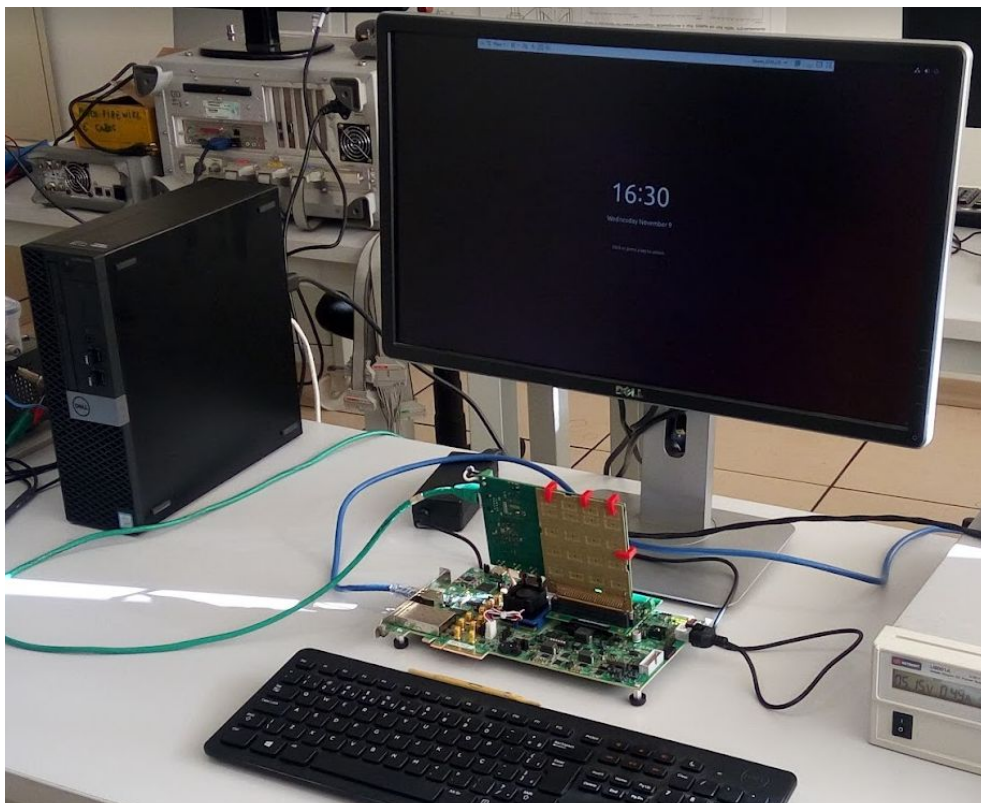


BR input to FoCal-E pad electronics

August 10, 2023



Test bench in Sao Paulo
(remotely accessible)

- HGCROC (v1):

```
>>single_hgcroc IDC00E 0x5110fb06 Single pad V1
```

- KCU105

- Injector board v1

TOT saturation in high energy showers (e-mail thread)

Issue

Constantinos Loizides



To: Max Philip Rauch; Norbert Novitzky; Tommaso Isidori **+1 other**

Mon 7/24/2023 4:31 AM

Cc: alice-focal-epad (Discussion related to FoCal-E Pad layers)

Dear Max, et al.,

as pointed out by Max, it looks from the TB data, we may be reaching max TOT values (ie saturated) channels, already at 300 GeV electrons.

