Chemical experiments at electromagnetic separators

Proposal for future experiments at TASCA separator from SHE group of Technische Universität München

Scientific goal

- Physical and chemical study of elements with Z=108…114
- Search for relativistic effects in chemical properties and electron structure of SHE
- Search for new isotopes in the region of interest
- Development of new techniques of chemical separation

Objects for chemical experiments at TASCA

- Element 108, Hassium

  $^{248}Cm + {}^{25,26}Mg = {}^{268,269,270}Hs$

  $^{238}U + {}^{36}S = {}^{269,270}Hs$

  $^{230,232}Th + {}^{48}Ca = [Ds] \rightarrow {}^{270,271,272,273}Hs$

- Element 112

  $^{238}U + {}^{48}Ca = {}^{283}112$

- Element 113

  $^{243}Am + {}^{48}Ca = [E115] \rightarrow {}^{284}113$

- Element 114

  $^{244}Pu + {}^{48}Ca = {}^{289}114$

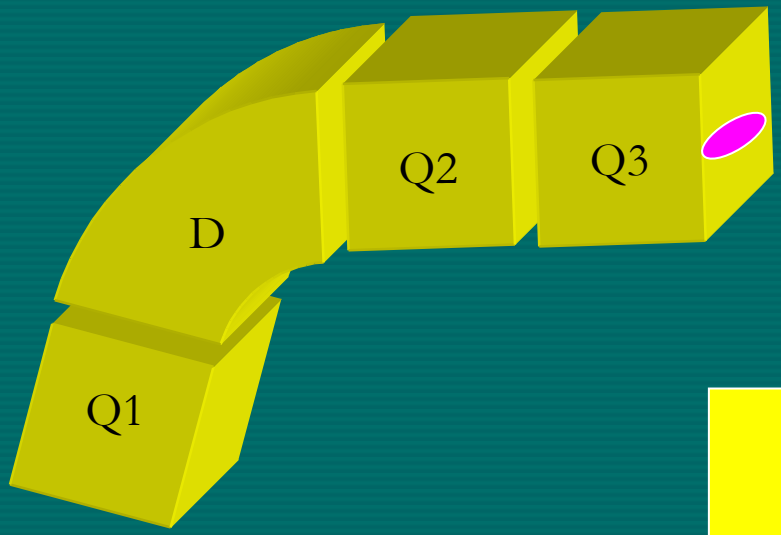
Experimental background

- Beams
  ^{25,26}Mg, ^{36}S, ^{48}Ca (+ actinide target)
  ^{40}Ar…… (+ lanthanide target)
- Beam intensity
  ~ 1pμA
- Separation from by-products (Z=82…100)
  > 10^3
- Transmission
  > 50%
- Image size
  < 15 cm^2

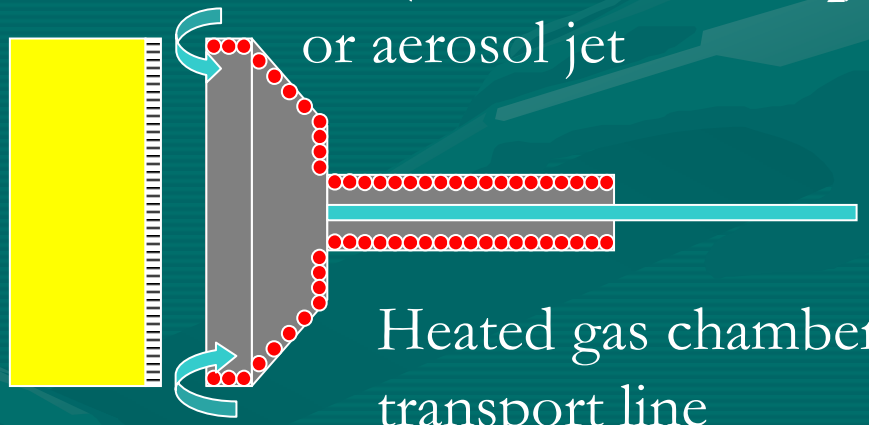
Future technical developments

- Recoil chamber – as interface between TASCA separator and chemistry
- Fast (hot) transport to chemistry or detector
- Efficient detection after chemical separation
- Thermostable vacuum window or differential pumping (no window)
- Combination of gas phase and solution chemistry

