



Flerov Laboratory of Nuclear Reactions
Joint Institute for Nuclear Research
Dubna

CRC
Louvain-la-Neuve



Université catholique de Louvain
Centre de Recherches du Cyclotron
Louvain-la-Neuve

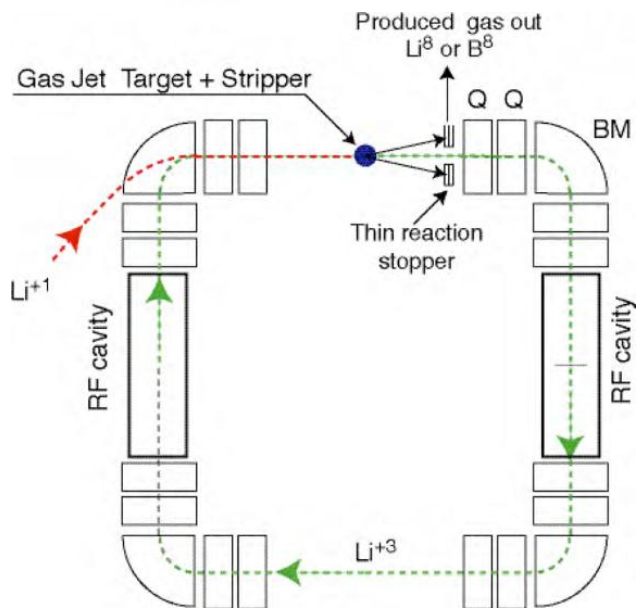
Collection device for Li-8 and B-8.



Semen Mitrofanov
Marc Loiselet
Thierry Delbar
Thomas Keutgen



Main idea - "Beam cooling with ionisation losses" - C. Rubbia, A Ferrari, Y. Kadi and V. Vlachoudis in NIM A 568 (2006) 475-487



* From Rubbia.

Inverse kinematics !!!

${}^7\text{Li} + \text{D} \rightarrow {}^8\text{Li} + \text{p}$ - Beam: Li-7, target: D - gas

${}^6\text{Li} + {}^3\text{He} \rightarrow {}^8\text{B} + \text{n}$ - Beam: Li-6, target: ${}^3\text{He}$ - gas

Li-8 : β^- decay, antineutrino source

B-8 : β^+ decay, neutrino source

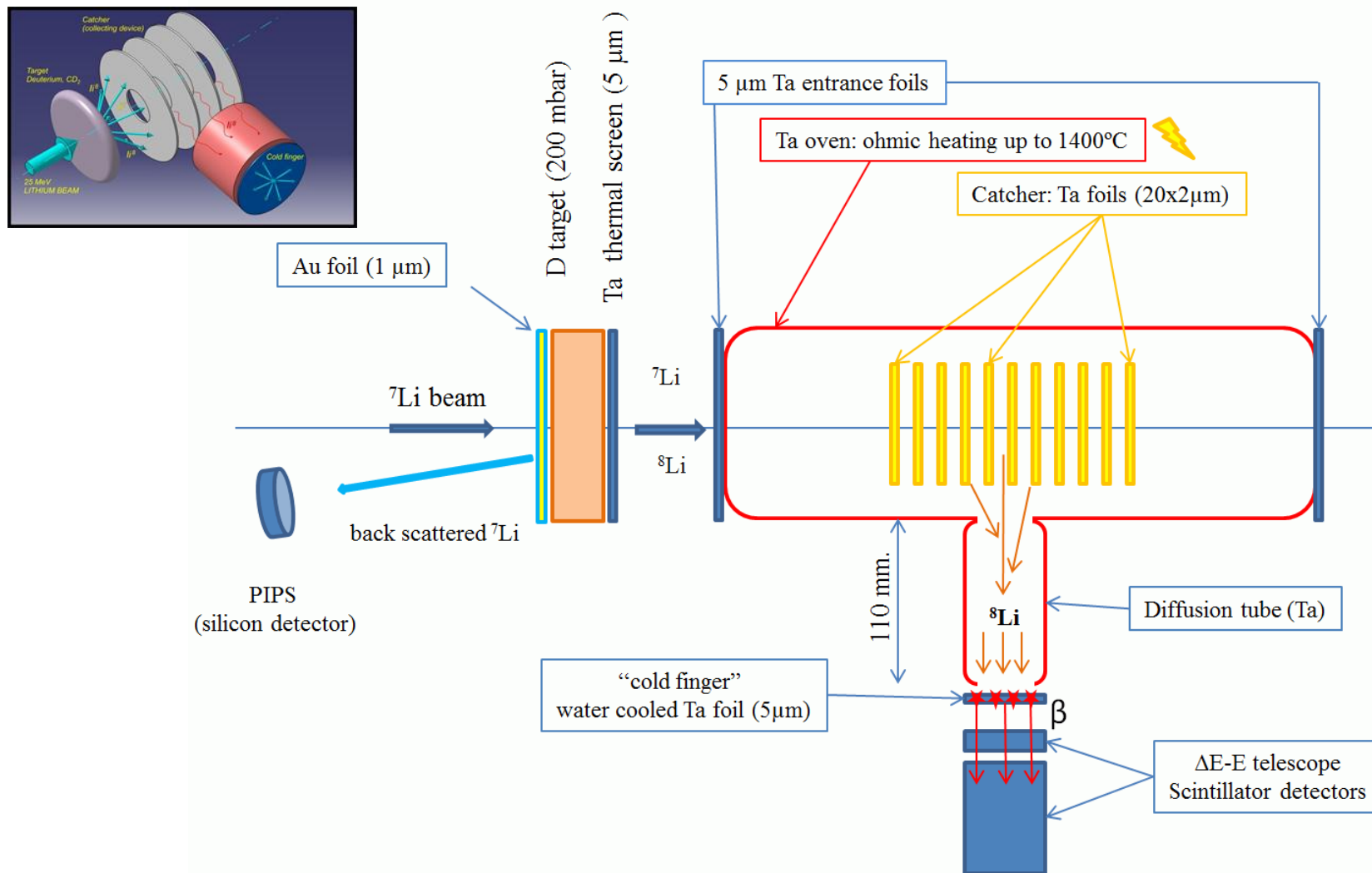
Collection device task:

- ✓ To slow down , stop and extract Li-8 or B-8 produced in the gas target.
- ✓ Extraction of Li-8 is known, but B-8 was never extracted.
- ✓ Is it possible to extract B-8 ???

Experiment setup



Scheme: beam→target→collection device→diffusion + effusion→ detection





Planning

Step 1.

- Test of the detection system without collection device (Li-8).

Step 2.

