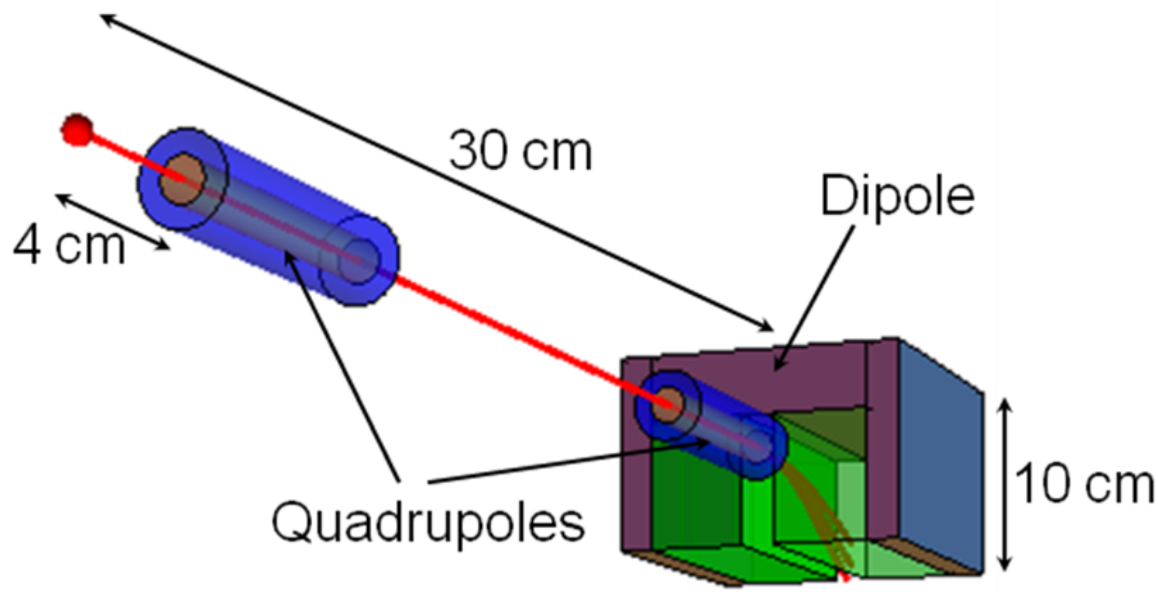
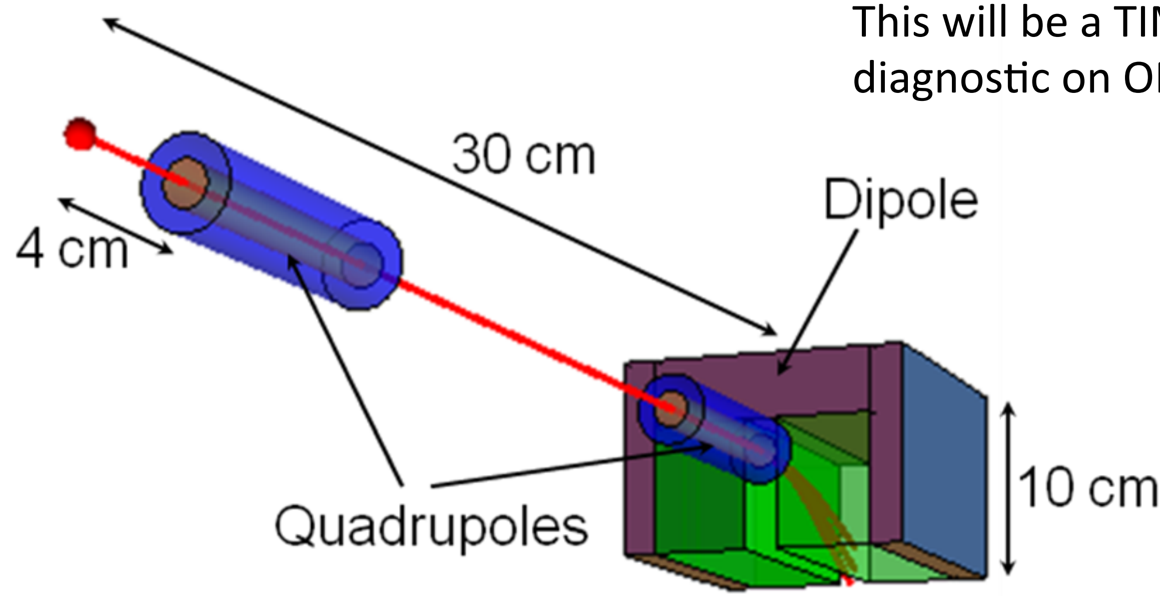
An ultra-low-yield charged-particle spectrometer for studying nucleo-synthesis reactions in OMEGA implosions.

Compact magnetic spectrometer



High spectral accuracy at low yield will be obtained with a new, novel compact collimating magnetic spectrometer

This will be a TIM-based diagnostic on OMEGA.



This diagnostic would allow measurements of charged particle spectra (a, p, D, …) at low yield ($\geq 10^6$)

Existing magnetic spectrometers (CPS, TP) are limited to yields $\geq 10^9$

Motivation: Several reactions relevant to stellar nucleosynthesis and basic nuclear physics can be studied at ICF facilities using charged particles.

