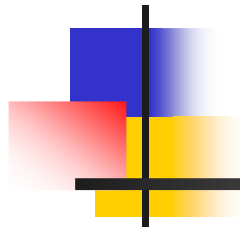
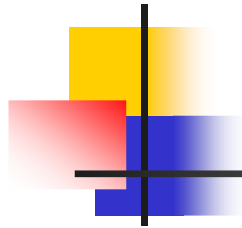


I Workshop de Proteção Radiológica em Física Médica e Radioecologia



Determinação de Parâmetros para Simulação de Detectores HPGe e NaI(Tl)

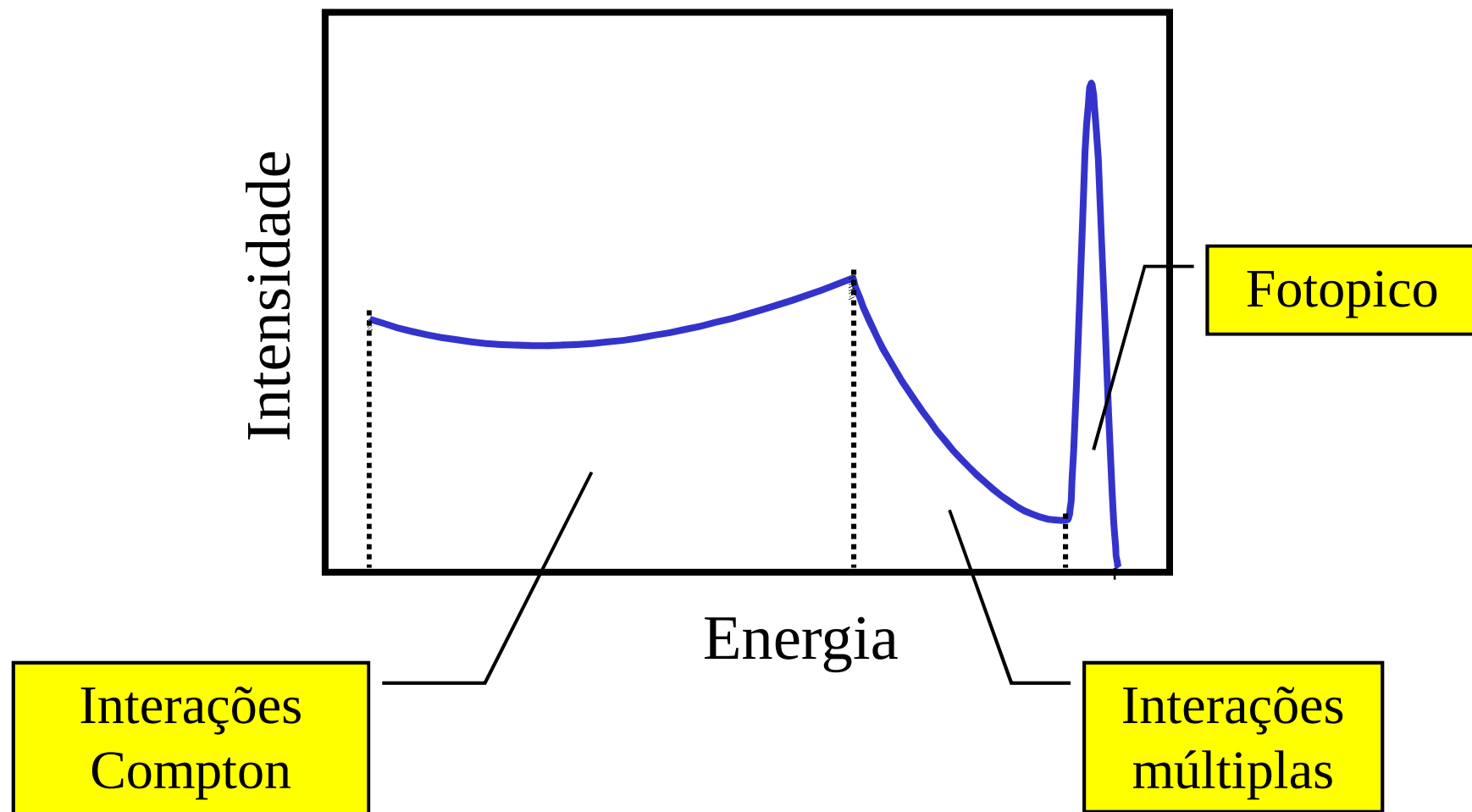
Claudio C. Conti
IRD/CNEN



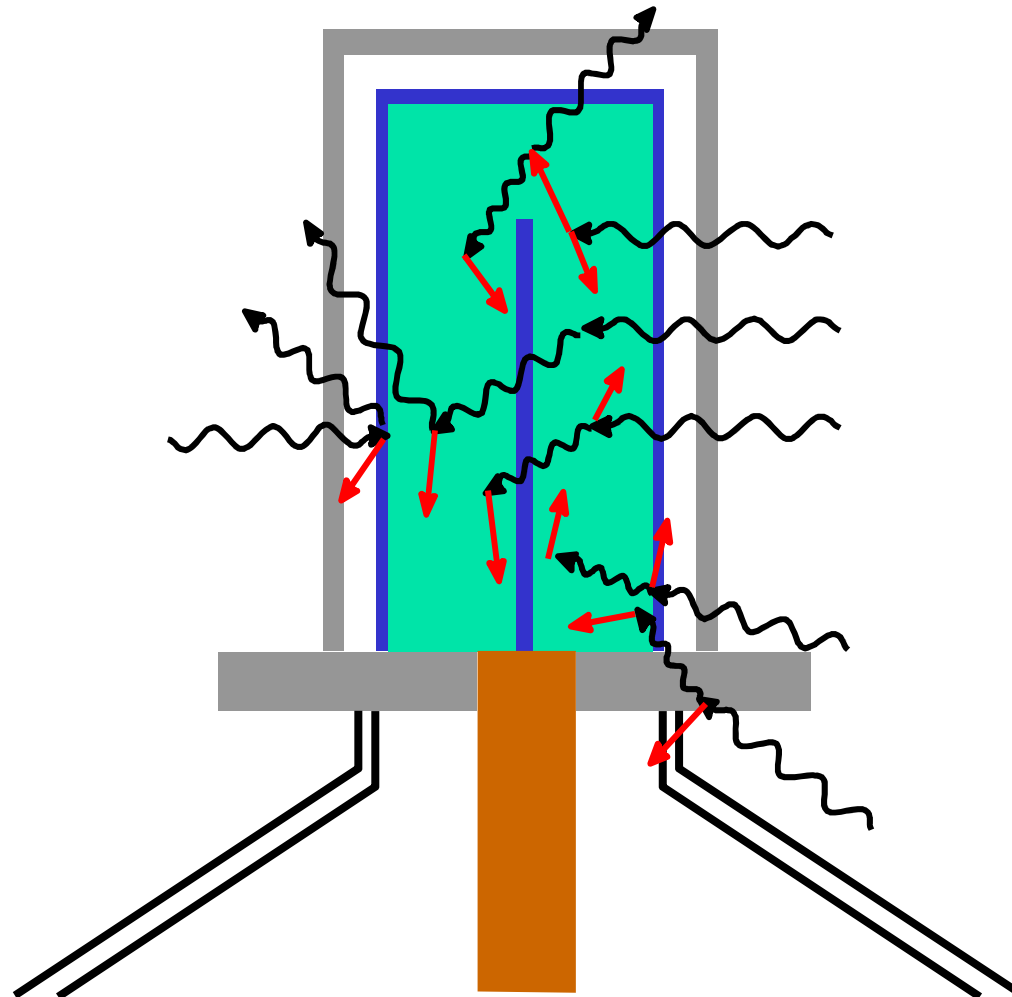
Espectros gama

- Devido aos diferentes processos de interação da radiação gama com o meio de detecção, até mesmo feixes monoenergéticos dão origem a uma complexa função resposta no detector.

