CaF_2純化開発

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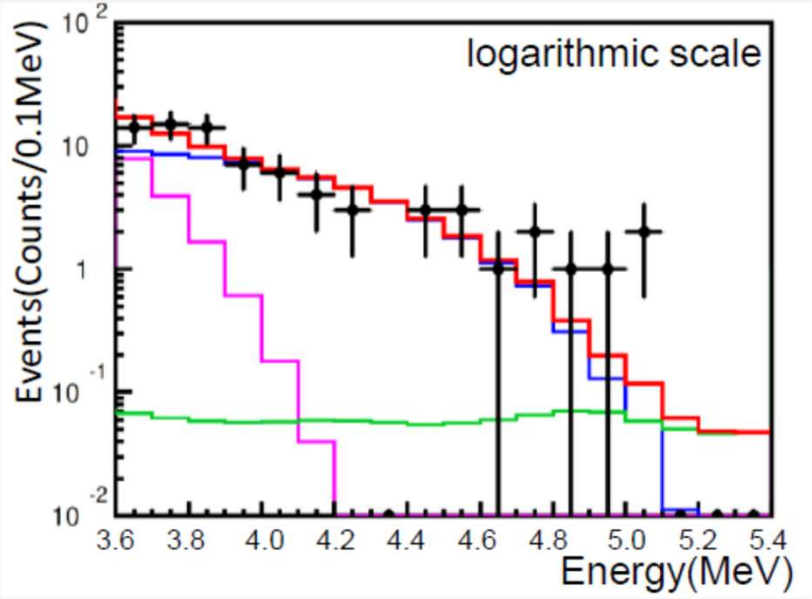
1. 目的と目標
2. 坩堝の選定
3. 溶融品の生成
4. 不純物濃度測定(神岡)
5. 不純物濃度測定（徳島）
6. 展望

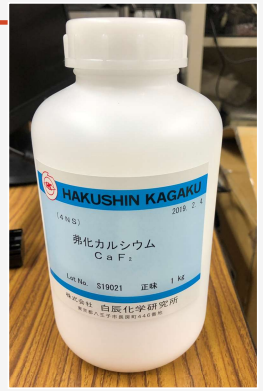
1. Aim and Goal

- Present BG 10~100 μBq/kg of U,Th
  - Present background origins.
  - Intrinsic ^{208}Tl and ^{212}BiPo.
  - External gamma ray due to (n,γ).
  - 2νββ beta rays.
  - Purification of CaF_2.

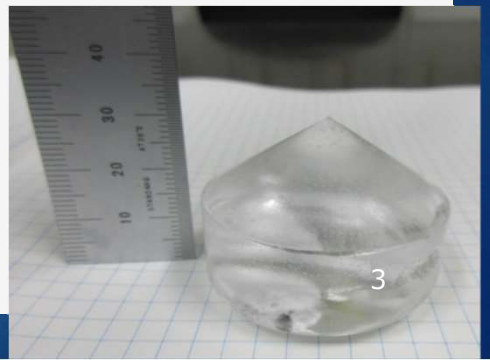


- Goal
- High purity CaF_2 , <1 μBq/kg
- Improve materials used for crystallization.

Procedure of CaF_2 development



- Synthesis of CaF_2 powder
  - Need to collaboration with a maker.
    - Under discussion.
    - Now we select a best powder by ourselves.
- Crystallization
  - We can control. (Knowledge from pure NaI(Tl) development)