1. **T + T → 2n + ♋**

   TPIE, CPS can measure spectra at high T_i (≥4 keV)
   Compact spectrometer would allow measurements at 2-3 keV
   - extend CM energy range of measurements

2. **^{3}He + ^{3}He → 2p + ♋**

   Existing diagnostic (WRF) can measure proton spectra for Ep ≥ 4 MeV
   Compact spectrometer would measure low-energy protons and as

3. **T + ^{3}He → ♋ + n + p**
   → ♋ + D
   → ^{6}Li + g

   TPIE, CPS capability can measure spectra at high T_i (≥7-8 keV)
   This spectrometer would allow measurements at ≥4 keV
   - extend CM energy range of measurements

4. **p + ^{11}B → 3♋**

   No existing diagnostic can measure ♋ spectra

5. **p + ^{15}N → ♋ + ^{12}C**

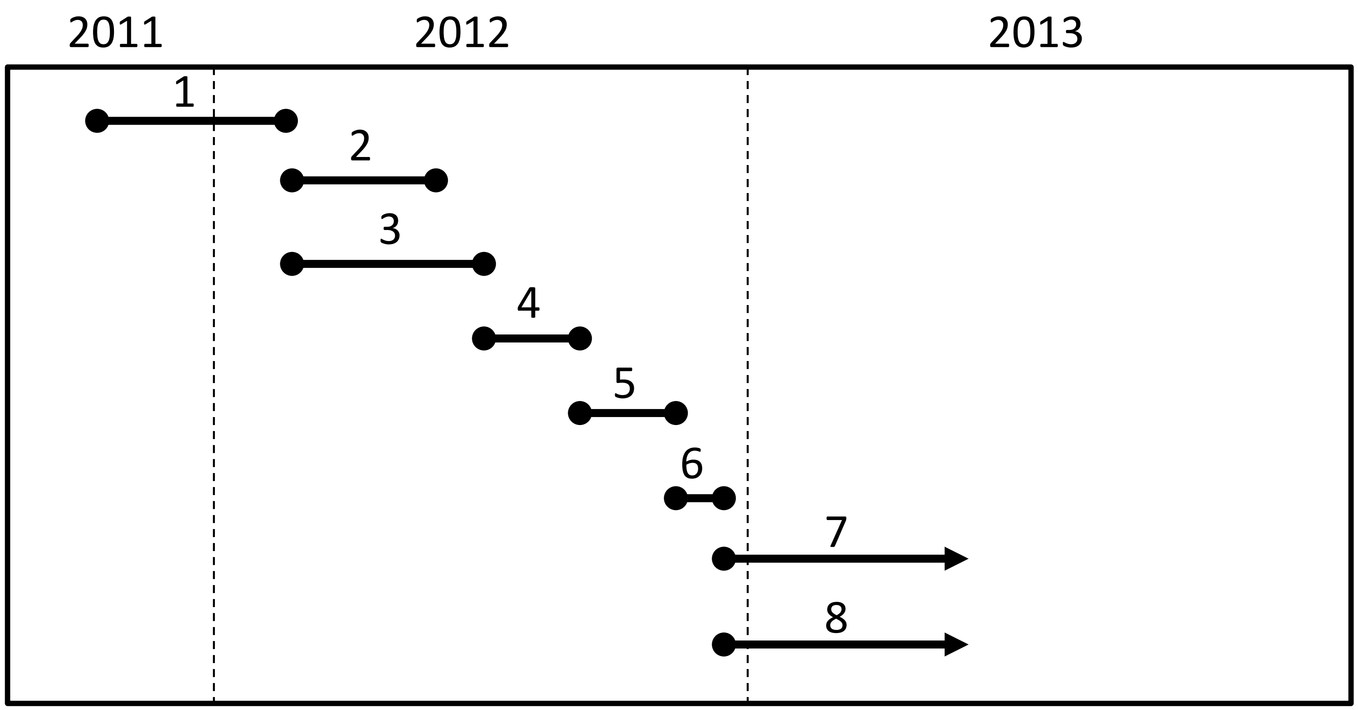
   No existing diagnostic can measure ♋ spectra

Groups interested in these capabilities:
MIT, LLNL, LLE,
LANL, IU

CPS = Charged Particle Spectrometer
WRF = Wedge Range Filter

Proposed project phases and timeline

1. Complete conceptual design (MIT)
2. Acquire magnets
3. Housing / TIM interface design (MIT and LLE)
4. Fabrication (MIT and LLE)
5. Testing and calibration on MIT accelerator
6. Implementation at OMEGA
7. Field on implosions
8. Construct additional detectors (to allow fielding in multiple TIMs)



Required resources and facility impacts

1. **Required resources**
   - Fabrication ~ $150 -200k per spectrometer
     - Magnets $25k
     - Support structure and housing $40k
   - Determine what additional LLE resources/engineering support required.
   - MIT accelerator needed for calibration and end-to-end instrument testing and debugging

2. **Facility impacts**

   Minimal, since this is a TIM-based diagnostic