

Introduction

- ASTER: Accélérateur pour les Sciences de la Terre, Environnement, Risques
- 5 MV Cockcroft-Walton by HVEE
- installation: October 2006
- acceptance tests: April 2007
- currently dedicated to Earth science studies



Main applications:

- AMS developments
- cosmogenic nuclides systematics
- quantification of Earth's surface processes
- geochronology



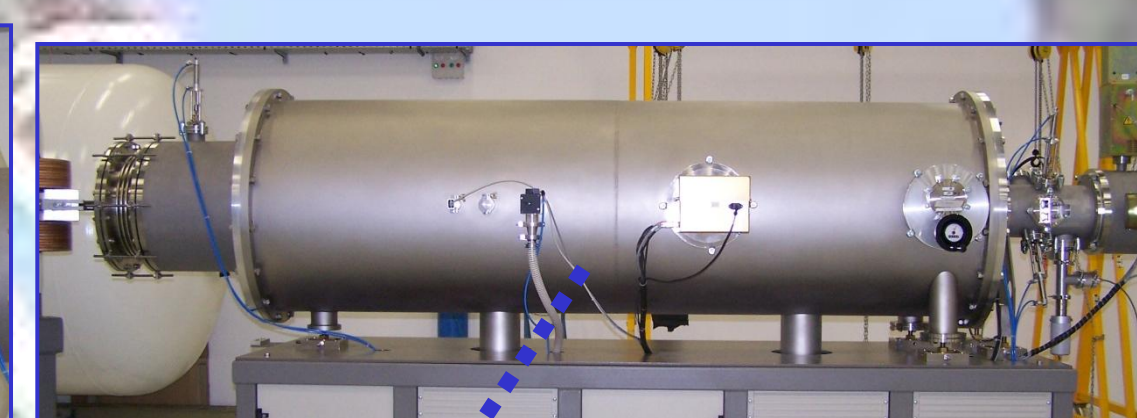
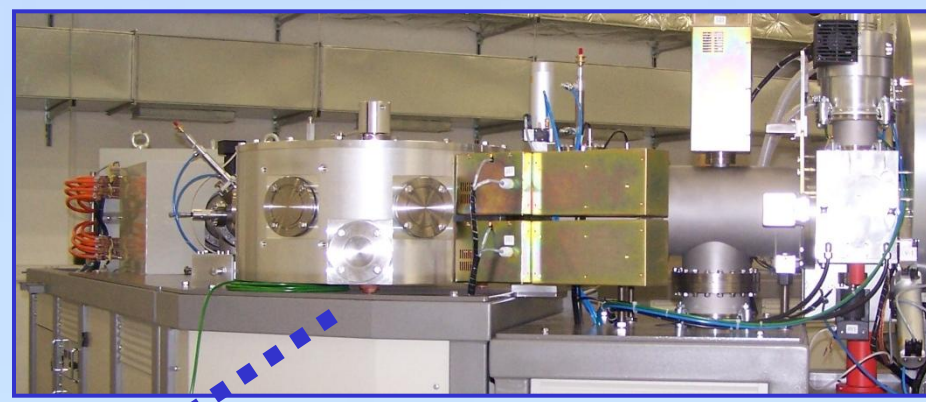
Performance data (more information in [1])

	¹⁰ Be	²⁶ Al	³⁶ Cl	⁴¹ Ca	¹²⁹ I
extraction as	BeO ⁻	Al ⁻	Cl ⁻	CaF ₃	I ⁻
currents [μA]	3-5	0.1-0.4	15-20	0.2-0.3	3-5
terminal voltage [MV]	4.5	2.7	5.0	5.0	5.0
stripped to (with absorber foil)	Be ²⁺ Be ⁴⁺	Al ³⁺	Cl ⁵⁺ Cl ¹⁰⁺	Ca ⁴⁺	I ⁵⁺
total transmission [%]	60	38	20	15	8
only absorber foil	36		14		
total with absorber foil	22		2		
detection efficiency [%]			56	68	
suppression factor (detector only)			³⁶ S 1 ³⁶ Cl 2.3·10 ⁶	⁴¹ K 1 ⁴¹ Ca 7·10 ³	
background [10 ⁻¹⁵]	0.15	0.9	0.28*	30	20
STDV [%] on 10 ⁻¹¹	0.3	1.3	1.0	1.6	1.1

