

SKIROC interchannel cross-talks measured with FEV8 and charge injection

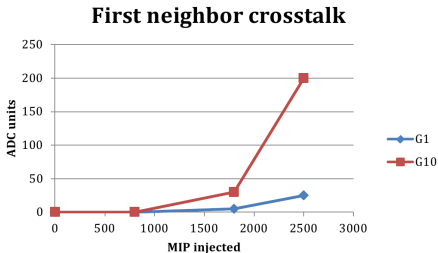
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Cross talk measurements by Jean-Baptiste Cizel

Reported at Annecy'13 CALICE meeting. Performed with Omega testboard.

- 2500 MIP pixel signal fires 3 closest neighbor channels
- Analog signal amplitude after slow or fast shapers was studied
(note: not necessarily == ADC output due to x-talk timing mismatch.)
 - nonlinear cross-talk for high signals

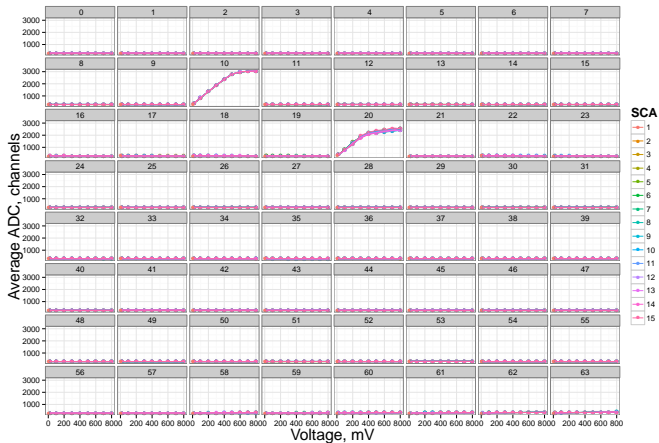


- 1.3% first neighbor cross-talk after slow shaper, **0.4% far pixel x-talk** after fast shaper.

Current setup with FEV8

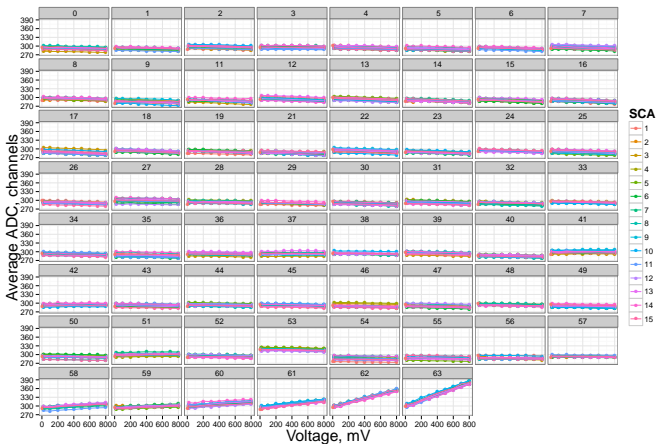
10 kHz pulse generator injects charges into channels 10 and 20 of FEV8 (slab 10). Configuration of 4 chips are identical. Trigger is allowed only in channel 10. All preamplifiers are switched ON. Power pulsing mode, MIP is at 70 ADC channels. High voltage = 120 V (to reduce noises).

Mean ADC versus injection pulse amplitude for chip 0 per chan. and per SCA (color).



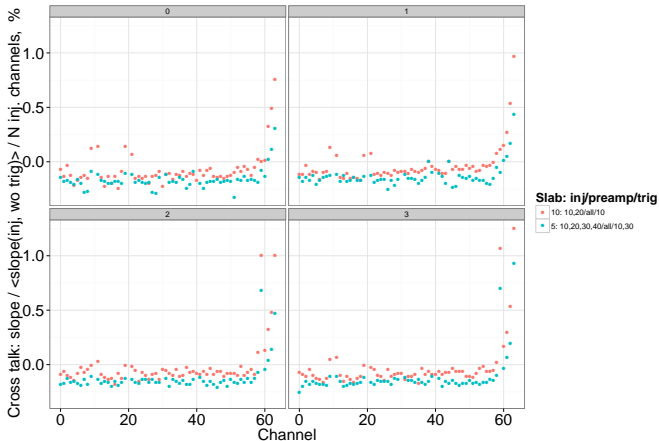
Cross-talk with pedestals

Same but with channels #10,20 excluded. Pedestal offsets depend on SCA, but slopes do not (lines look parallel). Pedestals anticorrelate with injected signals except for channels ≥ 60 . No **saturation** is visible. Still, take only 50 - 400 mV range (linear range for channels #10,20) to find slopes.



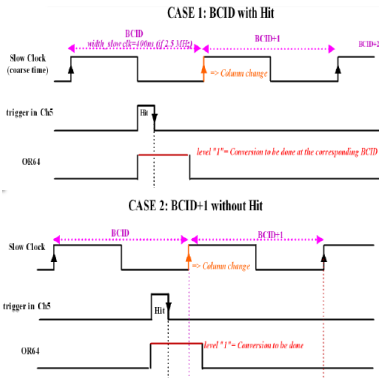
Normalized pedestal slopes = xtalk in %

Averaged over SCA slopes, normalized to total injected to chip charge, approximated as $N_{inj\ channels} \times \text{slope}$ for channel(s) with injection but without trigger (closer in timing to pedestal channels, see later). Similar measurement was done for slab 5: inj. to chan. 10,20,30,40, trigger: 10,30, all preamps ON (blue points). Strong correlation in channels ≥ 60 in all 4 chips in both slabs. Only if all preamps are enabled (see later).



