Lampiran 1. Penjabaran Persamaan (28) menjadi (29)

$$C = \int_0^{t_3-t_1} A dt$$

$$= As(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)}) \int_0^{t_3-t_2} e^{-\lambda t} dt$$

$$= \frac{As}{\lambda}(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})$$

$$As = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

Lampiran 2. Penjabaran Persamaan (30) menjadi (31)

$$k\Sigma_{act}\phi V = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$\phi = \frac{\lambda C}{kV\Sigma_{act}(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$\phi = \frac{\lambda C}{k\frac{Bc}{\rho}\sum_{act}(1-e^{-\lambda t_1})(e^{-\lambda t_2-t_1})(1-e^{-\lambda t_3-t_2})}$$

$$\phi = \frac{\lambda C\rho}{kBc\sum_{act}(1-e^{-\lambda t_1})(e^{-\lambda t_2-t_1})(1-e^{-\lambda t_3-t_2})}$$

Lampiran 3. Penjabaran Persamaan (32)

$$\phi = \frac{As}{k\Sigma_{act}V}$$

$$= \frac{As}{kN\sigma_{act}V}$$

$$= \frac{As}{k\frac{\rho}{A}N\sigma_{act}V}$$

$$\phi = \frac{AsA}{kN_A\sigma_{act}Bc}$$

Lampiran 4. Penjabaran persamaan (33)

Dari persamaan (31) bahwa $\phi = \dfrac{\lambda C\rho}{kBc\sum_{act}(1-e^{-\lambda t_1})(e^{-\lambda t_2 - t_1})(1-e^{-\lambda t_3 - t_2})}$ dan

Persamaan (33) bahwa $\Delta\phi = \left|\dfrac{\partial\phi}{\partial Bc}\right|\Delta Bc + \left|\dfrac{\partial\phi}{\partial t_i}\right|\Delta t_i + \left|\dfrac{\partial\phi}{\partial t_d}\right|\Delta t_d + \left|\dfrac{\partial\phi}{\partial t_c}\right|\Delta t_c$

Diperoleh turunan dari fluks neutron terhadap Bc dan As sebagai berikut:

$$\frac{\partial\phi}{\partial B_c} = -\frac{\lambda C\rho}{k\sum_{act} {B_c}^2(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}$$

$$\frac{\partial\phi}{\partial t_i} = -\frac{\lambda^2 C\rho(e^{-\lambda t_i})}{k\sum_{act} B_c(1-e^{-\lambda t_i})^2(e^{-\lambda t_d})(1-e^{-\lambda tc})}$$

$$\frac{\partial\phi}{\partial t_d} = \frac{\lambda^2 C\rho(e^{-\lambda t_d})}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}$$

$$\frac{\partial\phi}{\partial t_c} = -\frac{\lambda^2 C\rho(e^{-\lambda t_c})}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})^2}$$

Turunan diatas disubstitusikan ke persamaan (33)

$$\Delta\phi = \left|-\frac{\lambda C\rho}{k\sum_{act} {B_c}^2(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\right|\Delta Bc + \left|-\frac{\lambda^2 C\rho(e^{-\lambda t_i})}{k\sum_{act} B_c(1-e^{-\lambda t_i})^2(e^{-\lambda t_d})(1-e^{-\lambda tc})}\right|\Delta t_i$$

$$+\left|\frac{\lambda^2 C\rho(e^{-\lambda t_d})}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\right|\Delta t_d + \left|-\frac{\lambda^2 C\rho(e^{-\lambda t_c})}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})^2}\right|\Delta t_c$$

$$= \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

Lampiran 5. Penjabaran Persamaan (36)

Dari persamaan (34) $CR = \frac{As}{As_{cd}}$

$$As_{cd} = \frac{As}{CR}$$

Fluks neutron thermal ditentukan dari hubungan:

$\phi = c(As - As_{cd})$

$= c\left[As - \frac{As}{CR} \right]$

$= cAs - \frac{cAs}{CR}$

$= cAs\left[1 - \frac{1}{CR} \right]$

$\phi = cAs\left[\frac{CR-1}{CR} \right]$

Lampiran 6. Penjabaran Persamaan (52)

Fluks neutron thermal adalah selisih antara fluks neutron total dan neutron cepat:

$\phi_{th} = \phi_{\tau} - \phi_c$

dengan

$\phi_{\tau} = \phi_{\tau} \pm \phi_{\tau}$

$\phi_c = \phi_c \pm \phi_c$

sehingga

$\phi_{th} = \left|\frac{\partial \phi_{th}}{\partial \phi_{\tau}}\right| \Delta\phi_{\tau} + \left|\frac{\partial \phi_{th}}{\partial \phi_c}\right| \Delta\phi_c$

$= |1| \Delta\phi_{\tau} + |-1| \Delta\phi_c$

$= \phi_{\tau} + \phi_c$

Lampiran 7.Penjabaran Persamaan (53)

$$R_{cd} = \frac{\phi_\tau}{\phi_c}$$

$$\Delta R_{cd} = \left|\frac{\partial R_{cd}}{\partial \phi_\tau}\right| \Delta\phi_\tau + \left|\frac{\partial R_{cd}}{\partial \phi_c}\right| \Delta\phi_c$$

$$\Delta R_{cd} = \left|{\phi_c}^{-1}\right|\Delta\phi_\tau + \left|-\phi_\tau {\phi_c}^{2}\right|\Delta\phi_c$$

$$\Delta R_{cd} = \left|\frac{1}{\phi_c}\right| \Delta\phi_\tau + \left|\frac{-\phi_\tau}{{\phi_c}^{2}}\right| \Delta\phi_c$$