Norbert Novitzky



To: Max Philip Rauch

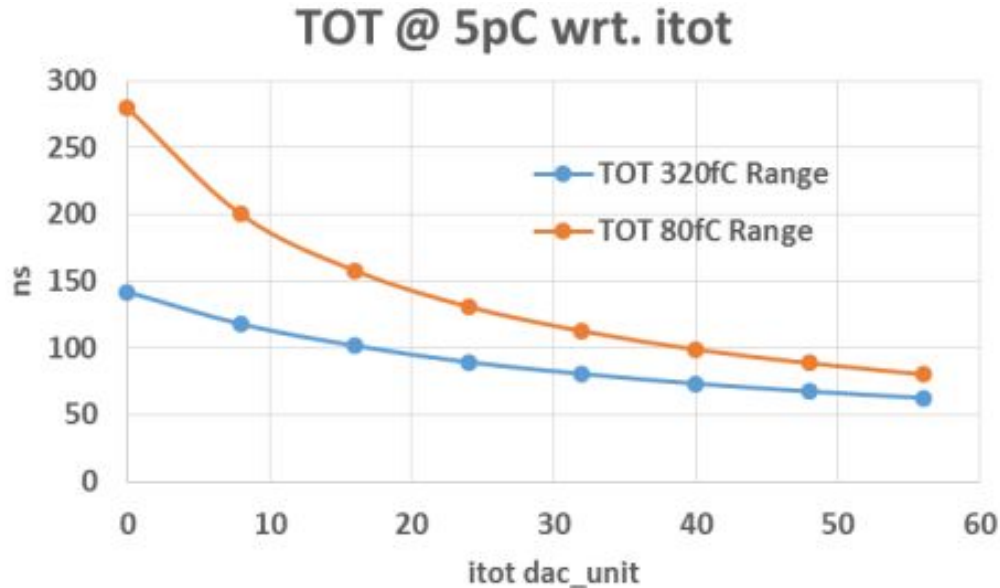
Mon 7/24/2023 7:27 AM

Cc: Tatsuya Chujo; Constantinos Loizides; Tommaso Isidori **+2 others**

Dear Max,

I would not take 10pC as a hard limit. It depends on the gain. Do you have TOT close to 4000

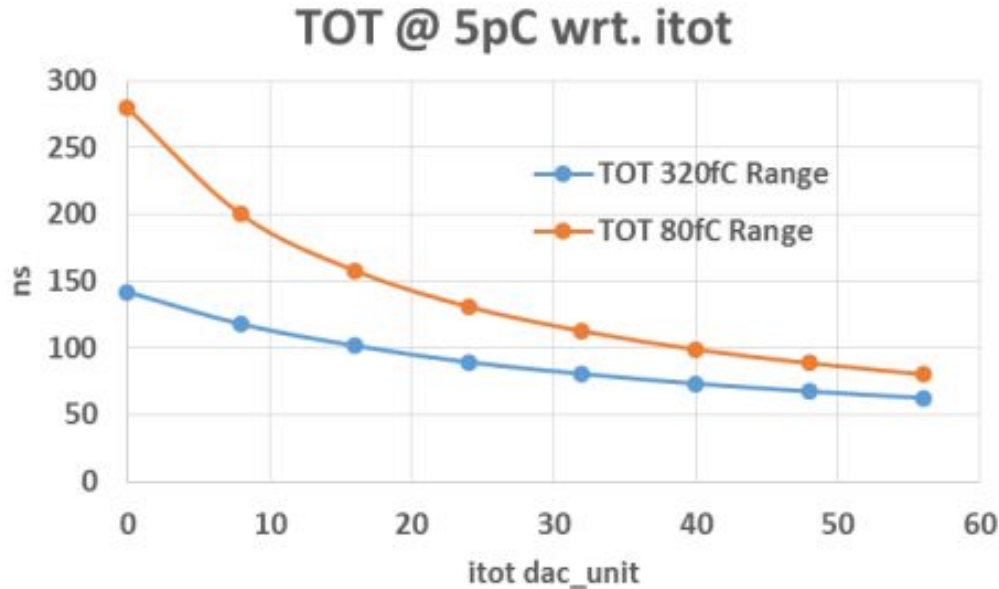
We tested different "itot" settings inspired by:



HGCROC2 datasheet, p. 14

On the itot setting: the TOT discriminator "enables a constant current source which discharges the preamplifier so that the duration of the preamp signal is proportional to the input charge. **This current source can be adjusted over 6 bits in order to adjust the width of the TOT** (nominal specification is 200 ns [full range] for 10 pC)."

We tested different "itot" settings inspired by:

