MERIT Status

NFMCC Collaboration Meeting

FNAL

March 17-20, 2008

Harold G. Kirk
Brookhaven National Laboratory

The Collaborating Institutions

U.S.

- **Brookhaven National Laboratory**
- **Fermi National Accelerator Laboratory**
- **Oak Ridge National Laboratory**
- **Princeton**

Europe

- **CERN**
- **Rutherford Appleton Laboratory**

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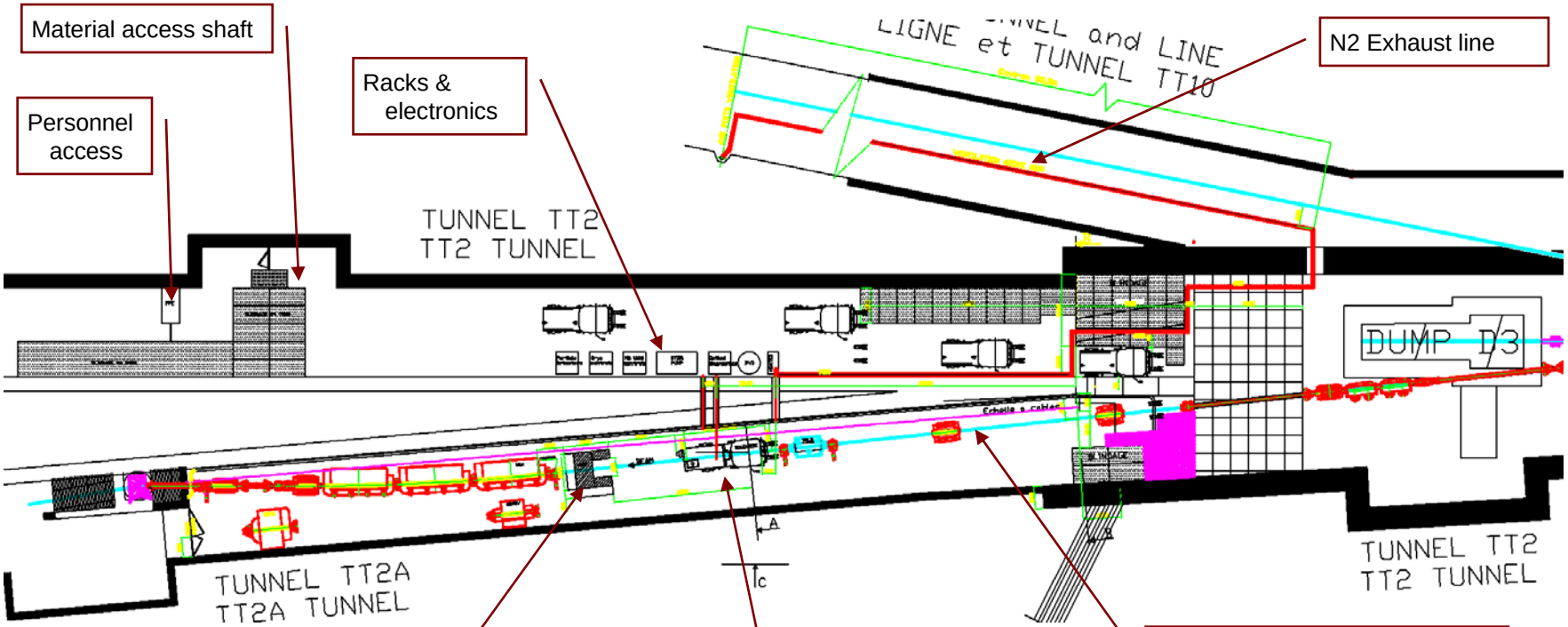
MERIT Experiment in the TT2a Area