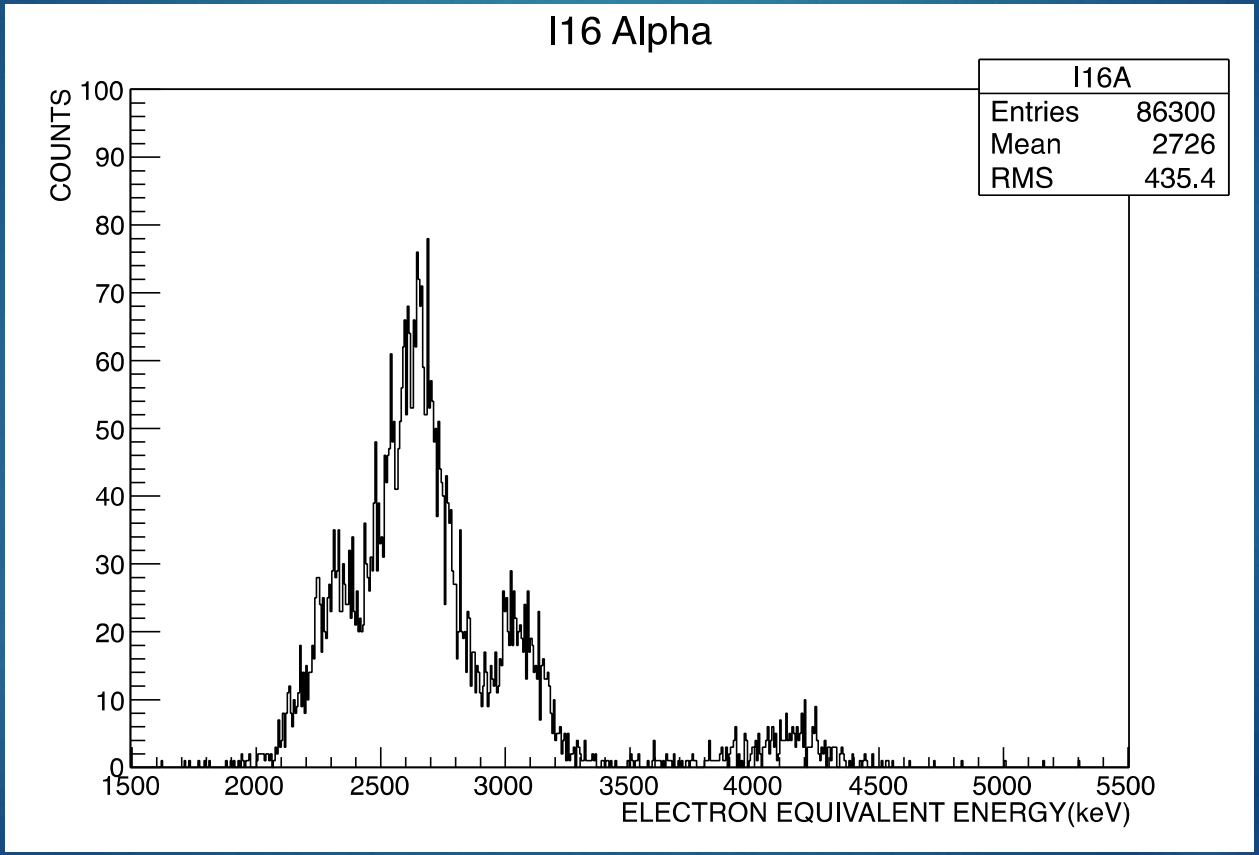
Measurement of impurity in graphite (2011)

- Method
- ICP-MS (Agient7500cs)
- Dirty sample (1) , (3)
- Clean sample (2)

