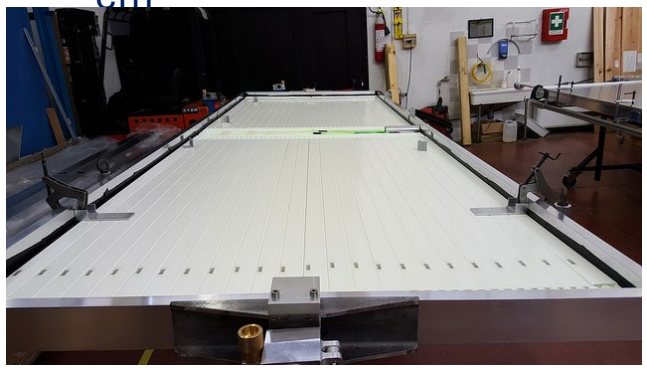
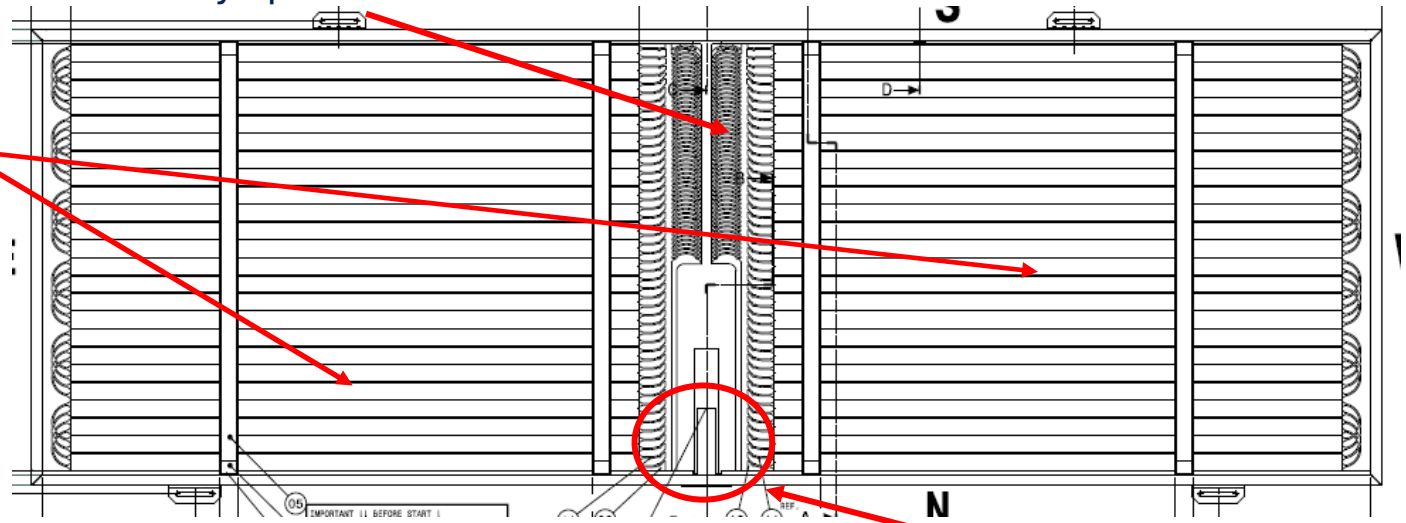
AugerPrime
Scintillator Surface Detector
OPERATIONS READINESS REVIEW
The Detector

