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The CANDOR Polychromatic Beam Reflectometer at NIST

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The design and development of the polychromatic beam reflectometer CANDOR (for Chromatic Analyzer Neutron Reflectometer Or Diffractometer) currently being commissioned at the NIST Center for Neutron Research is described. This includes the performance of an energy-dependent neutron detector which incorporates pyrolytic graphite analyzer crystals (54 separate elements in series) in conjunction with $^6\text{LiF}/\text{ZnS}(\text{Ag})$ scintillation detectors and silicon photomultiplier (SiPM) devices. This array simultaneously detects neutrons within a 4 to 6 Angstrom bandwidth at a fractional wavelength resolution of approximately one percent and with an efficiency comparable to conventional ^3He tube detectors. How 18 such energy-dependent detector arrays are to be configured within the reflectometer is described, particularly in regard to achieving a focusing condition in the wavevector transfer Q for specular reflectivity measurements. For specular reflectivity measurements, an order of magnitude gain or more over a conventional monochromatic beam instrument at a continuous source is expected. Other principal components of this instrument, including polarizers, focusing optics, and filters to suppress undesirable portions of the incident spectrum, are described as well.

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