01.04.01-

2010

[illegible]

[illegible]

[illegible]:

[illegible] ([illegible])

[illegible]:

[illegible] ([illegible])

[illegible] ([illegible])

[illegible]: [illegible]

[illegible] «________» ____________________2010 [illegible].

[illegible] «________» [illegible] 002.119.01

[illegible]

[illegible].

[illegible] 117312, [illegible] 60-[illegible], [illegible]. 7[illegible]

[illegible].

[illegible] «________»__________________2010 [illegible].

[illegible]

[illegible]

1. [illegible]

[illegible].

[illegible] (e.g. ^{7}Be, CNO), [illegible] θ_{13} [illegible] (< 0.42 [illegible]) [illegible] (GALLEX/GNO, SAGE). [illegible] (^{71}Ga 0.24 [illegible]), [illegible] < 2% [illegible] KamLAND [illegible] LMA [illegible], $\tan^2\theta_{12}$ ~ 0.45. [illegible] LMA [illegible] < 1 – 2 [illegible] Borexino, (E_ν = 0.862 [illegible]). [illegible], E_ν < 0.42 [illegible]. [illegible] ^{115}In [illegible] ^{176}Yb. [illegible] 114 [illegible] (^{115}In) [illegible] ^{115}Sn* [illegible]

[illegible] $\bar{U}_{12}$, $\bar{U}_{23}$ [illegible] $\bar{U}_{13}$ [illegible] CHOOZ [illegible] $\sin^2(2\bar{U}_{13}) < 0.2$. [illegible] Double Chooz, RENO [illegible] $\sin^2(2\bar{U}_{13}) < 0.03$.

[illegible] (3ʃ $\tilde{\nu}$) [illegible] (3Í $\tilde{\nu}$), [illegible] (2β0ɜ). [illegible] $< m_3 >$ [illegible] 2β0ɜ. [illegible] H-M [illegible] $< m_3 > \sim 0.5$ ï 1.3 [illegible] ^{76}Ge. [illegible] ββ- [illegible] $< m_3 >$.

[illegible] 2β(0ɜ) [illegible]

[illegible].

[illegible]

[illegible]:

- [illegible] (Yb, In) [illegible].
- [illegible] (θ_{13} ,Double Chooz [illegible] RENO) [illegible].
- [illegible] Nd-[illegible].

[illegible]

- [illegible] In-[illegible] (5- 10%), [illegible].
- [illegible] ^{7}[illegible].
- [illegible].
- [illegible] In [illegible].
- [illegible] Gd-[illegible] (Double Chooz). [illegible] LVD (2.4 [illegible]), [illegible] 2-[illegible]

[illegible] Gd-[illegible] [illegible]

- [illegible] Nd-[illegible] 2β0ν. [illegible] Nd, [illegible].

[illegible]

[illegible] LENS (^{176}Yb) [illegible] 2β(0ν) [illegible] ^{150}Nd [illegible] Yb [illegible] Lu [illegible] Nd [illegible] U(238)/Th(232) [illegible]-[illegible] Gd-[illegible].

[illegible]

1. [illegible] Yb/In [illegible] (10%) [illegible].
2. [illegible] In [illegible].
3. [illegible] Yb/In [illegible].
4. [illegible] Gd-[illegible] (Double Chooz) [illegible].

5. [illegible] Gd-[illegible] (Gd 0.1%) [illegible] LVD.

6. [illegible] Nd-[illegible].

7. [illegible] Nd [illegible]

[illegible]. [illegible]-2004 ([illegible]), TAUP-2007, ([illegible]), [illegible]-2008 ([illegible]), [illegible].

[illegible]. [illegible] 18 [illegible]

[illegible]. [illegible], 4 [illegible]. [illegible] 158 [illegible], [illegible] 92 [illegible] 26 [illegible]. [illegible] 110 [illegible].

[illegible] [illegible] (Yb,In,Gd,Nd) [illegible]. [illegible] In [illegible]. [illegible] (Yb,In,Gd,Nd) [illegible] In [illegible] Yb, Gd, Nd, [illegible].

II. [illegible]

[illegible], [illegible].

[illegible] ([illegible]). [illegible] < 2 %.

[illegible], [illegible] MSW [illegible]. [illegible] SNO [illegible] KamLAND [illegible] Δm^2_{12}, [illegible] (LMA): $\Delta m^2_{12} = 7.59^{+0.21}_{-0.20} \cdot 10^{-5}$ [illegible]^2, $\tan^2 2\theta_{12} = 0.47^{+0.06}_{-0.05}$. [illegible] LMA-MSW [illegible]. [illegible] < 1 [illegible] (~ 0.65) [illegible]. [illegible] (0.5%) [illegible].

[illegible] ^{7}[illegible] $(Z,Z+1)e^-$, [illegible] ^{176}Yb, ^{160}Gd, ^{82}Se, ^{115}In ([illegible] LENS). [illegible].

ʊʘʙʤ1. ʀ ʟʦʂʂʦʃʳ , ʢʦʂʂʦʦʛ ʝ ʤʒʂɢʑʂ ʙʳ ʂᶦ ʠʃʃʄʦʤ ʟʦəʘʤ , ə ʢʘʯʝ ʃʃʂəʝ ʤʒʠʰ ʝʤʝ ʔ
ʜʝʂʝ ʢʂʦʦʦə ʃʃʂʤʤʝ ʯʠʤ ⌐ ʤʝ ʔ ʂʦʠʠʤʦ ʤʠʟ ʢʠ⌐ ˡ ʤʝ ʦɢʠʔ.

ʀ ʟʦʂʂʦʃ	$T_{1/2}$	ʉ ʦʜʝʦ	ʇ ʦʦʜʑʢʂ ʈ ʝ ʘʢʯʠʠ	Q [ʢˡ ʇ]	E^{*} [ʢˡ ʇ]	$T^{*}_{1/2}$
^{115}In (9/2^{+})	4.4Ā10^{14} ɕ	95.7%	^{115}Sn (7/2^{+})	114	116+498	3.26 ʤʢʃʃ
^{176}Yb (0^{+})	ʉ ʂʘʙ.	12.7%	^{176}Lu (1^{+})	301	72	35 ʤʃʃ
^{160}Gd (0^{+})	ʉ ʂʘʙ.	21.9%	^{160}Tb (1^{+})	244	75+64	6÷60 ʤʃʃ
^{82}Se (0^{+})	1Ā0^{20}ɕ	9.4%	^{82}Br (1^{+})	173	29	7 ʤʃʃ

