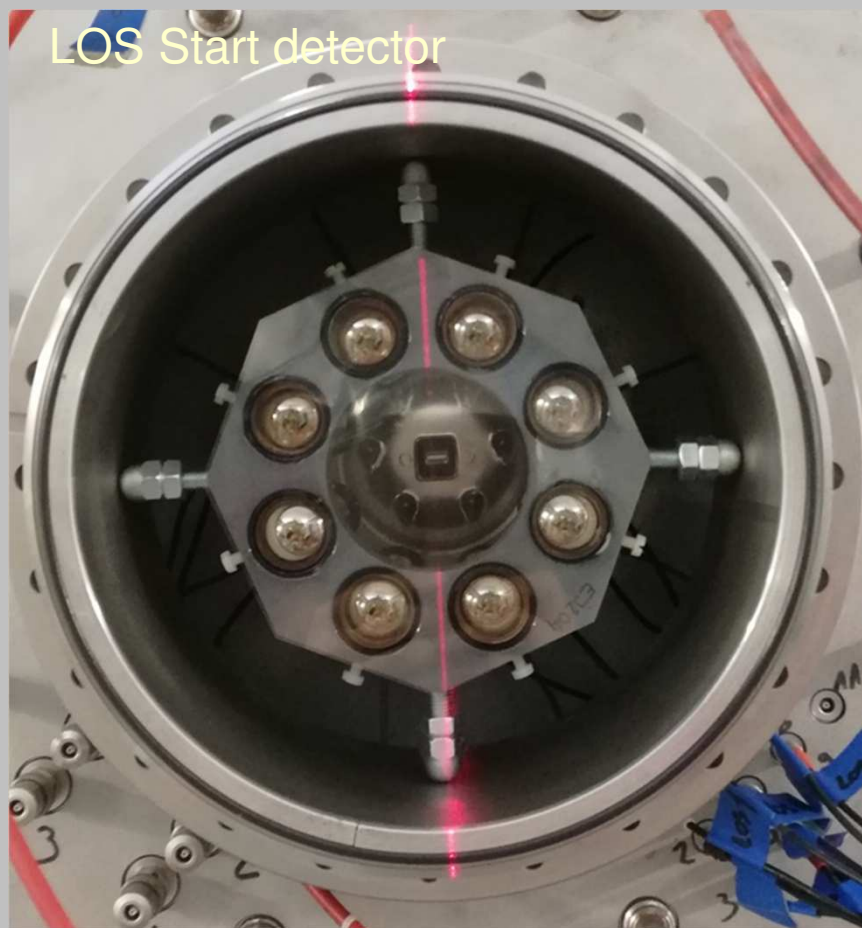


News from R3B engineering run 2019 (and recommissioning 2020)



H. Simon • GSI Darmstadt

NUSTAR Annual Meeting
GSI
20200302-06



Starting point 2016



- Starting point: stable beam setup (ultrafast tracking)
- Setup for secondary beam experiments
 - Califa
 - MUSICs
 - MWs
 - AMS Si tracker
 - LH₂ target
- Commissioning of Beam line via FRS
- Improved GLAD operation
- Lessons learned

R3B setup

L3T (DSSSD, delayed) →

AMS up to 8 systems

18 det.ladders (6+12)

Strip pitch 50µm

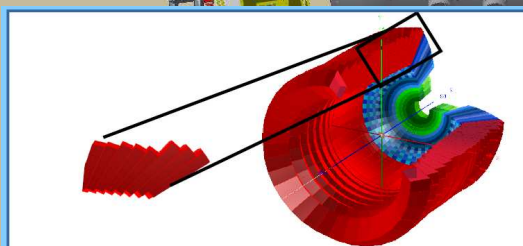
912 ASICS 116736 channels

NeuLAND

8/12 (30) double planes + frame

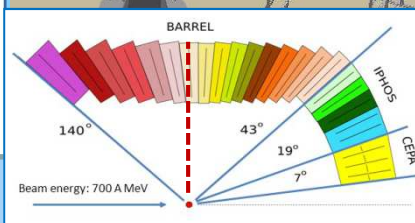
1600/2400 (6000) el. channels
& HV

GLAD & LH2 target station



Califa (forw. Barrel)

- Barrel (red) – 1952 CsI(Tl) Crystals
- Endcap – 608 Crystals
 - iPhos (blue) – CsI(Tl)
 - CEPA (green) – LaBr_3 & LaCl_3
- 2560 crystals in total

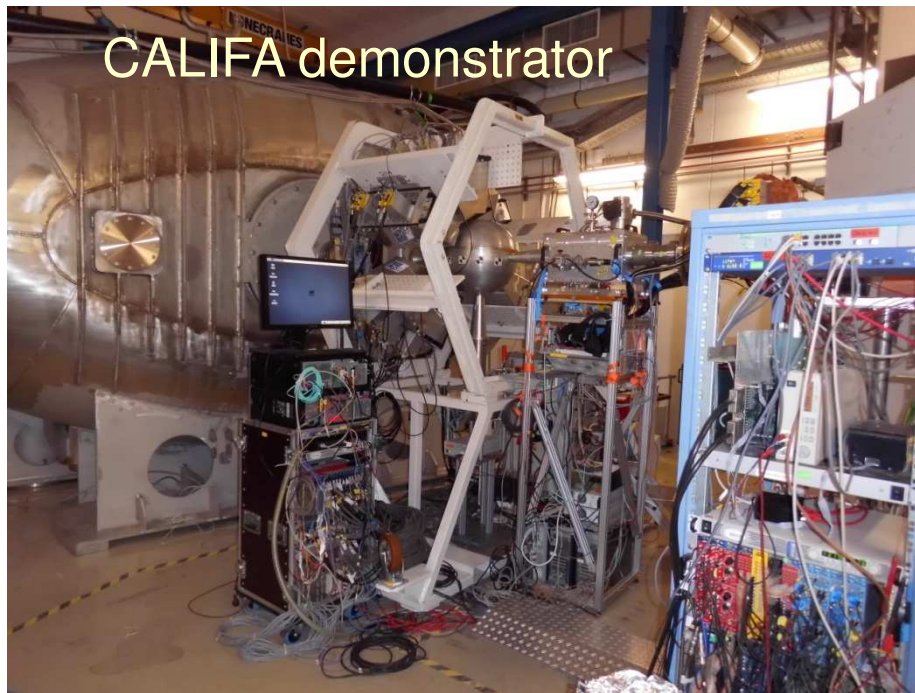


Advanced tracking system

PSPs, MUSIC,
plastic ToF (ΔE and position via ToT)
fibre detector trackers
(partly in vacuum, with electronics)

DAQ & Controls (NUSTAR DAQ / EPICS)
Simulation-Analysis (UCESB/R³Root)

All new detectors built and set up: (Nov/Dec 2018) First GLAD operation



CALIFA demonstrator

S454/S444/S473 stable beam runs
quench in magnet due to fault in CL sensors.

Meanwhile:

T. Hackler et al.

LN₂ pre-cooler prepared for sustained operation (07/2019-01/2020).
Campus infrastructure: media supplies - computing –
counting room – preparation areas: upgrade measures (2019/20).

