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Parametric evaluation of boron based neutron imaging screens for improved detection efficiency and light output

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Neutron imaging with cold and thermal neutrons typically use scintillator screens that use lithium-6 as a neutron converter. Compared to lithium-6, boron-10 offers nearly four time higher neutron absorption cross-section and larger daughter products that deposit their energy locally, offering the potential for higher neutron capture efficiency and spatial resolution. Screens were fabricated with varying neutron converter, mix ratio, phosphor type and particle size, and each screen had varying thickness. A set of over 200 samples was evaluated at ANTARES that represented thousands of parameter variations of screens. This series of measurements required changing samples between measurements over 600 times, which was enabled by the efficient facility and imaging system design at ANTARES and mature user program to facilitate access. The measurements led directly to two papers and development of improved screens continues. Boron-10 based screens exhibit higher neutron capture efficiency compared to lithium-6 based screens typically used today, offering improved image quality and/or reduced exposure times for the neutron imaging community.

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