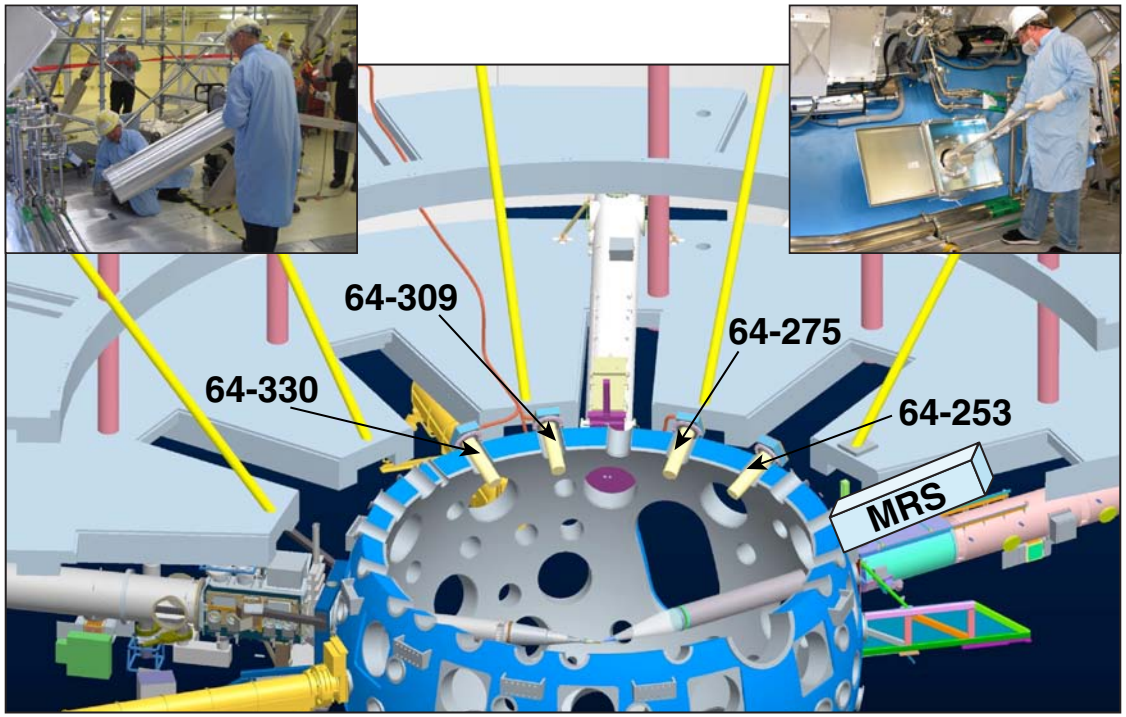
Neutron Time-of-Flight Diagnostic Performance During the National Ignition Facility 2010 Campaign



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52nd Annual Meeting of the
American Physical Society
Division of Plasma Physics
Chicago, IL
8–12 November 2010

Summary

The full neutron time-of-flight (nTOF) system is now operational at the National Ignition Facility

- The NIF nTOF system measures neutron yield, ion temperature, bang time, and down-scattered neutron fraction
- The 8-detector, 18-channel nTOF system will measure yield and ion temperature over 11 orders of magnitude from 10^8 to 10^{19}
- The nTOF yield transfer from OMEGA to the NIF is sensitive to the details of the detector installations at both facilities; corrections are still being developed

The full performance validation of the nTOF system will require the completion of the commissioning campaign.

Related talks:
A. Mackinnon (CO5.00001).
S. Friedrich (CO5.00011).
C. Stoeckl (CO5.00013).

