CALICE Calorimeter for ILC

Analog Channel for SiPM charge readout

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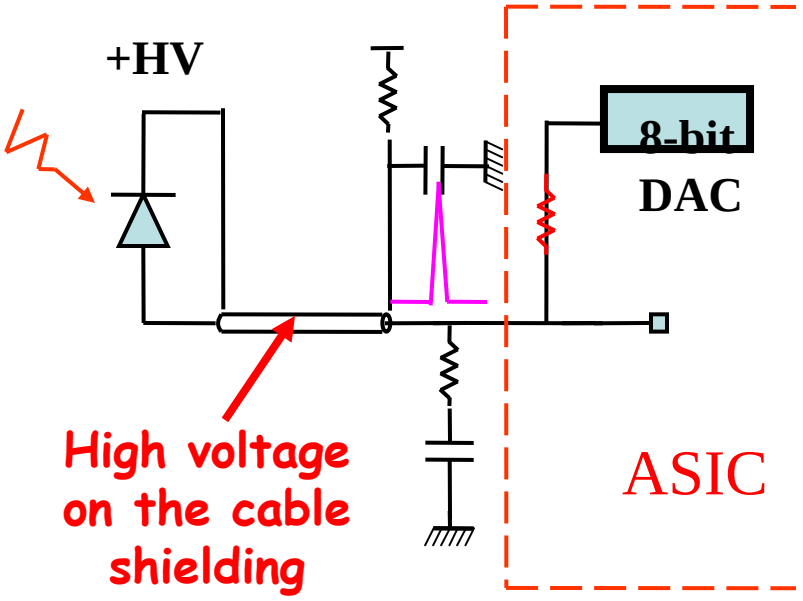
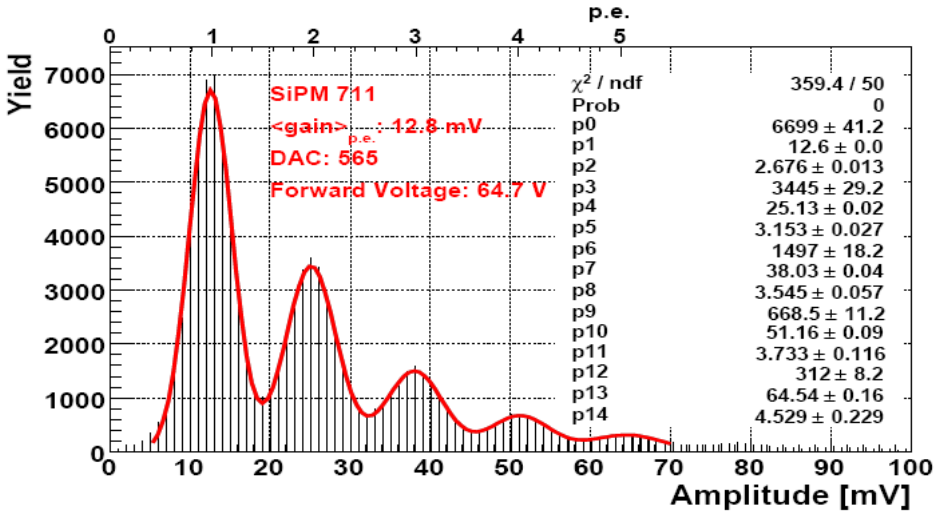
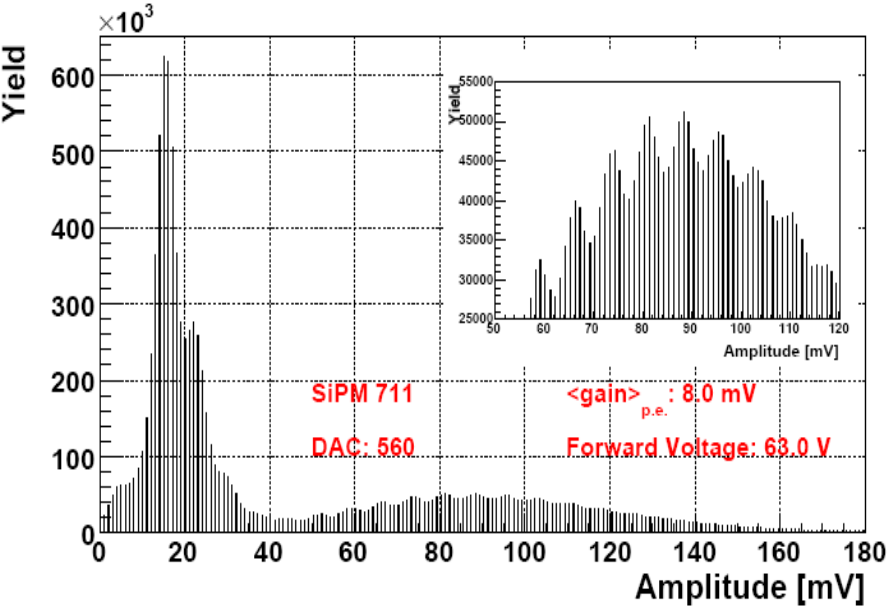
DESY

