Kinematical properties of fragmentation residues

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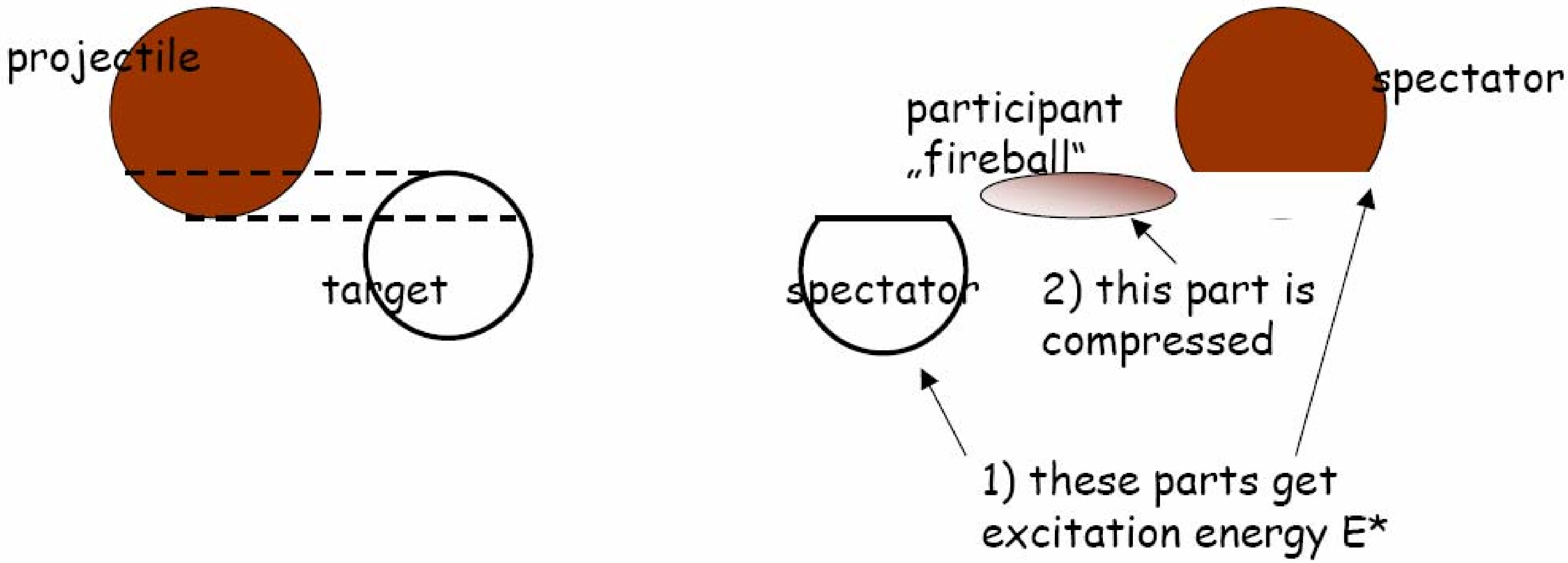
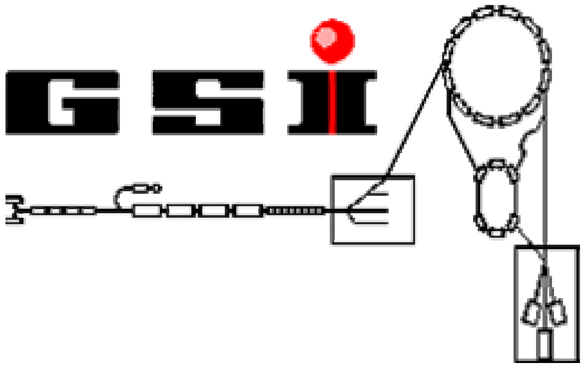
http://www-win.gsi.de/charms/index.htm

