AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Towards front-end for LHCb upgrade tracker
Some considerations

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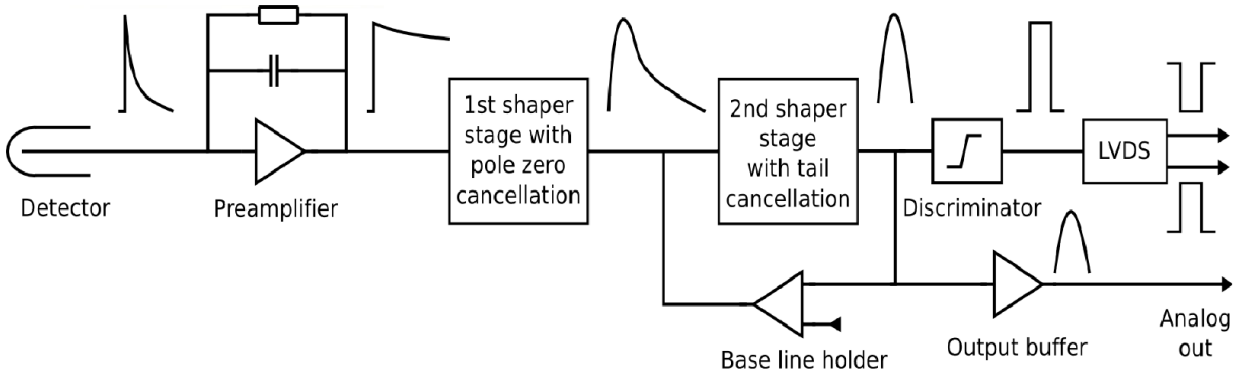
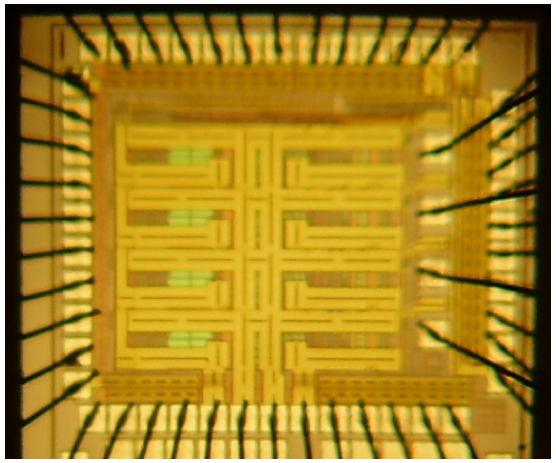
PANDA STT Front-End Architecture

