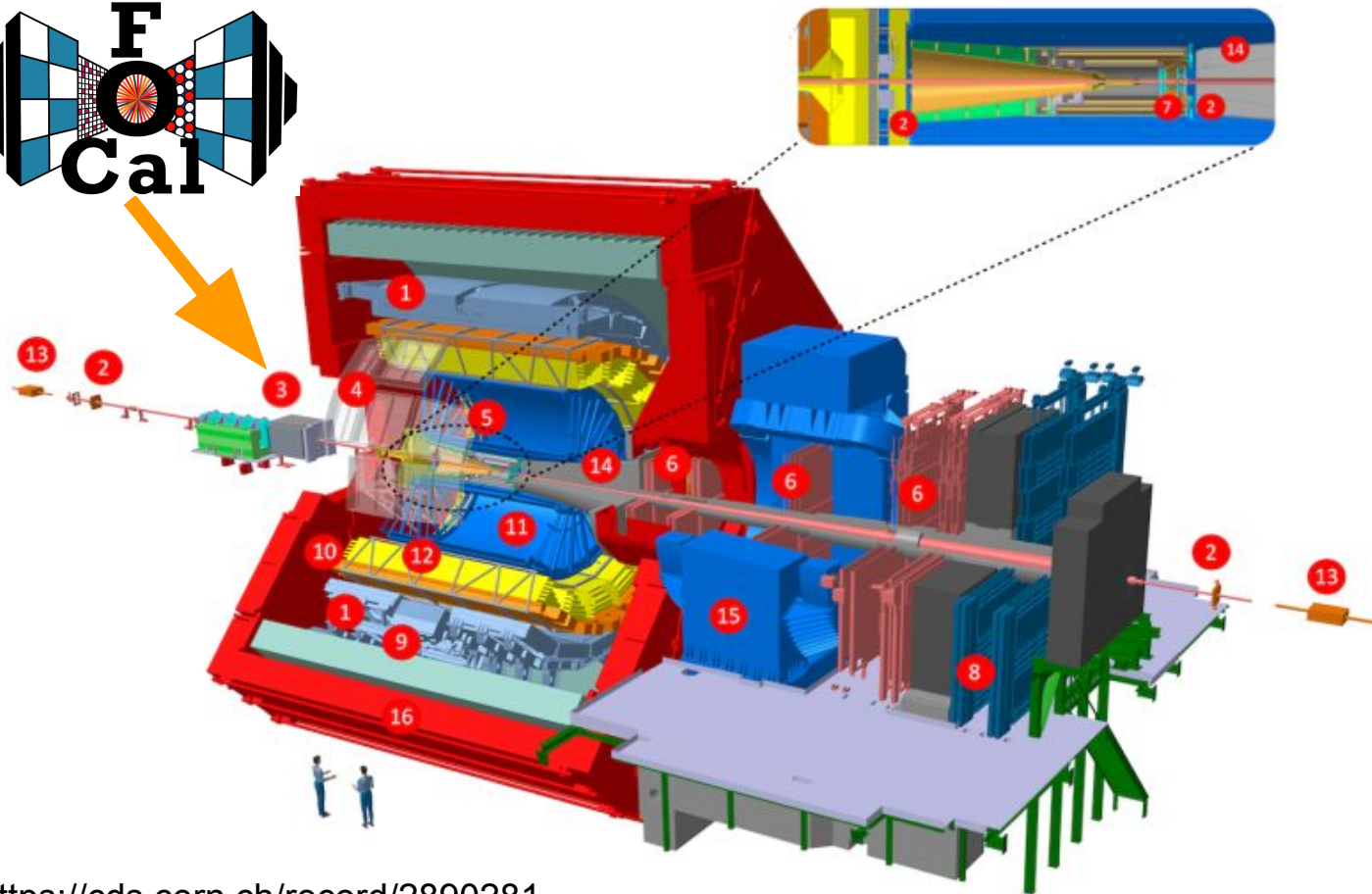
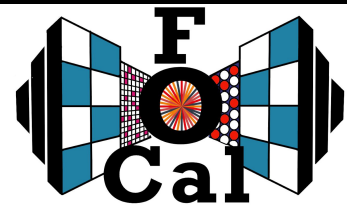