Lampiran 8. Perhitungan Aktivitas pada Kalibrasi Efisiensi Detektor

Besarnya Aktivitas :

$A = A_0 e^{-\lambda t}$

dengan :

$A_0 = 1{,}975 \times 10^5$

Waktu awal = 15 Juni 1979

Waktu Pencacahan = 25 April 2012

Waktu paro ($T_{1/2}$) = 12,7 tahun

Waktu tunda(t) = 32,861 tahun

$\lambda = \frac{0{,}693}{T_{1/2}}$ = 5,4567x10^{-2}tahun^{-1}

Maka dapat dihitung besarnya aktivitas sebagai berikut:

$A = A_0 e^{-\lambda t}$

A = $1{,}975 \times 10^5 \; e^{-(5{,}4567 \times 10^{-2})(32{,}861)}$

= 32872,40363*dps*

Lampiran 9. Perhitungan Efisiensi Detektor HPGe dengan Sumber Standar $^{152}_{63}Eu$

$$\%\,k(E) = \frac{cps}{dps.Y(E)} \text{x} 100\%$$

1. $k(121{,}77) = \frac{149{,}32}{32872{,}404\ (0{,}2924)} = 0{,}01553492 = 1{,}55\ \%$

2. $k(244{,}59) = \frac{26{,}32}{32872{,}404\ (0{,}0761)} = 0.01052131 = 1{,}05\ \%$

3. $k(344{,}21) = \frac{64{,}76}{32872{,}404\ (0{,}2700)} = 0.00729645 = 0{,}73\ \%$

4. $k(443{,}97) = \frac{3{,}34}{32872{,}404\ (0{,}0284)} = 0.00357764 = 0{,}36\ \%$

5. $k(778{,}93) = \frac{13{,}01}{32872{,}404\ (0{,}1299)} = 0.00304675 = 0{,}30\ \%$

6. $k(964{,}05) = \frac{11{,}37}{32872{,}404\ (0{,}1458)} = 0.00237231 = 0{,}24\ \%$

7. $k(1112{,}05) = \frac{8{,}99}{32872{,}404\ (0{,}1358)} = 0.00201386 = 0{,}20\ \%$

8. $k(1407{,}87) = \frac{11{,}13}{32872{,}404\ (0{,}2121)} = 0.00159633 = 0{,}16\ \%$

Lampiran 10. Perhitungan Nilai Fluks Neutron

Dengan mengetahui hasil cacah dari detektor dan data-data lainnya, dapat dihitung besarnya aktivitas dan fluks neutron dengan menggunakan persamaan (29) dan (32)

1. Data $^{197}_{79}Au$foil yang tidak dibungkus cadmium (Fluks Neutron Total)

a. Data cuplikan :

Cuplikan $=^{197}_{79}Au$ t_i = 600 sekon

A = 197 t_d = 695340 sekon

Bc = 0,004 gram t_c = 600 sekon

σ_{act} = 98,8 barn = 9,88 x10^{-23}cm^2 C = 4900,71 *cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00554 = 5,54x10^{-3}

N_A = 6,023 x10^{23} atom/mol

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\,X10^{-6})(4900{,}71\,x\,600)}{\left(1-e^{-(2{,}9762\,x10^{-6})(600)}\right)\left(e^{-(2{,}9762\,x10^{-6})(695340)}\right)\left(1-e^{-(2{,}9762\,x10^{-6})(600)}\right)}$$

$$= 21776137{,}49\ dps$$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(21776137{,}49)(197)}{(5{,}54\,x10^{-3})(6{,}023\,x10^{23})(9{,}88\,x10^{-23})(0{,}004)}$$

$$\phi = 3{,}25\ \text{x}10^{12}\text{ncm}^{-2}\text{s}^{-1}$$

b. Data cuplikan :

Cuplikan = $^{197}_{79}Au$ t_i = 600 sekon

A = 197 t_d = 696960 sekon

Bc = 0,005 gram t_c = 600 sekon

σ_{act} = 98,8 barn = 9,88 x10^{-23}cm^2 C = 5437,63*cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00554 = 5,54x10^{-3}

N_A = 6,023 x10^{23} atom/mol

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(5437{,}63x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(696960)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$$= 24278699{,}82\ dps$$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(24278699{,}82)(197)}{(5{,}54\ 10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}005)}$$

$$\phi = 2{,}90\text{x}10^{12}\text{ncm}^{-2}\text{s}^{-1}$$

c. Data cuplikan :

Cuplikan =$^{197}_{79}Au$ t_i= 600 sekon

A = 197 t_d = 706200 sekon

Bc = 0,006 gram t_c = 600 sekon

σ_{act} = 98,8 barn = 9,88 x10^{-23}cm^2 C = 3409,51*cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00554 = 5,54x10^{-3}

N_A = 6,023 x10^{23} atom/mol

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(3409{,}51x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(706200)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$= 15647713{,}20\ dps$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(15647713{,}20)(197)}{(5{,}54\ \text{x}10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}006)}$$

$\phi = 1{,}56\ \text{x}10^{12}\text{ncm}^{-2}\text{s}^{-1}$

d. Data cuplikan :

Cuplikan	$=^{197}_{79}Au$	t_i= 600 sekon
A	= 197	t_d = 707580 sekon
Bc	= 0,007 gram	t_c = 600 sekon
σ_{act}	= 98,8 barn = 9,88 x10^{-23}cm^2	C = 2203,84*cps*
$\boldsymbol{\lambda}$	= 2,9762x10^{-6}s^{-1}	k = 0,00554 = 5,54x10^{-3}
N_A	= 6,023 x10^{23} atom/mol	

