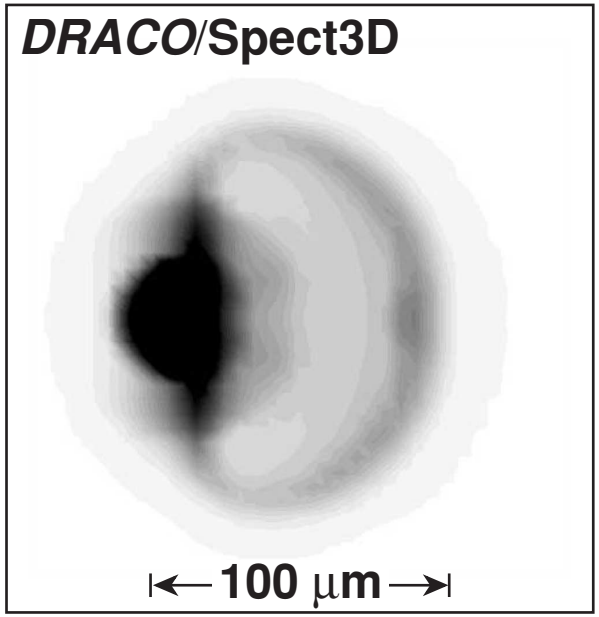
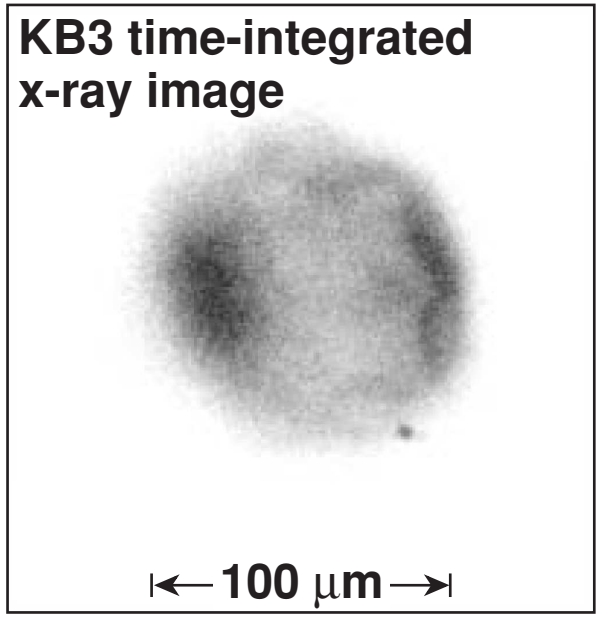
Effects of Low-Order Irradiation Nonuniformity on X-Ray Images of ICF Implosion Experiments on OMEGA

UR LLE

OMEGA shot 26646
D_2(15)CH[20]





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Summary

Spect3D* analysis of 2-D *DRACO* simulations shows good agreement with experimentally obtained images of offset implosions

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- Image symmetry is a useful indicator of irradiation uniformity at low harmonic order.
- The size and asymmetry of observed time-integrated images are reproduced by 2-D hydrodynamic simulations with radiation-transport post-processing.
- Simulated time-resolved images show a sequence of shock features followed by persistent shell emission that are seen in time-resolved image measurements

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Outline

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- Offset implosions
- Simulation
- Observed and simulated asymmetry
- Simulation of time-resolved detail

The offset implosions show asymmetric x-ray emission that correlates with the offset axis

