E951

Beam Studies

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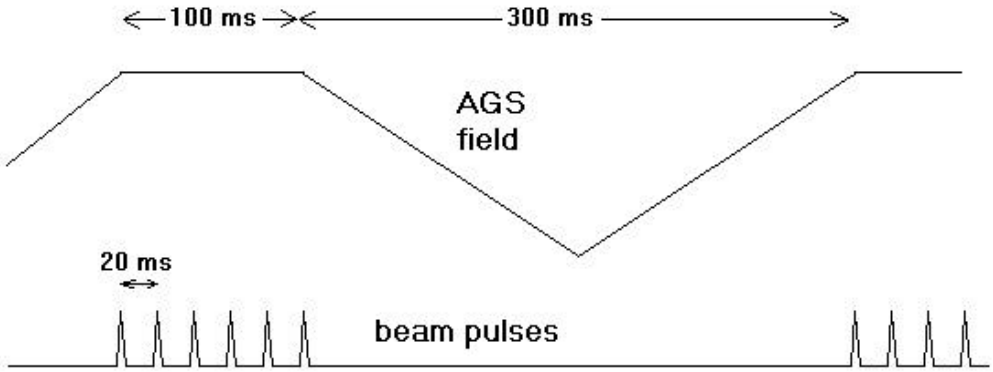
Brookhaven National Laboratory

Technical Board Meeting

Illinois Institute of Technology

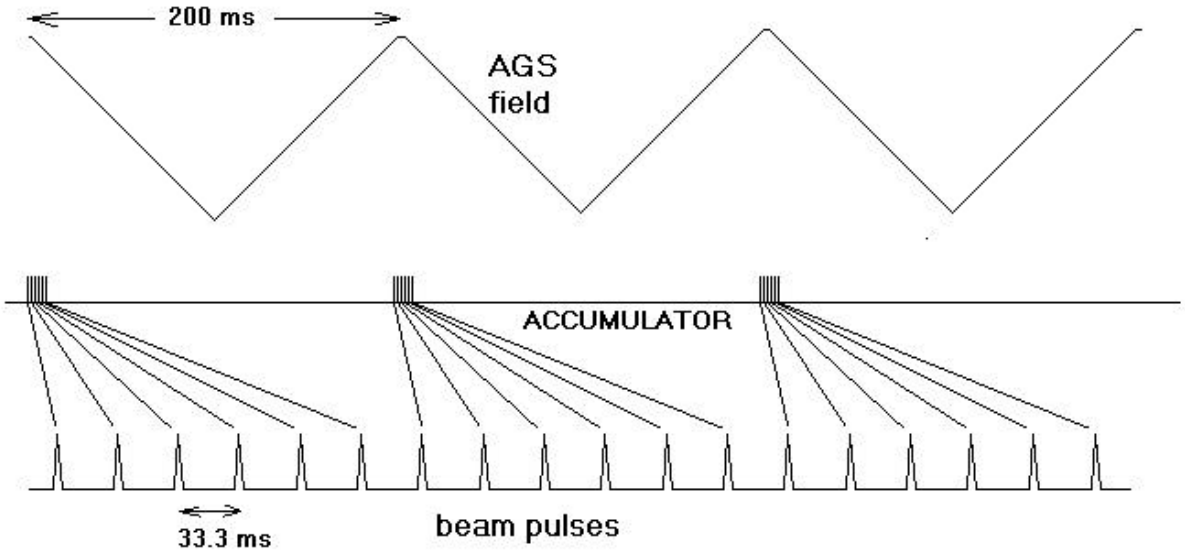
Feburary 9-10, 2002

1 MW OPTION



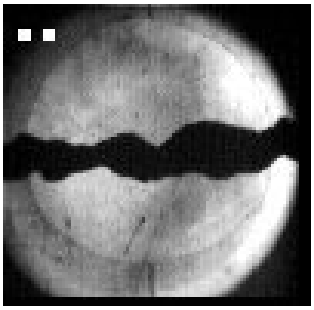
15 pulses per second
66.7 kJ per pulse
17.3 TP per pulse