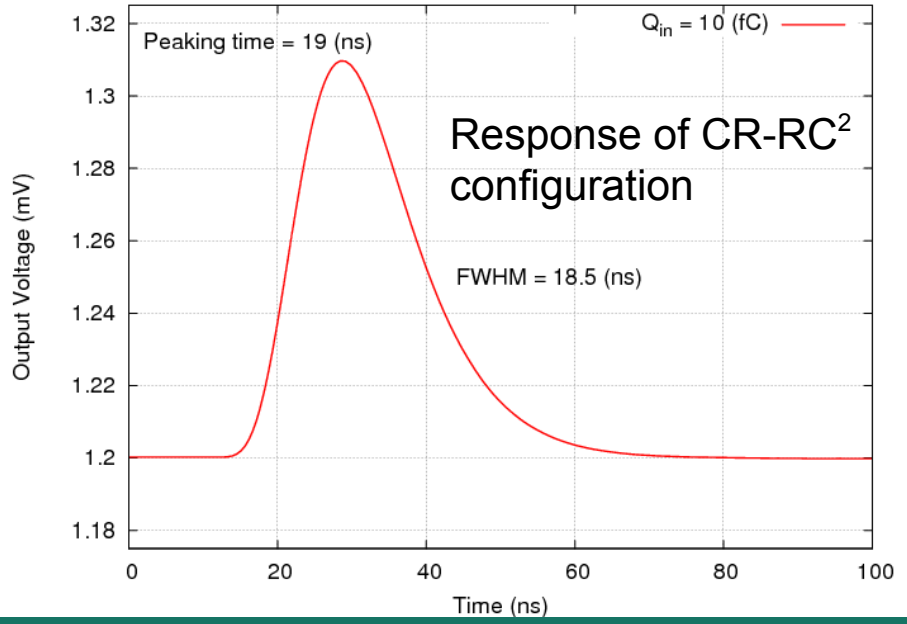


- Preamplifier with variable gain and time constant
- CR-RC^2 shaper with variable T_{peak} (default ~20ns for delta)
- Tail cancellation with two variable time constants
- Baseline stabilized by BLH circuit
- Leading edge discriminator for time measurements
- Fast LVDS output
- Buffered analog output

PANDA STT ASIC – First Prototype

- ASIC designed and fabricated in AMS 0.35um technology
- Four channels implemented
- ~15.5mW/channel plus LVDS (~12mW)
- Channel size 200um x 1130um
- Gain in 2 – 20 mV/fC range
- ENC < 700e- for highest gain (25pF Cd)
- Time walk < 8ns; Jitter < 0.2ns





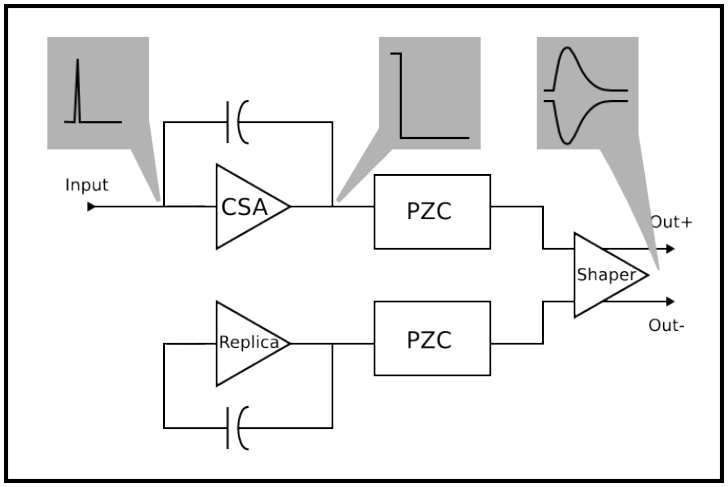
LumiCal FEE in 130nm, in progress...

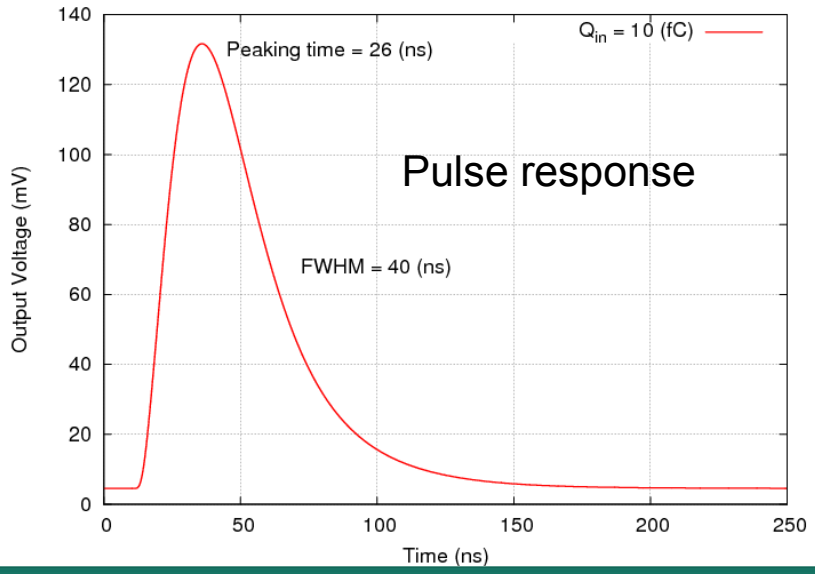
Specifications, still under discussions:

- Charge Sensitive Preamplifier with PZC
- Fully differential CR-RC Shaper
- Variable gain: 0.15 $^{mV}/_{fC}$ – 15 $^{mV}/_{fC}$