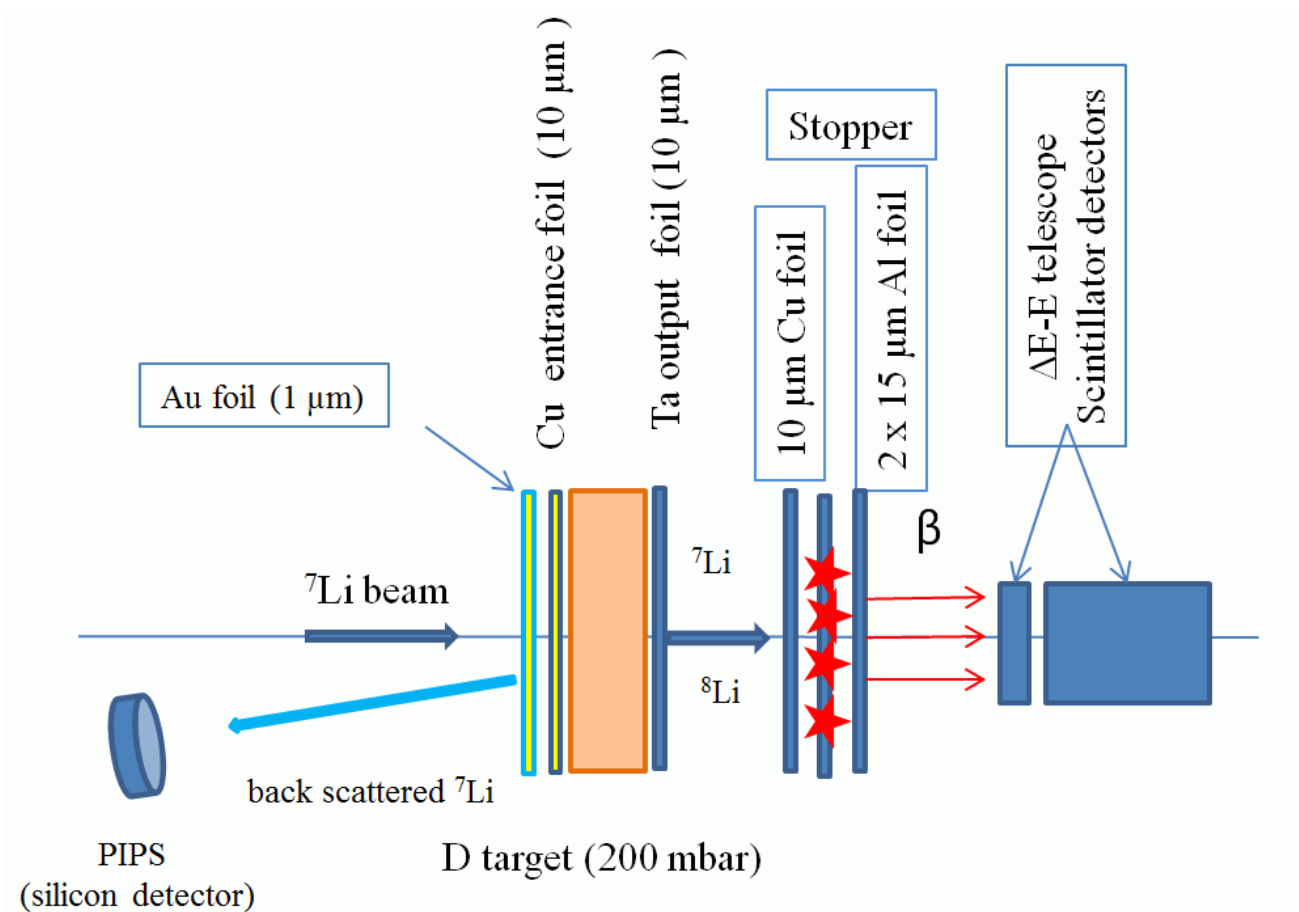
- Test of the collection device with Li-8.

Step 3.

- Extraction of B-8

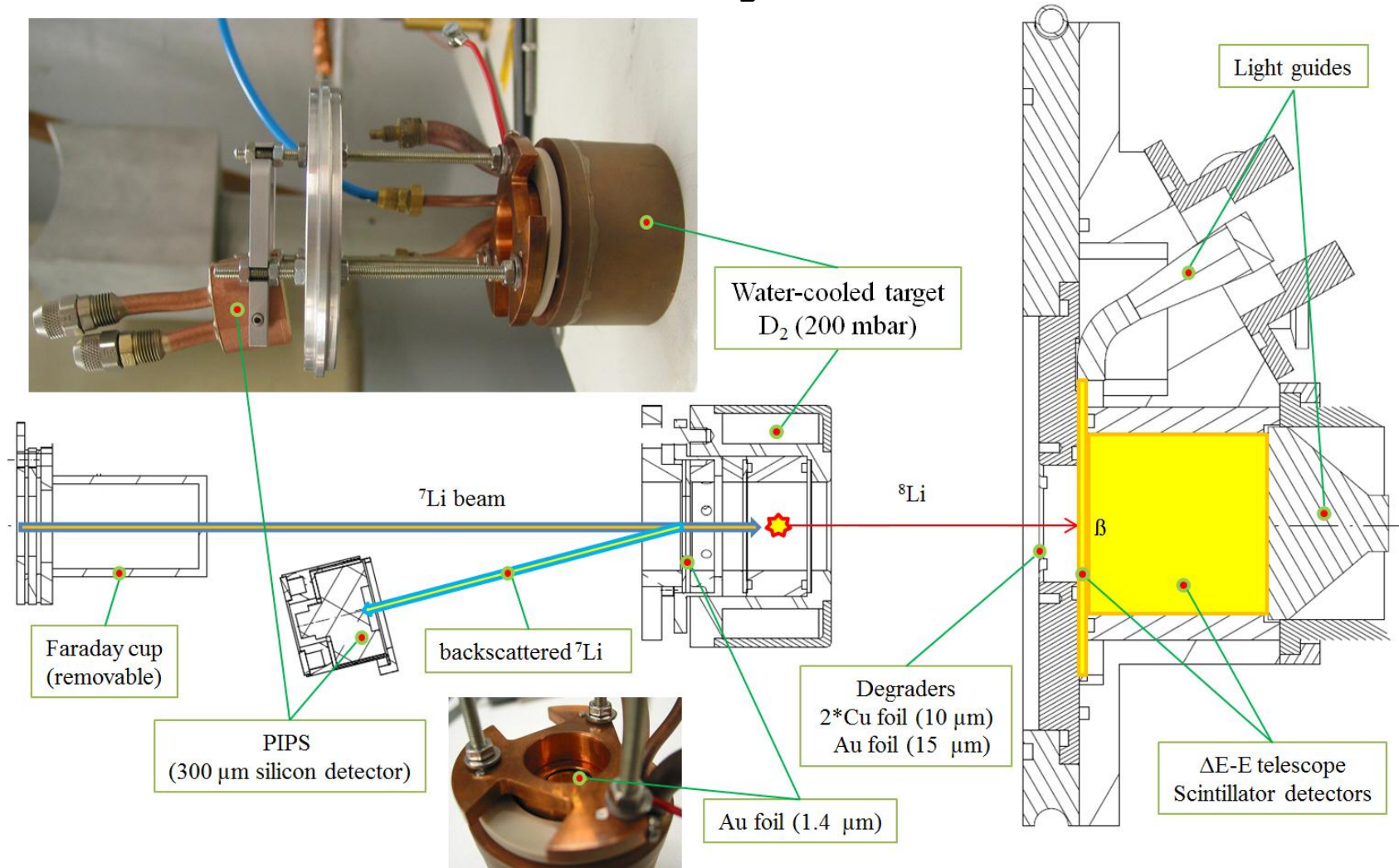
Step 1. Test of the detection system without collection device