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(2203{,}84x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(707580)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$= 10155999{,}84\ dps$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(10155999{,}84)(197)}{(5{,}54\ \text{x}10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}007)}$$

$$\phi = 8{,}69\ \text{x}10^{11}\text{ncm}^{-2}\text{s}^{-1}$$

e. Data cuplikan :

Cuplikan	$=^{197}_{79}Au$	t_i = 600 sekon
A	= 197	t_d = 709020 sekon
Bc	= 0,009 gram	t_c = 600 sekon
σ_{act}	= 98,8 barn = 9,88 x10^{-23}cm^2	C = 584,53*cps*
$\boldsymbol{\lambda}$	= 2,9762x10^{-6}s^{-1}	k = 0,00554 = 5,54x10^{-3}
N_A	= 6,023 x10^{23} atom/mol	

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(584{,}53x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(709020)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$$= 2705270{,}51\ dps$$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(2705270{,}51)(197)}{(5{,}54\ \text{x}10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}009)}$$

$$\phi = 1{,}80\ \text{x}10^{11}\text{ncm}^{-2}\text{s}^{-1}$$

2. Data foil $^{197}_{79}Au$yang dibungkus cadmium (Fluks Neutron Cepat)

a. Data cuplikan :

Cuplikan	$=^{197}_{79}Au$	t_i= 600 sekon
A	= 197	t_d = 696240 sekon
Bc	= 0,004 gram	t_c = 600 sekon
σ_{act}	= 98,8 barn = 9,88 x10^{-23}cm^2	C = 1597,51*cps*
$\boldsymbol{\lambda}$	= 2,9762x10^{-6}s^{-1}	k = 0,00553 = 5,53x10^{-3}
N_A	= 6,023 x10^{23} atom/mol	

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(1597{,}51x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(696240)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$$= 7117654{,}12\ dps$$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(7117654{,}12)(197)}{(5{,}53\ \text{x}10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}004)}$$

$$\phi = 1{,}06\ \text{x}10^{12}\text{ncm}^{-2}\text{s}^{-1}$$

b. Data cuplikan :

Cuplikan	$=^{197}_{79}Au$	t_i= 600 sekon
A	= 197	t_d = 697920 sekon
Bc	= 0,005 gram	t_c = 600 sekon
σ_{act}	= 98,8 barn = 9,88 x10^{-23}cm^2	C = 1494,24*cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00553 = 5,53x10^{-3}

N_A = 6,023 x10^{23} atom/mol

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(1494{,}24x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(697920)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$$= 6690783{,}48\ dps$$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(6690783{,}48)(197)}{(5{,}53\ \text{x}10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}005)}$$

ϕ = 7,99 x10^{11}ncm^{-2}s^{-1}

c. Data cuplikan :

Cuplikan = $^{197}_{79}Au$ t_i = 600 sekon

A = 197 t_d = 706980 sekon

Bc = 0,006 gram t_c = 600 sekon

σ_{act} = 98,8 barn = 9,88 x10^{-23}cm^2 C = 433,43*cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00553 = 5,53x10^{-3}

N_A = 6,023 x10^{23} atom/mol

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(433{,}43x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(706980)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$$= 1993820{,}53\ dps$$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(1993820{,}53)(197)}{(5{,}53\ \text{x}10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}006)}$$

$$\phi = 1{,}99\ \text{x}10^{11}\text{ncm}^{-2}\text{s}^{-1}$$

d. Data cuplikan :

Cuplikan = $^{197}_{79}Au$ t_i = 600 sekon

A = 197 t_d = 708300 sekon

Bc = 0,007 gram t_c = 600 sekon

σ_{act} = 98,8 barn = 9,88 x10^{-23}cm^2 C = 220,22*cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00553 = 5,53x10^{-3}

N_A = 6,023 x10^{23} atom/mol

$$A_s = \frac{\lambda C}{\left(1-e^{-\lambda t_1}\right)\left(e^{-\lambda(t_2-t_1)}\right)\left(1-e^{-\lambda(t_3-t_2)}\right)}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(220{,}22x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(708300)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$$= 1017021{,}22\ dps$$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(1017021{,}22)(197)}{(5{,}53\ \text{x}10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}007)}$$

$$\phi = 8{,}71\ \text{x}10^{10}\text{ncm}^{-2}\text{s}^{-1}$$

e. Data cuplikan :

Cuplikan = $^{197}_{79}Au$ t_i= 600 sekon

A = 197 t_d = 709680 sekon

Bc = 0,009 gram t_c = 600 sekon

σ_{act} = 98,8 barn = 9,88 x10^{-23}cm^2 C = 26,54*cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00553 = 5,53x10^{-3}

N_A = 6,023 x10^{23} atom/mol

$$A_s = \frac{\lambda C}{(1-e^{-\lambda t_1})(e^{-\lambda(t_2-t_1)})(1-e^{-\lambda(t_3-t_2)})}$$

$$A_s = \frac{(2{,}9762\ X10^{-6})(26{,}54x\ 600)}{\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)\left(e^{-(2{,}9762\ x10^{-6})(709680)}\right)\left(1-e^{-(2{,}9762\ x10^{-6})(600)}\right)}$$

$$= 123071{,}61\ dps$$

$$\phi = \frac{AsA}{KN_A\sigma_{act}Bc}$$

$$\phi = \frac{(123071{,}61)(197)}{(5{,}53\ \text{x}10^{-3})(6{,}023\ x10^{23})(9{,}88\ x10^{-23})(0{,}009)}$$

$$\phi = 8{,}19\ \text{x}10^{9}\text{ncm}^{-2}\text{s}^{-1}$$

Lampiran 11. Perhitungan Nilai Ralat Fluks Neutron

1. Data $^{197}_{79}Au$foil yang tidak dibungkus cadmium (Fluks Neutron Total)

a. Data cuplikan :

