

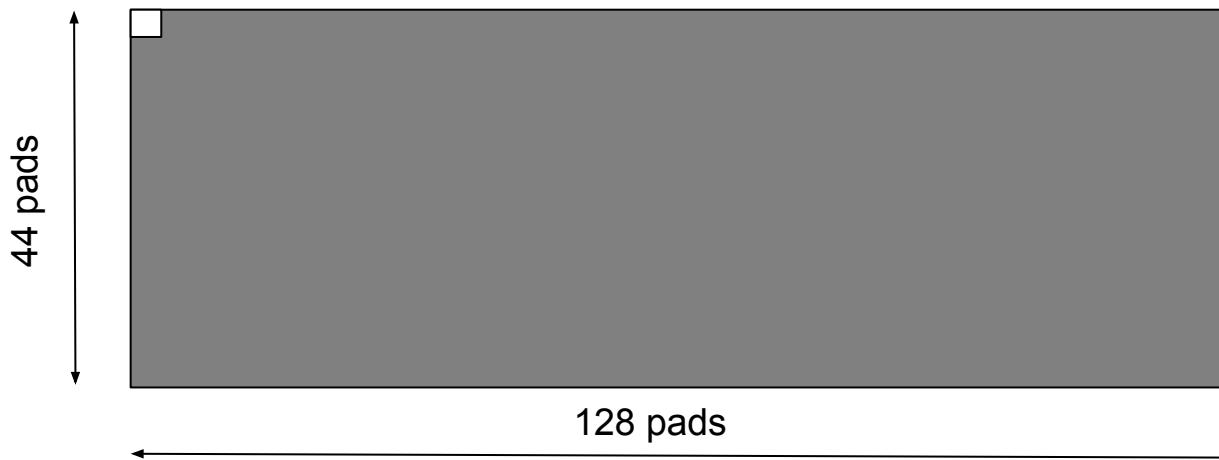
Simulation

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HYDRA meeting

Drift of the electrons

- **Homogeneous** **B** field parallel to the **E** drift field
- $2 \times 2 \text{ mm}^2$ pad size
- Projection of the electrons into the pad-plane



Electronics response (1)

- **Amplification** stage: random gain for each pad, following the **Polya distribution**

$$P_G(G/\bar{G}; \theta) = \frac{(\theta+1)^{\theta+1}}{\Gamma(\theta+1)} \left(\frac{G}{\bar{G}} \right)^\theta \exp \left(-(\theta+1) \left(\frac{G}{\bar{G}} \right) \right)$$

- **Pad response**: The signal for each pad is

$$N(t) \propto \sum_{i=1}^N G_i * \exp \left(-3 \frac{t-t_i}{\tau} \right) \sin \left(\frac{t-t_i}{\tau} \right) \left(\frac{t-t_i}{\tau} \right)^3$$

- The signal is **sampled** in time and white noise is added for each sample

- A **threshold** is applied to select pads for which SNR is larger than

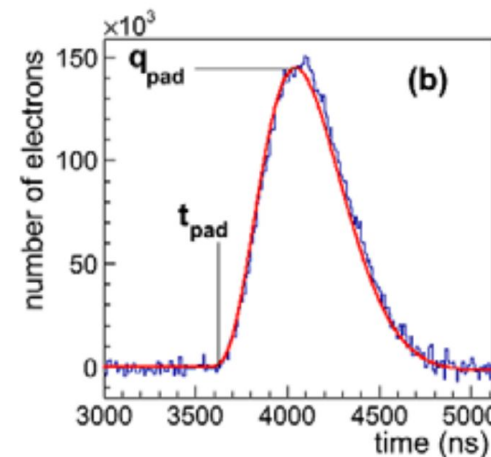
$$5 * \sigma_{r.m.s.} \quad \text{of the noise}$$

Electronics response (2)

→ Finally, the signal is analyzed by the following mathematical function

$$f(t) \propto Q_{pad} * \exp\left(-3\frac{t-t_{pad}}{\tau}\right) \sin\left(\frac{t-t_{pad}}{\tau}\right) \left(\frac{t-t_{pad}}{\tau}\right)^3$$

- Q_{pad} represents the total number of electrons collected on the pad
- t_{pad} is the trigger time of the pad converted in a drift distance



Electronics response (3)

