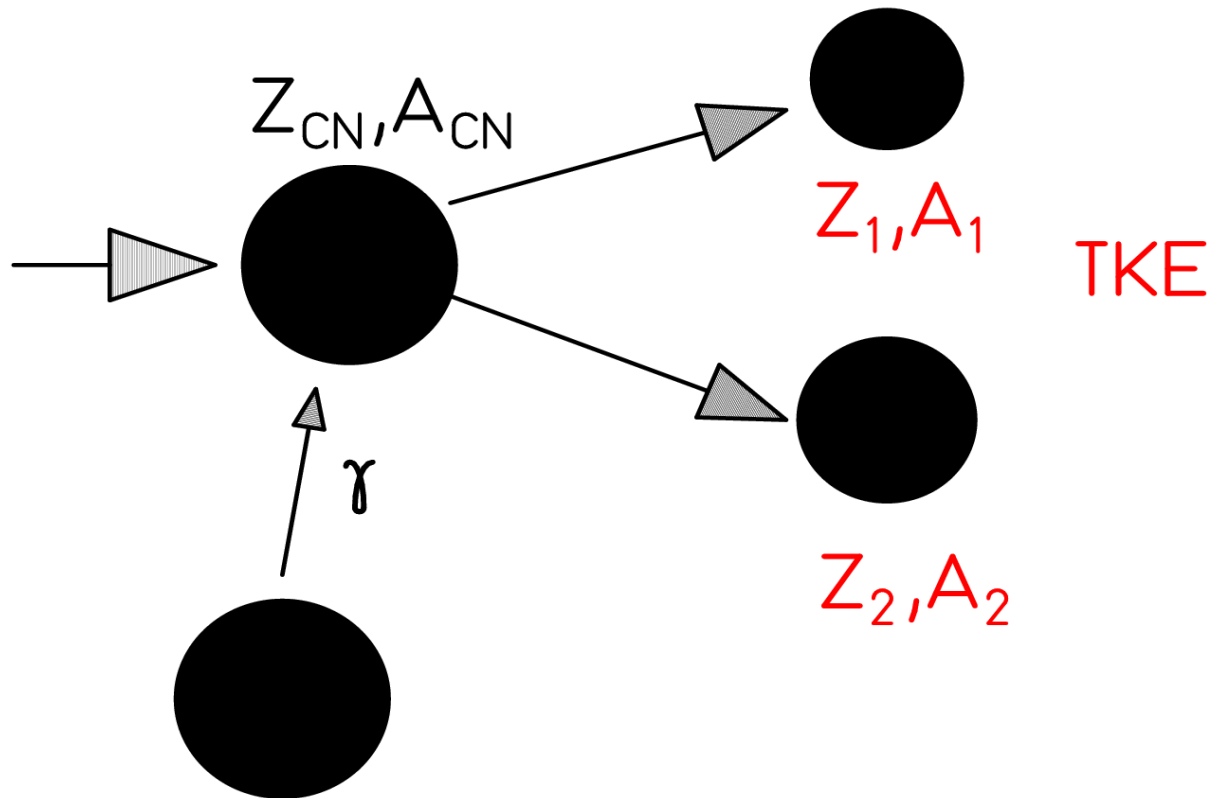


Optimization of the experimental parameters for SOFIA/ANDES

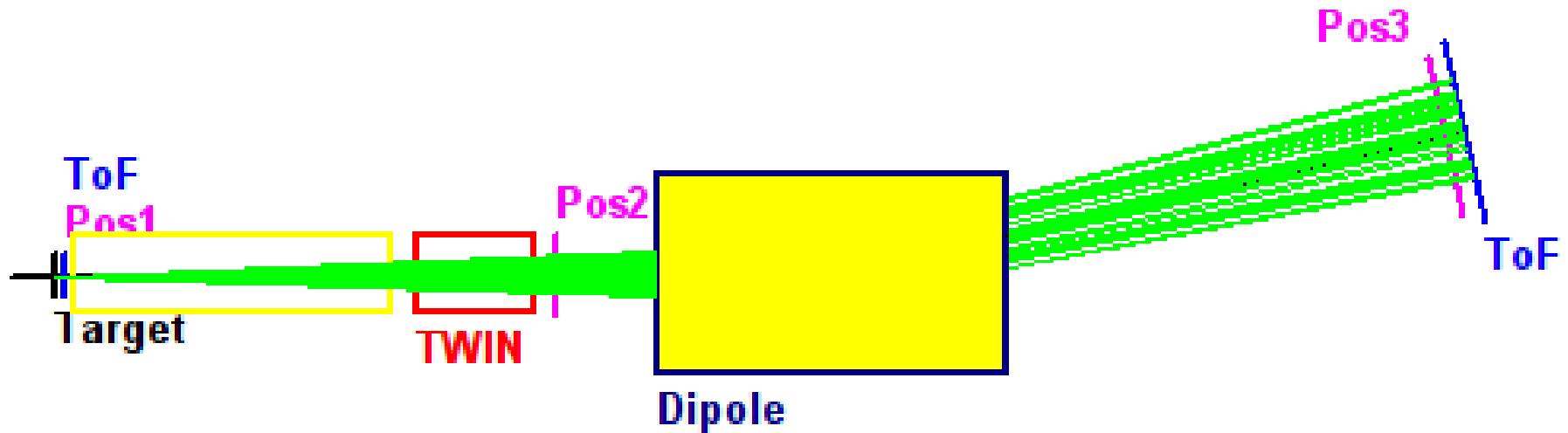
Karl-Heinz Schmidt

SOFIA/ANDES collaboration meeting
Orsay,, January 20th, 2011

Aim of the experiment



Experimental set-up and information to be extracted



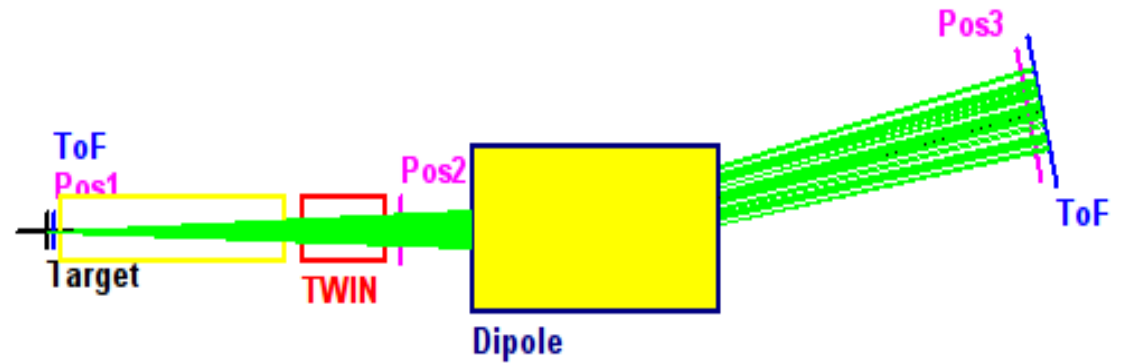
Pos1, Pos2, Pos3 \rightarrow magnetic deflection $B\rho \rightarrow p / Z = m v / Z = A m_0 \gamma v / Z$

ToF $\rightarrow v$

ΔE and $v \rightarrow Z$

Pos1, Pos2, ToF or $B\rho \rightarrow$ velocity vector in space \rightarrow TKE

Main disturbing effects



Z resolution:

ΔE resolution of TWIN chamber

Mass resolution:

Angular straggling between Pos1 and Pos3 ($\rightarrow B\rho$)

Resolution of position detectors ($\rightarrow B\rho$)

Time resolution of ToF detectors ($\rightarrow v$)