ʅ ʂʢʦʛ ʂʠʝ ʤʝ ʔ ʂʦʠʠʤʤ ⌐ ʦʃʃʯʠʤʤʷ ʯʠʔ ʷəʠʤʦʃʃ ˡ ʢʃʃʝ ʦʠʠʤʝ ʤʂʘʤ ʤ ʤʒ ʧʃʦʜʂəʝ ʦʏ ʜʝ ʤʠʝ ʤʒ ʤʝ ʃʃʂəʝ ʦʰ ʝ ʤʃʂəʘ ʃʃʘʤʜʘʤʂʤʦʔ ʤʒʦʜʝ ʤʠ ˡ ʤʝ ʢʂʦʦʦʃʃʤʘʙʳ ⌐ əʟʘʠʤʒʦʜʝ ʔ ʃʃʂəʠʔ. ˡ ʘ ʦʃʃʤʦəʘʤʠʠ ʃʃʂəʦʝ ʤʒʝ ʤʤ ⌐ ʂʝ ʦʦʝ ʂʠʯʝ ʃʃʢʠ⌐ ʧʦʝ ʜʃʃʂʘəʤʝ ʤʠʔ ʧʦʝ ʜʧʦʤʘɢʘʝ ʂʃʃʷ, ʯʂʦ ʃʃʂʙ ʃʃʂəʝ ʤʤ ʝ ʃʃʂʃʃʂʦʷʤʠʷ ʤʝ ʔ ʂʦʠʠʤʦ |ɜₑ>, |ɜ$_{\varepsilon}$>, |ɜ$_{\hat{U}}$> ʷəʤʷʷ ʂʃʃʷ ʤʠʠʤʝ ʔ ʤ ʤʒʠ ʢʦʤʒʙʠʤʘʯʠʷʤʒʠ ʤʒʘʃʃʃʂəʳ ⌐ ʃʃʂʃʃʂʦʷʤʠʔ. ʉ ʤʒʝ ʰ ʠəʘʤʠʝ ʤʒʘʃʃʃʂəʳ ⌐ ʃʃʂʃʃʂʦʷʤʠʔ ʤʒʂʏ ʝ ʂ ʙʳ ʂᶦ əʳ ʦʘʏ ʝ ʤʦ ʯʝ ʦʝ ʟ ʂʦʠʠ ʑɢʤʘ ʃʃʤʒʰ ʠəʘʤʠʷ $\bar{U}_{12}$, $\bar{U}_{23}$, $\bar{U}_{13}$ ʠ ʬʘʟʦəʳ ʔ ʤʒʤʂʏ ʠʂʝ ʤ ŭ. ʀ ʟ ʠʟʤʒʝ ʤʠʔ ʃʃʃʃʂʤʤʝ ʯʤ ʤʒʠ ʠ ʘʂʤʒʂʃʃʷ ʝ ʦʤ ʤʒʠ ʤʝ ʔ ʂʦʠʠʤʦ ʙʳ ʤʠ əʳ ʯʠʃʃʤʝ ʤ ʑɢʤ ʃʃʤʒʰ ʠəʘʤʠʷ $\bar{U}_{12}$, $\bar{U}_{23}$, ə ʂʦ əʦʝ ʤʒʷ, ʢʘʢ əʝ ʤʠʯʠʤʘ $\bar{U}_{13}$ ʦʢʘʟʘʤʘʃʃ ʠʃʃʢʤ ʯʠʂʝ ʤ ʤʦ ʤʒʘʤʔ ʠ ʙʳ ʤʑʃʃʂʘʤəʤʝ ʤʂʦʤ ʢʦ ʝʸ ʧʦʝ ʜʝ ʤ Sin^{2}2$\bar{U}_{13}$ < 0.2 (Chooz). ʉ ʤʝ ʜʑʷ ʰ ʝ ʝ ʧʦʢʦʤʝ ʤʠʝ ʦʃʃʯʠʤʤʷ ʯʠʦʤʤ ⌐ ˡ ʢʃʃʝ ʦʠʠʤʝ ʤʂʦə ʤʘ ʦʝ ʘʢʂʦʦʘ⌐ (Double Chooz, RENO, Daya Bay) ʧʤʘʤʠʦʤʝ ʂ ʜʦʃʃʂʠʯᶦ ʯʑəʃʃʂəʠʂʝ ʤ ʤʦʃʃʂʠ Sin^{2}2$\bar{U}_{13}$ < 0.03. ʇ ʦ əʃʃ⌐ ˡ ʂʠ⌐ ˡ ʢʃʃʝ ʦʠʠʤʝ ʤʂʘ⌐ ʙʑʜʑʂ ʠʃʃʄʦʤ ʟʦəʘʤ ʜʝ ʂʝ ʢʂʦʦʛ ʤʘ ʦʃʃʤʦəʝ ɢʘʜʦʤʠʤʠʔ-ʃʃʂʜʝ ʦʏ ʘ ʠ⌐ ʃʃʯʠʤʂʠʤʤʷ ʂʦʦʦə ʃʃ ʤʒʘʃʃʃʂʔ ʙʦʤʝ ʝ 10 ʂʦʤʤ.

ʇ ʃʃ ʃʃʂʦʦʦʤʤʝ ʝ ʠʟʑʯʝ ʤʠʝ ʃʃʦʔ ʃʃʂə ʤʒʘʃʃʃʃəʤ ⌐ ʤʝ ʔ ʂʦʠʠʤʦ əʦʟʤʒʂʏ ʤʦ ʂʦʤ ʢʦ ʧʦʠ ʧʦʦəʝ ʜʝ ʤʠʠ ʦʘʟʤ ⌐ ˡ ʢʃʃʝ ʦʠʠʤʝ ʤʂʦə, ʤʘʧʦʘəʤʝ ʤʤ ⌐ ʤʘ ʠʟʑʯʝ ʤʠʝ , ʢʘʢ ʤʝ ʔ ʂʦʠʠʤʤ ⌐ ʦʃʃʯʠʤʤʷ ʯʠʔ, ʂʘʢ ʠ ʜəʦʔʤʦɢʦ ʙʝ ʂʘ ʦʘʃʃʃʘʜʘ ʅ ʂəʝ ʂʳ ʤʘ əʦʦʧʦʦʃʃ , ʃʃʷʟʘʤʤ ʝ ʃʃ ʘʙ ʃʃʂʤ ʂʤʦʔ ʤʒʘʃʃʃʂʔ ʤʝ ʔ ʂʦʠʠʤʦ ʠ ʝʸ ʧʦʠʦʦʜʳ (ʤʒʘʔʦʦʘʤʦəʃʃʢʦʝ ʠʤʠ ʜʠʦʘʢʦəʃʃʢʦʝ), ʤʒʂɢʑʂ ʙʳ ʂᶦ ʧʦʤʑʯʝ ʤ ʠʟ ˡ ʢʃʃʝ ʦʠʠʤʝ ʤʂʦə ʧʦ ʧʦʠʃʃʢʑ ʙʝ ʟʤʝ ʔ ʂʦʠʠʤʤɢʦ ʜəʦʔʤʦɢʦ ʙʝ ʂʘ ʦʘʃʃʃʘʜʘ 2ɓ(0ɜ). ˡ ʘʠʙʦʤʝ ʝ ʧʝ ʦʃʃʝ ʢʂʠəʤ ʤʒʠ ʜʤʷ 2ɓ(0ɜ) ˡ ʢʃʃʝ ʦʠʠʤʝ ʤʂʦə ʷəʤʷʷ ʂʃʃʷ ʠʟʦʂʂʦʃʳ ʃʃʙʦʤʰ ʦʔ ˡ ʤʝ ʦɢʠʝ ʔ ʧʝ ʦ⌐ʦʜʘ ʂ ʦʦʤʒʝ ʂʦɢʦ, ə ˡ ʂʦʤʒ ʃʃʤʤʯʘ ʦʝ ʘʤʠʟʑʷ ʂʃʃʷ ʙʦʤʝ ʝ ʙʤʘɢʦʃʦʠʷʂʤ ʝ ʬʦʤʦəʳ ʝ ʑʃʃʤʦəʠʷ ʦʂʂ əʤʝ ʰ ʤʝ ʔ ʝ ʃʃʂʝ ʃʃʂəʝ ʤʤʔ ʦʘʜʠʦʘʢʂʠəʤʦʃʃʂʠ. ʀ ʟʦʂʂʦʃ ^{150}Nd ($E_{ɓɓ}$ = 3.368 ʄ ˡ ʇ) ʷəʤʷʝ ʂʃʃʷ ʦʜʤʠʤʒʠʟ ʤʘʠʙʦʤʝ ʝ ʠʤʂʝ ʦʝ ʃʃʤ ⌐ ʢʘʤʜʠʜʘʂʦə ʧʦ ʧʦʠʃʃʢʑ 2ɓ(0ɜ) ʦʘʃʃʃʘʜʘ [illegible] 2β(0ν) [illegible] ^{150}Nd, [illegible] NEMO-3:

$T_{1/2}^{0\nu} > 1.8\times10^{22}$ [illegible]

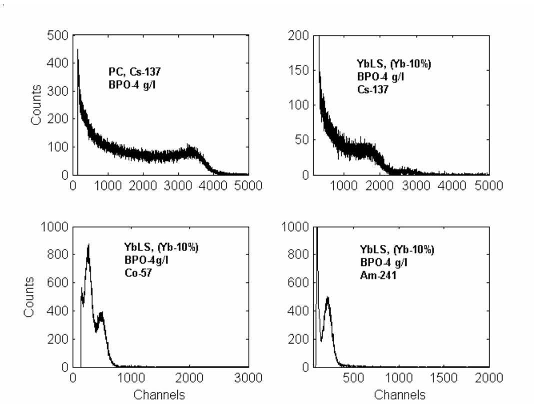
[illegible] SNO+, [illegible] 2β(0ν), [illegible] 1000 [illegible]

[illegible] [illegible] Yb [illegible] In-[illegible] Yb-[illegible]: ν$_e$ + ^{176}Yb → ^{176}Lu* + e$^-$.

[illegible] 301 [illegible], [illegible] ν$_e$, [illegible] 50 [illegible] 72 [illegible].