Cuplikan	= $^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 695340 sekon
Bc	= 0,004 gram	t_c	= 600 sekon
σ_{act}	= 98,8 barn = 9,88 x$10^{-23}$$cm^2$	C	= 4900,71 *cps*
$\boldsymbol{\lambda}$	= 2,9762 x$10^{-6}$$s^{-1}$	k	= 0,00554 = 5,54x10^{-3}
N_A	= 6,023 x10^{23} atom/mol	Σ_{act}	= 59,50724
$\Delta t_i = \Delta t_d = \Delta t_c$ = 0,5 sekon		ΔB_c	= 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(4900{,}71)(19{,}32)}{(5{,}54\ \text{x}10^{-3})(59{,}50724)(0{,}004)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(695340)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}004)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

$= 6{,}73x10\text{n}cm^{-2}s^{-1}$

b. Data cuplikan :

Cuplikan	= $^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 696960 sekon
Bc	= 0,005 gram	t_c	= 600 sekon

σ_{act} = 98,8 barn = 9,88 x10^{-23}cm^2 C = 5437,63*cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00554 = 5,54x10^{-3}

N_A = 6,023 x10^{23} atom/mol Σ_{act} = 59,50724

$\Delta t_i = \Delta t_d = \Delta t_c = 0{,}5$ sekon ΔB_c = 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(5437{,}63)(19{,}32)}{(5{,}54\ \text{x}10^{-3})(59{,}50724)(0{,}005)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(696960)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}005)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

=4,82x10^7 ncm^{-2}s^{-1}

c. Data cuplikan :

Cuplikan = $^{197}_{79}Au$ t_i = 600 sekon

$\boldsymbol{\rho}$ = 19,32gram cm^{-3} t_d = 706200 sekon

Bc = 0,006 gram t_c = 600 sekon

σ_{act} = 98,8 barn = 9,88 x10^{-23}cm^2 C = 3409,51*cps*

$\boldsymbol{\lambda}$ = 2,9762x10^{-6}s^{-1} k = 0,00554 = 5,54x10^{-3}

N_A = 6,023 x10^{23} atom/mol Σ_{act} = 59,50724

$\Delta t_i = \Delta t_d = \Delta t_c = 0{,}5$ sekon ΔB_c = 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(3409{,}51)(19{,}32)}{(5{,}54\ \text{x}10^{-3})(59{,}50724)(0{,}006)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(706200)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}006)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

$=2{,}16\ \text{x}10^{7}\ \text{ncm}^{-2}\text{s}^{-1}$

d. Data cuplikan :

Cuplikan	$= {}^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 707580 sekon
Bc	= 0,007 gram	t_c	= 600 sekon
σ_{act}	= 98,8 barn = 9,88 $\text{x}10^{-23}\text{cm}^2$	C	= 2203,84*cps*
$\boldsymbol{\lambda}$	= $2{,}9762\text{x}10^{-6}\text{s}^{-1}$	k	= 0,00554 = $5{,}54\text{x}10^{-3}$
N_A	= 6,023 $\text{x}10^{23}$ atom/mol	Σ_{act}	= 59,50724
$\Delta t_i = \Delta t_d = \Delta t_c$	= 0,5 sekon	ΔB_c	= 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(2203{,}84)(19{,}32)}{(5{,}54\ \text{x}10^{-3})(59{,}50724)(0{,}007)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(707580)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}007)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

$=1{,}04\text{x}10^{7}\ \text{ncm}^{-2}\text{s}^{-1}$

e. Data cuplikan :

Cuplikan	= $^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 709020 sekon
Bc	= 0,009 gram	t_c	= 600 sekon
σ_{act}	= 98,8 barn = 9,88 x$10^{-23}$$cm^2$	C	= 584,53*cps*
$\boldsymbol{\lambda}$	= 2,9762x$10^{-6}s^{-1}$	k	= 0,00554 = 5,54x10^{-3}
N_A	= 6,023 x10^{23} atom/mol	Σ_{act}	= 59,50724
$\Delta t_i = \Delta t_d = \Delta t_c$	= 0,5 sekon	ΔB_c	= 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(584{,}53)(19{,}32)}{(5{,}54\ \text{x}10^{-3})(59{,}50724)(0{,}009)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(709020)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}009)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

$=1{,}68\text{x}10^{6}\ \text{ncm}^{-2}\text{s}^{-1}$

2. Data foil $^{197}_{79}Au$yang dibungkus cadmium (Fluks Neutron Cepat)

a. Data cuplikan :

Cuplikan	= $^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 696240 sekon
Bc	= 0,004 gram	t_c	= 600 sekon

σ_{act}	= 98,8 barn = 9,88 x10^{-23}cm^2	C	= 1587,54*cps*
$\boldsymbol{\lambda}$	= 2,9762x10^{-6}s^{-1}	k	= 0,00553 = 5,5310^{-3}
N_A	= 6,023x10^{23} atom/mol	Σ_{act}	= 59,50724
$\Delta t_i = \Delta t_d = \Delta t_c$	= 0,5 sekon	ΔB_c	= 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(1597{,}54)(19{,}32)}{(5{,}53\ 10^{-3})(59{,}50724)(0{,}004)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(696240)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}004)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

=2,20x 10^7 ncm^{-2}s^{-1}

b. Data cuplikan :

