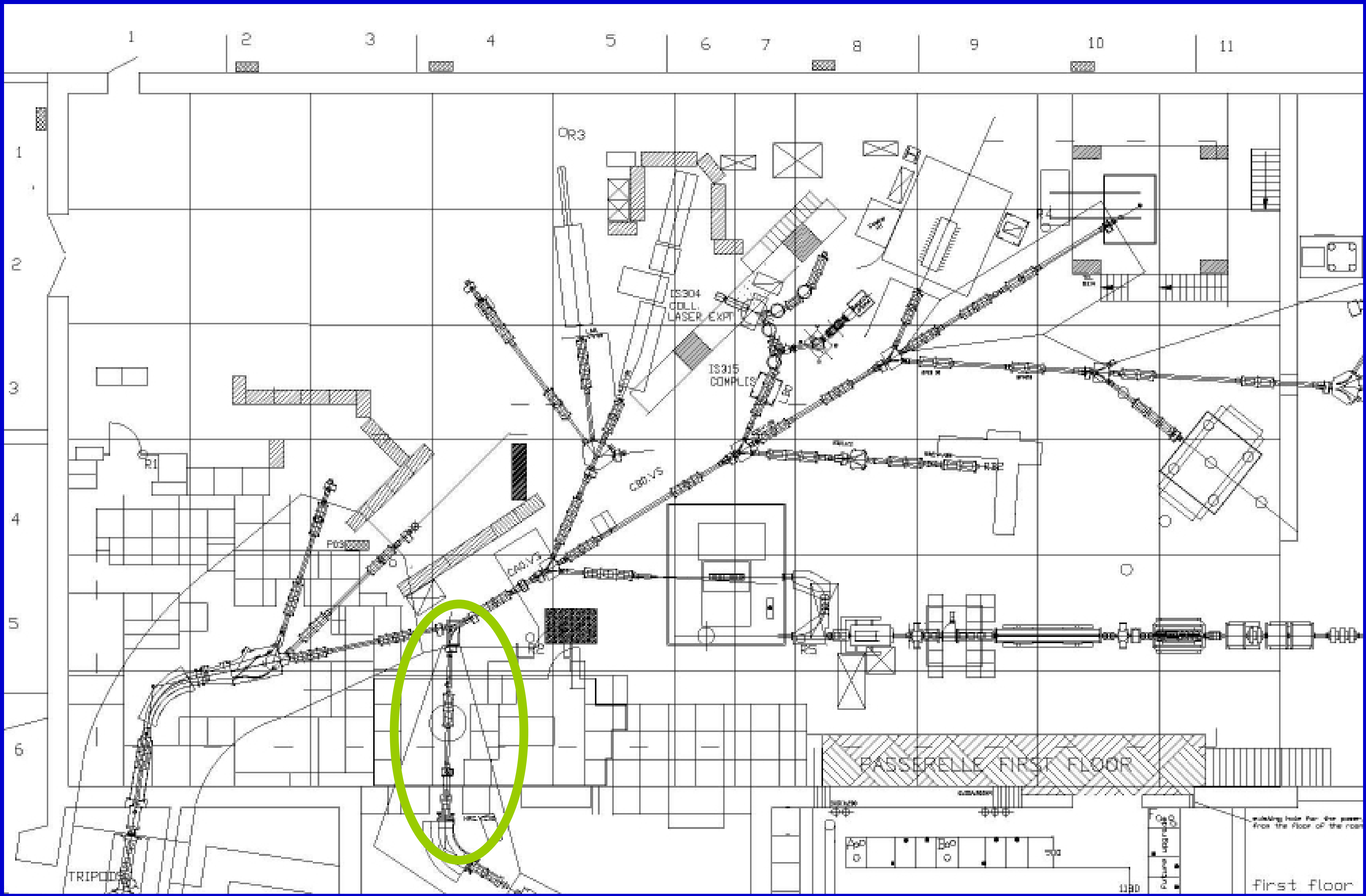
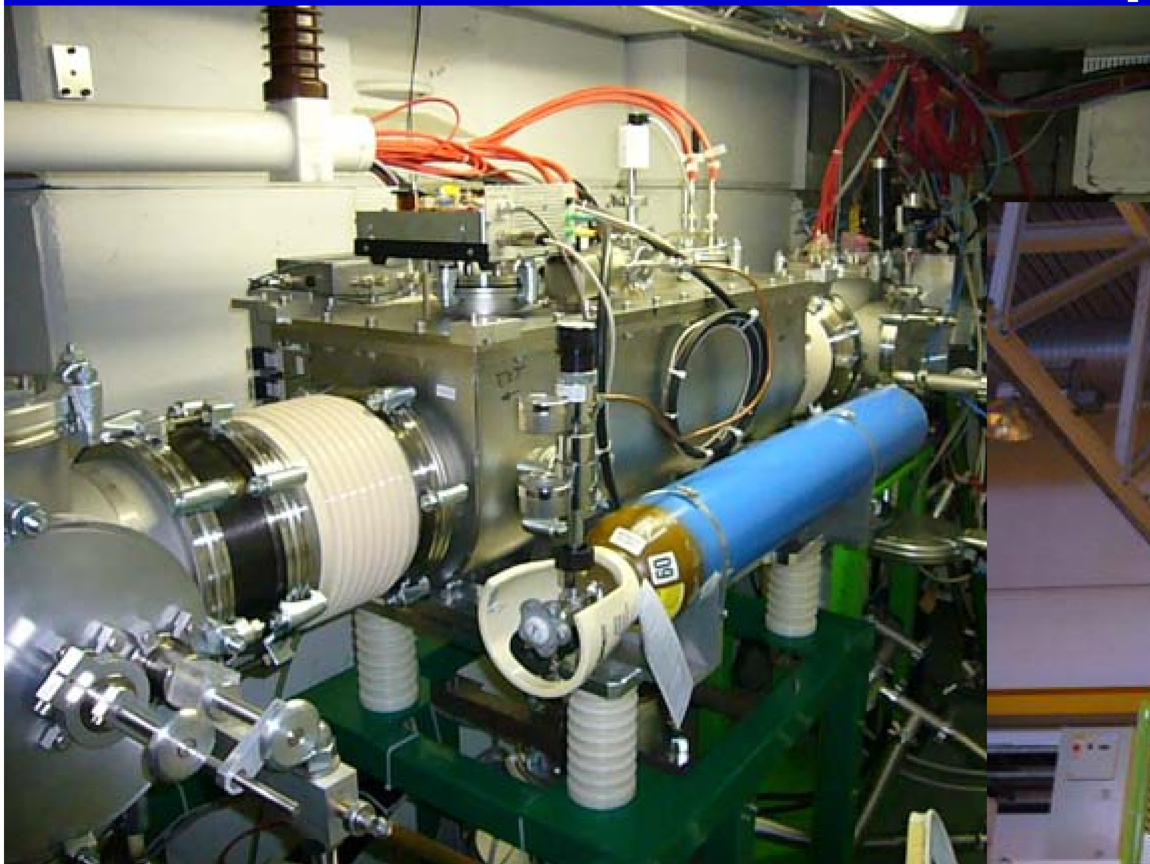
Results with ISCOOL a new Radio Frequency Quadrupole Cooler and Buncher at ISOLDE