Configuração de readout ASIC para o calorímetro frontal do experimento ALICE

Ana Maria Ramos Silveira

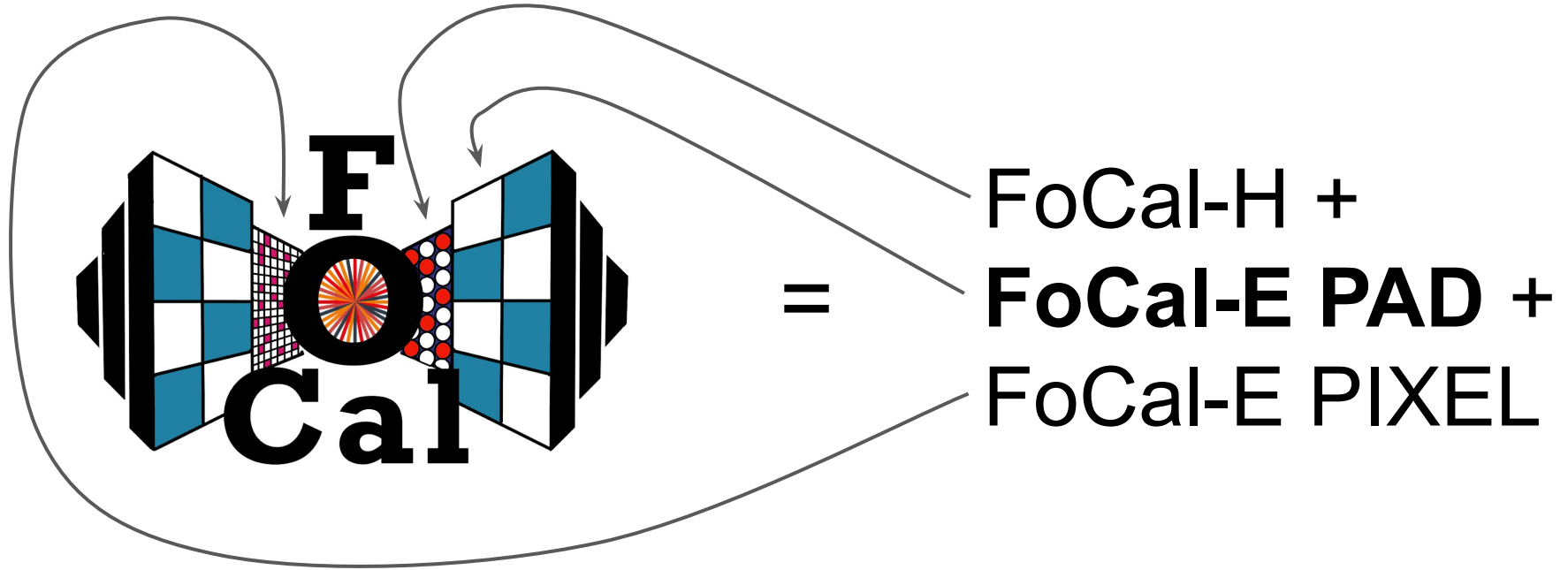
Maio, 2026

ALICE no Run 4 do LHC

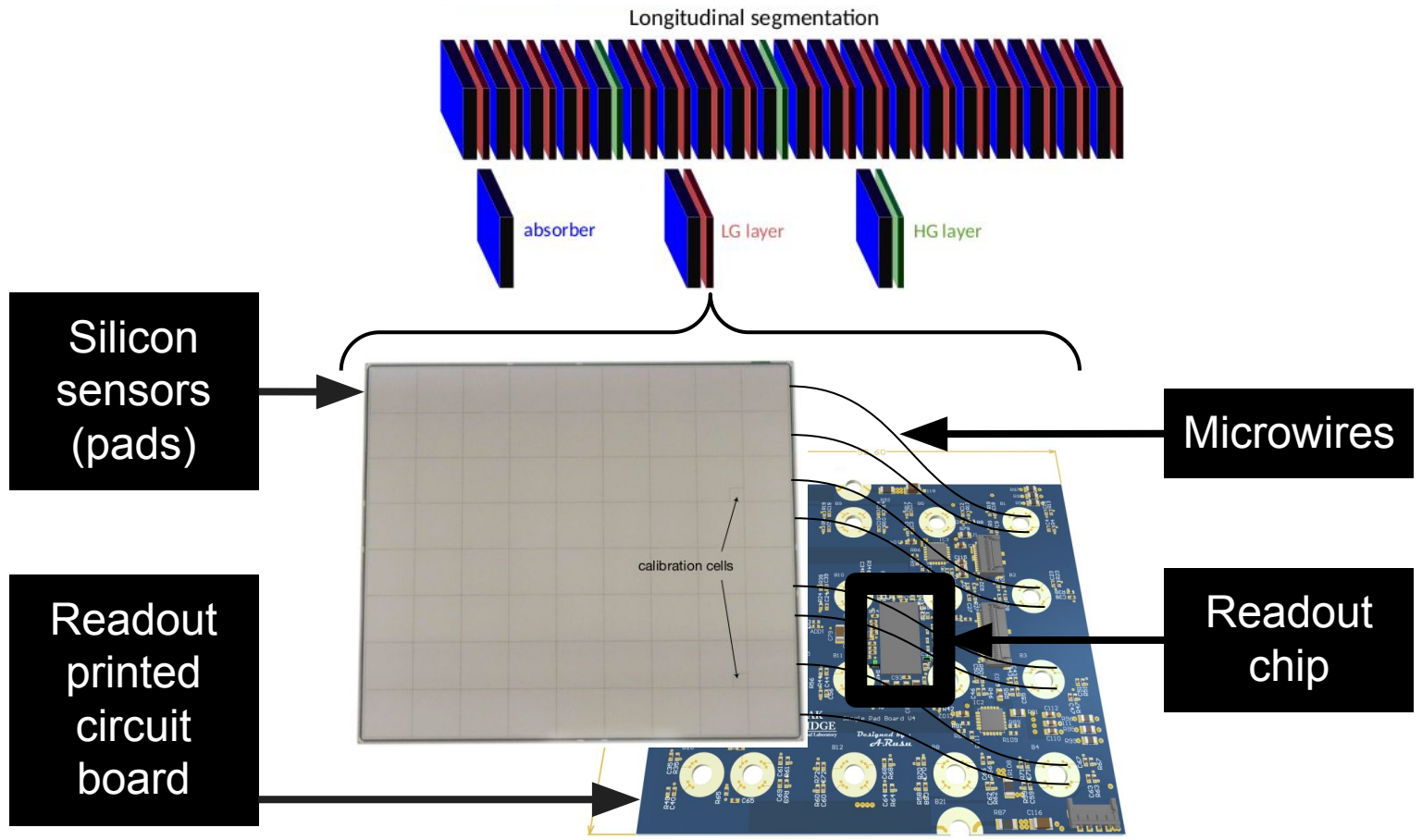


- 1 EMCAL | Electromagnetic Calorimeter
- 2 FIT | Fast Interaction Trigger
- 3 FoCal | Forward Calorimeter
(in front of compensator magnet)
- 4 HMPID | High Momentum Particle Identification Detector
- 5 ITS | Inner Tracking System
- 6 MCH | Muon Tracking Chambers
- 7 MFT | Muon Forward Tracker
- 8 MID | Muon Identifier
- 9 PHOS/CPV | Photon Spectrometer
- 10 TOF | Time Of Flight
- 11 TPC | Time Projection Chamber
