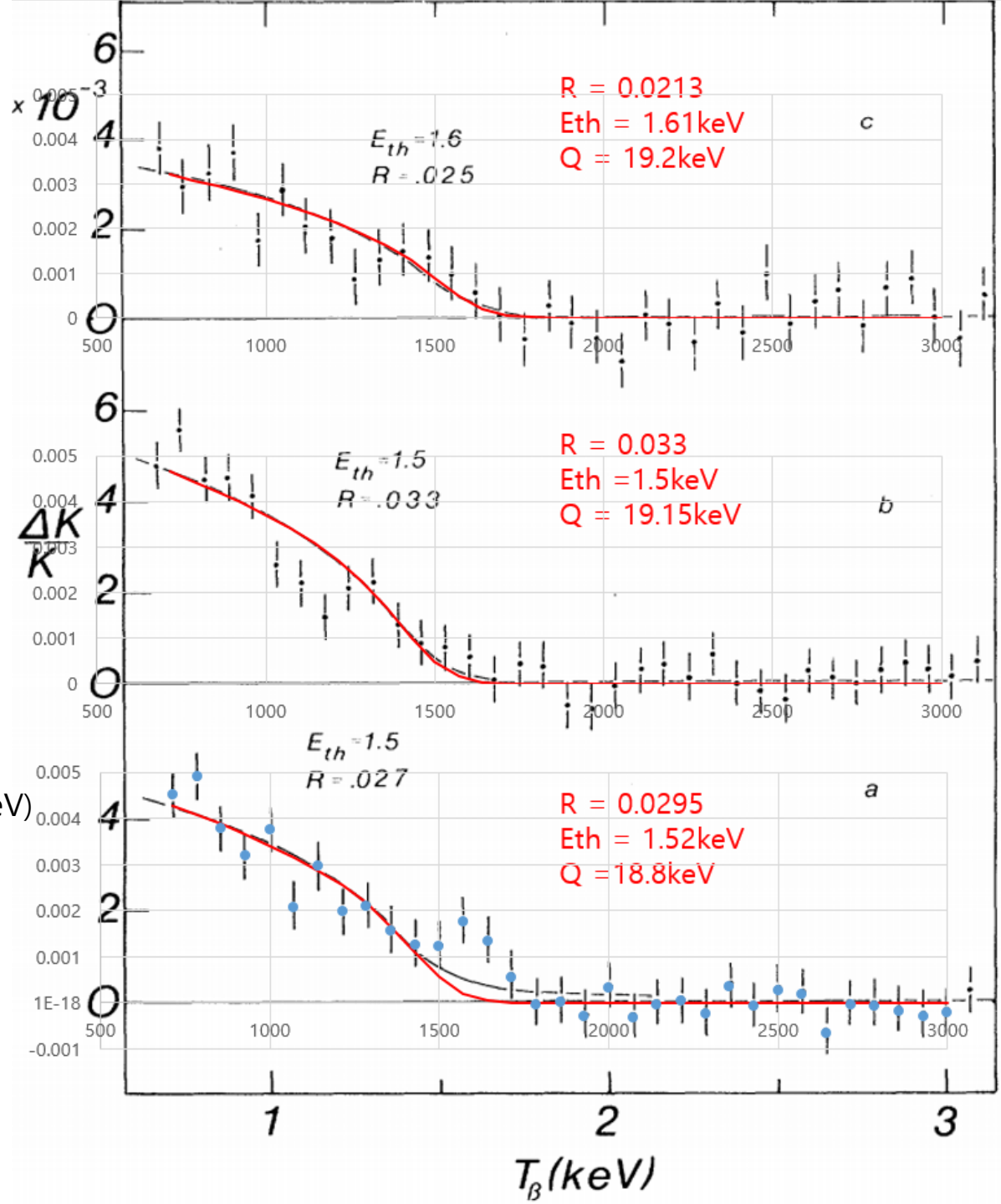
Weekly report

2019/05/20

1. Sensitivity of J. J. Simpson's result(1985)

$$\left(\frac{dN_\beta}{dE_e}\right)_{tot} = \frac{dN_\beta}{dE_e}(E_e - \Delta, m_\nu = 0, Q - \Delta) + R\frac{dN_\beta}{dE_e}(E_e - \Delta, m_s, V)$$

