

# DDAp - ITeDA+KIT

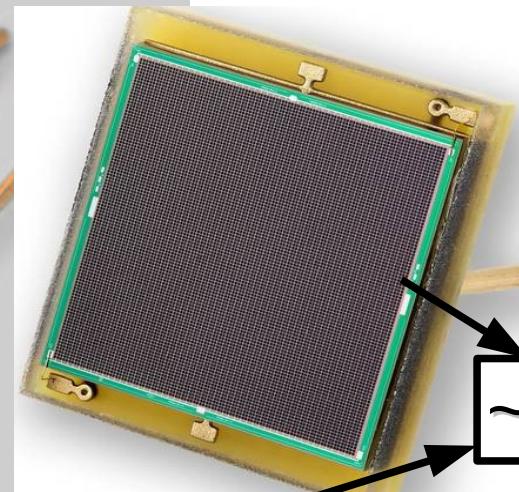
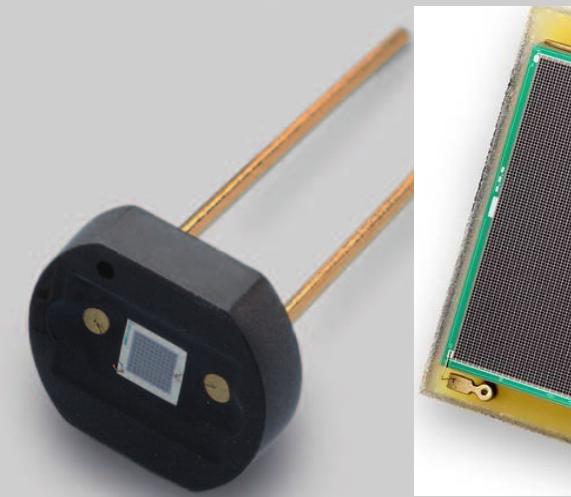
## Física de Astropartículas - 2017

- **Unidad** 03 – Técnicas de detección
- **Clase** U03-b
- **Cont** Detectores
- **Cátedra** Asorey
- **Web** <https://github.com/asoreyh/astroparticulas>



Otras Técnicas:  
Centelladores  
Resistive Plate Chambers (RPC)  
Multi-wire proportional chambers (MWPC)

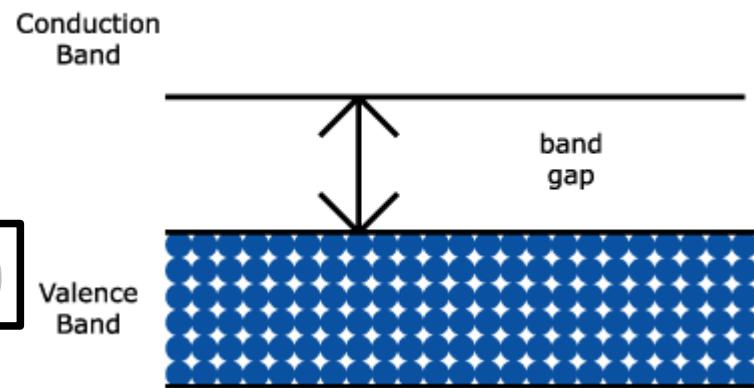
# Silicon PhotoMultiplier (SiPM)



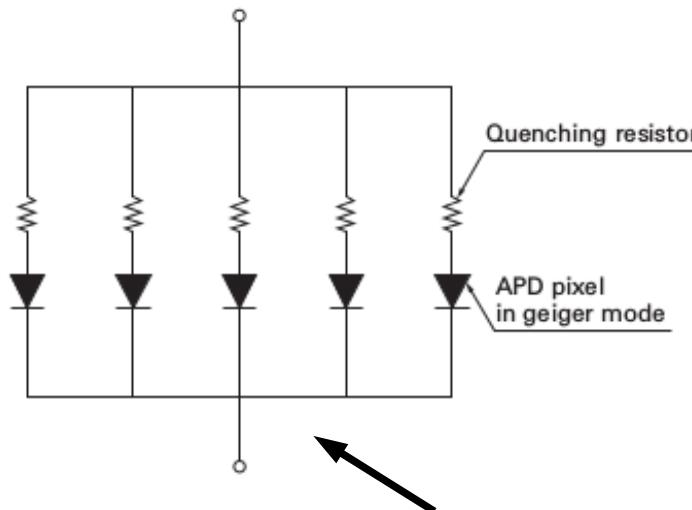
- Muchas celdas

(50 $\mu$ m)