4 MW OPTION

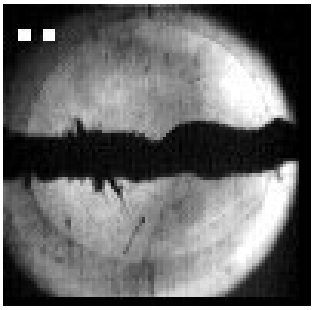


30 pulses per second
133 kJ per pulse
34.7 TP per pulse

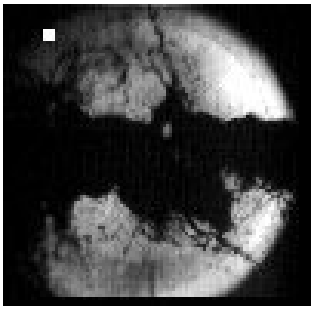
3.8×10^{12} 24 GeV Protons on Hg Jet



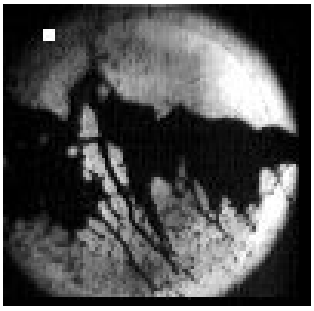
t=0 ms



t=0.75 ms



t=10 ms



t=18 ms

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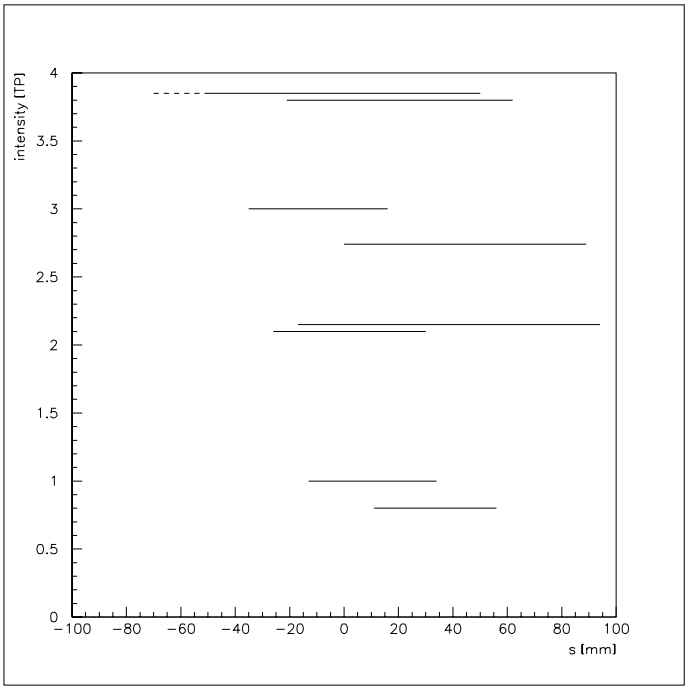
Disruption Length of Hg Jet

