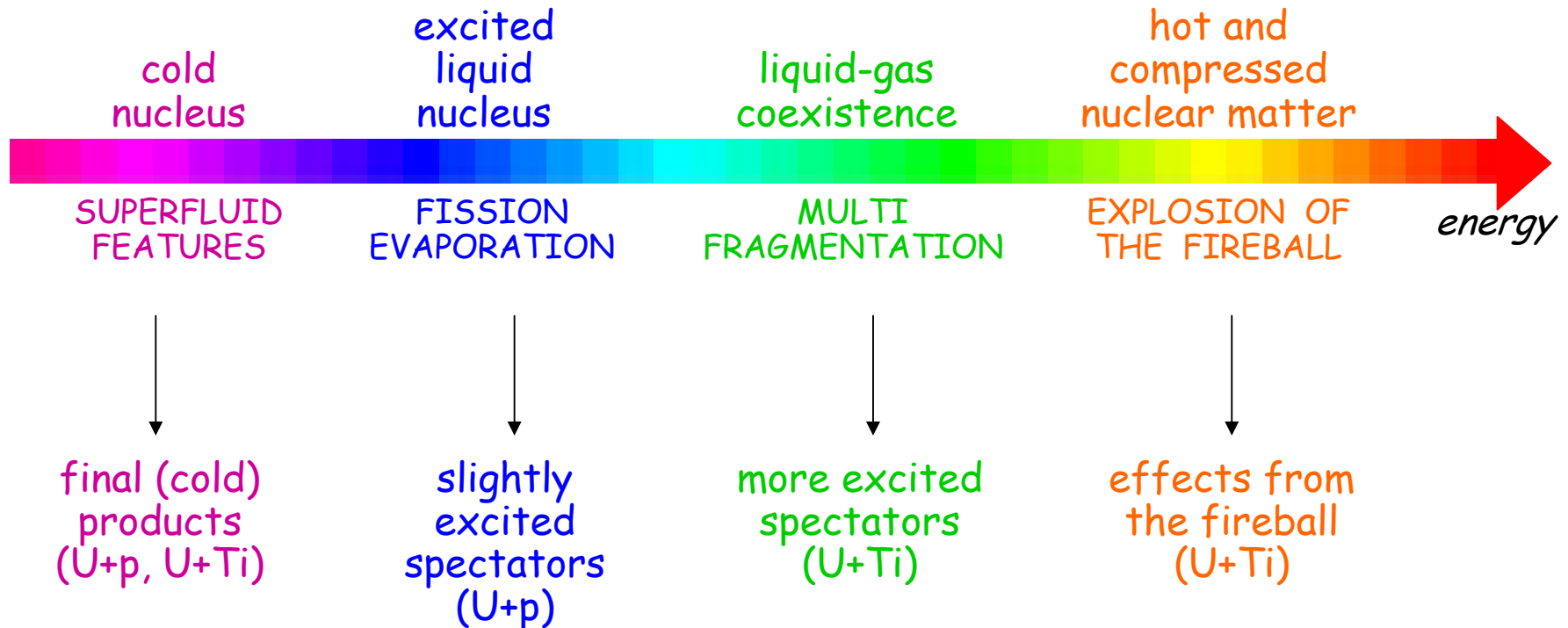


High-resolution magnetic spectrometers: an excellent tool to investigate the properties of nuclear matter