- Semiconductor

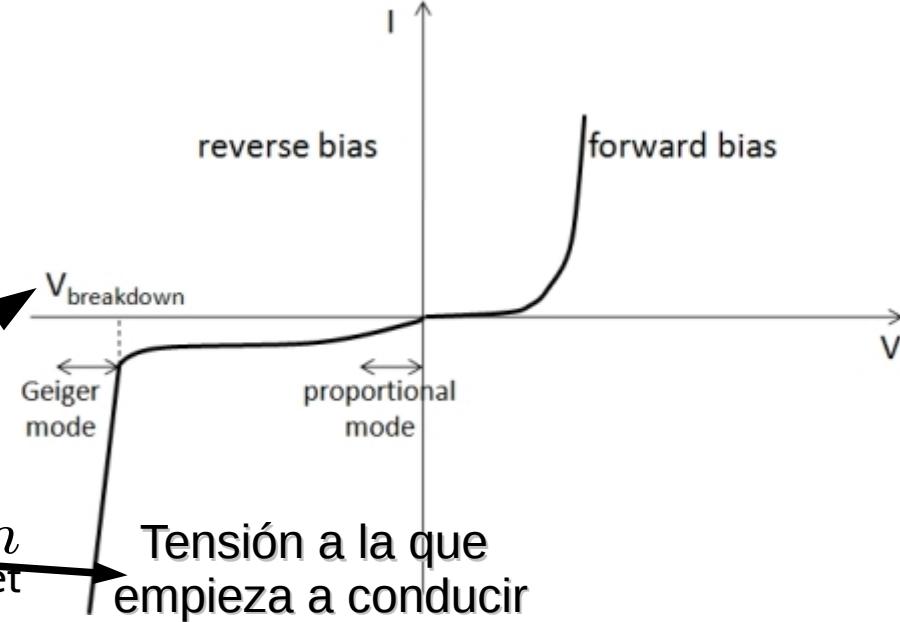


- Diodo polarizado en inversa



$V_{overvoltage} \equiv V_{bias} - V_{breakdown}$   
Tensión aplicada al SiPM

Asorey - AP - UO3 Det

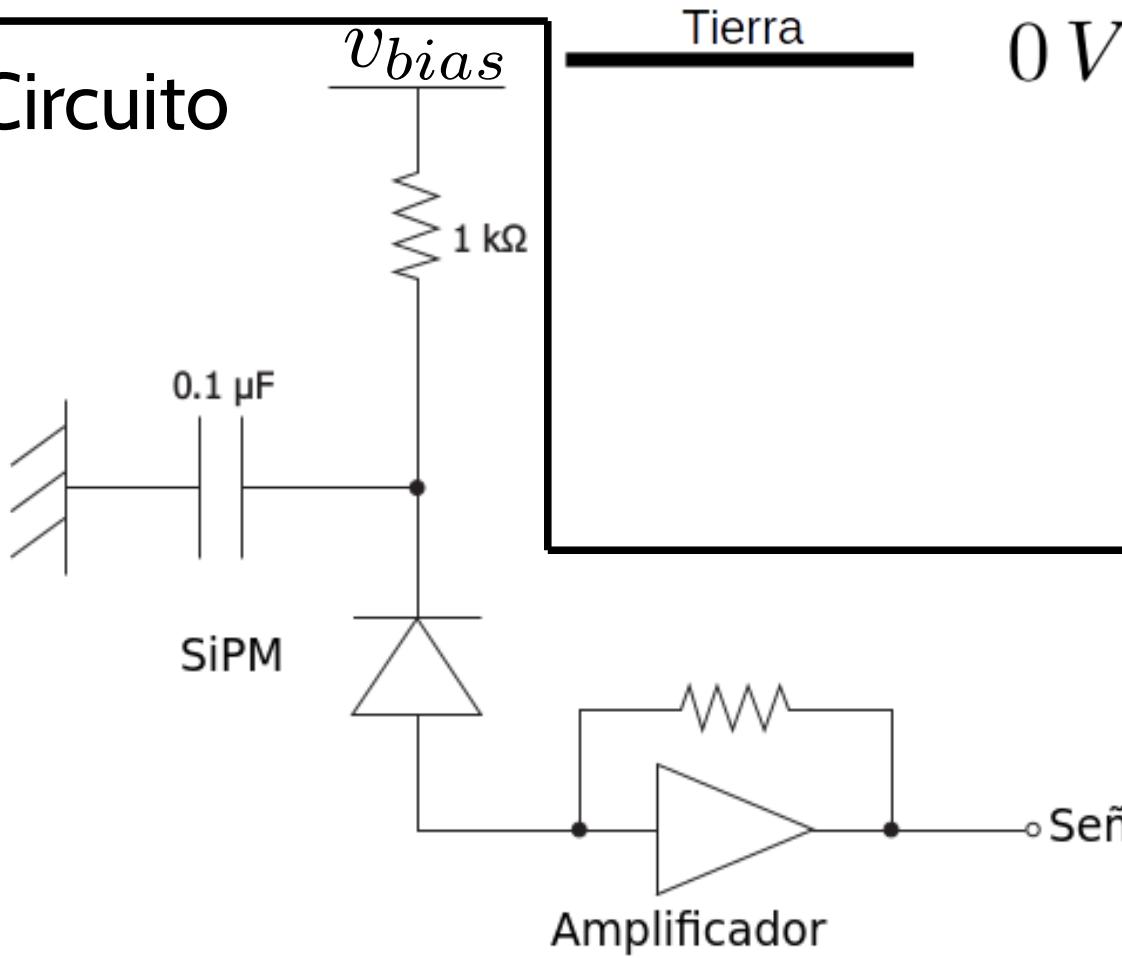


# Electrónica

Aplicada  
Conduce

$$v_{bias} \sim 60 V \\ v_{bd} \sim 55 V \quad } v_{ov} \sim 5 V$$

Circuito

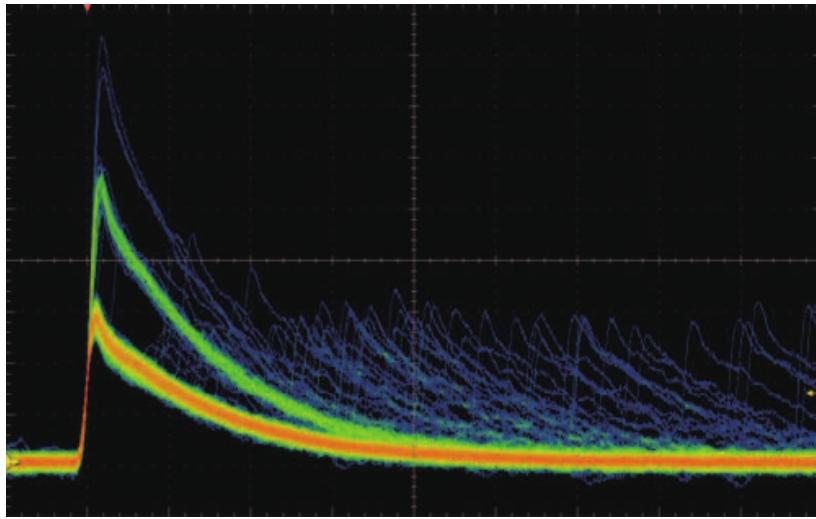


ctores



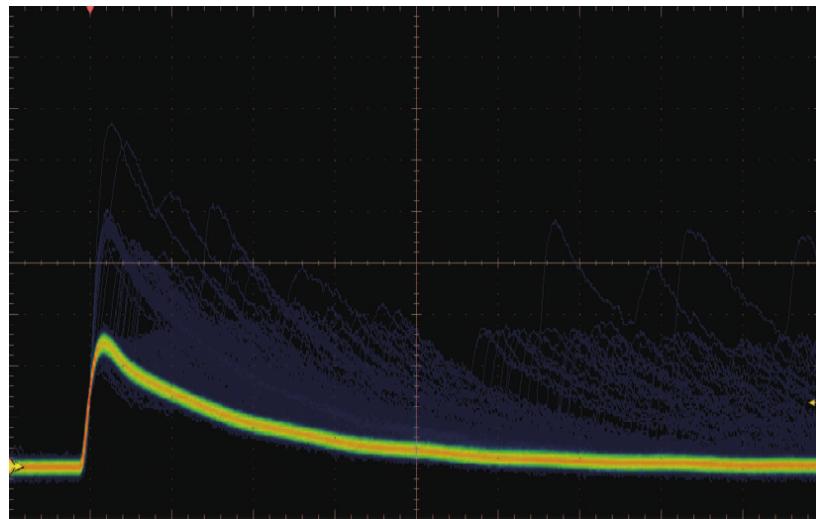
# Output: Pulsos

- S11



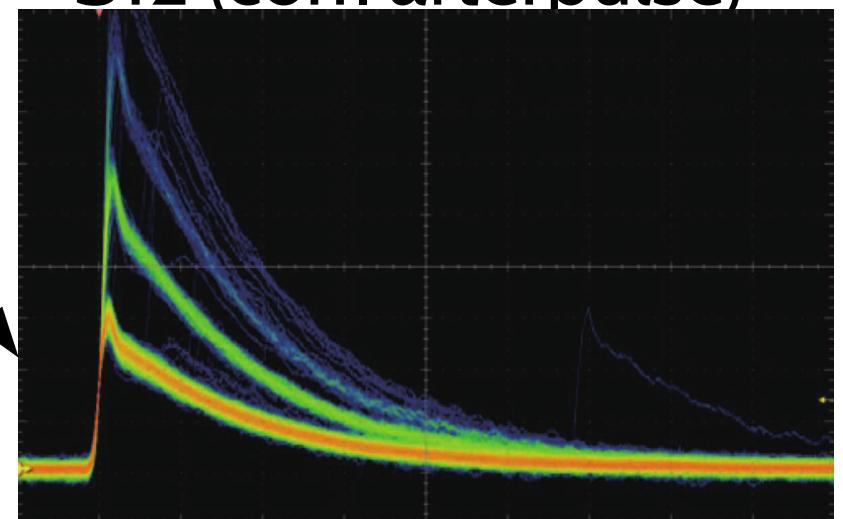
Datasheet

- S13 (corr. crosstalk)