Scheme: beam \rightarrow target \rightarrow stopper \rightarrow ^8Li detection

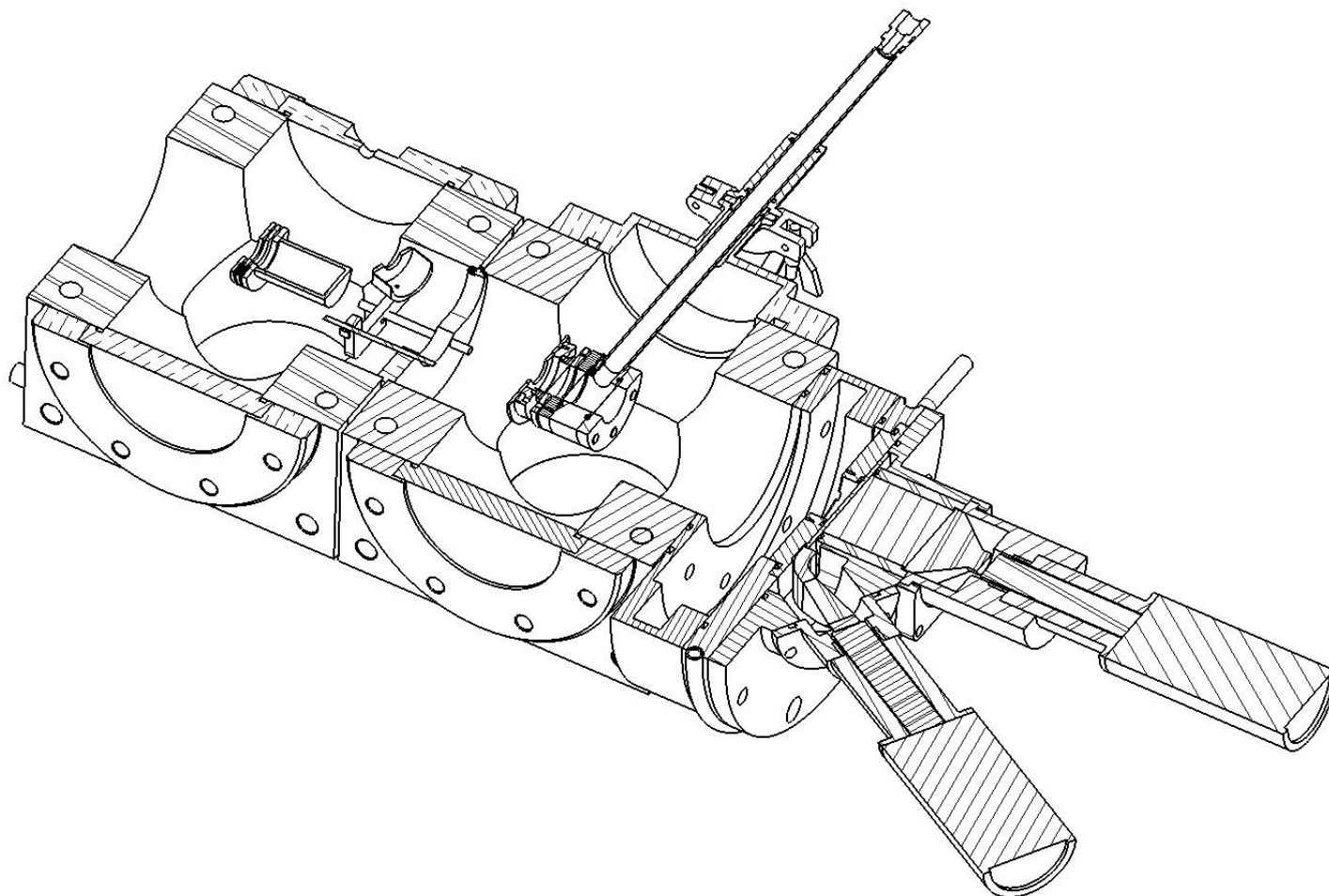


Step 1. Test of the detection system without collection device

Scheme: beam \rightarrow target \rightarrow ^8Li detection

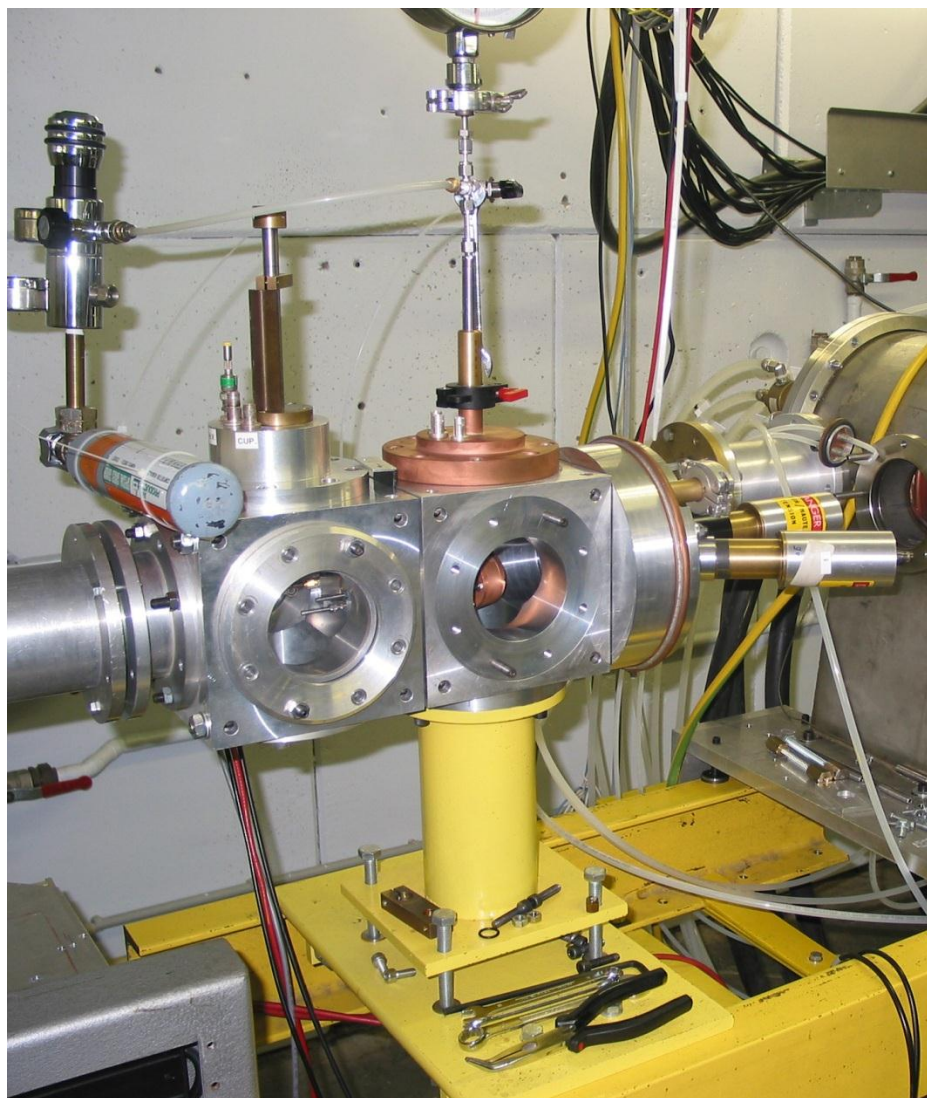


Technical drawing....



