Cherenkov tank for solar events detection

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Abstract
At this work we studied the cosmic radiation muons and put on data acquisition one muon detector which uses the Cherenkov effect as physical process to detect muons. Moreover, we briefly describe the muons origin at Earth’s atmosphere. Afterwards we explain how the Cherenkov radiation occurs in water and calculated the number of photons produced in the tank. Lastly, we show the tank restructuring, in which we were able to set the tank in continuous data acquisition, as result we detected a Forbush decrease solar event.

Key words: solar physics, cosmic rays, Cherenkov radiation.

Introduction
The Cherenkov tank of Unicamp has as objective to detect muons from the interaction of cosmic rays with Earth’s atmosphere and, from that, to detect solar events that change the muons flux. Cosmic rays are deflected by the Earth’s magnetic field, causing particles derived from them will be more easily detected at the poles, however, because we are localized at the Magnetic Anomaly of South Atlantic, where the magnetic field has a minor intensity, we can easily register variations in the flux of muons.

To detect the muons we utilize the Cherenkov effect, which is nothing more than the production of light when a charged particle crosses a transparent mean with speed greater than the speed of light in the mean. The Cherenkov tank uses the water as the transparent mean for the production of light; photomultipliers convert the photons in measurable electric pulses, lastly, it is done the double and triple time coincidences of the three photomultipliers to obtain the count rate of muons.

Results and Discussion
With regard to the Cherenkov radiation, the study has provided us with the knowledge to properly understand this effect, we performed some calculations as the number of photons emitted or average angle of emission of the Cherenkov radiation, for cosmic rays muons at Earth’s surface.

We performed the tank restructuring and currently it is in continuous acquisition, collecting data daily and without interruption, we basically rewrote the data acquisition program and installed news access hatches of the tank. At the end of June we were able to detect an solar event called Forbush decrease, where there is a decrease in the flux of muons. It can be seen in Figure 1 the time series of muon count rate for the triple coincidence between the photomultipliers.

Conclusions
Although still missing a few adjustments, the tank has proved effective by to be able to detect the solar events. Regarding the restructuring it is now extremely more practical and easier to make adjustments and maintenance inside the tank, the main part was the exchange of the access hatches which was decisive in the tank restoration.

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