Collaborators

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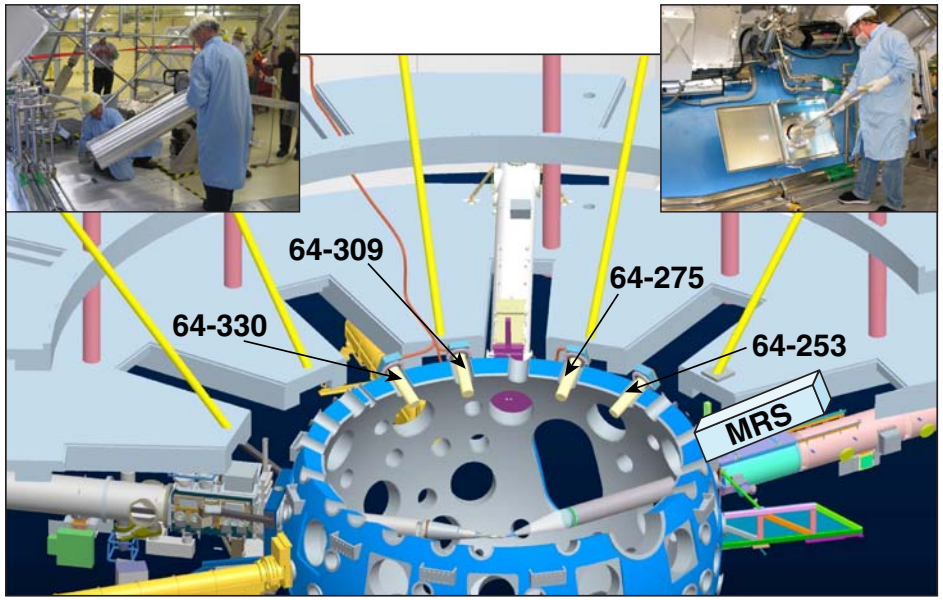
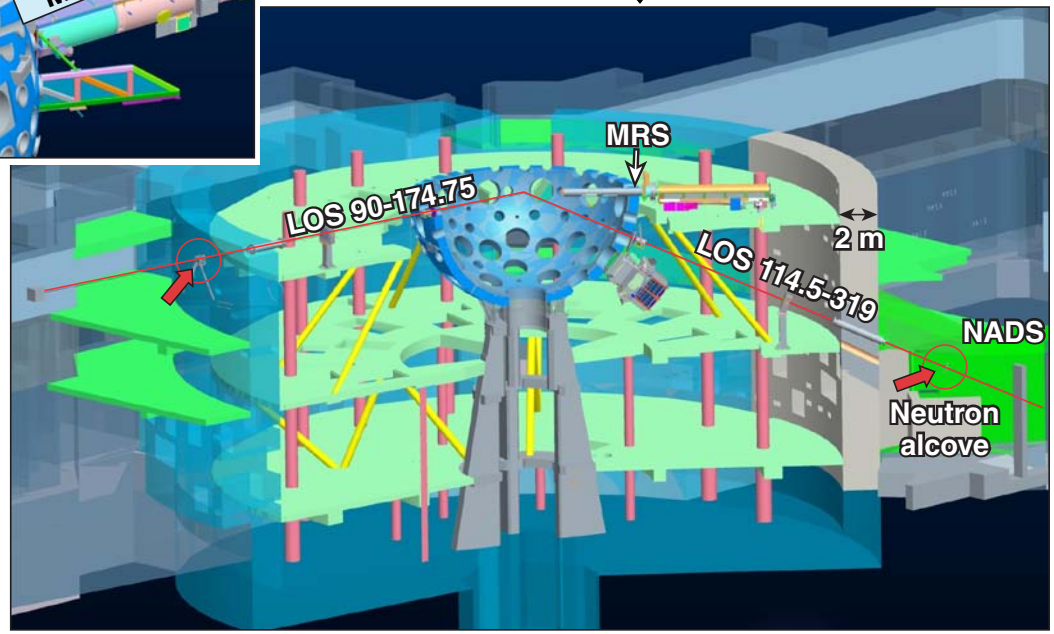
J. D. Kilkenny, R. A. Lerche, A. J. Mackinnon, J. McNaney,
M. J. Moran, and D. H. Munro

