Diseño, construcción y calibración del telescopio de muones, MuTe 2.0

Christian Sarmiento Cano
Escuela de Física
Universidad Industrial de Santander

christian.sarmiento@correo.uis.edu.co

Universidad Industrial de Santander

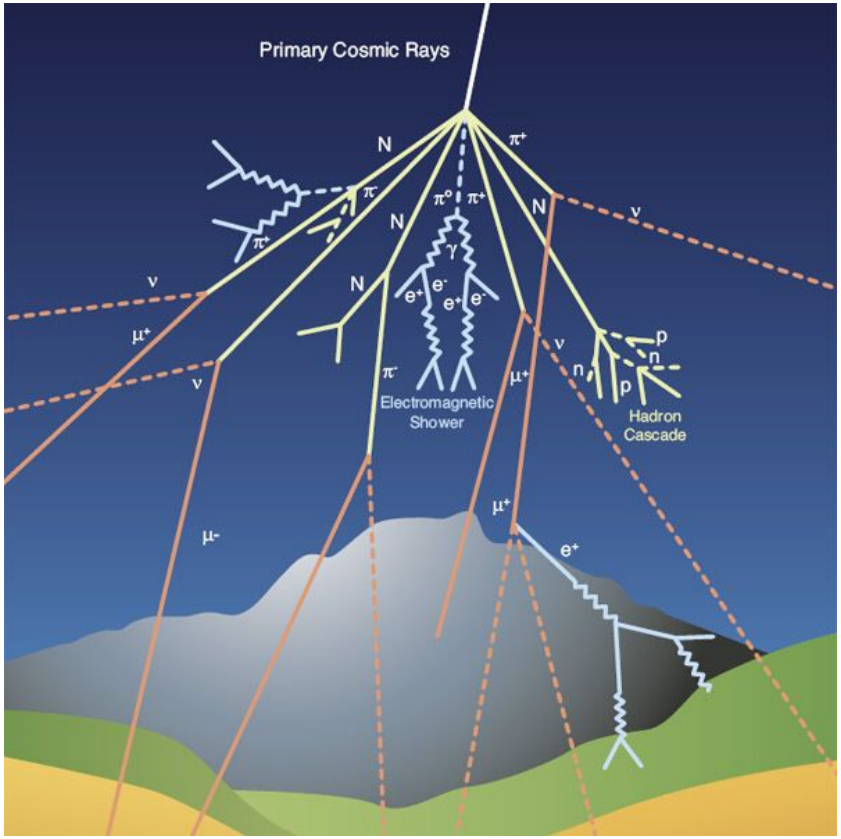
76 Aniversario UIS 1948 - 2024

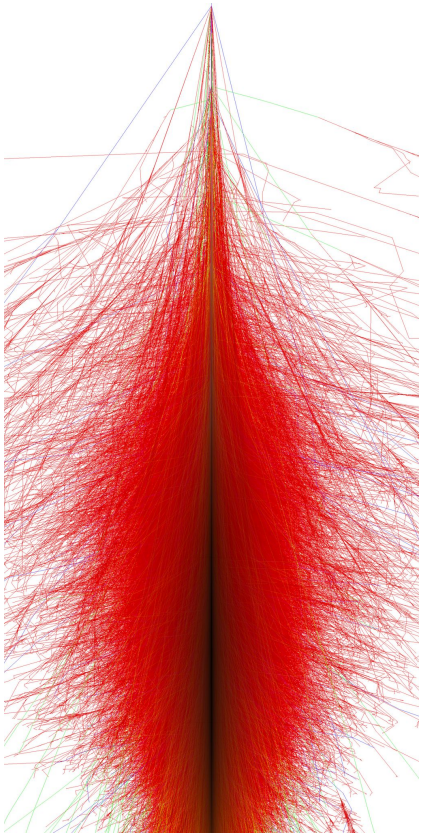
Contenido

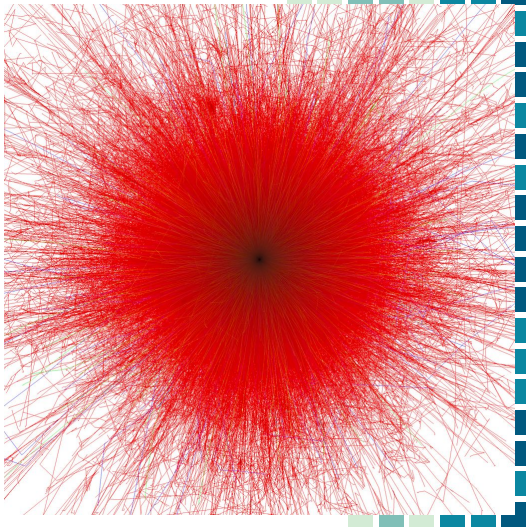
- Muografia
- Volcan Cerro Machín
- MuTe 2.0
  - Construcción
  - Simulación

1.
Muografía

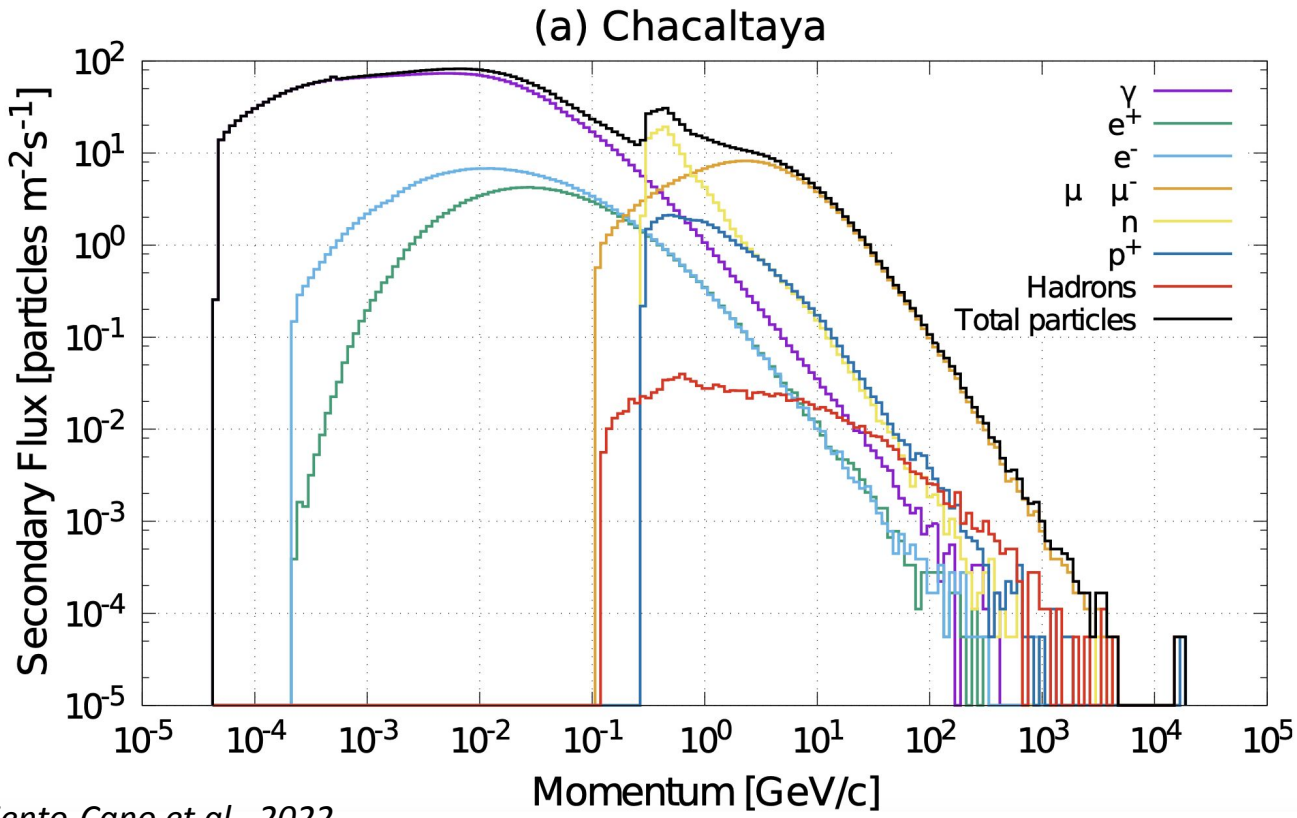
Flujo de rayos cósmicos





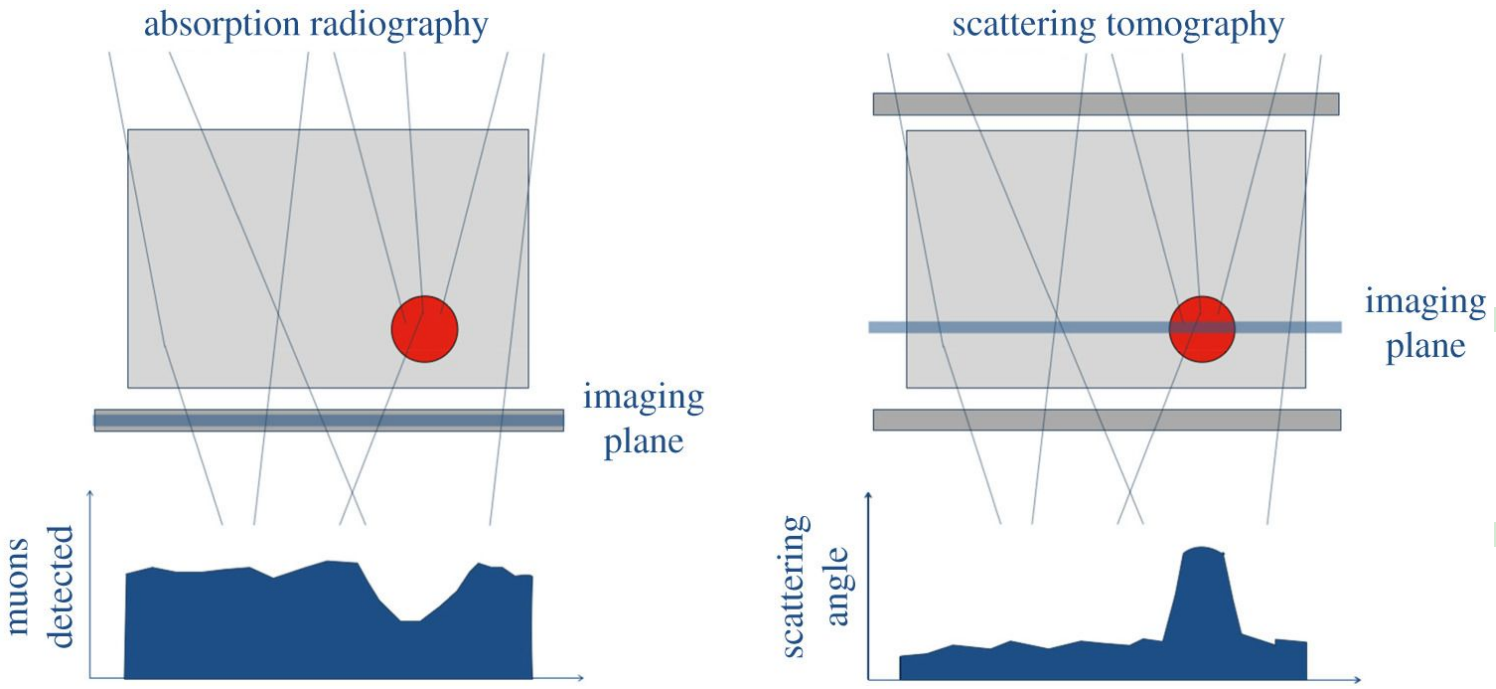


Flujo de rayos cósmicos (ARTI)



