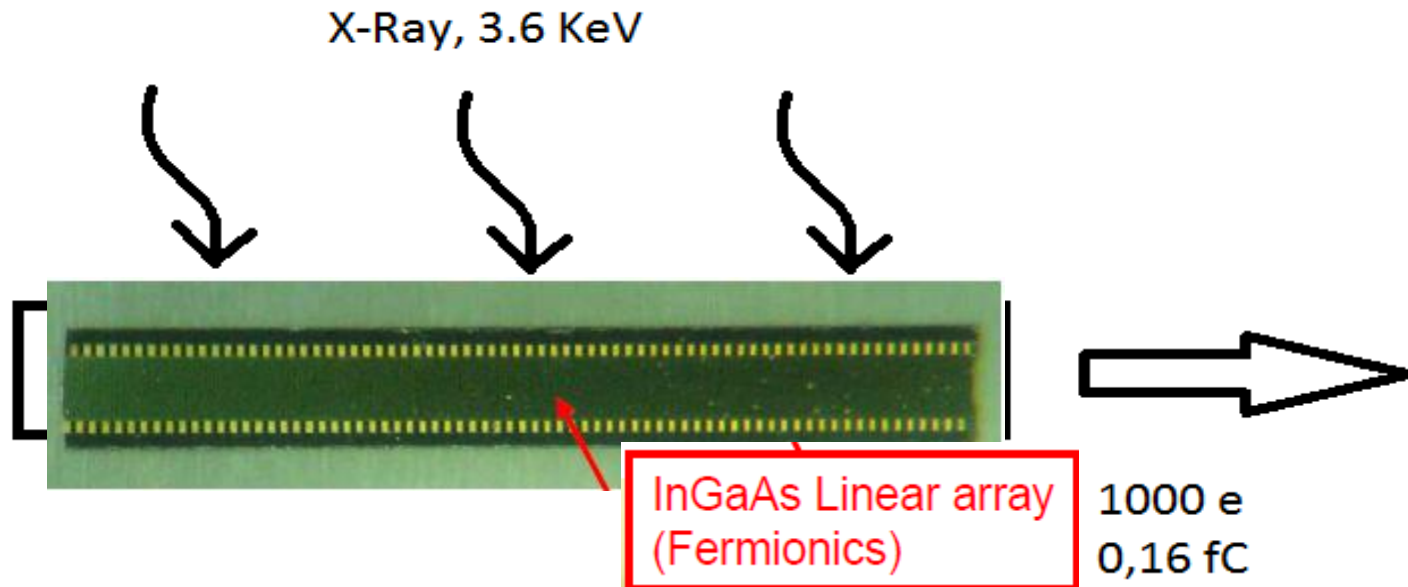
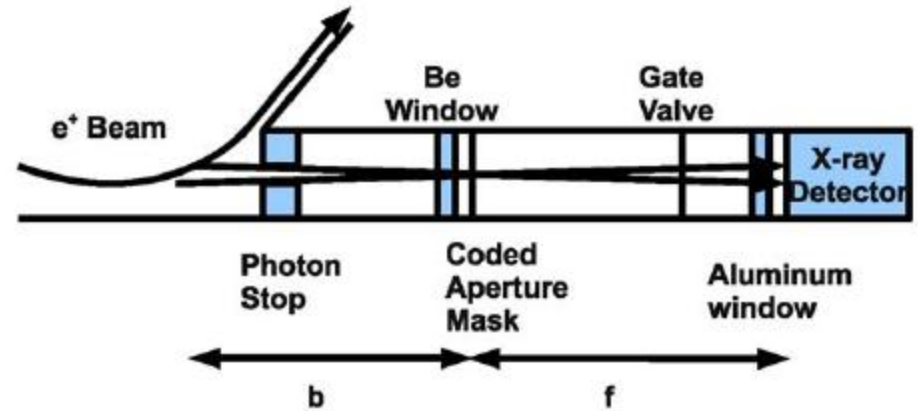


Amp Gain Derivation (60dB)

- X-ray magnitude arriving to sensor (X-Ray detector is between 2-4 Kev)
- To release one electron-hole pair from silicon material 3.6 eV is needed
- X-ray with 3.6 KeV (extimated) magnitude will produce 1000 electron-hole pairs, equal to 0.16 fC charge(1e



.The sensor response time is 0.5 nS, Signal low-high change time Δt is 0.25 nS.



.In this time the charge from the sensor will produce following current

$$\Delta I = \frac{\Delta q}{\Delta t} = \frac{1.6 * 10^{-16} C}{2.5 * 10^{-10} s} = 0.7 \mu A$$

. With 50 Ω transfer line, sensor output voltage is

$$\Delta V = \Delta I * R = 0.7 \mu A * 50 \Omega = 35 \mu V$$

.At least 10 mV output is needed in order to get the signal in a reasonable resolution

.With 35 μ V input signal, the total gain needed is

$$G = 20 * \log_{10} \frac{U_{OUT}}{U_{IN}} = 20 * \log_{10} \frac{10 \text{ mV}}{0.035 \text{ mV}} = 49.11 \text{ dB} \approx 50 \text{ dB}$$