Discussion Summary

Multiple Particle Detection in a Neutron Monitor

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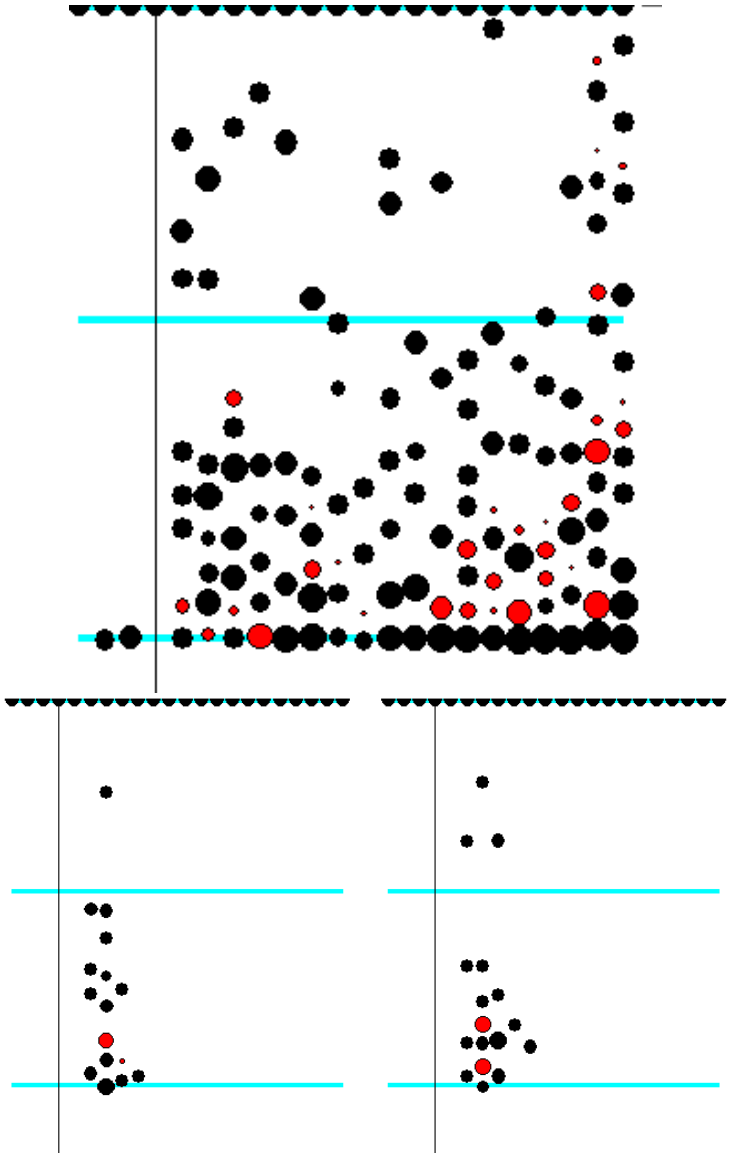
Princess Sirindhorn Neutron Monitor (PSNM) is an 18NM64 located in Thailand at a geomagnetic cutoff of 17 GV and an altitude of 2565 m

