STUDIES OF NUCLEAR REACTIONS IN SOLIDS UNDER ELECTRON BEAM IRRADIATION TO METAL DEUTERIDE

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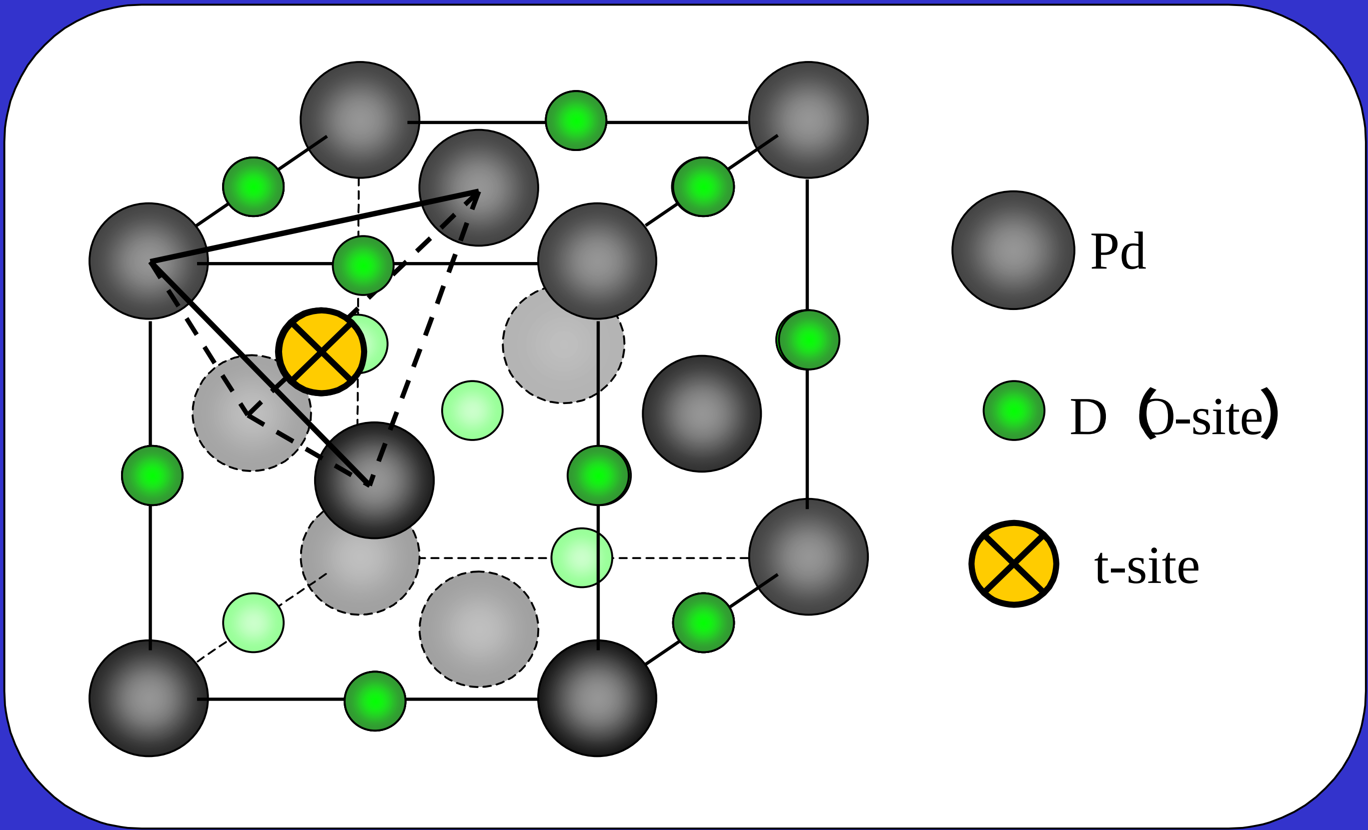


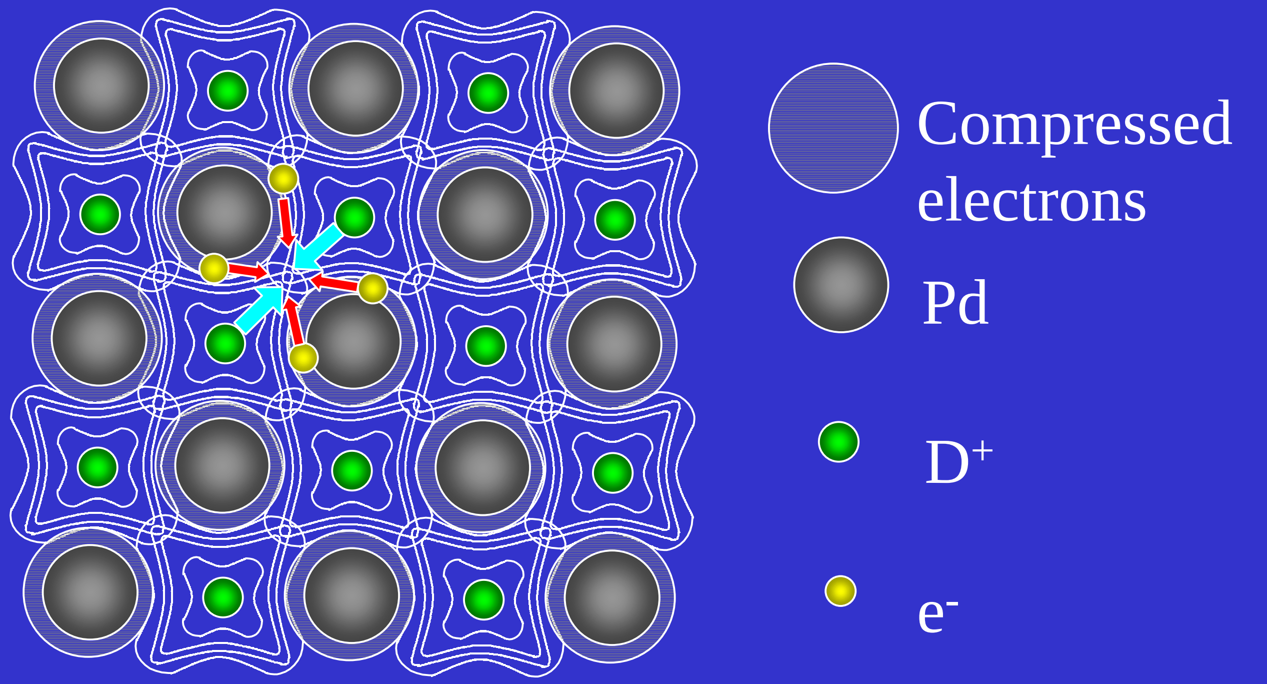
Schematic view of PdDx cube

<u>Highly D-loaded metals</u> are produced.