Hg Jet Apex

↓

Beam Intensity

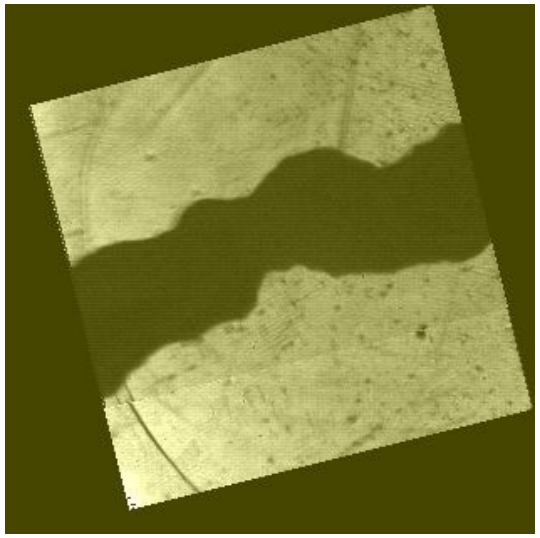


← Proton Beam

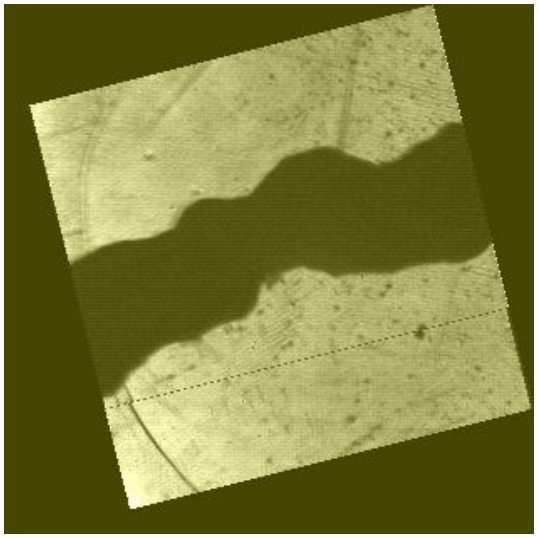
Interaction Length

The SMD 64k1M Fast Camera
10μs per frame–150 ns exposure

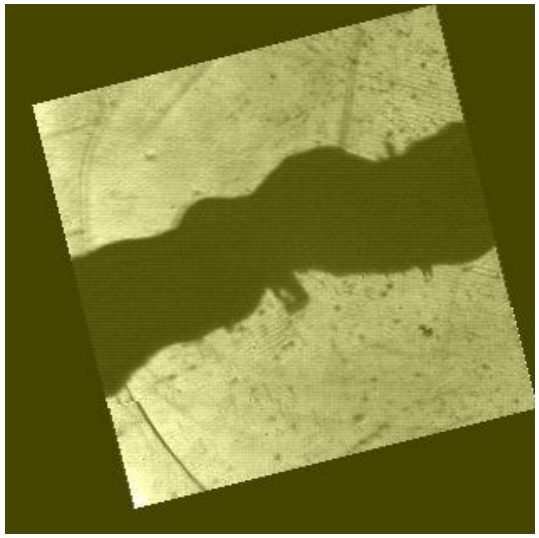
T = 0 μs



T = 40 μs

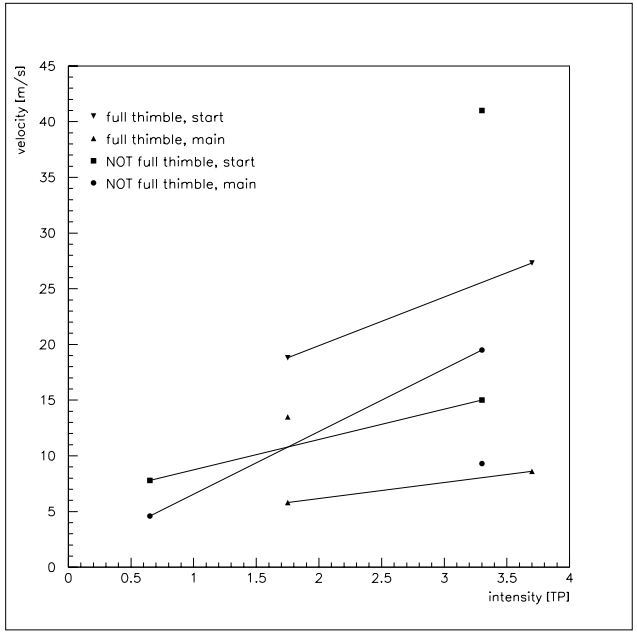