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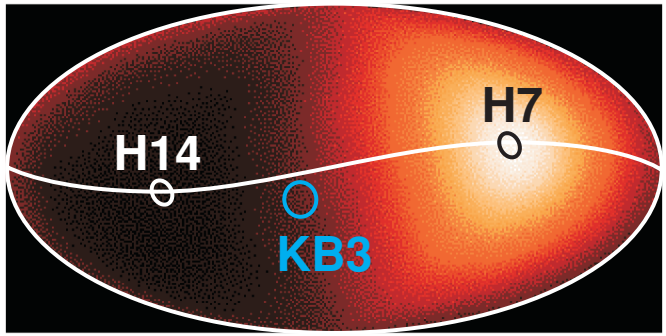
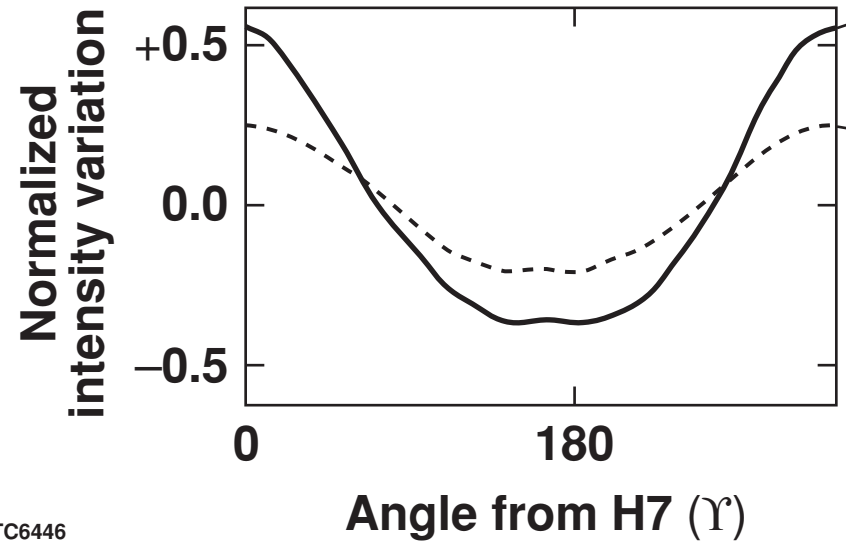
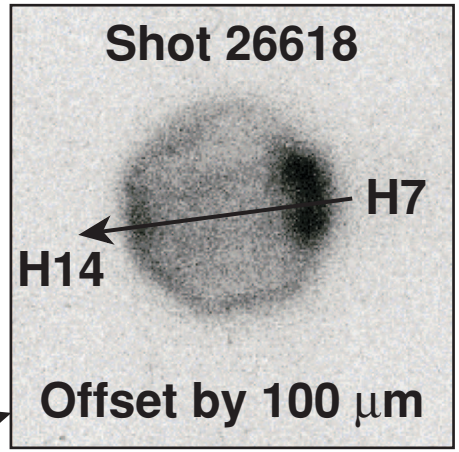
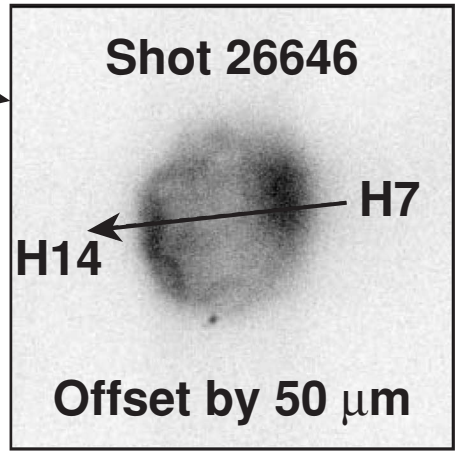
OMEGA offset implosion of 15-atm-D_2-filled, ~920-μm-diam, 20-μm-thick CH shells







100 μm



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Simulated images are obtained from 2-D hydrodynamic simulation and 3-D radiation transport post-processing

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- *DRACO* hydrocode
  - 2-D Lagrangian hydrodynamics with interface tracking
  - Laser absorption fraction calculated from ray tracing in a spherical hydrodynamic model
  - 2-D irradiation distribution calculated from known beam energies and positions
- Spect3D* radiation transport post-processing
  - Full 3-D straight-line integration of equation of transfer
  - Tabulated LTE opacities valid for intended application
  - Detailed response function of XRFC

