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| 9/16/2021 | Project (Working) Title: Analysis of Varying PMT Detector Efficiencies at Auger@TA through Simulations  Project (Working) Description: Two cosmic ray detectors, one called the Pierre Auger Observatory (PAO) in Argentina, and one called the Telescope Array (TA) located in Utah, are measuring cosmic ray events using different types of detectors and are getting incongruous flux vs. energy distributions. There are two possible reasons for this: first, the two detectors are in different hemispheres, and are therefore looking at different parts of the universe, meaning both measurements could be correct, and the readings for different parts of the universe don’t align. Second, the two detectors use different kinds of detection methods (PAO uses a Water Cherenkov Detector (WCD) while TA uses a scintillation Surface Detector (SD)) and because of the design difference and implicit bias, the data measured doesn’t match. To perform a cross-calibration of these two detection methods, the research team is building a WCD detector, the one used in Argentina, in Utah, which will be known as Auger@TA. However, the WCD detector will only have one single photomultiplier tube (PMT) to measure the radiation ejected when a cosmic ray event occurs, while the PAO uses three PMTs to reduce noise-to-signal ratio. My job is to ensure that the readings from a single PMT detector will match the readings from a triple PMT detector, specifically event energy, direction, trigger rate/efficiency, PMT response, traces, zenith dependence, and other measurements. My main tasks will be obtaining the data through Offline simulations and analyzing the results in Python, while meeting weekly with Eric Mayotte, a postdoctoral researcher working with Dr. Sarazin, to discuss progress.  Tasks   * Got connected to the Slack team * Downloaded MobaXterm and Ubuntu to work in Linux terminals to run the simulations * Username: bhanson * Password: Keehawk#123!   Commands   * Connecting to Virtual Terminal   + ssh [bhanson@eusoable.mines.edu](mailto:bhanson@eusoable.mines.edu)   + Login using password * Seeing who is logged in   + who * Location of Offline simulations   + /usr/local/Auger/Offline/v3r3/share/auger-offline/doc/StandardApplications/SdSimulationReconstruction * Running simulation (creates the ADST.root file)   + cd ~/SdSimulationReconstruction   + eval `/usr/local/Auger/Offline/v3r3/bin/auger-offline-config --env-sh`   + make   + ./userAugerOffline * Observing simulated file   + EventBrowser ADST.root * Make an alias for sourcing Offline   + Go to home directory   + vim .bash\_profile   + alias Offline='eval `/usr/local/Auger/Offline/v3r3/bin/auger-offline-config --env-sh`'   + Hit escape   + :wq   + Next time you login, type offline to use offline |
| 9/30/2021 | Notes from Sarazin Meeting   * Scintillation detector + metal middle device + scintillation detector reduces the noise-to-signal ratio, making for better measurements * Looking to deploy one of the WCD stations before the end of the year with the others coming next August * High energy charged particles can interact with photons, the photons are blue shifted, and can slow down the charged particle * Magnetic field warps travel of cosmic rays   Notes from Mayotte Meeting   * The method for converting the root file to a python file is this; sshing through the usable, going to the location of the root file, running all of that code that Sonja set, running the python file within the usable, then getting a csv or panda file. Going to attempt to do that before our meeting on Thursday |
| 10/5/2021 | Commands   * Running “SdSimulationReconstruction”   + Move to “SdSimulationReconstruction” directory   + Type “bash”   + Type “make clean; make”   + Type “./userAugerOffline”   + This should run the simulation and create an ADST.root file in that directory * Running “SdSimulation Calibration”   + Move to “SdSimulationCalibration” directory   + Type “bash”   + Type “make clean; make”   + Type “./userAugerOffline -b bootstrap\_WCDLarge\_G4StationSimulatorOG.xml”   + This should run the simulation, but will not create any files. This is something that needs to be fixed * Running root to npz conversion script   + Type “bash”   + Use vim name\_of\_file.py to edit the file in a linux text editor. Hit i (insert) to start typing, then move around with arrows. Once finished, hit esc, :wq, to write the file than quit the editor. Make sure that the script is searching for the root file in the correct   + Type “python2 name\_of\_file.py” to run the script   + This should output a .npz file that can be converted to something that makes sense in python   Notes   * Currently, the simulations that I’m running create one event and all of the necessary variables that come with a single event. For this reason, graphing these files are not necessary. However, eventually Eric will have a simulation that runs a lot of shower events, with both 1 PMT and 3 PMTs. Once I have the data from these runs, I should be able to plot the difference. For now, I may need some documentation that explains the variable names and what each one represents. Also, are the two different ID’s two different showers? I think so. * These were the results of the calibration simulation, since those don’t write to a file   Graphical user interface, text  Description automatically generated with medium confidenceCalendar  Description automatically generated |
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