

## **X-ray Diffraction in the 25 T Florida Split Coil Magnet at the National High Magnetic Field Laboratory**

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A novel x-ray diffraction (XRD) system is under development at the 25 T Florida split coil magnet at the DC Field Facility of the National High Magnetic Field Laboratory (NHMFL), Tallahassee, FL. The purpose of the system is to probe spin-lattice interactions and structural phase transitions as observed in various materials including magnetocaloric, metamagnetic, multiferroic, magnetostrictive, and valence transition compounds. The project builds upon the proof-of-concept study performed at NHMFL by Wang, et al (Rev Sci Instrum **86**, 123902, 2015) and fills a niche among magnetic field diffraction systems. High-field XRD enables study of materials with small sample sizes compared to the large sample sizes needed for neutron diffraction. High-field XRD with a DC field allows for measurement without the possibility of sample heating from eddy currents and also measurement under the condition of sample cooling in field, a thermodynamic state not accessible in pulse field systems. The system is constructed around the 25 T split coil magnet with the primary elements of the system consisting of a Mo/Cu rotating anode X-ray source and a PILATUS 300K-W X single photon counting hybrid pixel array detector customized to tolerate the substantial fringe field of the split coil magnet. The challenges of XRD in a magnetic field, the strategies to overcome them, and the ongoing evolution of the system will be discussed. A preliminary study of a magnetocaloric material,  $\text{AlFe}_2\text{B}_2$ , is presented with emphasis on the role of high magnetic field XRD in the investigation.

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