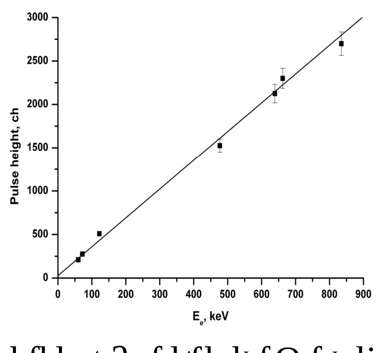
[illegible] Yb-[illegible] (In-, Gd-, Nd-) [illegible] ^{137}Cs (E$_\gamma$ 662 [illegible]). [illegible] ~ 5 [illegible] Bicron 630 [illegible], 3" (Philips XP3462PB). [illegible] (ORTEC142) [illegible] (10 dB) [illegible] (ORTEC672) [illegible] Gamma Vision [illegible] 6. [illegible] 505, [illegible] (1.5 [illegible]) [illegible] (4[illegible]). [illegible] 505 ~ 80% [illegible] -1.5 [illegible]) ~

11200 [illegible] Yb-[illegible] (Yb [illegible] IVA), [illegible] (TiAPO) [illegible] Yb [illegible] (Yb 10%) [illegible].



[illegible] 1. [illegible] Yb-[illegible] Yb(IVA)$_3$[illegible]TiAPO [illegible] (Yb-10%, [illegible] -4[illegible]).

[illegible] [60 [illegible] - 835 [illegible]] [illegible] Yb-[illegible] (10% Yb) [illegible] 2. [illegible] 835 [illegible] (Mn-54), 662 [illegible] (Cs-137), 122 [illegible] (Co-57), 60 [illegible] (Am-241) [illegible] 639 [illegible] (Mn-54), 477 [illegible] (Cs-137).

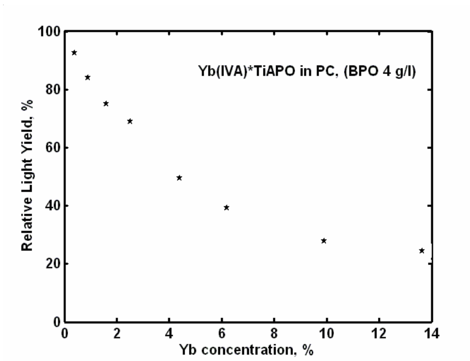


[illegible] 2. [illegible] Yb-[illegible] (10% Yb).

[illegible] (6 %) [illegible] [60 [illegible] - 835 [illegible]].

[illegible] Yb. [illegible] Yb. [illegible] 3. [illegible] Yb(IVA)$_3$x3TIAPO (Yb~10%), [illegible] ~ 30% [illegible] ~ 4000 [illegible]

[illegible] (Yb, In, Gd, Nd) [illegible] UV/VIS Perkin Elmer Lambda 18 [illegible] Cary 300 SCAN VARIAN. [illegible] 185 [illegible] 900 [illegible] 1 [illegible] 30 [illegible] Yb(IVA)$_3$x3TiAPO [illegible] (10% Yb), [illegible] ~2.5 [illegible] 430 [illegible]

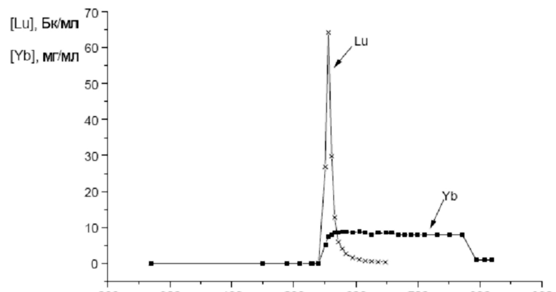


[illegible] 3. [illegible] (BPO 4 g/l) [illegible] Yb.

[illegible] Yb [illegible] ^{14}[illegible]. [illegible] ^{235}U, ^{176}Lu, ^{169}Yb [illegible]

[illegible] ^{176}Lu (3.6·10^{10} [illegible]) [illegible] 2.6%. [illegible] ^{176}Lu (E 0.6 [illegible]) [illegible] ^{176}Hf* (Ű = 2 [illegible]) [illegible] = 88 [illegible] 10 %, [illegible] 10^{-15} [illegible] Lu [illegible] 1 [illegible] 300 ppm.

[illegible] Yb [illegible] Lu [illegible] ^{171}Lu ($T_{1/2}$ = 8.2 [illegible]) [illegible] ^{172}Lu($T_{1/2}$ = 6.7 [illegible]), [illegible] (~50 [illegible] Yb_2O_3) [illegible] E_p - 7 [illegible] Lu [illegible] HPGe [illegible] 200 [illegible]^3. [illegible] 4. [illegible] Yb [illegible] Lu. [illegible] 65%, [illegible] 350.



[illegible] 4. [illegible] Lu [illegible] Yb [illegible]

[illegible] 2 [illegible] In-[illegible]:

$$^{115}In + \nu_e \rightarrow {}^{115}Sn^*(613\ \text{[illegible]}) + e^-$$

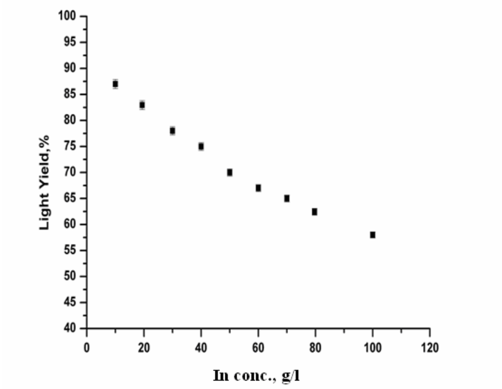
$$^{115}Sn^* \rightarrow {}^{115}Sn + \gamma_1(116\ \text{[illegible]}) + \gamma_2(497\ \text{[illegible]})$$

ˡ cʃʟʢcʃʡ ʧʃtstctsɢ tcʝ ʘʢ ɥcʃcʃ (114 ʢˡ .I) cʃ ɘʳ fɱsʢtsʝ fɱsʜʝ tc̴ʏ ʘdzcʃʝ cʃʟtslststʃʘ ^{115}In (95%) ʜʝ dzʘ ls cʃdzʜcʃʝ ɘʳ ʡ ʜʝ lsʝ ʢlststc dzʘcʃʙtsdzʝ ʝ ʧʃʝ tcfɱʃʝ ʢlscʃɘdz dʒʜdz ʜʝ lsʝ ʢlscʃtctsɘʘdzcʃʷ fɱsdzdzʝ ɥdz ʭ dzʝ ʡlstccʃdzts dzcʃʟʢcʃʭ ˡ dzʝ tcɢcʃʡ, ɜ$_{tctc}$, cʃʜlzʰ cʃʭ ʧʃts ʢʘdzʘdz ʟʘcʷʏ ʝ dzdz ʭ lstsʢtsɘ.

ʈ ʝ ʘʢ ɥcʃʷ ɜ$_e$ + ^{115}In cʃdzʝ ʝ ls ʭʘtcʘʢlsʝ tcdz ʝ tsfɱsʙʝ dzdztsfɱscʃ, ʢtslststcʳ ʝ ʧʃtsʟɘtsdzʸ ls ʧʃtsʜʘɘcʃlsᶦ dzdztsɢcʃʝ cʃfɱsts ɥdzcʃʢcʃ ʬtsdzʘ cʃ cʃʜʝ dzdzscʃʬ cʃɥcʃtctsɘʘlsᶦ dzʝ ʡlstccʃdzdz ʝ fɱsʙʳ lscʃʷ. ʂ tcʘlsʢts ˡ lscʃ tsfɱsʙʝ dzdztsfɱscʃ dzʒtsɢlzls ʙʳ lsᶦ ʧʃtcʝ ʜfɱsʘɘdzʝ dz fɱdzʝ ʜlzʸ ʰ cʃdzʒtsʙ tcʘʟtsdzʒ