(Two modes: calibration – high gain and physics – low gain**)**

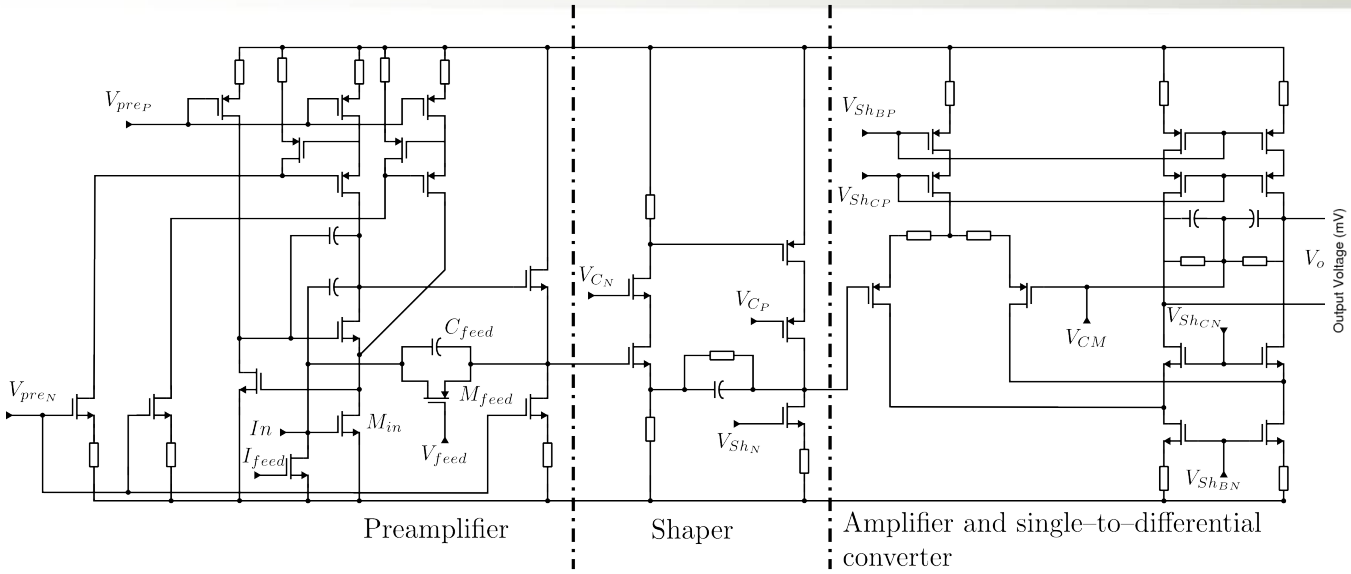
- Variable peaking time: 25 – 100 ns
- Cdet ~ 5 - 30 pF
- Noise < 0.4 fC (SNR ~ 10 for MIP)
- Power cons. ~2mW/channel

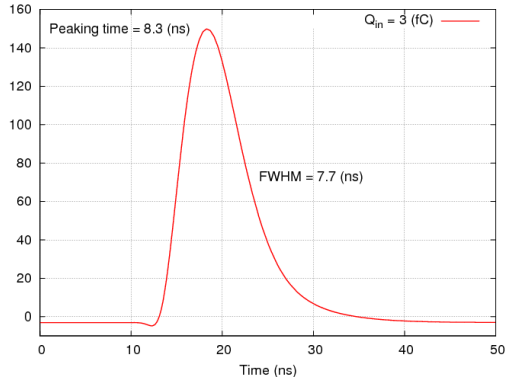




Front-End for BCM, in progress...