Lawrence Livermore National Laboratory

Four nTOF detectors are located in the wells at 4.5 m and four at 22 to 23 m in the neutron alcove and switchyard



nTOF20-IgnLo
nTOF20-IgnHi
nTOF20-SpecA
nTOF20-SpecE

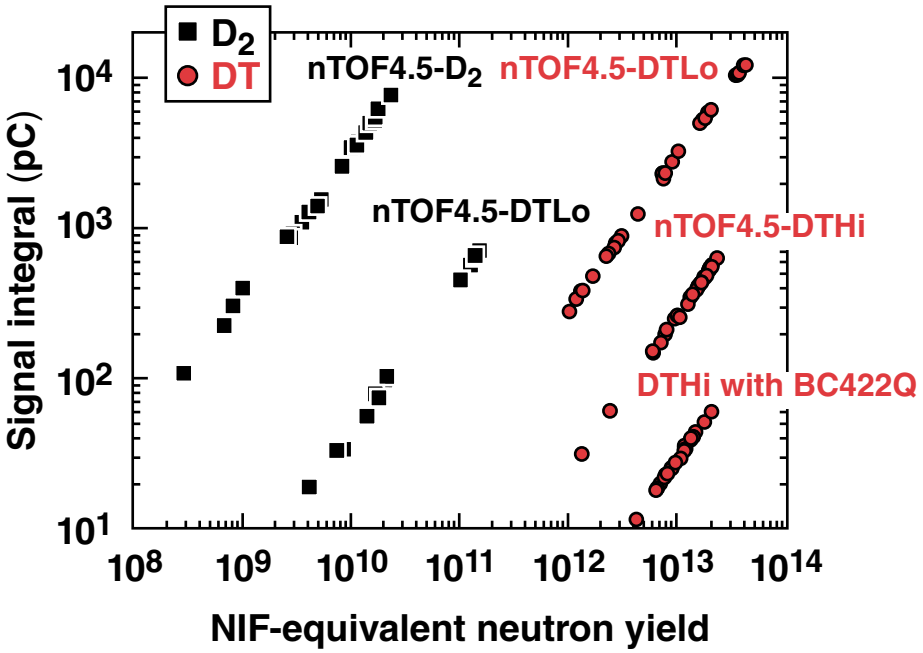


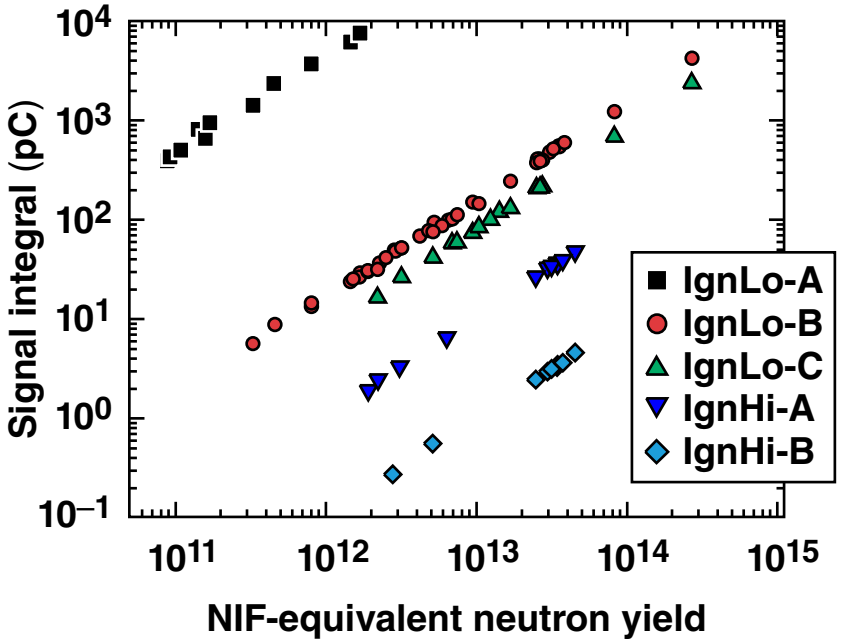
nTOF4.5-D2
nTOF4.5-DTLo
nTOF4.5-DTHi
nTOF4.5-BT

E19475

*V. Yu. Glebov *et al.*, Rev. Sci. Instrum. 81, 10D325 (2010).