*no AgBr backing! Ni cathodes with Ni pins

Machine layout

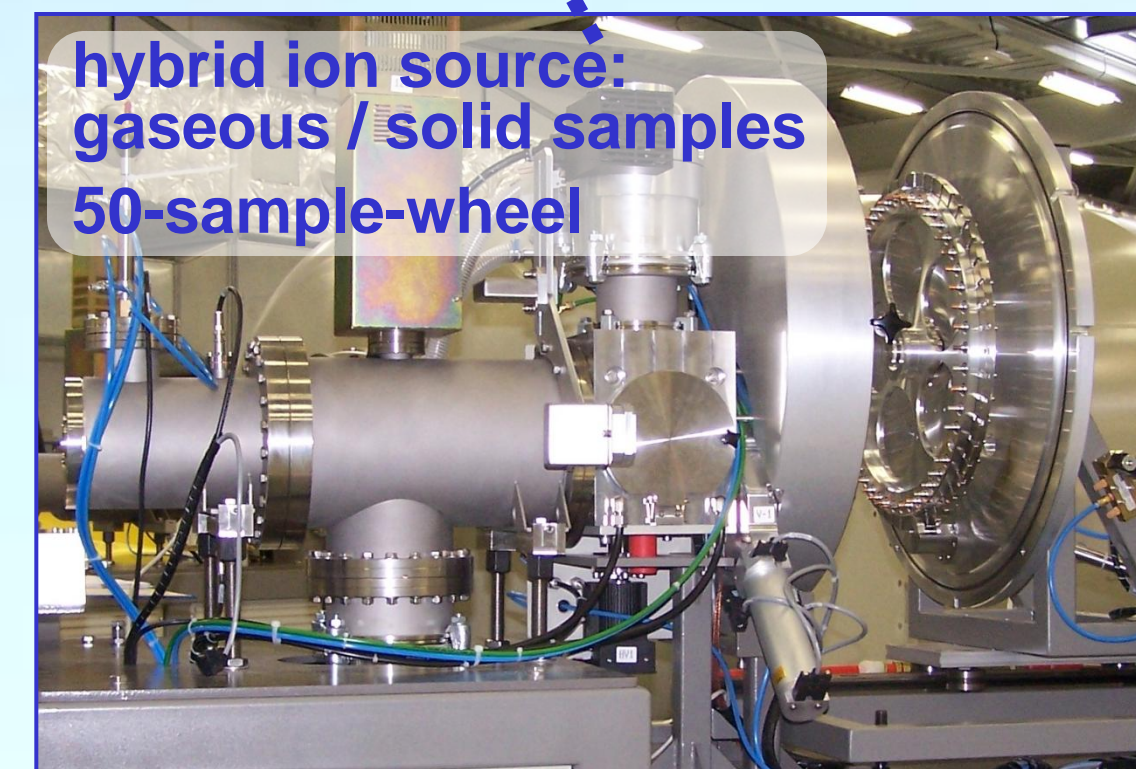
low-energy side:
energy-analyser: 54°
electrostatic deflector
mass-analyser:
90° magnet (fast-
bouncing system: 100 Hz)



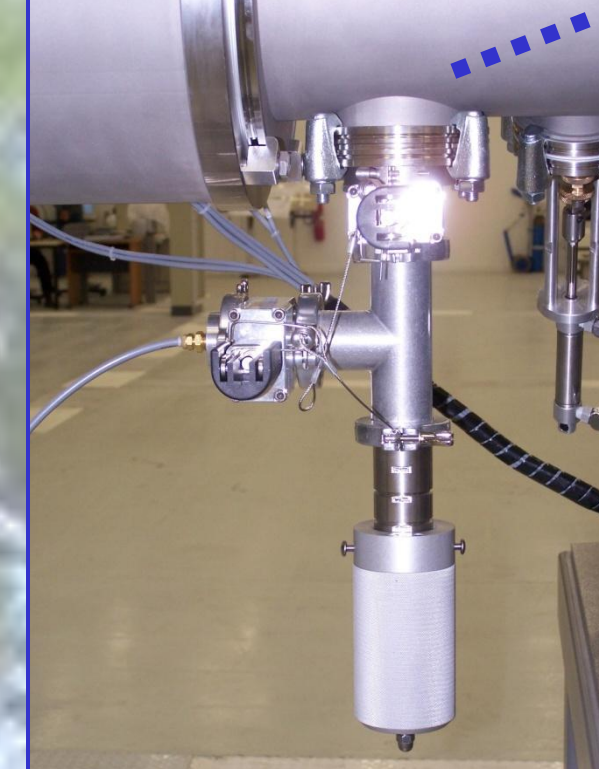
high-energy side:
90° analysing
magnet
stable
isotopes:
Faraday cups