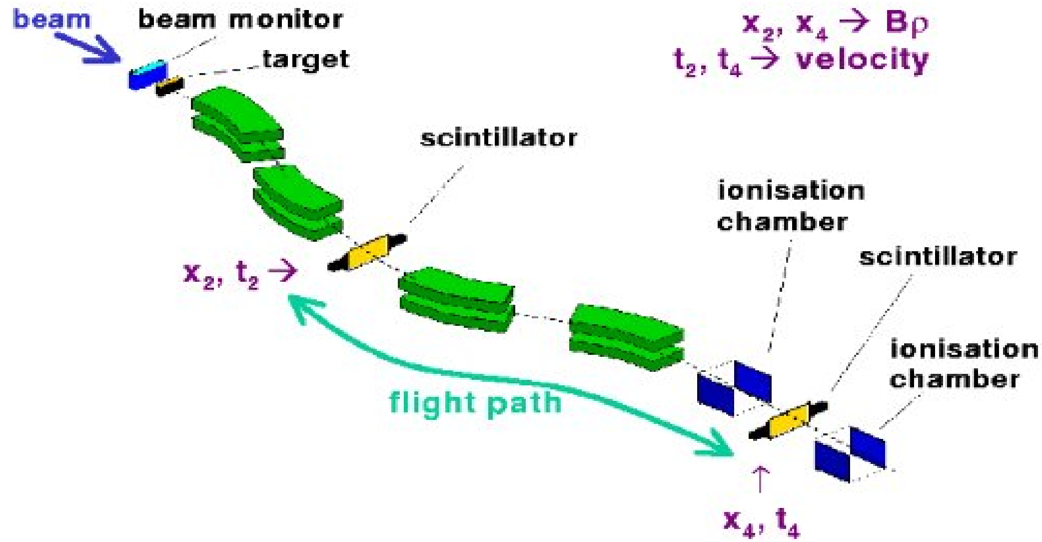
Nucleus-nucleus collisions at relativistic energies



spectator fragments are interesting for technical applications:

- secondary beams (emittance...)
- ADS (damages in the spallation target...)





1.Identification

scintillators : - position at S2 and S4 $\rightarrow B\rho_{pos}$

- time of flight $\rightarrow \beta\gamma_{TOF}$

$$\frac{A}{Z} = \frac{e}{c \cdot m_0} \cdot \frac{B\rho_{pos}}{\beta\gamma_{TOF}}$$

MUSIC : energy loss $\rightarrow Z$

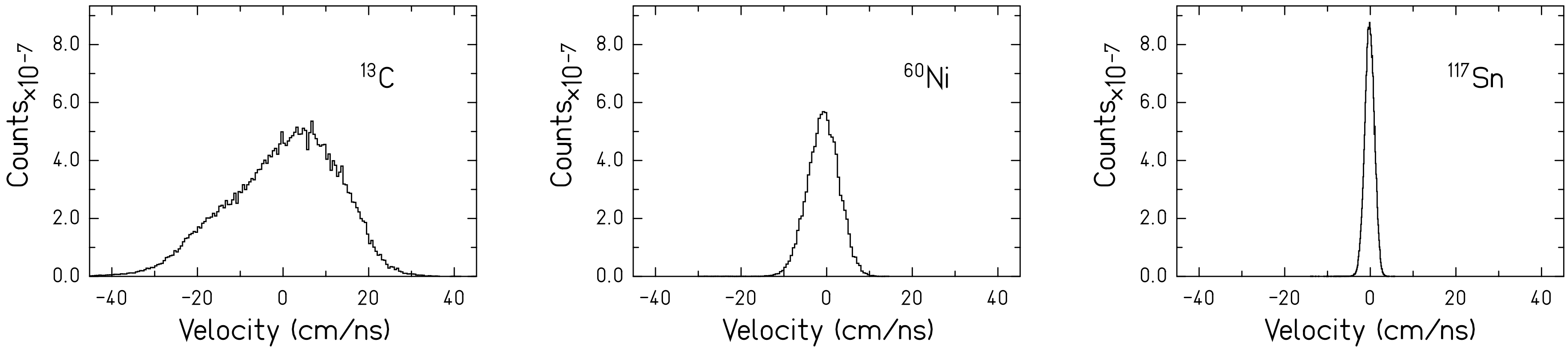
2.High-precision velocities

Exact values for A and Z (integers)

Precise calculation of the velocity $\Delta v/v \approx 5 \cdot 10^{-4}$

$$\beta\gamma = \frac{e}{c \cdot m_0} \cdot \frac{A}{Z} \cdot B\rho$$

Velocity distributions



data from D. Henzlova et al, in preparation

Gaussian distributions for most fragments
something different for very light residues