SSD: The Scintillator Surface Detector

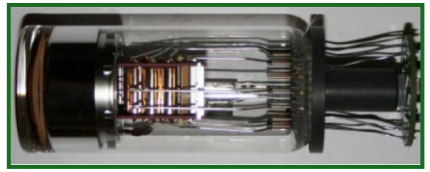
Light collected by optical fibers

Two panels of extruded scintillator of 120 cm X 160 cm



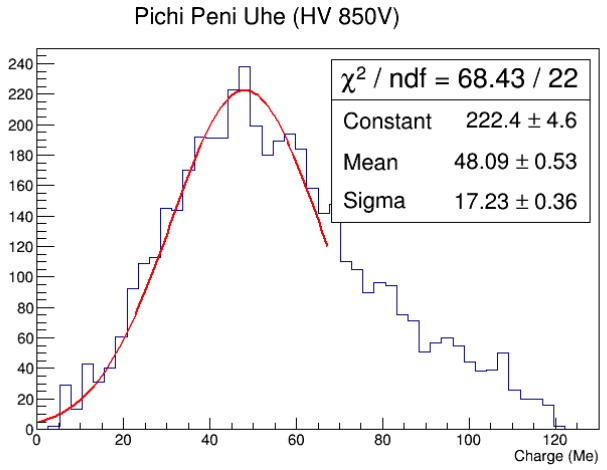


Large dynamic PMT



Aluminum Enclosure

Calorimetric Particles Counting thanks to online calibration.

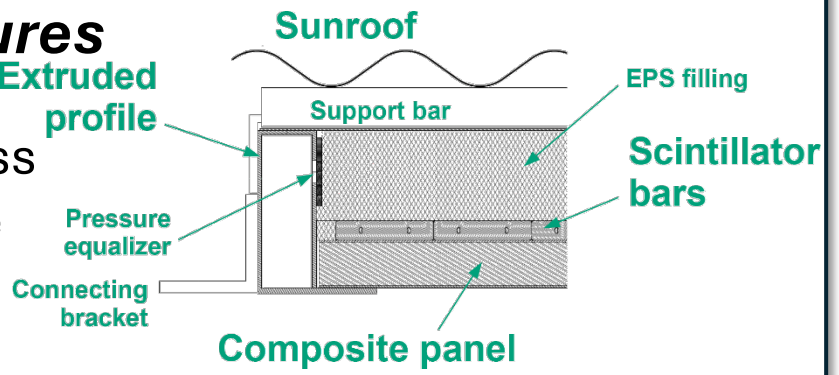


$$\text{N. Particles} = \frac{\text{Tot. Charge}}{\text{MIP Charge}}$$

SSD: The Scintillator Surface Detector

The enclosures

- Robustness
- Light tightness
- Maintenance



Combination of aluminum bars and composite panel.
Two separated volumes
PMT easily to extract.

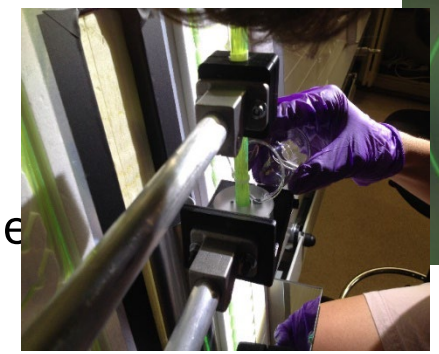
The active detector

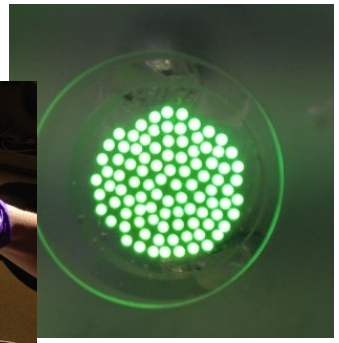
- Uniformity
- Dynamics
- Durability
- Low maintenance
- Cost

Plastic extruded scintillator with holes.
Optical fibers to collect the light
Foam “routers” for easily assembling and robustness

The active detector

- Uniformity
- Dynamics
- Durability
- Low maintenance
- Cost

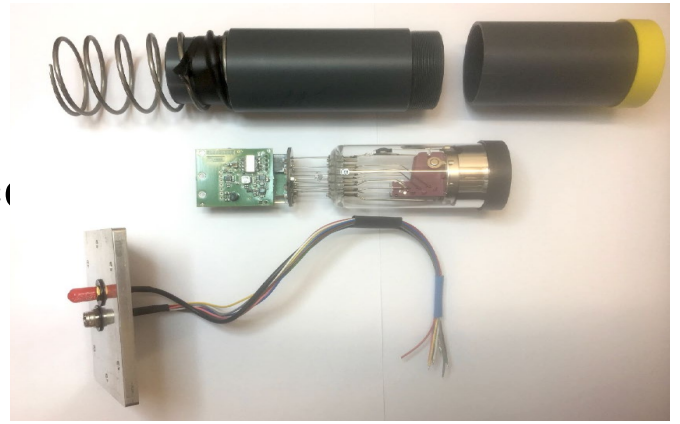




Fibers Kuraray Y11(300)M read from both ends.
Fibers bundled and glued in a PMMA cylinder

