

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

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Universidad  
Industrial de  
Santander



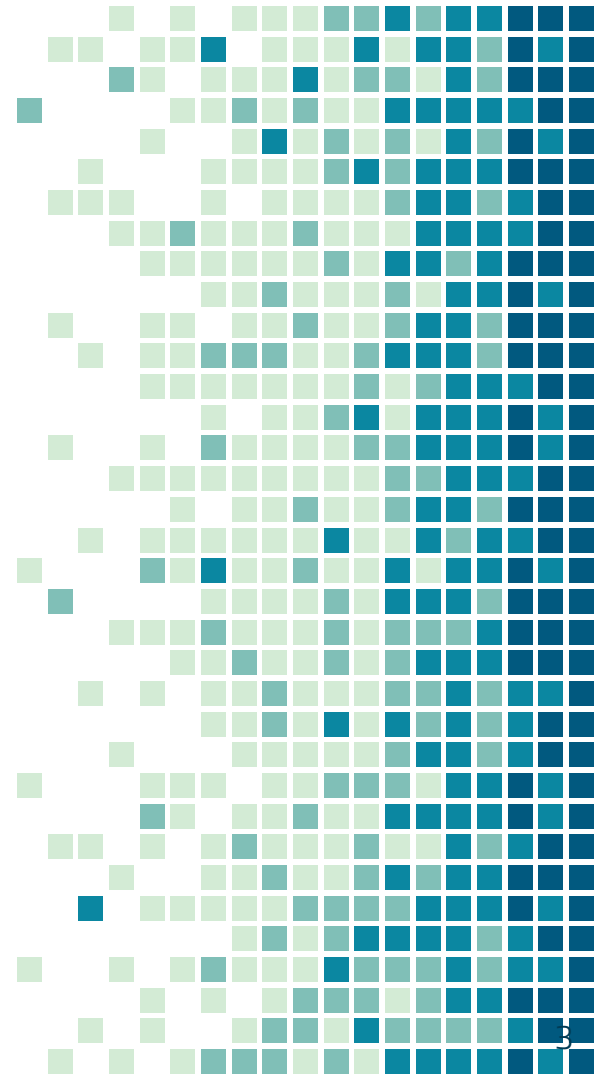
# Contenido

- Muografía
- Volcan Cerro Machín
- MuTe 2.0
  - Construcción
  - Calibración

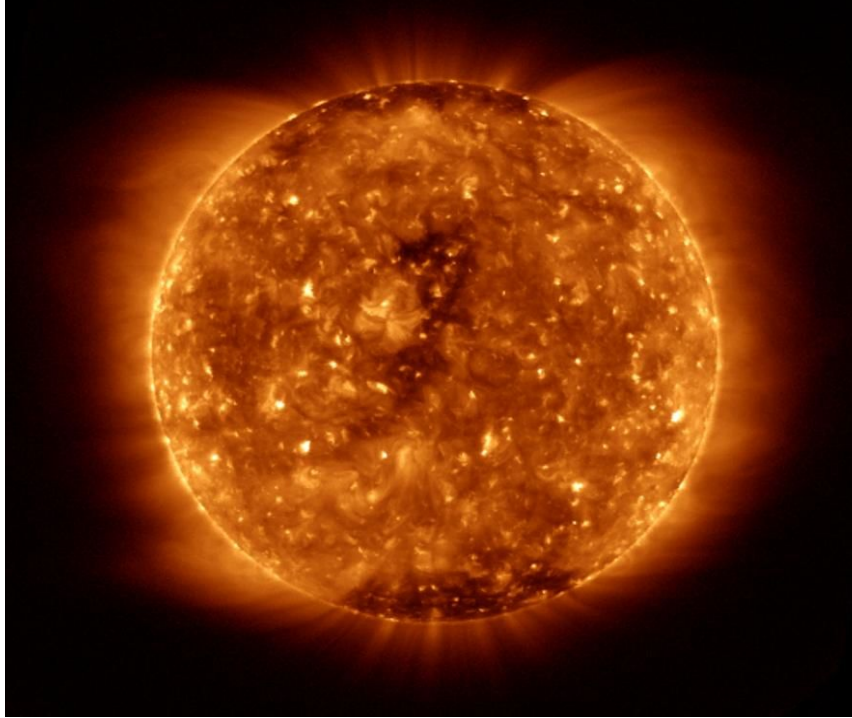


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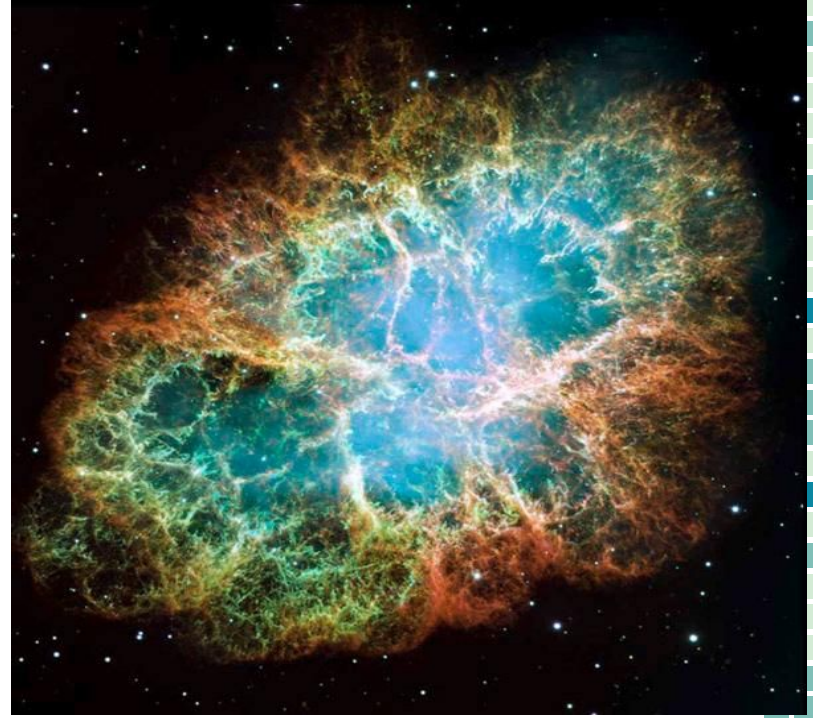
# Muografía



# Fuentes de rayos cósmicos

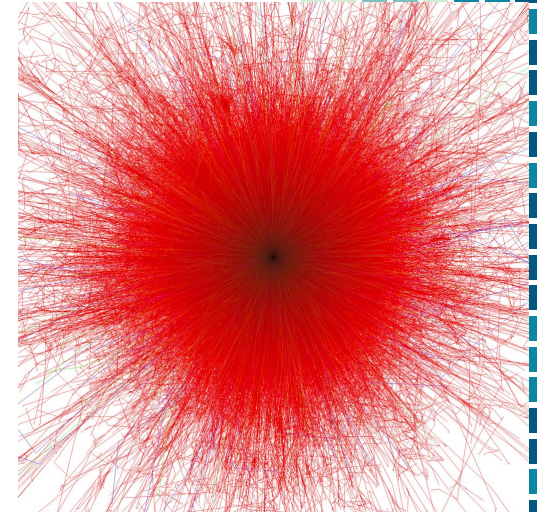
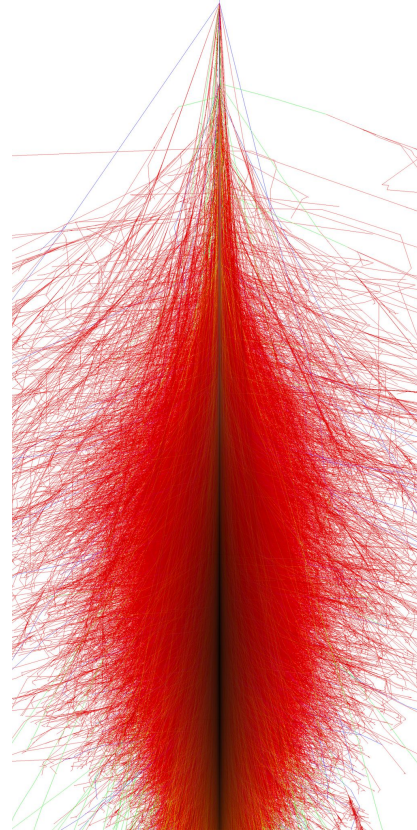
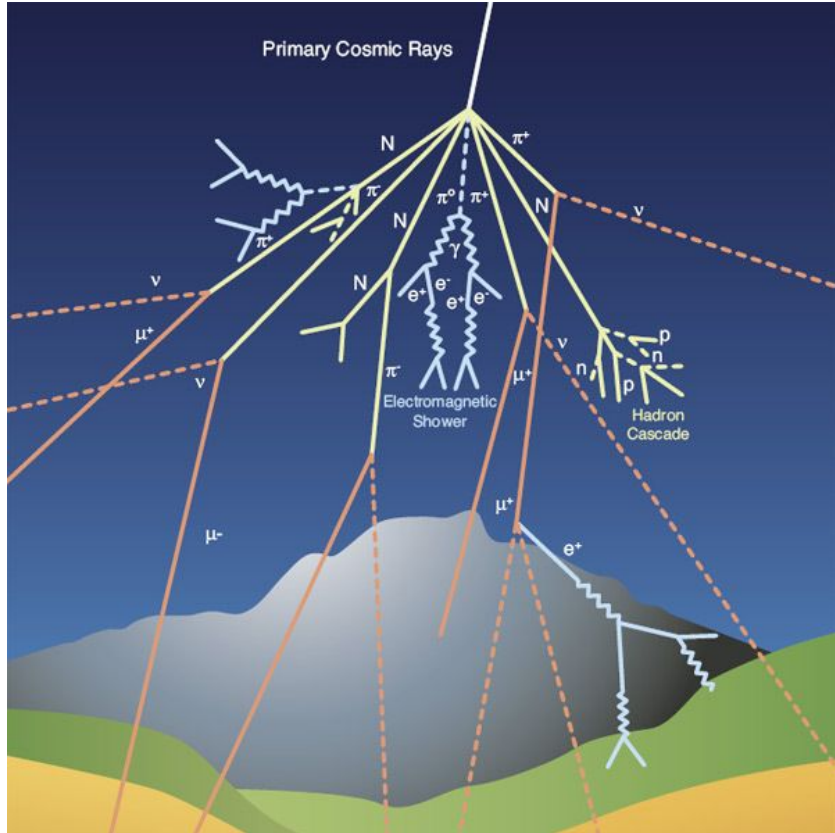


