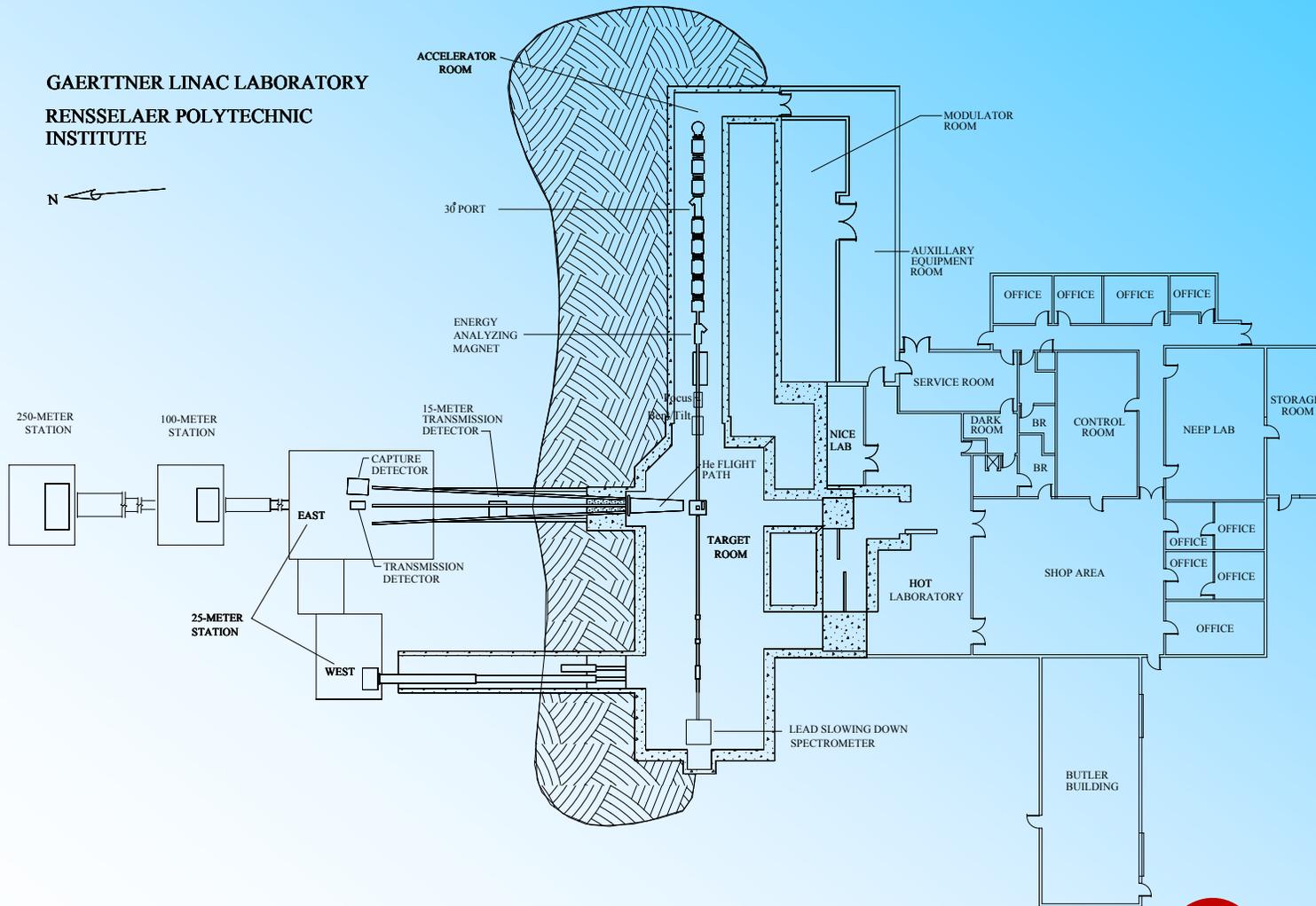


RPI LINAC Cross Section Capabilities

Advanced Fuel Cycle Workshop
Bethesda, MD
August 10-12, 2006



The RPI LINAC Facility



GAERTTNER LINAC LABORATORY
RENSSELAER POLYTECHNIC
INSTITUTE



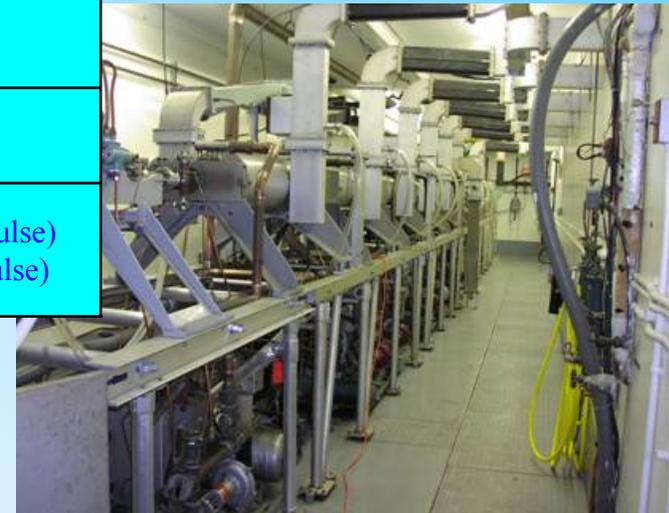
Rensselaer
Mechanical, Aerospace and Nuclear Engineering



The Gaertner Laboratory 2

LINAC Specifications

	Three Sections (Low Energy Port)	Nine Sections (High Energy Port)
Electron Energy	5 to 25 MeV	25 to over 60 MeV
Pulse Width	5 to 5000 ns	5 to 5000 ns
Peak Current	3A (short pulse: 5 to 50 ns) 400 mA (long pulse: 50 to 5000 ns)	3A (short pulse: 5 to 50 ns) 400 mA (long pulse: 50 to 5000 ns)
Average Power	10 kw @ 17 MeV, 5000 ns	>10 kw @ 60 MeV, 5000 ns
Peak Dose Rate	$\leq 1 \times 10^{11}$ Rads/s (in Si)	$\leq 6 \times 10^{11}$ Rads/s (in Si)
Neutron Production	n/a	$\sim 4 \times 10^{13}$ neutrons/sec
Pulse Repetition Rate	Single pulse to 500 pps (short pulse) Single pulse to 300 pps (long pulse)	Single pulse to 500 pps (short pulse) Single pulse to 300 pps (long pulse)



RPI Electron Linear Accelerator

- Recent Upgrades/Improvements
 - New klystrons
 - New pulse transformers
 - New thyratrons
 - Developed new gun and injection system
 - High peak current
 - Narrow pulse (5 ns)
 - Replaceable cathode
- Investment: Over \$1.5M

