

# Study of the EN-Detectors Array in Tibet

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# Electron-Neutron detector (EN-detector)

EN-detector can detect both thermal neutrons and “charged” components in a same EAS.

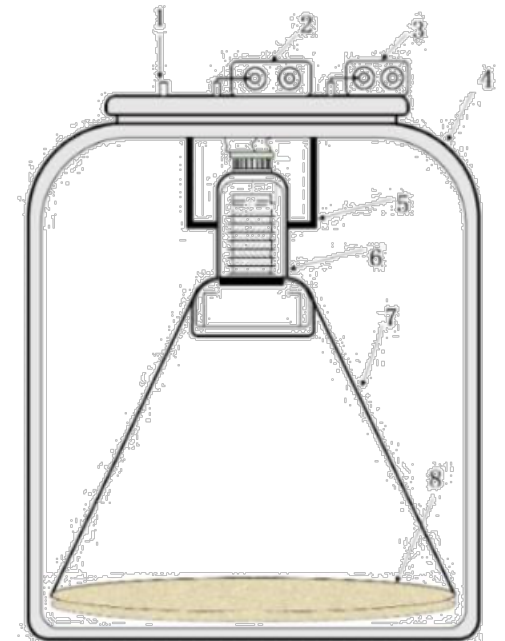
Two arrays composed by EN-detectors are running at high altitude.



↑ Upper: P-TU  
at Tibet University(3800m a.s.l)

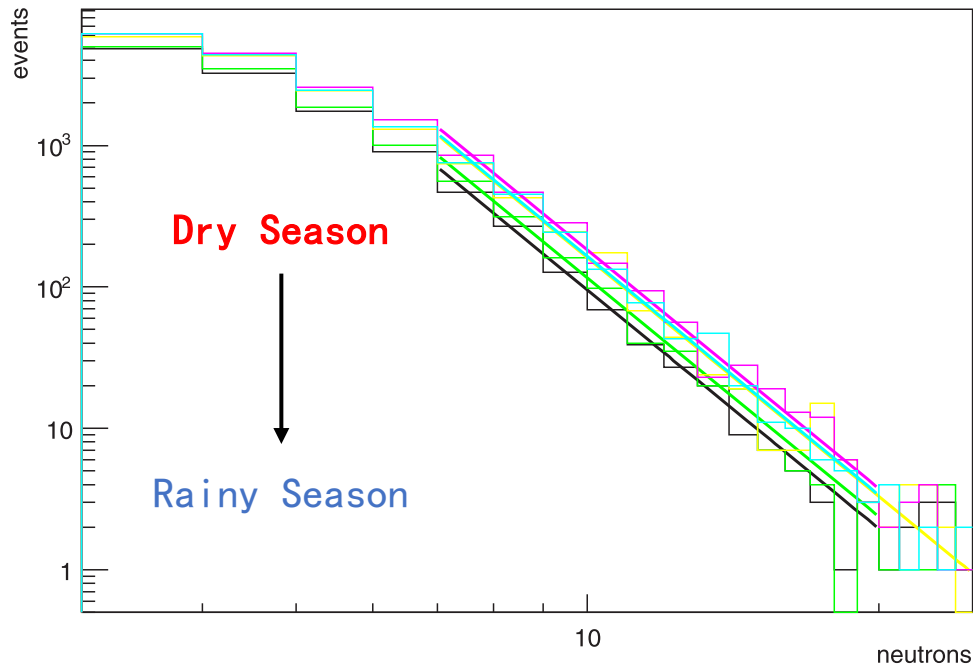
Schematic of EN-detector: right →

← Left: PRISMA-16 at Yangbajing  
Cosmic Ray Observatory(4300m a.s.l)



1- HV input port, 2- d8 preamplifier (DIU), 3- d5 preamplifier (UI), 4- black tank, 5- PMT fixed holder, 6-PMT, 7- light collecting cone, 8- scintillator

