Exceptional service in the national interest

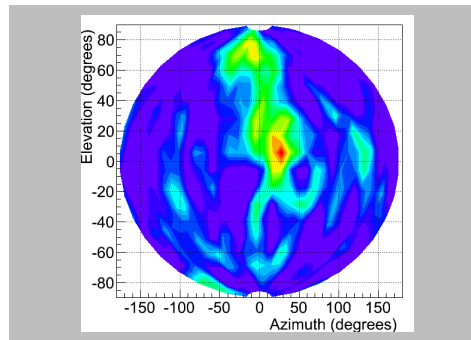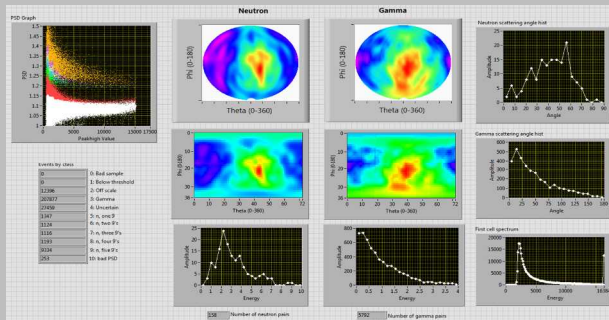Sandia National Laboratories

A Comparison of Neutron Detection Systems

Zach Strater

Introduction

- Reasons for Neutron Detection
  - Why neutrons?
    - Difficulty to detect
  - Where will these detectors be used?
- What does MINER stand for?
- Comparison of MINER and Helium-3
  - Difference of detection capabilities
  - How scintillators work
- Differences
  - Locating sources
  - Time to detect
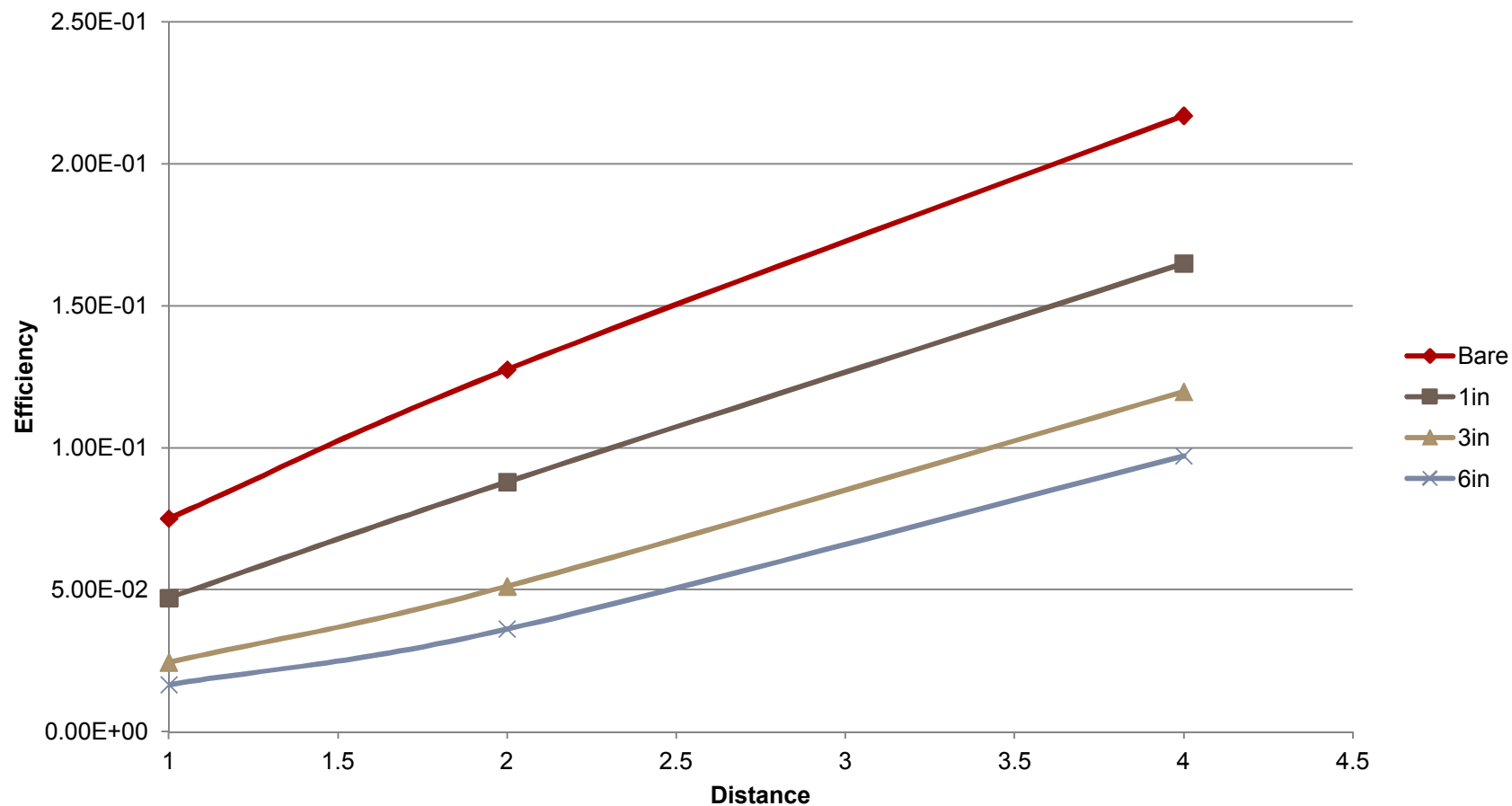 - Type of neutrons (thermal vs. fast)