The NIF nTOF detectors* were calibrated at the LLE's Omega Laser Facility





Additional detectors for yields greater the 10^{15} will be calibrated *in situ* on the NIF.

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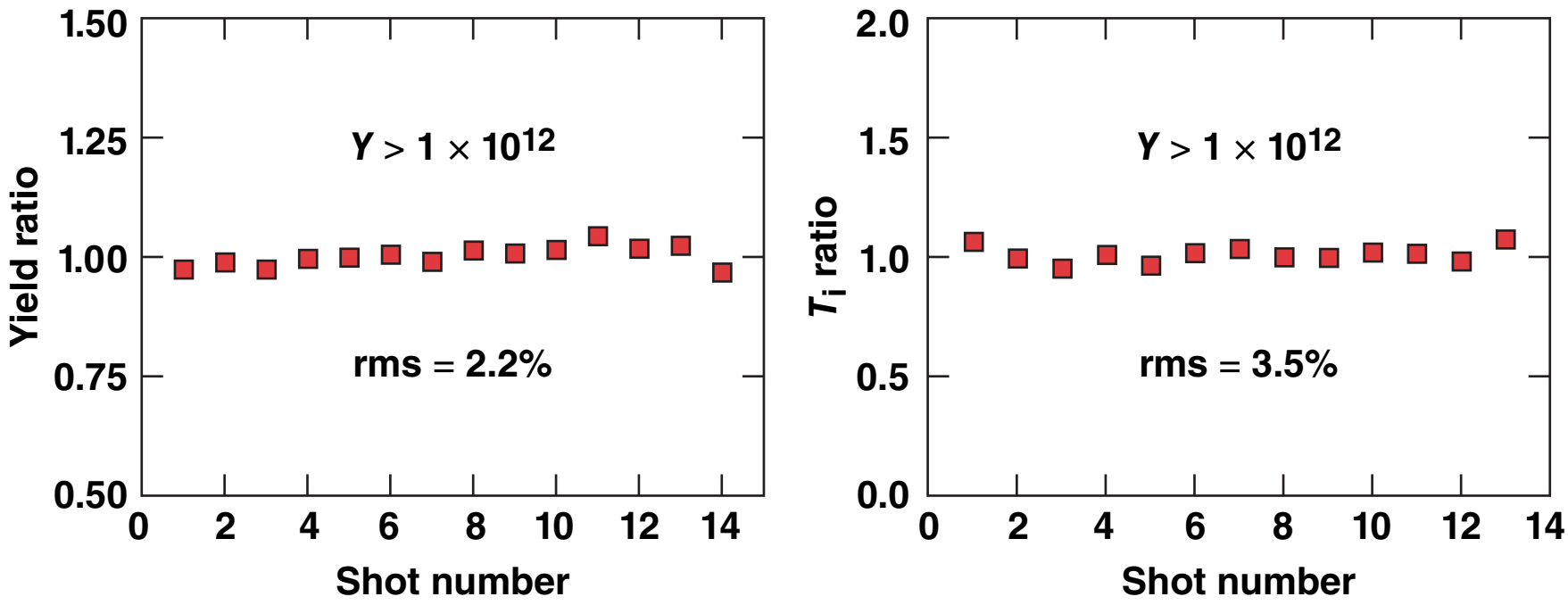
*V. Yu. Glebov *et al.*, Rev. Sci. Instrum. 81, 10D325 (2010).

The calibration on OMEGA establishes the nTOF yield sensitivity and the detector response function



Transport simulations are needed to validate the calibration transfer from OMEGA to the NIF (typically ~10% in yield and 0.2 to 0.3 ns in impulse response).