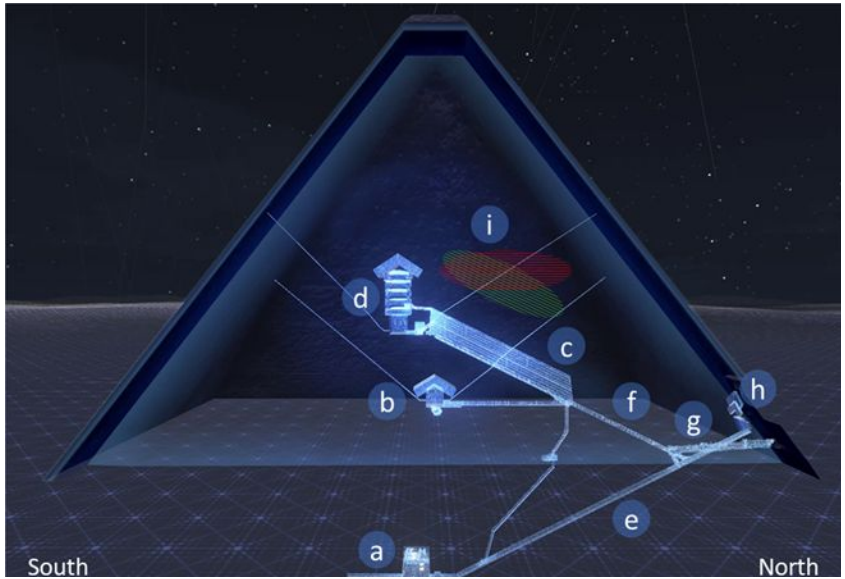
Sarmiento-Cano et al., 2022
https://doi.org/10.1140/epjc/s10052-022-10883-z

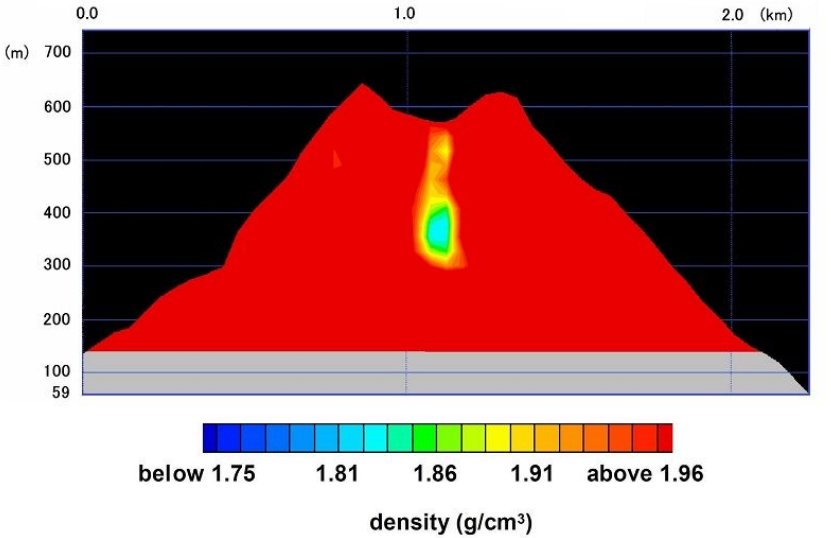
Muografía



Kaiser Ralf 2019, Muography: overview and future directions *Phil. Trans. R. Soc. A.* http://doi.org/10.1098/rsta.2018.0049

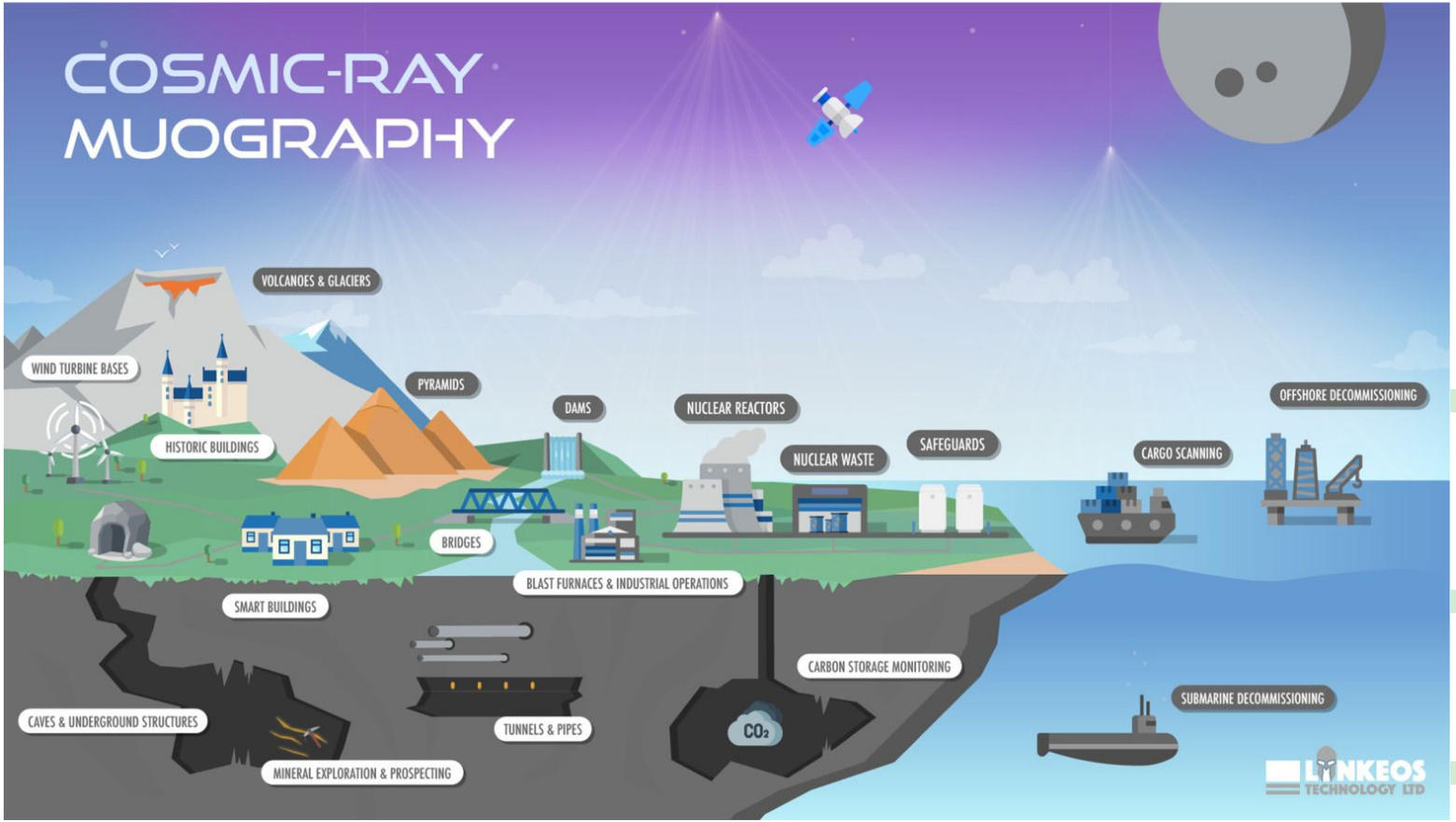
Muografía





Tanaka, H.K.M., Bozza, C., Bross, A. *et al.* Muography. *Nat Rev Methods Primers* 3, 88 (2023). https://doi.org/10.1038/s43586-023-00270-7

Muografía


COSMIC-RAY
MUOGRAPHY
VOLCANOES & GLACIERS
WIND TURBINE BASES
PYRAMIDS
HISTORIC BUILDINGS
DAMS
NUCLEAR REACTORS
NUCLEAR WASTE
SAFEGUARDS
OFFSHORE DECOMMISSIONING
CARGO SCANNING
BRIDGES
BLAST FURNACES & INDUSTRIAL OPERATIONS
SMART BUILDINGS
CARBON STORAGE MONITORING
SUBMARINE DECOMMISSIONING
CAVES & UNDERGROUND STRUCTURES
TUNNELS & PIPES
CO_2
MINERAL EXPLORATION & PROSPECTING
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2.
Volcán Cerro Machín

Cajamarca, Tolima – Colombia


Caribe
Mar
PANAMÁ
OCÉANO
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VENEZUELA
ECUADOR
PERÚ
BRASIL
Cordillera Occidental
Cordillera Central
Cordillera Oriental
SAN ANDRÉS Y PROVIDENCIA
MAR CARIBE


Nevado del Tolima
Volcán Cerro Machín
Toche
El Pando
Cajamarca
Ibagué
http://www.volcanmachin.com

Volcán Cerro Machín

MuTe Project

3.

MuTe2.0

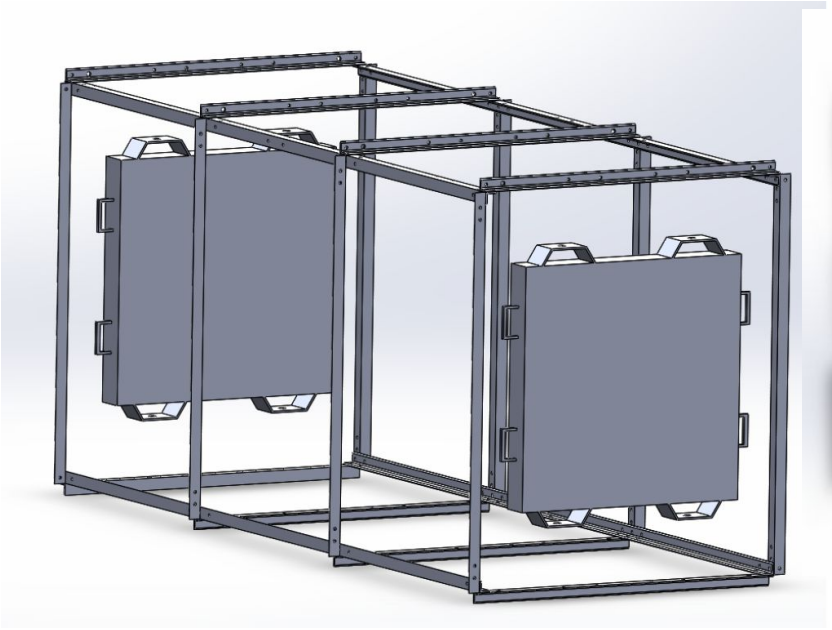
Muon Telescope

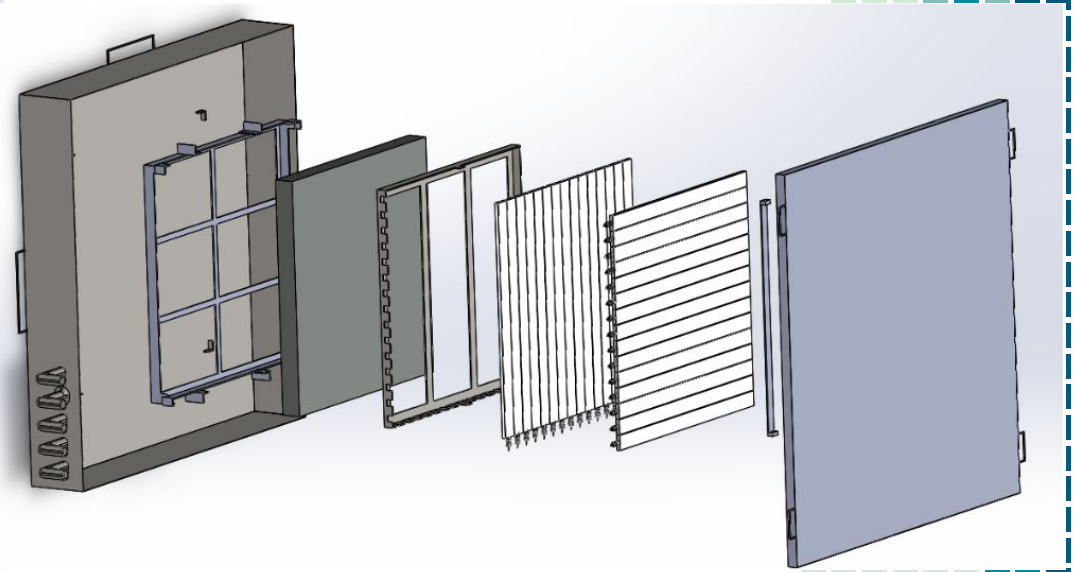
MuTe 2.0, Muon Telescope

- Dos paneles de barras centelladoras
- Cada plano contiene 15 barras
- Cada panel tiene 225 pixeles
- La barras tiene 60 cm x 4 cm x 1 cm
- Usa SiPM al final de cada barra para recolectar la señal
- Blindaje usando 3 cm de Pb