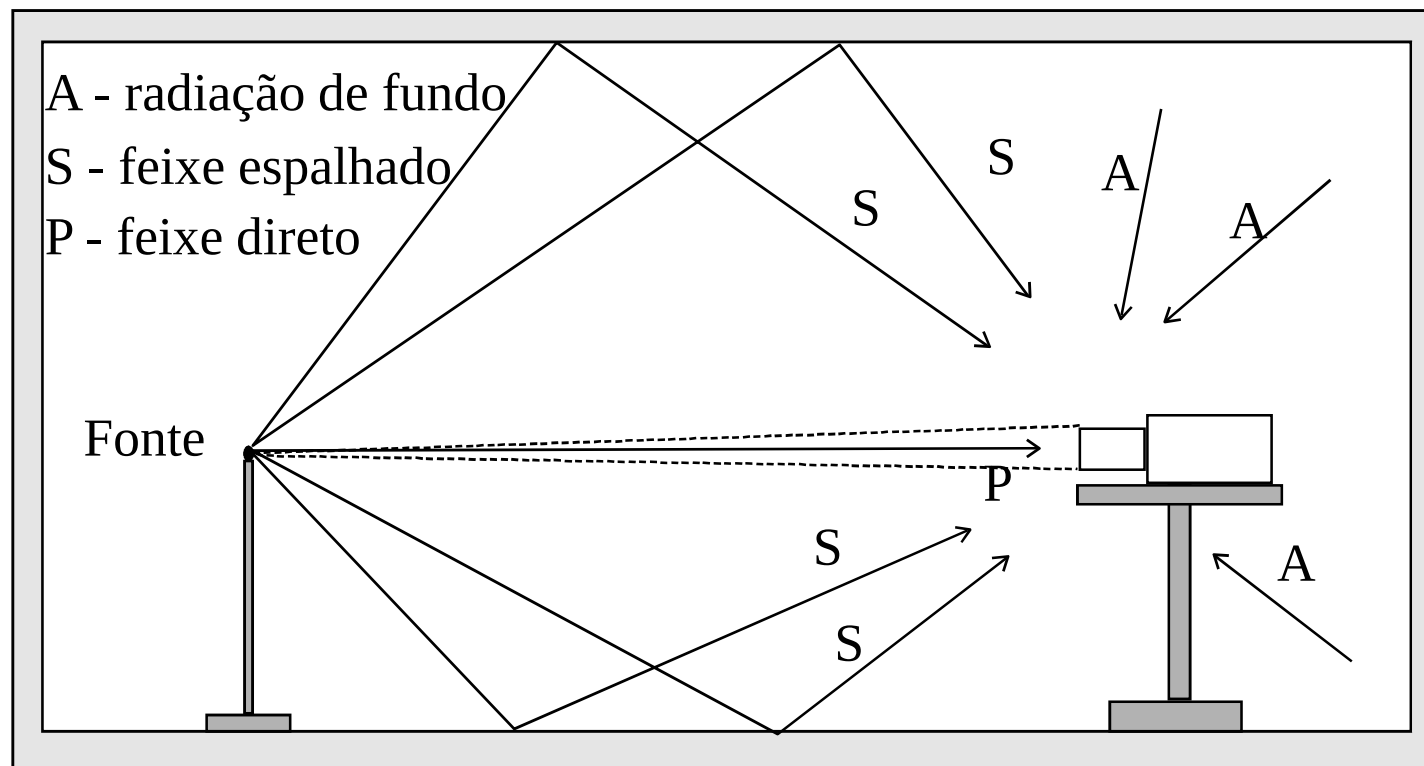
Função resposta do detector



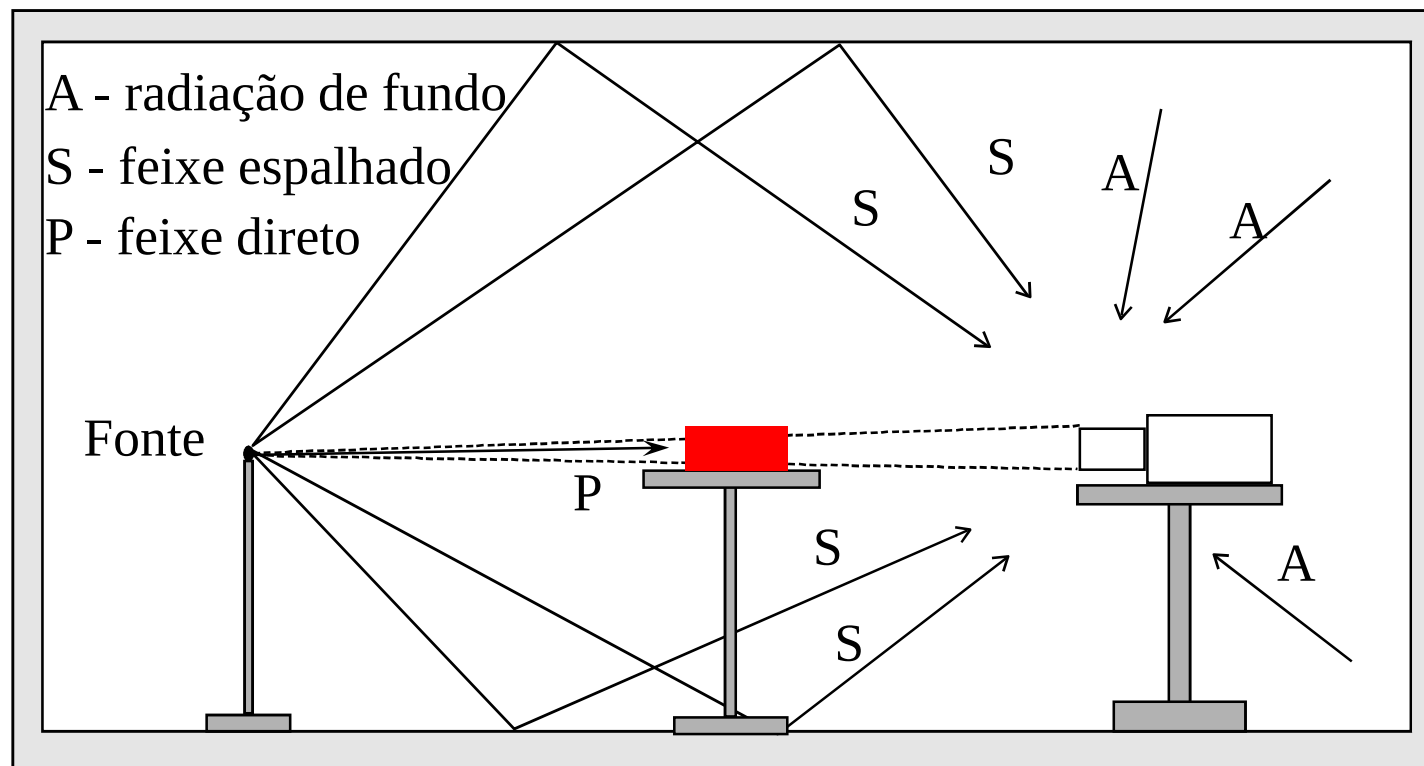
Efeitos em detector HPGe



Arranjo experimental



Arranjo experimental

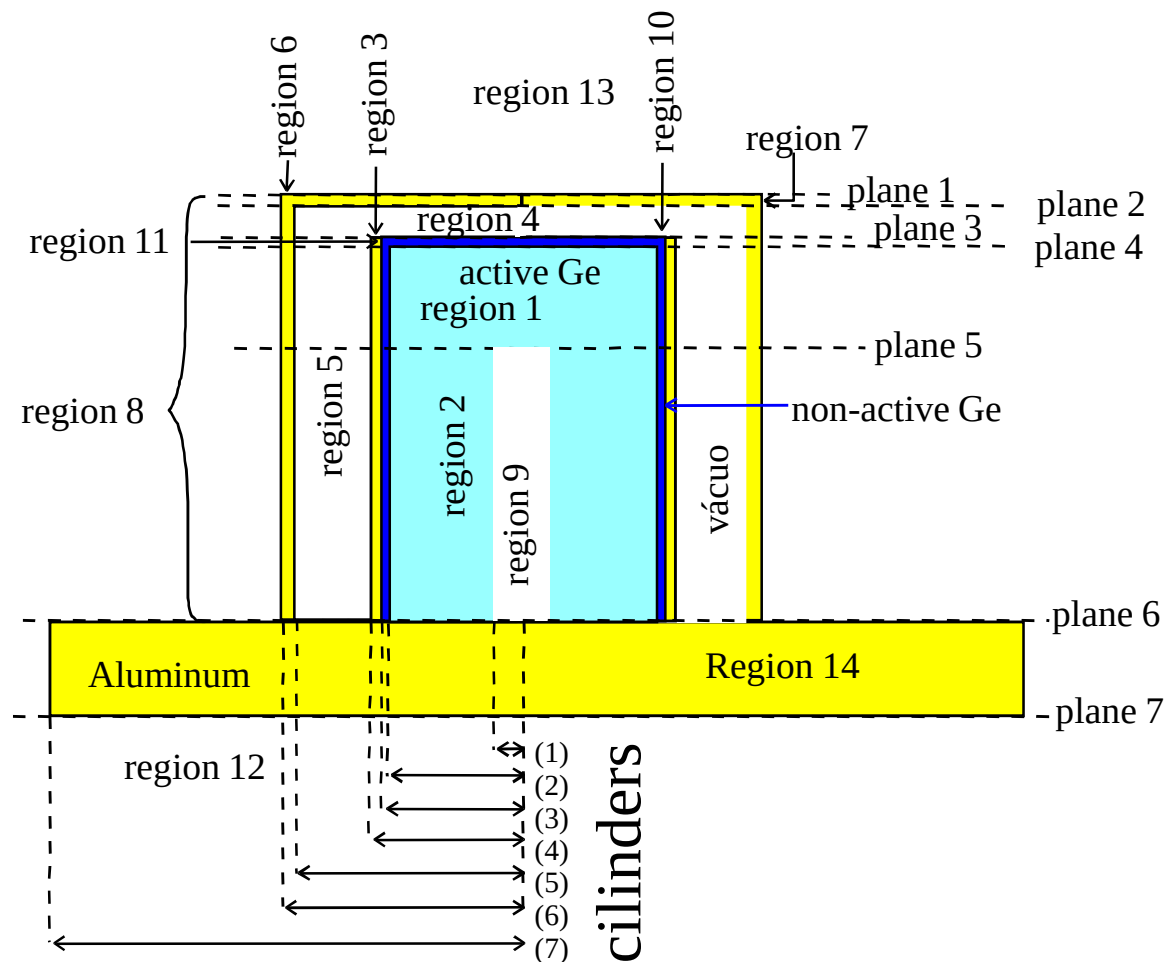


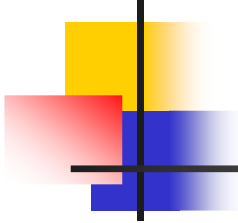
Experimental



HPGe coaxial

4 meios
14 regiões
7 planos
7 cilindros

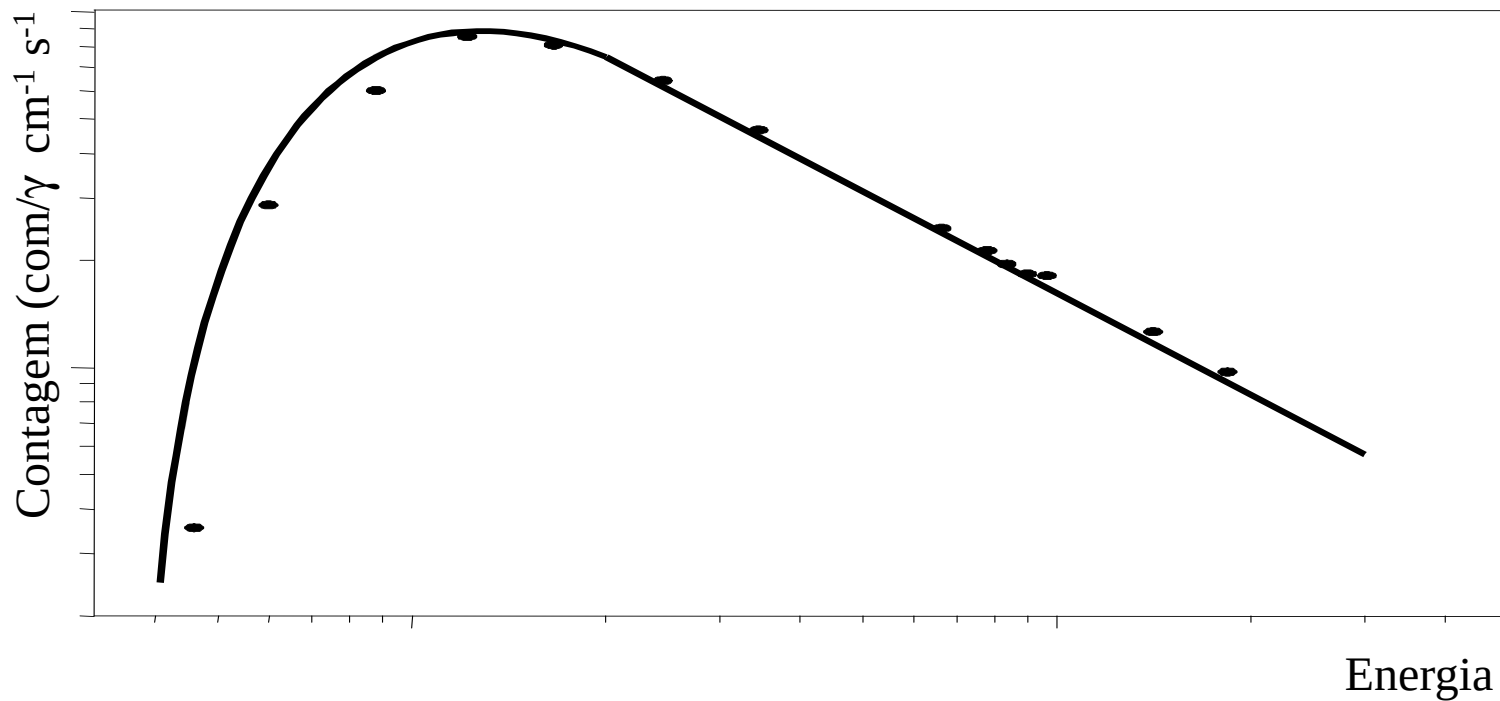




Determinação das camadas

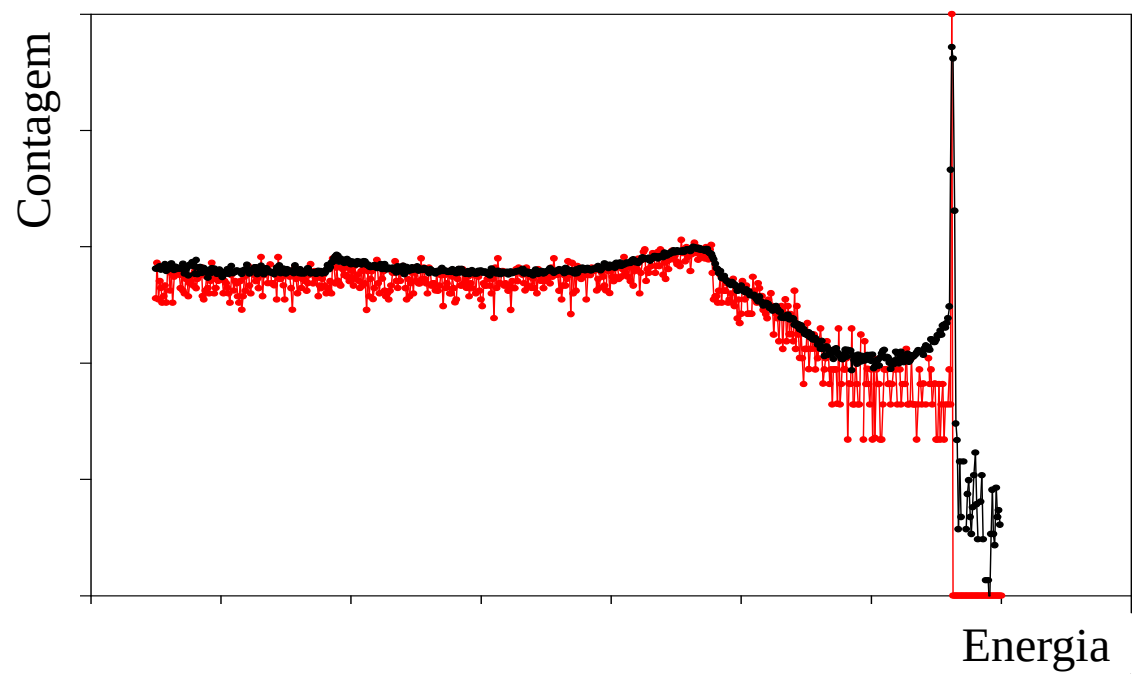
- Fonte ^{241}Am – $\sim 60\text{keV}$
