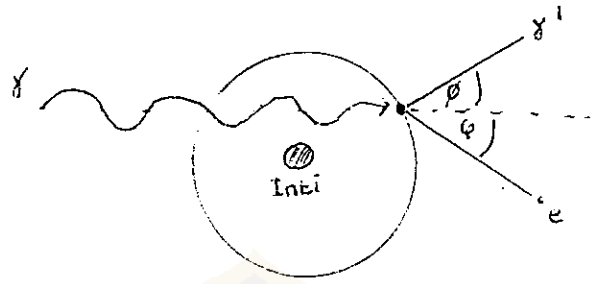
LAMPIRAN I

PERSAMAAN EFEK HAMBURAN COMPTON

Menurut teori kuantum cahaya, foton berlaku sebagai partikel. Hanya saja foton tidak mempunyai massa diam. Maka tumbukan antara foton dan elektron dapat dianalisa.



Gb. Li. Hamburan Compton

Jika foton datang mempunyai frekuensi ν, maka foton hambur mempunyai frekuensi yang lebih rendah ν', sehingga kehilangan energi foton = Energi yang diterima elektron.

$$h\nu - h\nu' = K \qquad (1)$$

Karena energi foton adalah $h\nu$, momentumnya adalah :

$$p = \frac{E}{c} = \frac{h\nu}{c} \qquad (2)$$

Momentum awal = momentum akhir, sehingga pada arah semula

$$\frac{h\nu}{c} + 0 = \frac{h\nu'}{c}\cos\phi + p\cos\theta \qquad (3)$$

dan tegak lurus arah ini, momemtum awal = momentum akhir.

$$0 = \frac{h\nu'}{c} \sin \phi + p \sin \theta \qquad (4)$$

Sudut ϕ menyatakan sudut antara arah semula dengan foton hambur, θ sudut antar arah semula dengan arah elektron terhambur.

Persamaan (3) dan (4) dikalikan dengan c dan menuliskannya kembali :

$$pc \cos \theta = h\nu - h\nu' \cos \phi \qquad (5.a.)$$

$$pc \sin \theta = h\nu' \sin \phi \qquad (5.b.)$$

Sudut θ dieliminasi dengan mengkuadratkan masing-masing persamaan dan menambahkannya.

$$p^2c^2 = (h\nu)^2 - 2(h\nu)(h\nu')\cos \phi + (h\nu')^2 \qquad (6)$$

Kemudian disamakan kedua rumus untuk energi total partikel.

$$E = K + m_o c^2 \qquad (7.a.)$$

$$E = \sqrt{m_o^2 c^4 + p^2 c^2} \qquad (7.b.)$$

sehingga :

$$p^2c^2 = K^2 + m_o^2c^2K \qquad (8)$$

Dengan mensubtitusikan persamaan (1) ke dalam persamaan (8) diperoleh :

$$p^2c^2 = (h\nu)^2 - 2(h\nu)(h\nu') + (h\nu')^2 + 2m_oc^2(h\nu - h\nu') \qquad (9)$$

Harga p^2c^2 ini disubstitusikan ke persamaan (6) sehingga dihasilkan :

$$2m_oc^2(h\nu - h\nu') = 2(h\nu)(h\nu')(1 - \cos\phi) \qquad (10)$$

Jika dinyatakan sebagai panjang gelombang, persamaan (10) dibagi dengan $2h^2c^2$.

$$\frac{m_oc}{h}\left\{\frac{\nu}{c} - \frac{\nu'}{c'}\right\} = \frac{\nu}{c} \cdot \frac{\nu'}{c'}(1 - \cos\phi) \qquad (11)$$

