

TASCA focal-plane detection system: past and present

J. Khuyagbaatar

GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

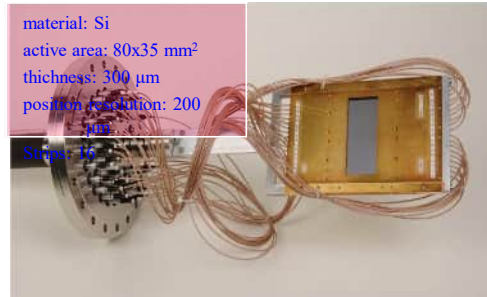
TASCA26 workshop, 19-21 May 2026, GSI, Germany

GSI, Darmstadt
19 May 2026



March 2006.
 St. Petersburg State University
 2006 PhD (with Yu.N. Novikov)
 St. Petersburg State University

January 2006
 @SHIP: GSI stipendium (S. Hofmann)



Focal plane detection system

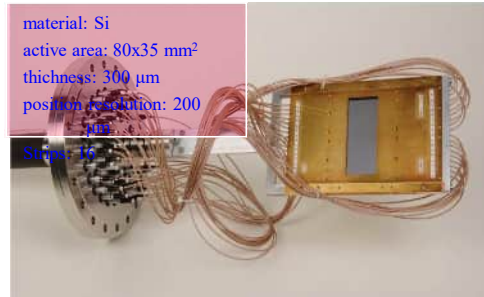
- Detector --- SHIP
- Electronics --- SHIP (GSI)
- DAQ --- SHIP (GSI)
- D. Ackermann ...

³⁰Si+²³⁸U @SHIP

| April 2006 | | | | | | | | | | Schedule as of 27-Apr-2006 | | | | | | | | | |
|---|----|----|----|----|---------|----|---|----|----|----------------------------|--|----|----|----|----|----|----|--|--|
| Week 15 | | | | | Week 16 | | | | | Week 17 | | | | | | | | | |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| U215, Nishio/Hofmann, 30Si (ECR), 4.8-5.6 MeV/u, 500 pA, Y7 | | | | | | | | | | | | | | | | | | | |
| T04, 30Si, 1nA, se, X3 | c) | | | | c) | d) | UBIO, Scholz, Ar, 11.4, 2 TnA, >1ms, X6 | c) | | | U219, Schaedel, M./Schaedel, 30Si, 6.5-7.5 MeV/u, X8 | c) | | | | | | | |

TASCA





Focal plane detection system

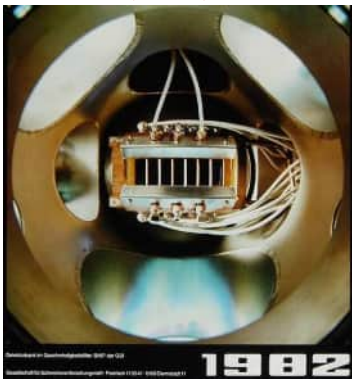
- Detector --- SHIP
- Electronics --- SHIP (GSI)
- DAQ --- SHIP (GSI)

D. Ackermann ...

1977: Velocity filter SHIP, @GSI, Germany

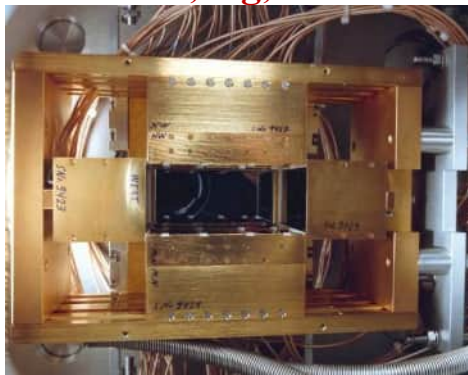
S. Hofmann, W. Faust, G. Münzenberg, W. Reisdorf, P. Armsbruster, K. Guttner and H. Eward, Z. Phys. A **291**, 53 (1979).
 S. Hofmann, G. Münzenberg, F.P. Heßberger and H.J. Schott, NIM A **223**, 312 (1984).