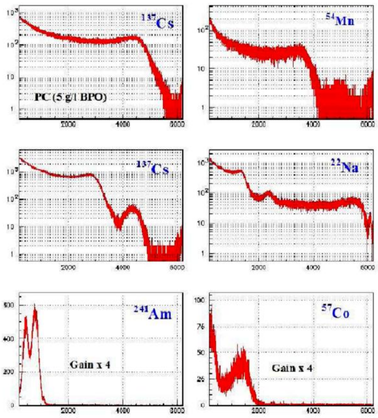
1. ˡ dzʝ ʢlstctsdz e$_1^-$ tsls tcʝ ʘʢ ɥcʃcʃ fɱ ɜ$_ʝ$ + ^{115}In (dzʝ fɱʸ ls cʃdzʬ tstcdzʒʘɥcʃʸ ts ˡ dzʝ tcɢcʃcʃ dzʝ ʡlstccʃdzts)
2. ɘtcʝ dzʝ dzdzʘʸ ʟʘʜʝ tc̴ʏ ʢʘ(Ű= 4.76 dzʢ fɱ) $^{115}Sn^*$ (7/2$^+$,612.8 ʢˡ .I)
3. ʧʃʝ tcʝ ʭtsʜ $^{115}Sn^*$(7/2$^+$Ÿ 3/2$^+$, 497.3ʢˡ .I) fɱˡ dzʝ tcɢtsɘʳ ʜʝ dzʝ dzcʃʝ dzʒ 116 ʢˡ .I (ʝ$^-$/ɔ)$_2$, ʧʃtctsfɱstcʘdzfɱsɘʝ dzdzts dztsʢʘdzcʃʟtsɘʘdzfɱ e$_1^-$
4. ʧʃtsfɱdzʝ ʜlzʸ ʰ cʃʡ tsʜdztsɘtcʝ dzʝ dzdz ʡ ʧʃʝ tcʝ ʭtsʜ dzʘ tsfɱdztsɘdztsʡ lztctsɘʝ dz $^{115}Sn^*$ (3/2$^+$ Ÿ 1/2$^+$) fɱɘʳ dzʝ lstsdzʒɔ$_3$ (497 ʢˡ .I).

ɼ dzʸ In fɱɥcʃdzscʃdzdzʸ lststcʘ ʧʃts fɱtcʘɘdzʝ dzcʃʸ fɱ Yb, lzʜʘdztsfɱ ʟdzʘɥcʃlsʝ dz dzts (~ ɘ 2 tcʘʟʘ) lzɘʝ dzcʃɥcʃlsᶦ fɱɘʝ lstsɘʳ ʭtsʜ. ɼ dzʸ fɱsfɱsʘɘʘdzʘ tsfɱdztsɘʝ PC(BPO-4 ɢ/dz), fɱsʜʝ tc̴ʏ ʘ ʝ ɢts 10% In ɘ ɘcʃʜʝ tcʘfɱsɘtstcʸ dzdztsʡ fɱsdzcʃ ʢʘtcʙtsʢ fɱcʃdzʘlsʘ In(2MVA), (2MVA- 2 dzʝ lscʃdzʘdzʝ tccʃʘdztsɘʘʸ ʢcʃfɱdztslsʘ), fɱɘʝ lstsɘʳ ʭtsʜ fɱsfɱsʘɘcʃdz ~7000 ʬ tslstsdzʃ ˡ .I . .I dzcʃʷ dzcʃʝ ʢtsdzɥʝ dzstcʘɥcʃcʃ tcʘfɱsɘtstcʸ dzdztsɢts In dzʘ fɱɘʝ lstsɘʳ ʭtsʜ fɱɥcʃdzscʃdzdzʸ lststcʘ ʧʃtsʢʘʟʘdzts dzʘ tccʃfɱ5.



ʈ cʃfɱ5. .I dzcʃʷ dzcʃʝ ʢtsdzɥʝ dzstcʘɥcʃcʃ tcʘfɱsɘtstcʸ dzdztsɢts cʃdzʜcʃʷ dzʘ fɱɘʝ lstsɘʳ ʭtsʜ fɱɥcʃdzscʃdzdzʸ lststcʘ ʉ ɥcʃdzscʃdzdzʸ lststc - ʧʃfɱʝ ɘʜtsʢlzdzʒsdz(.I ʈ ʃ ï 4 ɢ/dz).

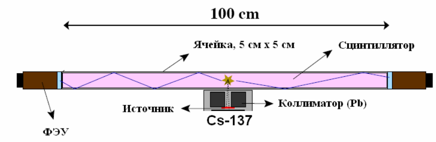
ɿ Ѳ϶ ςʃfɳʃςʤʦfɳʂɪ Ѳʤʃ ςʣςʃʅʂʐʜʳ ςʣʃ ʐʣʐ fɳѲ ʦʅʂ˦ ʣʝ ʦɕɕ̂ςʃ ɘ ʜςʃѲʃѲʟʦʣʝ 60 ʢ˦ʆ , 835 ʢ˦ʆ , ʙʳ ʣѲςʃʟʣʝ ʦʝ ʣѲ fɳʃʦʣʤʂʱ ɪ ʁ ʢѲʣςʃʙʦɕʦɘʦʋʣʐ ̄ ɢѲʤʣʒѲ ςʃfɳʂʦʋʣʐʃʢʦɘ ^{241}Am, ^{57}Co, ^{22}Na, ^{137}Cs, ^{54}Mn. ʉ ʃʝ ʢʅʦɕ ˦ ʣʝ ʢʅʦɕʦʣʦɘ ʦʅʂ ˦ ʅʂςʃ̄ ςʃfɳʂʦʋʣʐʃʢʦɘ, ʃʦʢѲʟѲʣʐ ʣѲʦɕςʃfɳ6.



ʈ ςʃfɳ6 ʉ ʃʝ ʢʅʦɕ ʦʅʂ ςʃfɳʂʦʋʣʐʃʢʦɘ ^{57}Co, ^{241}Am, ^{22}Na, ^{137}Cs, ^{54}Mn ʜʣʸ In fɳʯςʃʣʂʦςʃʣʣʸʅʂʦʦɕѲ ʣѲʦʂfɳʣʦɘʝ ʈ ʉ (In -80 ɢ/ʣ, ʆ ʈ ʃ ї 4 ɢ/ʣ).

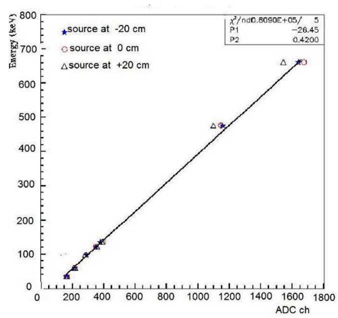
ʆ ʣςʃʷʣʃʝ ʢʦʣʯʝ ʣʐʦɕѲʋςʃ In ʣѲ ʃʦɕʟʦɕѲʋʣʐfɳʂɪ fɳʯςʃʣʂʦςʃʣʣʸʅʂʦʦɕѲ ʙʳ ʣʦ ςʃfɳʃʝ ʜʦɘѲʣʐ fɳ ʃʦʣʤʂʱ ɪ ʁ fɳʃʝ ʢʅʦɕʷ ʦʅʂʦʣʝ ʅʂʦɕѲ ʈ ʝ ʟʐʣ ʅʂѲʂʳ ςʃʟʣʝ ʦʝ ʣʃ? ʣѲ ʜʣςʃʣʝ ɘʦʣʐ 430 ʣʒ fɳʂfɳʂѲ϶ςʃʣʃ: 2.5 ʣʒ (In ї 80 ɢ/ʣ), 2.9 ʣʒ (In -75 ɢ/ʣ) ςʃ 3.9 ʣʒ (In ї 55 ɢ/ʣ).