we will concentrate on the width

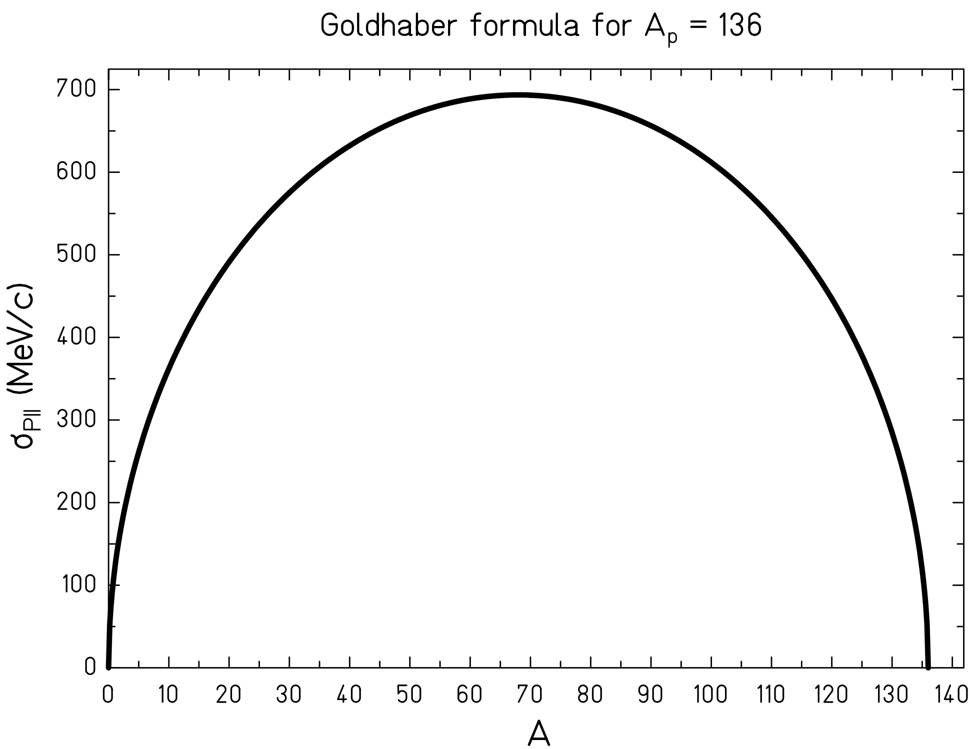
Goldhaber model

Sudden cut in a Fermi gas :

- Fermi momentum
- combinatorial effects

$$\sigma_{P_\parallel}^2 = \frac{p_F^2}{5}\frac{A\left(A_p - A\right)}{\left(A_p - 1\right)}$$

Phys. Lett. 53B (1974)

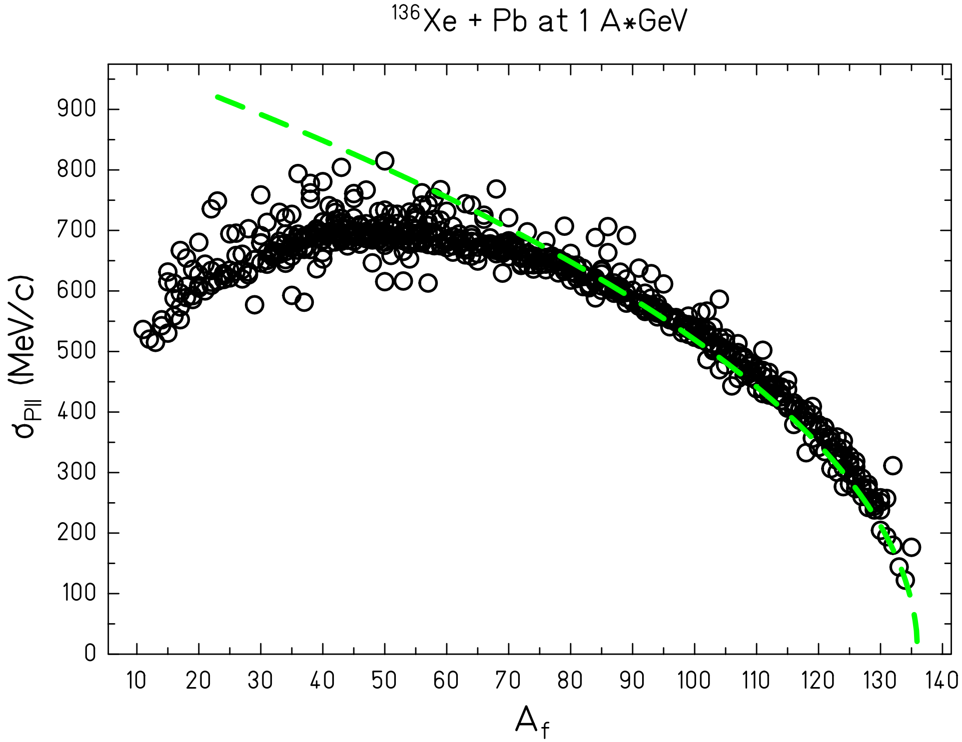


Morrissey formula

Simple fit of the data

$$\sigma^2_{P_\parallel} = \frac{150^2}{3} \cdot (A_p - A_f)$$

Phys. Rev. C39 (1989)



