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# New Startup Detectors For Criticality Safety Training and Experiment Execution

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# Overview

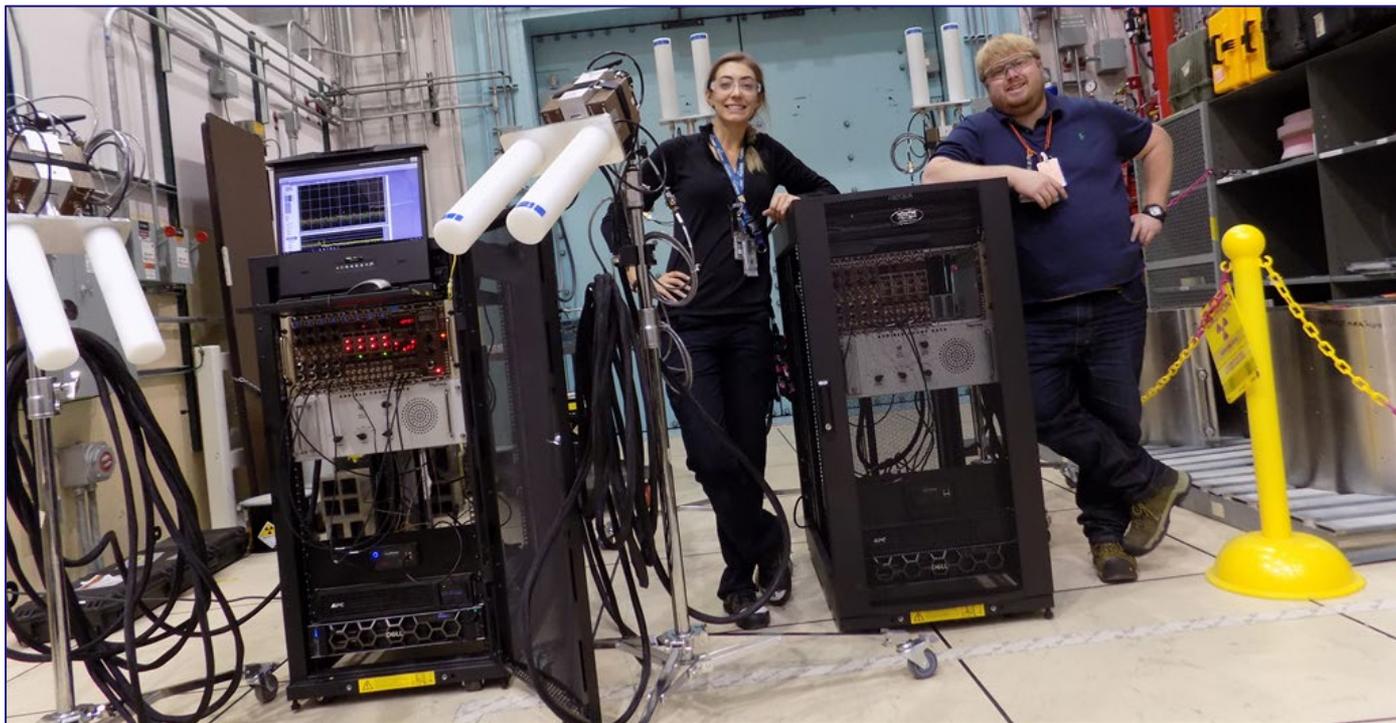
- History
- Need
- System Overview
- Impact
- Future Work

# History

- **As part of NCERC startup (called “CEF startup” at the time), detection equipment was purchased and installed.**
- **This included a low power system and a “high” power system in each critical assembly room.**
- **The low power system is referred to as the startup detector system.**
- **Consists of 4 He-3 tubes inside polyethylene per system/room.**
- **Data are fed to the startup channel program in the control rooms.**
- **Typical used for approach-to-critical operations.**

# Overview

- In 2018, LANL acquired two new startup detector systems.
- Purchased using LANL small equipment funding.
- Total cost for two systems was ~200K in parts and ~20K in labor.



# Need

- Why do we need additional startup systems?
  - Previously had two systems (one for each of the critical assembly rooms).
  - No full backups for either system.
  - Both are permanently located in contamination areas.
  - It is very crowded when doing initial hand-stacking operations for criticality safety training.
  - The NCERC calendar is much busier than several years ago, therefore it could be useful to perform initial hand-stacking for the next operation while performing a different operation on Planet or Comet.