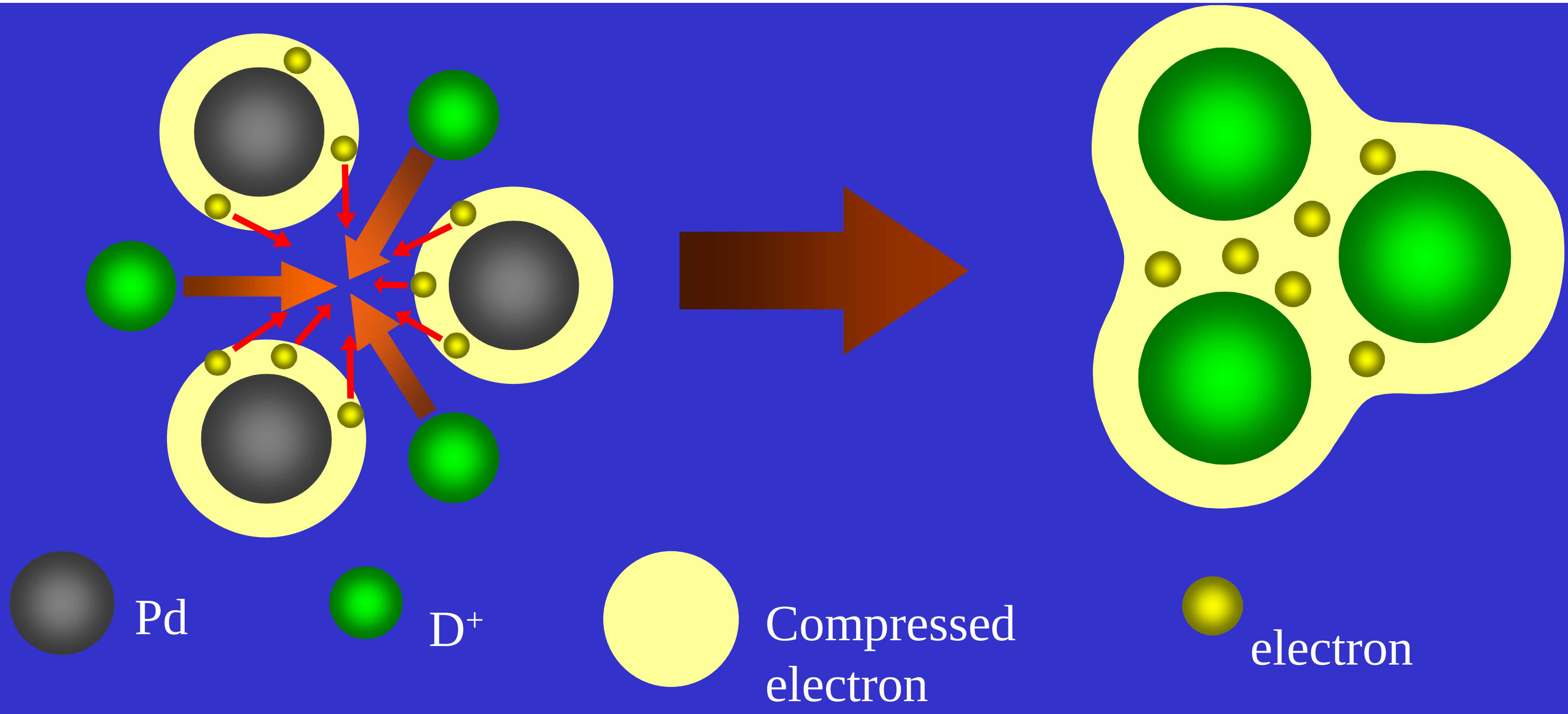
“Excess loading” may be attained partially.

PdDx: x = 1 or more

TiDx: x = 2 or more



<u>By stimulating</u> these D-loaded metals, oscillations of the deuteron trapped in metal lattice, plasma oscillations in solid and so on may be excited coherently. Under lattice dynamic process, deuterons gather at focal points accompanying with electrons.



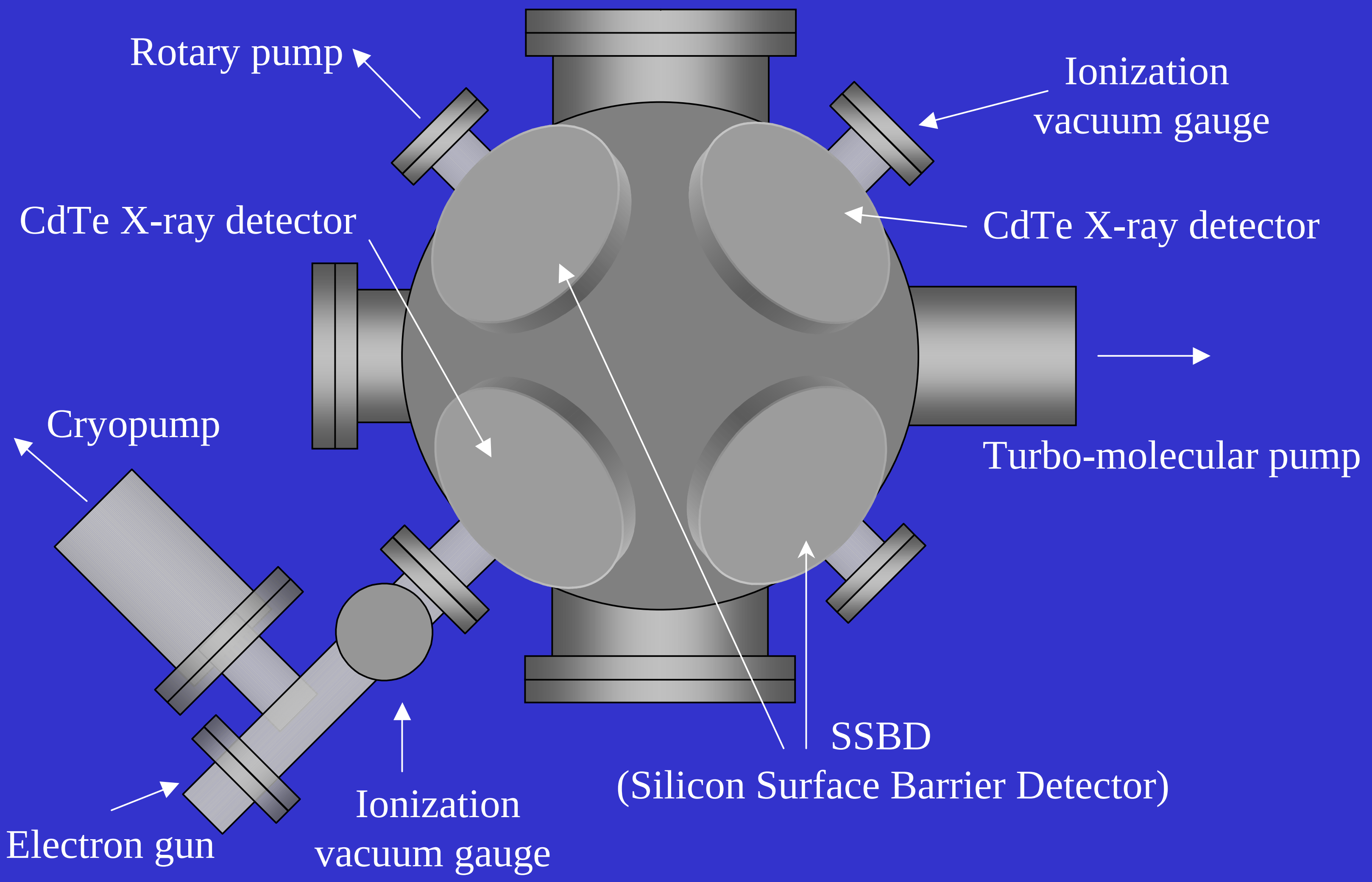
3D or 4D cluster wearing many electrons are produced in focal points , for example, tetrahedral site for Pd lattice, in lattice defects, boundary atom layers in different metal interfaces, and/or surface coating layer, transitionally. Squeezing electrons and compression into a highly dense negative-charge state in a short time interval can enhance the penetration probabilities for 3D and 4D interactions drastically.