Controls for Magnet
Powersupply, Quench Protection,
Cryo system running together
at real conditions:

- He consumption tested,
 - Ramping tested
 - Field alignment verified
- ➔ Prerequisites for 2019 runs !

setup in
vacuum
for runs
2018/19



R3B setup for 2019/2020 (i)

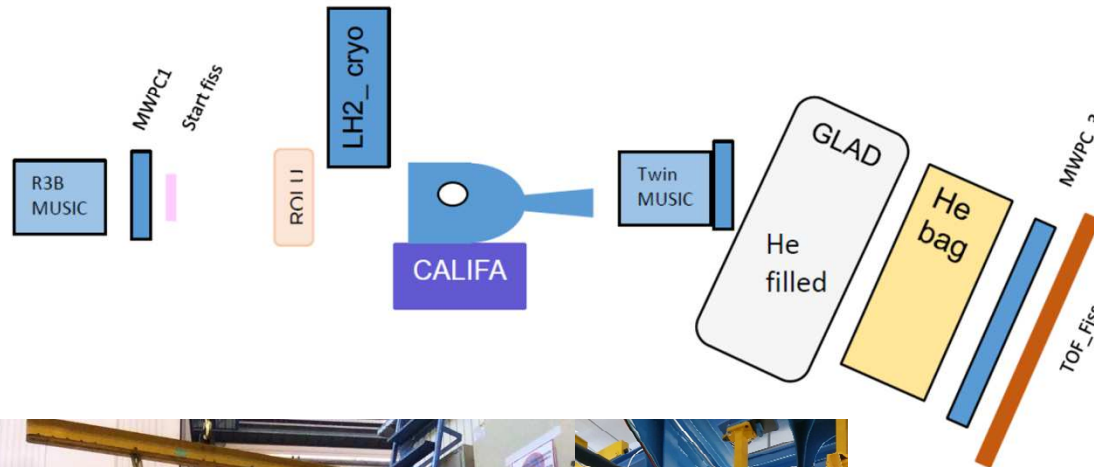
R. Gernhäuser et al.

Engineering run in Nov/Dec 2019:

Detector configuration as in the sketch.

21-23 November Ar-beam: Goals: TOF S8 – Cave C, Light ion response of beamline detectors (R3B Music, MWPC, Start, Twin Music and ROLU), optimizing the spill structure with the HADES trick.

02-03 December Bi-beam: Goals: TOF S2- S8 – Cave C, Delta electrons in AMS, Test of twin Music for heavy ions, FRS Transmission to Cave C, Fragment ID, Magnet test.



- i.e. GLAD vacuum chamber removed
- First CALIFA half to be installed
- gas detector infrastructure & LH2 safety
- gas detectors to be built & installed
- LH2 target ...

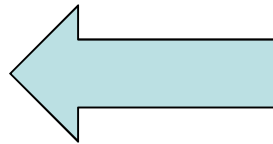
Setup rebuilt
from scratch !



Autumn 2019



A. Corsi et al.



E. Casarejos
D. Körper et al.



November 2019 (engineering run)

First operation at 0° due to power supply issues with GLAD
→ test & commissioning of detectors, optimization of spill structure

→ Final
optimization
of power supply
control parameters
H. Welker et al.

since then stable
operation!



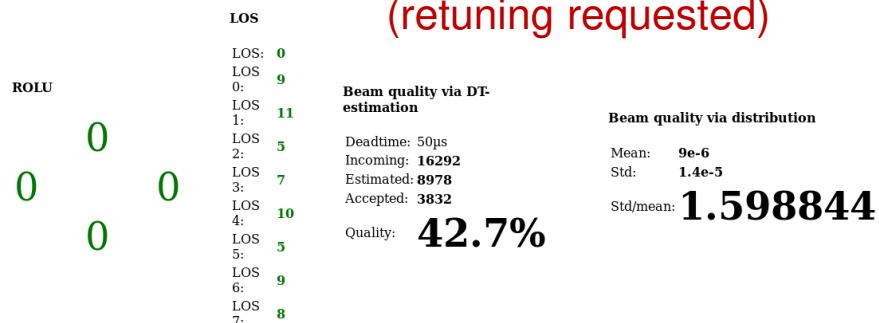
M. Heil et al.

Spill optimization via bunching

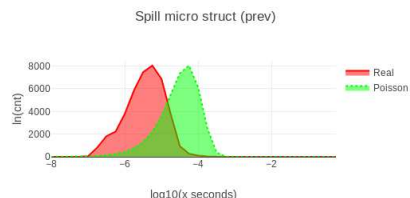
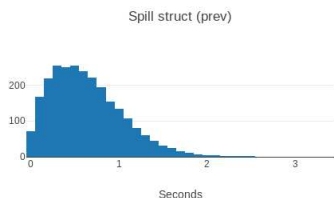
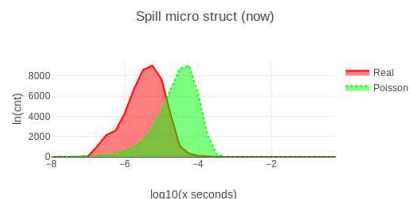
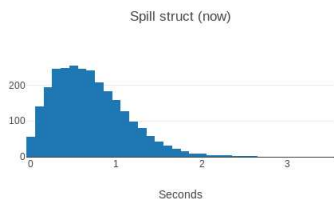
R3B Beam Monitor (V2)

Last update: 2019-11-22 23:23:38.234099
Server status: **Connected**

spill structure getting worse
(retuning requested)



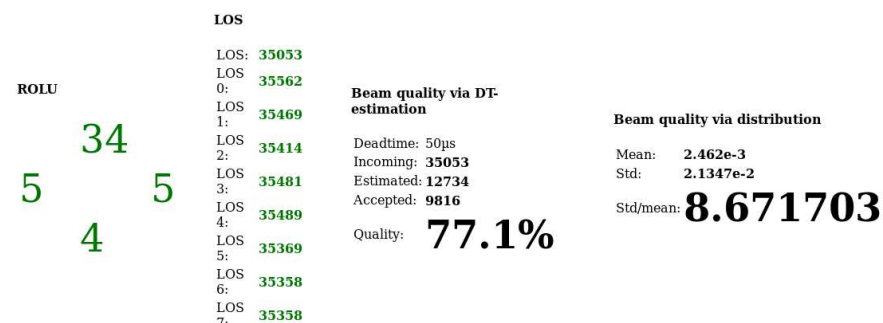
Spill



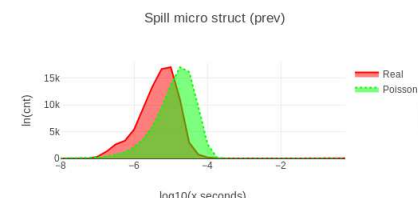
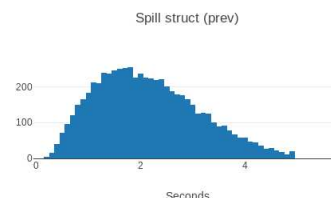
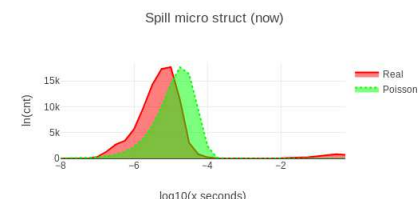
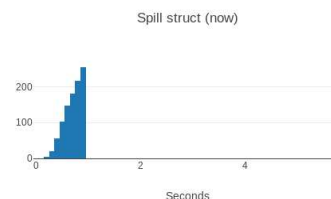
R3B Beam Monitor (V2)

