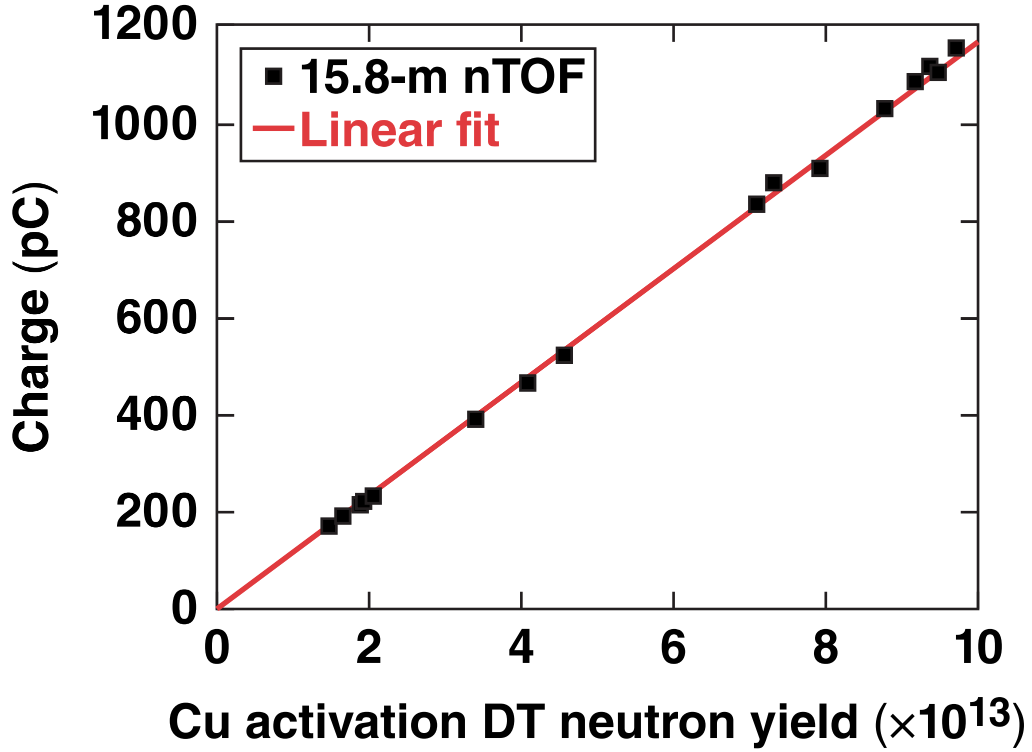
A New Neutron Time-of-Flight Detector for DT Yield and Ion-Temperature Measurements on OMEGA



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Summary

A new neutron time-of-flight (nTOF) detector for DT yield and T_i measurements was implemented on OMEGA

- The new 15.8-m nTOF detector has a 40 × 20-mm BC-422Q scintillator, ND2 filter, and PMT-140 photomultiplier in a lead-shielded housing
- It provides a second line of sight (LOS) for DT yield measurements from 1×10^{12} to 2×10^{14} and T_i measurements from 2 to 20 keV
- The 15.8-m nTOF detector measures yield with ~1% precision and ion temperature with better then 3% precision
- Large differences in the T_i in different directions suggest bulk fuel flows in cryogenic implosions

E24682

Collaborators

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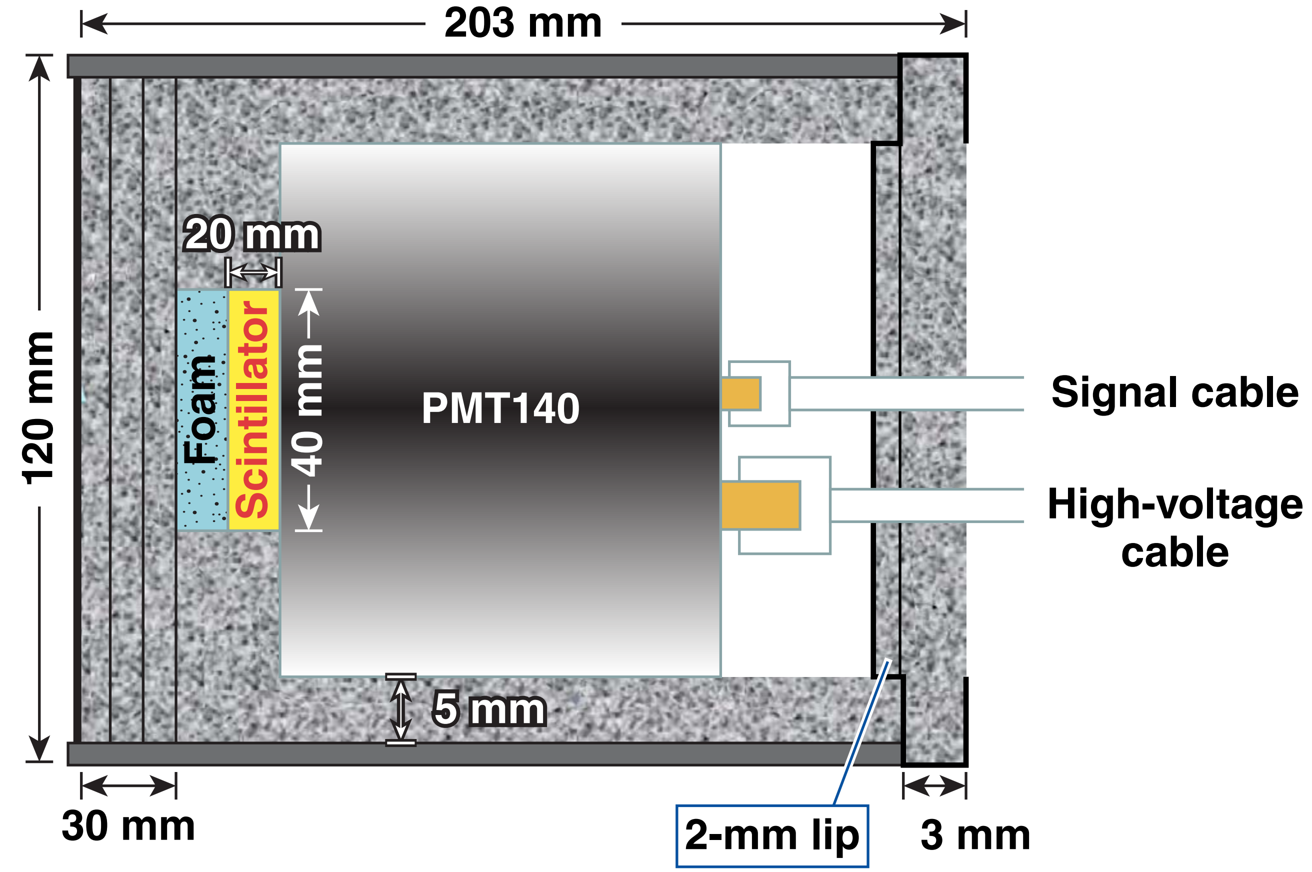
The design of the 15.8-m nTOF is similar to the 12-m nTOF* with some shielding thickness adjustments