P. Delahaye,
H. Frånberg,
AB-OP-PSB, ISCOOL, COLLAPS, ISOLDE collaboration

Where at ISOLDE



Installation in pictures



INSTALLATION

- ✓ Implementation of the RFQ into the ISOLDE vacuum system.
- ✓ Construction of HV platform and HV cage of the RFQ.
- ✓ Standard controls in the working sets: QP arrays for the RFQ and for the beam tuning after the cooler.
  - – RF and gas still on LabVIEW.

OPERATION OF ISCOOL

- Set-up by the ISOLDE operators.

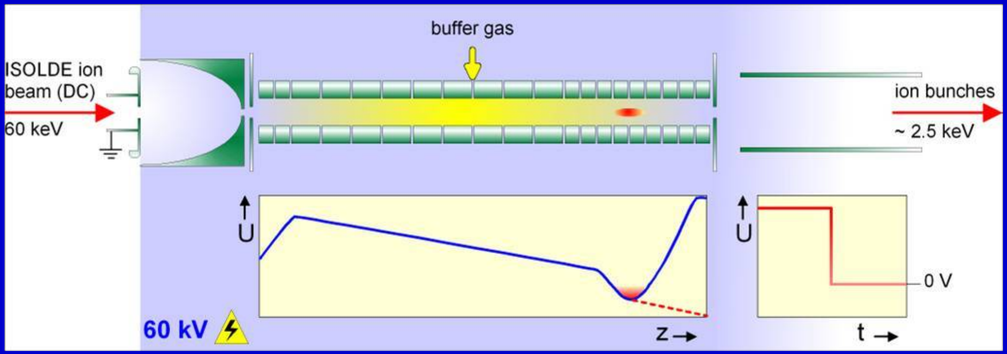
- Improved transmission past the switchyard
  → Improved (faster and easier) set-up for the beam to the experiments