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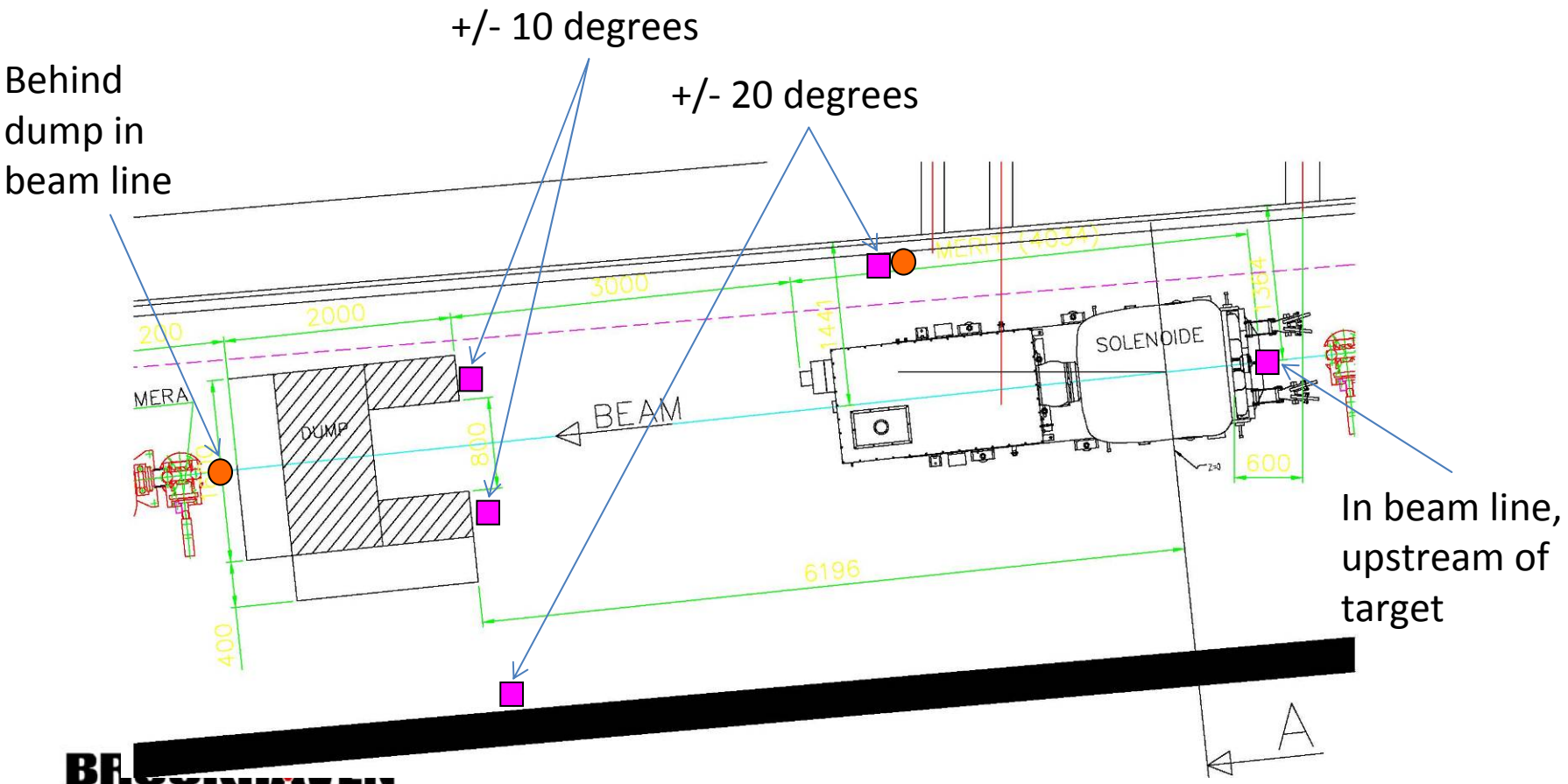