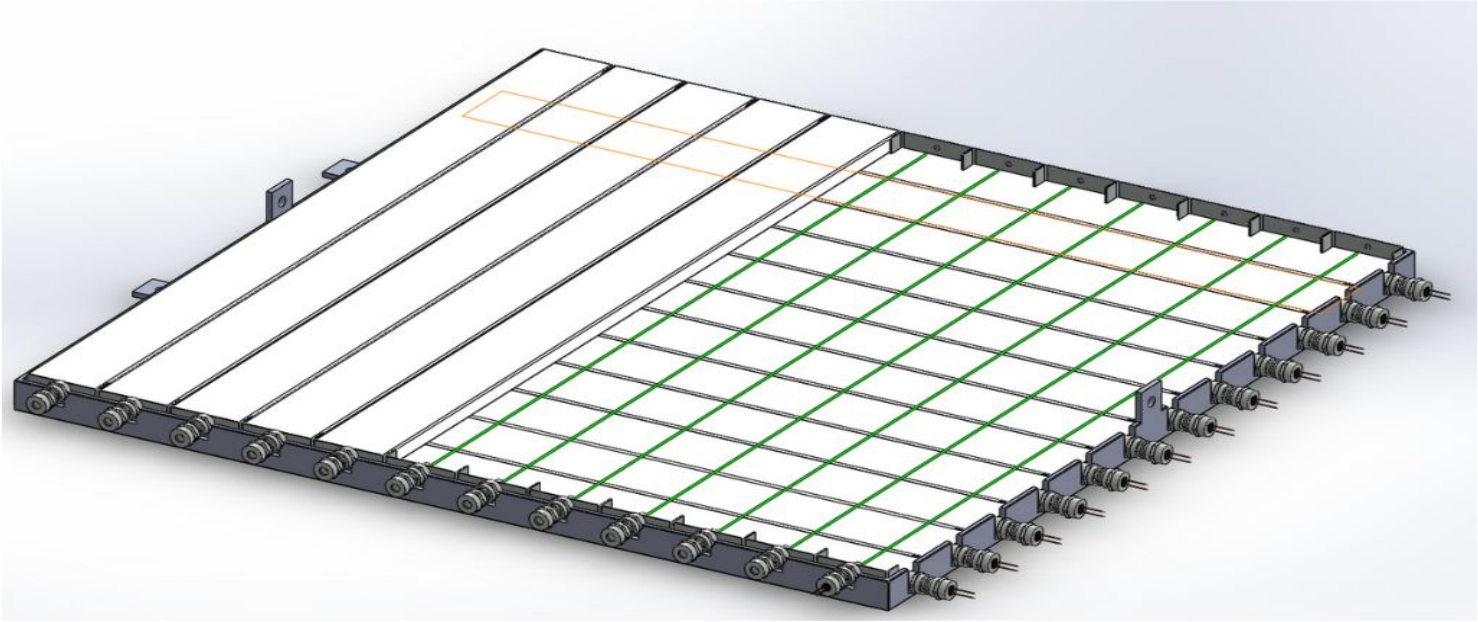
MuTe
The Muon Telescope

Diseño Mecánico

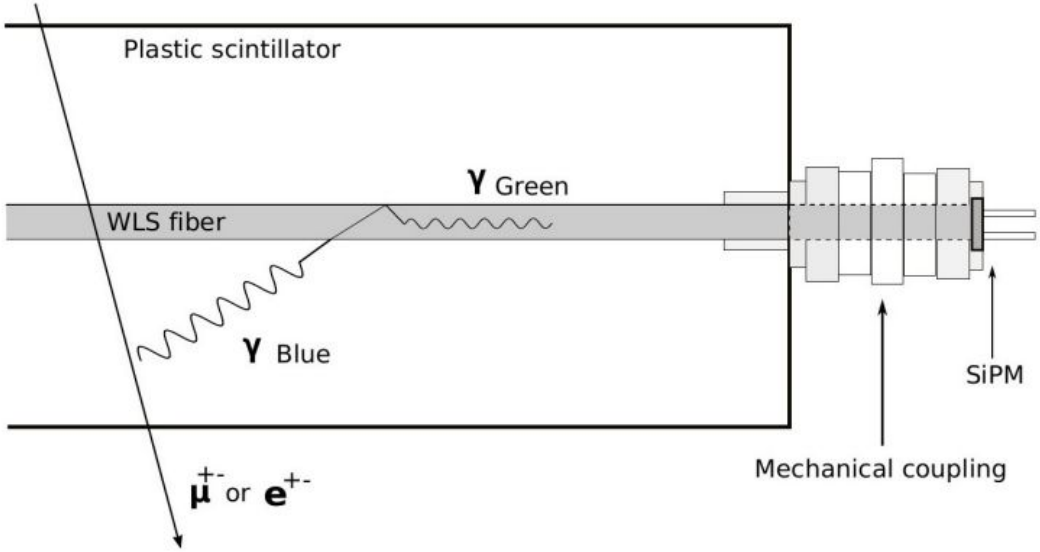


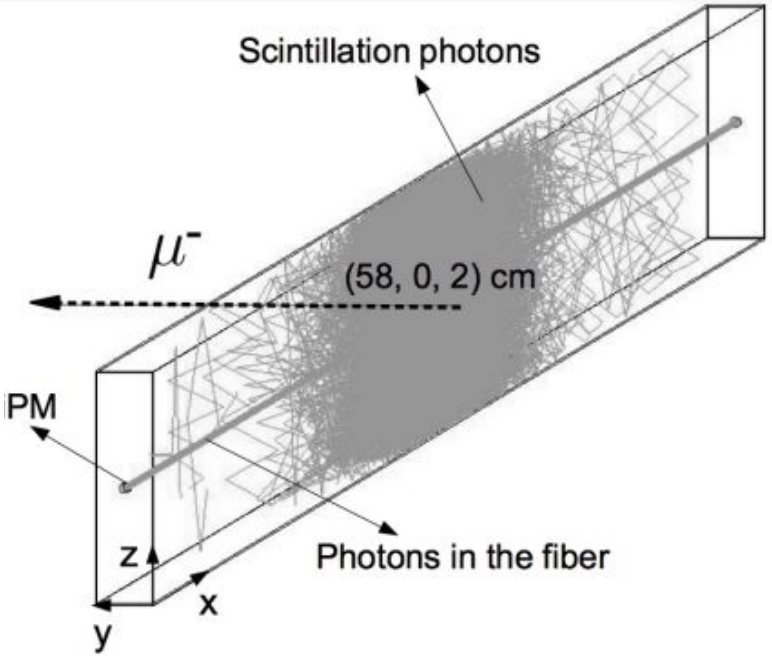


Panel centellador

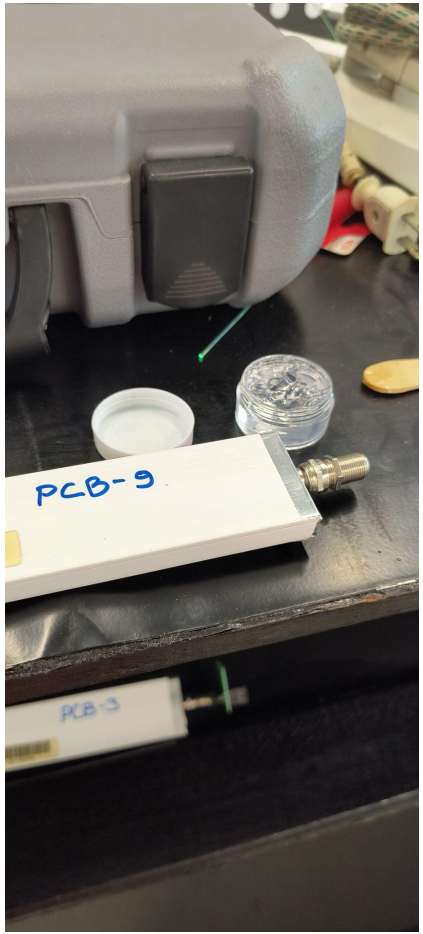


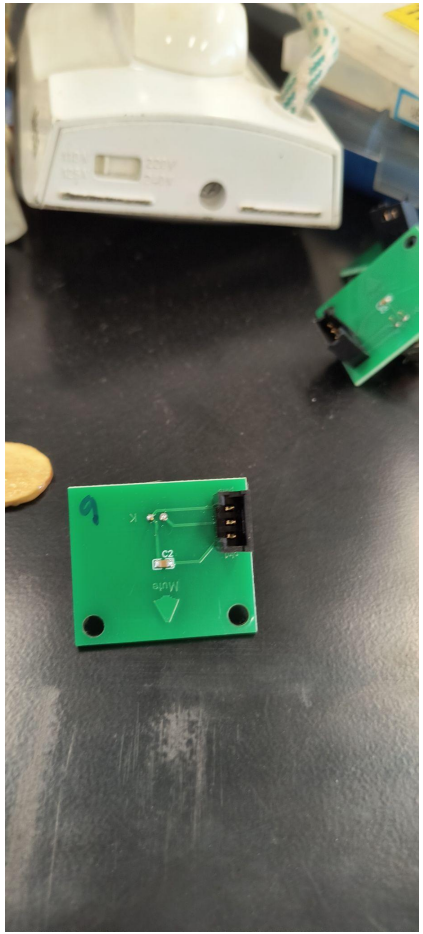
Barras centelladoras



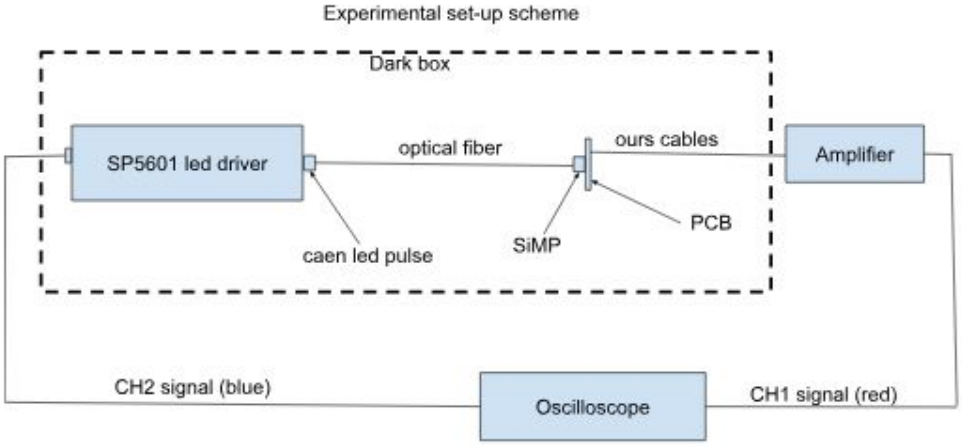


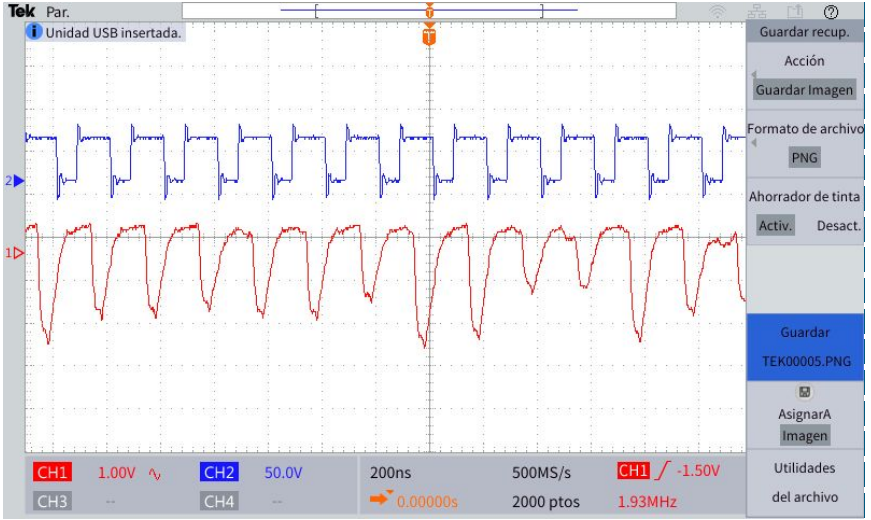
Barra-Cable-PCB



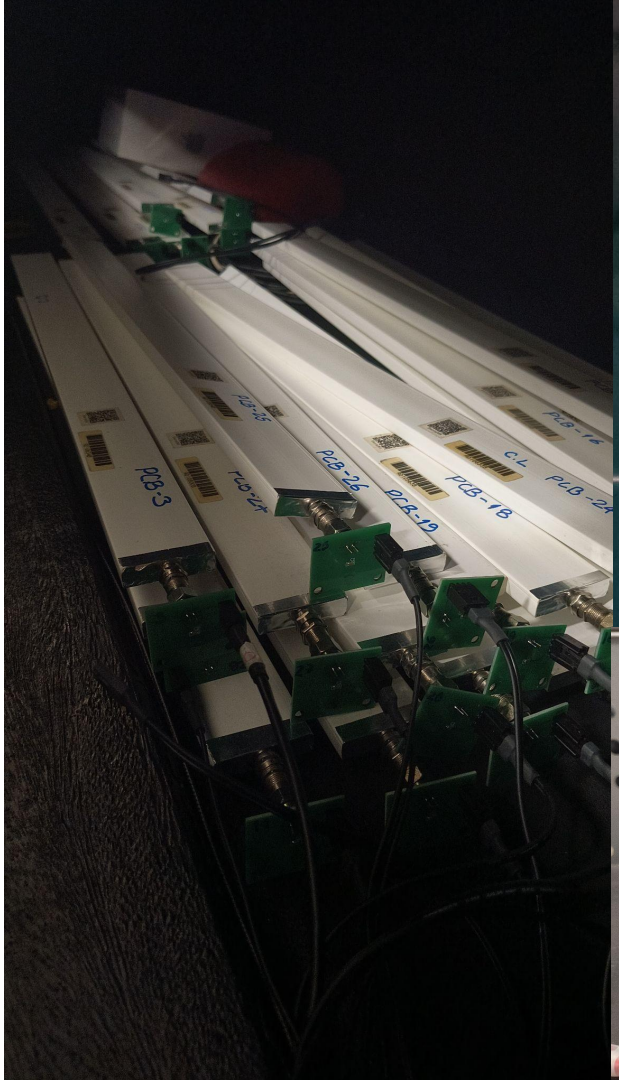


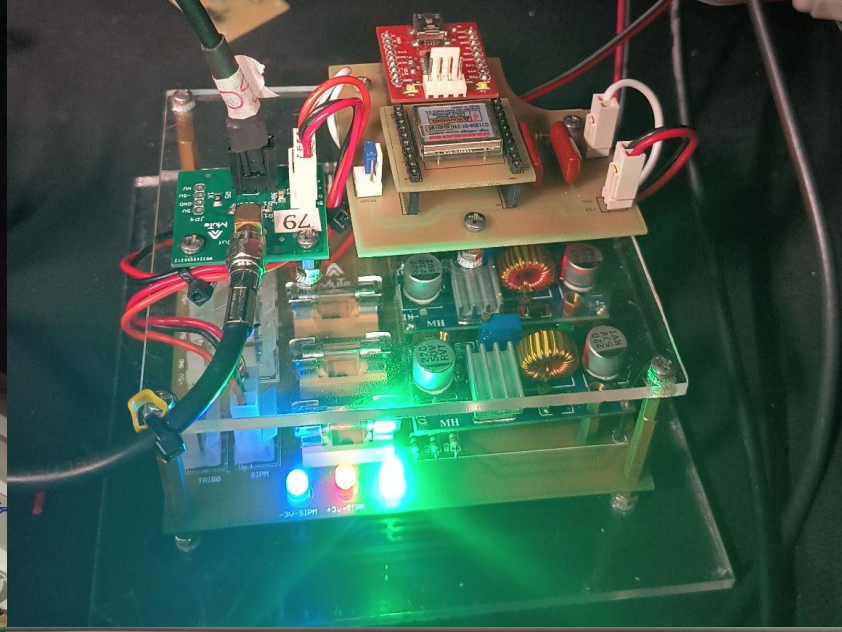