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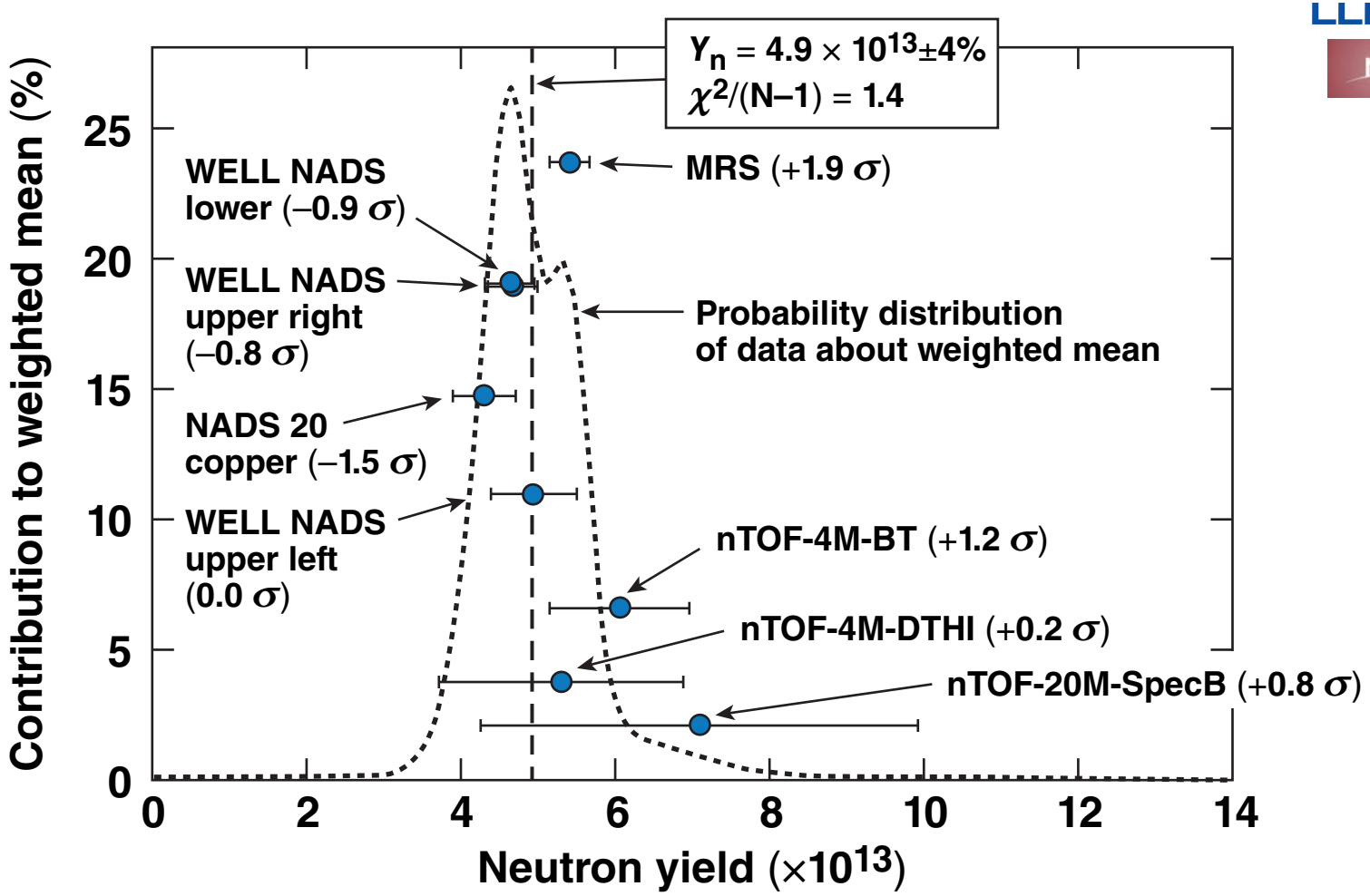
We are using a weighted mean to characterize the yield: for the exploding pusher shot N100923 this gives $4.9 \times 10^{13} \pm 4\%$