Last update: 2019-11-22 23:07:37.886188
Server status: **Connected**

bunched beam

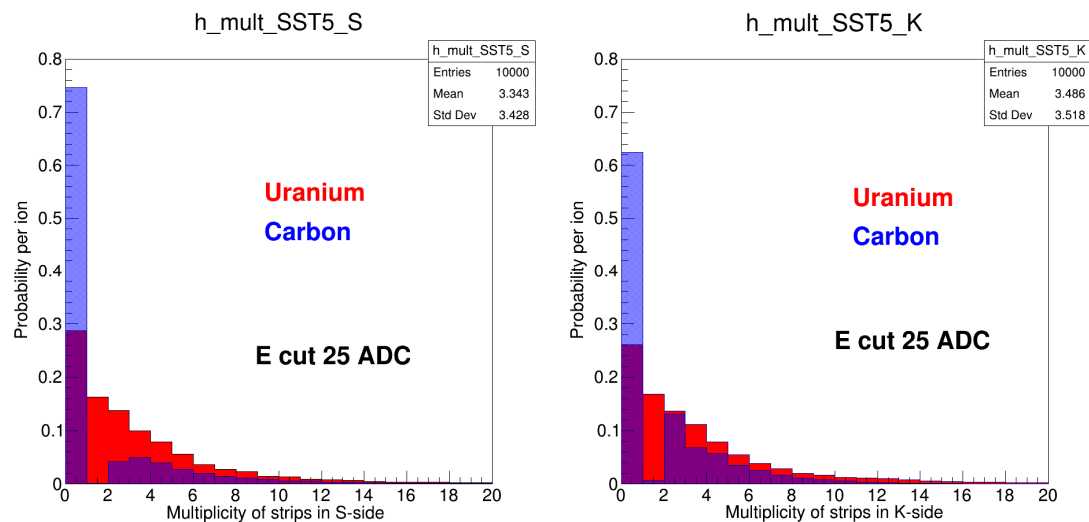


Spill

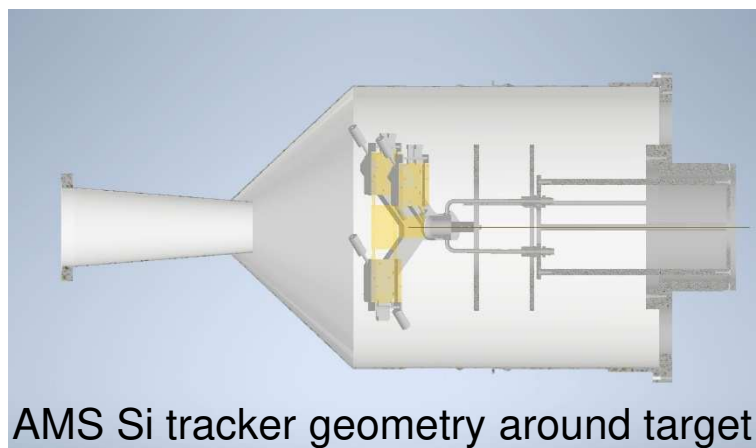


M. Heil / R. Singh / P. Forck et al.

AMS test: Uranium instead of Bi beam (December 2019)

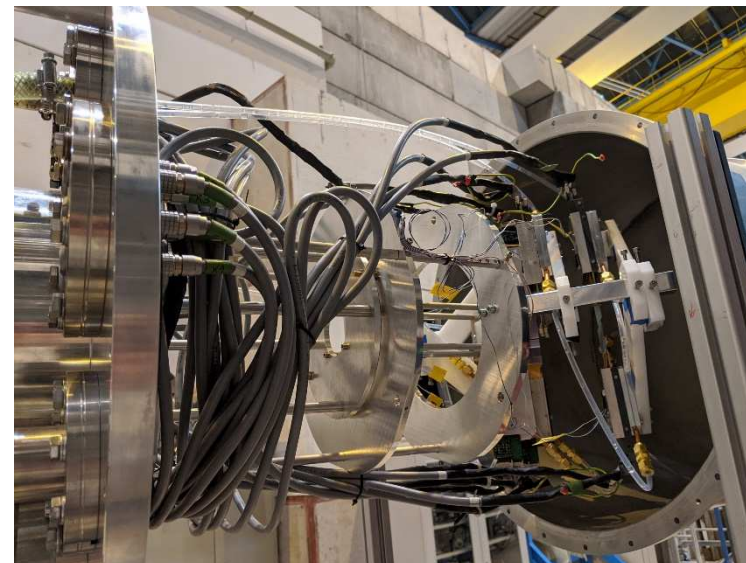


O. Kiselev, V. Panin et al.

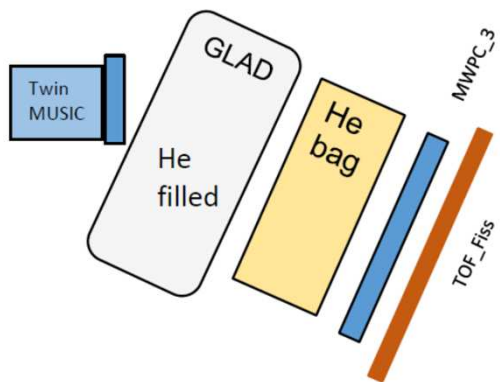


AMS Si tracker geometry around target
(Replacement for L3T tracker)

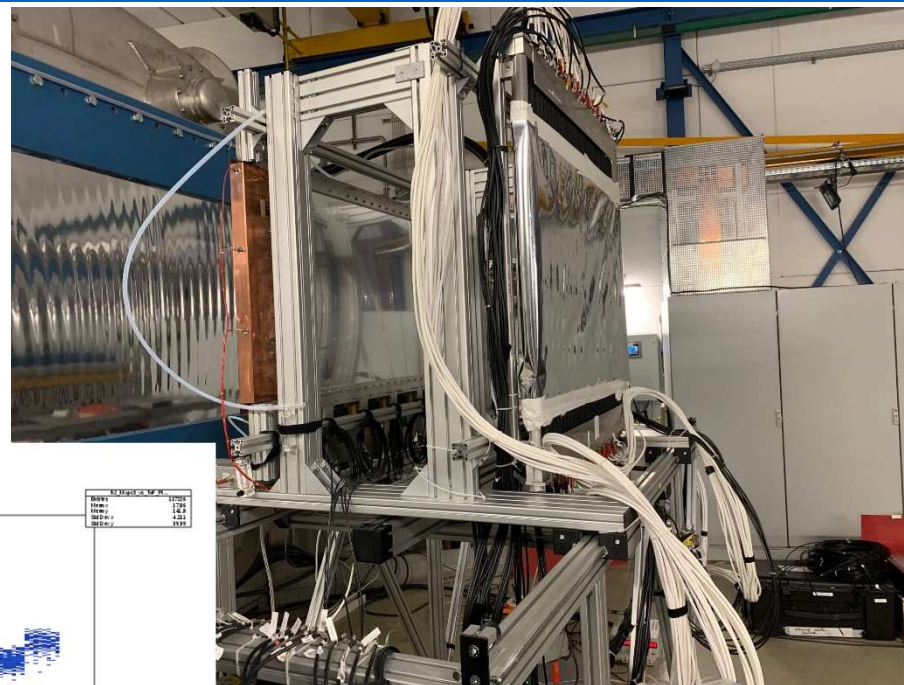
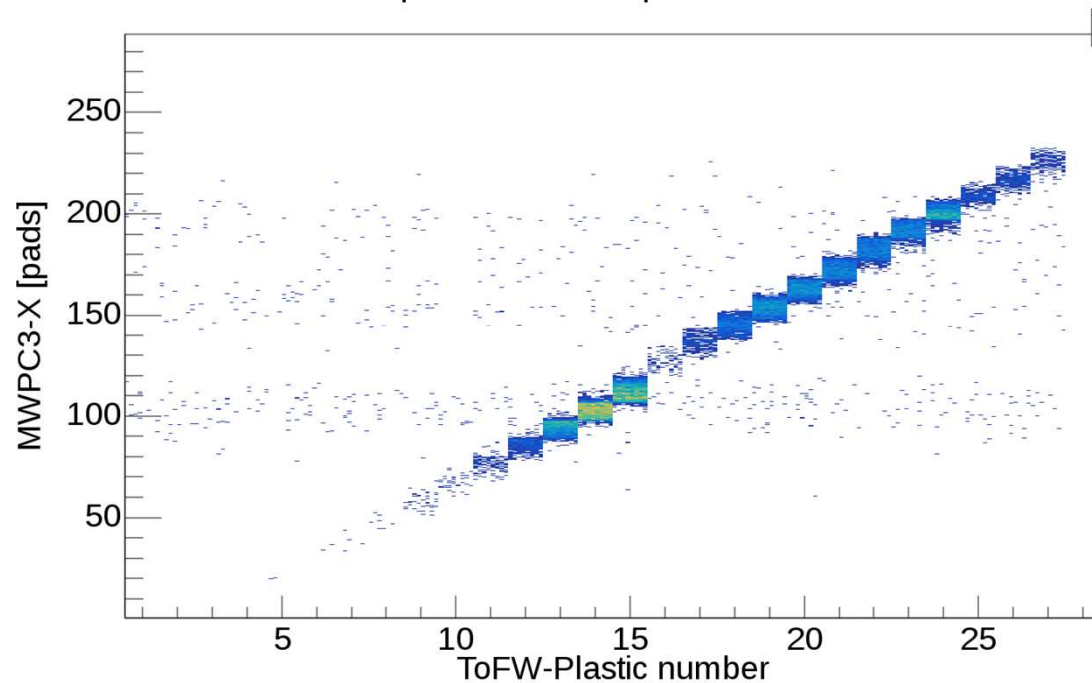
attempt
to verify (low)
delta electron
background
only partially
successful
due to bad
beam spot
& tuning
quality



