

Abstract

- Presentation details information related to the LANL ListMode Module and the Neutron Reference Detection System, both devices developed by LANL that have been used for various NCSP experiments.

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LLMM and NRDS

Los Alamos List Mode Module and Neutron
Reference Detection System for He-3 and BF₃
Systems

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LLMM and NRDS – What are they?

- LLMM: LANL ListMode Module
 - Electronics module that records listmode data
 - Input: TTL
 - Output: Binary listmode (timetagged)
- NRDS: Neutron Reference Detection System
 - He-3 or BF₃ gas-filled neutron detectors, various moderators and absorbers
 - Can be used with LLMM
 - Can be used to coarsely measure neutron energy spectrum

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LLMM and NRDS – Why Should NCSP Care?

- LLMM and NRDS are or can be used as diagnostic tools
- Both have been used in previous NCSP experiments
 - Both used together in IER 147 (steady-state)
 - LLMM used for Rossi-Alpha Measurements
 - Both will continue to be used in future experiments
 - IER 151 and more
- Useful for the NCSP community to have an understanding of the equipment for reference

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LLMM



LANL ListMode Module

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LLMM Specifications

- 32 channels (BNC)
- 100 nanosecond bin size
- TTL Specifications
- Output through ethernet or USB
- Count Rate Limited
 - ~300,000 cps
 - 1,000,000+ cps for alternate model
- Output limited based upon write speed

Specification	Value
Logical 1 output voltage (V_{OH})	$2.4\text{ V} \leq V_{OH} \leq 5\text{ V}$
Logical 0 output voltage (V_{OL})	$0.0\text{ V} \leq V_{OL} \leq 0.4\text{ V}$
Logical 1 output current (I_{OH})	$< 400\ \mu\text{A}$
Logical 0 output current (I_{OL})	$< 16\text{ mA}$
Pulse rise time	$< 50\text{ ns}$
Pulse fall time	$< 50\text{ ns}$
Pulse width (pw)	$50\text{ ns} < \text{pw} < 1\ \mu\text{s}$

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LLMM Specifications

- LLMM Input: 12 Volts (wall socket)
- LLMM Output: Ethernet or USB to PC
 - Binary file (can be converted to text file if needed)

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LLMM Experiments

- NCERC
 - Rossi-Alpha measurements
 - Neutron energy spectra measurements (IER 147)
 - Future IER and NCSP Work (IER 151)
- DNDO
 - Neutron Market Research Detector Project (NMRDP)
 - Government Developed Neutron Detector Test Campaign (GDND)
 - Backpack Handheld Vehicle-Mounted Portal (BHVMP)
- Neutron Watchdog (with NRDS)