hybrid ion source:
gaseous / solid samples
50-sample-wheel

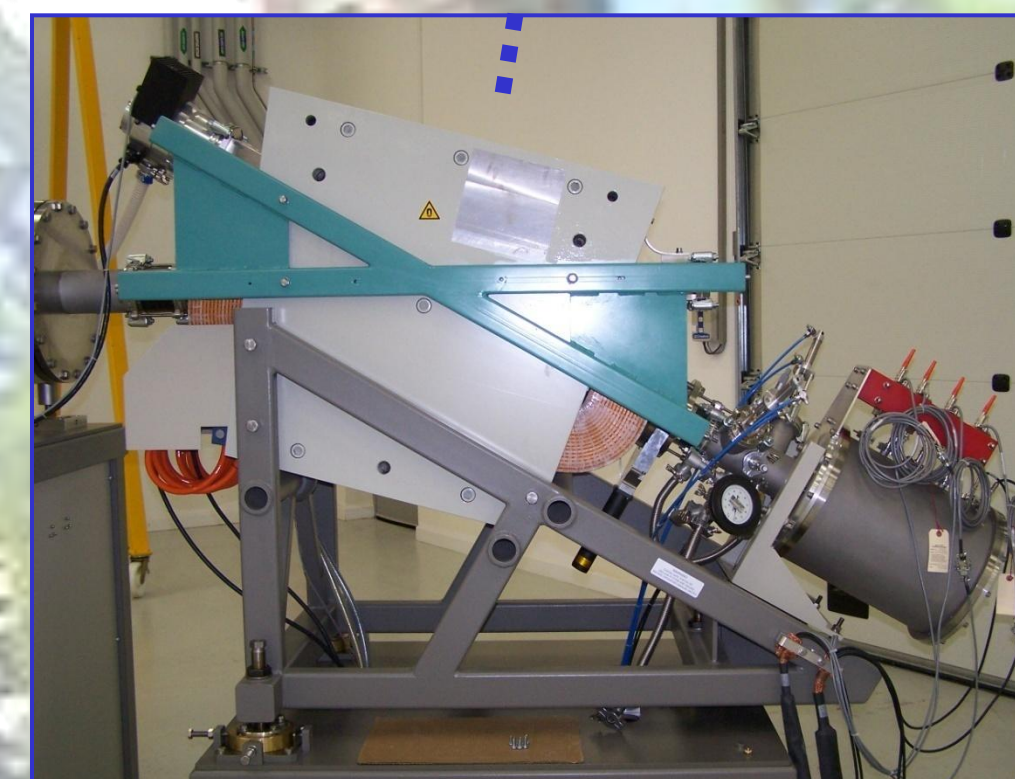


5 MV tandetron: gas
stripper with active
stripper gas regulation

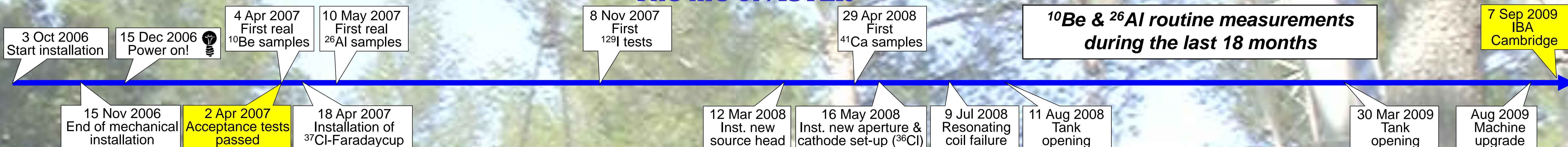


rare isotopes:
absorber foil (Si₃N₄; 1 μm) for
¹⁰Be & ³⁶Cl
35° electrostatic deflector

