SIDDHARTA-2 plans for Kd

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on behalf of the SIDDHARTA-2 collaboration

"Fundamental physics with exotic atoms and radiation detectors"
LNF- Frascati, November 25-26, 2021

Contents

- **Activities in DAΦNE – full SIDDHARTA-2 installation**
  - **Luminosity detector**
  - **Kaon trigger**
  - **SDD x-ray detectors**
  - **Front-end electronics**
  - **Veto systems**
  - **Shielding improvements**
- **Preparation for the HpGe test run**
- **Present status**
- **SIDDHARTA-2 strategy for Kd run**

Project timeline

Installation of SIDDHARTA-2 setup

2021, August - October

Start Run SIDDHARTA-2 and HPGe parasitic test

2021, November

Start of the data taking with ^{4}He to check run condition with respect to SIDDHARTINO run

DAΦNE shutdown for winter holiday

2021, December

SIDDHARTA-2 Kd run: run 1 (300 pb^{-1})
run 2 (500 pb^{-1})

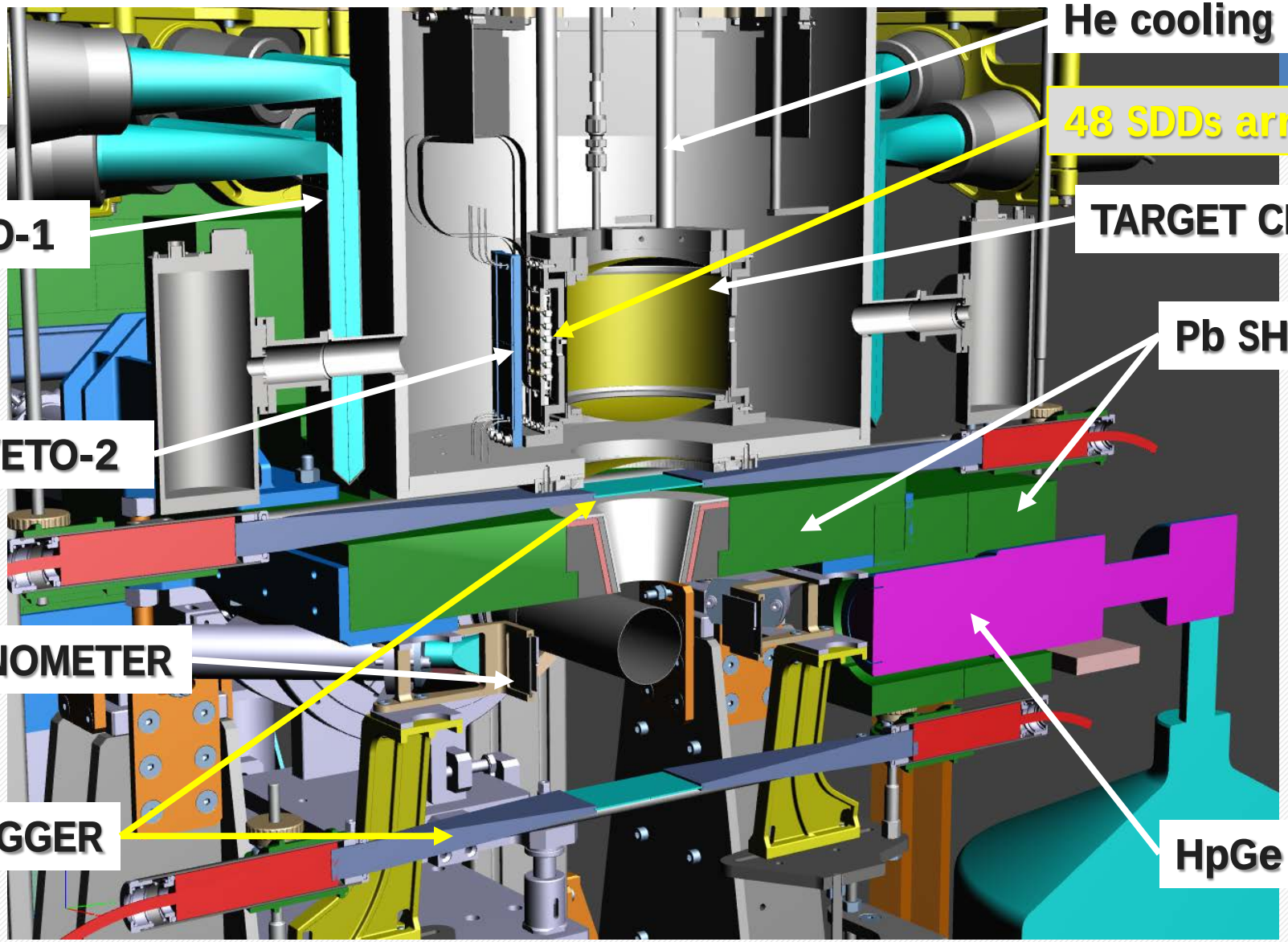
Continue the run SIDDHARTA-2

Kaonic Deuterium

HPGe

2022, January through all 2022

SIDDHARTA-2 setup



First step towards SIDDHARTA-2

SIDDHARTINO setup (April 2019)

SIDDHARTINO: during the commissioning of DAΦNE:

Luminosity detector

Kaon Trigger

Only 8 SDD arrays

Reduce

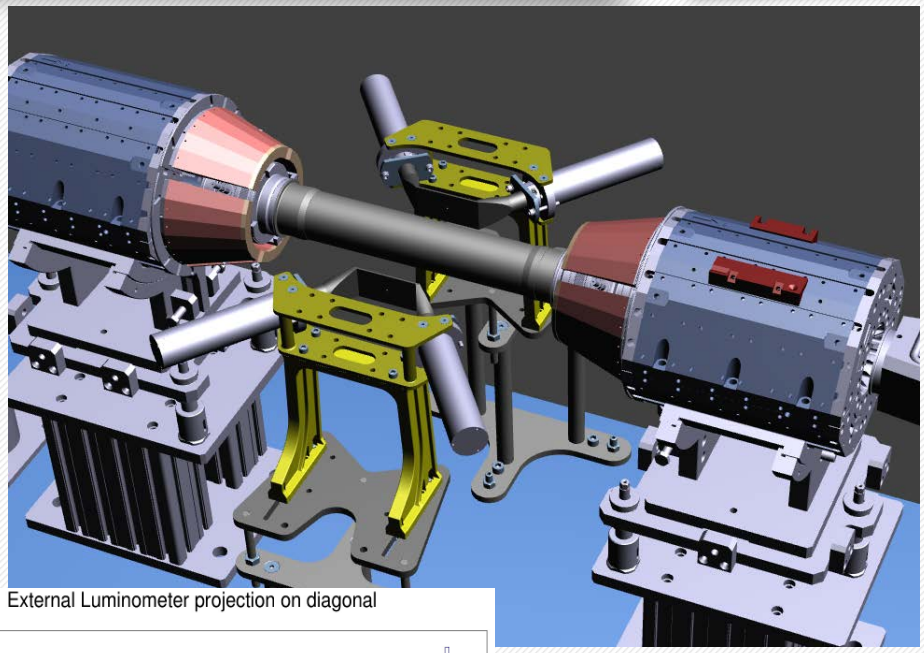
veto-2 (internal SiPm)

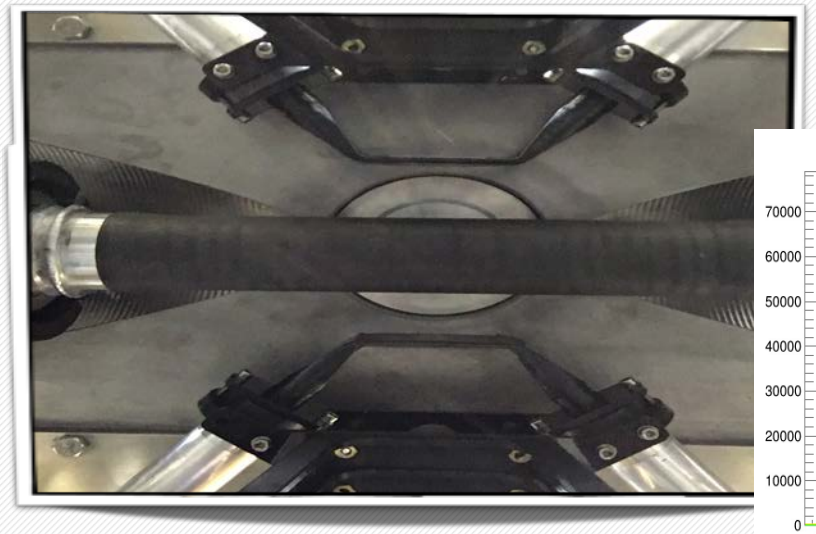
Veto-1 (external PMTs)

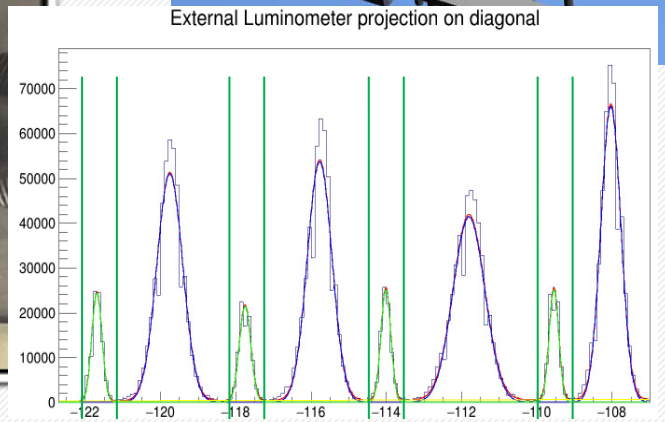
External Shielding wall

Luminosity detector

SIDDHARTA-2 luminometer
- calculation for the luminosity delivery by DAFNE
-used for background evaluation kaons/MIPS – online information to DAFNE