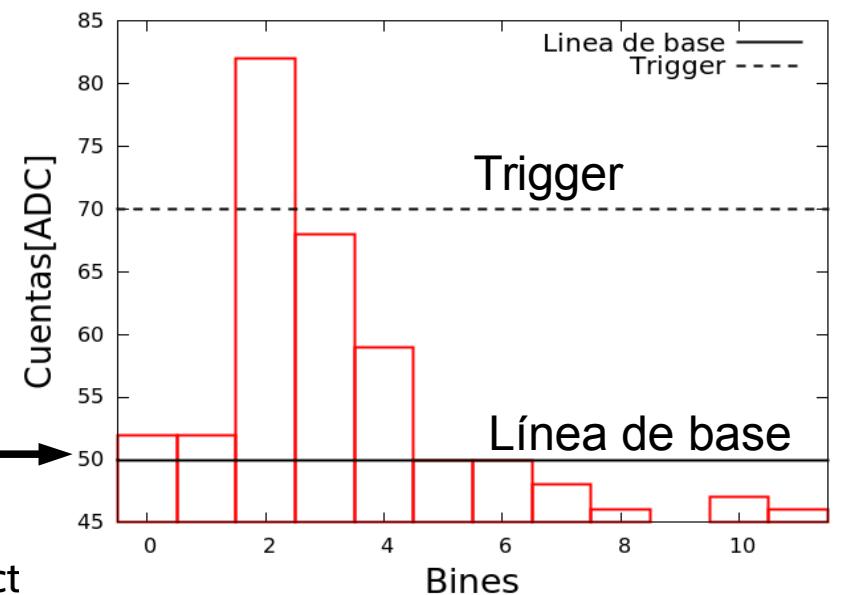


Datos

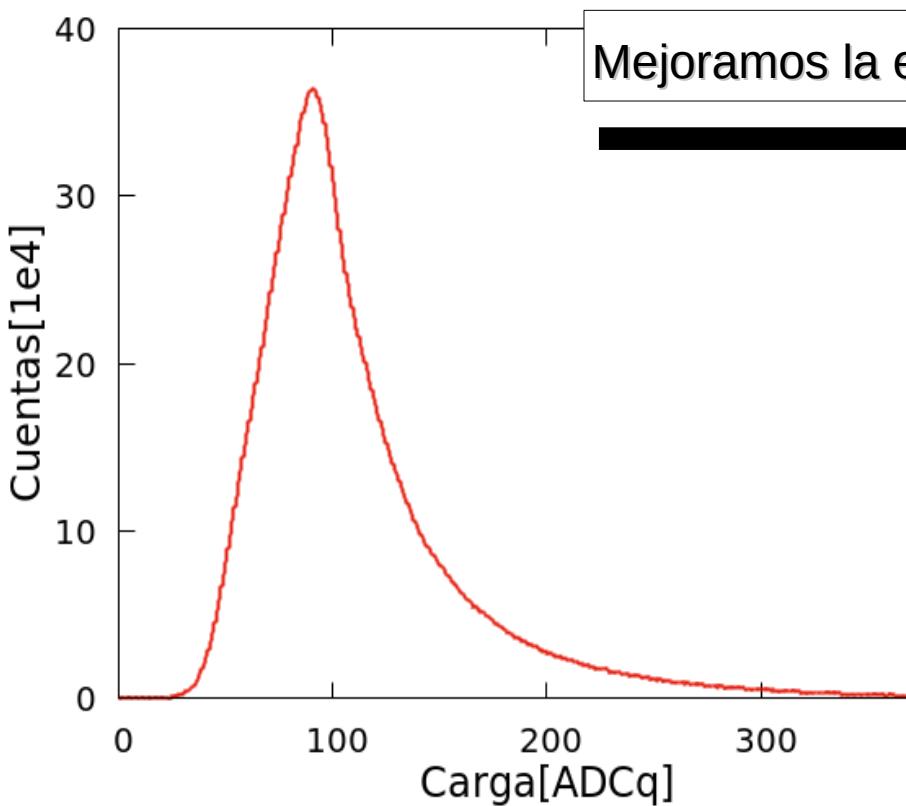
- S12 (corr. afterpulse)



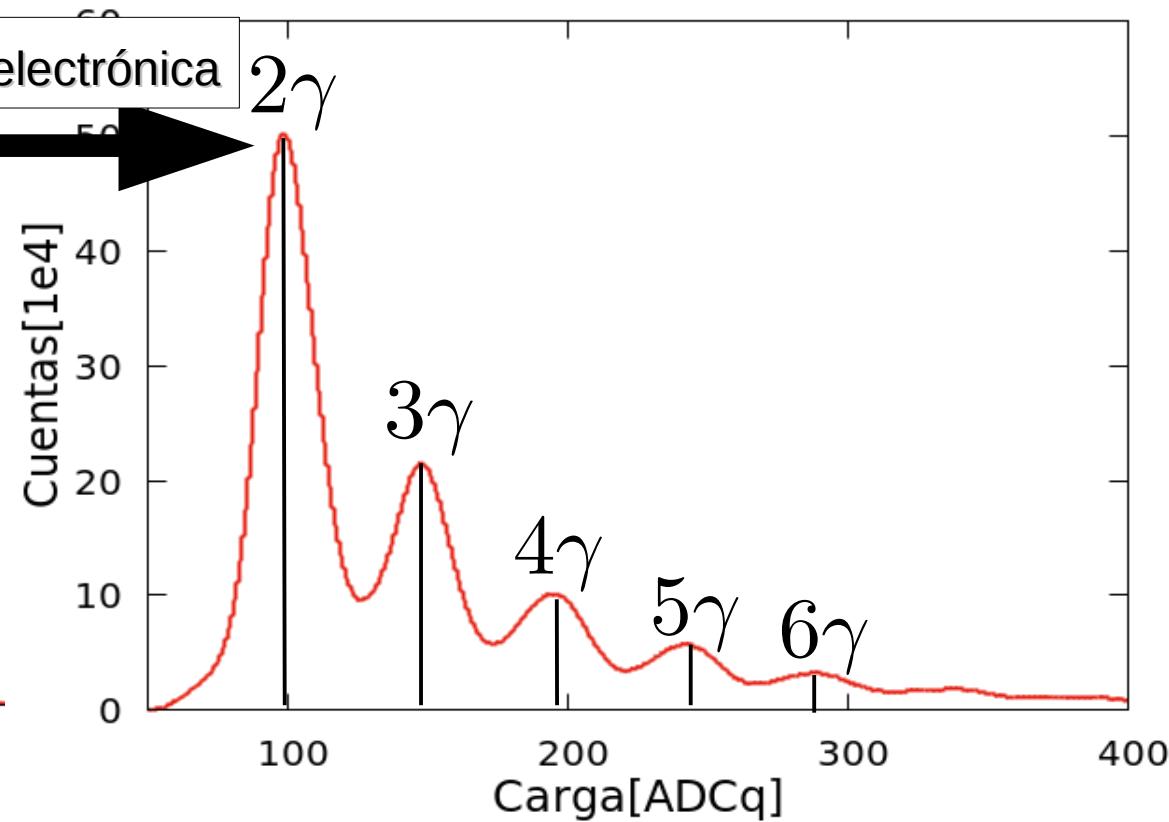
- Discretizado



# Histogramas de carga: Serie S12

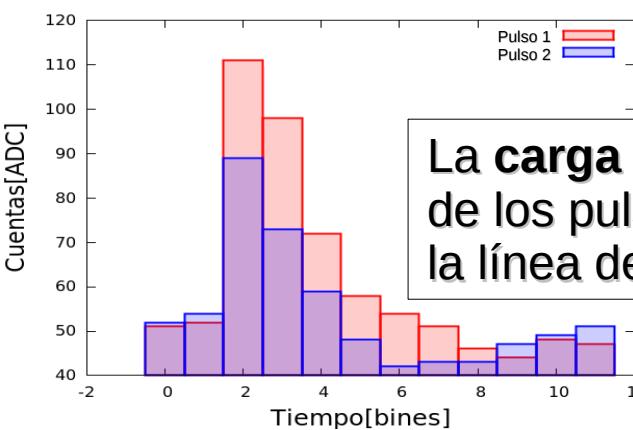


Mejoramos la electrónica



Cuentas[1e4]

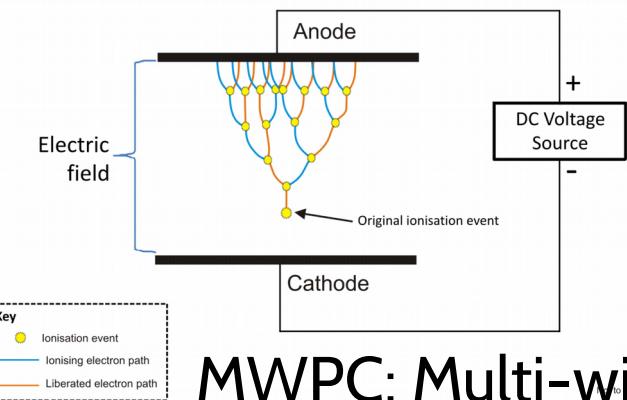
$2\gamma$



La **carga** es la integral  
de los pulsos menos  
la línea de base (50 ADC)

