# Neutron Benchmarking WG Status Update

Ray Bunker September 26, 2013

# **Working Group Activities**

- 1. Broad-interest discussions among all WG members
- 2. Ongoing analysis for first NMM measurement
- 3. Coordinated DAQ for NMM & veto shield

# **1. Broad-interest WG discussions**

#### • Started by mixing non-NMM topics into NMM Fri meetings

- Nov 2, 2012  $\rightarrow$  Chao updates USD liquid scintillator detector data analysis
- Jan 4, 2013  $\rightarrow$  Anthony leads discussion of Watchman Project (LLNL)
- Feb 8,2013  $\rightarrow$  Julien & Adam introduce their He-3 NCDs at MIT work

#### • Found new members at LRT 2013

- Tom Langford  $\rightarrow$  NIST Gaithersberg; the FaNS detector
- Lea Reichhart  $\rightarrow$  UCL; using ZEPLIN III to measure neutrons

#### • Began ~monthly "Summary" meetings

- Specifically dedicated to broad-interest discussions (high-level presentations):
  - May 10<sup>th</sup>  $\rightarrow$  FaNS & USD Liquid Scintillator
  - May  $31^{st} \rightarrow$  ZEPLIN III & MIT NCDs
  - Next meeting  $\rightarrow$  MIT NCD simulations, NMM status
- Extended summer hiatus ...

# 2. Ongoing NMM Analysis

- First NMM fast-neutron measurement
  - Use ~2 years of already acquired data
  - Measure flux of high-energy neutrons (>50 MeV)
    - Publish first NMM paper by summer 2014!
  - Primarily a Syracuse activity
    - Coordinated by Richard & Ray
    - Geant4 simulation work by Yu Chen (grad)
      - Builds on previous work by Melinda Sweany (Sandia)
    - Data analysis by Chris Nedlik (undergrad)
      - Builds on previous work by UCSB students (Ray, Joel, and others)

#### 2. **NMM Analysis**—*Highlights!*

mapCap

Geant4 MC simulation of neutron capture positions for neutrons generated across surface of Pb target



## 2. NMM Analysis—Highlights!

First estimate of absolute neutron capture efficiency



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## 2. NMM Analysis—Highlights!

#### Detailed data-driven understanding of 20" PMT afterpulsing



## 2. NMM Analysis—Highlights!

Using background gamma rate to understand detector stability





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# 3. Coordinated NMM & Veto-shield DAQ

### Reinstrument NMM & veto shield

- To correlate fast neutrons in NMM to veto-shield showers
- Added hardware to NMM to allow GPS time stamps
  - Modified NMM software to incorporate time stamps (Anthony)
- Recommissioned/upgraded entire LBCF veto shield
  UMN and Soudan crews
- Upgraded veto-shield DAQ to better manage data flow (UMN)
- Worked out & tested correlated time stamps between systems
  - UMN crew led by Anthony
- Recorded several weeks of "muon-mode" NMM data:
  - For further tests & to help develop analysis tools
- Began NMM fast-neutron search w/ fully instrumented veto shield!
  - To be continued through the next ~1 year

## 3. NMM/Veto-shield DAQ—Highlights!

Demonstration of time-stamp correlation timing resolution



Courtesy A. Villano

## 3. NMM/Veto-shield DAQ—Highlights!

Demonstration of time-stamp correlation timing resolution



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