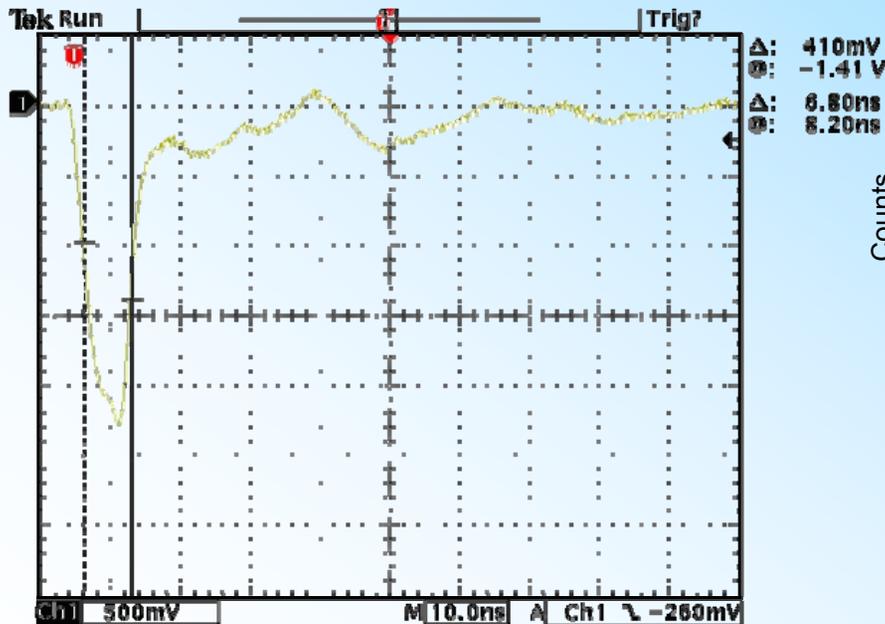


LINAC Injector Upgrade

- Completed Successfully

- 6ns pulse width
- ~5ns now available

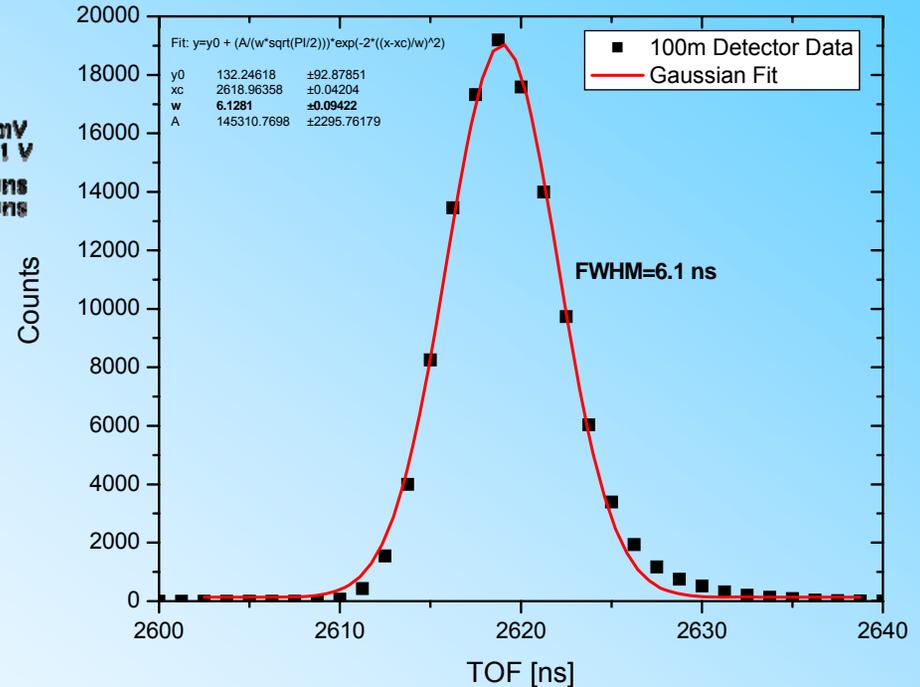
Current on Target



45.2000ns

20 Dec 2005
16:20:27

100m Detector γ Flash



Rensselaer

Mechanical, Aerospace and Nuclear Engineering



Experimental Setups

- Cross section measurements
 - Flight Paths at 15m, 25m, 30m, 100m and 250m
 - Several Neutron Production Targets
 - Lead Slowing Down Spectrometer
- Rabbit for sample activation
- X-Ray production target
- Low energy beam port for studies of radiation effects



Flight Station, Type of Measurement and Detector

15 m Flight Station

- Transmission Measurement
 - Thermal: 0.01 to 20 eV
 - ^6Li glass detector

25 m Flight Station

- Transmission Measurement
 - Epithermal: 5 eV to 3 keV
 - ^6Li glass detector
- Capture, Scattering and Fission
 - 0.01 eV to 1 keV
 - Large NaI multiplicity detector

30 m Flight Station

- Neutron Differential Scattering
 - 0.3 to 10 MeV
 - NE213-type scintillator detectors
 - » Pulse shape discriminator (separate neutrons from gammas)



Flight Station, Type of Measurement and Detector

100 m Flight Station

- Transmission & Neutron Spectra Measurements
 - 0.3 to 20 MeV
 - NE213-type scintillator detectors
 - » Large modular detectors
 - » Potential for pulse shape discrimination (separate neutrons from gammas)