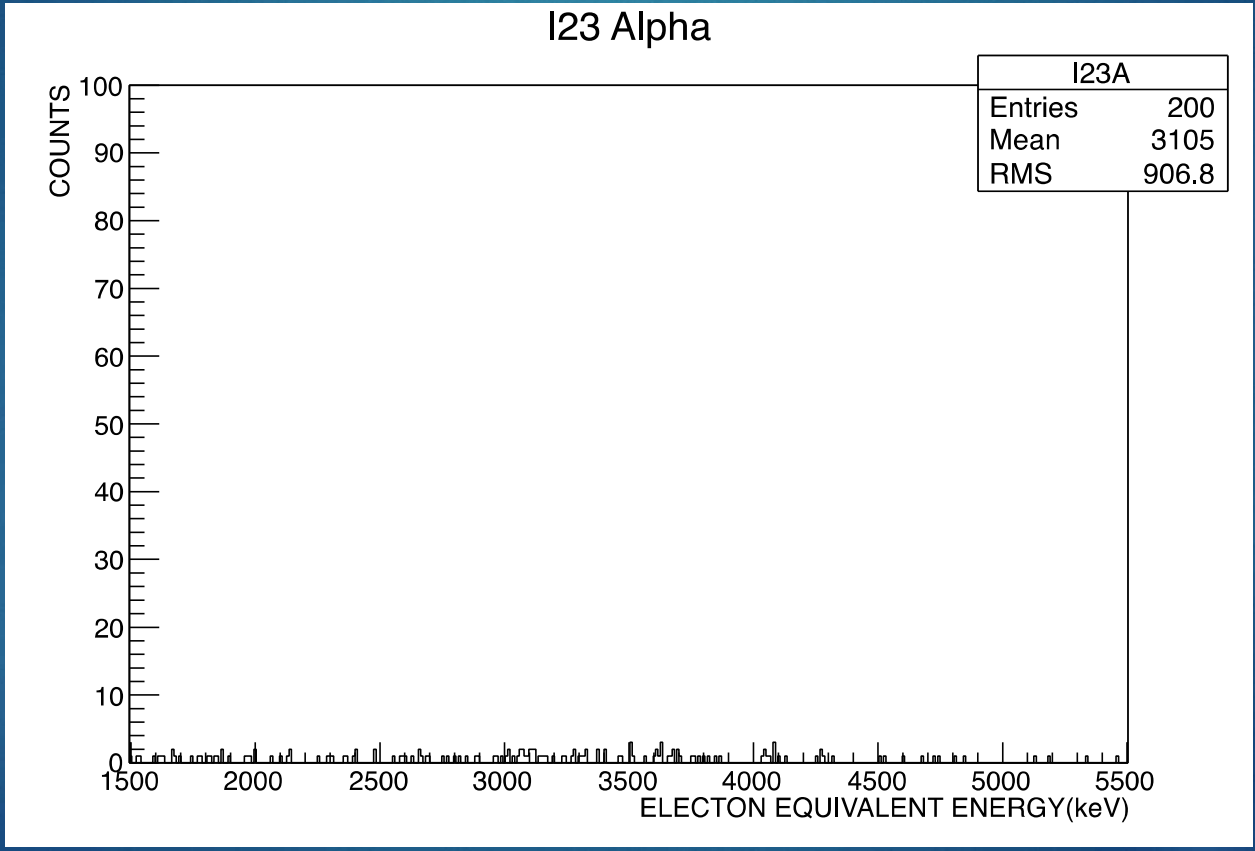
表： Concentration of U, Th, and K in graphite ng/g

Sample	U		Th		K	
	Conc.	Limit	Conc.	Limit	Conc.	Limit
Sample1	37	10	30	10	21000	5000
Sample2	<20	20	<20	20	<200	200
Sample3	430	10	350	10	<100	100