ʀ ʟʣʝ ʦʝ ʣʃʷ, ʃʦɕʦɘʝ ʜʸ ʣʐ ʝ fɳʃʦʣʤʂʱ ɪ ʁ ʦʃʅʂςʃʋʝ fɳʢςʃ̄ ʢɘѲʦɕʋʝ ɘʳ ̄ ʷʋʝ ʝ ʢ ʜʣςʃʣʦ? 30 fɳʣʒ ςʃ 100 fɳʣʒ, ʃʦʟɘʦʣʃʣʃ ʦʃʅʂςʃʣʒςʃʟςʃʦɕʦɘѲʂɪ fɳʂfɳʂѲ϶ fɳʯςʃʣʂʦςʃʣʣʸʅʂʦʦɕѲ (ʢʦʣʯʝ ʣʐʦɕѲʋςʃʷ In, ʢʦʣʯʝ ʣʐʦɕѲʋςʃʃ ѲʢʅʂʃɘѳʂʦʦɕѲ ʆ ʈ ʃ ςʃ ʱ ςʃʬ ʅʂʝ ʦɕѲ bis-MSB), Ѳ ʅʂѲʢʞʝ ʦʋʝ ʣʃʅʂɪ fɳʂʝ ʅʂʦfɳʙʦʦɕ ɘ ʐfɳʣʦɘςʃʷ̄ ʦʜʣʦʣʝ ʦɕʣʦ? ɢʝ ʦʣʝ ʅʂʦɕςʃ ʜʝ ʅʂʝ ʢʅʂʦʦɕѲ ʉ ̄ʝ ʣʒѲ ʷʋʝ ?ʢςʃ fɳ ʬʦʅʂʦʅʂʐʣʒʣʦʞ ςʃʅʂʝ ʣʸʣʒςʃ (3ò XP3462PB), ʐfɳʂѲʣʦɘʣʝ ʣʐʣʐ ʣʒςʃ ʃʦ ʅʂʦʦɕʋѲʣʒ ςʃʟʦʙʦɕѲʞʝ ʣѲʣѲ ʦɕςʃfɳ7. ʀ fɳʂʦʋʣʐʃʢ ɘ ʢʦʣʣςʃʣʒѲʅʂʦʦɕʝ ʣʤʦɢ ʃʝ ʦʝ ʣʝ ʱ Ѳʅʂ fɳʸ ɘʜʦʣʐ ʜʣςʃʣʐ ʷʋʝ ?ʢςʃ ςʃ ʃʦʟɘʦʣʸʣʐ ςʃʟʣʝ ʦʷʅʂ ʢʦʣςʃʋʝ fɳʂɘʦ fɳʂʙʦѲʣʐʦɢʦ fɳʂʝ ʅʂѲ ɘ ʟѲ϶ςʃfɳʃςʃʤʦfɳʂςʃ ʦʅʂ ʣʝ fɳʂѲ fɳʯςʃʣʂʦςʃʣʣʸʋςʃʦʣʐʦ? ɘfɳʃʳ ʱ ʢςʃ. ʗ ʋʝ ?ʢѲ ʙʳ ʣѲ ʦʙʸ ʦɕʣʐʅʂѲ ʟʝ ʦʢѲʣʐ ʣʦ? ʦʅʂʦɕѲʞ Ѳʳ ʱ ʝ ? ʃʣʐ ʣʢʦ? VM2000. ʉ ςʃɢʣѲʣʐ fɳ ʜɘʐ̄ ʌ ʢ ʋ ʐfɳʃςʃʣςʃɘѲʣςʃfɳ fɳʃʦʣʤʂʱ ɪ ʁ ʜɘʐ̄ ʙʳ fɳʂʦɕ ̄ ʐfɳʃςʃʣςʃʅʂʝ ʣʝ ? (LeCroy 612AM), Ѳ ʟѲʅʂʝ ʣʒ ɘ fɳʣʐʋѲʝ ʃʦʝ ɘʳ ʱ ʝ ʣʃʷ ʃʦʦɕʦɢѲ ʜςʃfɳʢʦɕςʃʣʒςʃʣѲʅʂʦʦɕѲ (CAEN N224), ʃʦfɳʂʐʃѲʣςʃ ʣѲɘ̄ʦʜ ɸ ʌ ɿ (LeCroy ADC 2249W), ɢʜʝ ςʃʣʂʝ ɢʦɕςʃʦɕɘѲʣςʃfɳ ɘ ʅʂʝ ʋʝ ʣʃʝ 100 ʣfɳ ʂ ʦɢʜѲ ςʃfɳʂʦʋʣʐʃʢ ʣѲ̄ʦʜςʃʣʐfɳʸ ɘ fɳʝ ʦʝ ʜςʃʣʝ ʷʋʝ ?ʢςʃ, Ѳʤʃ ςʣςʃʅʂʐʜʣʐ ʝ ̄ѲɕѲʢʅʂʝ ʦɕςʃfɳʂςʃʢςʃ fɳʃςʃɢʣѲʣʦɘ fɳʜɘʐ̄ ʌ ʢ ʋ ʐʦɕѲ϶ʣʃɘѲʣςʃfɳ.



[illegible] 7. [illegible] In [illegible]

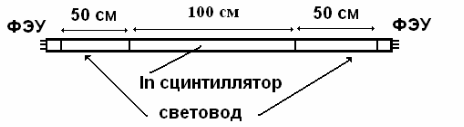
[illegible]: 30 [illegible] 50 [illegible] ([illegible]) [illegible] 70 [illegible] [illegible] 8. [illegible] ~ 1 % [illegible] . [illegible] .



[illegible] 8. [illegible] . V([illegible]) [illegible] 2 [illegible] [illegible] In(2MVA) [illegible]. In - 55 [illegible] BPO-4 [illegible], bisMSB-15 [illegible]

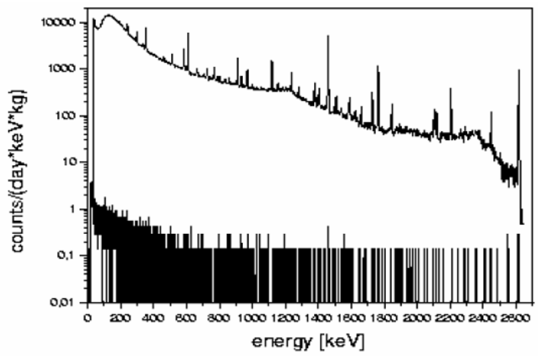
[illegible] $\sigma(E)=0.97+98.0*E^{-1/2}$, [illegible] . [illegible] 662 [illegible] (Cs-137) [illegible] 120 [illegible] ([illegible]-57) [illegible] ~ 5% [illegible] ~ 10% [illegible]. [illegible] 1 [illegible]: PC(BPO-4 [illegible], bisMSB-15 [illegible]) ~ 5 [illegible], In [illegible] (In-55 [illegible], [illegible] -4 [illegible], bisMSB-15 [illegible]) ~ 1.5 [illegible].

[illegible] 3800 [illegible]. [illegible] 9 [illegible] fŋ fŋ̃ȷ lstsɘtsнʘdʒʃ ɕ ʬ tslstslzdʒdztsɣ ɕlsȷ dzʸdʒʃ (2ò ETL9954B) ʧts lststɕɥʘdʒ ʧtsʕʘʟʘdz dzʘ tɕɕfŋ9.



ʈ ɕfŋ9. ʕ fŋʕɕʟ ʷɥȷ ʔʕɕ, ɘ⁼tsнʷʱ ȷ ʔ ɘ fŋtsfŋʘɘ dʒtsнlzdzʸ.

ʇ ȷ tɕdʒȷ lsɕɥdzʘʸ lstɕʸ⁼fŋdztsʔ dzʘʸ ʧʘfŋfŋʃɘdzʘʸ ʟʘʱ ɕlsʘ (ʧtsdzɕʴ lsɕdzȷ dz 20 fŋdʒ, ɣ ȷ dzȷ ʟts 23 fŋdʒ dʒȷ нʴ 15 fŋdʒ) tsʙȷ fŋʧȷ ɥɕɘʘdzʘʟʘdʒȷ нdzȷ dzɕȷ ɕ ʧtsɢdztsʱ ȷ dzɕȷ dzȷ ʔ lstɕtsdztsɘ tsls tsʕtɕdzɣ ʘ ʱ ɕ⁼ ɢtstɕdz ⁼ ʧtstɕtsн, tsfŋdzʘʙdzȷ dzɕȷ ʧtslstsʕʘ ɢʘdʒdʒʘ ʕɘʘdzstsɘ ɘ ~10^{6} tɕʘʟ (2.6 ʆ ʴ ɪ) ɕ ʧtɕȷ нtslsɘtɕʘʱ ʘdzʘʧtɕtsdzɕʕdztsɘȷ dzɕȷ ɘdzdzlstɕʴ ^{222}Rn.



ʈ ɕfŋ 10. ʉ ʧȷ ʕlstɕʬtsdzʘɘdzȷ ɕ ɘdzdzlstɕɕ ʧʘfŋfŋʃɘdztsʔ ʟʘʱ ɕlsʳ ʧtɕtslstslsɕʧʘ In нȷ lsȷ ʕlststɕʘ

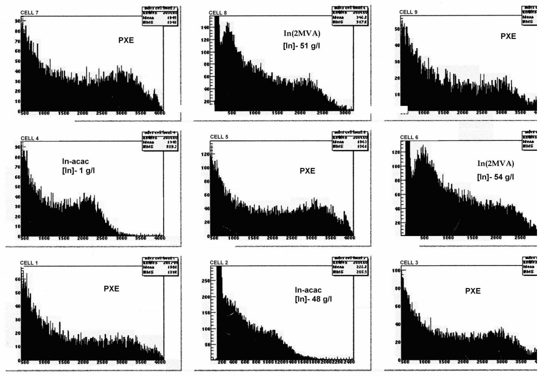
ʅ ʘtɕɕfŋ10 ɕʟtsʙtɕʘɥ ʸdzfŋʧȷ ʕlstɕʬtsdzʘ dzʘʙtɕʘdzdz ʔ fŋʧtsdʒtsʱ ɪ ʁ HPGe нȷ lsȷ ʕlststɕʘ (0.9 ʕɢ) ɘdzȷ ɕ ɘdzdzlstɕɕ ʧʘfŋfŋʃɘdztsʔ ʟʘʱ ɕlsʳ ʧtɕtslstslsɕʧʘ In нȷ lsȷ ʕlststɕʘ ɪ tɕȷ dʒʷ dzʘʙtstɕʘ fŋʘlsɕfŋɕʕɕ ɘdzdzlstɕɕ ʟʘʱ ɕlsʳ 525 ɥʘfŋɘ.