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Simulated irradiation asymmetry is a sample of the full irradiation pattern inferred from measured beam positions and energies

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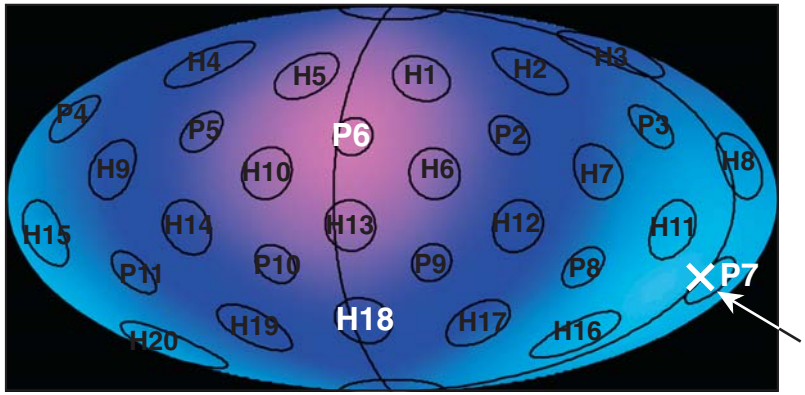
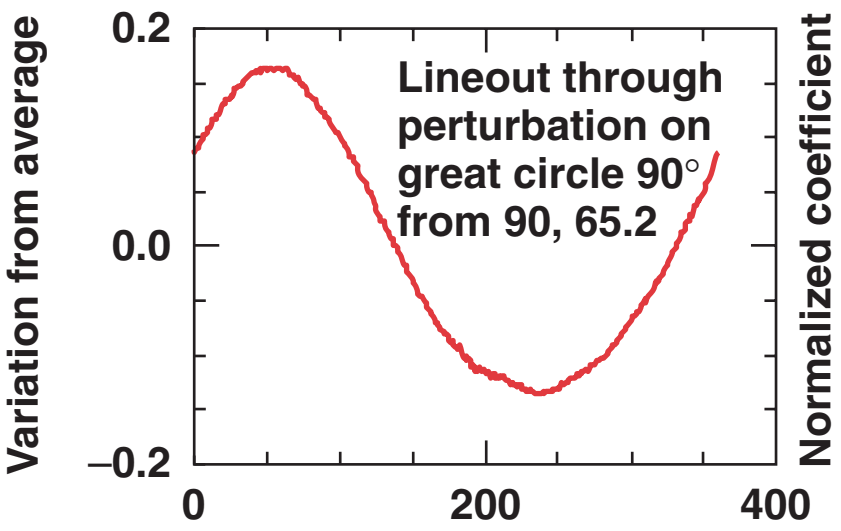
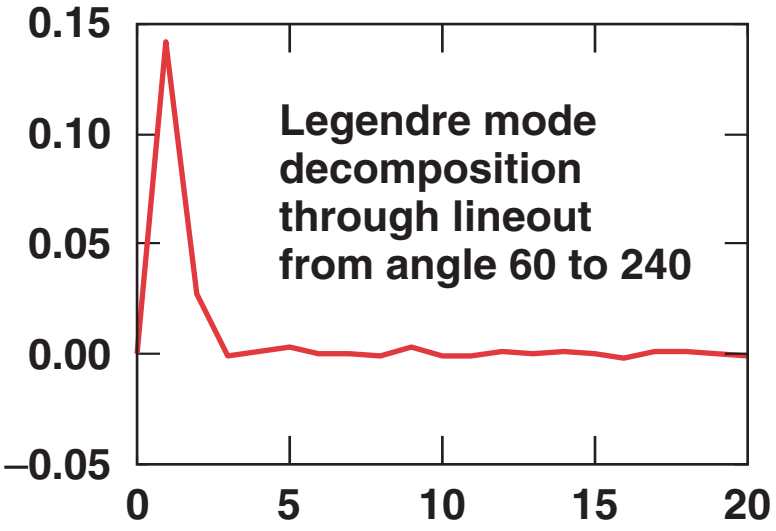
OMEGA
shot 31787