Normal NaI(Tl) : A few mBq of U,Th

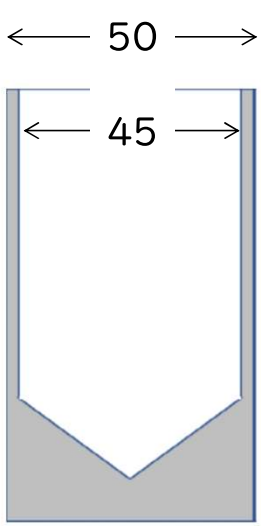


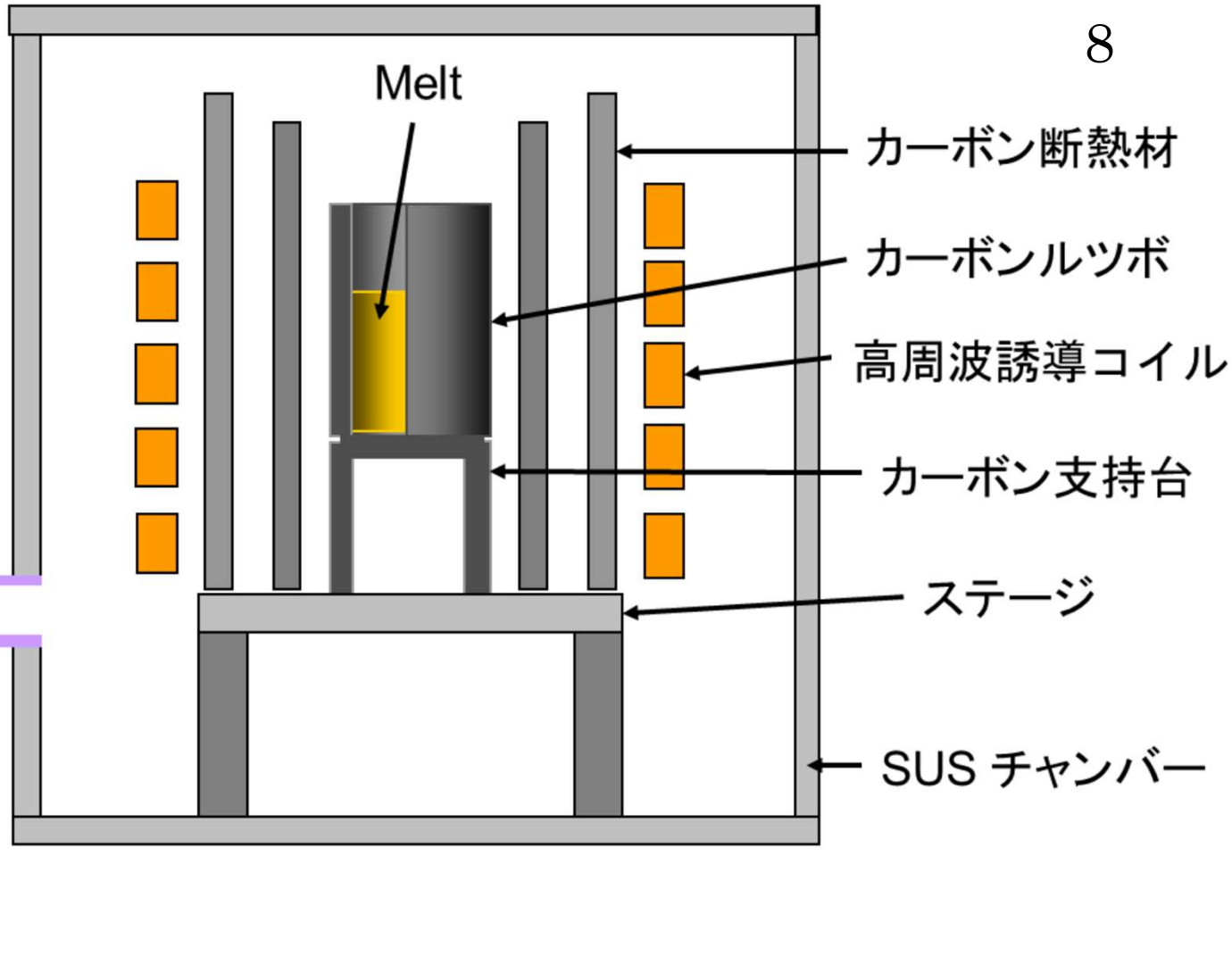
Selected crucible.



Selection of crucible

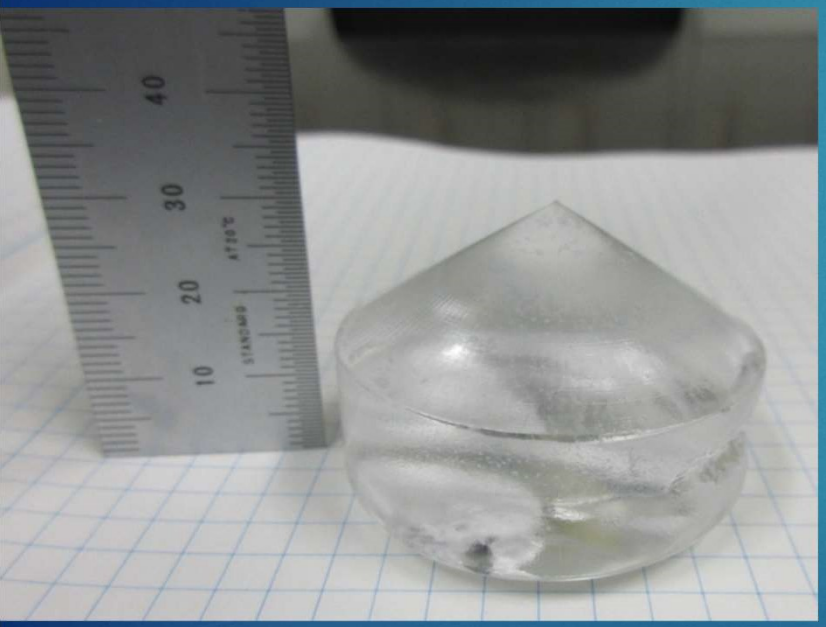
坩堝名称	メーカー
Normal	三幸社
PICOLON用	I.S.C.Lab.
高純度（鏡面）	I.S.C.Lab.
高純度（非鏡面）	I.S.C.Lab.