- $\frac{dN_\beta}{dE_e}(E_e, m_\nu, Q) = Cp_eE_e\sqrt{(Q-E_e)^2 - {m_\nu}^2}(Q-E_e)F(E_e, Z=e)$
- Δ : *average atomic energy difference between tritium and helium*
  = screnning potential + mean excitation energy + neutralization energy
  = 65.4eV -> Simpson : 99.4eV
- $F(E_e, Z=e) = x(1-e^{-x})^{-1}\left(1.002037 - 0.001427\left(\frac{v}{c}\right)\right),\ x = \frac{2\pi Z\alpha}{v/c}$
  -> relativistic correction to non-relativistic fermi function(effective at <10keV)



Paper : J. J. Simpson "Evidence of Heavy-Neutrino Emission in Beta Decay", PRL, Volume 54, Number 17 (1985)
-> review on un-correct theoretical spectrum Simpson used : J. Lindhard and P. G. Hansen "Atomic Effects in Low-Energy Beta Decay: The Case of Tritium", PRL, Volume 57, Number 8 (1986)

2. Working status at IBS

- Wire-bonding practice

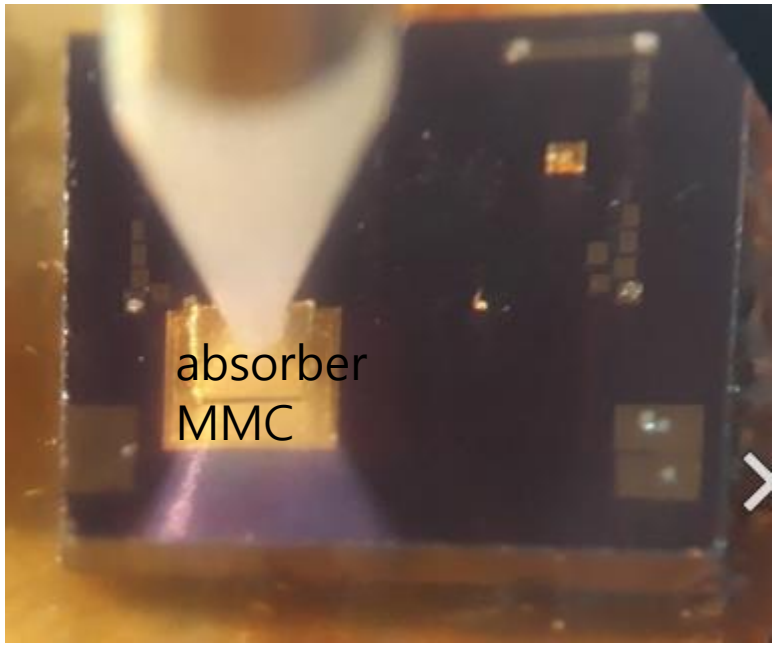
- Absorber-MMC connection : through the gold stem

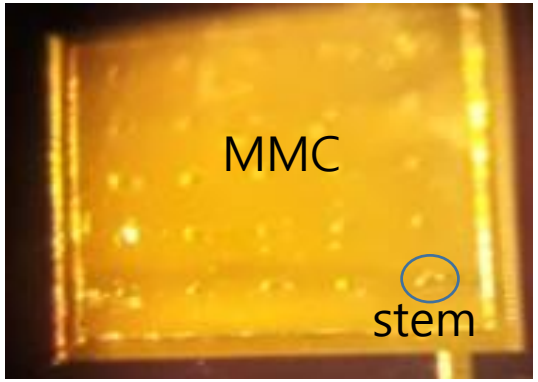
-> later, electroplating technique will be used