Solar

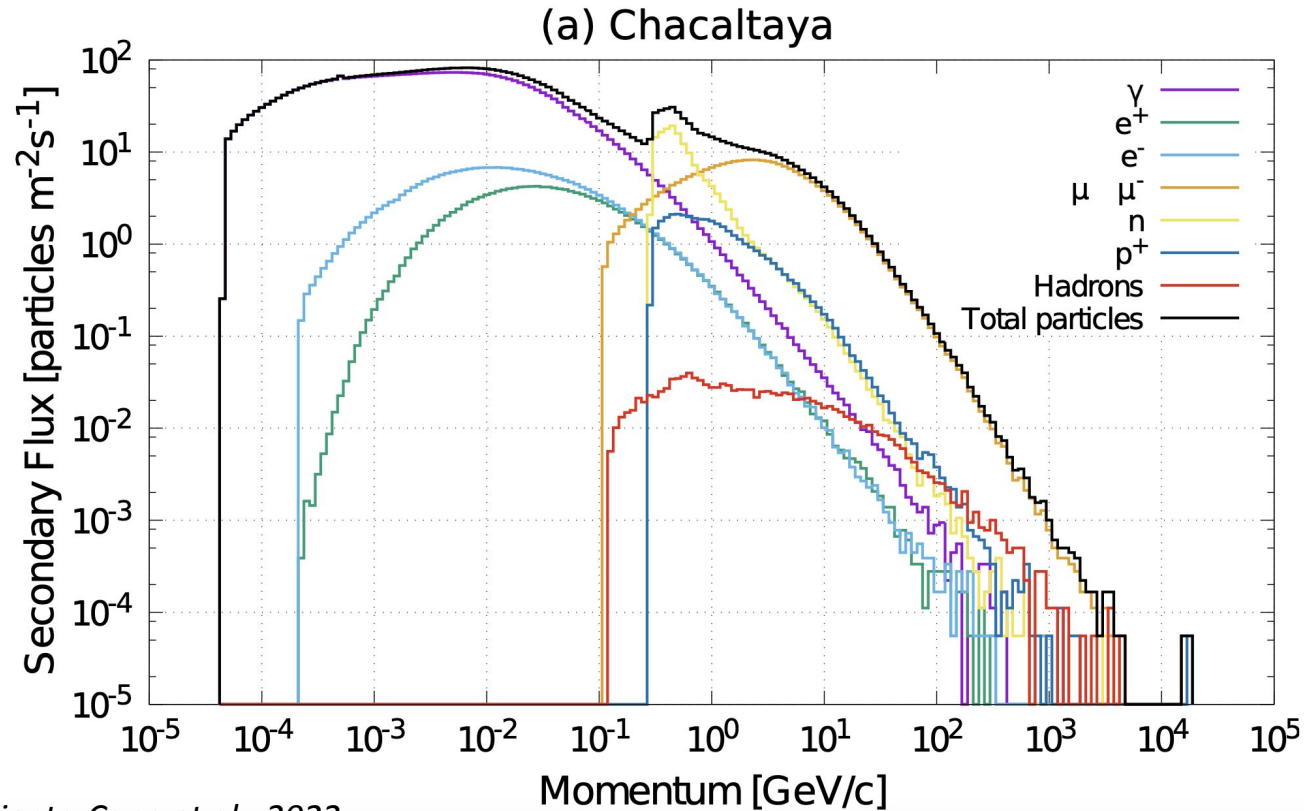
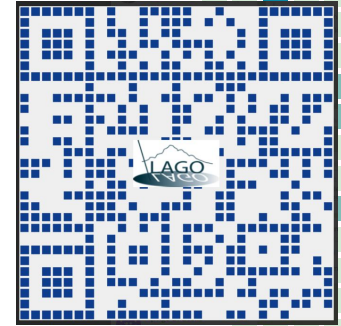


Galáctico

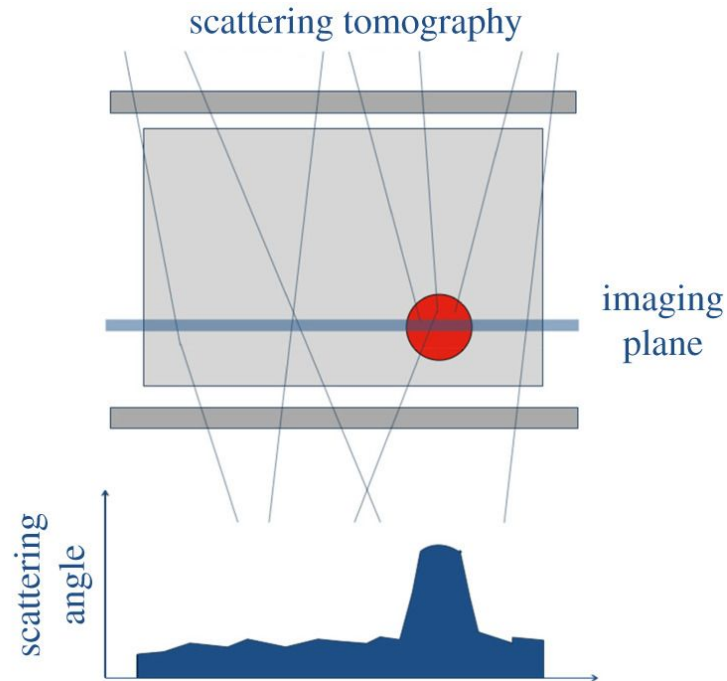
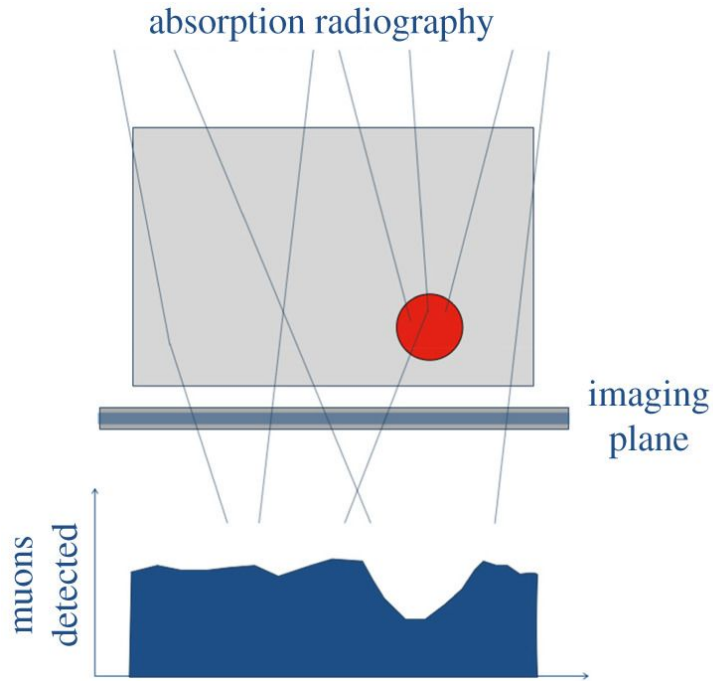
# Flujo de rayos cósmicos



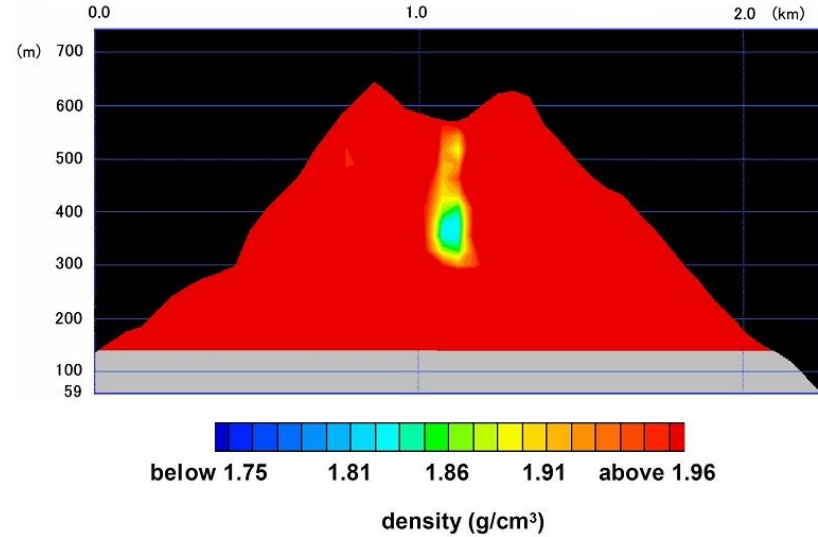
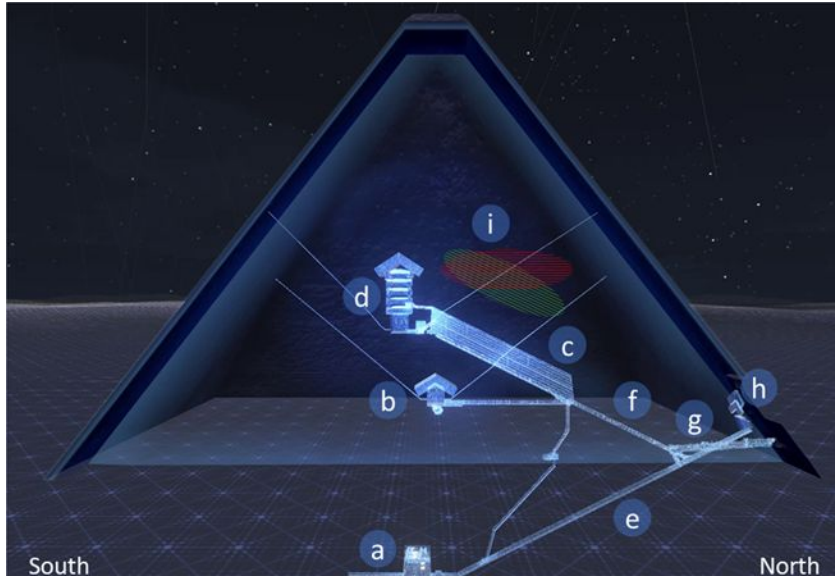
# Flujo de rayos cósmicos (ARTI)