- The front shielding has removable 10-mm-thick lead plates with three plates maximum; one plate is now in use

*V. Yu. Glebov *et al*., Rev. Sci. Instrum. 75, 3559, (2004).

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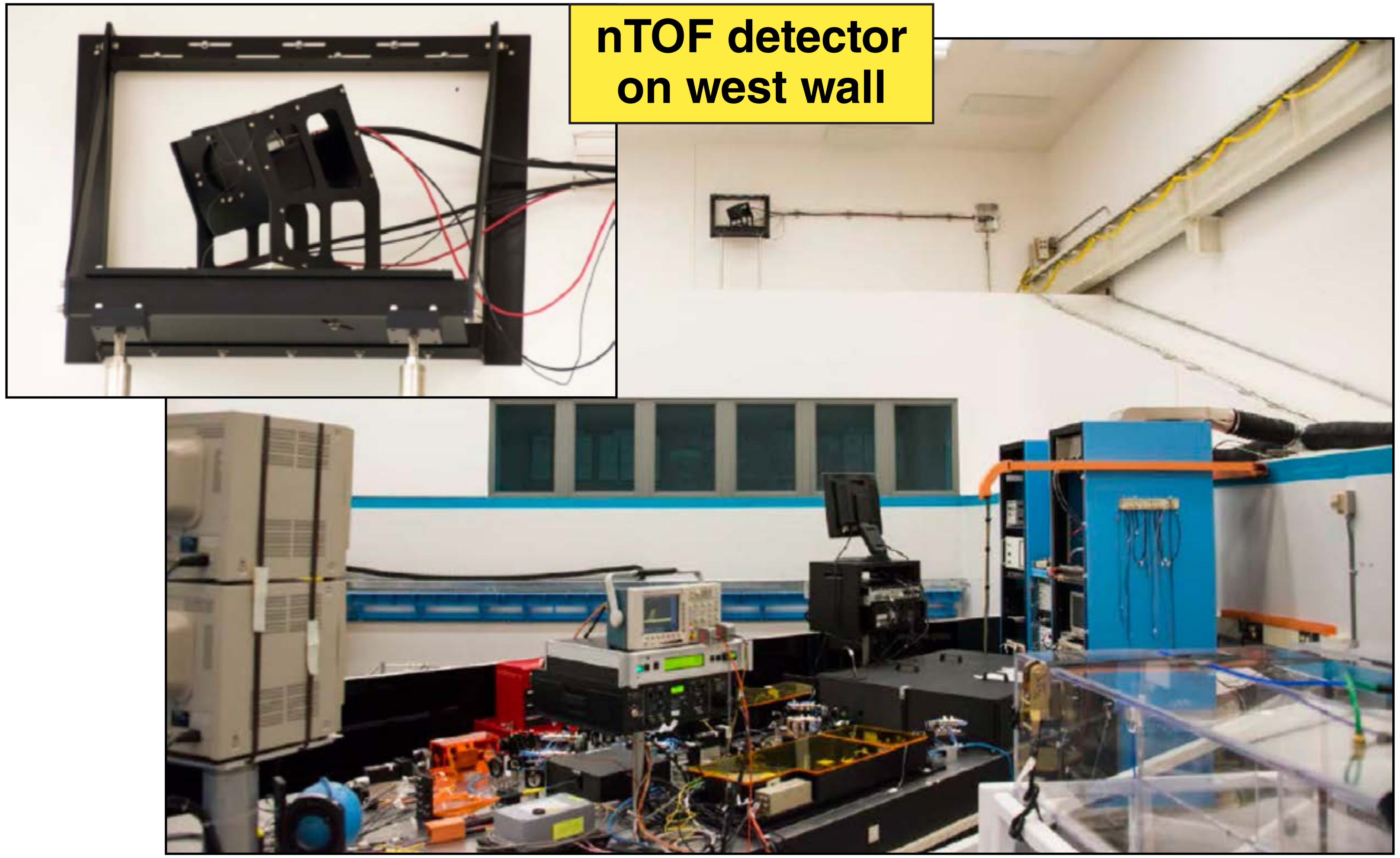
A new 15.8-m nTOF detector was installed on the west wall above the OMEGA viewing gallery



Electronics in viewing gallery closet

- The 15-m Heliax cable, four-way splitter, and 1-GHz, 10 GS/s Tektronix DPO7104 scope are used with the 15.8-m nTOF detector

