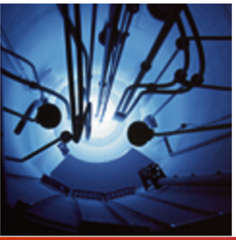

Institut für Kernchemie

JOHANNES GUTENBERG UNIVERSITÄT MAINZ

TASCA Target Group Status Report

K. Eberhardt for the TASCA Target Group

- **TASCA target group**
- **Target and backing materials**
- **Target group activities**
- **Outlook**

Target group members

GSI: D. Ackermann, W. Brüchle, E. Jäger, B. Kindler, B. Lommel, M. Schädel, E. Schimpf

A. Semchenkov

TUM: A. Türler, A. Yakushev

LMU Ludwig-Maximilians-Universität München: H.-J. Maier, J. Szerypo

Berkeley Lab: K. Gregorich, R. Sudowe

Johannes Gutenberg Universität Mainz: K. Eberhardt, J.V. Kratz, D. Liebe, P. Thörle

New members are always invited to join the group!

REC SEP @ SHE CHEM

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Target group meetings

Workshop on Recoil Separator for Superheavy Element Chemistry
March 20 - 21, 2002, GSI, Darmstadt, Germany

BGS / ChemSep Workshop
LBNL/Berkeley, November 21, 2003

3rd Workshop on Recoil Separator for Superheavy Element Chemistry
(TASCA 04): August 27, 2004, GSI, Darmstadt, Germany

Working groups started on specific tasks ⇒ TASCA target group:

- Targets (preparation, rotation, safety, control, cooling),
- Window
- Collimator

Dec. 10, 2004:	1st TASCA Target Group Meeting	GSI
March 2, 2005:	2nd TASCA Target Group Meeting	JOHANNES GUTENBERG UNIVERSITÄT MAINZ
July 20, 2005:	3rd TASCA Target Group Meeting	GSI

4th Workshop on Recoil Separator for Superheavy Element Chemistry
(TASCA05) October 6, 2005, Oslo, Norway

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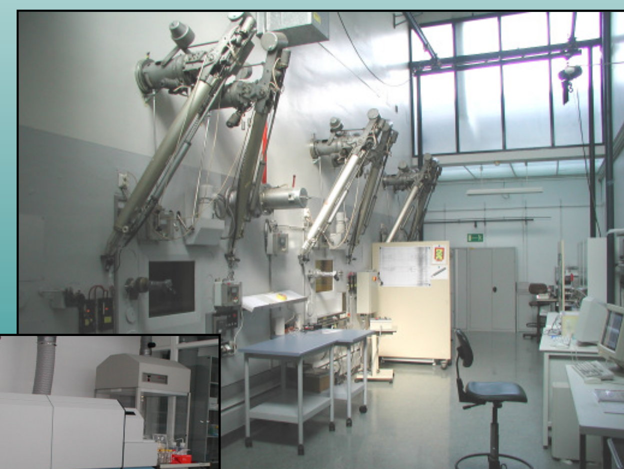
Target production techniques

GSI

Thermal- and electron gun evaporation, sputtering, cold rolling, cutting and polishing. No radioactive material (except nat. U)

TUM

Hot cell facilities for handling high activities of α-particle emitters. Analytical capabilities to measure concentration and purity of actinide elements (also Pu and Cm) in solution prior to target production. Preparation of ^{226}Ra-targets in the mg/cm^2 range