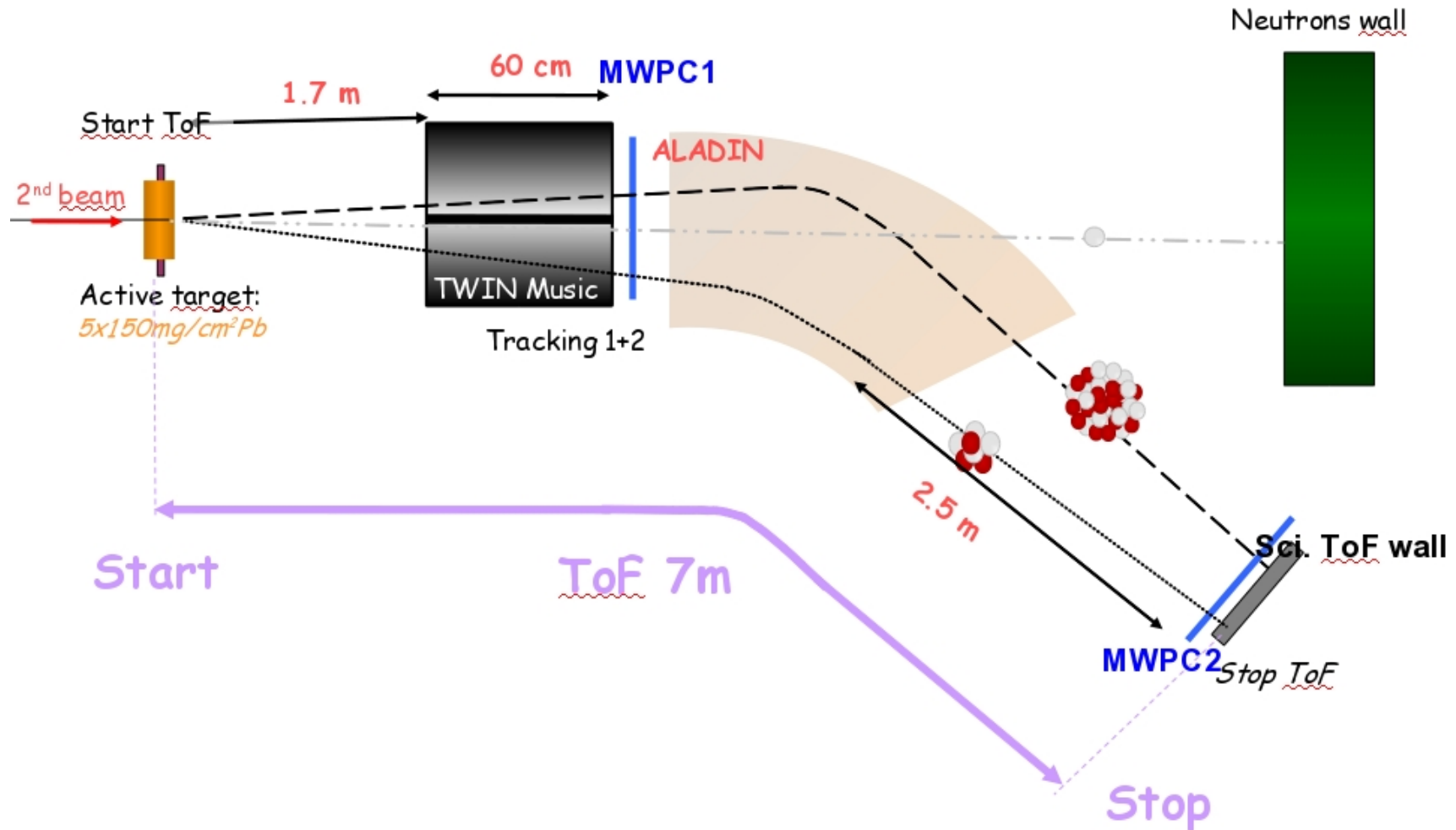
TKE resolution:

Angular straggling of fragments in target ($\rightarrow v_{\text{transversal}}$)