TC6448

Size and shape of a 50-mm-offset implosion image are reproduced by a *DRACO*/Spect3D simulation

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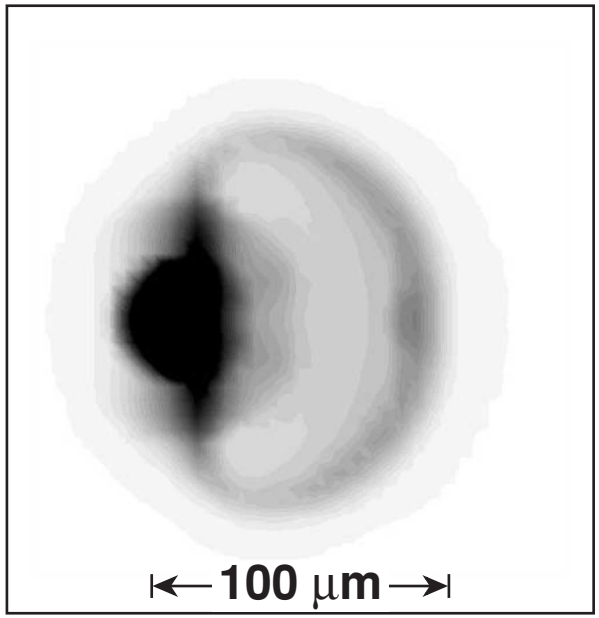
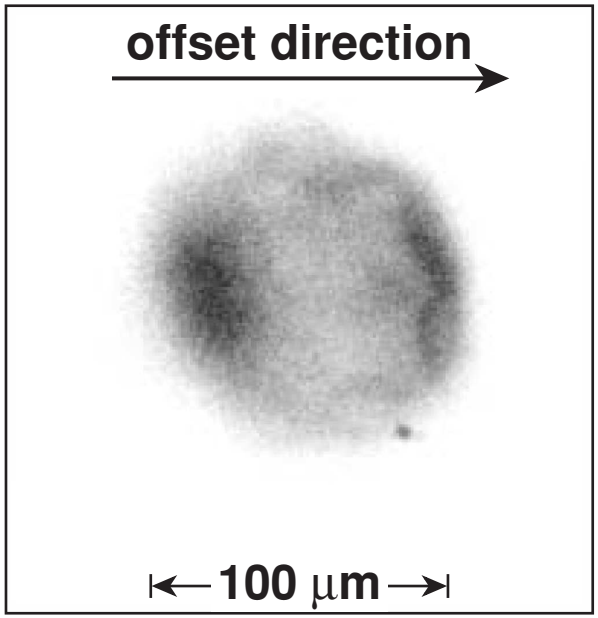
D_2(15)CH[20]

***DRACO*/Spect3D* simulation**



KB3 time-integrated x-ray image (3 to 7 keV)



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A 50-μm offset in target position introduces a strong $\ell = 1$ asymmetry to the implosion