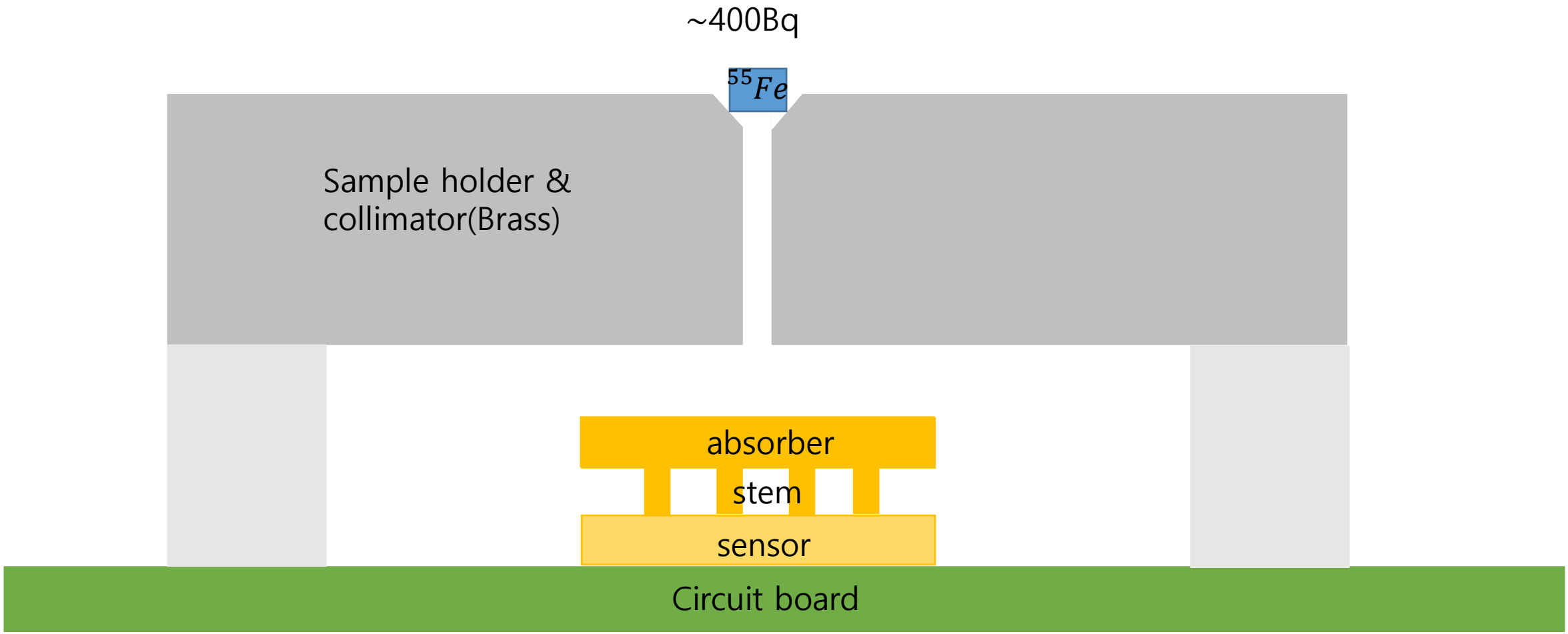
- SQUID and MMC test that will be used in test detector