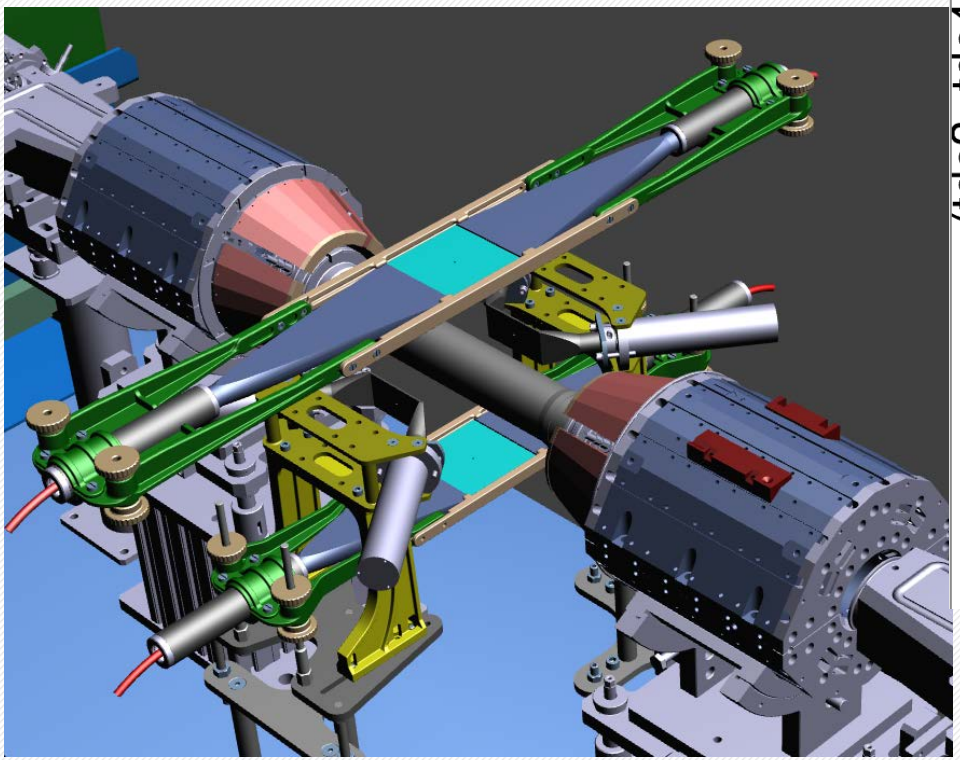


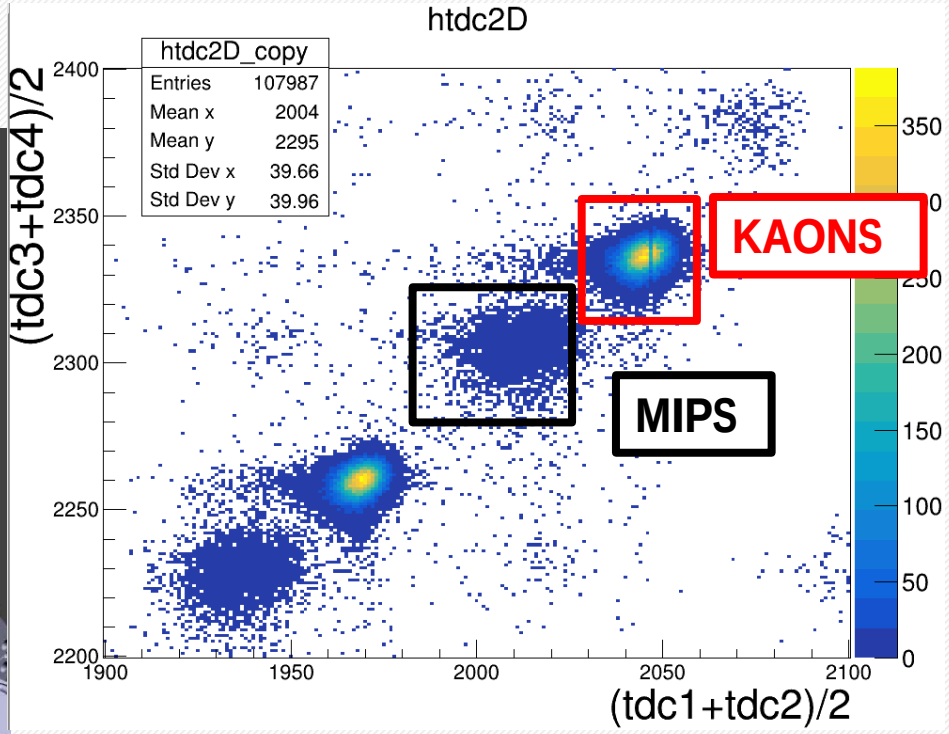


Back to plastic scintillators in coincidence with RF/4 signal

Kaon Trigger

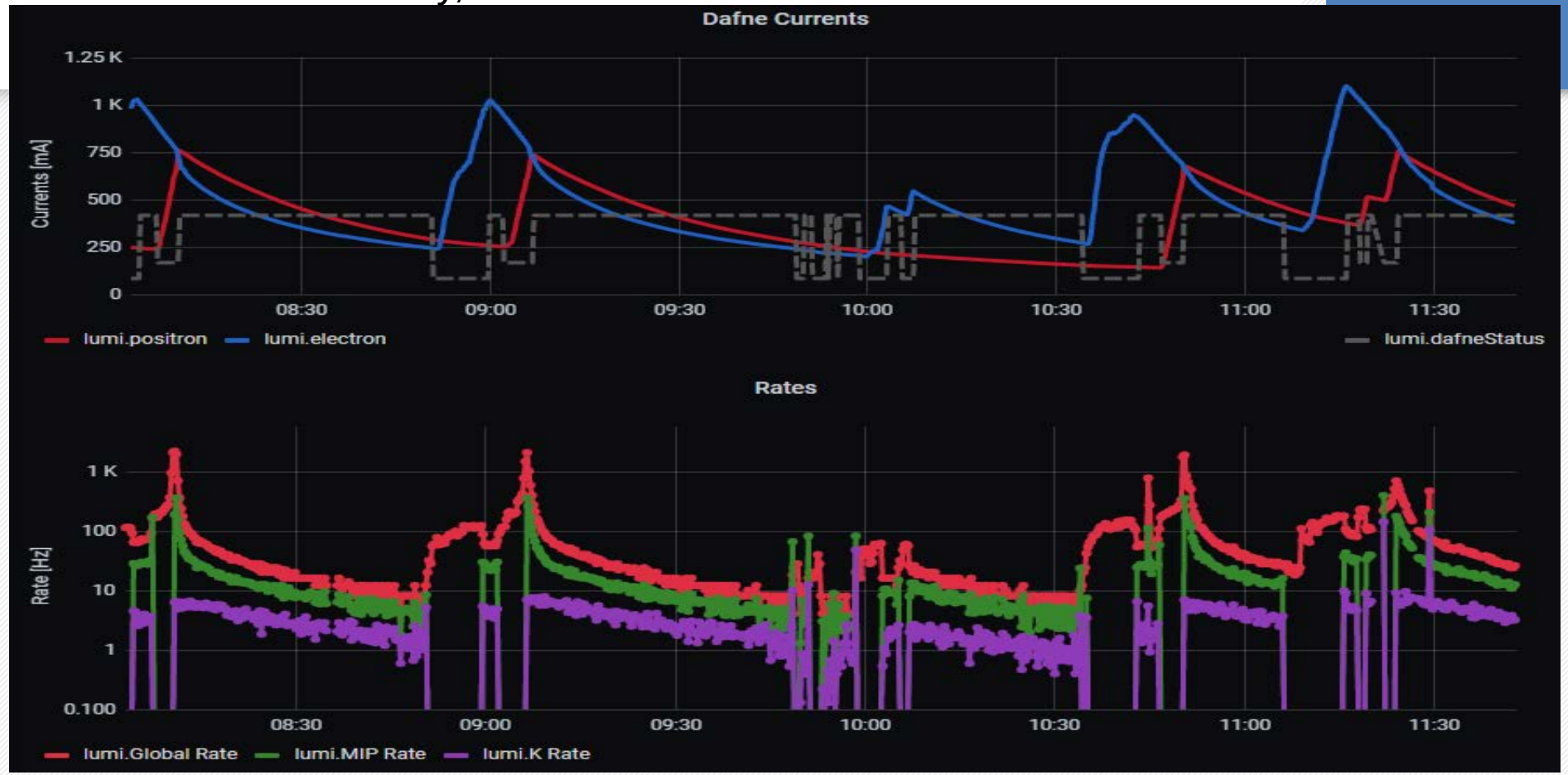
Back to plastic scintillators in coincidence with RF/2 signal





Background levels monitors

On-Line: easy, remote and real-time DASHBOARD

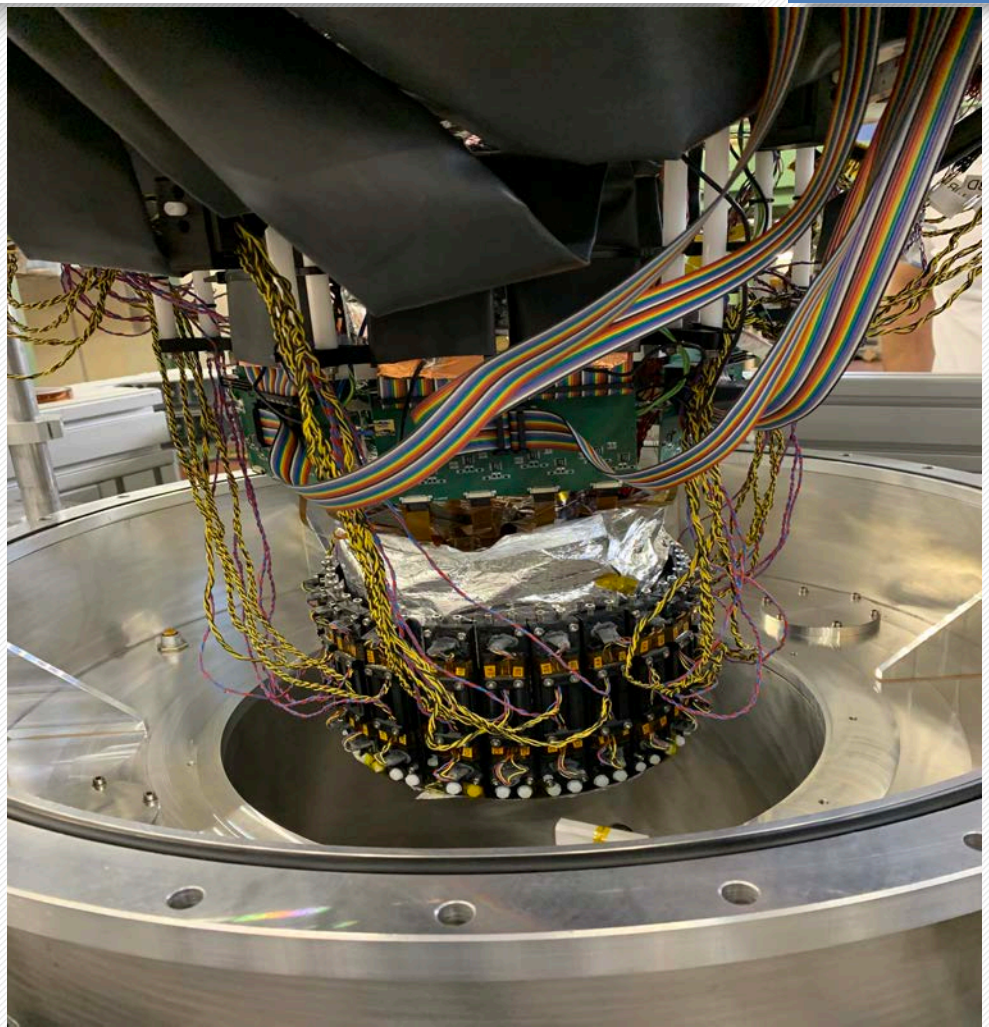


Background levels were monitored online by a counter based on Kaon/Mip rate and a second based on Kaon/SDD rate.