Light collection

- Large dynamics
- Easily maintenanc
- Stability



Hamamatsu R9420 eight-stage dynode linear up to 120 mA with modest gain of $5.0X10^5$

AugerPrime
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OPERATIONS READINESS REVIEW
Hardware

Comment: Cables are a critical risk, and a mitigation measure is required promptly. Control cables have a fragile connector which it is impossible to find in Argentina, shipment from Europe should be envisaged.

Solved. Thanks to Ioana new spare control cables are arrived in Malargue

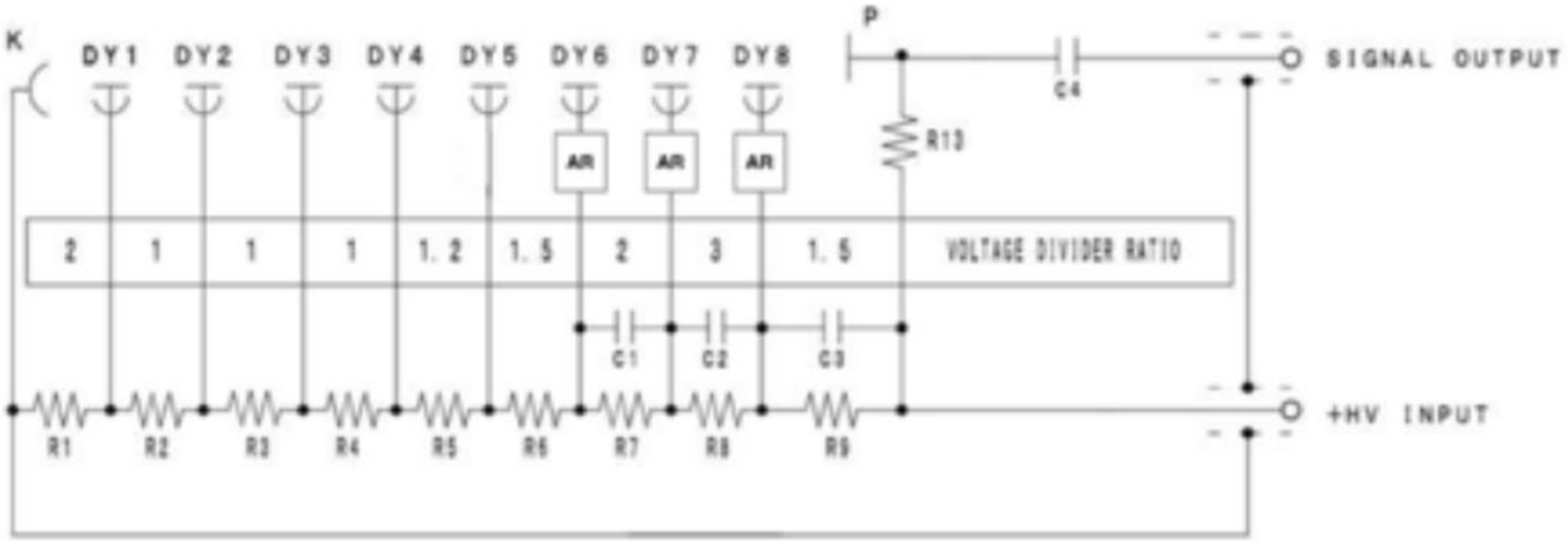
Comment: Cover protection of cables needs to be installed;

Almost solved: The cover protection for all the cable are in Malargue and 785 are installed

AugerPrime
Scintillator Surface Detector
OPERATIONS READINESS REVIEW
Documentation

Comment: PMT base design, schematic of the gasket, new cable protector;

PMT base design: The design is property of ISEG and can not be distributed. We have a schematic design only.