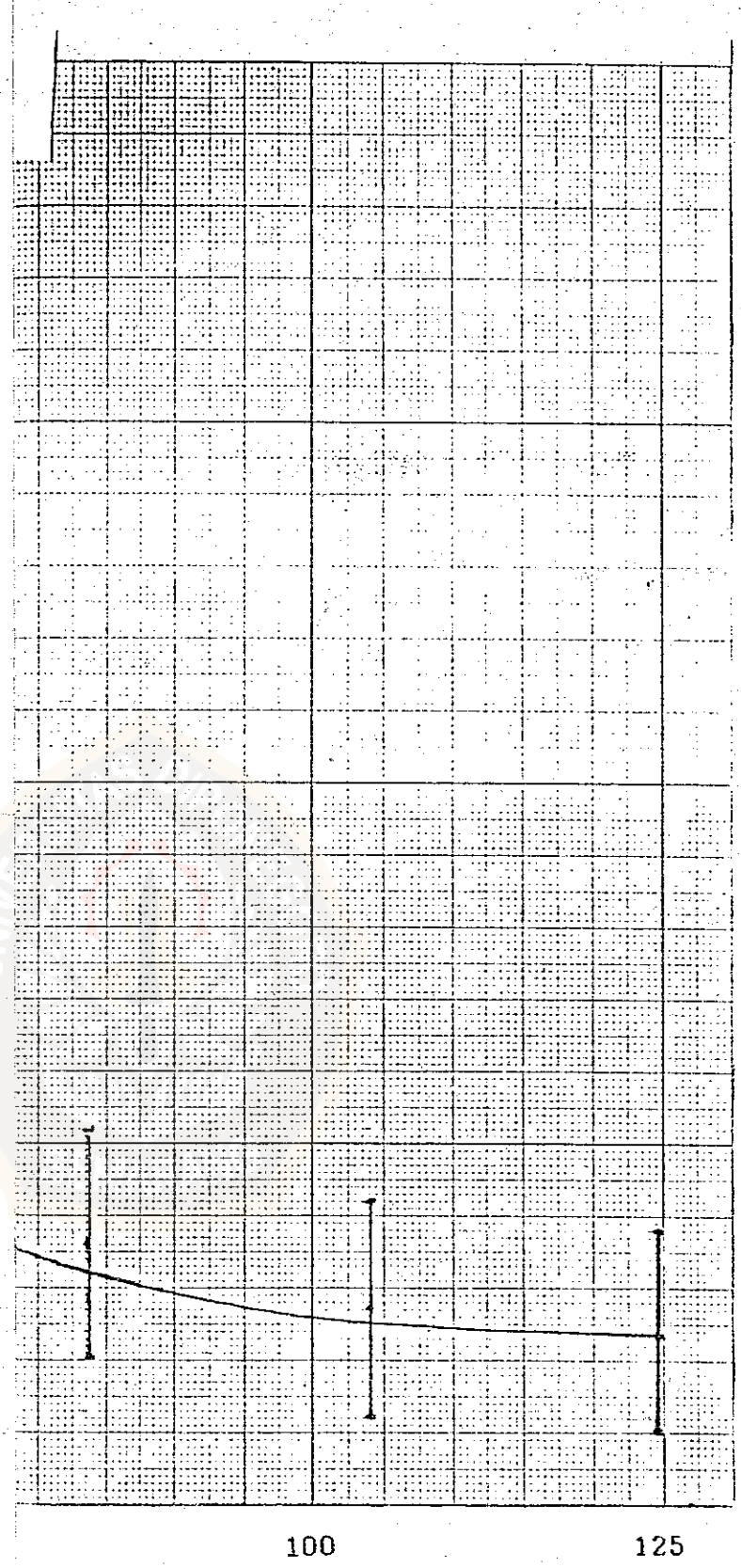
Karena $\nu/c = 1/\lambda$ dan $\nu'/c' = 1/\lambda'$ maka :

$$\frac{m_oc}{h}\left\{\frac{1}{\lambda} - \frac{1}{\lambda'}\right\} = \frac{(1 - \cos\phi)}{\lambda\lambda'} \qquad (12)$$

Sehingga persamaan akhir Compton adalah :

$$\lambda' - \lambda = \frac{h}{m_oc}(1 - \cos\phi) \qquad (13)$$

(Arthur Beiser, 1989)



LAMPIRAN III

PERHITUNGAN KEDAPAT ULANGAN (RECOVERY)