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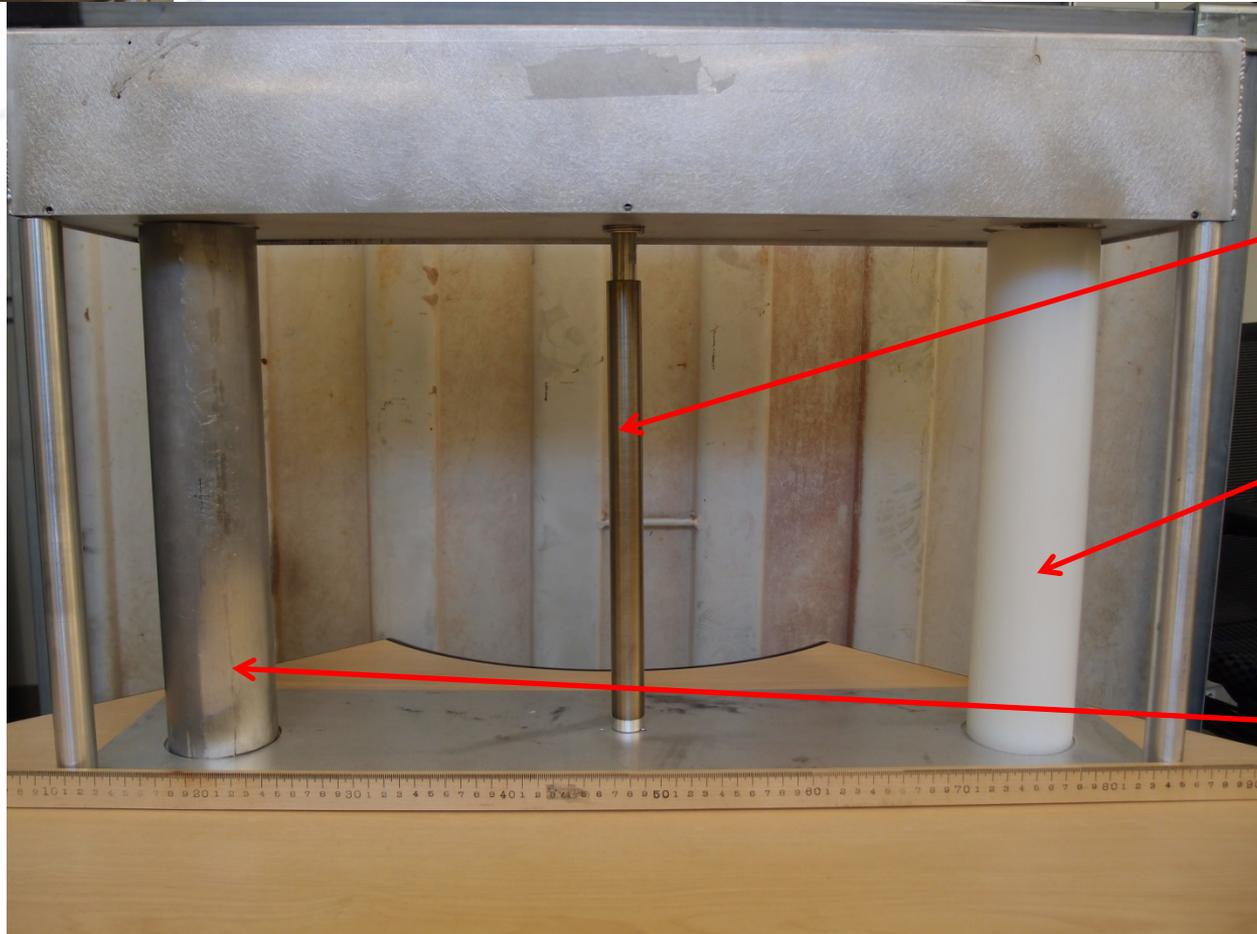
NRDS Specifications

- Neutron Reference Detection System
- Three gas-filled tubes on a 200 cm radius arc (30 cm apart)
 - He-3
 - 4 atm
 - 10 inch active length
 - Original plan was for 11 inch active length, 5.3 atm tubes, but unavailable due to He-3 shortage
 - High Voltage: 1720 V
 - BF₃
 - 1 atm
 - 12 inch active length
 - High Voltage: 2500 V UNCLASSIFIED

NRDS Specifications

- Varying amounts of moderator/absorber on each tube
 - One bare tube
 - One tube with 3" poly
 - One tube with 3" poly and 0.03" Cd
- Allows for coarse measurement of neutron energy distribution
- NRDS Input: 12 Volts (wall socket)
- NRDS Output: Three channel TTL signal output