T = 100 μs

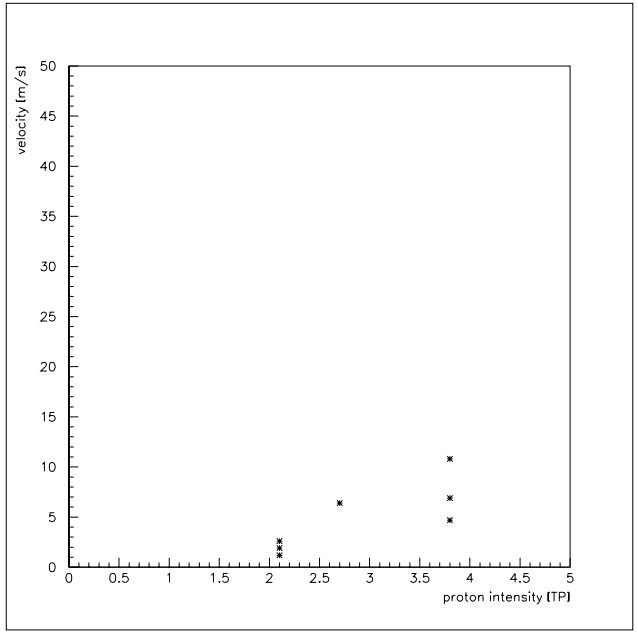


Explosion Velocity

– measured surface velocities



trough



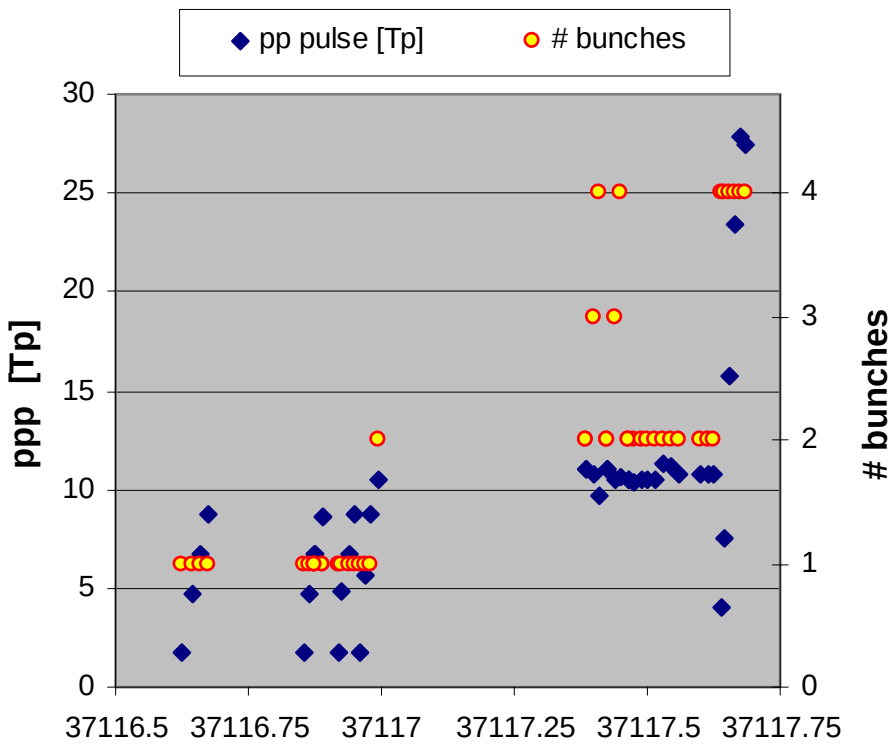
jet

maximum velocity observed: $70\,\mathrm{m/s}$

Protons vs. Mercury

ISOLDE GPS, Aug. 2001

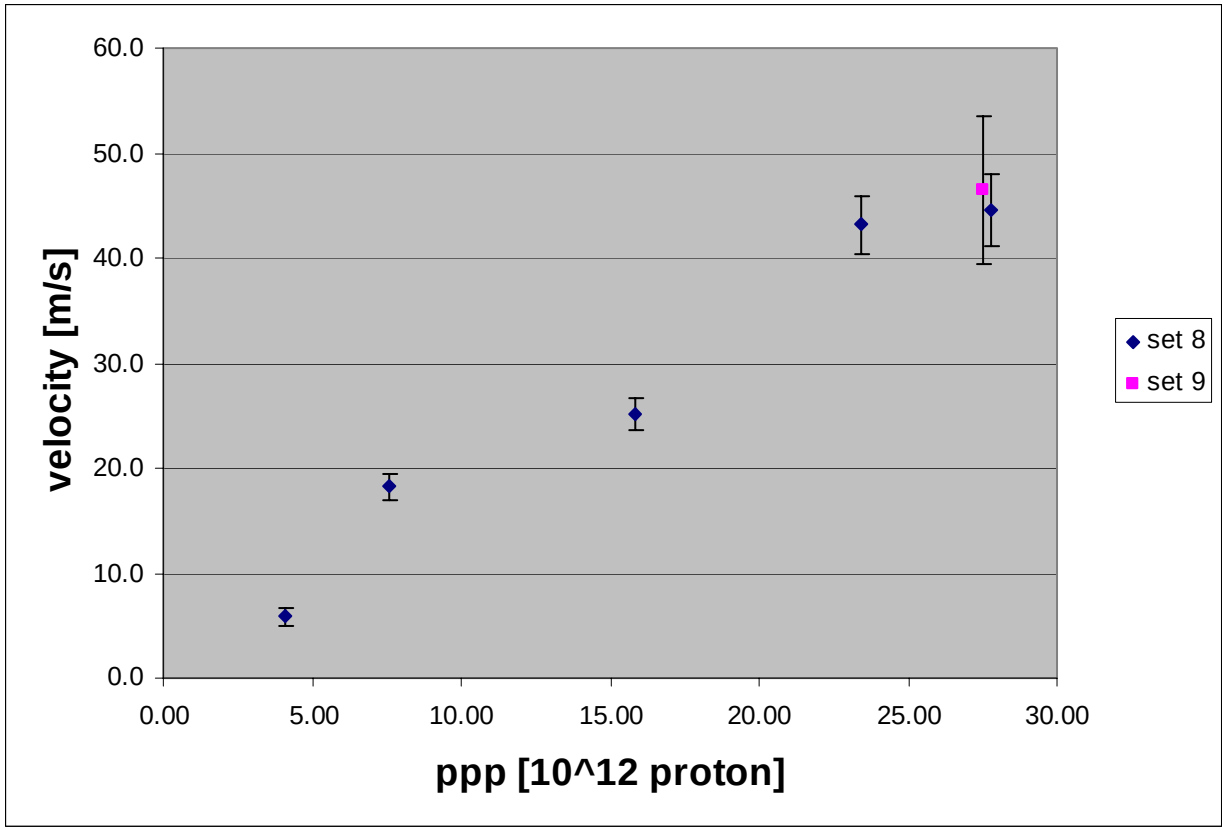
40 single pulse events at 1.4 GeV



PSB (NuFACT CERN)

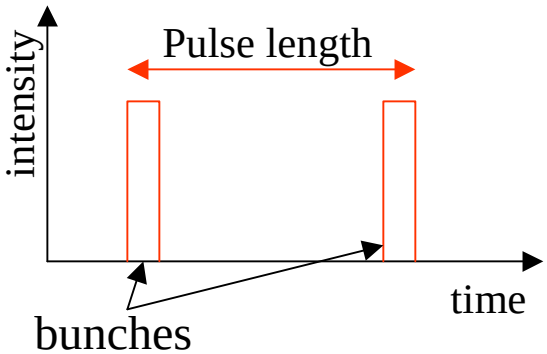
- pulse intensity
  1-28 10^{12} p^+ (230 10^{12} p+)
- pulse length
  0.6-8 µs (3.2 µs)
- height scan
- spot size (Gaussian)
  σ=1.2-3.5 mm (7.5 mm)
- Average beam density
  1.3-8.5 p^+/mm^2 (1.3 p^+/mm^2)