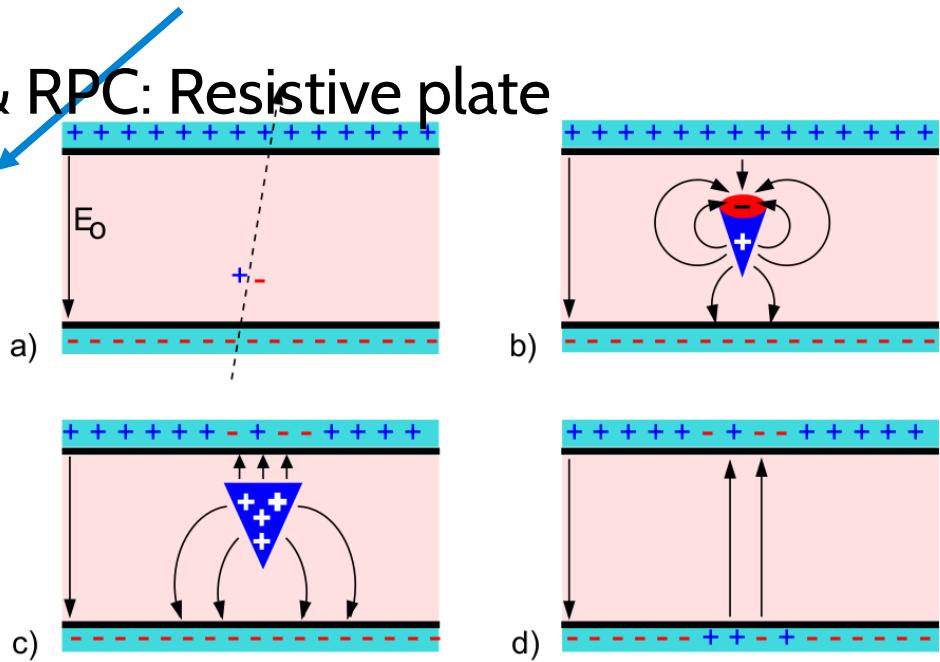
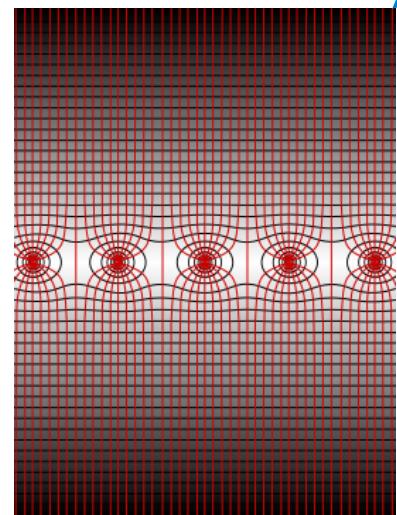
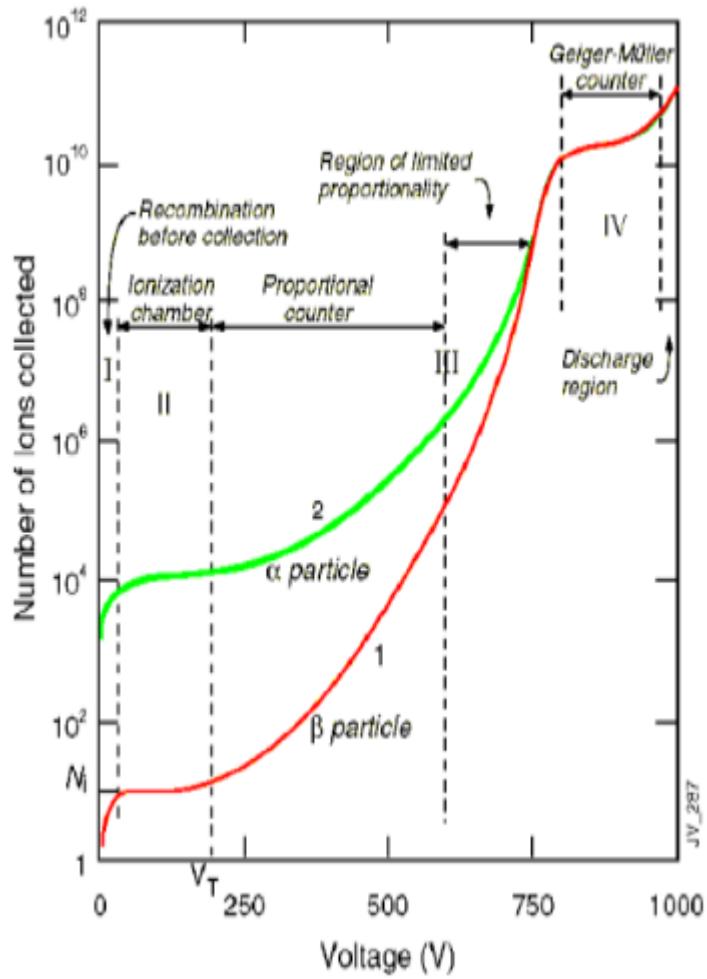
Y ahora podemos distinguir los **fotones**  
de forma individual!

