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# Emergency Response Demonstration: Preliminary MINER Results

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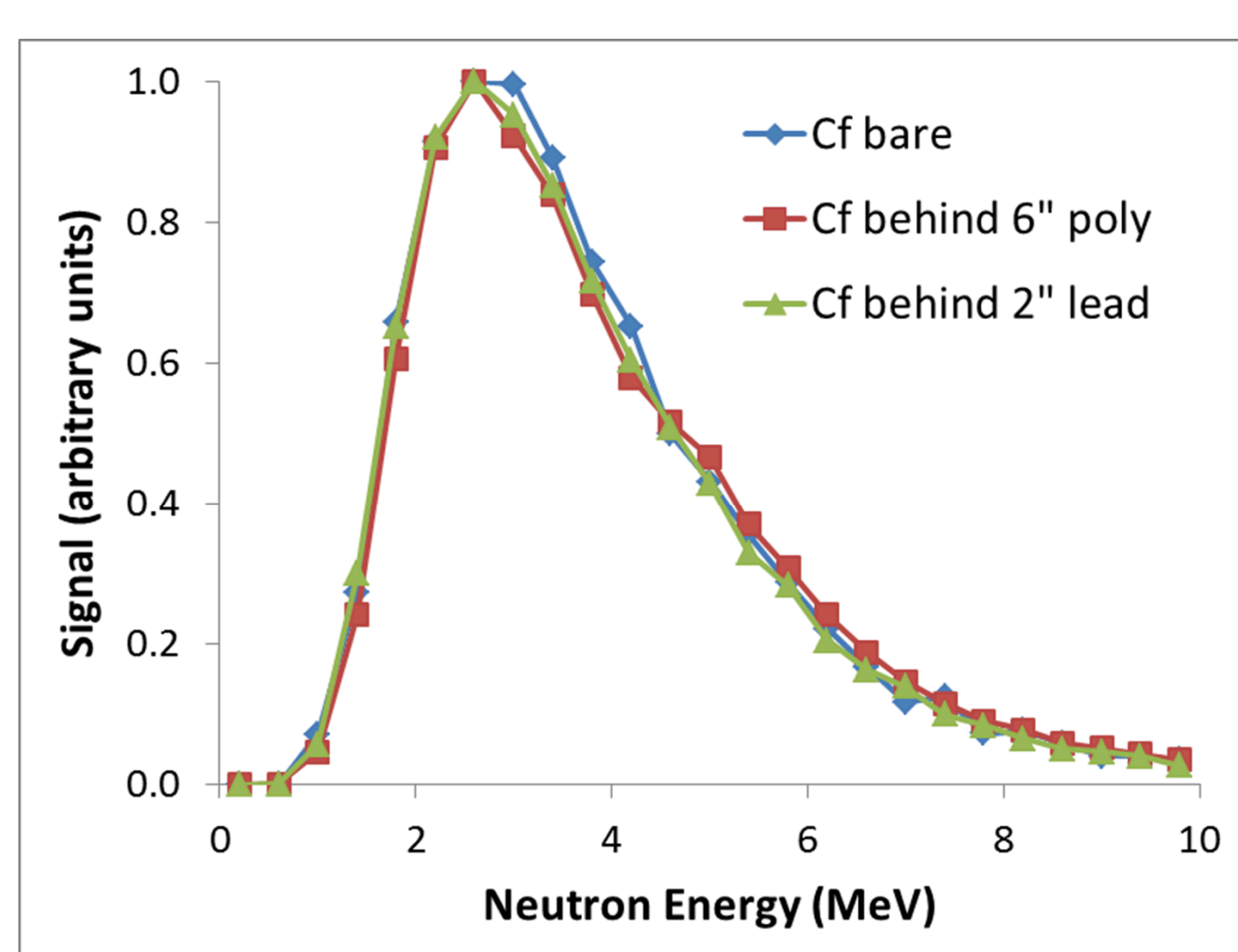
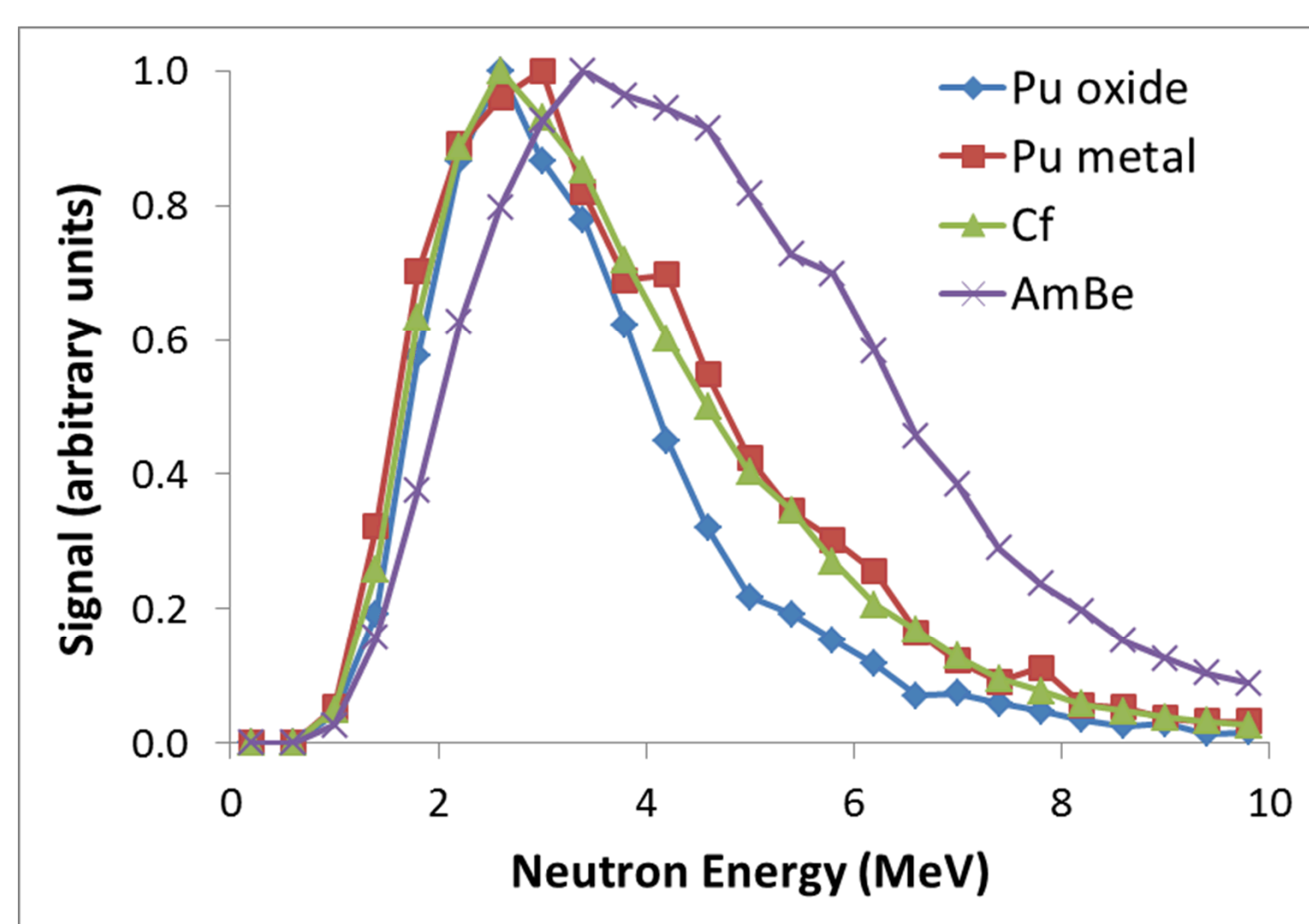
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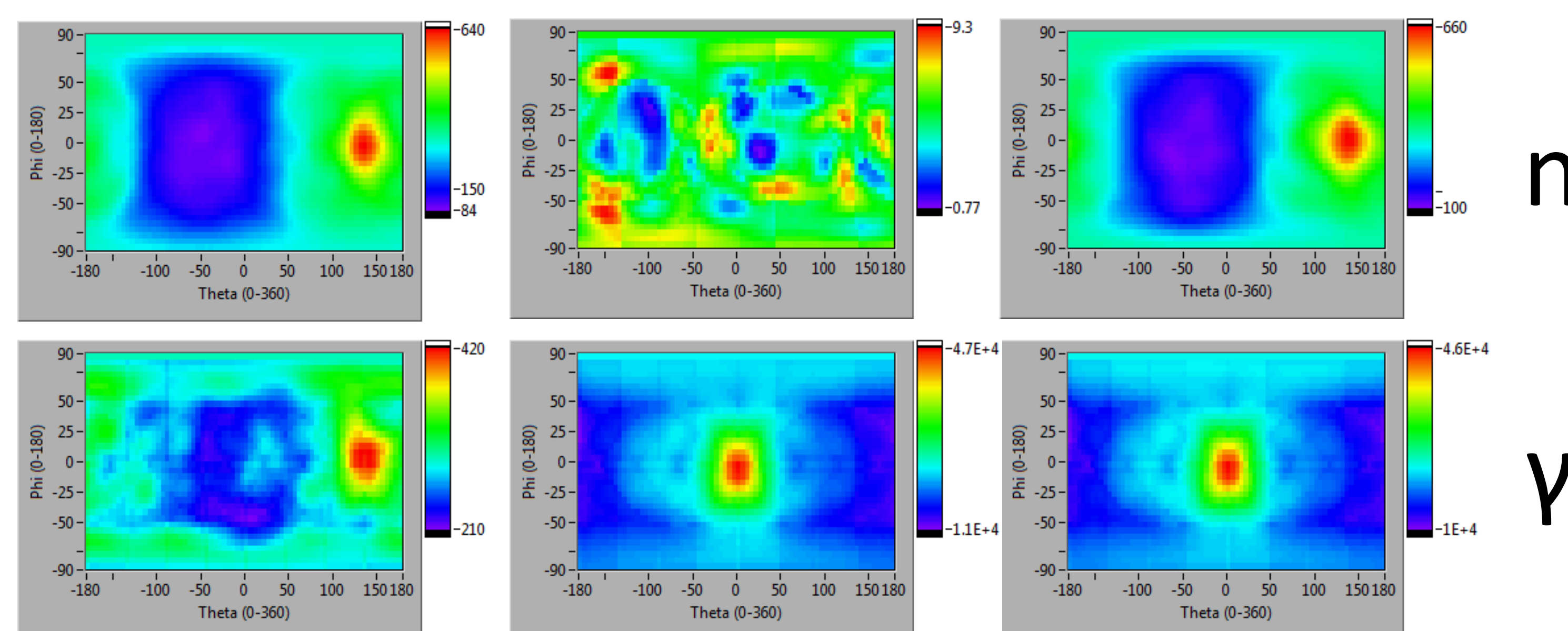
**Project overview:** We are demonstrating the capabilities of the MINER (mobile imager of neutrons for emergency responders) system, a compact neutron scatter camera, through a series of mission-based long-dwell search scenarios. This poster presents background information, and preliminary results from the first demonstration, localization and characterization of neutron and gamma sources in a 28-m high-rise-to-high-rise scenario conducted in downtown Chicago during the week of May 5-9, 2014.



**MINER system:** Left – interior of detector head. Center – entire MINER system (on side: power distribution box on top, 16-channel digitizer on bottom). This 36" high, 15" diameter, ~90-pound system can be operated using either wallplug or 12-24 V (110 W) battery power. Right – MINER in Chicago.