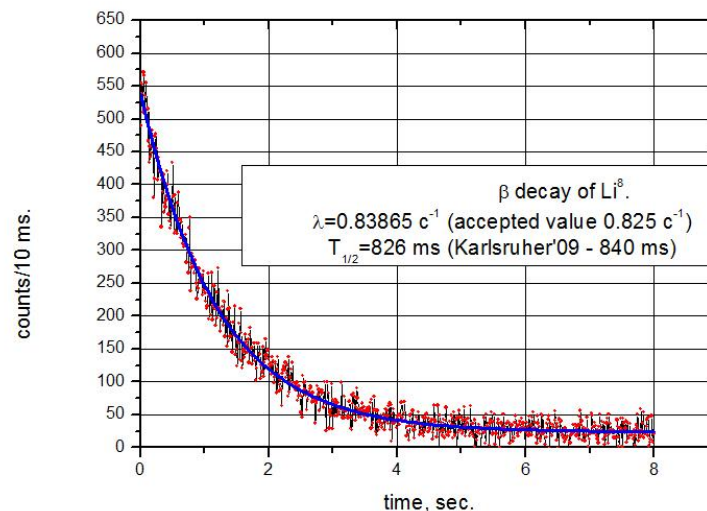
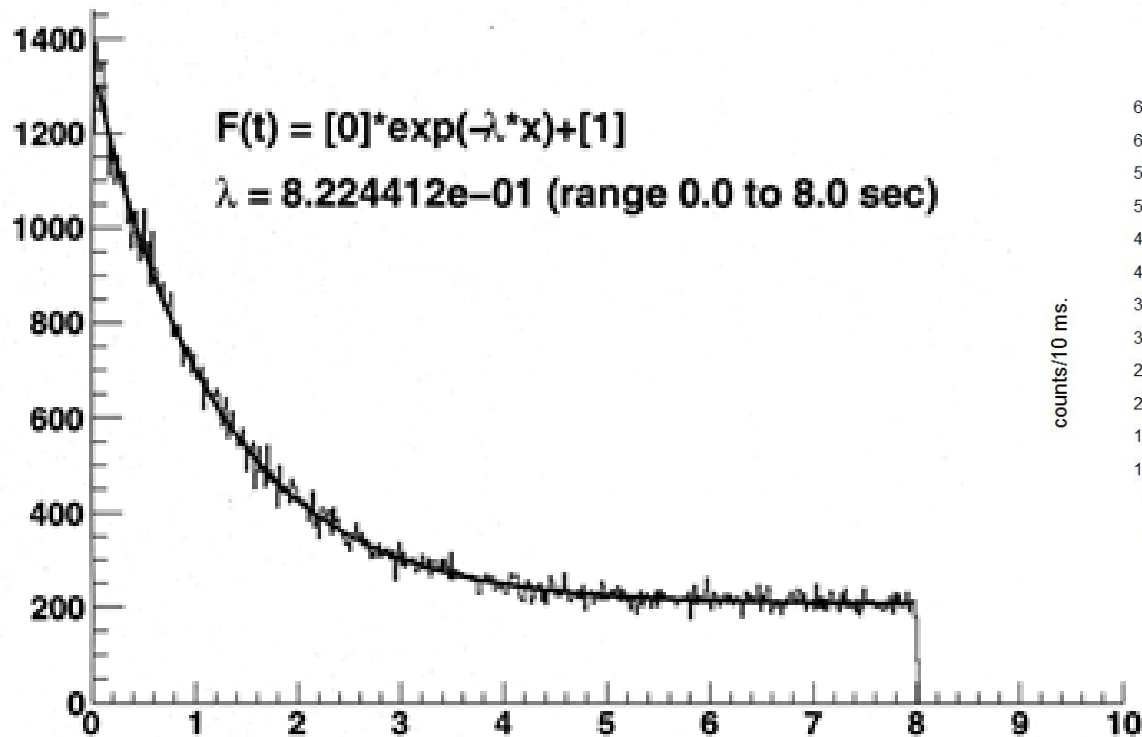
Isometric view
Scale: 1:1

In the Igloo....



Step 1. Test of the detection system without collection device. Li-8 decay curve.

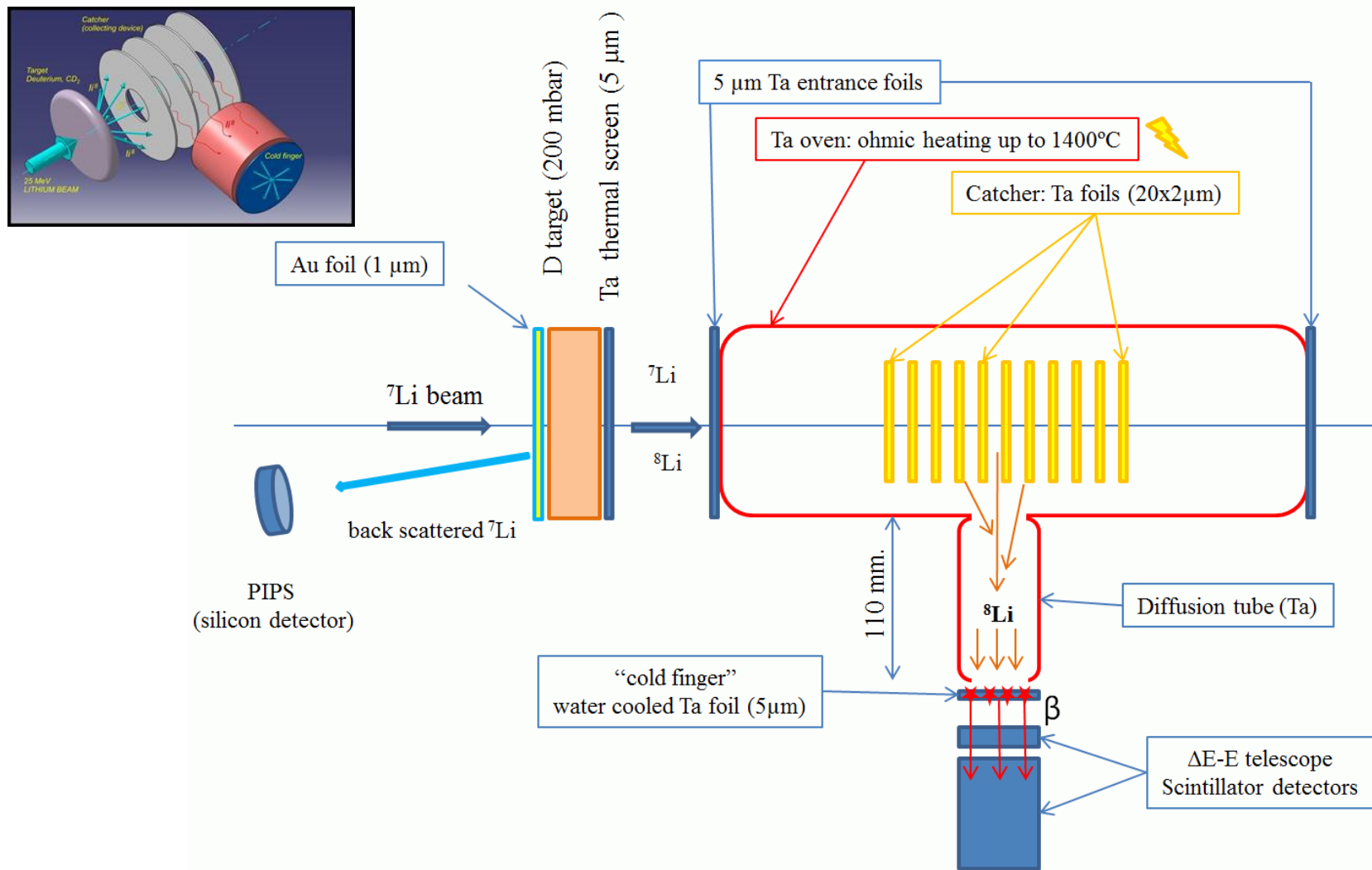
Time (sec) RUN 83



Our detection system is working properly !

