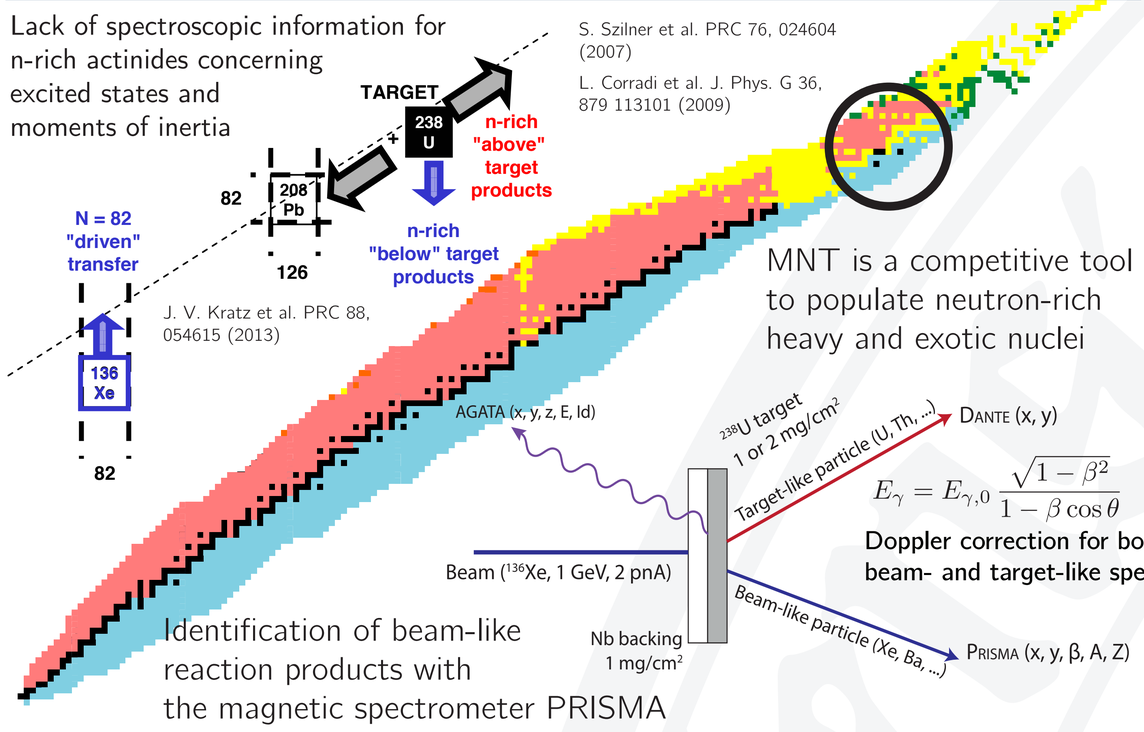
Light and Heavy Transfer Products in ^{136}Xe + ^{238}U Multinucleon Transfer Reactions

Andreas Vogt, Benedikt Birkenbach, Peter Reiter for LNL 11.22 and the AGATA collaboration

Multinucleon Transfer (MNT) in the Actinides

Lack of spectroscopic information for n-rich actinides concerning excited states and moments of inertia



