



MERIT Experiment Status

NFMCC Collaboration Meeting

FNAL

March 17-20, 2008



The Collaborating Institutions

U.S.

Brookhaven National Laboratory

Fermi National Accelerator Laboratory

Oak Ridge National Laboratory

Princeton

Europe

CERN

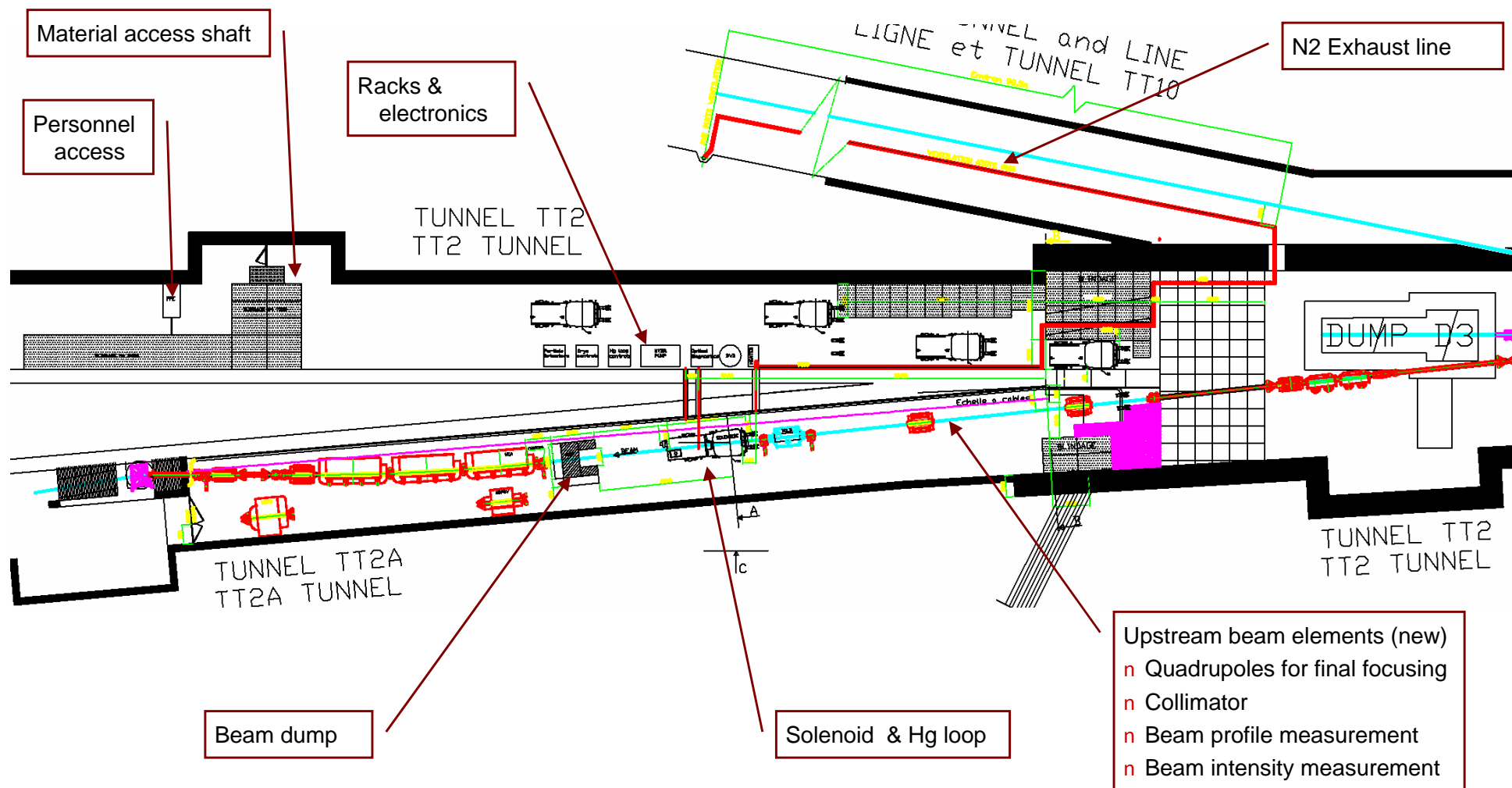
Rutherford Appleton Laboratory



NFMCC Mar. 17-20, 2008

