

Minutes of the first MACAC meeting : 3 and 4 April 2018

Participants :

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1. What already exists ?

Présentation « HESS Masterclass » (Cyril)

- Masterclass based on HESS event reconstruction, rather low level and focused on data analysis.
- Software is based on a Server-Client architecture. Using HESS calibrated camera images (real or simulated), student can first find cleaning cuts. Once this is done, they can try to perform gamma/hadron separation and define a cut value (MSW). Student do this on their Client machine and the results are sent to the Server to be gathered and accumulate stats.
- Software is installed in a virtual machine.
- 3D view of the events in preparation.
- Data are rather heavy (plus it is proprietary data and software). It seems rather difficult to easily distribute the masterclass outside of the HESS community (couldn't be used by tutors who are not members of the HESS collaboration)
- Evolutions are possible (also based on the feedback of the first session), e.g. include IRFs based analysis (spectra, lightcurves).

→ To follow : 19/04 was the first session at LLR : ask for feedback.

Presentation Auger masterclass (Markus)

- The masterclass consists of event reconstruction from the Auger experiment. The students (14-16 years olds) are given an introduction and then perform event reconstruction based on the public data release from the Auger Collaboration.
- Auger provide full low-level raw-data [1] : which water tank was hit together with the associated level of signal and the time of the detection. Given these infos, students can reconstruct the direction in the sky and the energy. They can compare with the Auger data analysis output.
- A third "moment" can happen during the masterclass day, for instance look at cloud chambers, etc...
- The masterclass focuses on low level event reconstruction and there are not really discussions about science.
- No software installation is needed (can be done in « excel » for instance)

Presentation MC Fermi (Benoit)

- Structure : Presentation in the morning and data analysis in the afternoon.
- Target audience : 12th grade ~ 16-17 years olds.
- Science-oriented day, with (in this exemple) a focus on black holes. The purpose of the day is to reproduce the press release about a flare of 3C454.3.

- The software is COSMAX : a series of scripts to interface the Fermi Science Tools and to interface with the server at NASA to download the data. It is installed in a VMWare/VirtualBox and high-schools have to install the software prior to the masterclass.
- COSMIX can also be shown during the day for illustration purposes (i.e. show that there are HE particles everywhere)
- At the end of the day, a skype call is organized with someone at NASA. Students can prepare questions in advance for a ~ 30' discussion. The masterclass is organized on the same day in several high schools and the skype call is shared.
- Note : Benoit showed this initiative at Fermi meetings + others and some people got interested and started to organize masterclasses as well :
 - Italian colleagues have set-up a web-accessible server. Students connect to it and run the analysis on the server. The only thing that needs to be installed is a browser.
- No low-level Fermi things, mostly because of time constraints (showing COSMIX may be considered as low level...)
- This of course can be "a la carte", any idea is welcome and people can use the software and make the masterclass the way they want! (for instance focusing on something else than black holes).

Discussion of other initiatives

- First of all the CERN masterclasses, organized in the « International Particle Physics Outreach Group (IPPOG) [2].
- In Innsbruck they're having a GW+Fermi Masterclass, organized partly by the Italian colleagues from Fermi
- Nicolas Arnaud (LAL+Pisa) : on-going work to setup a GW/Virgo Masterclass (Nothing there yet)
- IceCube seem to have a similar initiative [3]

2. General discussion

CONTENT

- A masterclass should go from the Question to the Answer in 1 day. We should have one question, one objective for the Masterclass day : « what should the students have learned by the end of the day ? »
- We should present the Masterclass with one question we want the students to answer and a list of things/notions that will be seen.
- From the teachers point of view, we should not forget that what is interesting is to be able to make links between the masterclass and the program of the year.
- Content should be flexible enough to adapt to 11th or 12th grade (1ere & terminales).
- Structure of the day : keep students active, think about interleave actions, blocks of activity (e.g. alternatively 1 hour talk with some calculations, 1 hour data analysis)?
- Could think of a set of different masterclasses with sets of different topics to explore : science, instrument, analysis.
 - One could think of series of Masterclasses, one on reconstruction, another one on data analysis...
 - agreement that for CTA, the masterclass should be science driven. Although it could be possible to include exercises on gamma/hadron separation, reconstruction, etc...