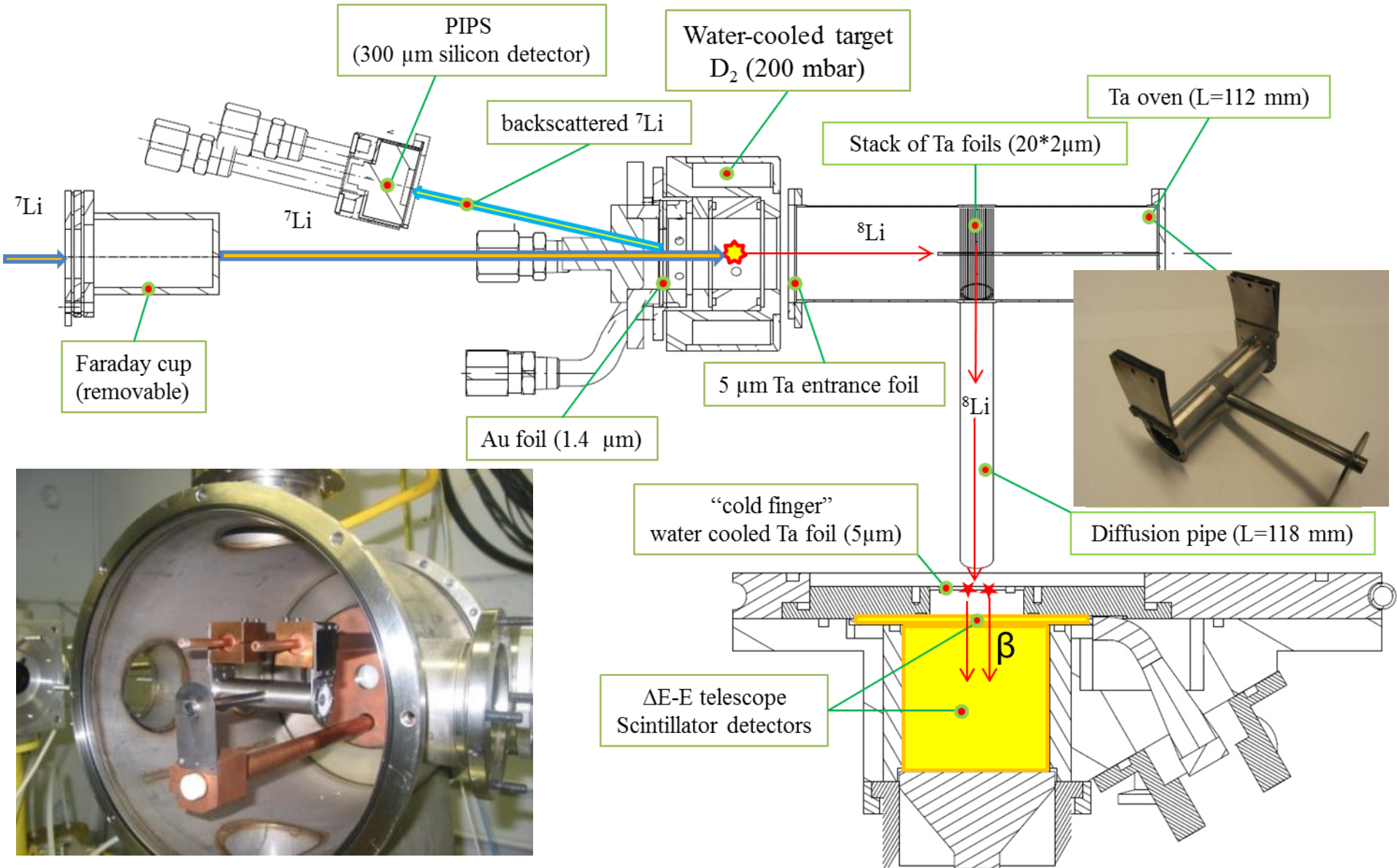
Step 2. Test of the collection device with Li-8.

Scheme: beam→target→collection device→diffusion + effusion→ ^8Li detection

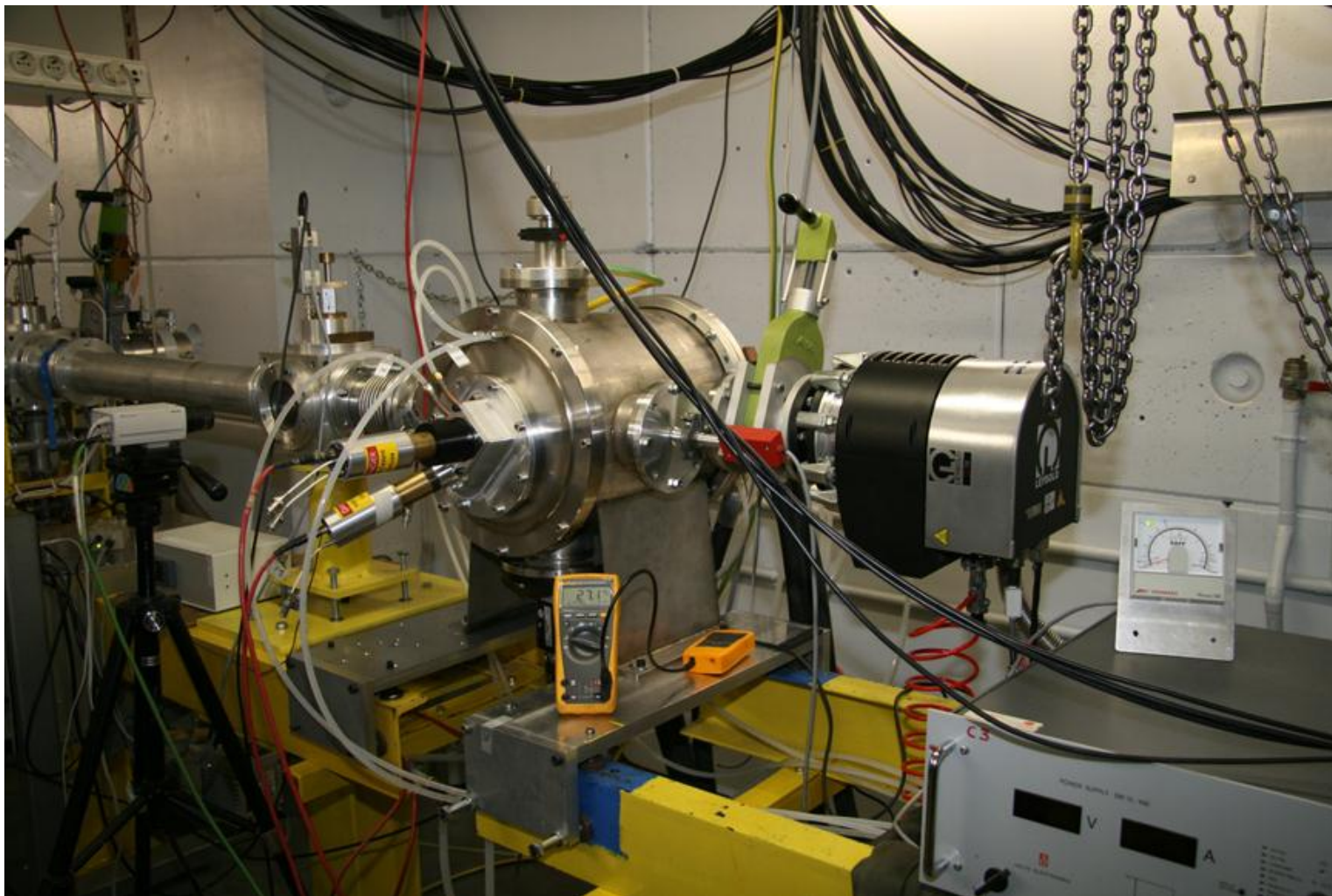


Step 2. Test of the collection device with Li-8.