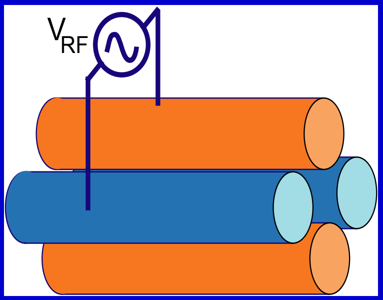
Principle

Three elements:
RF quadrupolar field
→Radial confinement

DC potentials
→Extracting ion in bunches or in continuous mode

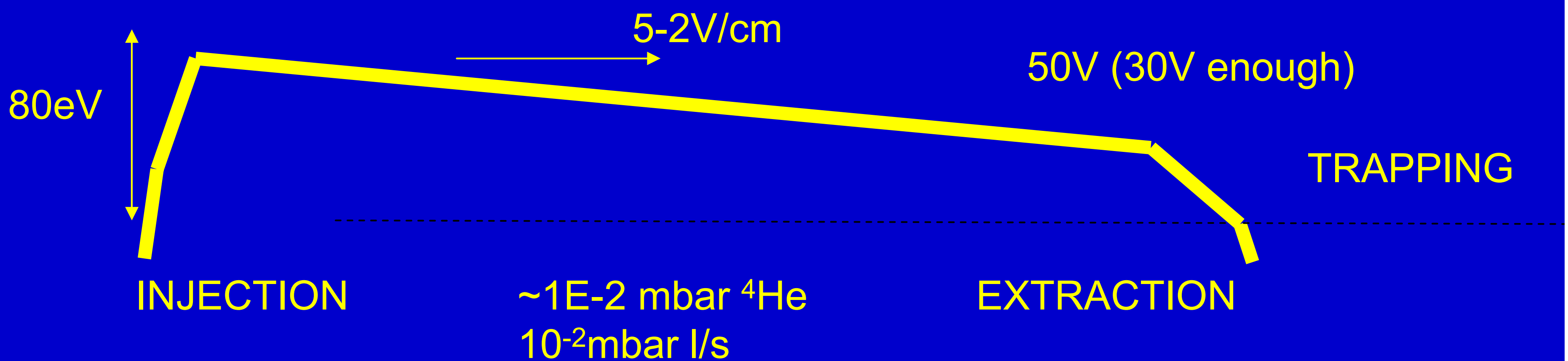
Buffer gas
→ Ion motion cooling

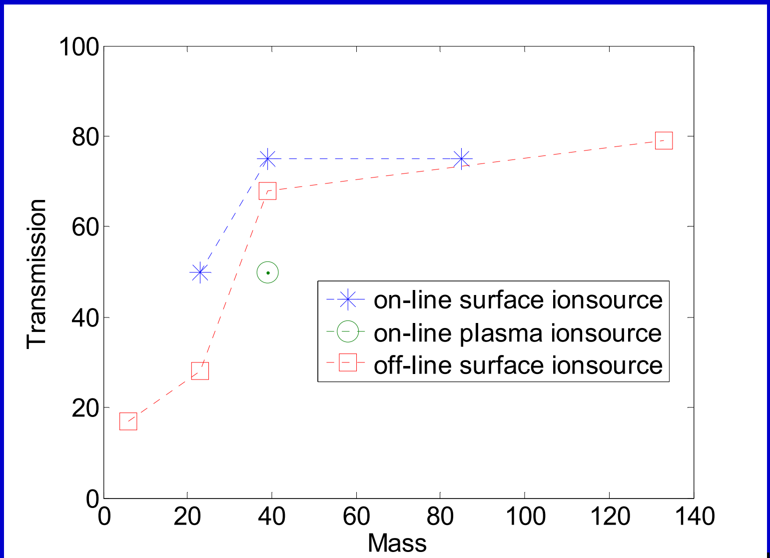




Transmissions

- Potentials along the axis

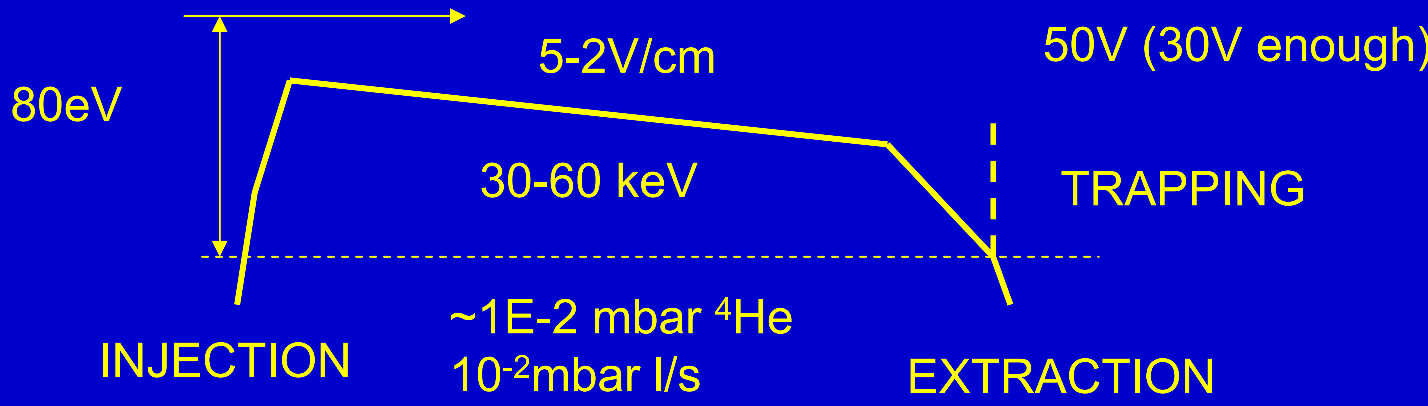


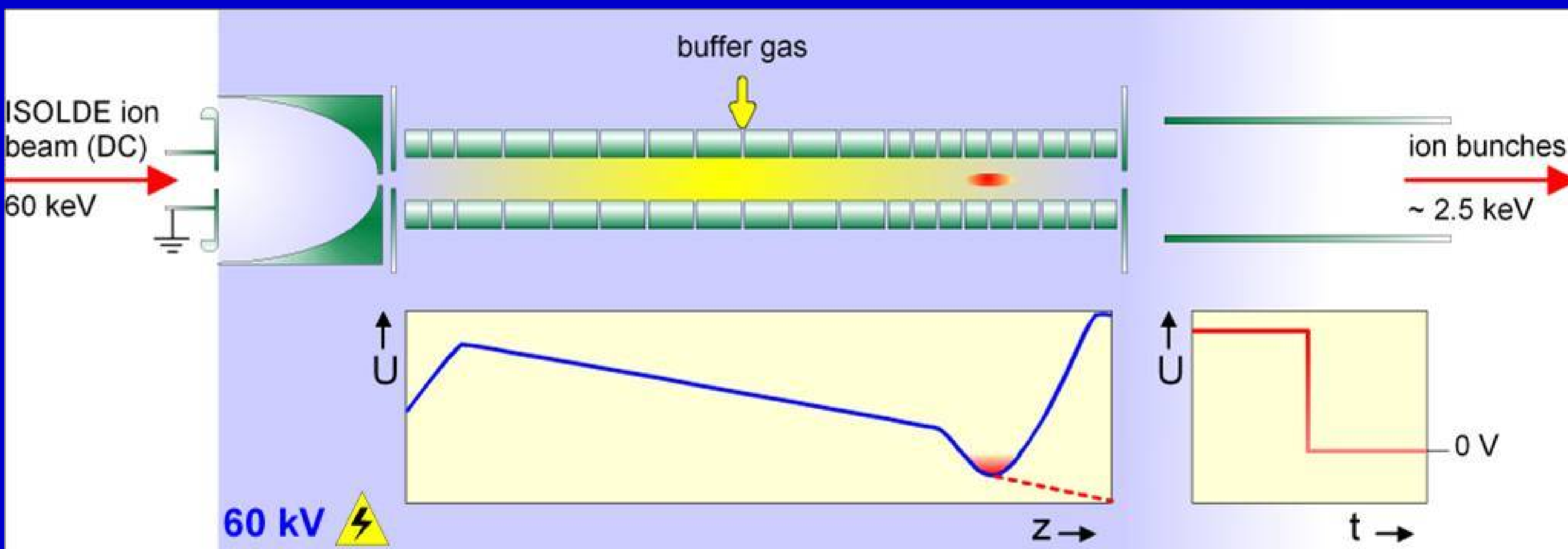


Transmission dependence on the emittance of the ISOLDE ion sources.

