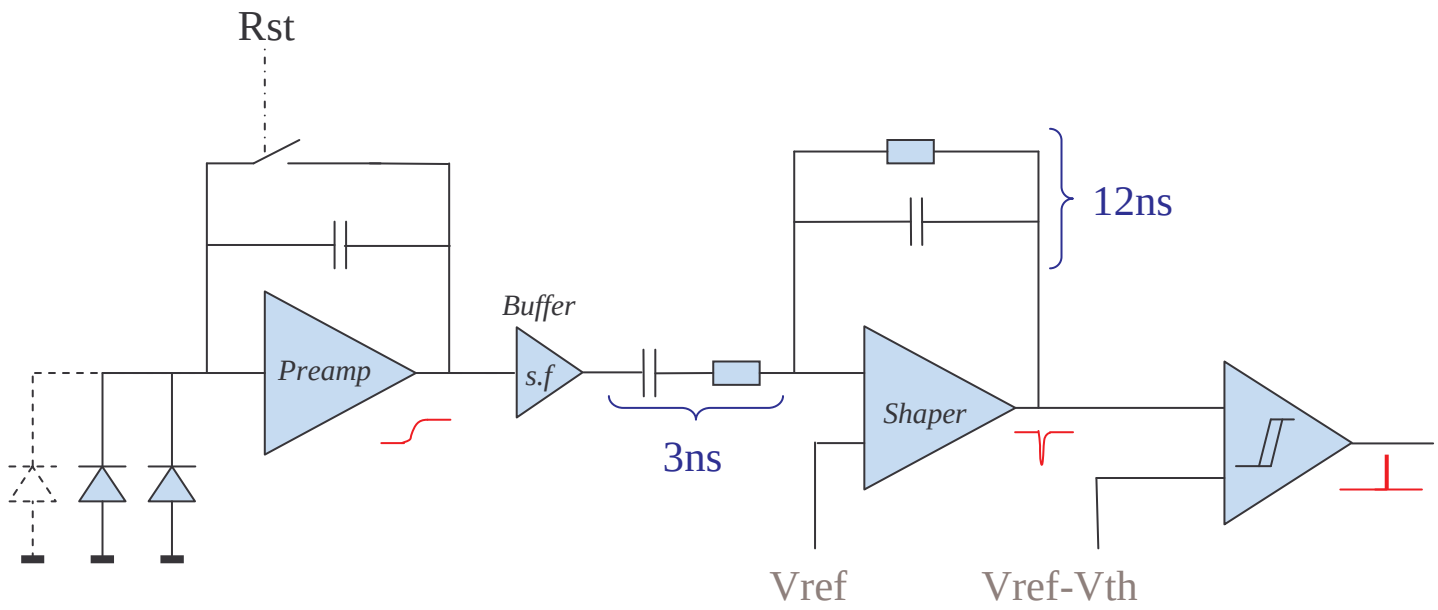
Tera-Pixel APS for CALICE

Progress

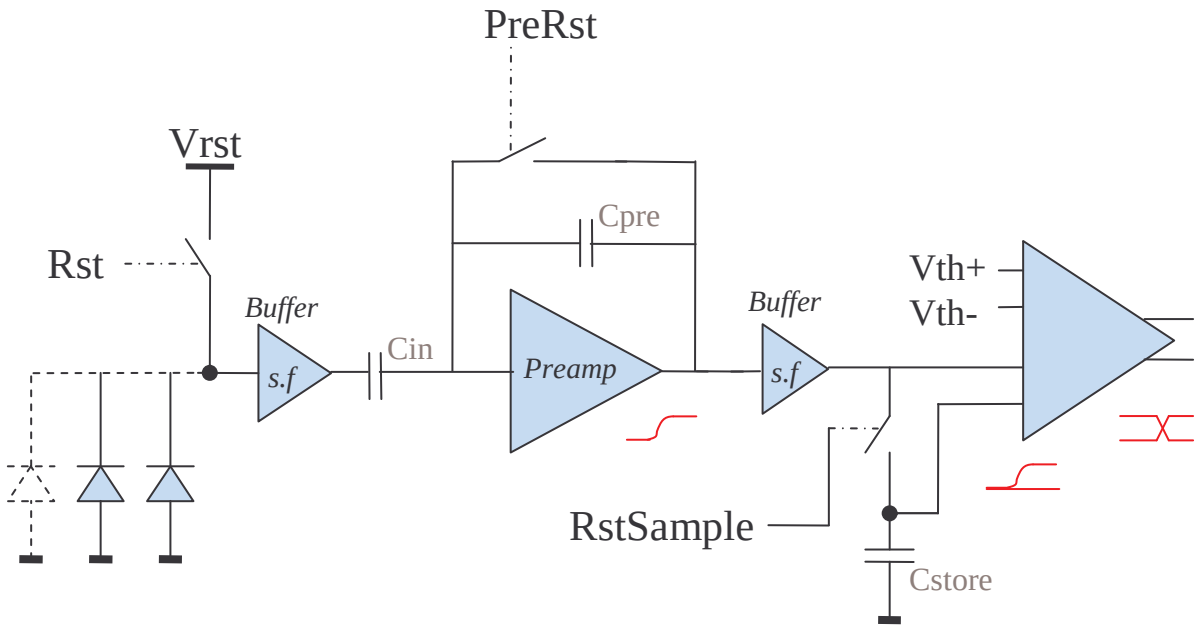
20th October 2006

[JC+RT]

PreShape Pixel



PreSample Pixel



PreShape Pixel

Pixel Source follower	Charge (Pre)amplifier	Output Source Follower	Comparator (in-pixel)	Comparator (off-pixel)
1.8v	1.8v	1.8v	1.8v	1.8v
0.9uA	1.3uA	1.2uA	1uA	750nA
1.6uW	2.4uW	2.2uW	1.8uW	1.3uW

