

SSD Commissioning

Meeting of the Auger Italian Collaboration 3/5 February 2025

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PIERRE AUGER observatory

OVERVIEW

Recap from Malargue 2024

Monitoring and (O)LTP **SSD** Monitoring

SSD PMT tables Baseline analysis for light-tightness

Matteo Conte^{1,2}, Daniele Martello^{1,2}, Gabriella Cataldi², Julian Rautenberg³







Progress Reports of the **ICRC25** Data Production

Task Force

January 23, 2025

13:00 UTC / 14:00 CET / 10:00 ART

PIERRE

AUGER

Meeting recording: If file

| Торіс | Presenter (on behalf of involved perons) | Slides |
|---------------------------------------|--|---|
| Overview | David Schmidt | Øslides |
| PMT quality cuts for Phase II | Max Stadelmaier | 0 slides |
| Bad Periods for Phase II | Carla Bonifazi | 0 slides |
| SSD PMT status | Matteo Conte | 0 slides |
| SSD shower size / quality | Kevin Cheminant | 0 slides |
| UMD Observer validation / bad periods | Federico Sanchez | Carica nuovo allegato "2025-01-23_umd_quality.pdf |
| Radio: remaining tasks | Marvin Gottowik | 0 slides |

Foundation Analysis SD Foundation - SSD calibration values and tagging in Offline

Matteo Conte^{1,2}, Daniele Martello^{1,2}, Gabriella Cataldi², Ugo Giaccari²



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Monitoring and (O)LTP **SSD Monitoring** SSD PMT tables Baseline analysis for light-tightness

SSD operational status on the field

Average Voltage PMT5 – 30 days



Overall Voltage PMT5 – from 12/2022



New specific SSD table in the Monitoring

- New table in the AugerMonitor databes called SSD_PMT_Status
- Basic idea is to fill with:
 - Date and LsId;
 - Daily average HV and Current of the PMT;
 - Moving average of the last 10 days for HV and Current;
 - 'On' flag (true or false) based on the moving averages to set the status of the tube for the current day.
- A python script produces the daily queries to fill the table
- Simple plots on the webpage
- Further development

| Field | Туре | Null | Key | Default | Extra |
|-----------|----------------------|------|-----------|---------|-------|
| LsId | smallint(5) unsigned | NO | PRI | NULL | |
| Date | date | NO | PRI | NULL | ĺ |
| DayAvgV | float(6,2) | NO | | NULL | |
| DayAvgI | float(6,2) | NO | ĺ | NULL | |
| Day10AvgV | float(6,2) | NO | ĺ | NULL | ĺ |
| Day10AvgI | float(6,2) | NO | ĺ | NULL | ĺ |
| On | smallint(1) | YES | ĺ | 0 | ĺ |

Baseline Anomalies Detection on PMT Traces

• From Data: PMT High Gain Traces \rightarrow Baseline (first 300 Time bins)



Day – Night analysis for light-tightness test

- GAP NOTE #2022-038 ٠
- Check for day/night differences in the RMS and Skewness distribution per single detector



332

343

Event Rate per ID and Date (Dav

Further investigation on outliers

- No day/night effect
- Still able to detect anomalous behaviours



LsID: 112

LsID: 1388 ⁸

Further investigation on outliers

- Still able to detect anomalous behaviours
- We can tag and report the outliers



Summary

- Only few anomalies detected
- Good stability in light-tightness
- New specific table to tag the status and stability of the PMTs
- Study on day/night differences in baseline stability to monitor the lighttightness

Outlook

- Enhancements in the new SSD PMT Status Table
- Development of an automatic routine (on a weekly/monthly basis)
- Further investigation in detecting outliers in the baseline PMT Trace analysis

ICRC25 Data Production Task Force SSD PMT status

MIP Charge distribution and time evolution

> SELECTION:

- only SSD PMT deployed
- HV in optimal operational range (760 V 980 V)
- IsTubeOK(SSD)=1
- test2/test3 comparison
- Lower tail sensitive to the tag version (due to the different efficient in tagging)
- Upper tail non dependent on the software









SSD PMT status now set correctly in Offline

- Fixed the tagging of the SSD PMT in Offline
- Now all the not-deployed SSD have a flag for the PMT Tube Status (GetPMTTraces(5).IsTubeOK()) set to False

Test 3 production – Malargue 11/2024

https://gitlab.iap.kit.edu/auger-observatory/offline/offline/-/commits/e77fc7ac3d24c96547a34b8f2d4f2a0e27f1f3f2

Local production – Still to be merged

Sd reconstruction, data from 2024-01-01 to 2024-12-03



SSD PMT status now set correctly in Offline

Local production

Sd reconstruction, data from <u>2024-01-01 to 2024-12-03</u>



- When the MIP Charge value is set as 0 in Offline, it always correctly set the Status of the tube to be **False**:
 - Not delployed SSD PMT
 - Unsuccessful fit (<u>next slide</u>)
- When the MIP Charge is well fitted from the Histogram it can still have bad PMT from Calibration, and again the Status of the tube is correctly set to be **False**
 - This accounts for less than 0.2% of the total entries

(black histogram w. MIP $\neq 0$)



SSD PMT MIP Charge Distribution – IsTubeOk True

Entr



Fixing of SSD integration window to 3 μs

Fixed time for the SSD integration window of $3 \mu s$ (360 Time Bins)

 $Stop_{SSD} = Start_{SSD} + 3\mu s$

Two classes of exception:

- In the current production still an exponential curve due to some events when the SSD start/stop are exactly like the WCD (fixed but still to be committed)
- 2. A very few cases (<0.02%) when stop would fall outside the trace length, so it's less than 3 μs
 (Discussion ongoing on wheter to exclude these in the LDF)

https://indico.nucleares.unam.mx/event/2234/session/8/contribution/76/material/slides/0.pdf

| Measuring the lateral distribution of SSD signals | Luis BELLM 📄 |
|---|---------------|
| Centro de Convenciones | 16:46 - 17:00 |

Current Test 4 production



Local production – 1 month (New version to commit)



Summary

- Tag of the not-deployed SSD now fixed in Offline (committed, to be merged)
- Evaluation of all the deployed SSD signals not used in analysis ($\leq 0.5\%$ IsPMTok **False**)
- Investigation on unsuccesful FIT of the Charge histogram
- Outliers in MIP Charge distribution ($\leq 0.2\%$) well understood (HV dependence)
- SSD integration window now fixed to $3\mu s$ (to be committed)

SSD signals properly flagged and ready to be used for analysis