Cuplikan	= $^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 697920 sekon
Bc	= 0,005 gram	t_c	= 600 sekon
σ_{act}	= 98,8 barn = 9,88 x10^{-23}cm^2	C	= 1494,24*cps*
$\boldsymbol{\lambda}$	= 2,9762x10^{-6}s^{-1}	k	= 0,00553 = 5,5310^{-3}
N_A	= 6,023 x10^{23} atom/mol	Σ_{act}	= 59,50724
$\Delta t_i = \Delta t_d = \Delta t_c$	= 0,5 sekon	ΔB_c	= 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(1494{,}24)(19{,}32)}{(5{,}53\ 10^{-3})(59{,}50724)(0{,}005)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(697920)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}005)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

$=1{,}33\text{x } 10^{7}\ \text{ncm}^{-2}\text{s}^{-1}$

c. Data cuplikan :

Cuplikan	$= {}^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 706980 sekon
Bc	= 0,006 gram	t_c	= 600 sekon
σ_{act}	= 98,8 barn = 9,88 $\text{x}10^{-23}\text{cm}^2$	C	= 433,43*cps*
$\boldsymbol{\lambda}$	= $2{,}9762\text{x}10^{-6}s^{-1}$	k	= 0,00553 = $5{,}5310^{-3}$
N_A	= $6{,}023\ \text{x}10^{23}$ atom/mol	Σ_{act}	= 59,50724
$\Delta t_i = \Delta t_d = \Delta t_c$	= 0,5 sekon	ΔB_c	= 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(433{,}43)(19{,}32)}{(5{,}53\ 10^{-3})(59{,}50724)(0{,}006)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(706980)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}006)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

$=2{,}77\text{x } 10^{6}\ \text{ncm}^{-2}\text{s}^{-1}$

d. Data cuplikan :

Cuplikan	= $^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 708300 sekon
Bc	= 0,007 gram	t_c	= 600 sekon
σ_{act}	= 98,8 barn = 9,88 x$10^{-23}$$cm^2$	C	= 220,22*cps*
$\boldsymbol{\lambda}$	= 2,9762x$10^{-6}s^{-1}$	k	= 0,00553 = 5,5310^{-3}
N_A	= 6,023 x10^{23} atom/mol	Σ_{act}	= 59,50724
$\Delta t_i = \Delta t_d = \Delta t_c$ = 0,5 sekon		ΔB_c	= 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(220{,}22)(19{,}32)}{(5{,}53\ 10^{-3})(59{,}50724)(0{,}007)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(708300)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}007)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

$= 1{,}04\text{x}\ 10^{6}\ \text{ncm}^{-2}\text{s}^{-1}$

e. Data cuplikan :

Cuplikan	= $^{197}_{79}Au$	t_i	= 600 sekon
$\boldsymbol{\rho}$	= 19,32gram cm^{-3}	t_d	= 709680 sekon
Bc	= 0,009 gram	t_c	= 600 sekon
σ_{act}	= 98,8 barn = 9,88 x$10^{-23}$$cm^2$	C	= 26,54*cps*
$\boldsymbol{\lambda}$	= 2,9762x$10^{-6}s^{-1}$	k	= 0,00553 = 5,5310^{-3}

N_A = 6,023 x10^{23} atom/mol Σ_{act} = 59,50724

$\Delta t_i = \Delta t_d = \Delta t_c$ = 0,5 sekon ΔB_c = 0,0005 gram

$$\Delta\phi = \frac{\lambda^2 C\rho}{k\sum_{act} B_c(1-e^{-\lambda t_i})(e^{-\lambda t_d})(1-e^{-\lambda tc})}\left[\frac{1}{\lambda Bc}\Delta Bc + \frac{e^{-\lambda t_i}}{1-e^{-\lambda t_i}}\Delta t_i + \Delta t_d + \frac{e^{-\lambda t_c}}{1-e^{-\lambda t_c}}\Delta t_c\right]$$

$$= \left[\frac{(2{,}9762\ 10^{-6})^2(26{,}54)(19{,}32)}{(5{,}53\ 10^{-3})(59{,}50724)(0{,}009)\left(1-e^{-(2{,}9762\ 10^{-6})(600)}\right)\left(e^{-(2{,}9762\ 10^{-6})(709680)}\right)\left((1-e^{-(2{,}9762\ 10^{-6})(600)})\right)}\right]$$

$$\left[\frac{1}{((2{,}9762\ 10^{-6})(0{,}009)}(0{,}0005) + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5 + 0{,}5 + \frac{e^{-(2{,}9762\ 10^{-6})(600)}}{1-e^{-(2{,}9762\ 10^{-6})(600)}}0{,}5\right]$$

=7,66x 10^4 ncm^{-2}s^{-1}

Lampiran 12. Perhitungan Fluks Neutron Thermal

$\phi_{th} = \phi_{\tau} - \phi_{c}$

1. Foil emas 0,004 gram

$\phi_{\tau} = 3{,}25 \times 10^{12} \text{ncm}^{-2}\text{s}^{-1}$

$\phi_{c} = 1{,}06 \times 10^{12} \text{ncm}^{-2}\text{s}^{-1}$

$\phi_{th} = (3{,}25 \times 10^{12}) - (1{,}06 \times 10^{12}) \text{ ncm}^{-2}\text{s}^{-1}$

$= 2{,}19 \times 10^{12} \text{ncm}^{-2}\text{s}^{-1}$

2. Foil emas 0,005 gram

$\phi_{\tau} = 2{,}90 \times 10^{12} \text{ncm}^{-2}\text{s}^{-1}$

$\phi_{c} = 7{,}99 \times 10^{11} \text{ncm}^{-2}\text{s}^{-1}$

$\phi_{th} = (2{,}90 \times 10^{12}) - (7{,}99 \times 10^{11}) \text{ ncm}^{-2}\text{s}^{-1}$