Commissioning successful

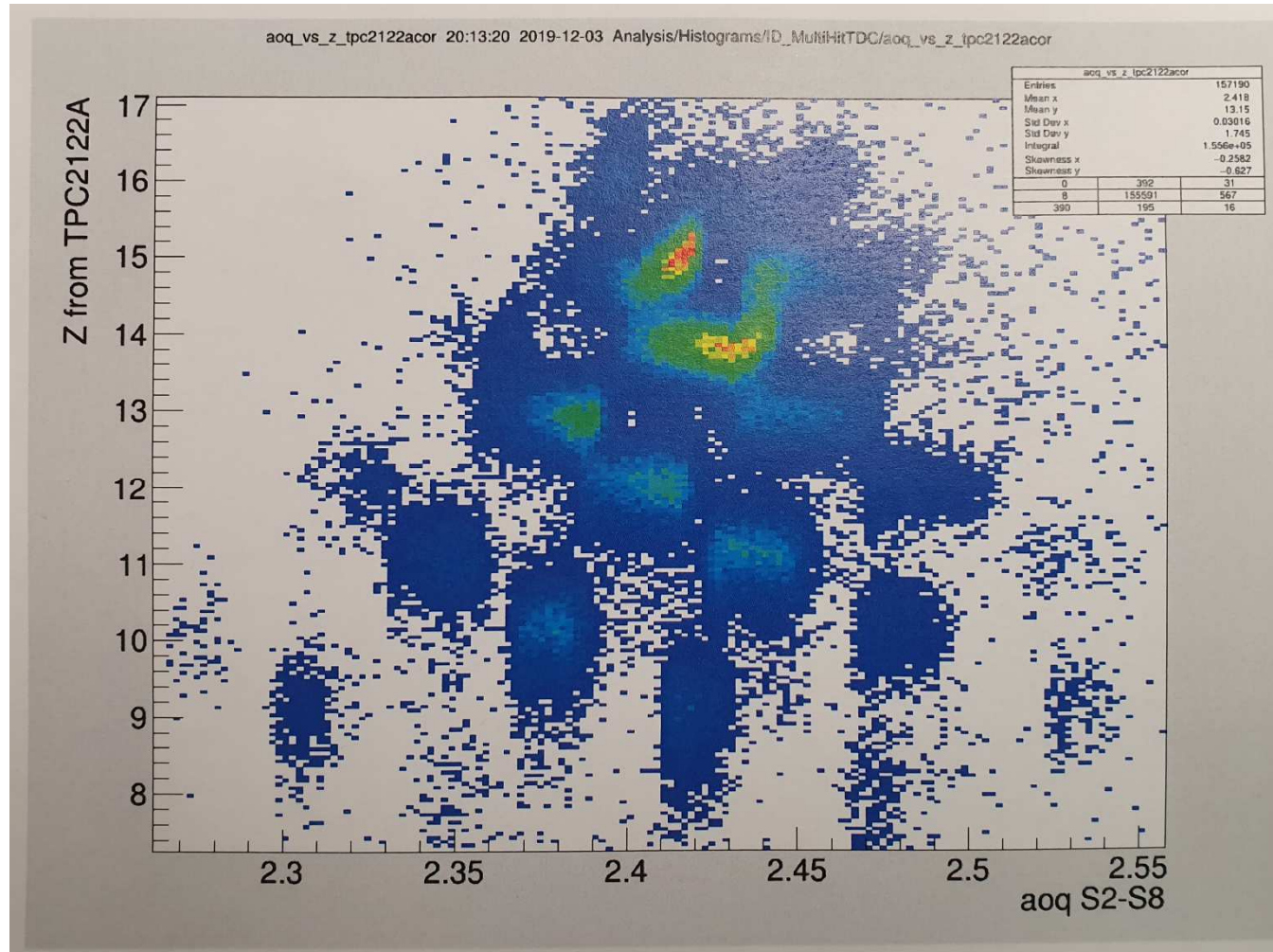


Mwpc3 vs ToF for plastic number



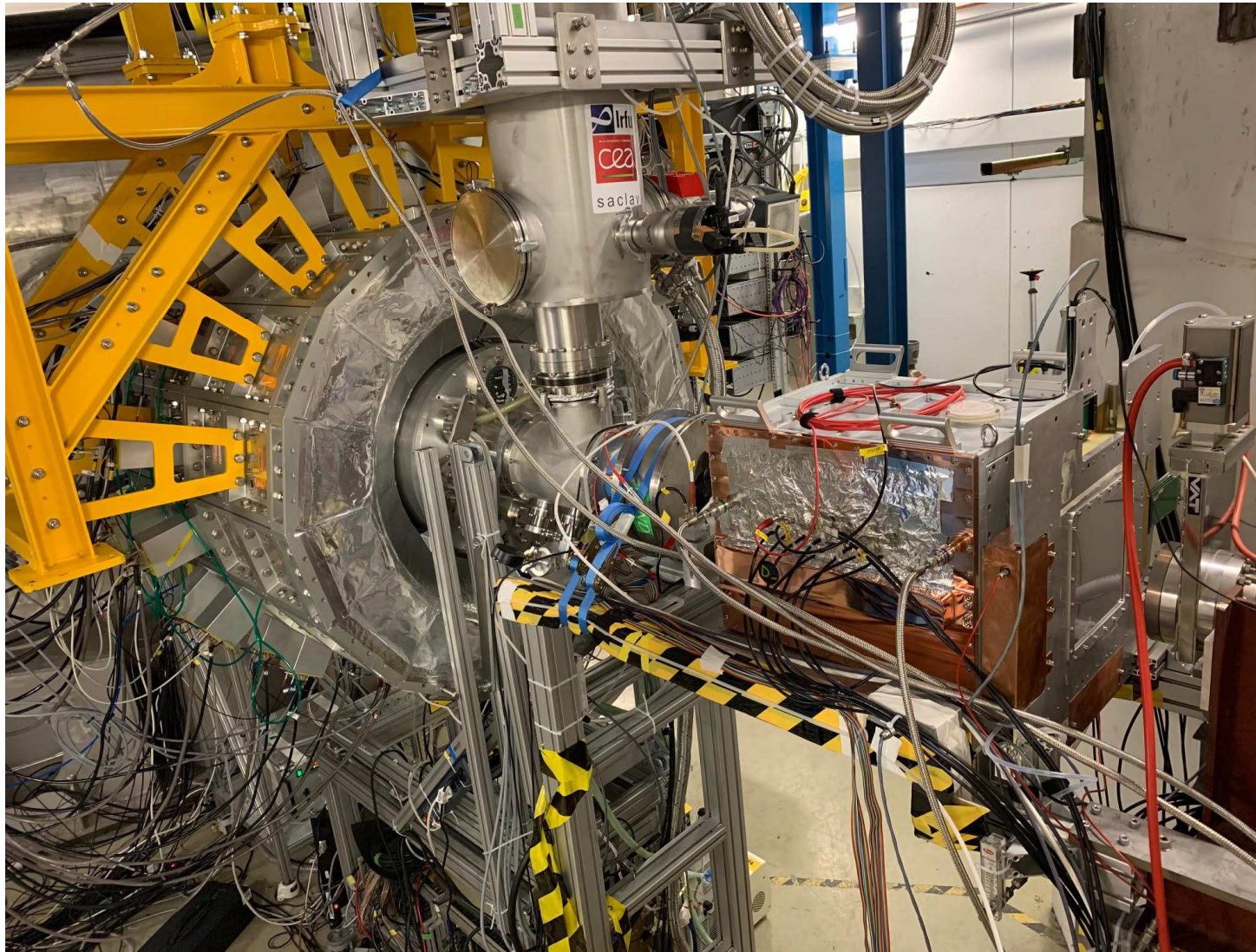
J. Taieb,
A. Chatillon,
et al.

