



irfu

Status of SEASON

Damien THISSE



October, 15th 2024



SEASON development team

Project Managers

O. Cloué (technic)

M. Vandebrouck (scientific)

Mechanical conception

S. Cazaux, P. Daniel-Thomas

Detection/Acquisition

F. Bouyjou, T. Chaminade, D. Thisse

Control & Command

A. Gaget, J. Relland, A. Roger

Electrical engineering

J. Noury, Y. Reinert

Students

E. Rey-herme, M. Ragot



Summary

Quick reminders on SEASON

Main objectives

Description of the detector

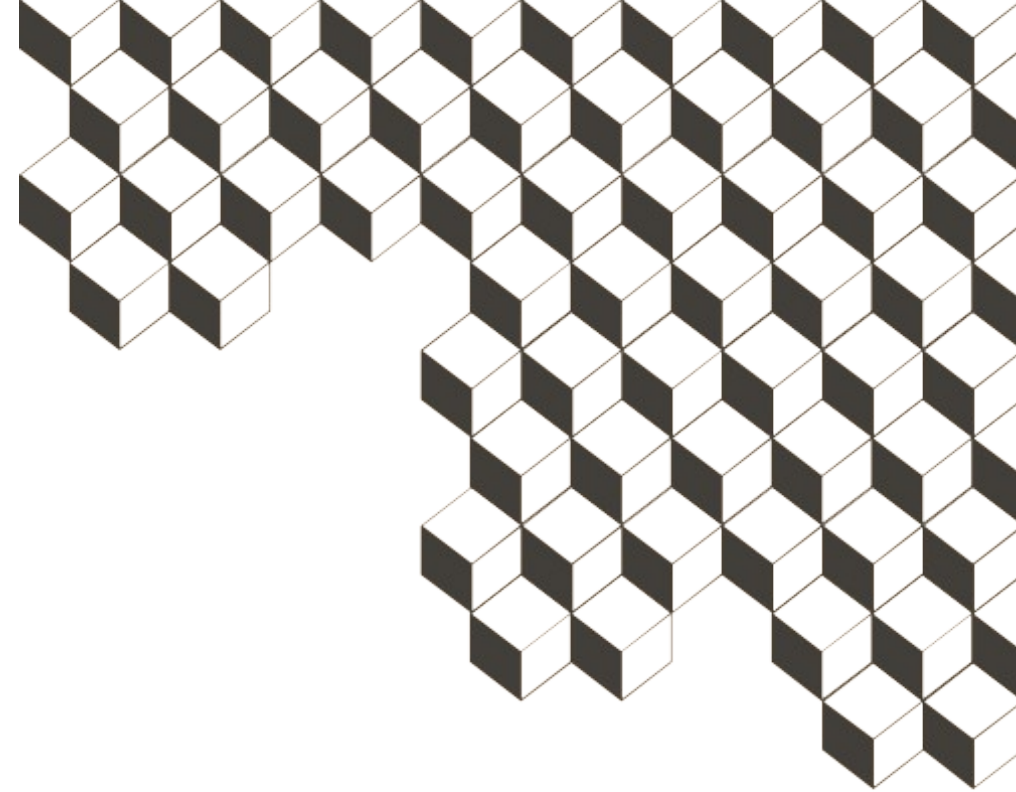
Current status of the development

Status of the mechanics

Status of the electronics

Schedule for upcoming months

Planning up to the installation in Jyväskylä



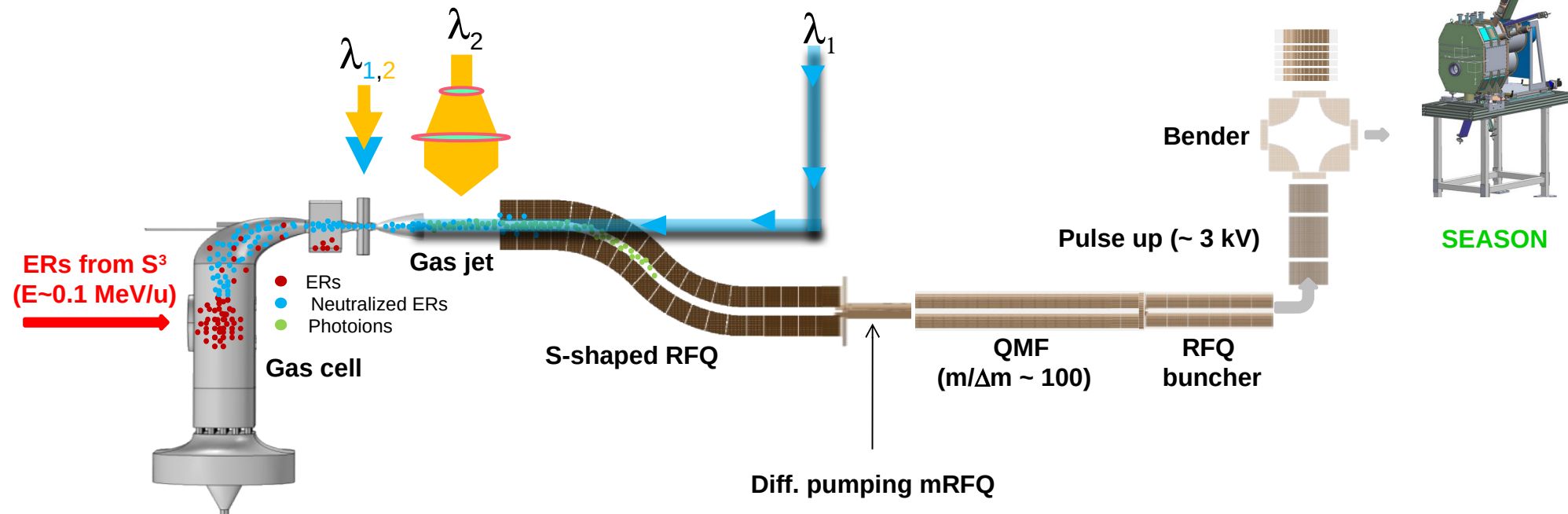
SEASON's objectives

It has been designed to be set at the end of S^3 low energy branch (LEB).

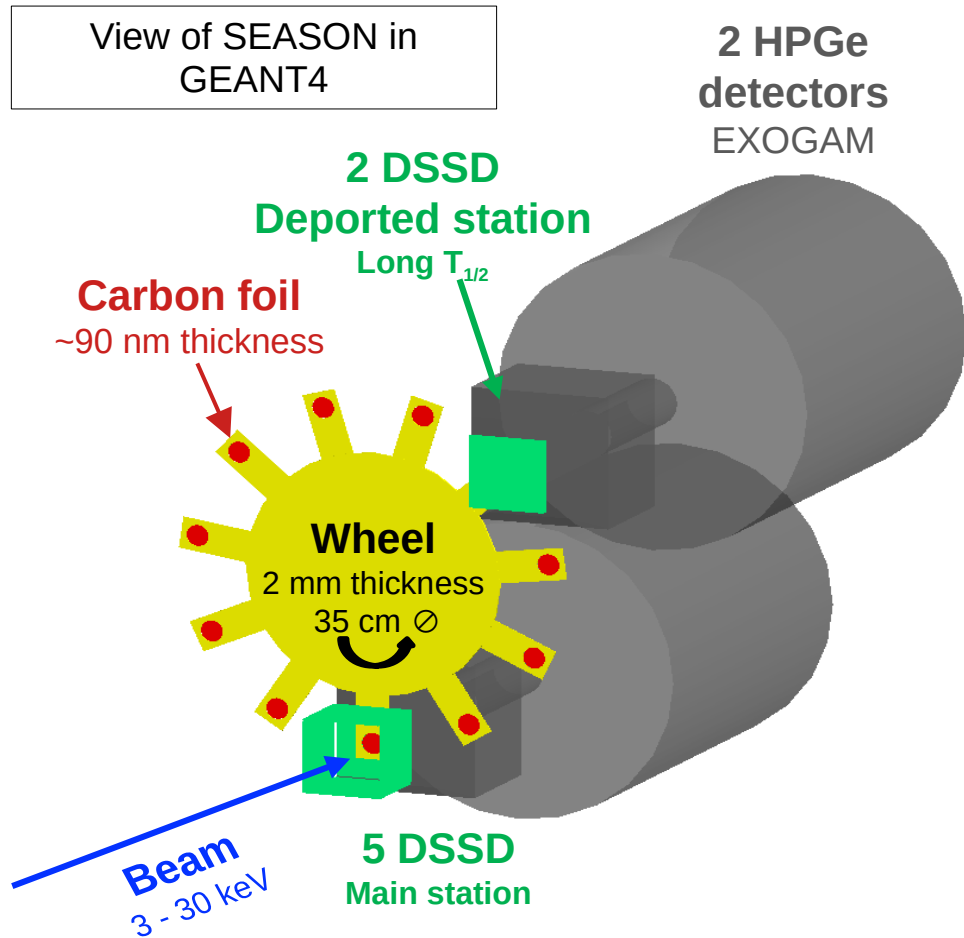
The two main purposes of SEASON@ S^3 -LEB :
Act as a **counter for laser spectroscopy**.
Perform a **detailed α - e^- - γ decay spectroscopy**.