# Visualisation of a Townsend Avalanche

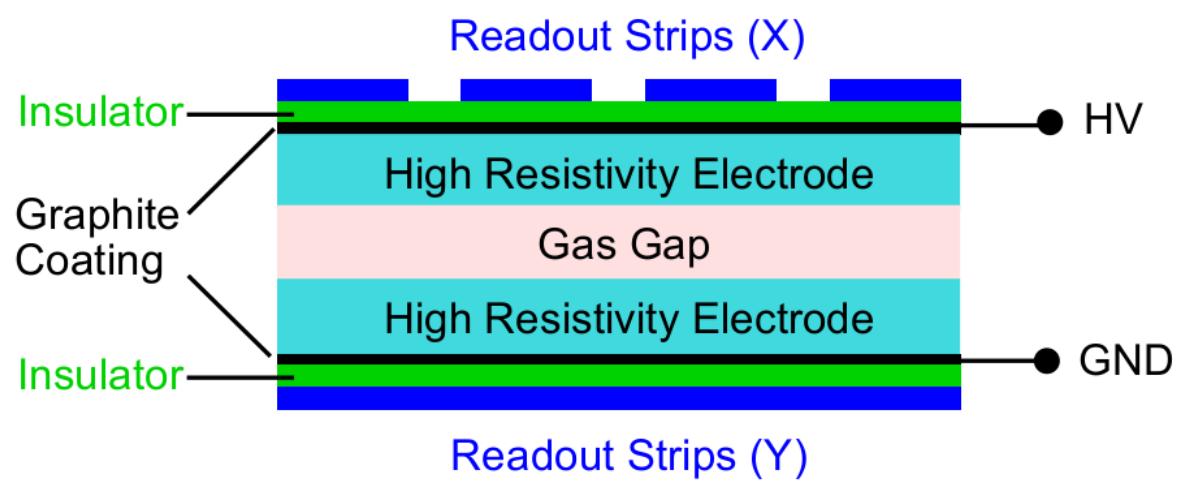


# Chambers Knoll cap. 5, 6 y 7

**MWPC: Multi-wire proportional & RPC: Resistive plate**

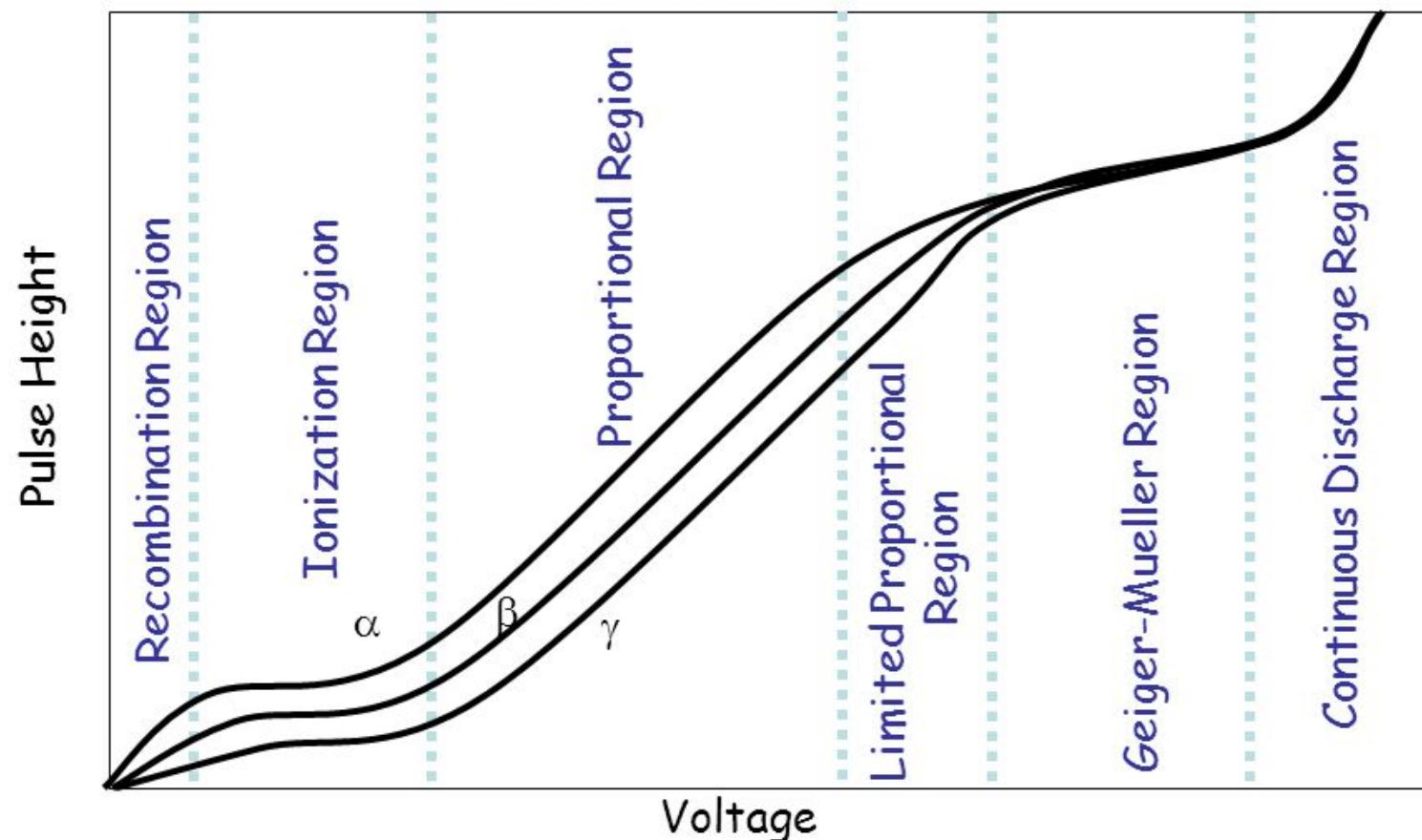


Asor



# Ionización, reonización, avalancha

## Operating Regions of Gas-Filled Detectors



# Centelladores plásticos Knoll cap. 8 y 10

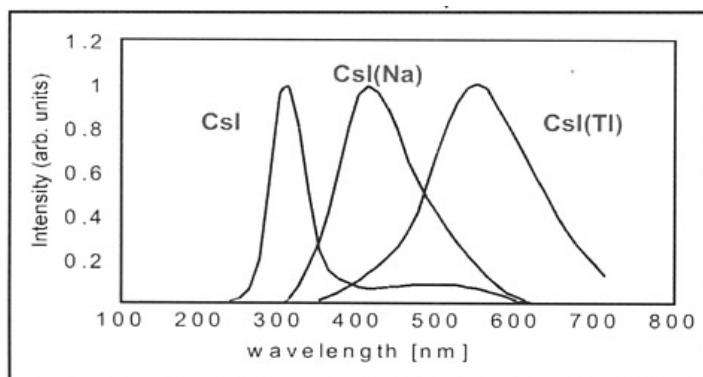
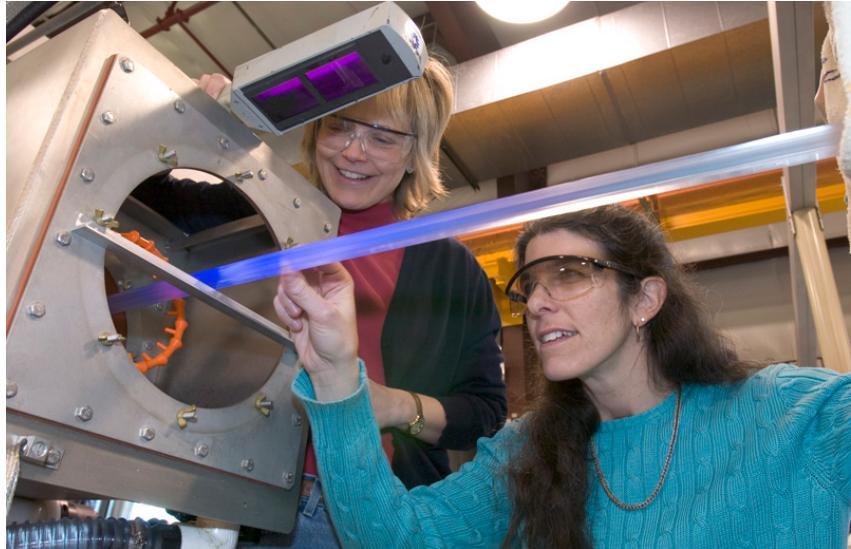
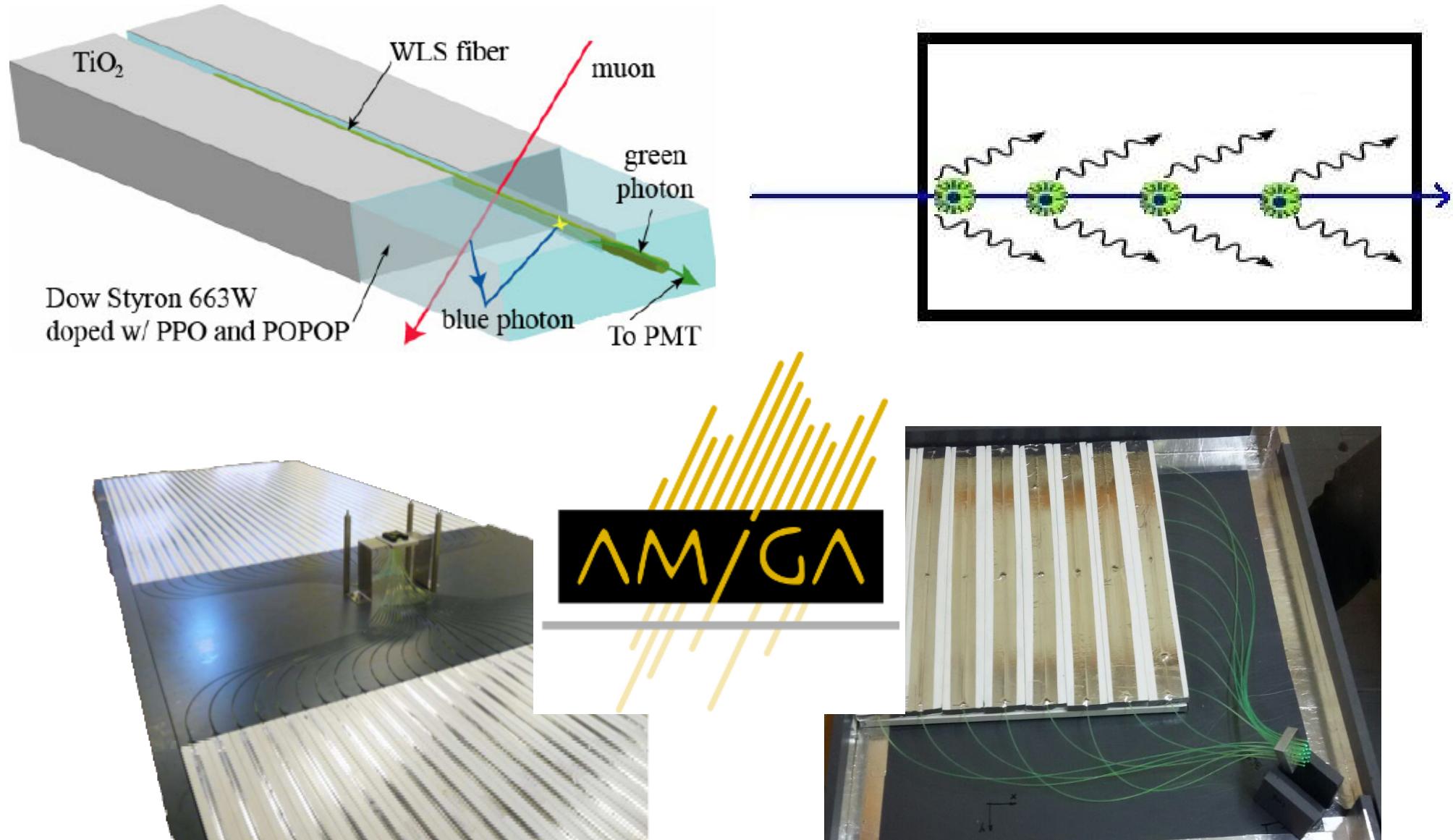


Fig. 3.2 Emission spectra of CsI, CsI(Na) and CsI(Tl) scaled on maximum emission intensity. Also a typical quantum efficiency curve of a bialkali photocathode is shown.

