Optimization of the experimental parameters for SOFIA/ANDES

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SOFIA/ANDES collaboration meeting
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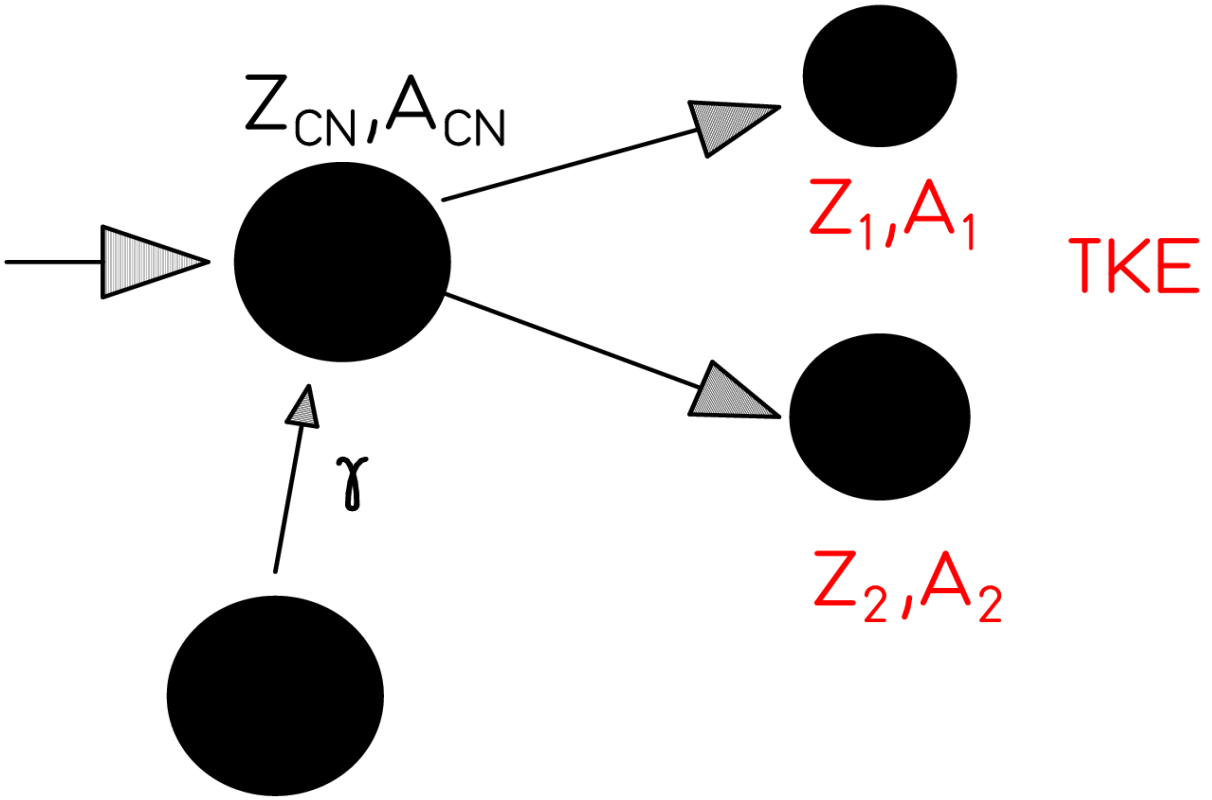
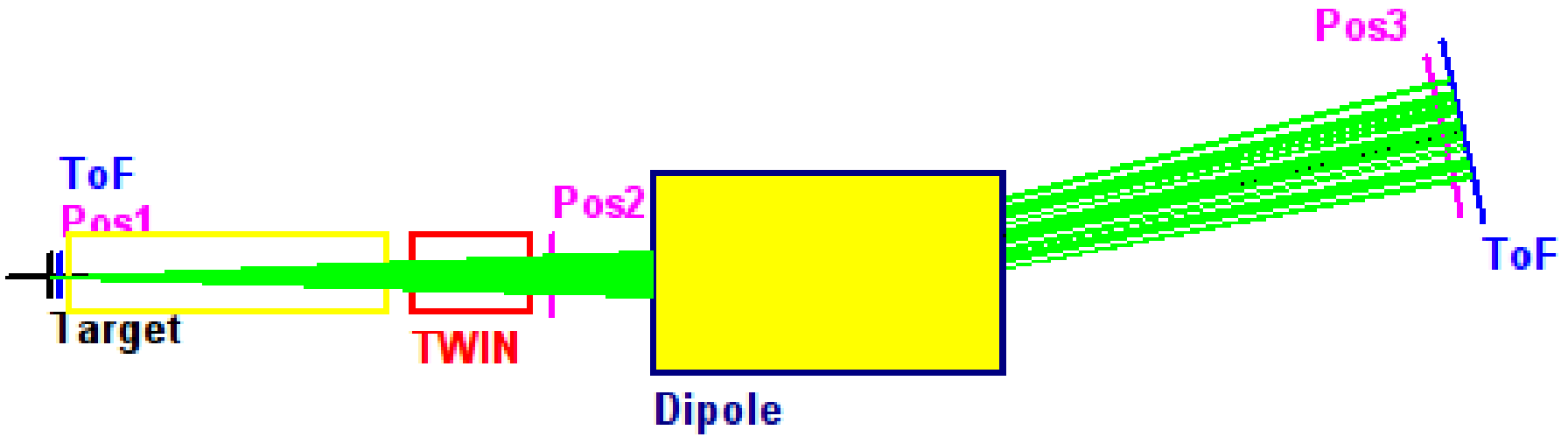
Aim of the experiment