真空ポンプ
Rotary &
Diffusion

4. Impurity measurement in Kamioka

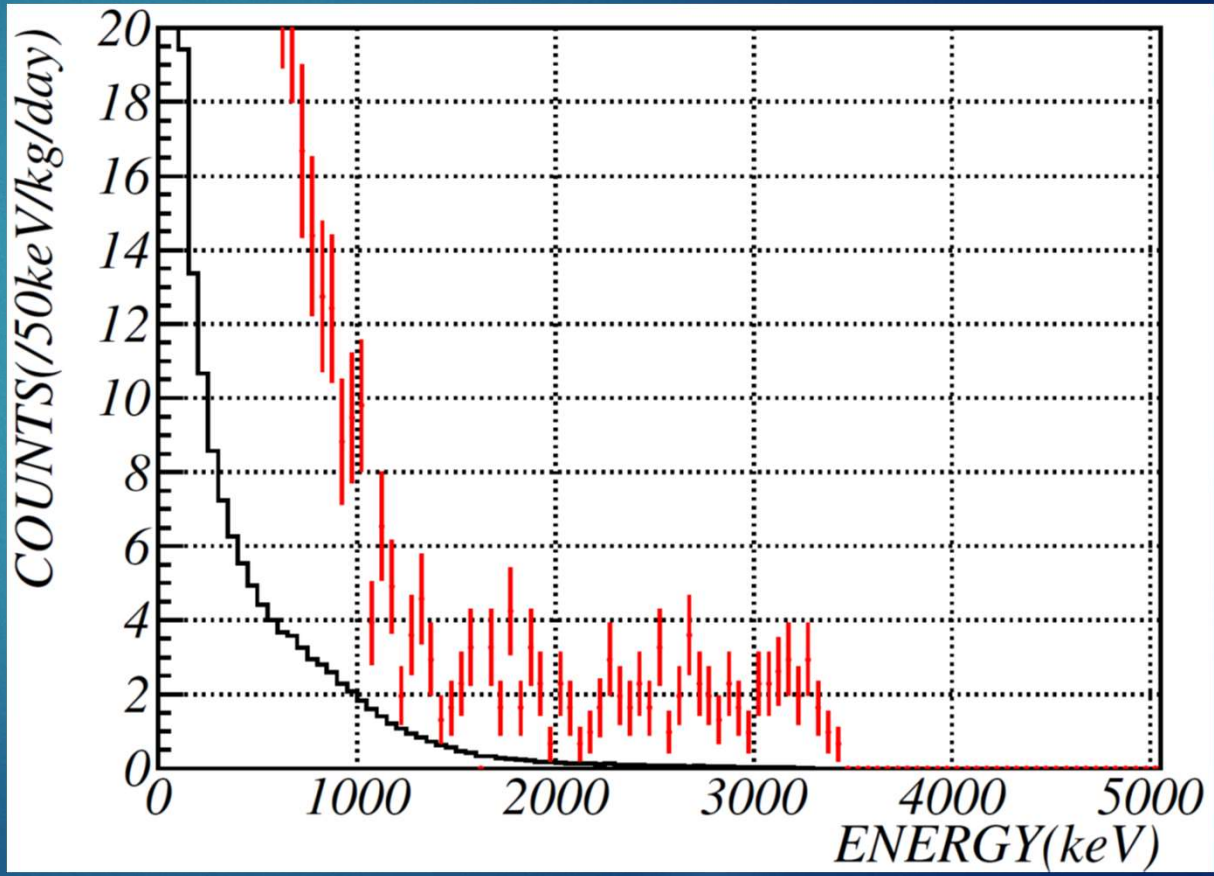


4. BG measurement (U-series)

Delayed coincidence of ^{210}Bi-^{214}Po