ISOLDE on-line surface ion sources has smaller emittance than ISOLDE FEBIAD ion sources (<25 π·mm mrad). The off-line tests were performed with an ion source with ε = 35π mm mrad

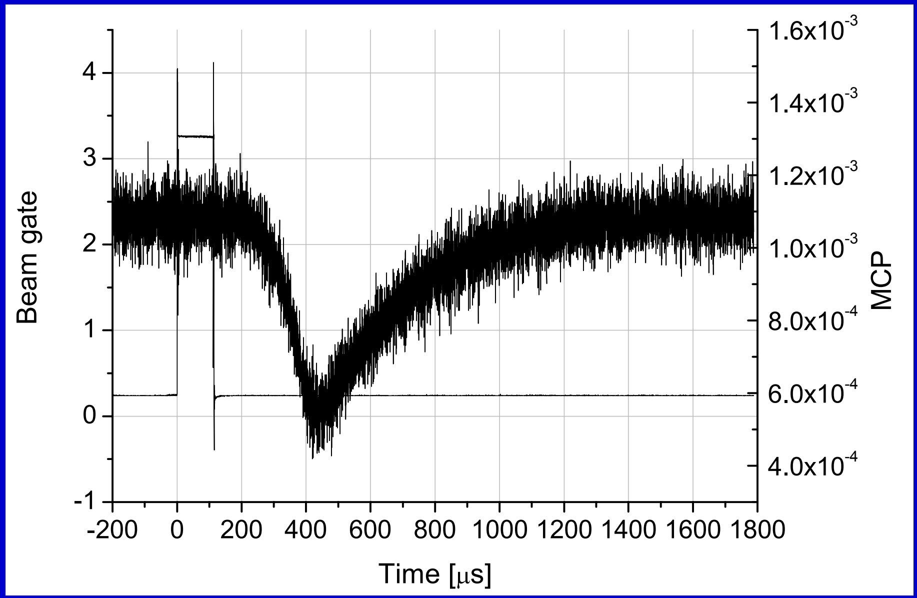
Bunching mode





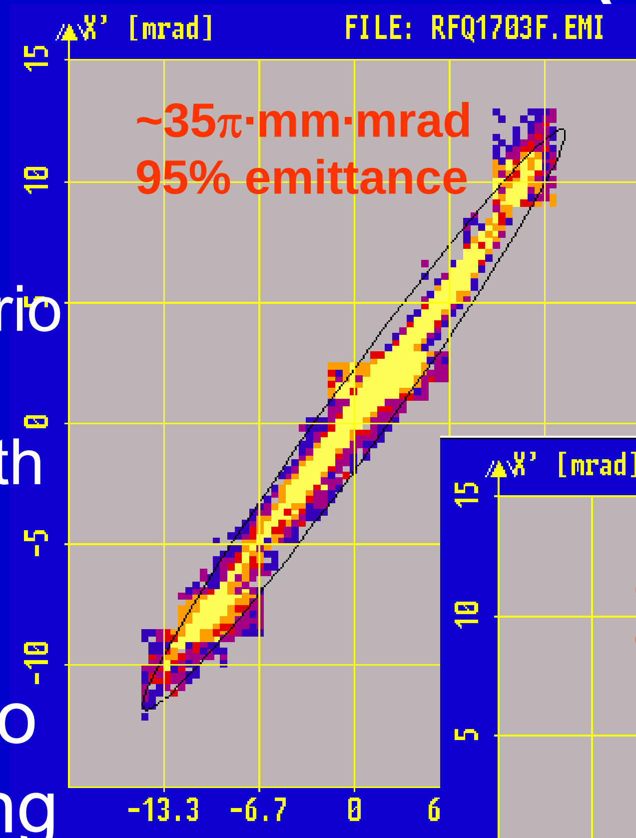
Cooling time

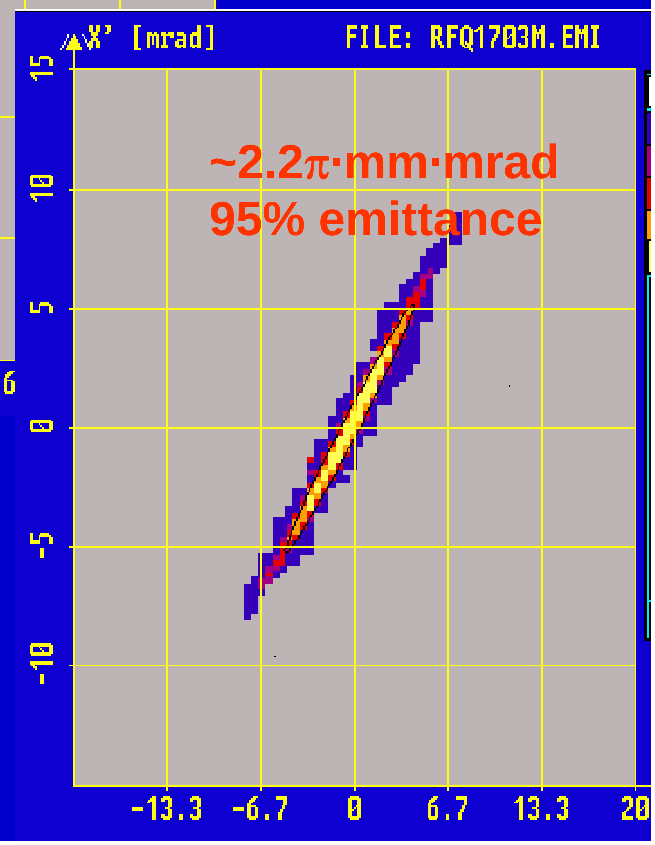
- TOF < 1ms from the entrance to the exit of the RFQ
  - No losses for short lived ions.
- 1 passage is enough to get a cold beam
  - as measured off-line, and other labs as predicted by simulations for other systems



Emittance measurements (off-line)