Comment: PMT base design, schematic of the gasket, new cable protector;

New Cable Protection: A GAP_NOTE with the test in the laboratory of the different material is almost ready.

GAPNOTE

Experimental activity report: Aging of three objects subjected to typical Pampa Amarilla environmental conditions

In this report three samples are treated for which an accelerated aging program has been studied to simulate the environmental conditions to which they are exposed and evaluate any changes in properties.

The samples analysed are shown in figure 1, they are two tubes (black and gray) and a band on which an adhesive velcro has been applied. The latter was analyzed in three different areas: the central area where there is no Velcro and the two side areas where they are present either the hard part of the Velcro or the soft part.

Figure 1: Grey tube, black tube, band (left to right)

Specifically, two different aging programs were used:

1. Program 1 provides daily 2 h of exposure to UV radiation (using a lamp with a power of 1000 W), 2 h of maintenance in a dry environment at 50 °F (inside a static furnace) and 20 h of maintenance at 4 °F (in a refrigerator). This program makes it possible to study both the effect of UV rays and the effect of the typical desert temperature ranges.
   A sample of the black tube and a sample of the grey tube were exposed for about a month, which suffered a total of 60 h of exposure to UV rays and 23 thermal changes, according to the program shown in Table 1.

DataSheet

HUMMEL
smart & reliable connections

Polyamide hose Slit

Item number 1527290100

Technical data

Material	Polyamide
Temperature range	-40°C to +120°C
Colour	black
RAL	9005
Size DN	29
d	29 mm
D	34.5 mm
Minimum bending radius	55 mm

RoHS

Dimensions and specifications may be changed without prior notice

www.hummel.com

Comment: PMT base design, schematic of the gasket, new cable protector:.

Installation procedure. Document ready. Need download in EDMS.

SSD Field Task Procedure

Procedimiento de tareas de SSD en campo

Corrugated Cable Cover Installation

Instalación de cobertor corrugado de cables

Rev. 0
Date/*Fecha* 29/05/2024
Authors/*Autores*: Fabián Gobbi

Considerations/Consideraciones:

The task can be performed by one person.
The total installation time is 2 minutes.
Materials will be provided by the SSD team.

La tarea se puede realizar por una persona.
El tiempo total de instalación es de 2 minutos.
Los materiales serán entregados por los responsables de SSD.

›tected (Ultraviolet radiation
›ver the cables connecting the
ctor) with the UUB (Upgrade

corrugado con protección UV
ıltra violeta) a los cables que
Scintillator Detector) con la

The SSD modules contain an SSD-PMT (Photo-Multiplier Tube) connected to the UUB via three cables: signal, control, and ground. These cables were initially protected with a cover that was damaged shortly after installation. As a temporary solution, UV ties were used, which proved effective but are not a long-term solution. This

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OPERATIONS READINESS REVIEW
Detector Performance and Monitoring

Comment: a systematic assessment of SSD functioning and data quality is of primary importance within the next month.

A procedure to monitoring the slow control parameter of the SSD is implemented into the official monitoring web page (see talks during this meeting).

Monitoring and (O)LTP

SSD Monitoring

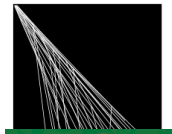
Matteo Conte[1,2], Daniele Martello[1,2], Gabriella Cataldi[2], Julian Rautemberg[3]

1 – Università del Salento, Lecce
2 – Istituto Nazionale di Fisica Nucleare, Lecce
3 – Bergische Universität Wuppertal

UNIVERSITÀ DEL SALENTO

Istituto Nazionale di Fisica Nucleare
SEZIONE DI LECCE

12/11/24



```
mysql> DESCRIBE SSD_PMT_Status;
+-----------+----------------------+------+-----+---------+-------+
| Field     | Type                 | Null | Key | Default | Extra |
+-----------+----------------------+------+-----+---------+-------+
| LsId      | smallint(5) unsigned | NO   | PRI | NULL    |       |
| Date      | date                 | NO   | PRI | NULL    |       |
| DayAvgV   | float(6,2)           | NO   |     | NULL    |       |
| DayAvgI   | float(6,2)           | NO   |     | NULL    |       |
| Day10AvgV | float(6,2)           | NO   |     | NULL    |       |
| Day10AvgI | float(6,2)           | NO   |     | NULL    |       |
| On        | smallint(1)          | YES  |     | 0       |       |
+-----------+----------------------+------+-----+---------+-------+
7 rows in set (0.27 sec)
```

Comment: a systematic assessment of SSD functioning and data quality is of primary importance within the next month.