Electron Beam Stimulation Experiments

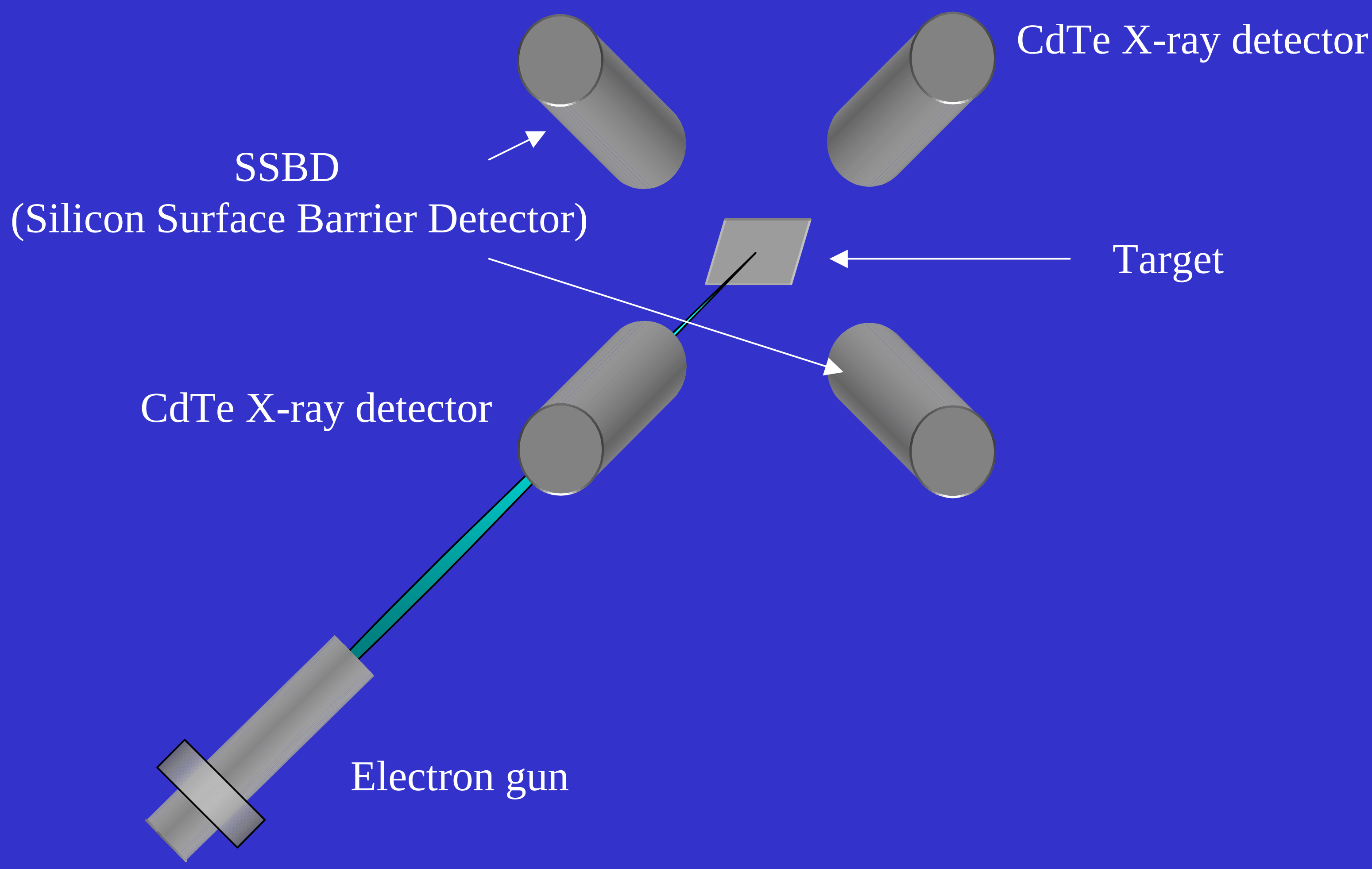
〔 A trial to induce the multi-body fusion by stimulating PdDx or TiDx with electron beam. 〕

<Measurements>

- Charged particle (by Silicon surface barrier detector: SSBD)
- X-rays (by Cadmium Telluride detector: CdTe detector)
- γ-rays (by High Purity Germanium Detector: HPGe detector)
- Low energy X-rays
  (by Lithium drifted silicon detector: Si(Li) detector)



Schematic view of the experimental setup

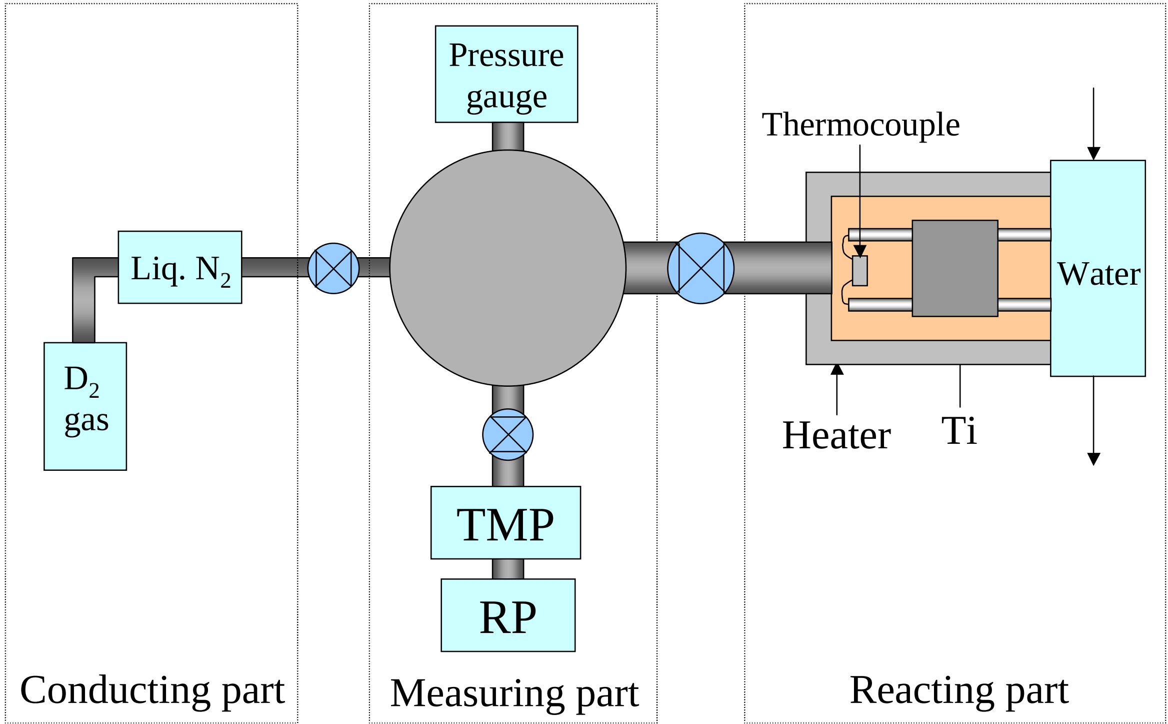


Schematic view of the measurement system (from upper side)

TiDx and PdDx were used as a target.

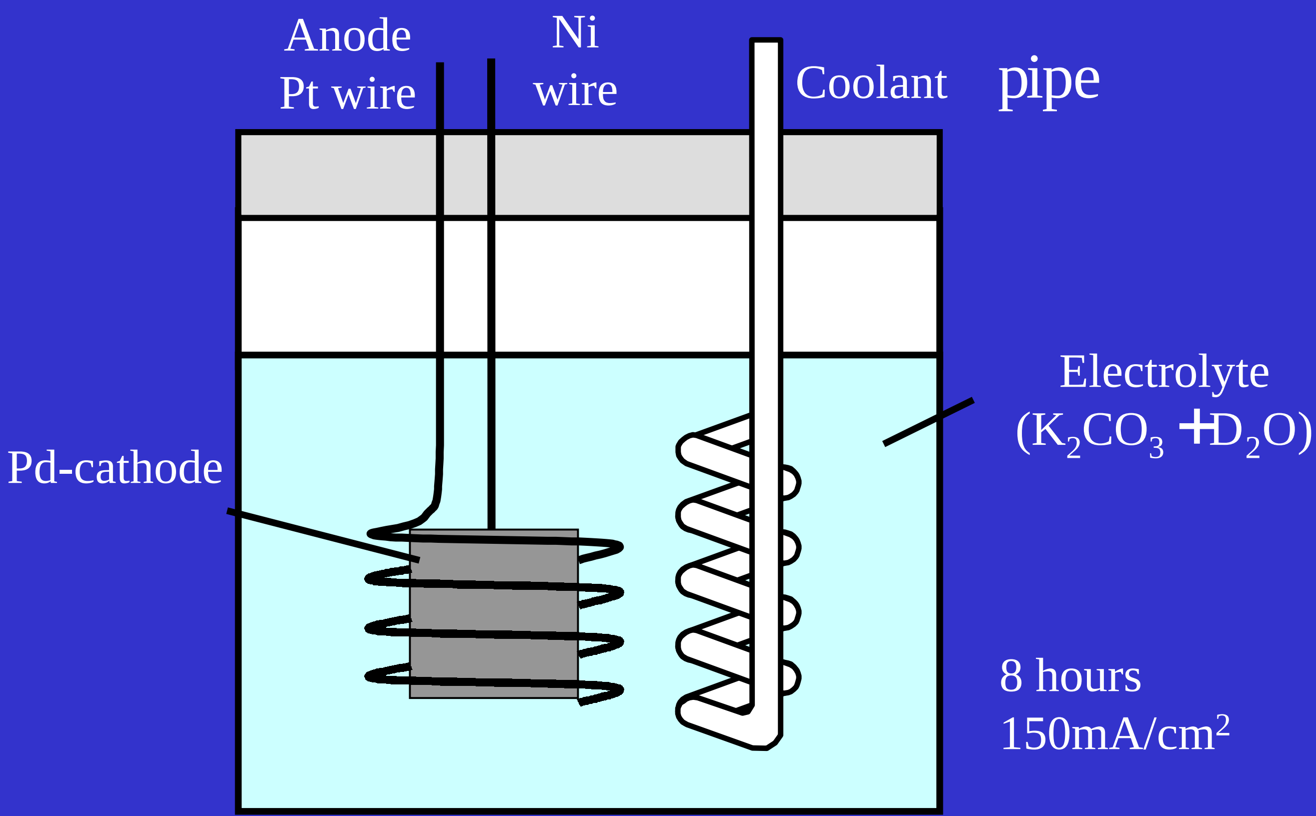
TiDx : x = 1.0 ~ 1.9 , by gas loading method

