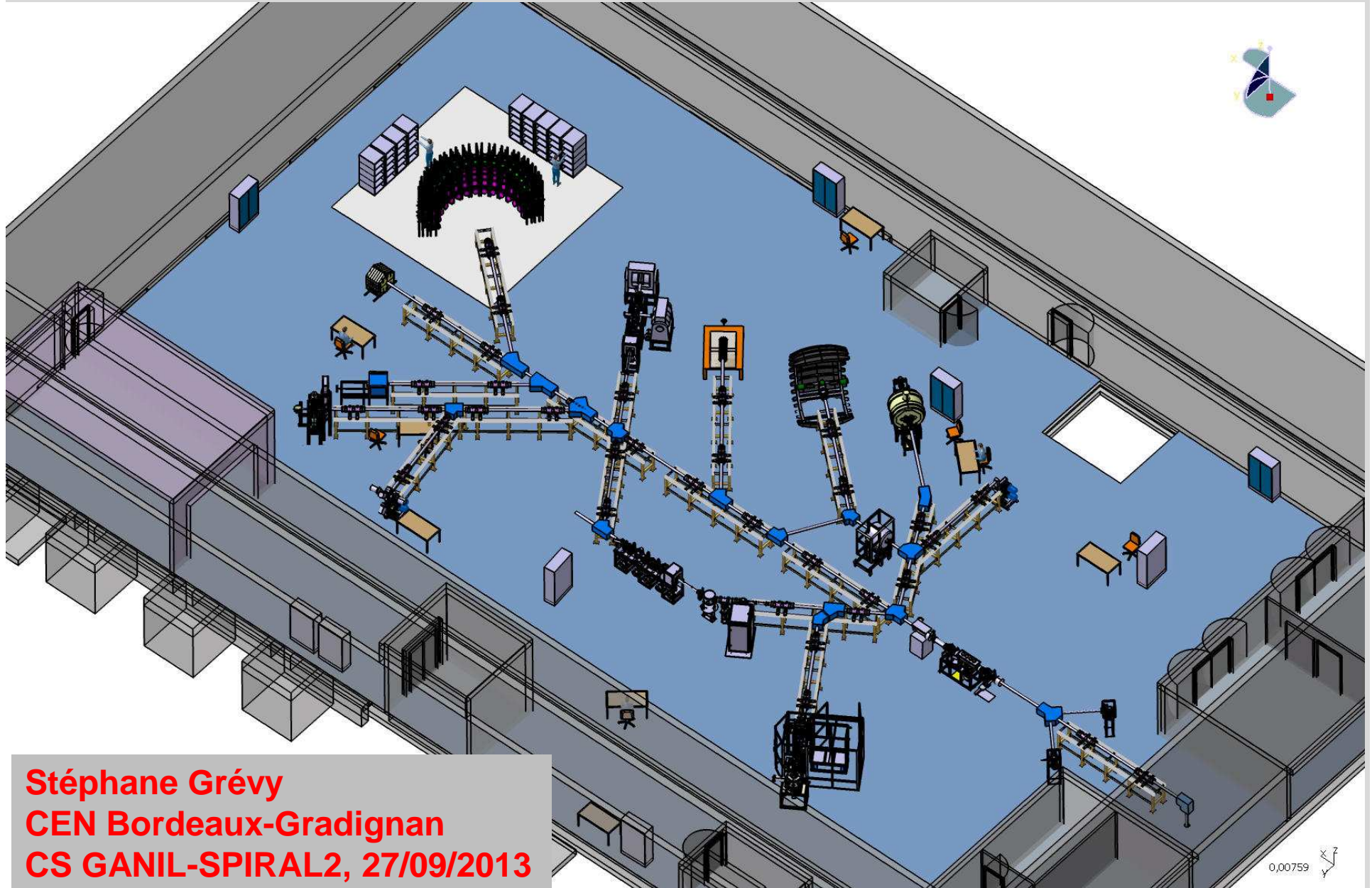
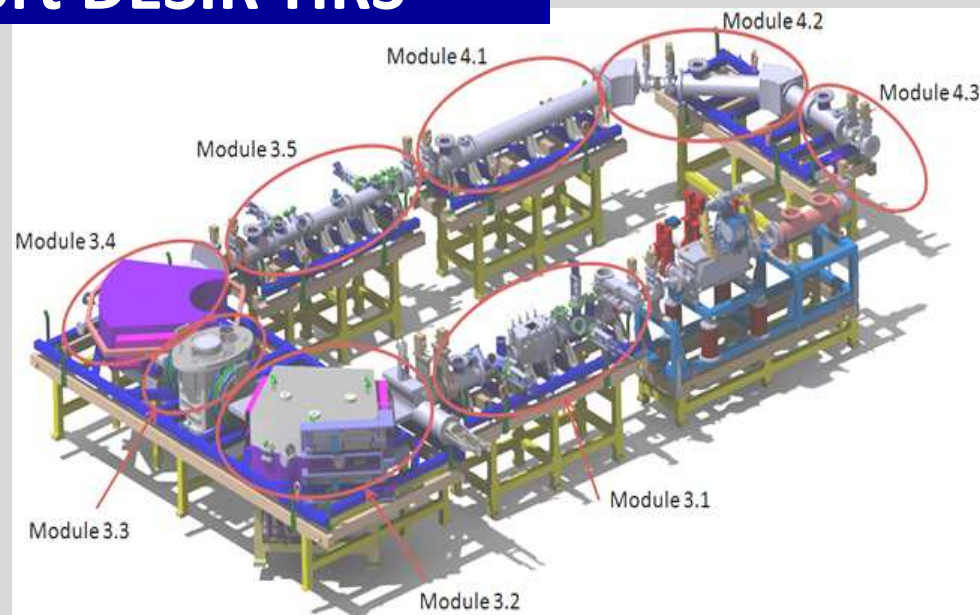


