Preliminary Report for the SDEU-ORR

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14th of April 2024

1 Introduction

The operation readiness review took place in Malargue, 14th of April 2024. Further documentation, i.e. all slides, can be found in the indico. The contributions have been well organized in the following way:

Introduction (Ingo Allekotte, slides)) Introduction to the charge of the comeettee and the general procedure.

Overview (Tiina Suomijarvi, slides) General introduction to the upgrade of the Surface Detector electronics together with the small PMT extension of the dynamic range of the water Cerenkov detector.

Documentation Patrick Stassi, slides The documentation is, following the requirement, uploaded to the EDMS (link), but in addition also available on a local web-page. This has the adventage of easy access, since the EDMS is only accessible with personal accounts registered as belonging to the Pierre Auger Collaboration. It has the risk of inconsistencies, though.

UUB Commissioning Martin Schimassek, slides The deployment, calibration and operation of the SDEU.

UUB Hardware failures, spares, and maintenance Patrick Stassi, slides Discussion of the UUB testing, the typical failures, the options to repair failed UUBs and the situation of spares.

UUB Firmware/software status David Nitz, slides Status of the firmware and the software on the UUB

SPMT status Antonella Castellina, slides Production, testing, deployment, calibration, failures, options for repair and the status of spares for the SPMT.

We thank the SDEU task for the comprehensive compilation of presentations to document the status of the SDEU. We will not repeat all the content of the contributions, but concentrate on the comments and discussions.

First of all, the deployment of the UUB in the difficult times of COVID is considered to be a success of the deployment team.

The time since installation was finished is not even a year, so estimates for failure rates are due to large uncertainties.

2 Documentation

The documentation in especially with the local web-page is in very good shape and clearly ready for operation.

We cannot validate here if all documents are accessible to all persons that need access. We suggest that this will be verified by the corresponding persons and the missing documents or access rights will be established.

3 Commissioning

The deployment is finished except for inaccessible areas. The commissioning of the stations is well documented. Still, the implementation of the monitoring of the UUB is incomplete.

Calibration for the LPMT is implemented, SSD and SPMT is not required online as no triggering is based on this components and thus an online-calibration is not required. Yet, online monitoring requires an online calibration for conclusive diagnosis. The supervision of the station operation using alarms is not completed. Like the monitoring, additional work has to be provided to conclude the monitoring and implement automatized notification of features with alarms.

4 Production and Maintenance

The production and repair of UUB has been a work-intensive and difficult task. It is good to see we have enough working UUBs on site. Yet, further investigations for repairs are ongoing, like a third party company replacing components on produced and failed UUBs. It is not clear, how repair of UUBs will be continued when the guarantee by the producer has finished. We suggest direct contact to in especially the third party. Additional electronic components should be procured in due time before not available anymore. We understand that the procurement of further tools to guarantee local diagnosis and repair are initiated and awaiting delivery. This includes the rework-station for SMD, the climate chamber and a signal generator. We understand that the low/high gain ration has been measured in the laboratory test as well as determined from the experimental data. So far there is no conclusion on the value to be used in the analysis. A re-analysis of the test-data was discussed, which should provide a conclusion on the value to be used.

5 Firmware and Software

In general the status of the firmware and software is good. The main required features are implemented. The triggers are processed in a compatibility mode which downsamples from the upgraded 120 MHz to the old SD-FE 40 MHz sampling. This way the trigger of the UUB is shown to better than 1% level to the Auger Phase I data. The integration of new triggers exploiting the full capabilities of the 120 MHz are not part of the general SDEU, but optional features not to be required in this ORR. The "new" triggers are currently disabled due to sensitivity features in noisy conditions like thunderstorm producing burst of triggers. This is an open issue for the operation of the UUB. We consider the functionality of the LED driver to by working as proven by GAP-notes documenting linearity-measurements campaigns. The implementation of LEDs is not the task of the SDEU.

6 SPMT

For the SPMT no concrete number of failures per year and thus no exact prediction of required spares has been given. The number of 16 SPMT units replaced in the field is not conclusive as 12 of them were deployed before the sealing procedure using additional silicon has been updated. The conservative estimate of 16 units per year would require 160 units for 10 years. We consider this number not to be realistic and expect more the number of 4 units in 1.5 years since the change of the deployment procedure in November 2022, which would lead to 27 required spares for 10 years of operation, which is well met by the 149 spare units available on site. In conclusion, we consider the required number of spares sufficient for the next 10 years of operation.

The test-setup is depending on one oscilloscope. This a critical point of failure, as replacement are time-consuming to organize. It should be considered to increase redundancy by providing an additional oscilloscope by the task.

The monitoring of the SPMT is based on a parallel data acquisition, the small shower file. The processing is based in Lyon, and this way not easy accessible on site. For maintenance of the SPMT tools for immediate test of the functionality, like the parameter "beta", are required and should be provided by the SPMT group, best the computed values as well as the algorithm used for the computation.

It would be very helpful to also provide a database with the factory values of the SPMTs.

7 Items considered not finished

Open issues which do not require a delay in the formal procedure but should be required to be finished by the task:

1. Low/high gain ration to be used in data analysis

2. Monitoring and Alarms
3. Compatibility mode of "new" triggers MoPs and ToTd
4. Transferring the databases for the UUB-factory, UUB-thermal, SPMT and SPMT-HV tests to Malargue for secure storage and unified access by the collaboration. The storage of the database-dumps at Lyon could serve as alternative.