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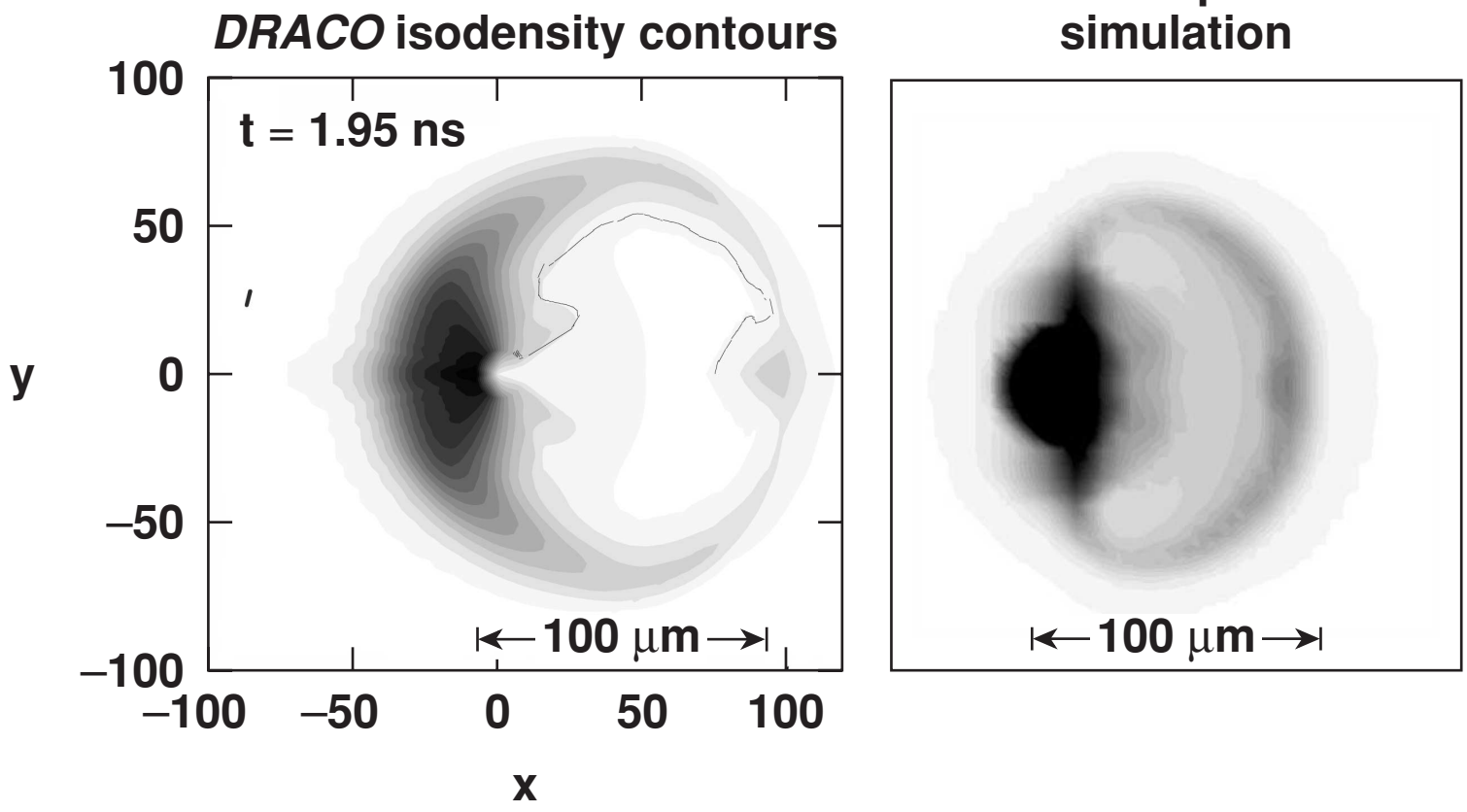
D2(15)CH[20]



TC6449

Hydro/radiation simulation of 59-μm-offset D^3He implosion images mimics observed time dependence