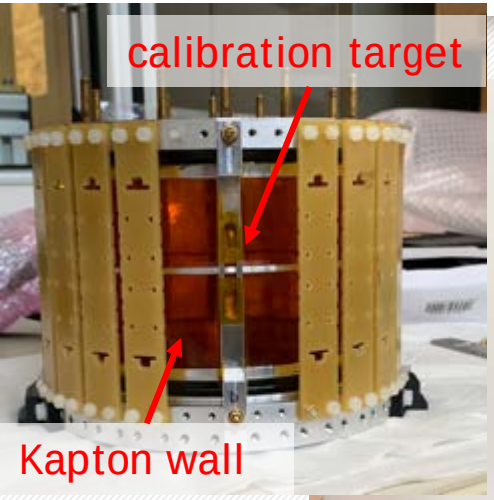
Shared with the DAΦNE staff to optimize the background

SIDDHARTA-2 internal components

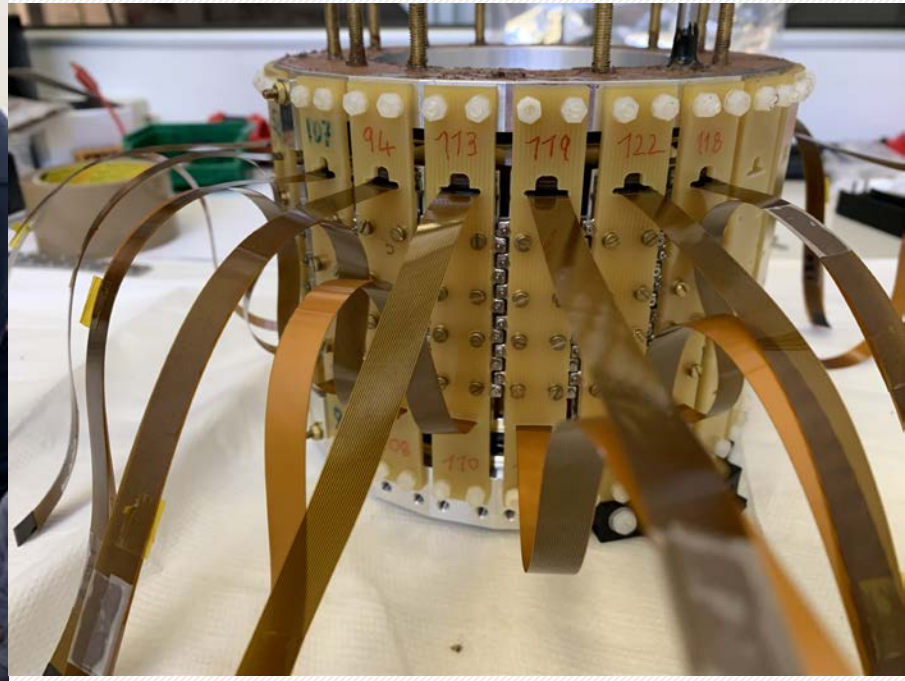
- Cryogenic target
- SDD detectors installation
- Veto-2 installation