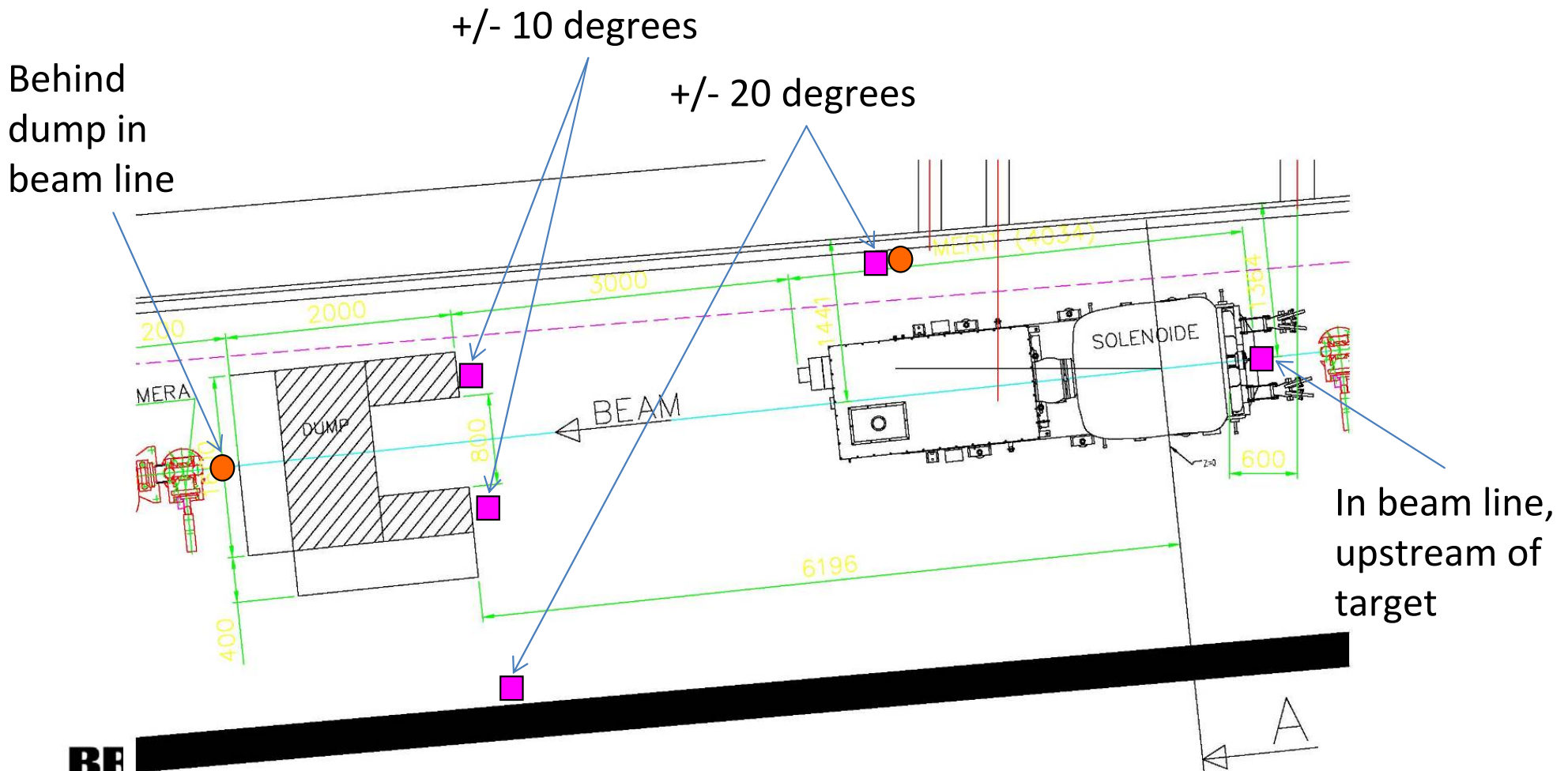
Harold G. Kirk

MERIT Experiment in the TT2a Area

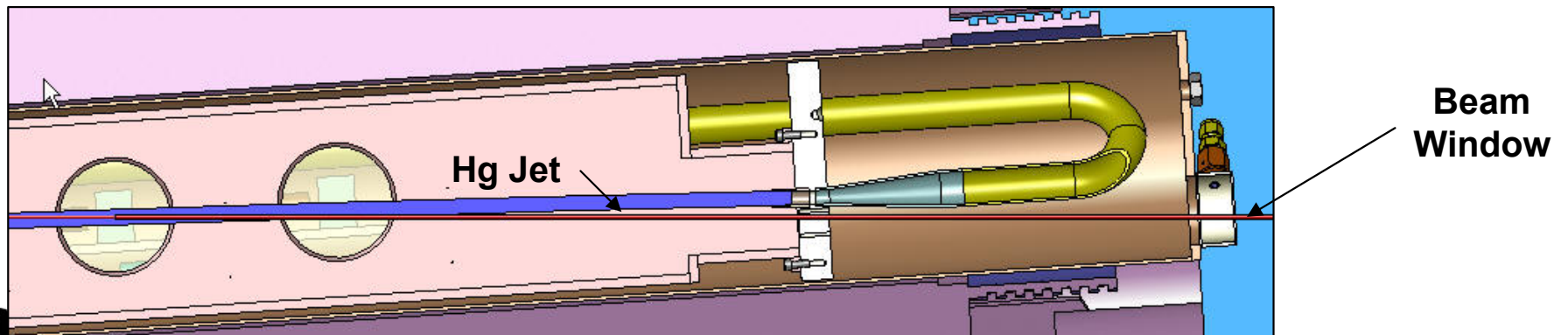
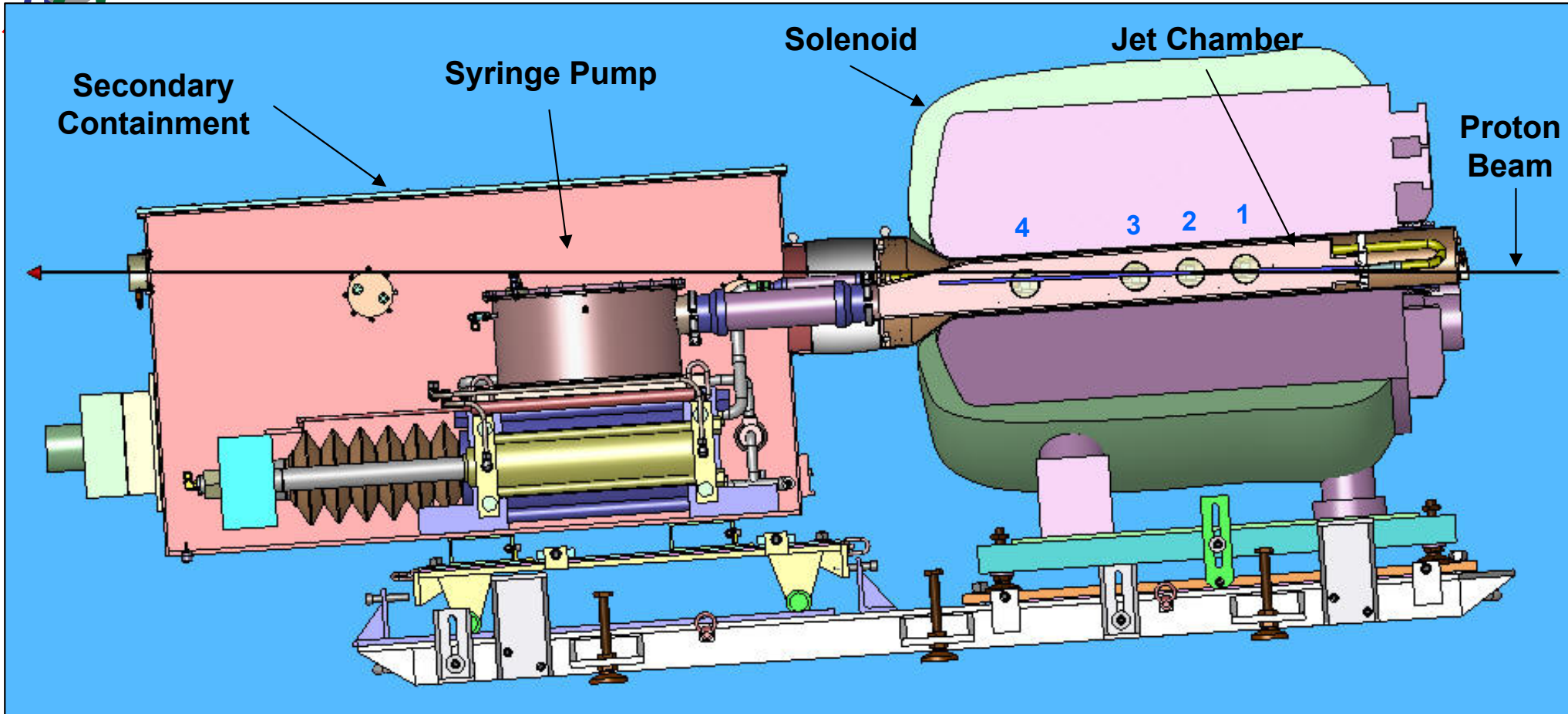