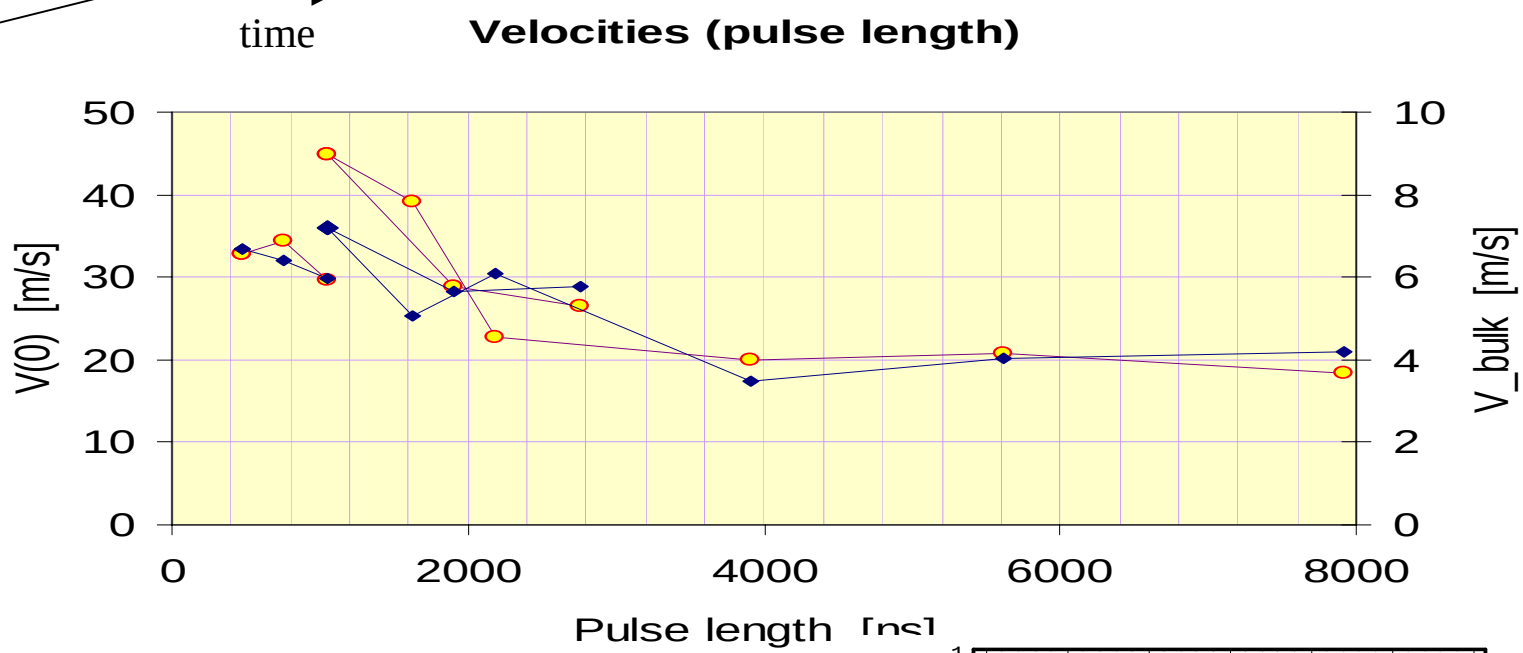
Intensity



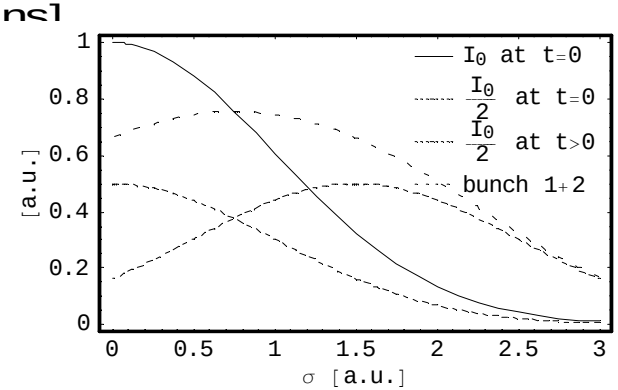
A.Fabich, NFWG Jan 2002

Pulse length





- velocity drops for pulse length > 3 μs
- due to traveling pressure wave $\longrightarrow$
- can not be due to cavitation as …