# Space and PPE

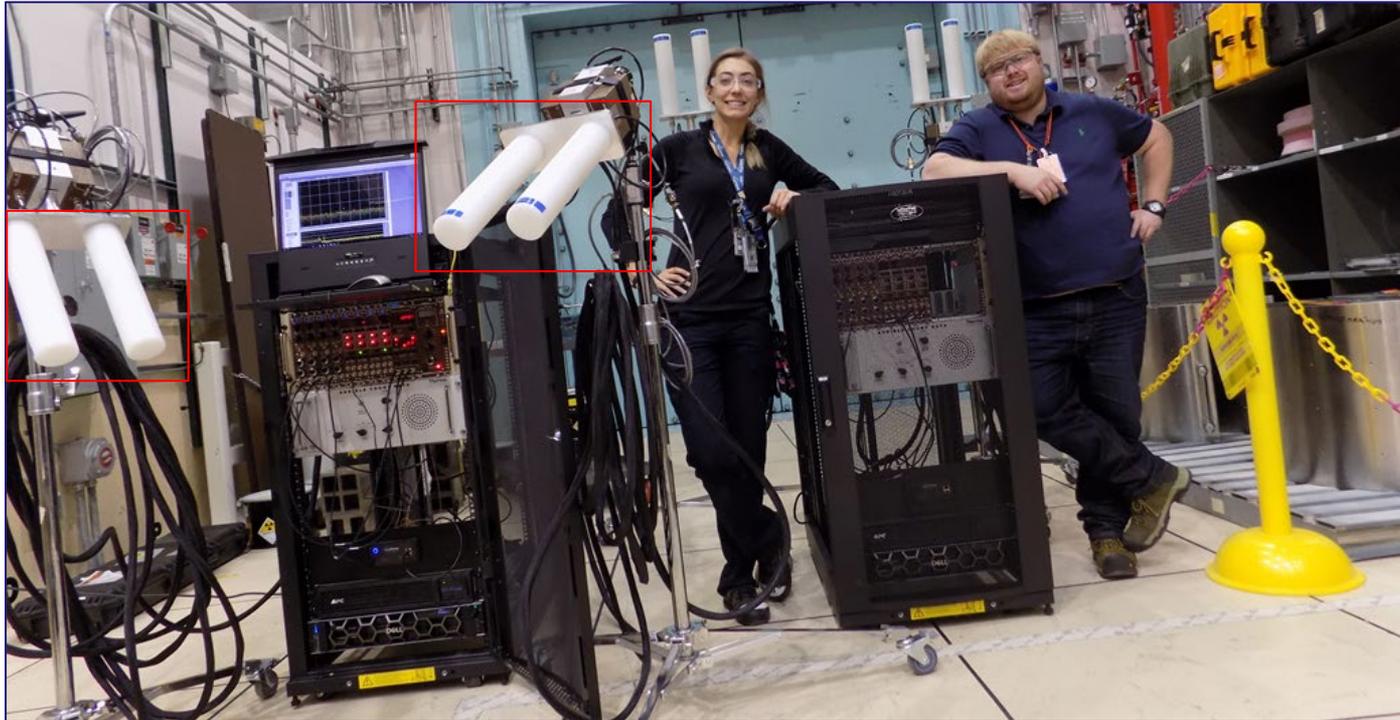
Previously hand-stacking operations have taken place in the same room as Planet. There is very little space for students. Also, PPE is required since it is in a contamination area.

With the new startup system, we can perform the initial hand-stacking in the same rooms as the BeRP/Np demo. Much more open space. Also, less PPE will be required (gloves only).