The Pump/Probe Detectors

- ACEM (Aluminum Cathode Electron Multiplier)
- Diamond



Sectional view of the MERIT Experiment





Profile of the Experiment

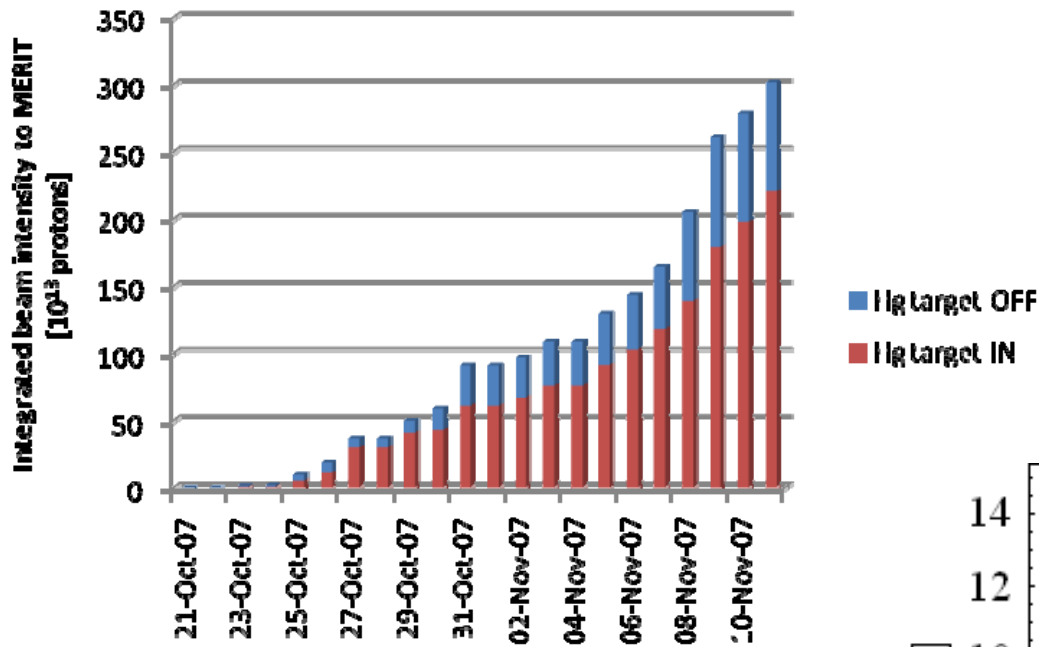
- 14 and 24 GeV proton beam
- Up to 30×10^{12} protons (TP) per $2.5\mu\text{s}$ spill
- Proton beam spot with $r \leq 1.5$ mm rms
- 1cm diameter Hg Jet
- Hg Jet/proton beam off solenoid axis
 - Hg Jet 33 mrad to solenoid axis
 - Proton beam 67 mrad to solenoid axis
- Test 50 Hz operations
 - 20 m/s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



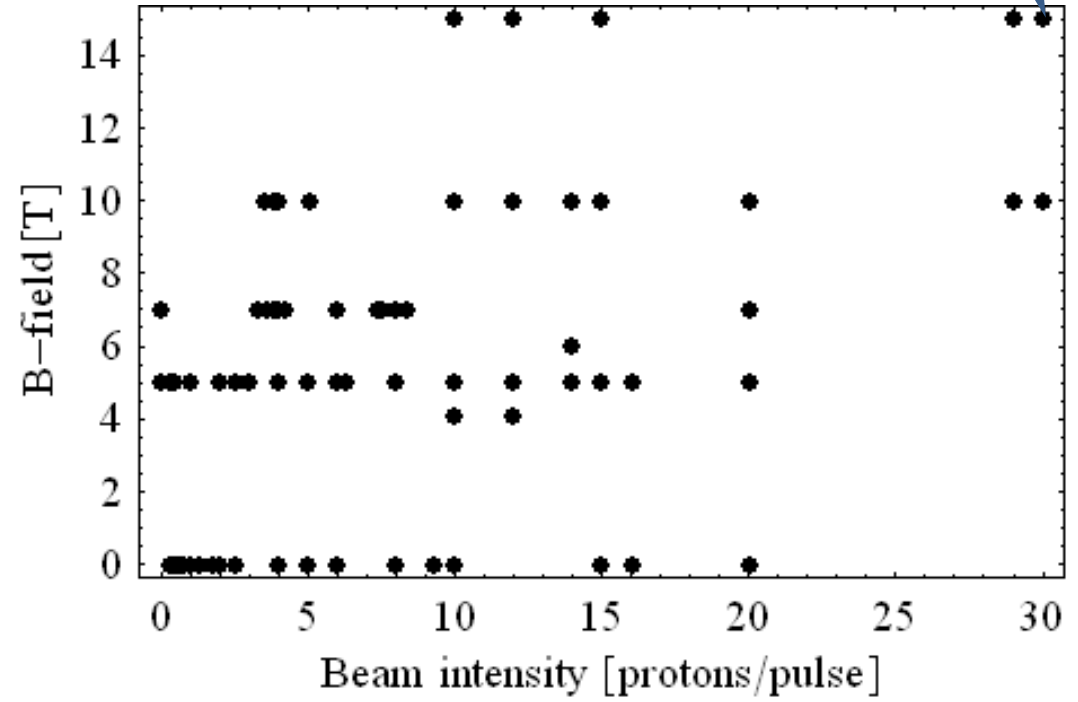
Proton Beam Characteristics

- PS was run in a harmonic 4, 8, and 16 mode
- Fast extraction can accommodate entire 2.5 μ s 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