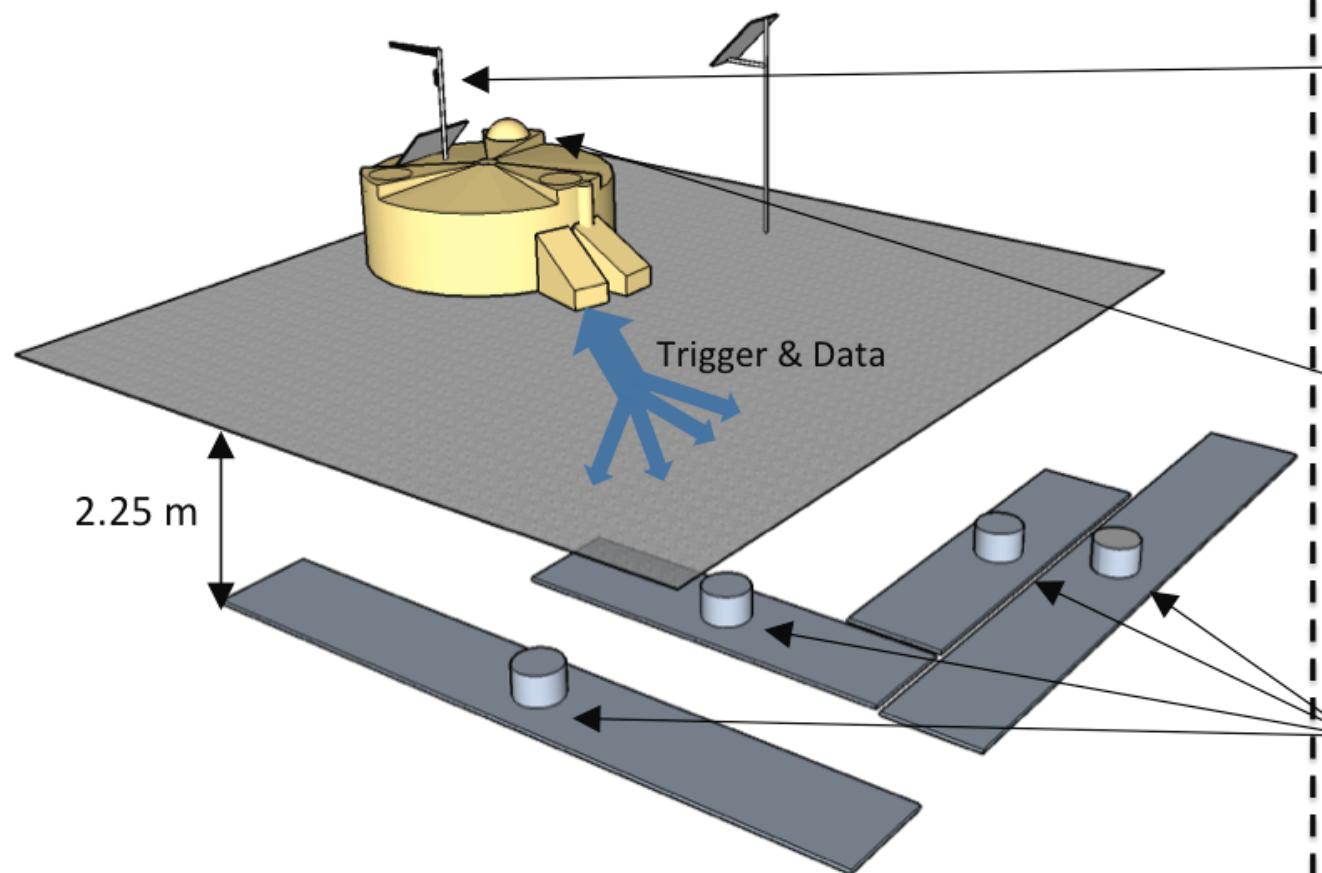


# Centelladores plásticos

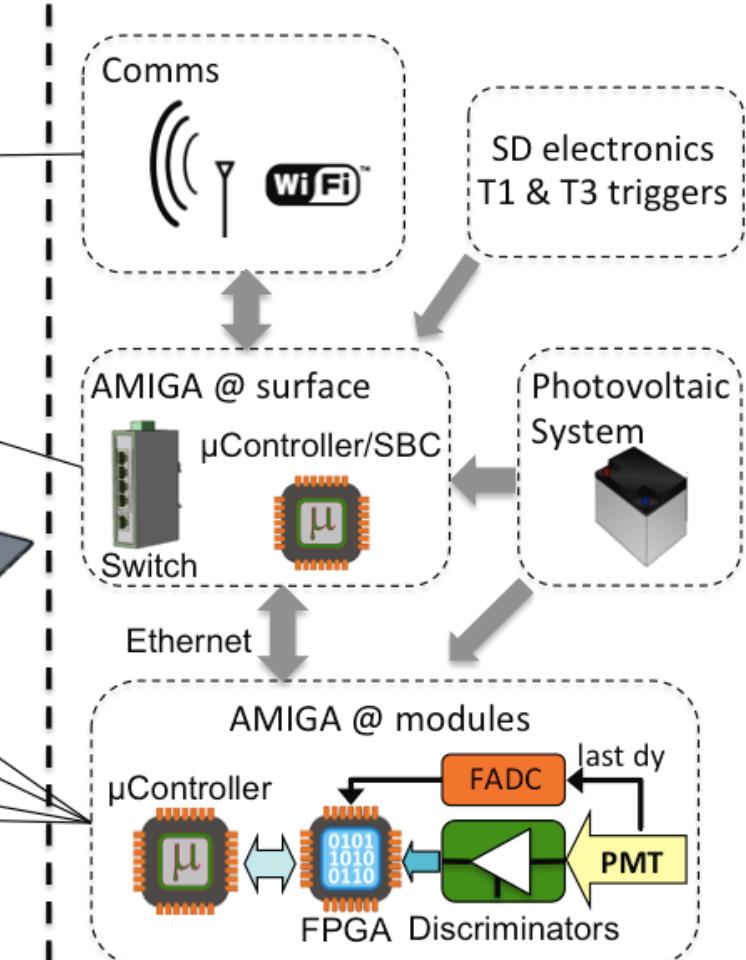


# Auger Muons and Infill for the Ground Array

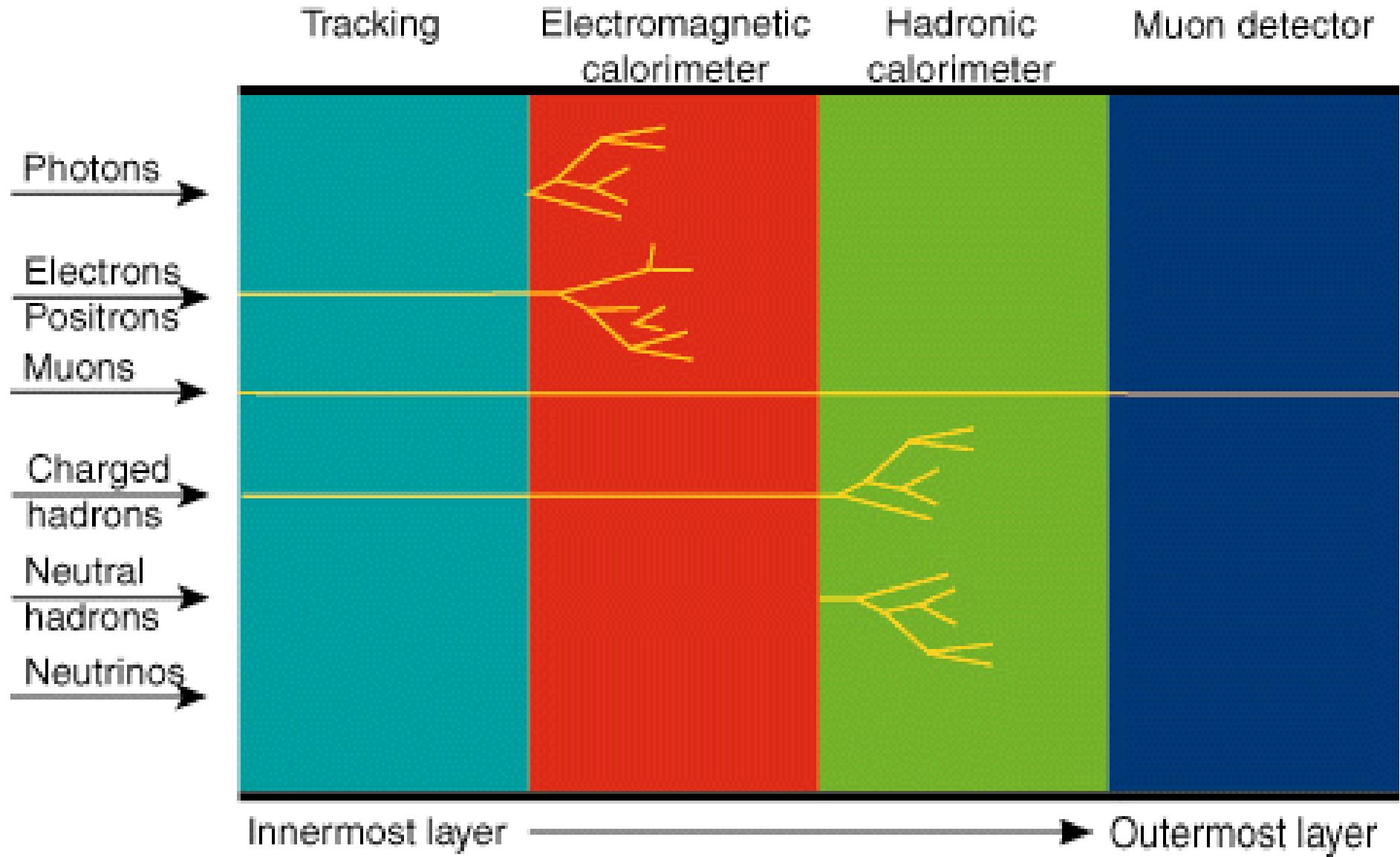
UC muon counter station



AMIGA electronics



# calorímetros





# Descripción de un calorímetro



# KASCADE



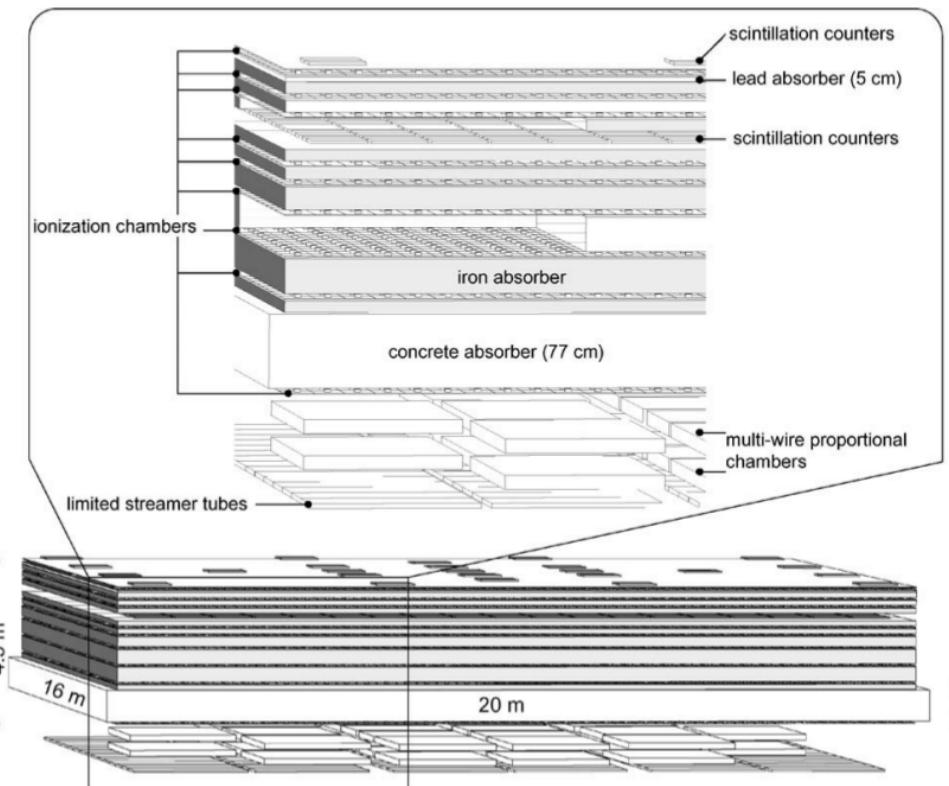
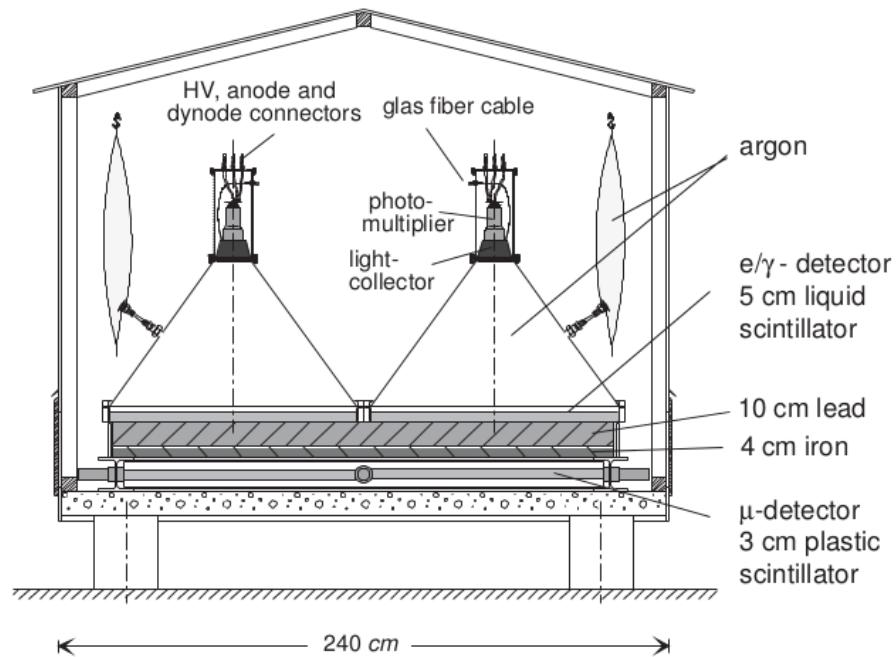
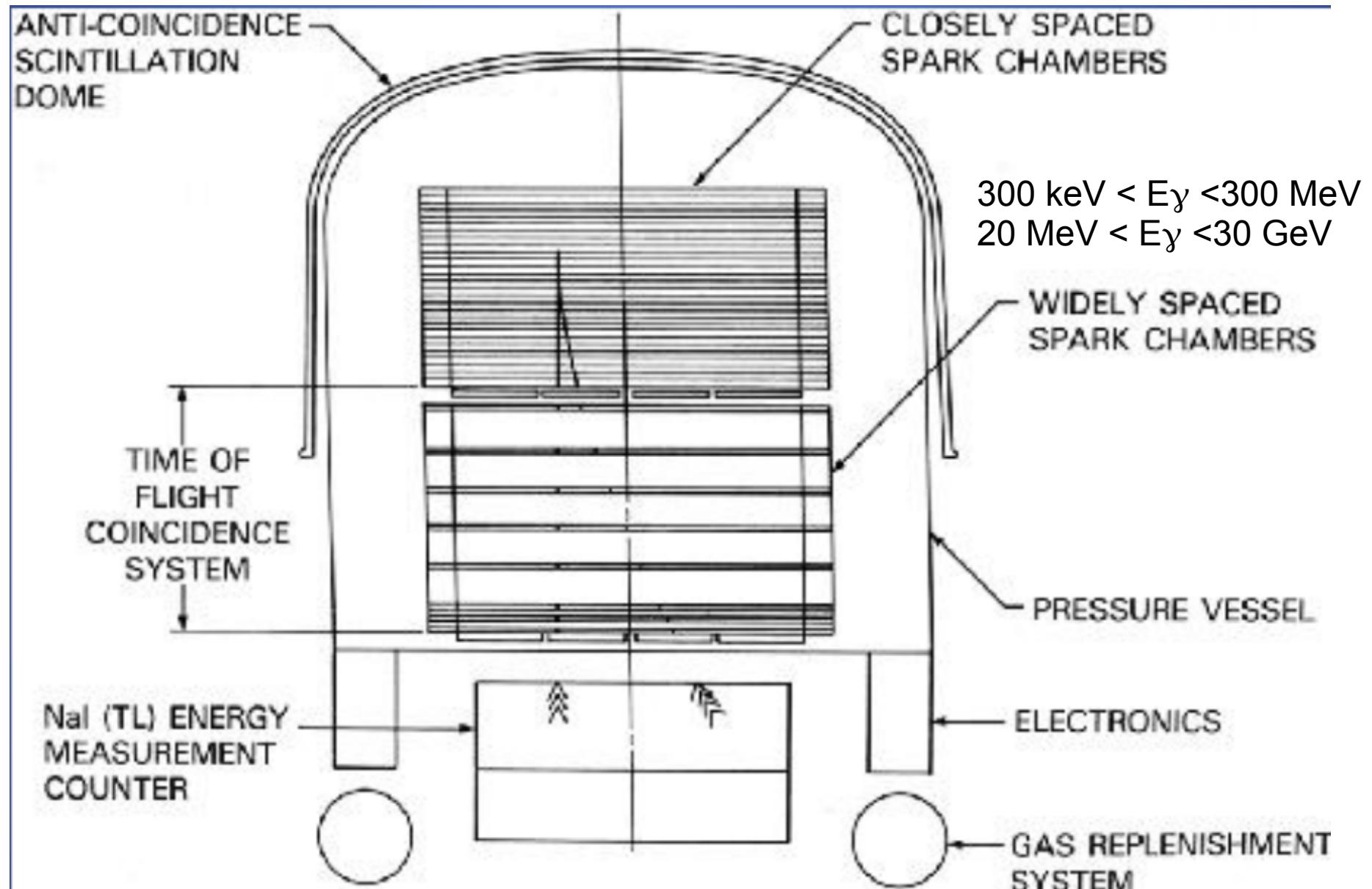
