

## Learning from Each Other: Cross-Cutting Diagnostic Development Activities Between Magnetic and Inertial Confinement Fusion

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The fields of Inertial and Magnetic Confinement Fusion (ICF and MCF) are separated by orders of magnitude in plasma parameters ( $10^{12}$  in time,  $10^{11}$  in density,  $\sim$ similar temperatures). Nonetheless, obvious commonalities exist, and significant diagnostic advancements have resulted from collaborations between these groups that have benefited both communities. Still, many unexplored opportunities exist for further coordination, exploration, and cross-pollination of ideas and techniques that would benefit both scientific communities and the field of fusion science as whole. This talk will discuss several of these areas of research, focusing on cross-cutting diagnostic-development activities and their particular relevance to the burning and ignited plasma regimes that both communities are entering. Examples will be presented including: diagnosing alpha particle confinement and heating; quantifying high-Z impurities entering the plasma periphery; x-ray, gamma and neutron spectroscopy; and measurements of fusion gain. Common calibration, data acquisition and synthetic diagnostic needs are also considered. There are additional engineering and reactor-relevant issues such as radiation-hardening diagnostics; tritium retention and handling; breeding blanket diagnostics; and generally transitioning from "research" type diagnostics to "industrial" types, that will be discussed as well. Fruitful existing collaborations between ICF and MCF will be highlighted. While the specific examples described in this talk are suggestive, the real significance of this work is to promote discussion and interaction between these communities, ideally in real-time, at the High Temperature Plasma Diagnostics conference. The topics discussed will form a foundation on which to build new collaborations.

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