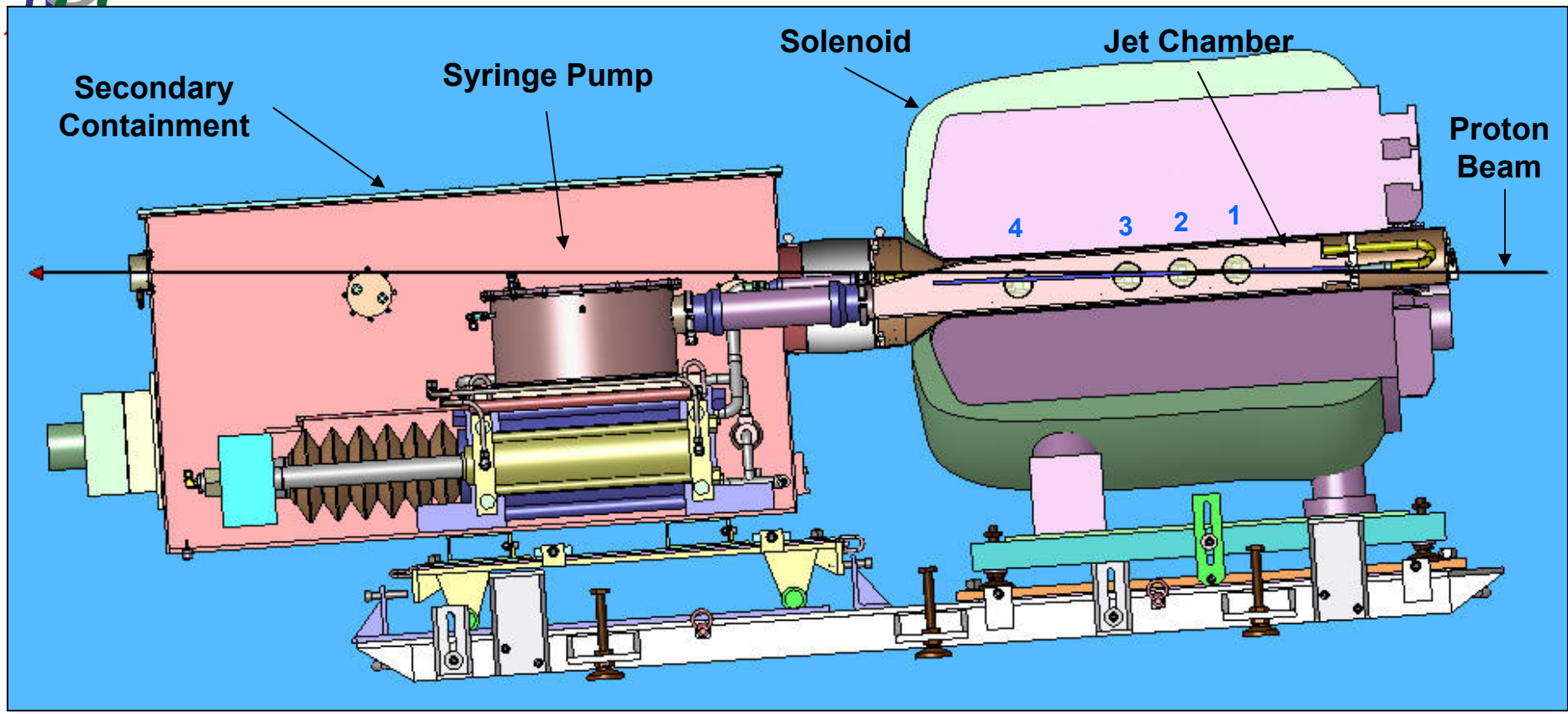
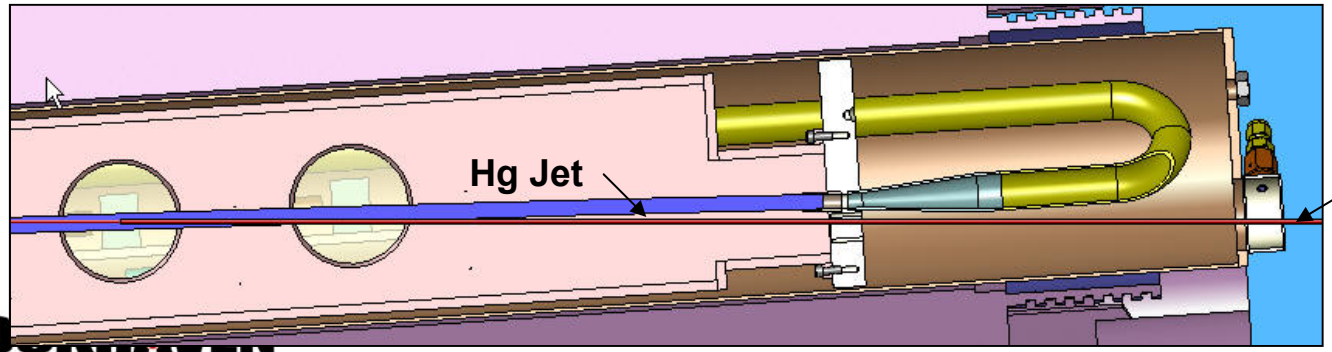
The Pump/Probe Detectors