Bh, Hs, Mt



Deutsches Museum in Bonn

Ds, Rg, Cn



Deutsches Museum in Munich

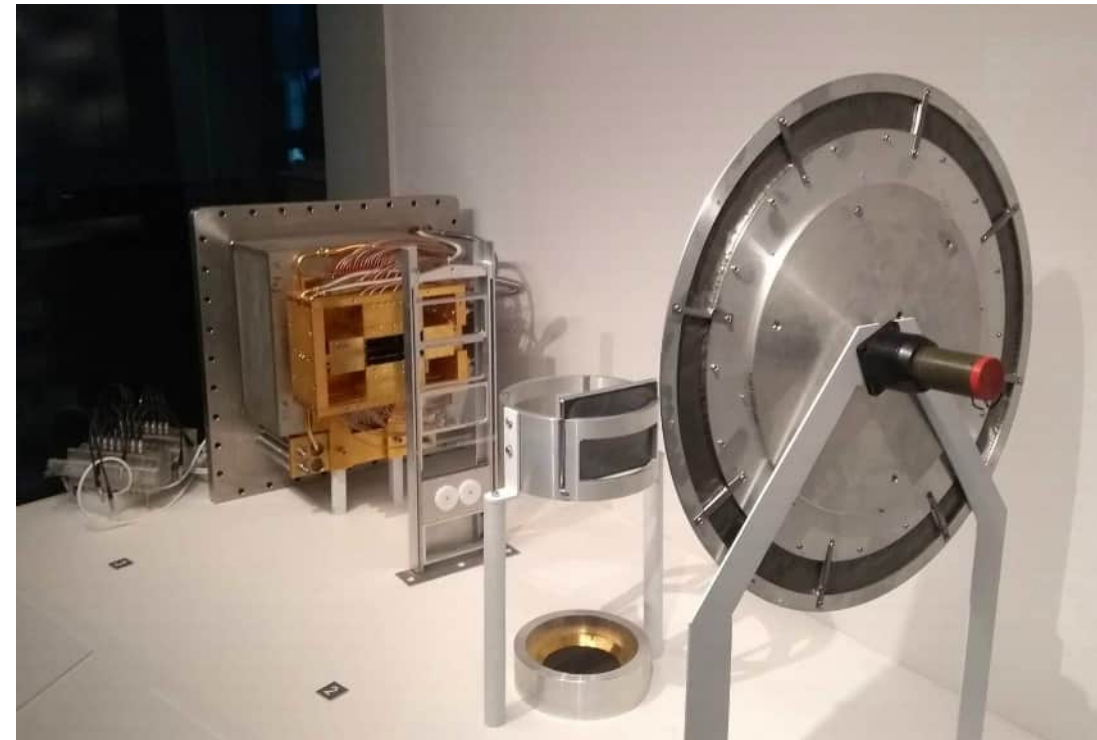


Photo: S. Raeder/GSI/FAIR
3

April 2006

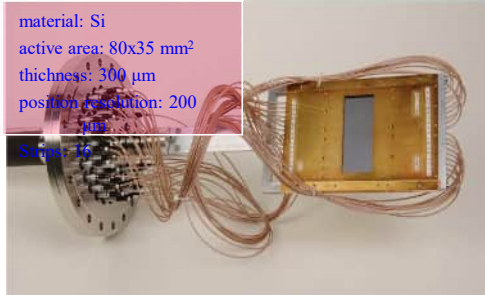
May 2006

PSSD-SHIP

An. Elect. -COMPACT

DAQ-COMPACT

material: Si
 active area: 80x35 mm²
 thickness: 300 μm
 position resolution: 200 μm
 Strips: 16

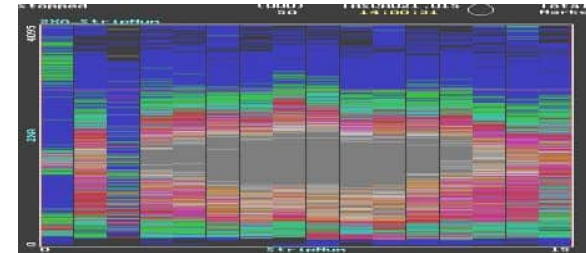
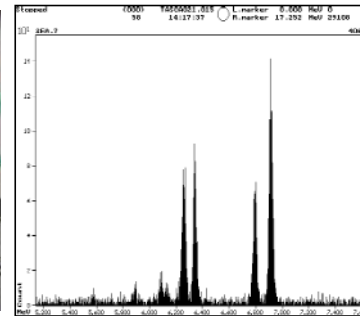
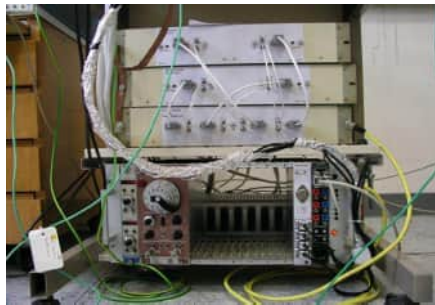
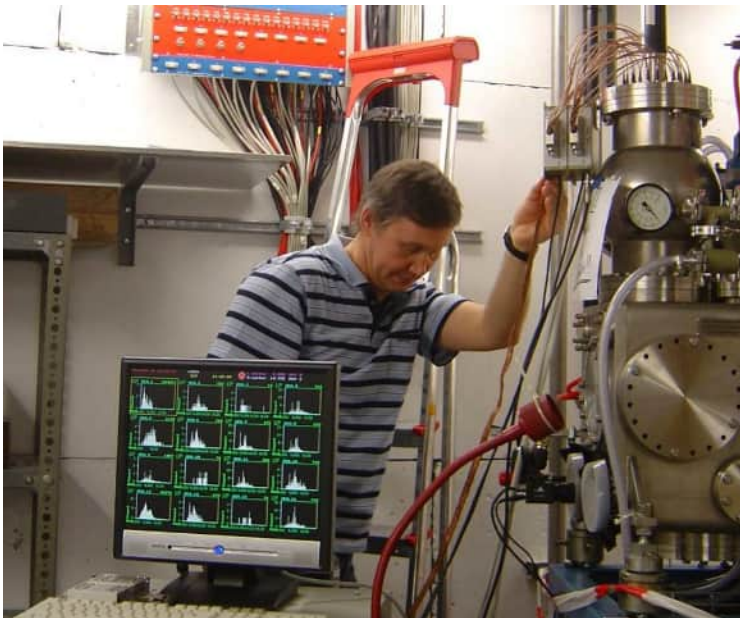