A strong effort put in the identification of a SSD alone trigger by the trigger sub-task (see gap 2024_65 and UHECR 2024 poster as example). While I am sceptic that that algorithm can be used for trigger, can be used to check the SSD status.

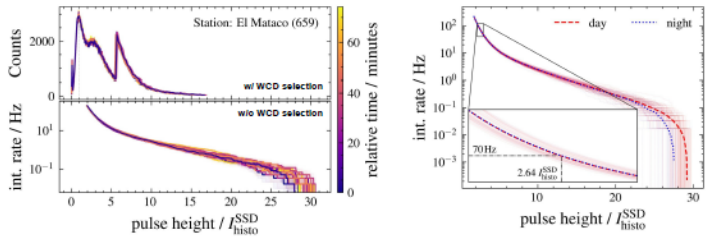
Calibration methods for the Surface Scintillator Detector of AugerPrime

Paul Filip [a] for the Pierre Auger Collaboration [b]

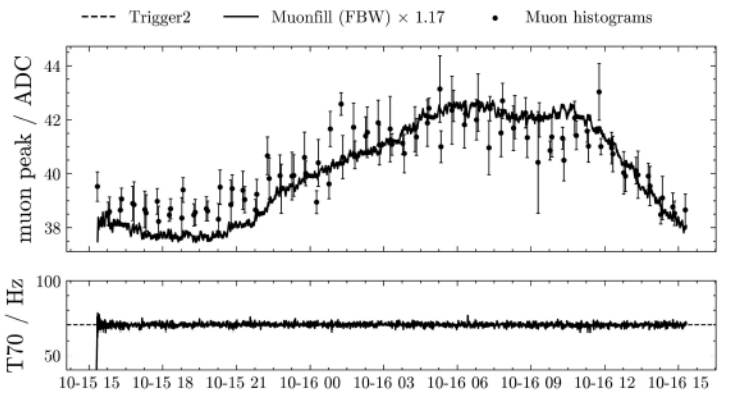
[a] Karlsruhe Institute of Technology, Institute for Astroparticle Physics, Germany
[b] Observatorio Pierre Auger, Av. San Martin Norte 304, 5613 Malargue, Argentina

Online algorithm

- Measure raw pulse spectrum of SSD events >70 ADC
- Find (calibrated) rate-threshold relationship is the same for different stations, times of day, temperature, etc.



- Build calibration trigger with predefined target trigger rate
- Change calibration trigger thresholds until rate converges
- Read off MIP peak from rate-threshold relationship
- Need further testing/checks before final implementation



Comment: a systematic assessment of SSD functioning and data quality is of primary importance within the next month.