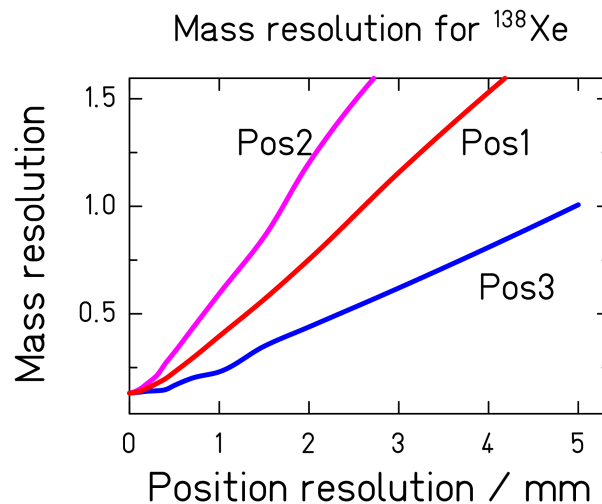
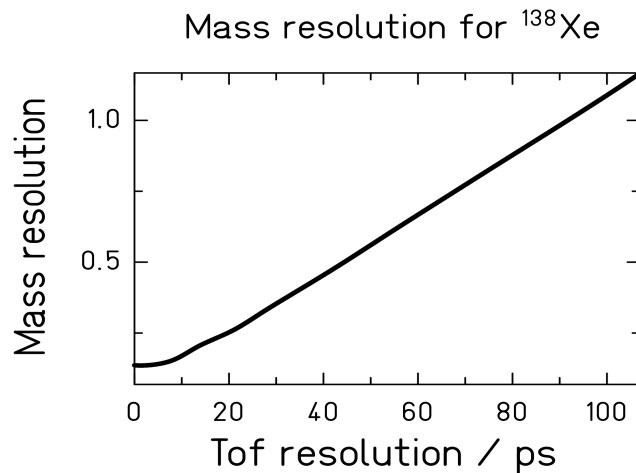
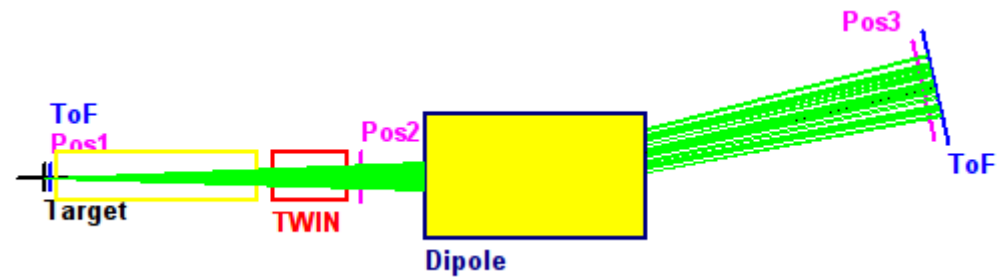
$B\rho$ and ToF resolution ($\rightarrow v_{\text{longitudinal}}$)

Present planning:

The set up



Effects on mass resolution, one by one



Dipole with air: $\Delta A = 0.377$

TWIN with P10: $\Delta A = 0.570$

Air in front of dipole: $\Delta A = 0.286$

Air behind dipole: $\Delta A = 0.214$

5cm argon in Pos2: $\Delta A = 0.200$

Present planning: $\Delta A = 0.540$

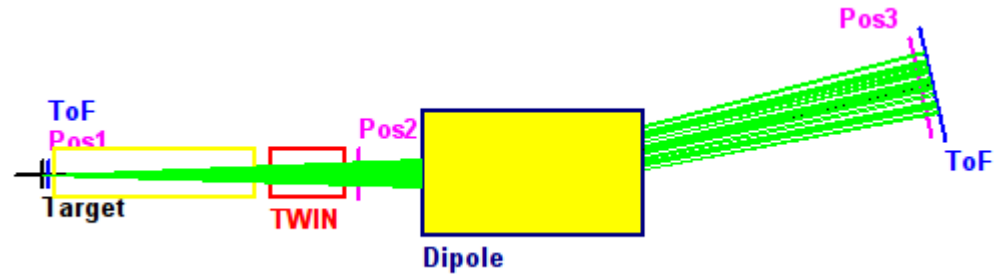
*(ToF resolution 35 ps,
Pos resolution 0.2 mm,
TWIN with neon,
all sections with helium)*