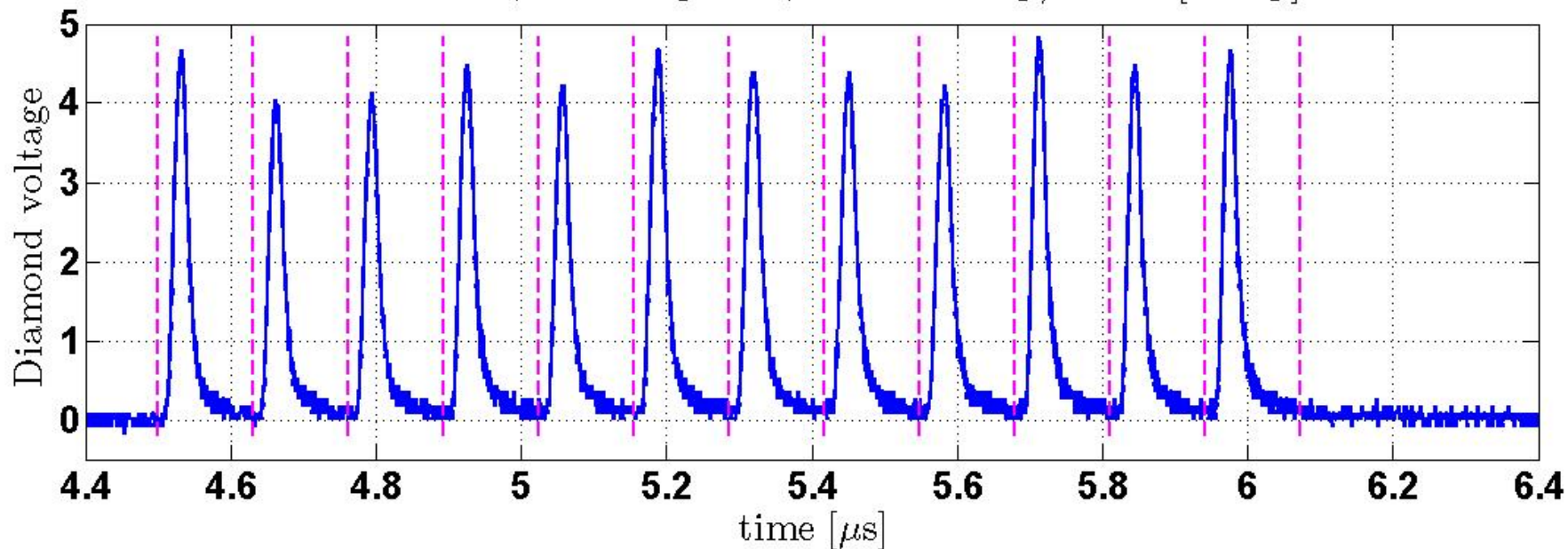


• 30×10^{12} protons/pulse!!!
 • 24 GeV
 • 115kJ !!! a PS record

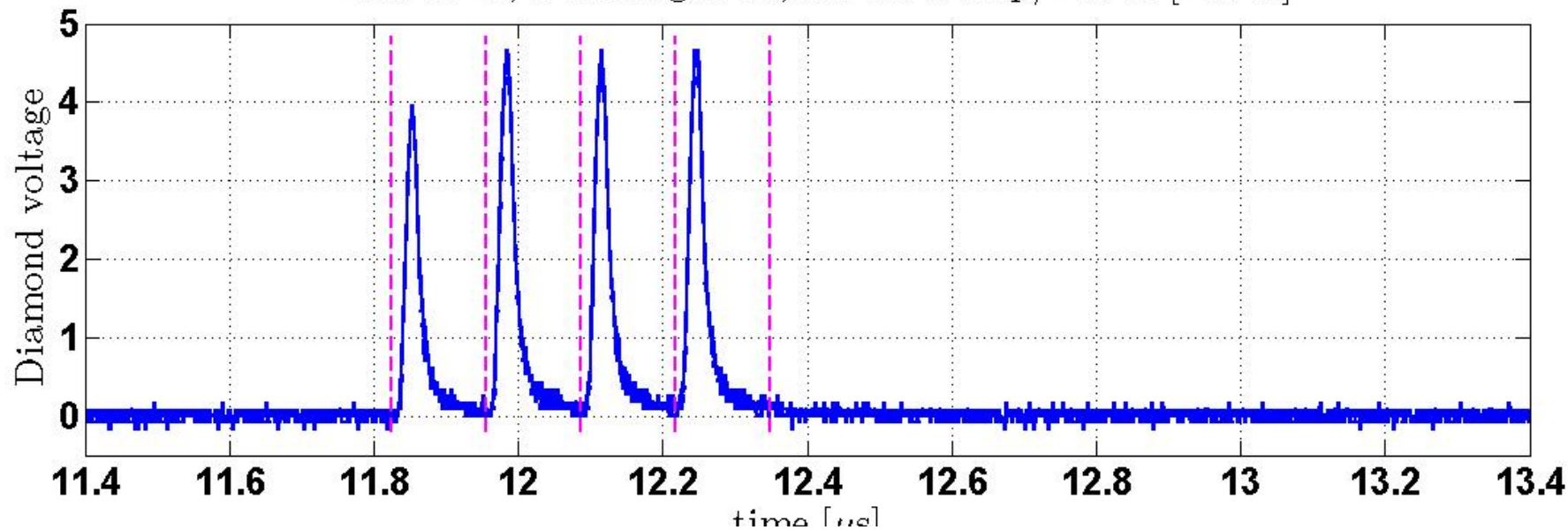


