

High-multiplicity neutron events registered by NEMESIS experiment



Marcin Kasztelan on behalf of

The NEMESIS Collaboration

T. Enqvist^b, K. Jędrzejczak^a, M. Kasztelan^a, J. Joutsenvaara^d, O. Kotavaara^d, P. Kuusiniemi^b, K.K. Loo^f, J. Orzechowski^a, J. Puputti^d, A. Sobkow^a, M. Słupecki^e, J. Szabelski^a, I. Usoskin^c, W.H. Trzaska^b, and T.E. Ward^{g,h}

a National Centre for Nuclear Research, Łódź, **Poland**

b Department of Physics, University of Jyväskylä, Jyväskylä, **Finland**

c University of Oulu, Sodankyla, **Finland**

d University of Oulu, Nivala, **Finland**

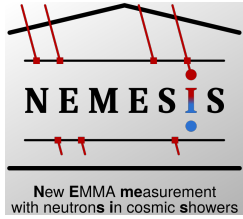
e Helsinki Institute of Physics (HIP), **Finland**

f Institut für Physik (IPH), Mainz, **Germany**

g High Energy Physics (HEP), U.S. Department of Energy, Washington, D.C., **United States**

h TechSource, Santa Fe, **United States**

15 members, 4 countries



Importance & goal

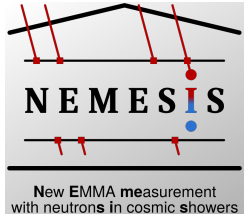


Importance:

Neutron induced interactions may be an important background for experiments looking for exotic phenomena like: Dark Matter searches, neutrino-less double beta decay, proton decay, neutrino detection, etc.

Main goal:

Improve our knowledge and understanding of cosmic muon-induced neutron production (large multiplicities) in high-Z targets.

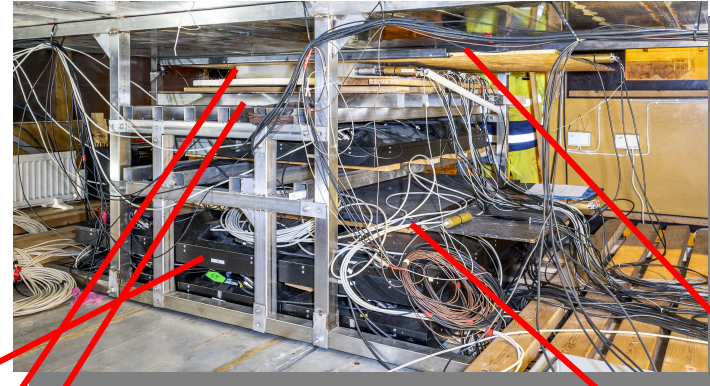


The NEMESIS setup

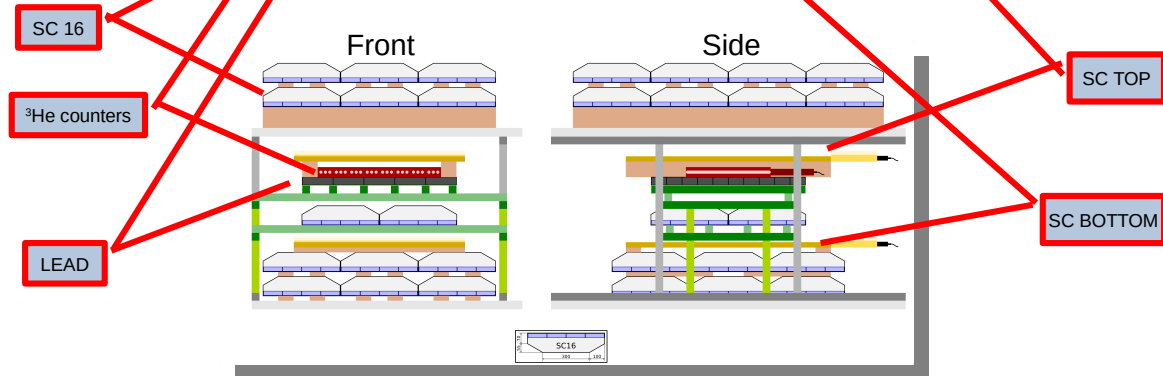


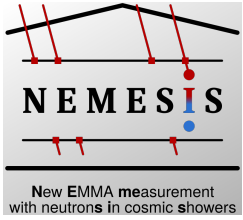
- 46 – pixel scintillator modules (SC16)
- 14 – ^3He neutron detectors in PE blocks
- 2 – Amplitude-sensitive 1m^2 scintillators
- Target material (eg. lead)

Central part



75m →

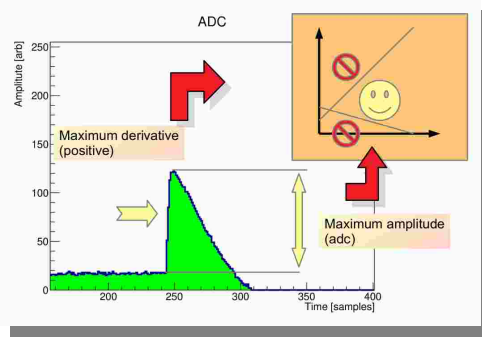




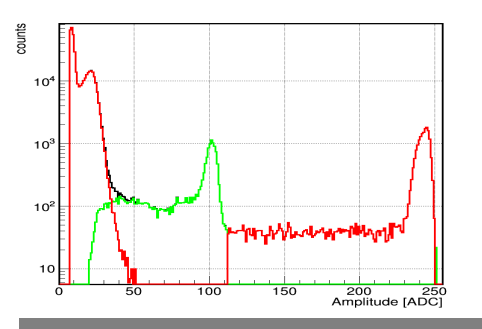
Analysis procedure (simplified)