PSNM Interaction Time Histories

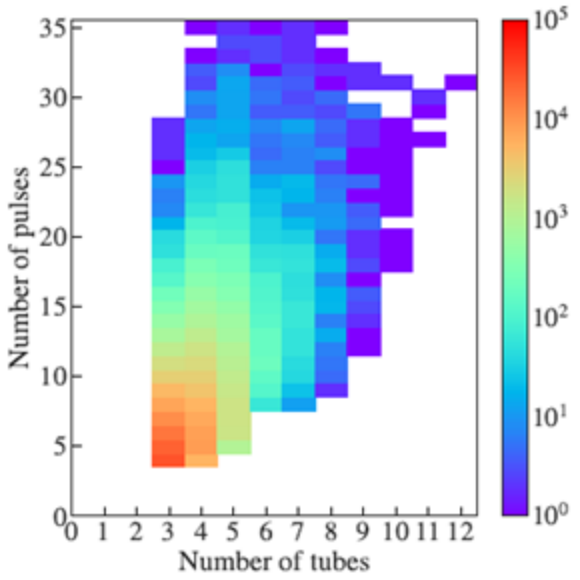


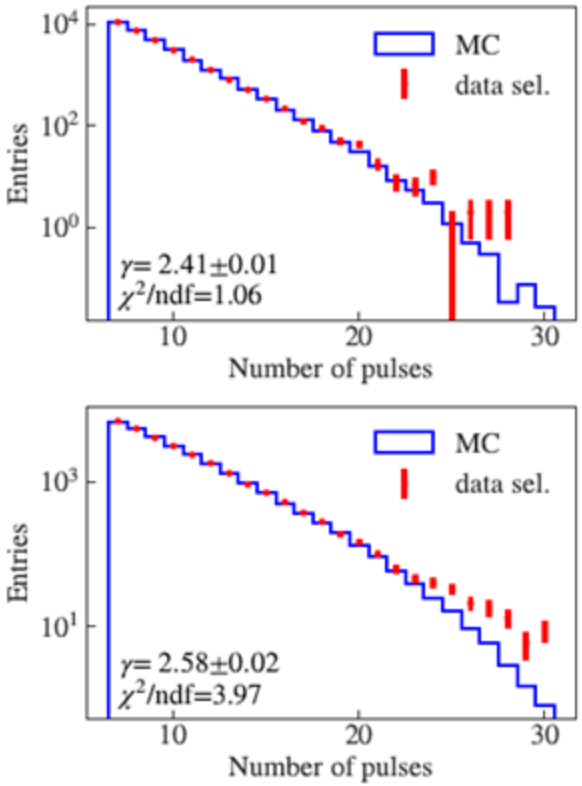
We record the time of each interaction to an accuracy of two microseconds and are able to form “images” of complex interactions. Here we show an actual air shower core (top) and two simulated 100 GeV neutrons.

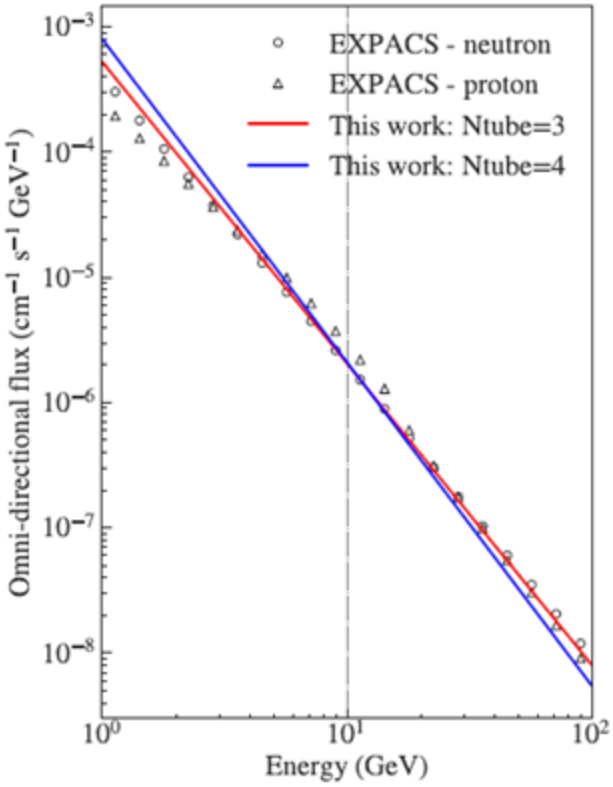
Time runs upward; blue lines are one millisecond apart.

We classify the interactions in terms of the number of individual monitor units hit and the number of hits summed over all units.