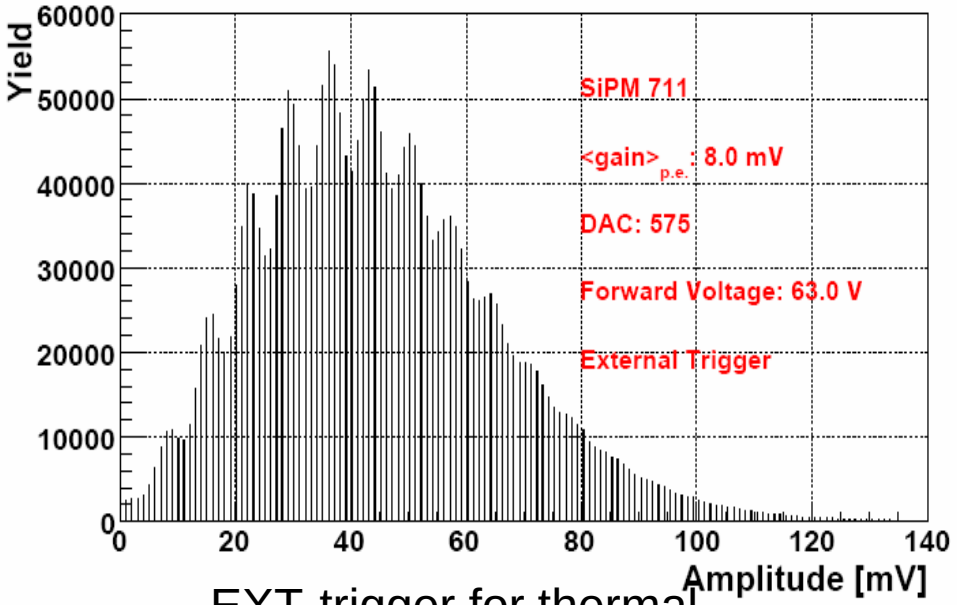




Auto-trigger for thermal noise,gain~ O(10^6)