Annealed Ti plates were put in D_2 gas atmosphere, the pressure of D_2 gas and the temperature of Ti plate were well controlled.



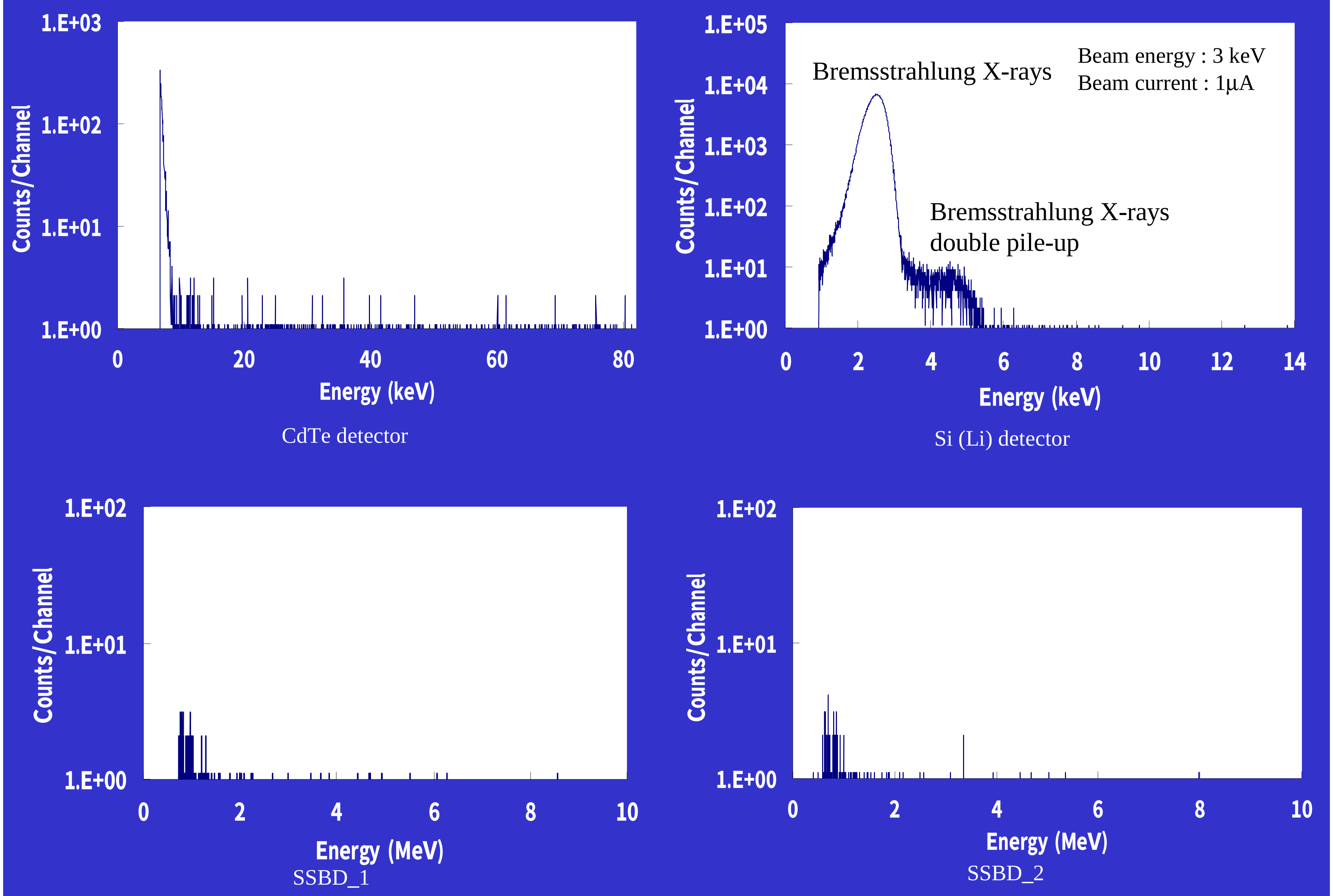
Schematic view of the experimental setup

PdDx : x = ~ 0.7 , by electrolysis method

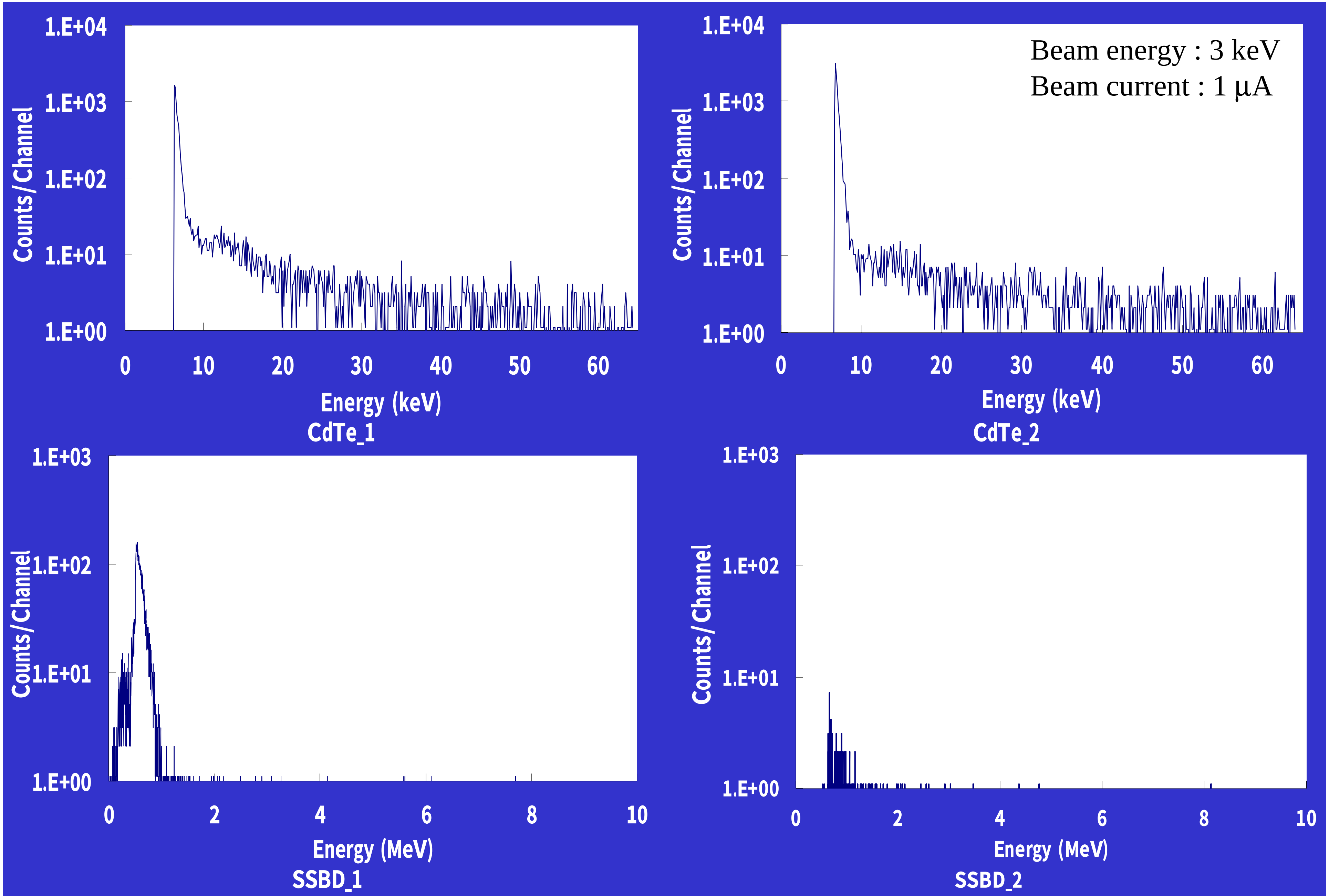


The PdDx target was prepared by using electrolysis method.