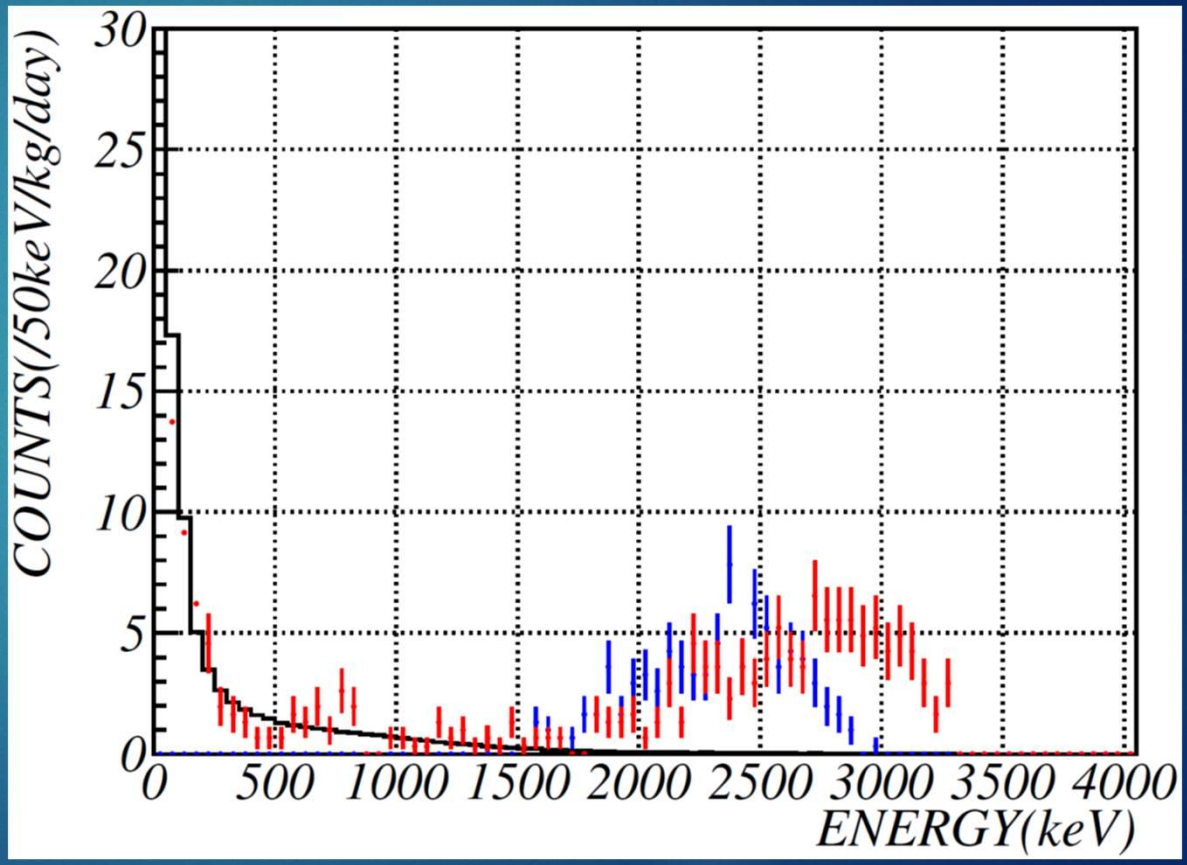
Red : Delayed events.

Black : Accidental background.



Th-series

- ^{220}Rn-^{216}Po
- Blue : 220Rn (6.288 MeV)
- Red : 216Po (6.779 MeV)