GANIL

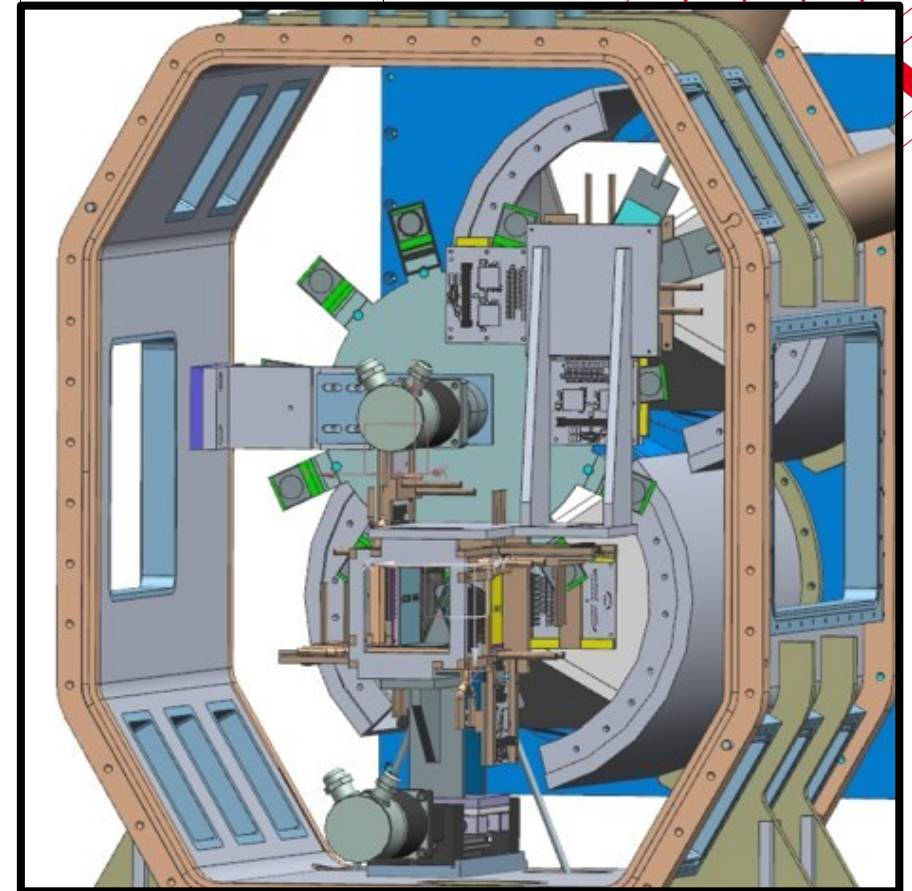
Coupling of both **nuclear and atomic approaches** to get a more complete description of the nucleus.



SEASON decay station

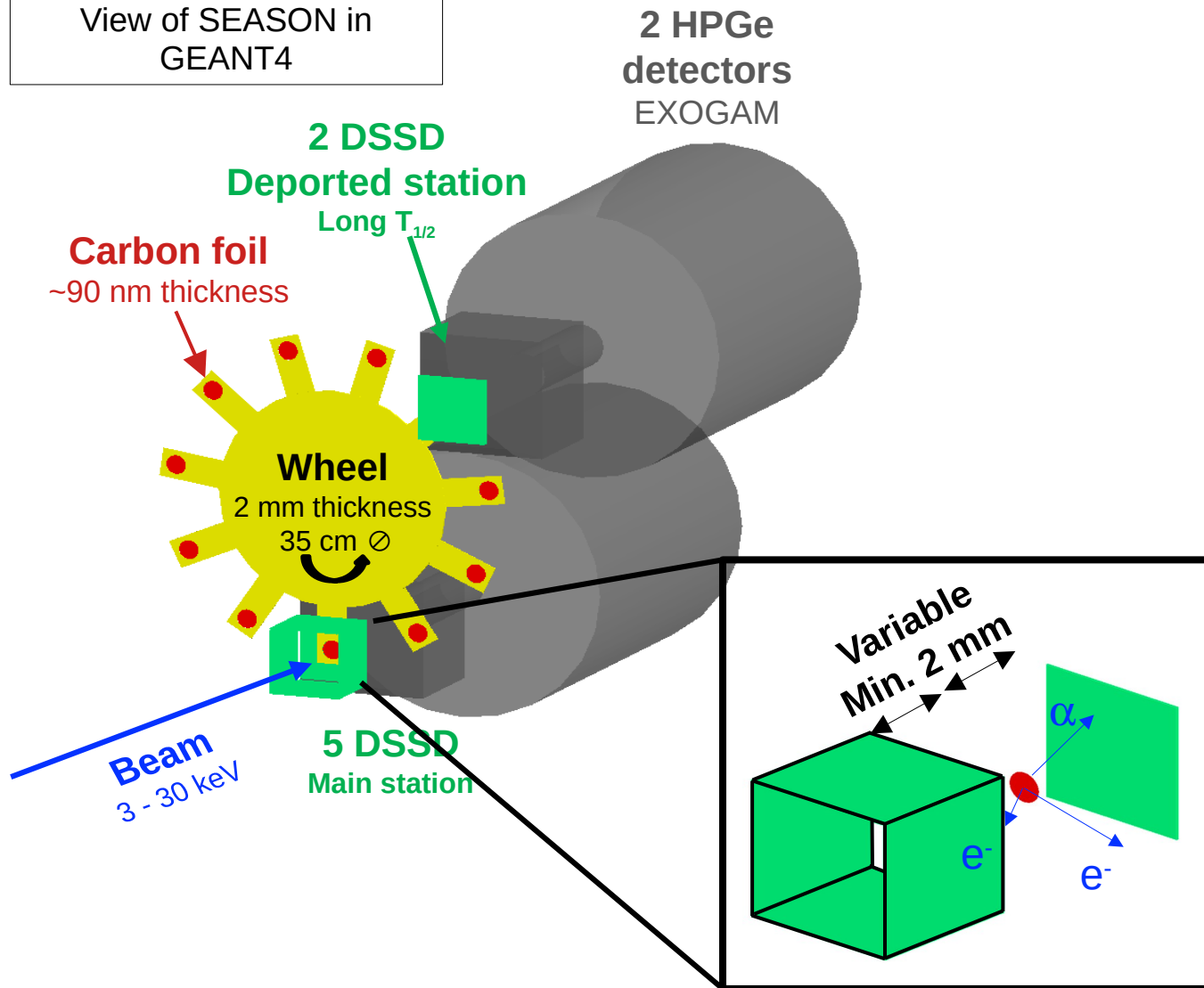


CAD of SEASON

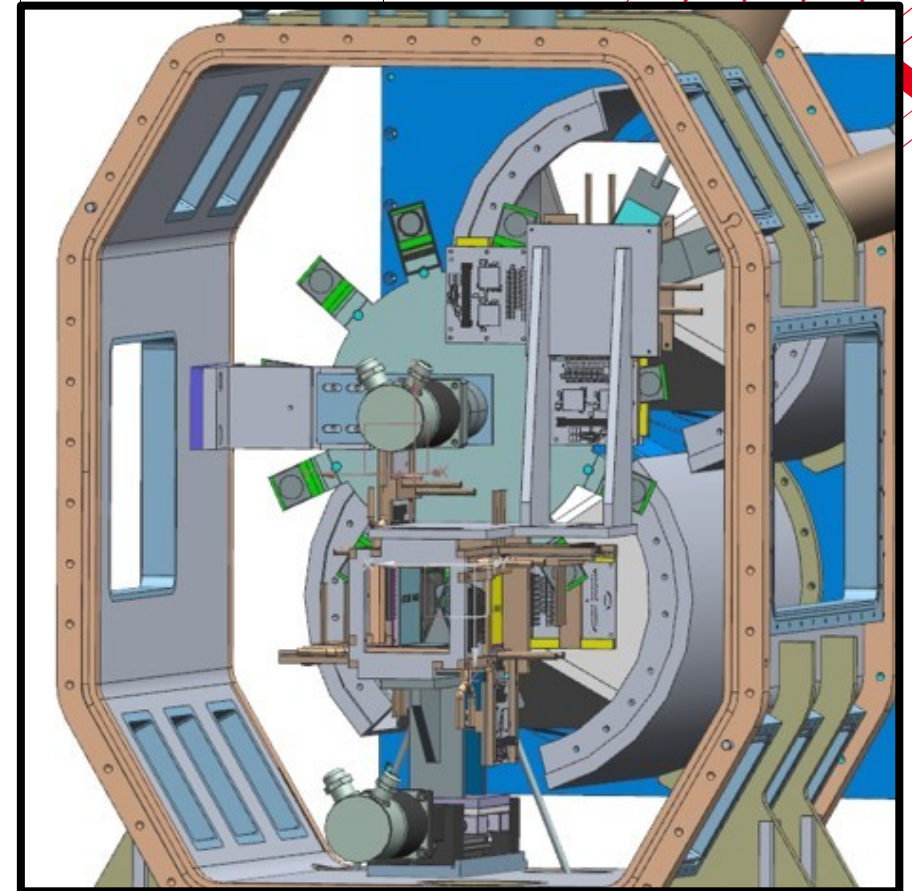


SEASON decay station

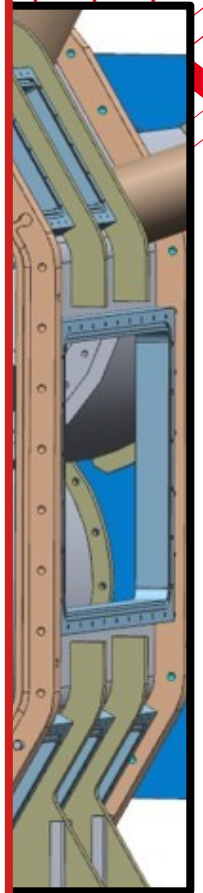
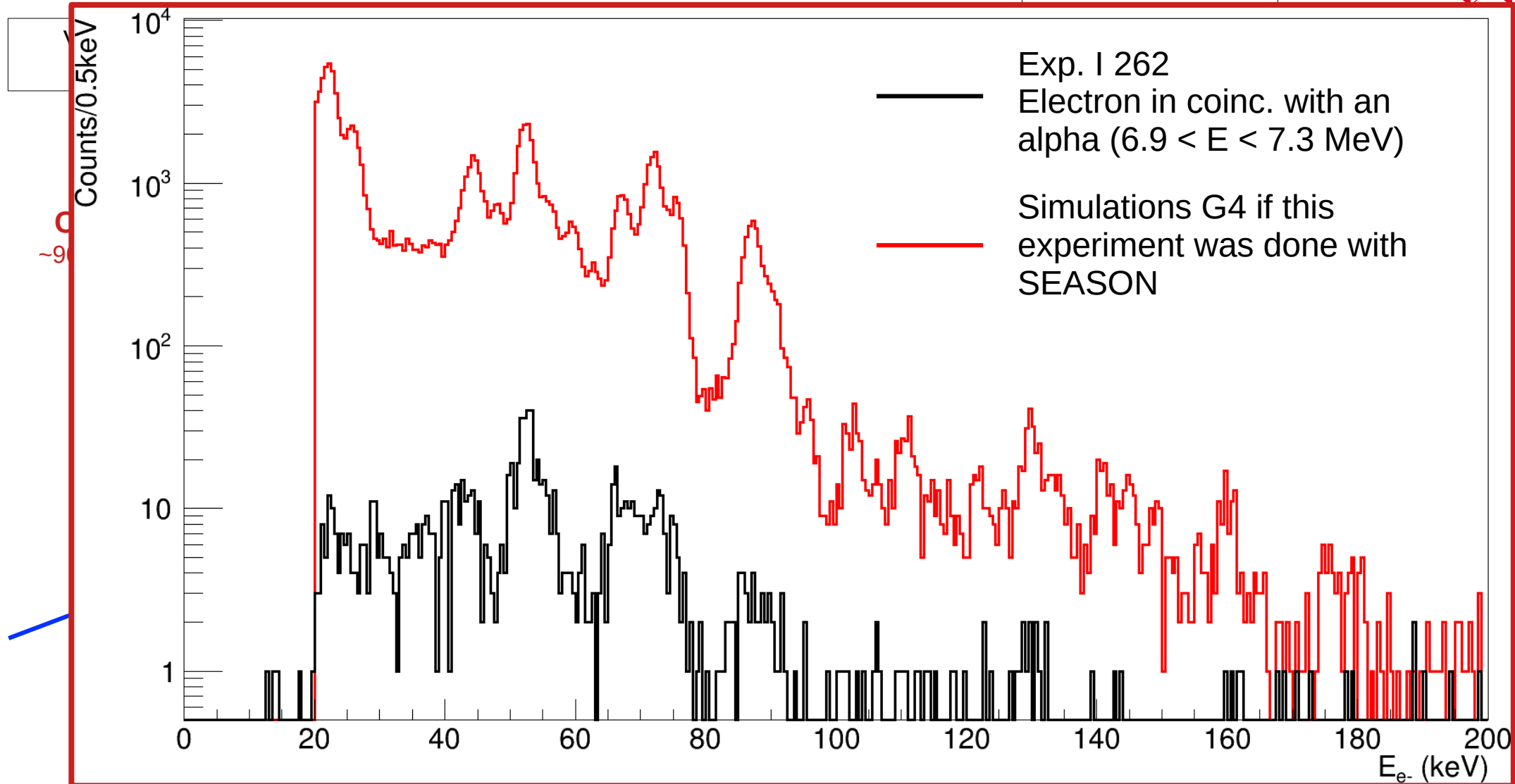
View of SEASON in GEANT4



