Active volume determination

M. Shirchenko,
RRC “KI”

- Present situation and methods
- Our suggestions
- Conclusion and possible steps

Gerda CM, Gran-Sasso,26/06/2006

Main previous results

Energy,KeV	ANG2	ANG3	ANG3/ANG2
0-500	9091738	8854681	0.9737
500-1000	*2210210*	*2005222*	*0.9074*
1000-1500	*1082521*	*967526*	*0.8937*
1500-2000	279906	250020	0.8929
2000-2500	141463	126288	0.8929
2500-3000	65059	55255	0.8496
> 3000	195	166	0.8511

Energy,KeV	ANG2	ANG4	ANG4/ANG2
0-500	9243055	8585334	0.993
500-1000	2261337	1978721	0.8749
1000-1500	1105581	947334	0.8569
1500-2000	285559	244740	0.8569
2000-2500	*144341*	*124555*	*0.8628*
2500-3000	*66286*	*53631*	*0.809*
> 3000	191	143	0.7485

Energy,KeV	ANG2	ANG5	ANG5/ANG2
0-500	*10079897*	*9993852*	*0.9911*
500-1000	*2459835*	*2315800*	*0.9416*
1000-1500	1209987	1115576	0.9217
1500-2000	311295	290592	0.9337
2000-2500	157411	145290	0.9234
2500-3000	72985	65272	0.8945
> 3000	192	190	0.9891

ratios of count rates DO NOT equal to ratios of mass of the detectors

should it corresponds to the chanhging of the dead layer?

	Total mass	Active mass
ANG2	2.906 kg	2.758 kg
ANG3	2.446 kg	2.324 kg
ANG4	2.400 kg	2.295 kg
ANG5	2.781 kg	2.666 kg
ANG3/ANG2	0.8418	0.8425
ANG4/ANG2	0.8258	0.8319
ANG5/ANG2	0.9569	0.9662

MC simulation of Tl-208 and Bi-214

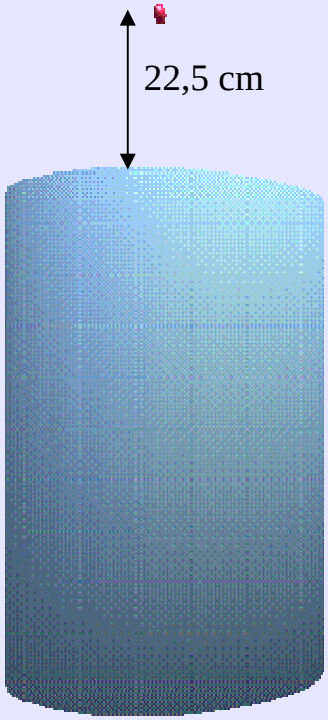
	Tl-208	Bi-214
10-500	0.9042±0.016	**0.8929±0.012**
500-1000	0.9208±0.020	**0.9259±0.017**
1000-1500	0.9363±0.040	**0.8960±0.020**
1500-2000	0.9560±0.041	**0.9166±0.035**
2000-2500	0.9588±0.037	**0.9090±0.065**
> 2500	1.161±0.043	**Too little events**

Main point – the ratios are not equal to the ratios of detector mass

practically impossible to get the information about dead layer, using only experimental background data and mass ratio of the detectors, and, may be, possible only taking into account all geometrical sizes of crystals and comprehensive taking into account their constructive surrounding

Another way to go

Simultaneous measurement and MC calculations:



- used sources ^{133}Ba, ^{57}Co, ^{60}Co, ^{137}Cs
- CR ~ 1000/s
- Summation of real background and calculated spectra from sources
- Squares of photopeaks are used
- Variation of dead layer

^{133}Ba

Energy (KeV)	3.89 cm	3.88 cm	3.87 cm	3.86 cm	3.85 cm	3.84 cm	3.83 cm	3.82 cm	3.81 cm	3.80 cm	3.79 cm
81	2021±71	1936±70	1880±69	1664±68	1745±67	1558±66	1474±65	1448±65	1347±64	1339±63	1231±62
160.61	708±76	738±76	768±76	667±76	664±75	717±75	689±75	700±75	740±75	709±75	628±74
223.24	440±65	466±65	422±64	368±64	461±64	395±64	444±64	369±64	488±64	429±64	346±63
276.4	9226±116	9129±116	9058±115	9121±115	8982±114	8998±114	8686±116	8638±113	8595±112	8529±112	8496±112
302.85	22296±170	22064±169	21852±169	21769±168	21320±167	21034±166	21078±166	20977±165	20697±164	20149±163	20181±163
356.01	68429±291	67581±289	67097±288	66066±286	65642±285	65486±284	64638±283	63931±281	63469±280	62954±279	62085±277
383.85	9681±108	9626±65	9474±108	9372±107	9362±106	9301±106	9051±105	9177±105	8997±104	8799±104	8726±103

^{57}Co

Energy (KeV)	3.89 cm	3.88 cm	3.87 cm	3.86 cm	3.85 cm	3.84 cm	3.83 cm	3.82 cm	3.81 cm	3.80 cm	3.79 cm
122	119144±394	116447±390	114407±386	111718±382	109637±378	107056±374	104895±370	102234±366	99961±362	98215±358	95835±354
136	21465±163	20949±161	20539±159	20368±158	19925±157	19727±156	19201±154	19062±153	18595±152	18278±150	17813±149

^{137}Cs

Energy (keV)	3.89 cm	3.88 cm	3.87 cm	3.86 cm	3.85 cm	3.84 cm	3.83 cm	3.82 cm	3.81 cm	3.80 cm	3.79 cm
661.6	76468±298	75812±297	75147±296	74310±294	73615±293	73451±292	72396±290	71999±289	71266±288	70494±287	69863±285

^{60}Co

Energy (keV)	3.89 cm	3.88 cm	3.87 cm	3.86 cm	3.85 cm	3.84 cm	3.83 cm	3.82 cm	3.81 cm	3.80 cm	3.79 cm
1173	295729±592	292729±590	290394±587	287863±585	286310±583	284272±581	281368±578	279197±576	276983±573	274158±571	271718±568
1332	286606±576	284135±574	282755±572	280049±569	277497±567	275821±178	272365±562	270755±560	268760±558	266501±555	264252±553

pro and contra

- Strict dependence of the active volume
- Easy for realization
 (~ h measurement)
- High energy sources allow to test all the crystal

- Rigid geometry :
0.1 mm of dead layer
1 mm precision in source position
- Testing of active volume but not the dead layers itself
 (this could be done with Ba-133)

Conclusion

- Using only comparative methods it is impossible to determine the value of the dead layers
- There is a good method to measure it with simultaneous MC calculations
- The realization of such method looks not so difficult and could be done during a few months