A 3TP Pump Pulse and a 1TP Probe Pulse with 1ms delay

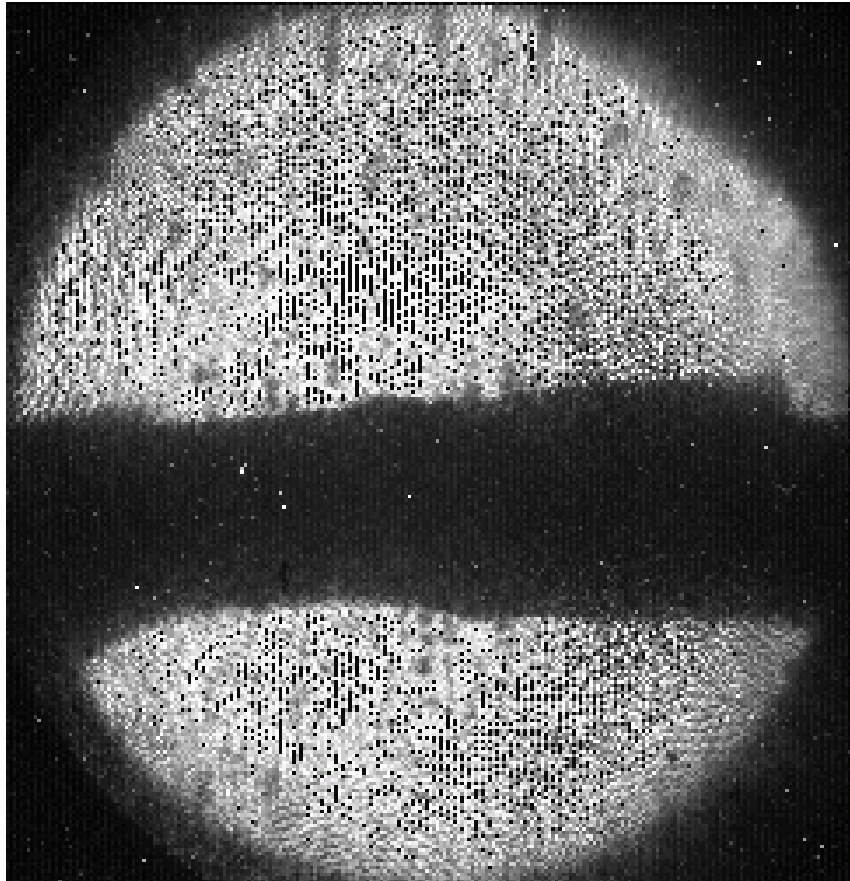
Run 3011, Diam right 10, 1.0 ms Pump/Probe [Pump]



Run 3011, Diam right 10, 1.0 ms Pump/Probe [Probe]