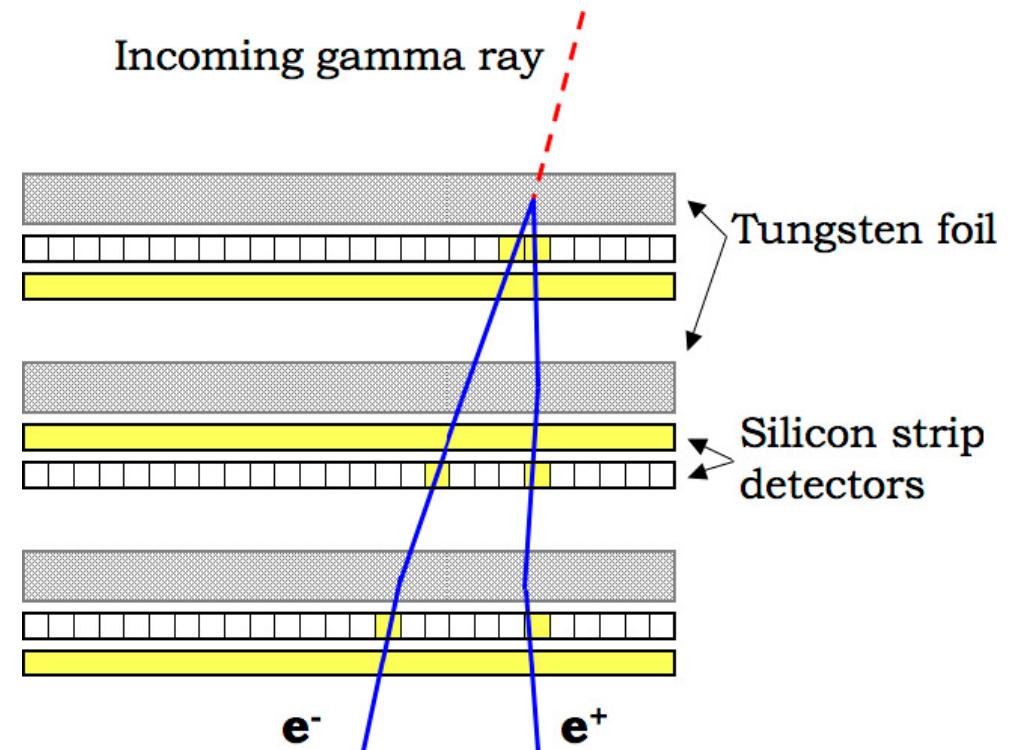
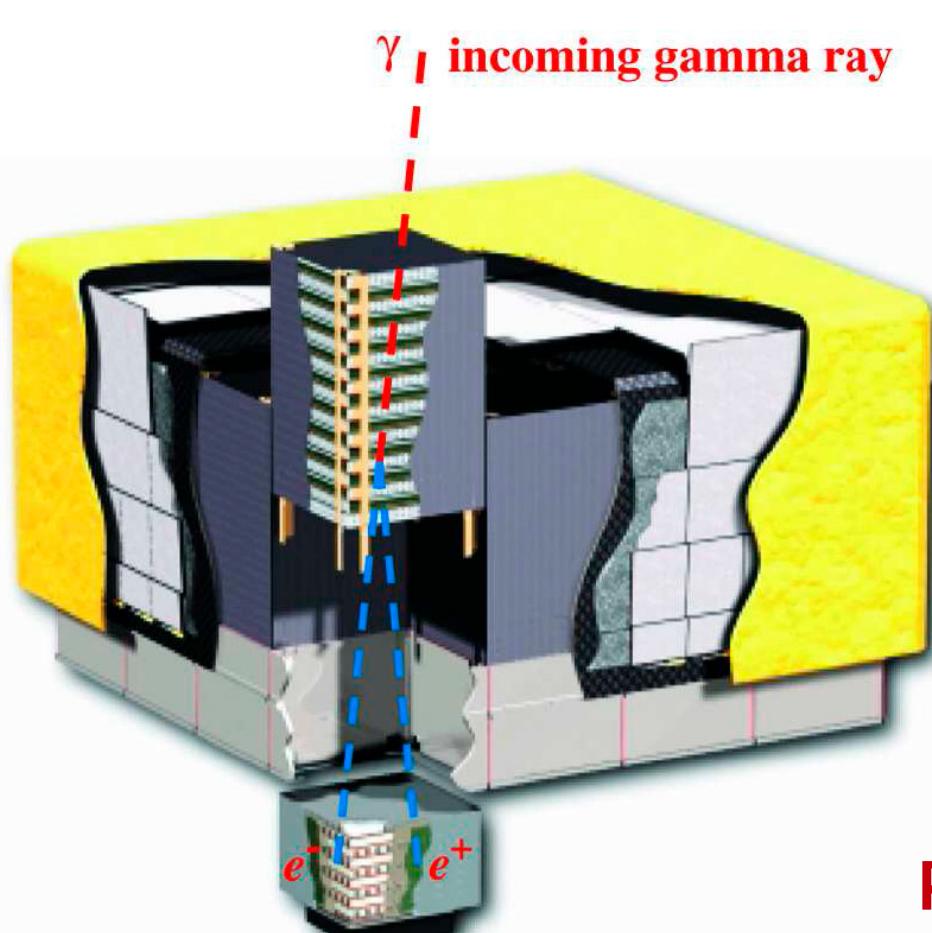


Table 1  
Detector components of KASCADE, their total sensitive area and threshold for vertical particles

Detector	Particle	Total area (m <sup>2</sup> )	Threshold
Array, liquid scintillators	e/γ	490	5 MeV
Array, plastic scintillators	μ	622	230 MeV
Muon tracking detector, streamer tubes	μ	128 × 4 layers	800 MeV
central detector:			
Calorimeter, liquid ionization chambers	h	304 × 8 layers	50 GeV
Trigger layer, plastic scintillators	μ	208	490 MeV
Top cluster, plastic scintillators	e/γ	23	5 MeV
Top layer, liquid ionization chambers	e/γ	304	5 MeV
Multi-wire proportional chambers	μ	129 × 2 layers	2.4 GeV
Limited streamer tubes	μ	250	2.4 GeV

# EGRET: Detección directa





**PSF (point spread function)**  
**68% de los gamma en un cono de  
 $3^\circ$  a 100 MeV y  $0.04^\circ$  a 100 GeV**