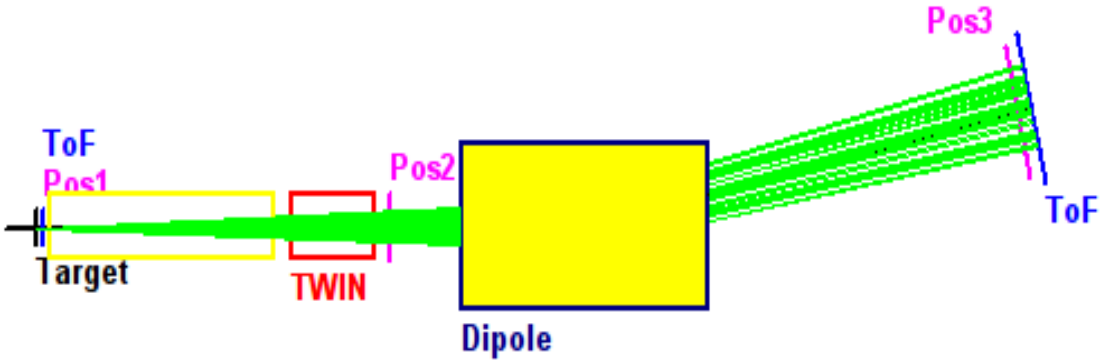


Experimental set-up and information to be extracted



Pos1, Pos2, Pos3 → magnetic deflection Bρ → p / Z = m v / Z = A m_0 γ v / Z
ToF → v
ΔE and v → Z
Pos1, Pos2, ToF or Bρ → velocity vector in space → TKE