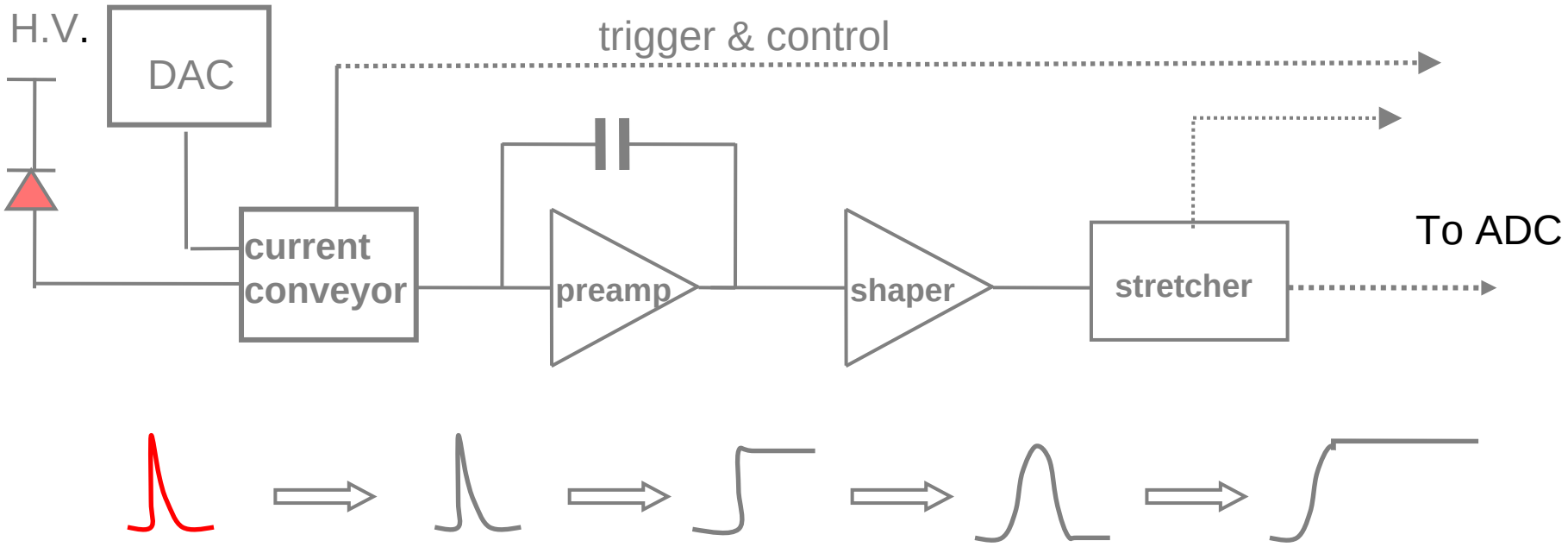


Auto-trigger for thermal noise,gain ~O(0.5*10^6)



EXT-trigger for thermal noise,gain ~O(0.5*10^6)

single channel architecture



input DAC : gain tuning

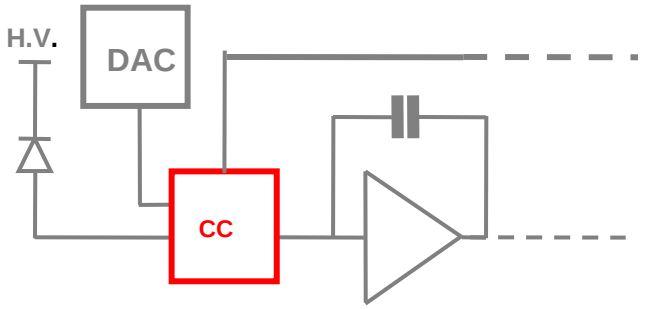
current conveyor : fast rising edge and large dynamic range