- ACEM (Aluminum Cathode Electron Multiplier)
- Diamond



Sectional view of the MERIT Experiment





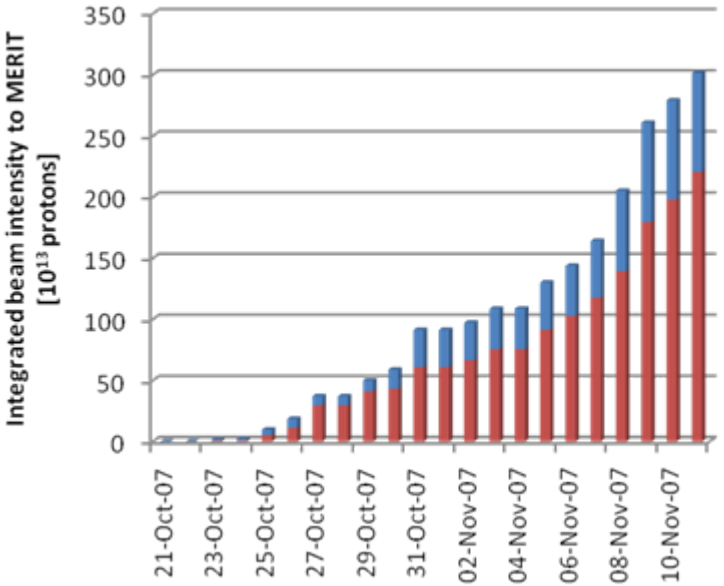
Profile of the Experiment

- 14 and 24 GeV proton beam
- Up to 30 x 10^{12} protons (TP) per 2.5μs spill
- Proton beam spot with r ≤ 1.5 mm rms
- 1cm diameter Hg Jet
- Hg Jet/proton beam off solenoid axis
  - Hg Jet 33 mrad to solenoid axis
  - Proton beam 67 mrad to solenoid axis
- Test 50 Hz operations
  - 20 m/s Hg Jet

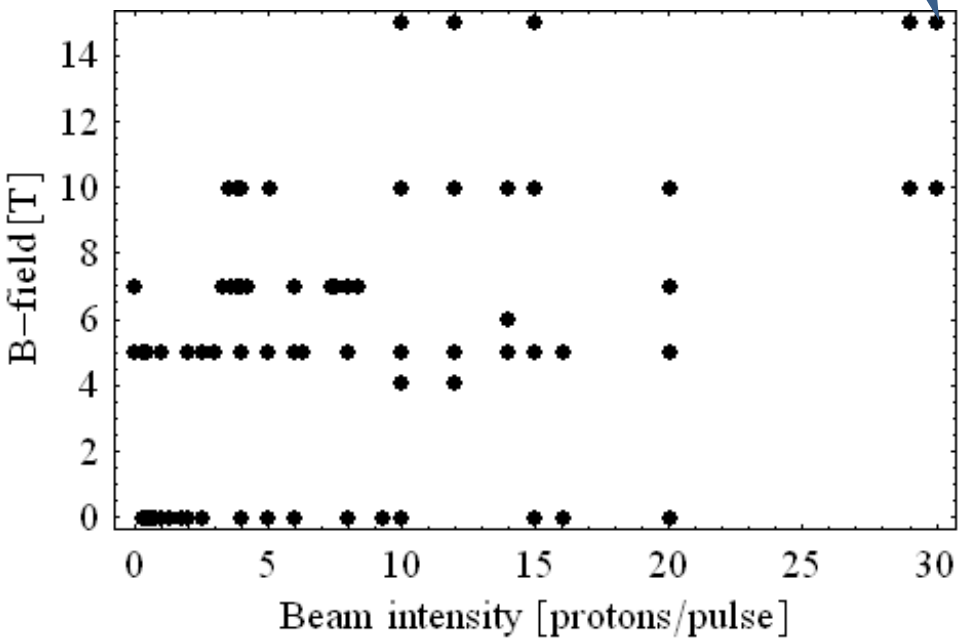
Proton Beam Characteristics

- PS was run in a harmonic 4, 8, and 16 mode
- Fast extraction can accommodate entire 2.5 μs PS fill.
- Full single turn extraction at 24 GeV
- Partial/multiple extraction possible at 14 GeV
- First Beam on Target October 17 2007