DESIR hall



Stéphane Grévy
CEN Bordeaux-Gradignan
CS GANIL-SPIRAL2, 27/09/2013

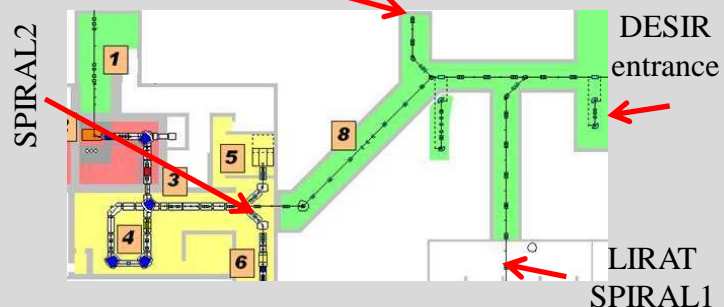
- ❖ Global optical design finished and presented at EMIS2012, Japan. T. Kurtukian-Nieto et al., NIMB 2013, DOI: 10.1016/j.nimb.2013.07.066.
- ❖ Mechanical design and integration is almost ready.
- ❖ Dipoles already ordered. Delivery expected for May 2014. Expected field transversal homogeneity of 10^{-5} over a zone of ± 150 mm around the central beam trajectory. The design for the dipoles also includes the possibility of easily changing magnetic edges to refine the minimization of aberrations.
- ❖ Manufacturing of other elements by CENBG.
- ❖ Expected working performance of the HRS considering misalignment and positioning precision of different elements : $m/\Delta m = 20,000$ for a 3π mm mrad 60keV beam and energy spread $\sim eV$.
- ❖ Due to the evolution of SPIRAL2 Project, a reevaluation of the objectives at short- and mid-term will be done before the end of 2013 in coordination with the project leader and the SFRE team for operational consideration.



DESIR beam lines

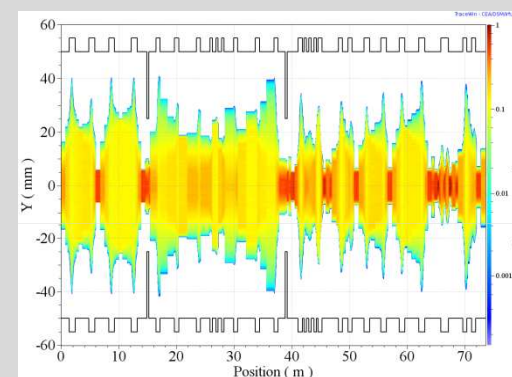
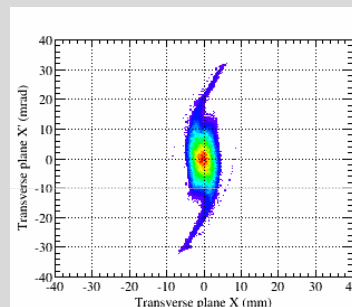
- 3 lines: SPIRAL2/S3/LIRAT up to DESIR: L=117m

- Inside hall (max.) S3 fish-bone: L~40m



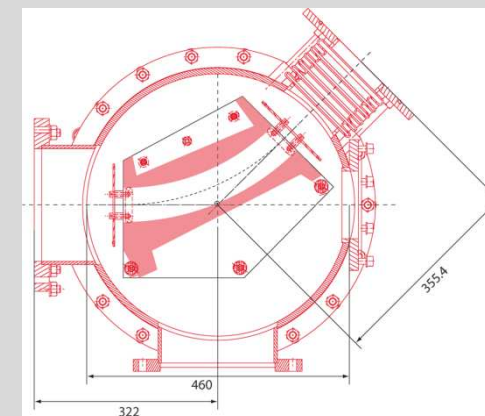
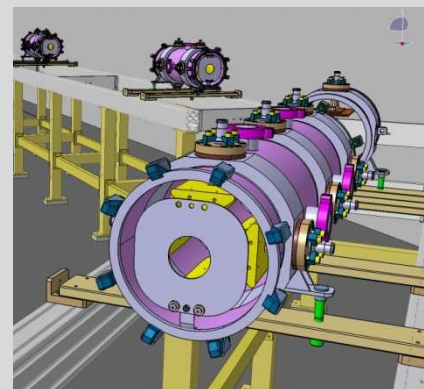
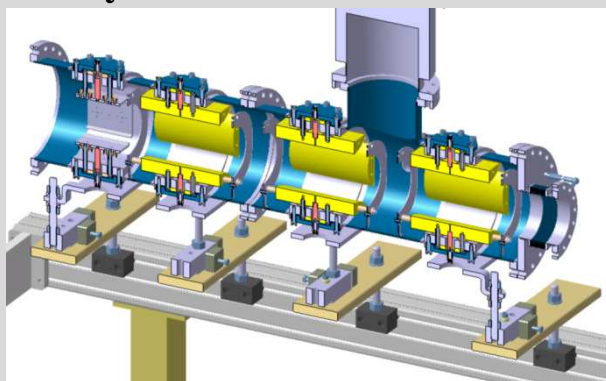
➤ Beam dynamics