- 12 TRD | Transition Radiation Detector
- 13 ZDC | Zero Degree Calorimeter
- 14 Absorber
- 15 Dipole Magnet
- 16 L3 Magnet

1 detector, 3 readouts



Como tirar dados de FoCal-E PAD?



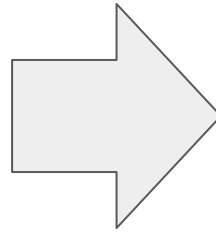
Readout chip: HGCROC (ALICE FoCal, CMS High Granularity Calorimeter)

Features

Wide dynamic range
(1 - 1000+ **Minimum Ionizing Particles**)

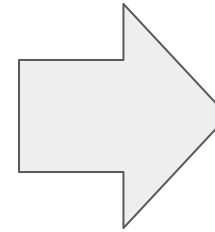
High resolution
(1 MIP @ 1 - 100 MIP)

72 channels



Technologies

Analog to
Digital Conversion
+
Time of Arrival
+
Time over Threshold

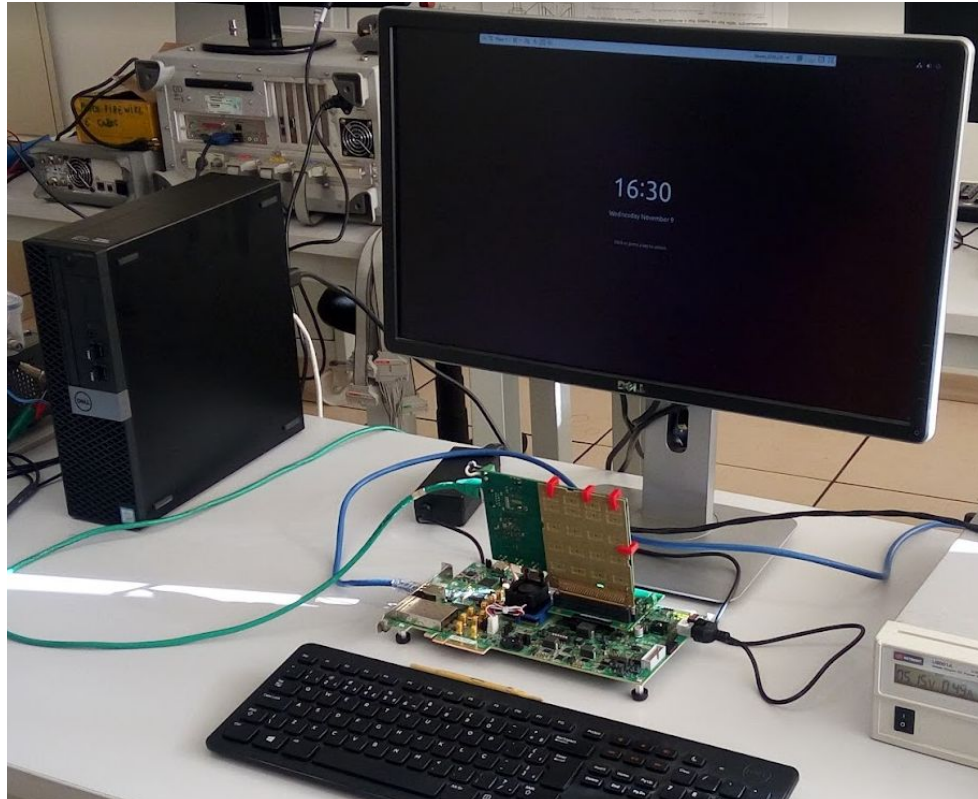


Need to set...

7900+
parameters

x 1944
chips!