dv/dt=-dP/dr

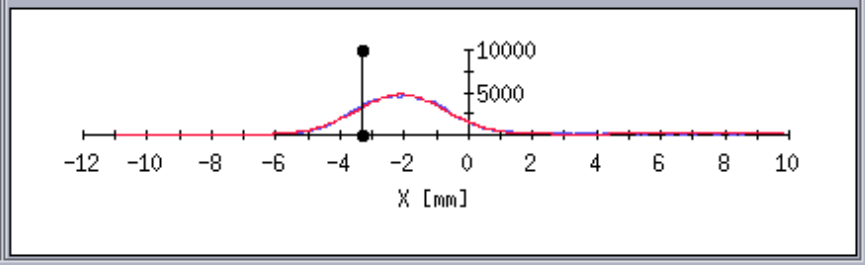
FPM -- Profile Display

Data Stream: seb-fg2 | One Pass | Least Square | Simplex

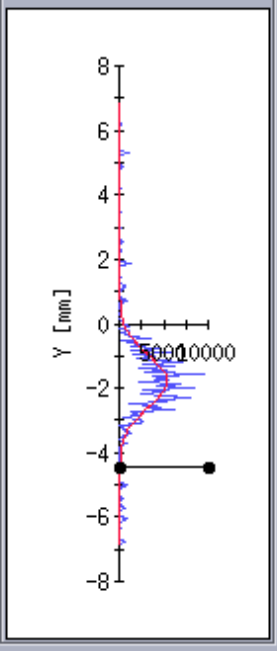
Flag Name

a3f508

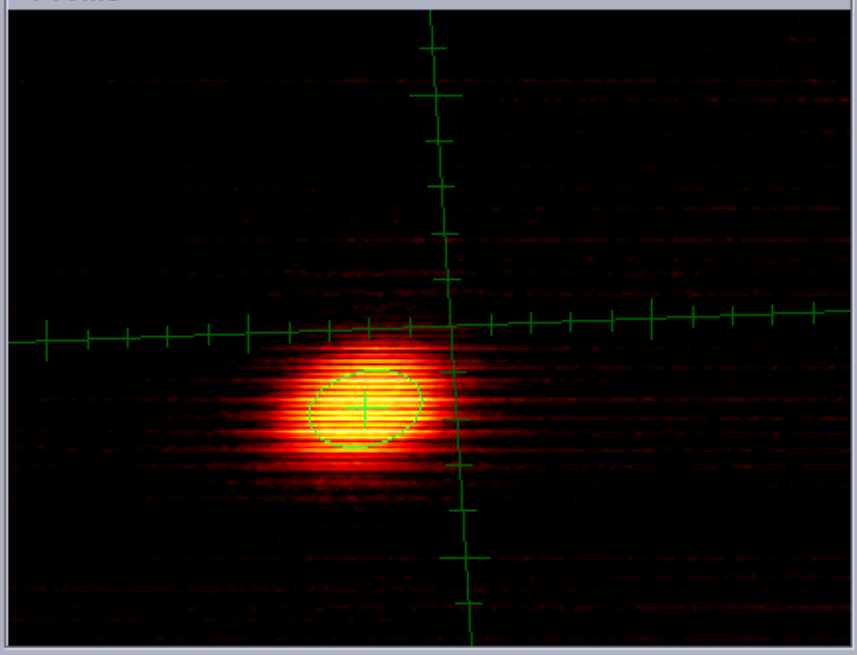
Horizontal



Vertical



Profile



X = 72.5765, -3.66421 mm Y = 163.664, -4.34006 mm Data = 0

Description

Flag Name = a3f508 Frame Grabber = seb-fg2
Timestamp = Thu Apr 26, 2001 18:02:15 149994914 ns
Center [mm] = (-2.23049, -1.71417) Centroid [mm] = (13.141, -12.4545)
Sigma [mm] = (1.36554, 0.812117)
Ellipse [mm] = (1.33199, 0.917889) Theta = -0.558757
Intensity = 1073479675 Transmission = 100% Plunger State = Unknown
Background Subtraction Mode = On Signal Range = 0 205

Comment

Close | Update | Save | Print... | File...

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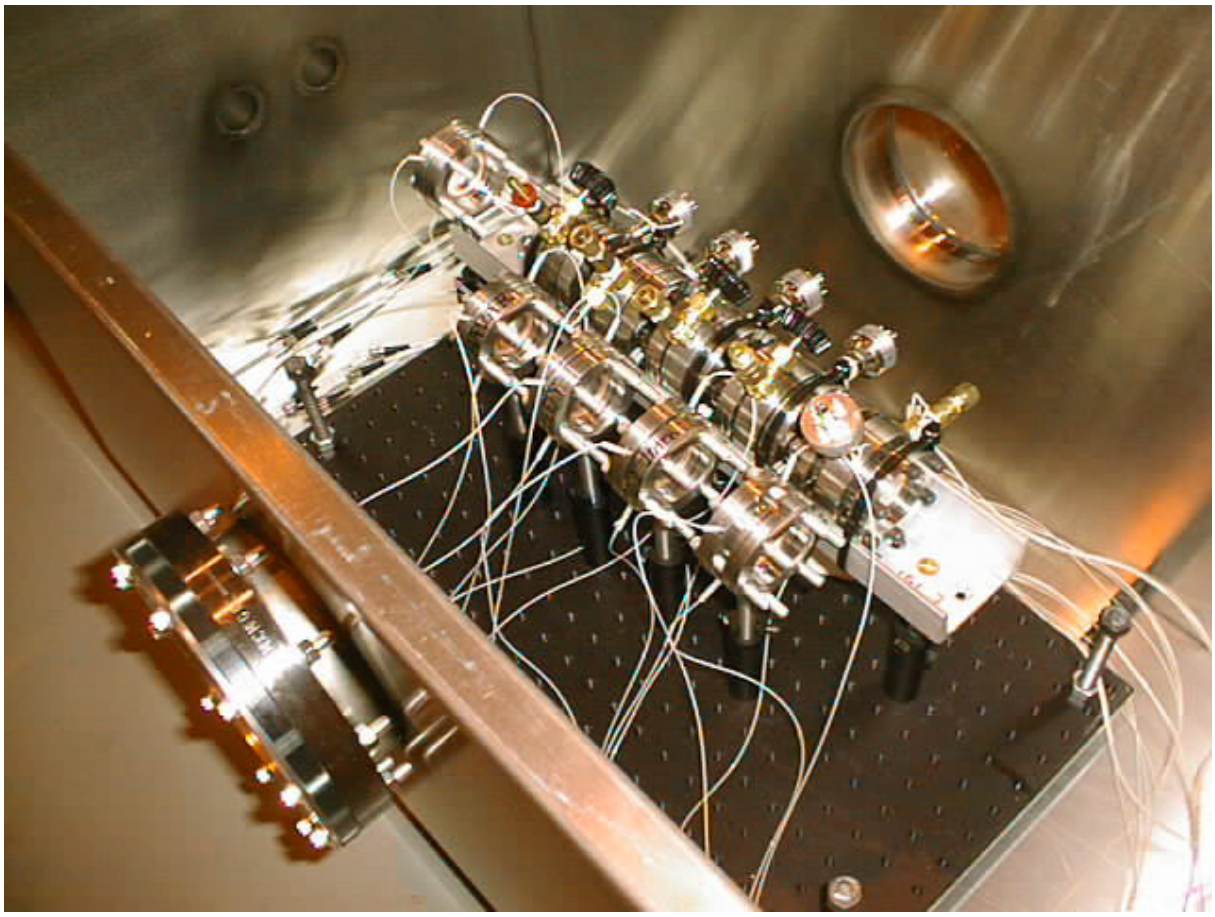
Windows Test Setup