CAD of SEASON



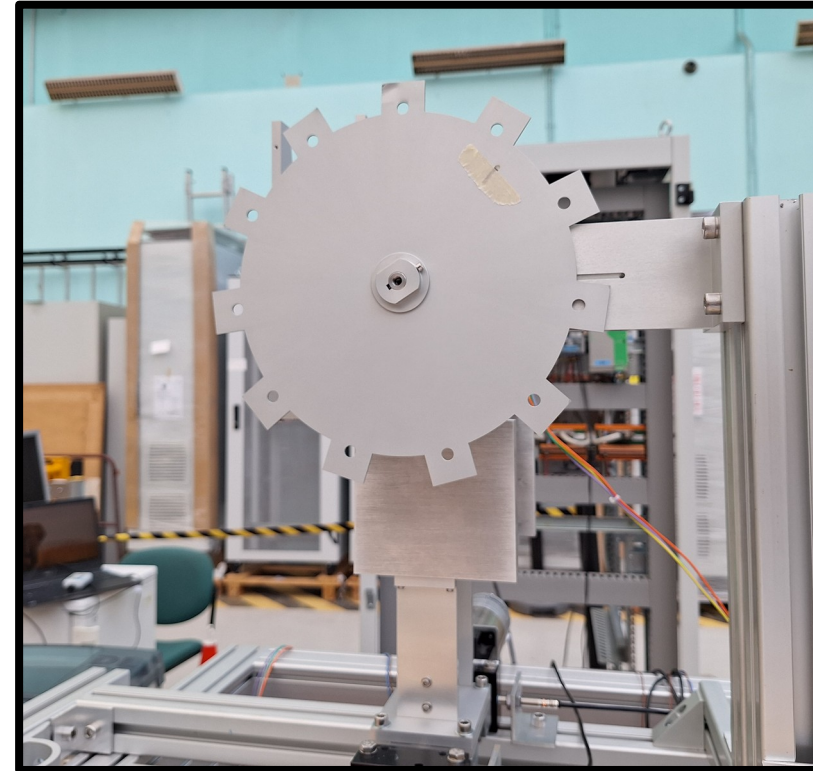
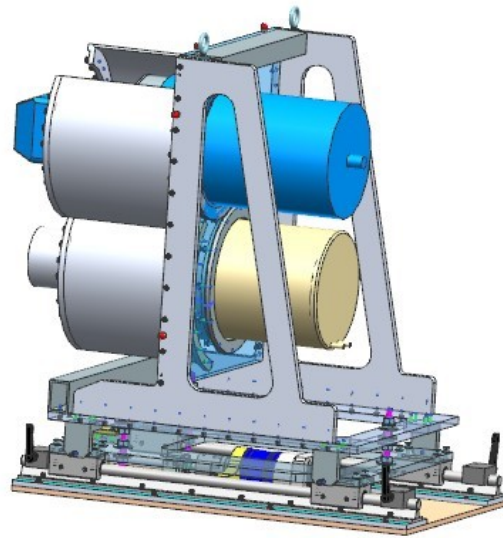
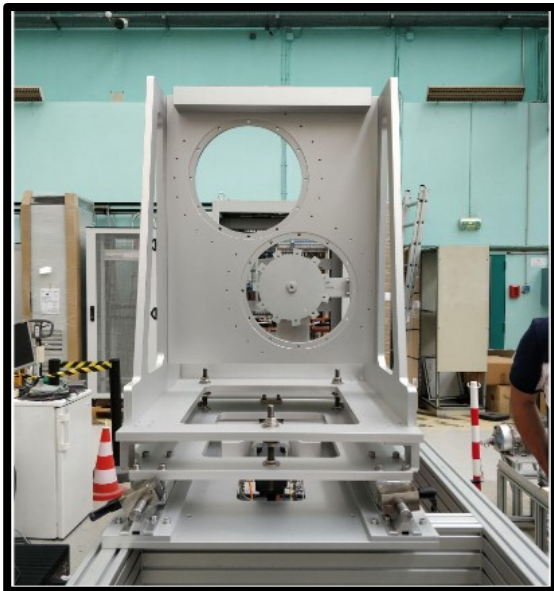
SEASON decay station



Thomas

Status of the mechanics

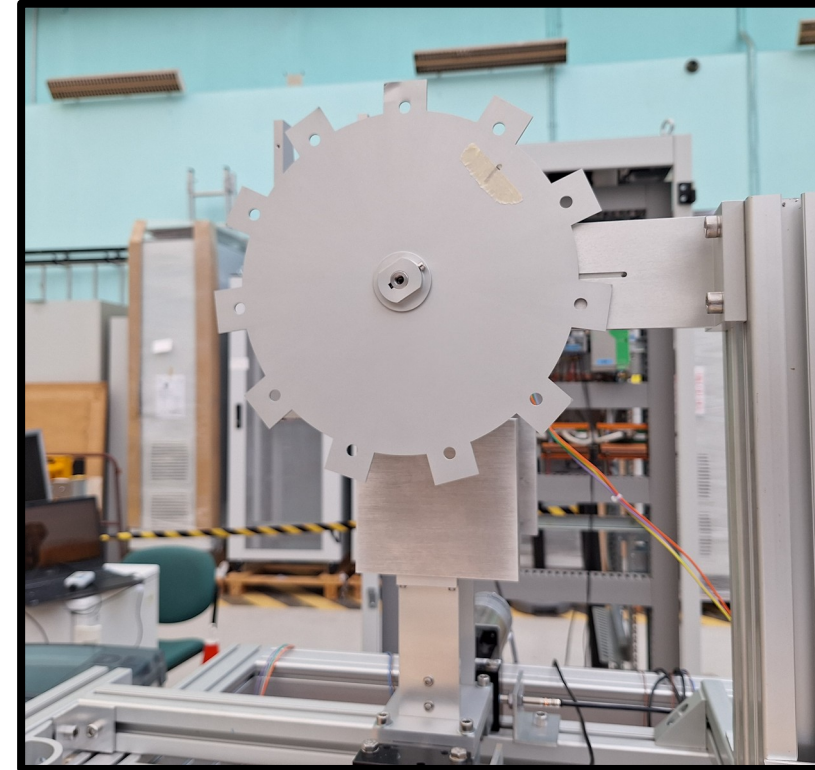
Wheel and HPGe support received and tested
Control and command being developed and tested



Status of the mechanics

Wheel and HPGe support received and tested
Control and command being developed and tested

Carbon **implantation foils** from ACF Metal (US)
Already tested twice in experiments

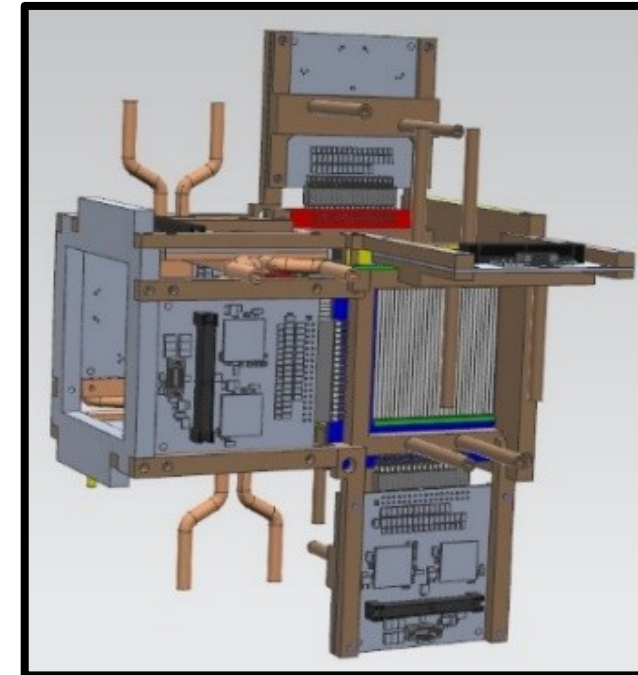
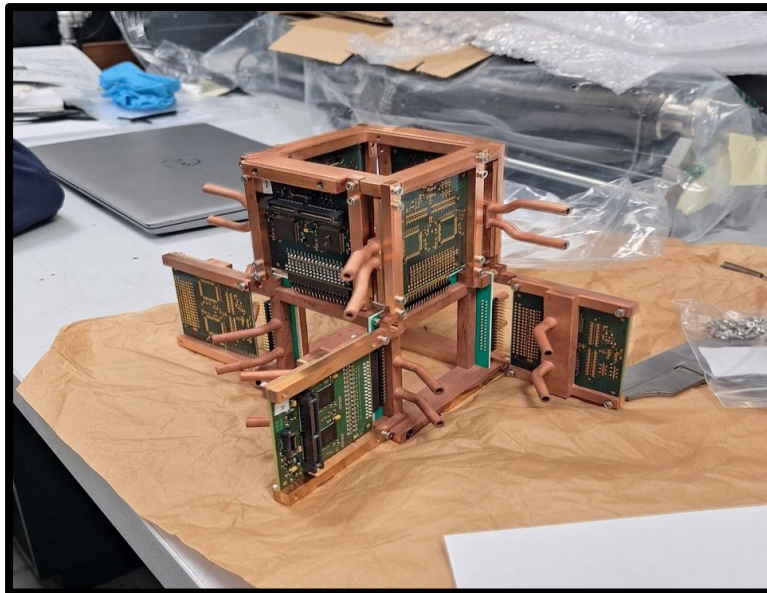