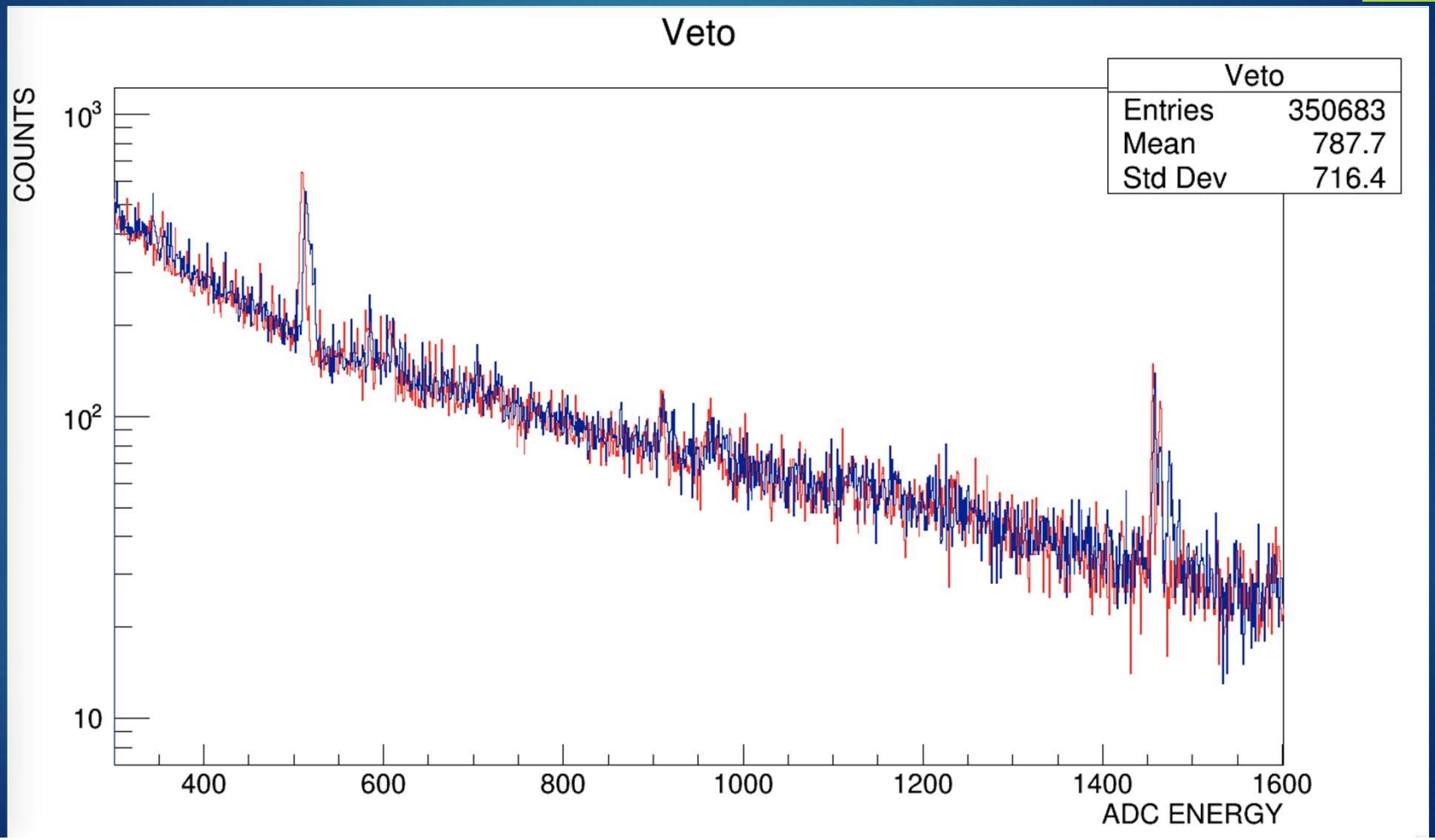
Present results

Crucible	Crystal	U (mBq/kg)	Th (mBq/kg)
Normal	Clear	0.91±0.07	1.38±0.08
Normal	Clear	1.33±0.08	0.63±0.06
PICOLON	Clear	9.08±0.37	5.62±0.32
PICOLON	Clear	0.90±0.12	1.36±0.14

5. Screening in Tokushima

- Less shield thickness.
  - 10 cm Pb
  - 1 cm Cu
  - Additional Cu (2 cm) near Ge crystal.
- Cosmic ray veto
  - Upper & East

DAQ trouble (peak shift)



Screening result

- Sensitivity reduction by peak shift.
- Sensitivity will be improved about X1.5 after fixing the peak shift.
- Long live time (3~4 weeks).

	CaF_2 (Bq/kg)	通常るつぼ (Bq/kg)	高純度るつぼ (Bq/kg)
^{40}K (1461keV)	2.9	2.8	3.4
^{208}Tl (511keV)	0.9	0.5	0.6
^{208}Tl (583keV)	0.2	0.1	0.2
^{208}Tl (2615keV)	0.1	0.1	0.3
^{214}Pb (352keV)	0.4	0.2	0.2
^{214}Bi (609keV)	0.2	0.2	0.2

6. Prospect

- Crystallization by purified crucible.
  - Furnace was broken by earthquake. → Repairing.

- Tune up the Tokushima-Ge detector
- Fix the peak shift problem.
- Optimization of PL Veto. (Take the energy data or timing data?)
- Shield improvement. (Limited by stand strength)