# Muografia



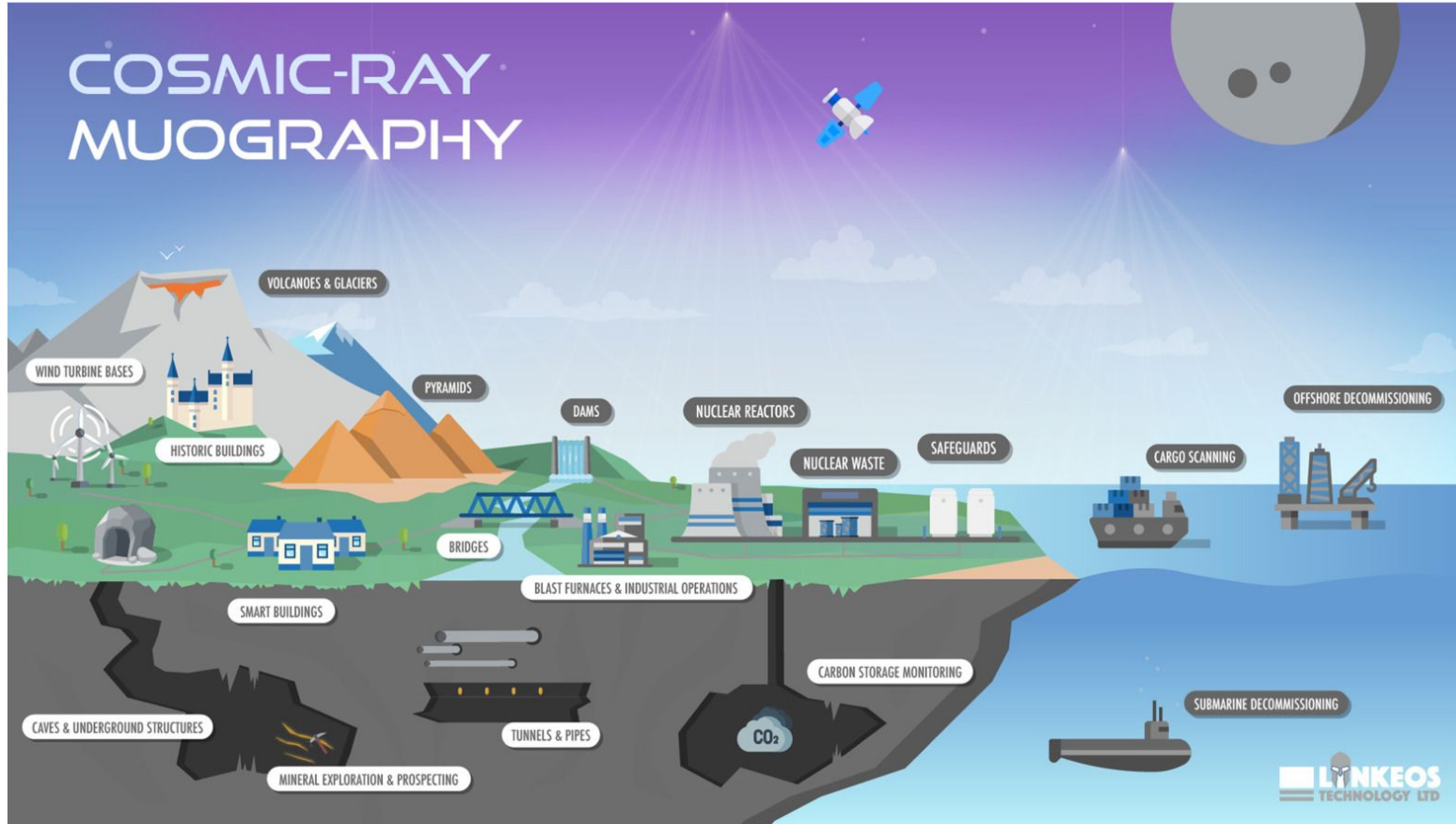
# Muografia



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>



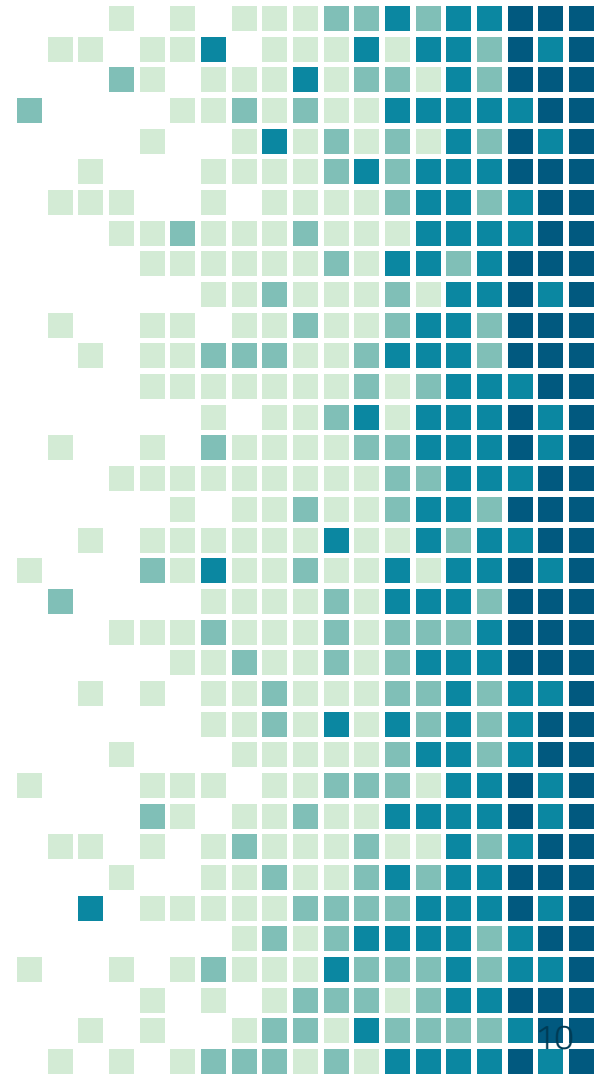
# Muografia



2.

# Volcán Cerro Machín

Cajamarca, Tolima - Colombia





# Volcán Cerro Machín



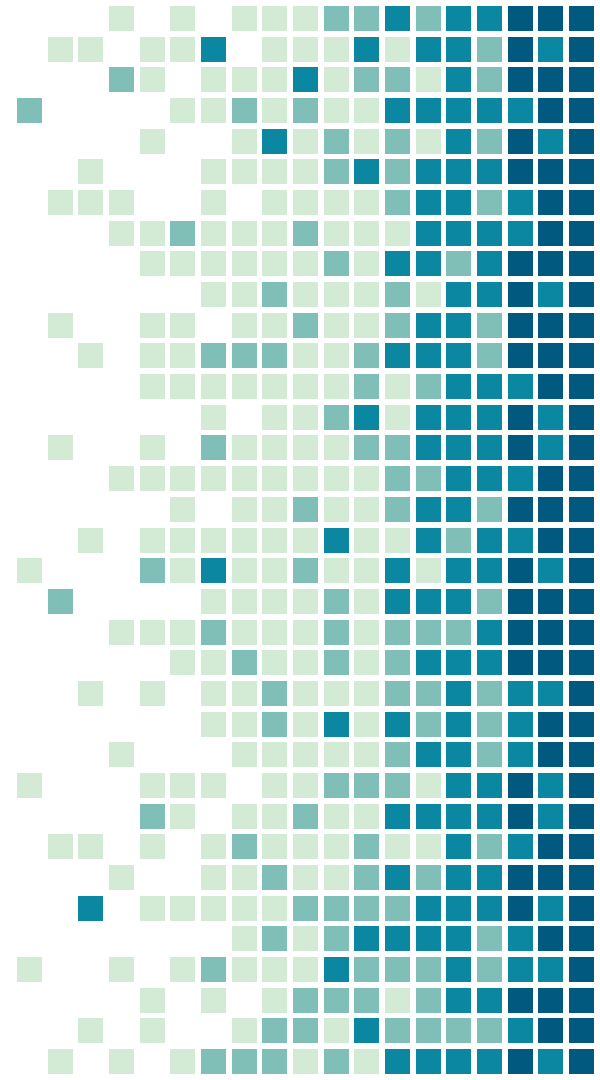


MuTe Project

3.

MuTe2.0

Muon Telescope

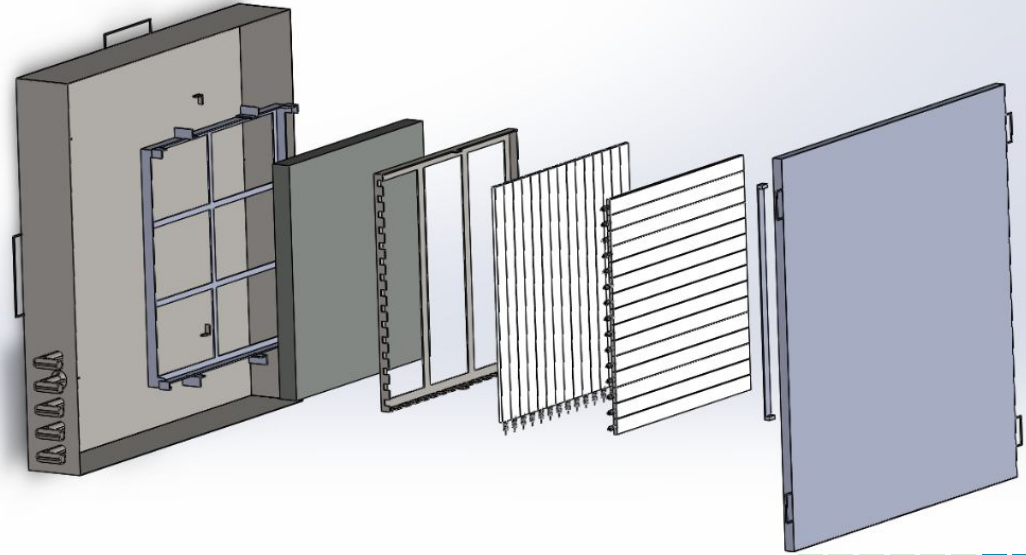
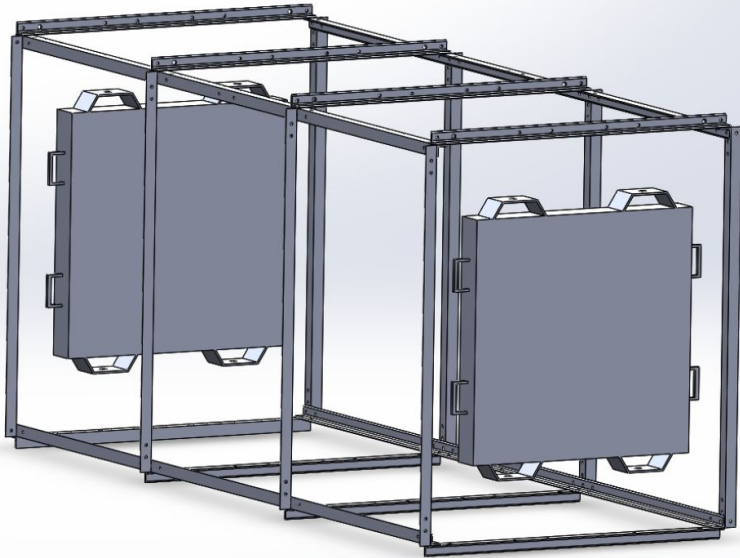


# MuTe 2.0, Muon Telescope

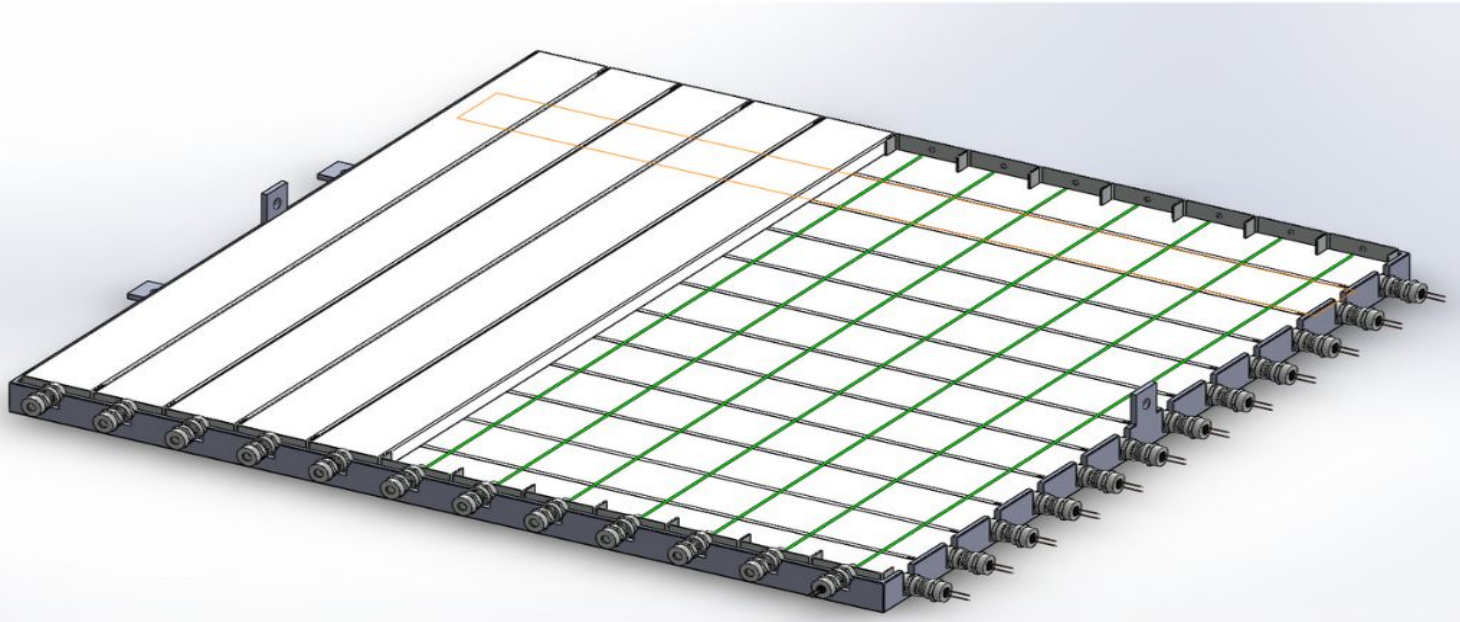
- Dos paneles de barras centelladoras
- Cada plano contiene 15 barras
- Cada panel tiene 225 pixeles
- La barras tiene 60 cm x 4 cm x 1 cm
- Usa SiPM al final de cada barra para recolectar la señal
- Blindaje usando 3 cm de Pb