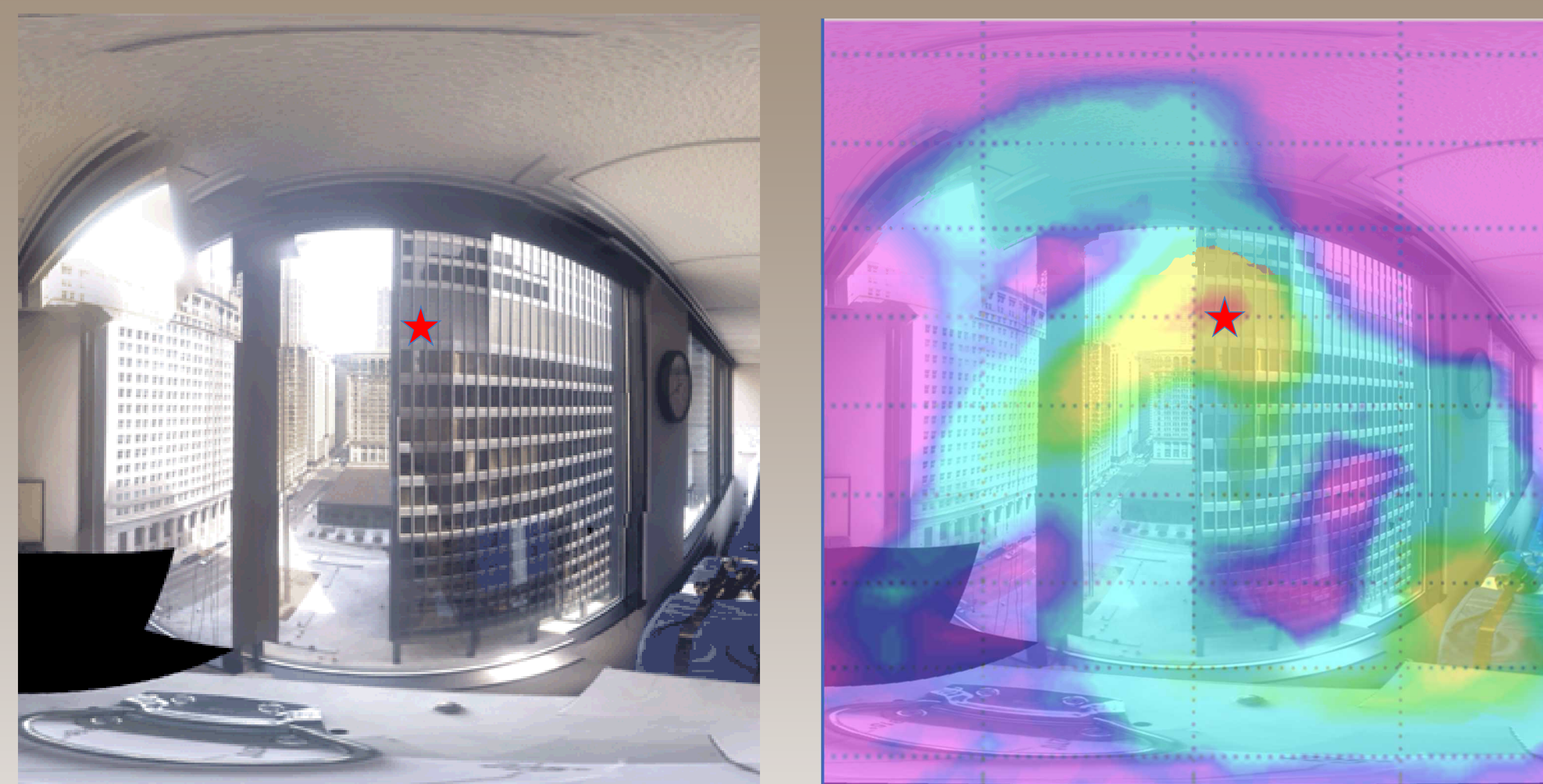
**MINER neutron spectra:** Left – peak-normalized spectra as measured using MINER. Right – insensitivity of Cf spectrum to intervening material as measured by MINER.