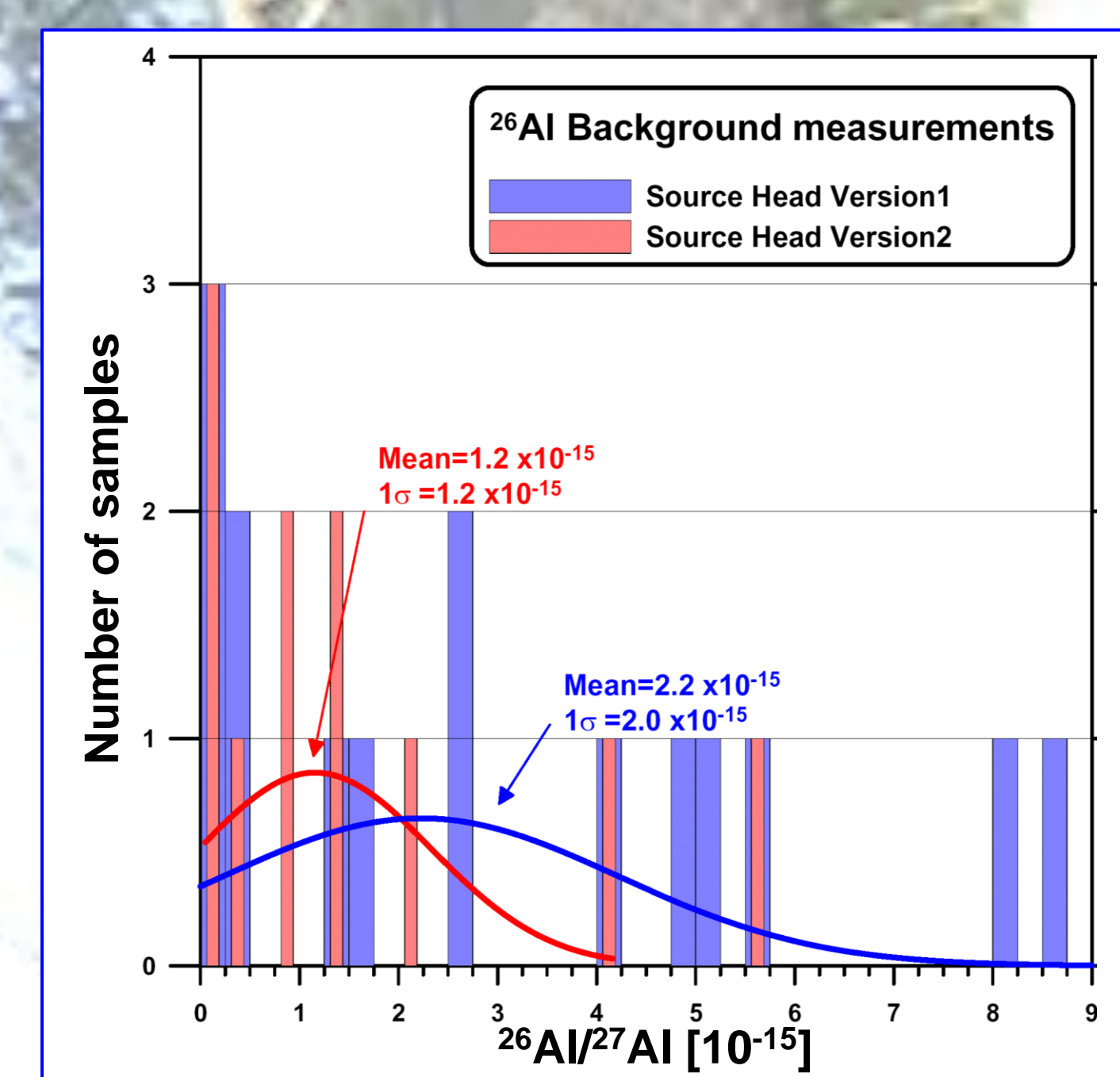
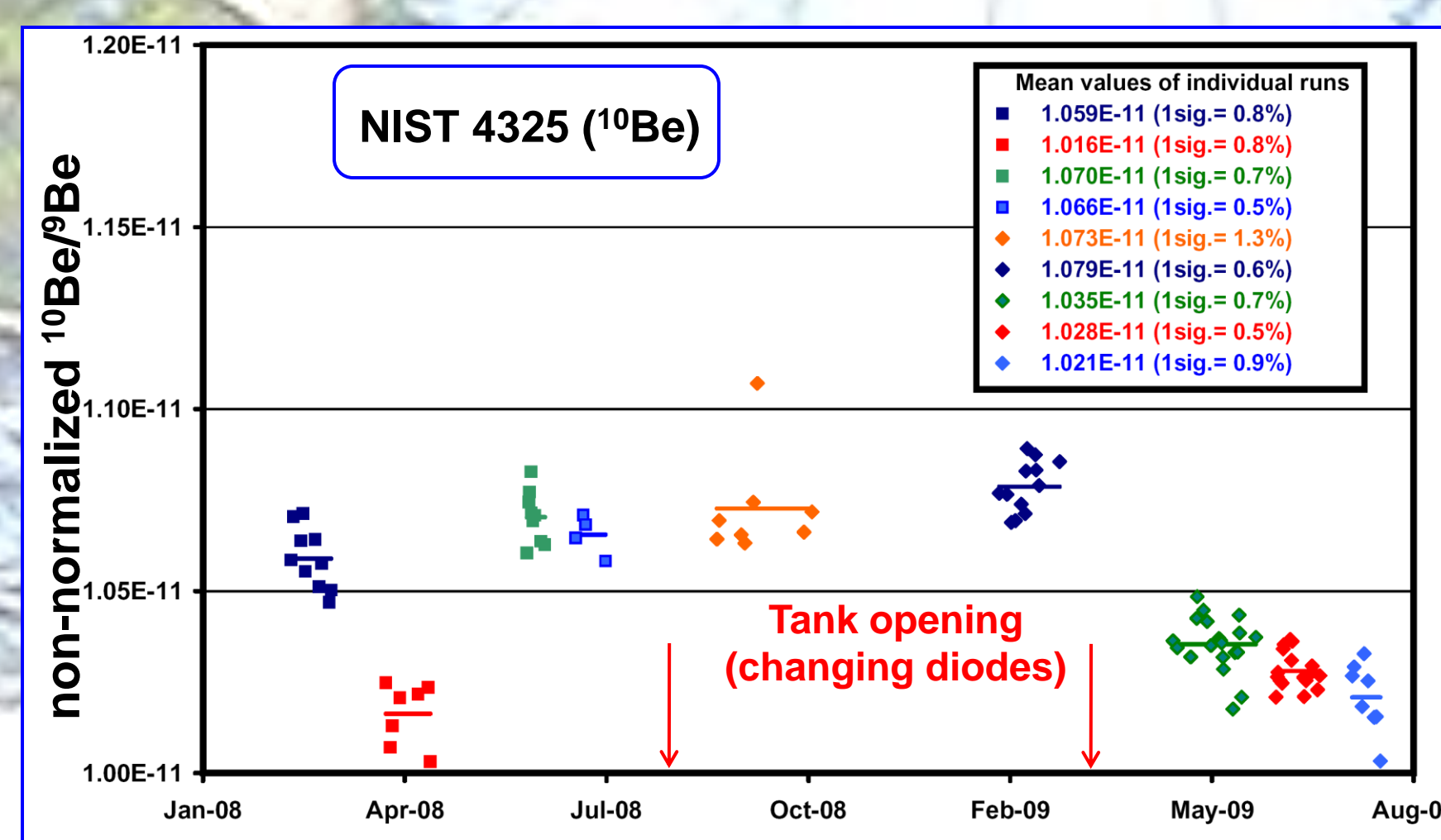