Readout of **NOT** triggered channels

... starts at clock rising edge **AFTER** common trigger OR64. It is delayed compared to triggered channel. If OR64 happens just at clock edge, next bunch crossing (BX+1) is also read out but there are no triggers in it (if no retriggers in BX+1, BX+2, ...).

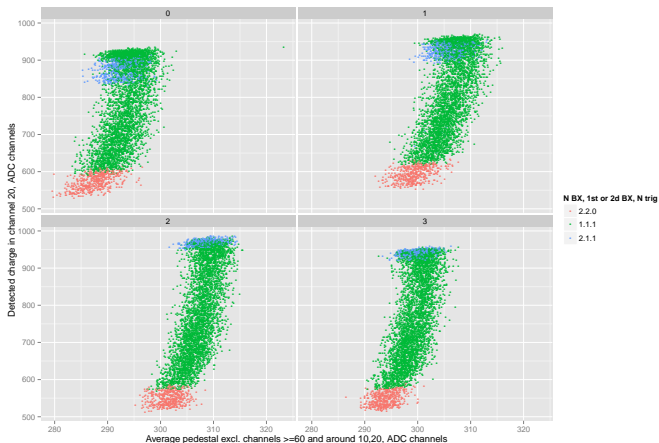


Readout of **NOT** triggered channels (cont.)

Y = ADC in #20 (with masked trigger), slab 10, **100 mV injection only**

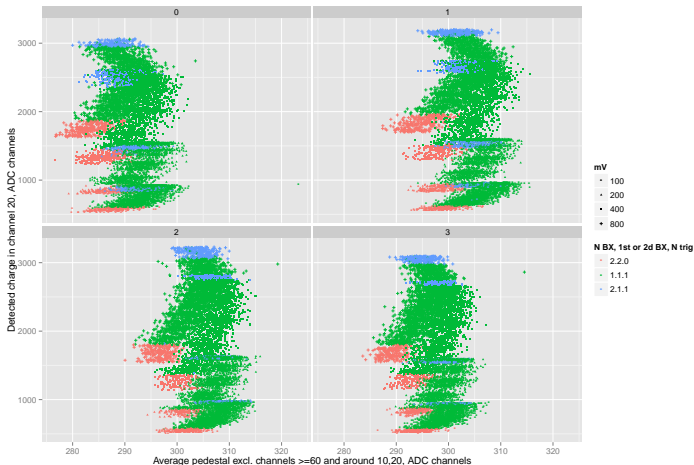
X = average pedestal excluding channels around #10,20 and ≥ 60 .

If clock and injection are desynchronized, varying timing mismatch (ΔT) results in varying signal suppression in the range $\times 0.6 \dots 1$ (green). If OR64 happens at clock edge, both BX = blue and BX+1 = red are present in data.



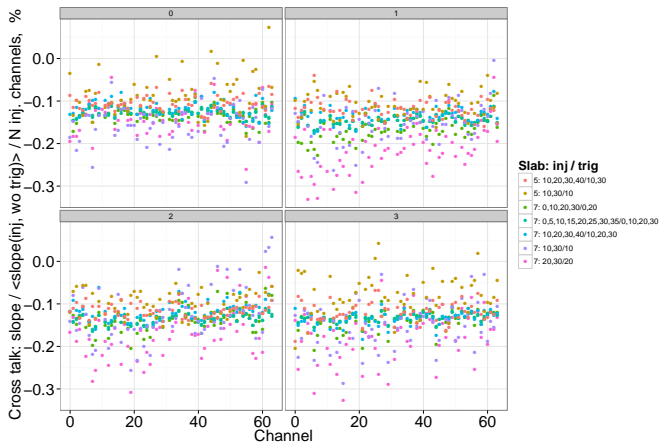
Readout of **NOT** triggered channels (cont.)

Same for injection voltages **100, 200, 400, 800 mV**. Note complex nonlinear “banana” shape reflecting timing dependence (probably, overshoot oscillation). To select minimal ΔT , only **blue points** are taken in **all previous and the following slides**, ie. only BX when BX+1 is present and does not contain triggers.



More results for slabs 5, 7.

Same method was applied for slabs 5, 7, but **with preamps OFF except for channels with injection**, for various injection / trigger patterns. Eg. for slab 5: injection and preamp for 10,20,30,40 (10,30), trigger in #10, 30 (10); and 5 patterns for slab 7. Normalization to total inj. charge, again approximated as N injection channels \times mean slope in channels with injection but no trigger. Strong fluctuations, average anticorrelation $\sim 0.1 \dots 0.15\%$. No strong correlation for channels ≥ 60 .



Conclusions

- Jean-Baptiste measurement (reported in Annecy'13 CALICE meeting): 2500 MIP pixel signal fires 3 neighbours, cross-talk is nonlinear at high signals.
- Current measurement with FEV8: ≤ 50 MIP/channel, ≤ 400 MIP/chip, 768 channels, preamps OFF except for channels with injection:
average x-talk level = -0.1 .. -0.15% (anticorrelation), large fluctuations. If all preamps ON: correlation (up to $\sim 1\%$) in channels ≥ 60 .
- Complicated timing dependence. Select events when pedestals and triggered signals are readout approximately at the same time (to mimic influence on physical signals).

Backup slides

Pedestal width in chip 0, slab 10

Pedestal RMS for different SCA (shown by color gradient) versus injection amplitude. 1 MIP = 70. Higher RMS is either around channels #10, 20 (injection) or for channels with 4 connected Si pixels (7, 8, 27, 28, 37, 41, 42, 51, 58, 60, 62, 63). All preamps ON.