- Consolidated: first order
- Inside hall: definition of optics will be done in agreement with set-up and experiment requirements
- Quadrupoles design is fixed
- Deflectors design must be done
- Errors calculation will restart soon



➤ Mechanical integration & transverse

- Construction of a brick: quadrupoles triplet+steerer by IPN, mounted downstream the GPIB at CENBG
- 2014: construction of an electrostatic deflector
- Full integration of the S3 to DESIR transfer beam line by 2014



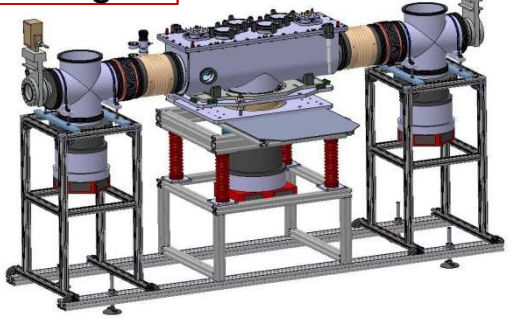
AIM Purify ($\Delta M/M \sim 10^{-5}$ → isobaric separation)
large samples (up to 10^6 pps) of exotic nuclei

➤ Ion Source + GPIB @ CENBG

simulations :



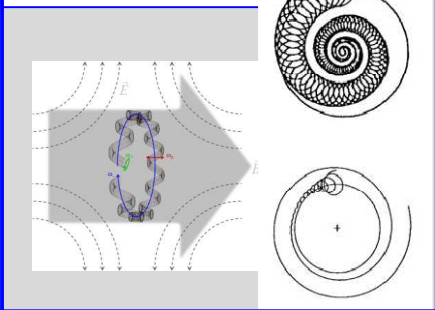
design :



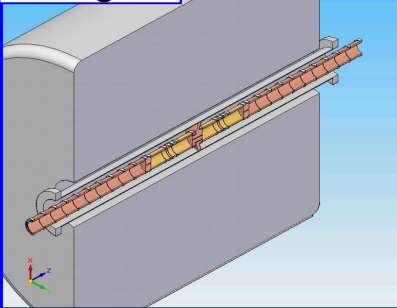
status: IS → running since march 2013, 25 nA
 GPIB → mechanics ready, to be installed in june 2013

➤ Double Penning Trap @ CSNSM + MPIK

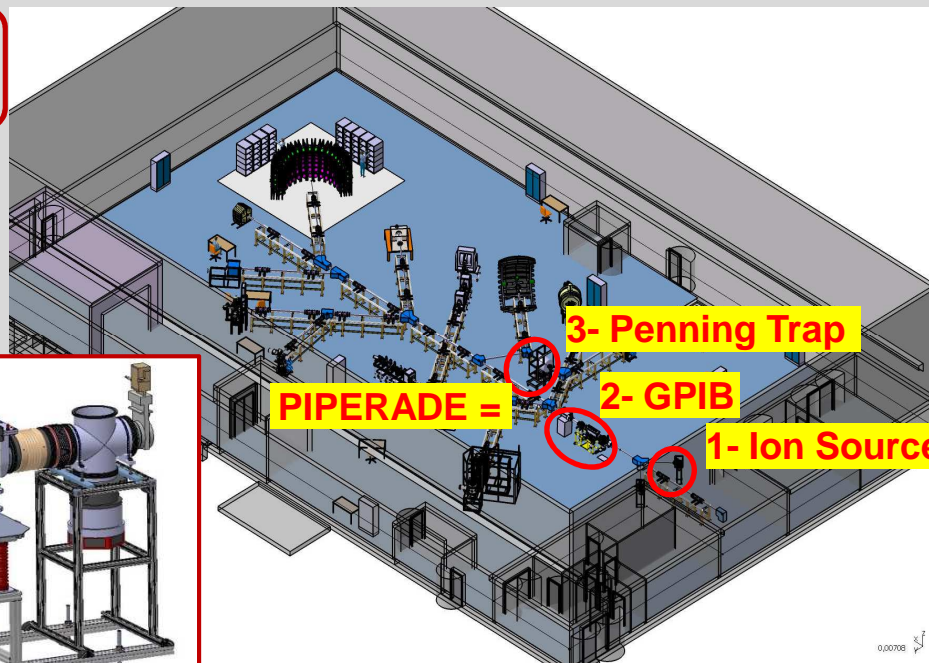
simulations :



design :