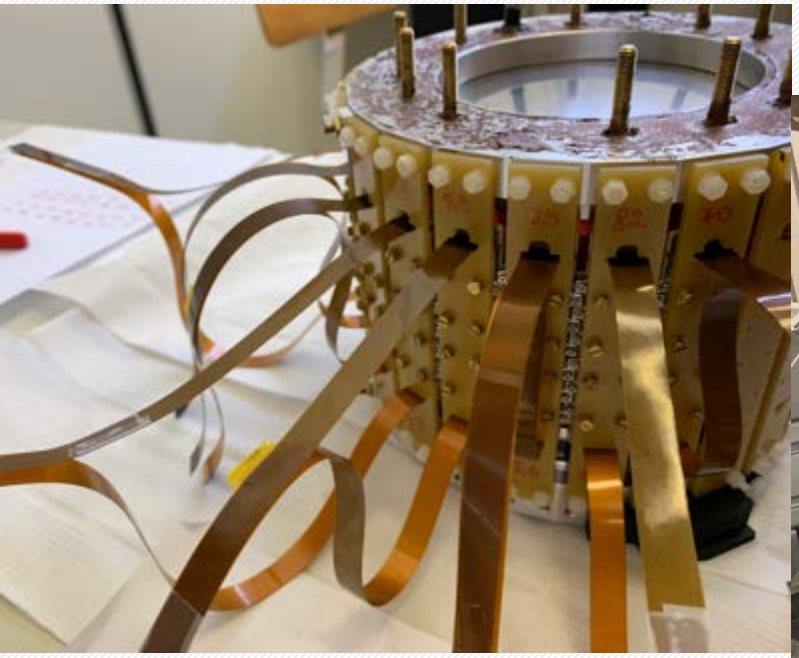
SDD installation



SDD installed around the target

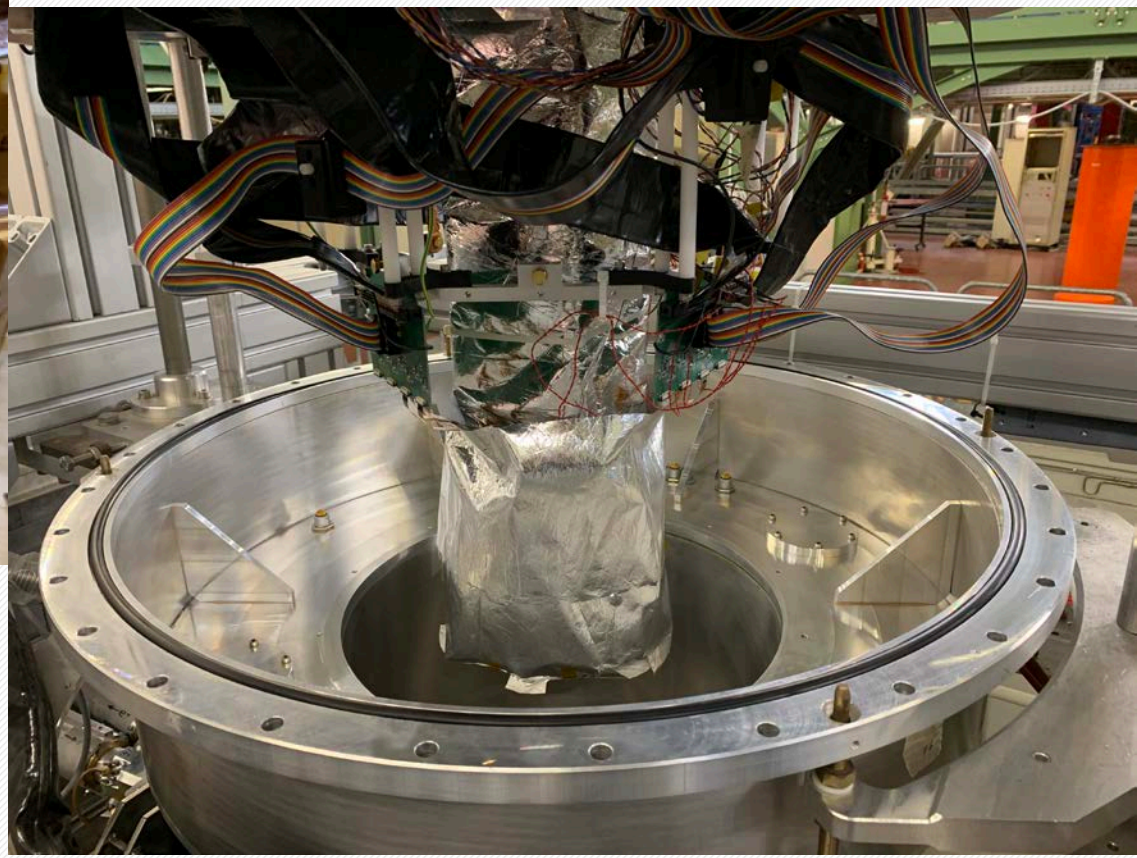


SDD installation

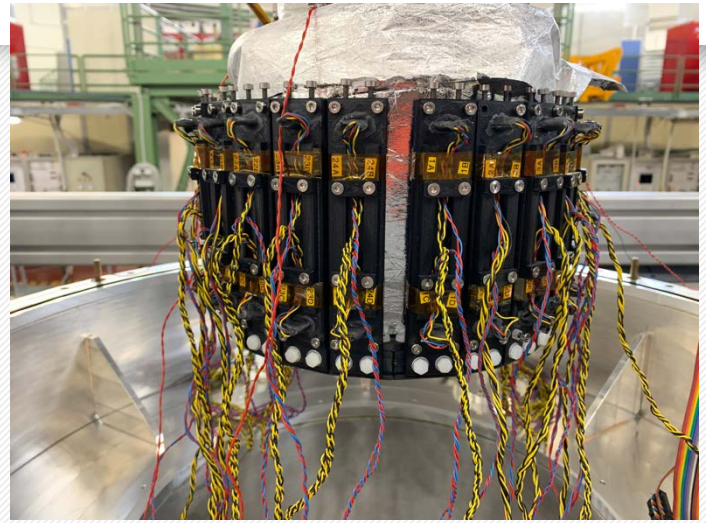


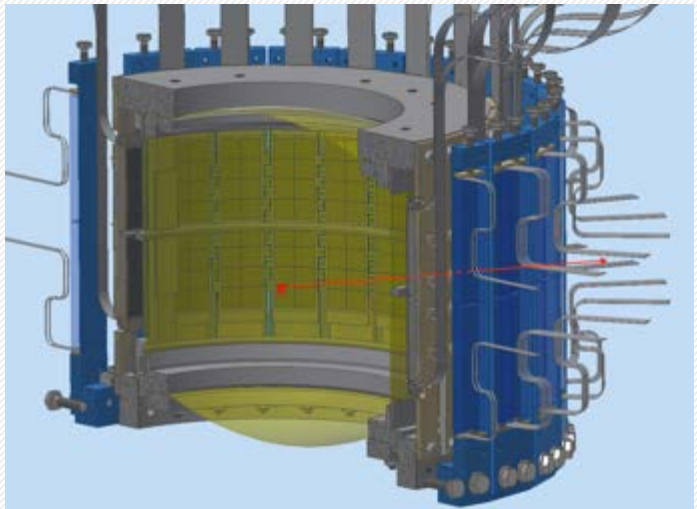
48 SDD arrays
384 channels

Wrap for thermal isolation

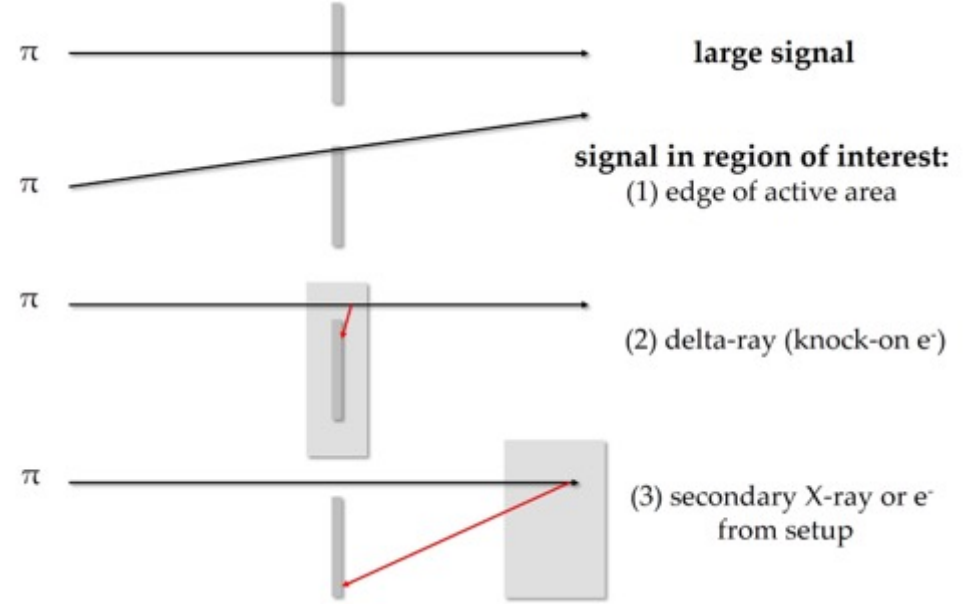


Veto-2 installation



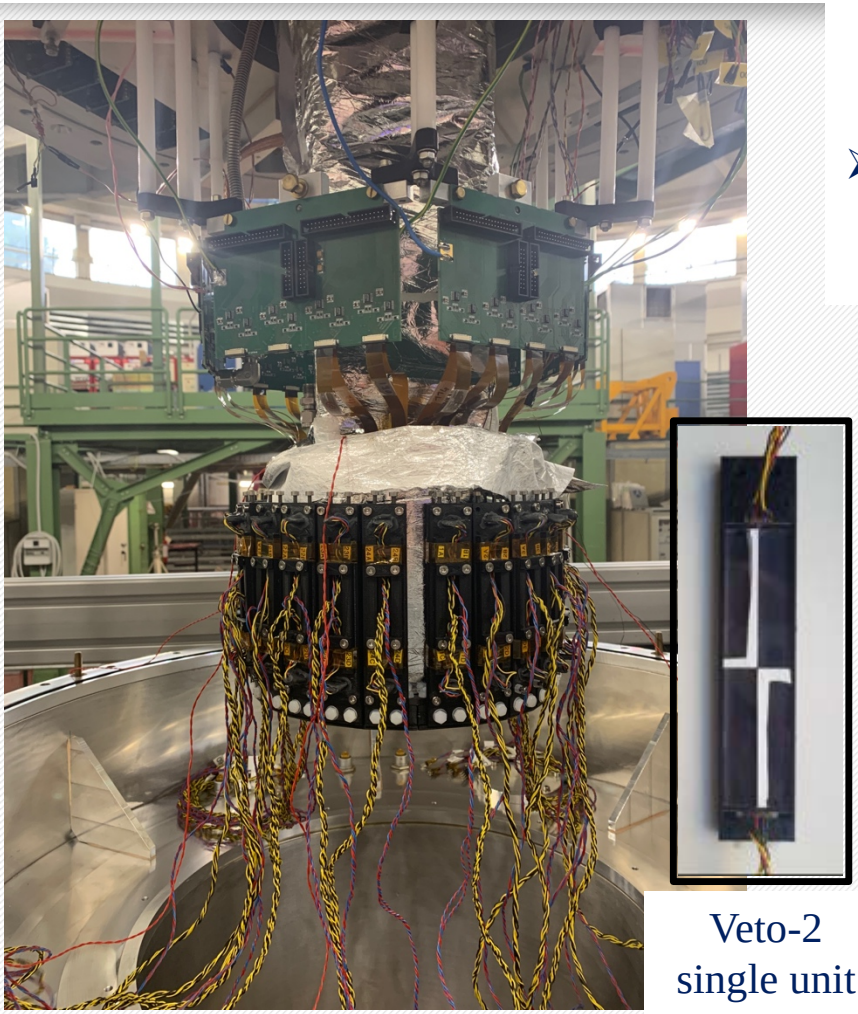


Working principle of veto-2 system

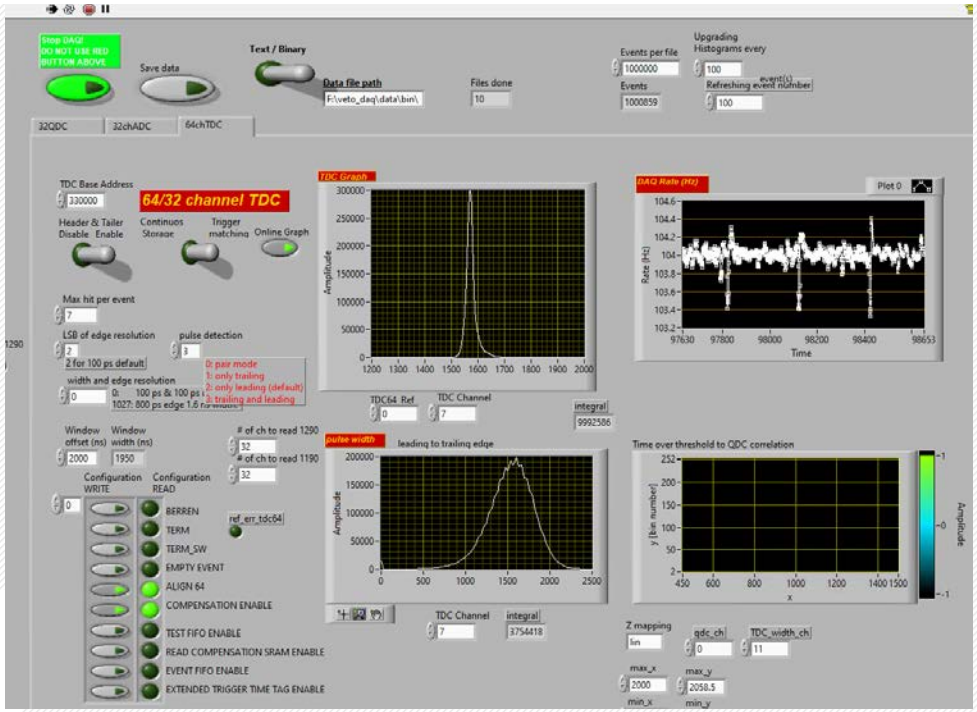


Veto-2 installation

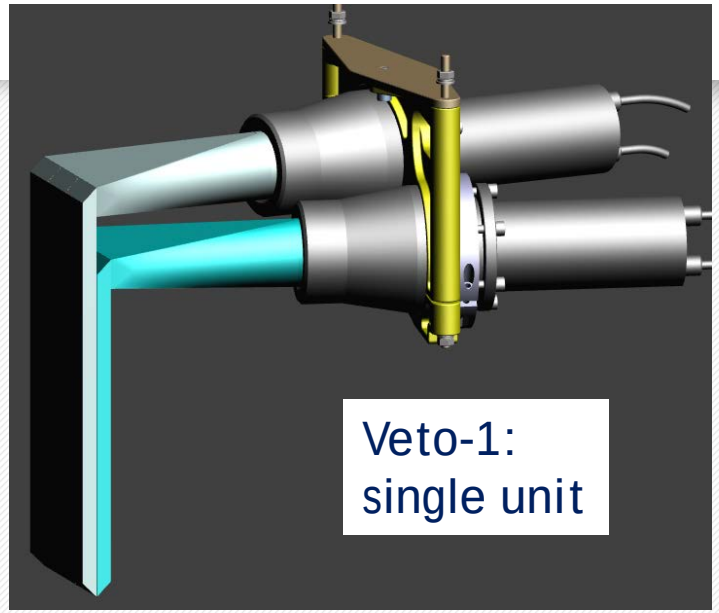
- The installation of veto 2 has been completed and the correct operation of each unit has been verified
- Each veto-2 unit is equipped with an LED that will allow to calibrate and verify the correct functioning of the system with and without beams