MERIT Beam Shots



- 30 x 10^{12} protons/pulse!!!
- 24 GeV
- 115kJ !!! a PS record



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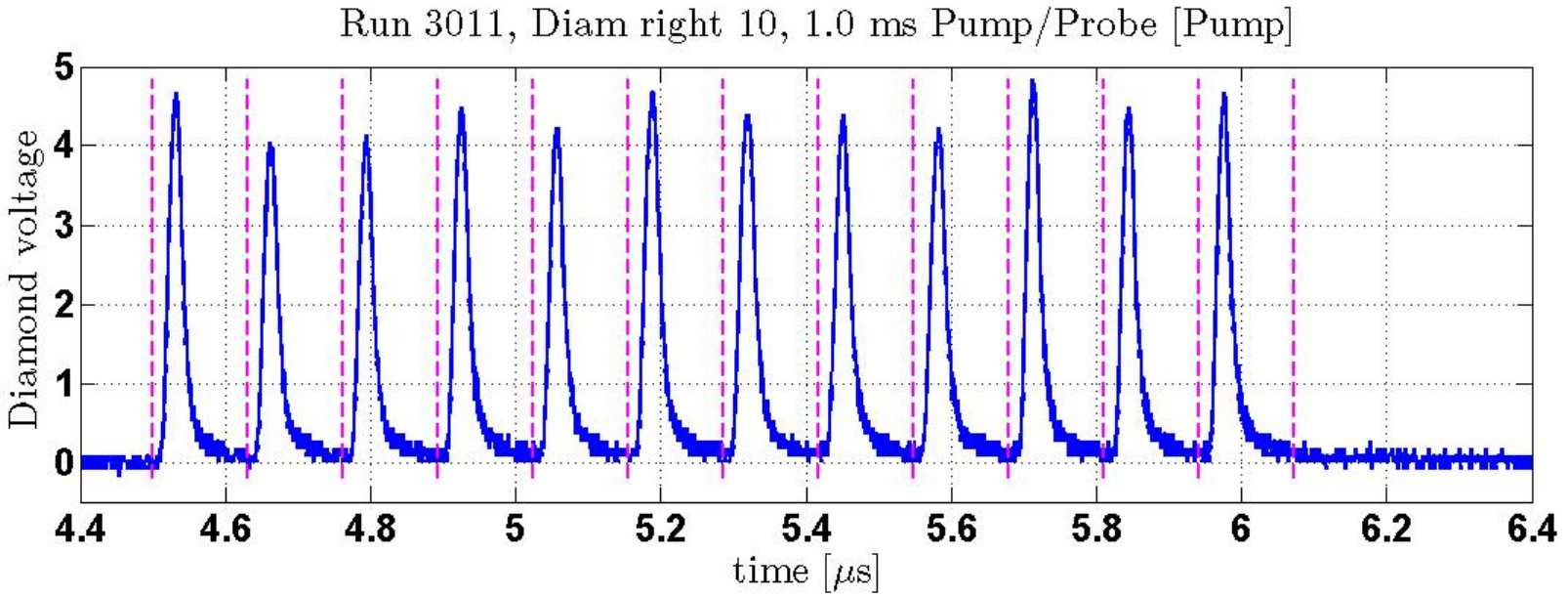
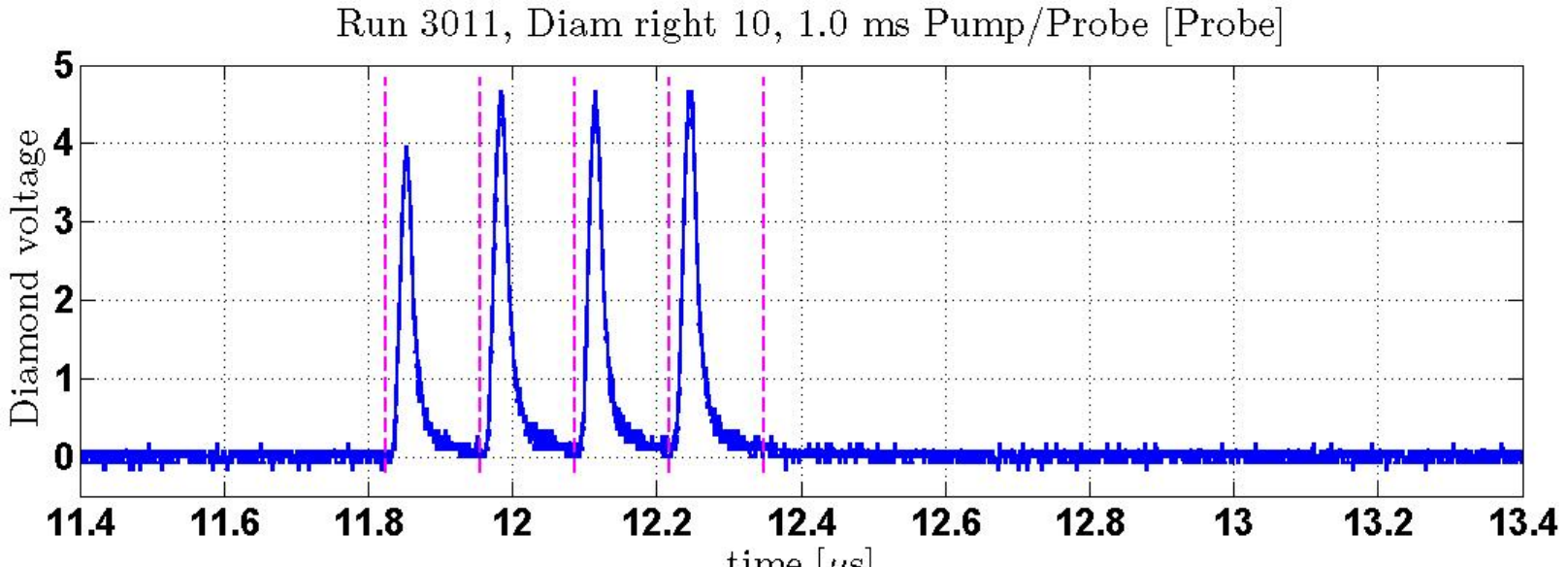
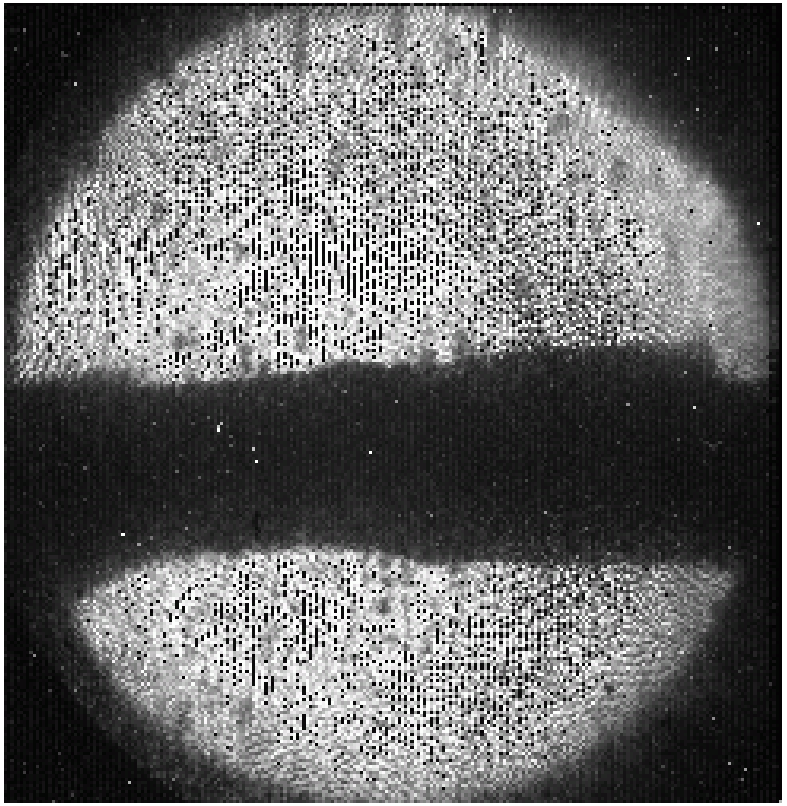
A 3TP Pump Pulse and a 1TP Probe Pulse with 1ms delay