Spectrum Derivation



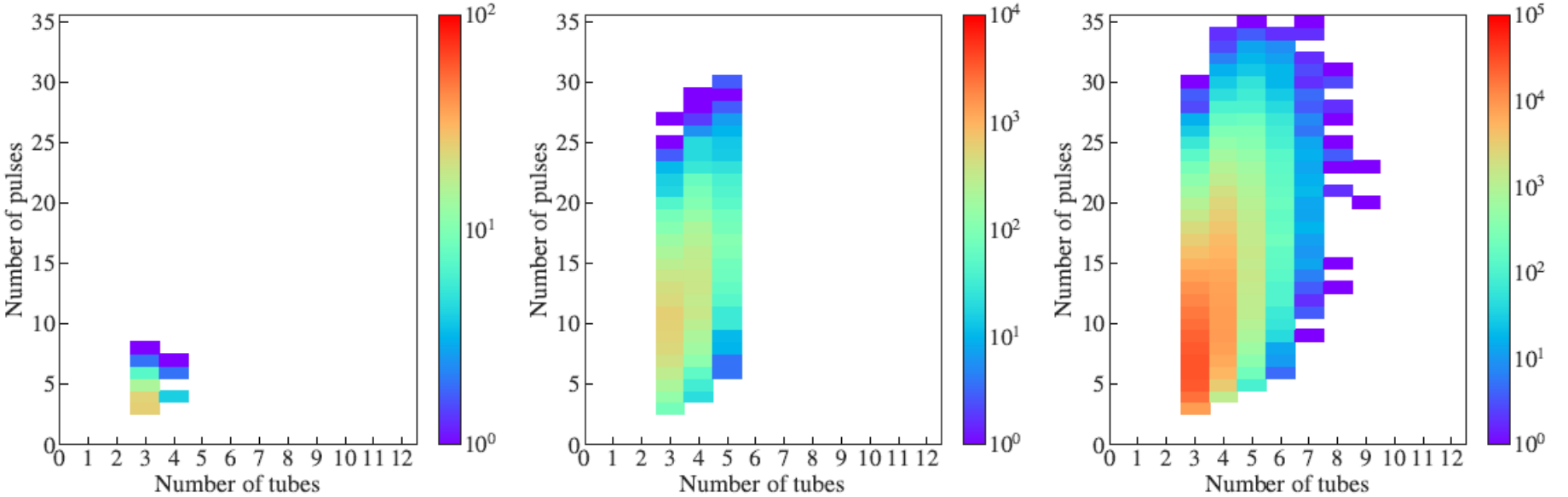




Left: Events at PSNM selected to have one, contiguous group of hits, with no hits in the end detectors. By weighting simulations with different spectral indices we explore different ways to fit the data (center). We get excellent agreement with calculations of the secondary spectrum (right)

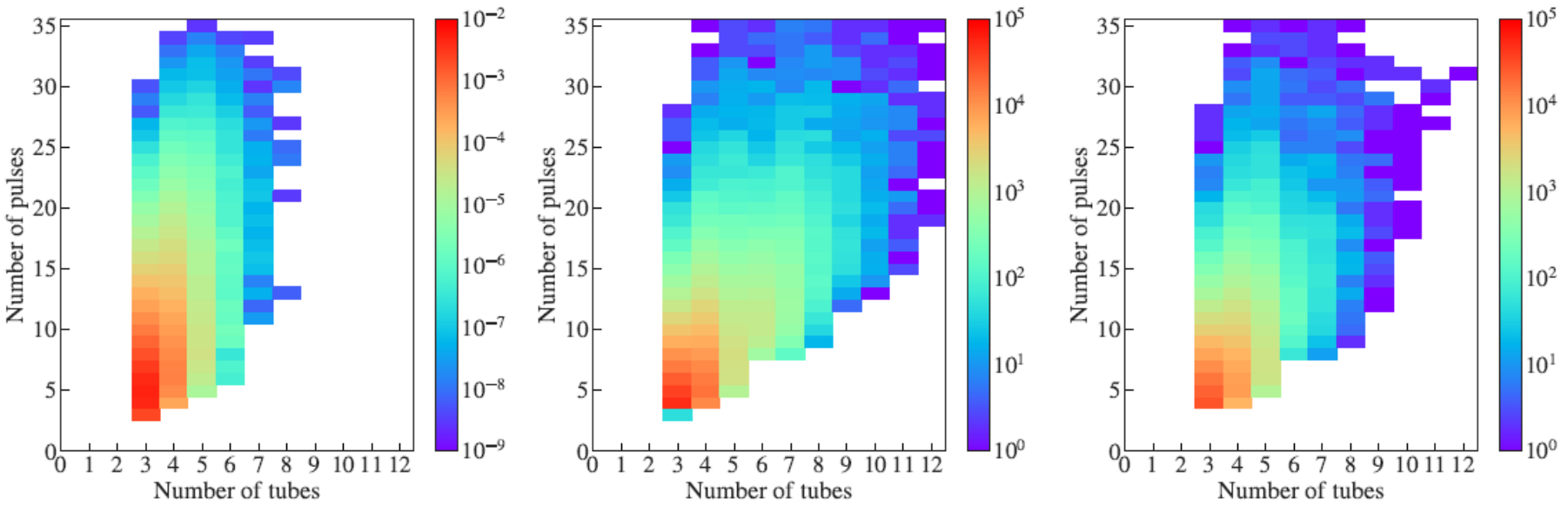
Backup Slides

PSNM Simulations



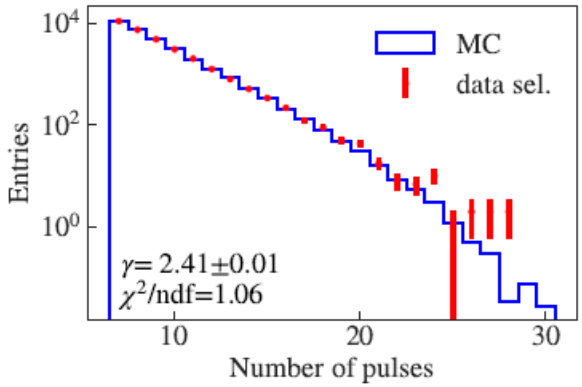
In each case the number of detectors hit is plotted horizontally, while the total number of hits is plotted vertically. Left: 1 GeV neutron pencil beam. Center: 100 GeV. Right: 1 to 100 GeV, E^{-1} spectrum distributed in location and incident direction.