(First) Ar fragment beam via FRS 20191202: SIS-HFS-Cave-C beam line commissioning



E. Hättner et al.
R. Gernhäuser et al.

R3B setup for 2019/2020 (ii)



J. Cederkäll
D. Cortina et al.,
J. Taieb
B. Voss et al.,
A. Corsi et al.

...

- full CALIFA
- MUSIC
optimized
- LH2 target
operation
attempt

AMS & LH2 test: noise conditions also ok but ...

Message ID: 26 Entry time: Thu Jan 30 12:02:56 2020

Author: Silvia, Valerii
Category: Detectors
Experiment: s467
Phase: Experiment
Subject: AMS look fine after LH2 first attempt

AMS look fine after LH2 first attempt.

Mapping should be checked *especially for Silicons 2 and 3*

Attachment 1: after_LH2_.png 103 kB | Hide | Hide all

ROOT http server

lxg1290.gsi.de:8886

ROOT online server

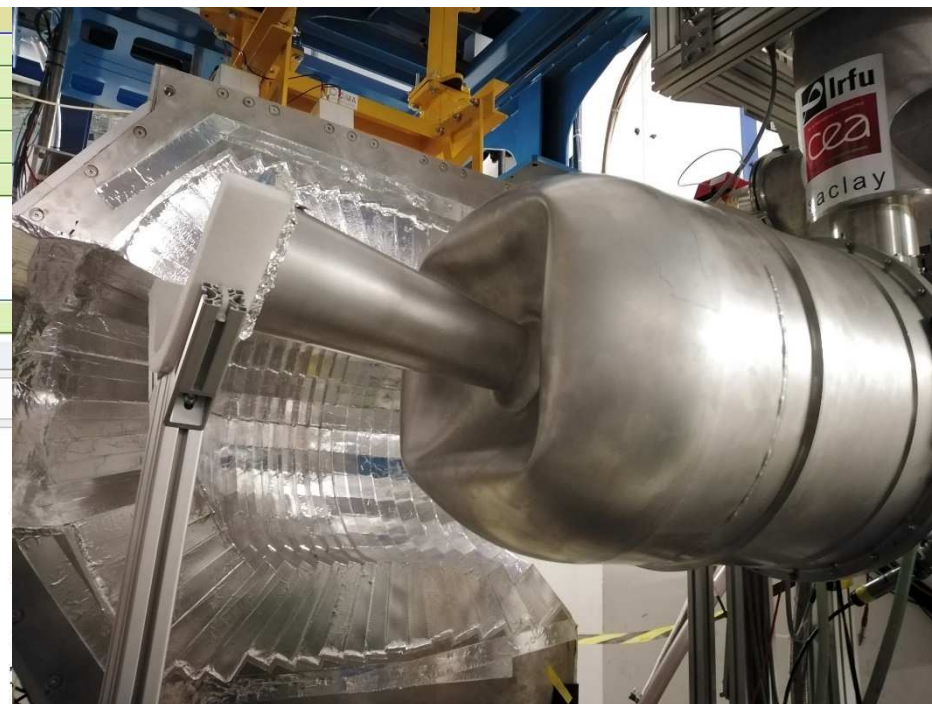
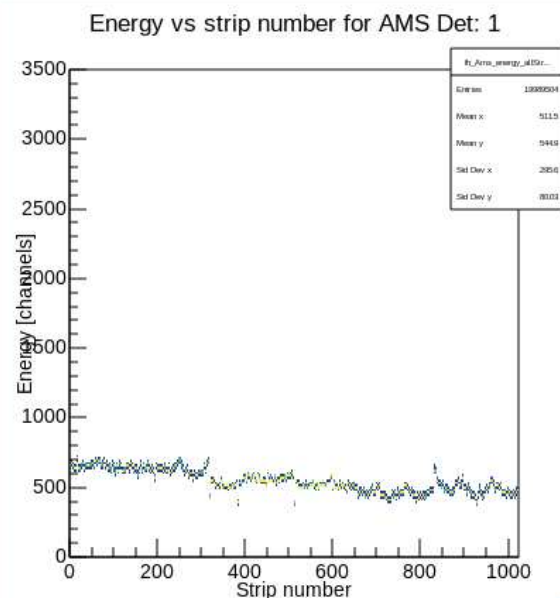
JSROOT version ROOT 6.16.00

Hierarchy in json and xml format

Monitoring simple

open all | close all | reload | clear

ROOT
Objects
AMS
Map
AMS_mapped
Cal
Hit
Correlations_per_side
Canvases
Files

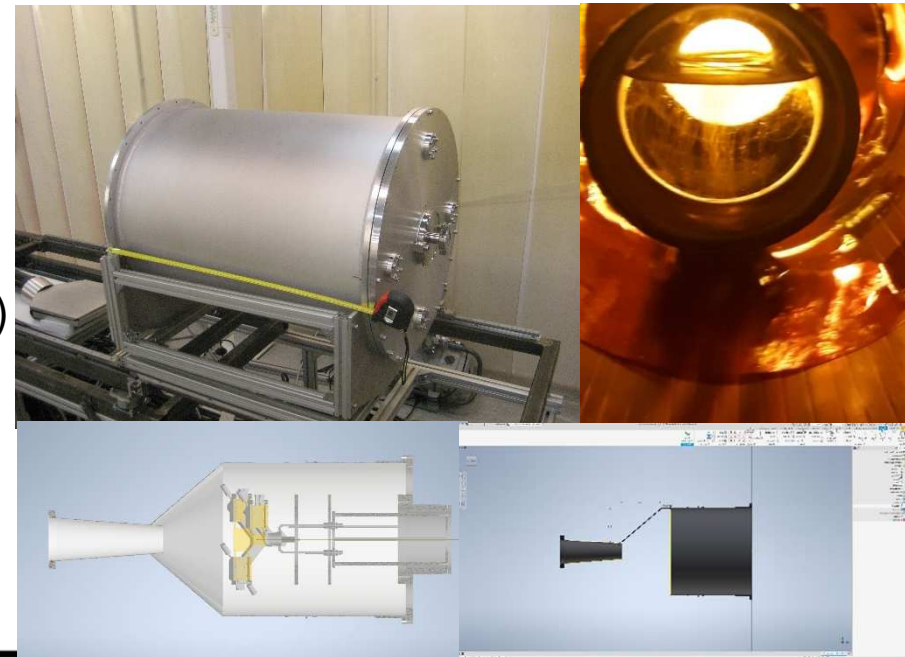


- Target liquification failed (vacuum conditions) when vacuum seemed ok ...
- eventually chamber failed (20200203) destroying two AMS detectors
- mitigation ongoing ... (new chamber ordered after first analysis of the fault)