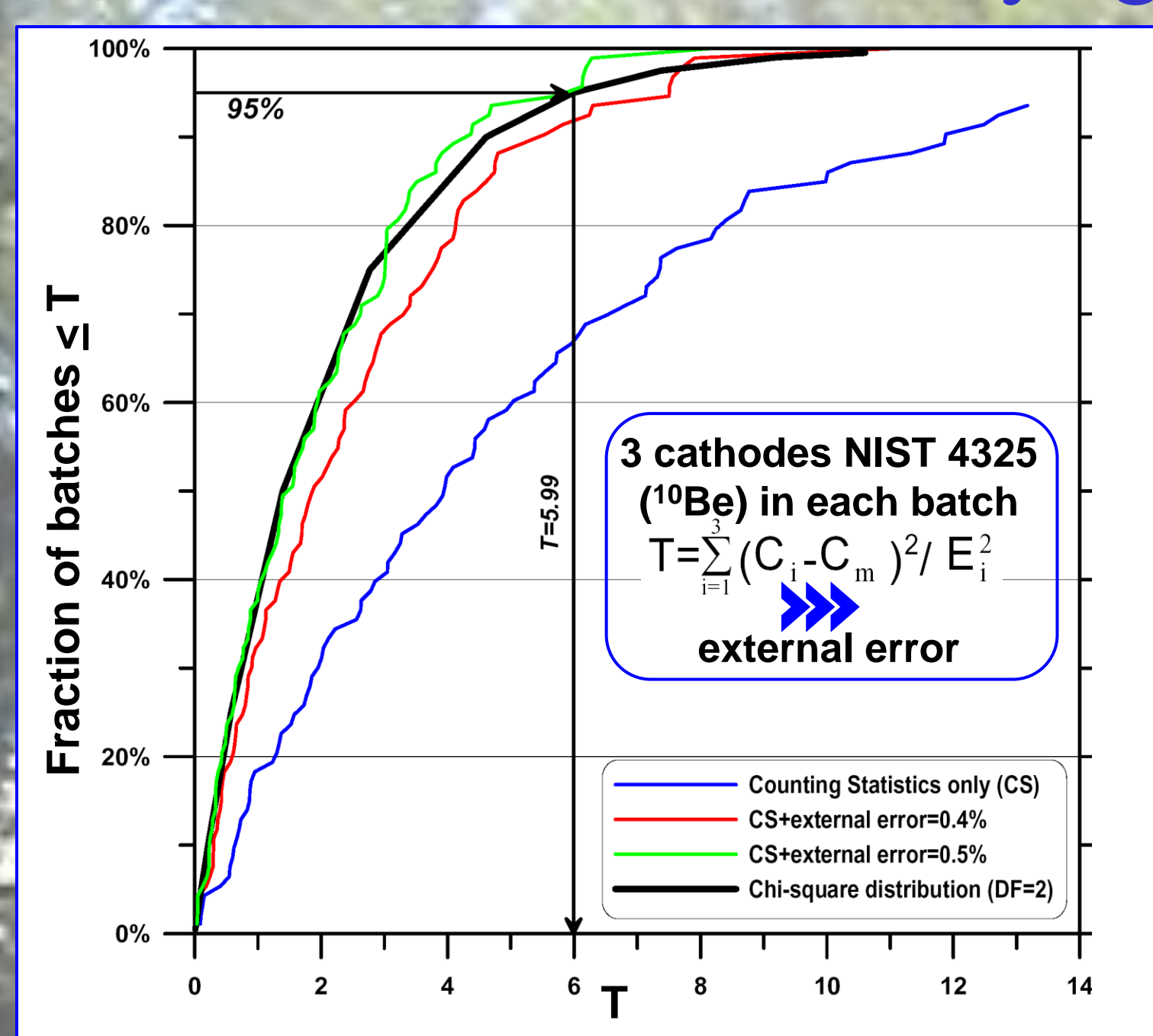
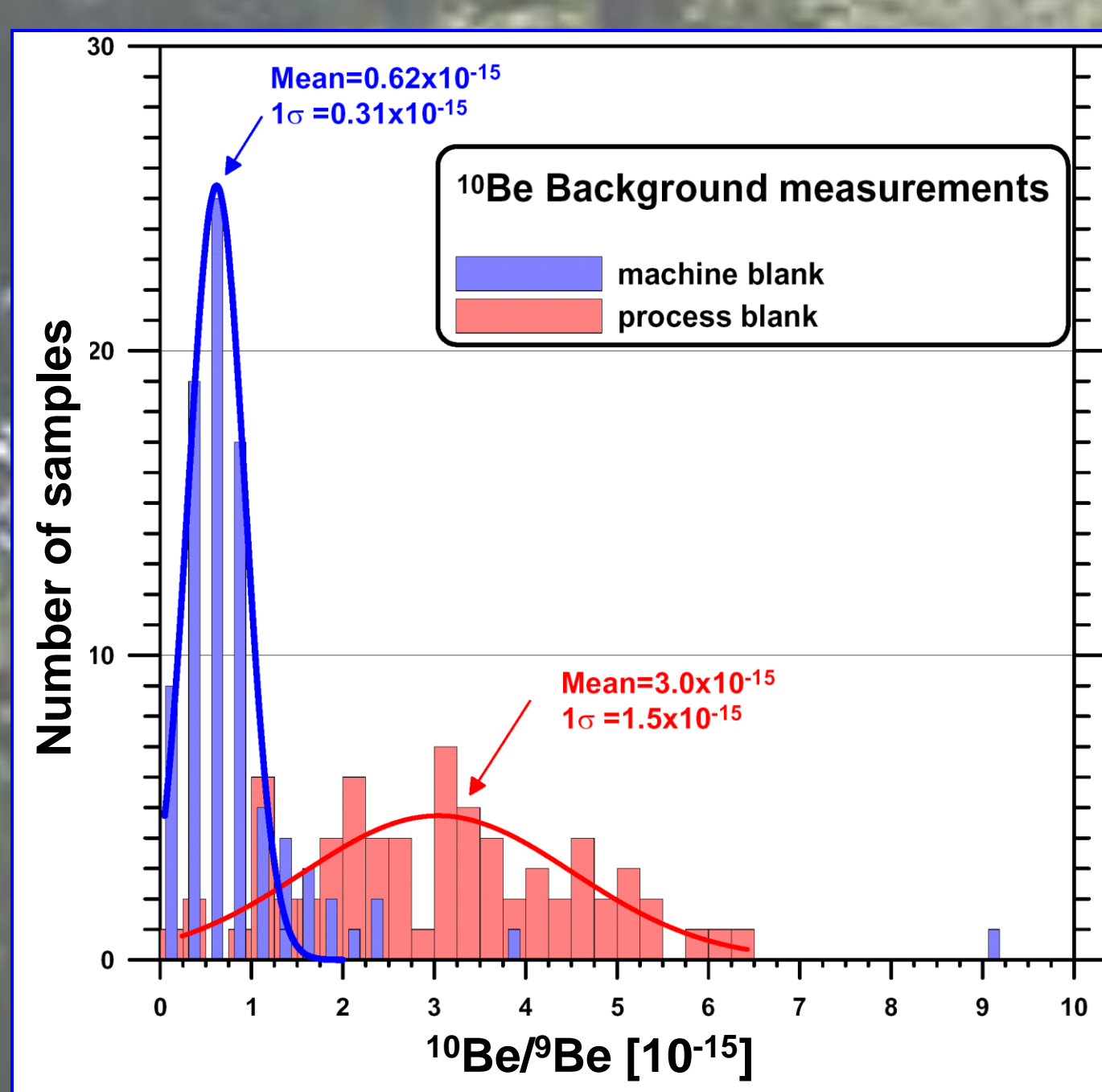
rare isotopes:
30° vertical
analysing
magnet
4-anode gas
ionization
chamber
(isobutene,
8-25 mbar,
75 nm Si₃N₄)