Scheme: beam->target->collection device->diffusion + effusion-> ^8Li detection

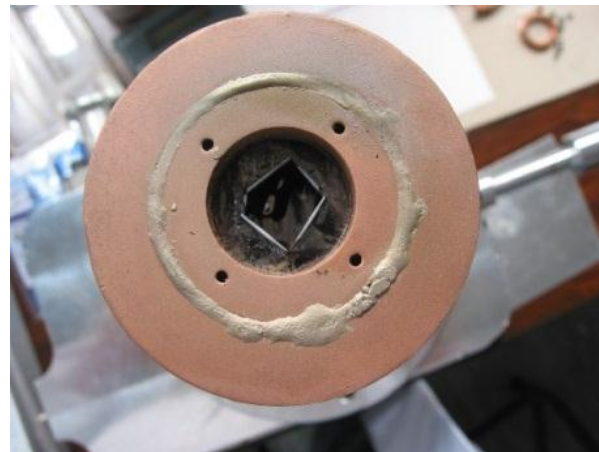
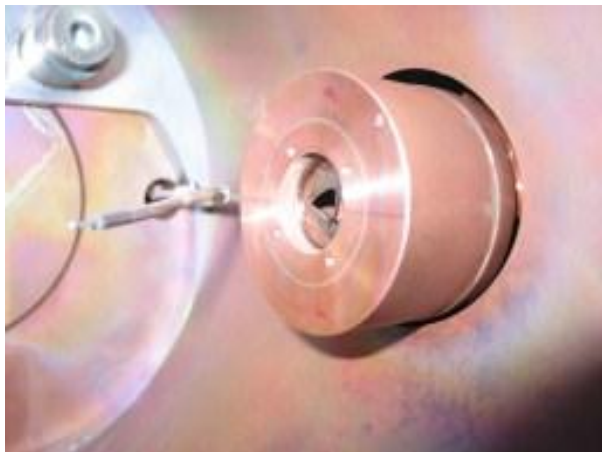


In the Igloo...

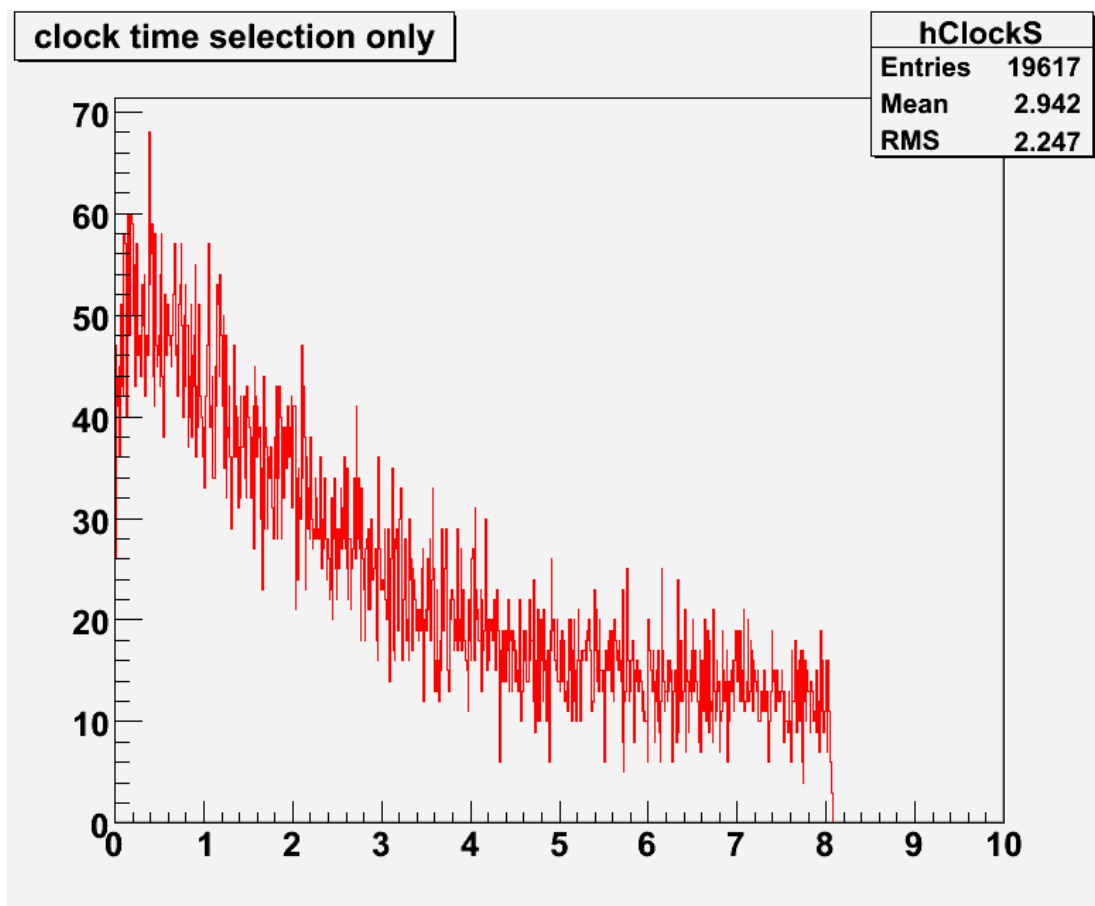


Difficulties....

- It is very difficult to keep a gas target close to the hot collector device (over 1500°C)
- Gas target = gas cell + pressure windows
- Reliable Ta-foil (gas cell windows) are not available. Each foil had to be tested individually. In spite of these tests, the windows are not reliable !!!
- The temperature of the collection device has to be limited (up to 1500°C).



Li-8 extracted from the collection device

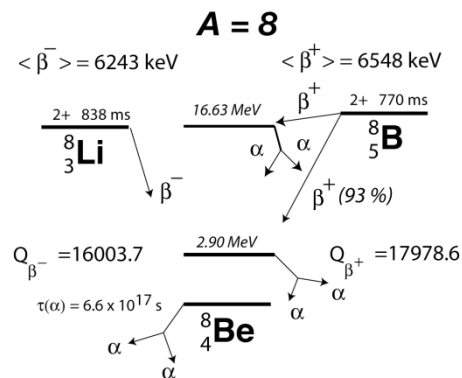


Our collection device is working !

Step3. Extraction of B-8 ?



