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CALICE

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Noise in counting system.

The noise in counting system is not exactly zero. There is always a finite probability that a noise hit is generated. This problem is a general statystical problem called ‘level-crossing’ problem. The exact analysis is complicated, but with some approximation a litteral expression for the number of noise hits in the unit time N_t can be found.
If the noise is of the gaussian type, the filter is a band-pass centered at frequency f_0, the noise at the input of the counting system is s and the threshold is V_{th}, we can show that

$$N_t = 2f_0 * \exp\left(-\frac{V_{th}^2}{\sigma^2}\right)$$

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Parameter	Unit	25 um pitch				50 um pitch			
fL	Hz	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06
fH	Hz	1.00E+08	1.00E+08	1.00E+08	1.00E+08	1.00E+08	1.00E+08	1.00E+08	1.00E+08
f0	Hz	5.05E+07	5.05E+07	5.05E+07	5.05E+07	5.05E+07	5.05E+07	5.05E+07	5.05E+07
epi thickness (um)	um	15	15	15	15	15	15	15	15
charge	electrons	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
charge /2	electrons	600	600	600	600	600	600	600	600
noise	electrons	40	40	40	40	40	40	40	40
S/N/2		15	15	15	15	15	15	15	15
Vth/noise		6	5	4	3	6	5	4	3
Vth		240	200	160	120	240	200	160	120
Noise hits / unit time	sec-1	2.34E-08	1.40E-03	1.14E+01	1.25E+04	2.34E-08	1.40E-03	1.14E+01	1.25E+04
Tint	sec	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Noise hits per Tint		2.34272E-11	1.4E-06	0.011366	12.46439	2.34E-11	1.4E-06	0.011366	12.46439
pixel pitch	m	2.50E-05	2.50E-05	2.50E-05	2.50E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05
size x	m	3.00E-01	3.00E-01	3.00E-01	3.00E-01	3.00E-01	3.00E-01	3.00E-01	3.00E-01
size y	m	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
n.pixel x		1.20E+04	1.20E+04	1.20E+04	1.20E+04	6.00E+03	6.00E+03	6.00E+03	6.00E+03
n.pixel y		6.00E+04	6.00E+04	6.00E+04	6.00E+04	3.00E+04	3.00E+04	3.00E+04	3.00E+04
n. pixel		7.20E+08	7.20E+08	7.20E+08	7.20E+08	1.80E+08	1.80E+08	1.80E+08	1.80E+08
Noise hits/ladder/Tint		1.69E-02	1.01E+03	8.18E+06	8.97E+09	4.22E-03	2.52E+02	2.05E+06	2.24E+09
Fraction of pixel with noise hits		2.34E-11	1.40E-06	1.14E-02	1.25E+01	2.34E-11	1.40E-06	1.14E-02	1.25E+01
Equivalent noise data volume	Mbyte	0.00	0.00	16.37	17,948.72	0.00	0.00	4.09	4,487.18