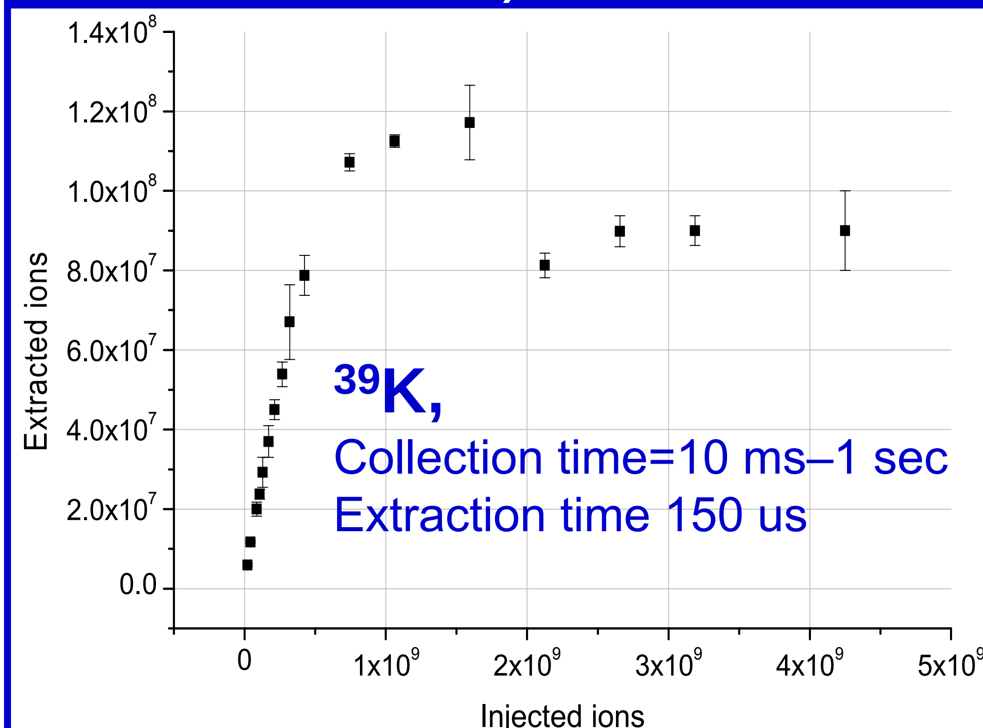
- 10 x decrease of the beam emittance
  - The worst case scenario at ISOLDE is the FEBIAD ion source with >25 p·mm·mrad emmittance.
- Injection efficiency into the cooler is depending on the beam emittance from the ISOLDE target and ion source unit.

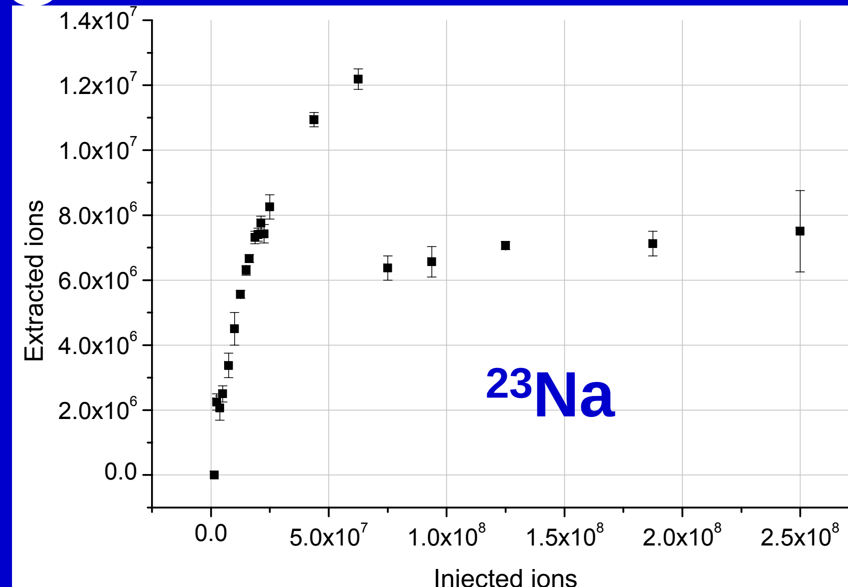


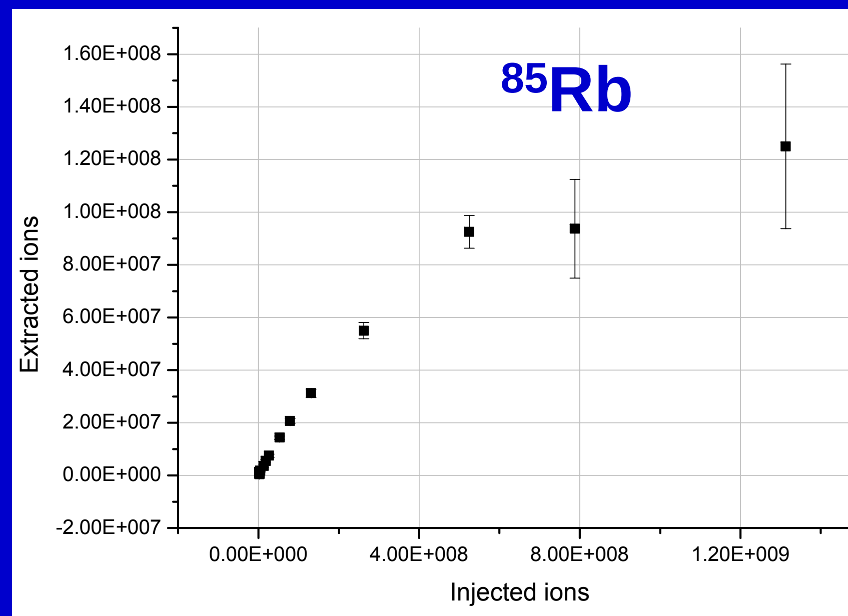


Space charge limits

- Up to 10^8/s!! As measured with FC (data under analysis with MCP)