S. Szilner et al. PRC 76, 024604 (2007)

L. Corradi et al. J. Phys. G 36, 879 113101 (2009)

J. V. Kratz et al. PRC 88, 054615 (2013)

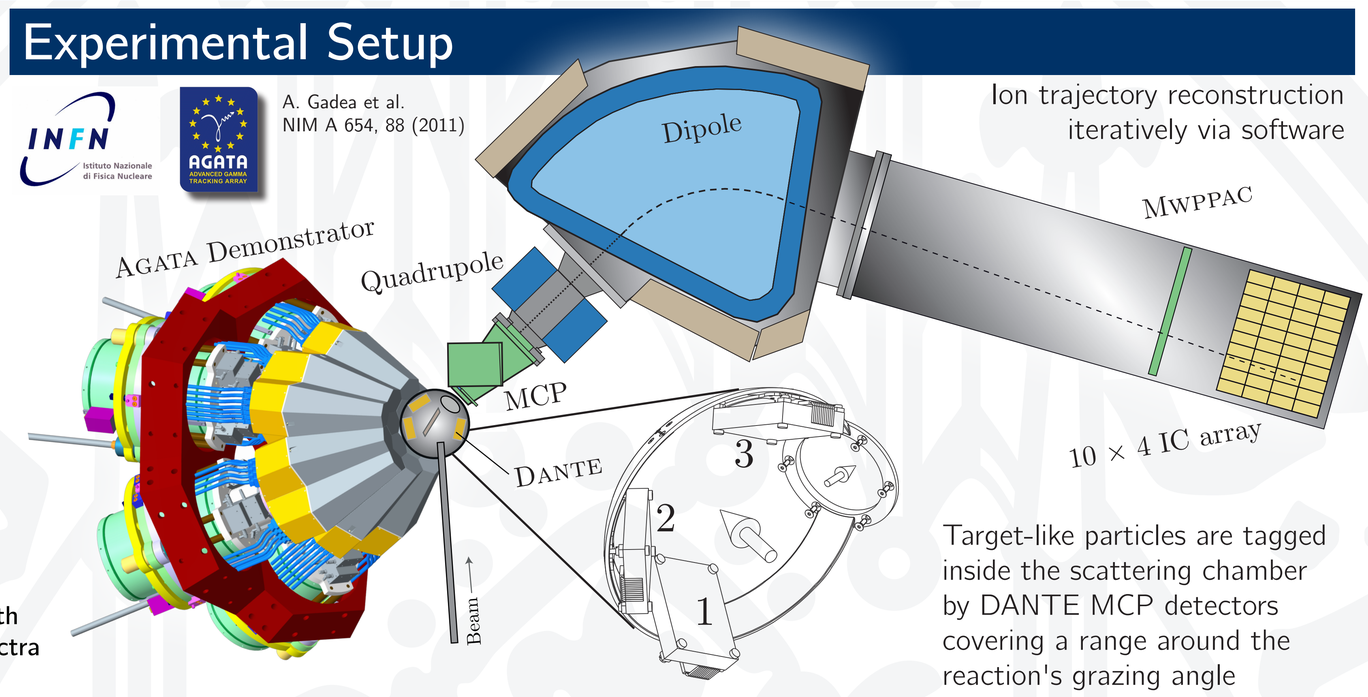
MNT is a competitive tool to populate neutron-rich heavy and exotic nuclei

$$E_\gamma = E_{\gamma,0}\,\frac{\sqrt{1-\beta^2}}{1-\beta\cos\theta}$$

Doppler correction for both beam- and target-like spectra

Identification of beam-like reaction products with the magnetic spectrometer PRISMA

Experimental Setup

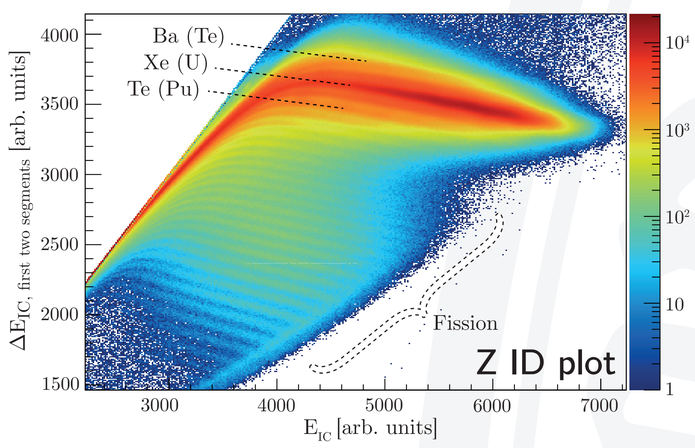


A. Gadea et al. NIM A 654, 88 (2011)

Ion trajectory reconstruction iteratively via software

Target-like particles are tagged inside the scattering chamber by DANTE MCP detectors covering a range around the reaction's grazing angle