*> Laju cacah kedapat ulangan (C_R) : 0,02798 cps

*> Laju cacah latar (C_b) : 0,01825 cps

*> Faktor pertumbuhan Y-90 8 hari (F_1) : 0,8742

*> Faktor peluruhan Y-90 27 jam (F_2) : 0,7471

*> Efisiensi (ε) m = 34,0 mg : 1,12 %

*> Aktivitas standar (A_{st}) : 2,20 Bq

Aktivitas kedapat ulangan dihitung dengan persamaan sebagai berikut :

$$A_R = \frac{C_R - C_b}{\varepsilon \cdot F_1 \cdot F_2}$$

$$= \frac{(0,02798 - 0,01825)}{0,0112 \cdot 0,8742 \cdot 0,7471}$$

$$= 1,33 \text{ Bq}$$

Kedapat ulangan merupakan perbandingan aktivitas kedapat ulangan dengan aktivitas standar yang dapat dituliskan :

$$R = \frac{A_R}{A_{st}} \cdot 100 \%$$

$$= \frac{1,33}{2,20} \cdot 100 \%$$

$$= 60,5 \%$$

LAMPIRAN IV

TABEL DAFTAR FAKTOR PERTUMBUHAN Y-90

SELAMA 0,00 SAMPAI 27,00 HARI

t(days)	$1-e^{-\lambda t}$	t(days)	$1-e^{-\lambda t}$	t(days)	$1-e^{-\lambda t}$
0.00	.0000	9.00	.9029	18.00	.9906
0.25	.0627	9.25	.9090	18.25	.9912
0.50	.1215	9.50	.9147	18.50	.9917
0.75	.1766	9.75	.9201	18.75	.9922
1.00	.2283	10.00	.9251	19.00	.9927
1.25	.2767	10.25	.9298	19.25	.9932
1.50	.3221	10.50	.9342	19.50	.9936
1.75	.3646	10.75	.9384	19.75	.9940
2.00	.4045	11.00	.9422	20.00	.9944
2.25	.4418	11.25	.9458	20.25	.9948
2.50	.4768	11.50	.9492	20.50	.9951
2.75	.5097	11.75	.9524	20.75	.9954
3.00	.5404	12.00	.9554	21.00	.9957
3.25	.5692	12.25	.9582	21.25	.9959
3.50	.5963	12.50	.9608	21.50	.9962
3.75	.6216	12.75	.9633	21.75	.9964
4.00	.6453	13.00	.9656	22.00	.9967
4.25	.6676	13.25	.9678	22.25	.9969
4.50	.6884	13.50	.9697	22.50	.9971
4.75	.7080	13.75	.9716	22.75	.9973
5.00	.7263	14.00	.9734	23.00	.9974
5.25	.7435	14.25	.9751	23.25	.9976
5.50	.7596	14.50	.9766	23.50	.9977
5.75	.7746	14.75	.9781	23.75	.9979
6.00	.7888	15.00	.9795	24.00	.9980
6.25	.8020	15.25	.9808	24.25	.9981
6.50	.8145	15.50	.9820	24.50	.9982
6.75	.8261	15.75	.9831	24.75	.9984
7.00	.8370	16.00	.9842	25.00	.9985
7.25	.8472	16.25	.9852	25.25	.9986
7.50	.8568	16.50	.9861	25.50	.9987
7.75	.8658	16.75	.9870	25.75	.9987
8.00	.8742	17.00	.9878	26.00	.9988
8.25	.8820	17.25	.9886	26.25	.9989
8.50	.8896	17.50	.9893	26.50	.9990
8.75	.8864	17.75	.9900	26.75	.9990
				27.00	.9991

(Emlinarti, 1993)