The life of ASTER



¹⁰Be and ²⁶Al: "Playing" with blanks and standards



Résumé & outlook

- routine and fully automated measurements of ¹⁰Be (3700 samples) and ²⁶Al (500 samples) ➤ world-wide Earth science applications (see map)
- development of upgrade of SO110 ion source ➤ routine ³⁶Cl measurements at the 10⁻¹⁴ level in the very near future
- (attempts of) cross-calibration of ²⁶Al/²⁷Al, ⁴¹Ca/⁴⁰Ca, ³⁶Cl/Cl in-house standards
- establishment of quality assurance by using traceable AMS standards for each nuclide and self-monitoring by taking part in round-robin exercises and proficiency testing [2]
- ASTER is capable of measuring ⁴¹Ca/⁴⁰Ca in the 10⁻¹² region applications from cosmochemistry, nuclear waste disposal, radiation safety, and biomedicine
- cross-calibration of ¹²⁹I/¹²⁷I in-house standards in preparation for 2009
- doubling of chemistry lab capacity for 2010



References

- [1] M. G. Klein *et al.*, Performance of the HVE 5 MV AMS system at CEREGE using an absorber foil for isobar suppression, *NIMB*, 266 (2008) 1828-1832.
- [2] S. Merchel & W. Bremser, Quality assurance in Accelerator Mass Spectrometry: Results from International Round-Robin Exercises for ¹⁰Be and ³⁶Cl, oral presentation, Tuesday 11:30 h.

Acknowledgments

- Klaus Knie, TU Munich (now GSI) for test samples
- Ulrich Hergers, U Cologne for ²⁶Al activity
- all AMS friends @ SUERC, VERA, ETH/PSI etc. for (fast!) answering questions
- all internal and external ASTER users for samples