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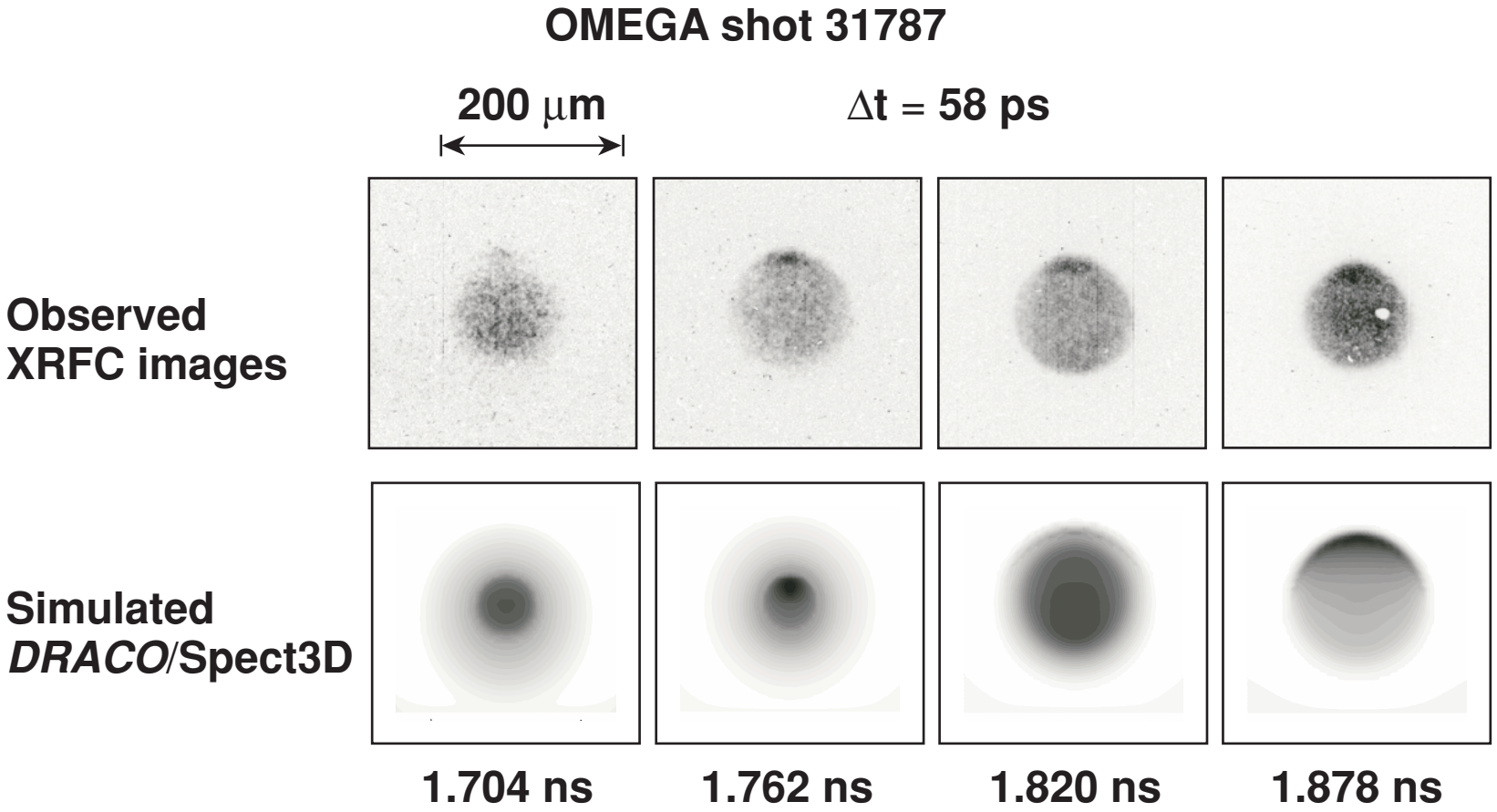
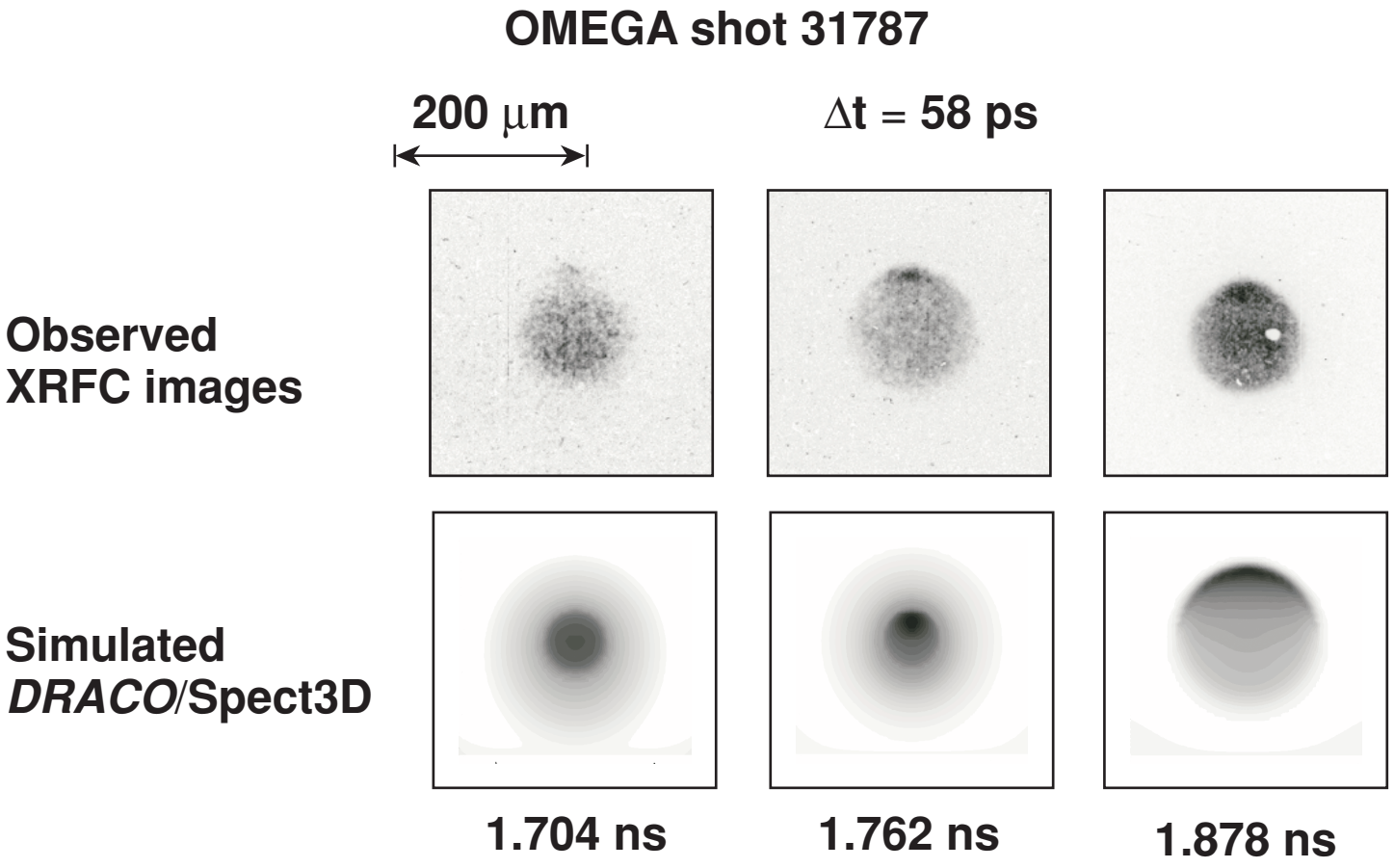