Prueba de los cables

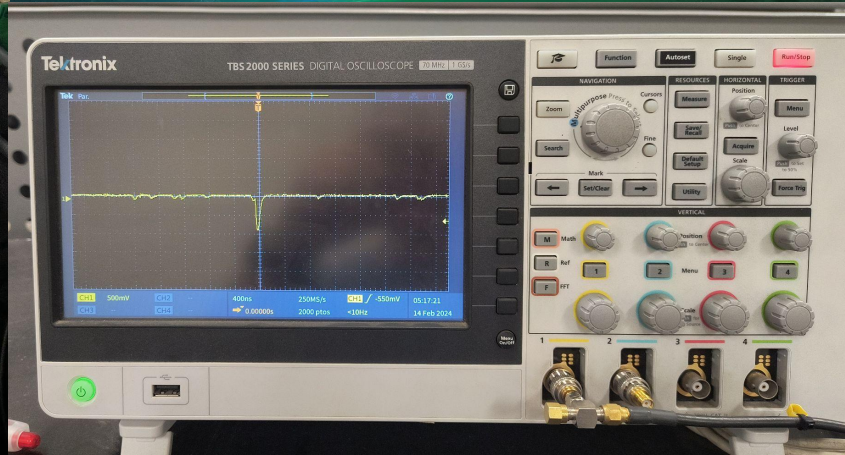




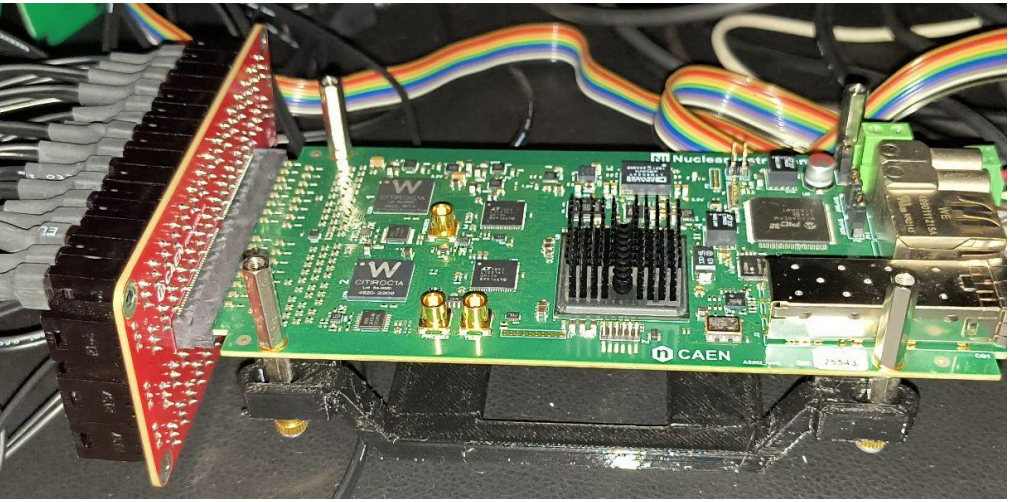
Sistema barra-SiPM -Fibra





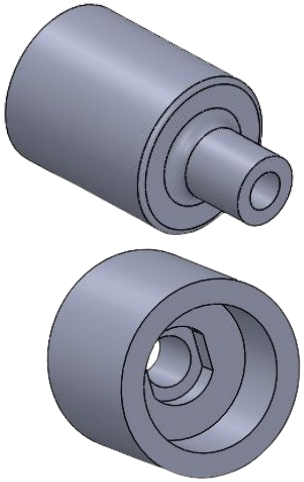


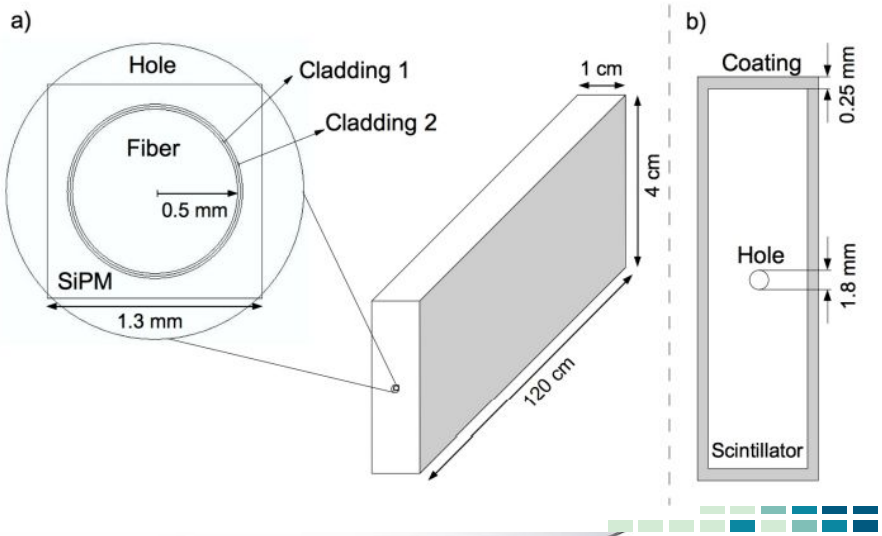
Sistema de adquisición

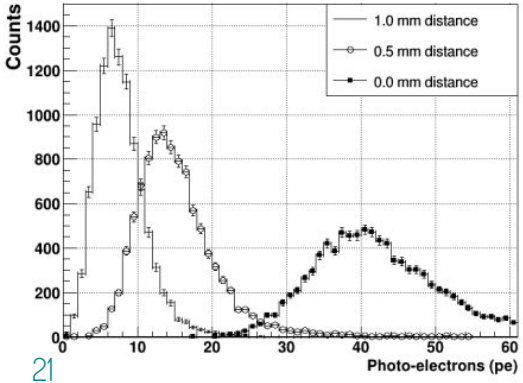


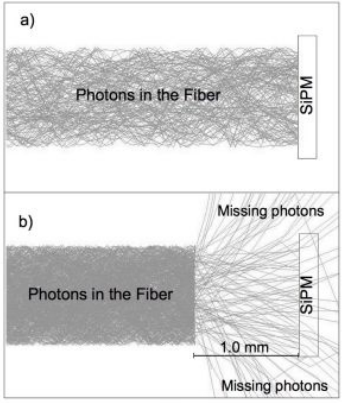
CAEN FERS-5200 DAQ, 64 Ch: convertidores AD, Logical Trigger, sincronización, memoria local e interfaz de lectura.