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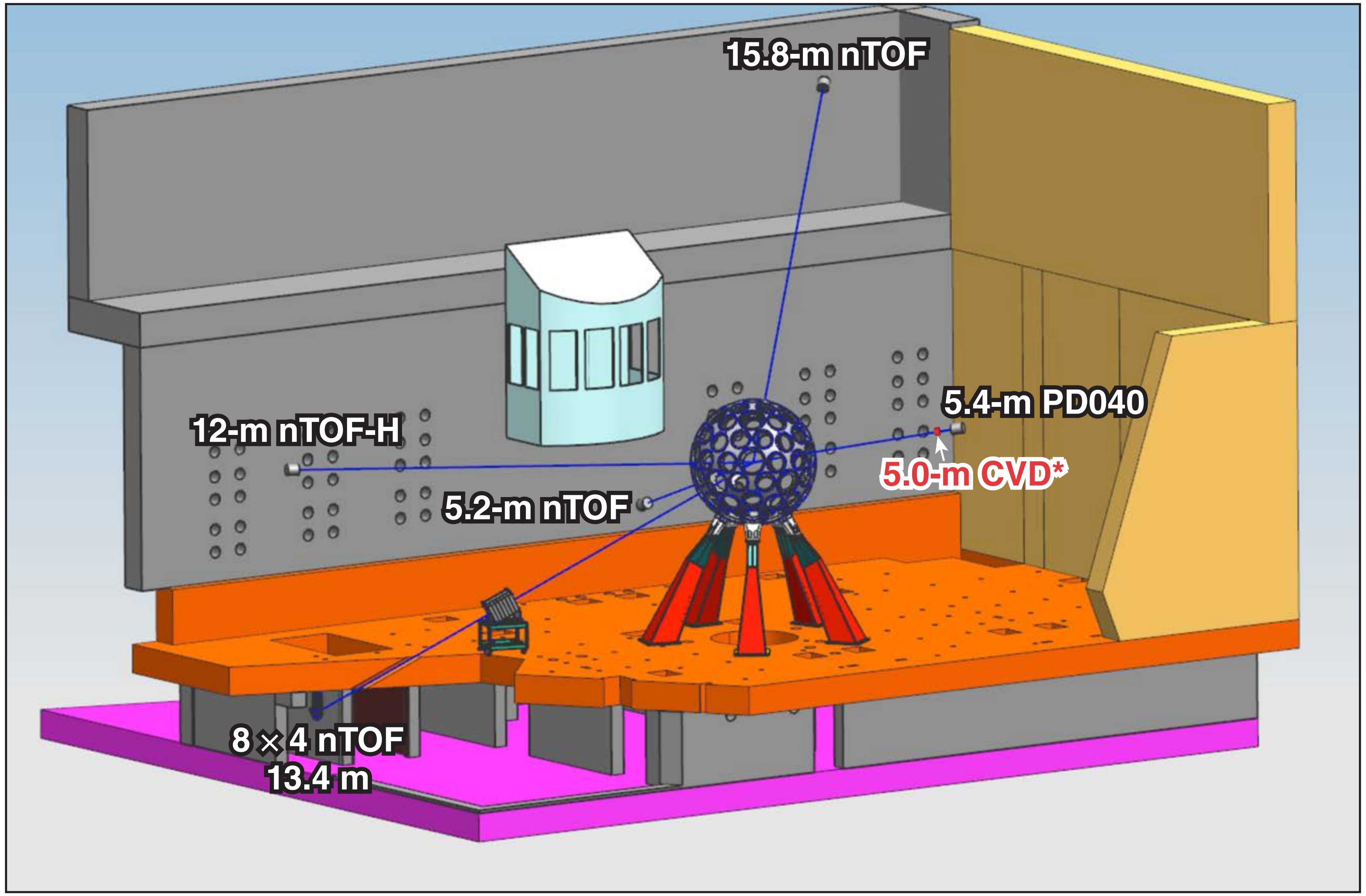
The 15.8-m nTOF has the longest distance from target chamber center (TCC) of all the nTOF detectors on OMEGA