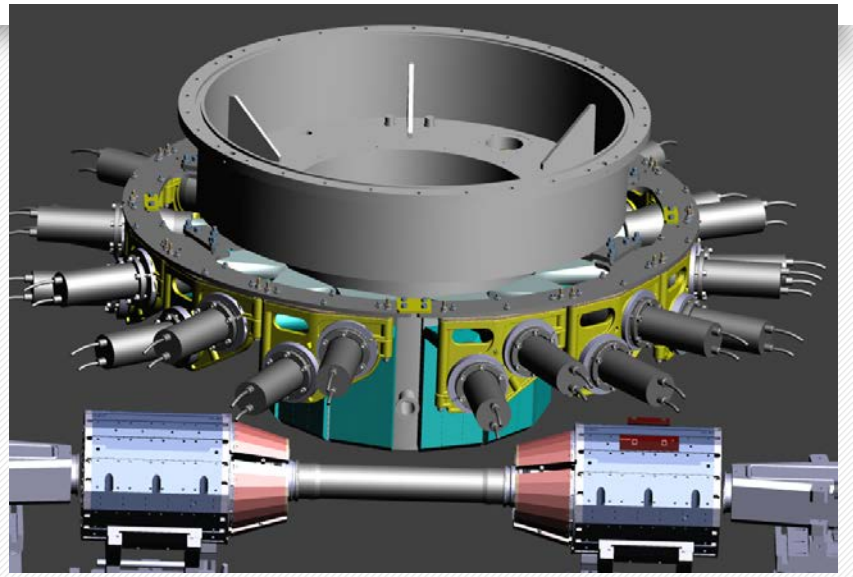


Veto-2 single unit



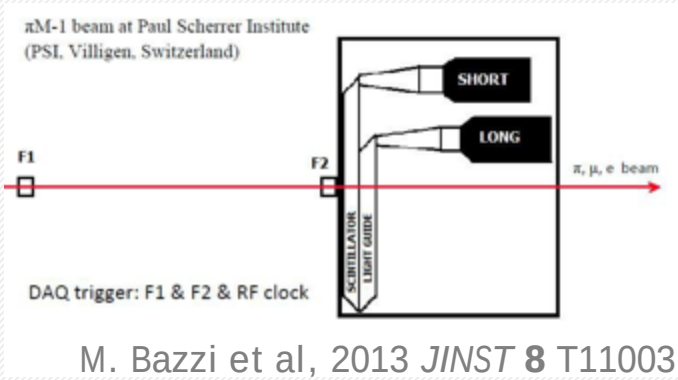
Veto-1 installation





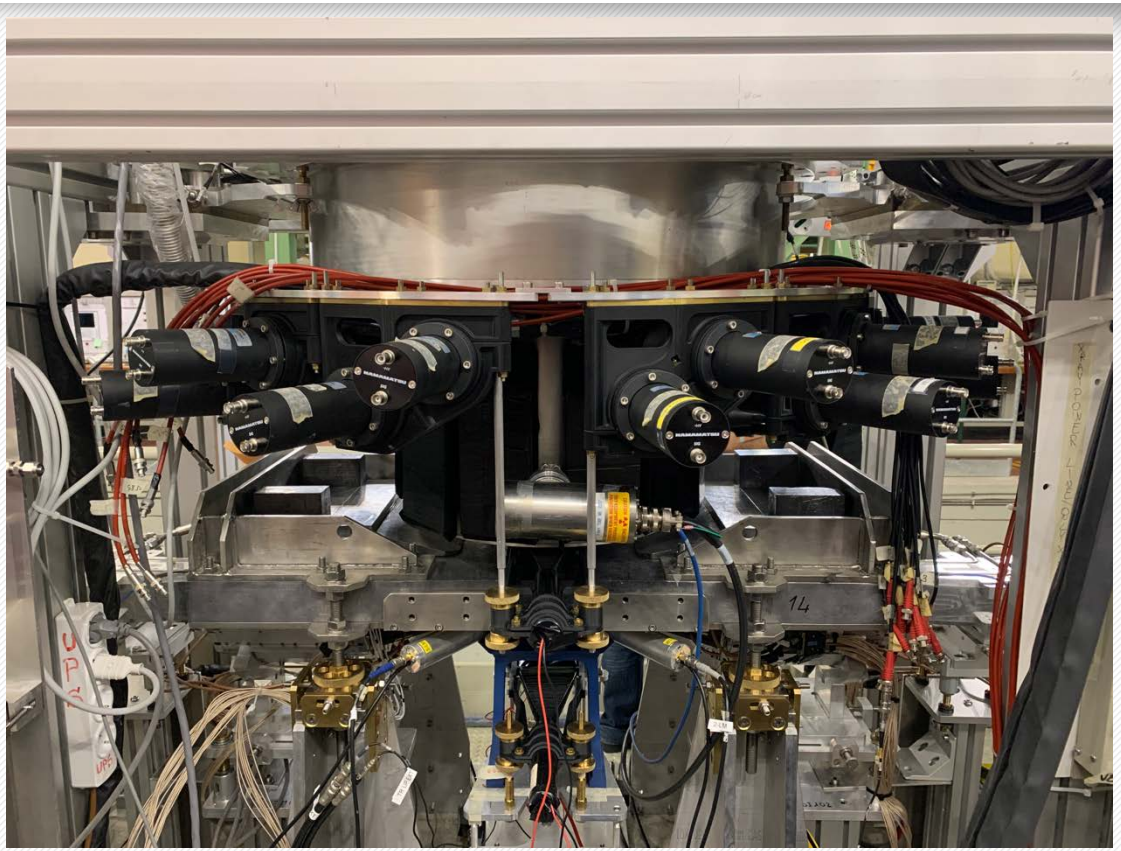
Drawing of the veto-1 elements placed around the vacuum chamber

Working principle of veto-1 system



M. Bazzi et al, 2013 *JINST* **8** T11003

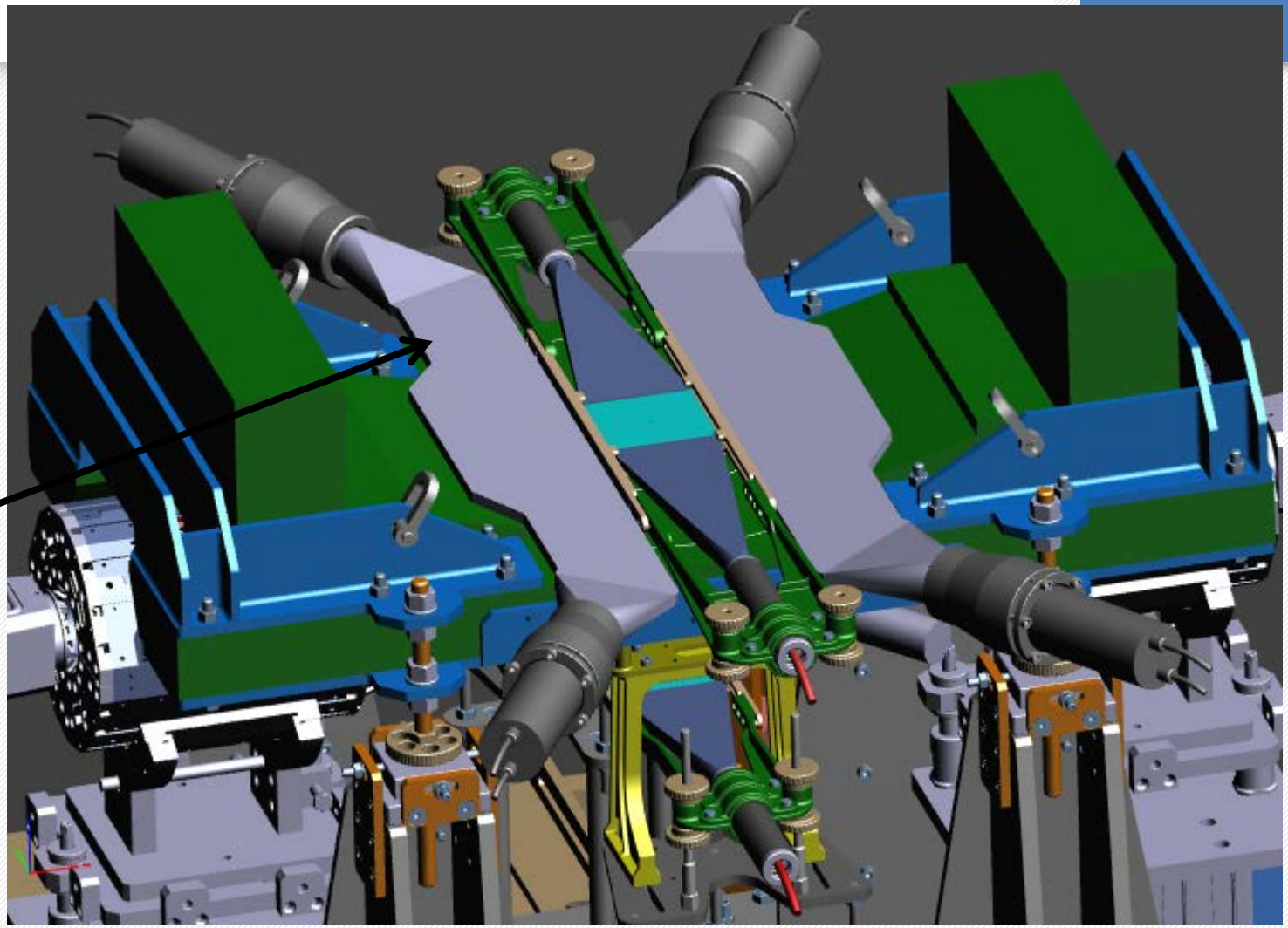
Veto-1 installation



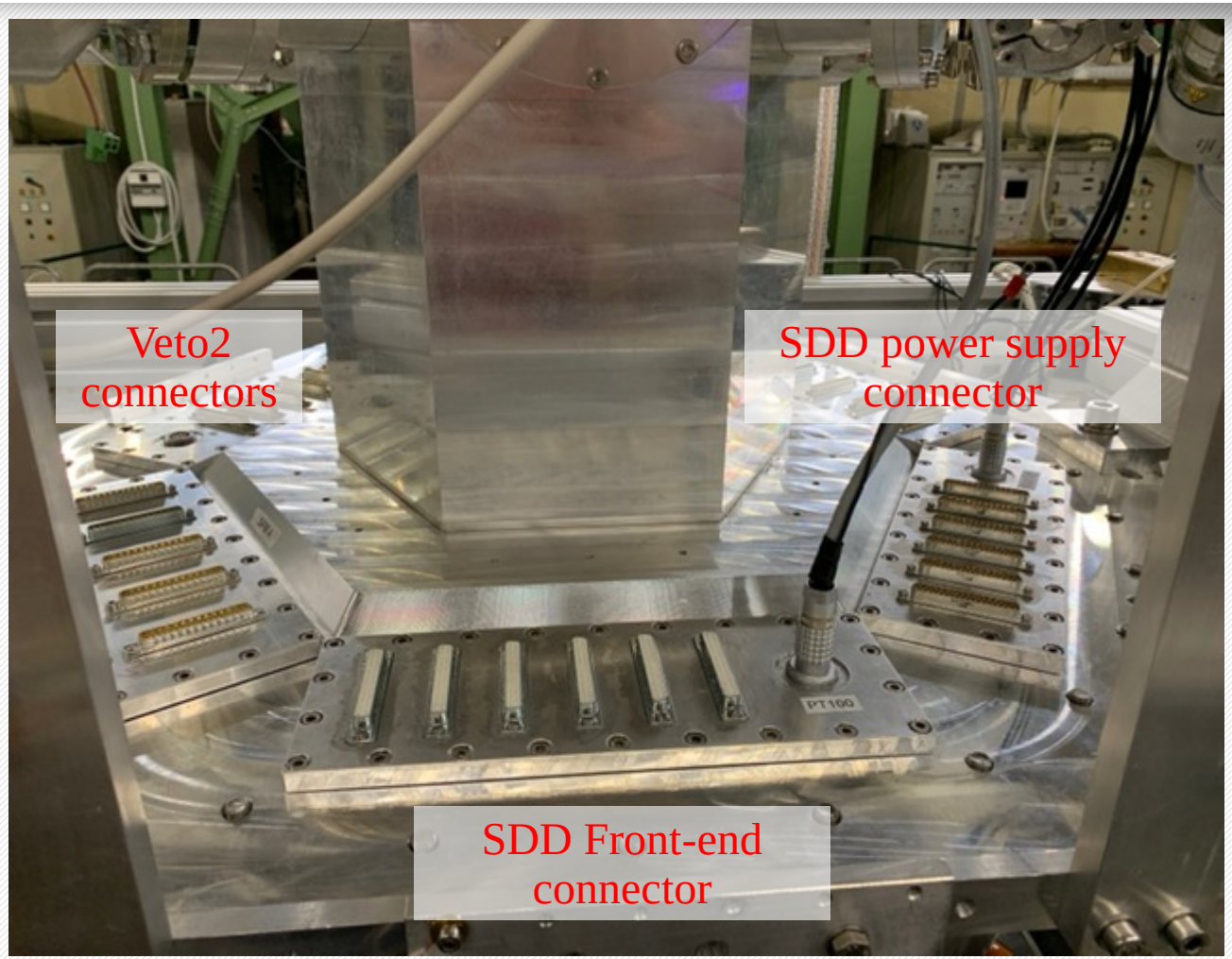
Veto-1 system installed around the vacuum chamber