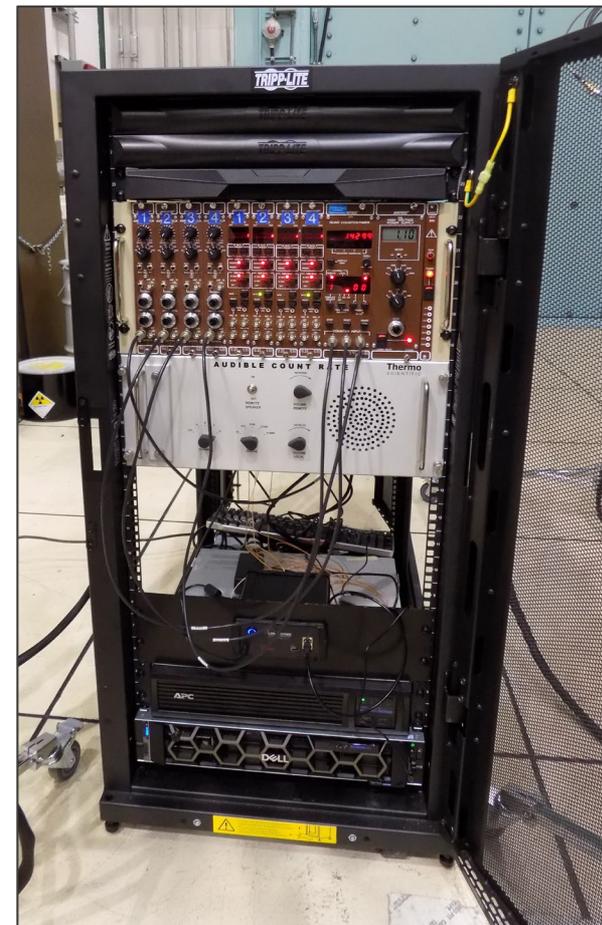


# System Overview

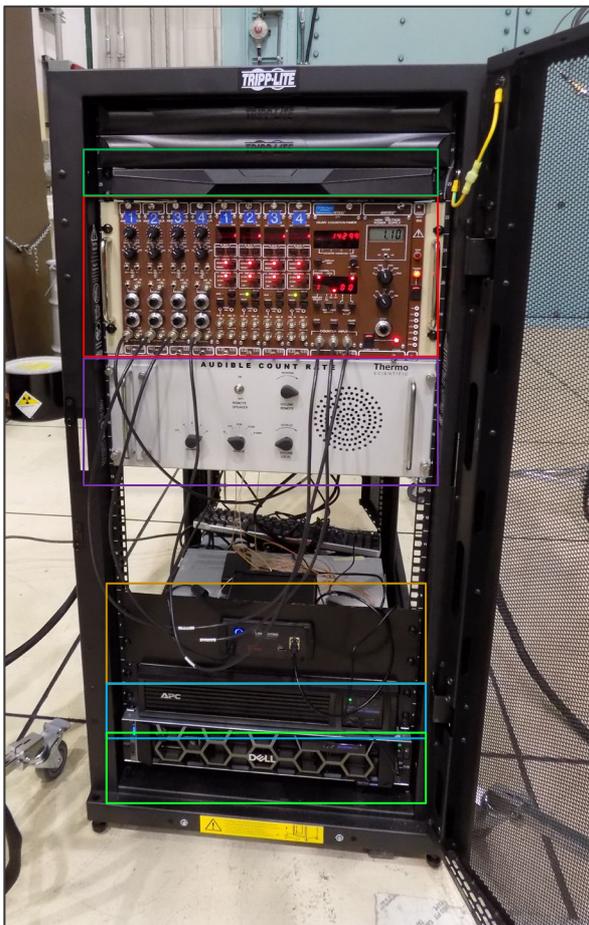
- Similar to the systems in the criticality assembly rooms, each unit has 4 He-3 tubes inside polyethylene. There are two He-3 tubes per mobile tripod.



# System Overview



# System Overview



Monitor and keyboard.

NIM electronics used to power the detectors and obtain counts.

Audible count rate.

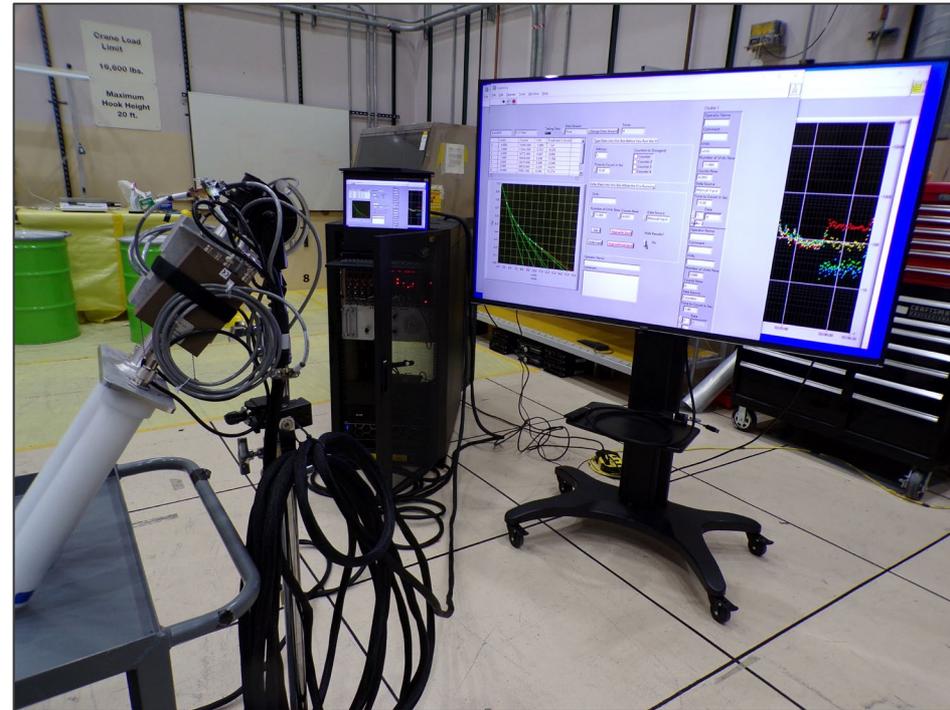
Advanced List-Mode Module.