Main disturbing effects



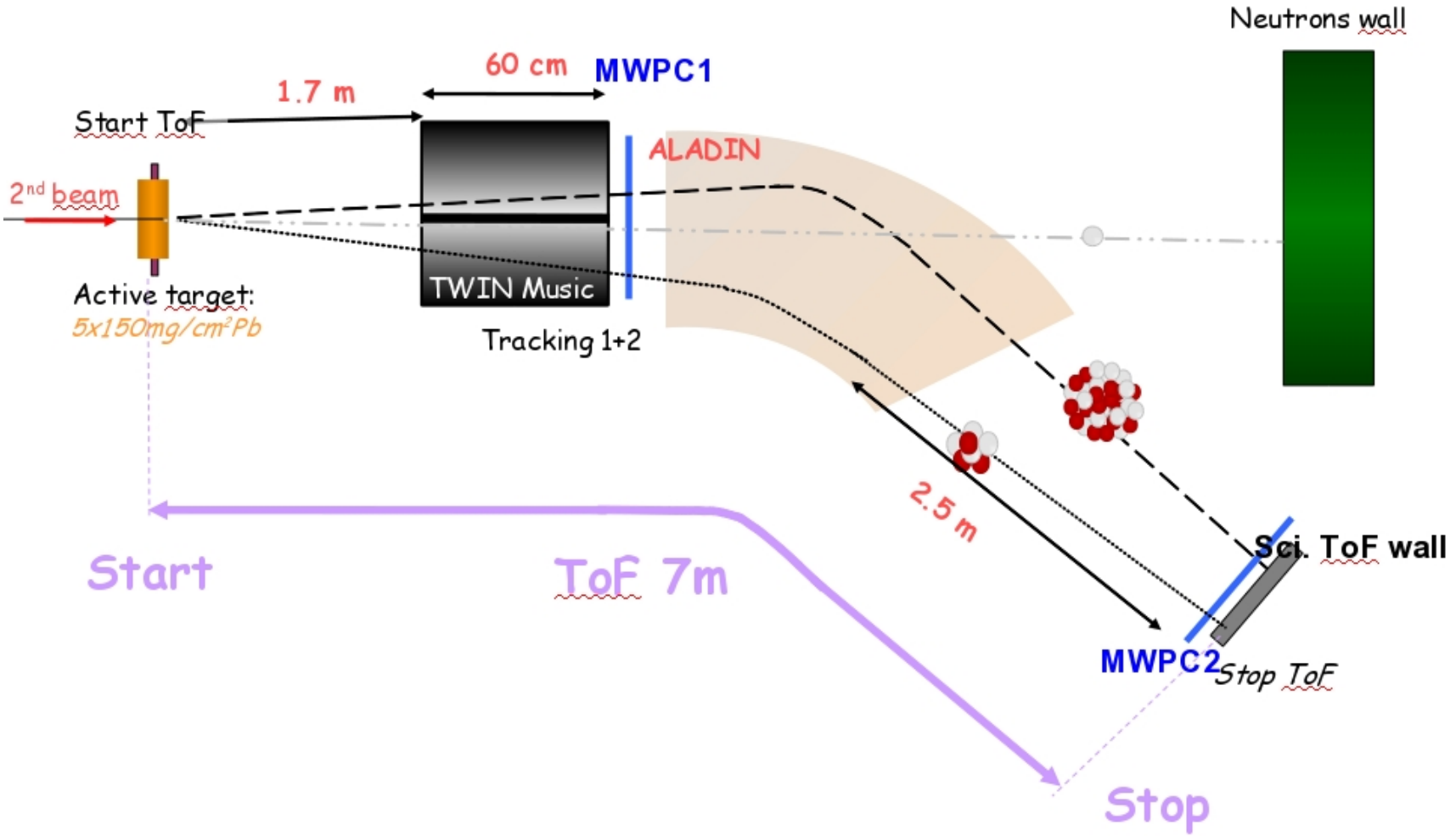
<u>Z resolution:</u>
ΔE resolution of TWIN chamber

<u>Mass resolution:</u>
Angular straggling between Pos1 and Pos3 (→ Bρ)
Resolution of position detectors (→ Bρ)
Time resolution of ToF detectors (→ v)

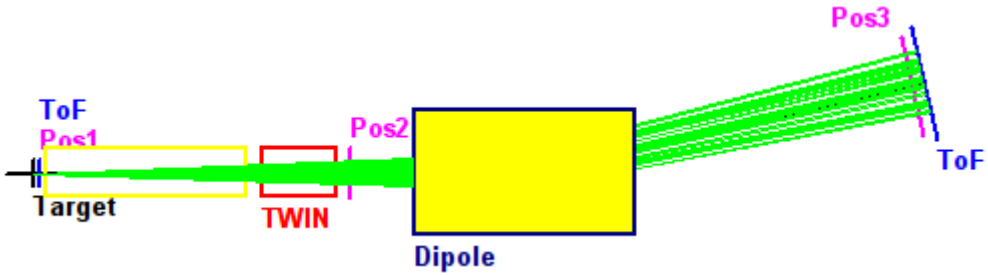
<u>TKE resolution:</u>
Angular straggling of fragments in target (→ $v_{transversal}$)
Bρ and ToF resolution (→ $v_{longitudinal}$)