$= 2{,}10 \times 10^{12} \text{ncm}^{-2}\text{s}^{-1}$

3. Foil emas 0,006 gram

$\phi_{\tau} = 1{,}56 \times 10^{12} \text{ncm}^{-2}\text{s}^{-1}$

$\phi_{c} = 1{,}99 \times 10^{11} \text{ncm}^{-2}\text{s}^{-1}$

$\phi_{th} = (1{,}56 \times 10^{12}) - (1{,}99 \times 10^{11}) \text{ncm}^{-2}\text{s}^{-1}$

$= 1{,}36 \times 10^{12} \text{ncm}^{-2}\text{s}^{-1}$

4. Foil emas 0,007 gram

$\phi_{\tau} = 8{,}69 \times 10^{11} \text{ncm}^{-2}\text{s}^{-1}$

$\phi_{c} = 8{,}71 \times 10^{10} \text{ncm}^{-2}\text{s}^{-1}$

$\boldsymbol{\phi}_{\text{th}} = (8{,}69 \text{ x } 10^{11}) - (8{,}71 \text{ x } 10^{10})\ \text{ncm}^{-2}\text{s}^{-1}$

$= 7{,}82 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1}$

5. Foil emas 0,009 gram

$\boldsymbol{\phi}_{\boldsymbol{\tau}} = 1{,}80 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1}$

$\boldsymbol{\phi}_{\text{c}} = 8{,}19 \text{ x } 10^{9}\text{ncm}^{-2}\text{s}^{-1}$

$\boldsymbol{\phi}_{\text{th}} = (1{,}80 \text{ x } 10^{11}) - (8{,}19 \text{ x } 10^{9})\ \text{ncm}^{-2}\text{s}^{-1}$

$= 1{,}72 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1}$

Dari hasil-hasil fluks thermal di atas maka dapat dihitung fluks neutron thermal sebagai berikut :

$$\phi_{th} = \frac{\phi_{t1} + \phi_{t2} + \phi_{t3} + \phi_{t4} + \phi_{t5}}{5}$$

$$\phi_{th} = \frac{(2{,}19 \text{ x } 10^{12}) + (2{,}10 \text{ x } 10^{12}) + (1{,}36 \text{ x } 10^{12}) + (7{,}82 \text{ x } 10^{11}) + (1{,}72 \text{ x } 10^{11})}{5}\ \text{ncm}^{-2}\text{s}^{-1}$$

$$\phi_{th} = 1{,}32\text{x } 10^{12}\text{ncm}^{-2}\text{s}^{-1}$$

Lampiran 13.Nilai Ralat Fluks Neutron Thermal

$\Delta\boldsymbol{\phi}_{th} = \Delta\boldsymbol{\phi}_{\tau} + \Delta\boldsymbol{\phi}_{c}$

1. Foil emas 0,004 gram

$\Delta\boldsymbol{\phi}_{\tau} = 6{,}73 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

$\Delta\boldsymbol{\phi}_{c} = 2{,}20 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

$\Delta\boldsymbol{\phi}_{th} = (6{,}73 \times 10^{7}) + (2{,}20 \times 10^{7})\,\mathrm{n\,cm^{-2}s^{-1}}$

$= 8{,}93 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

2. Foil emas 0,005 gram

$\Delta\boldsymbol{\phi}_{\tau} = 4{,}82 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

$\Delta\boldsymbol{\phi}_{c} = 1{,}33 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

$\Delta\boldsymbol{\phi}_{th} = (4{,}82 \times 10^{7}) + (1{,}33 \times 10^{7})\,\mathrm{n\,cm^{-2}s^{-1}}$

$= 6{,}15 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

3. Foil emas 0,006 gram

$\Delta\boldsymbol{\phi}_{\tau} = 2{,}16 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

$\Delta\boldsymbol{\phi}_{c} = 2{,}77 \times 10^{6}\,\mathrm{n\,cm^{-2}s^{-1}}$

$\Delta\boldsymbol{\phi}_{th} = (2{,}16 \times 10^{7}) + (2{,}77 \times 10^{6})\,\mathrm{n\,cm^{-2}s^{-1}}$

$= 2{,}44 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

4. Foil emas 0,007 gram

$\Delta\boldsymbol{\phi}_{\tau} = 1{,}04 \times 10^{7}\,\mathrm{n\,cm^{-2}s^{-1}}$

$\Delta\boldsymbol{\phi}_{c} = 1{,}04 \times 10^{6}\,\mathrm{n\,cm^{-2}s^{-1}}$

$\Delta\boldsymbol{\phi}_{\text{th}} = (1{,}04 \text{ x } 10^{7}) + (1{,}04 \text{ x } 10^{6})\ \text{ncm}^{-2}\text{s}^{-1}$

$= 1{,}14 \text{ x } 10^{7}\text{ncm}^{-2}\text{s}^{-1}$

5. Foil emas 0,009 gram

$\Delta\boldsymbol{\phi}_{\boldsymbol{\tau}} = 1{,}68 \text{ x } 10^{6}\text{ncm}^{-2}\text{s}^{-1}$

$\Delta\boldsymbol{\phi}_{\text{c}} = 7{,}66 \text{ x } 10^{4}\text{ncm}^{-2}\text{s}^{-1}$

$\Delta\boldsymbol{\phi}_{\text{th}} = (1{,}68 \text{ x } 10^{6}) + (7{,}66 \text{ x } 10^{4})\ \text{ncm}^{-2}\text{s}^{-1}$