status : Penning → design under way
 magnet → negotiations with vendor under way



➤ PIPERADE @ CENBG

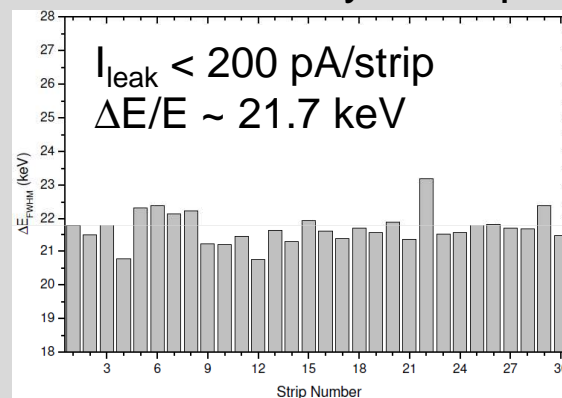
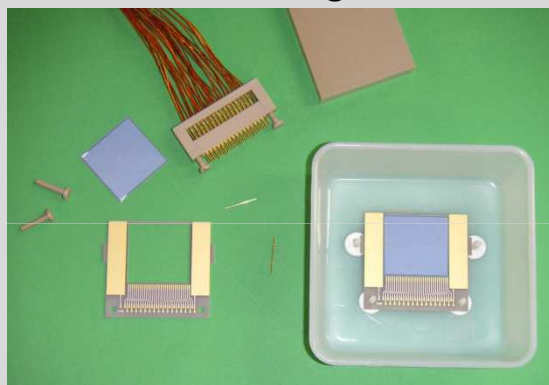


P.G. Thirolf, C. Weber, R. Meißner, P. Müller, S. Schulte-Heinemann
LMU München

➤ R&D for in-trap (α , conversion electron) decay spectroscopy:

(i) setup of 'detector trap' for α detection

- successful commissioning of home-built, UHV- and cryo-compatible Si strip detectors



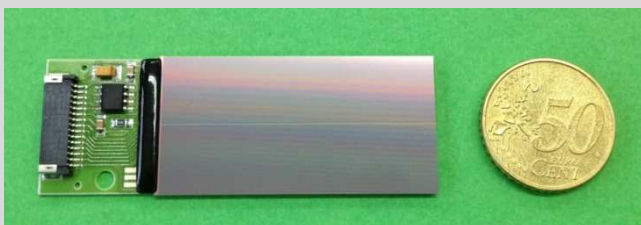
30x30 mm²
300 μ m
30 strips

- ongoing: characterization in magnetic field

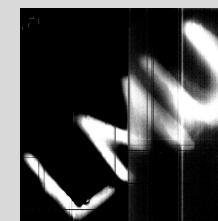
J. Moazzami-Fallah, B.Sc. Thesis (2012),
P. Müller, Ph.D. Thesis, in preparation.

(ii) tests with pixel detectors for electron detection (shake-off, conversion electrons)

- detector: RadEye[®] : developed for X-rays, suitable for (low-E) electrons ?



- 512 x 1024 pixel:
48 x 48 μ m²
- depletion depth 2 μ m



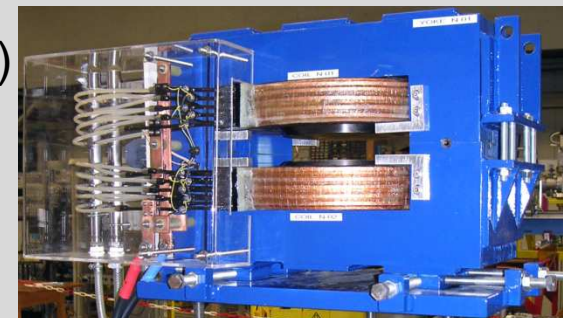
- tunable electron source (0.1-6 keV) under construction

S. Schulte-Heinemann (2013)

Multi-Passage Spectrometer (MPS)

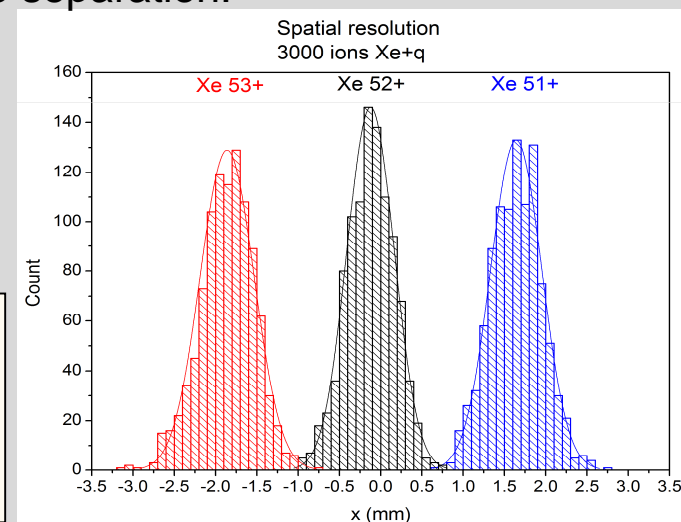
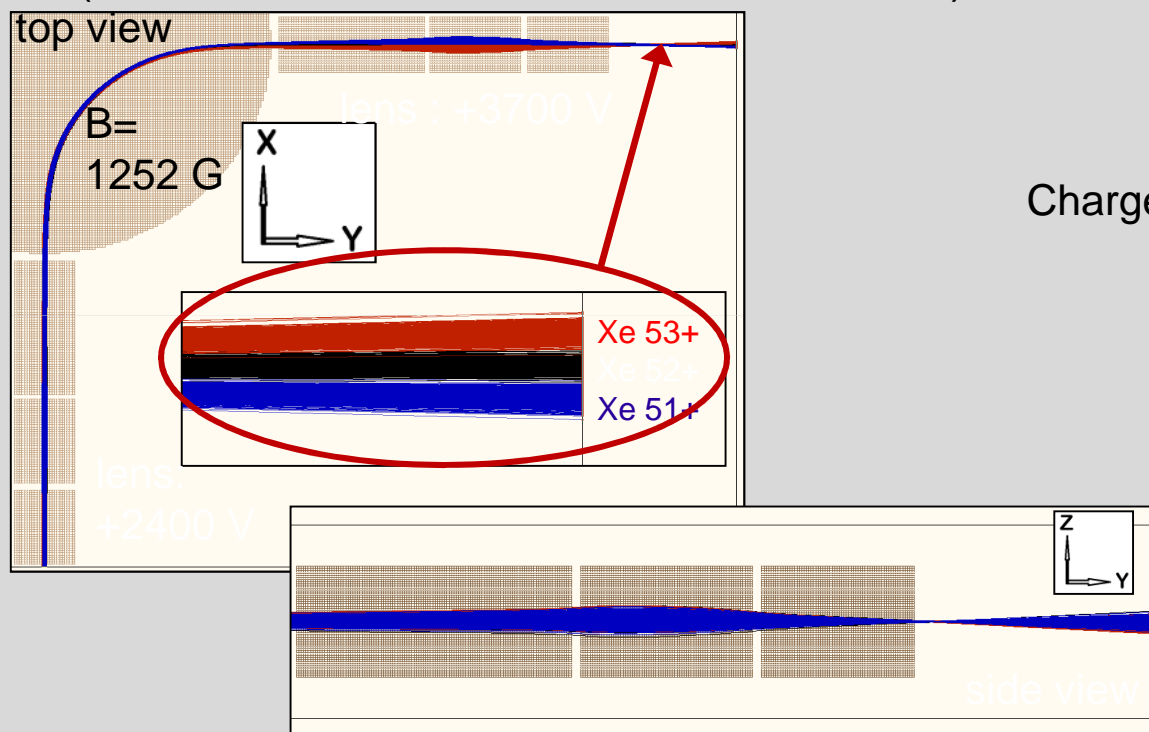
➤ **R&D for MPS setup:** (A/q separator for charge-bred ions)