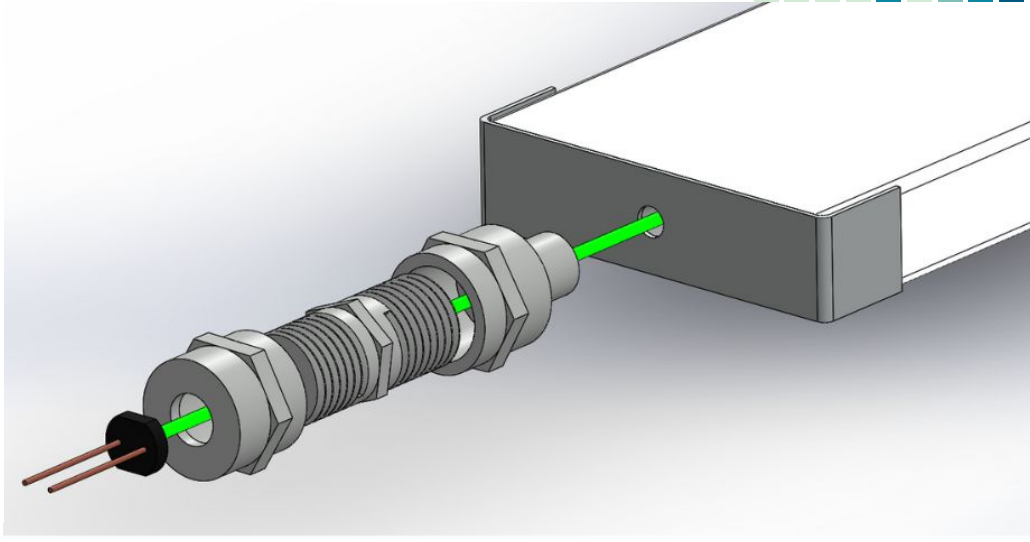
Acople SiPM-Fibra



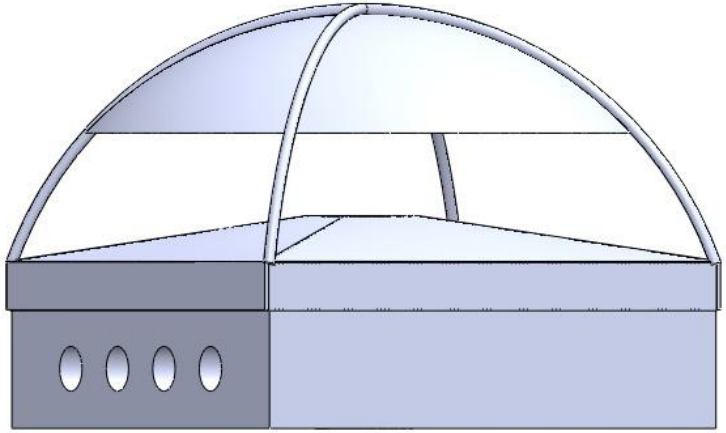


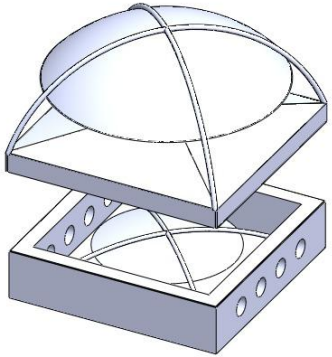


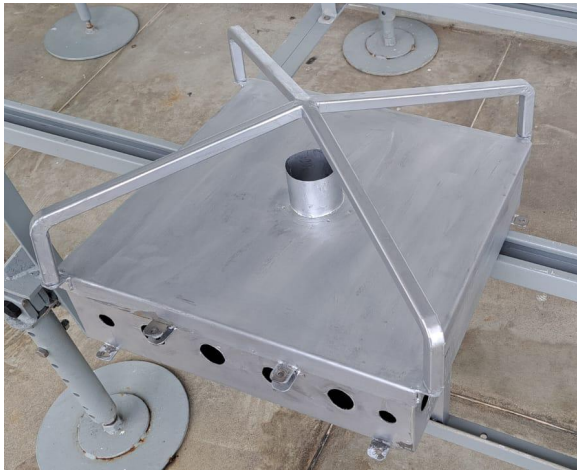


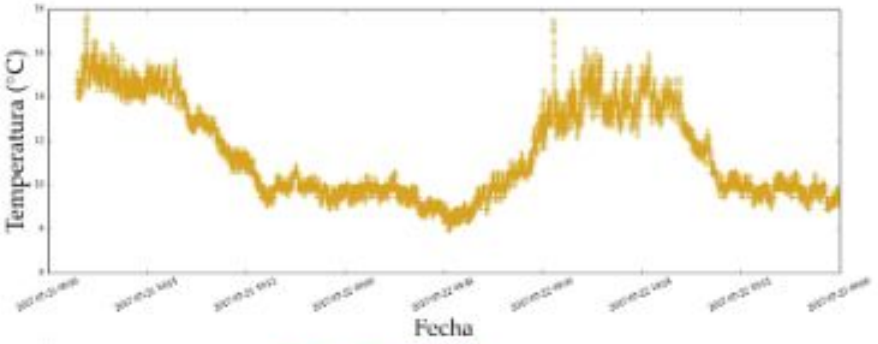


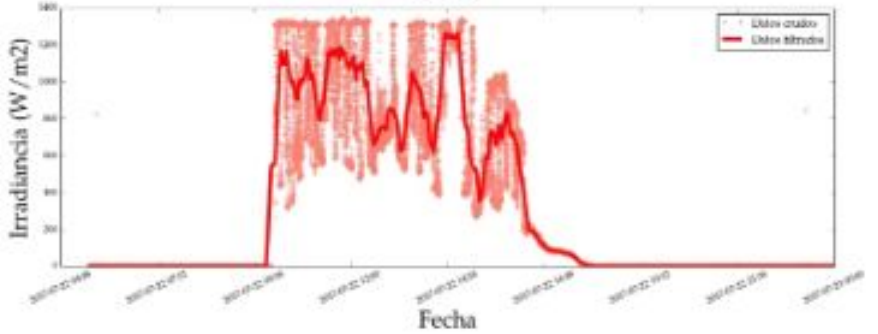
Caja térmica para la electrónica



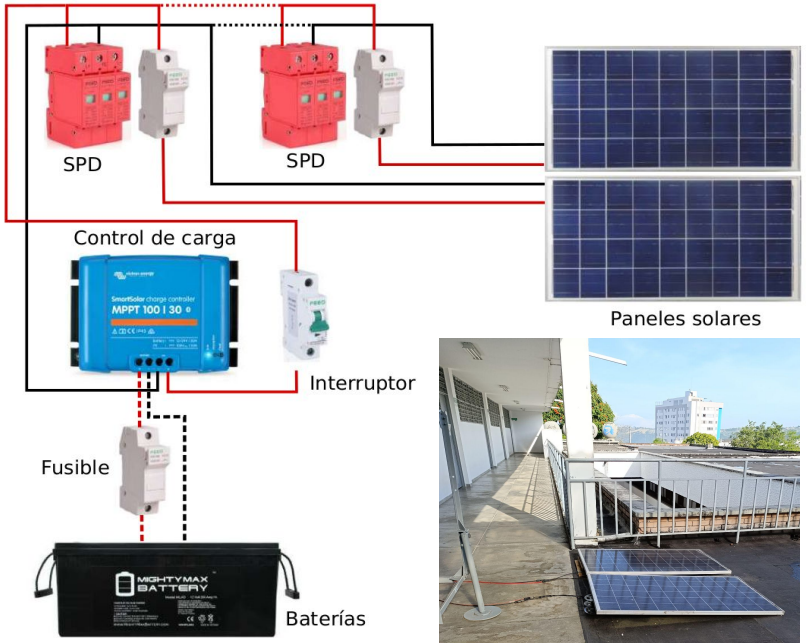




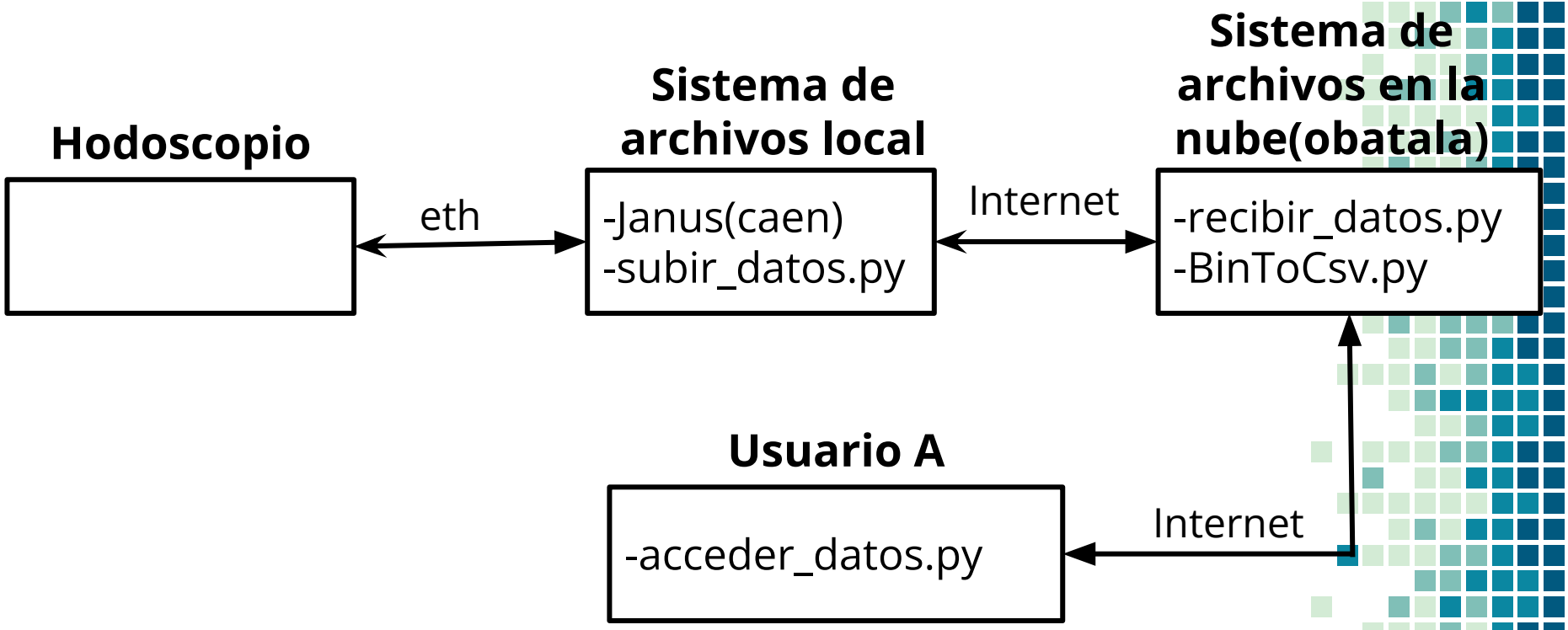




Sistema Fotovoltaico de respaldo



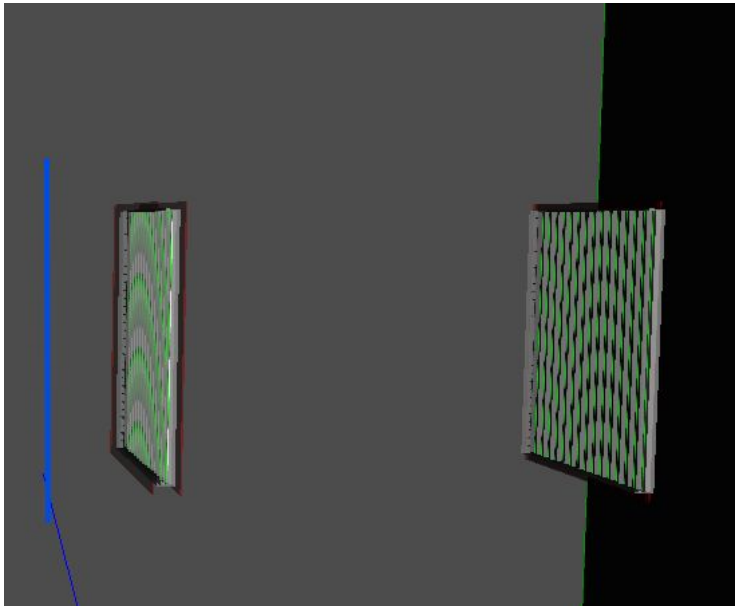