Focal plane detection system

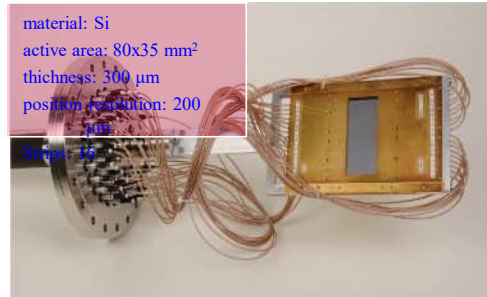
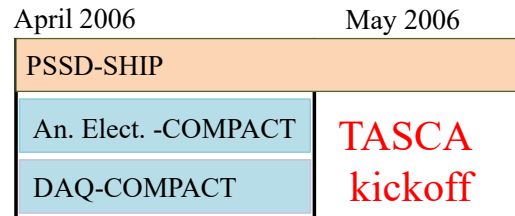
Detector --- SHIP
 Electronics --- FLNR
 DAQ --- FLNR

J. Khuyagbaatar @TASCA26

TU München: Dubna(FLNR) for COMPACT
 A. Yakushev,



Commissioning is successfully started !



Focal plane detection system

- Detector --- SHIP
- Electronics --- SHIP (GSI)
- DAQ --- SHIP (GSI)

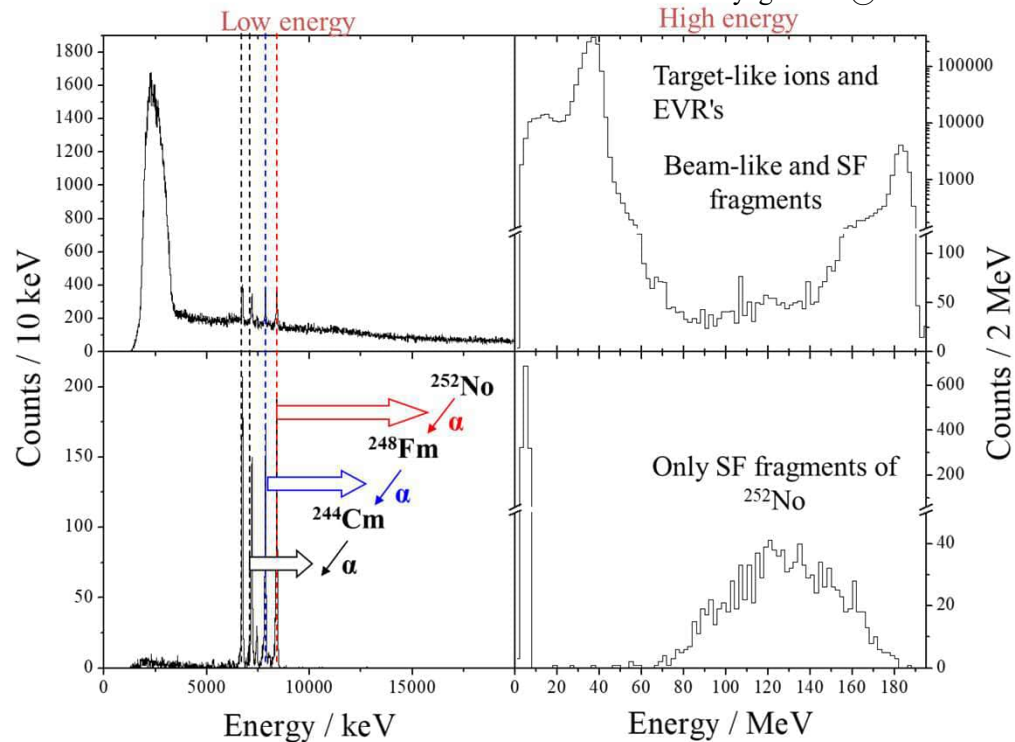
D. Ackermann ... + J. Khuyagbaatar
(2005: Ge-detectors for TASCA)

April 2006

February 2007

| | |
|---------------------|------------------|
| PSSD-SHIP | |
| An. Elect. -COMPACT | An. Elect. -SHIP |
| DAQ-COMPACT | DAQ-SHIP |

J. Khuyagbaatar @TASCA26



TASCA was successfully commissioned

J. Khuyagbaatar *et al.*,
 Nucl. Inst. Meth. A **689**, 40 (2012)

Influence of a density effect for the charge-equilibration process @gas-filled separator was fully understood !