15TP 14GeV Proton Beam



Oct. 27, 2007
Solenoid Field at 5T

Viewport 2

Beam 5016, Hg 15m/s, 100μs/frame, Total 1.6ms

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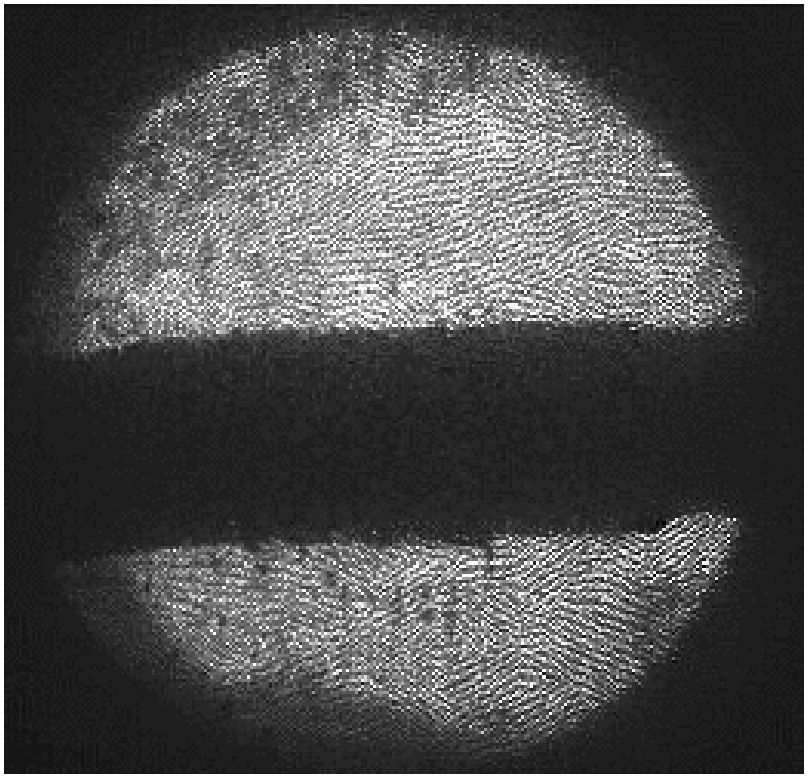
Viewport 3: Jet/proton interaction

