Name of research institute or organization:

Istituto Nazionale di Fisica Nucleare, Torino (Italy)

Title of project:

Neutron background measurements at Jungfraujoch Research Station

Project leader and team:

Alba Zanini, Project leader
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Project description:

From 21st of May 2005 until 28th of May 2005 a short time neutron cosmic ray background measurement was carried out at the Sphinx laboratory, located at Jungfraujoch research station, 3580 m geographical co-ordinates 7° 59' 2" E, 46° 32' 53" N. The experimental set up included a set of 10 integral neutron dosimeter (BD-PND) working in the energy range 100 keV-20 MeV, a bubble detector spectrometer able to detect neutron in the energy range 10 keV-20 MeV, available by the BTI Inc., (constituted by 18 dosimeter). The bubble detector readings are elaborated by using the unfolding code BUNTO especially developed for this application [1]

Results

The data collection was carried out with two different instruments in such a way to cross-check the results.

The measurements were stopped after 576000 seconds (160 h).

Table 1 lists the neutron dose equivalent rate obtained using two different methods. The BD-PND dose is measured counting the tracks in the dosimeter and using the conversion coefficients provided by BTI. The BDS dose equivalent rate is obtained coupling the dosimeter readings with the BUNTO unfolding code.

Detector	**Energy range**	**H rate**
BD-PND	100 keV- 20 MeV	(9E-02±2 E-02) μSv/h
BDS	10 keV to 20 MeV	(5E-02±1 E-02) μSv/h

Table 1: Neutron dose equivalent rate measured at Jungfraujoch.

As it can be noticed the dose rate calculated using the BDS spectrometer is different from the dose rate measured with BD-PND integral dosimeters. The difference is due to the fact that the BDS dose rate is calculated applying the conversion coefficients to the reconstructed spectrum shown in figure 2. The same neutron background measurements have been carried out during the year 2003 in the high mountain laboratory (Testa Grigia, Matterhorn 3480m), using the same detection system, in figure 1 the two spectra are shown together.

As it can be noticed, the expected 1 MeV peak in cosmic rays neutron spectrum is not correctly reconstructed by the unfolding procedure for Jungfraujoch spectrum. The reason is probably due to the fact that the BDS system was not inserted into a pressure box (while it was during Testa Grigia experiments) so that the readings are affected by the high altitude pressure conditions.

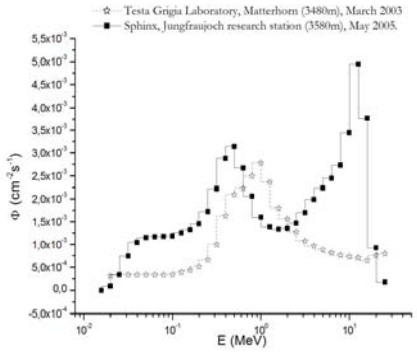

Fig. 1: Jungfraujoch and Testa Grigia neutron spectra.

Due to the short time exposure and the lack of pressurized container, the measurements are to be considered as a preliminary test. It is necessary to repeat the measure using the pressure box in such a way to cross check the neutron spectrum with the data from other high altitude laboratories. The pressure box will be provided by ASI (Agenzia Spaziale Italiana).

This device is realized by Kayser Italia Factory and is in use for ASI balloon flights and is able to maintain pressure and temperature in extreme conditions as encountered at 40000 meters of altitude. By using this device, it should be possible to perform the neutron measurements outside the laboratory, avoiding the neutron background due to the concrete walls of the building.

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Key words:

Neutron spectra, bubble detectors.

Internet data bases:

www.to.infn.it/~zanini

Collaborating partners/networks:

Marisa Storini IFSI-INAF Roma

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