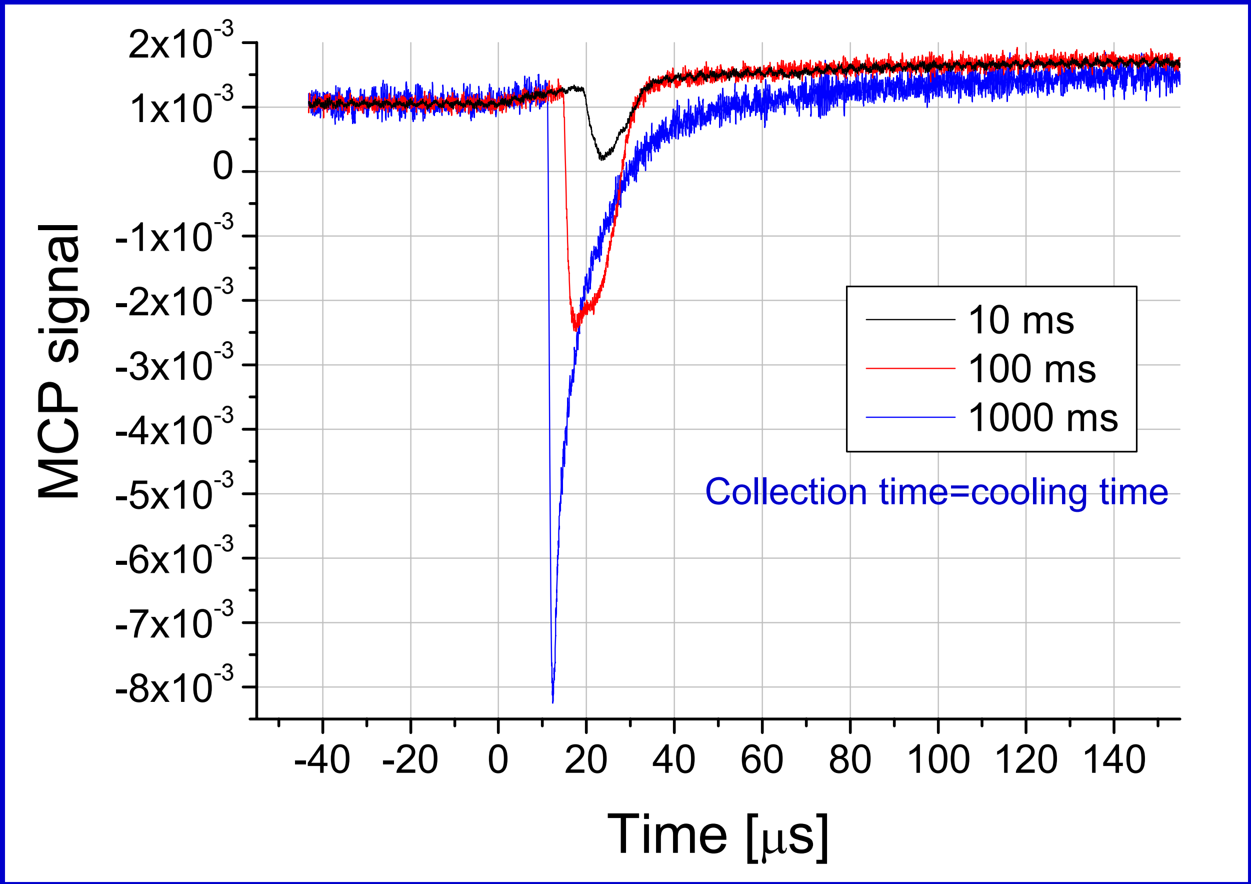






Bunch width

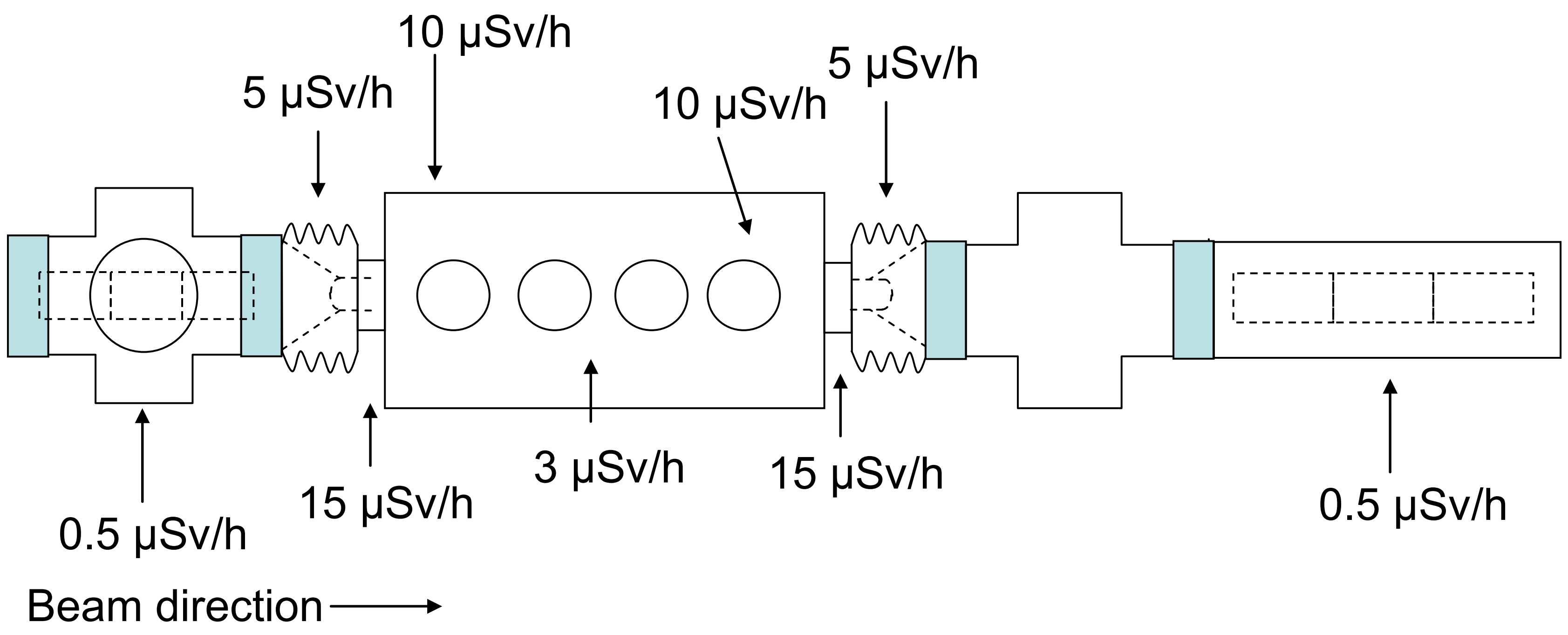
Depends on the space charge and cooling time



Yield measurements

- ^{26}Na $T_{1/2}$=1.07 s
- ^{48}K $T_{1/2}$=6.8 s
- Yields in continuous mode:
  - ^{26}Na :1.2e6 at/uC
  - ^{48}K: 2.2e4 at/uC
- Yields in bunched mode
  - analysis under progress