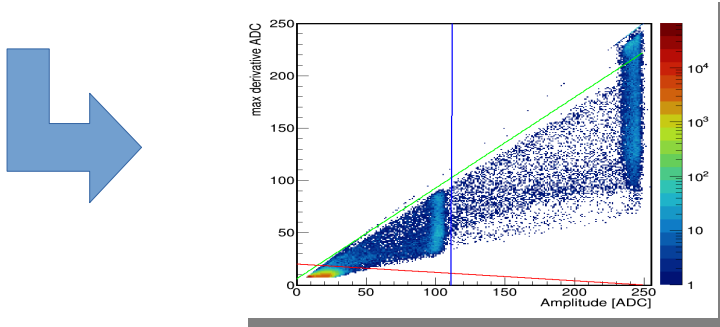
For details look for proceeding article



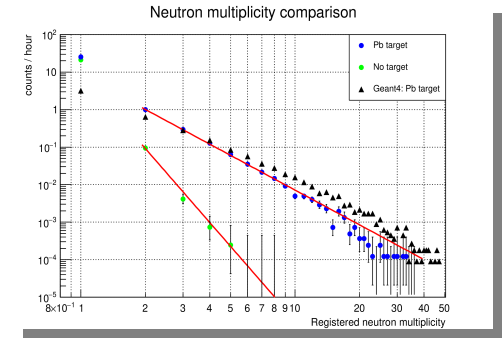
Signals



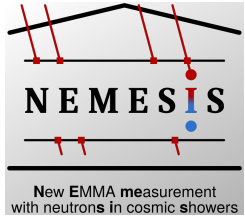
Neutrons



Cuts



Neutron multiplicity spectra



Neutron multiplicity spectra



Results of measurements of neutron multiplicities for run with

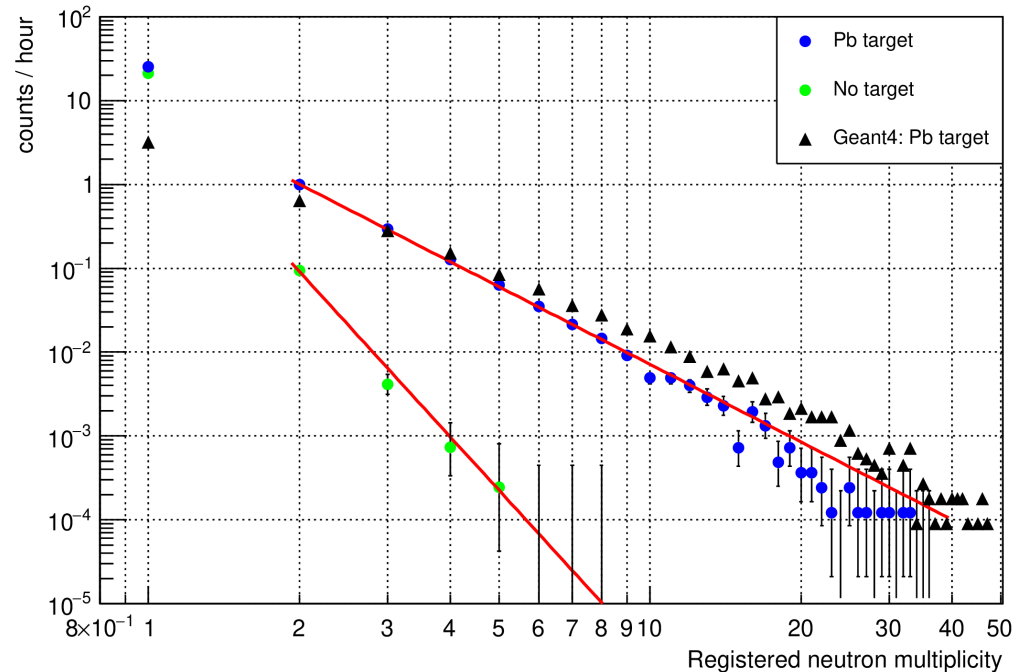
- lead target (349 days)
- without any target (166 days).

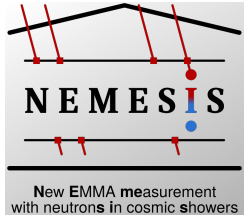
For run with lead target, is clearly visible a inefficiency of registration of high number of neutrons.

Power law fit parameters. $f(m) = a m^k$

Target:	Pb	none
a	9.35 ± 0.53	10.05 ± 23.05
k	-3.15 ± 0.03	-6.92 ± 2.29

Neutron multiplicity comparison





Summary



- We observe large multiplicities of neutrons
- Large multiplicities cannot be fully explained by monte carlo simulations.
- Possible candidates for DM-like interactions (see poster #394)

Thank you for attention