MIT PhD students work on NIF diagnostics (2nd DTn[1], WRF/SRF[2], PRAD[3], MRS-t[4], PTOF) and fundamental physics (hohlraum x-rays[5] and fields[6])

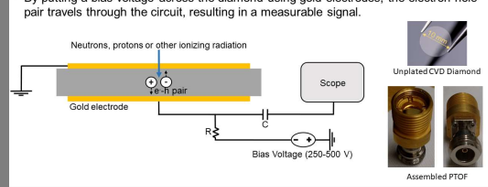
Neel Kabadi*, Benjamin Reichelt*, Hong Sio^, Hans Rinderknecht#, Eddie Mariscal^, Edwin Casco^, Francisco Barbosa^, Dusty Boyle^, Matt Hamamoto^, Jason Prince^, Maria Gatu Johnson*, Johan Frenje*, Chikang Li*, Fredrick Séguin*, Richard Petrasso*, Alastair Moore^, Richard Bionta^, Shahab Kahn^
* Massachusetts Institute of Technology Plasma Science and Fusion Center
^ Lawrence Livermore National Laboratory
# Laboratory for Laser Energetics

Background and Motivation

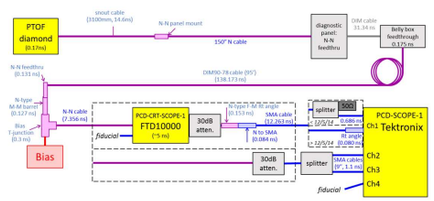
- PTOF is a CVD-diamond based detector that is regularly used at the NIF on many campaigns
- The primary purpose of PTOF is to measure both shock and compression nuclear bang times
- PTOF data combined with proton spectra can be used to infer information about ρR evolution.
- MagPTOF uses a permanent magnet to deflect protons onto the diamond detector while blocking large X-ray signals
- The MagSpec diagnostic used the same magnet at MagPTOF to make proton spectral measurements

The active medium in PTOF is a Chemical Vapor Deposition (CVD) diamond which is biased to high voltage

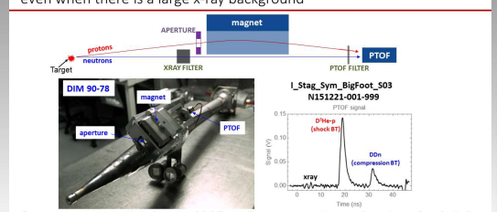
- When energetic particles or radiation hit the diamond it frees an electron hole pair.
- By putting a bias voltage across the diamond using gold electrodes, the electron hole pair travels through the circuit, resulting in a measurable signal.



A cable chain is used to transport the electrical signals from the NIF target chamber to a series of digitizers and scopes



The MagPTOF upgrade allows measurement of nuclear bang times even when there is a large x-ray background

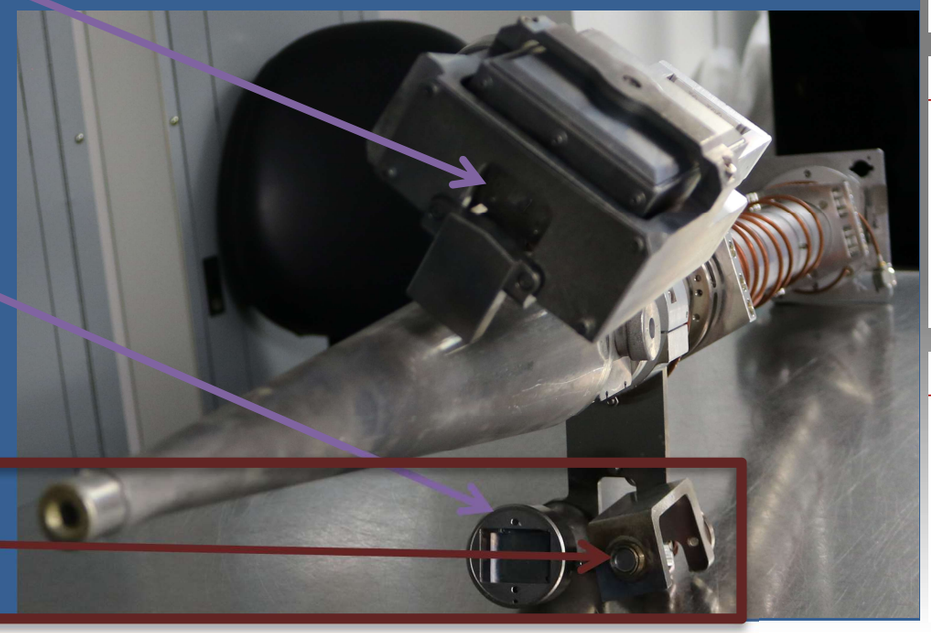


A permanent magnet and x-ray shielding allow x-ray, proton, and neutron signals to be measured with similar amplitudes

PTOF/MagPTOF is regularly used to measure DD-n, D^3He-p, and low yield DT-n bang times at the NIF

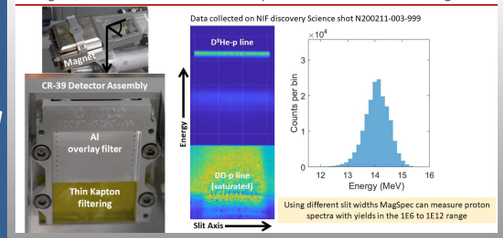
MagSpec is a new proton spectrometer for measuring protons in the 1-16 MeV range

WRF spectrometers are regularly used to measure proton spectra in the 5-15 MeV range

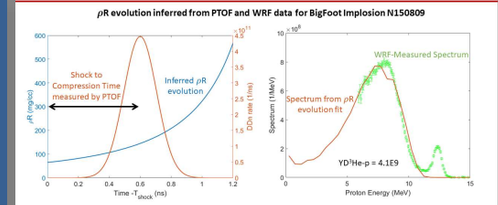


The PTOF diagnostic on a NIF DIM build

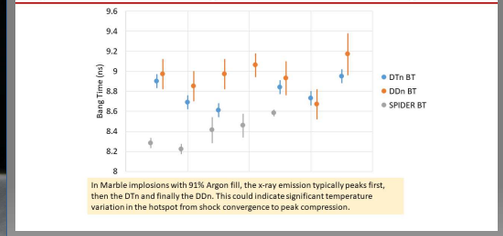
MagSpec is a new Proton Spectrometer that uses the existing MagPTOF infrastructure to measure protons in the 1-16 MeV range



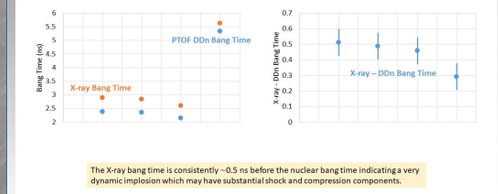
Data from PTOF and proton spectrometers (like WRFs or MagSpec) can be used to constrain ρR evolution.



The DDn and DTn bang times were both measured on MARBLE experiments and indicate large temperature variation during burn



On NIF exploding pusher shots the PTOF-measured DDn bang times are consistently earlier than SPIDER X-ray bang times



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[1] poster by Patrick Adrian
[2] poster by Tim Johnson
[3] poster by Graeme Sutcliffe
[4] poster by Justin Kunimune
[5] poster by Ben Reichelt
[6] poster by Jacob Pearcy