# Diseño Mecánico

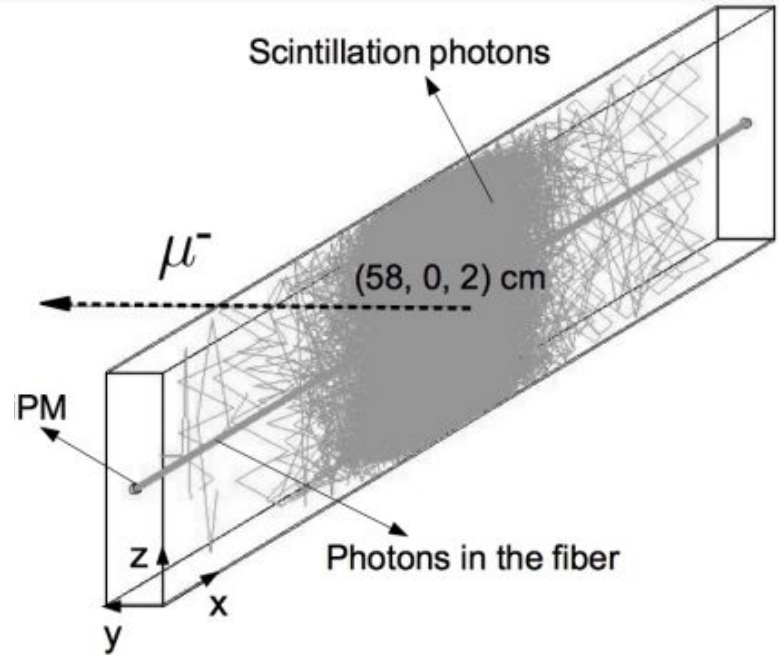
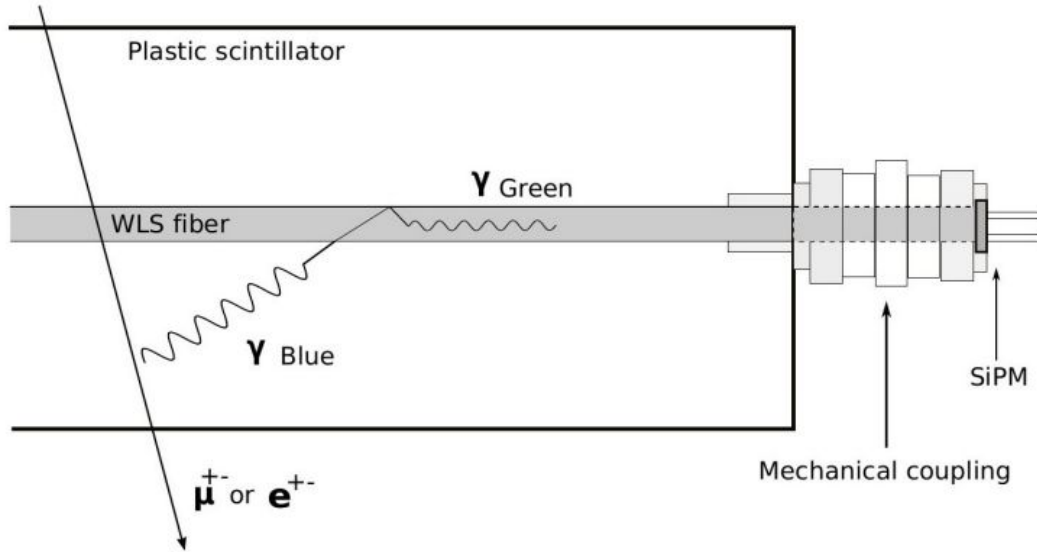


# Panel centellador

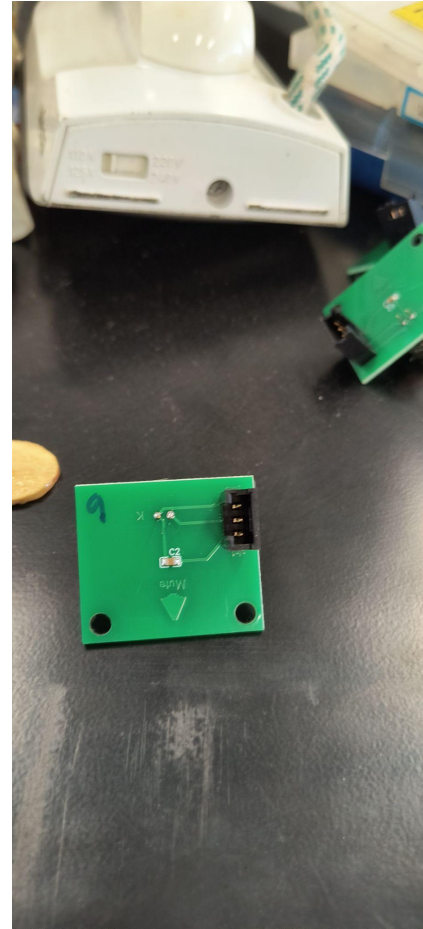
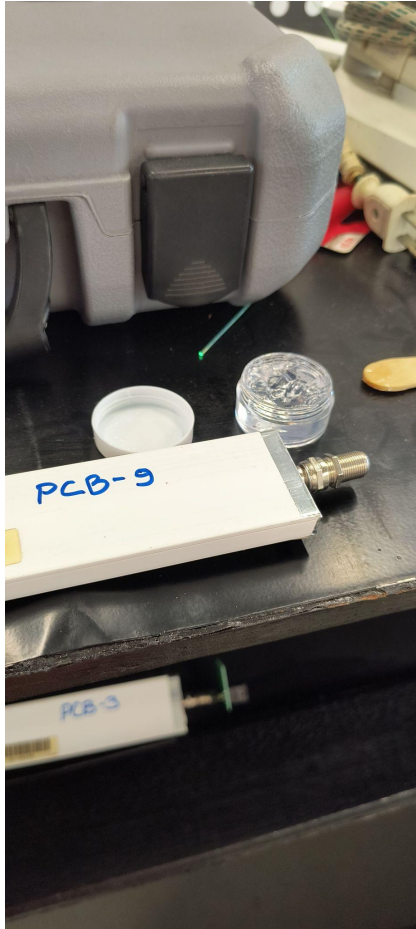




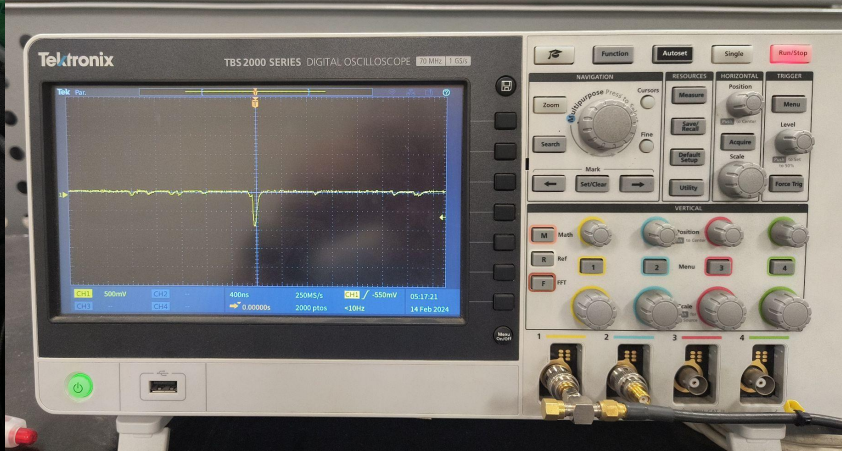
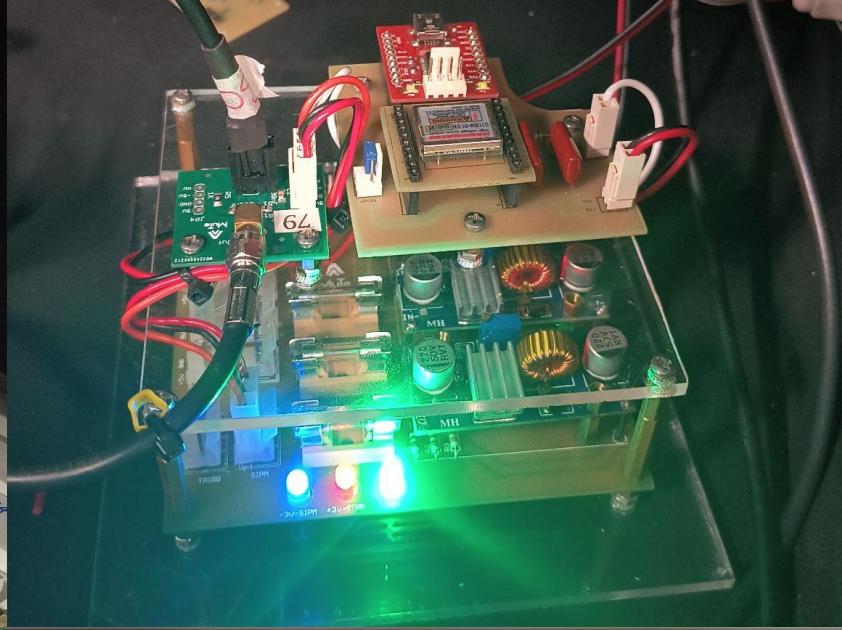
# Barras centelladoras