Este trabalho



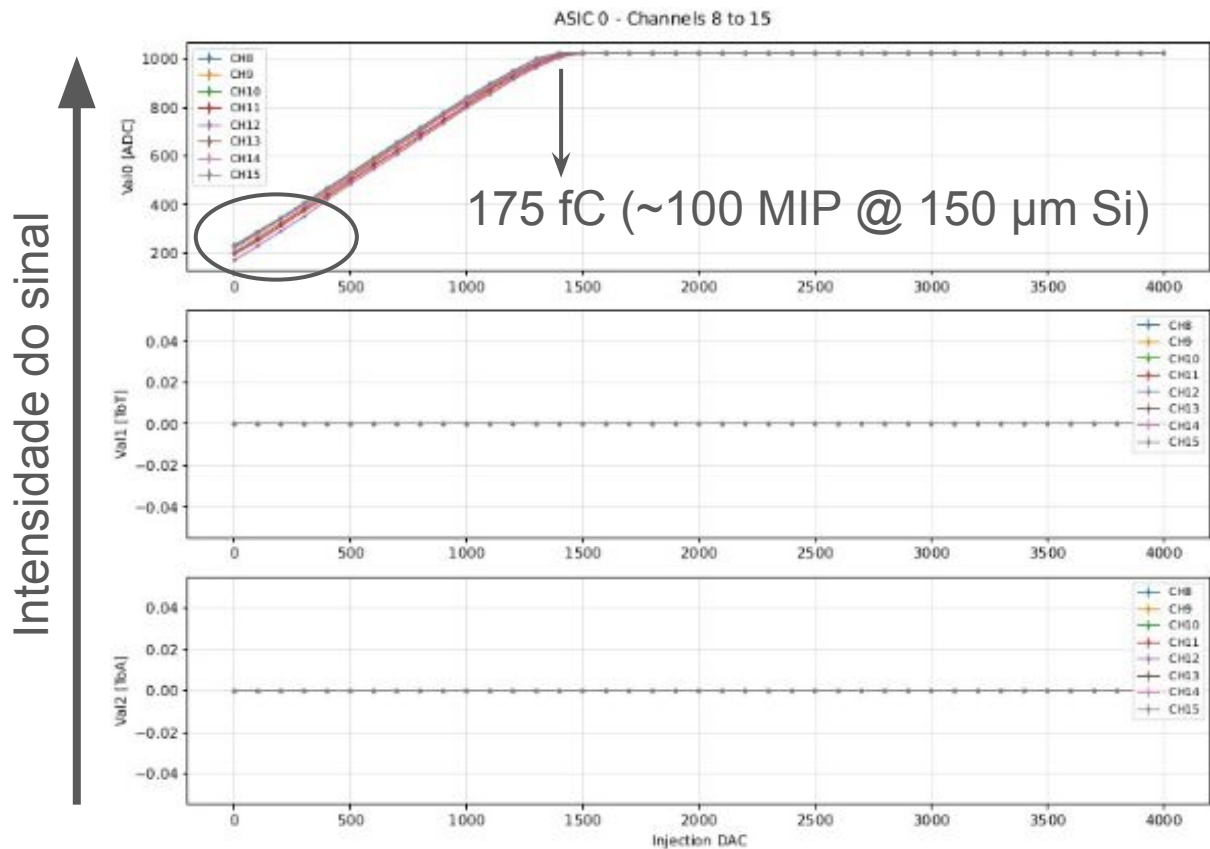
Placa de circuito impresso com HGCROCv3

Interface Xilinx KCU105

Software de FoCal-H (H2GCROC) adaptado por nós

Acesso remoto no Variable Energy Cyclotron Centre (VECC) em Calcutá, Índia

Antes da configuração



Intensidade do sinal

ADC

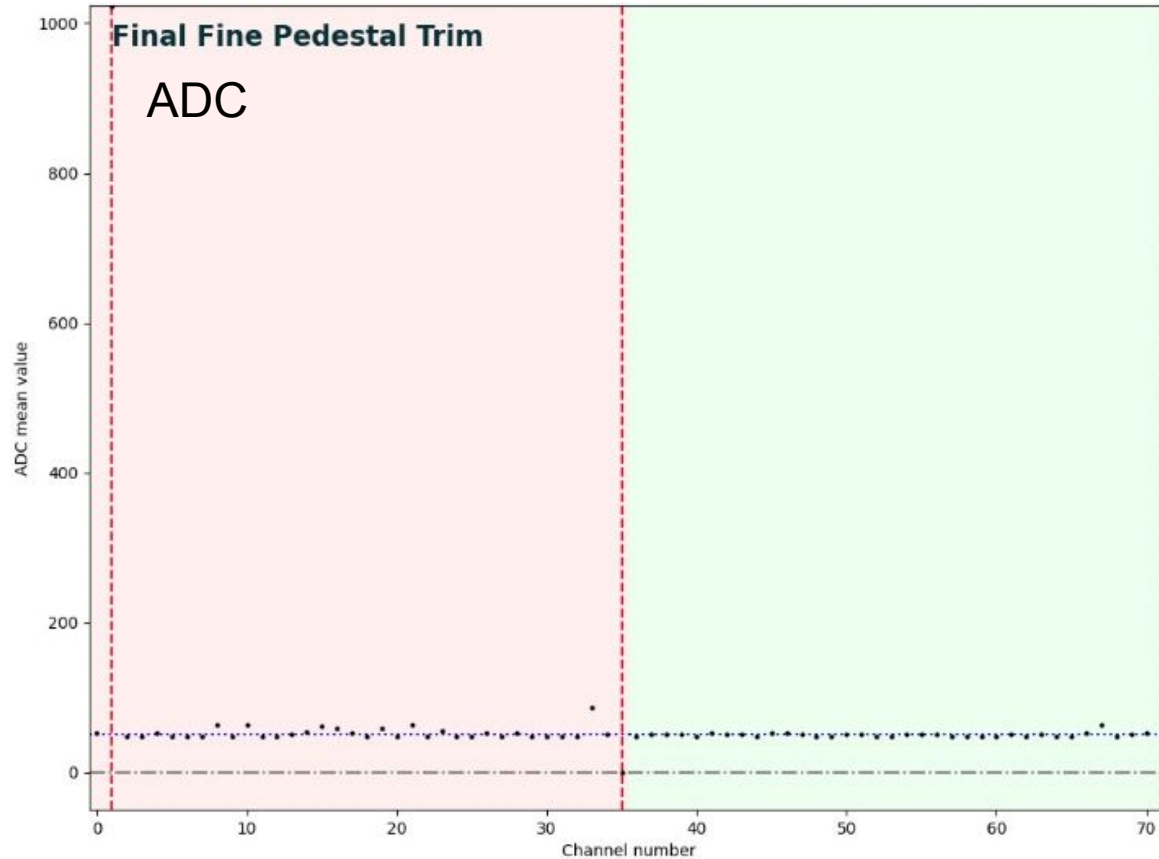
ToT

ToA

- Pedestal elevado (20% do range do ADC)
- Significativa dispersão entre os canais
- Ausência de ToA, ToT