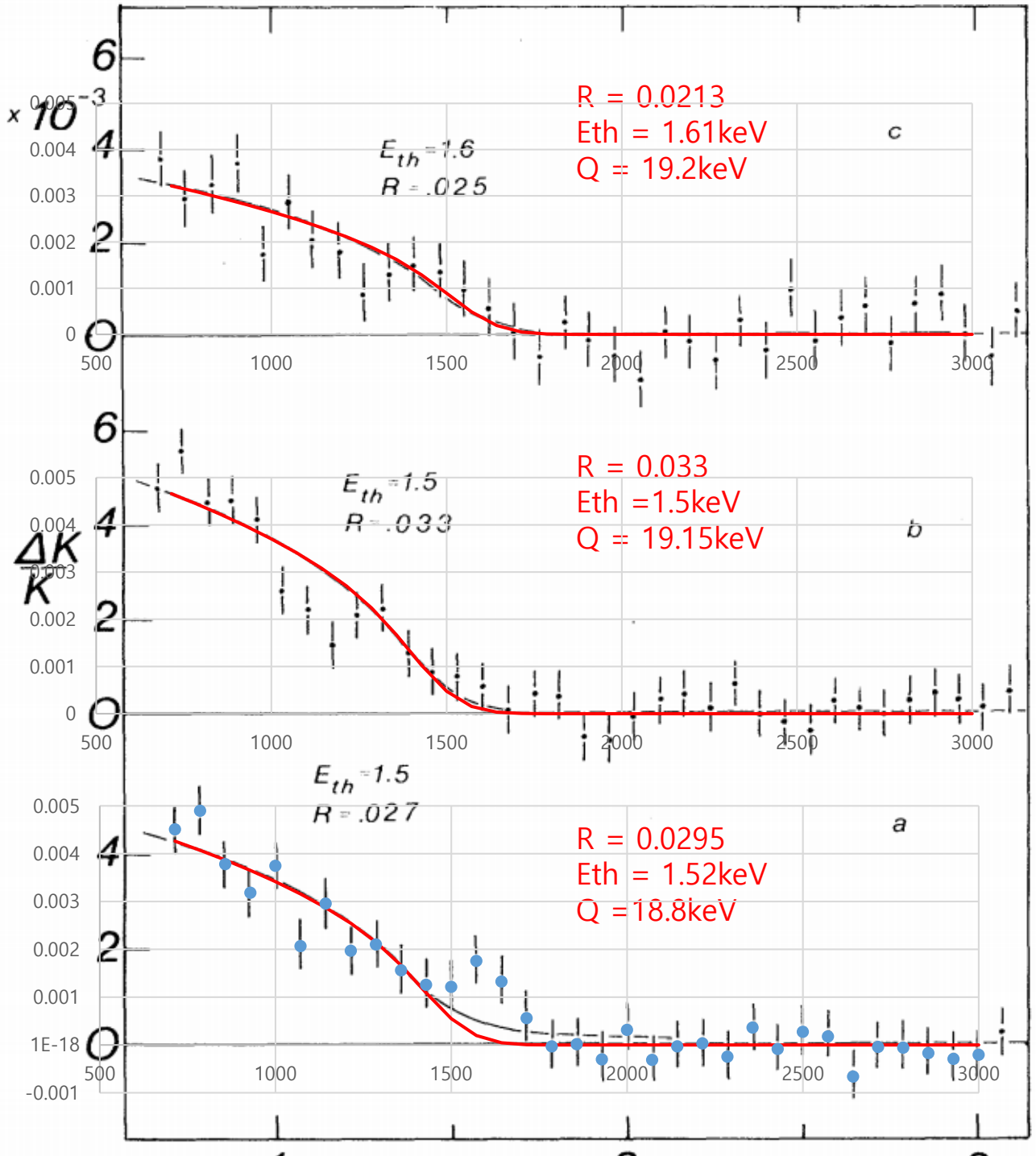
- Simulation study on energy deposit distribution on absorber of x-ray from Fe55 source

- Drawing test detector by “Solid Works”






~400Bq
^{55}Fe
Sample holder &
collimator(Brass)
absorber
stem
sensor
Circuit board


x 10^-3
ΔK/K
E_th = 1.6
R = .025
R = 0.0213
Eth = 1.61keV
Q = 19.2keV
c
E_th = 1.5
R = .033
R = 0.033
Eth =1.5keV
Q = 19.15keV
b
E_th = 1.5
R = .027
R = 0.0295
Eth = 1.52keV
Q = 18.8keV
a
0.005
0.004
0.003
0.002
0.001
0
1E-18
-0.001
500
1000
1500
2000
2500
3000
6
4
2
0