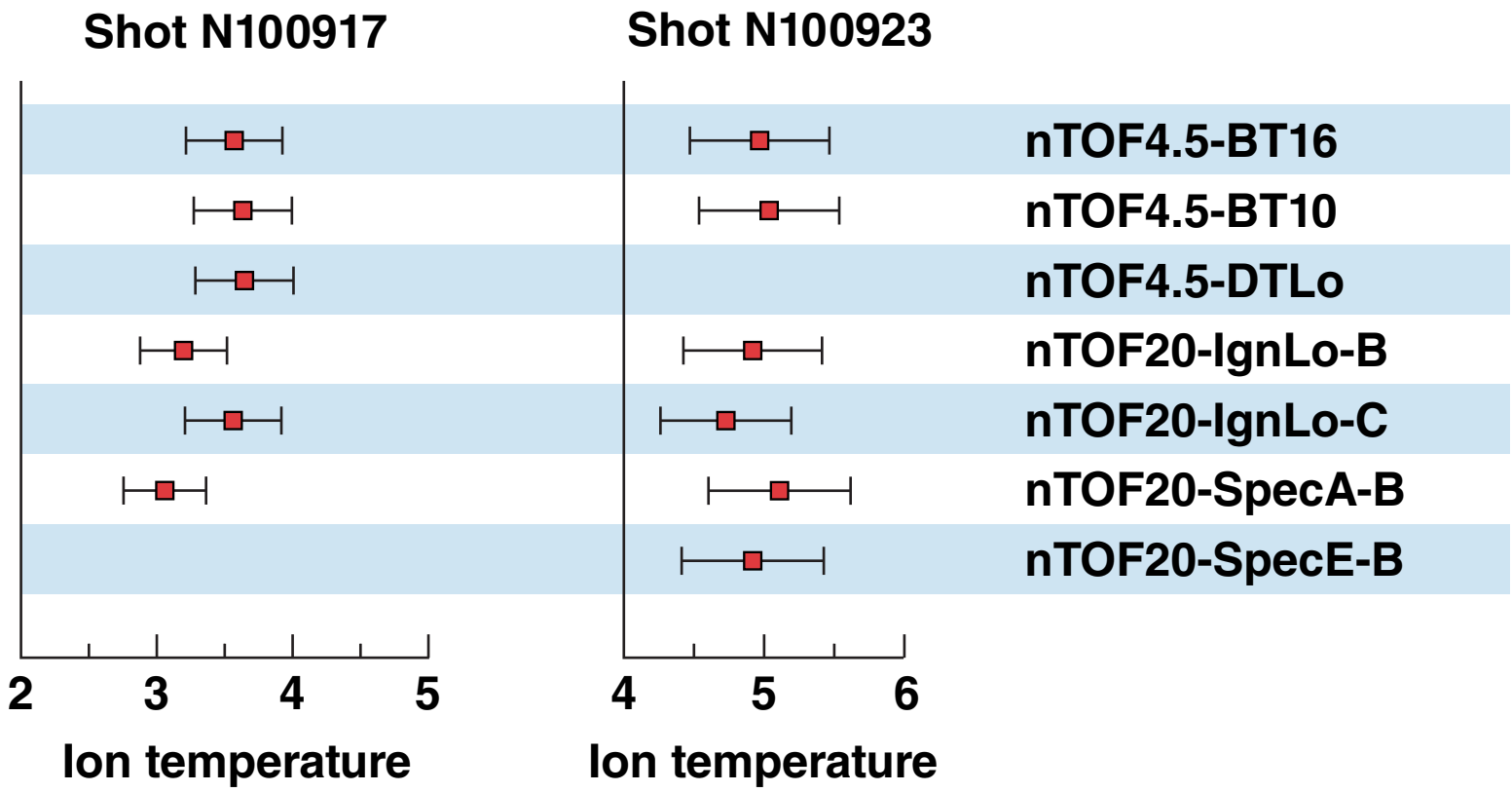


The neutron-scattering environment is different between OMEGA and the NIF—we are examining how this influences the transfer of calibration for the nTOF detectors.