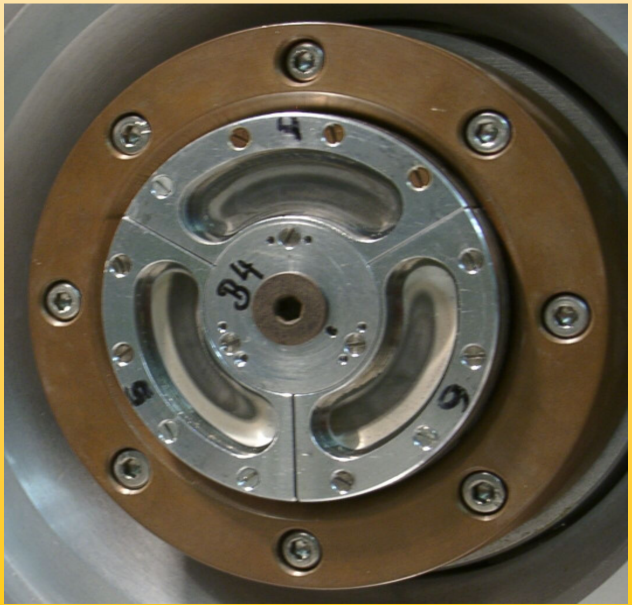


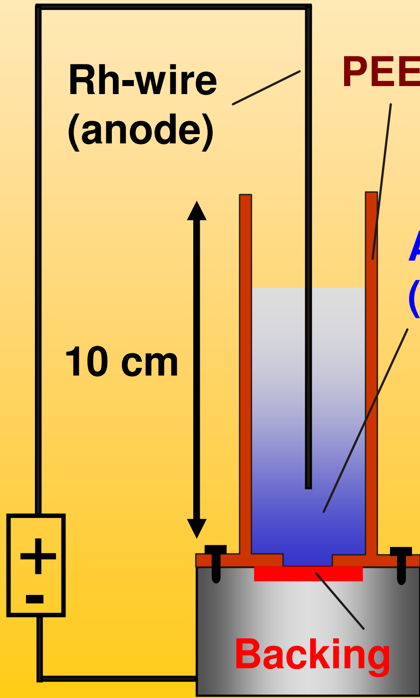
LMU Ludwig-Maximilians-Universität München

Plasma vapour deposition (PVD), micro-evaporation for rare meterials. Stable isotopes but also radioactive material, like ^{210}Pb, ^{226}Ra, ^{227}Ac, ^{229}Th, ^{244}Pu, ^{248}Cm.

Target production techniques

Preparation of rare earth element and actinide targets (e.g. Th, U, Pu, Cm, Cf) using electrochemical deposition techniques. Target thicknesses up to the mg/cm^2 range possible. Chemical purification of target material prior to deposition. Recovery of target material from used targets





Target- and backing materials

TASCA will be used for physical studies as well as for chemical investigations of the transactinide elements.

- Mass asymmetry influences transmission through TASCA
- Recoil energy of the compound nucleus must be high enough to pass exit window
- Availability of target material might be limited
- Chemistry: half-life > 1 s ; production cross section in the nb-region

Production of Rf and Db:

- $^{208}Pb(^{50}Ti,1n)^{257}Rf$
- $^{209}Bi(^{50}Ti,1n)^{258}Db$

Production of heavier transactinides:

- $^{248}Cm(^{22}Ne,5n)^{265}Sg$
- $^{244}Pu(^{27}Al,5n)^{266}Bh$
- $^{248}Cm(^{26}Mg,5/4n)^{269/270}Hs$
- $^{232}Th(^{48}Ca,5/4/3n)^{275/276/277}Ds$
- $^{238}U(^{48}Ca,3n)^{283}112$

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Target- and backing materials

Target material	Current availability	Target production
^{208}Pb	unlimited	GSI/LMU
^{209}Bi	unlimited	GSI/LMU
^{230}Th	to be checked	Mainz
^{232}Th	unlimited	LMU/Mainz
^{238}U	unlimited	GSI/LMU/Mainz
^{243}Am	20 mg	Mainz
^{244}Pu	20 mg	Mainz
^{248}Cm	10 mg	Mainz

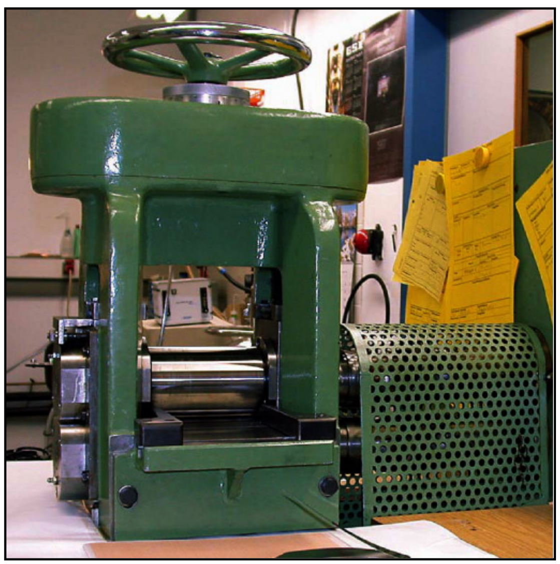
Backing materials: 2-5 µm Al / 5 µm Ti / 10 µm Be / C (50 µg/cm^2)

Target geometry / Al as target backing

<u>Ion optical calculations (A. Semchenkov):</u> Transmission through the TASCA-magnet depends – among other parameters - strongly on beam size and the target material.