D. Przyborowski under J. Kaplon supervision

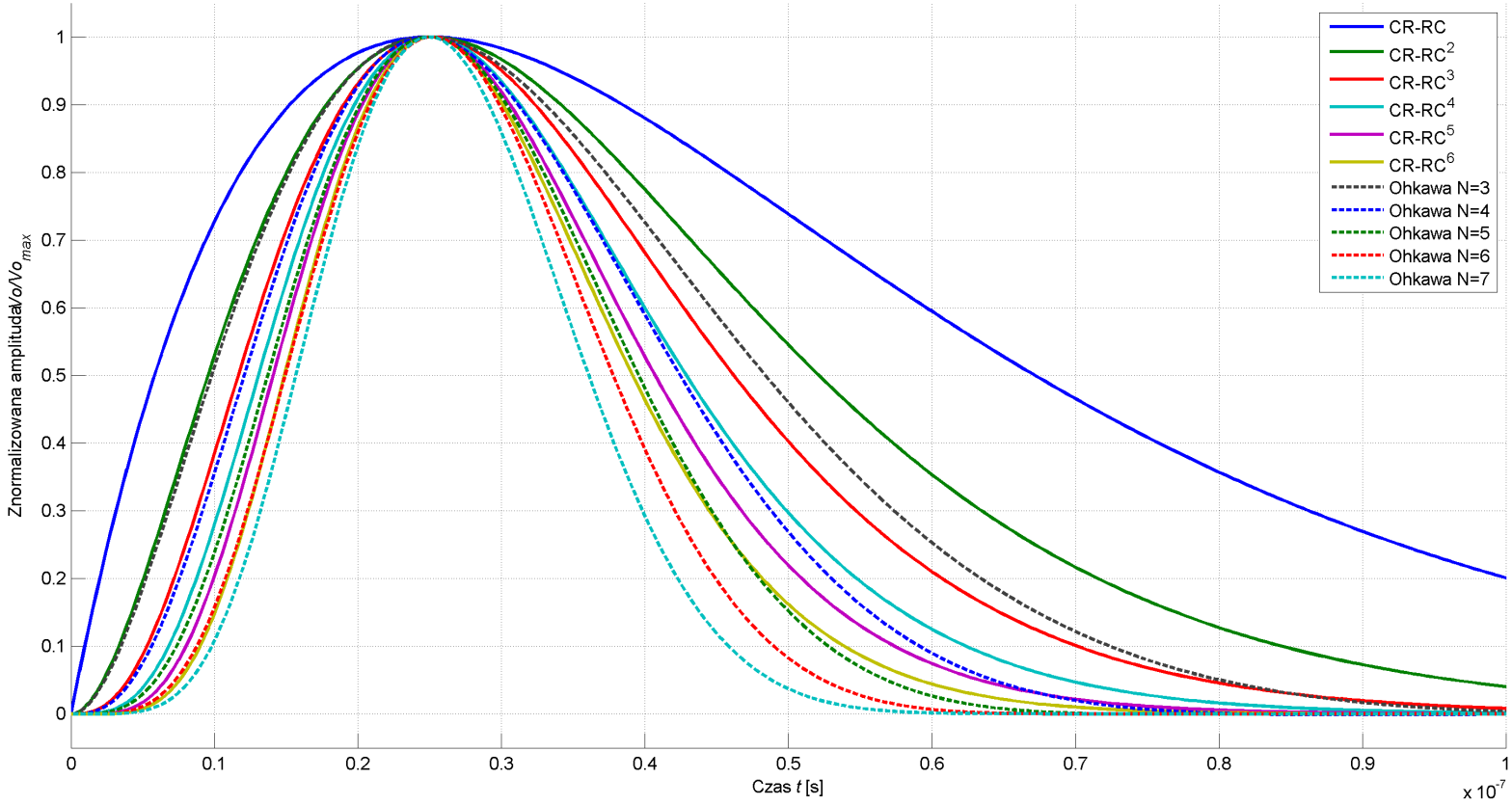




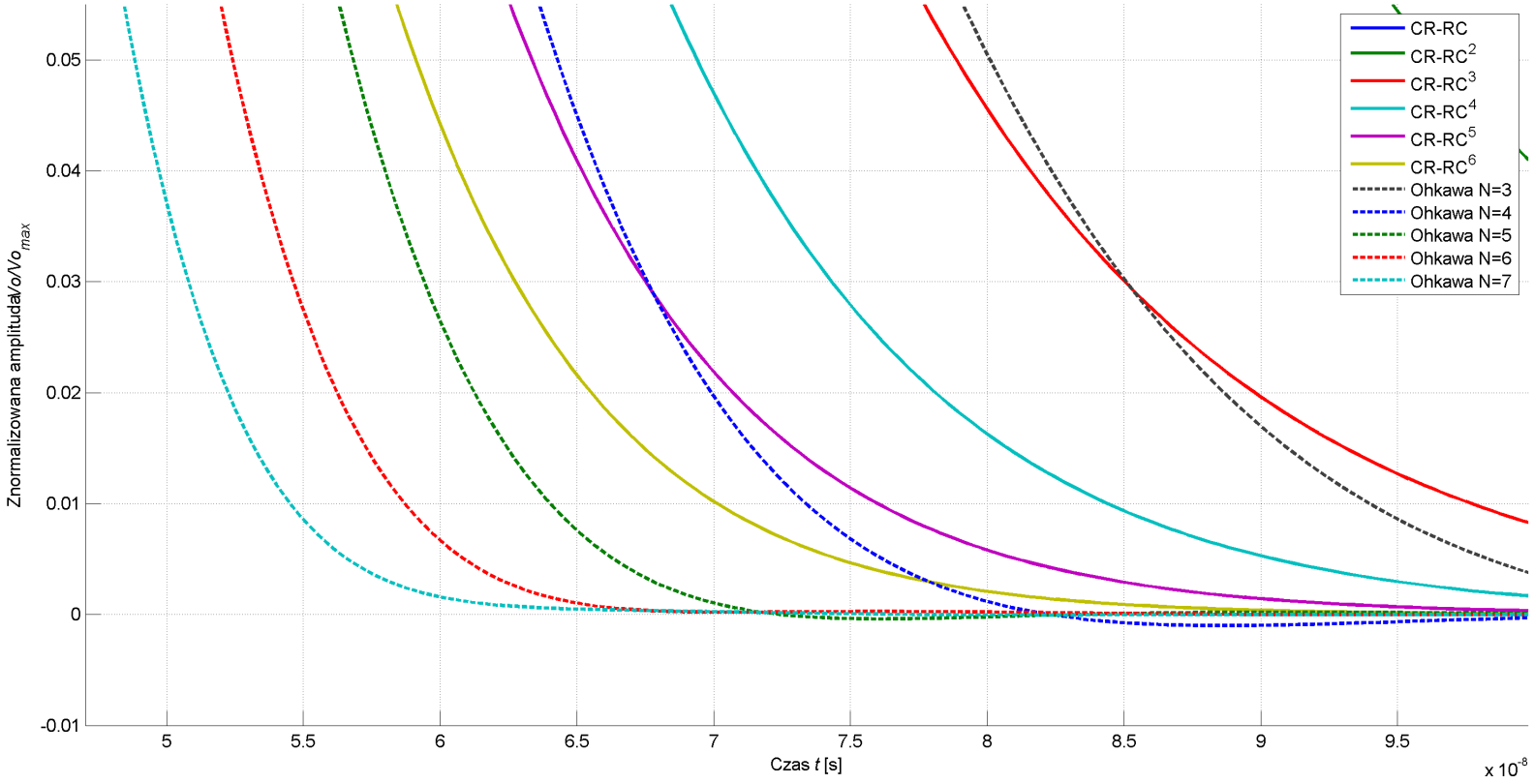
Pulse response

- IBM 130 nm Technology
- Fast transimpendance preamplifier with CR–RC^2 shaping
- HV enabled design – 2.5V supply with thin oxide devices
- 50mV/fC gain
- ~8 ns of Tpeak and FWHM
- < 800e- for 5pF Cin
- Power cons. ~1.3 mW/Ch
- Fast return to baseline after high overdrive signal (~200ns for 1pC input)

Pulse shaping - theory



Pulse shaping - theory



Few conclusions for LHCb upgrade front-end

- For fast return to baseline higher order and non-standard pseudo-gaussian shaping is advocated, or shorter peaking time...
- Differential output requires fully differential amplifier driving capacitive ADC inputs (each one ~0.5pF),
- Both mentioned issues together with rather large sensor capacitance (5-30pF), will affect front-end power consumption.