- ion-optical trajectory simulations (SIMION):
(benchmark ions: Xe^{52+} , $\varepsilon = 5 \pi \text{ mm mrad}$)



fast-ramping (50 ms)
1.2 T dipole

Charge separation:



- **next to come:**
- design and manufacturing of steering mirrors and lenses
 - design and manufacturing of vacuum chamber

recent publications:

- C. Weber et al., Int. Jour. Mass Spectr., in print (2013),
- C. Weber et al., Nucl. Instr. Meth. B in print (2013),
- B. Blank et al., Int. Jour. Mass Spectr., in print (2013)
- C. Weber et al., Hyp. Int., in preparation



Multi Reflection Time-of-Flight Mass spectrometer (MR ToF MS)

- Cutting edge technique for exotic isotopes with short $T_{1/2}$
mass resolving power $> 10^5$
mass measurement relative accuracy 10^{-6}
Typical trapping time $\sim 10\text{ms}$
see R. Wolf's presentation

MR ToF MS project at GANIL/SPIRAL 2:

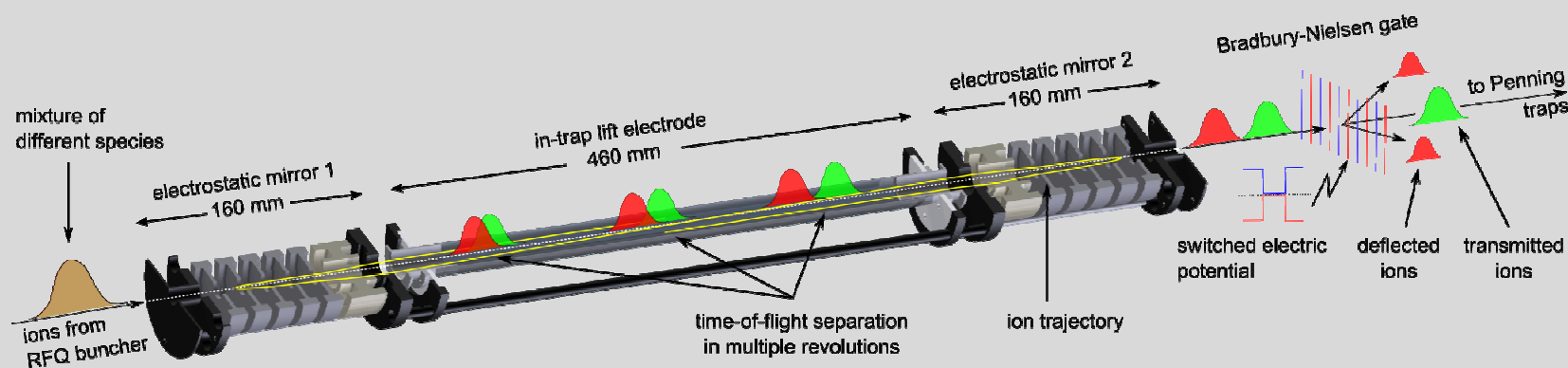
mass separation and mass measurements for present and future low energy experiments at LIRAT, S3, and DESIR