Same but

*TWIN with P10,
all sections in air*

$\Delta A = 0.885$

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

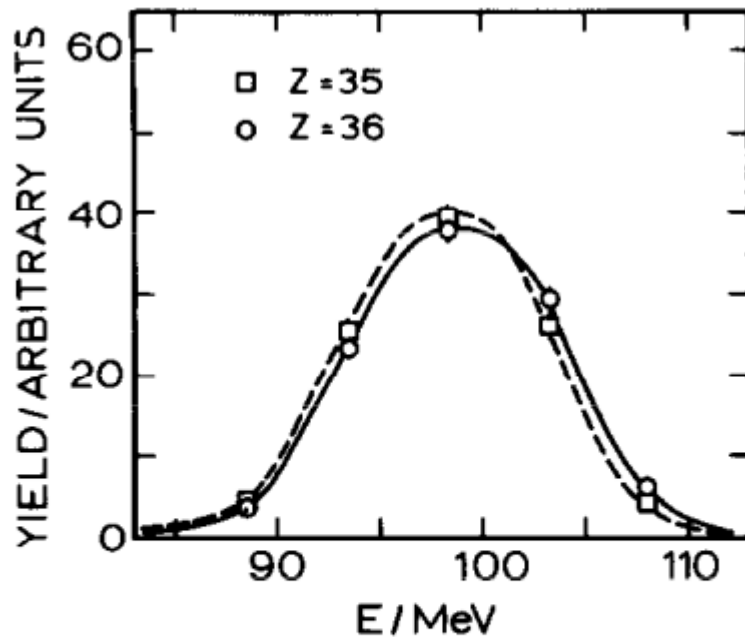


Fig. 17. Kinetic energy distributions of the elements bromine ($Z = 35$) and krypton ($Z = 36$). The measured yields are normalized to 100 % in both cases.

The FWHM of the kinetic energy in low-energy fission (also TKE) is about 10 %.

An experimental resolution of about 5 % is interesting!

The CONFID code

Layer	Z	d/(mg/cm ²)	Position/mm	Resolution*
Target	82	750	0	
Pos1	18	9	50	0.2 mm
ToF1			50	25 ps
Pos2	18	9	2500	0.2 mm

Dipole	B/Tesla	Length/mm	Position/mm (entrance)
	1.2	1760	3000

Gas Z: 2

Mean angle: 220 mrad

Layer	Z	d/(mg/cm ²)	Position/mm	Resolution*
Pos3	18	9	7000	0.2 mm
ToF			7100	25 ps

Gas layers	Z	length/mm	Position/mm (entrance)
TWIN	10	600	1800
He	2	1600	100
He	2	1700	4900

* FWHM

Beam energy: 550 A MeV

Beam divergence (sigma): 0.5e-8 mrad

Fragments: Z1 54 A1 138
Z2 38 A2 96

TKE: 170 MeV

Fission direction: Longitudinal
 Lateral
 Vertical
 Isotropic

CONFID -
an experiment with a dipole
K.H. Schmidt, 2009-2010

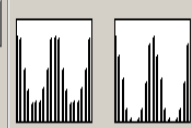
Read setup and start

Outputfile: confid.lmd

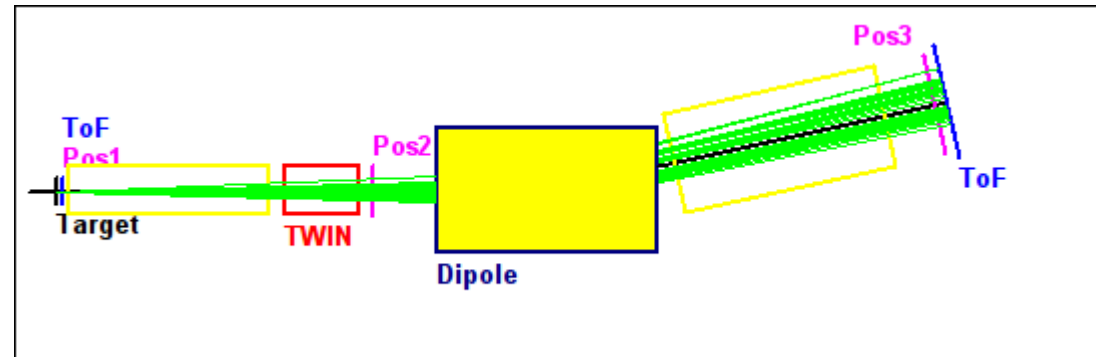
Events: 1000
Counter: 1000

Stop calculation
Quit CONFID
Export setup
Import setup

Output FWHM
A1: 0.54
A2: 0.369
+0.017 +0.012



FWHM
TKE



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.