Liquid-Phase Chemistry with SISAK using Preseparated Activity

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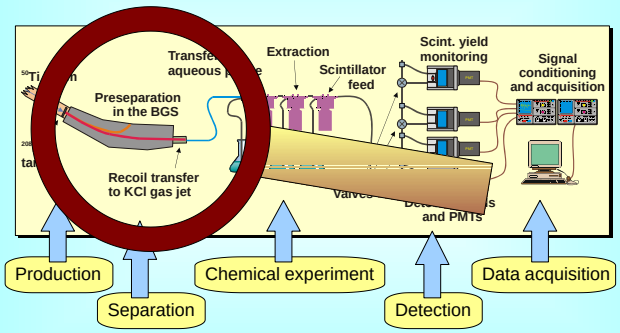
Preseparation!



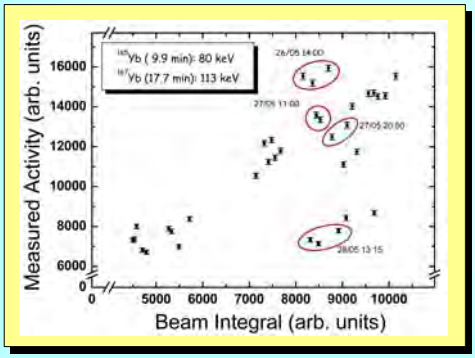
Experiments with Preseparation

- November 2000
  - The transactinide ^{257}Rf detected in LS detectors for the first time.
  - Rutherfordium extracted from 6 HNO_3 into toluene with HDBP.
- March 2001
  - N_2 was tried instead of He as carrier in gas jet.
  - Rutherfordium extracted from oxalic acid into toluene with TOA.
  - Experiment with ^{258}Db failed.
- March 2003
  - Rutherfordium extracted from sulphuric acid into toluene with TOA.
  - ^{253}No experiment failed.
- March 2004
  - ^{253}No experiment to investigate detector properties.
  - Used $PbCl_2$ to improve gas-jet yield.

Current Issues

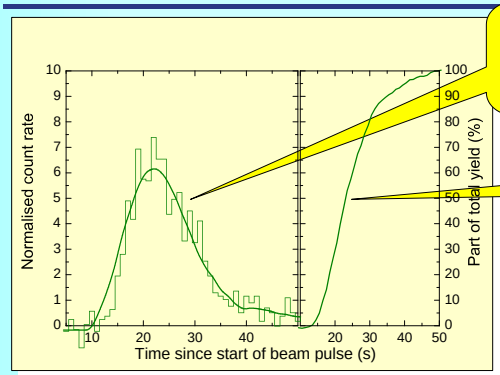
- Transport yield.
- Transport time.
- Waste.
- Digital acquisition.
- Measure both phases.

Gas-Jet Yield



- $PbCl_2$ aerosols.
- 0.5 L/min gas flow
- 0.4 mL/s liquid flow
- 697±1 °C oven temp.

Transport Time

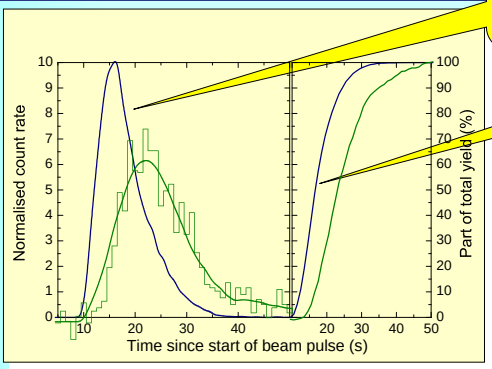


Measured transport time for long- lived activity.

50% yield after 23 s.

Flow rates:
Aq.: 0.44 mL/S
Org.: 0.40 mL/s
Scint: 0.40 mL/s
RTC depth: 42 mm
Gas Jet: 1.70 bar

Transport time March 2003



Monte Carlo simulation of 4 s half-life activity yield.

50% yield after 16.6 s.

Flow rates:
Aq.: 0.44 mL/S
Org.: 0.40 mL/s
Scint: 0.40 mL/s
RTC depth: 42 mm
Gas Jet: 1.70 bar

Plans

- Reduce transport time.
- Improve transfer between gas jet and liquid phase.
- Improve LS detection system.
- Permanent SISAK setup in Berkeley.
- Second extraction with high yield to measure activity in both phases of first extraction step.
- Experiments with ^{257}Rf and ^{258}Db.

Wish List

- Possibility to use preseparated activity from elements heavier than Rf and Db!
- Possibility to use ^{261}Rf (78 s) instead of ^{257}Rf!

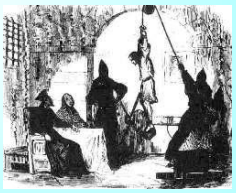
- Requires(?):
  - Thinner window between separator and gas-jet transfer chamber
    - Lower gas-jet pressure, which again require new method of transfer from gas to liquid.
  - or acceleration and focussing of ions after separation.

The SISAK collaboration

- The Oslo group
  - PhD students: Liv Stavsetra, Darina Polakova, Li Zheng
  - Prof. Jorolf Alstad, Prof. Tor Bjørnstad, and Prof. Jon Petter Omtvedt
- The LBNL group
  - Prof. Darleane C. Hoffman, Prof. Heino Nitsche, Dr. Ken Gregorich, Dr. Ralf Sudowe and students.
- The Gothenburg group
  - Prof. Gunnar Skarnemark
- The Mainz group
  - Prof. Jens Volker Kratz, Dr. Norbert Trautmann, Dr. Klaus Eberhardt, co-workers and students.

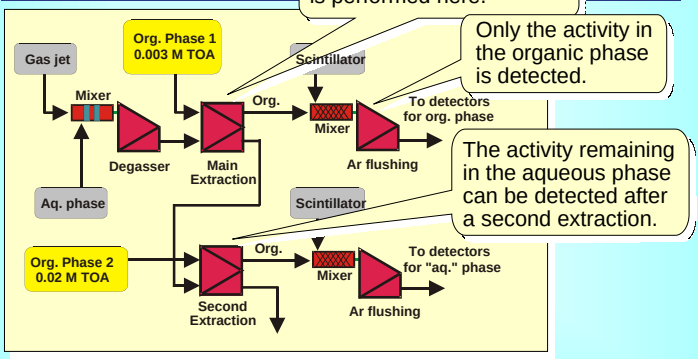
The restrains of the past...

- Using preseparated activity feels like advancing from the medieval dark ages to the modern age...
- The nearly background free spectra makes life so much more enjoyable!



An Additional Extraction Stage

The liquid in Stage 1 extraction is performed here.



Only the activity in the organic phase is detected.

The activity remaining in the aqueous phase can be detected after a second extraction.