$= 1{,}76 \text{ x } 10^{6}\text{ncm}^{-2}\text{s}^{-1}$

Dari hasil-hasil nilai ralat fluks thermal di atas maka dapat dihitung rata-rata nilai ralat fluks neutron thermal sebagai berikut :

$$\Delta\phi_{th} = \frac{\Delta\phi_{t1} + \Delta\phi_{t2} + \Delta\phi_{t3} + \Delta\phi_{t4} + \Delta\phi_{t5}}{5}$$

$$\Delta\phi_{th} = \frac{(8{,}93 \text{ x } 10^{7}) + (6{,}15 \text{ x } 10^{7}) + (2{,}44 \text{ x } 10^{7}) + (1{,}14 \text{ x } 10^{7}) + (1{,}76 \text{ x } 10^{6})}{5}\ \text{ncm}^{-2}\text{s}^{-1}$$

$$\Delta\phi_{th} = 3{,}77\text{x } 10^{7}\text{ncm}^{-2}\text{s}^{-1}$$

Lampiran 14. Nilai Banding Cadmium

$R_{cd} = \frac{\phi_\tau}{\phi_c}$

1. Foil emas 0,004 gram

$\boldsymbol{\phi_\tau}$ = 3,25 x 10^{12}ncm^{-2}s^{-1}

$\boldsymbol{\phi}_c$ = 1,06 x 10^{12}ncm^{-2}s^{-1}

$R_{cd} = \frac{3{,}25 \text{ x } 10^{12}\text{ncm}^{-2}\text{s}^{-1}}{1{,}06 \text{ x } 10^{12}\text{ncm}^{-2}\text{s}^{-1}}$

R_{cd}= 3,06

2. Foil emas 0,005 gram

$\boldsymbol{\phi_\tau}$ = 2,90x 10^{12}ncm^{-2}s^{-1}

$\boldsymbol{\phi}_c$ = 7,99 x 10^{11}ncm^{-2}s^{-1}

$R_{cd} = \frac{2{,}90 \text{ x } 10^{12}\text{ncm}^{-2}\text{s}^{-1}}{7{,}99 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1}}$

R_{cd}= 3,63

3. Foil emas 0,006 gram

$\boldsymbol{\phi_\tau}$ = 1,56 x 10^{12}ncm^{-2}s^{-1}

$\boldsymbol{\phi}_c$ = 1,99 x 10^{11}ncm^{-2}s^{-1}

$R_{cd} = \frac{1{,}56 \text{ x } 10^{12}\text{ncm}^{-2}\text{s}^{-1}}{1{,}99 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1}}$

$R_{cd} = 7{,}85$

4. Foil emas 0,007 gram

$\boldsymbol{\phi_\tau}$ = 8,69 x 10^{11}ncm^{-2}s^{-1}

$\boldsymbol{\phi}_c$ = 8,71 x 10^{10}ncm^{-2}s^{-1}

$$R_{cd} = \frac{8{,}69 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1}}{8{,}71 \text{ x } 10^{10}\text{ncm}^{-2}\text{s}^{-1}}$$

$$R_{cd} = 9{,}99$$

5. Foil emas 0,009 gram

$\boldsymbol{\phi_\tau}$ = 1,80 x 10^{11}ncm^{-2}s^{-1}

$\boldsymbol{\phi}_c$ = 8,19 x 10^{9}ncm^{-2}s^{-1}

$$R_{cd} = \frac{1{,}80 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1}}{8{,}19 \text{ x } 10^{9}\text{ncm}^{-2}\text{s}^{-1}}$$

$$R_{cd} = 21{,}98$$

Dari hasil-hasil nilai banding cadmium di atas maka dapat dihitung rata-rata nilai banding cadmium sebagai berikut :

$$R_{cd} = \frac{R_{cd1} + R_{cd2} + R_{cd3} + R_{cd4} + R_{cd5}}{5}$$

$$= \frac{3{,}06+3{,}63+7{,}85+9{,}99+21{,}98}{5}$$

$$= 9{,}30$$

Lampiran 15. Ralat Nilai Banding Cadmium

$$\Delta R_{cd} = \left|\frac{1}{\phi_c}\right| \Delta\phi_\tau + \left|\frac{\phi_\tau}{{\phi_c}^2}\right| \Delta\phi_c$$

1. Foil emas 0,004 gram

$\boldsymbol{\phi_\tau}$ = 3,25 x $10^{12}\text{ncm}^{-2}\text{s}^{-1}$

$\boldsymbol{\phi}_\text{c}$ = 1,06 x $10^{12}\text{ncm}^{-2}\text{s}^{-1}$

$\Delta\boldsymbol{\phi_\tau}$ = 6,73 x $10^{7}\text{ncm}^{-2}\text{s}^{-1}$

$\Delta\boldsymbol{\phi}_\text{c}$ = 2,20 x $10^{7}\text{ncm}^{-2}\text{s}^{-1}$

$$\Delta R_{cd} = \left|\frac{1}{1{,}06 \text{ x } 10^{12}\text{ncm}^{-2}\text{s}^{-1}}\right|(6{,}73 \text{ x } 10^{7}\text{ncm}^{-2}\text{s}^{-1}) + \left|\frac{3{,}25 \text{ x } 10^{12}\text{ncm}^{-2}\text{s}^{-1}}{(1{,}06 \text{ x } 10^{12}\text{ncm}^{-2}\text{s}^{-1})^2}\right| (2{,}20\text{x } 10^{7}\text{ncm}^{-2}\text{s}^{-1})$$