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Copper frame for the tunnel received and mounted
once (only with detectors PCBs)



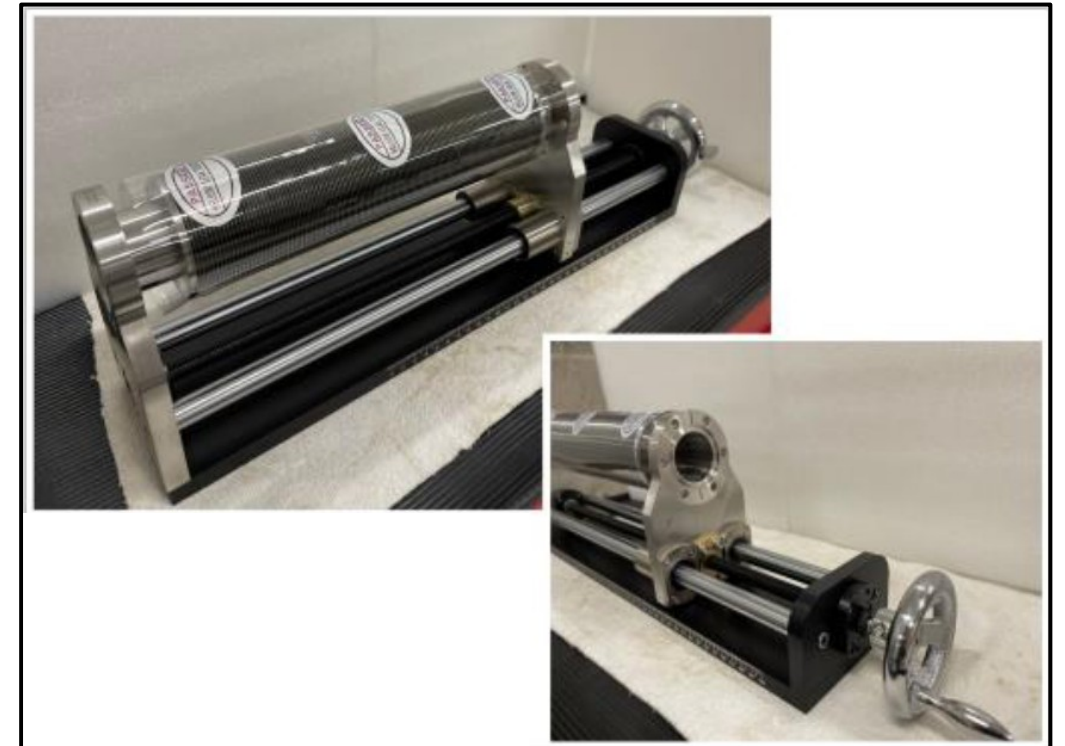
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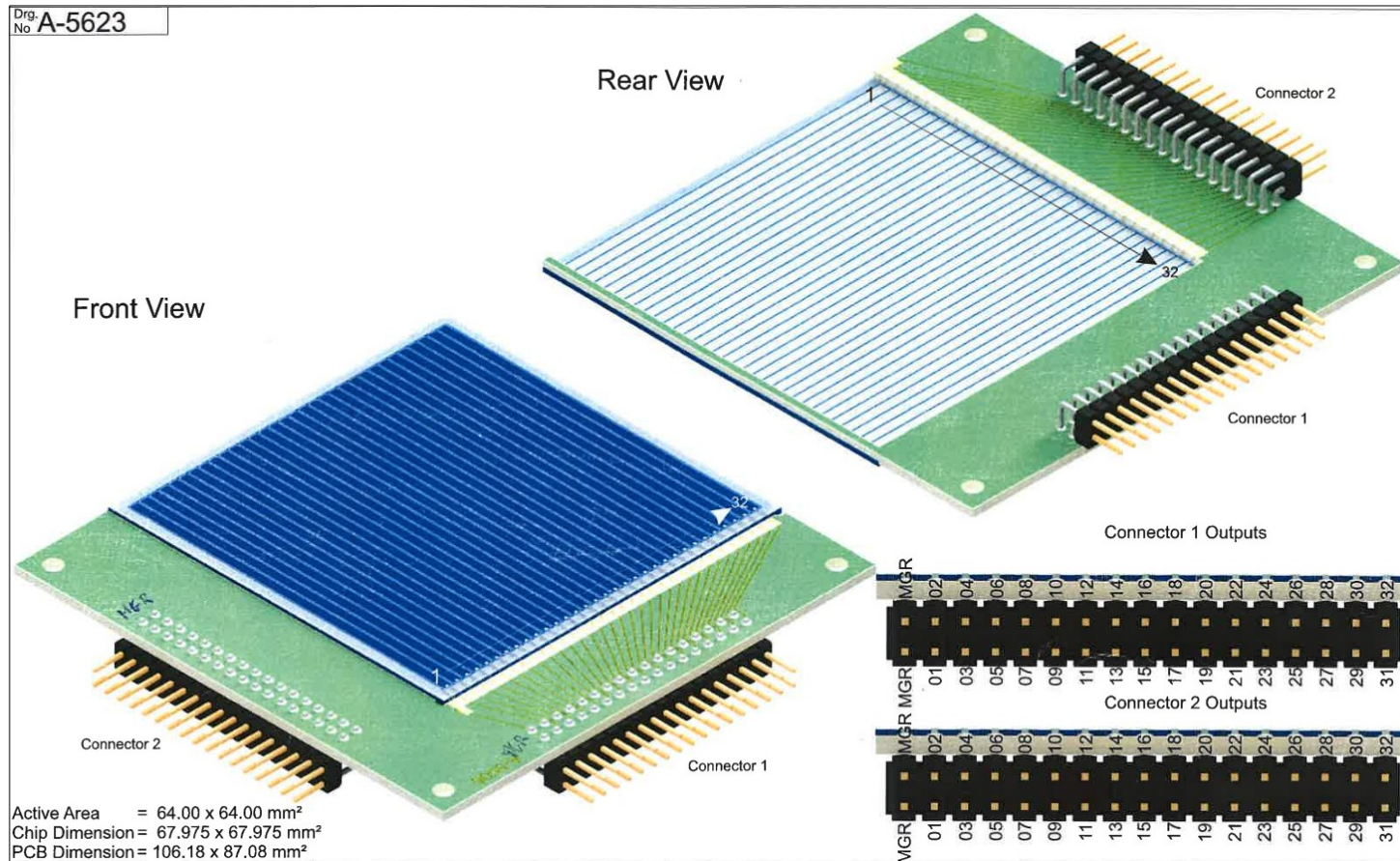
Vacuum chamber should be received this week at
CEA-Saclay



Mechanical integration can start this week or next week !

Status of the electronics

BB7 detector from Micron



Some important characteristics :

32 strips on each face
Active area : 6.4 x 6.4 cm²

Dead layer : **50 nm**
Thickness: 1037 μm

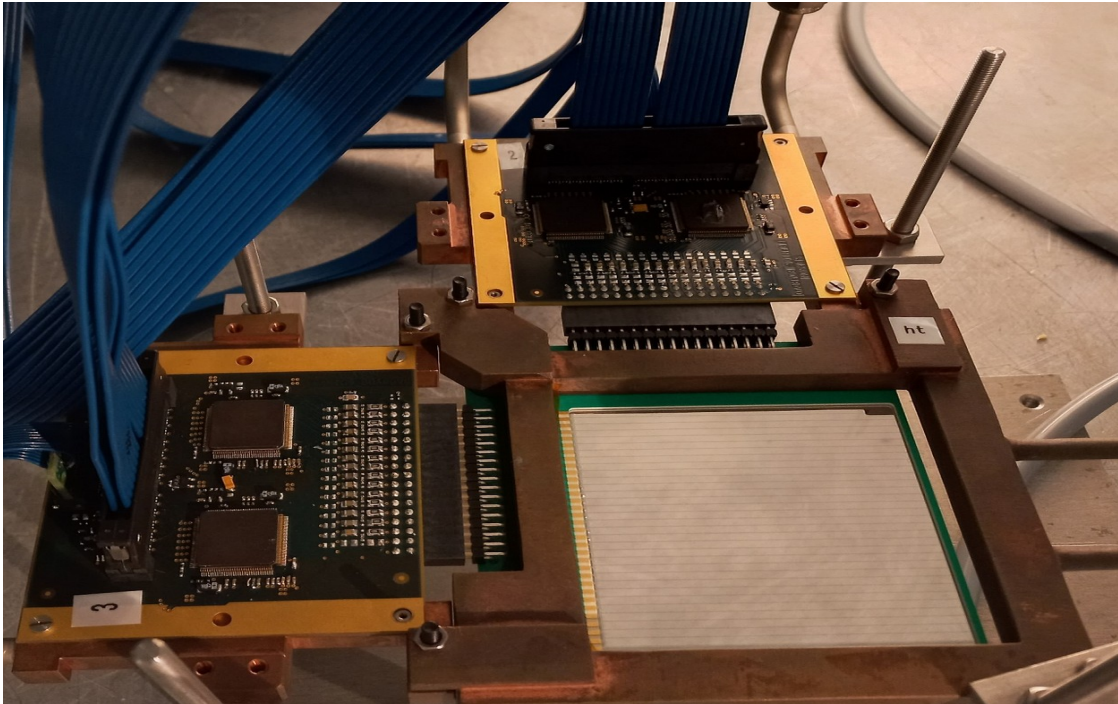
Ultra high resistivity

Nominal depletion voltage : ~75 V

5 out of 7 already received and tested
+ 2 grade B detectors for spare
2 last detectors should arrive **in few weeks**