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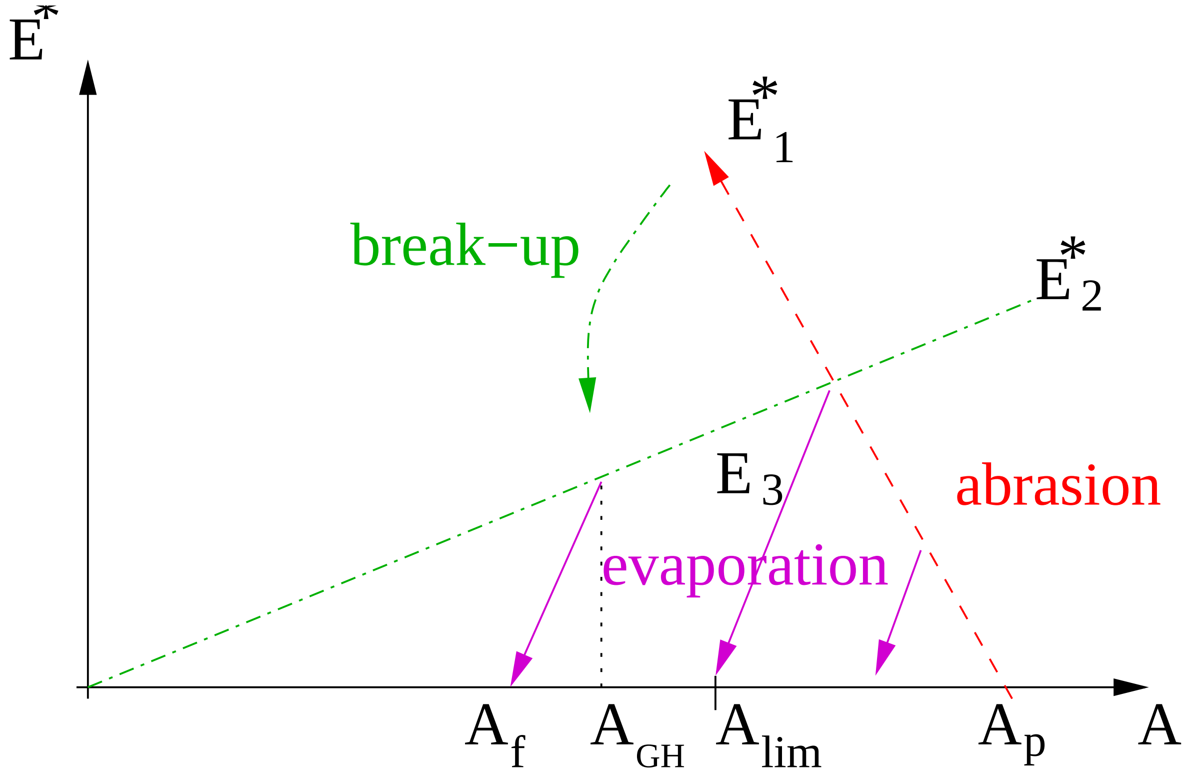
A new model



A new model

$$A_{\lim} = \frac{E^*_{abr} \cdot 11}{E^*_{abr} \cdot 11 + T^2_{bu}} \cdot \frac{11 \cdot \delta_{ev} - T^2_{bu}}{11 \cdot \delta_{ev}} \cdot A_p$$