Recoil chamber



Optimized image size



He (He/Ar or He/O_2)
or aerosol jet

Heated gas chamber and
transport line

Window – thin Al-mylar (0.9 μ)
on support grid with high transparency

Connection to chemistry

- Hs and E112 chemistry

  In-flight gas phase chemistry and transport by carrier gas (He, He/Ar, He/O_2)

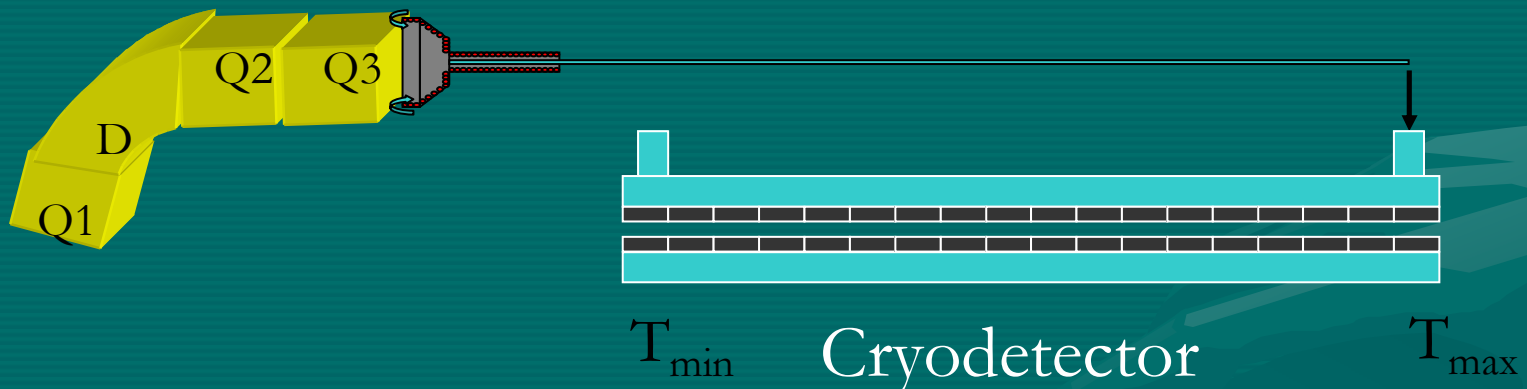
- E113 and E114 chemistry

  „Hot line“ transport by carrier gas at high temperatures T>600°C

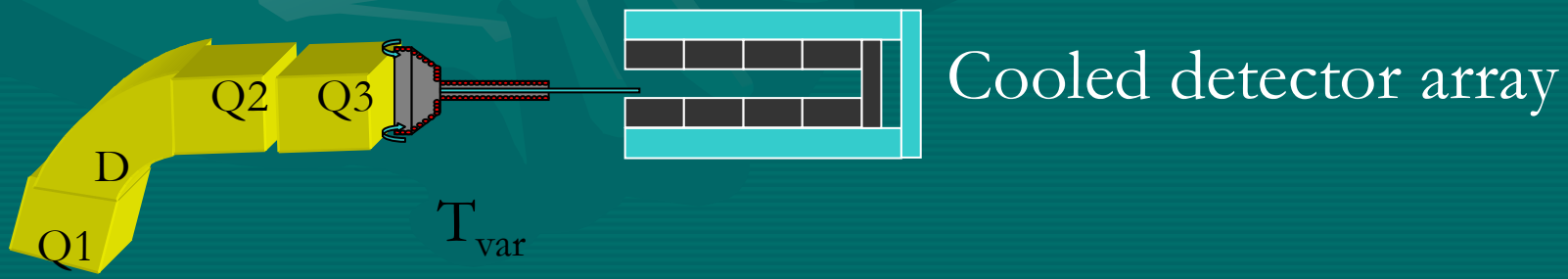
  Aerosol transport by CO_2 ice aerosol („cold line“) or others