 - Determinação da camada morta + transição
- Fonte ^{137}Cs – $\sim 662\text{keV}$
 - Determinação das dimensões do orifício

Curva de eficiência



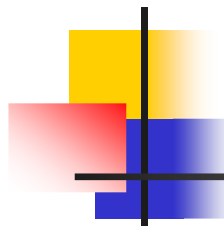
Curva de eficiência para o detector HPGe, obtida por modelagem; os pontos representam os valores obtidos experimentalmente.

Espectro 662keV

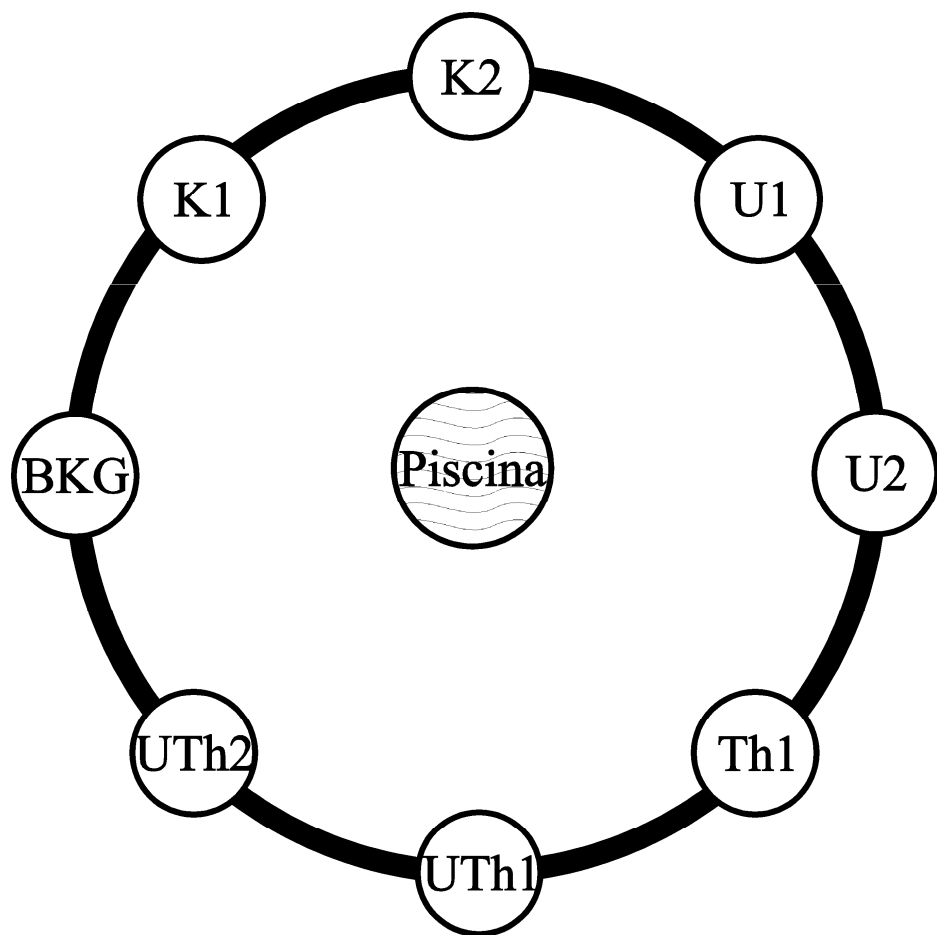


Vermelho → simulação

Preto → experimental (espectro total - espectro com a blindagem de sombra)