Status of the electronics

Coupling to the front-end electronics FEANICS



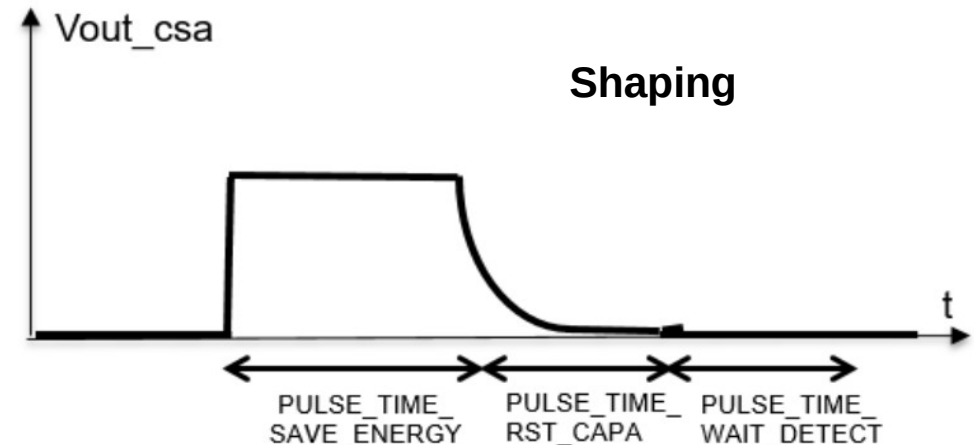
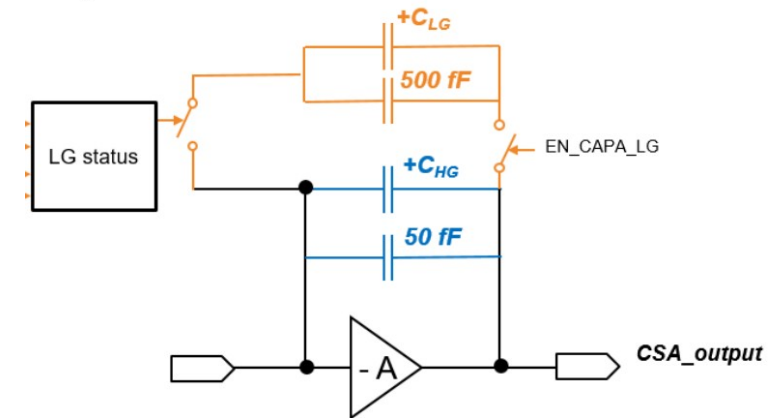
Directly connected to the detector to limit the noise
Output as a **differential signal** to be sent to your
favorite digitizer (NUMEXO2 at GANIL)

CSA floor noise (no detector) : **~2.3 keV**



FEANICS

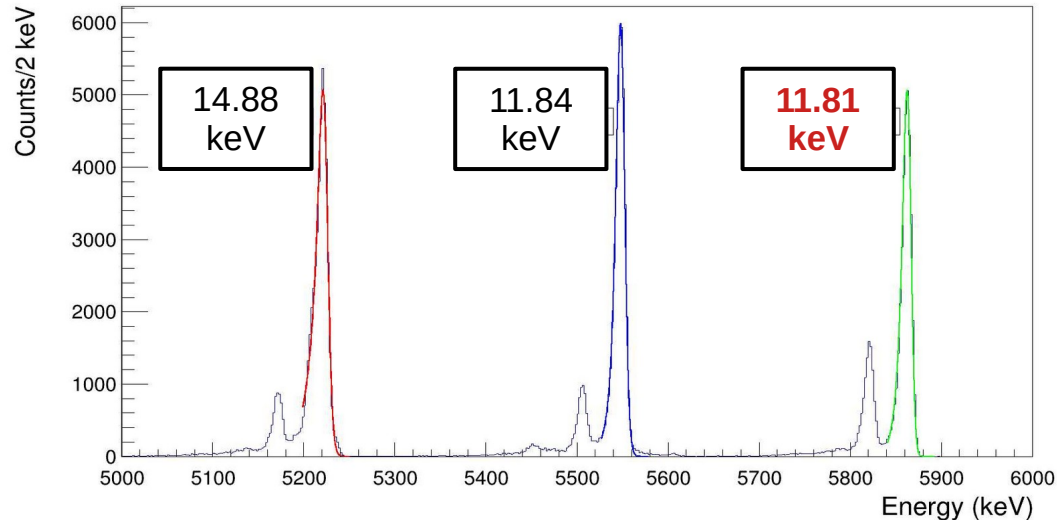
Double gain preamplifier with **automatic gain switch**



Status of the electronics

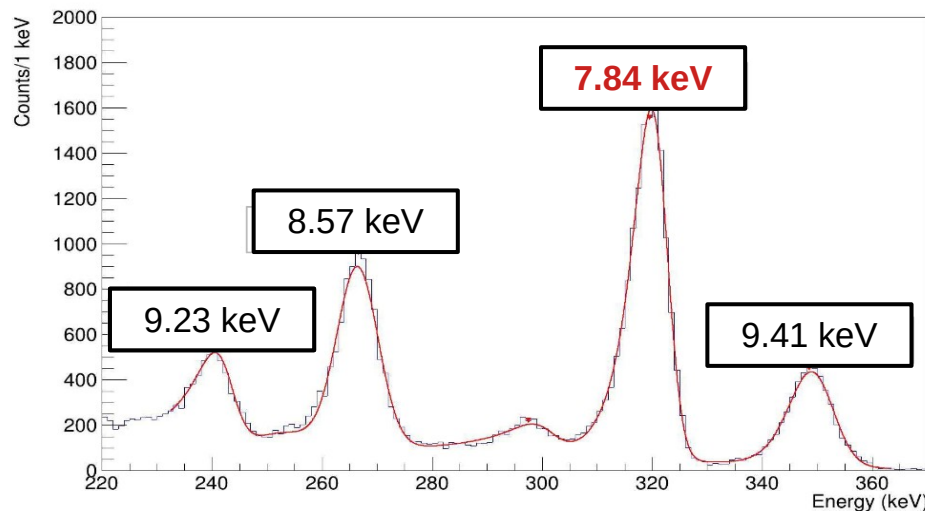
Focus on our DSSD test bench

We're characterising the full electronic acquisition chain : DSSD → FEANICS → Numexo2



3- α calibration source (^{239}Pu , ^{241}Am , ^{244}Cm)
FWHM @ 5804.77keV : ~ **12 keV**

Obtained with fixed Gain
Measured on central strips (normal incidence)
Signal processed with trapezoid filter



Electron source (^{133}Ba)
FWHM @ 320.3 keV : ~ **8 keV**

Obtained with fixed Gain
Measured on central strips (normal incidence)
Signal processed with trapezoid filter

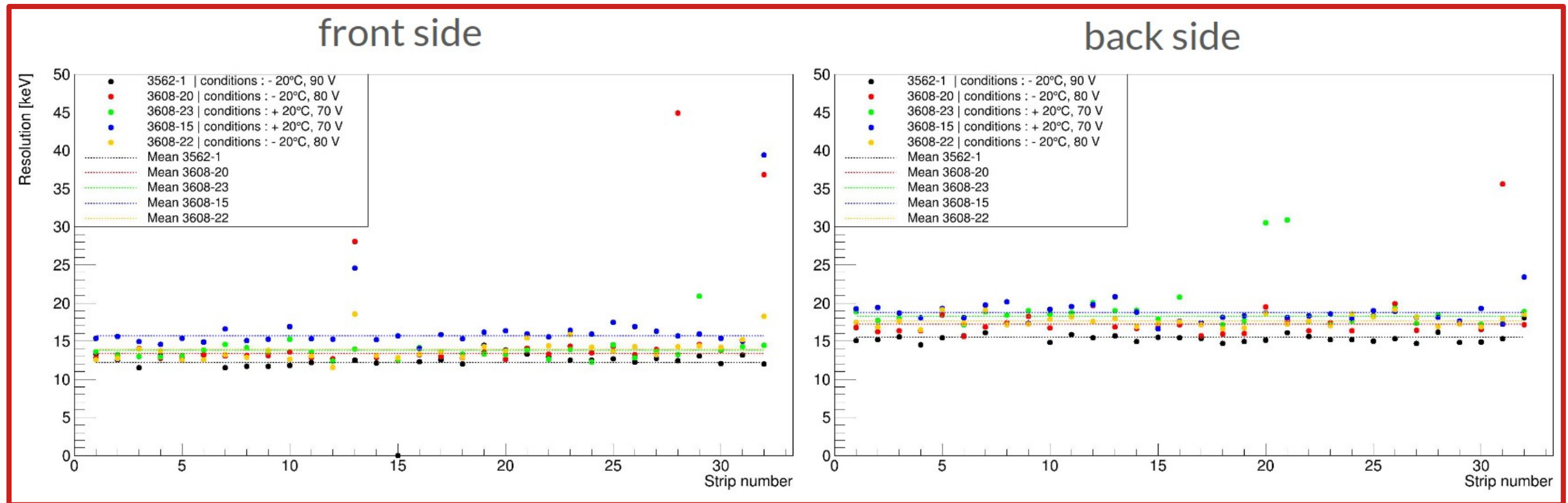
Work of M. Ragot (PhD student)

Status of the electronics

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Summary of the resolution of all strips for the 5 tested DSSDs coupled to FEANICS