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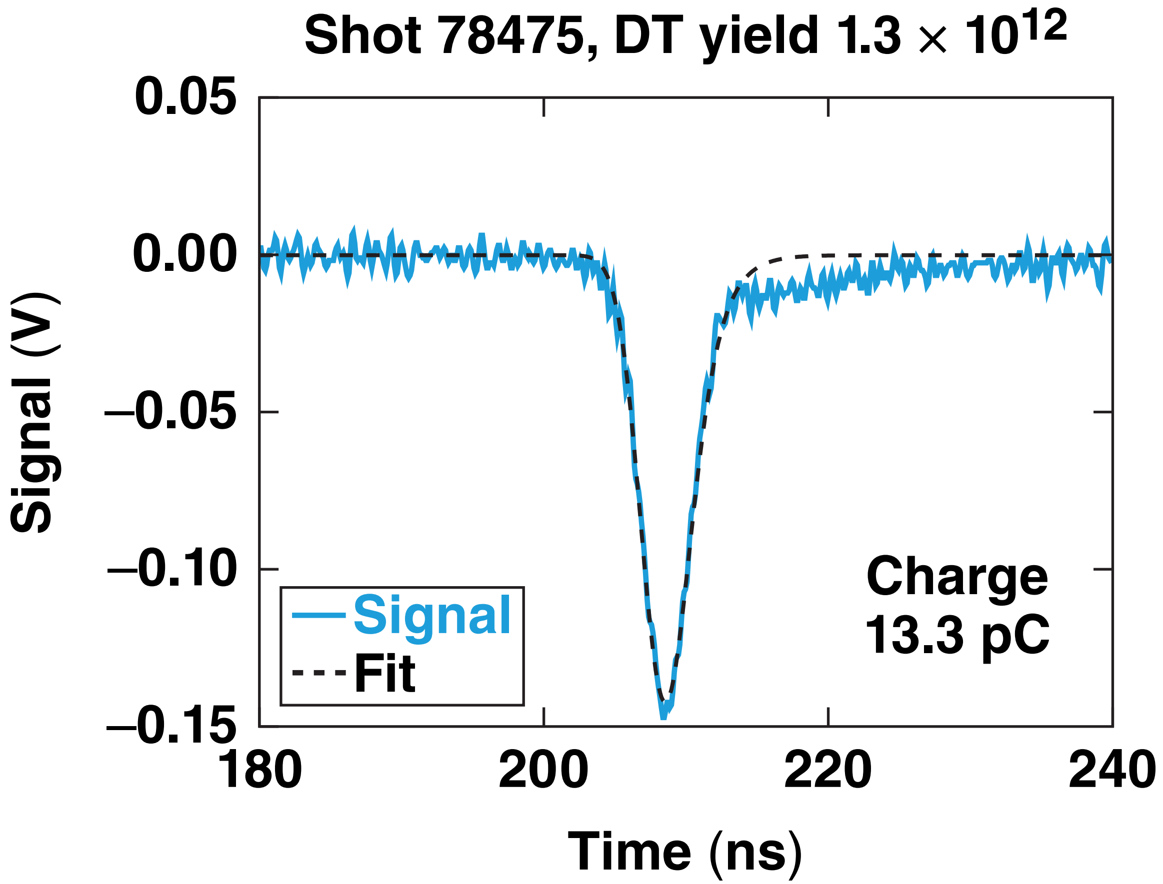
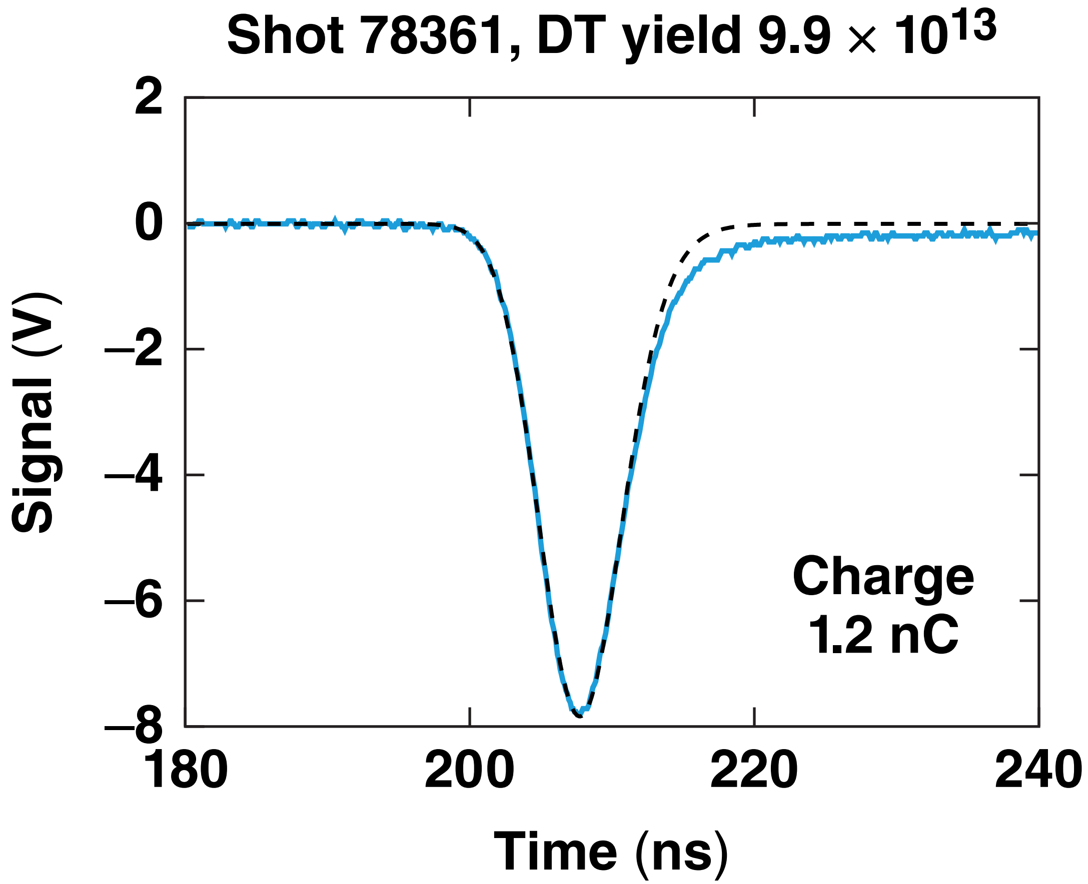
*CVD: chemical vapor deposition

The 15.8-m nTOF detector is capable of measuring DT yields from 1×10^{12} to at least 2×10^{14}





To avoid photomultiplier tube (PMT) saturation at high DT yields, an ND2 filter was placed between the scintillator and the PMT, and the PMT was operated at low gain.