Additional VETO counters

To improve the VETO system we add other counters below the vacuum chamber



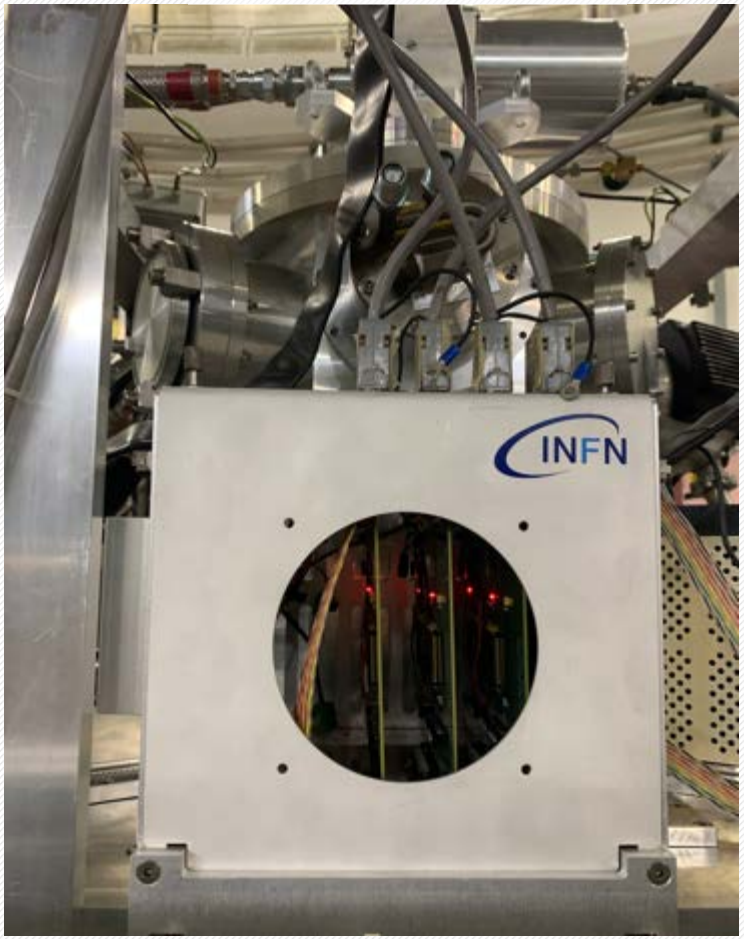
Front-end electronics installation



SIDDHARTA-2 setup before the installation of electronic components

Front-end electronics installation

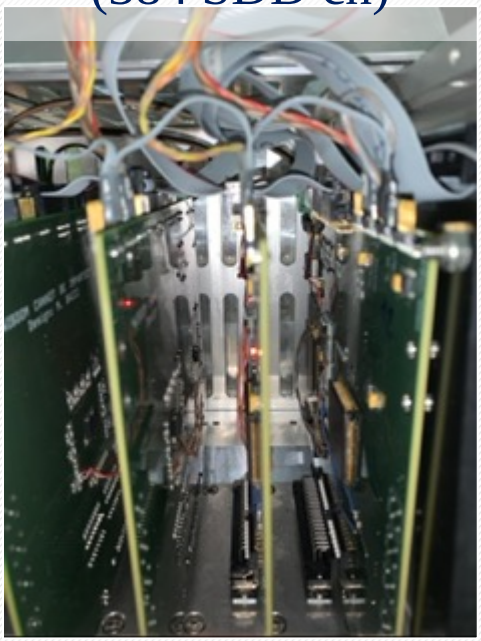
Electronic Box

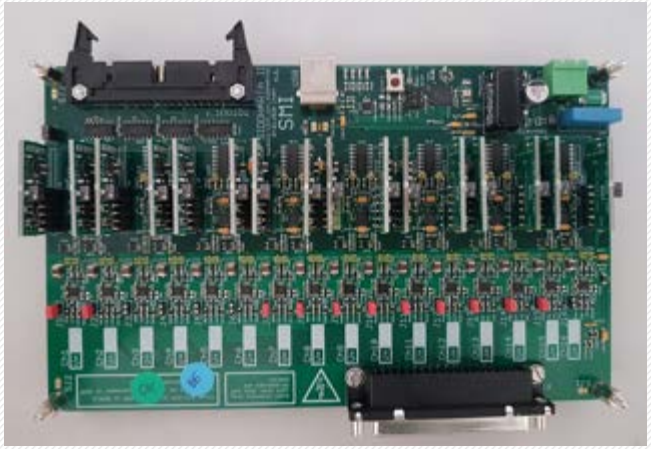


SDD Front-end electronics

12 boards with 24 SFERA ASIC

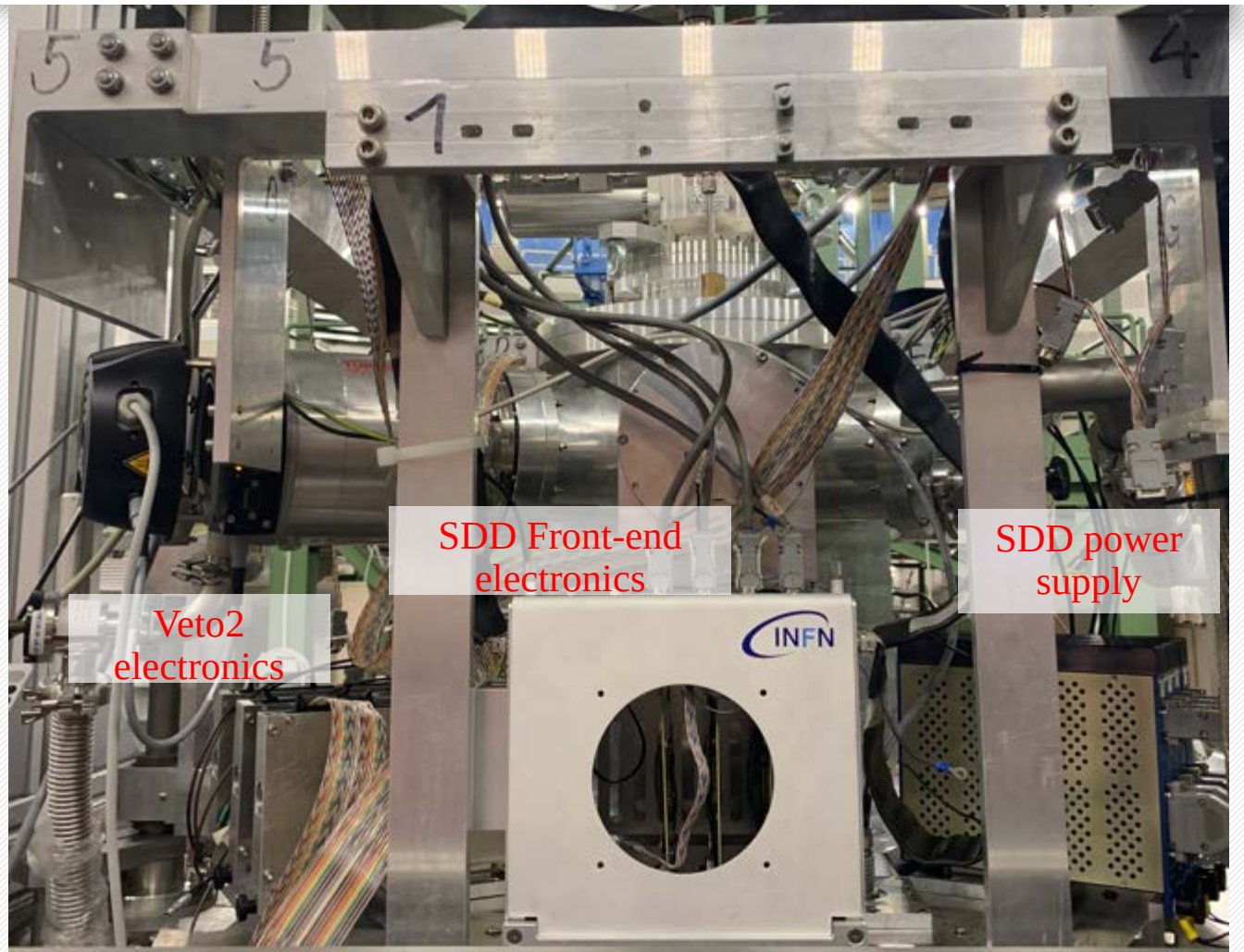
(384 SDD ch)



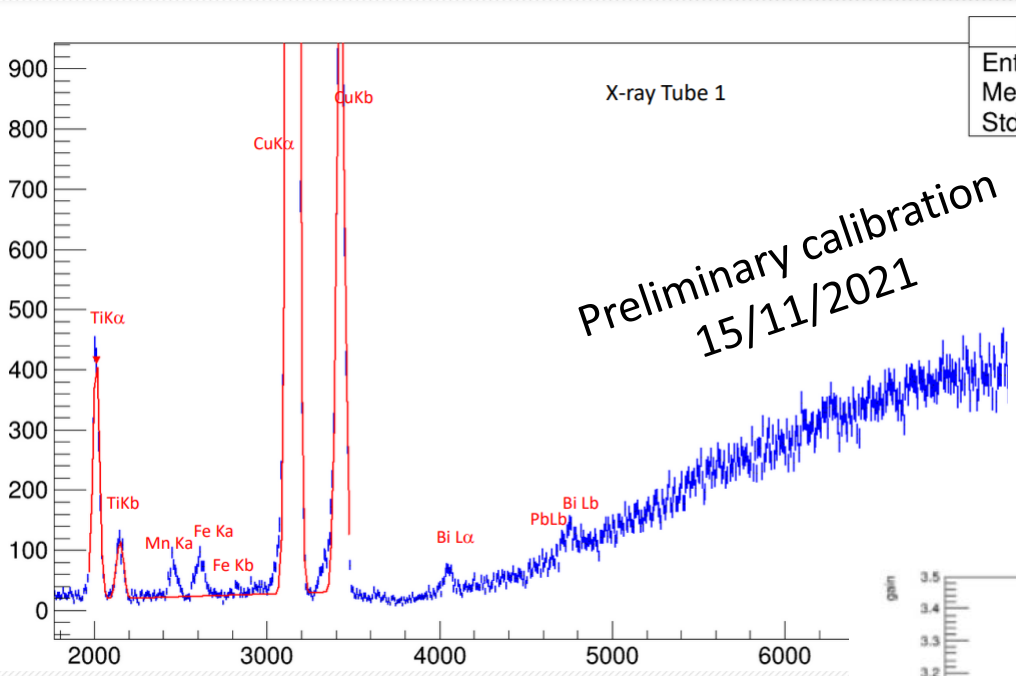


Veto-2
New front-end electronics

Front-end electronics installation



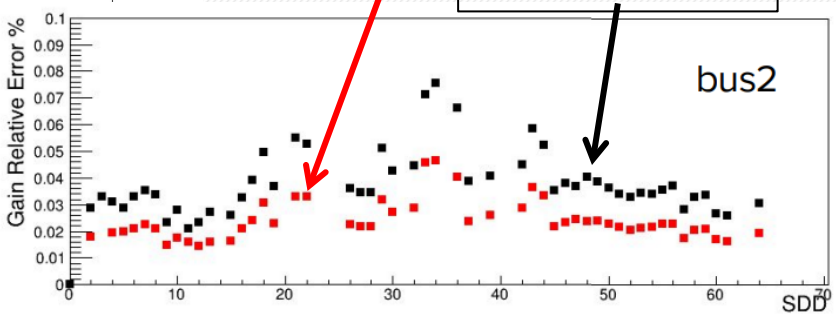
SDD calibration spectrum acquired with SIDDHARTA-2