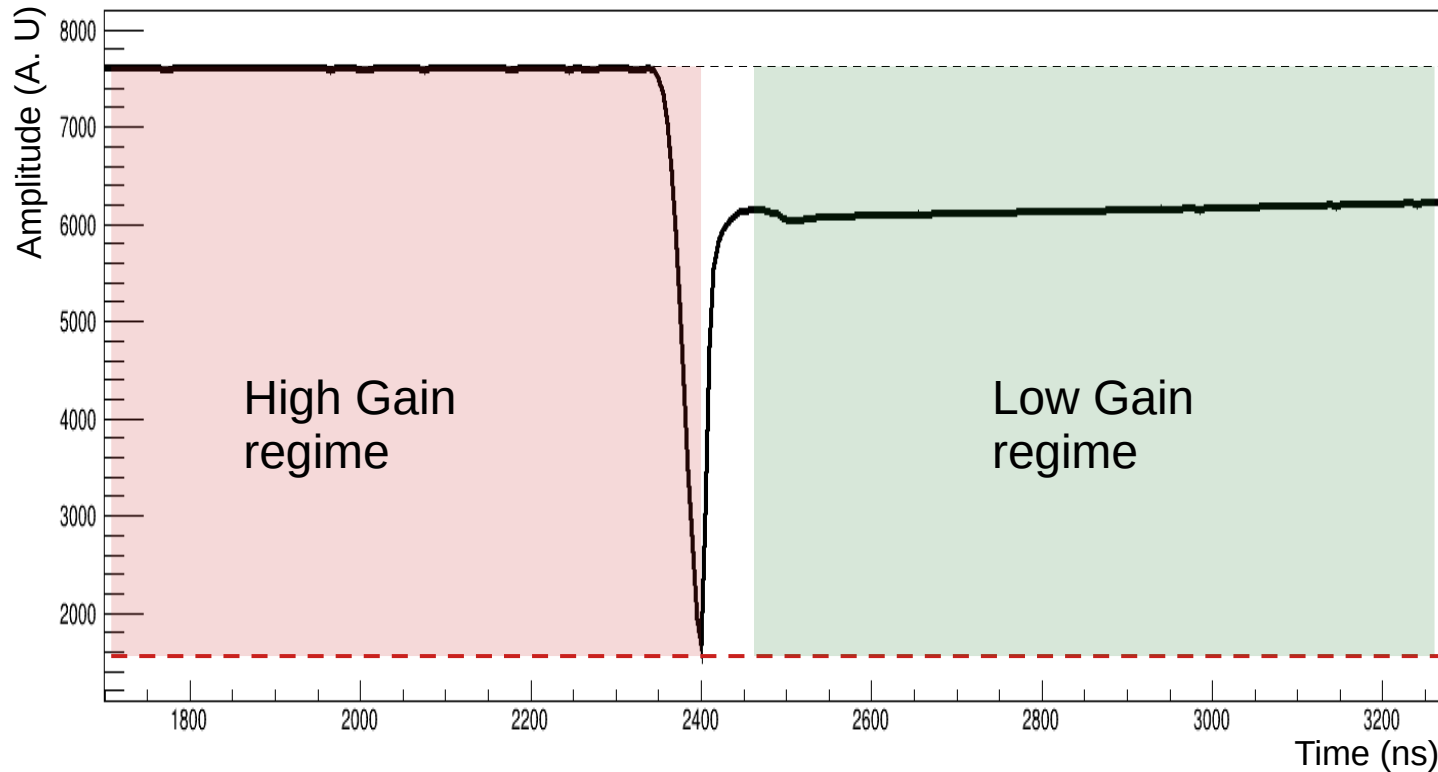


Status of the electronics

Focus on our DSSD test bench

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Characterization of the gain switch mode



Baseline

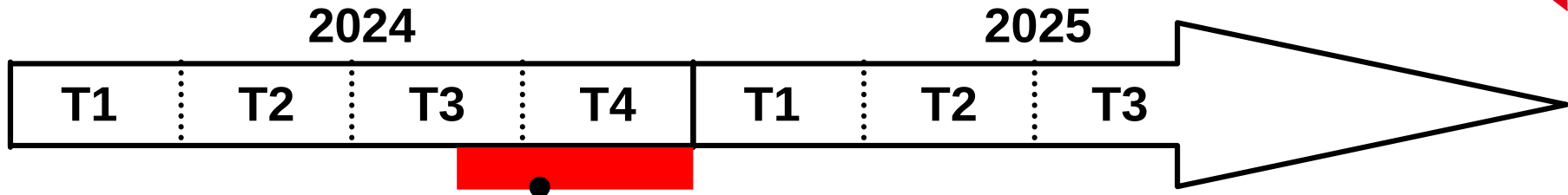
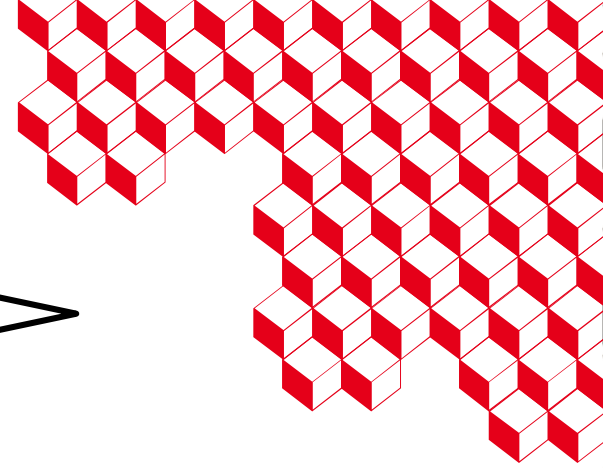
Development of methods to accurately tackle with the gain switched traces

For now, resolutions around **21 keV** in gain switch mode

Also : channels coupling to be tested

Gain Switch Threshold

Next months schedule



Mechanical mounting at CEA-Saclay

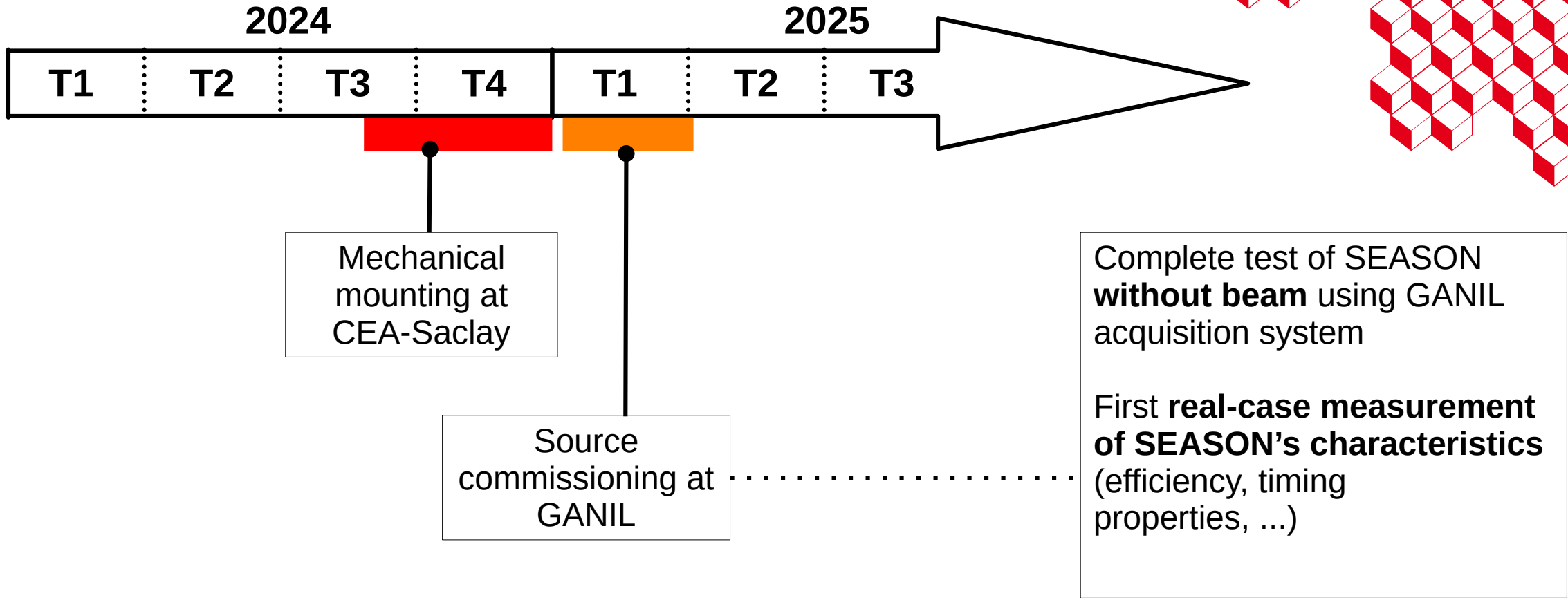
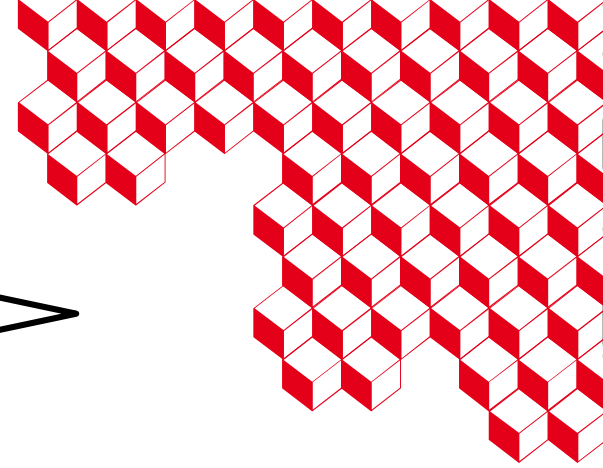
General test of all the **electronics**

Test of **control and commands** (wheel, det. position, calibration arms...)