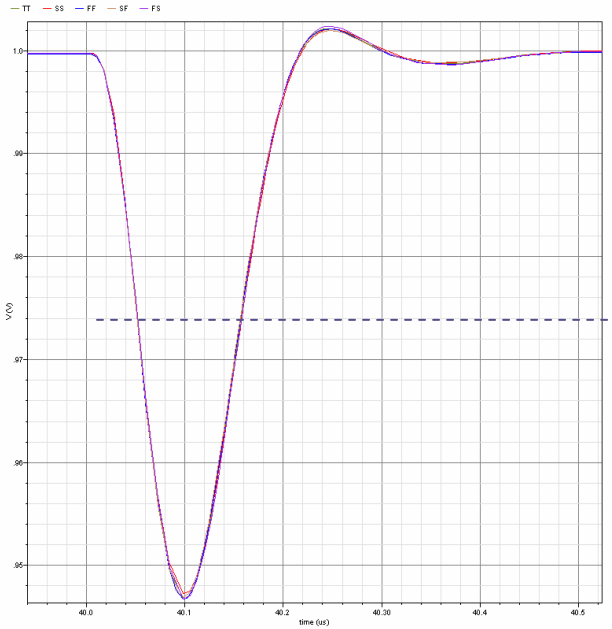
⇨ 11.8µW

PreSample Pixel

Preamp	Source Follower	Shaper	Comparator (in-pixel)	Comparator (off-pixel)
1.8v	1.8v	1.8v	1.8v	1.8v
3uA	1.1uA	1.7uA	0.5uA	0.3uA
5.4uW	2uW	3uW	0.9uW	0.5uW

⇨ 9.3µW

PreShape Pixel

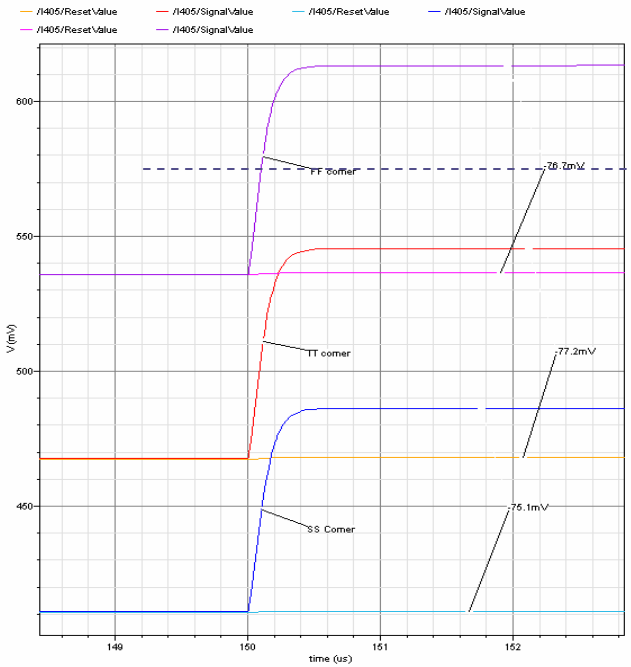


250 electron hit

55mV typ.
~150ns above threshold

220uV/electron

PreSample Pixel



250 electron hit

75mV typ.
requires reset (150-300ns)