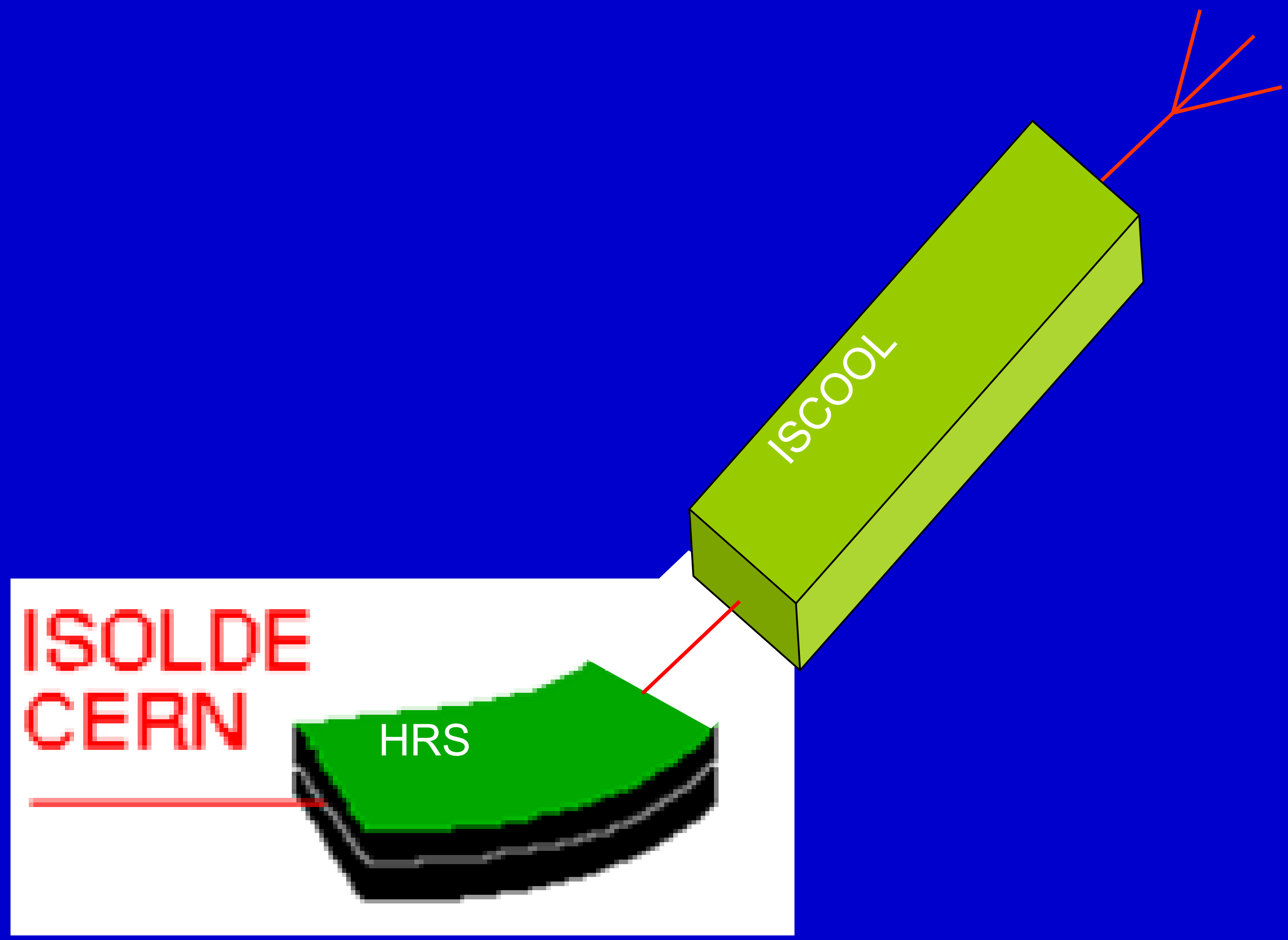
HOT SPOTS


10 μSv/h
5 μSv/h
5 μSv/h
10 μSv/h
0.5 μSv/h
15 μSv/h
3 μSv/h
15 μSv/h
0.5 μSv/h
Beam direction

Results

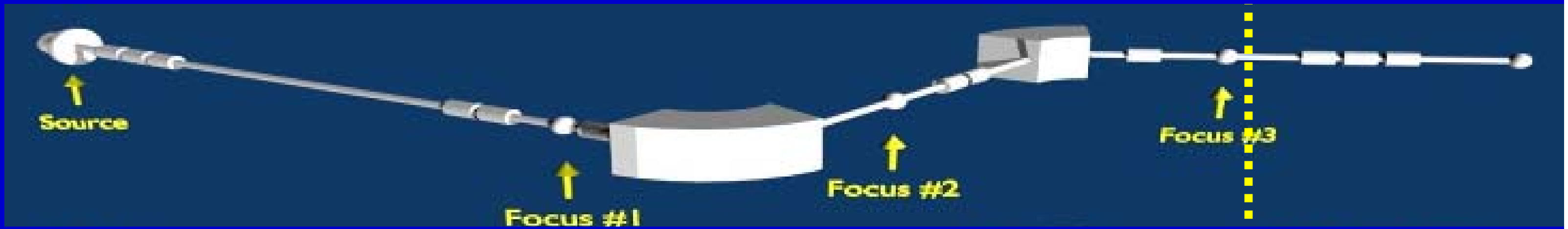
- High transmission efficiencies
- Easy beam tuning to experiments
- Yield measurements continuous vs. bunched mode
- Losses due to trapping time (analysis in progress
- First measurements with radioactive isotopes performed together with COLLAPS (see next talk)

ISOLDE HRS + Cooled beams



Outlook

Up to
October 2007:



From
Nov. 2007:

Next step:

Upgrade of
HRS Mag 90:

EURISOL
HIE Isolde:

Thanks to:

- AB-OP-PSB-iso team: Pascal, Erwin, Magnus, Emiliano and Tim.
- AB/ATB
- AB/CO
- AB/PO
- AB/VAC
- SC/RP
- ISOLDE collaboration
- COLLAPS collaboration
- ISCOOL collaboration