- Target spot size of 8 mm (± 4 mm) possible
- $^{238}U(^{48}Ca,3n)^{283}112$: Metallic U-target seems to be best suited

Backing materials: Be, Al, C, Ti (2-10 µm). Thin Al-backing not easy to handle



Rolling of 2-10µm Al-foils (pinhole free!)

Foil glued to $AlMg_3$-frames

Evaporation of UF_4 on Al

10 µg/cm² carbon covering

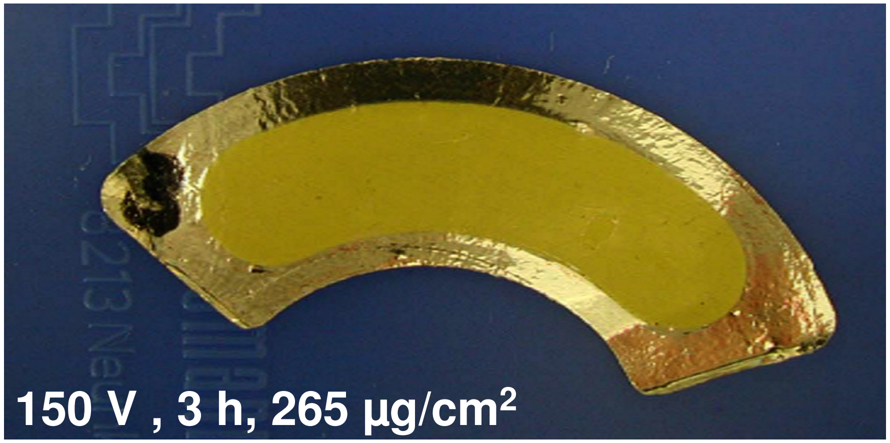