After electrolysis, **the PdDx was coated with thin Cupper layer by electroplating method** to prevent trapped deuterium releasing out.



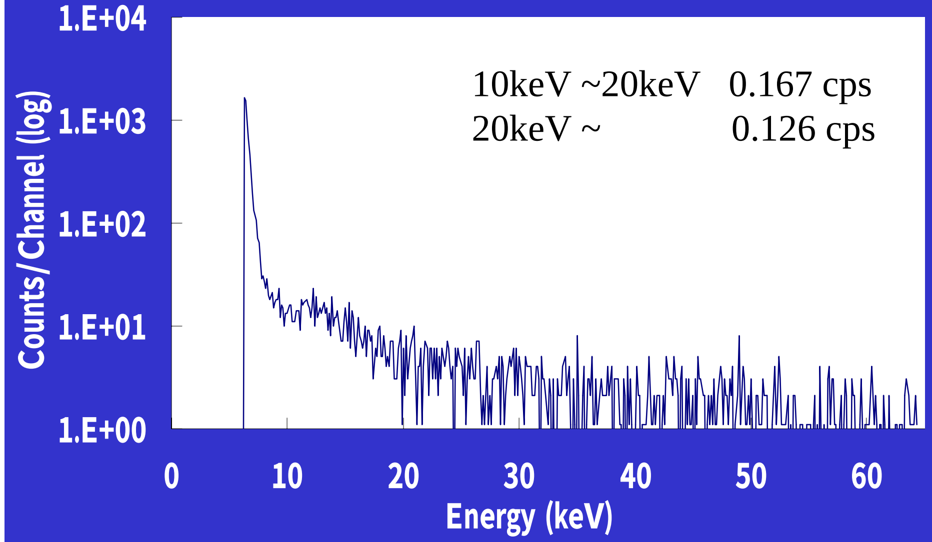
Energy spectrum measured under electron beam irradiation (TiDx : x =1.5)



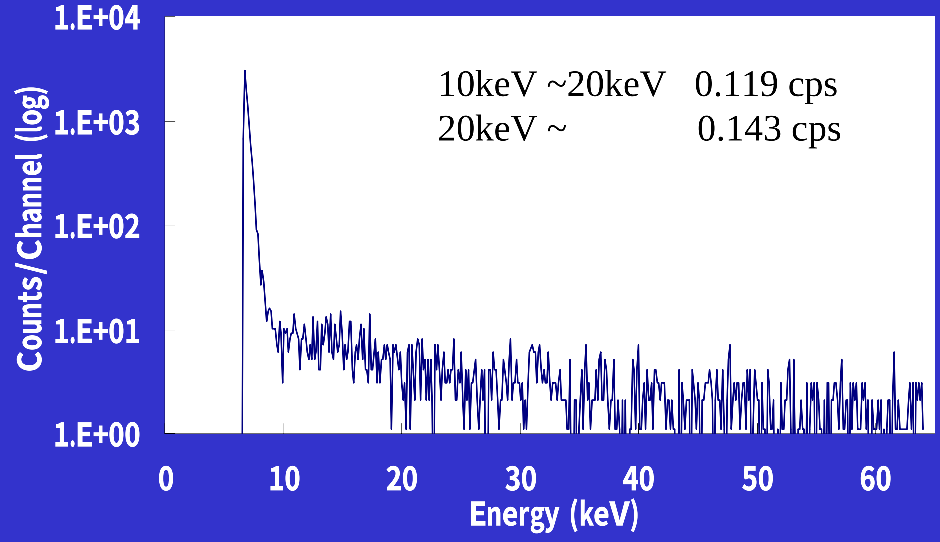
Energy spectrum measured under electron beam irradiation (PdDx)

PdDx is coated with Cu. The thickness is about 0.05μm

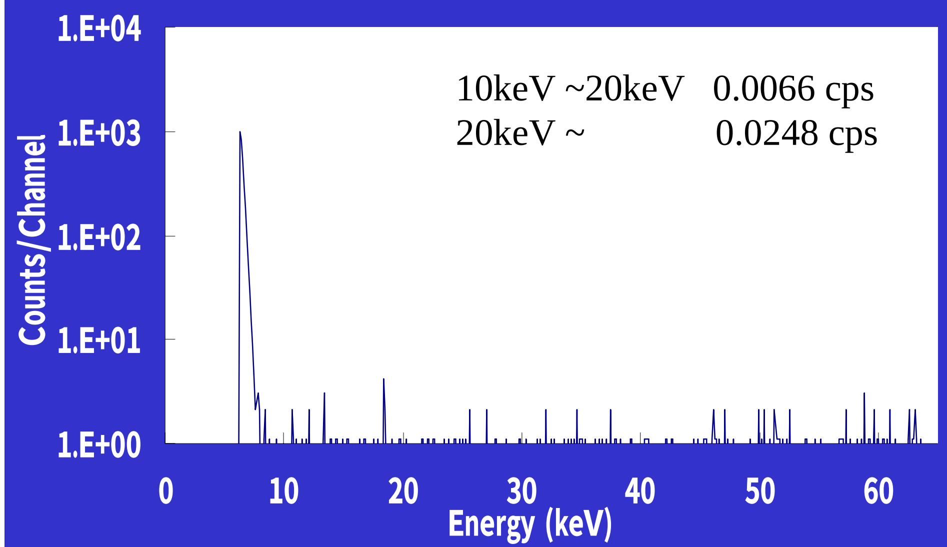
Measurement time 5000 sec



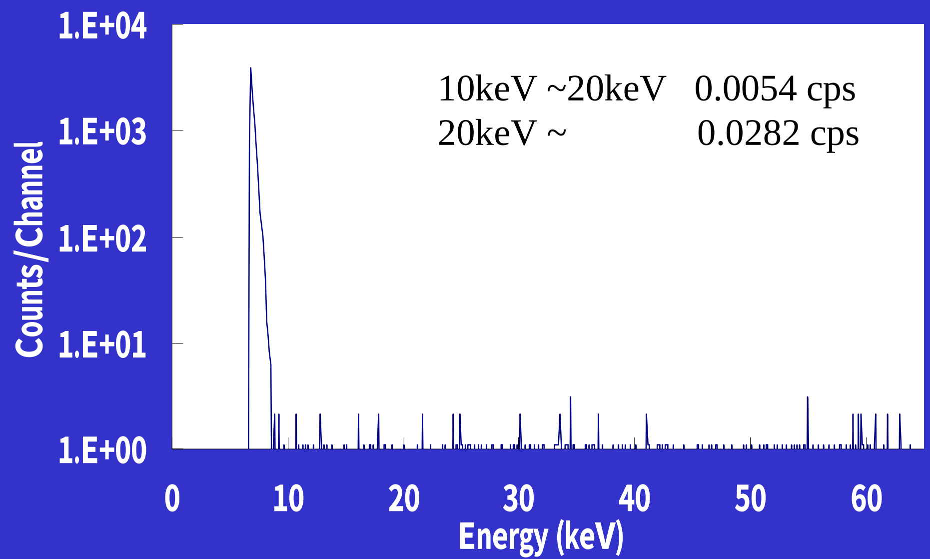
Energy spectrum measured under electron irradiation with CdTe_1