Procedure

- Change in distance
    - What is the functional range of the detectors?

- Change in moderation (polyethylene)
    - How will the moderator effect each system individually?

- Time of readings
    - Trial lengths

- Background
    - Basis to relate trials to.
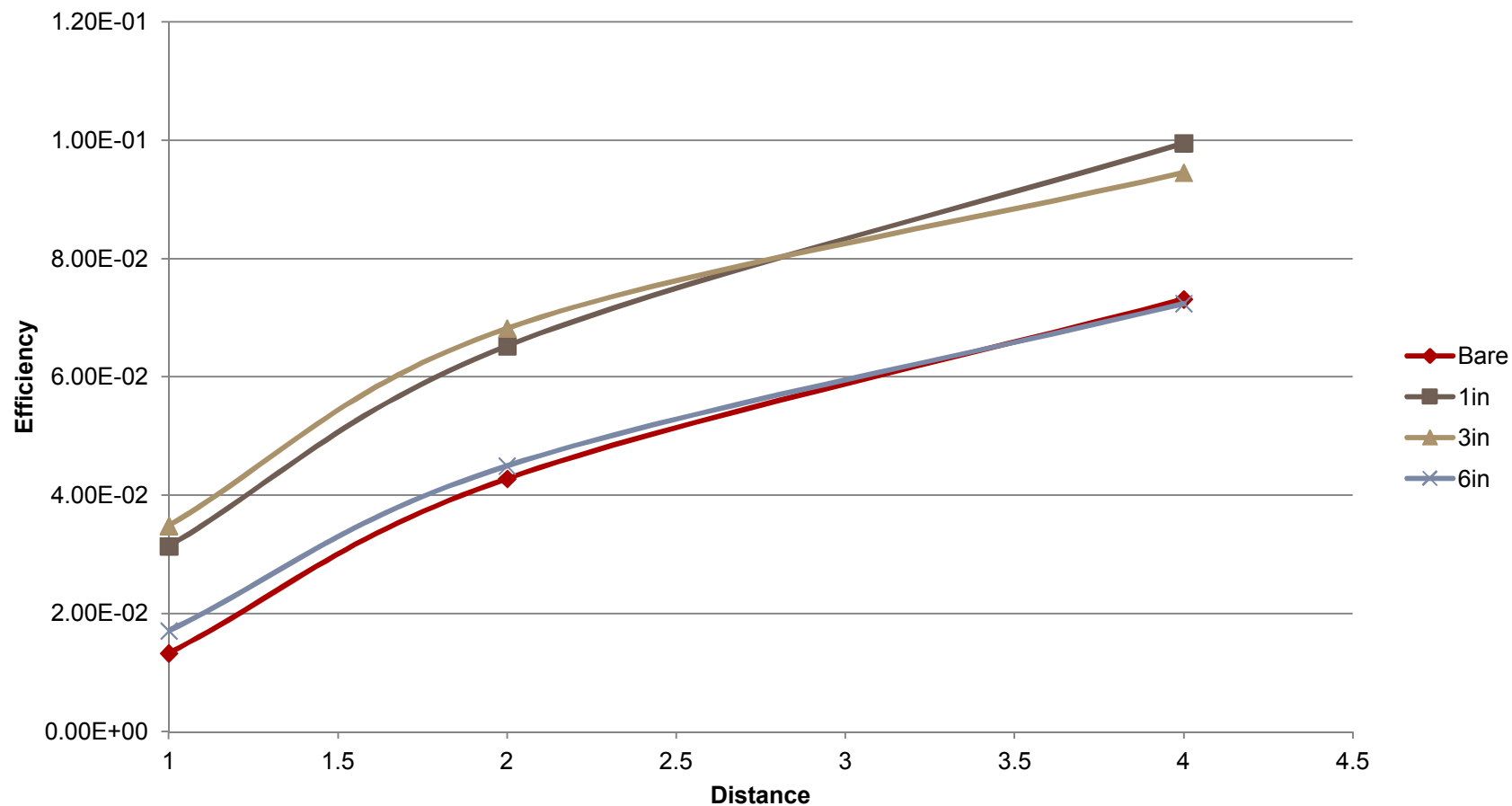   - Natural Radiation