April 2006

2009

August 2010

J. Khuyagbaatar @TASCA26

| | | |
|---------------------|------------------------|-----------------------|
| PSSD-SHIP | | DSSD-TASCA |
| An. Elect. -COMPACT | An. Elect. -SHIP (GSI) | An. Elect. -FLNR/CAEN |
| DAQ-COMPACT | DAQ-SHIP (GSI) | DAQ-TASCA (GSI) |

Physics results on SHE !

Ch.E. Düllmann et al.,
Phys.Rev. Lett. **104**, 252701 (2010).

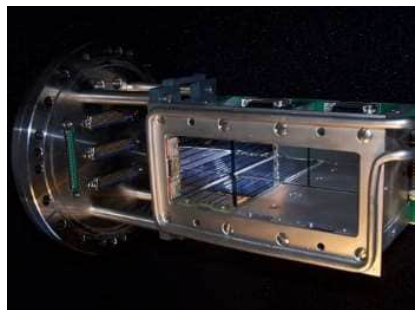
J. M. Gates et al.,
Phys. Rev. C **83**, 054618 (2011).

Focal plane detection system

Detector --- DSSD (Warsaw)
Electronics --- TASCA (FLNR, CAEN)
DAQ --- TASCA (GSI)

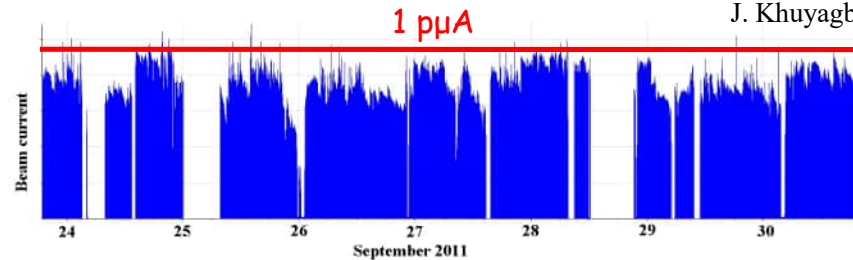
TASCA detection system (TU München and GSI)

A. Yakushev, A. Gorshkov, N. Kurz, H. Essel ...



- 1) Stable and reliable ^{50}Ti beam
- 2) New target wheel for high intensity beam
- 3) Production of ^{249}Cf
- 4) Improved background suppression and charge state predictions of heavy ions at **TASCA**
- 5) New „fast“ electronics for μs -activities

- ✓ 1) Stable and reliable ^{50}Ti beam
Ion source + UNILAC groups, TASCA, Target lab
GSI + HIM



- ✓ 2) New target wheel for high intensity beam

TASCA, GSI experimental electronics

E. Jäger *et al.*, J. Radioanal. Nucl. Chem 299, 1073 (2014).



- ✓ 3) Production of ^{249}Cf
LBNL, Berkeley; Inst. Nuclear Chemistry Uni Mainz; GSI target lab
J. Runke *et al.*, J. Radioanal. Nucl. Chem. 299 1081 (2014)

- ✓ 4) Improved background suppression and charge state predictions of heavy ions at **TASCA**