Energy spectrum measured under electron irradiation with CdTe_2



Background measured with CdTe_1



Background measured with CdTe_2

Energy spectra measured with CdTe X-ray detector (PdDx : x = 0.7)

	CdTe_1		CdTe_2	
	10-20keV	20-60keV	10-20keV	20-60keV
Background (using pure-Ti)	6.6E-3 *)	2.5E-2	5.4E-3	2.8E-2
Foreground (using PdDx)	1.7E-1	1.3E-1	1.2E-1	1.4E-1
Ratio(fore/back)	26	5.2	22	5.0

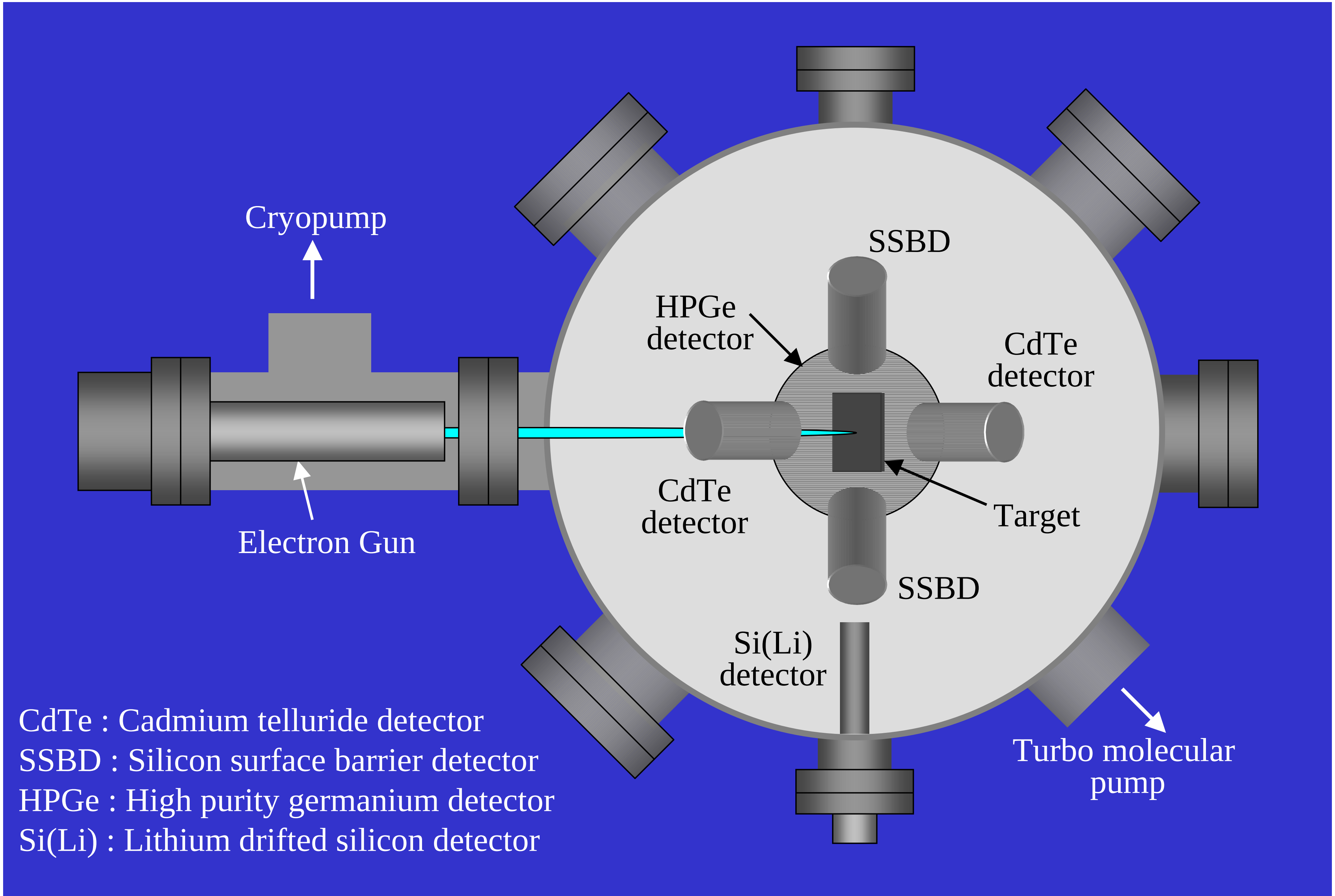
*) counts per second (cps)

Bumps from 10 keV to 20 keV were detected by both CdTe detectors. ⇒ These are **hardly malfunction of detectors.**

Electron beam energy was 3keV. ⇒ These are **not bremsstrahlung X-rays of incident electrons**.

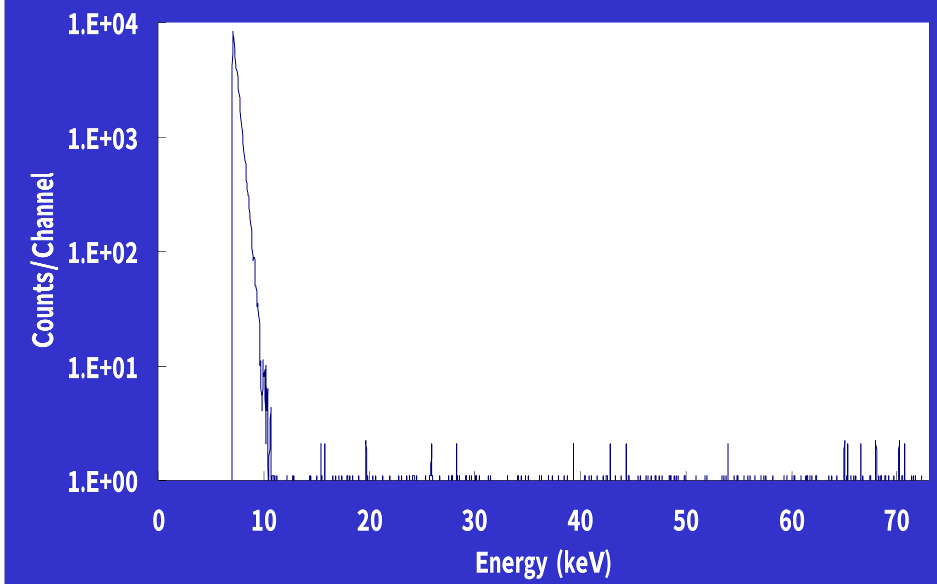
These were not detected in the experiment with pure-Ti (not D-loaded). ⇒ These are **not noises of electron beam irradiation**.

- There are some possibilities that these spectra are responses of **bremsstrahlung X-rays by slowing down of generated charged particle**, of **scattered γ-rays by Compton effect**, or **some pumped-up photons in the system**.