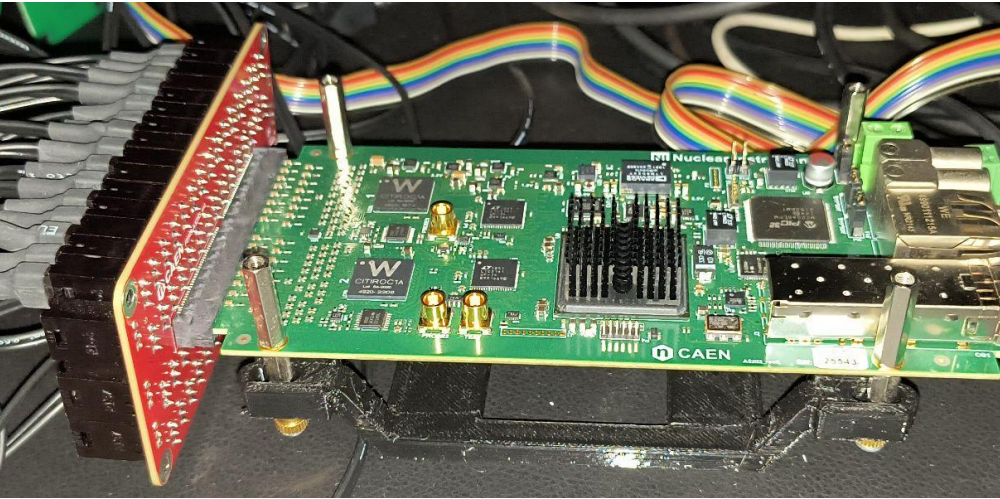
# Barra-Cable-PCB



# Sistema barra-SiPM -Fibra



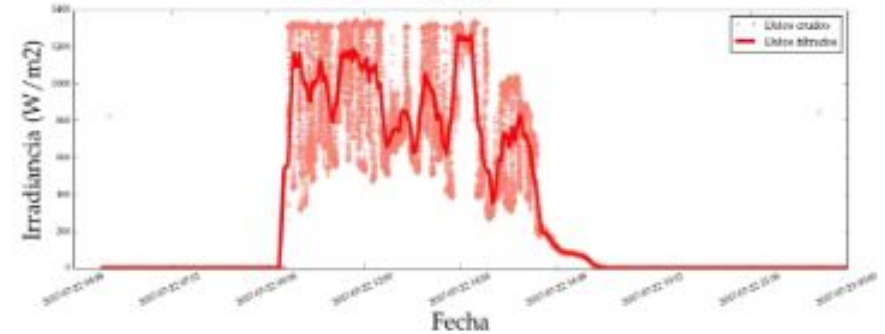
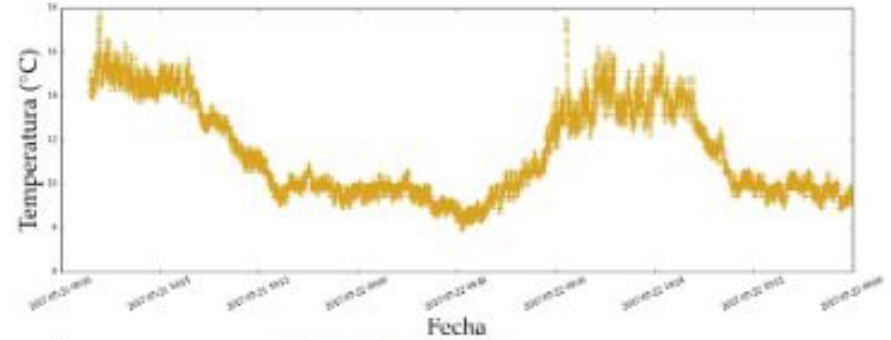
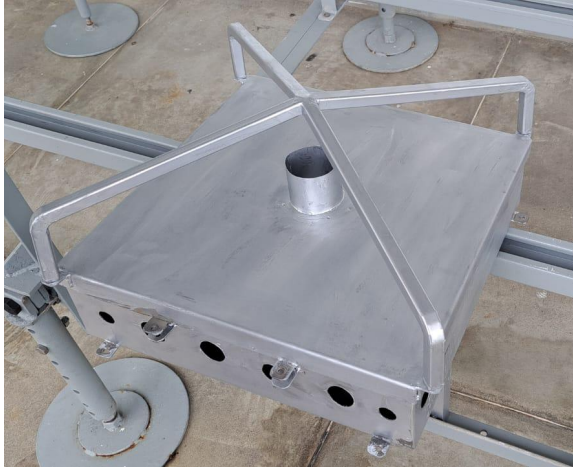
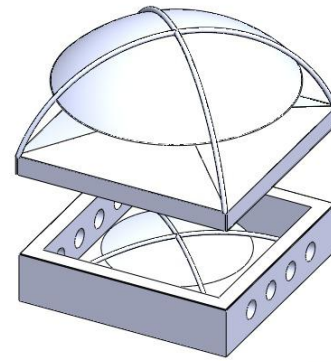
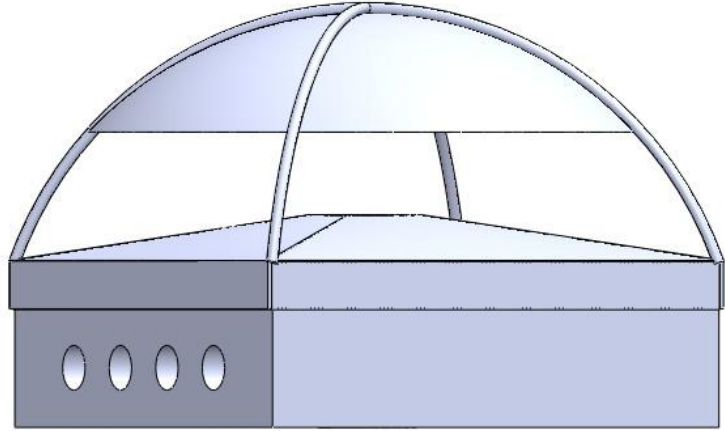
# Sistema de adquisición



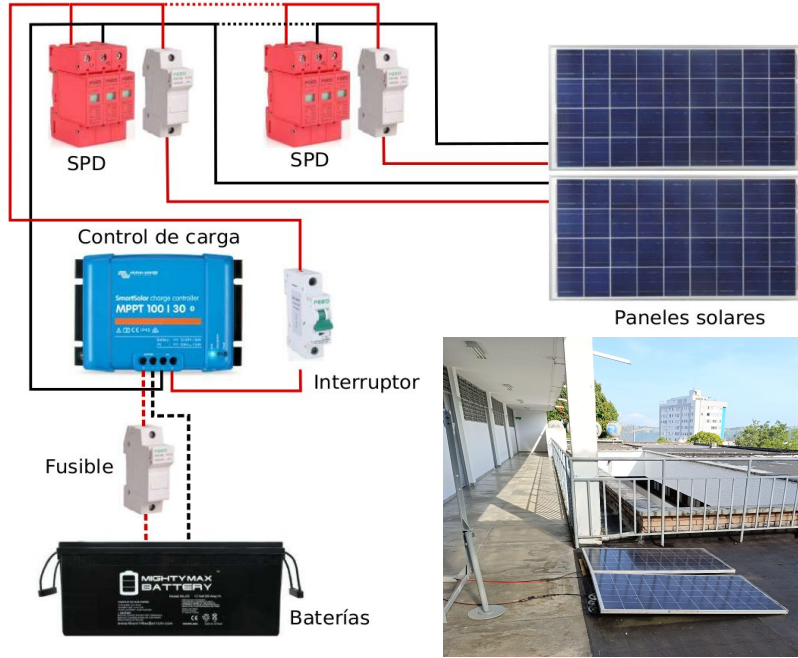
CAEN FERS-5200 DAQ, 64 Ch: convertidores AD, Logical Trigger, sincronización, memoria local e interfaz de lectura.



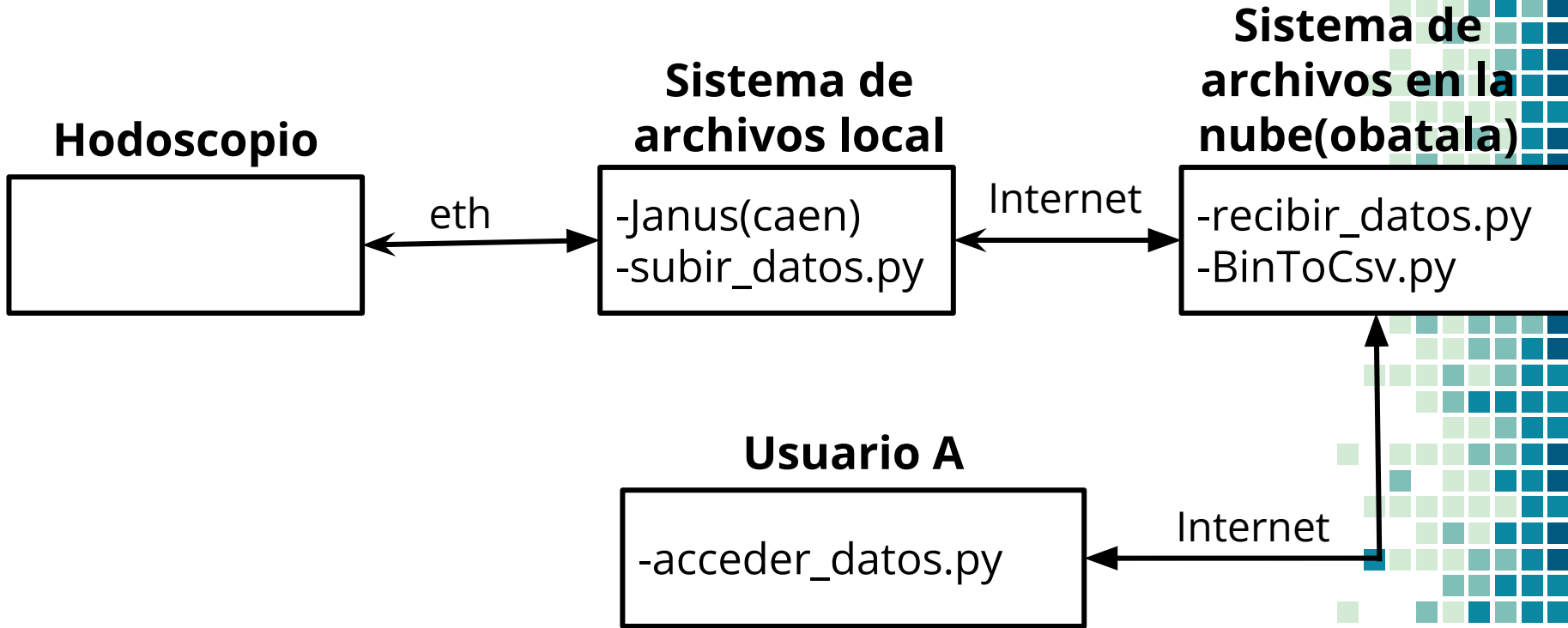
# Caja térmica para la electrónica



# Sistema Fotovoltaico de respaldo



# Sistema de gestión de datos

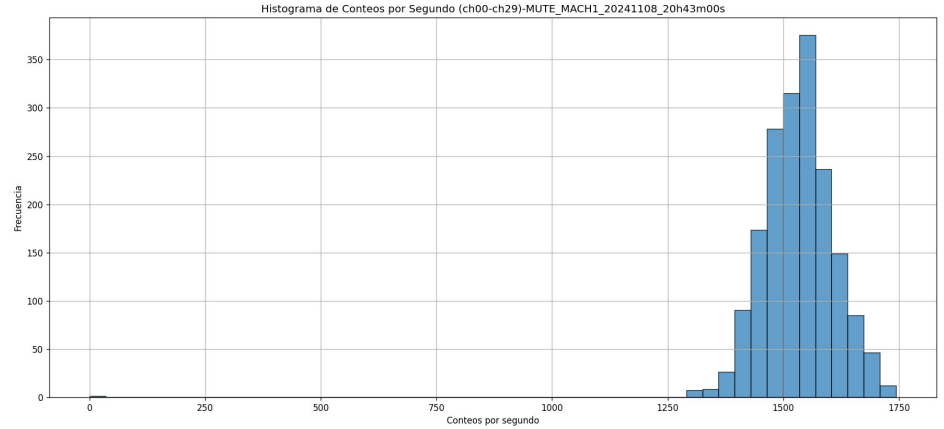
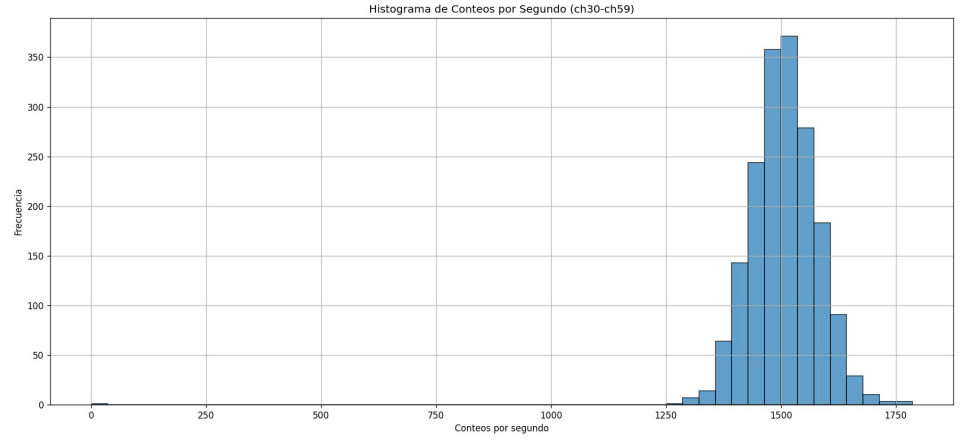
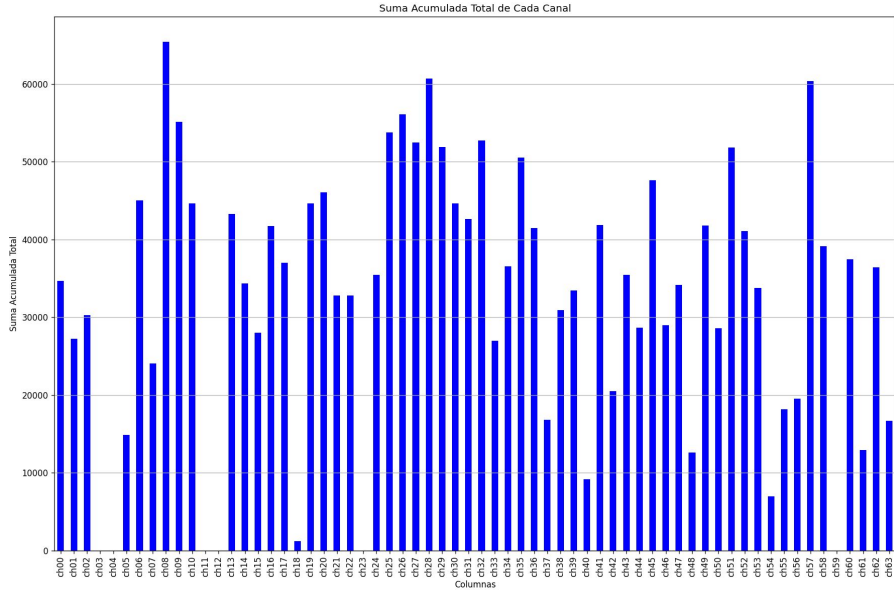