TASCA, GSI and LBNL, Berkeley, USA

J. Gates *et al.*, GSI Scientific Report 218 (2012).

J. Khuyagbaatar *et al.*, NIM A 689 40 (2012)

J. Khuyagbaatar *et al.*, PRA 88 042703 (2013)

- ✓ 5) New „fast“ electronics for μs -activities

GSI experimental electronics, Univ. Lund, Sweden, HIM

N. Kurz *et al.*, GSI Scientific Report 252 (2012)

J. Hoffmann *et al.*, GSI Scientific Report 253 (2012)

J. Khuyagbaatar *et al.*, GSI Scientific Report 212 (2012)



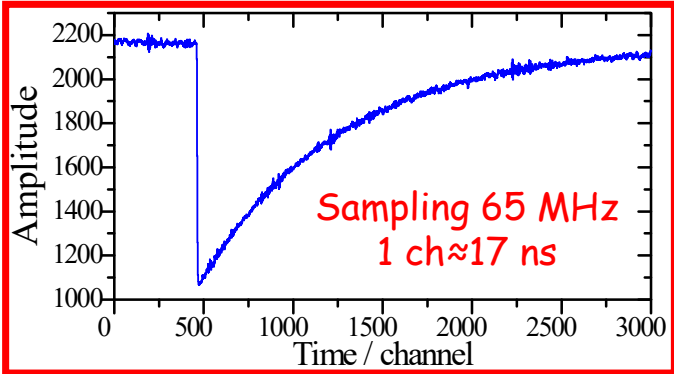
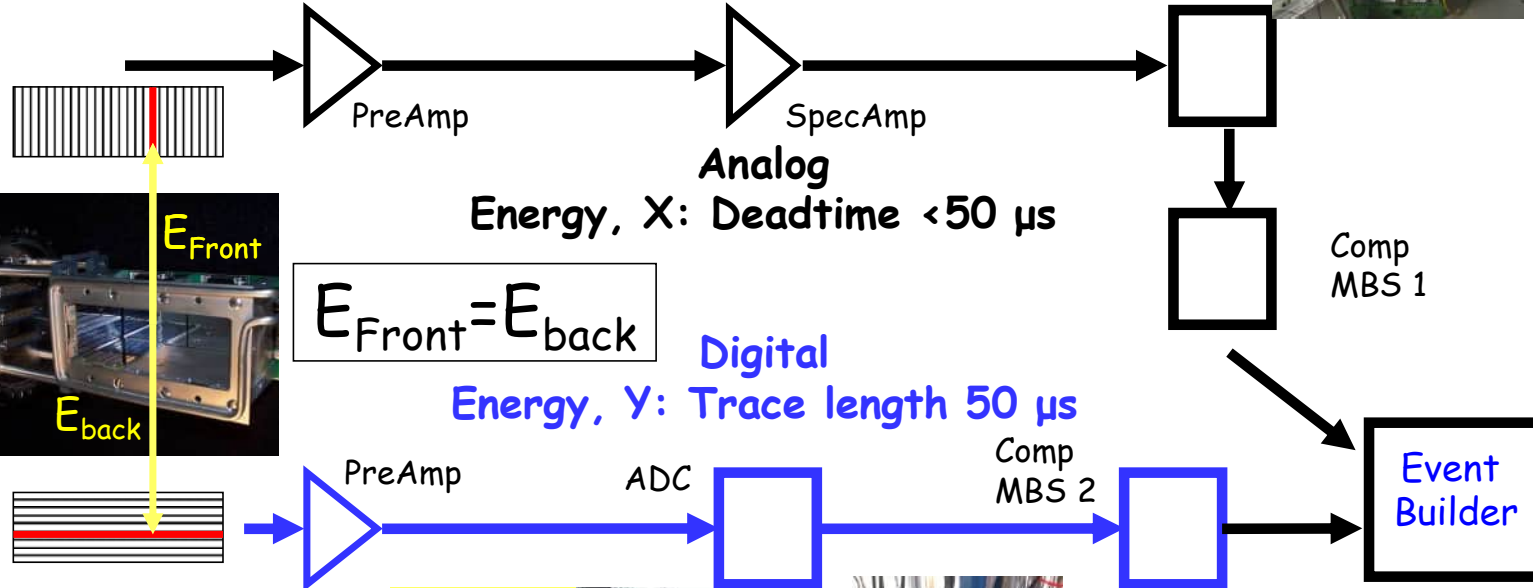
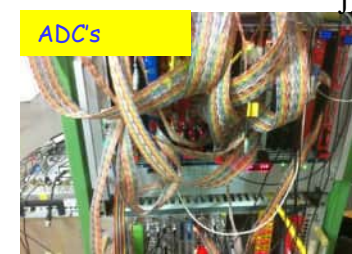
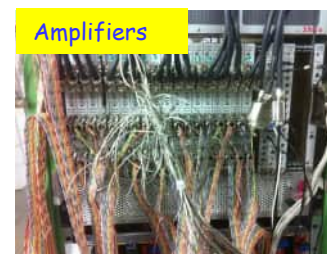
► Full system
(640 ADC channels)

2009

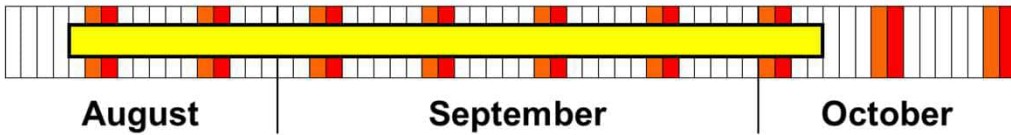
June 2011

I. Khuyagbaatar @TASCA26

| | |
|-----------------------|-------------------------------|
| DSSD-TASCA | DSSD-TASCA |
| An. Elect. -FLNR/CAEN | CANDI: An. Elect. (FLNR/CAEN) |
| DAQ-TASCA (GSI) | DAQ-TASCA upgrade |



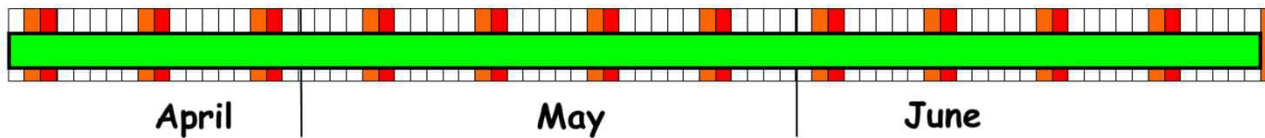
2011



**Identification of non-fusion reaction products.
Dynamics of the nuclear reaction**

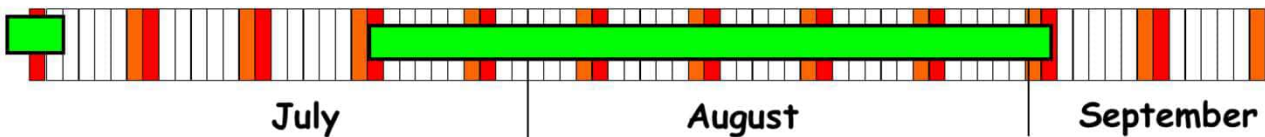
A. Di Nitto et al., Phys. Lett. B **784**, 199 (2018).