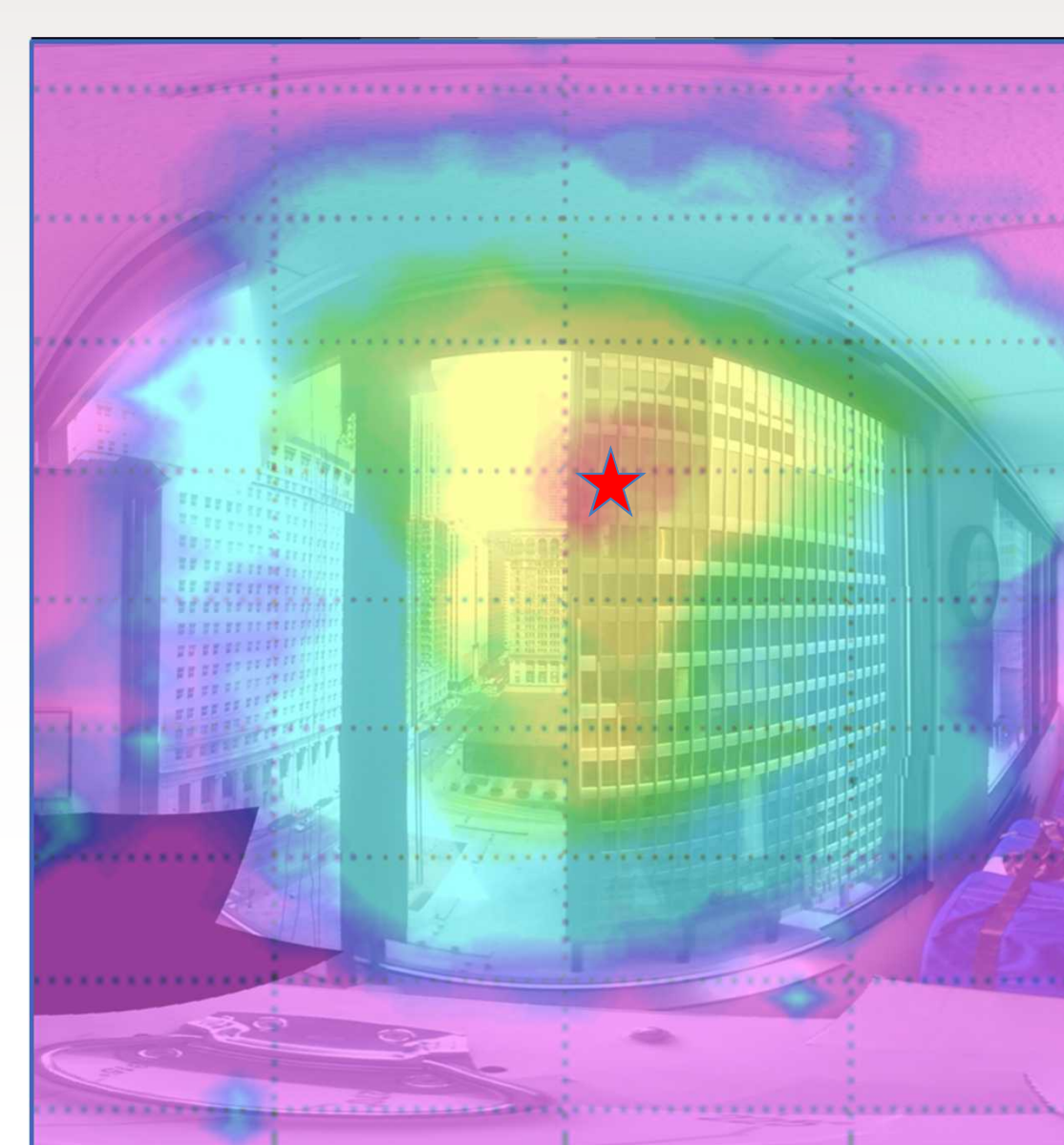
**Cf                      Eu                      Cf + Eu**

**Gamma insensitivity of neutron imaging:** The images above were recorded using a <sup>252</sup>Cf source 2 m from MINER at a relative angle of 0°, a strong <sup>152</sup>Eu source 1 m from MINER at a relative angle of 135°, and both sources together. This demonstrates the robustness of the neutron image reconstruction process in the presence of gamma fields.