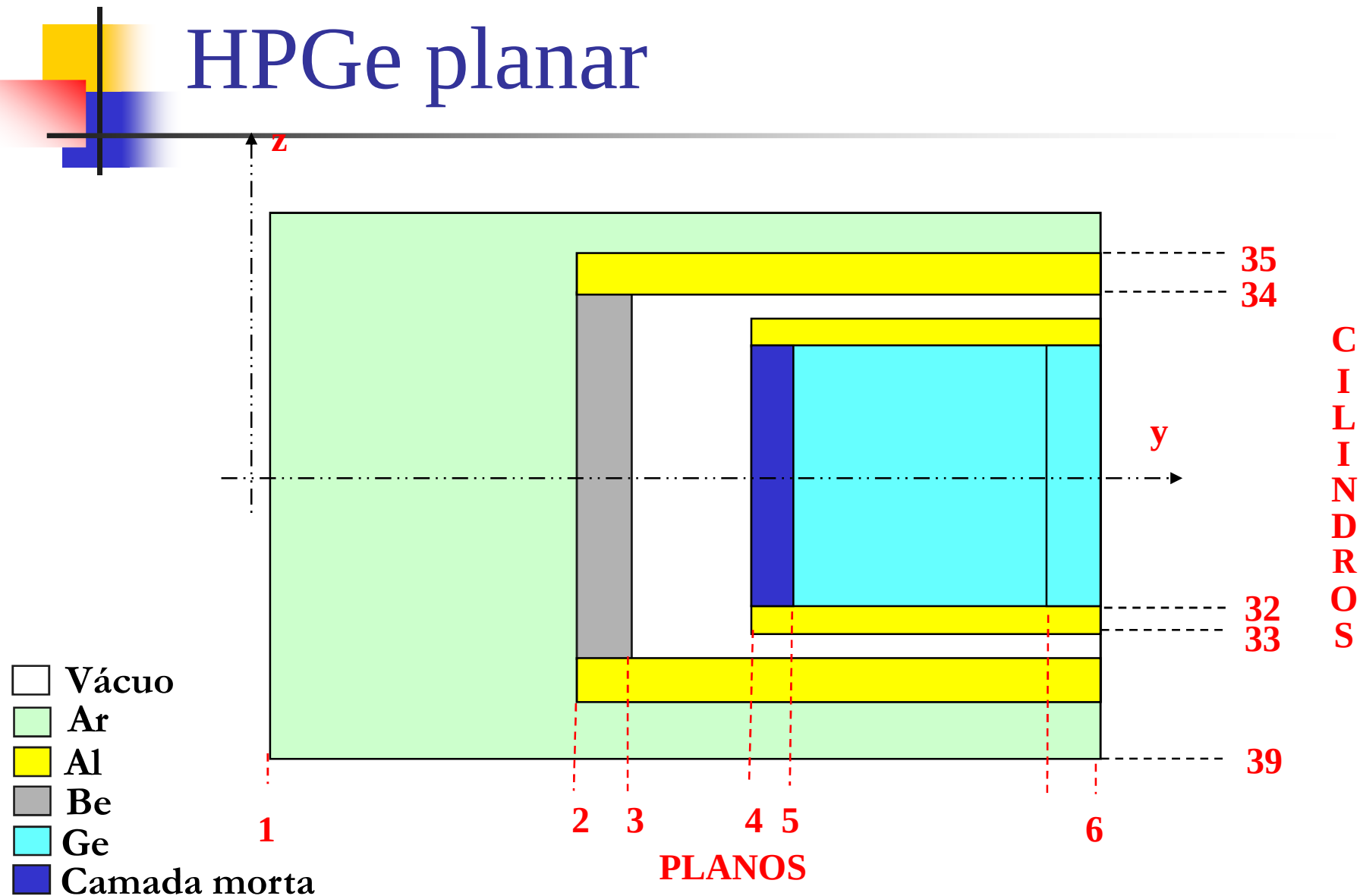


Resultados

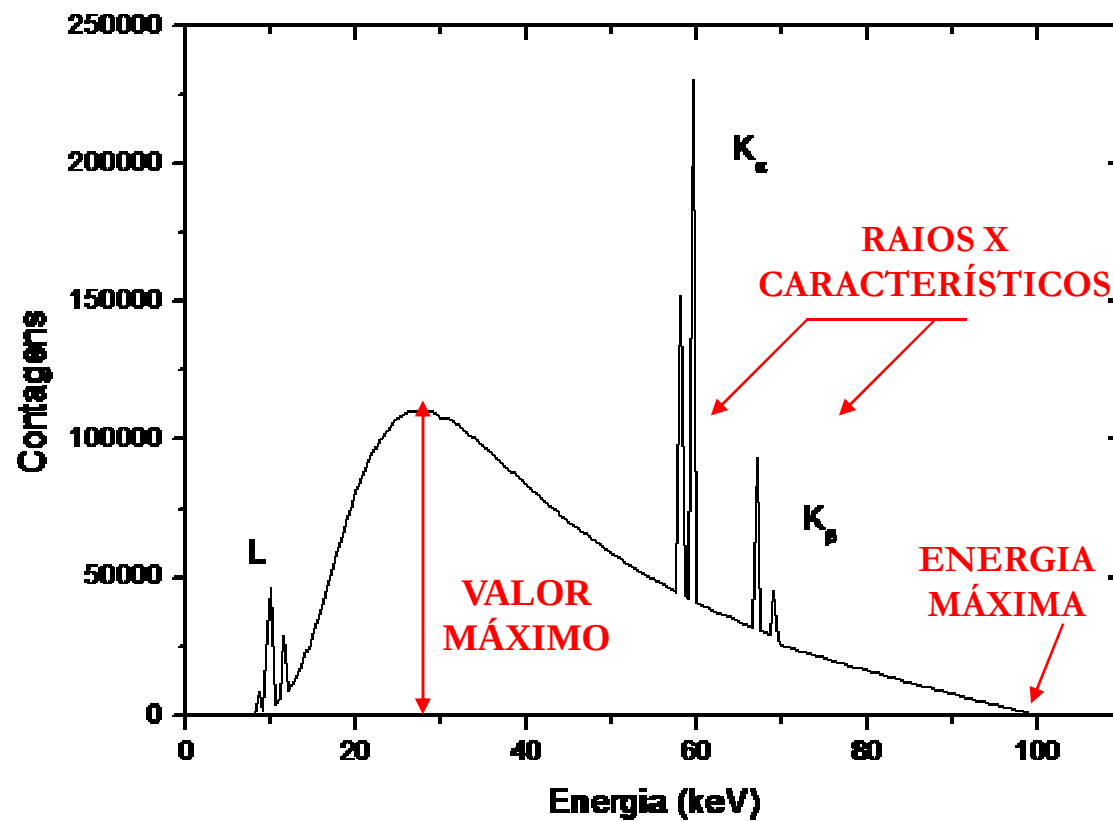


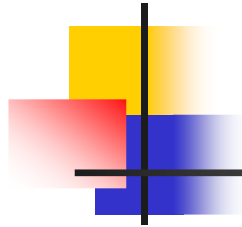
Fonte	Calculado ($\mu\text{Gy/h}$)	HPGe $\mu\text{Gy/h}$)
K1	$0,113 \pm 0,005$	$0,111 \pm 0,005$
K2	$0,109 \pm 0,006$	$0,119 \pm 0,004$
Th1	$0,534 \pm 0,028$	$0,515 \pm 0,018$
U1	$0,324 \pm 0,017$	$0,312 \pm 0,008$
U2	$0,184 \pm 0,007$	$0,189 \pm 0,005$
Uth1	$0,208 \pm 0,009$	$0,209 \pm 0,006$
Uth2	$0,446 \pm 0,023$	$0,441 \pm 0,020$