2012



Sensitivity limits for production of elements 119 and 120

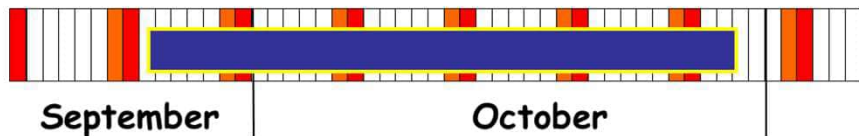
J. Khuyagbaatar et al., Phys. Rev. C **102**, 064602 (2020).



Syntheses of the element 117 and the new isotope ${}^{266}\text{Lr}$

J. Khuyagbaatar et al., Phys. Rev. Lett. **112**, 172501 (2014).

J. Khuyagbaatar et al., Phys. Rev. C **99**, 054306 (2019).



Evolution of N=126 shell and discovery of ${}^{221}\text{U}$

J. Khuyagbaatar et al.,
Phys. Rev. Lett. **115**, 242502 (2015).

Study of the isomeric states in the triggerless measurements

J. Khuyagbaatar et al.,
Nucl. Phys. A **994**, 121662 (2020).

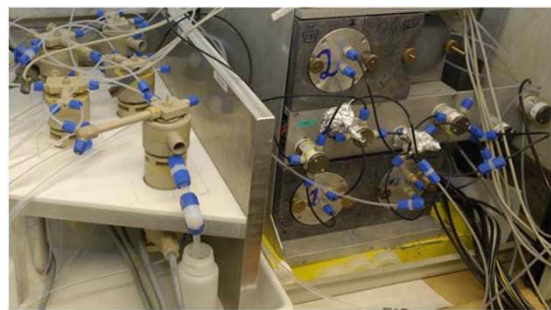
J. Khuyagbaatar et al.,
GSI Scientific report 2012, 131 (2013)

Gas/KCl + spectroscopy: ROMA



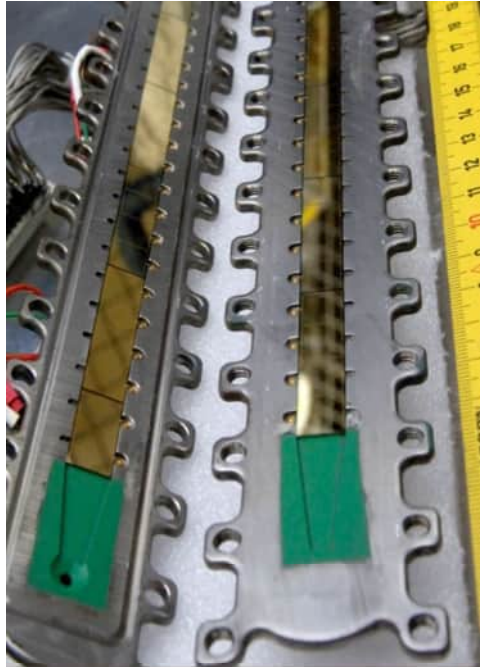
A. Gorshkov,
Ph.D thesis, TUM (2010).

SISAK Setup (Uni Oslo)



F. Samadani
Ph.D thesis, University of Oslo (2010)

Chemistry: Compact



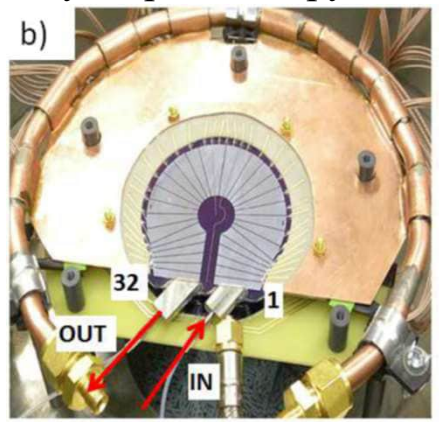
A. Yakushev et al.,
Inorganic chemistry 53 (3), 1624-1629 (2014)
Frontiers in chemistry 9, 753738 (2021)
...