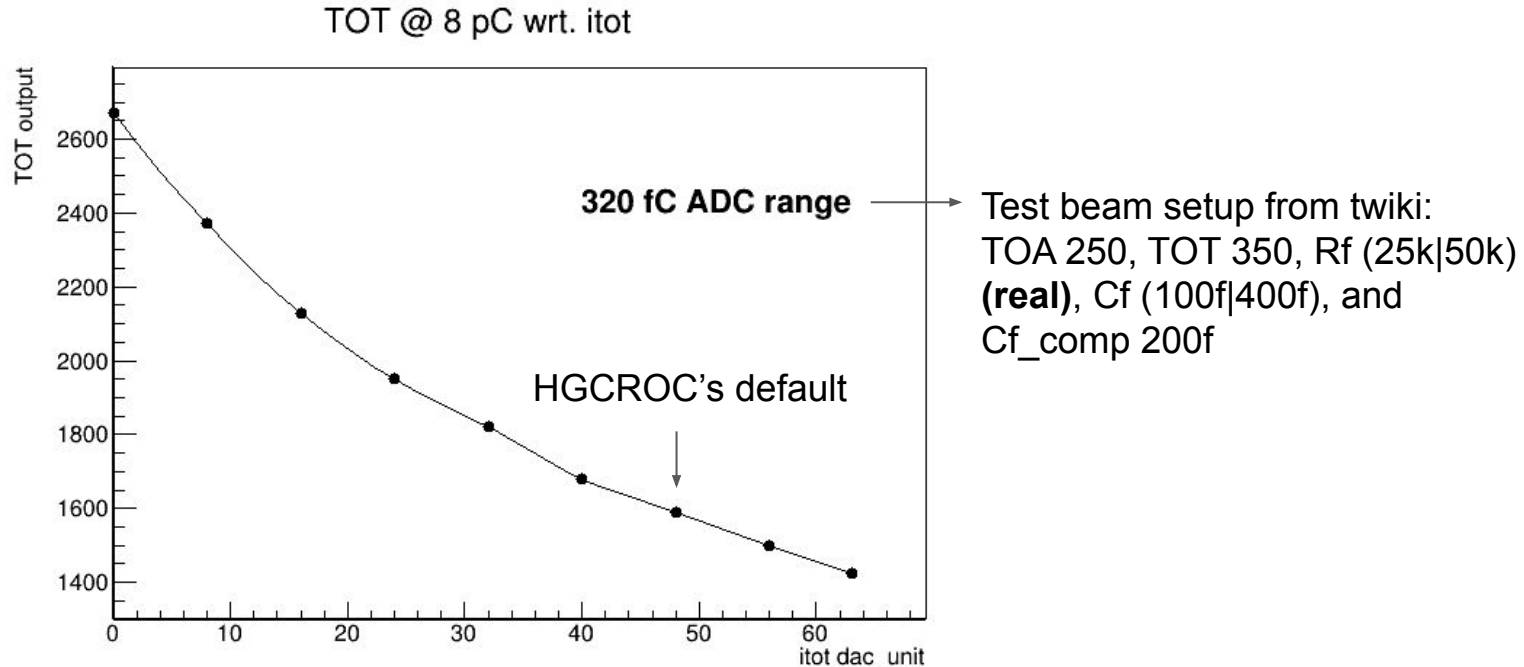


HGCROC2 datasheet, p. 14

TDC ToT specifications	
Resolution	< 50 ps RMS
Range	12 bits over 2-200 ns
Min time between hits	25 ns
Power consumption	< 2 mW / channel
Fixed latency	12 clock periods
Technology	TSMC 130 nm
Area	Pitch 120 μ m
Temperature	-30 $^{\circ}$ C

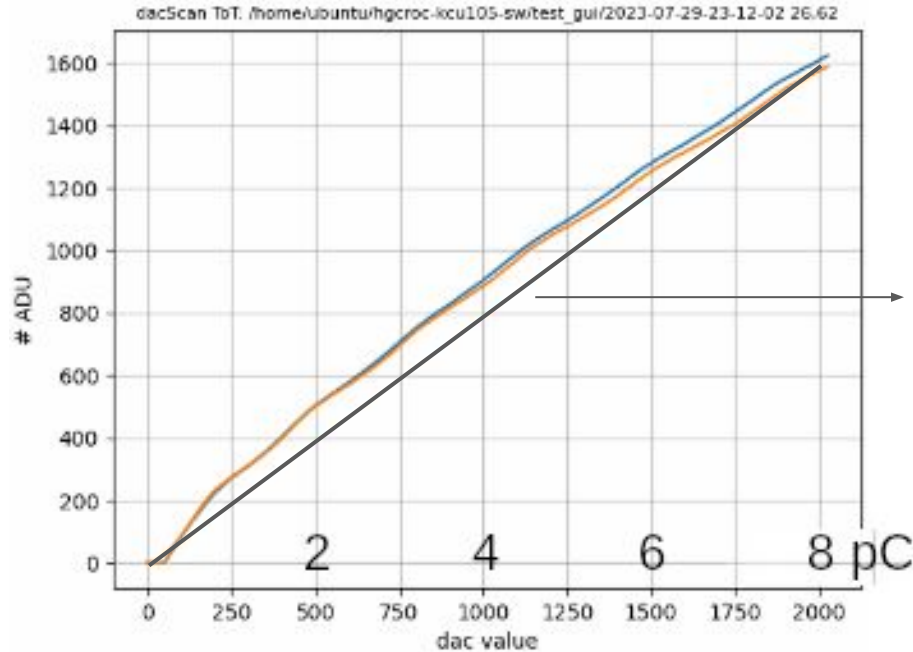
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Internal calibration circuit as input