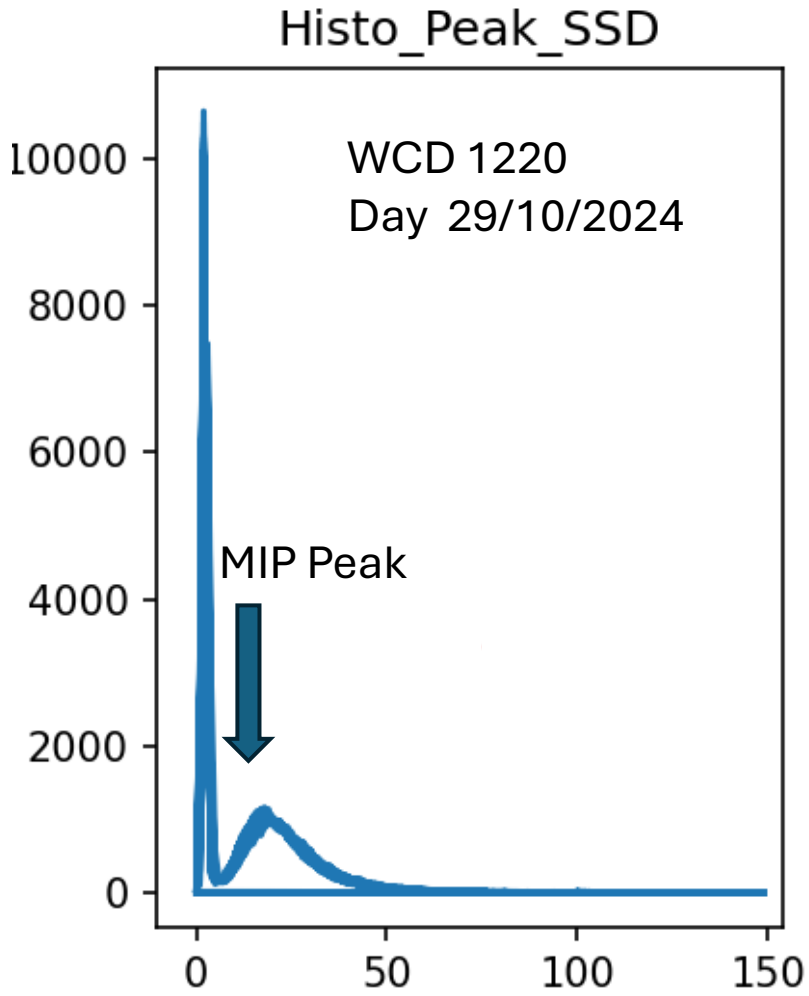
Also the staff in Malargue are developing independent tools to check easily the status of all PMTs

Python script

```
import matplotlib.pyplot as plt
import numpy as np
import sys
import pandas as pd

# Capturar el parámetro desde la línea de comandos
if len(sys.argv) != 2:
    print("Introducir numero de estacion xxxx , ejemplo: 0293 <número>")
    sys.exit(1)

param = sys.argv[1]

# Crear una figura grande para contener todas las
fig, axs = plt.subplots(1, 4, figsize=(15, 10), s
fig.suptitle('Histogramas de diferentes medicione

#===========Histograma==PEAK============

data_pk = np.loadtxt(f'/Users/ccdan/Auger/h/pk_{p
x_pk = data_pk[:, 1]  # Segunda columna
axs[ 0].plot(x_pk, data_pk[:, 2])
axs[ 0].set_title('Histo_Peak_PMT1')
axs[ 1].plot(x_pk, data_pk[:, 3])
axs[ 1].set_title('Histo_Peak_PMT2')
axs[ 2].plot(x_pk, data_pk[:, 4])
axs[ 2].set_title('Histo_Peak_PMT3')
axs[ 3].plot(x_pk, data_pk[:, 5])
```