Can be combined with PIPERADE at DESIR

Collaboration between GANIL, LPC Caen and Greifswald university

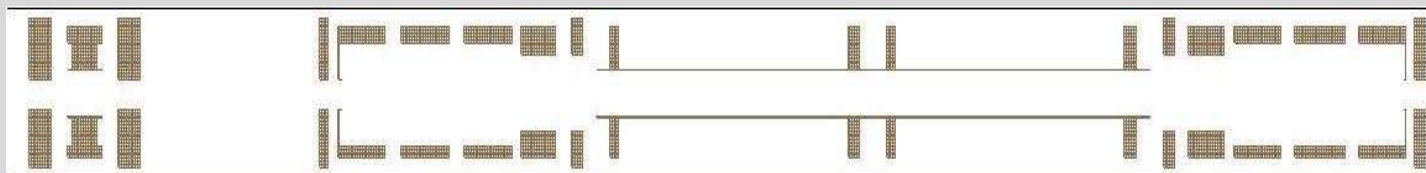
Multi Reflection Time-of-Flight Mass spectrometer (MR ToF MS)

Principle: mass separation by time-of-flight of ion bunches trapped between two mirrors



see R. Wolf's presentation

Several geometries benchmarked



~1m

Starting from ISOLTRAP's simplified geometry



Multi Reflection Time-of-Flight Mass spectrometer (MR ToF MS)

Status

Conceptual design study from first SIMION and SIMBUCA simulations

Simulated resolving power $>10^5$ achieved

Master thesis B. Kansal

Simulated space charge effects above $5 \cdot 10^3$ ions/bunch

BUT experimentally seen at Greifswald: space charge effect could be dealt with up to 10^4 - 10^5 ions/bunch

Some key components ordered

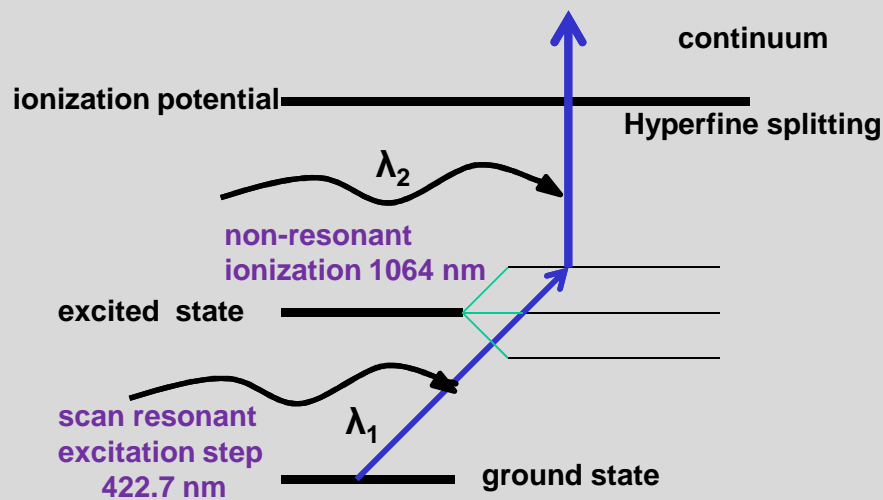
Indicative time plan

2014: Detailed design, construction

2015-....: Commissioning at LIRAT and S3

PhD thesis P. Chauveau

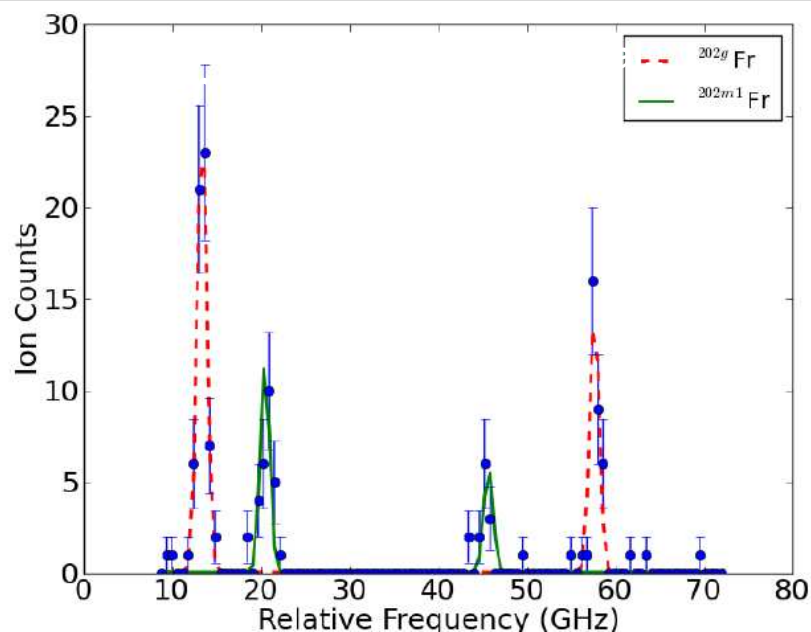
CRIS: Collinear Resonance Ionization Spectroscopy on Fr isotopes at ISOLDE