Home | Archives | Contact us | CERN Home

search english | francais

The Bulletin

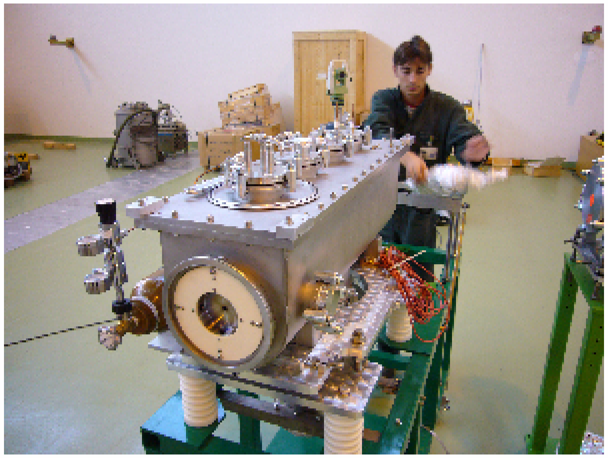
Issue No. 51-52/2007 - Monday 17 December 2007

News Articles | Official News | Training and Development | General Information

- News from the CERN Council
- Rolf-Dieter Heuer, CERN's next Director General
- A word from the DG: A decisive year
- Two ATLAS suppliers honoured
- A tribute to friends
- A better beam for ISOLDE
- Sound of mind and fleet of foot!
- CERN, as seen by Google Earth
- Trams and roadworks on the route de Meyrin
- Lecture programme The reality of science today

A better beam for ISOLDE

ISCOOL, the RFQ Cooler and Buncher, recently installed at ISOLDE, heralds a new generation of beam quality.



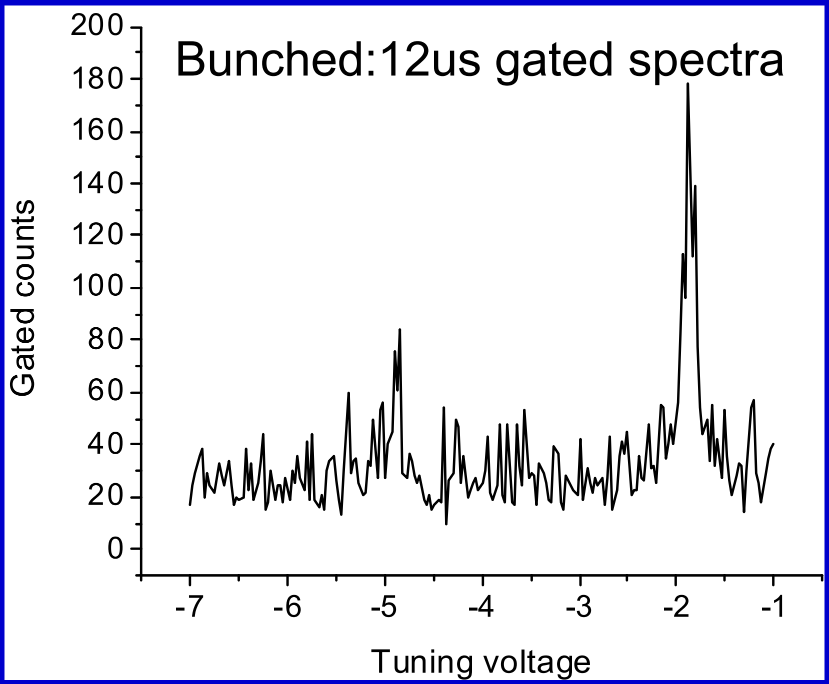
Jérôme Sarret working on the alignment of ISCOOL, ISOLDE's new RFQ Cooler and Buncher.

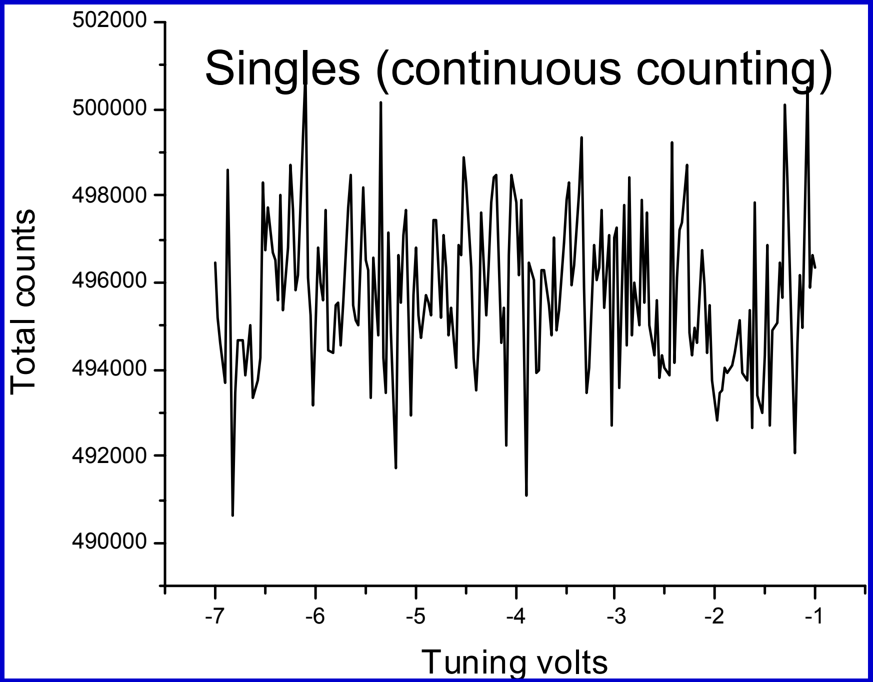
As any good chef knows, the secret to a good dish lies in the quality of its ingredients. And at ISOLDE, unlocking the juiciest secrets of the nucleus needs a high-quality beam. One recently installed device, the RFQ Cooler and Buncher (RFQCB), will enhance the emittance and bunching properties of the ion beam, giving ISOLDE's experiments a better shot at teasing out the properties of exotic nuclei.

The device, originally conceived in a PhD thesis by Ivan Podadera, was installed and commissioned over the past few weeks by the AB-ATB-IF, AB-OP and PH-IS groups. At ISOLDE, radioactive nuclides are produced in thick high-temperature targets and the RFQ cooler will use a buffer gas, segmented cylinder and RF quadrupole to slow the ions, delivering a lower emittance continuous or bunched beam. This will enable the physicists in the various user groups to perform more detailed and higher resolution spectroscopic analysis on the ions than ever before.

ISCOOL tests with COLLAPS

^{46}K Beam 1E5 ions/s after the cooler.
Collection time 20 minutes, with 300ms bunching and a 12us gate and 2mW of laser power.





Background suppression factor~1E4