Carga injetada usando o circuito interno de calibração

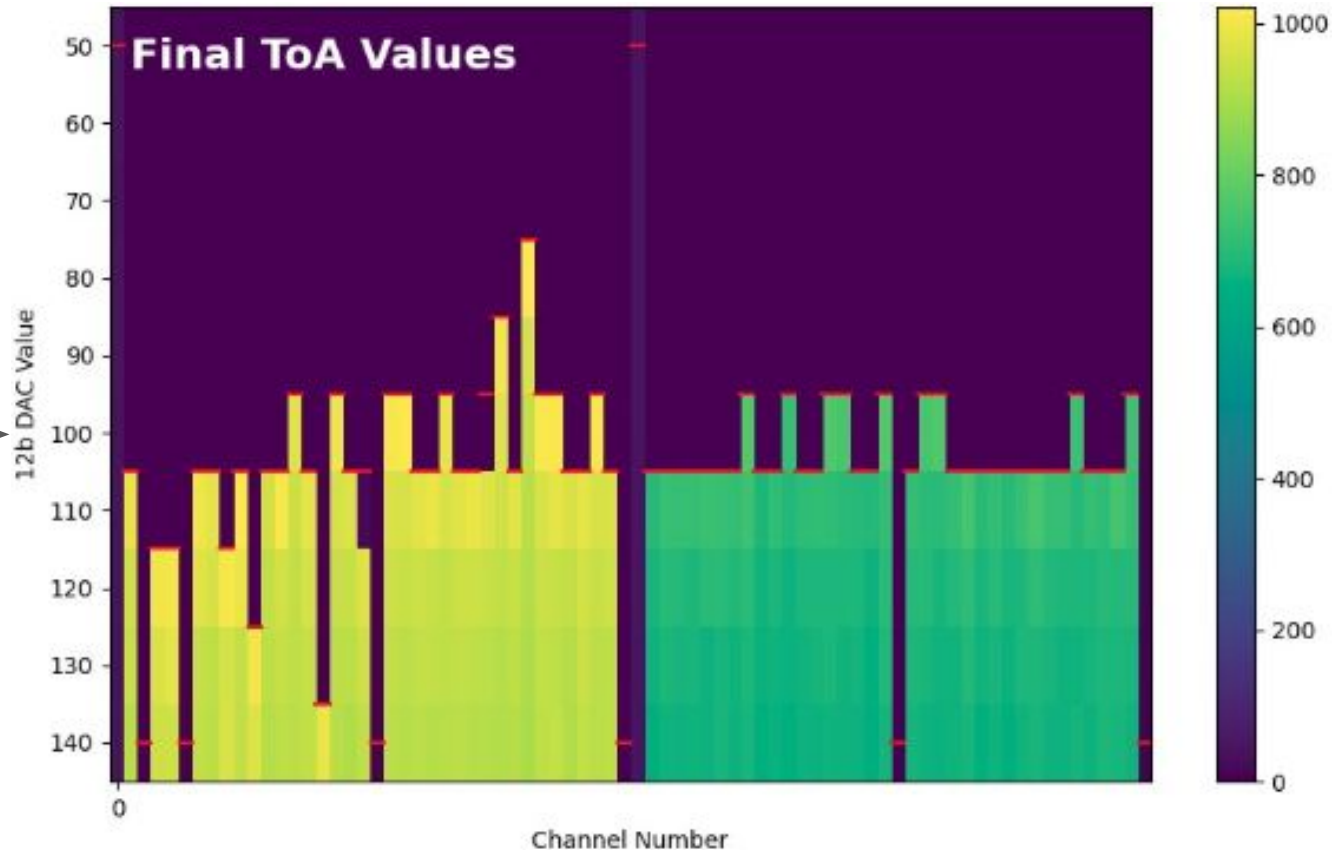
Pedestal trimming and setting



- Pedestal reduzido a 5% do range do ADC
- Baixa dispersão entre os canais