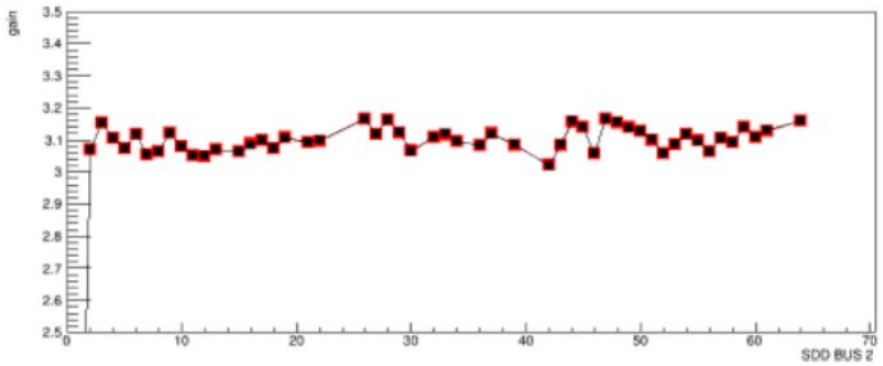


hPRECAL_1_3	
Entries	196547
Mean	5525
Std Dev	1833

High statistic run

Low statistic run

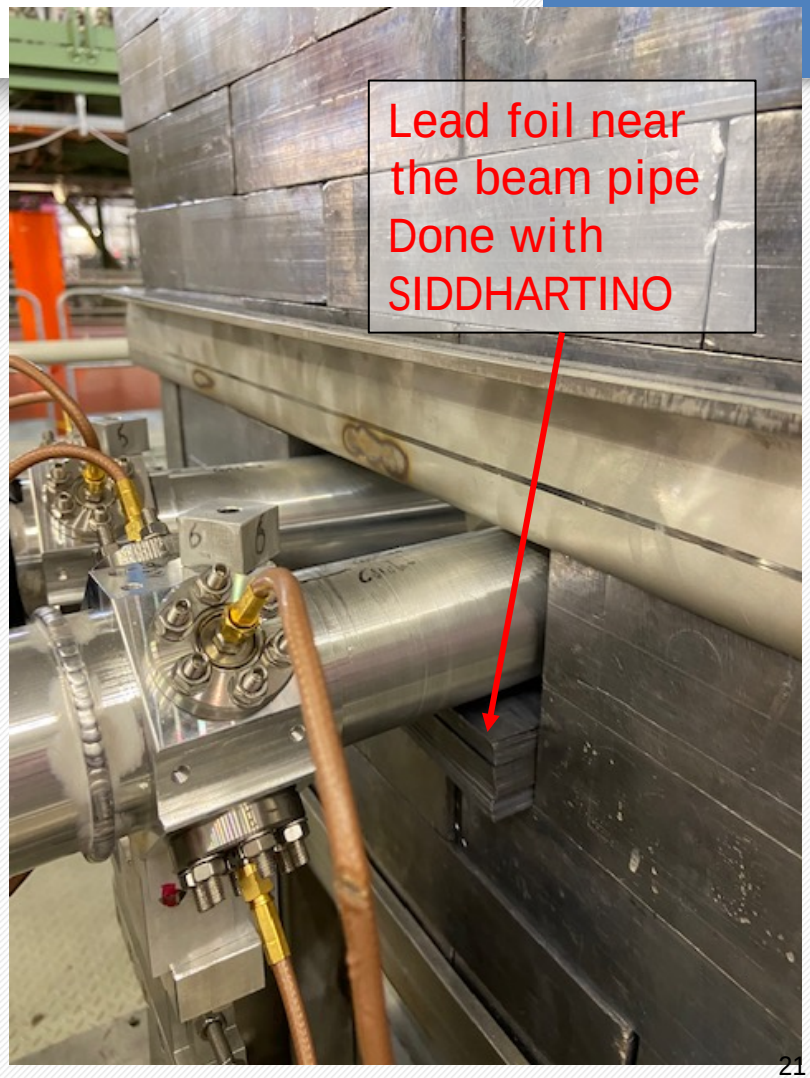




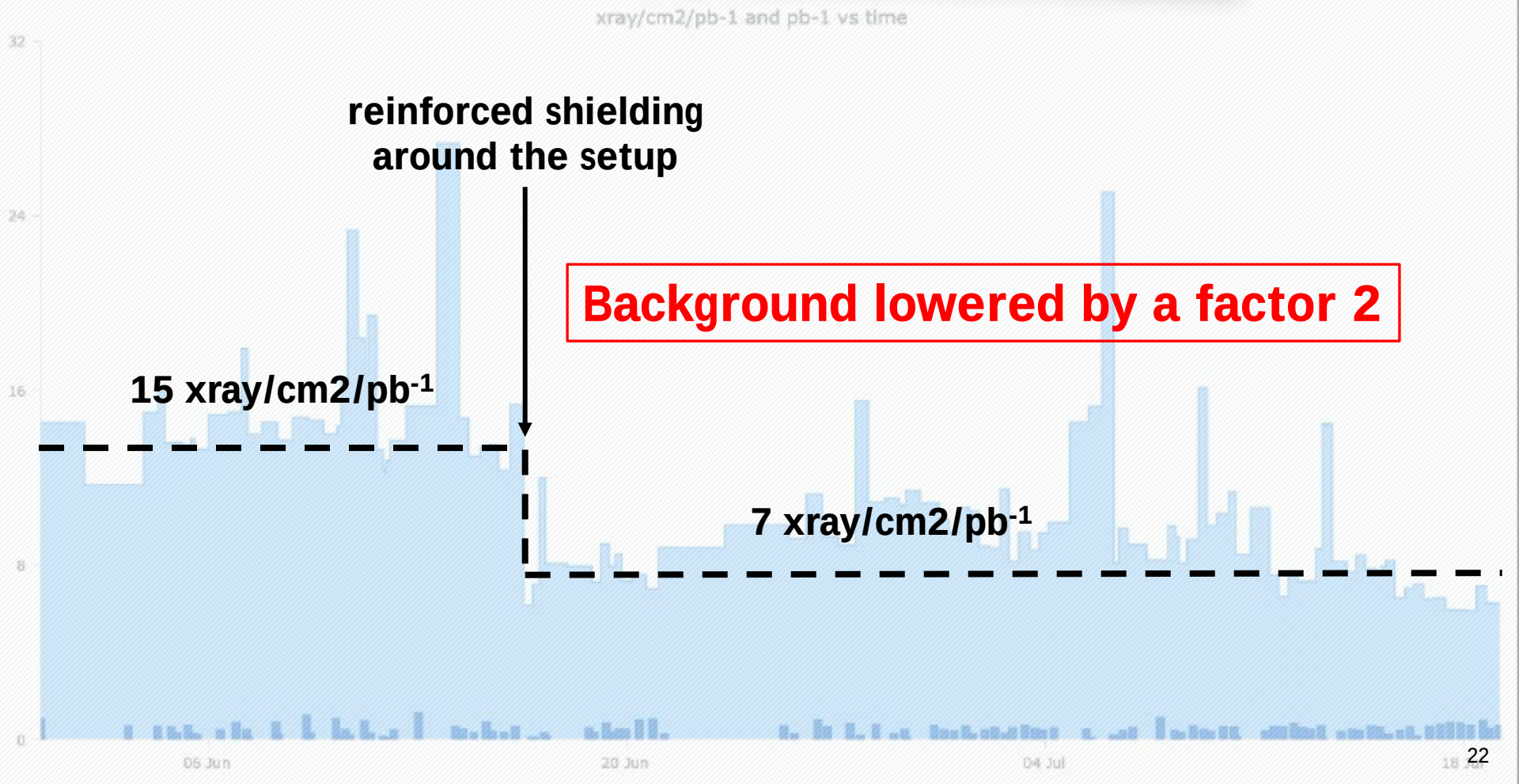
Gain obtained from calibration for one BUS (64 SDD ch)

