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Detection of Shielded Special Nuclear Material With a Cherenkov-Based Transmission Imaging System PAUL ROSE, ANNA ERICKSON, Georgia Institute of Technology, MICHAEL MAYER, IGOR JOVANOVIC, Pennsylvania State University — Detection of shielded special nuclear material, SSNM, while in transit, offers a unique challenge. Typical cargo imaging systems are Bremsstrahlung-based and cause an abundance of unnecessary signal in the detectors and doses to the cargo contents and surroundings. Active interrogation with dual monoenergetic photons can unveil the illicit material when coupled with a high-contrast imaging system while imparting significantly less dose to the contents. Cherenkov detectors offer speed, resilience, inherent energy threshold rejection, directionality and scalability beyond the capability of most scintillators. High energy resolution is not a priority when using two well separated gamma rays, 4.4 and 15.1 MeV, generated from low energy nuclear reactions such as ^{11}B(d,n-γ)^{12}C. These gamma rays offer a measure of the effective atomic number, Z, of the cargo by taking advantage of the large difference in photon interaction cross sections, Compton scattering and pair production. This imaging system will be coupled to neutron detectors to provide unique signature of SNM by monitoring delayed neutrons. Our experiments confirm that the Cherenkov imaging system can be used with the monoenergetic source to relate transmission and atomic number of the scanned material.

Paul Rose
Georgia Institute of Technology

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