LAMPIRAN V

FAKTOR PELURUHAN DAN PERTUMBUHAN Y-90

SELAMA 0,0 SAMPAI 71,0 JAM

t(hr)	$e^{-\lambda t}$	$1-e^{-\lambda t}$	t(hr)	$e^{-\lambda t}$	$1-e^{-\lambda t}$	t(hr)	$e^{-\lambda t}$	$1-e^{-\lambda t}$
0.0	1.0000	.0000	22.5	.7843	.2157	45.0	.6151	.3849
0.5	.9940	.0054	23.0	.7801	.2199	45.5	.6118	.3882
1.0	.9893	.0107	23.5	.7759	.2241	46.0	.6085	.3915
1.5	.9839	.0161	24.0	.7717	.2283	46.5	.6053	.3947
2.0	.9786	.0214	24.5	.7676	.2324	47.0	.6020	.3980
2.5	.9734	.0266	25.0	.7634	.2366	47.5	.5988	.4012
3.0	.9681	.0319	25.5	.7593	.2407	48.0	.5955	.4045
3.5	.9629	.0371	26.0	.7552	.2448	48.5	.5923	.4077
4.0	.9577	.0423	26.5	.7512	.2488	49.0	.5891	.4109
4.5	.9526	.0474	27.0	.7471	.2529	49.5	.5860	.4140
5.0	.9474	.0526	27.5	.7431	.2569	50.0	.5828	.4172
5.5	.9423	.0577	28.0	.7391	.2609	50.5	.5797	.4203
6.0	.9373	.0627	28.5	.7351	.2549	51.0	.5766	.4234
6.5	.9322	.0678	29.0	.7311	.2689	51.5	.5735	.4265
7.0	.9272	.0728	29.5	.7272	.2728	52.0	.5704	.4296
7.5	.9222	.0778	30.0	.7233	.2767	52.5	.5673	.4327
8.0	.9172	.0828	30.5	.7194	.2806	53.0	.5642	.4358
8.5	.9123	.0877	31.0	.7155	.2845	53.5	.5612	.4388
9.0	.9074	.0926	31.5	.7117	.2883	54.0	.5582	.4418
9.5	.9025	.0975	32.0	.7078	.2922	54.5	.5552	.4448
10.0	.8976	.1024	32.5	.7040	.2960	55.0	.5522	.4478
10.5	.8928	.1072	33.0	.7002	.2998	55.5	.5492	.4508
11.0	.8880	.1120	33.5	.6965	.3035	56.0	.5462	.4538
11.5	.8832	.1168	34.0	.6927	.3073	56.5	.5433	.4567
12.0	.8785	.1215	34.5	.6890	.3110	57.0	.5404	.4596
12.5	.8737	.1263	35.0	.6853	.3147	57.5	.5375	.4625
13.0	.8690	.1310	35.5	.6816	.3184	58.0	.5346	.4654
13.5	.8644	.1356	36.0	.6779	.3221	58.5	.5317	.4683
14.0	.8597	.1403	36.5	.6743	.3257	59.0	.5288	.4712
14.5	.8551	.1449	37.0	.6706	.3294	59.5	.5260	.4740
15.0	.8505	.1495	37.5	.6670	.3330	60.0	.5232	.4768
15.5	.8459	.1541	38.0	.6634	.3366	60.5	.5203	.4797
16.0	.8413	.1587	38.5	.6599	.3401	61.0	.5175	.4825
16.5	.8468	.1632	39.0	.6563	.3437	61.5	.5148	.4852
17.0	.8323	.1677	39.5	.5428	.3472	62.0	.5092	.4880
17.5	.8278	.1722	40.0	.6493	.3507	62.5	.5092	.4908
18.0	.8234	.1766	40.5	.6458	.3542	63.0	.5065	.4935
18.5	.8189	.1811	41.0	.6423	.3577	64.0	.5010	.4990
19.0	.8145	.1855	41.5	.6388	.3612	65.0	.4957	.5043
19.5	.8101	.1899	42.0	.6354	.3646	66.0	.4903	.5097
20.0	.8058	.1942	42.5	.6320	.3680	67.0	.4851	.5149
20.5	.8014	.1986	43.0	.6286	.3714	68.0	.4799	.5201
21.0	.7971	.2029	43.5	.6252	.3748	69.0	.4747	.5253
21.5	.7928	.2072	44.0	.6219	.3781	70.0	.4696	.5304
22.0	.7885	.2115	44.5	.6185	.3815	71.0	.4646	.5354

(Emlinarti, 1993)