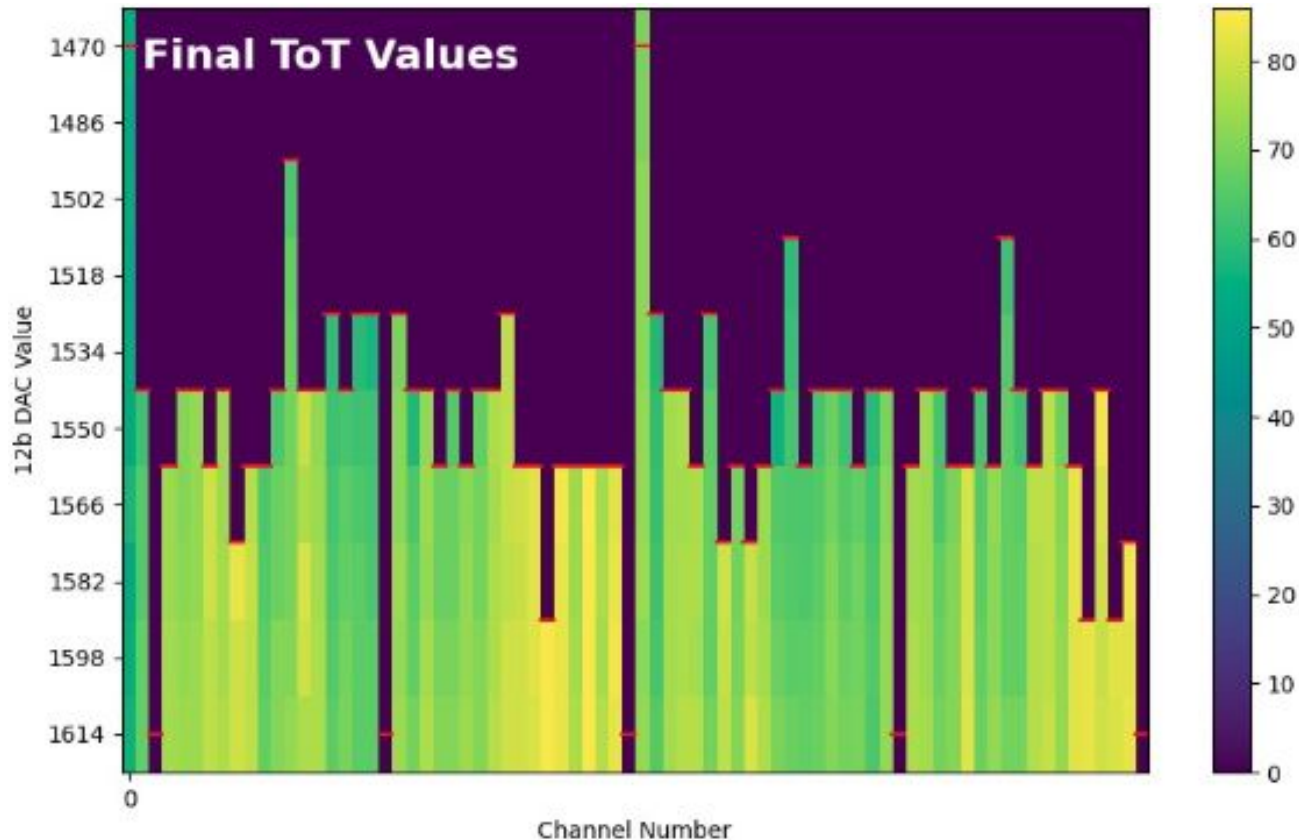
Ajuste do limiar para ToA

Target foi a transição em DAC = 100 (~12 fC) para todos os canais

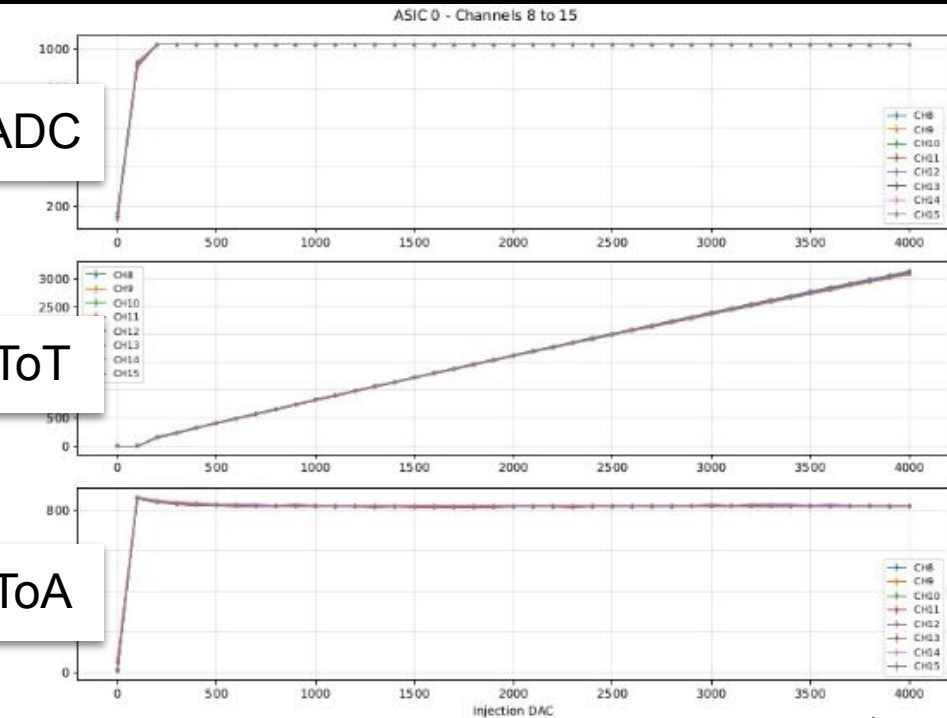
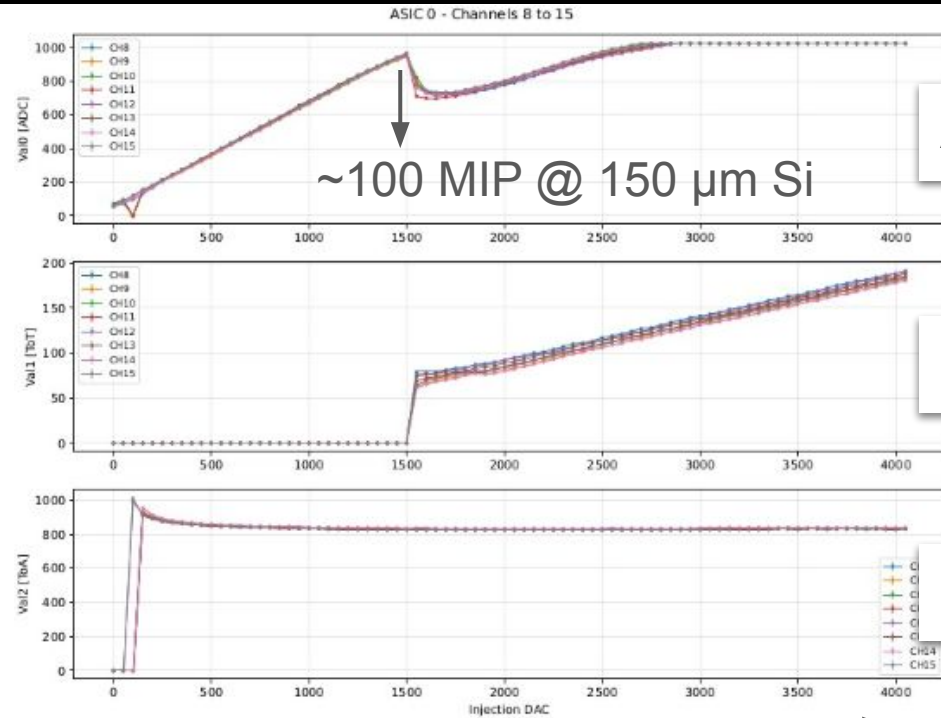