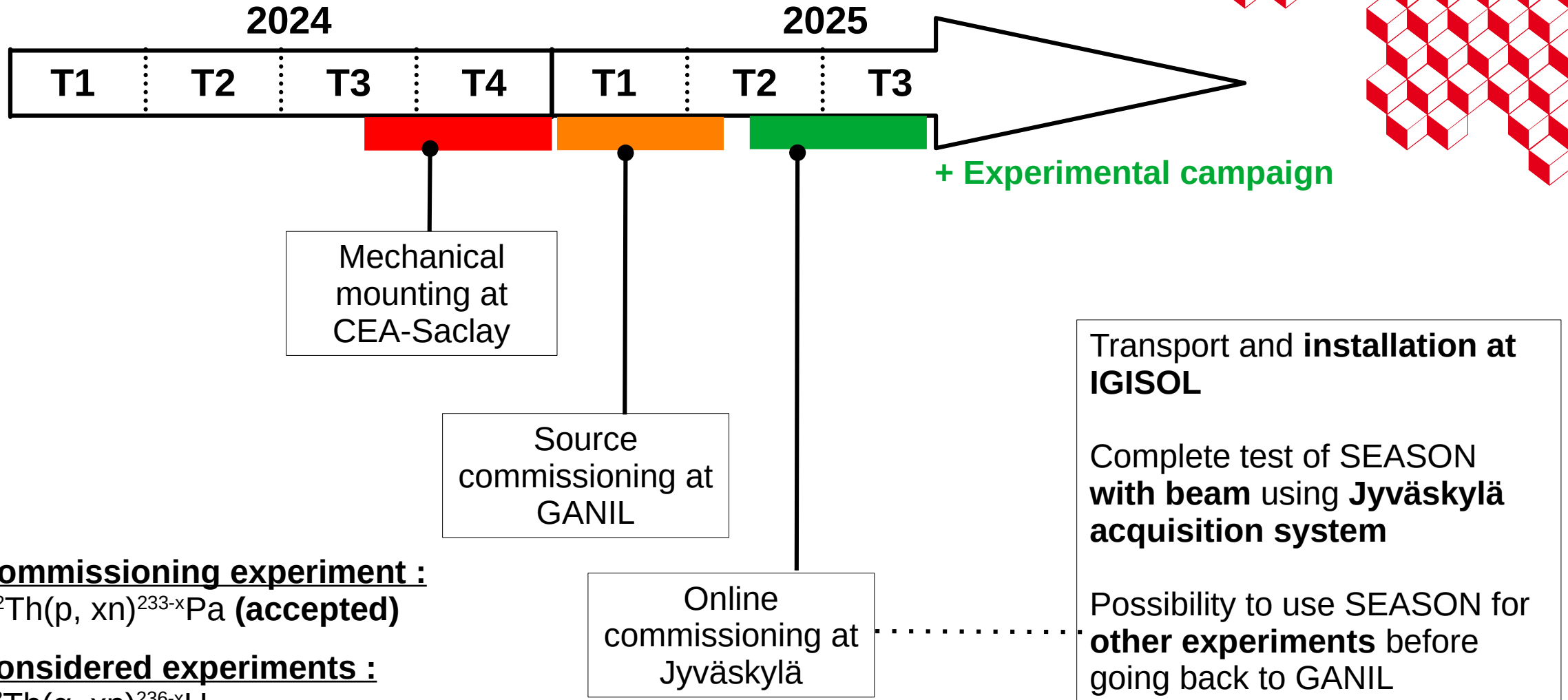
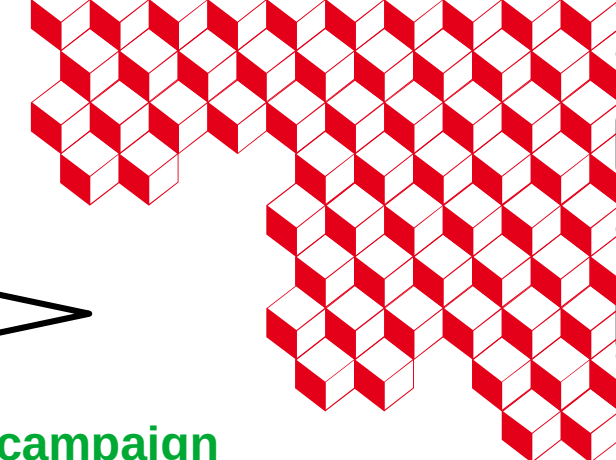
Complete **mounting and alignment** of SEASON

Write/adjust a **set-up protocol**

Next months schedule



Next months schedule



Commissioning experiment :

$^{232}\text{Th}(p, xn)^{233-x}\text{Pa}$ (accepted)

Considered experiments :

$^{232}\text{Th}(\alpha, xn)^{236-x}\text{U}$

$^{233}\text{U}(p, xn)^{234-x}\text{Np}$

$^{233}\text{U}(\alpha, xn)^{237-x}\text{Pu}$

Coupling with mass measurement (trap)

Conclusions

SEASON is a decay station **designed for S3-LEB** and aiming to couple **laser spectroscopy** measurements to **decay spectroscopy** measurements.

The mechanical assembly of some parts have already started. The **complete integration should start next week** after reception of the vacuum chamber.

The electronic tests have been **completed for 5 out of 7 DSSD**. The results are promising with **excellent energy resolutions** for both electrons and alphas. Channels coupling still to be tested (to limit the number of readout electronics channels needed)

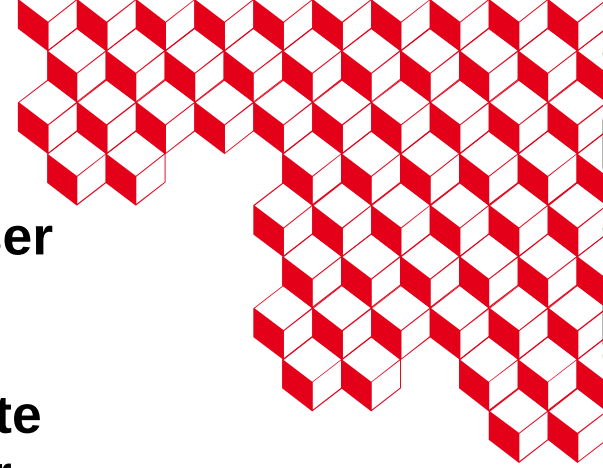
Next steps :

Source commissioning at GANIL (starting Dec 2024 – Jan 2025)

1st complete characterisation of SEASON (efficiency, timing, ...)

Online commissioning at JYFL (expected mid 2025)

Comparison with previous measurement of the same reaction



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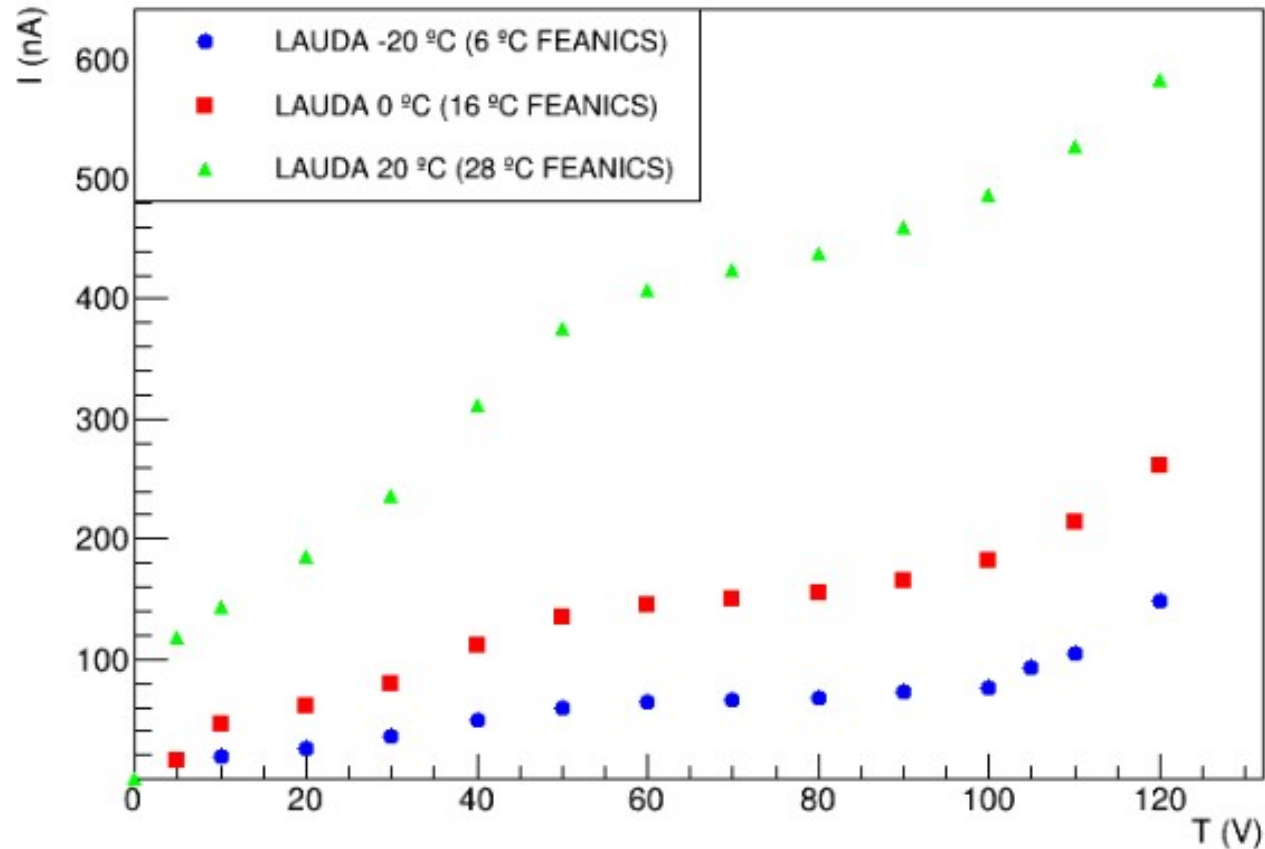
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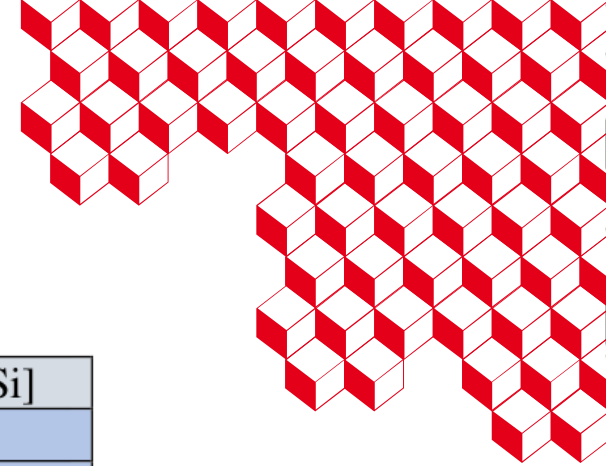
**Thank you for
your attention**