$Al/UF_4/C$ stable in C-beam

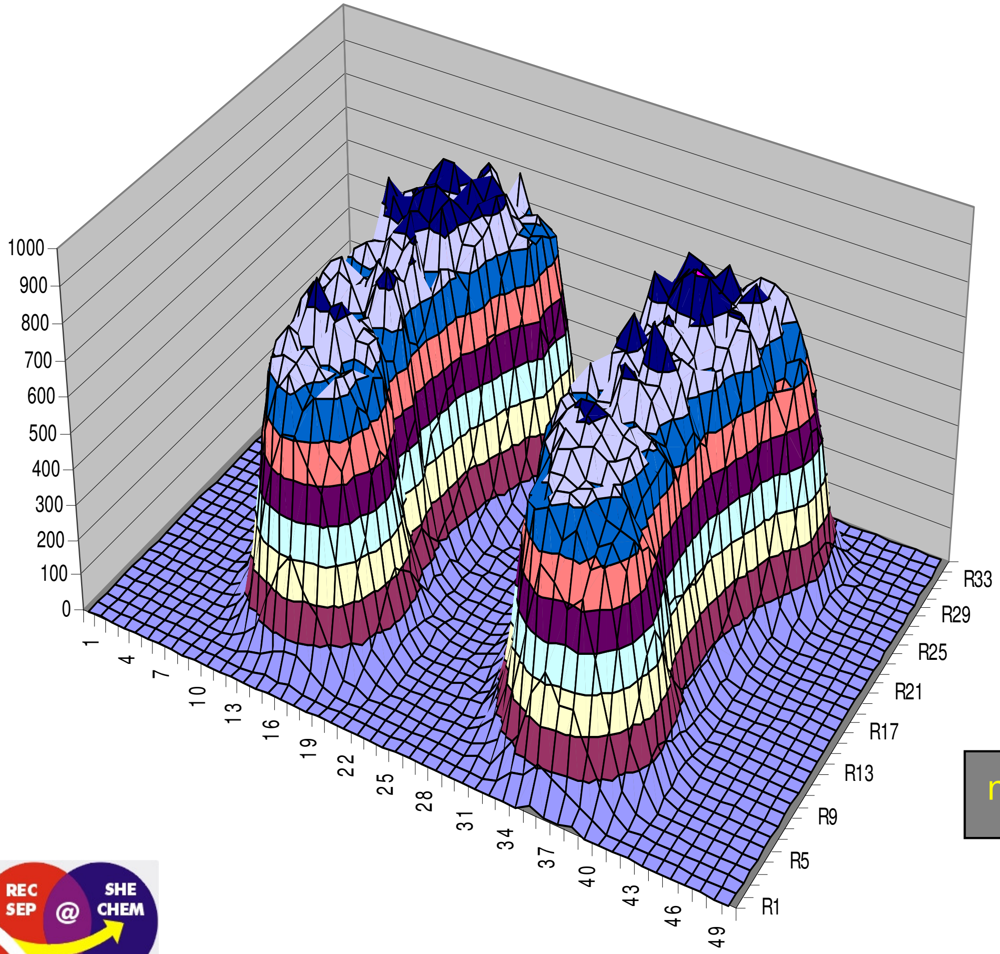
Further test in Mg-beam

Electroplating of U on Al / Target Imaging

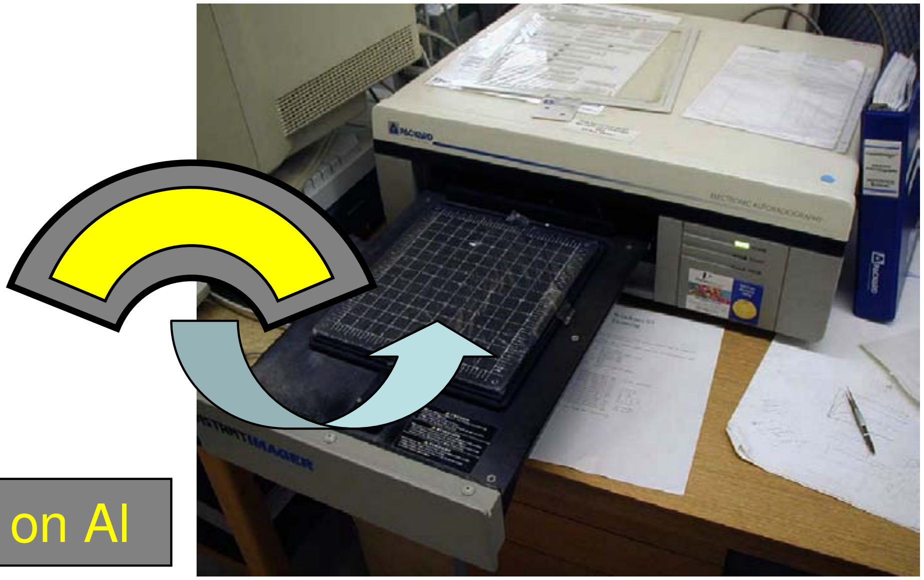
Deposition of U on thin Al-foils

- Switch from Isopropanol to Isobutanol
- 1 h plating time at 1 kV ⇒ ≤ 14 h at 150 V





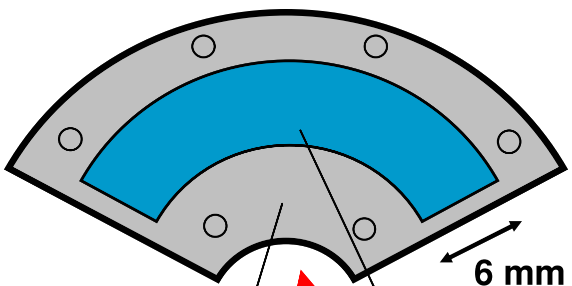
Autoradiographic imaging of target surface