300uV/electron

PreShape Pixel

Transient Noise

11mV typ at input to comparator

~ 50 electrons

PreSample Pixel

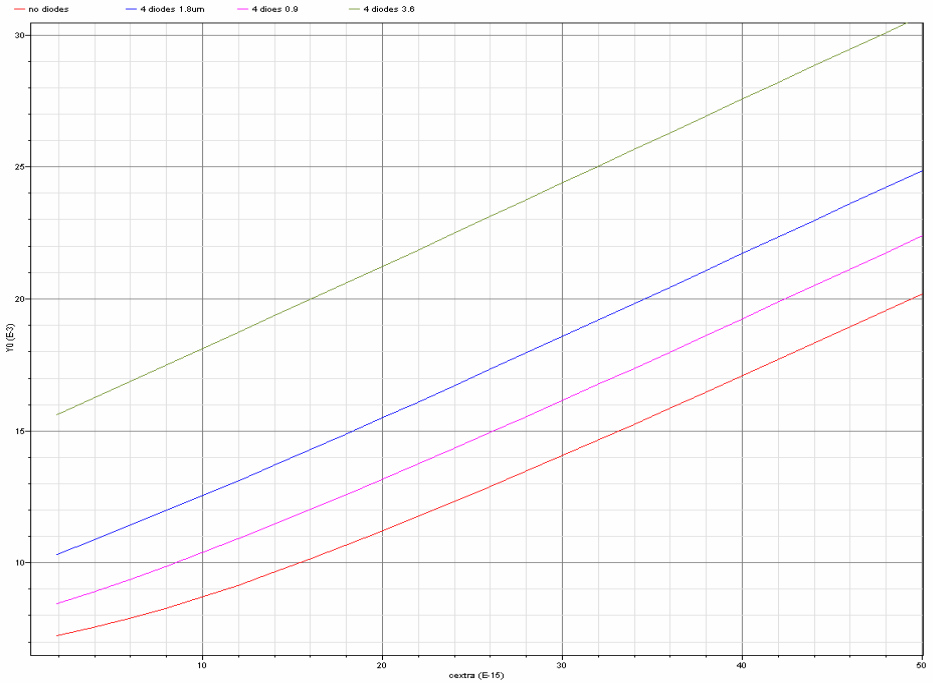
Transient Noise

6.9mV typ at input to comparator

√2 = 9.8mV (√2 due to sampling)