HPGe planar



Espectro de raios X





Determinação camada morta

- Geometria experimental

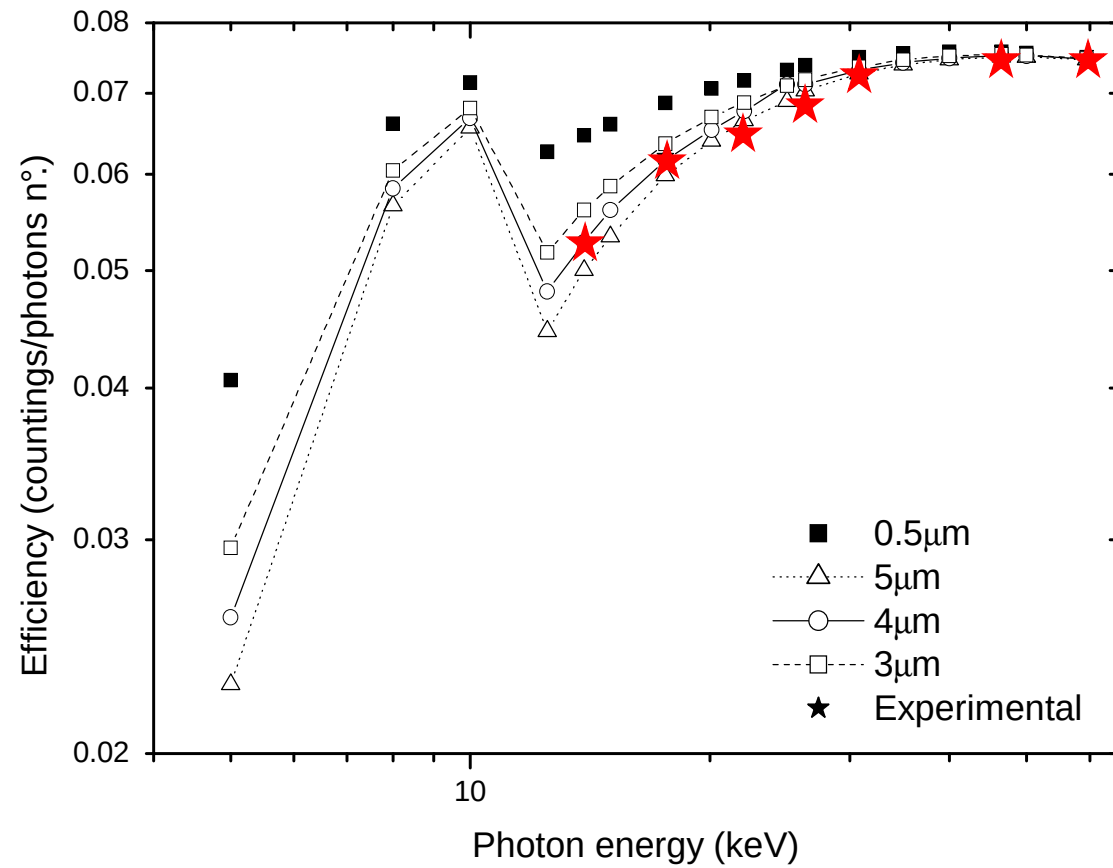
Fonte ^{241}Am : DFD de 10 cm

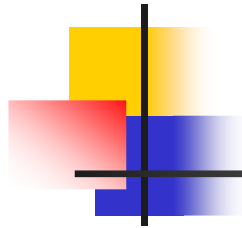
– Otimização das contagens

- Processo interativo

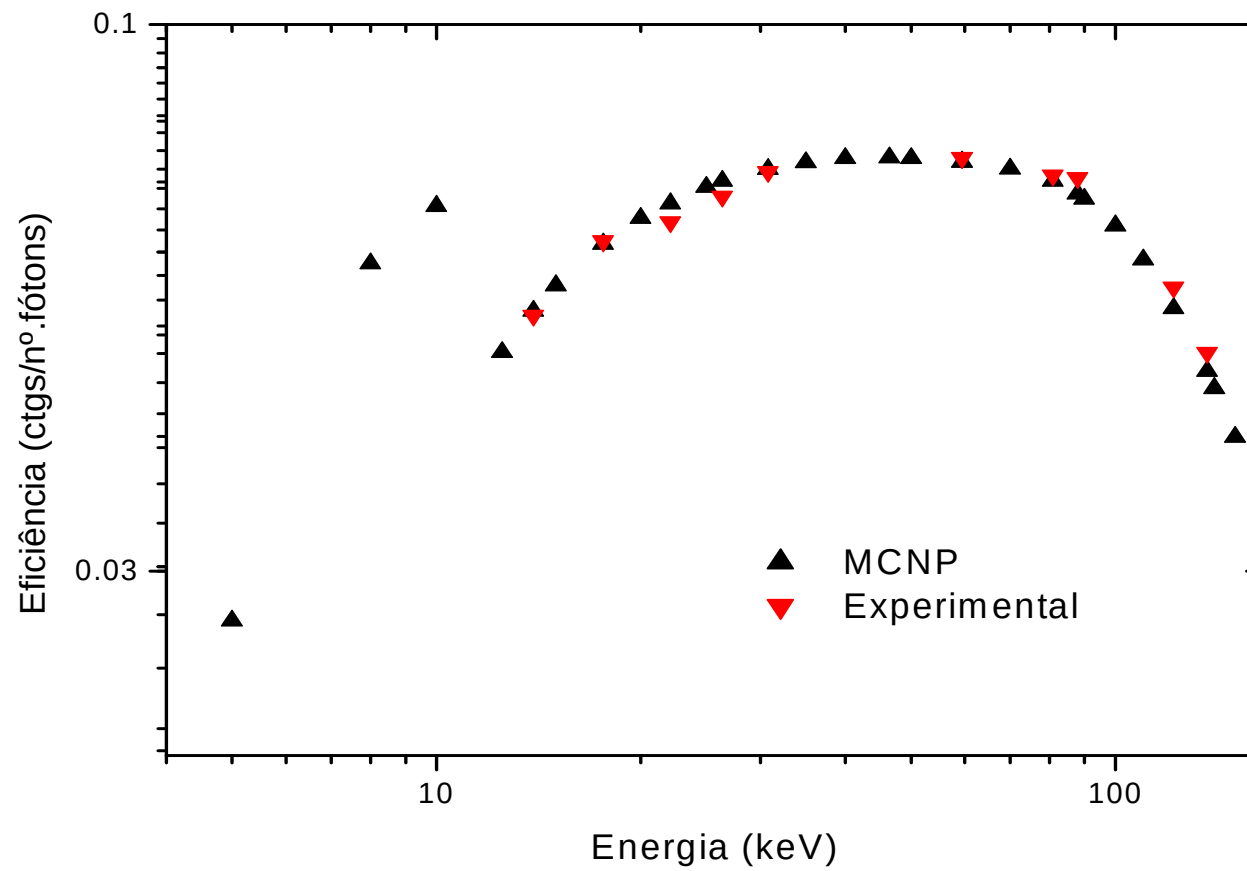
Comparação: Modelagem x Experimental

4 μm

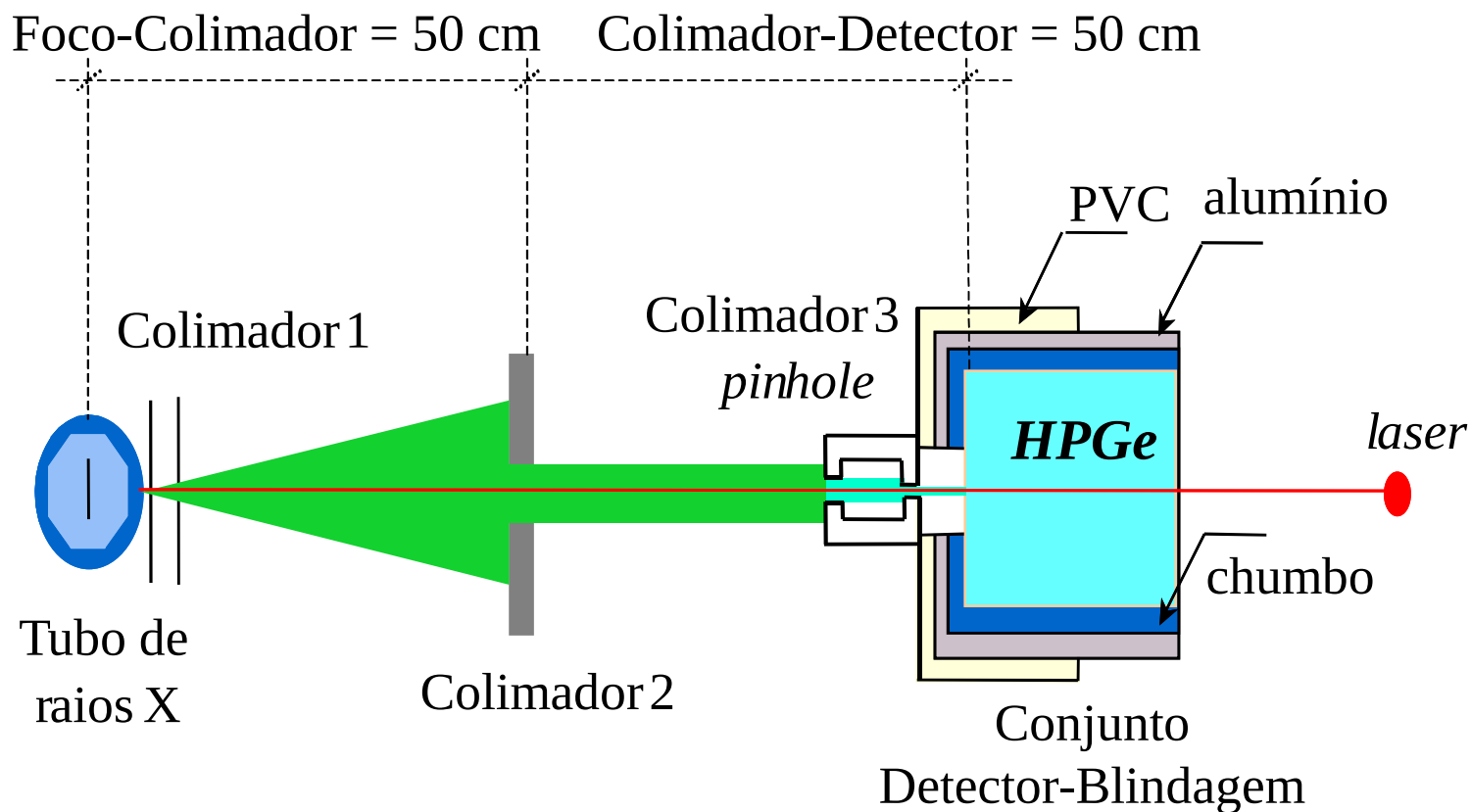


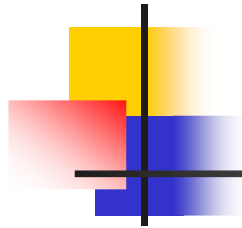