8 Additional suggestions

1. Validation of the documentation by persons involved in the maintenance
2. Redundant oscilloscope for the SPMT test-setup
3. Online-calibration of SSD
4. Online charge calibration of LPMT

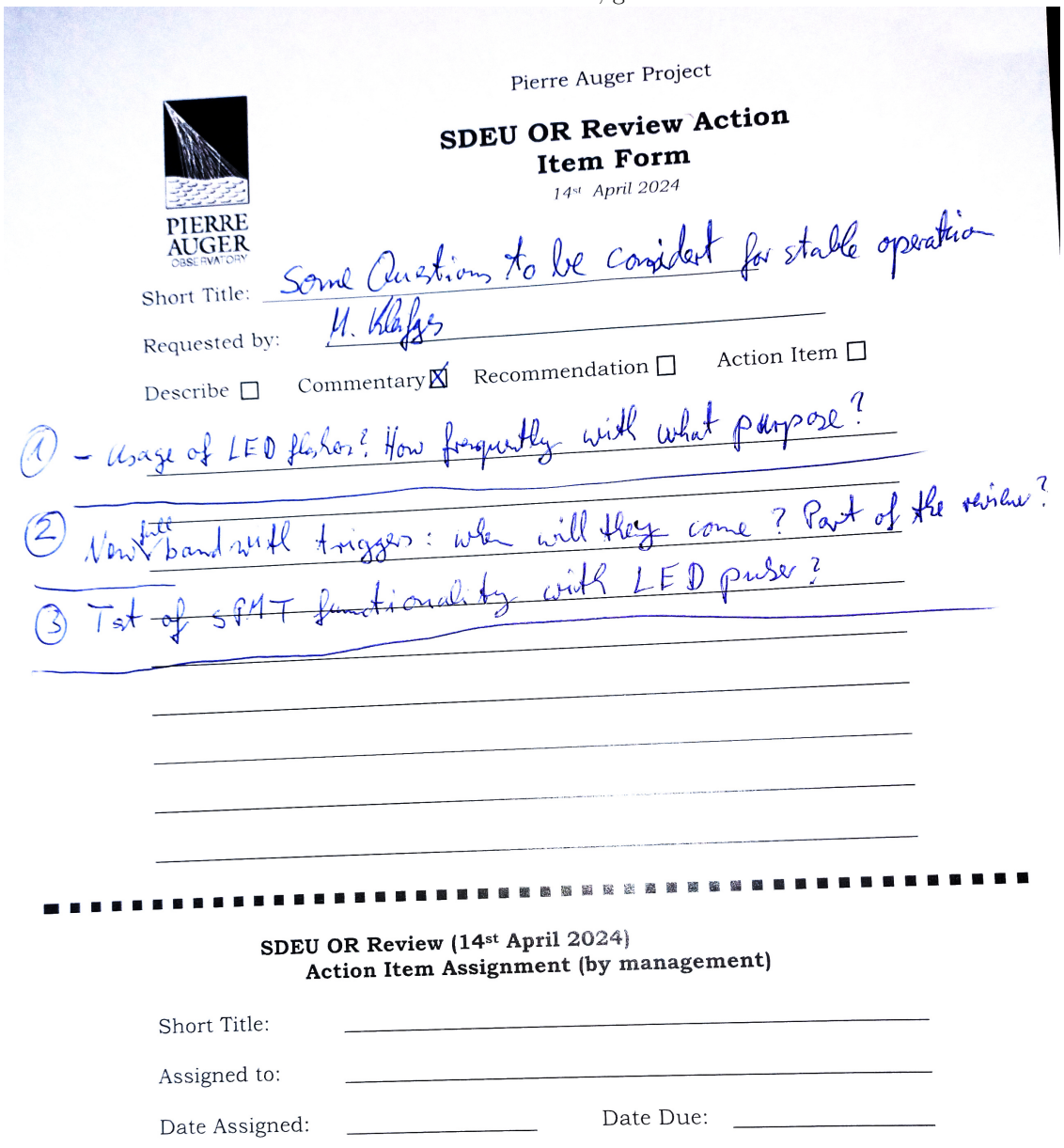
9 Person power

At the moment only one person is available on site for electronic board maintenance. We suggest a second person should be added to guarantee the knowledge and timely availability of the service. The Collaboration can profit from the potential of the SDEU in case of further person power to be invested in the following items:

- Calibration of baseline and online calibration
- Trigger development on 120 MHz trace
- Monitoring validation and alarm development

A ORR Action Item Form

The Form of the Action Item can be found online on the indico: Form.pdf
We had one form handed in in the session, given below.



Pierre Auger Project

SDEU OR Review Action Item Form

14st April 2024

PIERRE AUGER OBSERVATORY

Short Title: Some Questions to be considert for stable operation

Requested by: M. Kleifges

Describe ☐ Commentary ☒ Recommendation ☐ Action Item ☐

(1) - Usage of LED flashers? How frequently with what purpose?

(2) Narrowband wifi triggers: when will they come? Part of the review?

(3) Test of SMT functionality with LED pulse?

SDEU OR Review (14st April 2024)
Action Item Assignment (by management)

Short Title: _____

Assigned to: _____

Date Assigned: _____ Date Due: _____