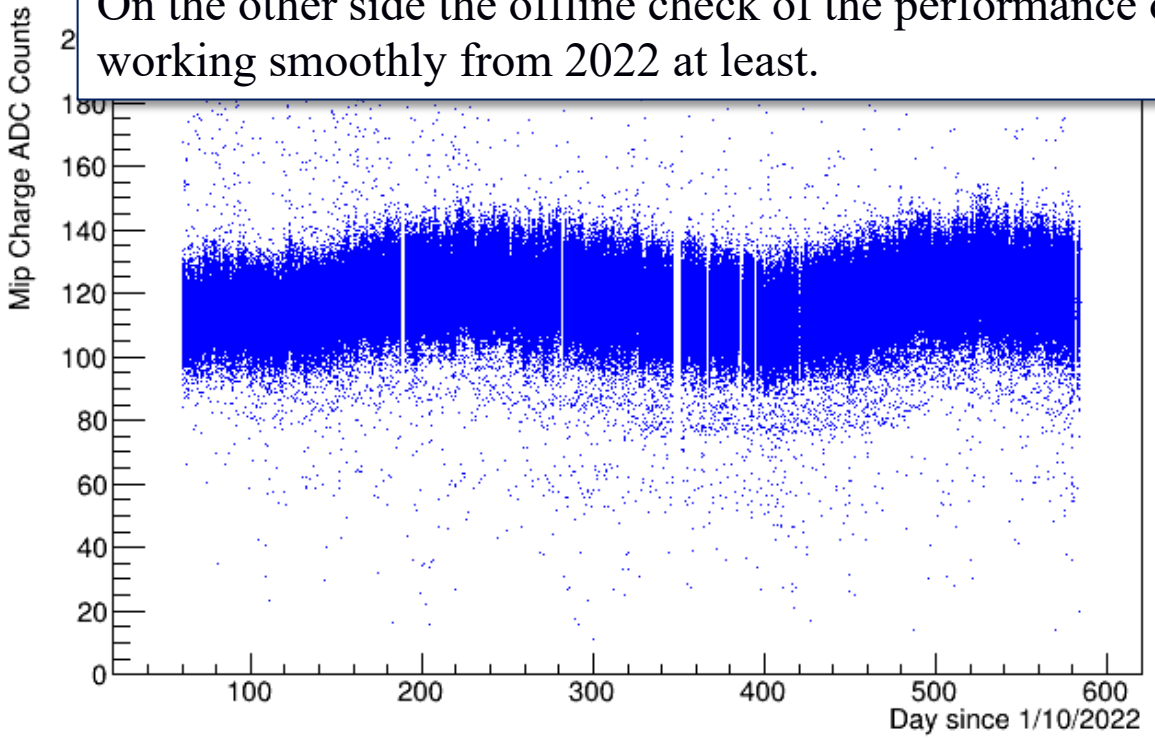
List of data from UUB

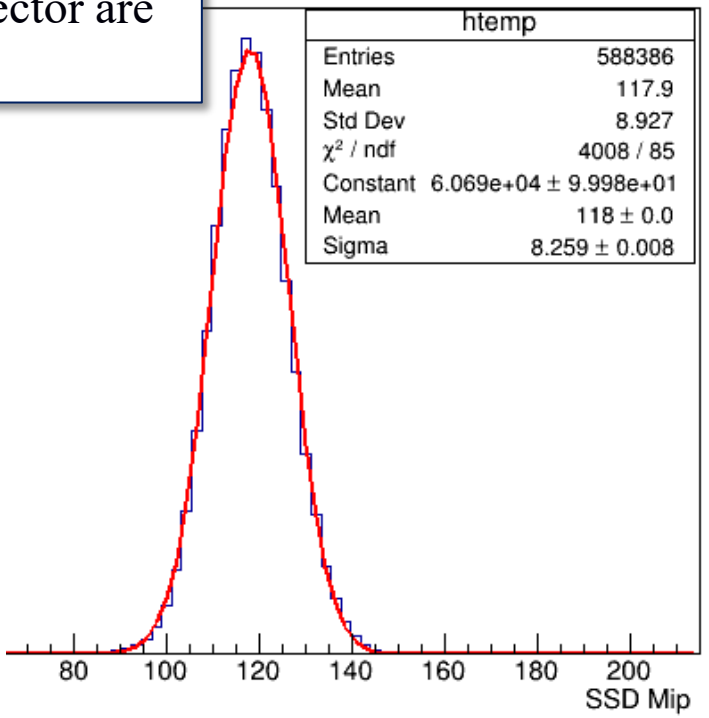
pk_0141	06/11/2024 11:25	File	202 KB
pk_0142	06/11/2024 11:25	File	165 KB
pk_0143	06/11/2024 11:25	File	180 KB
pk_0144	06/11/2024 11:25	File	113 KB
pk_0145	06/11/2024 11:25	File	113 KB
pk_0146	06/11/2024 11:25	File	180 KB
pk_0147	06/11/2024 11:25	File	180 KB
pk_0148	06/11/2024 11:25	File	157 KB
pk_0149	06/11/2024 11:25	File	113 KB
pk_0150	06/11/2024 11:25	File	120 KB
pk_0151	06/11/2024 11:25	File	105 KB
pk_0152	06/11/2024 11:25	File	90 KB
pk_0153	06/11/2024 11:25	File	83 KB
pk_0154	06/11/2024 11:25	File	98 KB
pk_0155	06/11/2024 11:25	File	98 KB
pk_0156	06/11/2024 11:25	File	105 KB