Sistema de gestión de datos

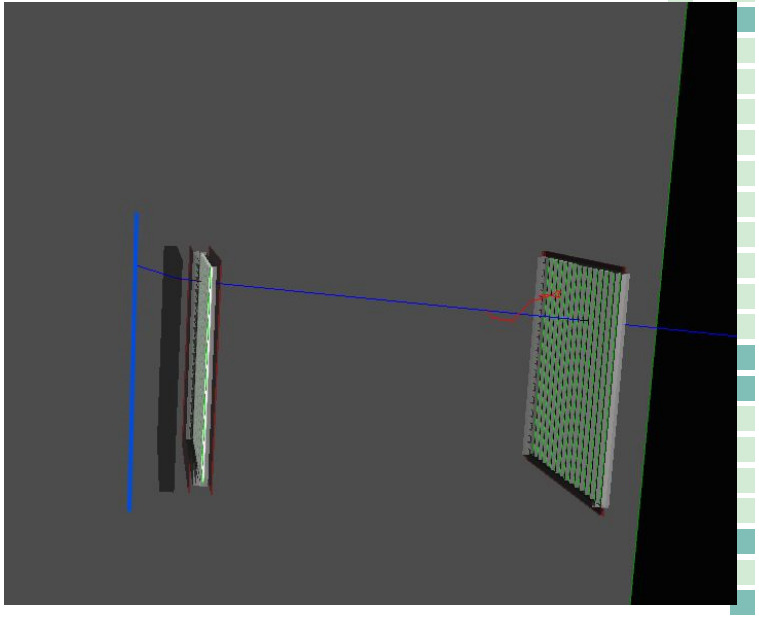


MuTe 2.0

Esquema de Simulación

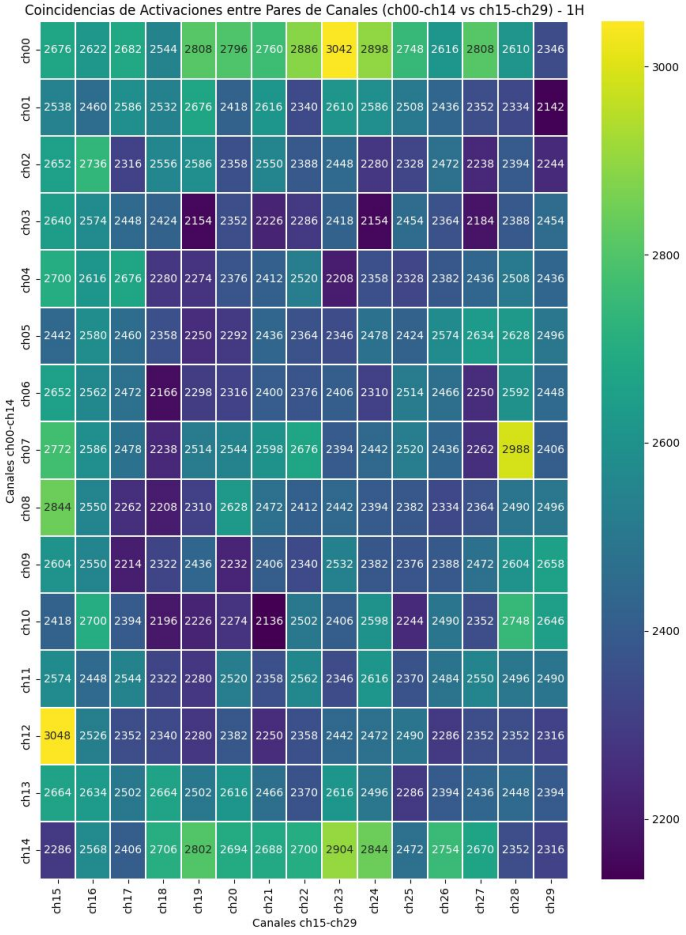
Inyección de 1 Hora de flujo Bga en un círculo de 1m^2 de Área a 0.5cm del Hodoscopio, con y sin Pb.

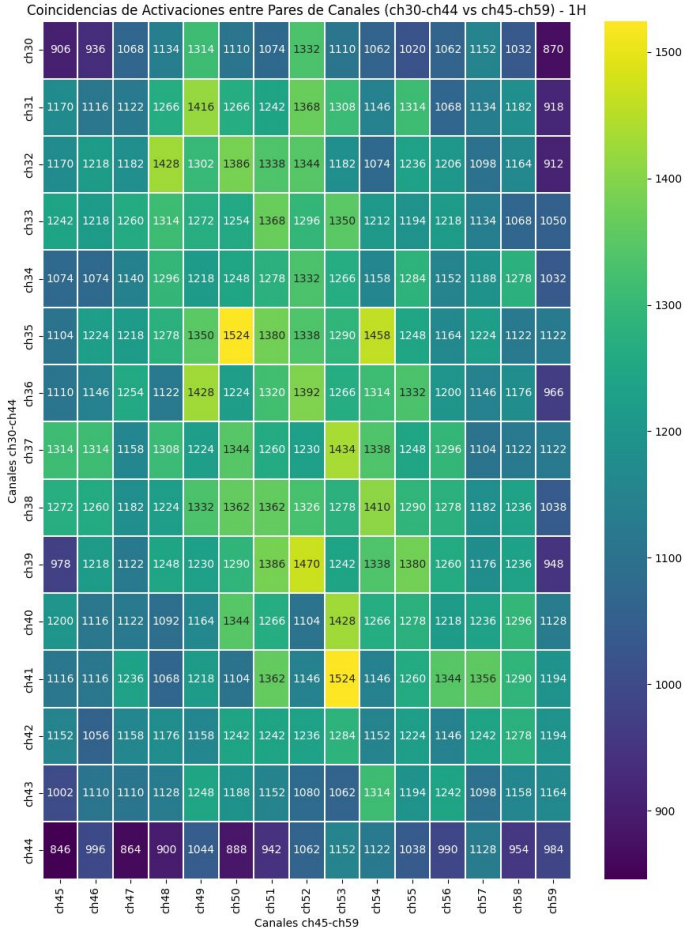




Taboada, A., *et. al* (2022). Meiga, a Dedicated Framework Used for Muography Applications. *Journal of Advanced Instrumentation in Science*, *2022*. https://doi.org/https://doi.org/10.31526/jais.2022.266