Curva de eficiência

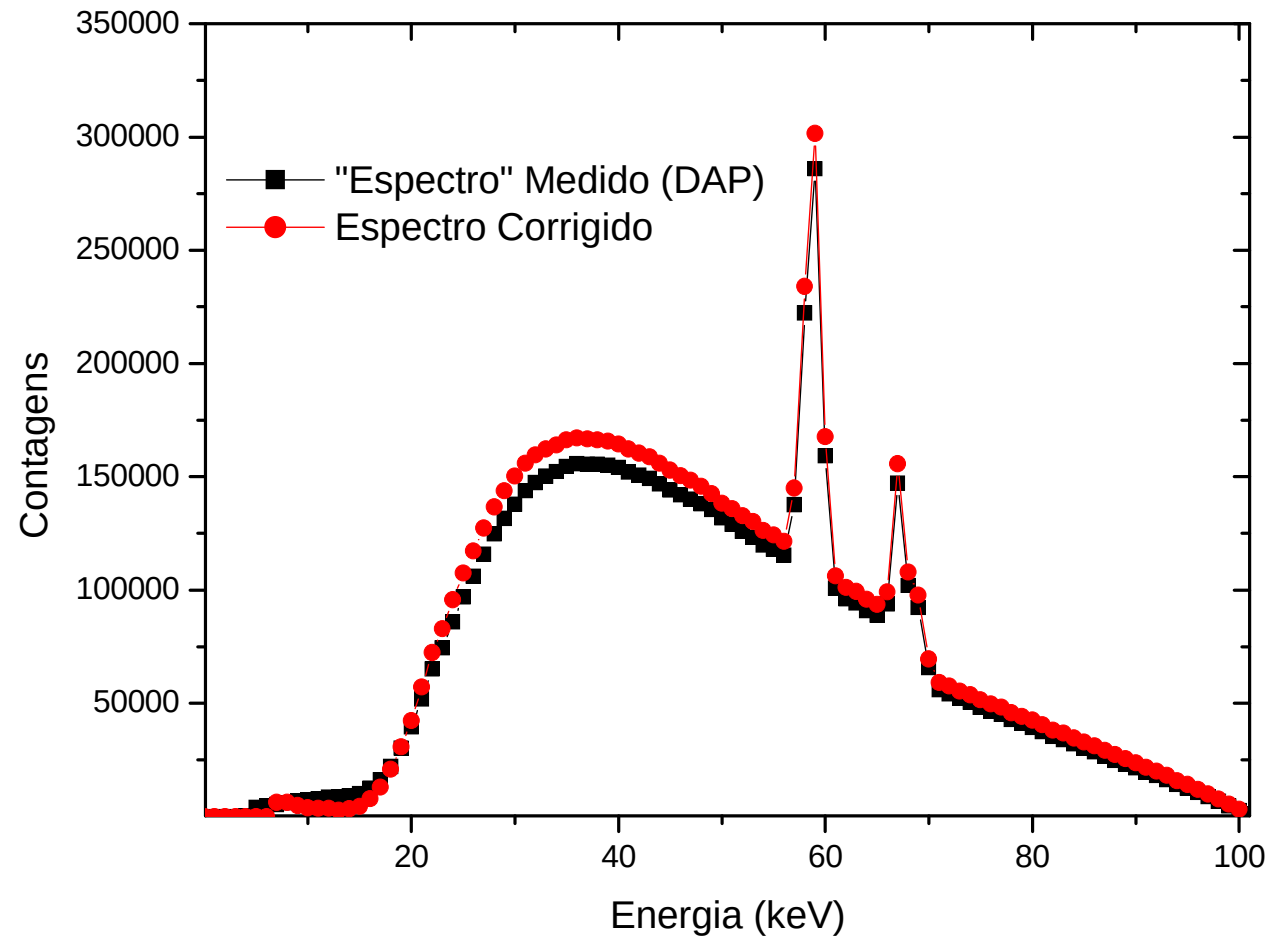


Arranjo experimental

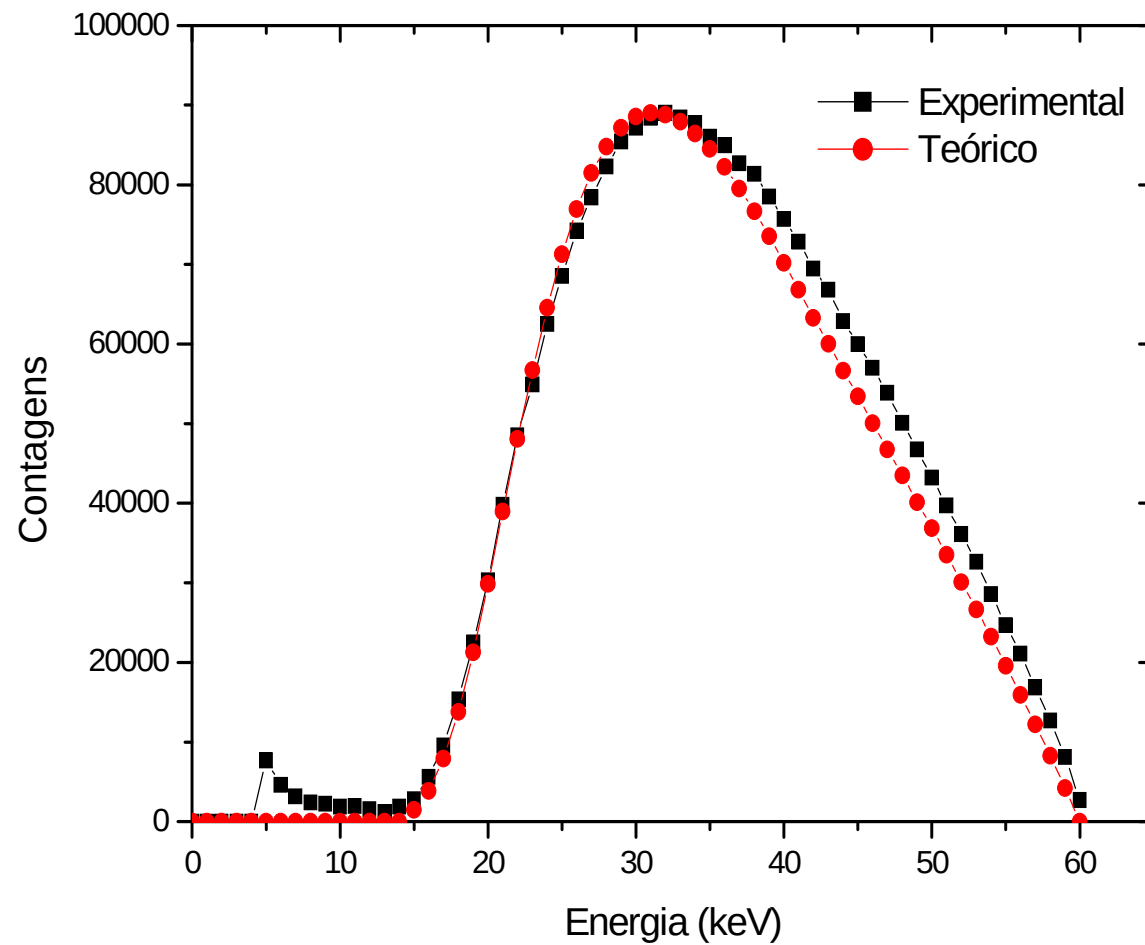




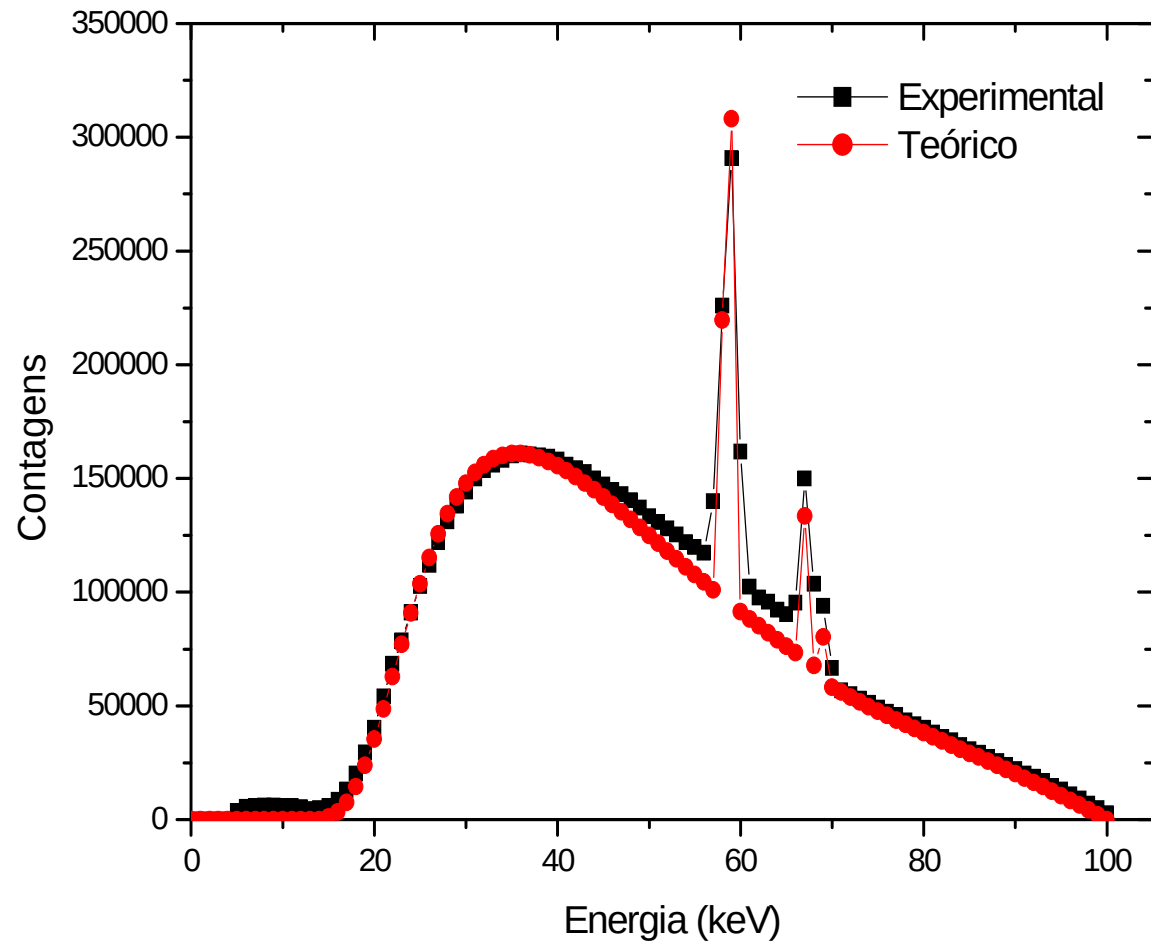
Espectro real



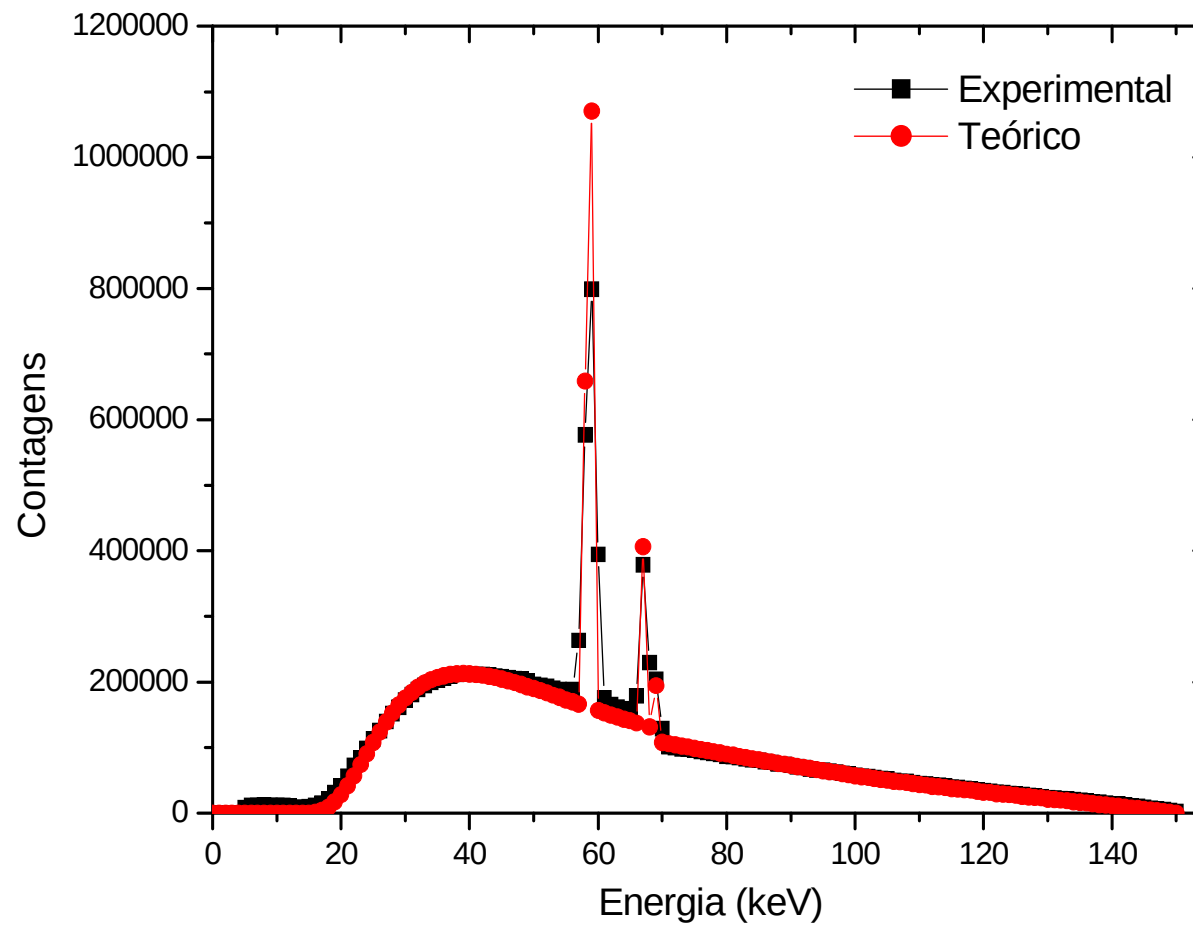
Espectro 60 kV – 0,5 mA



Espectro 100 kV – 0,5 mA



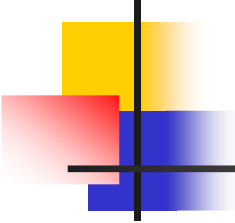
Espectro 150 kV – 0,5 mA





Resultados

AJUSTES DO TUBO			KERMA (m Gy)	