Methods

- Testing being done by efficiency
  - Intrinsic Efficiency- Spherical Surface area vs. Surface area of system
  - Absolute Efficiency- Total counts vs. total read
- Testing of Alarm Time
  - Which system alerts of radiation quicker?
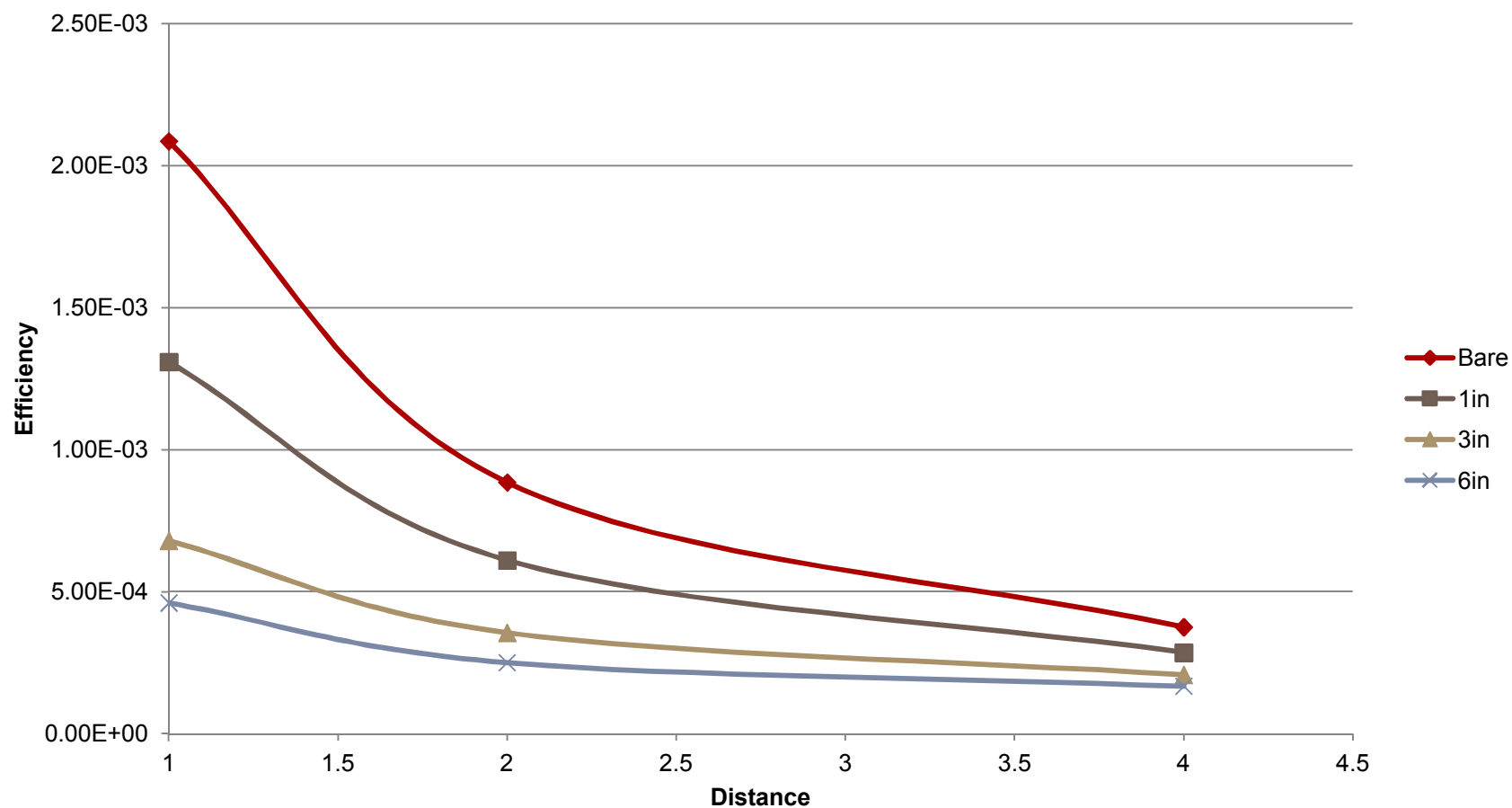 - Upper limit vs. Lower Limit
  - How do you find these limits?
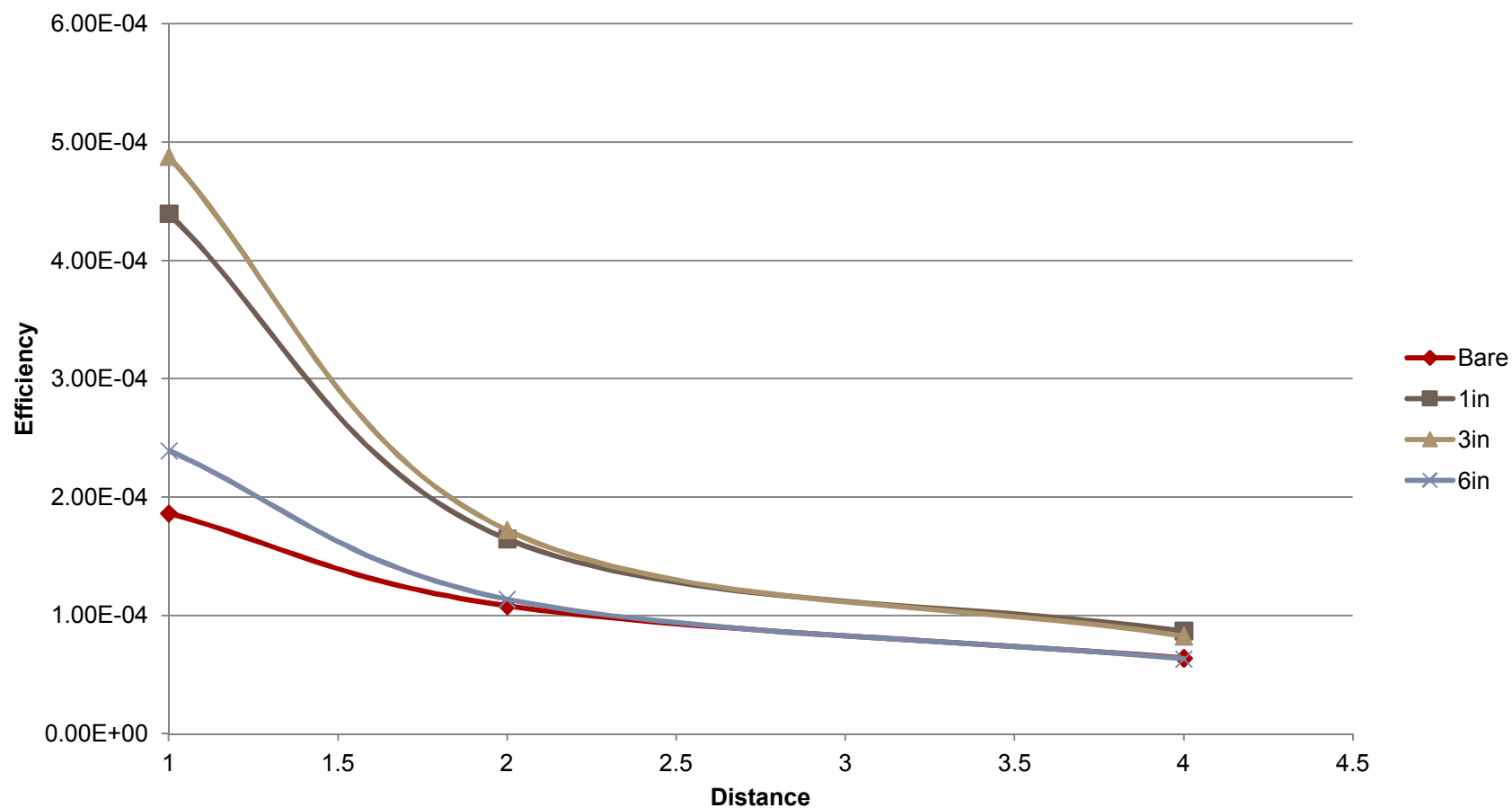
Data

Intrinsic Efficiency-MINER

Data

Intrinsic Efficiencies- He-3 Backpack

Data

Absolute Efficiencies- MINER

Data

Absolute Efficiency- He-3 Backpack

Distance/Moderation	MINER Alarm Time (5 sigma)	He-3 Alarm Time (5 sigma)
1m/Bare	Instantaneous	Instantaneous
1m/1in	Instantaneous	Instantaneous
1m/3in	Instantaneous	Instantaneous
1m/6in	Instantaneous	Instantaneous
2m/Bare	Instantaneous	Instantaneous
2m/1in	Instantaneous	Instantaneous
2m/3in	Instantaneous	Instantaneous
2m/6in	10s	Instantaneous
4m/Bare	Instantaneous	Instantaneous
4m/1in	Instantaneous	Instantaneous
4m/3in	10s	Instantaneous
4m/6in	20s	Instantaneous

Figure 5

Figure 5: Chart of alarm time for both systems at the various tested distances and amounts of moderation.

Conclusion

- Conclusion
  - He-3 Backpack detection time success
  - MINER efficiency success
  - MINER's size advantage
  - Is this a fair test between the two?