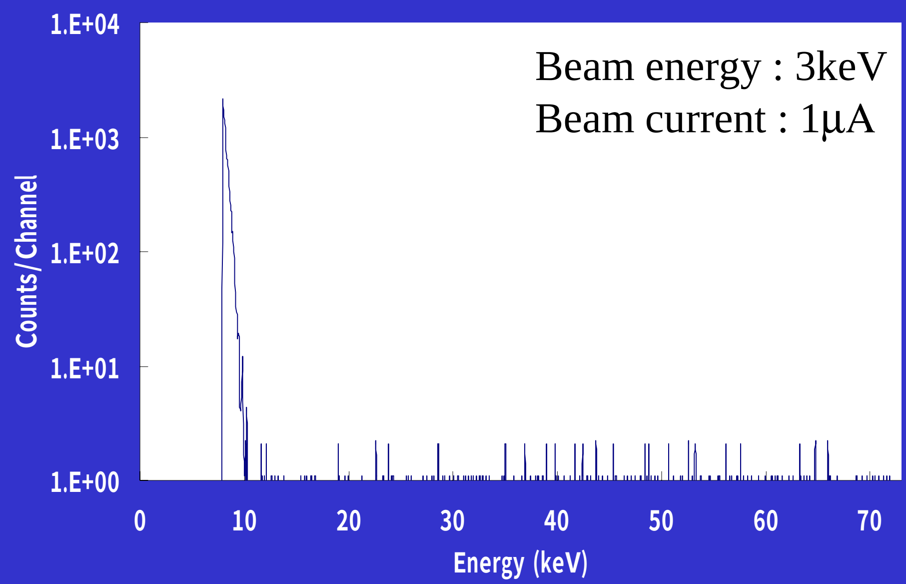


Schematic view of the experimental setup II

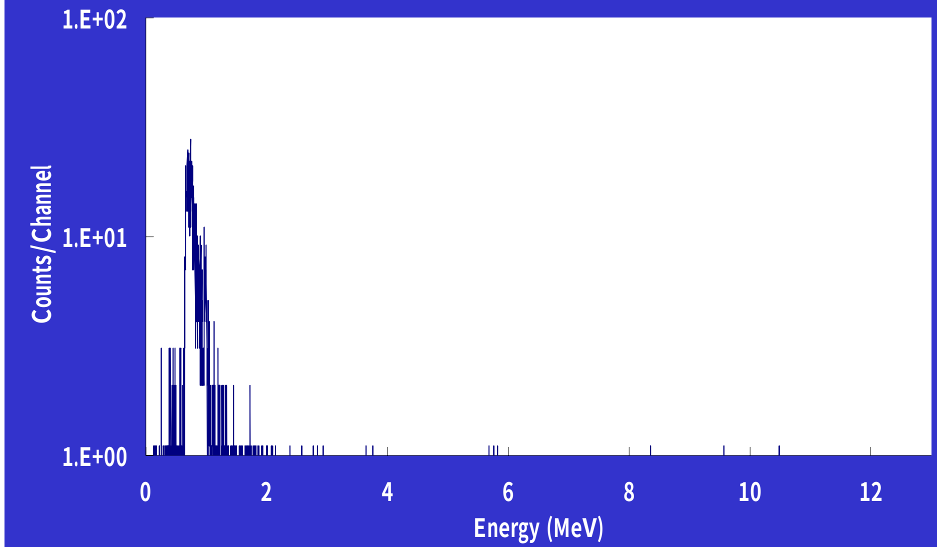
	SSBD	CdTe	Si (Li)	HPGe
Active area (mm^2)	450	19.6	28.3	2107
Solid angle (sr)	4.08E-2	1.78E-3	2.57E-3	9.36E-2
Distance from target (mm)	105	105	105	150
Depletion layer (mm)	0.3	0.3	1.2	70.9



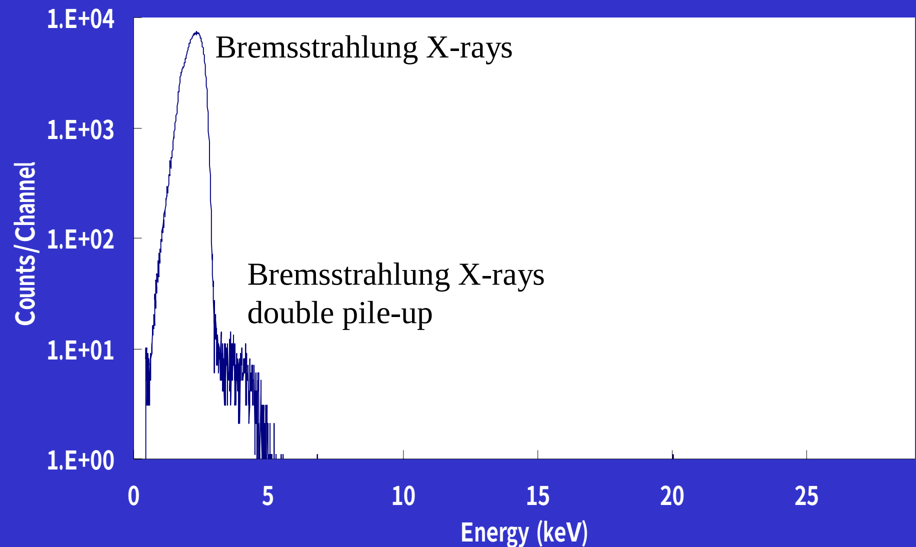
CdTe-1 X-ray detector



CdTe-2 X-ray detector (covered with Zr filter)