# MuTe 2.0



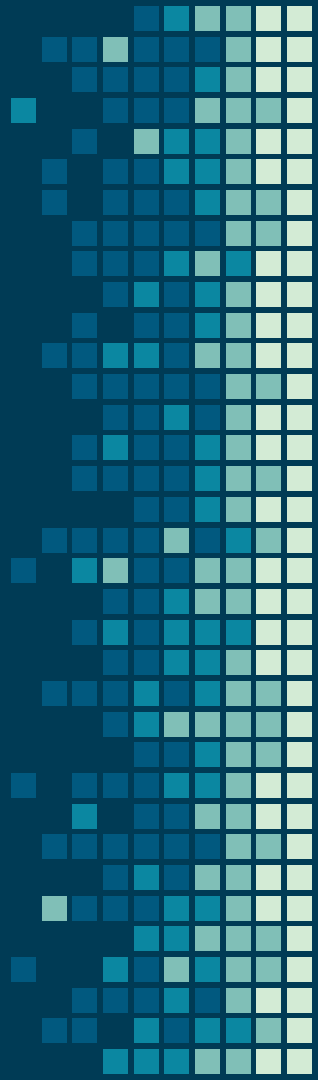


# Calibración de los paneles

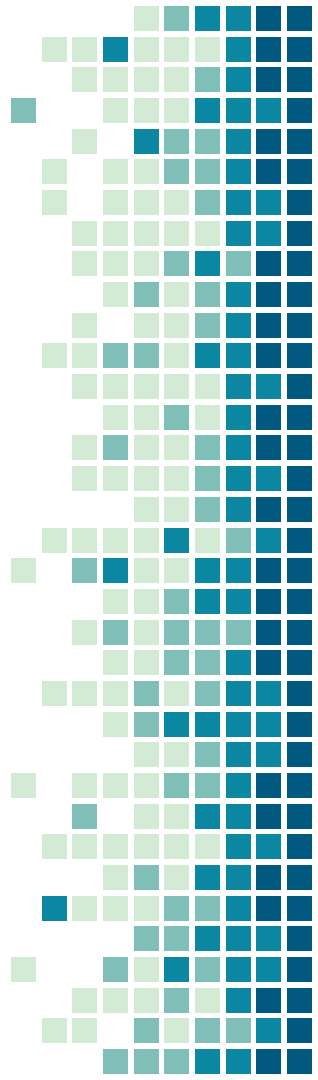
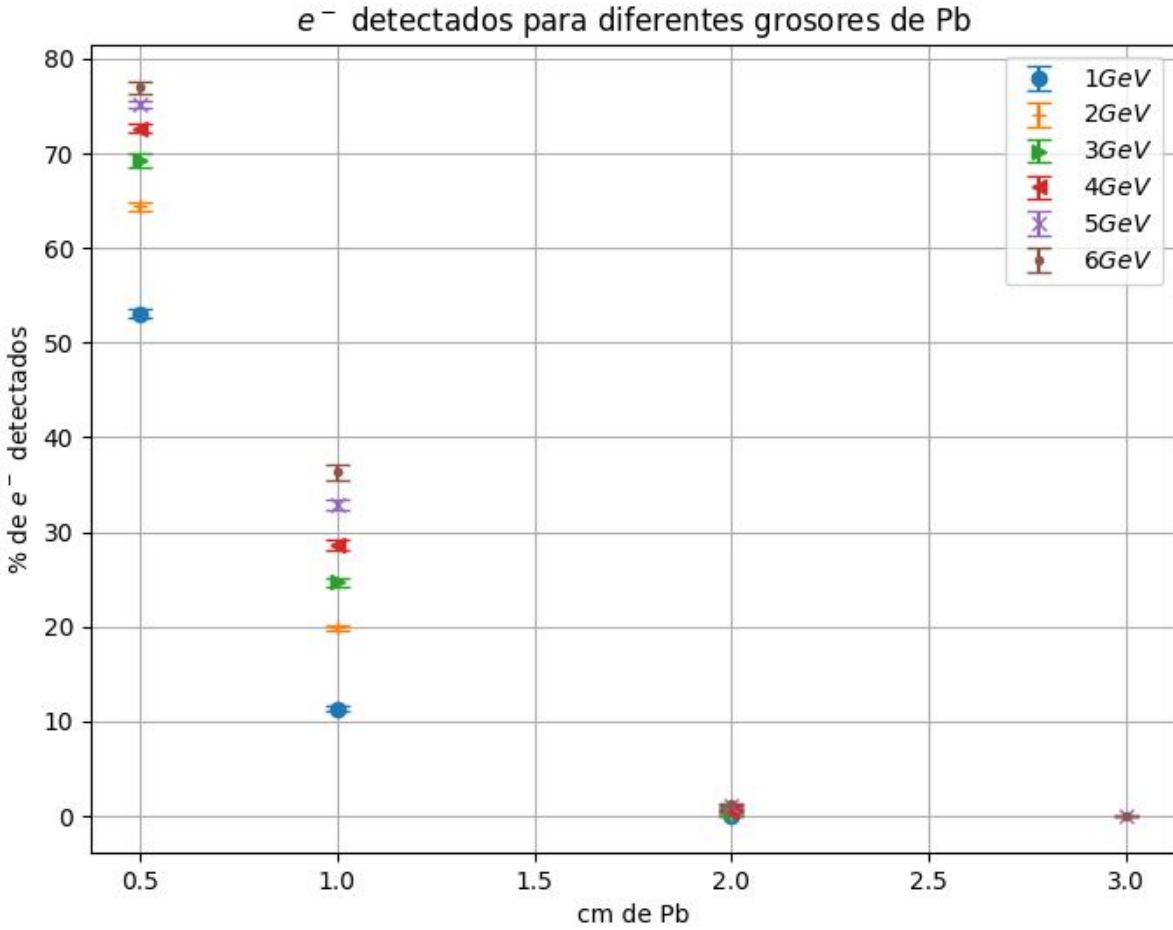




Gracias



# Atenuación Pb: Simulación



# ROADMAP

Blue is the colour of the clear sky and the deep sea

1

Red is the colour of danger and courage

3

Black is the color of ebony and of outer space

5

Yellow is the color of gold, butter and ripe lemons

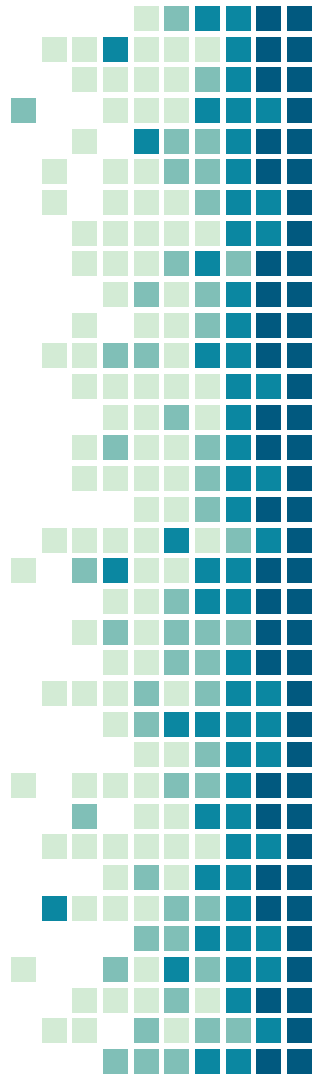
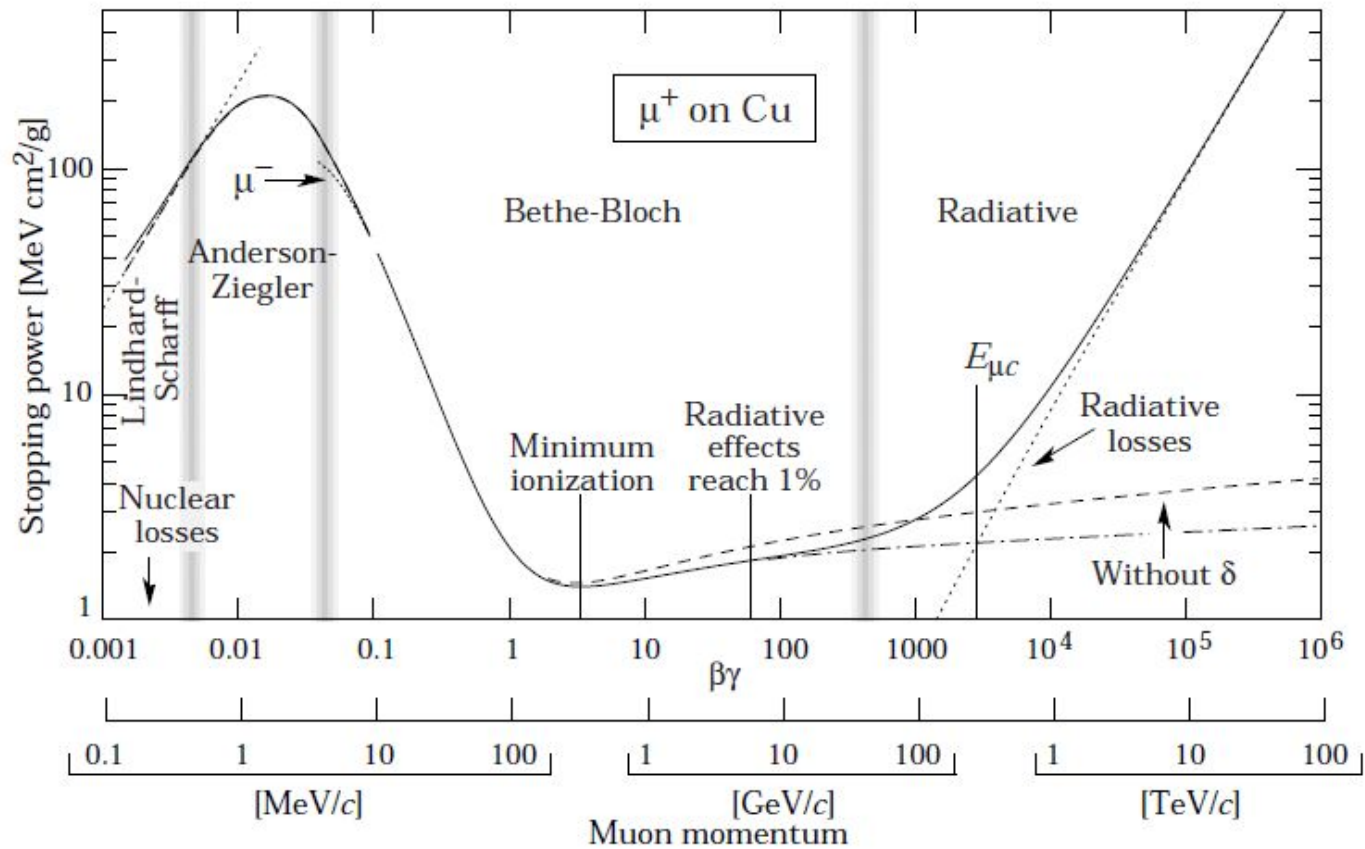
2

