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Impact of temperature-velocity distribution on fusion neutron peak shape[1]

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Doppler broadening of the 14 MeV DT and 2.45 MeV DD fusion neutron lines has long been our best measure of temperature in a burning plasma. At the National Ignition Facility yields are high enough and our neutron spectrometers accurate enough that we see finer details of the peak shape. For example, we can measure the shift of the peak due to bulk motion of the plasma, and we see indications of non-thermal broadening, skew, and kurtosis of the peak caused by the variations of temperature and fluid velocity during burn. We can also distinguish spectral differences among several lines of sight. This talk will review the theory of fusion neutron line shape, show examples of non-Gaussian line shapes and directional variations in NIF data, and describe detailed spectral shapes we see in radhydro implosion simulations.

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