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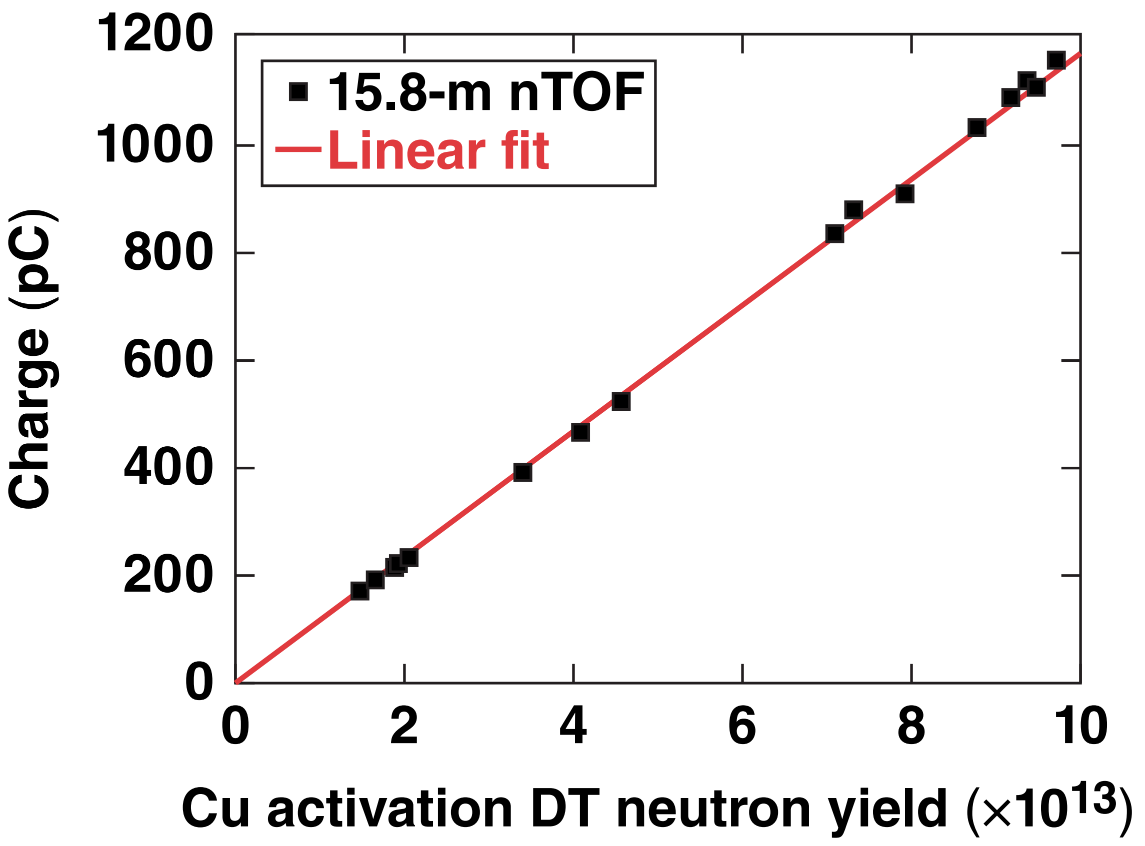
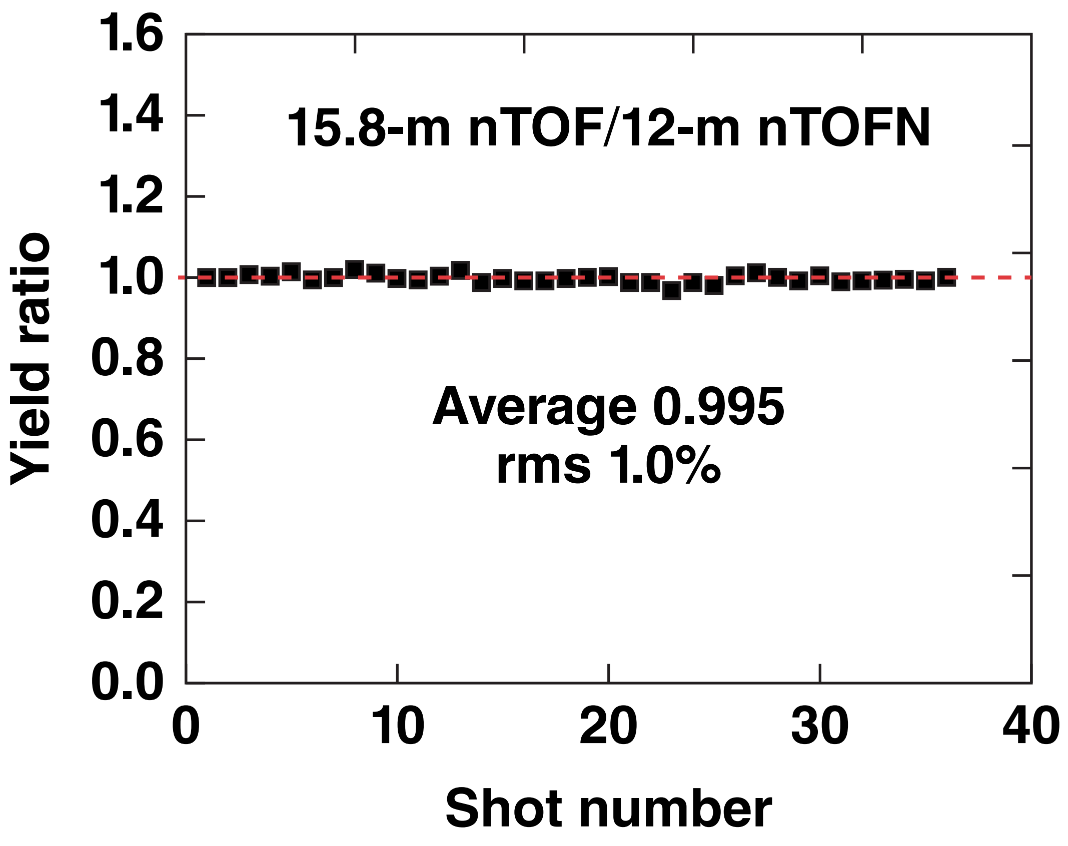
The 15.8-m nTOF detector was calibrated against copper activation neutron yields from room-temperature targets





The nTOF detectors on OMEGA measure high DT yield with high precision.