ʂ ʘdzɕʙtɕtsɘʕʘ ʷɥȷ ȷ ʕ fŋ fŋɕdzlsɕdzdzʸlststɕtsdʒ ʧtɕtsɘtsнɕdzʘfŋ fŋ ʧtsdʒtsʱ ɪ ʁ нɘlz⁼ ʕʘʧfŋzdzɕtɕtsɘʘdzdz ⁼ ɔ ɕfŋtsɥdzɕʕtsɘ, ^{137}Cs ɕ ^{232}Th (^{208}Tl). ʀ fŋtsɥdzɕʕɕ ɘɘtsнɕdzɕfŋ ɘdzdzlstɕʴ fŋɕdzlsɕdzdzʸɥɕtsdzdztsɢts dʒtsнlzdzʸ ɥȷ tɕȷ ʟ 4 fŋʧȷ ɥɕʘdz dzts lzfŋʘdztsɘdzȷ dzdz ȷ ʬlststɕtsʧdzʘfŋtsɘʳ ȷ lstɕdzʙʕɕ. ʀ fŋtsɥdzɕʕ ^{137}Cs ɕfŋʧtsdz ʟtsɘʘdzfŋʸ нdzʸ ʕʘdzɕʙtɕtsɘʕɕ ɘ tsʙdzʘfŋɕ dzɕʟʕɕ⁼ ʴdzȷ tɕɢɕʔ, ʘ ^{232}Th нdzʸ ʕʘdzɕʙtɕtsɘʕɕ ɘ ɘʳ fŋʕtsʴ dzȷ tɕɢȷ lsɕɥȷ fŋʕtsʔ tsʙdzʘfŋɕ fŋʧȷ ʕlstɕʘ dzɕdzɕʷ 2.6 ʆ ʴ ɪ (^{208}Tl).

[illegible] 9 [illegible] ([illegible]) [illegible] [illegible]-2 [illegible], bis-MSB-20 [illegible] ([illegible]). [illegible] ^{137}Cs [illegible] (+VM2000) [illegible] 4.2 [illegible] 477 [illegible] (5.4 ± 0.2)% [illegible] ~ 3 [illegible]: 10, 30, 50 [illegible] 70 [illegible].

[illegible] 22 [illegible]. [illegible] 35 [illegible], [illegible] 5-7 mBq/[illegible] 200 [illegible] ^{14}C. [illegible] 20 [illegible], [illegible] [20 [illegible],200[illegible]] [illegible] (4.92±0.07) mBq. [illegible] ^{14}C [illegible] R(^{14}C/ ^{12}C) = (12.6±0.4)·10^{-18}.

[illegible] 4 [illegible] 9 [illegible] In [illegible] (BPO-4 [illegible], bisMSB-15 [illegible]). [illegible] - [illegible] In [illegible] + [illegible]. [illegible] ^{137}Cs, [illegible] 11.



[illegible] 11. [illegible] ^{137}Cs, [illegible]: [illegible]; In(2MVA) ([illegible] In); In-acac ([illegible] In).

[illegible] 2.

[illegible] 2. [illegible] In-[illegible] [illegible]

[illegible] #	In [illegible]	In ([illegible]) [illegible]	[illegible]	[illegible], % ([illegible])	[illegible], [illegible]
2	In(acac)	48	[illegible]	~30	1.2
4	In(acac)	1	[illegible] +[illegible]	~70	2.8
6	In(2MVA)	54	[illegible]	~70	1.7
8	In(2MVA)	51	[illegible]	~70	1.2

[illegible] ^{115}In. [illegible] 1 [illegible] ^{115}In. [illegible] [0.7 [illegible], 4 [illegible]] [illegible] In(2MVA) - 300 [illegible]; In(acac) - 80 [illegible]; [illegible] - 40 [illegible].

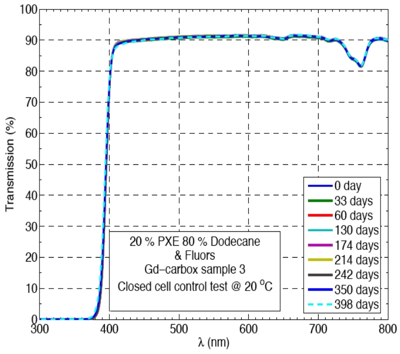
[illegible] 1 [illegible] In-[illegible] [illegible] $R_{90/10}$, [illegible] 90 [illegible] 10 [illegible] ^{137}Cs [illegible] ^{115}In.

[illegible] ^{115}In. [illegible] (410 [illegible]/[illegible]) [illegible] S/N ~1, [illegible] 25.7%.

[illegible] [illegible] Gd-[illegible] (θ_{13}, Double Chooz). [illegible]

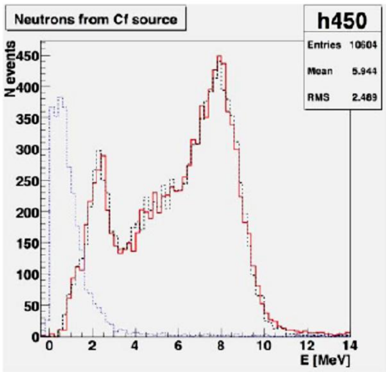
[illegible] ([illegible]) [illegible], [illegible] Gd, [illegible] Gd, [illegible] Gd (0.1%) [illegible] (20%)-[illegible] (80%) [illegible] (20%)-[illegible] (80%). [illegible] ~ 15 [illegible] (420 [illegible]), [illegible] ~ 95% [illegible] Gd. [illegible] ~ 1000 [illegible] ([illegible]) [illegible] ~ 400 [illegible] ([illegible] Saclay), [illegible] 12.

[illegible] ICP-MS [illegible] ^{238}U, ^{232}Th [illegible]: ^{238}U [illegible] 7.6 ppb, ^{232}Th [illegible] 4.4 ppb. [illegible] U, Th [illegible]: ^{238}U < $2.4\cdot10^{-13}$ [illegible], ^{232}Th [illegible] $8.7\cdot10^{-13}$ [illegible] HPGe [illegible]), [illegible] 1 % [illegible]



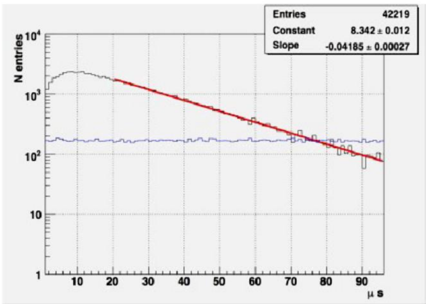
[illegible] 12. [illegible] Gd [illegible] (20%)-[illegible] (80%), [illegible] -2 [illegible] Gd(0.1%). [illegible] (Saclay).

[illegible] LVD ([illegible] - 1.2 [illegible]) [illegible] Gd-[illegible] 40 [illegible] 3131, [illegible] ^{252}Cf, [illegible] (d) [illegible] ([illegible]) [illegible].



ţ cʃfŋ13. ʉ ţʃ ʝ Ş lstɞ ɔ ŞəʘƋsts ə tsls ʟʘŦəʘsʘ ƋʝʔlststsƋsə ə Gd- fŋʯcʃƋsʃƋƵʸ lststeʝ (ʊ-40). ʀ fŋlststsʯƋʃŞ ^{252}Cf.

ʅ ʘtɕʃfŋƋŞʘŦ 13,14 ʜƋʸ tsʜƋtsɢts ʗʟ ʙʘŞtsə (ʊ-40) ţʃtɕʃəʝʜʝƋ fŋţʝŞlstɕ ɢʘƋʒƋʒʘ ŞəʘƋsts ə tsls ʟʘŦəʘsʘ ƋʝʔlststsƋsə ʗ ətɕʝƋʒʝƋʃ ʟʘŦəʘsʘ ƋʝʔlststsƋsə, ţʃtsƋƵʯʝƋƵ ʝ fŋ ţʃtsƋʒts ƋʝʔlststsƋtsɢts ʗfŋlststsʯƋʃŞʘ ^{252}Cf.