250 m Flight Station

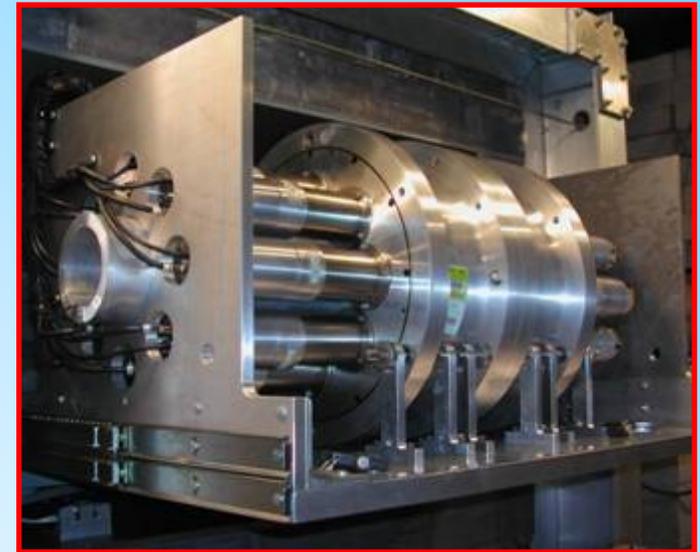
- Transmission & Neutron Spectra Measurements
- Currently Not Instrumented



Setup For Cross Section Measurements

- ^6Li -glass detectors for transmission measurements
- 16 segment NaI(Tl) multiplicity detector for capture, scattering and fission measurements
- Modular proton-recoil detectors for $\sim\text{MeV}$ energy transmission measurements
- Proton-recoil detectors for scattering neutron angular distribution
- Automated sample changers and beam blocks
- Neutron producing targets
- Lead slowing down spectrometer
- TOF data acquisition systems
- Data reduction systems

Many years of accumulated experience



Multiplicity Detector

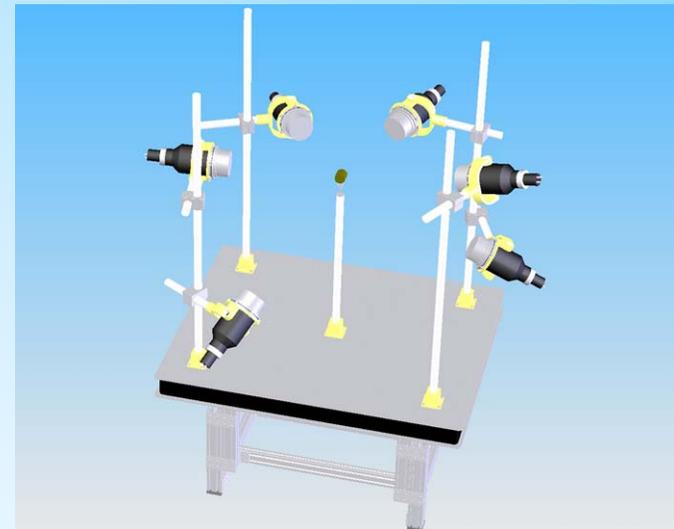
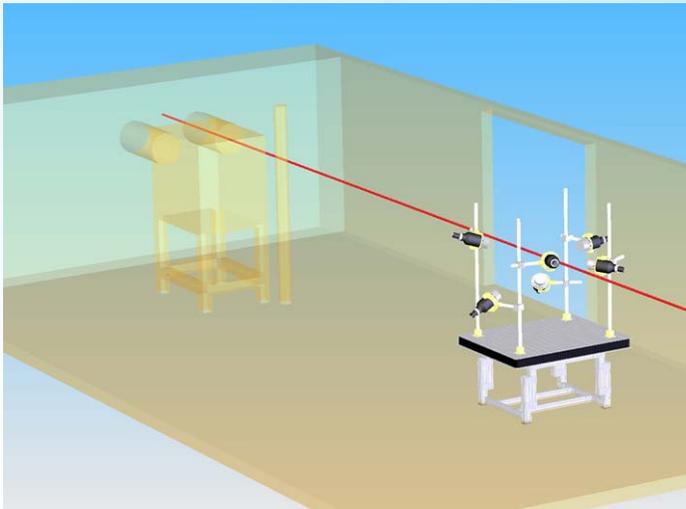
100m Transmission/Spectra Measurements

- Large Proton Recoil Detector
 - Modular Design
 - Six modules
 - 7"x14"x5" liquid scintillator
 - Two photomultipliers per module
 - Potential for pulse shape discrimination