Ajuste do limiar para ToT

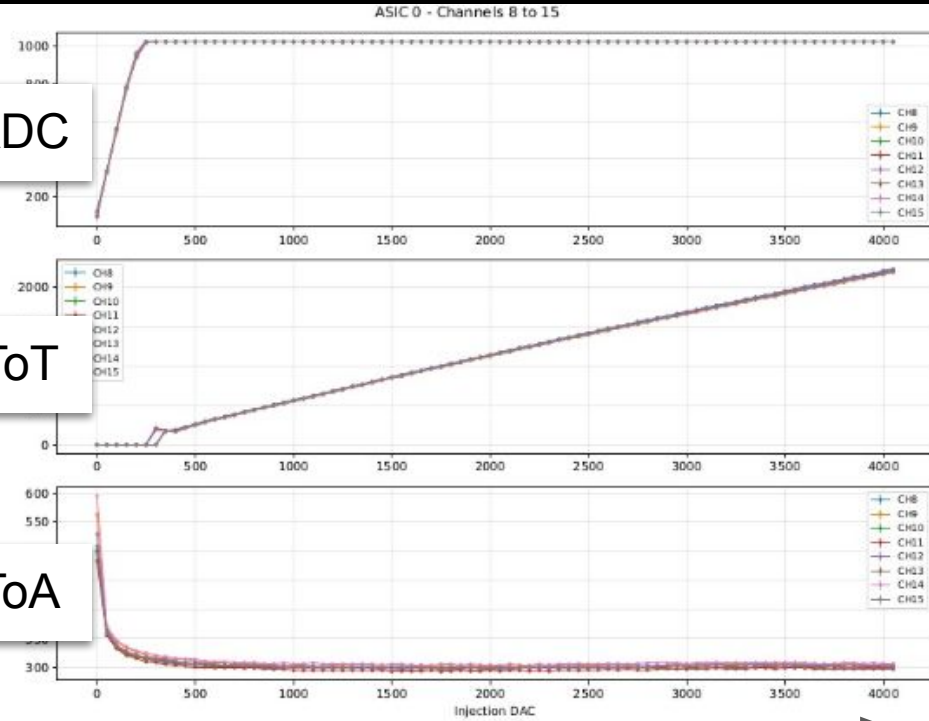
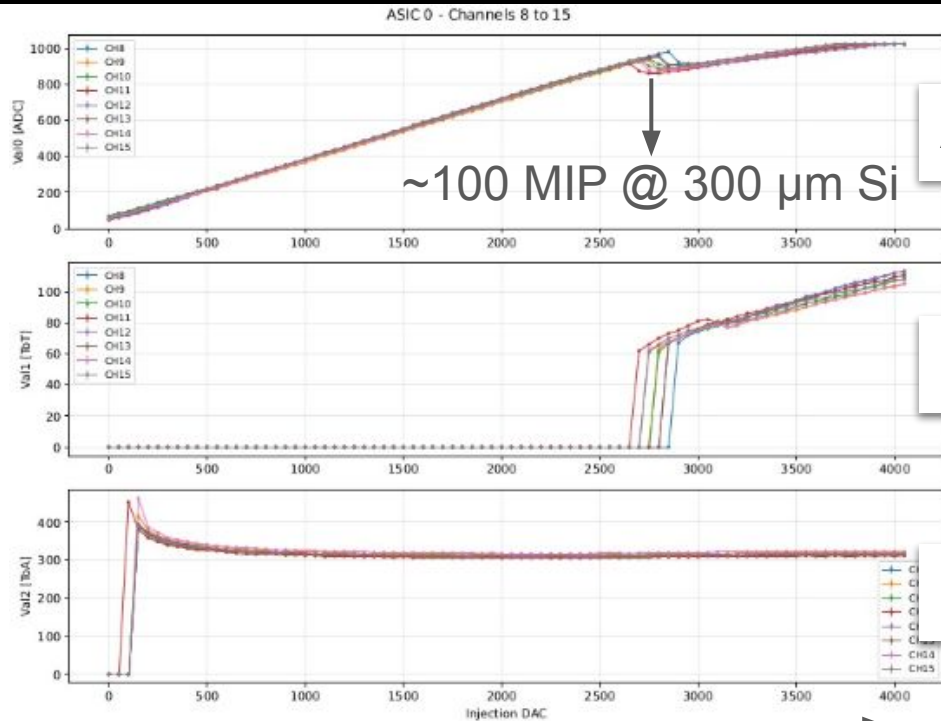
Target foi a transição em DAC = 1550 (saturação do ADC, ~190 fC) para todos os canais



