

Name of research institute or organization:

Department of Physics University of Rome La Sapienza

Title of project:

Measurement of cosmic rays at large zenith angles

Project leader and team:

Prof. Maurizio Iori, project leader

Prof. Marco Merafina, Dr. Huluk Denzyli, A. Sergi

Project description:

The interest in Ultra High Energy Cosmic Rays (UHECR) produced a large variety of experiments, with different purposes and based on several techniques (Cherenkov, air fluorescence and radio waves); while timing information is often used to obtain directional information, none of the present techniques is based on upward/downward discrimination by time of flight (TOF).

The prototype detector present at Jungfraujoch Station and under test is capable to measure large zenith angle cosmic rays as well to be a module (see Fig. 1) used in an array for Ultra High Energy tau neutrinos detection by the Earth skimming strategy as shown in the TAUWER proposal.

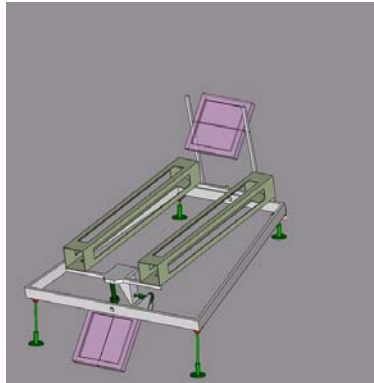


Fig. 1 Schematic view of the detector. The electronic box and the wireless connection are not shown

The base detector consists in two parallel scintillating plates ($20 \times 20 \text{ cm}^2$, 1.4 cm thick), separated by 160 cm, read by one low voltage R5783 Hamamatsu photomultiplier (PMT). Each scintillating plate is embedded in a PVC box which also contains the PMT. The two boxes are attached to a metal structure that defines the covered solid angle of about $1.4 \times 10^{-2} \text{ sr}$. The choice of this particular model of PMT is due to its low time resolution (300 ps) and the possibility to use an autonomous low voltage power supply, like a solar panel or a wind turbine, to make it an affordable elementary module of a large area array.

A custom electronic board for time and charge analysis designed by Dr. E. Delagnes (CEA-Saclay) and Dr. D. Breton (IN2P3-Orsay), in substitution of standard NIM-CAMAC modules, is under development. This board permits a sampling at 2GS in a range of $2\mu\text{s}$. During 2008 we have taken data with this new electronic to evaluate if a resolution of Time of Flight of about 1 ns is reachable by using the shape of the PM signal. The results obtained show we can use this board to collect the PM charge and

at same time evaluate the TOF with resolution of 1.1 ns, hence discriminate the upwarding track from the vertical and downwarding tracks. The cosmic rays flux in the interval 70° - 95° is measured. Now we are investigating the electron-gamma and muon selection by a layer of lead put in front of the rear tiles.

Key words:

Astroparticle, scintillator detector, Time of flight, Ultra high energy neutrinos

Scientific publications and public outreach 2008:

Refereed journal articles and their internet access

M. Iori and A. Sergi Nuclear Instruments & Methods in Physics research Vol **588**
April 1, 2008, ISSN-0168-9002, <http://www.elsevier.com/locate/NIMA>.

Address:

Departement of Physics
University of Rome La Sapienza
P.zza A. Moro 5
I00198 Rome Italy

Contacts:

Prof. Maurizio Iori
Department of Physics
University of Rome La Sapienza
Italy
Tel. +039 06 499 14422
Fax +039 06 495 7697