ΔR_{cd}= 1,27 x10^{-4}

2. Foil emas 0,005 gram

$\boldsymbol{\phi_\tau}$ = 2,90x $10^{12}\text{ncm}^{-2}\text{s}^{-1}$

$\boldsymbol{\phi}_\text{c}$ = 7,99 x $10^{11}\text{ncm}^{-2}\text{s}^{-1}$

$\Delta\boldsymbol{\phi_\tau}$ = 4,82x $10^{7}\text{ncm}^{-2}\text{s}^{-1}$

$\Delta\boldsymbol{\phi}_\text{c}$ = 1,33 x $10^{7}\text{ncm}^{-2}\text{s}^{-1}$

$$\Delta R_{cd} = \left|\frac{1}{7{,}99 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1}}\right| (4{,}82\text{x } 10^{7}\text{ncm}^{-2}\text{s}^{-1}) + \left|\frac{2{,}90 \text{ x } 10^{12}\text{ncm}^{-2}\text{s}^{-1}}{(7{,}99 \text{ x } 10^{11}\text{ncm}^{-2}\text{s}^{-1})^2}\right| (1{,}33 \text{ x } 10^{7}\text{ncm}^{-2}\text{s}^{-1})$$

ΔR_{cd}= 1,21 x10^{-4}

3. Foil emas 0,006 gram

$\boldsymbol{\phi_\tau}$ = 1,56 x $10^{12}\text{ncm}^{-2}\text{s}^{-1}$

$\boldsymbol{\phi}_c$ = 1,99 x 10^{11}ncm^{-2}s^{-1}

$\Delta\boldsymbol{\phi}_{\boldsymbol{\tau}}$ = 2,16 x 10^{7}ncm^{-2}s^{-1}

$\Delta\boldsymbol{\phi}_c$ = 2,77 x 10^{6}ncm^{-2}s^{-1}

$$\Delta R_{cd} = \left|\frac{1}{1{,}99 \times 10^{11}\text{ncm}^{-2}\text{s}^{-1}}\right| (2{,}16 \times 10^{7}\text{ncm}^{-2}\text{s}^{-1}) + \left|\frac{1{,}56 \times 10^{12}\text{ncm}^{-2}\text{s}^{-1}}{(1{,}99 \times 10^{11}\text{ncm}^{-2}\text{s}^{-1})^2}\right| (2{,}77 \times 10^{6}\text{ncm}^{-2}\text{s}^{-1})$$

ΔR_{cd}= 2,18 x10^{-4}

4. Foil emas 0,007 gram

$\boldsymbol{\phi}_{\boldsymbol{\tau}}$ = 8,69 x 10^{11}ncm^{-2}s^{-1}

$\boldsymbol{\phi}_c$ = 8,71 x 10^{10}ncm^{-2}s^{-1}

$\Delta\boldsymbol{\phi}_{\boldsymbol{\tau}}$ = 1,04 x 10^{7}ncm^{-2}s^{-1}

$\Delta\boldsymbol{\phi}_c$ = 1,04 x 10^{6}ncm^{-2}s^{-1}

$$\Delta R_{cd} = \left|\frac{1}{8{,}71 \times 10^{10}\text{n cm}^{-2}\text{s}^{-1}}\right| (1{,}04 \times 10^{7}\text{n cm}^{-2}\text{s}^{-1}) + \left|\frac{8{,}69 \times 10^{11}\text{ncm}^{-2}\text{s}^{-1}}{(8{,}71 \times 10^{10}\text{ncm}^{-2}\text{s}^{-1})^2}\right| (1{,}04 \times 10^{6}\text{ncm}^{-2}\text{s}^{-1})$$

ΔR_{cd}= 2,39 x10^{-4}

5. Foil emas 0,009 gram

$\boldsymbol{\phi}_{\boldsymbol{\tau}}$ = 1,80 x 10^{11}ncm^{-2}s^{-1}

$\boldsymbol{\phi}_c$ = 8,19 x 10^{9}ncm^{-2}s^{-1}

$\Delta\boldsymbol{\phi}_{\boldsymbol{\tau}}$ = 1,68 x 10^{6}ncm^{-2}s^{-1}

$\Delta\boldsymbol{\phi}_c$ = 7,66 x 10^{4}ncm^{-2}s^{-1}

$$\Delta R_{cd} = \left|\frac{1}{8{,}19 \times 10^{9}\text{ncm}^{-2}\text{s}^{-1}}\right| (1{,}68 \times 10^{6}\text{ncm}^{-2}\text{s}^{-1}) + \left|\frac{1{,}80 \times 10^{11}\text{ncm}^{-2}\text{s}^{-1}}{(8{,}19 \times 10^{9}\text{ncm}^{-2}\text{s}^{-1})^2}\right| (7{,}66 \times 10^{4}\text{ncm}^{-2}\text{s}^{-1})$$

ΔR_{cd}= 4,11 x10^{-4}

Dari hasil-hasil nilai ralat nilai banding cadmium di atas maka dapat dihitung rata-rata nilai ralat nilai banding cadmium sebagai berikut :

$$\Delta R_{cd} = \frac{R_{cd1} + R_{cd2} + R_{cd3} + R_{cd4} + R_{cd5}}{5}$$

$$\Delta R_{cd} = \frac{1{,}27 \text{ x}10^{-4} + 1{,}21 \text{ x}10^{-4} + 2{,}18 \text{ x}10^{-4} + 2{,}39 \text{ x}10^{-4} + 4{,}11 \text{ x}10^{-4}}{5}$$

$$\Delta R_{cd} = 2{,}23 \text{ x}10^{-4}$$