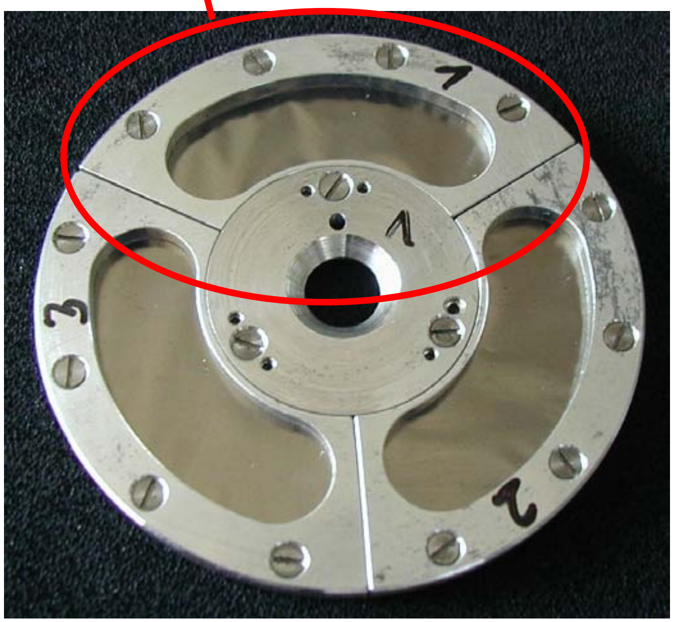


$^{nat}UF_4$ on Al

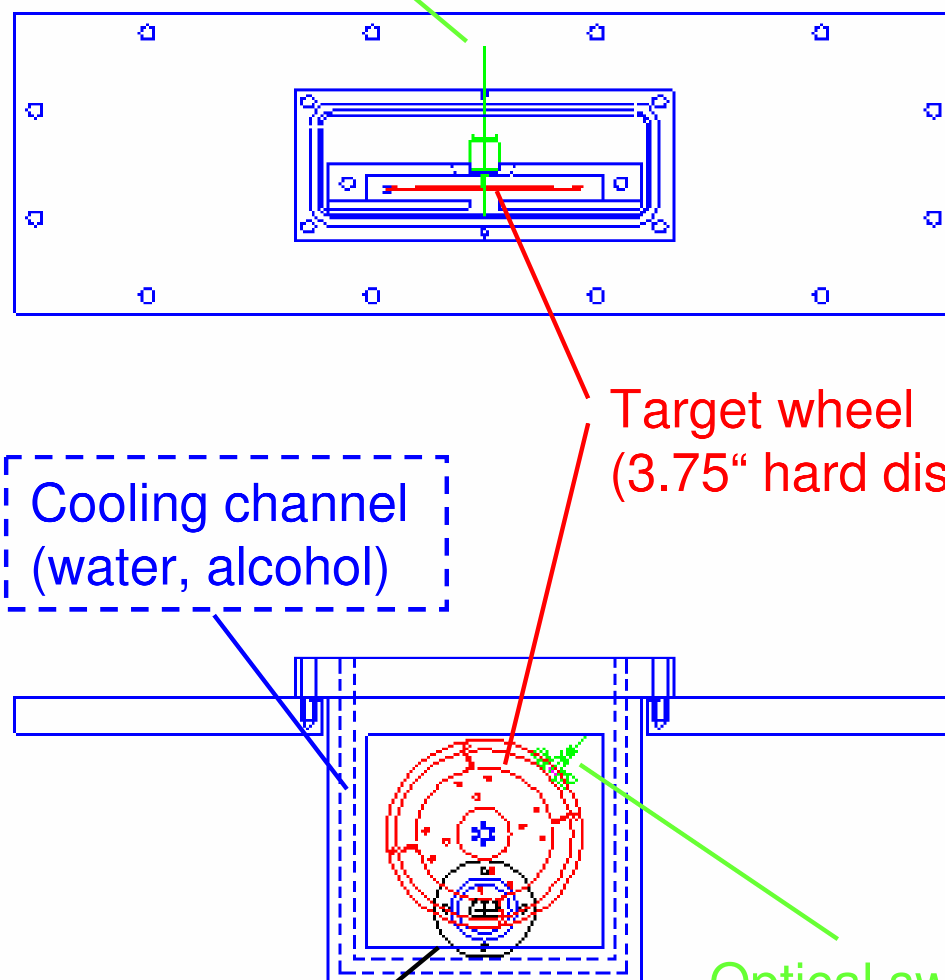
Rotating target wheels

ARTESIA at GSI

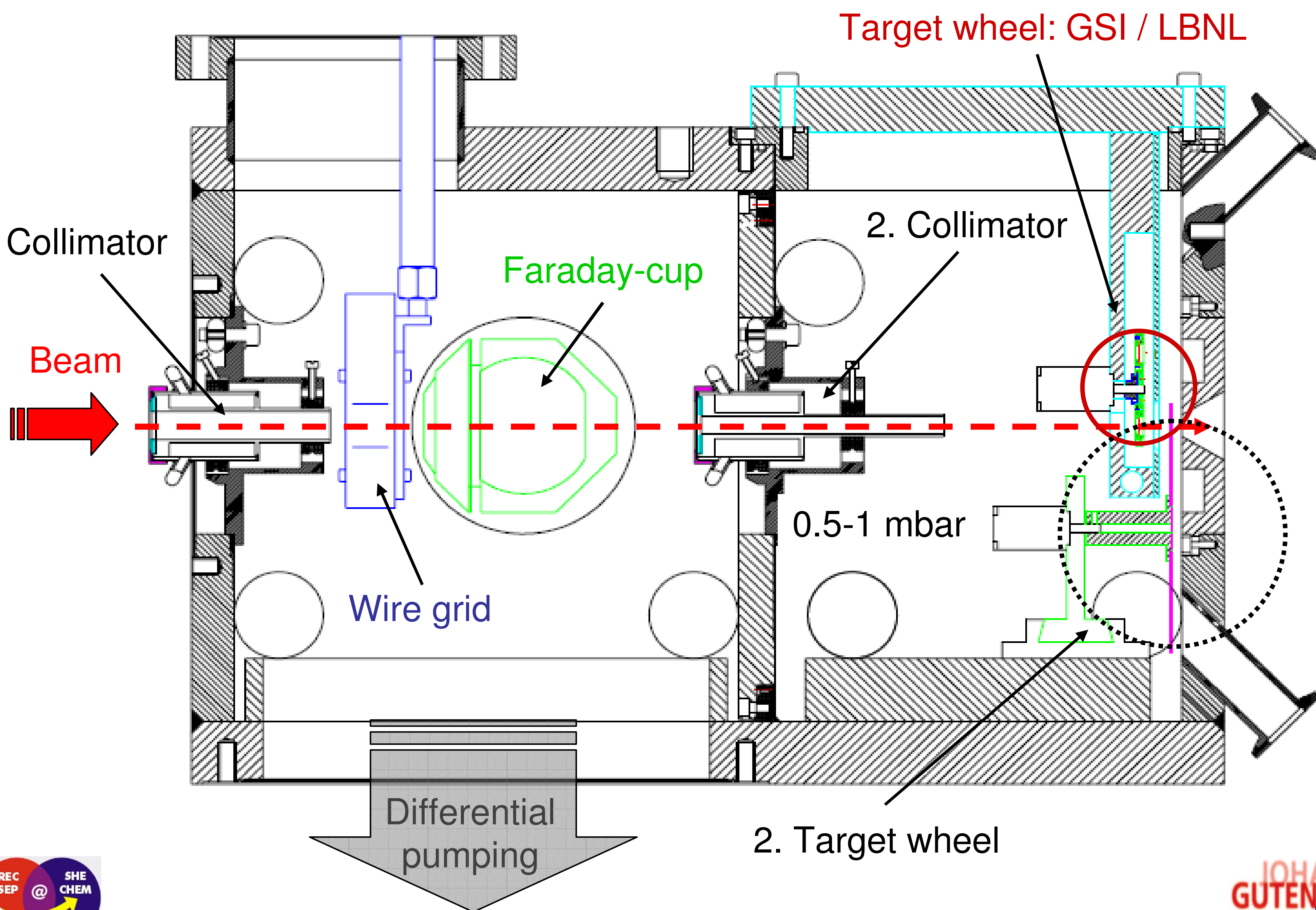




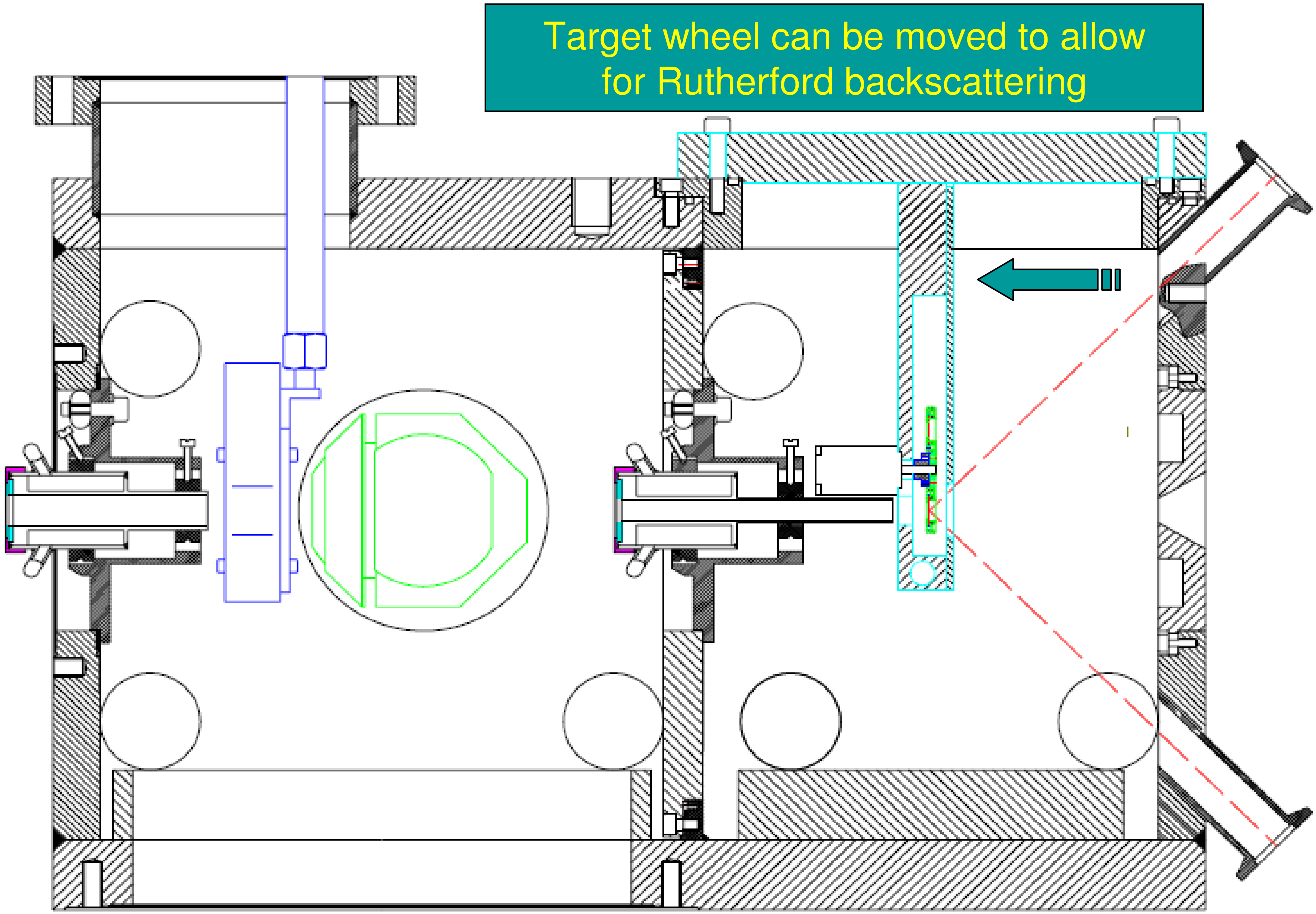
Targetstation at BGS



New target station for TASCA



New target station for TASCA



Outlook

Th-Oxide targets (400 µg/cm²) on Al-backings of different thickness and on C as backing material. Rolled Al-backings from GSI target laboratory

Design and construction of target station for TASCA/BGS

Production of thin Al backing foils. Preparation of U/UF_4 targets (Al-backing)

Electroplating of Th-Nitrate on 5 µm (2 µm?) Al-backings. Optimize plating procedure for U, Th, Gd. Gd serve as model element for the trivalent Actinides. Autoradiographic imaging of U- and Th-targets before and after irradiation.

Isotopic analysis of the UF_4 material used for target production by means of ICP-MS