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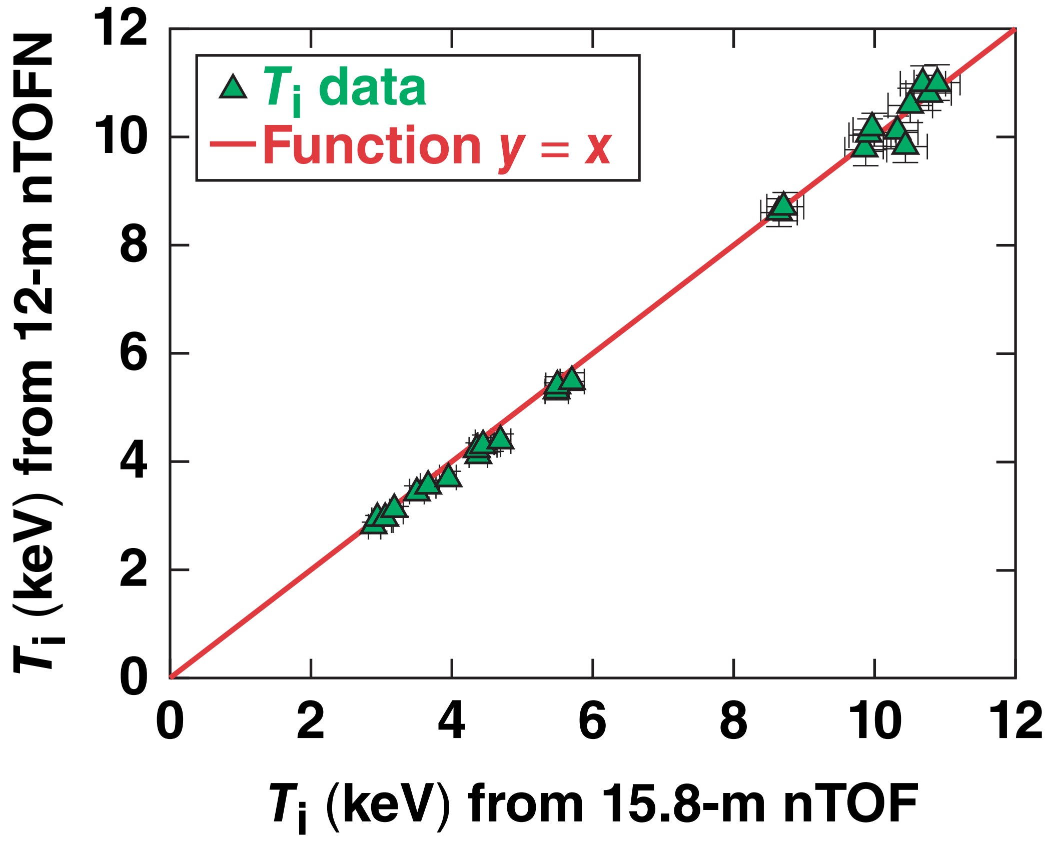
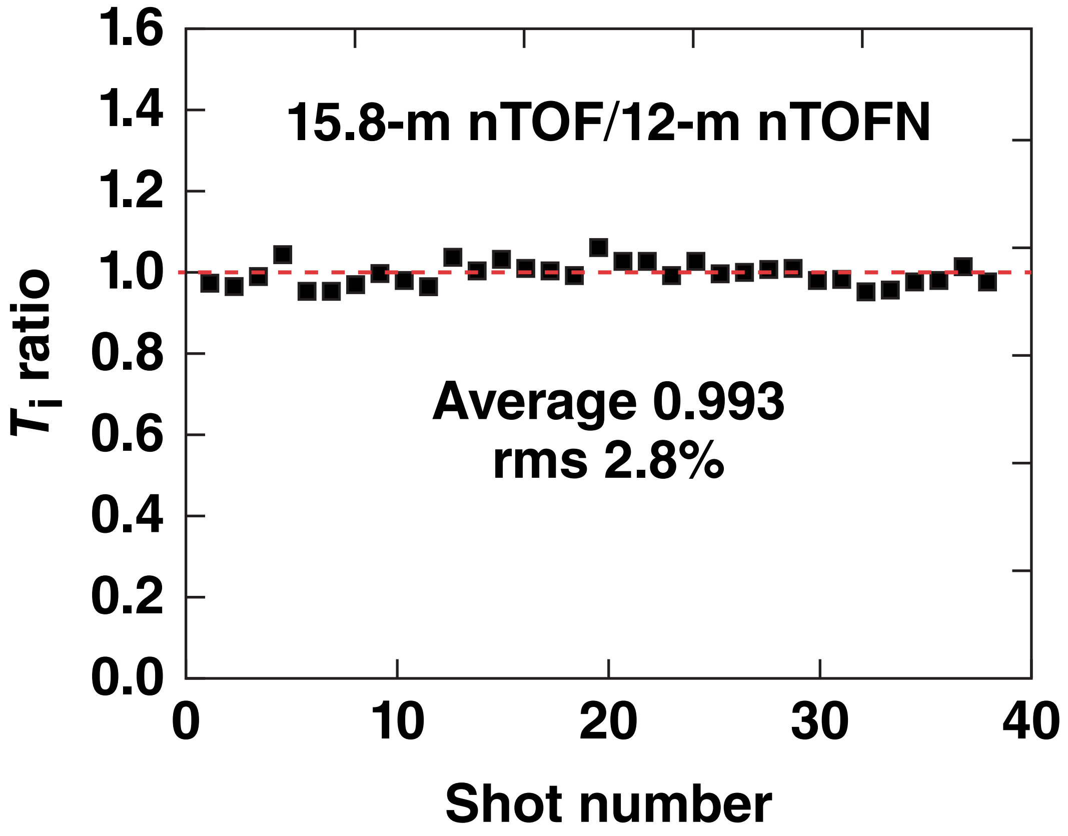
The 15.8-m nTOF and 12-m nTOFN detectors measure ion temperature with better than 3% precision





All data on this slide were recorded during room-temperature target implosions.