$$E^*_{abr} = 27\ MeV$$

$$\mathrm{T}_{bu} = 5\ MeV$$

$$\delta_{ev} = 15\ MeV$$

$for\ A \leq A_{\lim},$

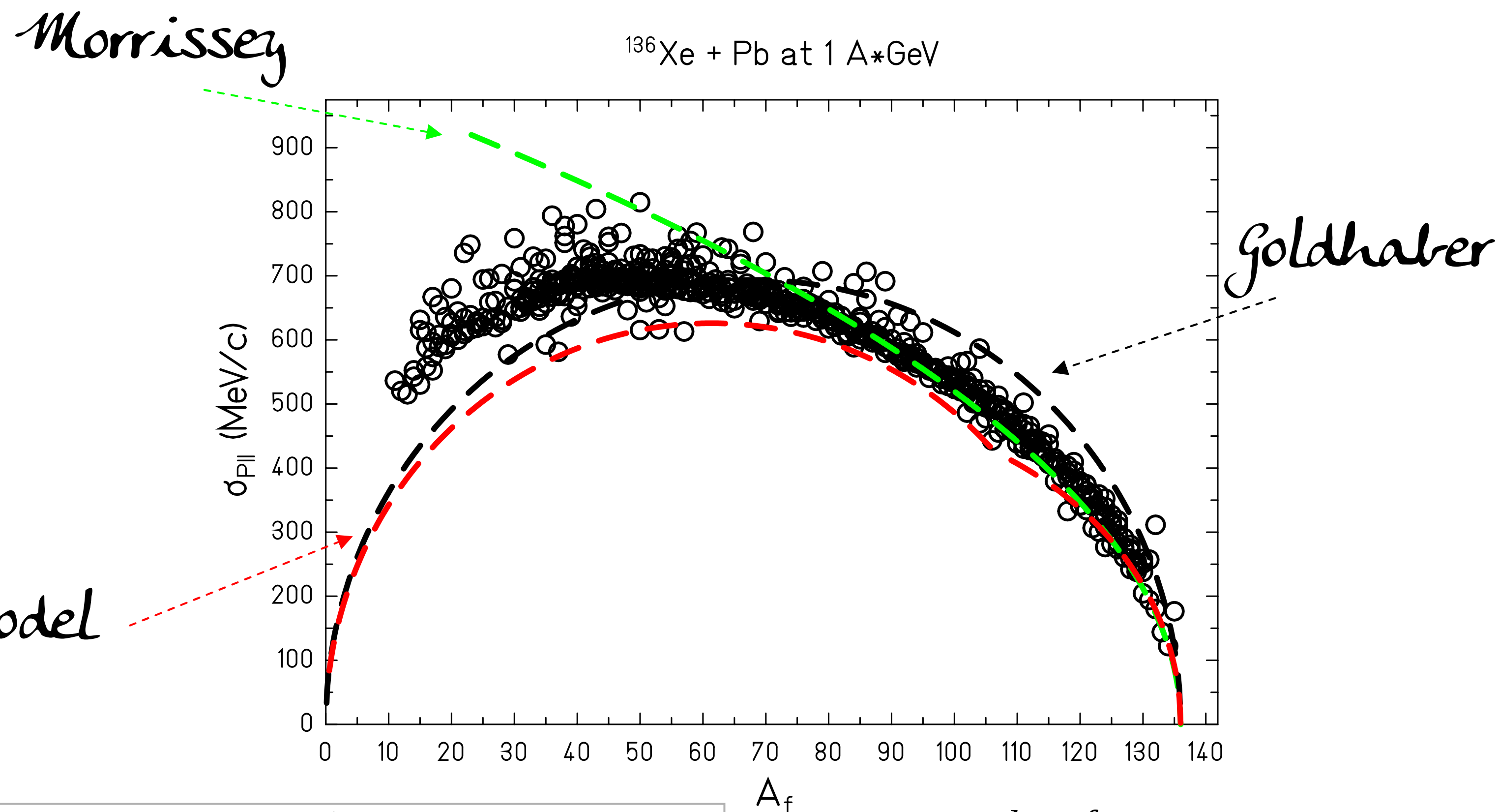
$$A_{GH} = \frac{11 \cdot \delta_{ev}}{11 \cdot \delta_{ev} - T^2_{bu}} \cdot A_f$$

$for\ A \geq A_{\lim},$

$$A_{GH} = \frac{\delta_{ev} \cdot A_f + 27 \cdot A_p}{27 + \delta_{ev}}$$

$$\sigma^2_{P_\parallel} = \left(\frac{A_f}{A_{GH}}\right)^2 \cdot \frac{p_f^2}{5} \cdot \frac{A_{GH}(A_p - A_{GH})}{(A_p - 1)} + A_f^2 \cdot \frac{p_f^2 \eta^2}{5} \cdot \left(\frac{1}{A_f} - \frac{1}{A_{GH}}\right)$$

A new model



model fits honorably the data
much more complete than before !

data from
D. Henzlova et al., in preparation