

**ALICE/PHOS on T9 in 2022 (Weeks 42-43, 17.10-31.10)**

**17.03.2022 T9/T10 Users Meeting**

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Current EM calorimeter PHOS uses  $\text{PbWO}_4$  (PWO) crystals, rectangular parallelepiped  $22 \times 22 \times 180 \text{ mm}^3$ , photodetector - the Hamamatsu S8148 (S8664-55) type APD, active area of  $5 \times 5 \text{ mm}^2$  and low noise CSP.

To increase the light yield of the PWO crystal (by a factor of 3) and to reduce the electronic noise, the PWO crystals, APD and CSP are cooled down to  $-25^\circ\text{C}$  (stability  $\sim 0.2^\circ\text{C}$ )

In total 12 544 channels

### **PHOS upgrade program (Run 4):**

#### **Upgrade of photodetectors APD → SiPM**

- + Improved time resolution for particle ID
- + Improved energy resolution
- Strong non-linearity at high energy

#### **Upgrade of FEE**

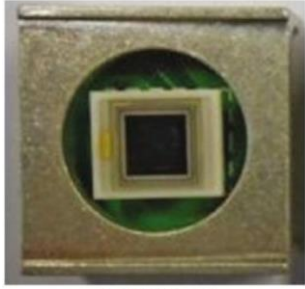
- => Chips for current FEE version out of market
- => Additional timing channel provides a precise time measurement

#### **Upgrade of mechanics**

- => Provide access to FEE during data taking

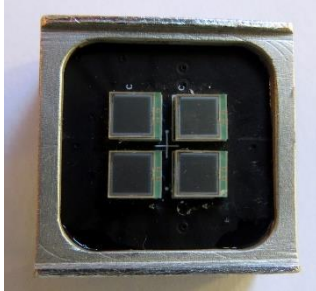
## Photodetectors

Current PHOS

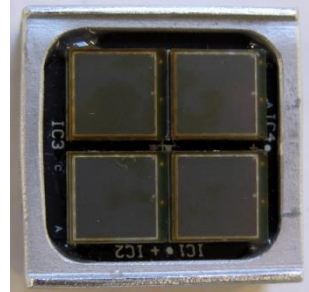


S8664-55 APD

S14160-3015PS



S14160-6015PS



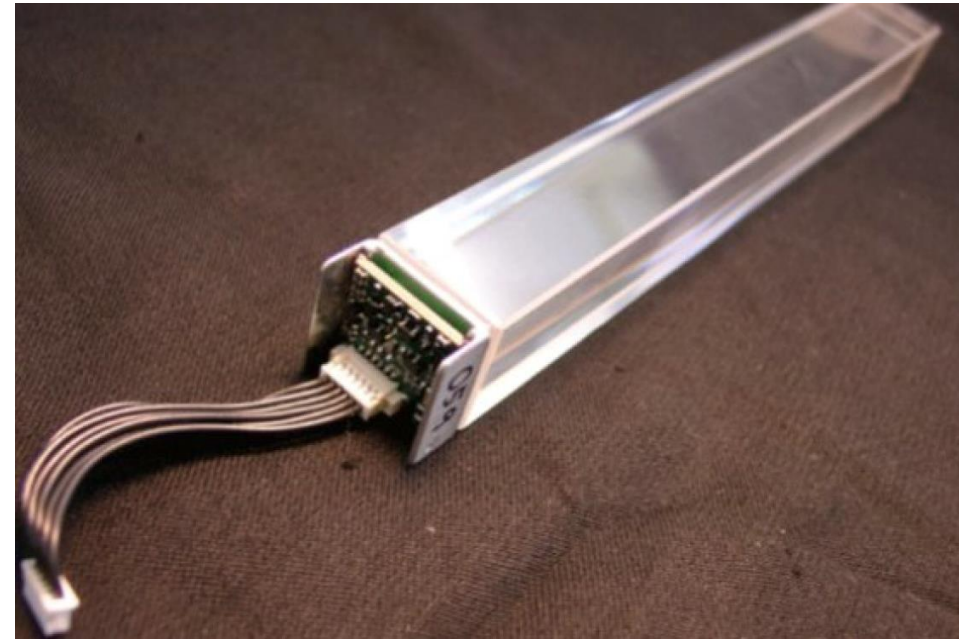
PbWO<sub>4</sub> arrays of 3×3

APD from current PHOS

Sensitive area 3x3 mm<sup>2</sup>, 40k pixels (S14160-3015PS).  
Possible array of 4 SiPM per crystal. Signal –serial,  
voltage – in parallel

6x6 mm<sup>2</sup>, 160k pixels (S14160-6015PS )

Two SiPMs – with different pixel size, one for low  
energy, one for high energy



**PHOS crystal with photodetector**

**Main goals of the test PHOS T9 test in 2022  
are:**

- 1) measurements (at momenta from minimum available on T9 up to max possible) energy resolution curve and the time resolution crystals at temperatures  $t=+16^{\circ}\text{C}$  and  $t=-25^{\circ}\text{C}$
- 2) test of the new prototype of the 32-channels PHOS readout card (FEC32).

## New PHOS FEE parameters

- E channel: Dynamic range: from 1 MeV to 130 GeV. Digitization – 12 bit, 40 Msps, 2 channels → effectively 17 bits  
Two gains. max HG – 4 GeV (1 MeV/ADC\_ch) max LG – 130 GeV (32 MeV/ADC\_ch)
- T channel: TOF with Start-Stop method; Time bin size – 0.1ns or less HPTDC(in future picoTDC)
- Readout – E and T codes
- Analog Trigger L0 (2x2) – 8 analog trigger signals
- Readout method – 10G Ethernet, P2P (SRU) IT RU (ALICE O2 ).
- Voltages and dimensions are the same as present PHOS FEC.

