Long Term Performance & Operation Task
July 28th, 2020 13:00 CEST (11:00 UTC), Wednesday
Minutes of Zoom Meeting

Participants:
Ingo Allekotte, Josè Bellido, Corinne Berat, Rossella Caruso, Bruce Dawson, Mariano Del Rio, Ralph Engel, Alina Esfahani, Eric Mayotte, Herman-Joseph Mathes, Ioana Maris, Christoph Schäfer, Martin Schimassek, David Schmidt, Ricardo Sato, Darko Veberic, Orazio Zapparrata.

Chair: Ioana Maris
Author of Minutes: Rossella Caruso
Link to presentations:
https://indico.nucleares.unam.mx/event/1587/

1) *"FD cross-calibration with the XY-scanner"*
presentation (with slides) by Christoph Schäfer

Christoph Schäfer presents a study using the XY scanner measurements on a cross-check of the HEAT correction factor, presented by Josè during a previous LTP meeting (see *"Comparison between stars and background analysis fro HE-CO"* by J.Bellido at LTP Meeting on Tuesday, June 30th 2020) where the data from Night Sky Background (NSB) analyses by Alberto and Kenneth are both reported in comparison with HEAT (Bay1)/Coihueco (Bay3) Relative calibration measurements performed by star tracking analysis. He explains how to perform HE-Co cross-calibration with the XY scanner measurements: it's a first approach for HEAT (Bay1) and Coihueco (Bay3) using around 1600 positions of the scanner from Nov 2019 with the Olomouc sphere with the same light intensity at each position (after a proper calibration of the light source) and selecting only common positions for HEAT and Coihueco telescopes. Currently the work is still in progress (see slide#2 where the (X-Y) plots, respectively for HEAT (Bay1) and Coihueco (Bay3) on the top and their comparison on the bottom, are reported according to a color code intensity on the right where each dot in the plot represents a given scanner position so, for instance, in the (X-Y) comparison plot the red dots on the upper part represent a big ratio in the HE-CO cross-calibration due to a lower intensity in the corresponding part of the HEAT (Bay1). Checking closer outside that region (see slide#3 on the right above, in correspondence with a position of scanner located with a black cross in the (X-Y) HE-Co plot), it's possible to observe the shadow of the camera while, inside the "red" region (see slide#3 in the lower plot on the right) in correspondence with the black cross, it's possible to see an effect due to the lower intensity in the HEAT (Bay1), persistent through time by comparing scanner measurements from March 2019 to November 2019 (see slide#4) using KIT sphere. Instead, comparing HEAT telescopes 1 & 2 the shadow is not visible in the HEAT 2 telescope (see slide#5). Christoph comments that all HEAT telescope building should be constructed identical so he supposes that there was a problem with the curtain and sure enough, according to Primo, the curtain of HEAT (Bay1) is ~25 cm lower than it is supposed to be and a rough estimate gives 15 cm of top aperture obscured, reducing the aperture by ~ 3% .In the slide#8, Christoph reports the final plot concerning the HEAT correction factor versus time (over 2010-2020 time period) where the XY scanner measurements on Coihueco (Bay3) and HEAT (Bay1) provide correction factors to be added on the Bellido's plot in comparison with Alberto's and Kenneth's data: the XY cross-calibration results are compatible with NSB analysis. Moreover Christoph performed also a cross-calibration of the XY measurements with diffuse NSB analysis for Coihueco Bay3 & Bay4 (see slide#9, where a blue cross, representing the XY measurement, is superimposed on the NSB Bay3/Bay4 plot by Alberto) and Bay4 & Bay5 (see slide#10, where a blue cross, representing the XY measurements, is superimposed on the NSB Bay4/Bay5 plot by Alberto).

Discussion

- **Bruce appreciates** a lot this work and in light of the fact that the Christoph's analysis using XY measurement confirm Alberto's results, he wishes for a long and detailed discussion within the LTP group to understand, instead, why the results of Alberto's analysis differs from the Adelaide's analysis.
- **Josè asks** which is the final value of light intensity that Christoph uses to compare his measurements with the NSB data (mean value, a given value, maximum value) and Christoph states to use the mean value.
- **Ioana asks** if the curtain status can be explored using a standard calibration and Josè answers that it wolud be possible by means an absolute ("drum") calibration.
- **Christoph reminds** that he didn't look at the Coihueco Bay 6 because there is no XY scanner for it.