Chemistry and detection

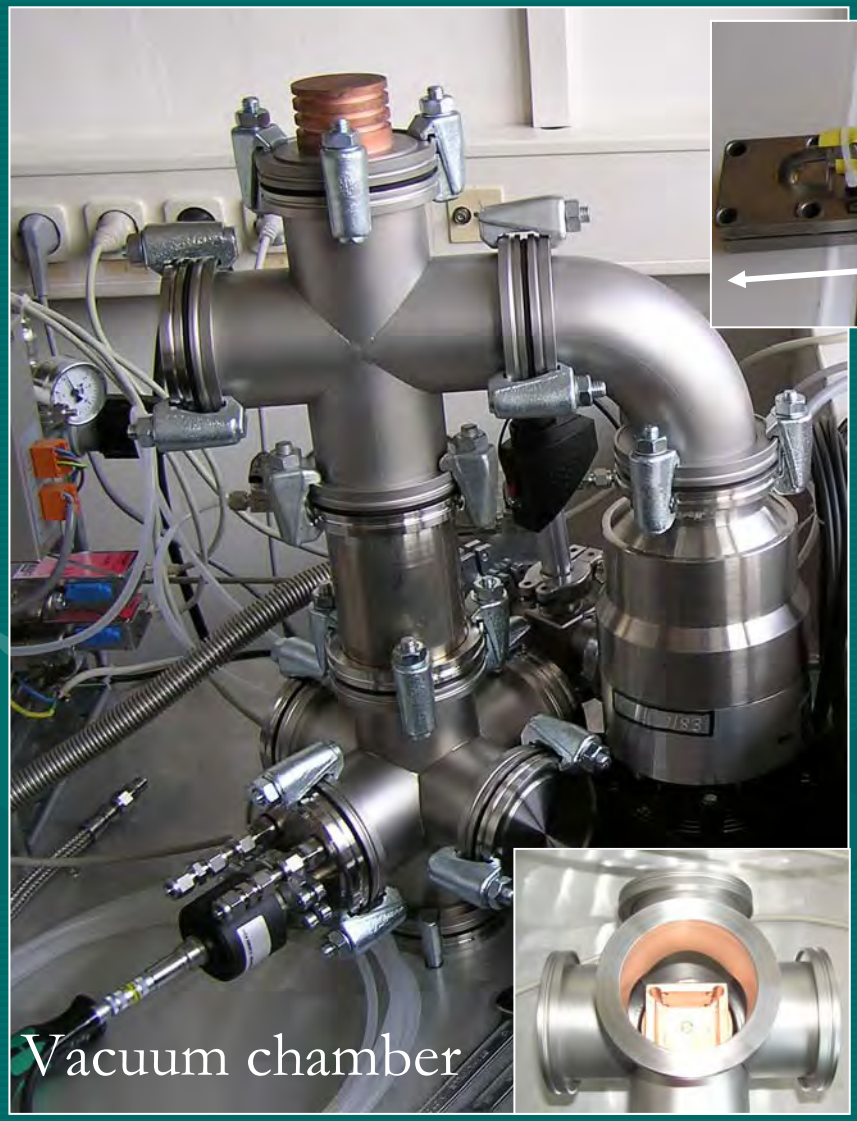
I. Thermochromatography

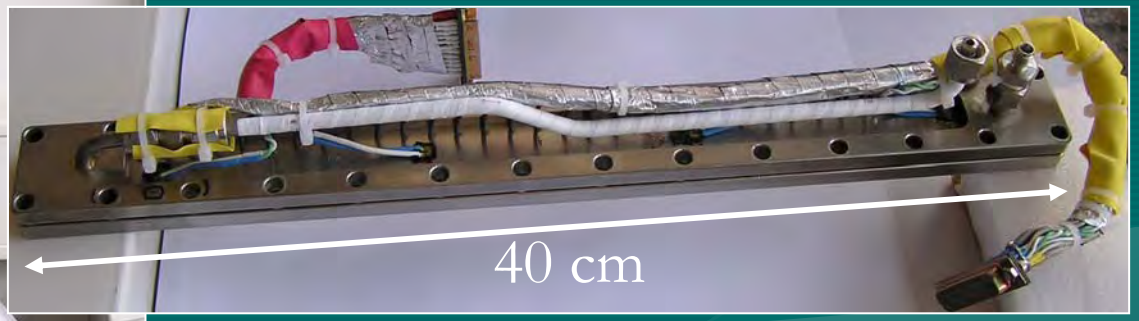


II. Isothermal chromatography



Munich cryodetector





2x32 PIPS covered with Au (5-10 μg/cm^2)