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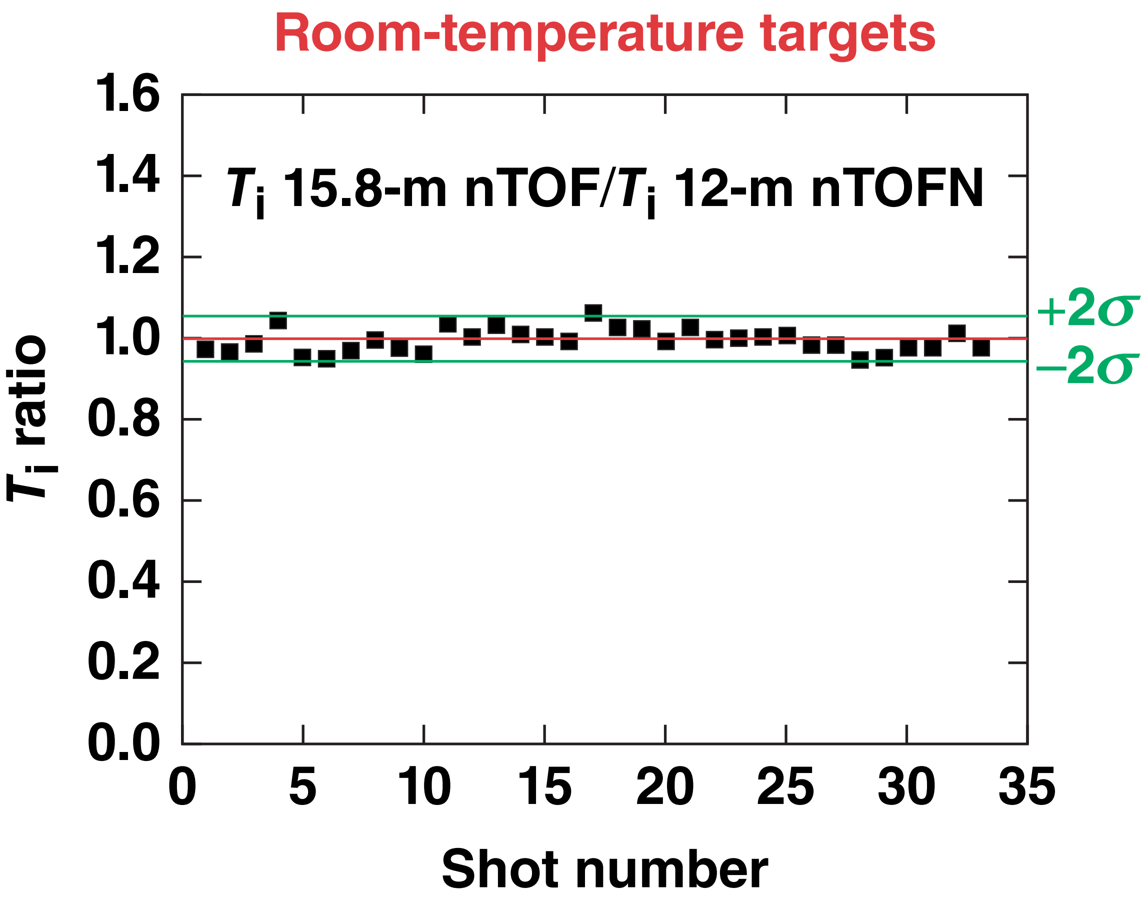
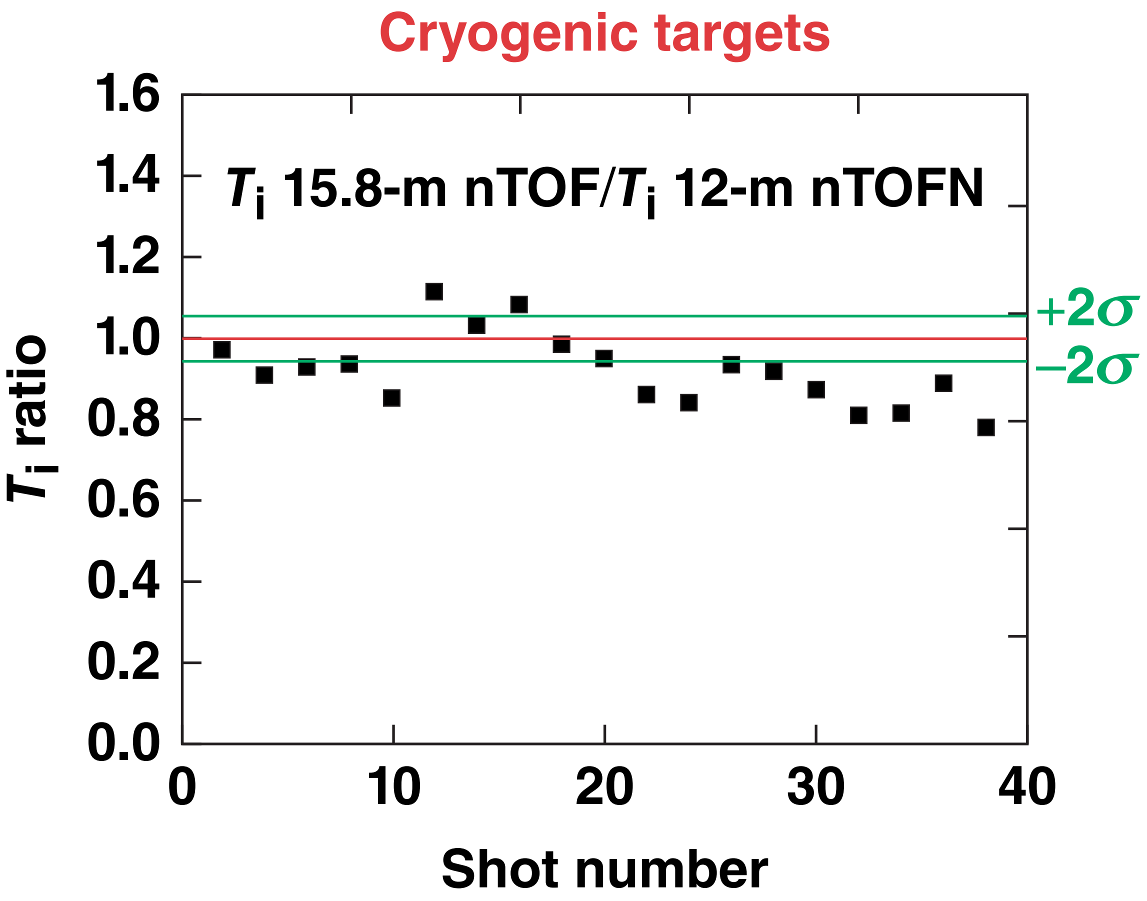
The T_i ratio in different LOS varies more in cryogenic implosions than in room-temperature targets