2) *"Using SSD for the VEM calibration"*
presentation (with slides) by Ioana Codrina Maris

Ioana C. Maris reports the idea of using SSDs for the WCD calibration (that is to say to search for a better determination of the calibration constants) and the results performed. The first step of this study is the simulation of the calibration histograms starting from examples of calibration histos (see slides#1 & 2 where histos for Kosak, Roma Joyce, Valerita & Denisa Maria tanks are reported). They analyse the coincidence calibration histograms (see slide#3) between WCD and SSD (red crosses) in comparison with the signal by the single WCD (black line), using a liner reflectivity of 0.94 nominal value, and report the ($N_{SSD\&WCD}/N_{WCD}$) ratio of the histograms as function of the charge (FADC). So they find out that the ratio is sensitive to the electromagnetic component: the coincidence calibration histograms reduce, as expected, the photon contribution and can improve the determination of the muon charge, as it is possible to observe (see slide#3) in the coincidence calibration histograms between WCD and SSD (red crosses) in comparison with the signal by the single WCD (black line) and overlapping the muonic component (magenta line) and the electromagnetic one (yellow line) from WCD&SSD. The ratio between histograms might give further insights in electromagnetic calibration. Based on previous Offline configurations, then they studied what happens changing liner reflectivity using 0.9 nominal value (see slide#4) and 0.85 nominal value (see slide#5) by noticing in both cases that a smaller peak x-value can be easier reconstructed (might solve the problematic stations). In the following, the electromagnetic component is multiplied by a factor 1, 2, 3, 10 (where a cut @20MeV is applied) using a liner reflectivity of 0.94, 0.9, 0.85 nominal values respectively (see slide#5, slide#6, slide#7). At last (see slide#8) the peak for different reflectivities in the coincidence calibration histograms - this time entries (in arbitrary units) versus peak (in FADC counts) – are studied and, as result, the muon peak value (not only charge) can be easily reconstructed. In conclusion, Ioana underlines that this study it should take into account for the asymmetries among the 3 PMTs in the WCD and threshold effects and it would need to implement a test on a local station software and check the information gained with data.

Discussion

A rich discussion takes place among **Darko, Jose, Bruce, Ralph, Ingo and Ioana**.

- Mainly **Darko asks** about the treshold used, if the injected particles used are from the Herman's simulation and how Ioana forms the trigger to reduce the random coincidences. She argues that a simple threshold trigger should reduce enough these, and this is the subject of further studies.
- **Ingo asks** how the SSD presence affects the WCD behaviour, the data taken and the acquired events.

- **Bruce appreciates** a lot this study and the underlying idea. It is a big problem to treat the WCD calibration using the muonic component in the presence of the electromagnetic contamination! Many times that problem was faced in the past without solutions.
- **Ralph suggests** that correlation studies might be used to calibrate the electromagnetic component in a similar way that is used for Small PMTs.

3) *"News from Malargue and AOB"*

A) News from Malargue

Mariano Del Rio reports news from the Observatory: the FD shifts are running normally. He points out only a problem on the shutters of Telescope 1 in HEAT; for the rest, the whole FD is working conveniently. The weather conditions are very bad due to the snowy and cold winter in Malargue. Concerning the lockdown due the Coronavirus pandemy, on July 17th the government announced the lockdown would be loosened in the coming weeks, in an attempt to return to normality.

B) AOB: GPS clock problems

Bruce comes back on some comments reported by Herman-Joseph that mentioned FD problems related with the communication antenna, but maybe related to GPS clock, so he asks clarifications on that and if this problem could be happened also in the SD.

A discussion starts among **Bruce, Herman-Joseph, Darko, Ioana and Ralph** on that.

Mainly **Herman-Joseph comments** that it's not clear if the problem is in the connection between GPS clock and the antenna or maybe in the antenna itself. Primo is involved in replacing firstly the GPS module and trying to fix the problem. Herman-Joseph reminds that the FD DAQ philosophy implicates that possible GPS errors reflects on the FD data taken so that they have to be corrected. He also comments that sometimes such problems are related to the cables and that in general by inserting more cables you introduce more attenuation in the signals: that is a typical problem in the FD installation. But he is not still able to have a clear idea on the present status nor concerning last Xavier's comments on that (recently circulated within the LTP mailing-list). A discussion follows about buying a new device and the price will be investigated. It could be in principle shipped with the next shipment.

The Zoom Long Term Performance Meeting ends at 14:05 CEST (12:05 UTC).

The Long Term Performance Meetings will be resumed in September 2020.