Chemistry + spectroscopy: ALBEGA

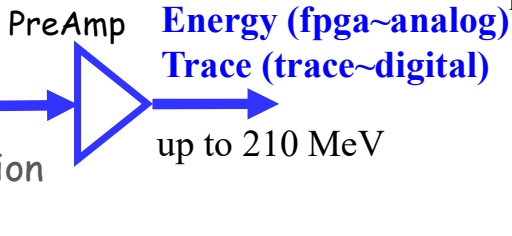
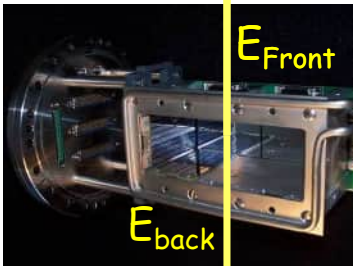
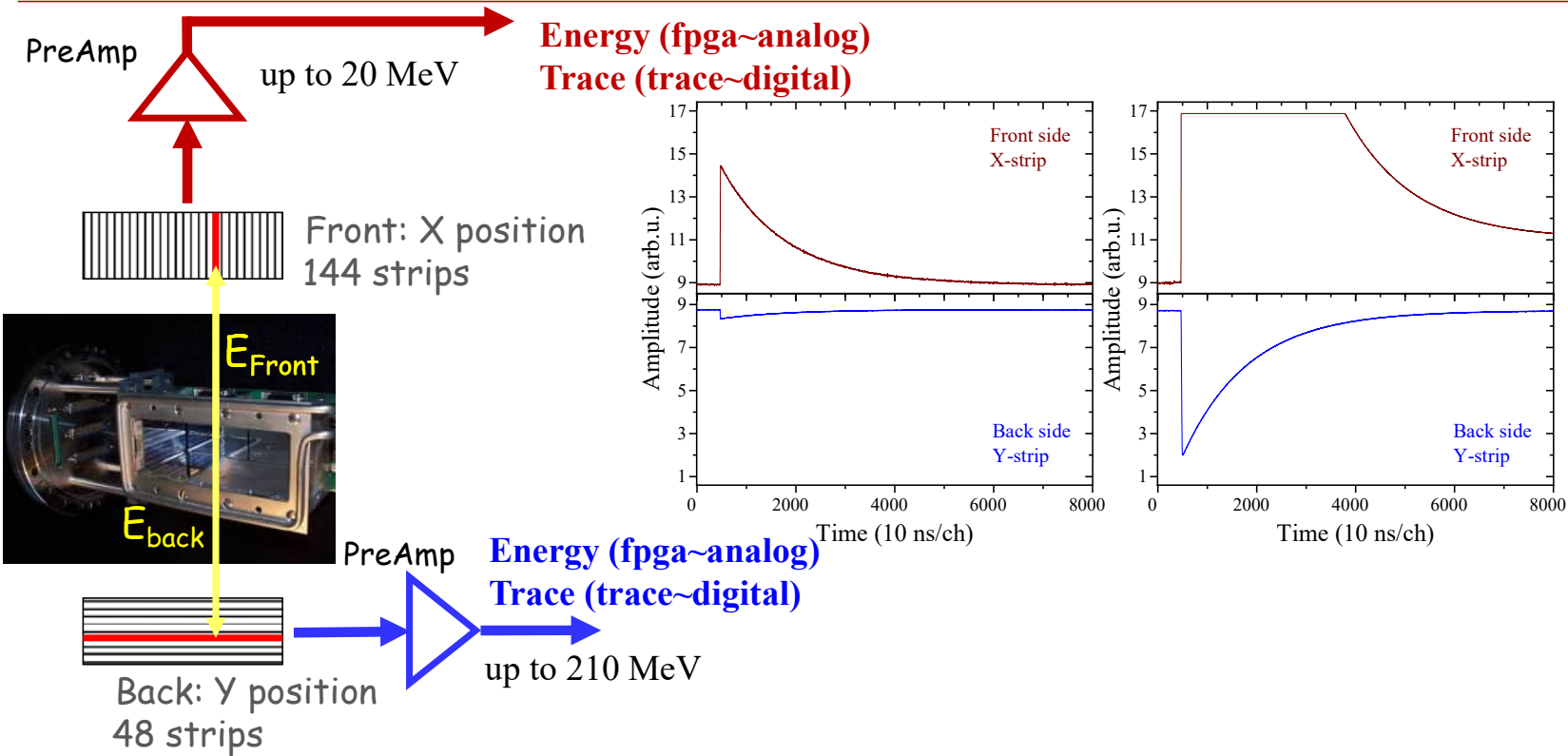
Spectroscopy: TISISPEC (Uni Lund)



D. Rudolph et al.,
PRL 111, 112502 (2013) ...



A. Di Nitto et al.,
GSI scientific report 2015-1 (2015)



Febex2 and 3
since 2018:
Febex4, 100MHz, 14 bit

Search for ECDF in and discovery of ^{244}Md

J. Khuyagbaatar et al.,
Phys. Rev. Lett. **125**, 142504 (2020)

Isomeric states in ^{256}Rf

Phys. Rev. C **103**, 064303 (2021)

Fission study of ^{253}Rf and discovery of ^{249}No

Phys. Rev. C. **104**, L031303 (2021)

New isomeric state in ^{250}No

Phys. Rev. C. **106**, 024309 (2022)

ECDF in ^{242}Es

Phys. Rev. C. **109** (3), 034311 (2024)