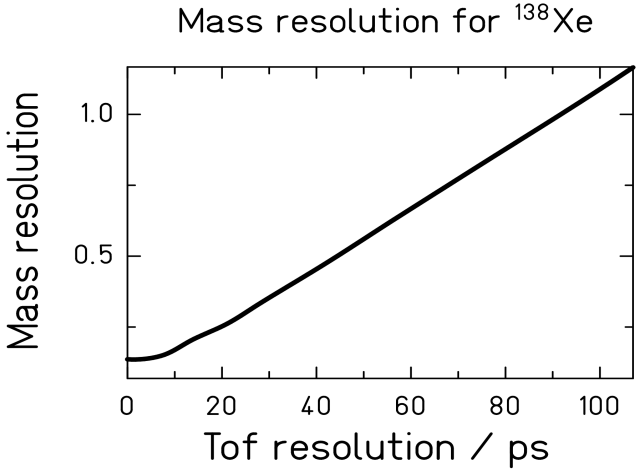
Present planning:

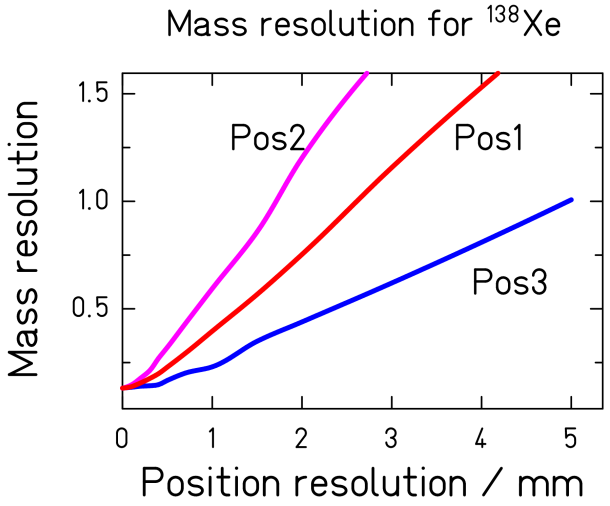
The set up



Effects on mass resolution, one by one







Dipole with air: ΔA = 0.377

TWIN with P10: ΔA = 0.570

Air in front of dipole: ΔA = 0.286

Air behind dipole: ΔA = 0.214

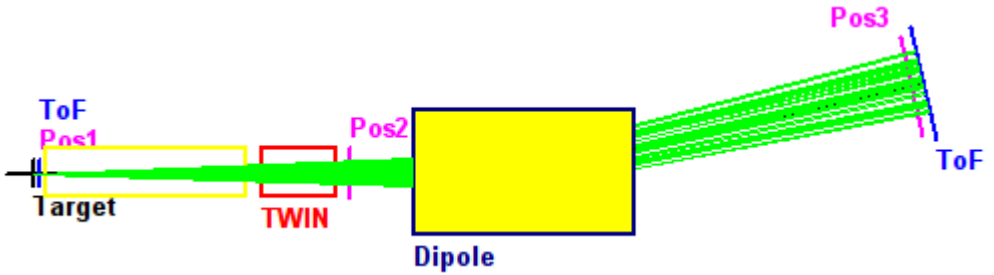
5cm argon in Pos2: ΔA = 0.200

Present planning: ΔA = 0.540

(ToF resolution 35 ps,
Pos resolution 0.2 mm,
TWIN with neon,
all sections with helium)