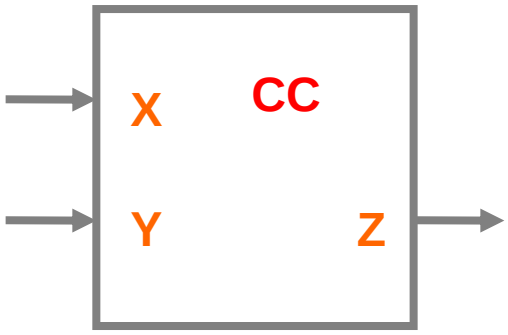
CSA : high signal to noise ratio

different shaping time : avoid pile up

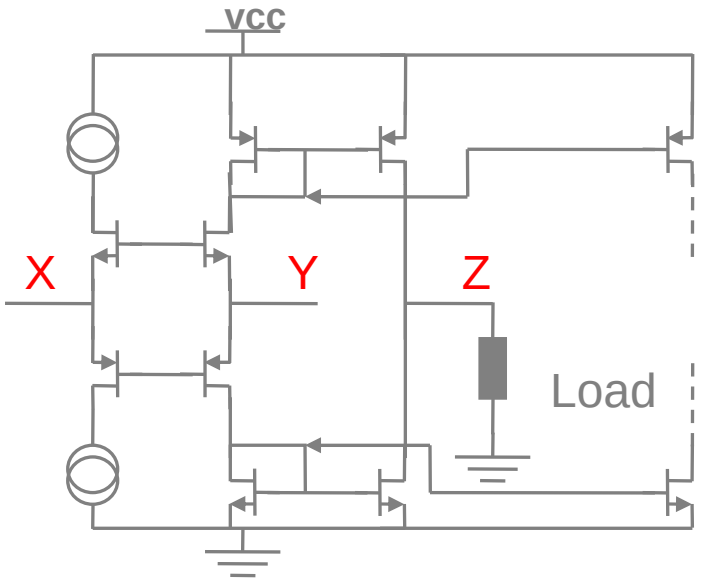
AMS 0.35um CMOS technology

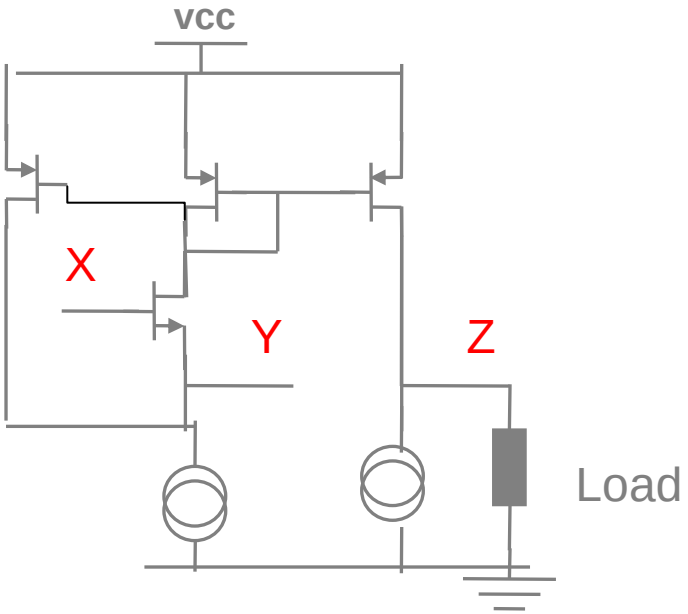
current conveyor



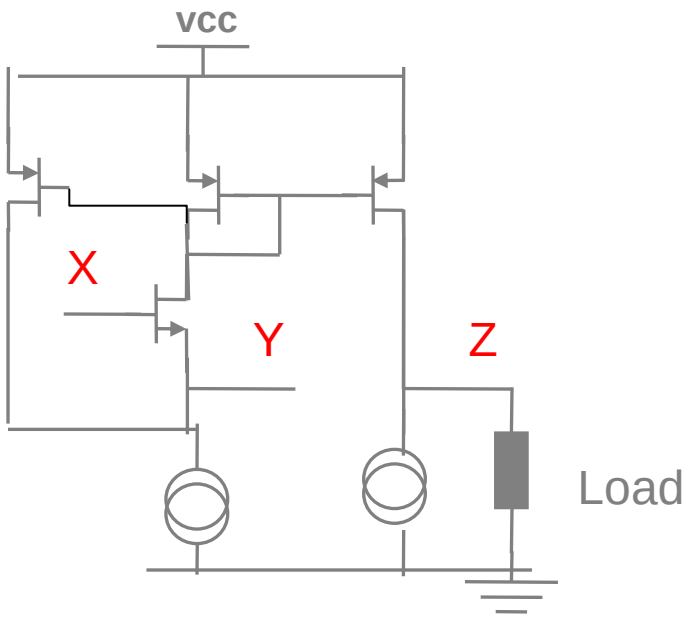


$V_Y=V_X$ $I_Z=I_Y$ $I_X=0$





current conveyor : detail



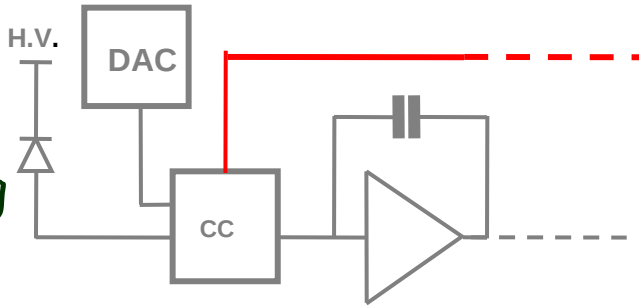
1. Input impedance
2. Oscillation, due to output impedance of conveyor
3. undershoot