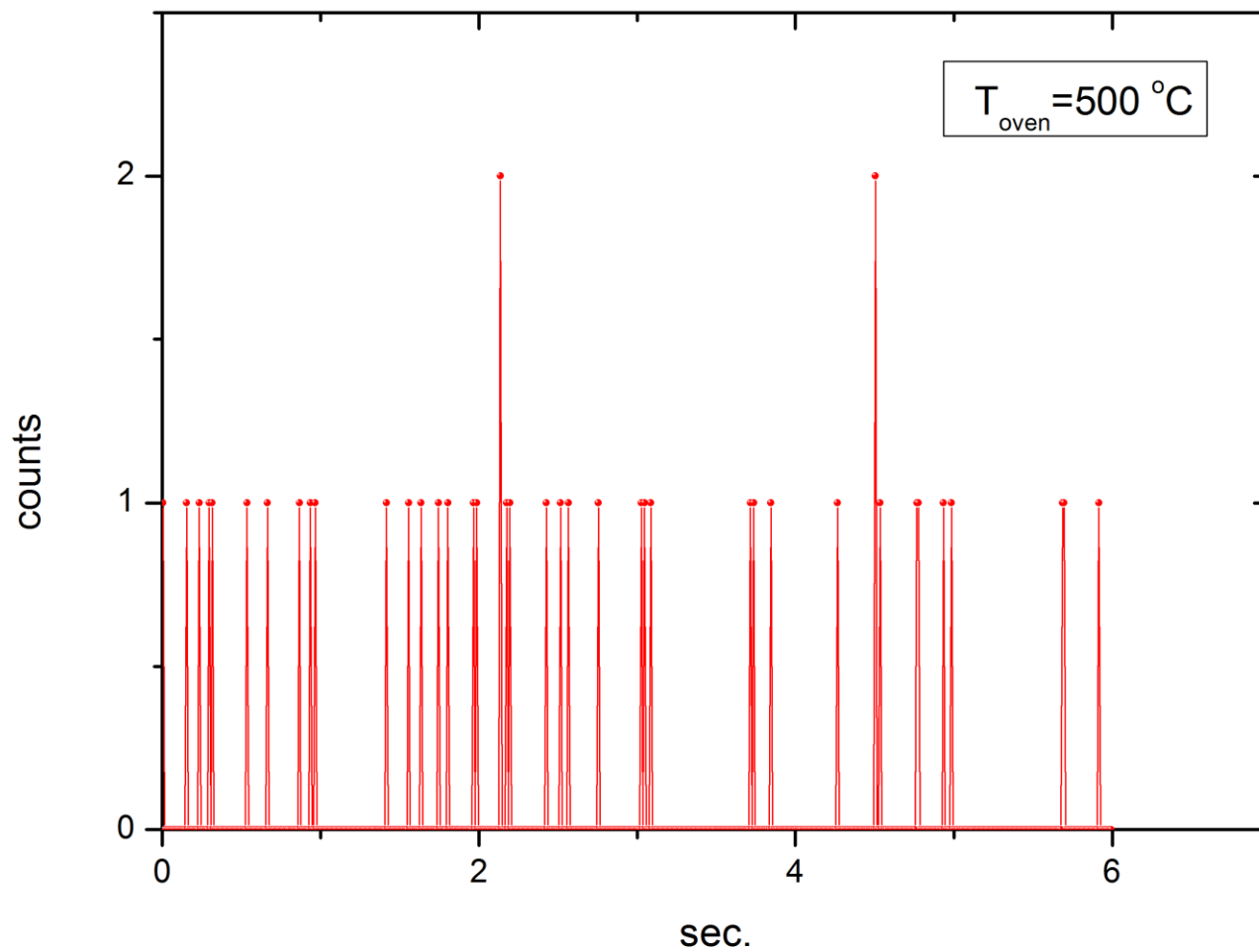
Beam: Li-6, target: ${}^3\text{He}$ - gas



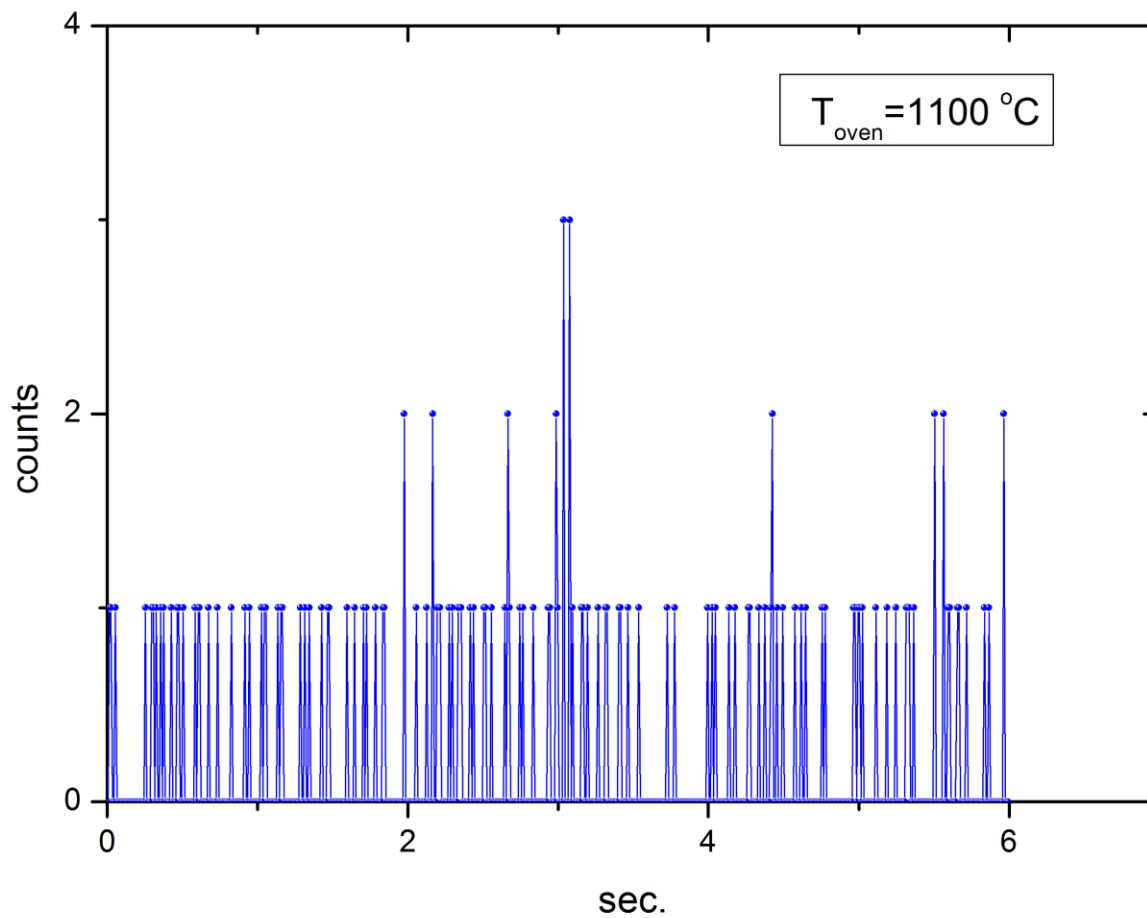
Boron... Cross-section is lower in 20 times.... Natural Li-6 - less than 10%.

Is it possible to extract B-8 as an element like Li-8 was extracted ?