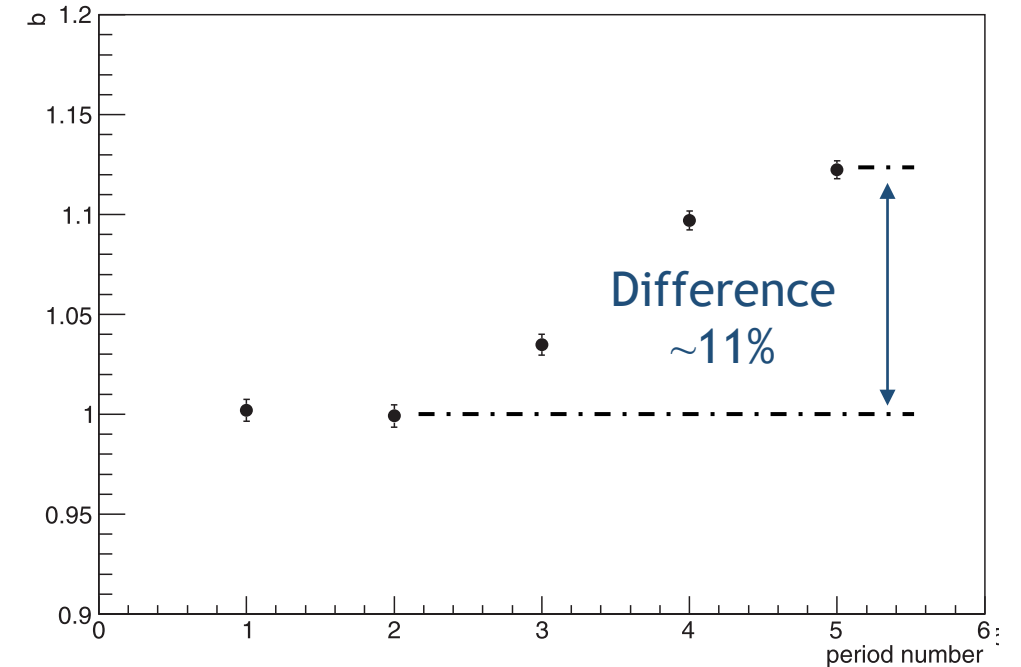
# Generation Neutron influenced by soil moisture



Neutron spectrum over periods from rainy season to dry season.

$$y = A\left(\frac{x}{b}\right)^{-r}$$

Fitting  $b$



Fitting parameter of  $b$  over periods.