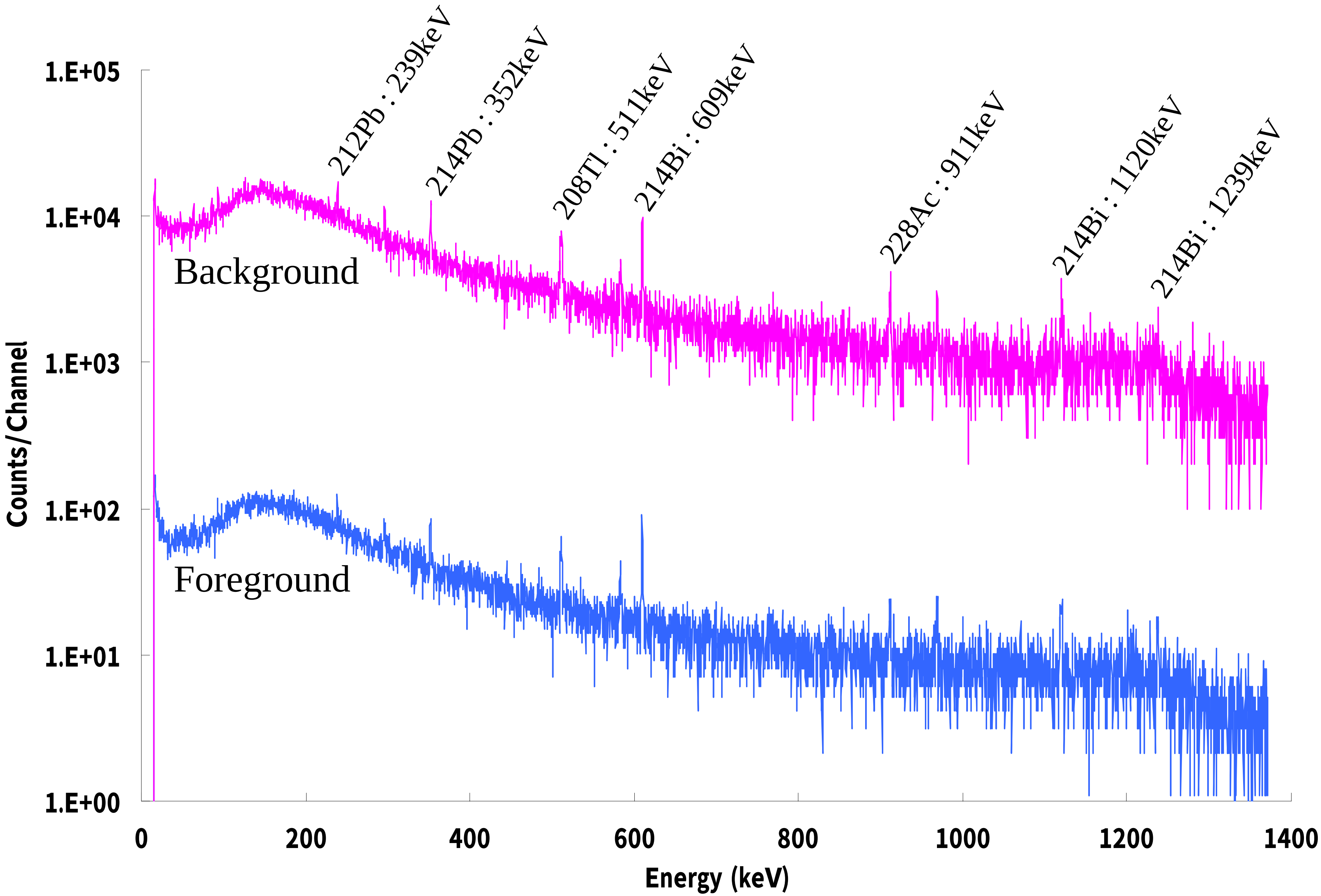
SSBD



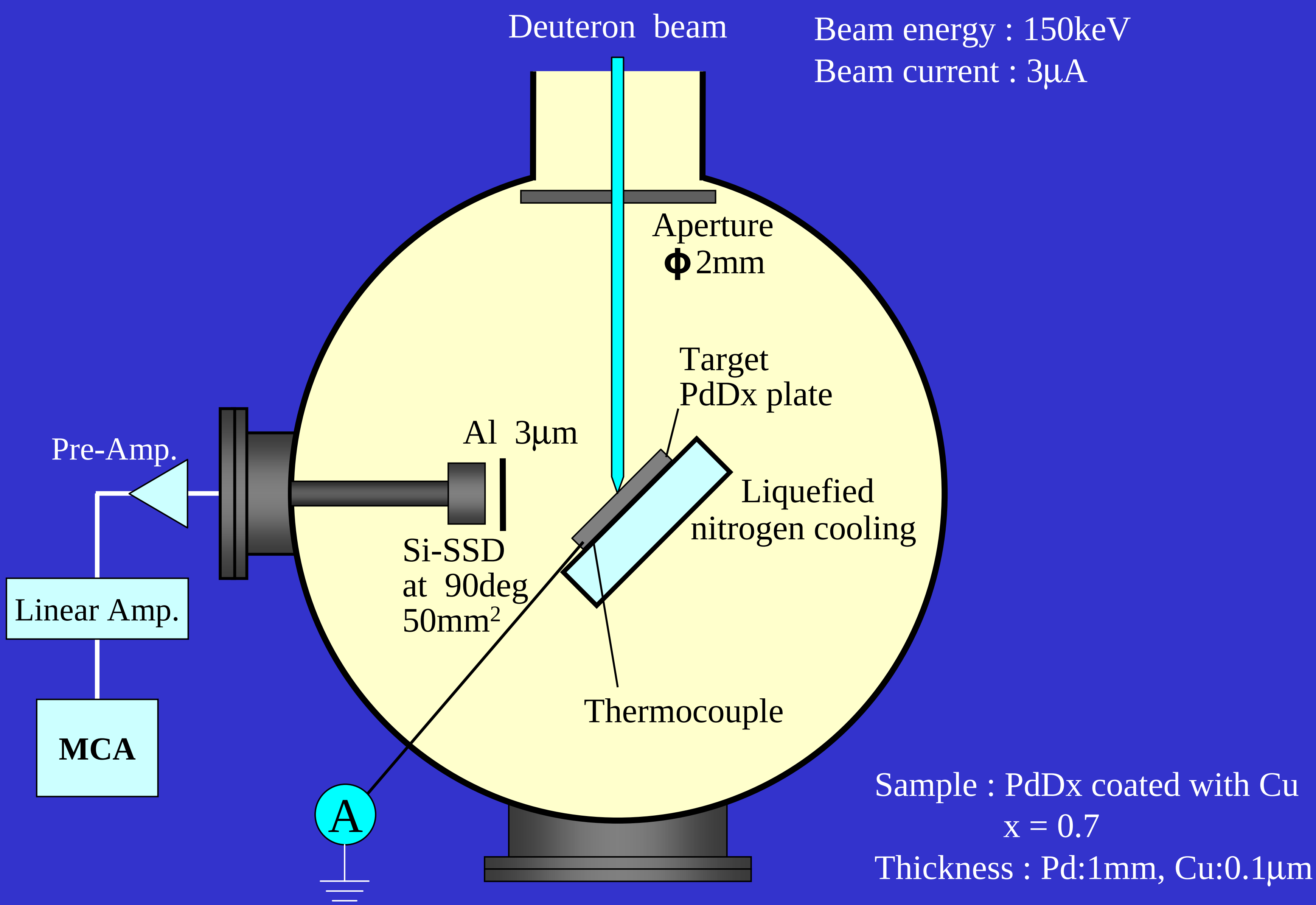
Si (Li) detector

Energy spectra measured under electron beam irradiation (PdDx : x = 0.7)

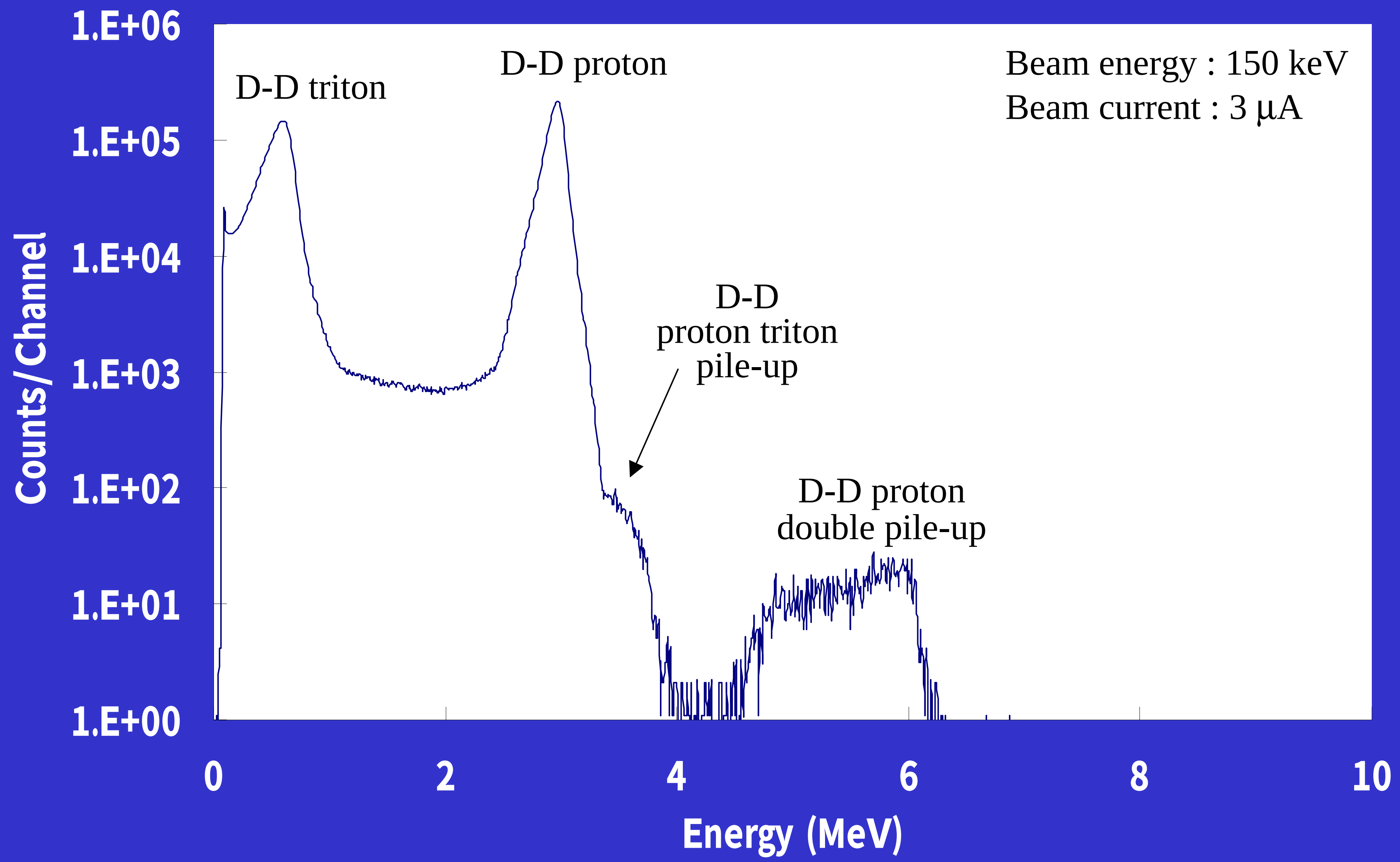
PdDx is coated with Cu.



Energy spectra measured with HPGe under electron irradiation (PdDx : x = 0.7)



Schematic view of the experimental setup of the D^+ beam implantation



Energy spectrum measured with SSBD under D^+ beam implantation

(PdDx is coated with Cu. (x = 0.7) The thickness is about 0.1 μm)

Conclusion

- Measurements of charged particles, X-rays and γ-rays were performed under electron beam irradiation to highly D-loaded metals.

- Anomalous continuous spectra which were obviously differ from of background were obtained by two identical CdTe detectors in the run using PdDx as a target.

- We try to cover PdDx with metal oxide layer to prevent trapped deuterium releasing out and to produce focal points in different metal interfaces.