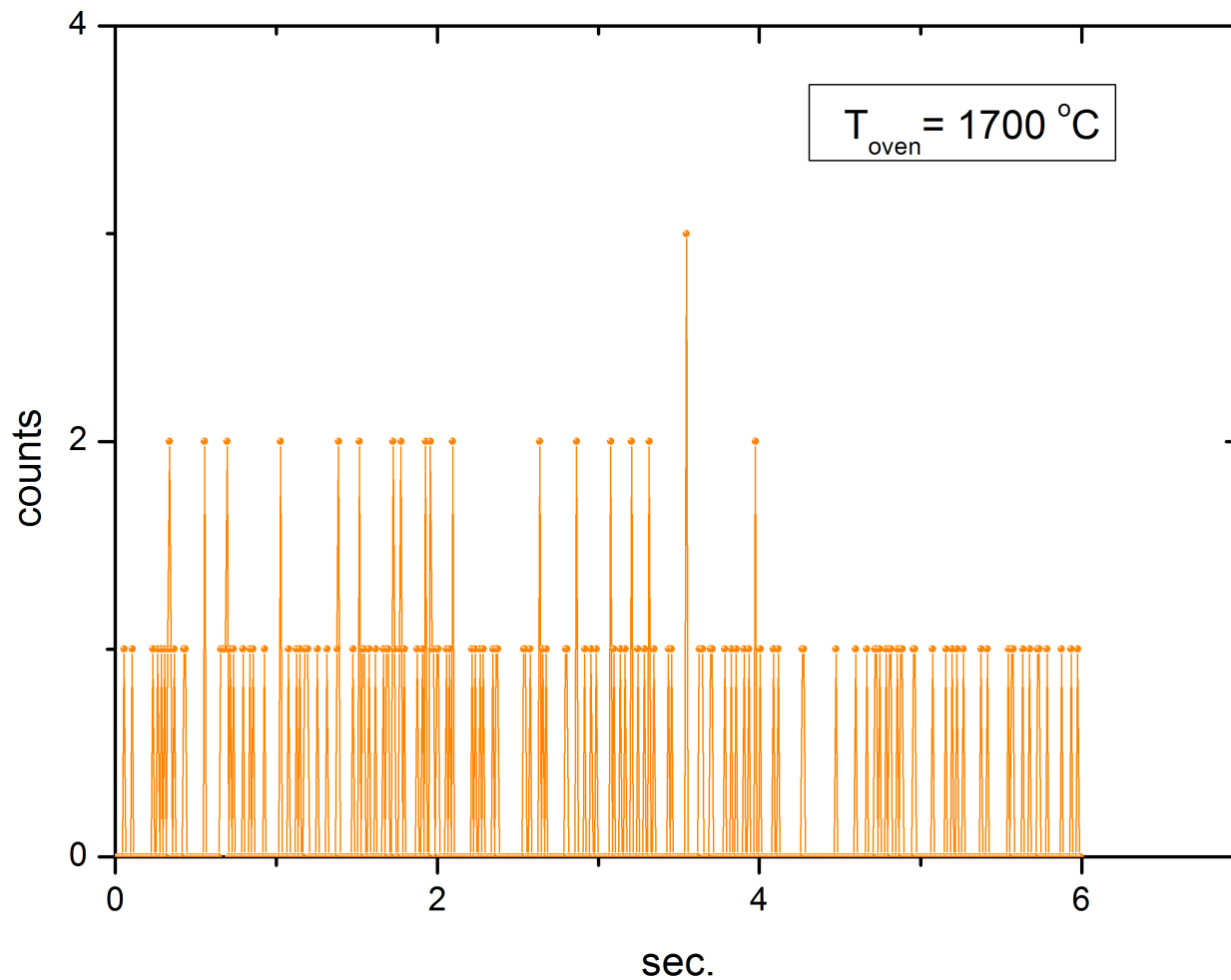
Step3. Extraction of B-8 ?



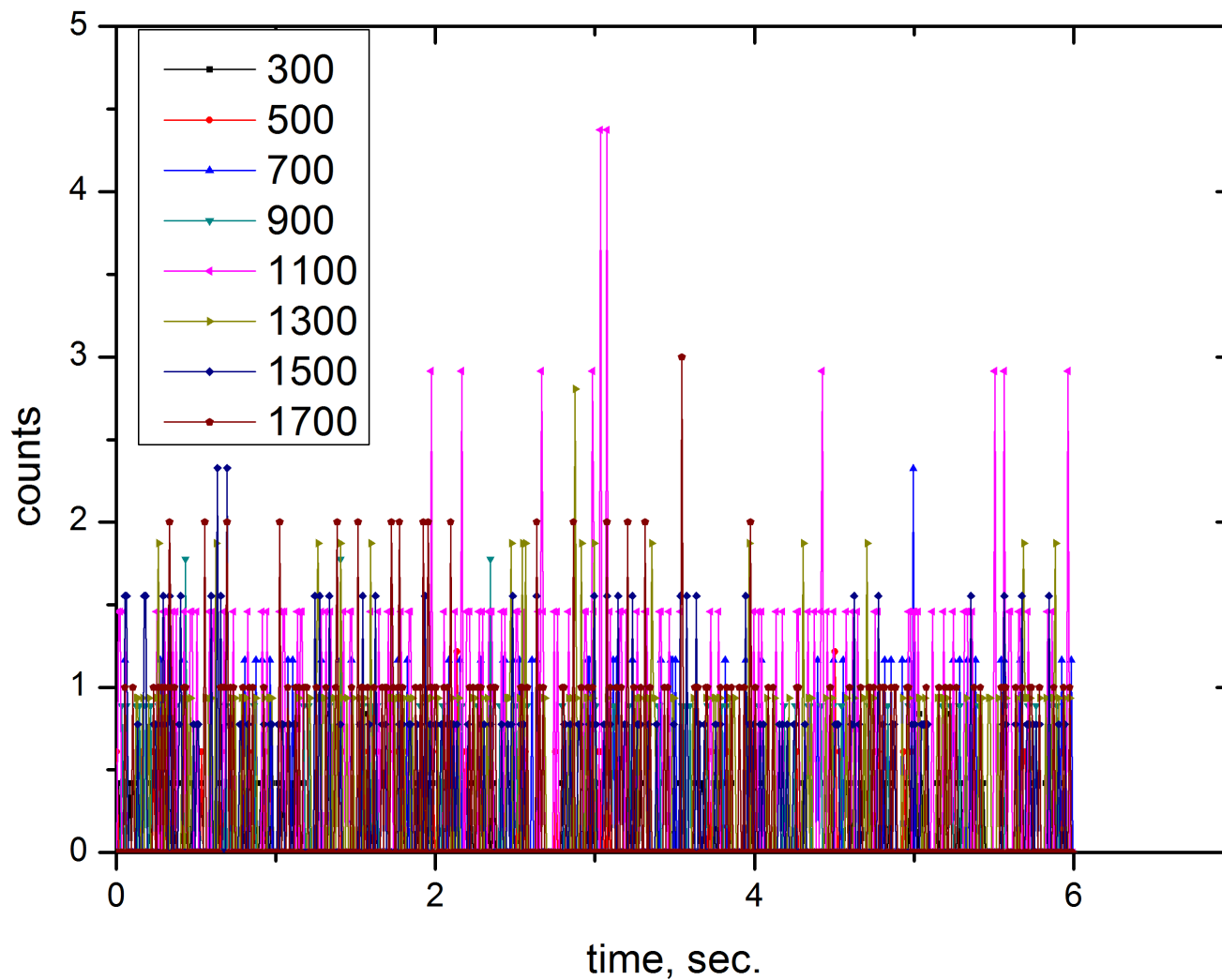
Step3. Extraction of B-8 ?



Step3. Extraction of B-8 ?



Step3. Extraction of B-8 ?



Conclusion for B-8 .

- We measured "0" extraction efficiency for B-8 but we will double check with Li-8 again to be sure there is no "bug".
- If the extraction efficiency for B-8 is indeed "0" what is the difference between Li-8 and B-8 ?
- CHEMISTRY ?! Boron does not belong to the same column of the periodic table.
- There is a chemical reaction between Boron and collection device material which traps the element.

Conclusion for B-8 .

Other solution for the B-8 extraction ?

slow down B8 in AlF_3 to form 8BF_3 - which is a volatile molecule .

But for this, we will need another experimental setup...



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Thank You for Your attention



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