Injeção de carga após a configuração (default ADC range: 160 fC)

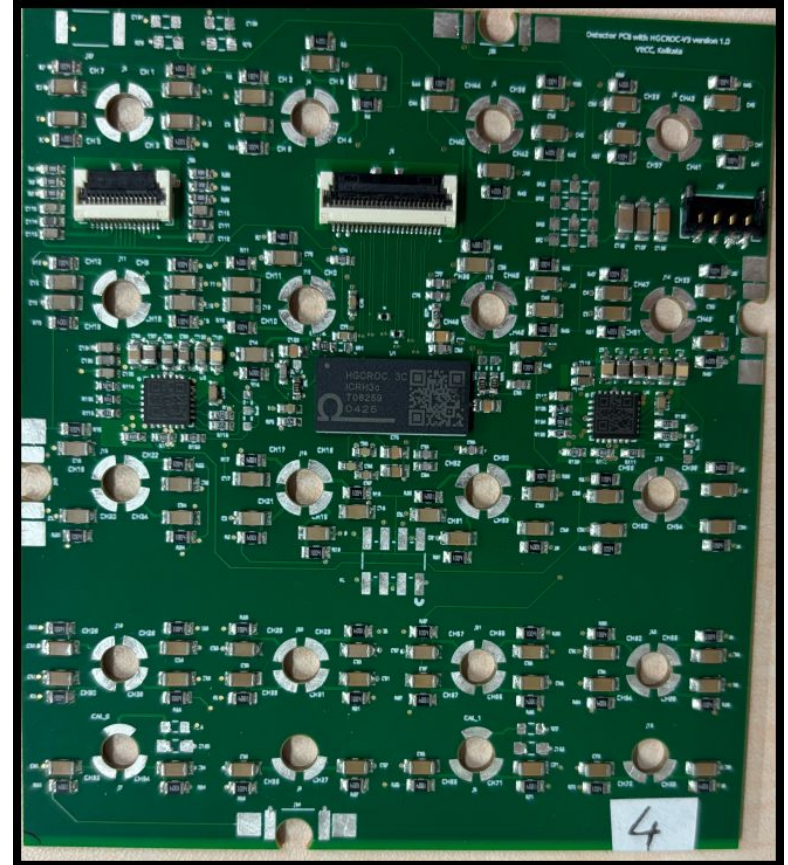


Injeção de carga após a configuração (ADC range: 320 fC)



Conclusão

- O software de configuração do H2GCROC foi adaptado para o HGCROC com sucesso
- O ajuste de pedestal é satisfatório
- Há espaço para melhoria na determinação dos limiares de ToA e ToT
- A próxima geração de PCB brevemente estará disponível para testes



Backup

Analog Channel Overview (Silicon version)

- New calibration pulser, 0.5pF and 8 pF calibration cap.
- Preamp : adjustable gains for 80, 160 and 320 fC ranges
- Tunable TOT over 5 bits

- Compensation for the leakage current, 10 μ A max. (not shown in the figure)
- Sallen Key shaper RC4, $t_p < 25$ ns, tunable ($\sim 20\%$) with 2 bits, $BX+1/BX < 0.2$
- Temperature stabilization to < 0.5 mV/K
- 10 bit ADC from Krakow AGH
- TOT and TOA TDCs from CEA-IRFU
- Total analog power (static, without ADC and TDCs): 5.5 mW (typ)