Same but
TWIN with P10,
all sections in air ΔA = 0.885

Effects on TKE resolution



Simple reasoning:

TKE resolution in **longitudinal** direction is **linked to** the **mass resolution**.
→ typically 10 MeV (= 6 %)

TKE resolution in **transversal** direction is given by the **position resolution** of Pos2 and angular **straggling** (target, all layers up to Pos2).
→ typically 1 MeV (= 0.6 %) by position resolution
→ typically 10 MeV (= 6 %) by target thickness

Requirement on TKE resolution

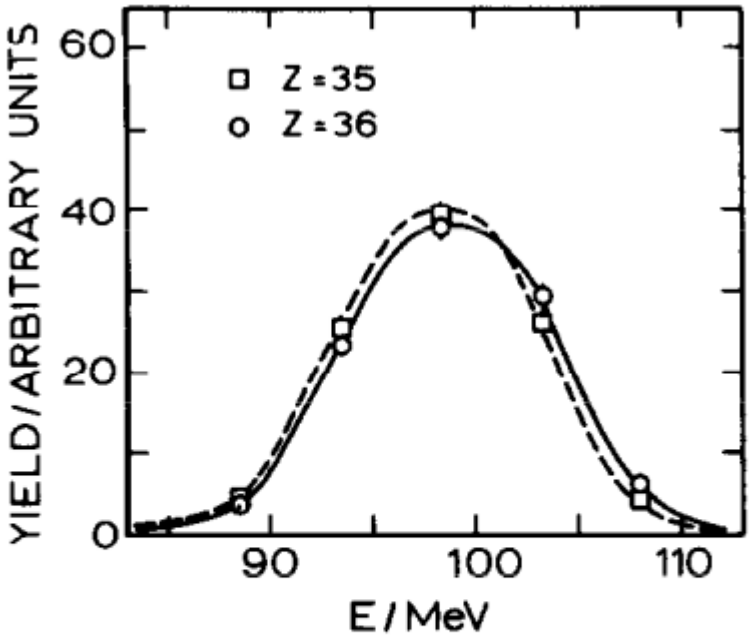
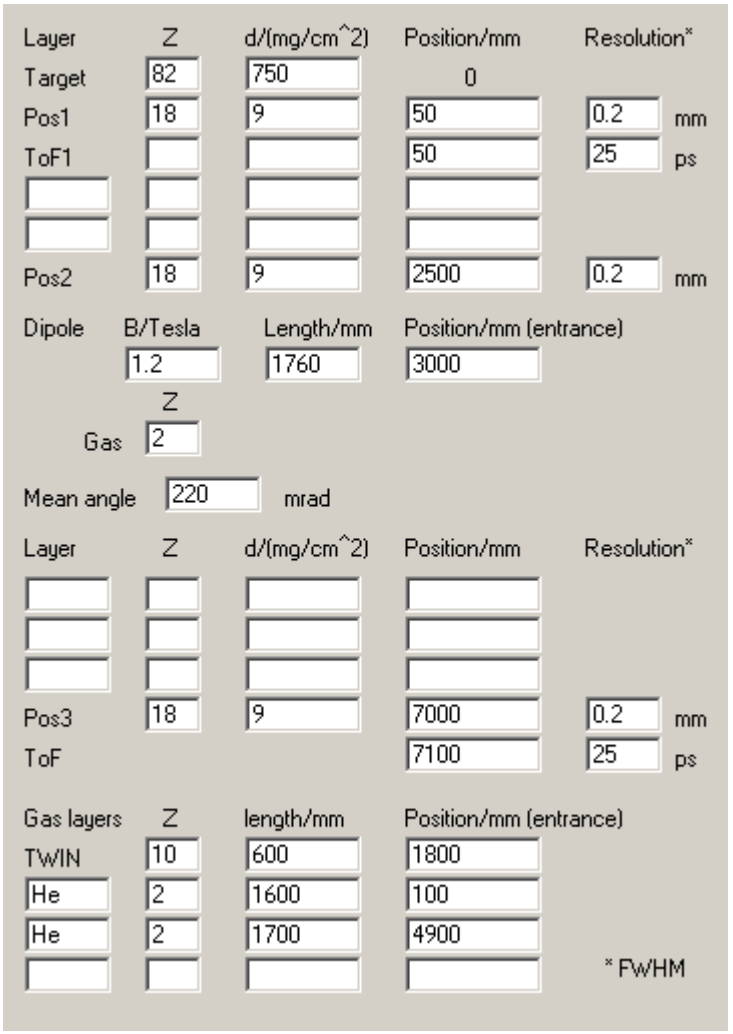