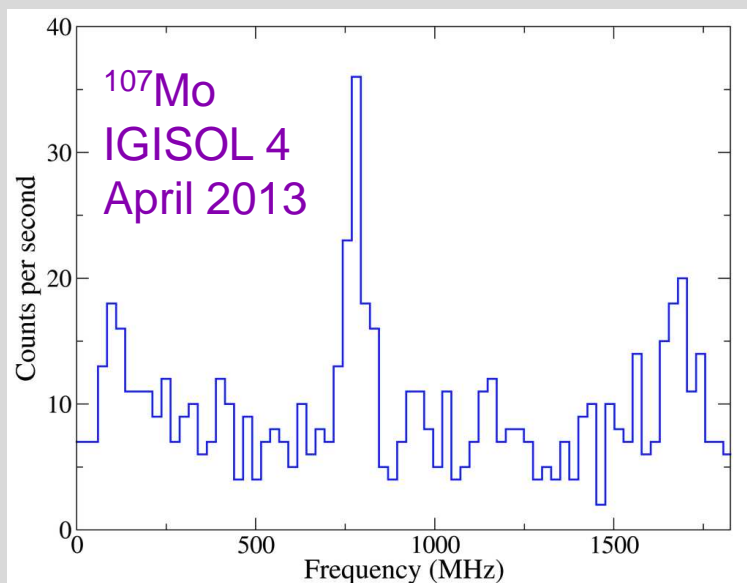
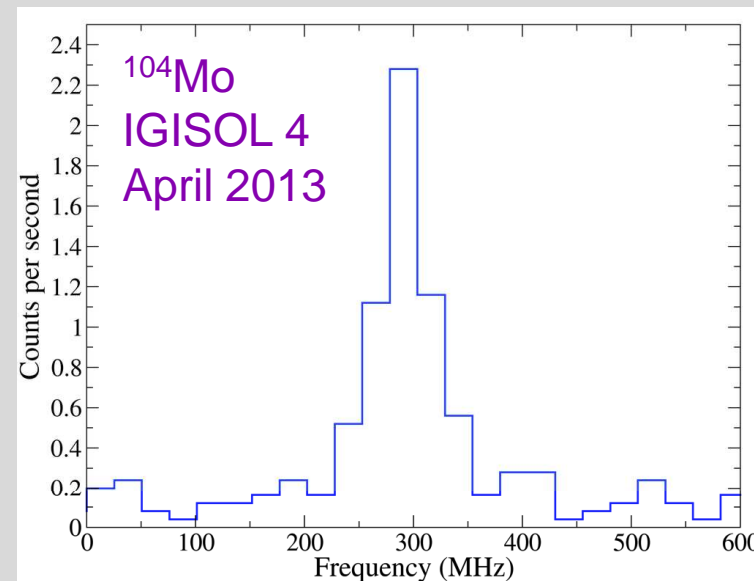
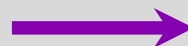
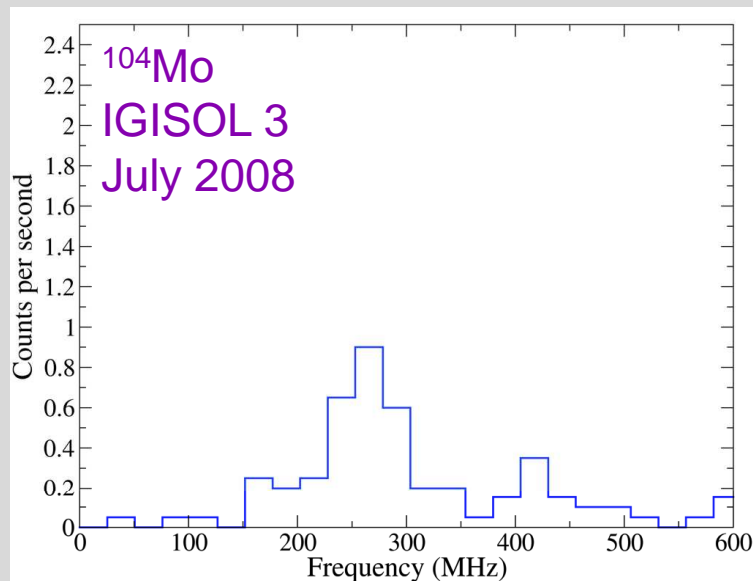
- count resonantly produced ions:
- highly efficient and background-free
 - current resolution ~ 1 GHz (to be improved to < 100 MHz)

Key results from commissioning experiments:

- 9 new isotopes and 5 new isomeric states studied, n-def down to ^{202}Fr , n-rich up to ^{231}Fr .
- Experimental efficiency of 1:100 measured for ^{202}Fr based on an independent yield measurement.
- Factor of 1000 improvement in efficiency over previous attempt to demonstrate CRIS.
- A factor of 10^6 increase in sensitivity compared to previous laser spectroscopy measurements on $^{207-213}\text{Fr}$.
- Non-resonant ionization efficiency (leading to background counts) of less than 1:100000 thanks to UHV (to be improved)
- First demonstration of laser assisted nuclear decay spectroscopy on ultra-pure isomeric beam (K. Lynch et al., Hyp. Int. 216 (2013) 95)



First on-line laser spectroscopy experiment at the new IGISOL facility



- First "commissioning run"
- Already seeing improvements
- ^{107}Mo now measured
- similar set-up under preparation for DESIR



Decay γ -ray Total Absorption Spectrometer (DTAS) accurate measurement of β -strength distributions