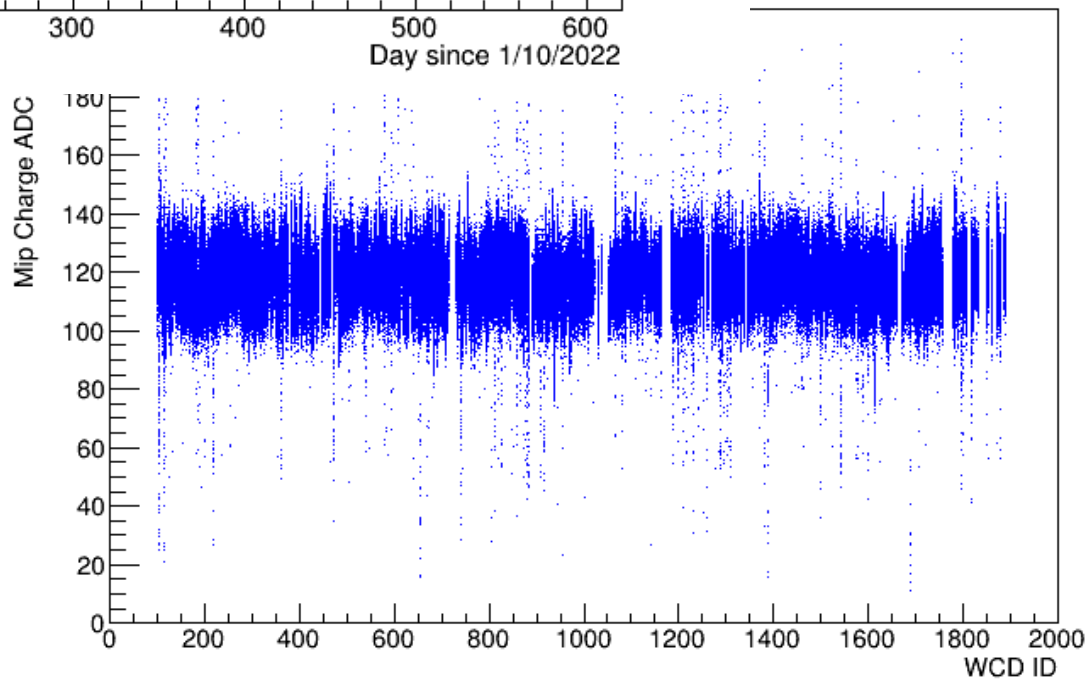


Example of online calibration histogram.

On the other side the offline check of the performance of the SSD prof that the detector are working smoothly from 2022 at least.







Up to now only 3 PMTs has been changed in the field (excluding production problems).
The failure rate in the field in the last 22 months is 0.14 per month.
We have 120 spare PMTs.
Spare sufficient for 70 years....

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Operation Resources

Comment: The estimation of the required resources (person-power and costs for operation and maintenance) has not been presented.

Failure rate very low. The impact on the Observatory of the maintenance is minimal.

With current rate of failure (1.5 per year) it is not convenient to fix the PMTs broken in Malargue and the effort to substitute PMTs in the field is 1-2 tripes per year.

Comment: test bench for PMTs in Malargue should be of high priority.

I can understand the worry of the commit, but I do not think that a test bench is a high priority for the SSD-PMTs due to the almost zero failure rate. The spares available in Malargue are enough for more than 50 years.

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OPERATIONS READINESS REVIEW
Staff Training

Comment: Even though several people from the staff are properly trained, we highly encourage the training of other teams to be able to solve possible SSD issues and therefore limiting the number of interventions in the field.

This is a good idea, but in our opinion the problem could be the loss of knowledge. If the failure rate that we have up to now will be confirmed in the future, the number of operation in the field involving SSD will be almost zero. Therefore, also well-trained people will start to lose knowledge. We think that a good documentation of the PMTs and SSD deployment and substitution could be the only option.