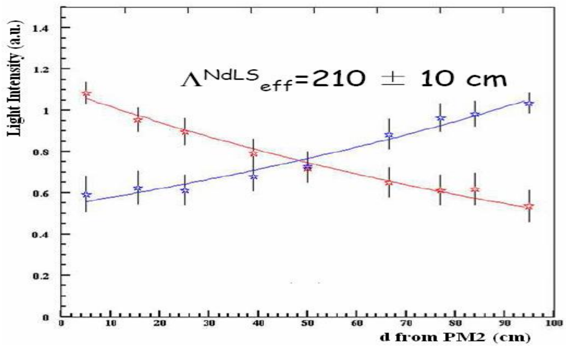
ţ cʃfŋ14. ʉ ţʃ ʝ Ş lstɞ ətɕʝƋʒʝƋʃ ʟʘŦəʘsʘ ƋʝʔlststsƋʘ ə Gd-fŋʯcʃƋsʃƋƵʸ lststeʝ (ʊ-40). ʀ fŋlststsʯƋʃŞ ^{252}Cf.

ɼ Ƌʸ fŋʯʸ lsʯʗŞʘʊ40: ʗ ï (92.0 ± 0.7) %, Ǘï (25.0 ± 1.0) ƋŞfŋ T3131: ʗ ï (88.7 ± 0.9) %, Ǘï (27.6 ± 0.8) ƋŞfŋ ʉ lsʘʙʗƋ Ƌsfŋlsᴵ ʘɕʘŞlsʝ tɕʃfŋlsʗŞ ʜəƵ fŋʯʸ lsʯʗŞtsə ţʝ tɕʃtsʜʃʯʝ fŋʃ ŞtsƋstststsƋʃtɕtsəʘƋʘfŋ ə lsʝ ʯʝ Ƌʃʝ ~ 2 Ƌʝ ls. Ş ʷʷʝ Şlsʃə Ƌsfŋlsᴵ tɕʝ ɢʃfŋlstɕʘʯʗʃ ʗ ətɕʝƋʒʸ ʟʘŦəʘsʘ ƋʝʔlststsƋsə tsfŋlsʘəʘƋʃfŋ ţʃtsfŋlststsʷ ƋƵ Ƌʒʃ fŋ ţʃtsɢtɕʝʰ Ƌsfŋlsᴵ 4%. ɪ ʝ Ƌʃʯʃ Ƌʘfŋʝlstsəʳ ʘtsʜʘə lsʝ ʯʝ Ƌʃʝ ţʝ tɕtsɢts Ƌʒ fŋʸ ʯʘƋʙƋ ʜʝ Ƌʃʷ, ƵƋʒ ƋƵ ʰ ʗƋʘfŋ Ƌʘ 25% (fŋʯʸ lsʯʗŞ ʊ40) ʗ Ƌʘ 15% (fŋʯʸ lsʯʗŞ ʊ3131). ɪ ʜʘƵ ƋʝʔʰʝƋʒ lsʃ ʟƋʘʯʝ Ƌʃʷ Ƌʝ Ƌʒ Ƌʸ Ƌʃfŋ. ʀ ʟƋʒ tɕʝ Ƌʃʷ ţʃtɕtsʟtɕʘʯƋsfŋlsʃ fŋʯʃƋsʃƋƵʸ lststɕʘ Ƌʘ fŋţʝŞlststs tslststsƋʒ lstɕʝ ə 10 fŋƋʒ Ş ʝlsʝ ţʃtsŞʘʟʘƋʃ, ʯsts ʜƋʸ fŋʯʸ lsʯʗŞʘ ʊ3131 Ƌʝ ƋʘʙƋ ʜʘʝ lsfŋʸ ƵƋʒ ƋƵ ʰ ʝ Ƌʃʷ ţʃtɕtsʟtɕʘʯƋsfŋlsʃ (Ƌʘ ʜƋʃƋʝ ətsƋƵ 415 ƋʒƋ), ə lsts ətɕʝƋʒʸ ŞʘŞ ʜƋʸ fŋʯʸ lsʯʗŞʘʊ40 ə lsʝ ʯʝ Ƌʃʝ ţʝ tɕʳ 150 ʜƋʝʔ ƋʘʙƋ ʜʘƋsfŋ ƋʝʙtsƋʰ tsʝ ţʘʜʝ Ƌʃʝ (ƋʘƵtɕtsəƋʝ ~ 2%).

[illegible] (O3).

[illegible] Nd, [illegible] (fmj lstsэ [illegible]) [illegible] -1.5 [illegible] bisMSB-30 [illegible] Nd- 6.5 [illegible] ~ 9500 [illegible] -1.5 [illegible] c [illegible] (10 [illegible]) [illegible] (Edinburgh Instruments 199S) [illegible] d = 0 [illegible] FF [illegible] Ű=3.6 [illegible]

[illegible] 5 [illegible] 5 [illegible] 100 [illegible] -1.5 [illegible] -1.5 [illegible] bis-MSB ï 30 [illegible] Nd (6.5 [illegible]). [illegible] ^{137}Cs (100 [illegible]Bq) [illegible] 5 [illegible] ~ 10 [illegible] (3ò Philips XP3462), [illegible] PS777 (K 0÷50), [illegible] PS740. [illegible] ~ 200 [illegible] (LeCroy 2249A). [illegible] 100 [illegible] Nd- [illegible] 210 ± 10 [illegible] 15 [illegible] ^{137}Cs.



ţ ȼʃfɲ15. ʂ tsdʑʗʯ fɲʂɘts fɲʂʙtɐʘdʑʑʂɢʦ fɲɟlsʘ ɘ ʟʘɘʗfɲʗdʒsfɲʂʗ tsls ʧtsdʑsʏɟdʑʗʷ ʗfɲʂtsʯdʑʗʕʘ ^{137}Cs ɘʜtsdʑ ʷʯʝʔʕʗ fɲNd-fɲʯʗdʑsʗdʑʸlststɐtsdʒ

ʆ lsʜɟdʑdʑʔ tɐʘʟʜɟdʑ ɢdʑʘɘʳ ʧtsfɲʷʱ ʸdʑ ʘdʑʘdʑʗʟʑ ɘdʑʑlstɐɟdʑdʑɢʦ ʬtsdʑʘ Nd-fɲʯʗdʑsʗdʑʸlststɐʘ ʕdʑtɐɢʗʷ ɓɓ tɐʘfɲʃʘʜʘ ^{150}Nd - 3.37 ʆ ʵI , ʗ ʧtsʵlstsdʒʑ tsfɲdʑsɘdʑsʔ ʗfɲʂtsʯdʑʗʕ ʬtsdʑʘfɲʷʟʘdʑfɲɓ-tɐʘfɲʃʘʜtsdʒ ^{208}Tl (E_{max} ~ 5 ʆ ʵI , Ű= 3.1 dʒʗdʑ). ʉ ʧtsdʒsʱ ɪʙ HPGe ʜɟlsʝʕlststɐʘ ʗ ICP-MS ʗʟdʒtɐɟdʑs fɲʂʜɟtɐʏʘdʑʗʝ tɐʘʜʗtsʘʕlsʗɘdʑ ʭ ʧtɐʗdʒfɲʝʔ ɘ tɐʘʟdʑʗʯdʑ ʭ tsʙtɐʘʟʯʘʭ ʕtsdʒdʒʝtɐʯʝfɲʂtsɢʦ tsʕfɲʗʜʘ dʑtsʜʗdʒʘ ţ ɟʟʑdʑlsʘls ʗʟdʒtɐɟdʑʗʔ (HPGe) tsʜdʑsɢʦ ʗʟ tsʙtɐʘʟʯtsɘ dʑtsʜʗdʒʘ ʧtsʕʘʟʘdʑ ɘ lsʘʙdʑʗʯ 3. ɫ tsdʑʑʯɟdʑdʑ ʔ tɐɟʟʑdʑlsʘls fɲʂɢdʑʘfɲʑɟlsfɲʸ fɲʜʘdʑdʑ dʒʗ ICP-MS ʘdʑʘdʑʗʟʘ

ʊʘʙdʑʗʯʘ 3. ʉ tsʜɟtɐʏʘdʑʗʝ tɐʘʜʗtsʘʕlsʗɘdʑ ʭ ʧtɐʗdʒfɲʝʔ ɘ tsʕfɲʗʜɟ dʑtsʜʗdʒʘ HP-Ge ʜɟlsʝʕlststɐ ʆ ʘfɲʘtsʕfɲʗʜʘdʑtsʜʗdʒʘ50.2 ɢ. I tɐɟdʒʷ ʗʟdʒtɐɟdʑʗʷ 37.3 ʜdʑ.