~ 32 electrons

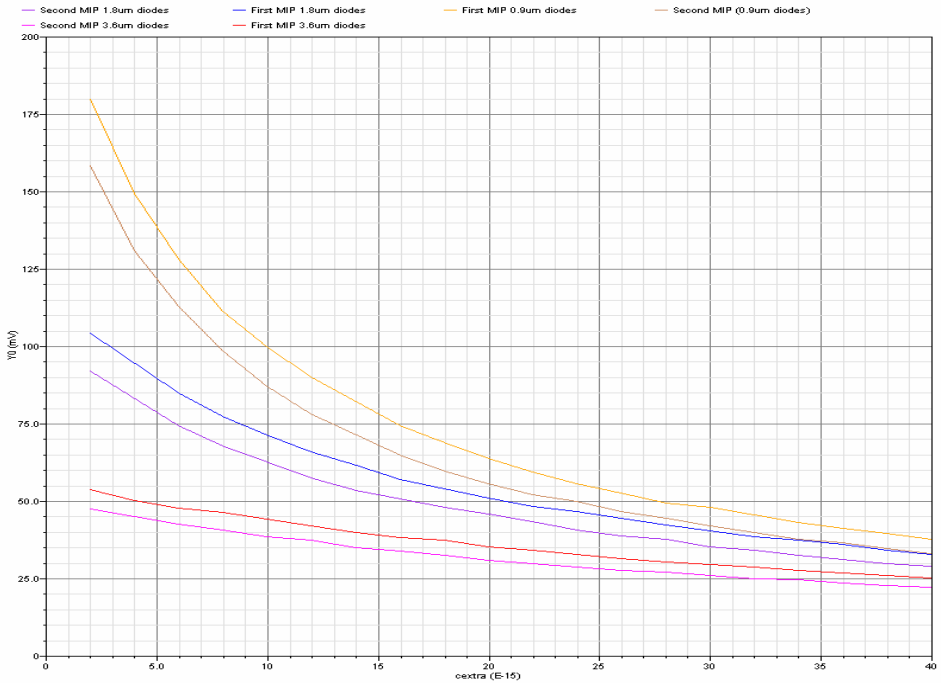
PreShape Pixel



Signal/Noise optimisation

Larger diode capacitance increases noise

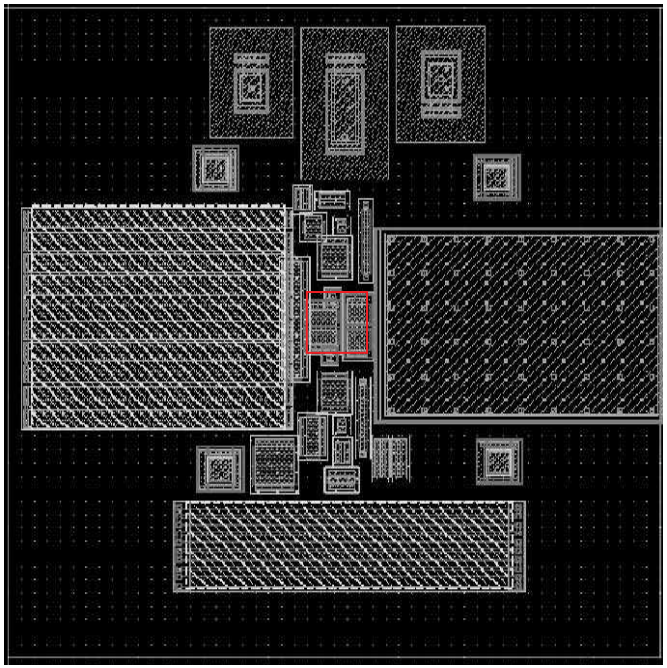
PreSample Pixel



Signal/Noise optimisation

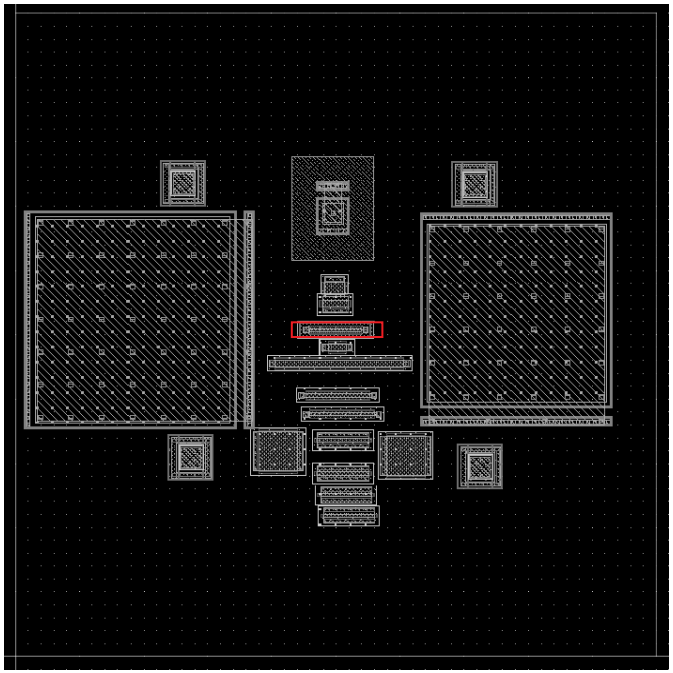
Larger diode capacitance decreases signal

PreShape Pixel



NWELL = 5 x 5 μm

PreSample Pixel



NWELL = 1.3 x 6.3 μm

PreShape Pixel

Advantages

Always active (no reset)
No overflow (pixel recovers after saturation)

Disadvantages

Power
NWELL
S/N
Mismatch

Risks

Cpre feedback cap

>10 MIP behaviour

Saturation causes pulse elongation à double hits

PreSample Pixel

Advantages

Power
NWELL
S/N

Disadvantages

Requires reset after hit
à additional logic
à dead time after hit
Reset sample can contain error
Pixel can saturate (overflow)

Risks

Cpre feedback cap

>10 MIP behaviour

Increased error in reset sample for subsequent hit