Neutron Burn History Measurements of D₂ Cryogenic Targets on OMEGA

V. Yu. Glebov
University of Rochester
Laboratory for Laser Energetics

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Collaborators


Laboratory for Laser Energetics
University of Rochester

Related Talks:

J. A. Delettrez  GO2.004
T. C. Sangster  RI1.006
Summary

CryoNTD records the important neutron burn history information for D$_2$ cryogenic implosions on OMEGA

- CryoNTD was built because the NTD system on OMEGA is too insensitive to measure the burn history of D$_2$ cryogenic implosions due to standoff requirements of the Cryogenic Target Handling System.

- CryoNTD has a time resolution $\sim$ 80 ps, absolute timing calibration $\sim$ 40 ps, and a sensitivity of $\sim$ 10$^9$ neutrons.

- CryoNTD data is correlated with ice-layer quality (melting or crystallization) at shot time.

- The neutron burn history of the layered D$_2$ cryogenic targets generally agrees with the LILAC calculation.
We built a TIM-based cryoNTD specially for D₂ cryogenic target shots on OMEGA

- **NTD**
  - 0.6-cm scintillator at 20 cm from TCC

- **CryoNTD**
  - 3-cm scintillator at 9 cm from TCC
The cryoNTD setup uses the OMEGA fiducial system as a timing reference.
Cryo NTD sensitivity is about $1 \times 10^9$ neutrons

Streak camera image

Shot 27143
$Y = 1.72 \times 10^9$
Absolute timing of the cryoNTD was established with 40-ps accuracy using NTD as a reference.
A layered cryogenic target can be in one of the three stages inside the OMEGA target chamber:

- Heating = Cooling
- Heating > Cooling
- Heating < Cooling

A cryogenic target inside the target chamber is in the layering sphere before the shot.

Transmission of the IR fiber can change up to 10% during insertion into the target chamber.
A “crystallized” cryogenic target has a neutron burn width much wider than predicted by *LILAC*.
A “melted” cryogenic target has a neutron bang time much earlier than predicted by *LILAC*.
A layered cryogenic target has a neutron burn history in general agreement with *LILAC* prediction.
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