27-μm shell, 18-atm D^3He, 2-to-7-keV Be/Au response function

TC6451

Hydro/radiation simulation of 59-μm-offset D^3He implosion images mimics observed time dependence

UR LLE

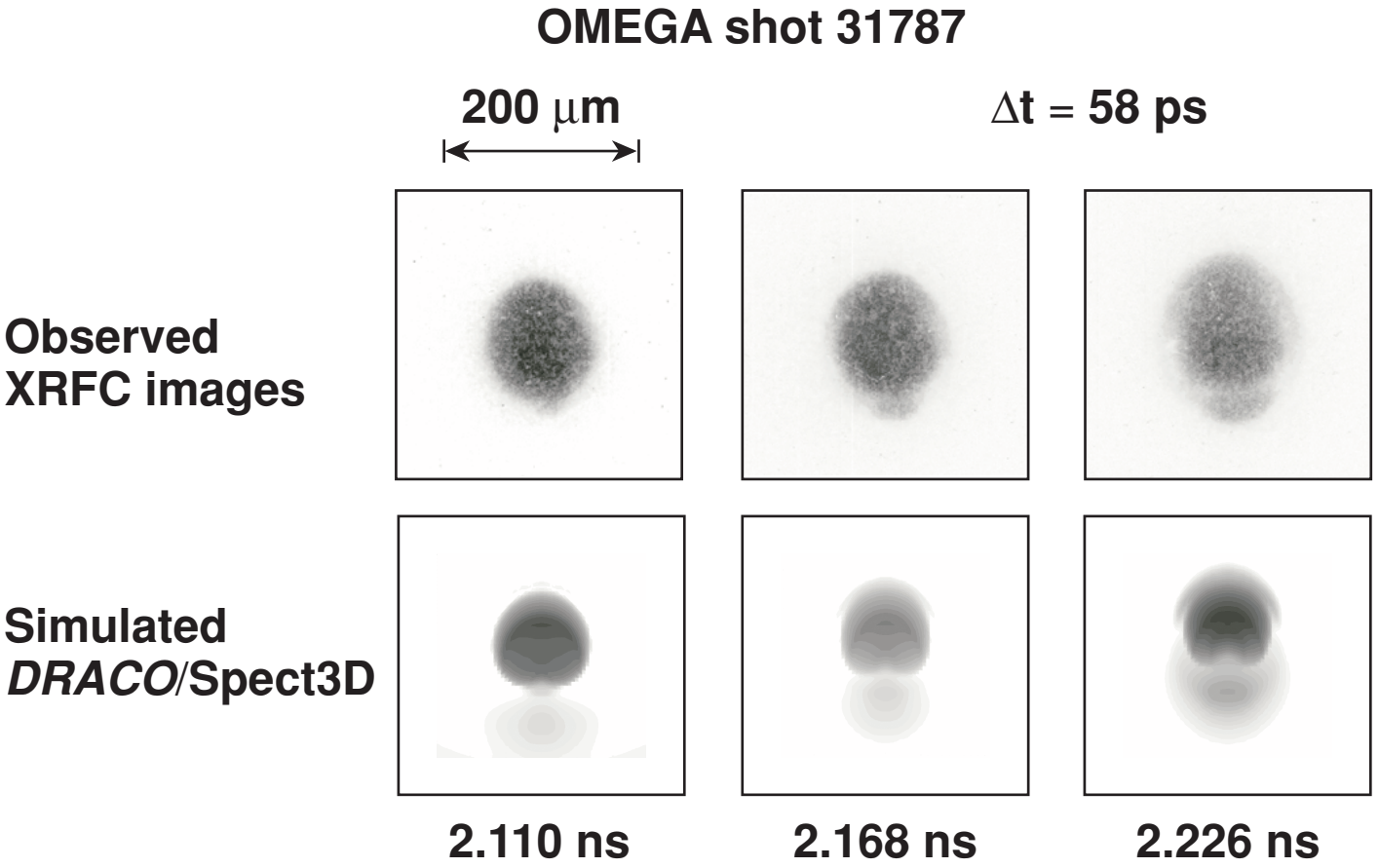


27-μm shell, 18-atm D^3He, 2-to-7-keV Be/Au response function

TC6451a

Hydro/radiation simulation of 59-μm-offset D^3He implosion images mimics observed time dependence

UR LLE



27-μm shell, 18-atm D^3He, 2-to-7-keV Be/Au response function

TC6471

Summary/Conclusions

Spect3D* analysis of 2-D *DRACO* simulations shows good agreement with experimentally obtained images of offset implosions

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