White is the color of milk and fresh snow

4

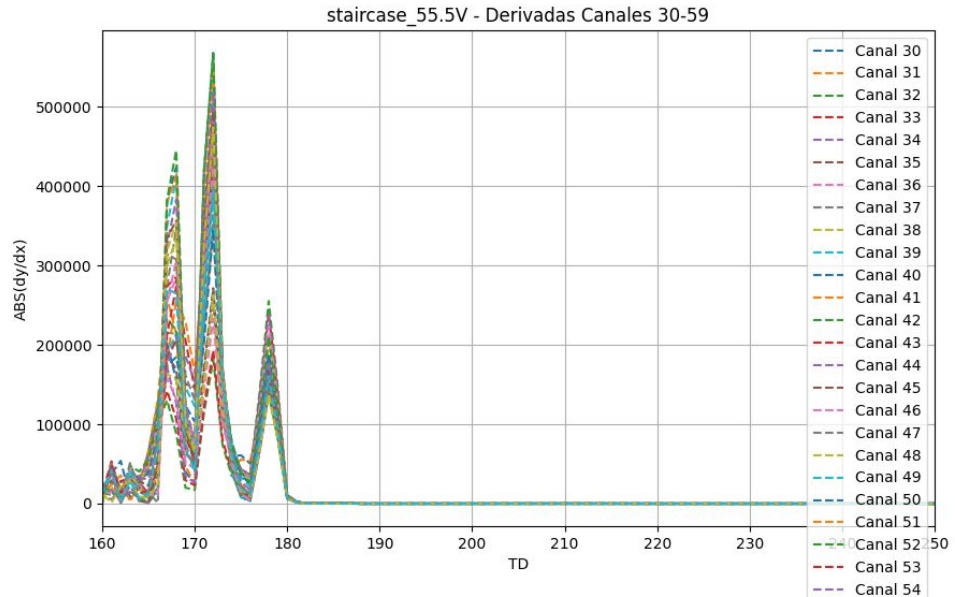
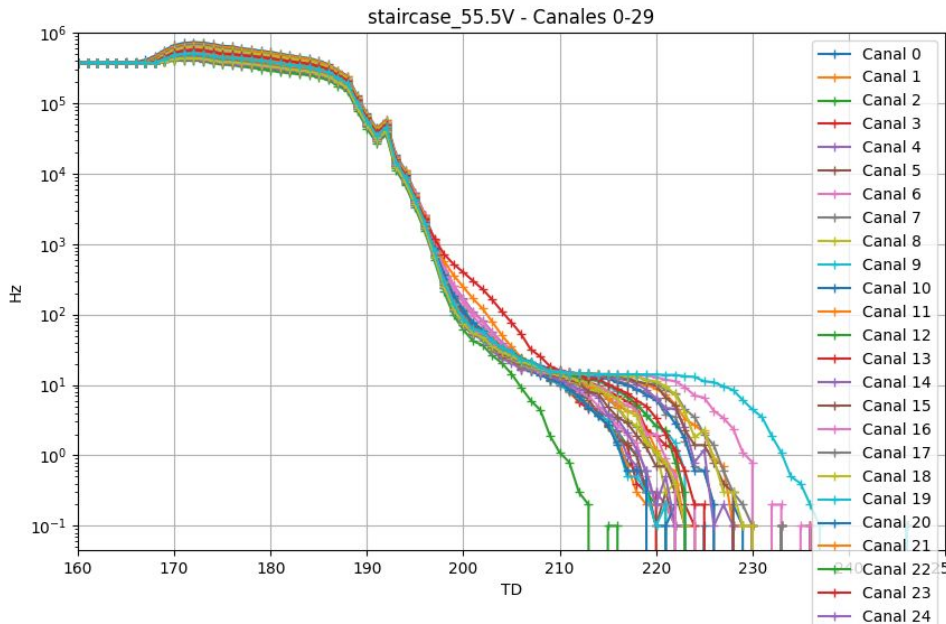
Blue is the colour of the clear sky and the deep sea

6

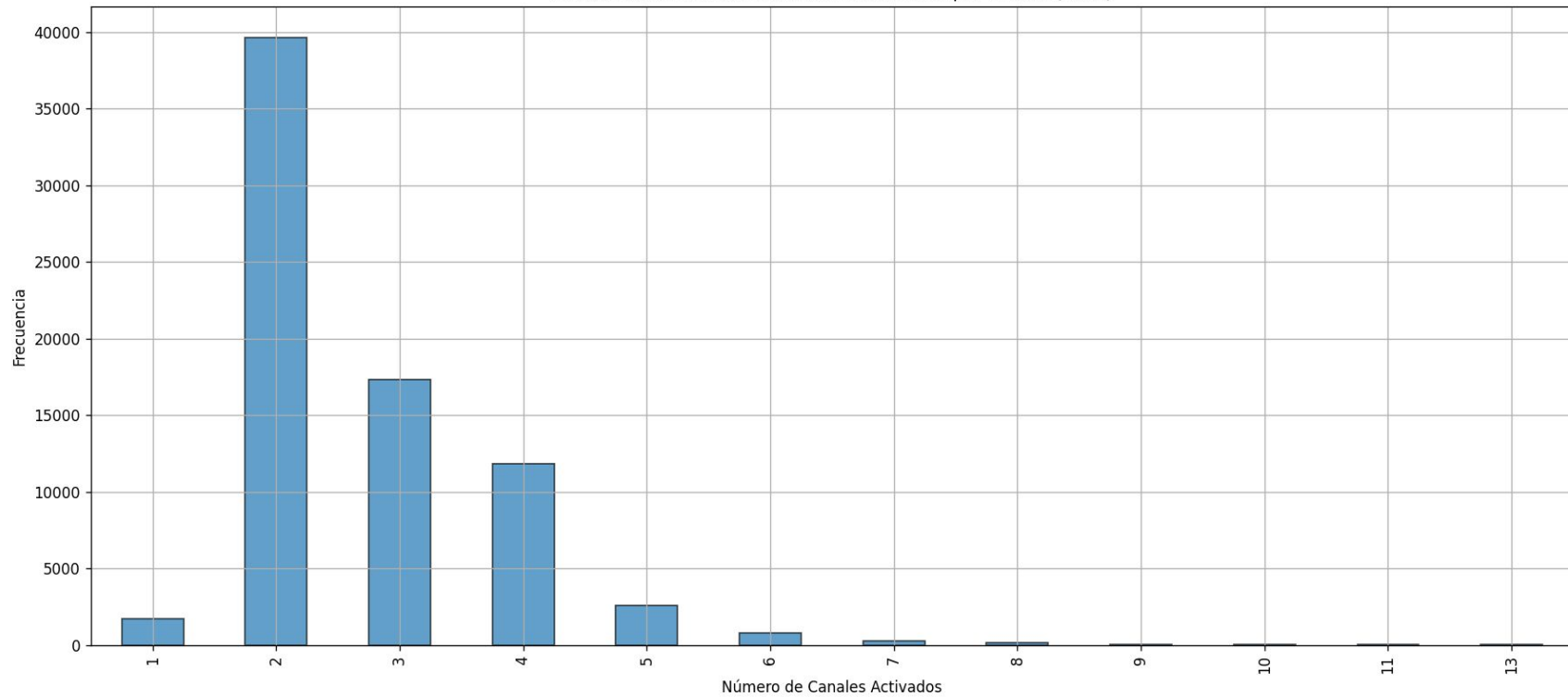


# Calibración y Análisis de mediciones

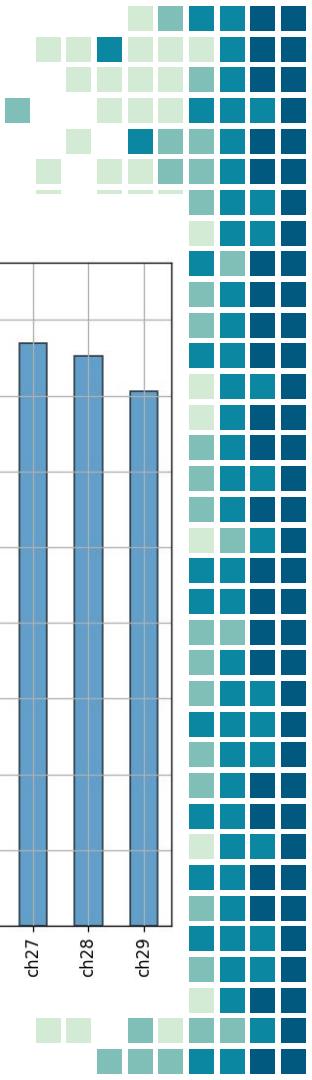
## Dark Count Rate



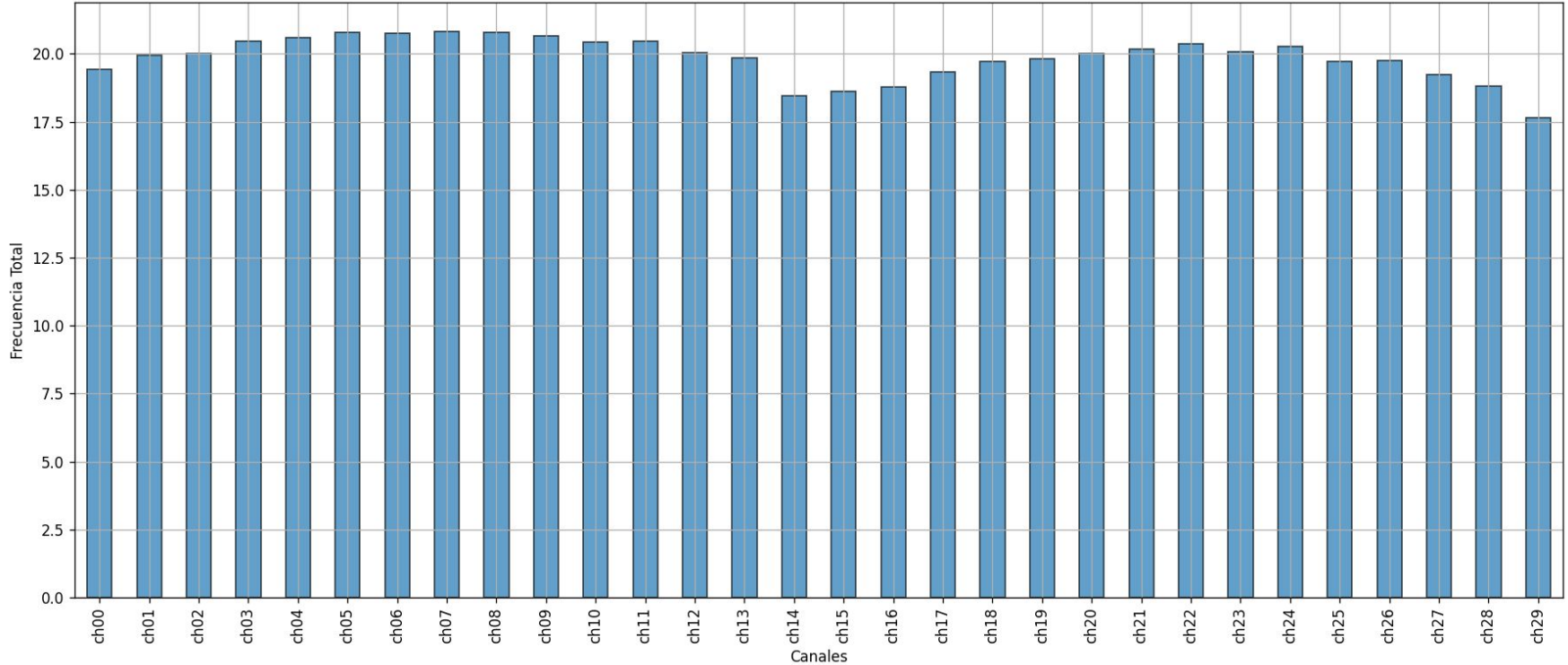
Frecuencia de Número de Canales Activados por Evento (ch09)