Leakage current comparison

Courbe courant tension BB7 3562-1



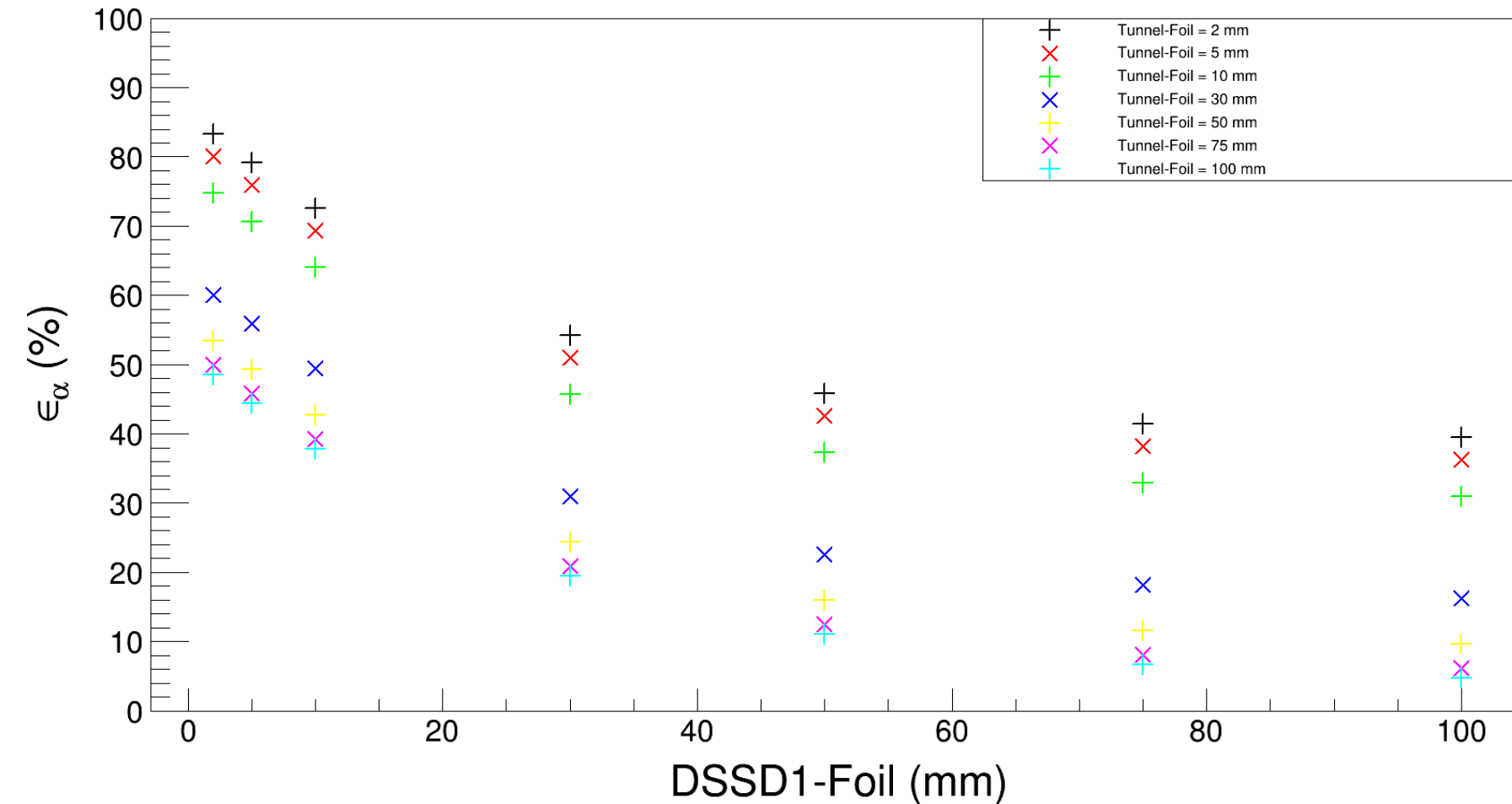
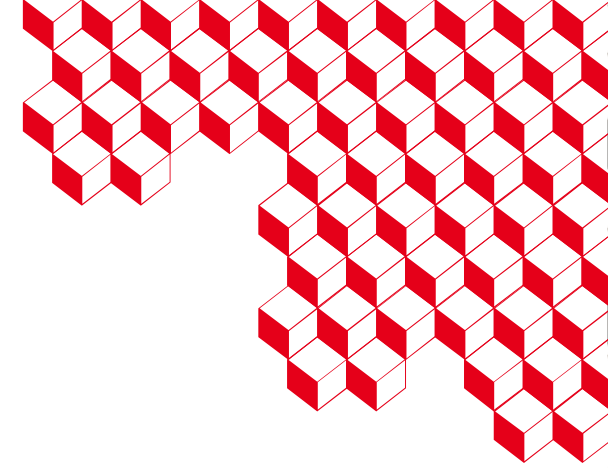
4 times smaller compared to the previous FEANICS card



	CAPA [fF]	GAIN [mV/fC]	RANGE [fC]	RANGE [MeV Si]
HG (default)	50	20,00	100	2,25
add+	100	10,00	200	4,50
add+	200	5,00	400	9,00
add+	500	2,00	1000	22,50
add+	1000	1,00	2000	45,00
max	1850	0,54	3700	83,25
LG (default)	500	2,00	1000	22,50
add+	1000	1,00	2000	45,00
add+	2500	0,40	5000	112,50
add+	5000	0,20	10000	225,00
add+	10000	0,10	20000	450,00
max	19000	0,05	38000	855,00

SEASON's technical specifications

High efficiency for both electron and α -particle

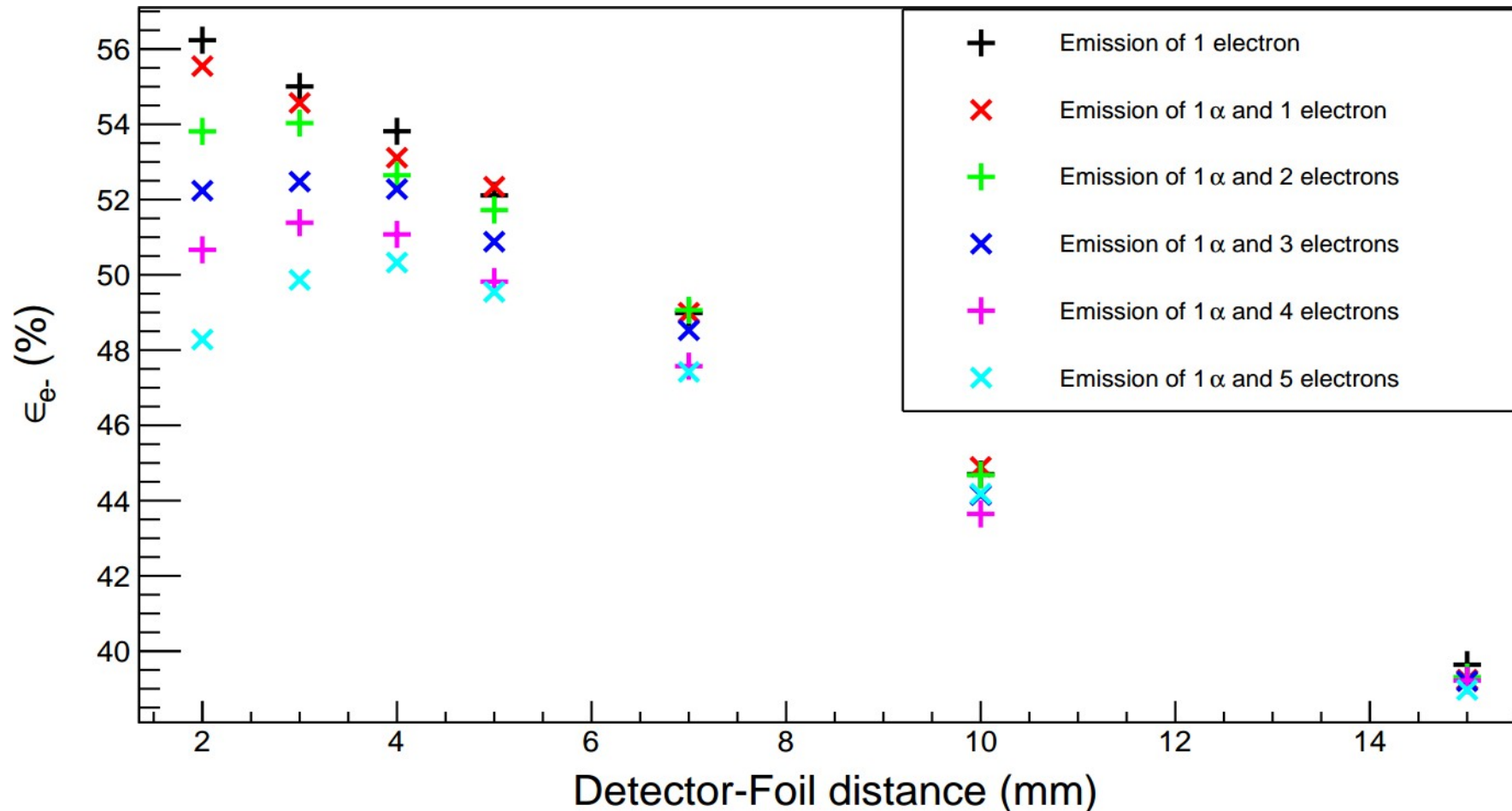
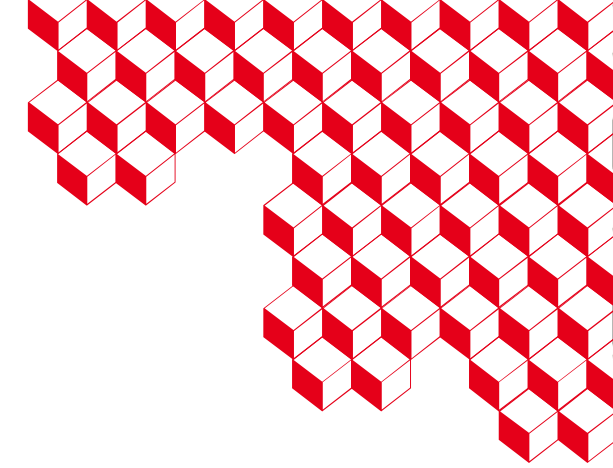


Most compact configuration :

Alpha efficiency = 84 %

SEASON's technical specifications

High efficiency for both electron and α -particle



Most compact configuration :

Alpha efficiency = 84 %
Electron efficiency = 56 %

... but impact of the summing effect to be taken into consideration