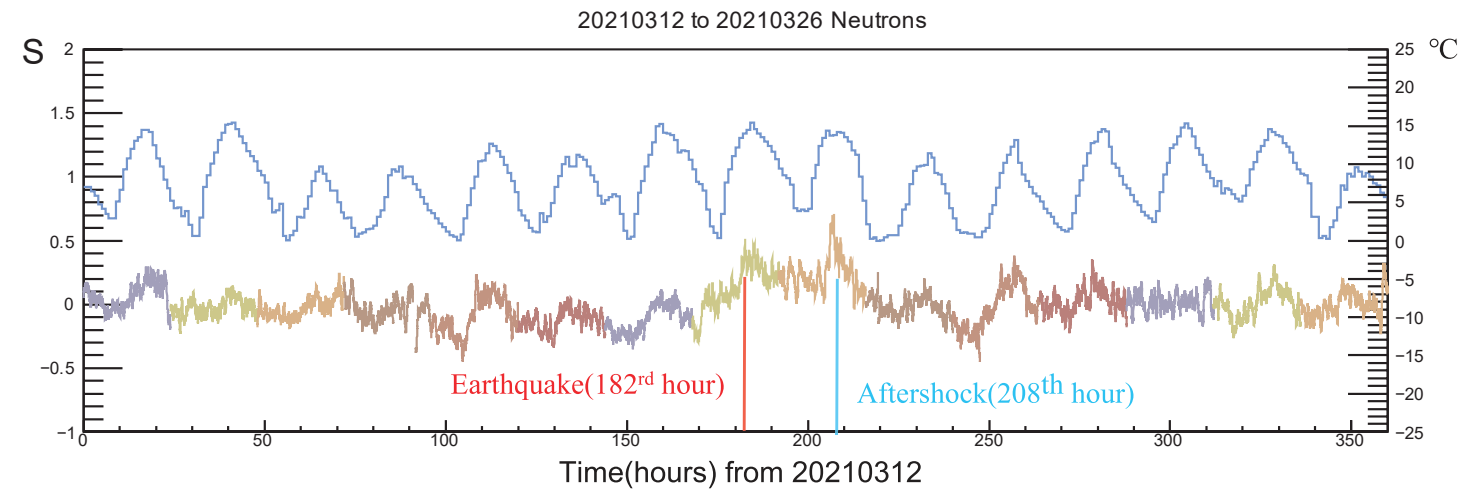
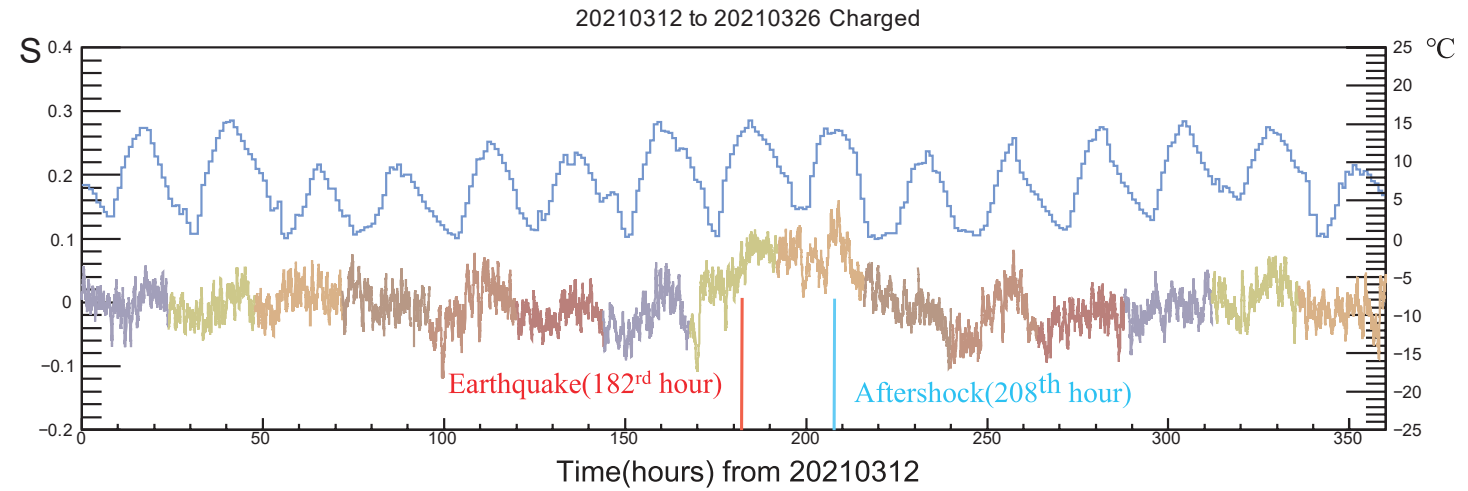
*PRISMA-16 found:*

The neutron spectrum in dry season is higher than in rainy season. The maximum difference could be 11%.  
But it will be averaged for long-term measurement.

# Counting rate increasing during earthquake

On march 19, at 14:11 when Naqu earthquake happen, P-TU recorded a possible increase.

And another increase was recorded when aftershock happen on March 20, at 2:04 am.



$$S = \frac{N}{\langle N \rangle} - 1, N \text{ is counting rate of neutron or charged particle. 30-min smoothing is used.}$$

# *“Sand cube” to reduce seasonal effect*

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“Sand cube” is a cubic tank of 1 m<sup>3</sup> filled with dry sand, on which an EN-detector mounted.

“Sand cube” can apart detector and soil, and dry sand is favorable for neutron generation.

Therefore “seasonal effect” caused by water could be reduced.



Sand Cube under construction