Tensão (kV)	Corrente (mA)	Detector HPGe	Câmara de Ionização (CI)	Razão (CI/HPGe)
60	0,5	17,13±0,32	18,20±0,61	0,94
	1,0	37,87±0,12	40,76±1,42	0,93
80	0,5	27,51±0,11	29,71±1,03	0,93
	1,0	62,45±0,17	68,78±2,33	0,91
100	0,5	37,65±0,14	41,30±1,4	0,91
	1,0	87,84±0,21	99,28±3,36	0,88
120	0,5	48,87±0,17	53,05±1,82	0,92
150	0,5	66,99±0,23	67,75±2,29	0,99



NaI(Tl)

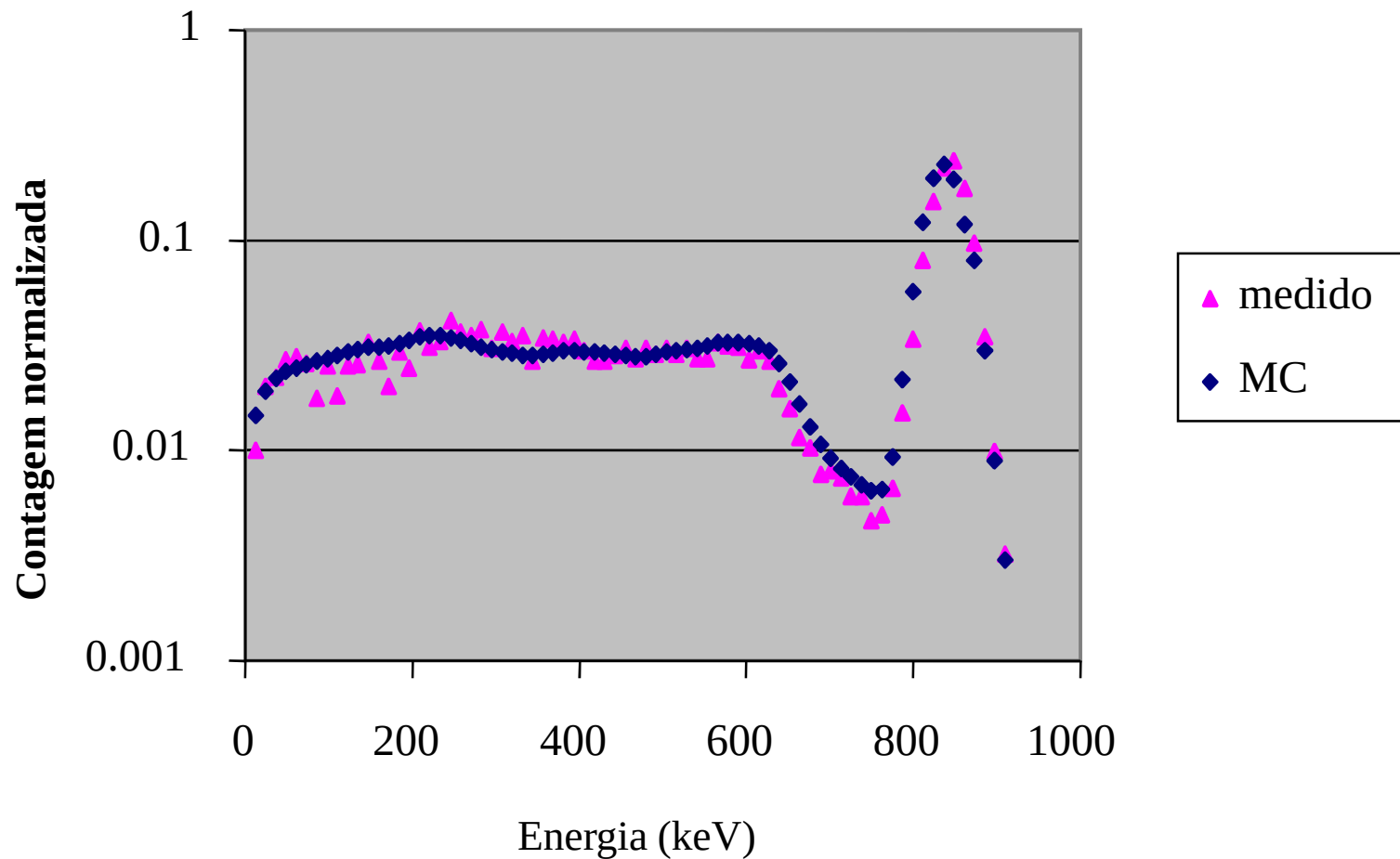
4x 4L NaI(Tl)



