

PEPS meeting minutes

08/07/2025

Communications

- A PEPS and GCOS get-together will take place at ICRC25. Stay tuned.
- PEPS meeting to be resumed after the ICRC (and some holidays).

M. Prouza: SST-1M Cherenkov telescopes

- 2 fully operating telescopes, both mono and stereo regimes, are currently at **Ondřejov Observatory**.
- **Publications in 2024, 2025. Look forward to many talks and posters at ICRC25.**
- **@Auger: Well detailed simulation studies have been performed regarding the expected performance. The optimal spacing is ~118m** as a trade-off between low energy sensitivity and good angular resolution. Low altitude of the site leads to large sensitivity at higher energies.
- Many candidate sources identified (PWN, SNR, The Ridge, ...) Less competition in the Southern Sky, only HESS. Timing is crucial to hopefully move the telescopes there before any Southern CTA telescope.
- Synergies with PEPS: a similar study has already been done with SWGO, SD can improve sensitivity at high energy. SST-1M benefits from SD due to g/h discrimination - PEPS too sparse below 100 TeV; how at >PeV?
- Location: two options, either sitting directly in the field next to PEPS detector or going to Colhueco site. Infrastructure is already available, and the possibility of a parallel program to observe horizontal showers going through mountains.

- Potential timeline: 2025, evaluate logistics, expenses, and prepare necessary simulations. Installation in Argentina by the end of 2026.

Questions:

- Ioana, Q:
What is the status of the negotiations of moving the telescopes to Argentina? A: Trying to convince other partners that this is scientifically the best option. Further discussions to be held at the ICRC.
- Frank, Q:
Regarding the location, have you thought about radio emission emitted by the telescope? It might interfere with AERA and SKA-type antennas. A: Location on the field seems more unlikely at the moment, not sure if anyone has investigated in detail the radio emission of the telescopes. Maybe the motor could have some emission, but it's in a steel cage. At the Czech observatory, there is a radio telescope 50 m away which is not troubled, need to check the frequency range.
- Markus, Q: The other groups who prefer the India location, did they harvest the scientific merit of the other location? A: Tried to investigate the potential of the India site, the second likely candidate considered. Analysis and simulation give results which are less favorable. Having them at such high altitude takes away the advantage at very high energy. Northern hemisphere is also much more crowded, can't compete with LHAASO. Instead can complement nicely HESS observations from Auger site.
- Ioana, Q: Did you calculate the coincidence event rate with PEPS? A: At the Colhuenco site, there will be no coincidence. In the field, it strongly depends on the acceptance of SST, it can see showers up to a few hundred meters distance. Depends on the actual flux of photons. No number available. Maybe a back-of-the-envelope calculation can be done. Probably not worth having it in the field.

-Markus,

Q: The horizontal shower program can also allow looking at vertical photons? A: It should not be a problem; you can switch between modes.

A. Parenti: Simulation of double-layered tanks

- Fast simulation tool (from Pierre Billoir) is able to reproduce data from the prototypes @ Auger.
- Simulation indicates that top PMT calibration can be performed by asking for a coincidence with the bottom PMT.
- PEPS geometry of $d = 3.0$ m, $h_{\text{top}} = 0.5$ m $h_{\text{bottom}} = 0.8$ m simulated: points to larger signals compared to Auger tank geometry.
- Time
constant of top and bottom layer obtained from simulation $\tau_{\text{top}} \sim 24$ ns $\tau_{\text{bottom}} \sim 48$ ns. With a fast time response, one can better reconstruct peaks in the PMT traces.

Questions:

- Q: Why would the PEPS tank have a reduced radius of 3.0 m ? A: For transportation, reasons.
If it is 3.0m there is no need to ask for police approval to move the tanks and it should not affect the physics.

I. Mariş: Expected number of events for PEPS

- Assuming 2 km^2 effective area at 2.5 PeV, a separation power of 10^{-4} wrt proton
at 50% photon efficiency, 1 deg and 0.5 deg angular resolution are considered.
- Tibet CR
flux is used to estimate CR background. LHAASO proton flux used to estimate proton background. Signal is given by LHAASO sources extrapolated beyond PeV, assuming no flux suppression in propagation.
- 1 deg, 5 years, above 2.5 PeV: 2-20 bkg events with 5 to 100 photons
- 0.5 deg, 5 years, 2.5 PeV: 0-5 bkg with 5 to 100 photons

- For a source 3 kpc away, the flux reduction should be of 30% in propagation, for 7 kpc distance it increases to 70%.

Questions:

- Vladimir,
Q: The trigger efficiency you mention is that one of photons? A: Yes, it's the photon trigger efficiency. Only photon and proton have been computed so far, and the trigger efficiency is very similar. At 1 PeV the trigger efficiency is around 70% for showers up to 40 deg of zenith, however the separation power is much lower.
- Markus, Q: What is the driving factor in the trigger probability? A: Driven by the lateral trigger probability, at these energies, the showers are not very wide. Going to distances below 90 m between the detectors would increase the cost too much. Trigger efficiency at 1 PeV can be improved with scintillators, but the number of tanks per event triggered would be low (1-2), so the separation power would remain low. Need to investigate. You need at least three stations to have a good gamma-hadron separation.
- Fabian, Q: 10^{-4} separation power, where does it come from? How stable is it? A:
First estimate done using the full GEANT4 simulation, by calculating two variables: the ratio between top and bottom signals summed over the events, extracted muon number. Combining the two at 3 PeV gives 10^{-4} at 50% photon efficiency. At 1 PeV it is $\sim 10^{-3}$.
- Q: Was
this computed with vertical showers only? A: No, for a range of zenith angles. There is an interplay between multiplicity and angles. Sweet spot is 3 PeV and 20-30 deg. Vertical showers don't trigger enough stations. A neural network should guarantee at least 10^{-4} .