J.L. Tain et al., IFIC-U.Surrey-CIEMAT-JYFL-GSI-PNPI

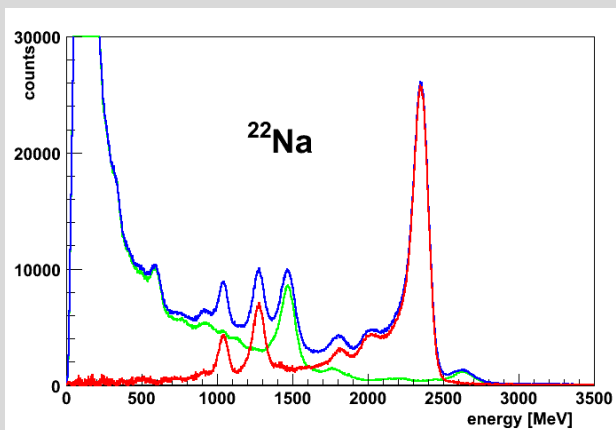
✓ 18x 15x15x25cm³ NaI(Tl) modules

✓ Pb-SS shielding + support table for JYFL/DESIR ready



✓ Electronics + DACQ ready

Total absorption ²²Na spectrum



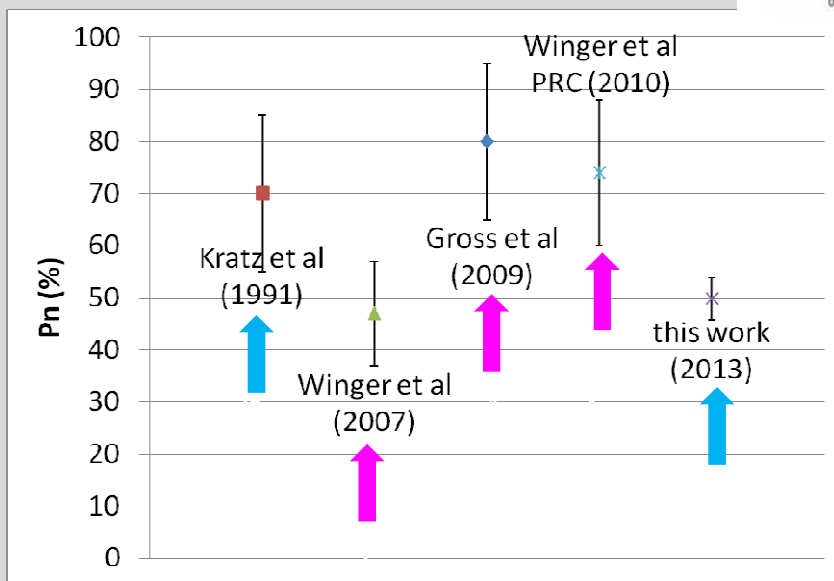
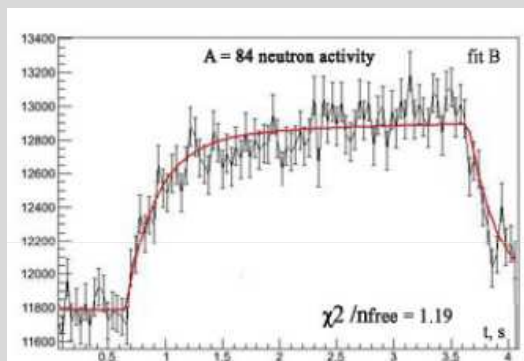
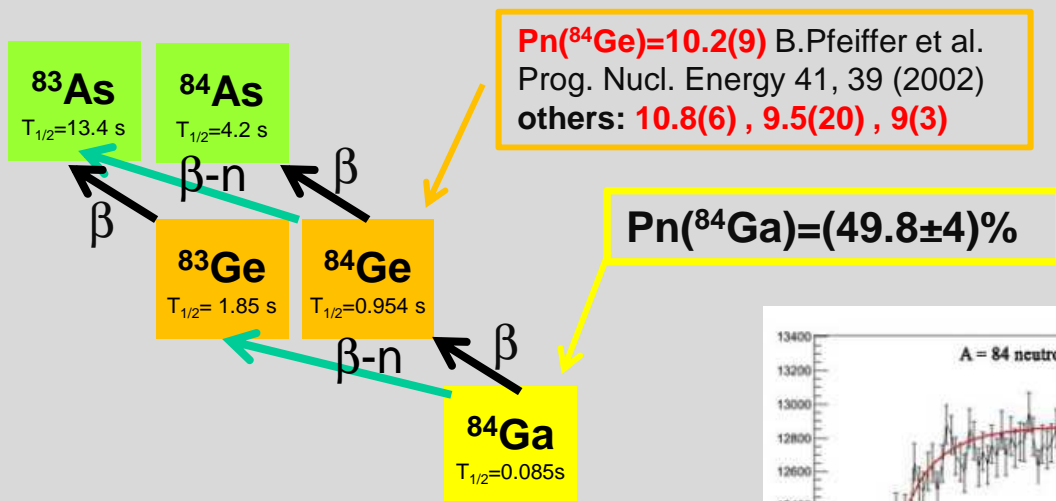
➤ Working on gain stabilization system: light-source + light-splitter + reference-detector



➤ Commissioning at JYFL 2013/2014

Direct β -delayed neutron emission measurement of $^{82,83,84}\text{Ga}$ with TETRA at ALTO

D. Testov (PhD work) and Orsay-Dubna collaboration



TETRA detector at BEDO setup:

- 4π neutron detector with 90 ^3He counters at 7 atm
- measured eff. $63\pm 5\%$ (on line)
- 4π beta detector
- 1 Ge detector
- movable tape