15TP 14GeV Proton Beam

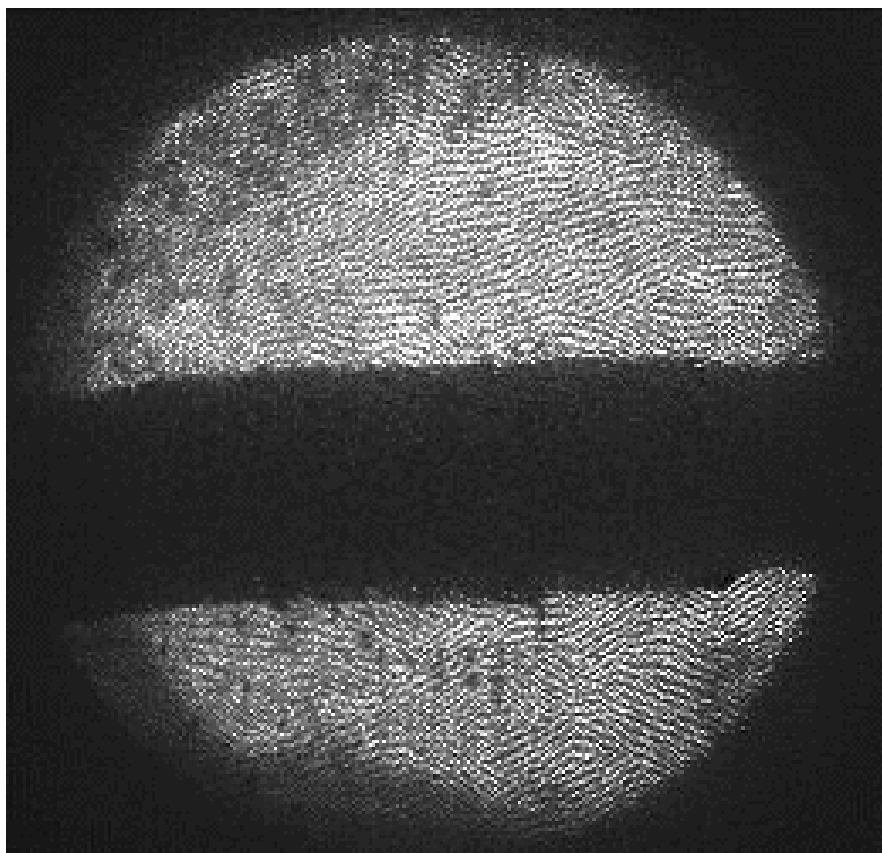


Oct. 27, 2007
Solenoid Field
at 5T

Viewport 2

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

Viewport 3: Jet/proton interaction



Shot 16014

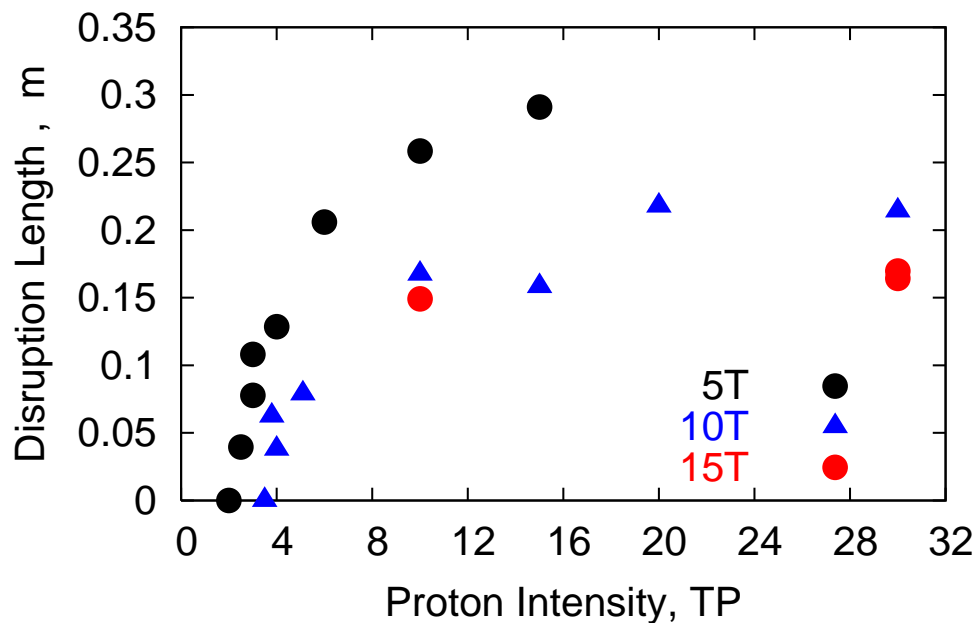
- 14 GeV
- 12×10^{12} protons/pulse
- B-field 10 T
- 500 μ s/frame