E19510

The ion temperature on the NIF is measured by several different nTOF detectors

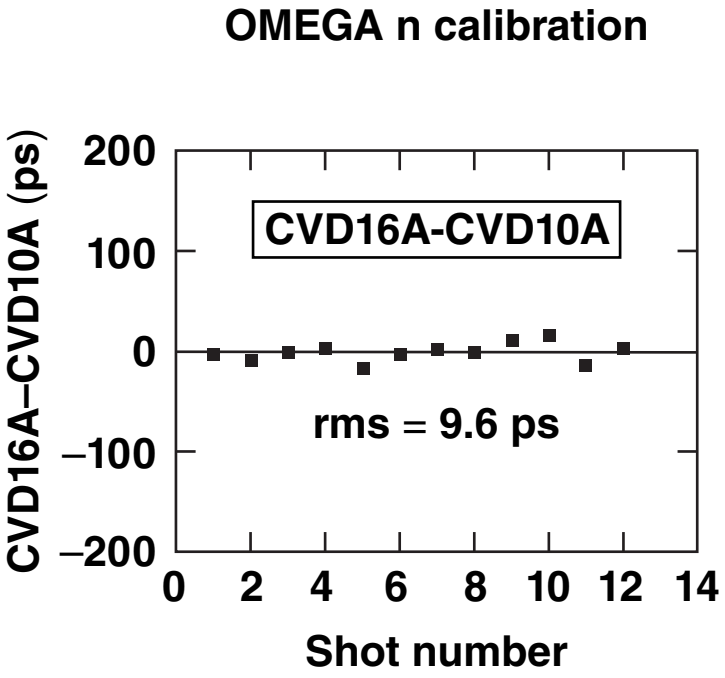
Preliminary analysis based on LLE calibration

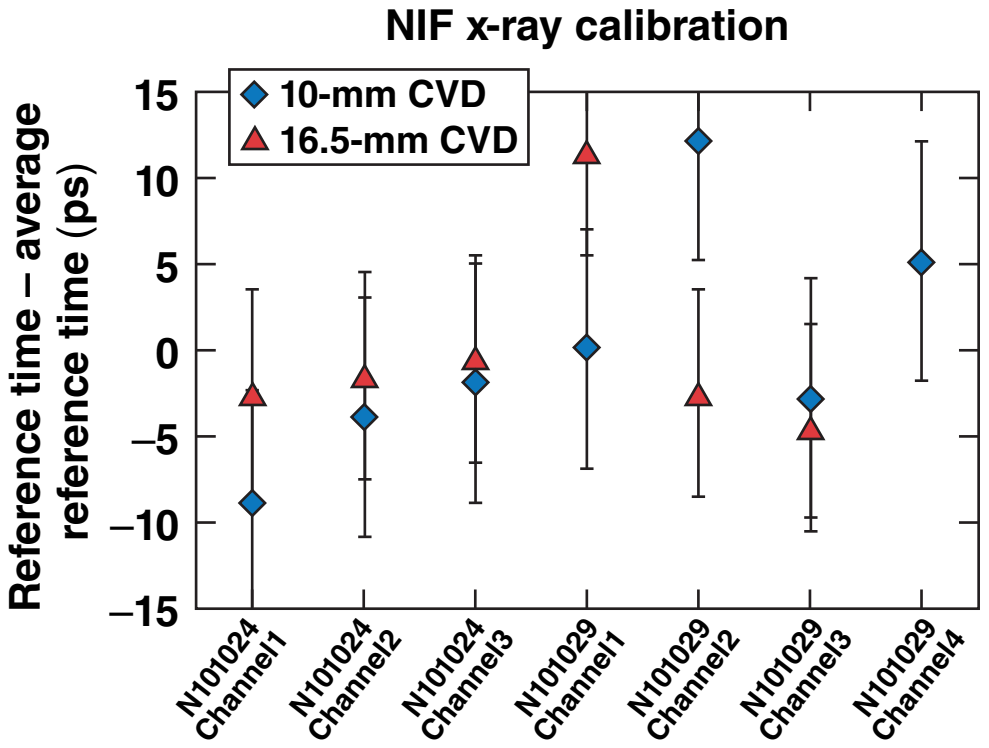


Further work is necessary to finalize the nTOF response functions and settle on the correct absolute errors