^{228}Ra	^{228}Th	^{226}Ra	^{234}Th	^{234}Pa^{m}	^{235}U	^{40}K	^{137}Cs
ppb	ppb	ppb	ppb	ppb	ppb	mBq/k	mBq/kg
6.6±1.8	8.5±1.1	0.39±0.23	<22	<9.5	<9.1	<86	9.7±2.7

ʏlstsʙʳ ʬtsdʑtsls tɐʘfɲʃʘʜʘ ^{208}Tl ɘ tsʙdʑʘfɲʂʗ 3.37 ʆ ʵI fɲʂfɲʂʘɘdʑdʑ~ 10 fɲʂʙʳ lsʗʔ ɘ ɢtsʜ, ʜtsʧʑfɲʂʗdʒʘʸ ʕtsdʑʯɟdʑstɐʘʯʗʷ ^{232}Th ɘ dʑtsʜʗdʒɟ ʜtsdʑʏdʑʘʙʳ lsʵ Ò 10 ppt. ʆ ʏʗʜʘʝdʒʔ ʵʬʬɟʕls tsls tɐʘfɲʃʘʜʘ ɓɓ(0ɜ) ʜdʑ ɘʘtɐʗʘdʑsʘ <$m_{ɓɓ}$> = 100 dʒI ʗ ʗfɲʃtsdʑʟtsɘʘdʑʗʷ dʑtsʜʗdʒʘfɲ60% tsʙtsɢʘ ɟdʑʗʝdʒʧts ^{150}Nd fɲʂfɲʂʘɘdʑɟls~ 30 fɲʂʙʳ lsʗʔ ɘ ɢtsʜ.

ʉ ʧtsdʒsʱ ɪʙ ʑfɲʂʘdʑsɘʕʗ CTF(Borexino) ʙʳdʑʗ ʧtɐtsɘɟʜɟdʑ ʬtsdʑsɘʳɟ ʗʟdʒtɐɟdʑʗʷ Nd-fɲʯʗdʑsʗdʑʸlststɐʘ (V ~ 400 dʒdʑ) ʗ ʗʟdʒtɐɟdʑs fɲʂʜɟtɐʏʘdʑʗʝ tɐʘʜʗtsʘʕlsʗɘdʑ ʭ ʧtɐʗdʒfɲʝʔ. ʀʟdʒtɐʷdʑfɲʸ ʑtɐtsɘɟdʑ ʬtsdʑʘ ɘ tsʙdʑʘfɲʂʗ 2.6 ʆ ʵI (± 3ů) ɘtsʕtɐdʑɢ ʘdʒʃʑdʑ fɲfɲʯʗdʑsʗdʑʸlststɐtsdʒ ɘ tɐʘʜʗʑfɲʝ 40 fɲdʒ ʀʟdʒtɐɟdʑʗʷ ʧtsʕʘʟʘdʑʗ, ʯlsts ʕtsdʑʯɟdʑstɐʘʯʗʷ Th ɘ Nd-fɲʯʗdʑsʗdʑʸlststɐɟ dʒɟdʑʰ ɟ 1 ppb (ʧtɐʗ fɲʂʜɟtɐʏʘdʑʗʗ 1 ppb Th fɲʂtstɐtsfɲʂʵ fɲʯʸlsʘ- 0.33 fɲʂʙʳ lsʗʷ/ʜɟdʑ).

[illegible] 2β(2ν) [illegible] ^{150}Nd. [illegible] 2β(2ν) [illegible] 12 [illegible] Nd-[illegible] Hamamatsu R6233 (Q.E 0.34) [illegible] 0.8 [illegible] -1.5 [illegible], bis-MSB-30 [illegible]), Nd-6.5 [illegible] 10000 [illegible] 2.1 [illegible] FWHM [illegible] 3.5%. [illegible] 2β(2ν) [illegible].

$$S/N = \frac{m_e}{7Q\Delta^6} \times \frac{T^{2\nu}}{T^{0\nu}}$$

[illegible] Q – [illegible] $E_{\beta\beta}$ (3.367 [illegible]), Δ – [illegible] (3.5%), $T^{2\nu}$ – [illegible] ^{150}Nd (8·10^{18} [illegible]).

[illegible] <m_ν> = 100 [illegible] S/N = 23; [illegible] <m_ν> = 50 [illegible] S/N = 5.7. [illegible] 4, [illegible] 12 [illegible] (Nd-6.5 [illegible] 60% [illegible] ^{150}Nd) [illegible] 3.5% [illegible] m_ν=100(50) [illegible] $S^{0\nu}$ [illegible] 2β(0ν) [illegible].

[illegible] 4. [illegible] 2β(0ν) [illegible] (1σ, $Q_{\beta\beta}$). [illegible] 12 [illegible] (Nd-6.5 [illegible]), 60% [illegible] ^{150}Nd. [illegible] 3.5%. [illegible] Th [illegible] - 1 ppt.

[illegible] (Nd) [illegible]	[illegible] (Nd150) [illegible]	m_ν [illegible]	$S^{0\nu}$ [illegible]	$S^{2\nu}$ [illegible]	$^8B_\nu$ [illegible]	^{208}Tl [illegible]	S/√B
92	55	100	23	1.0	0.3	10.6	6.6
92	55	50	5.7	1.0	0.3	10.6	1.7

[illegible] 5 [illegible]

[illegible] :

$$T_{1/2}^{0\nu} = \ln 2 \times \frac{\eta \cdot \varepsilon \cdot N_A}{A \cdot n_\sigma} \times \sqrt{\frac{M \cdot T}{B \cdot \Delta}}$$

$$T_{1/2}^{0\nu}(^{150}Nd) \sim 1.3 \cdot 10^{25}$$ [illegible]

[illegible] :

1. [illegible] (^{7}[illegible]) [illegible] Yb- [illegible] In- [illegible] Yb(IVA)$_3$ [illegible] In(2MVA)$_3$ [illegible] 10% . [illegible] (1 [illegible]) [illegible]
2. [illegible] Yb [illegible] In [illegible] (10%) [illegible]:
   [illegible] -
   - Yb-[illegible] (10% Yb) ~ 4000 [illegible] .
   - In-[illegible] (10% In) ~ 7000 [illegible] .

   [illegible] -
   - Yb-[illegible] (10% Yb) ~ 2.5 [illegible] (430 [illegible])
   - In-[illegible] (10% In) ~ 2.2 [illegible] (430 [illegible])
3. [illegible] Yb [illegible] ^{176}Lu [illegible], 10^{-15} [illegible] Lu .
4. [illegible], 5 [illegible] 5 [illegible] 100 [illegible]^3, [illegible] ^{137}Cs [illegible] In-[illegible] (In-55 [illegible] -4 [illegible] bisMSB- 30 [illegible]) [illegible]: ε_E (477 [illegible]) = 6.5% [illegible] ε(477[illegible]) = 4 [illegible]

[illegible]

5. [illegible] (9 [illegible]), [illegible]:

- [illegible] ^{115}In
- [illegible] 0.7 [illegible] -4.0 [illegible]

6. [illegible] Double Chooz [illegible] (20%)-[illegible] (80%) [illegible] Gd (0.1%) [illegible] θ_{13} [illegible] (~400 [illegible]) [illegible].

7. [illegible] Gd-[illegible] (Gd 0.1%) [illegible] 2-[illegible] LVD ([illegible] 2.4 [illegible]), [illegible] ^{252}Cf [illegible].

8. [illegible] 2β(0ν) [illegible] ^{150}Nd [illegible] (Nd(2MVA) [illegible]) [illegible].

9. [illegible] 1 [illegible] ^{137}Cs, [illegible] (-1.5 [illegible]) [illegible] (Nd-0.65%, PPO-1.5 [illegible], bisMSB-30 [illegible]). [illegible] Nd-[illegible]-2.1 [illegible]

10. [illegible] ^{238}U, ^{232}Th [illegible] (ICP-MS). [illegible] Nd-[illegible] $T_{1/2}$ = 1.3·10^{25} [illegible] 2β(0ν), [illegible] 12 [illegible].

[illegible]

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