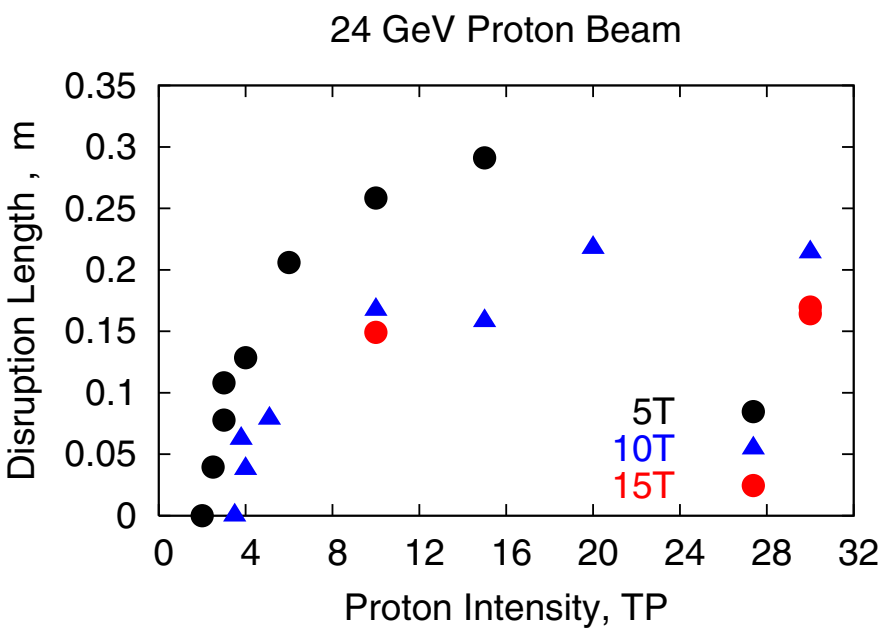


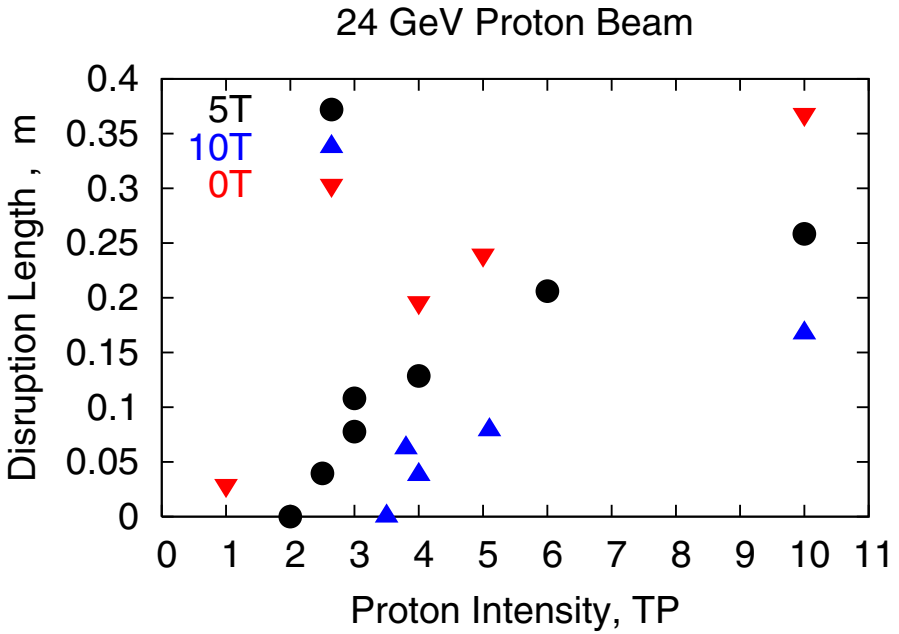
1 cm

Shot 16014
- 14 GeV
- 12×10^{12} protons/pulse
- B-field 10 T
- 500μs/frame

Disruption Length =16.5cm

Influence of B-field on Jet Disruption





The 24 GeV 30TP shot

Beam pulse energy = 115kJ

B-field = 15T

Jet Velocity = 20 m/s

Disruption Length = 16 cm

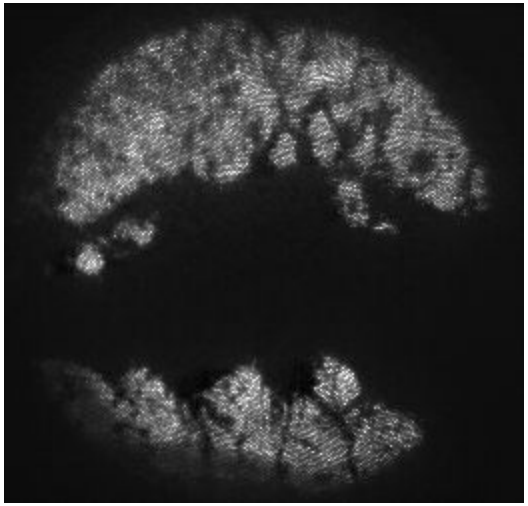
We will replace 2 interaction lengths (28cm)

Then the jet transport time is 28cm/20m/s = 14ms

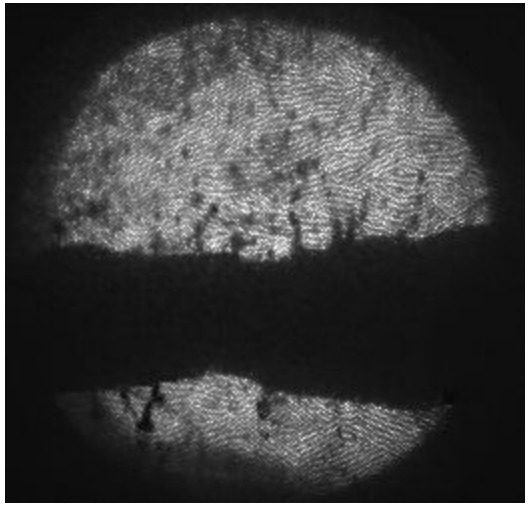
➔Rep rate of 70Hz

➔Proton beam power at that rate is 115kJ *70 = 8MW

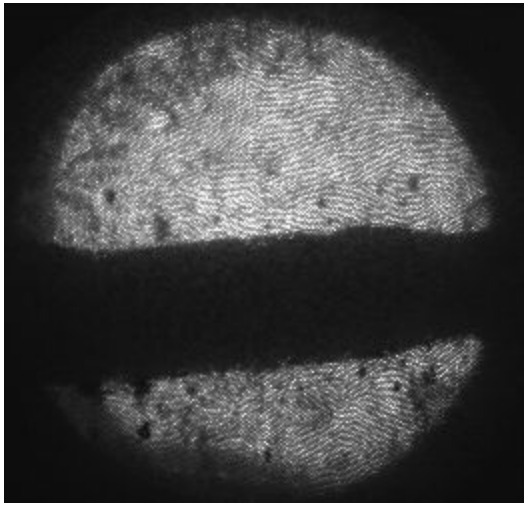
4TP + 4TP Delay Study:14 GeV 7T



Single Turn Extraction
➔ 0 Delay



4TP Probe extracted on subsequent turn
➔ 3.2 μs Delay



4TP Probe extracted after 2nd full turn
➔ 5.8 μs Delay

Target supports 14 GeV 4TP beam at 172kHz rep rate without disruption

Decommissioning

- Optics has been shipped to BNL
- Pulsed Solenoid ready to be removed from TT2a
- Hg Injection System
  - Hg removed to shipping vessels
  - 200 ml of Hg spilled and cleaned up (floor to be repainted)
  - Hydraulic fluid removed to shipping barrel
- Solenoid and Injection System to be removed from TT2a within next 2 weeks
- Solenoid, Cryo-system, Hg Injection system to be shipped to U.S. January 09

Data Analysis Activities

- Disruption threshold based on proton beam characteristics
  - Intensity variations
  - Proton beam harmonic structure
- Disruption threshold based on solenoid field strength
- Pump/probe studies
  - 15TP pump + 5TP probe with delays 2 to 700μs
  - 24 GeV pump/probe studies with delays < 2μs
- Magnetohydrodynamic studies
  - Disruption (filamentation) velocities
  - Quadruple distortions
- Proton beam spot size analysis

More MERIT Reports to Follow

Optical Diagnostic Results — **HeeJin Park**

MERIT Simulations — **Sergei Striganov**