1 cm

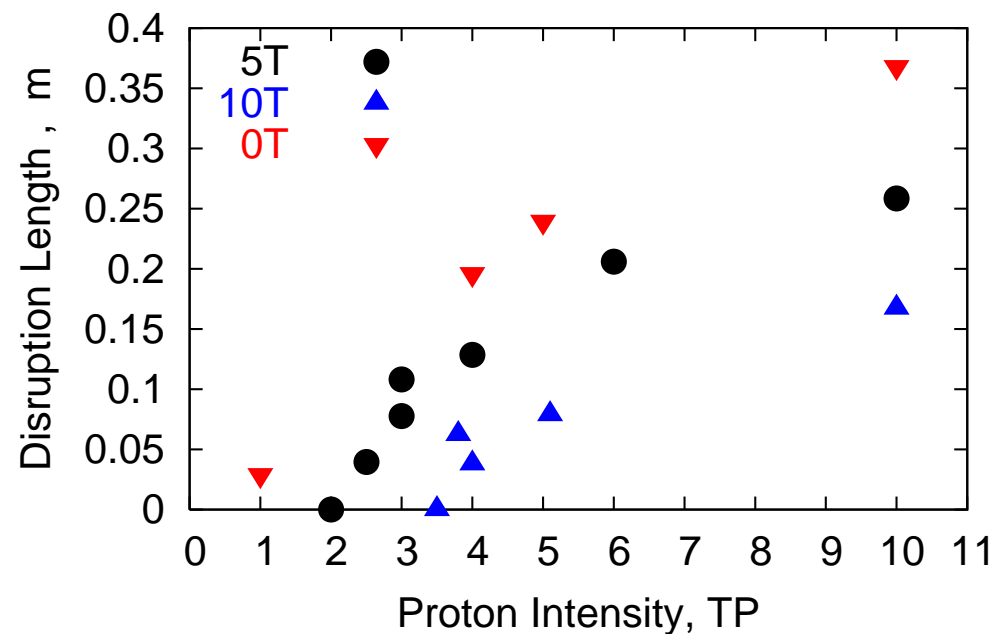
**Disruption Length
=16.5cm**

Influence of B-field on Jet Disruption

24 GeV Proton Beam



24 GeV Proton Beam





The 24 GeV 30TP shot

Beam pulse energy = 115kJ

B-field = 15T

Jet Velocity = 20 m/s

Disruption Length = 16 cm

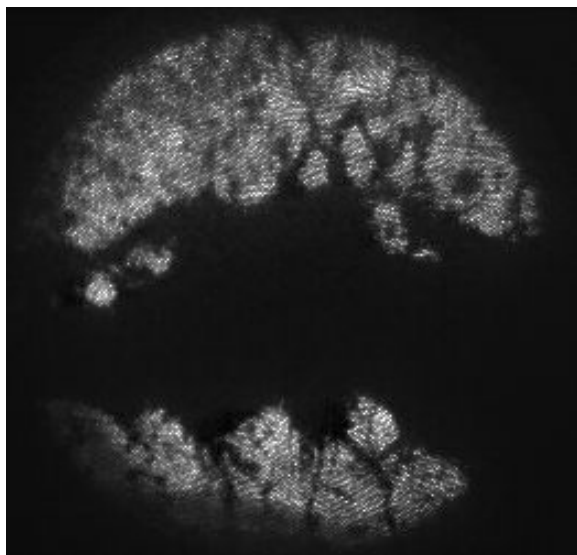
We will replace 2 interaction lengths (28cm)

Then the jet transport time is $28\text{cm}/20\text{m/s} = 14\text{ms}$

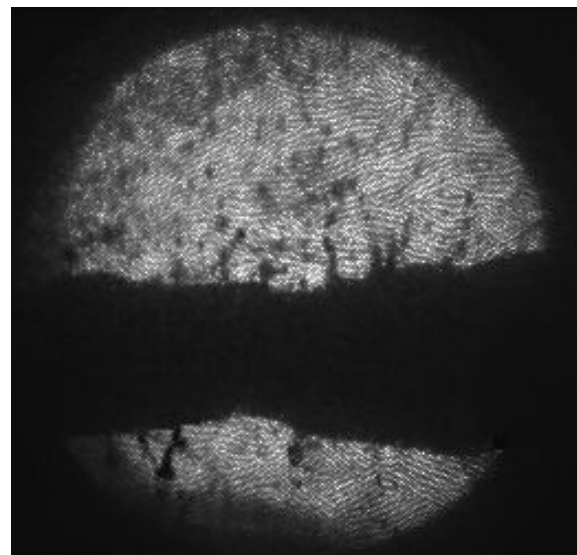
→ Rep rate of 70Hz

→ Proton beam power at that rate is $115\text{kJ} * 70 = 8\text{MW}$

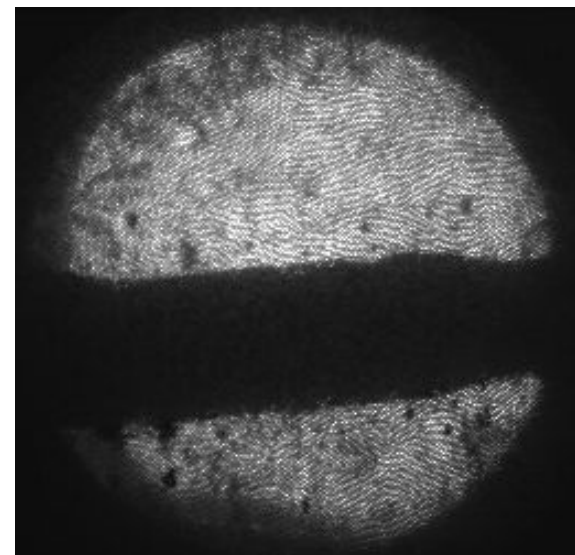
4TP + 4TP Delay Study: 14 GeV 7T



Single Turn Extraction
→ 0 Delay



4TP Probe extracted on
subsequent turn
→ 3.2 μ s Delay



4TP Probe extracted
after 2nd full turn
→ 5.8 μ s 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 700 μ s

24 GeV pump/probe studies with delays < 2 μ s

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