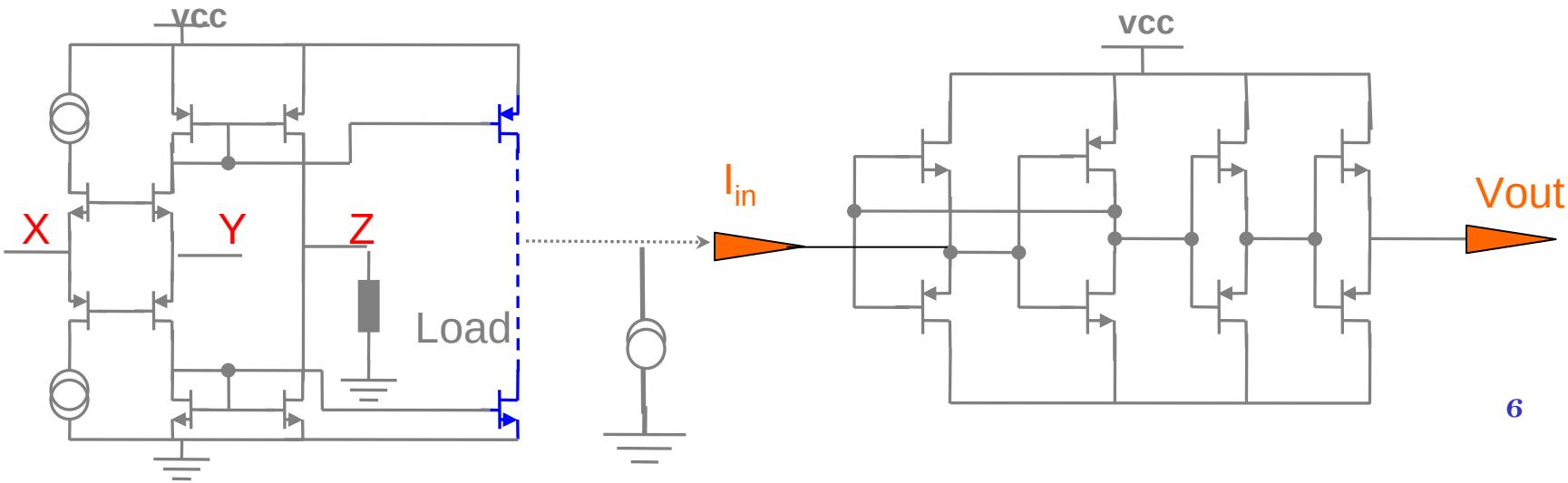
current comparator

- class B output stage & 3 inverter
  Latched output , low dc offset,
- low power consumption
- ~2 ns delay with leading edge triggering

TTL logic output

•different threshold can be set for triggering (standby current)