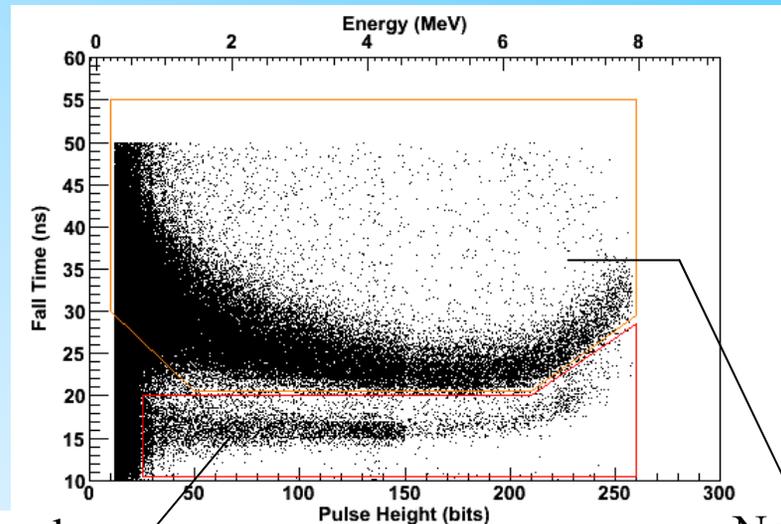


Differential Scattering Measurements

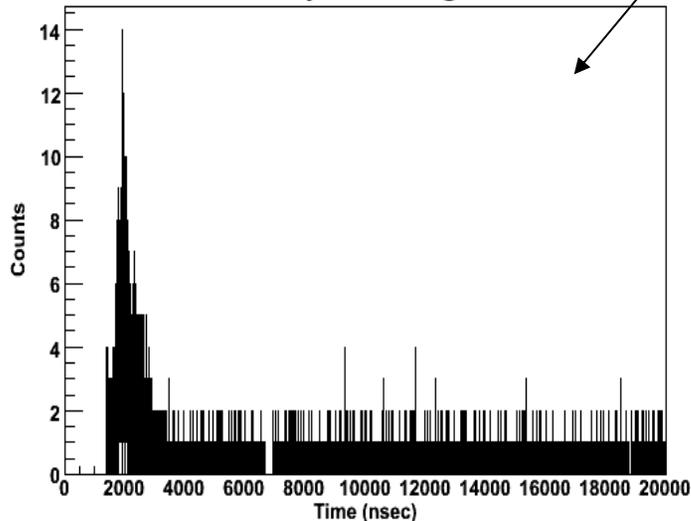
- 8 Proton Recoil Detectors
- Data Acquisition system
 - Record every pulse shape
 - Sort via software to separate neutrons from gammas



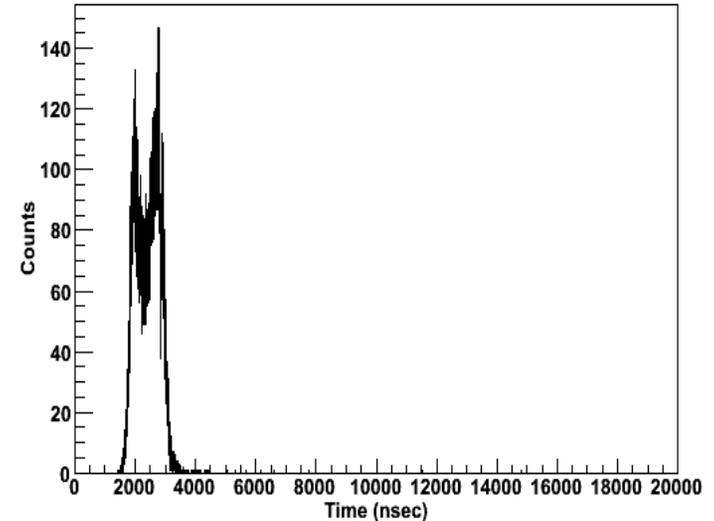
Background Reduction by Pulse Shape Analysis