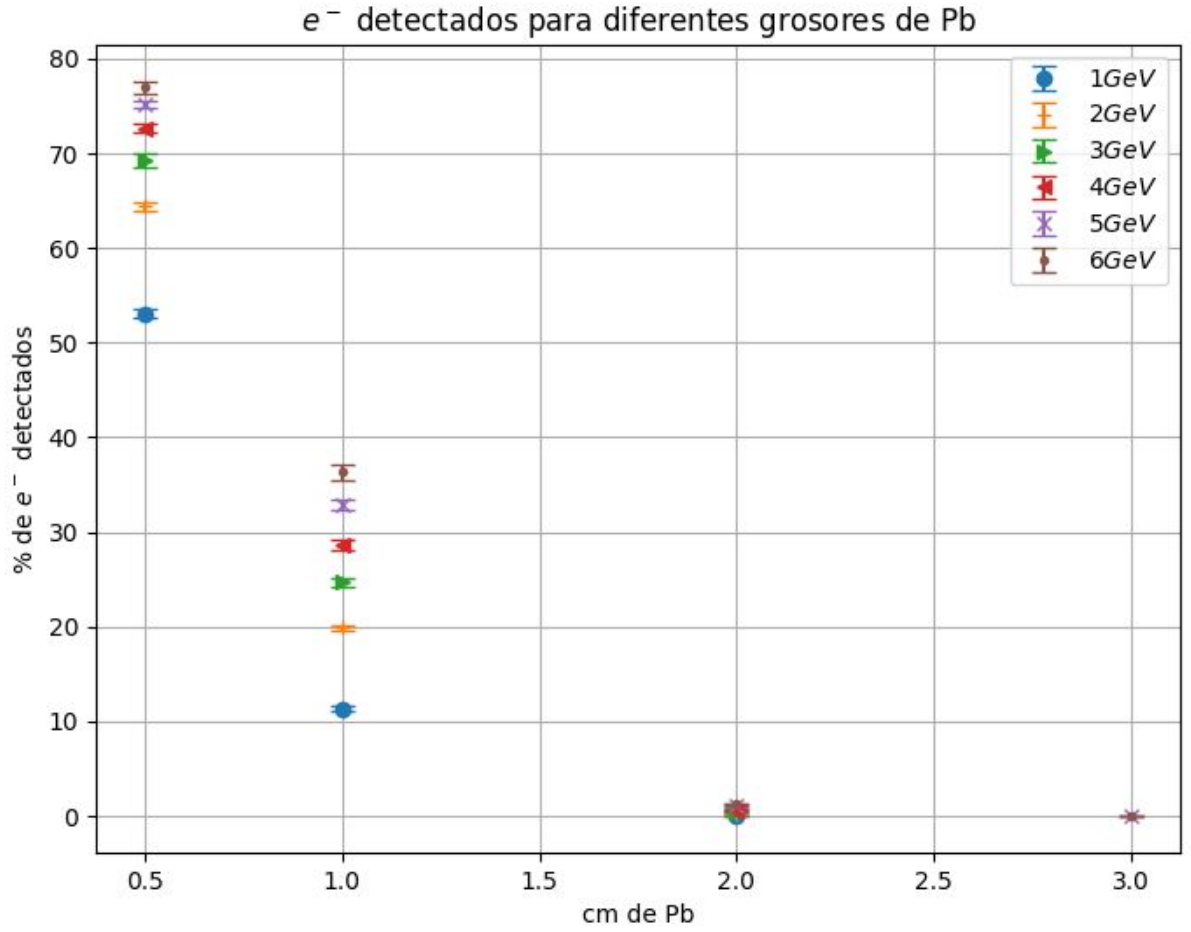
Mapa de Píxeles



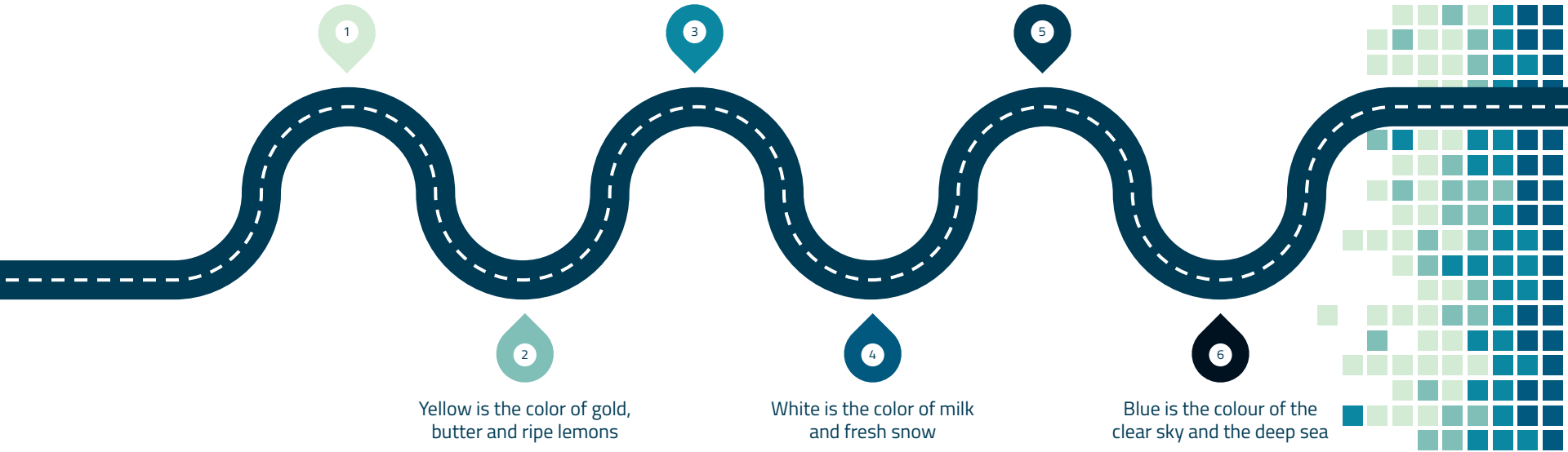


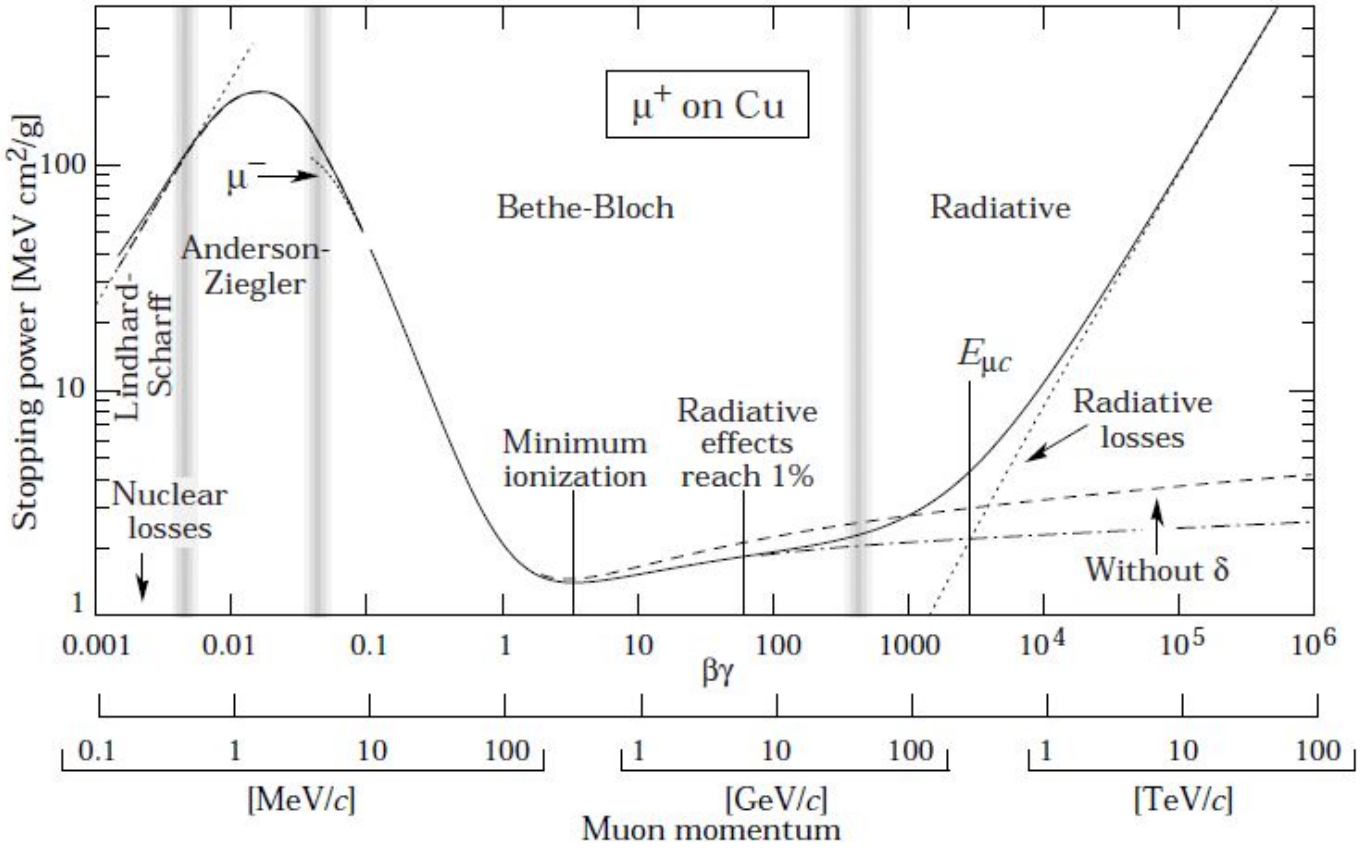
Gracias

Atenuación Pb: Simulación



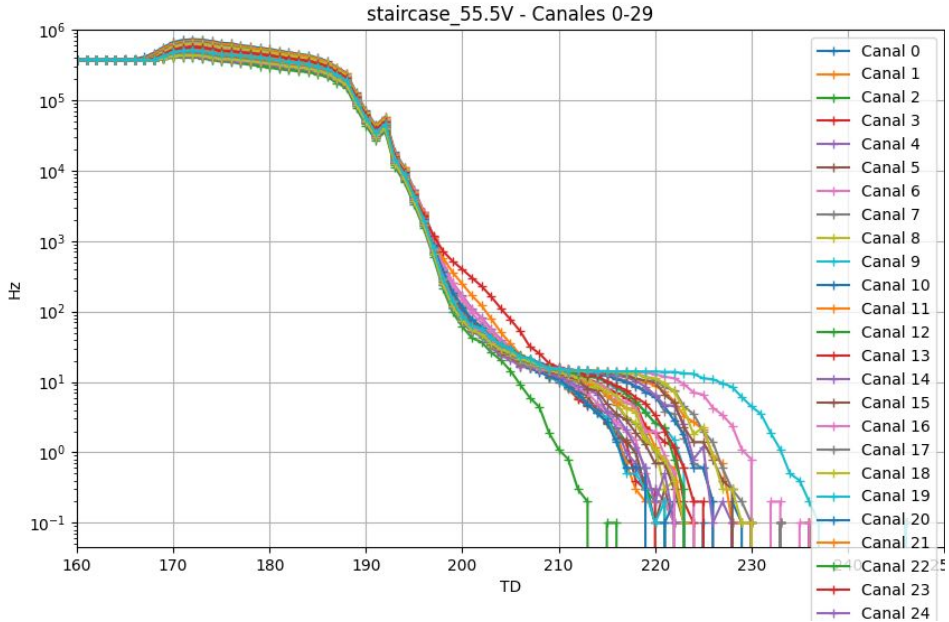
ROADMAP

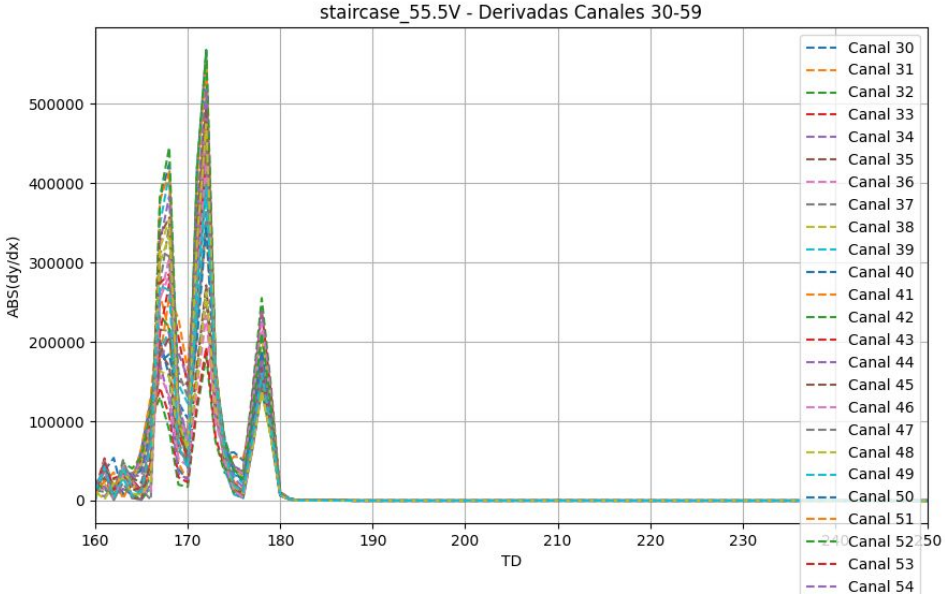

1
Blue is the colour of the clear sky and the deep sea
2
Yellow is the color of gold, butter and ripe lemons
3
Red is the colour of danger and courage
4
White is the color of milk and fresh snow
5
Black is the color of ebony and of outer space
6
Blue is the colour of the clear sky and the deep sea

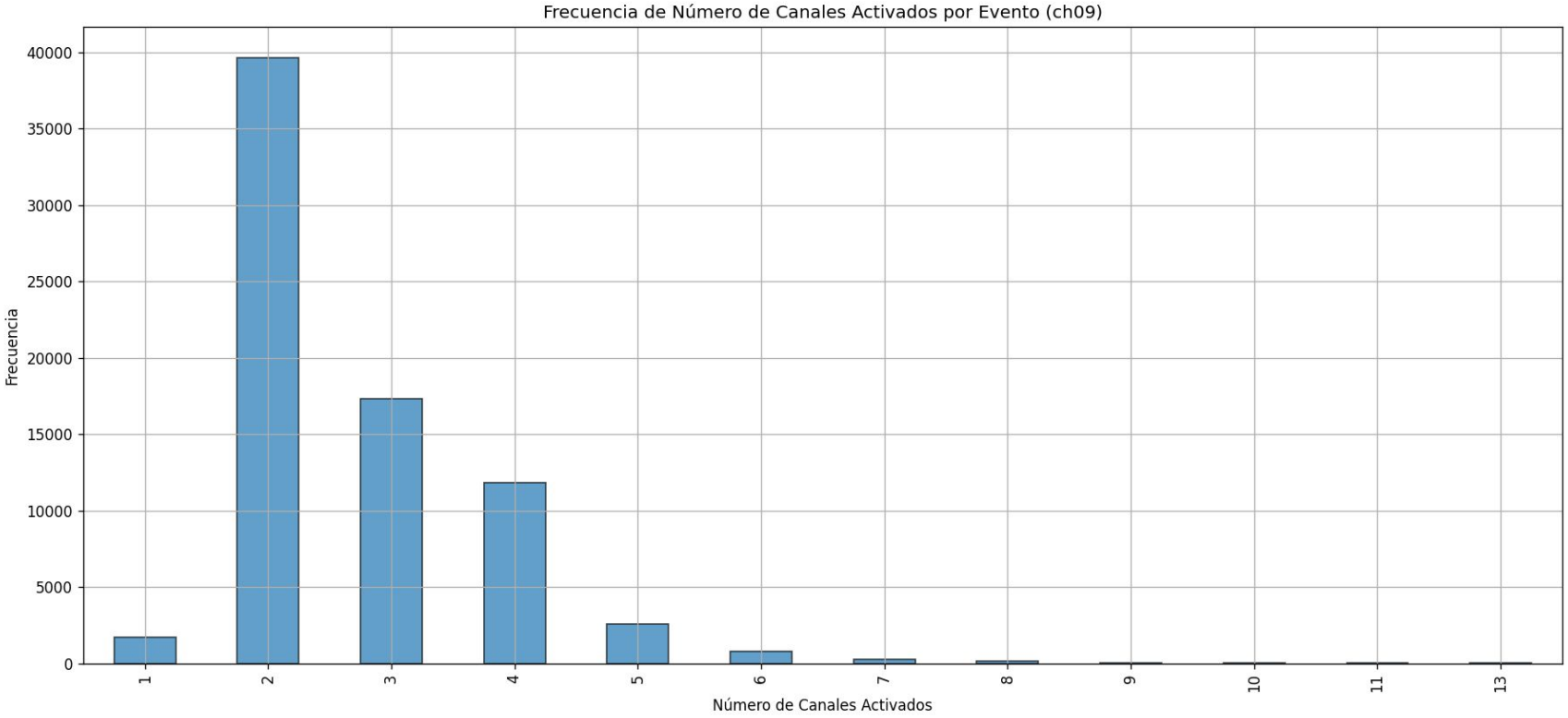

μ+ on Cu
μ−
Anderson-
Ziegler
Lindhard-
Scharff
Nuclear
losses
Bethe-Bloch
Minimum
ionization
Radiative
effects
reach 1%
Radiative
Eμc
Radiative
losses
Without δ
Stopping power [MeV cm2/g]
100
10
1
0.001
0.01
0.1
1
10
100
1000
10^4
10^5
10^6
βγ
0.1
1
10
100
[MeV/c]
1
10
100
[GeV/c]
1
10
100
[TeV/c]
Muon momentum