# Simulación sin Pb, Conteo total por segundo

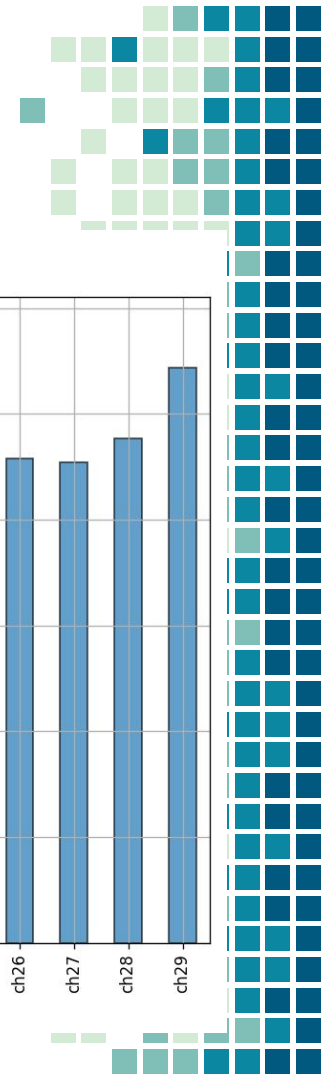


Frecuencia Total de Activación para Cada Canal  
Media: 19.86, STD: 0.79

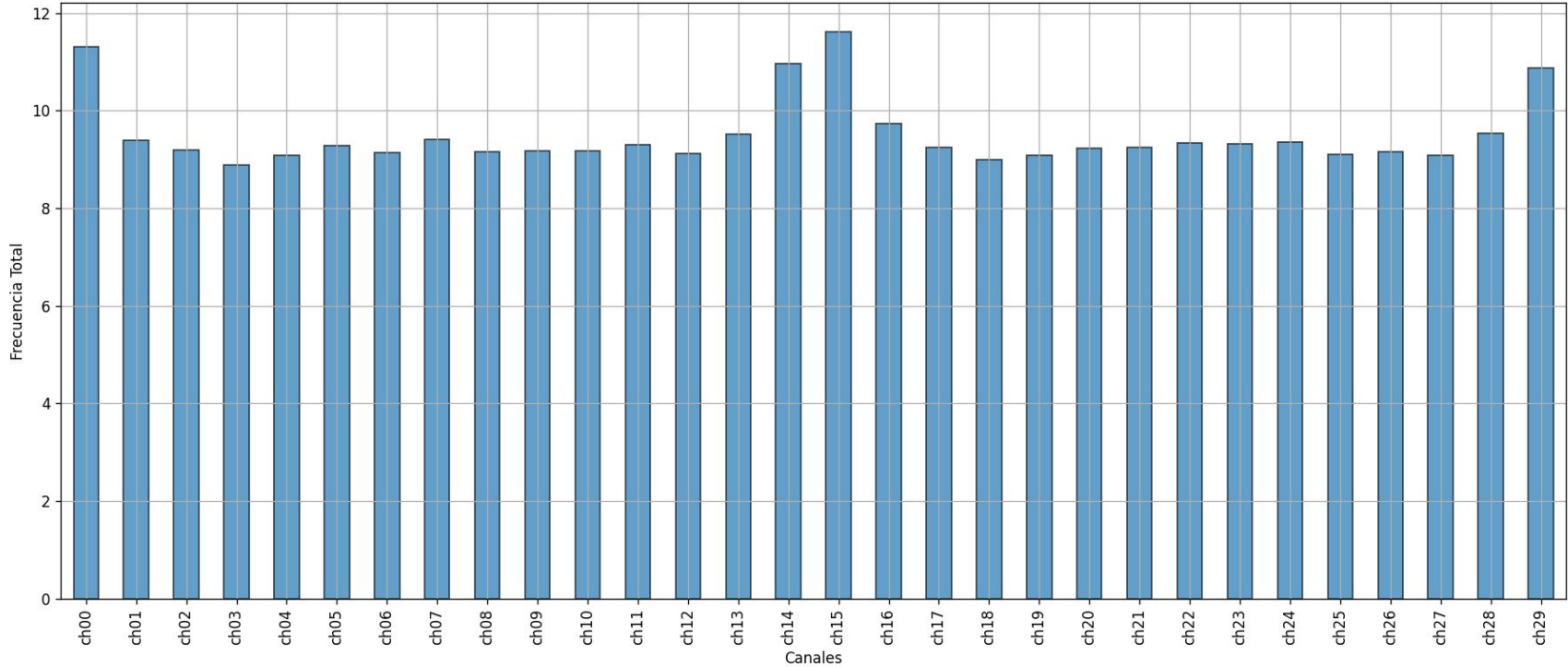




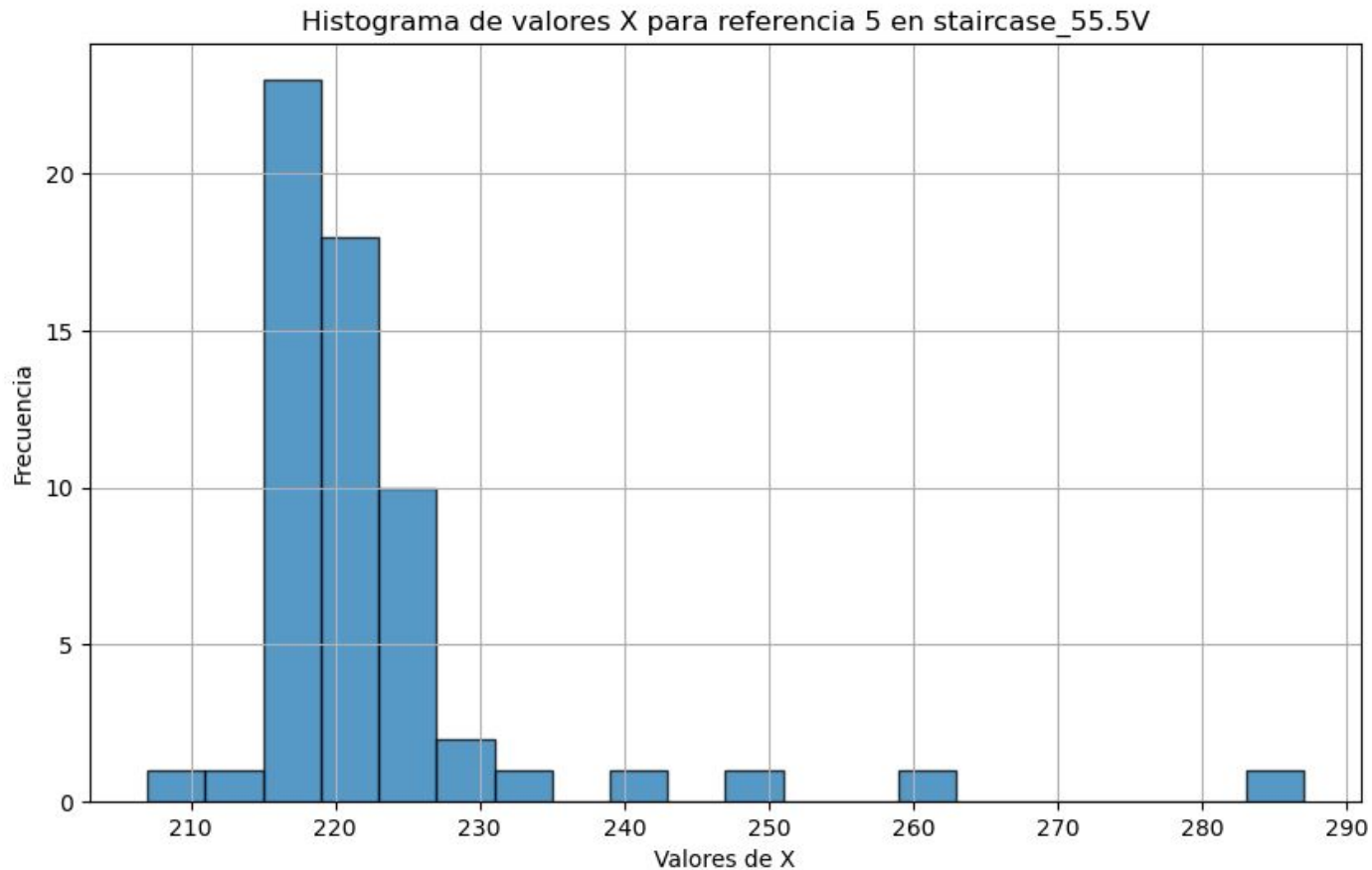
# Con Pb, Conteo total por segundo



Frecuencia Total de Activación para Cada Canal  
Media: 9.50, STD: 0.70

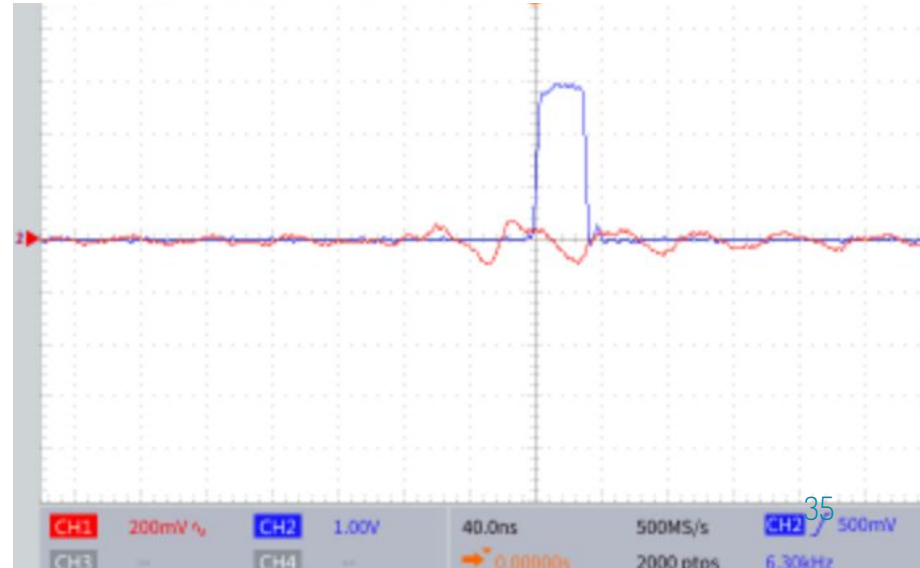
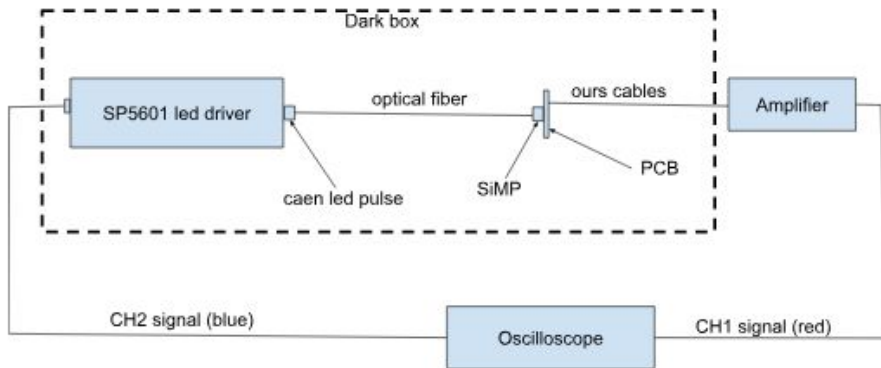


# Valor de TD

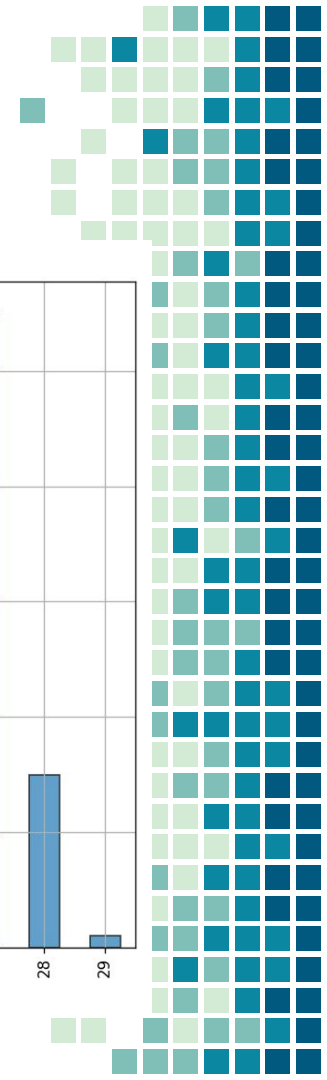


# Pruebas internas a la FERS

Experimental set-up scheme



# Datos Exp: # de canales activados por evento



Frecuencia de Número de Canales Activados por Evento (ch09)