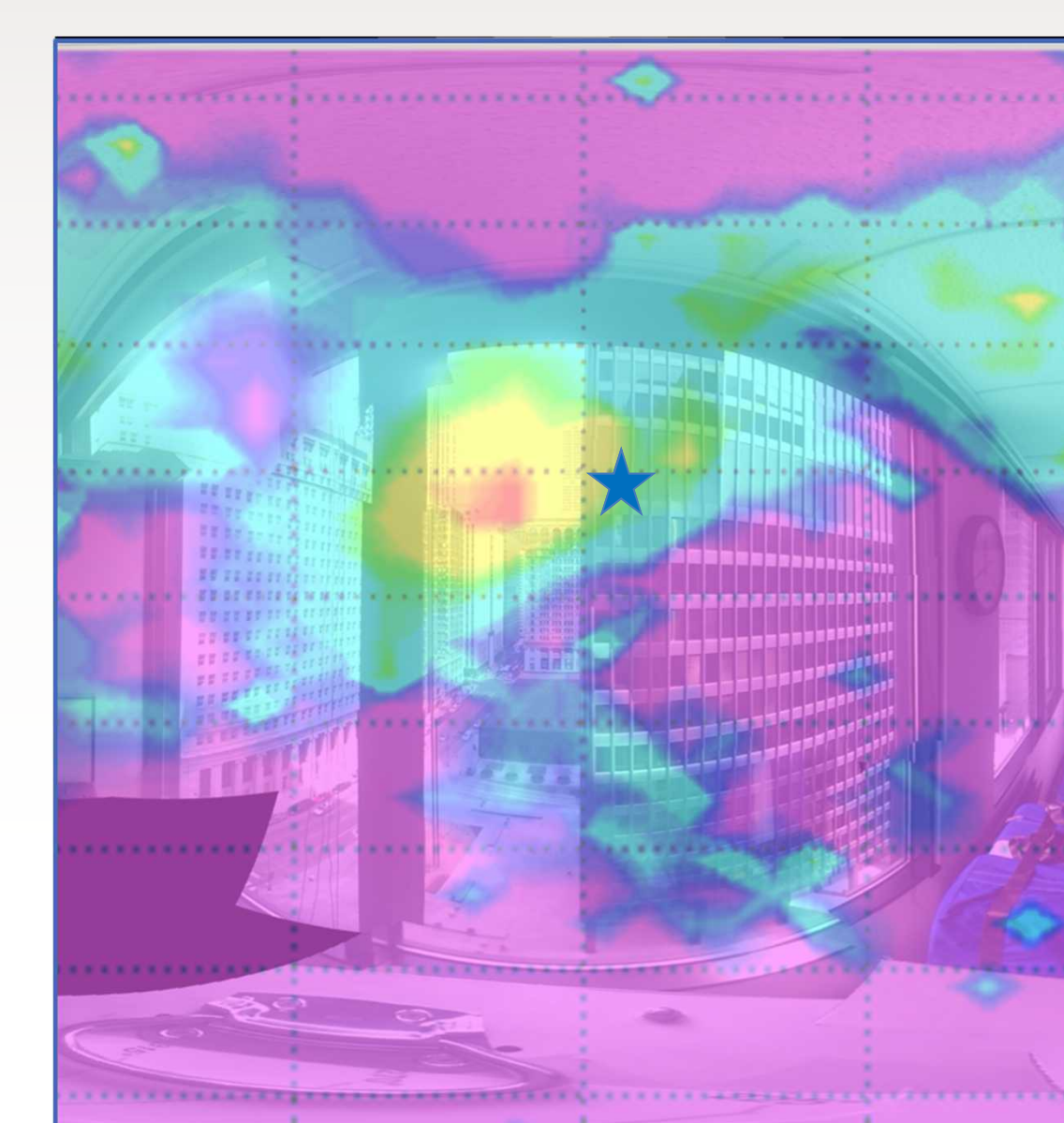
## Key Result



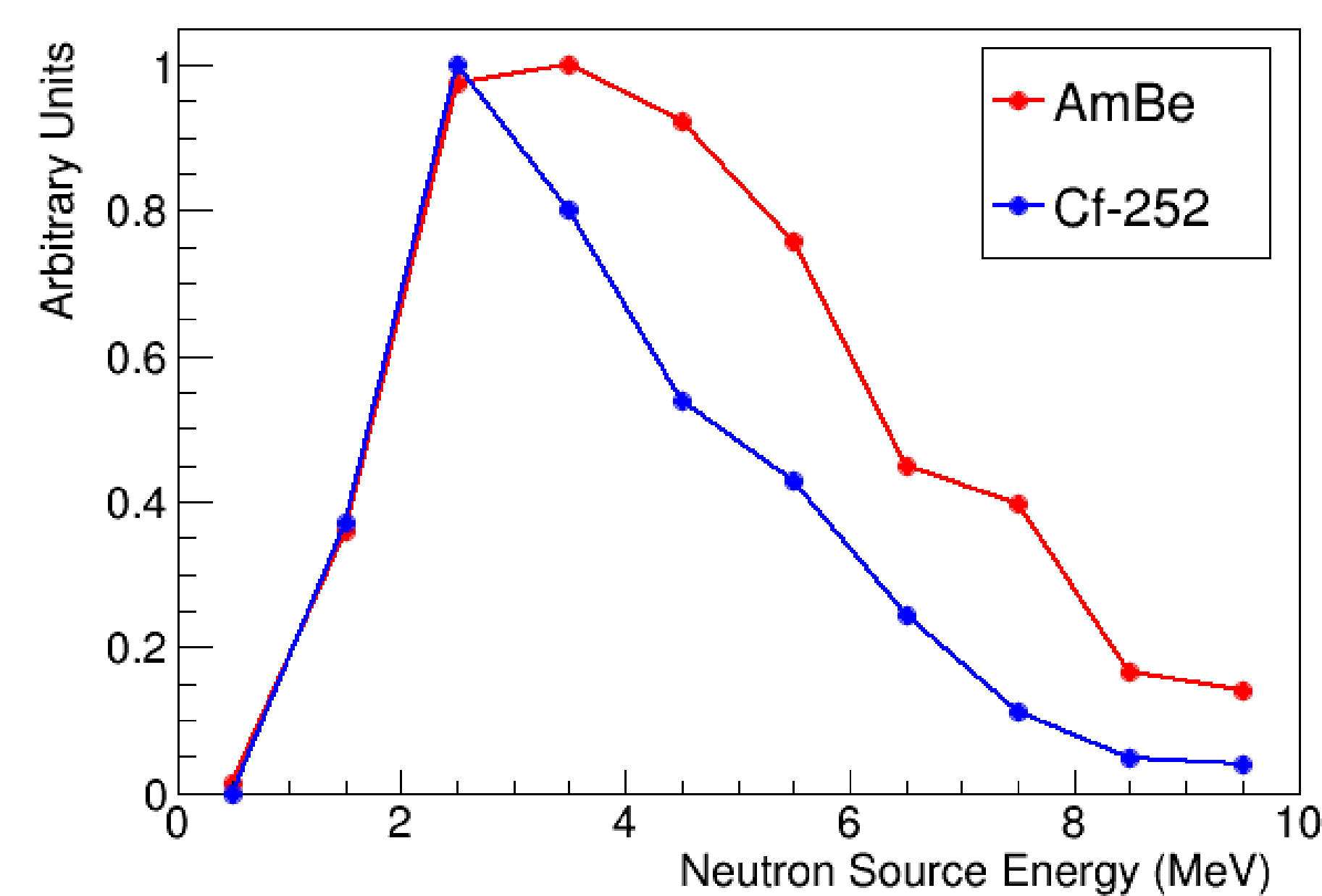
**<sup>252</sup>Cf, 28 m, 30 minutes**



**<sup>252</sup>Cf through 4" poly, 28 m, 618 min**



**10-hour background (dominated by open sky to left of building)**



**Spectroscopy at a distance:** Spectra recorded at the 28 m detector-source separation demonstrate our ability to distinguish <sup>252</sup>Cf from AmBe at a distance.

**Conclusions and future work:** We demonstrated localization of neutron sources (<sup>252</sup>Cf bare and surrounded by up to 4" of poly, and AmBe bare and surrounded by 2.75" of poly) across the 28 m gap between two high-rise-buildings in downtown Chicago. We were also able to distinguish Cf from AmBe based on their spectra. Although it is not described here, MINER also functions as a Compton camera for localizing gamma sources, and we demonstrated this for a <sup>137</sup>Cs source. Future work includes development of a quantitative metric for characterizing detection significance, investigation of neutron multiplication measurement capability, and participation in an at-sea maritime search scenario (tentative).