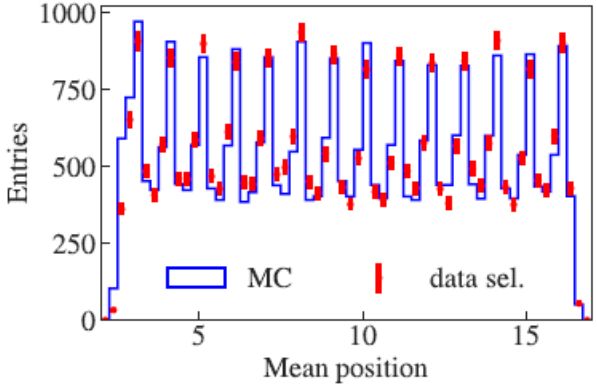
PSNM Simulation and Data

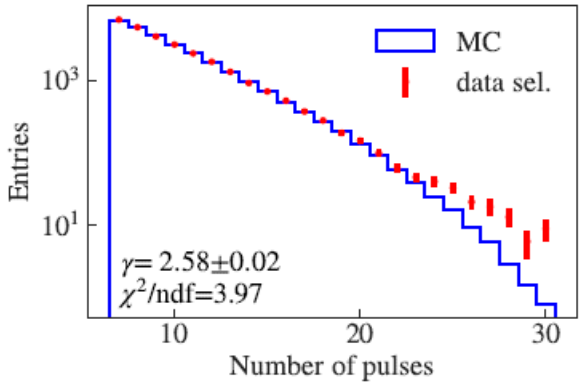


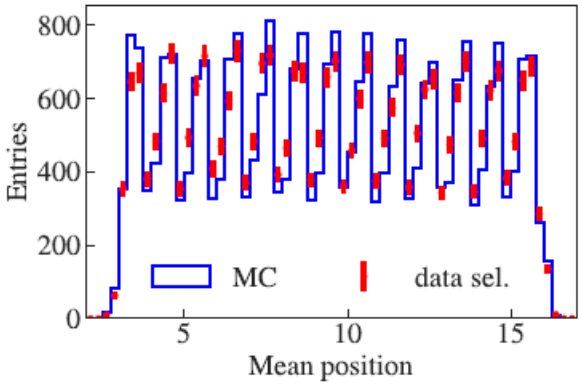
Left: Simulation re-weighted to $E^{-2.5}$. Center: Two days of actual data. Right: Data with a single, contiguous span of hit detectors with no hits in the end detectors.

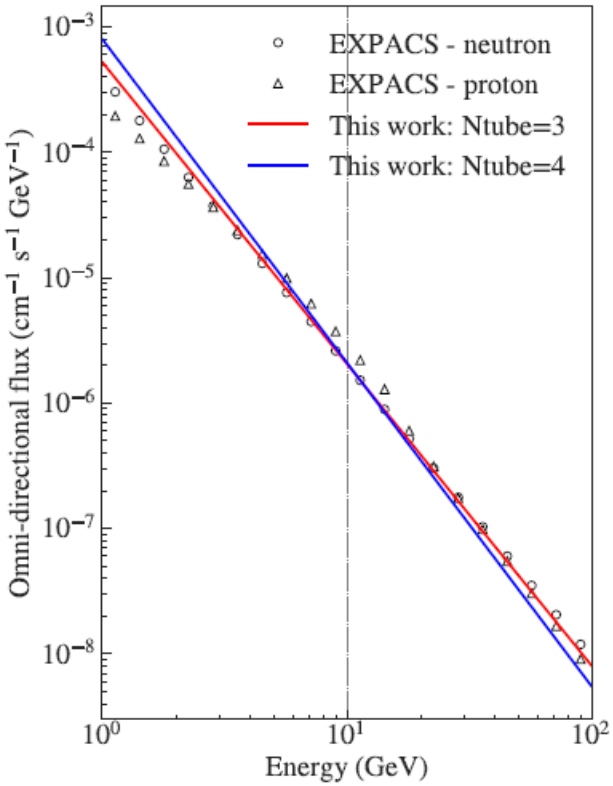
Analysis Compared to EXPACS











By adjusting the weighting we can produce good fits (normalized for now) to EXPACS calculations of the expected secondary spectrum

Conclusions:

- With a relatively simple analysis we can measure the spectrum of secondary particles at PSNM over a wide energy range with high statistics on a daily basis.
- Future Plans:
  - Better deconvolution and background rejection.
  - Atmospheric variability corrections.
  - Relate the secondary spectrum to primary spectrum
- We are taking data to span the next polarity reversal