- Exemple topic : « Cosmic ray aceleration ». We could hide PeVatrons in the data. We could have a FoV with several sources and the sources studies could be distributed among the students, with a summary/talk at the end of the day. This is an interesting and attractive idea that students have some challenge/game during the day.
- General agreement that putting things together is a very nice thing : it can be results (counts) or measurements (to build a SED, search for counterparts for MWL alerts...)
 - It would interesting to build a « scenario » for the day. For instance we could have an ATel at the beginning of the day and develop the story. This could be local first and if we have more participants, we could distribute the work on the electromagnetic spectrum and have interactions between the different classes.
 - MWL astronomy is another way to go : e.g. GRB/GW could be Fermi + Virgo. We could think of having things like Fermi in Italy, Virgo in France and combine results at the end of the day.
- What materials could be used? For instance to illustrate what is a B field, etc... The webpage that will host the material should also list potential activities (real things or videos) and/or devices that could be used.

SOFTWARE

- For the masterclass, a Web interface would be a very good way to go.
- We should develop a Virtual Machine and Investigate webserver solutions. What about FASTX solution [4] ?
- Masterclass could also serve as a starting point for CTA data analysis schools

DATA

- Real data is always better!
- It could be a "mix" : HESS data first, then to show how better the next generation of instrument will be : use MC for CTA. Like in a Data Challenge, we hide interesting things in the data and expect students to find them.

(INFRA)STRUCTURE

- We could get in touch with IPPOG to list the different initiatives
- PNHE should be a good starting point and we could ask to set up an outreach page for the Masterclasses
 - PNHE is the good structure to centralize the informations

3. Summary of the meeting and actions for the next few months

- We should start "small" : i.e. local and on one topic.
 - Topic : cosmic-rays
 - Data : real & MC (which could be simulated directly)
 - Soft : CTOOLS
 - Soft distribution : Virtual machine + investigate webserver solution
- « Template day » / « storyboard » to be created :
 - How to illustrate each concept ?
 - How do we articulate things ?
 - Once ready, ask feebdack from teachers

- Initiate discussion with people from CTA (T. Stolarczyk, M. Grünewald) : inform them of the initiative, ask if they are aware of similar actions
- Get in touch with PNHE to ask whether an "Outreach" (sub)webpage could be created which would be used to gather the "french" masterclasses organizers [5]. Also discuss the opportunity to have a talk at SF2A [6] and organize an informal meeting at SF2A for the webpage to learn about different existing initiatives (?)
- Ask for feedback to the italian colleagues about the server architecture : what is the infrastructure of their server system/how does it work...
- Think about organizing a 1-day meeting among Masterclasses organizers in France.
 - Get feedback from existing initiatives
 - Get info on the technical solutions adopted
 - Presentation of the different masterclasses
 - Who / What / When / How / people do this ?
- Start discussion with people from science didactics labs as they could be interested in the process of how initiatives such as masterclasses are setup, how it is received by teachers and students and what it tells about the way science is taught at school. They could also be interested in following high school students to assess the impact of the initiative.

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- [1] <https://www.auger.org/index.php/edu-outreach/event-display>
- [2] http://physicsmasterclasses.org/index.php?cat=teachers_educators
- [3] <http://www.rwth-aachen.de/cms/root/Studium/Vor-dem-Studium/Schnupperangebote-Infotage/~heke/International-IceCube-Masterclass-Hand/>
- [4] http://hannonlab.cshl.edu/fastx_toolkit/download.html
- [5] <http://pnhe.cnrs.fr/index.php>
- [6] <http://www.sf2a.eu/>

Other Webpages :

- <http://www.sciencesalecole.org/plan-cosmos-a-lecole-presentation/>
- <https://www.labex-ocevu.univ-amu.fr/?q=fr/content/e-p%C3%A9ron>
- <https://indico.scc.kit.edu/indico/event/187/contribution/4/material/slides/0.pdf>