Gamma Ray Background

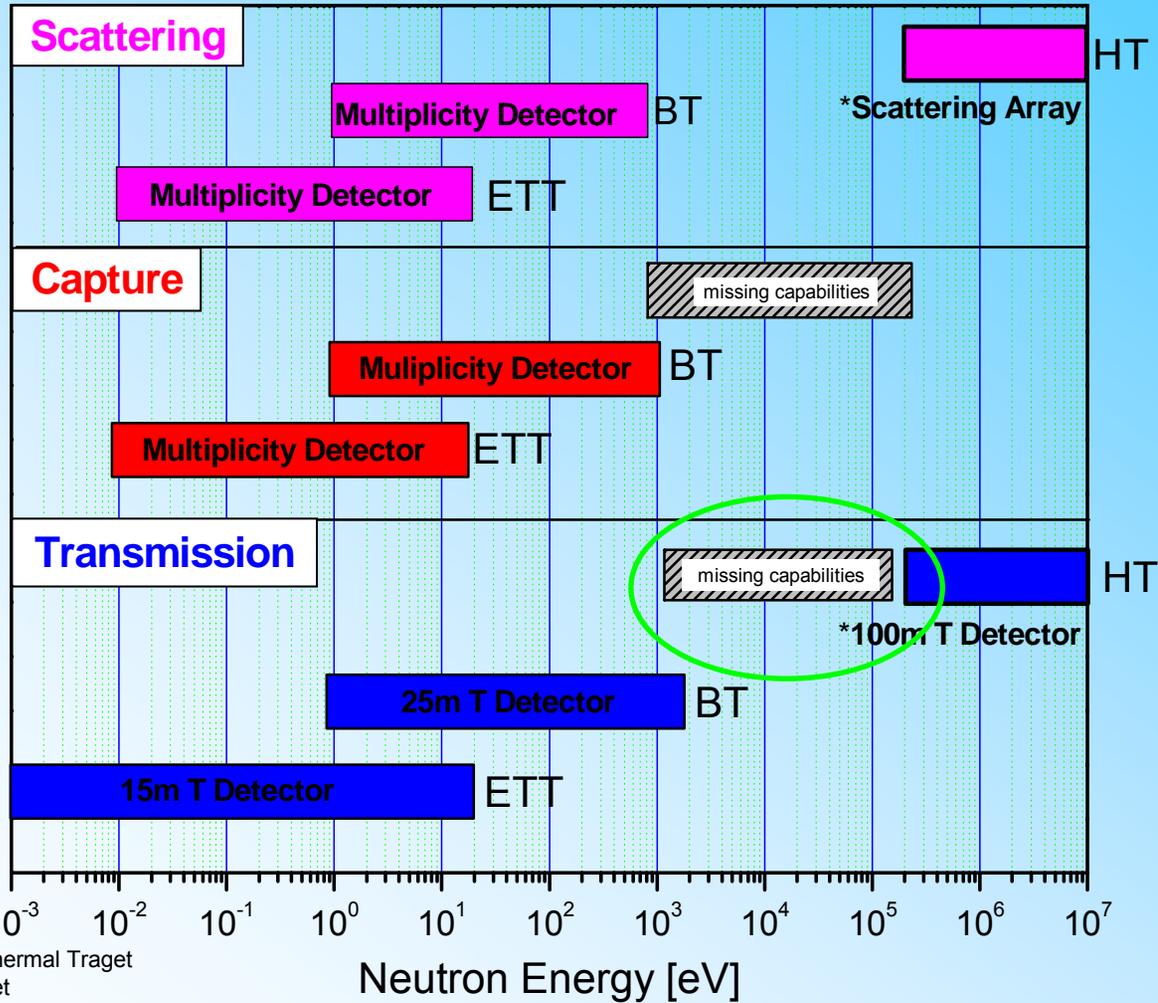


Neutron Time of Flight



Capabilities Matrix

RPI LINAC - Nuclear Measurement Data capabilities 2005



Targets

ETT- Enhanced Thermal Target

BT - Bounce Target

HT - High energy target (to be built)

* Under Construction



Rensselaer

Mechanical, Aerospace and Nuclear Engineering



The Gaertner Laboratory

RPI LINAC Cross Section Capabilities

Advanced Fuel Cycle Workshop
Bethesda, MD
August 10-12, 2006