Discriminating Fission and Transfer Products

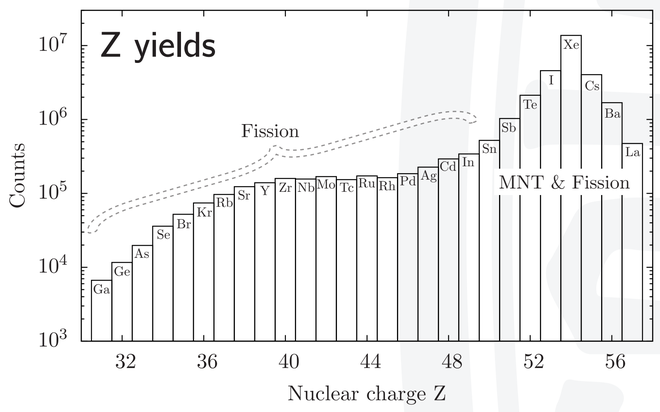


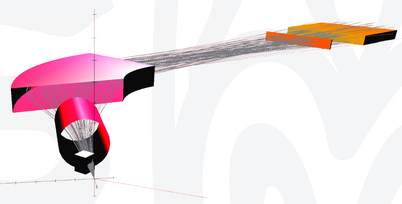
PRISMA analysis yields Z, q and A for each event

A/ΔA = 298(1)

PRISMA response function needed for cross-section determination:

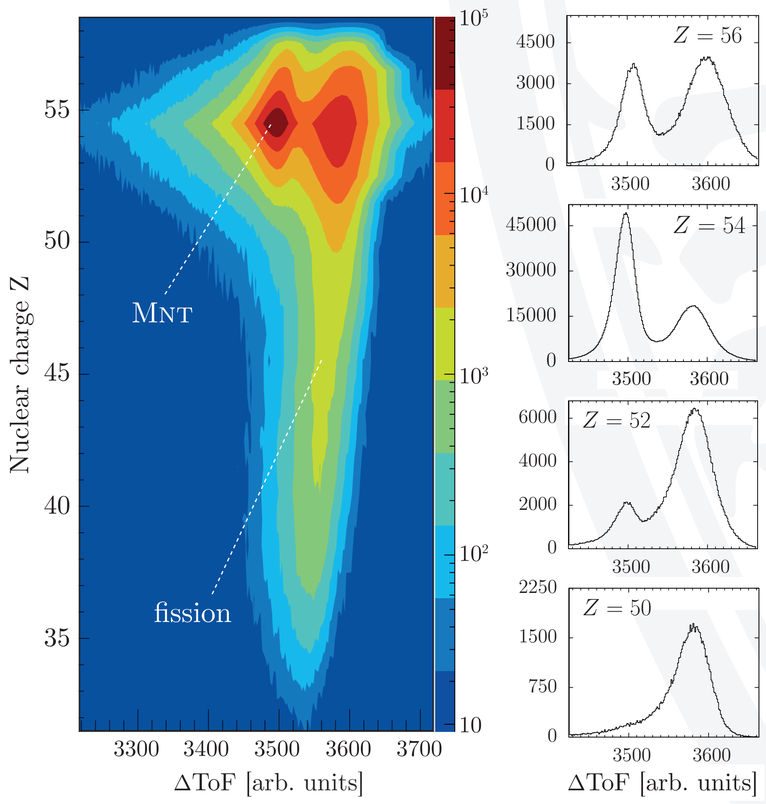
Transport of uniform event distribution in [E,θ,φ] with Monte Carlo simulation

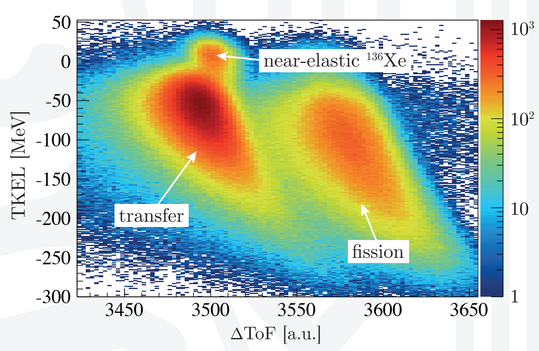




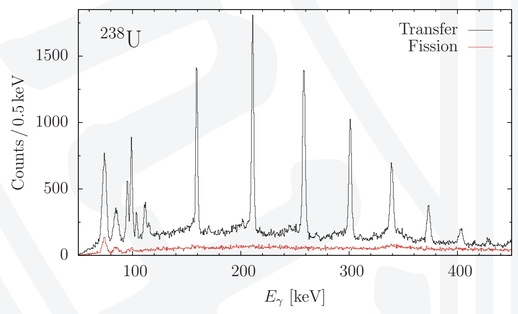
D. Montanari et al. Eur. Phys. J. A 47, 11004-9, 2011