The large difference in T_i measured from separate LOS in cryogenic implosions suggests bulk fuel flows caused by either perturbation growth or nonuniform drive.

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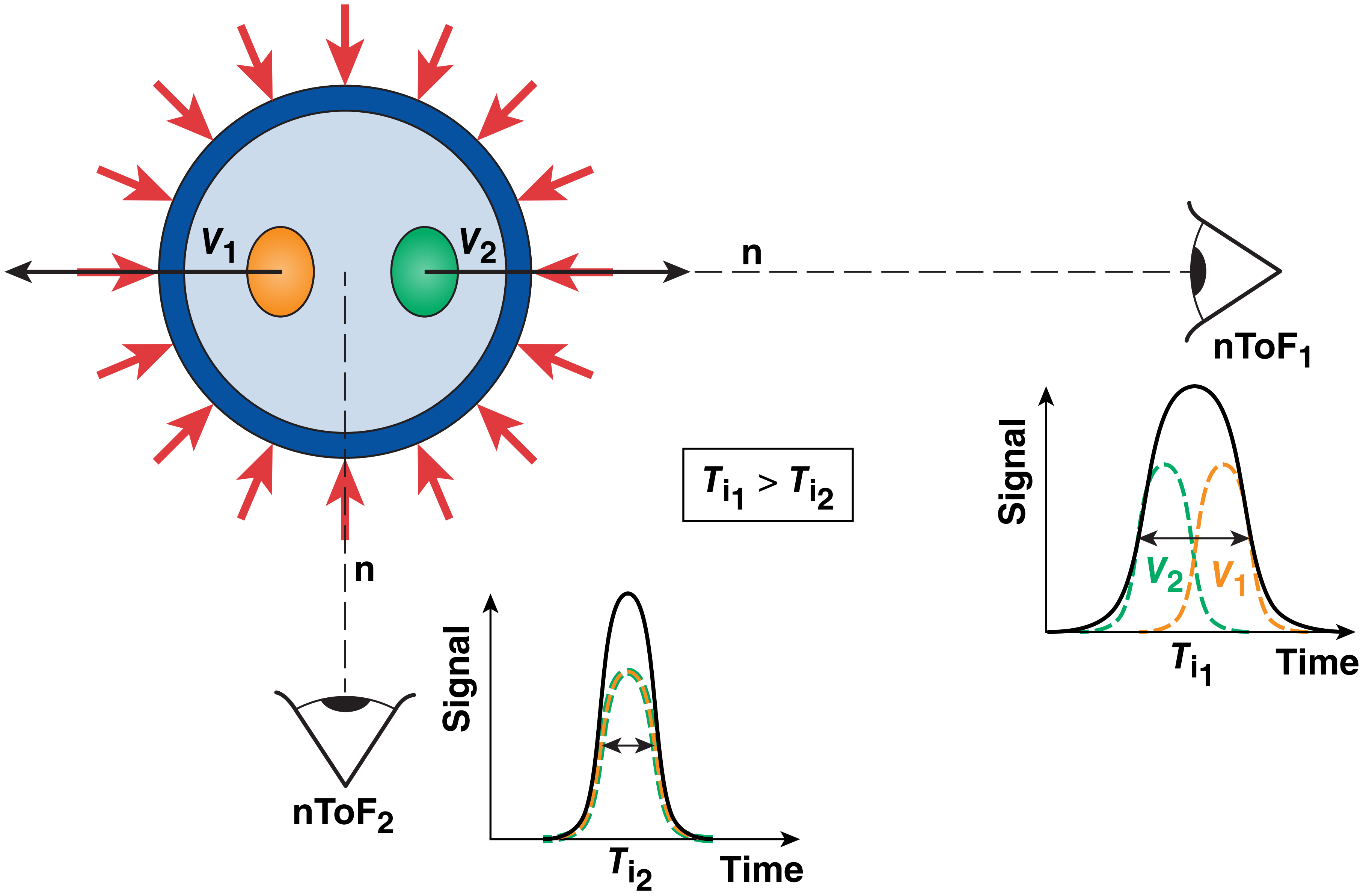
Bulk fuel flows during an implosion may create different T_i in different LOS



E23654a

A new neutron time-of-flight (nTOF) detector for DT yield and T_i measurements was implemented on OMEGA

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