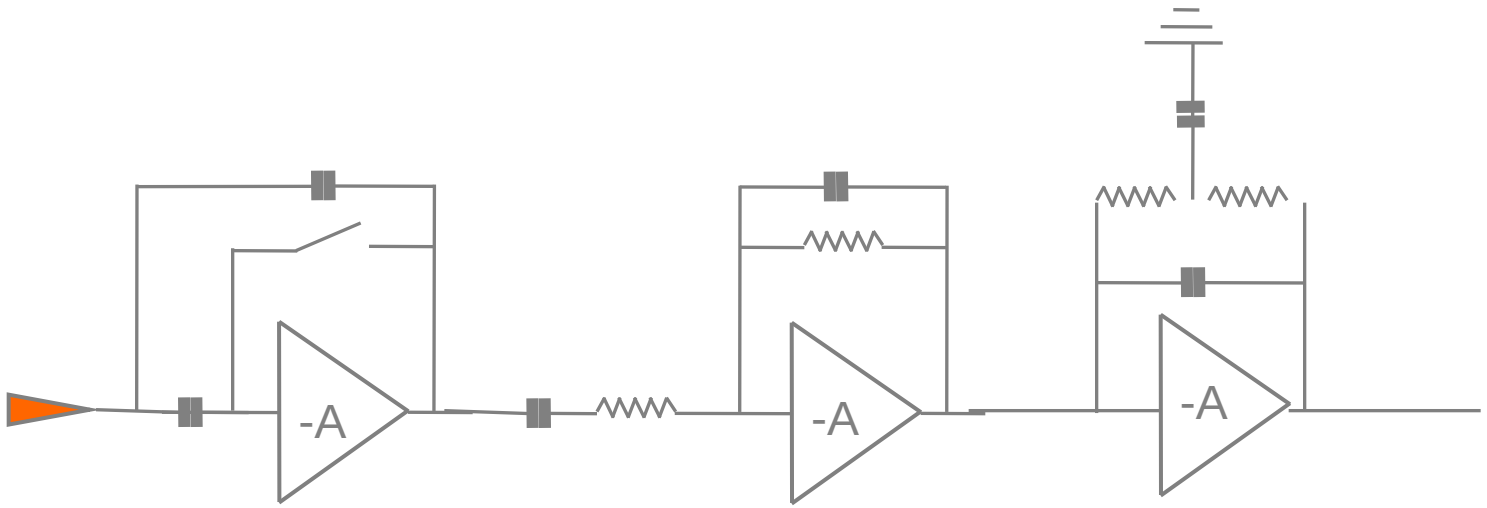


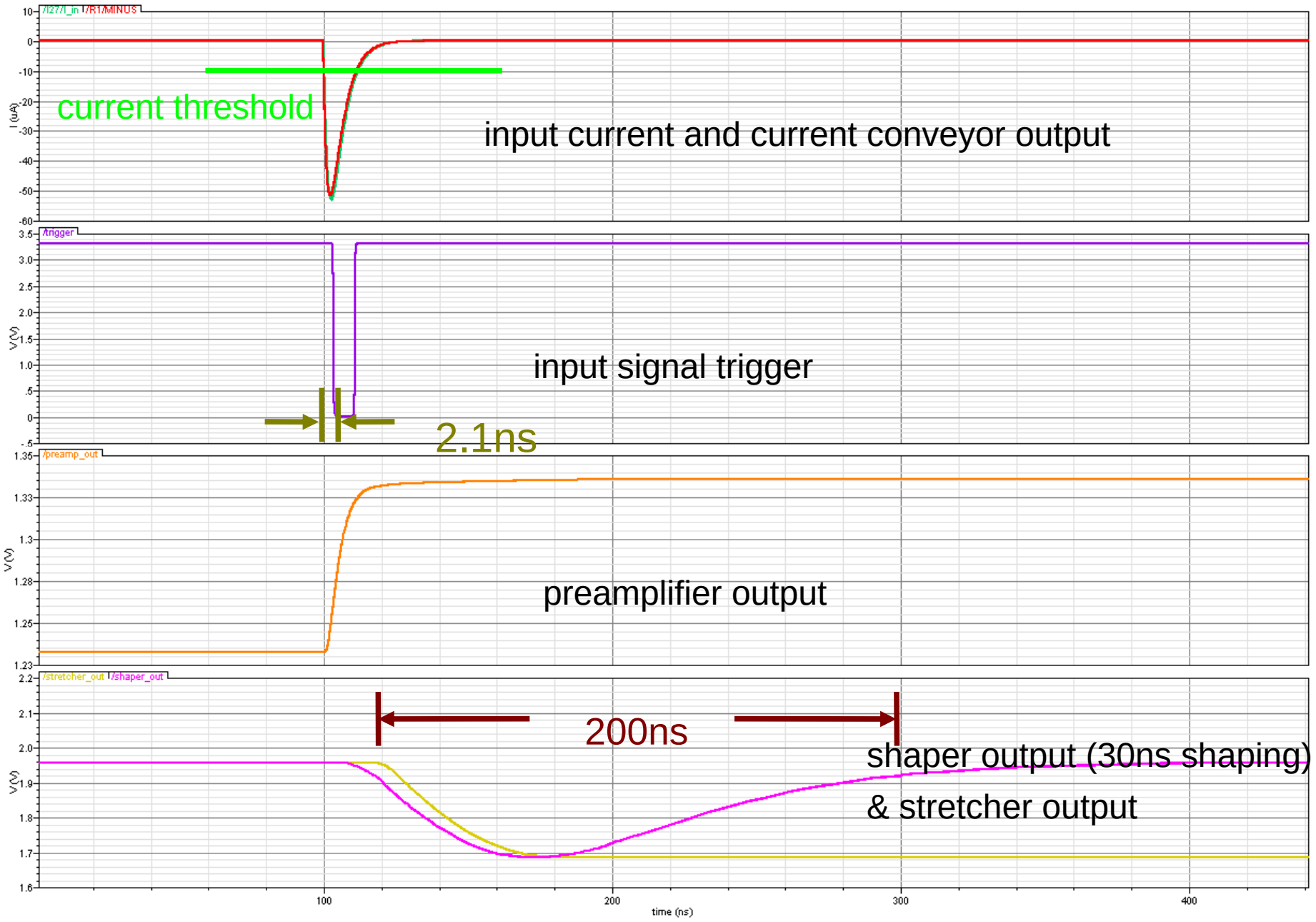
pre-amplifier + shaper

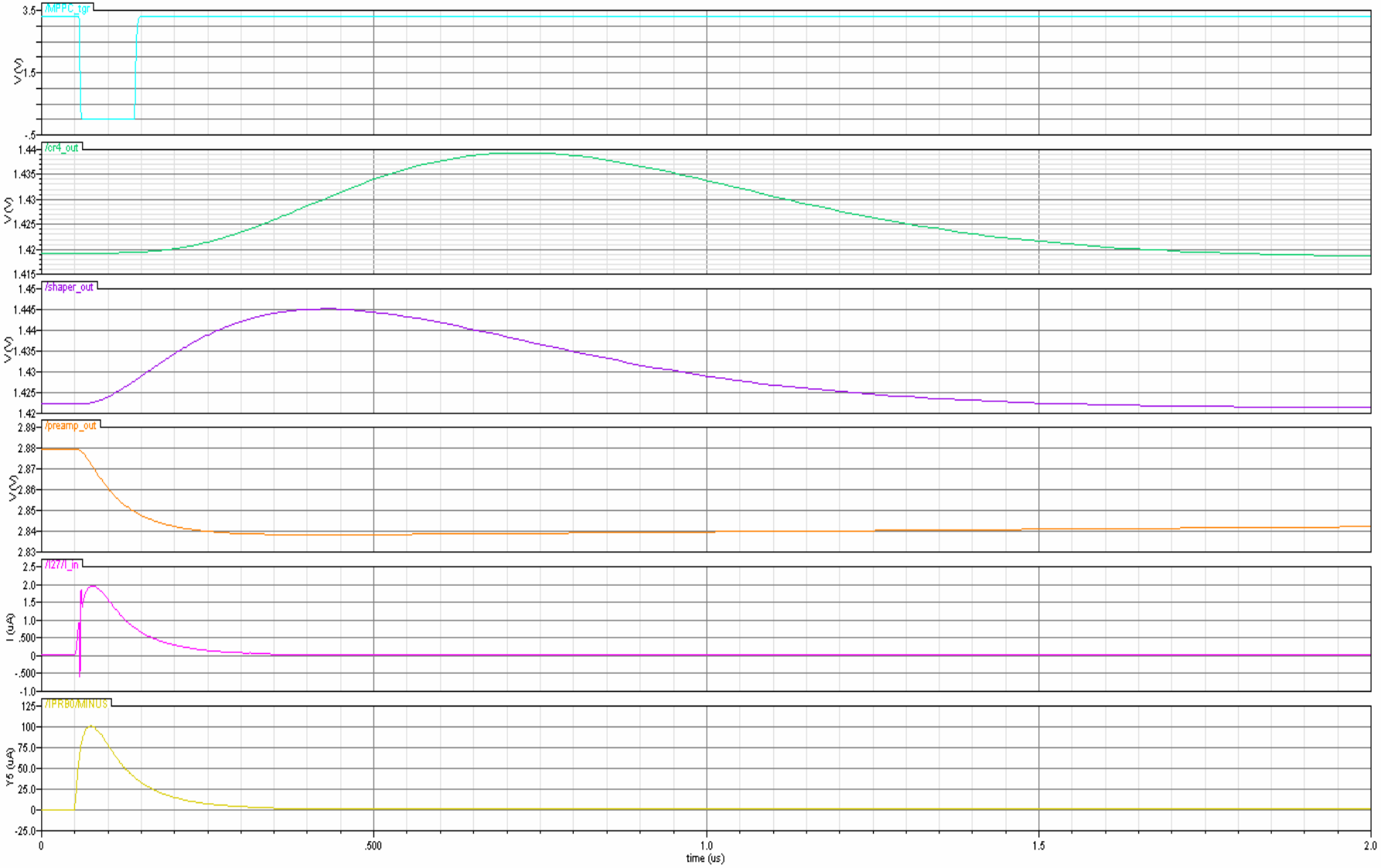
folded cascode structure

CR- (RC)4 shaper , shaping time (20ns - 200ns)

ballistic deficits




current threshold
input current and current conveyor output
input signal trigger
2.1ns
preamplifier output
200ns
shaper output (30ns shaping)
& stretcher output
time (ns)


/MPPC_tgr
V (V)
/cr4_out
V (V)
/shaper_out
V (V)
/preamp_out
V (V)
/I277I_in
I (uA)
/IPRBOMINUS
Y5 (uA)
time (us)

SUMMARY

- Analog channel designed for silicon photomultiplier
- High S/N ratio (>10 for single pixel w.r.t. 40fC charge)
- Narrow output to avoid pile up (20ns - 200ns)
- Fast trigger information (2ns delay for input current triggering)
- dynamic range : ~200pC

STATUS

- Layout : Preamp , shaper , discriminator
- Miniasic run in Oct.