Time difference ΔToF between PRISMA and DANTE allows to discriminate fission and transfer products. Production of actinide nuclei beyond Z = 93 is strongly suppressed.



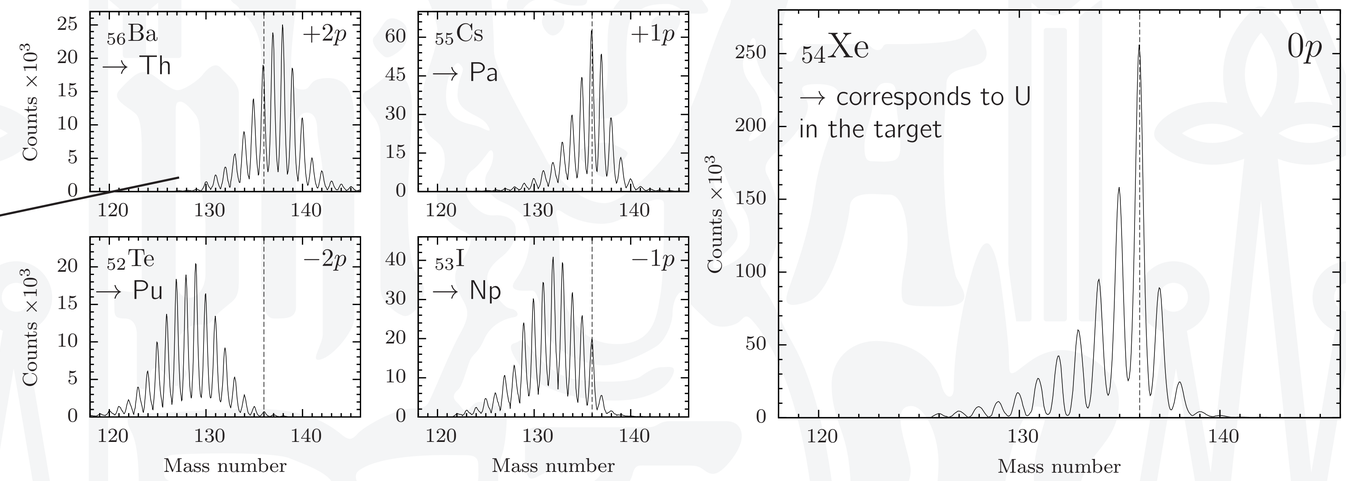


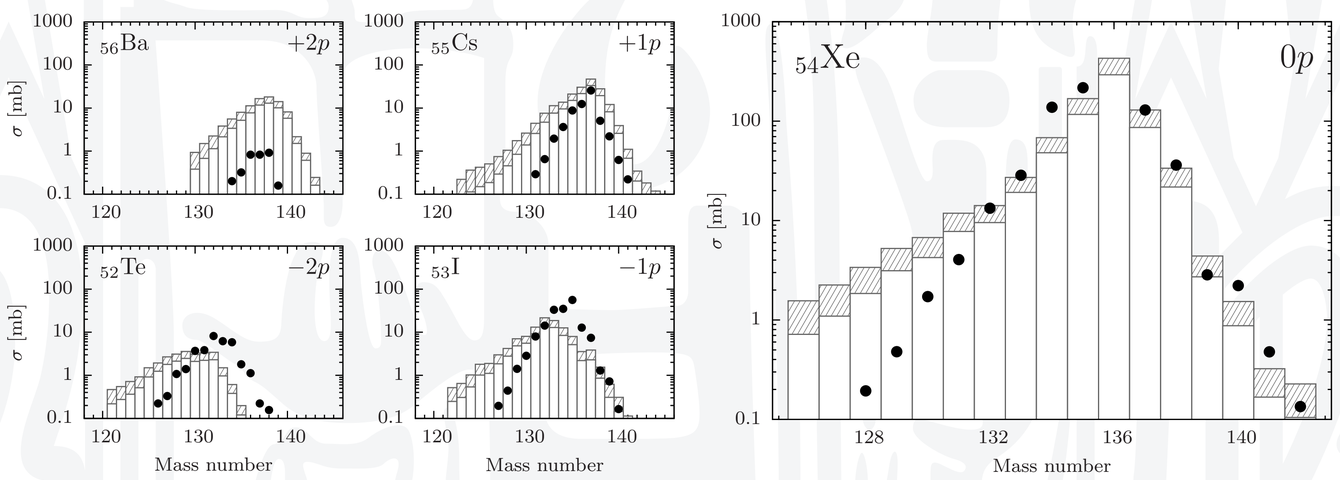
γ-ray spectroscopy exploiting kinematic coincidences: fission-background suppression for recoil Doppler-corrected spectra



Mass Yields and Cross Sections

Measured mass yields are contamination-corrected, response-corrected and normalized to calculated cross section of the GRAZING multinucleon transfer model in the +1n channel.



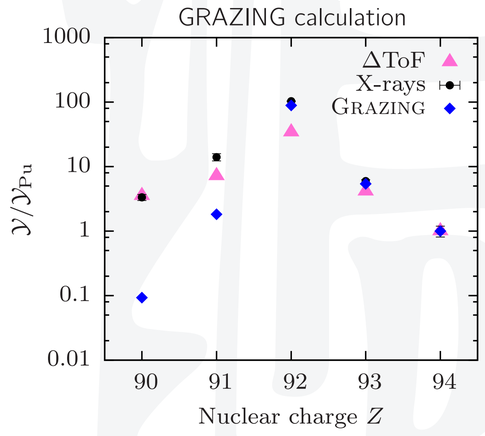


A. Winther, Nucl. Phys. A 572, 191 (1994)