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Bare Tube

Poly Tube

Cd Tube

NRDS Neutron Reference Detection System

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NRDS PDT Information



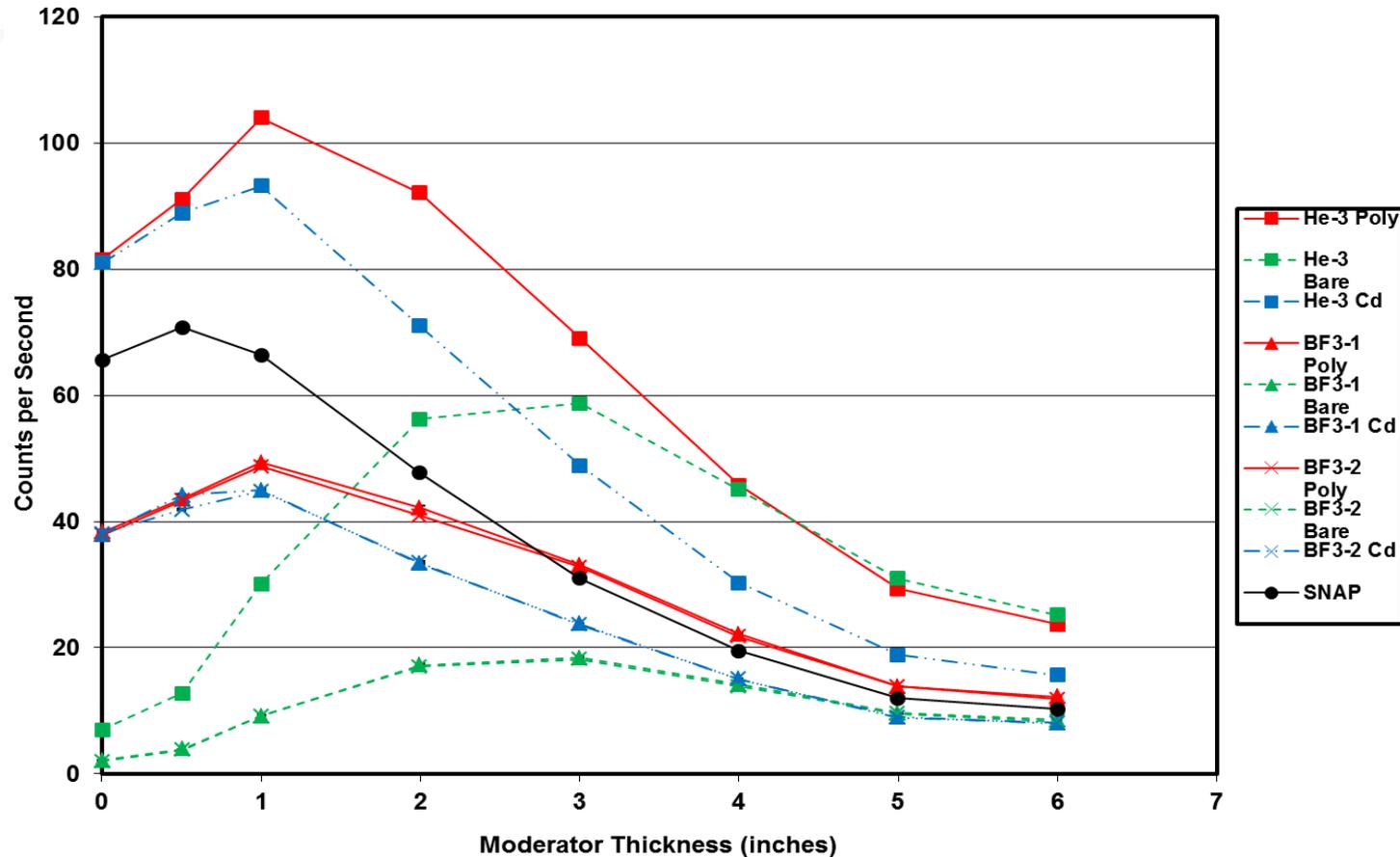
- Neutron pulse monitoring module (made by Precision Data Technology, INC) known as a PDT
- Three PDT modules per NRDS unit, tubes screw into the bottom
- Attaches to each detector tube, electronics module contains shaping amplifier, (perhaps) high voltage supply, outputs a TTL signal
 - Inputs: 12 V power supply, high voltage (if needed)
 - Outputs: TTL pulse for each neutron detected
 - Adjustment screws to change gain, high voltage, TTL pulse width
 - Ruggedized versions available
 - PDTs that supply their own high voltage also capable of supplying high voltage to other PDTs

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NRDS Benchmark

- Extensive benchmarking to compare He-3 NRDS to BF₃ NRDS



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