Isomers in $^{251-254}\text{No}$

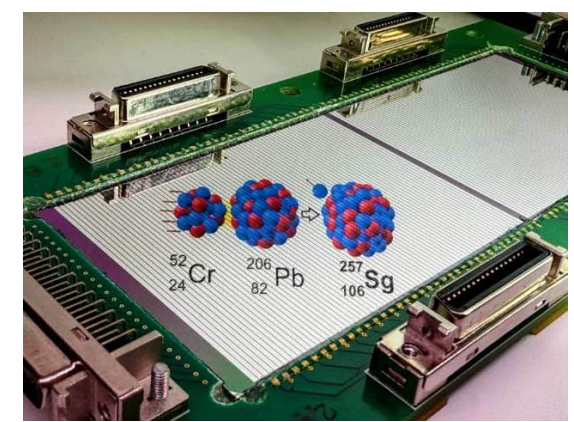
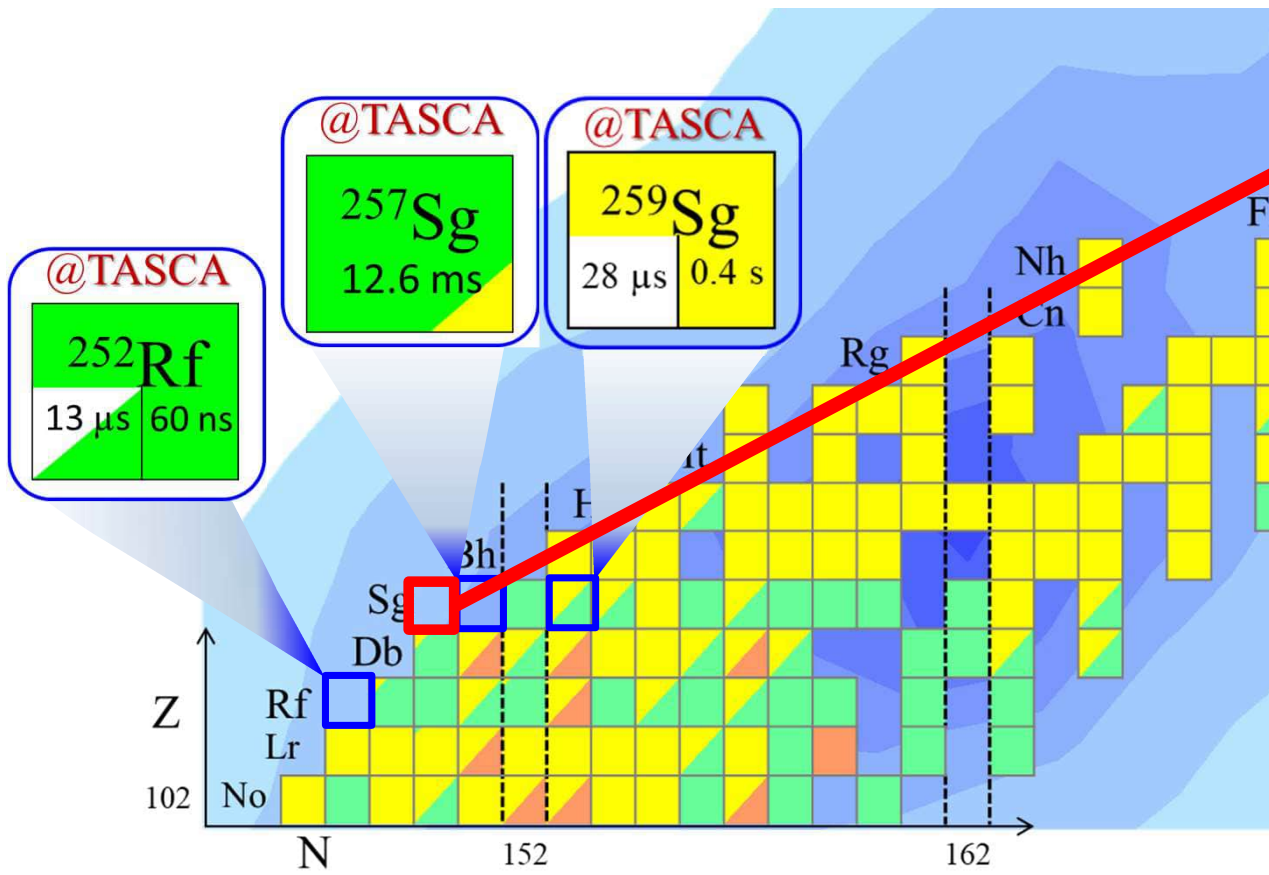
Nucl. Phys. A, **1070**, 123382 (2026)

J. Khuyagbaatar, P. Mosat et al., Phys. Rev. Lett. **134**, 022501 (2025)
Editors' Suggestion / Featured in Physics

P. Mosat, J. Khuyagbaatar, et al., Phys. Rev. Lett. **134**, 232501 (2025)
Editors' Suggestion / PRL collection 2025

**See talk by P. Mosat
tomorrow (20. May. 2026)
15:00**

Search for ^{256}Sg
approved exp. @TASCA (G-24-00246)



**Time to build a new focal plane
detection system !**

TASCA: Focal plane detection system (Physics)

2006-2009: **PSSD (SHIP)**

analog electronics/DAQ

2009-2024: **DSSD (Warsaw)** (7 new isotopes...)

analog, CANDI and full digital electronics/DAQ

2025- **BB20 (MICRON)** (1 new isotope...)

full digital electronics/DAQ (trace-length up to 6 ms)...

Upgrade ~ every three years

2026: One of golden standard in the field



TASCA: Focal plane detection system (Chemistry)