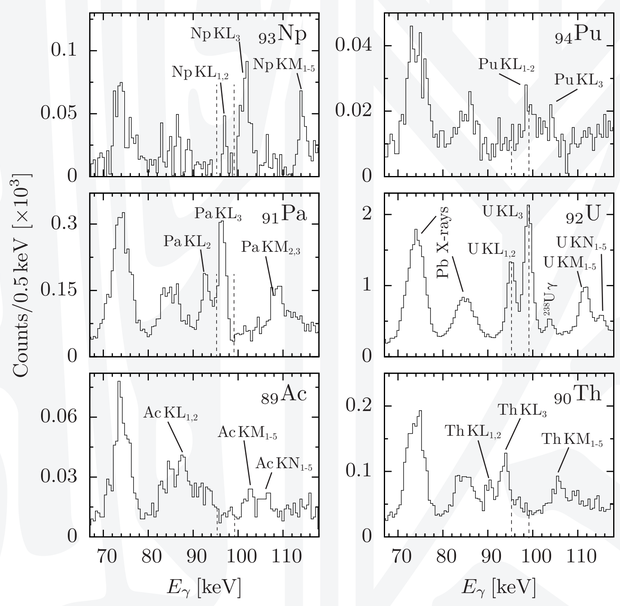
Production Yields of Actinide Nuclei

Time difference between PRISMA and DANTE detectors allows discrimination of fission and transfer products

Actinide yields normalized to the Pu channel, compared to GRAZING calculation



X-ray yields extracted from AGATA γ-ray spectra



Population of neutron-rich actinide nuclei without proton transfer is favored, especially the −2n channel leading to ^{240}U. No actinide and transactinide nuclei beyond Z = 93 are populated.

Institut für Kernphysik
Zülpicher Str. 77
50937 Köln

Andreas Vogt
andreas.vogt@ikp.uni-koeln.de
+49 221 470 3620

Bundesministerium für Bildung und Forschung