UPS.

Computer.

# System Overview

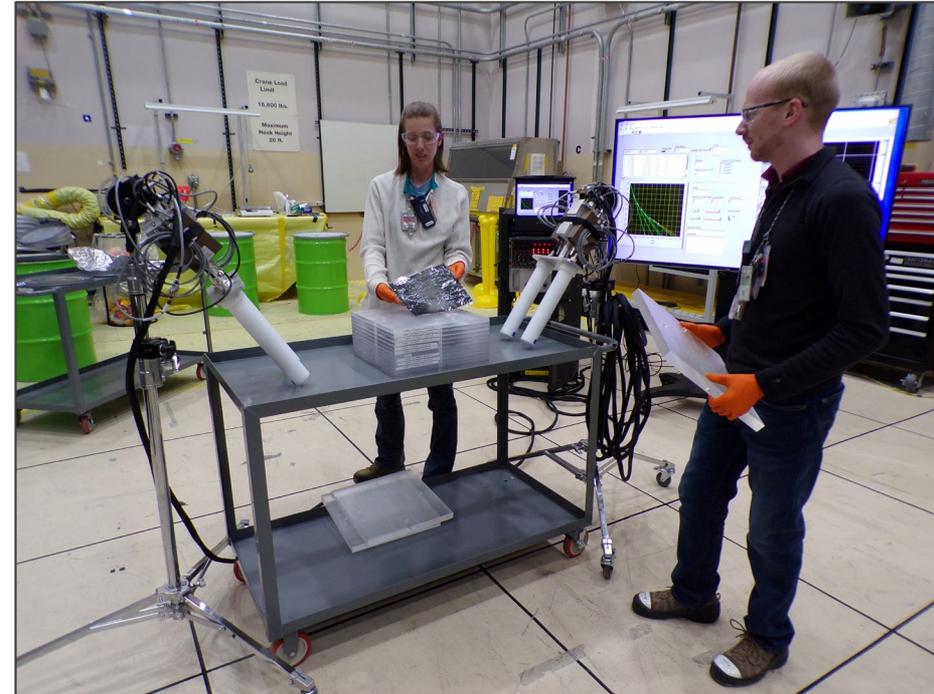
- Data are recorded via three methods:
  - Count rates go to individual counters. Used to record count information by hand for 1/M calculations.
  - Count rates are fed through the quad counter to the computer for use in the startup channel program (the exact same program used in the control room computers for critical experiments).
  - List-mode data is recorded by the ALMM (Advanced List-Mode Module). This data has a timing resolution of 100 nsec. In addition it is run by the same data acquisition as the NoMAD detectors and outputs the same file format. It can also accept data from 28 other channels.



# Impact

- **Criticality safety classes:**

- The new system will have a very positive impact on our criticality safety classes.
- The class foils initial hand-stack can now be performed in the same room as the BeRP/Np demo.
- This results in much more open space.
- It also reduces the amount of PPE needed (and therefore time spent dressing out).



# Impact

- **Initial hand-stacking operations (up to the local limits) can be built in the same room as the BeRP/Np demo.**
  - This can potentially help with scheduling as NCERC operations fill up the calendar.
  - This will help improve subcritical operations (in particular the new ALMM will make it easier to perform Rossi-alpha measurements).
- **These new systems will help serve as backups to the existing startup systems.**

# Future Work

- **In the future we will use these new systems during our NCSP criticality safety training courses.**
- **We will also perform many new experiments using these new systems.**
- **During the control upgrades we would like to also have ALMM systems present in each control room to allow for list-mode data at any time while performing critical experiments.**

# Acknowledgements

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- This work was sponsored by LANL small equipment funds.