Calibración y Análisis de mediciones

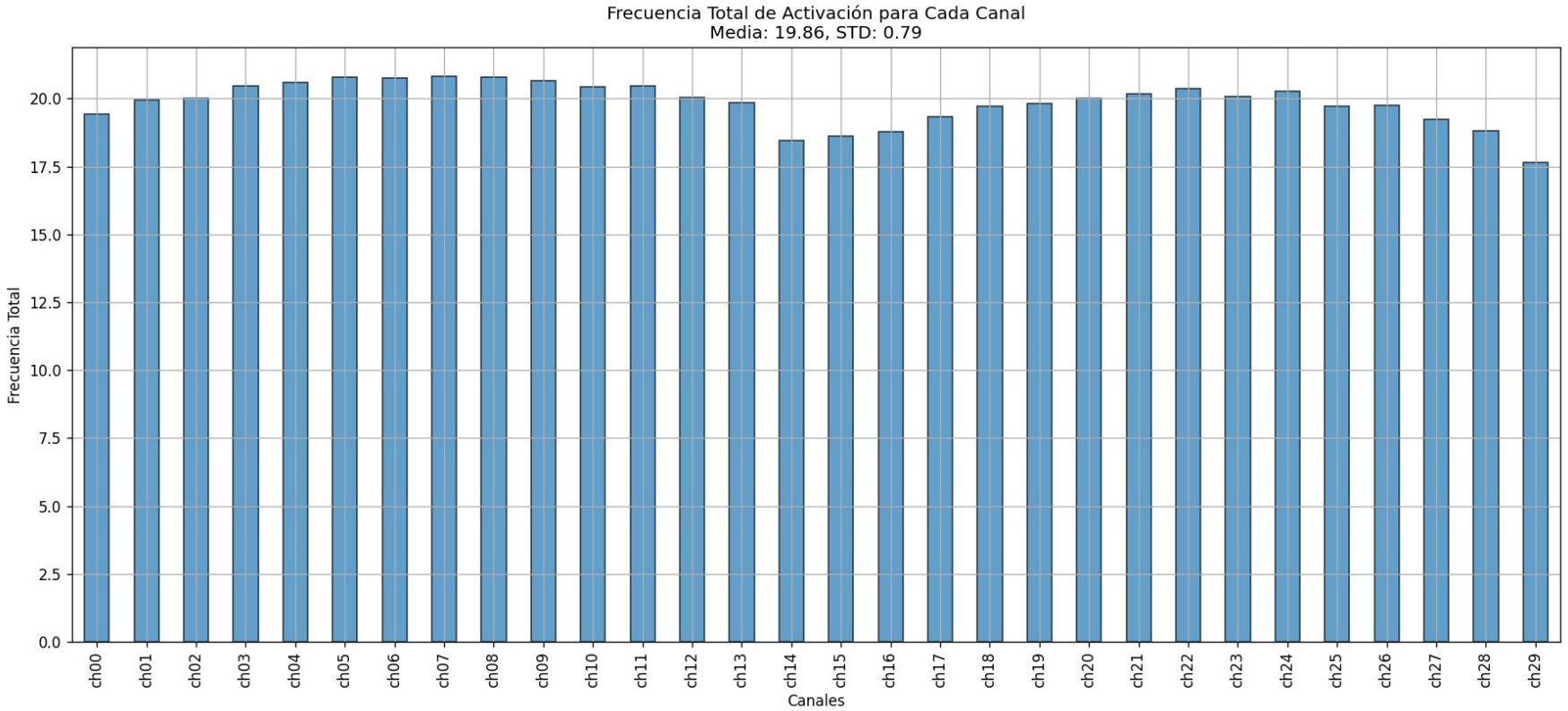
Dark Count Rate



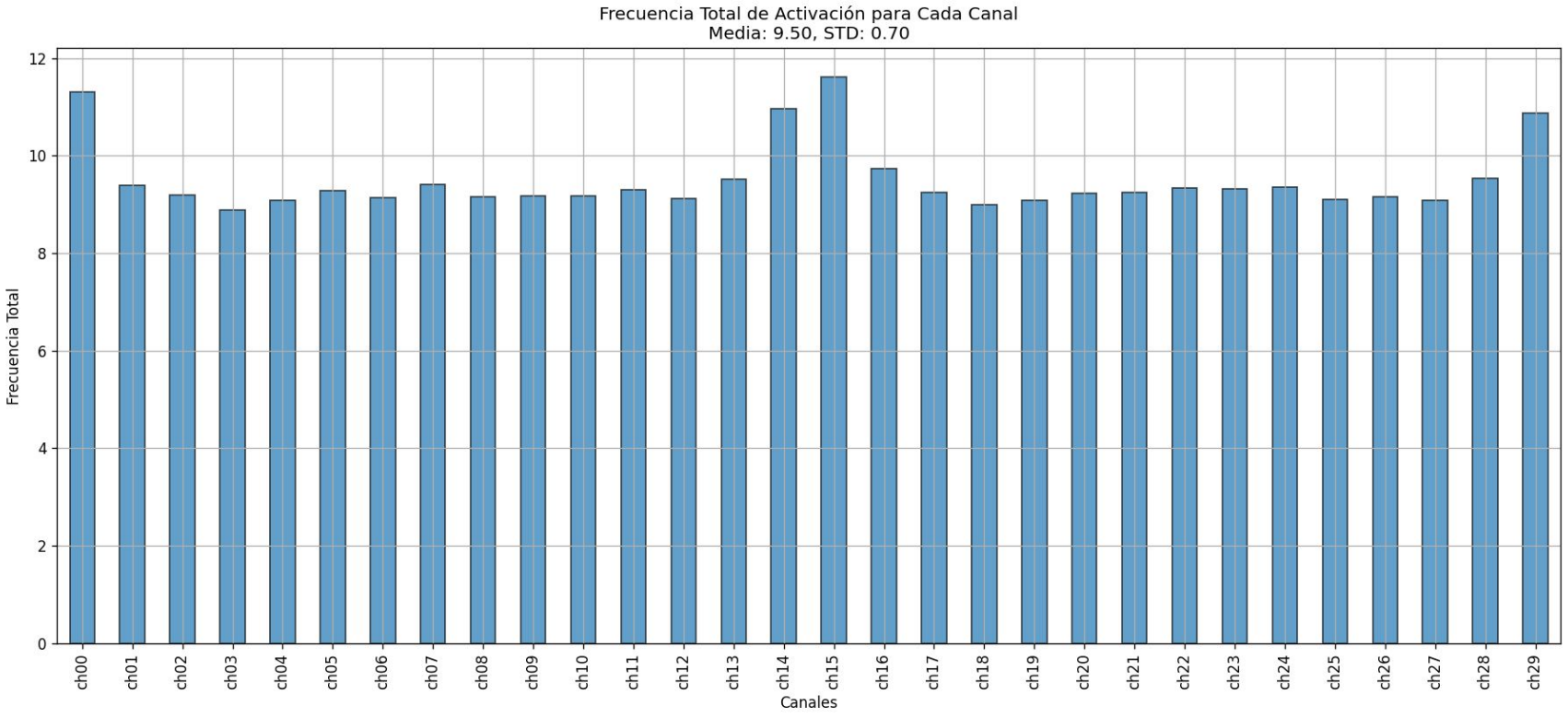



Frecuencia de Número de Canales Activados por Evento (ch09)
Frecuencia
40000
35000
30000
25000
20000
15000
10000
5000
0
1
2
3
4
5
6
7
8
9
10
11
13
Número de Canales Activados

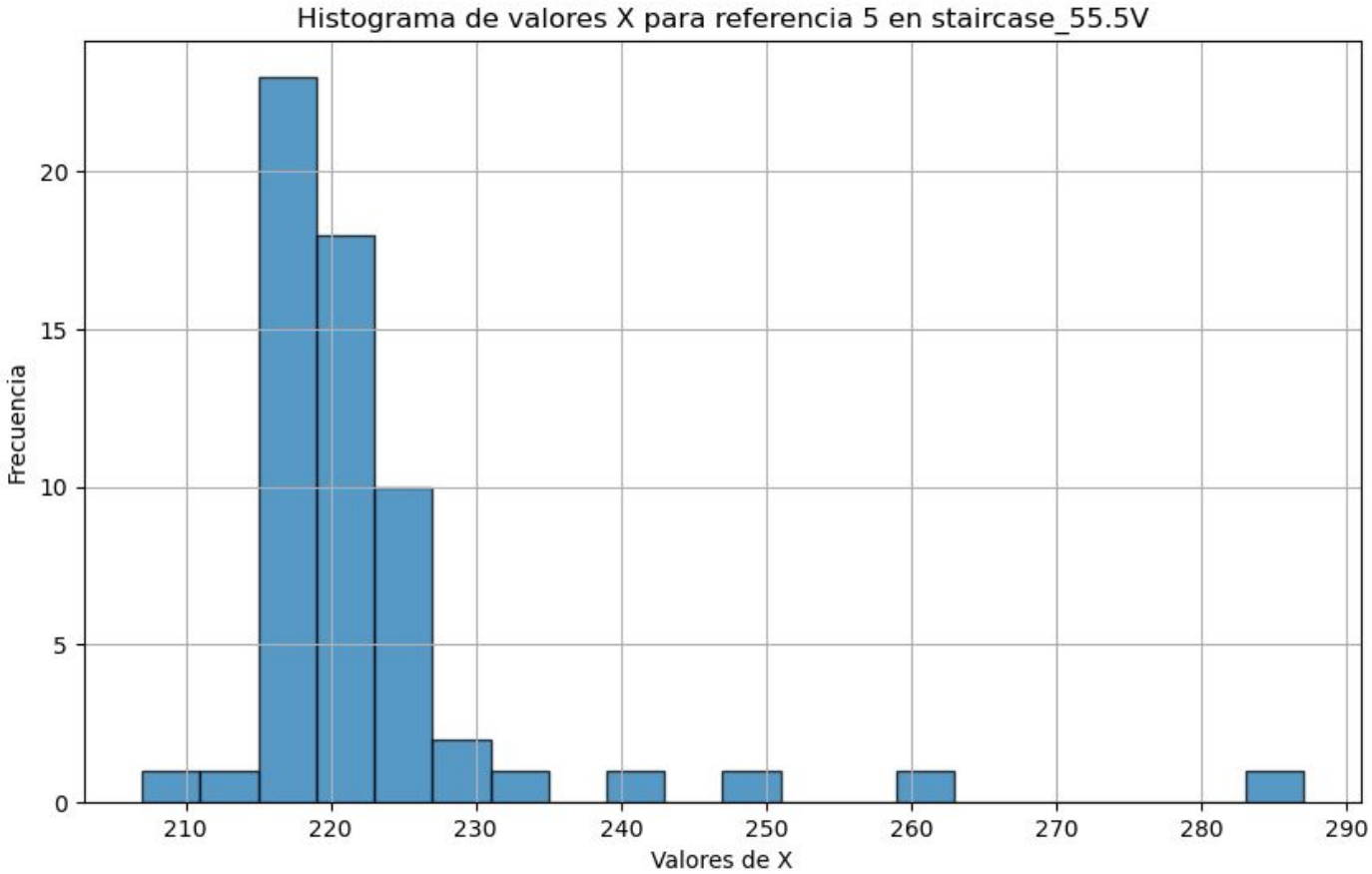
Simulación sin Pb, Conteo total por segundo



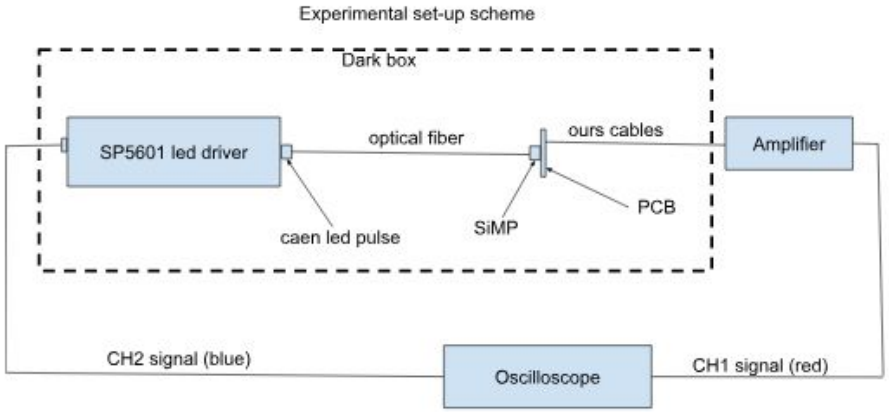
Con Pb, Conteo total por segundo

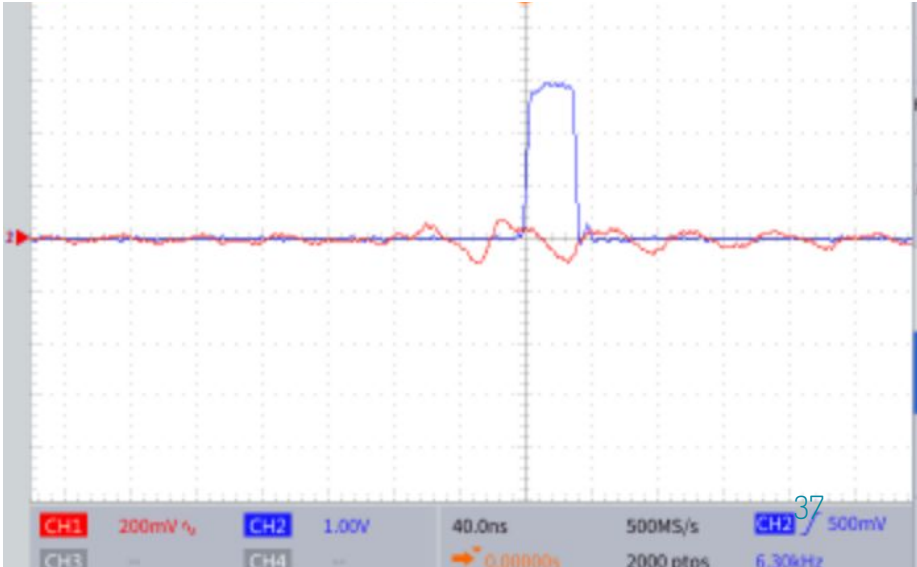


Valor de TD


Histograma de valores X para referencia 5 en staircase_55.5V
Frecuencia
Valores de X
0
5
10
15
20
210
220
230
240
250
260
270
280
290

Pruebas internas a la FERS





Datos Exp: # de canales activados por evento