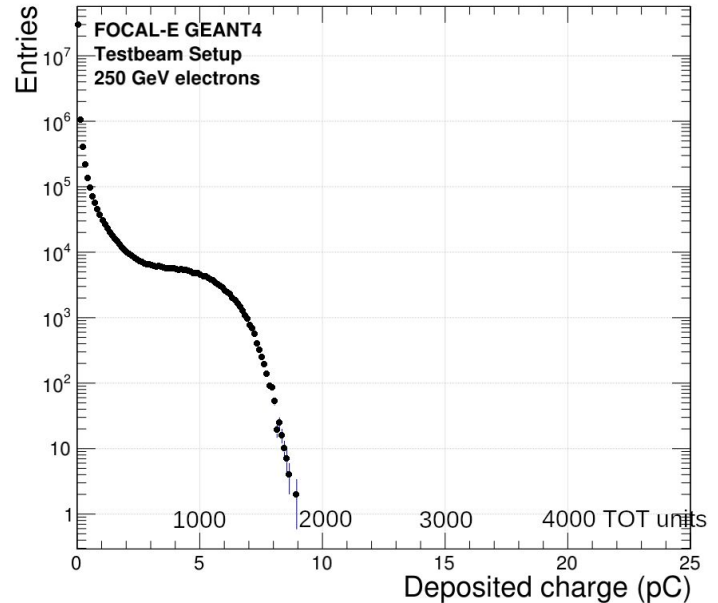
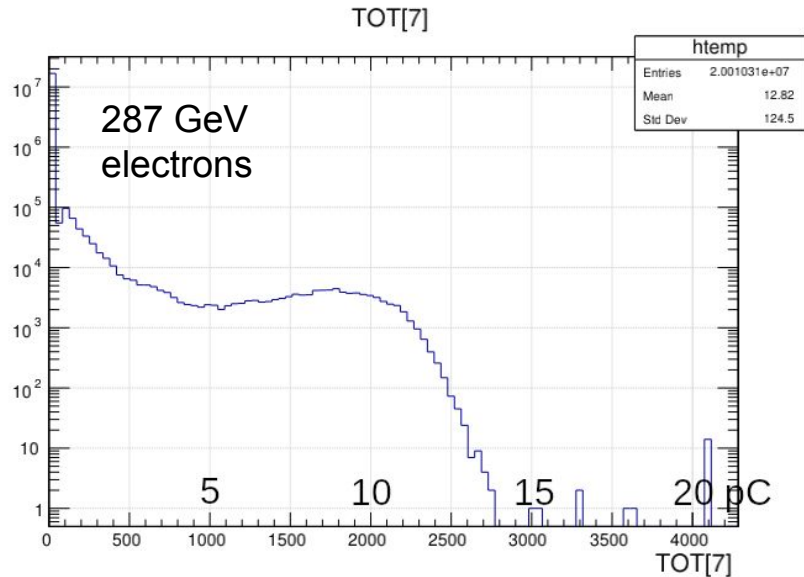
8 pC \rightarrow 1600 TDC units (200 TDC units/pC), then 4000 TDC units \rightarrow 20 pC already

“Linearity check” for extrapolation



We are using this “worst case scenario” regarding charge at TOT saturation

Overlay of “200 TDC units/pC” to Max’s figures



- TOT range already beyond 10 pC that appears in the datasheet and FoCal letter of intent
- Difference between measured 287 GeV and simulated 250 GeV electrons is significant (to the eye)
- The TOT range can be extended (~15%, to 23 pC) by changing the itot setting alone
- Further extension would require increased ADC range through preamp settings (reducing resolution)