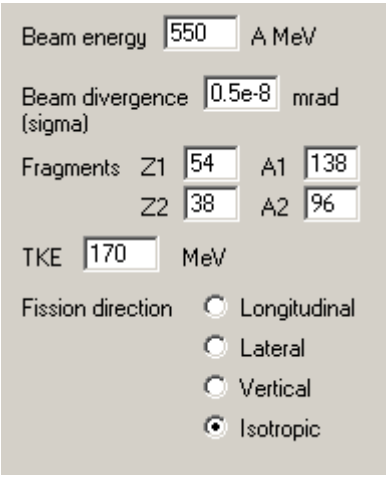
Fig. 17. Kinetic energy distributions of the elements bromine ($Z = 35$) and krypton ($Z = 36$). The measured yields are normalized to 100 % in both cases.

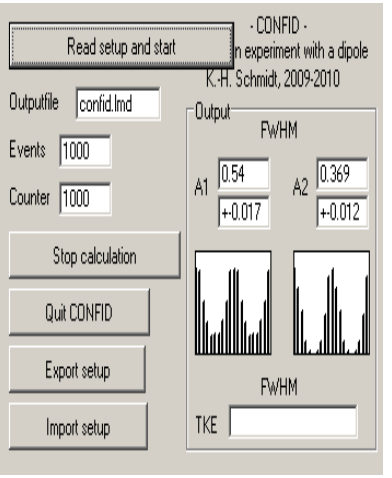
The FWHM of the kinetic energy in low-energy fission (also TKE) is about 10 %. An experimental resolution of about 5 % is interesting!

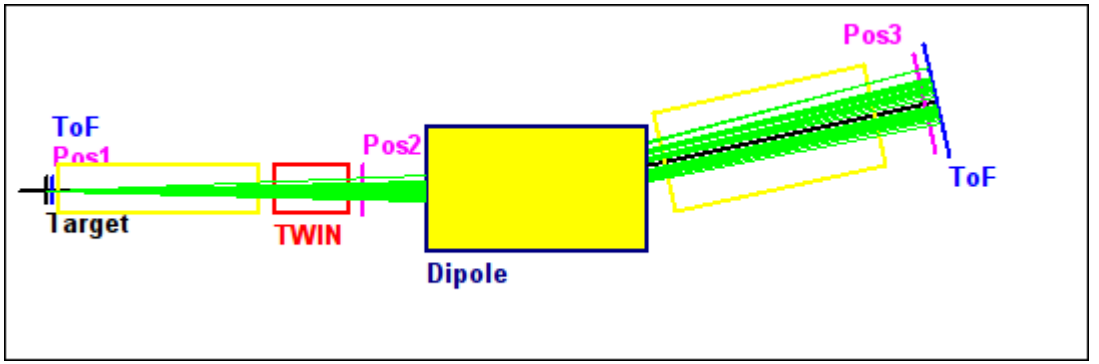
235U(nth,f) / From Lang et al. NPA 345 (1980) 34

The CONFID code









Available from www.khs-erzhausen.de

Fast Monte-Carlo code to simulate the experiment (study of resolution, production of list-mode data)

Summary

Individual contributions to the resolution in A and TKE investigated with the CONFID code.

Critical points identified.

Many improvements in present planning.

Magnetic reconstruction not discussed (it is in principle exact, just a question of data analysis)

CONFID code is available (www.khs-erzhausen.de)
for studying further optimization and
development of analysis tools.