100 ml NaI(Tl)



Espectro fonte pontua ^{54}Mn

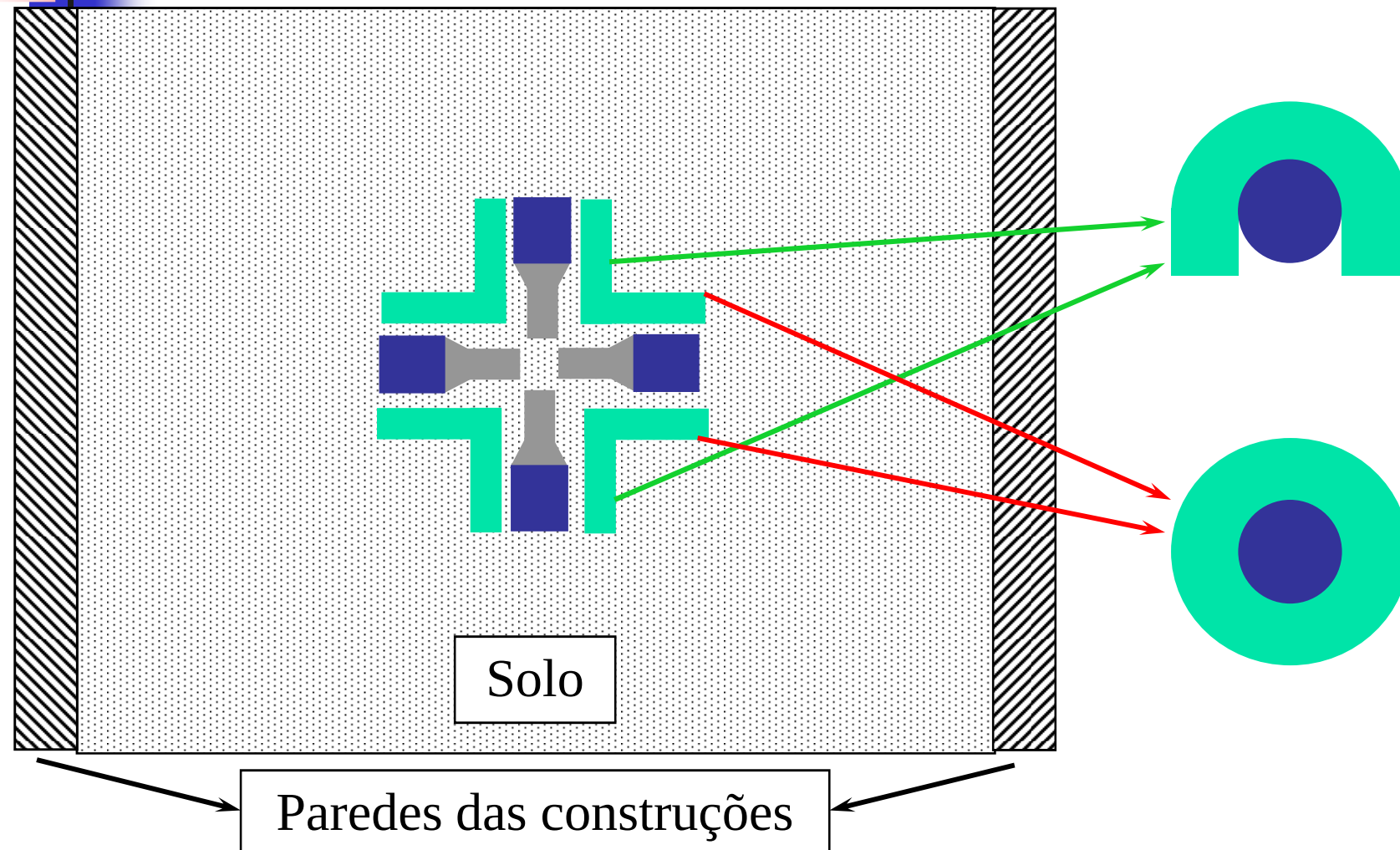


Resultados



Fonte	Calculado ($\mu\text{Gy/h}$)	HPGe $\mu\text{Gy/h}$	Medido GR320 $\mu\text{Gy/h}$
K1	$0,113 \pm 0,005$	$0,111 \pm 0,005$	$0,124 \pm 0,015$
K2	$0,109 \pm 0,006$	$0,119 \pm 0,004$	$0,121 \pm 0,014$
Th1	$0,534 \pm 0,028$	$0,515 \pm 0,018$	$0,497 \pm 0,062$
U1	$0,324 \pm 0,017$	$0,312 \pm 0,008$	$0,314 \pm 0,094$
U2	$0,184 \pm 0,007$	$0,189 \pm 0,005$	$0,176 \pm 0,021$
Uth1	$0,208 \pm 0,009$	$0,209 \pm 0,006$	$0,186 \pm 0,022$
Uth2	$0,446 \pm 0,023$	$0,441 \pm 0,020$	$0,394 \pm 0,043$

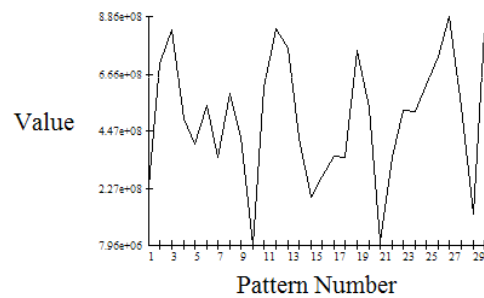
Atividade em superfícies urbanas



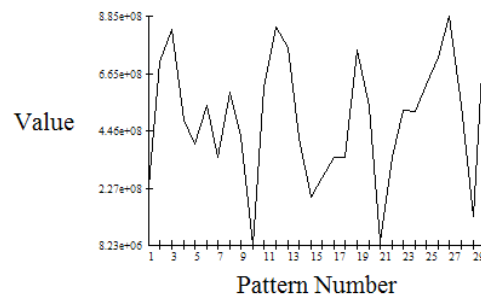
Resultados

Parede direita

Variables Thru Patterns

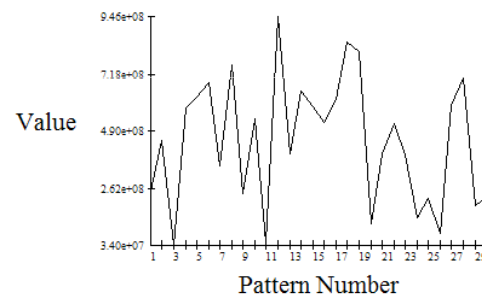


Variables Thru Patterns

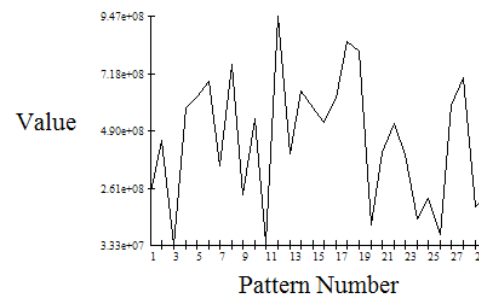


Parede esquerda

Variables Thru Patterns

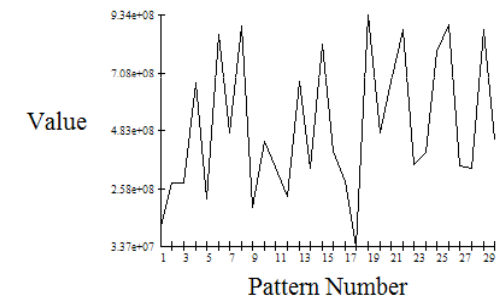


Variables Thru Patterns

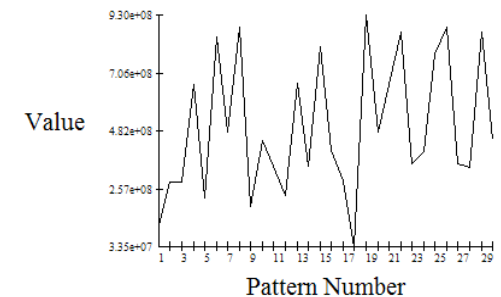


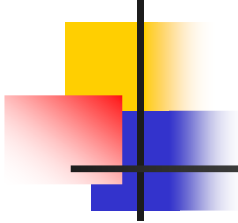
Solo

Variables Thru Patterns



Variables Thru Patterns

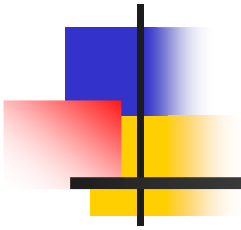




Bibliografia

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- Salgado, C.M.; Conti, C.C.; Becker, P.H.; Determination of HPGe Detector Response Using MCNP5 for 20-150keV X-Rays; App. Rad. Isto.; 64, pg. 700-705; 2006.
- Sachet, I.^a; Caracterização da Radiação Gama Ambiental em Áreas Urbanas Utilizando uma Unidade Móvel de Rastreamento; Tese Doutorado: www.ird.gov.br → Downloads → Trabalhos de Tese

Fim



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