E19481

The nTOF4.5-BT detector measures neutron bang time on the NIF with better-than-50-ps accuracy

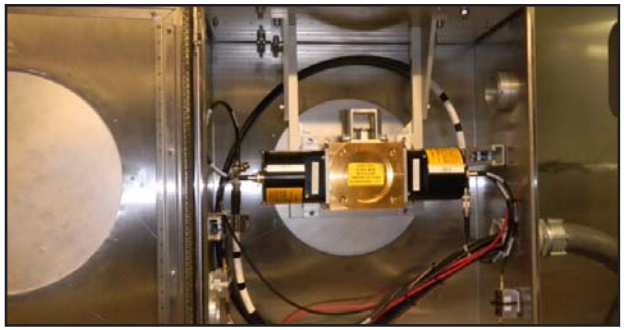


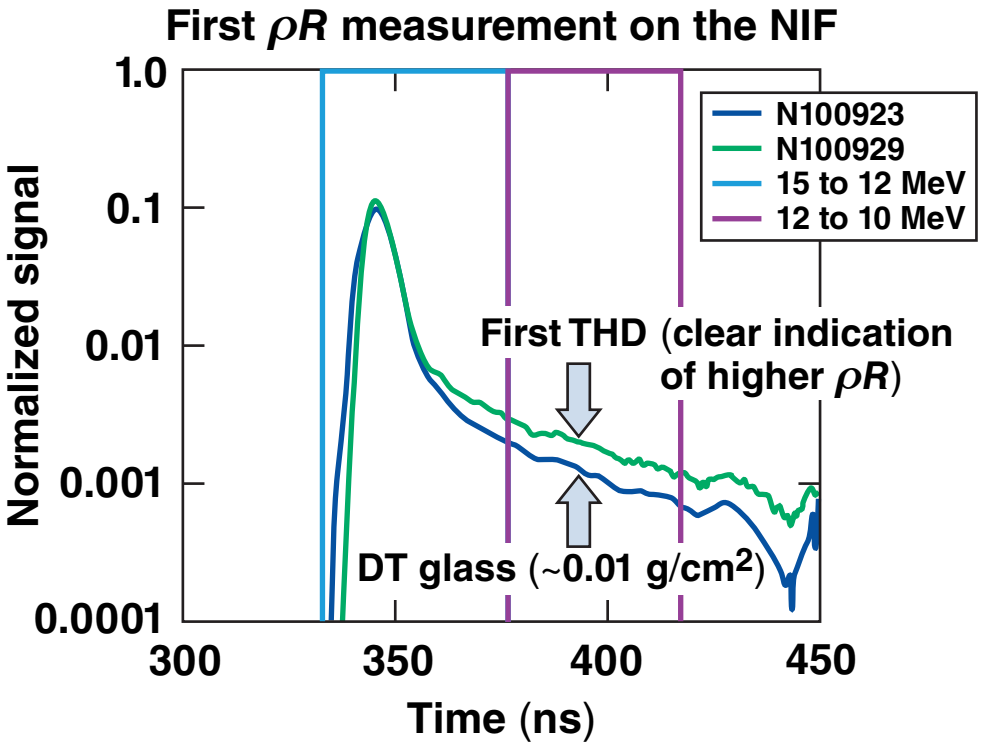


With a demonstrated neutron precision on OMEGA of ~10 ps and timing accuracy on the NIF of ~10 ps, the nTOF4.5-BT neutron-bang-time measurement accuracy is better than 50 ps.

E19511

The first signals from the nTOF20 equator show the changes expected with a high-ρR implosion





The deconvolution of the down-scattered spectrum is mathematically tricky and sensitive to the S/N in the tail.

E19389a

Summary/Conclusions

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