Background reduction reinforced shielding around the setup

Re-shape of lead bricks around the vacuum chamber for the VETO-1 insertion

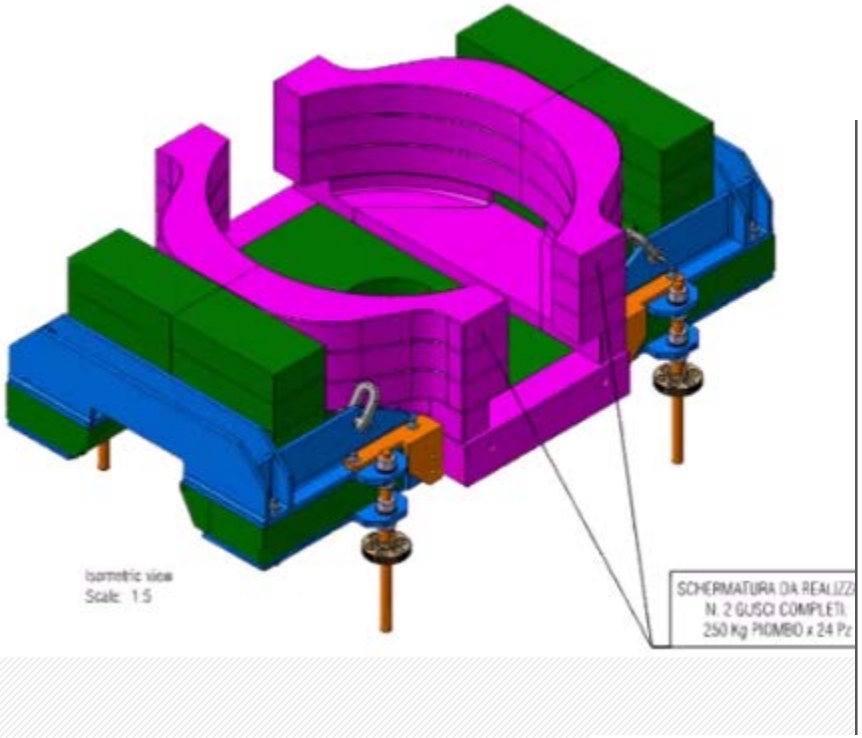


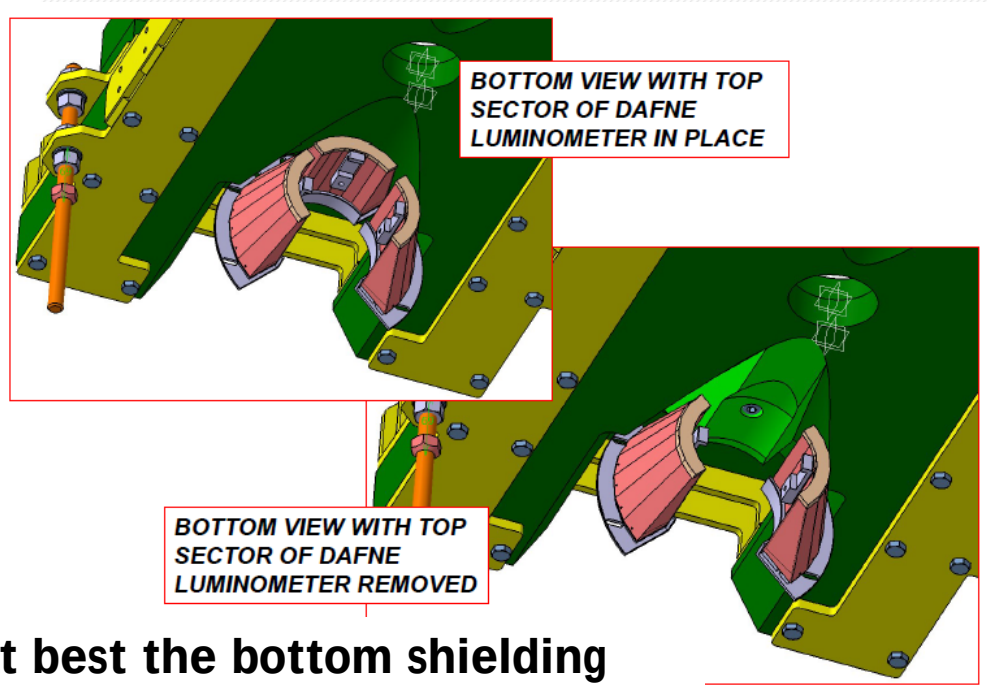
SIDDHARTINO - xray/cm2/pb^{-1}



Improvements for shielding

Additional shielding around the chamber



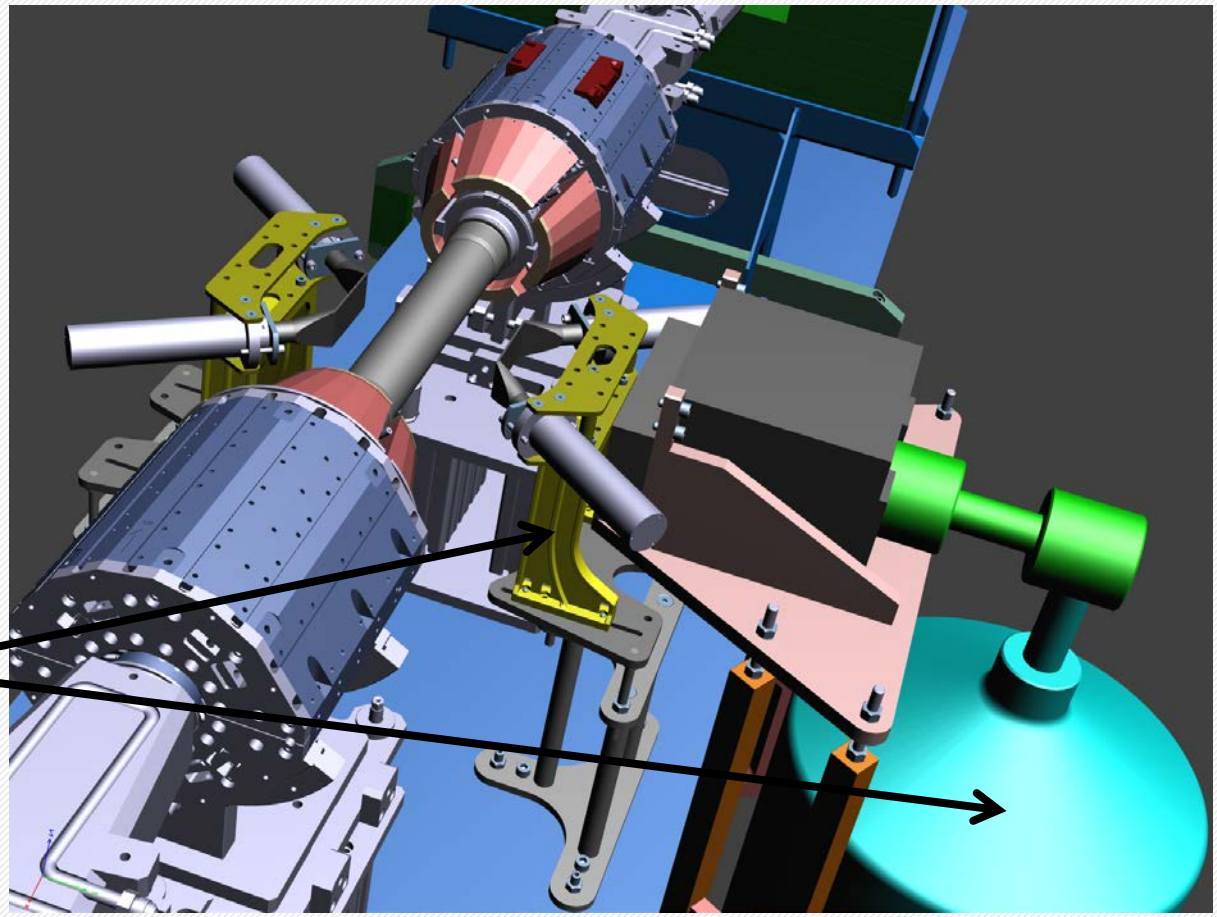


Cover at best the bottom shielding

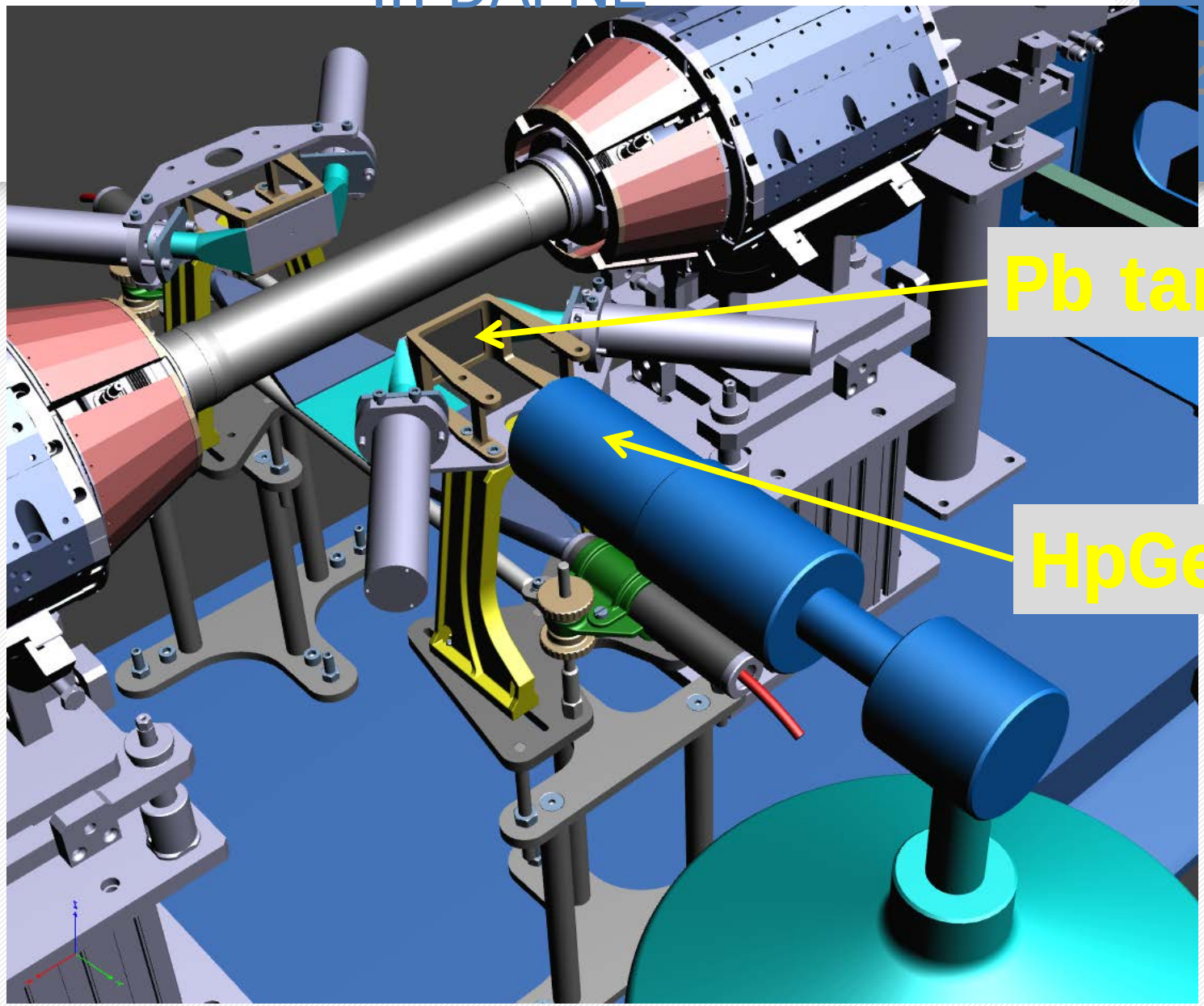
HPGe – preparation for feasibility test in DAFNE

-Trigger for the HpGe detector

Support structures modification
-Pb target
-HpGe



HPGe – preparation for feasibility test in DAFNE



HPGe – preparation for feasibility test in DAFNE

- HPGe detector available,
  Funded by University of Zagreb
  Croatian Science Foundation project 8570
- The HPGe has been transported to LNF from Zagreb
- Completed the installation of the support structure and the lead shielding

support structure

more details in the talk of Damir Bosnar

Present status

Present status

SIDDHARTA-2 strategy

Phase 1
SIDDHARTINO

DONE !

Run with
SIDDHARTINO
optimization of run conditions (backg)
verified with the measurement of K-^{4}He

SIDDHARTA-2 strategy

Phase 2
SIDDHARTA-2

We install all the SDDs (48 SDD arrays) and additional systems (VETO) ready to start the kaonic deuterium measurement for 800 pb-1

Action plan for Kd measurement:

- **First run with SIDDHARTA-2 setup as planned (about 300 pb^{-1} integrated)**

- **Second run with optimized shielding, readout electronics and other necessary optimizations; (for other 500 pb^{-1} integrated)**


SIDDHARTA-2 setup
ready for Kd run
Thank you !

spares