Gas

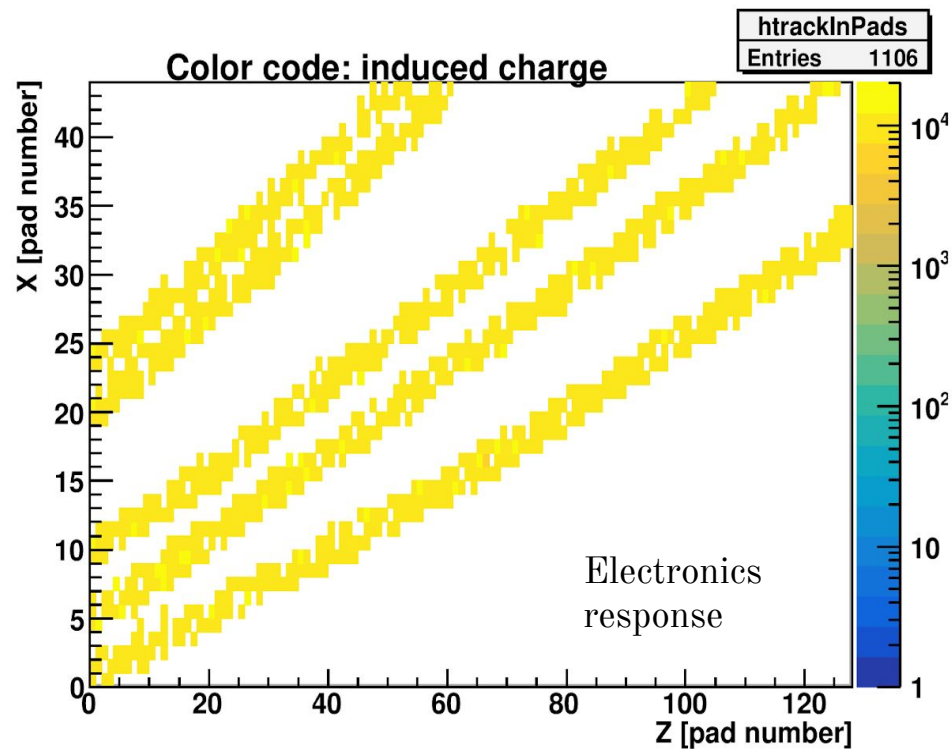
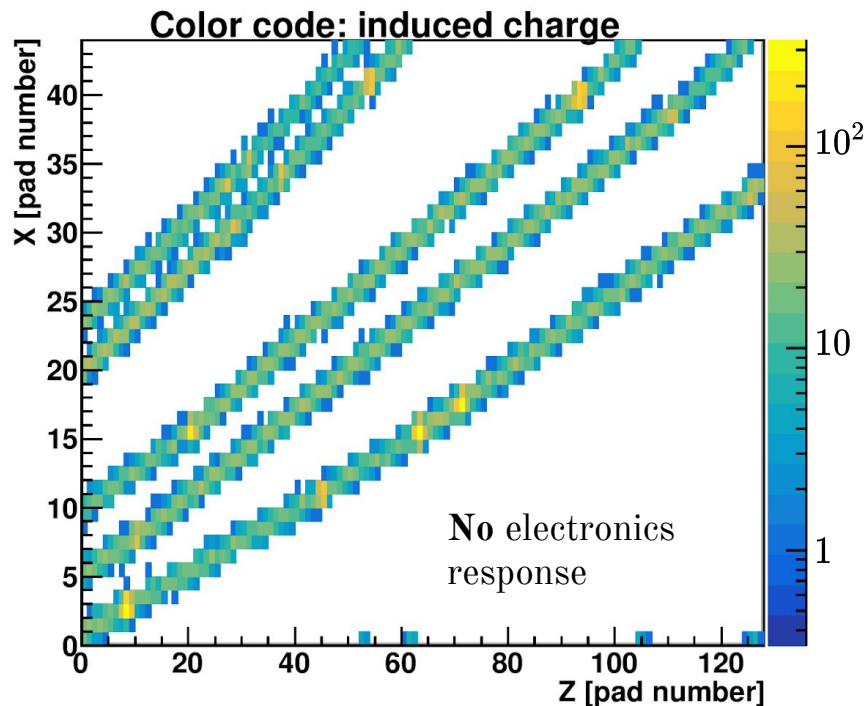
Composition	$\text{Ar}_{82}(\text{CF}_4)_{15}(\text{iso})_3$
Longitudinal diffusion	$186 \mu\text{m}/\sqrt{\text{cm}}$
Transverse diffusion	$195 \mu\text{m}/\sqrt{\text{cm}}$
Drift speed	$66 \mu\text{m}/\text{ns}$
Ionisation threshold	26 eV
Average gain	1500

Electronics

Shaping time	426 ns
Time sampling	10 ns
Noise ($\sigma_{\text{r.m.s.}}$)	2500 electrons r.m.s.
Detection threshold	$5\sigma_{\text{r.m.s.}}$

Electronics response (4)

5 pion events inside the active volume



- Compare different geometries for the final detector:
- **Efficiency**
 - Space charge
 - Momentum resolution
 - Trigger rate