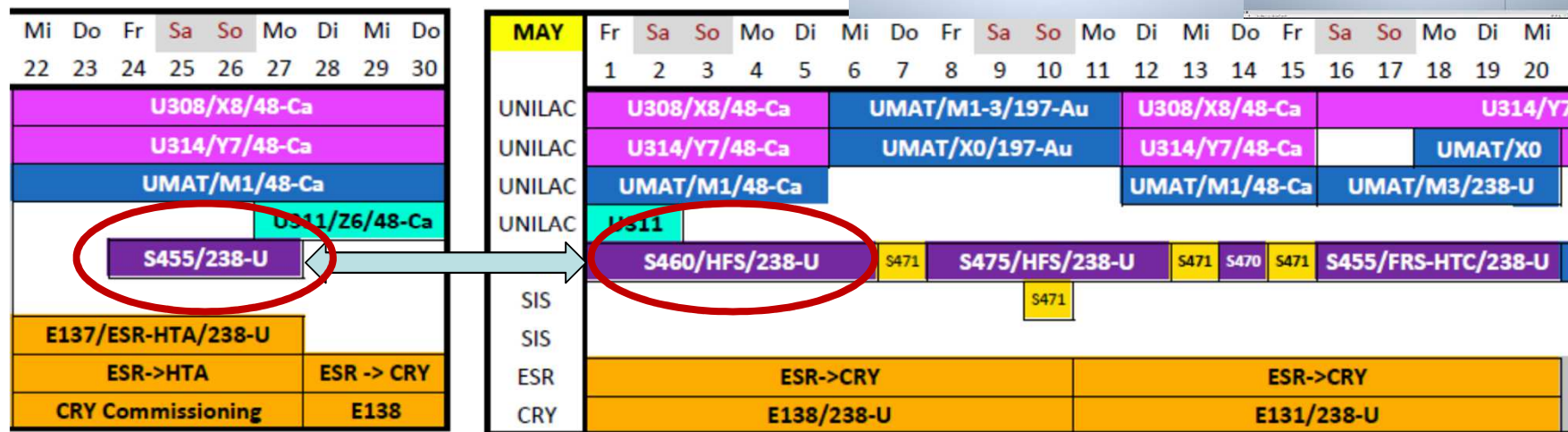
O. Kiselev, V. Panin et al.

Mitigation steps:

- LH2 target tests scheduled in UK spare chamber end of March
- Chamber repair and new production running (minimize risk in production, and mechanical studies, [D. Körper et al.](#))
- Swap of scheduling requested (agreed by S460 spokespersons)



➔ Readiness for fission campaign in May



SIS

HTC



S467

Single-particle structure of neutron-rich Ca isotopes: shell evolution along Z=20

Start: 21.02.2020, 06:00

End: 25.02.2020, 08:00

Ion: 86Kr

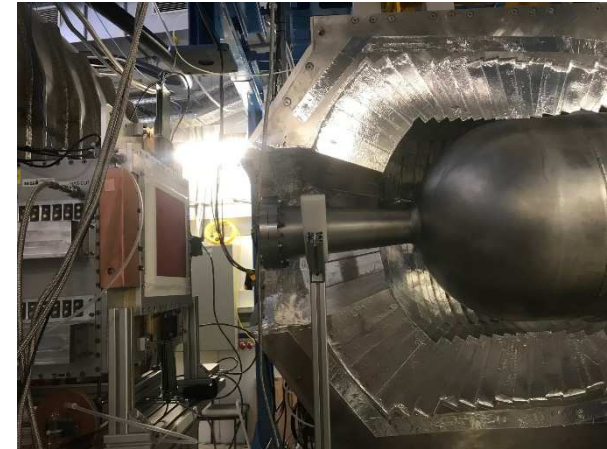
Energy: 580 AMeV

Intensity:

Pulse:

Contact:

S. Paschalis, M. Petri



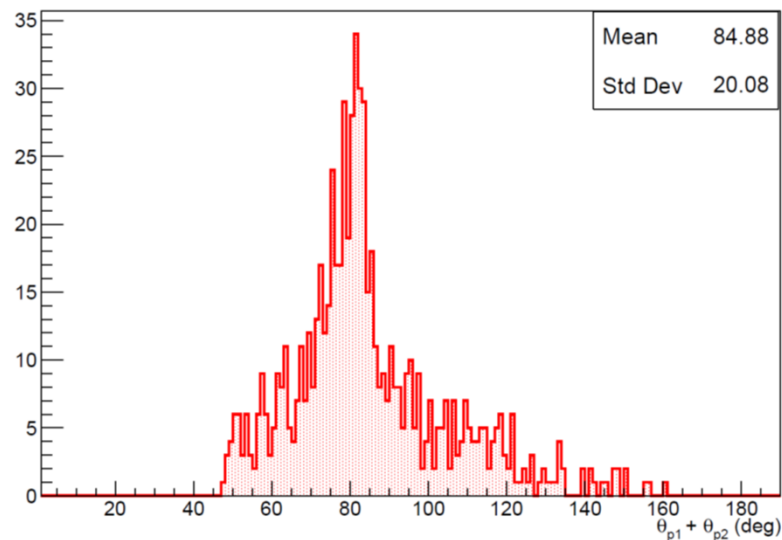
CALIFA array and target chamber of the R³B setup
(copyright: R³B Collaboration)

We will employ (p,2p) and (p,pn) Quasi-Free Scattering reactions on a proton target to study the ground state configuration of the $^{40-52}\text{Ca}$ isotopic chain. This measurement will probe the quenching of spectroscopic factors as a function of isospin asymmetry (believed to originate from short-range correlations), and it will establish the evolution of the shell structure at Z=20 and around N=28,30 and towards N=32; in particular, we will probe the potential breaking of the Z=20 proton core suggested by the recently reported anomalously large charge radii in $^{50,52}\text{Ca}$ relative to ^{48}Ca .

Eventually: Ready to run!

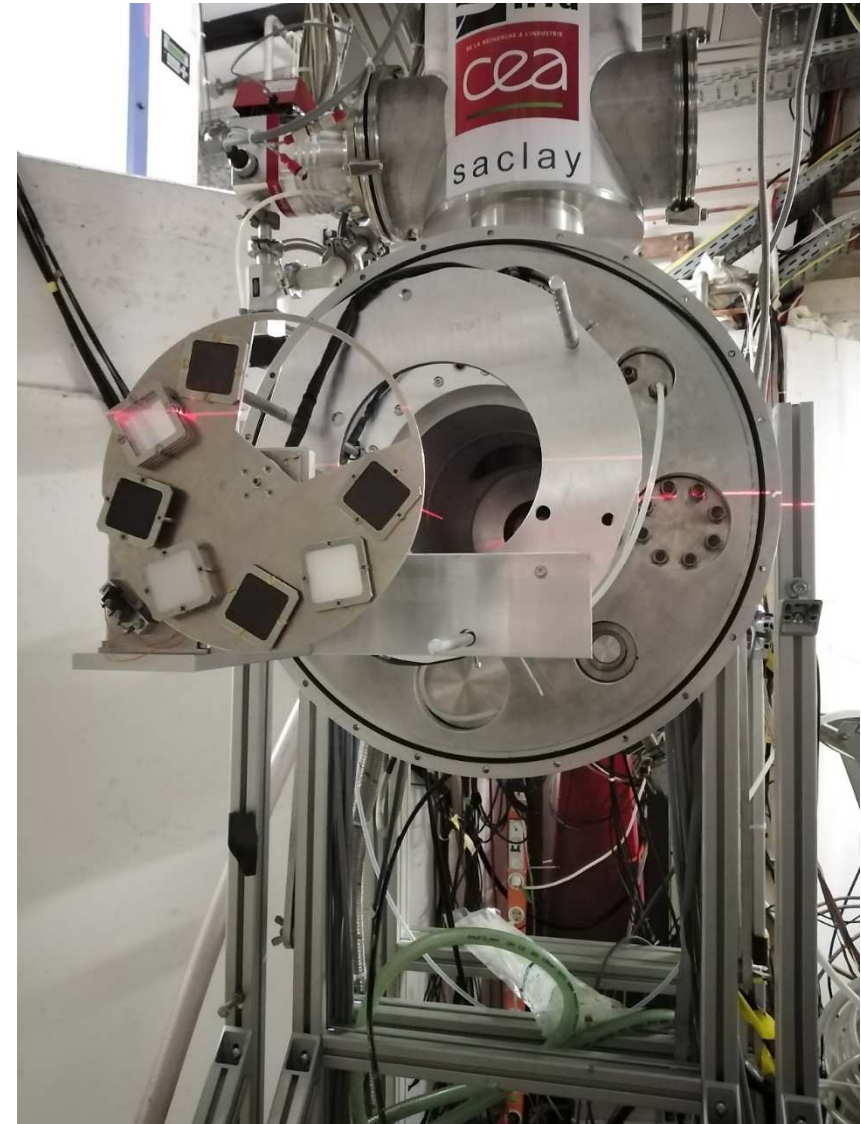
Setup simplifications:

- Target wheel installed
➔ CH₂ & C targets
- (Broken) AMS tracker removed and currently in repair

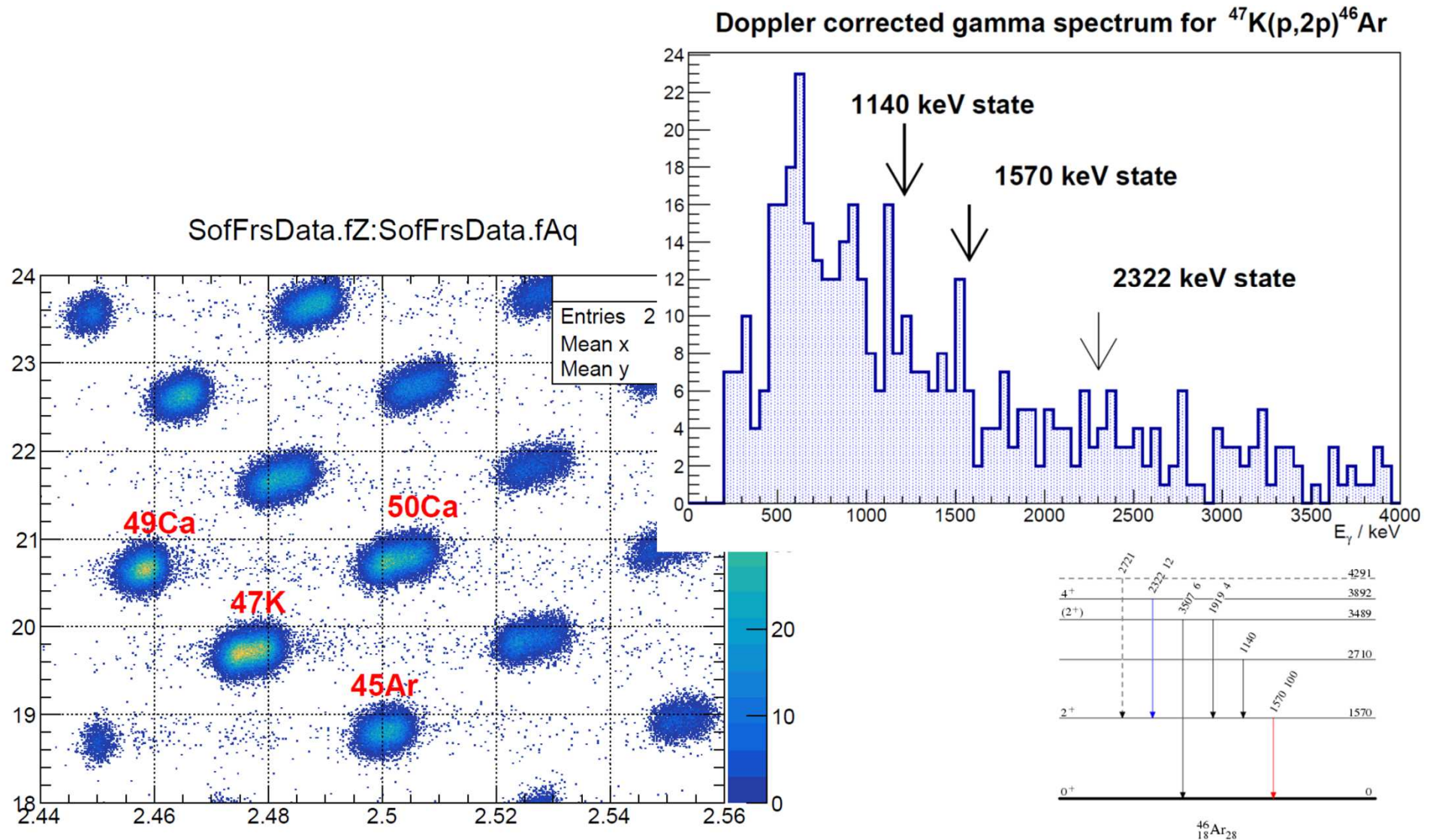


proton-proton correlations for (p,2p)

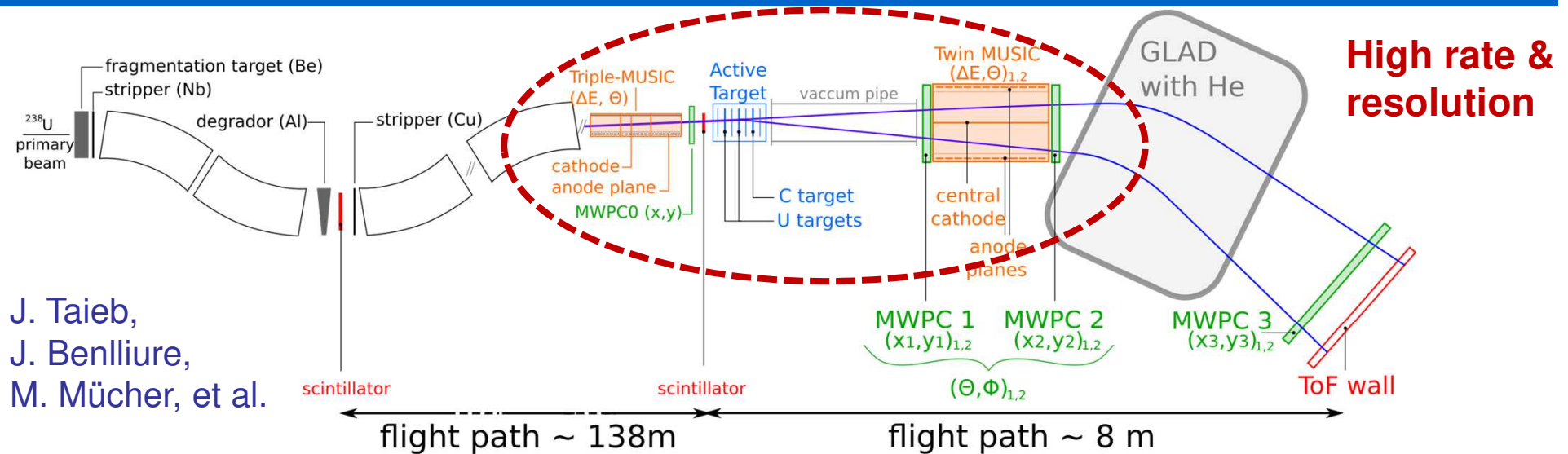
L. Atar



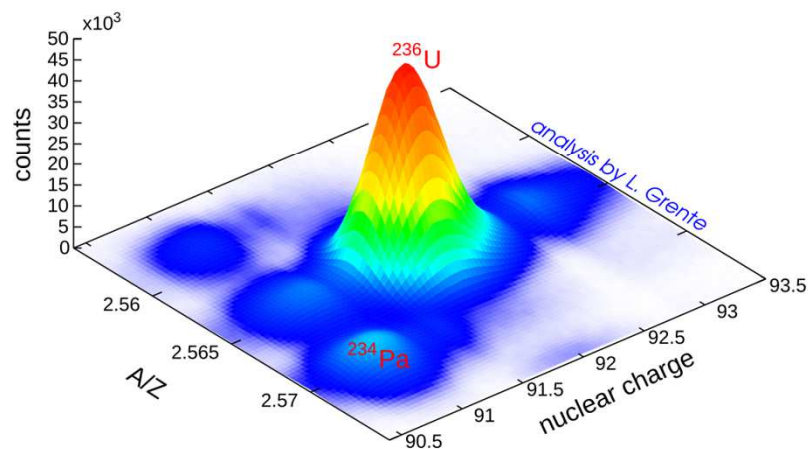
First preliminary (!!!) results:



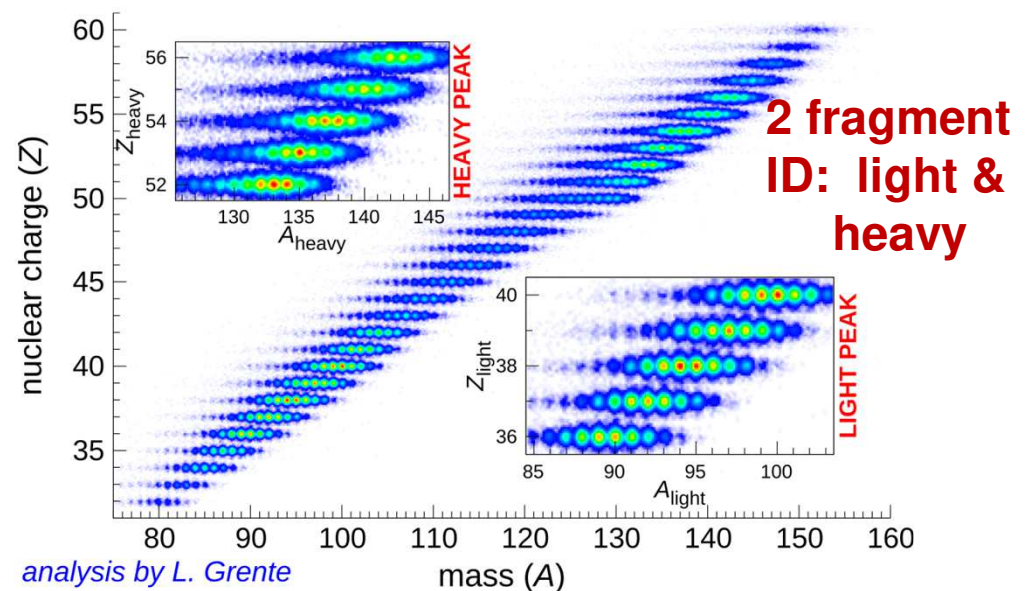
Setup for S454 (2nd half) (“SOFIA setup”)



J. Taieb,
J. Benlliure,
M. MÜcher, et al.



+ (p, 2p) excitation energy determination analysis by L. Grente



1. R³B beam times carried out in 2018-20
2. Meantime 2nd setup option rebuild from 'nothing'
3. Engineering beam times have proven to be indispensable for commissioning, especially for beam line(s) beam parameters, but also first tests of newly built detector systems and infrastructures.
4. Optimizations can be performed prior to beam time.
5. Successful beam times carried out with help of the whole Campus
6. We make an effort to be again ready for May fission campaign, thanks for the good cooperation within NUSTAR

The R³B Collaboration



Aksouh, Farouk; Al-Khalili, Jim; Algora, Alejandro; Alkhasov, Georgij; Altstadt, Sebastian; Alvarez, Hector; Atar, Leyla; Audouin, Laurent; Aumann, Thomas; Pellereau, Eric; Martin, Julie-Fiona; Gorbinet, Thomas; Seddon, Dave; Kogimtzis, Mos; Avdeichikov, Vladimir; Barton, Charles; Bayram, Murat; Belier, Gilbert; Bemmerer, Daniel; Michael Bendel; Benlliure, Jose; Bertulani, Carlos; Bhattacharya, Sudeb; Bhattacharya, Chandana; Le Bleis, Tudi; Boilley, David; Boretzky, Konstanze; Borge, Maria Jose; Botvina, Alexander; Boudard, Alain; Boutoux, Guillaume; Boehmer, Michael; Caesar, Christoph; Calvino, Francisco; Casarejos, Enrique; Catford, Wilton; Cederkall, Joakim; Cederwall, Bo; Chapman, Robert; Alexandre Charpy; Chartier, Marielle; Chatillon, Audrey; Chen, Ruofu; Christophe, Mayri; Chulkov, Leonid; Coleman-Smith, Patrick; Cortina, Dolores; Crespo, Raquel; Csatlos, Margit; Cullen, David; Czech, Bronislaw; Danilin, Boris; Davinson, Tom; Paloma Diaz; Dillmann, Iris; Fernandez Dominguez, Beatriz; D...oltan; Emling, Hans; Dmitri; Feldmeier, n; Garrido, Eduardo; il; Golubev, Pavel; Maria; Hasegan, gnatov, Alexander; n, Hakan; Johnson, parna; Kelic-Heil, Kojouharov, Ivan; Krupko, Sergey; t, Valerie; Larsson, e; Letts, Simon; Li, Songlin; Liang, 2...kasik, Jerzy; Loeher, Bastian; Mahata, Kripamay; Maj, Adam; Marganec, Justyna; uentz, Christian; Nacher, Enrique; Najafi, Ali; Nakamura, Takashi; Neff, Thomas; oran; Obertelli, Alexandre; Obradors, Diego; Ogloblin, Aleksey; Oi, Makito; Palit, ki, Piotr; Petri, Marina; Pietralla, Norbert; Pietras, Ben; Pietri, Stephane; Plag, Ralf; si; Prasad, Rajeshwari; Fraile Prieto, Luis Mario; Pucknell, Vic; Galaviz -Redondo, Rejmund, Fanny; Ricciardi, Maria Valentina; Richter, Achim; Rigollet, Catherine; icia; Gonzalez Rozas, Yago; Rubio, Berta; Roeder, Marko; Saito, Takehiko; Salsac, vajols, Herve; Savran, Deniz; Scheit, Heiko; Schindler, Fabia; Schmidt, Karl-Heinz; Philipp; Sharma, Manoj Kumar; Sherrill, Bradley; Shrivastava, Aradhana; Shulgina, mpson, John; Singh, Pushpendra Pal; Sonnabend, Kerstin; Spohr, Klaus; Stanoiu, n; Syndikus, Ina; Suemmerer, Klaus; Taieb, Julien; Tain, Jose L.; Tanihata, Isao; elala; Thies, Ronja; Togano, Yasuhiro; Tostevin, Jeffrey A.; Trautmann, Wolfgang; Tuboltsev, Yuri; Turrión, Manuela; Typel, Stefan; Udias-Moinelo, Jose; Vaagen, Jan; Velho, Paulo; Verbitskaya, Elena; Veselsky, Martin; Wagner, Andreas; Walus, Wladyslaw; Wamers, Felix; Weick, Helmut; Wimmer, Christine; Winfield, John; Winkler, Martin; Woods, Phil; Xu, Hushan; Yakorev, Dmitry; Zegers, Remco; Zhang, Yu-Hu; Zhukov, Mikhail; Zieblinski, Miroslaw; Zilges, Andreas;

