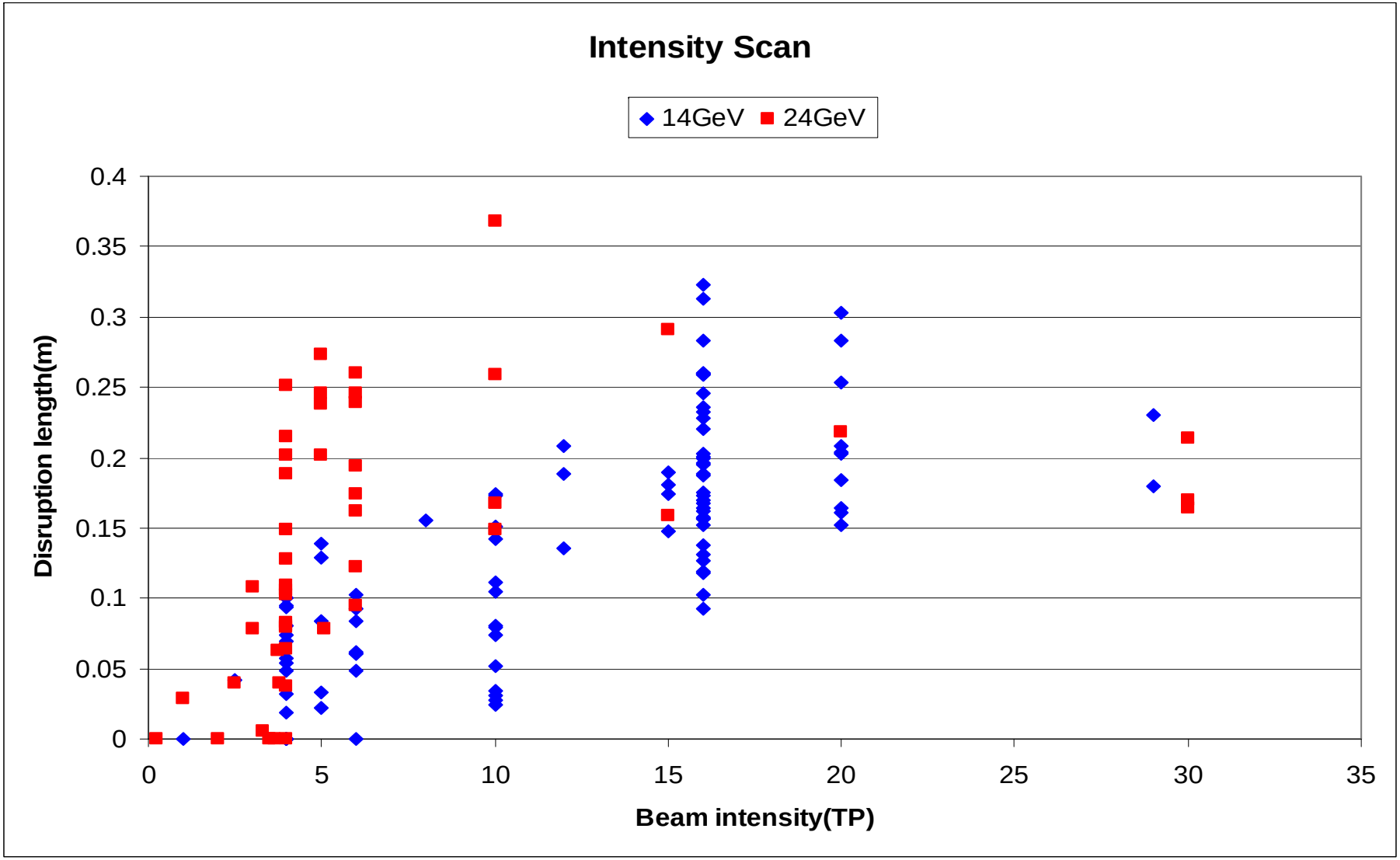
Intensity Scan, 24GeV Program



Mini Pump/Probe, 24GeV



Intensity Scan, 14GeV vs 24GeV Program



Conclusions

1. It is observed that the splash begins at the bottom of jet and ends at the top of jet, which seems to be consistent with the beam trajectory. With the interaction of beam jet breaks up but can be confined by magnetic field. The breakup line might be consistent with the beam trajectory and seems to be the by-product of cavity caused by the energy deposition of beam.

2. The splash velocity increases as the beam intensity increases. However, magnetic field reduces the effect.

3. As the beam intensity increases, the disruption length increases and it is somewhat suppressed by magnetic field.

4. 24GeV beam has longer disruption length than 14GeV beam. The intensity of threshold in 24GeV beam is lower than 14GeV beam.

Conclusions

5. The magnetic field stabilizes the Hg jet flow. Therefore, the fluctuation on the jet surface decreases as magnetic field increases.

6. The jet size increases as it moves to downstream and it was same up to 10T but increases at 15T. The jet size in 10T was smaller than that of 15T field, which might have varied between the major and minor axis of an elliptical core.

7. The longitudinal Hg jet velocity was almost not affected by the magnetic field. In other words, no pressure drops.