Window Material:

10 mil Aluminum

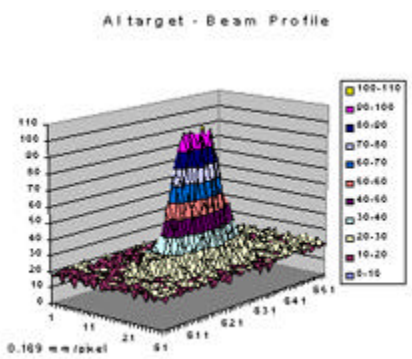
11 mil Havar

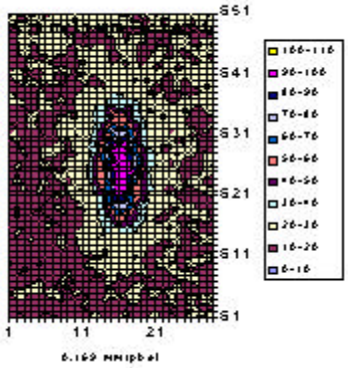
13 mil Titanium Alloy

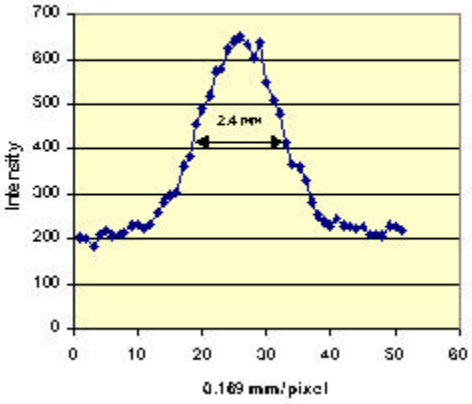
1 mm Inconel

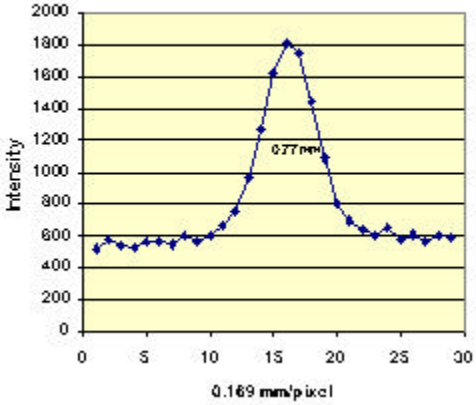
6 mm Inconel

Digitized autoradiographic image of a 10 mil Al window showing beam size smaller than anticipated.









Future Plans

- Work with the AGS to achieve a single bunch intensity of 16 TP deliverable to the A3 line.
  - Repeat Hg jet target
  - Explore other solid target candidates (Inconel, Invar, etc.)
- Develop a 20 m/s Hg jet.
- Develop and build a 2 m/s Wood's Metal Jet.
- Develop and build a High-field Pulsed Solenoid.