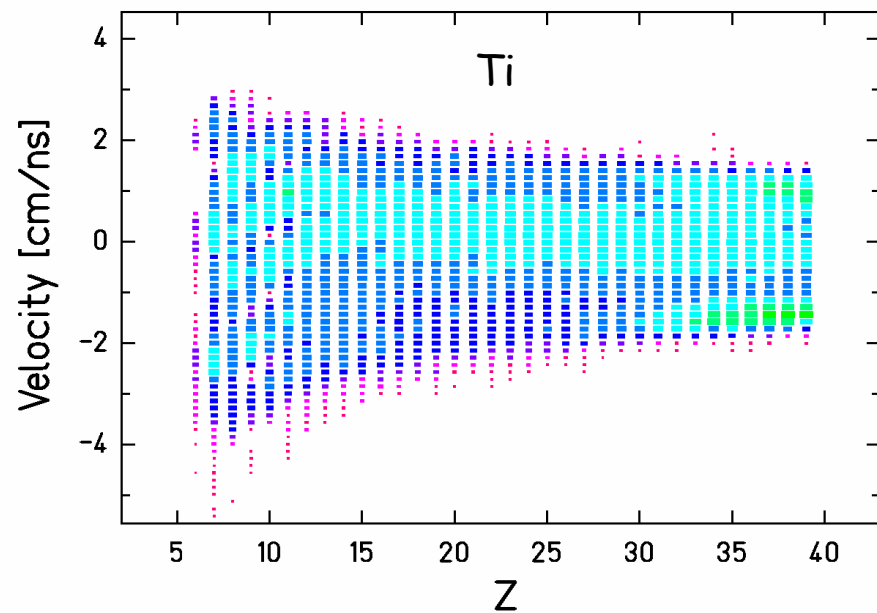
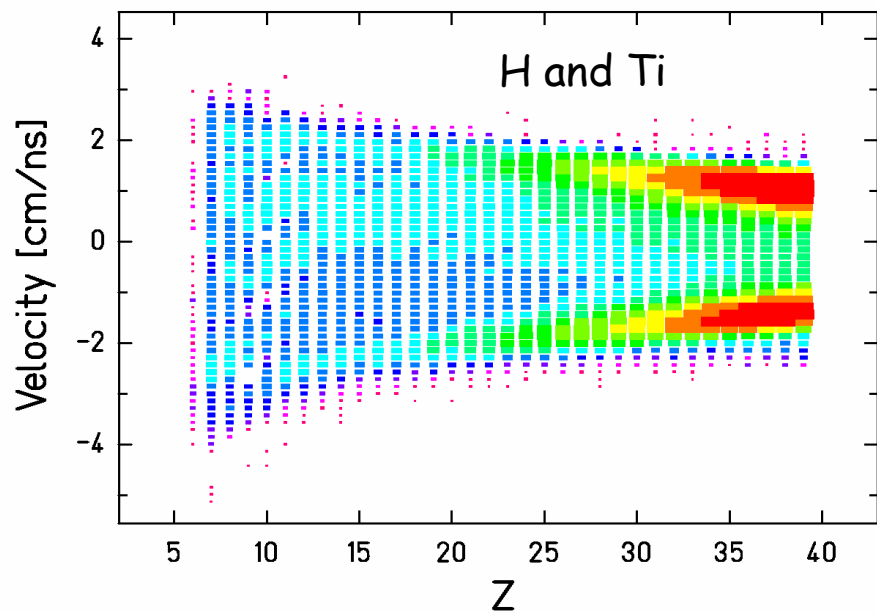
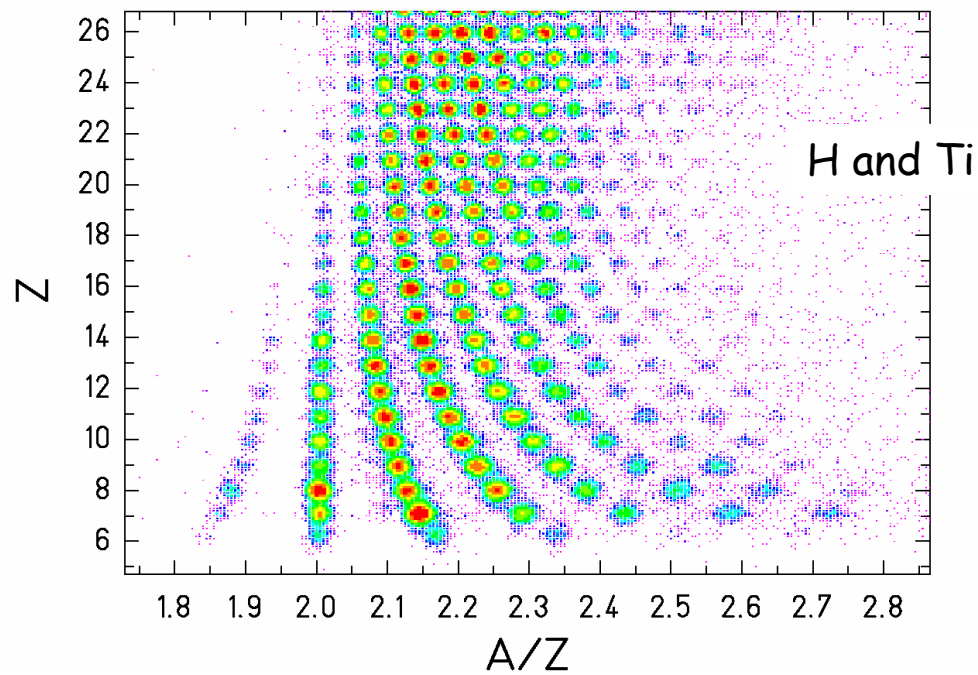
Reaction investigated & physics topics

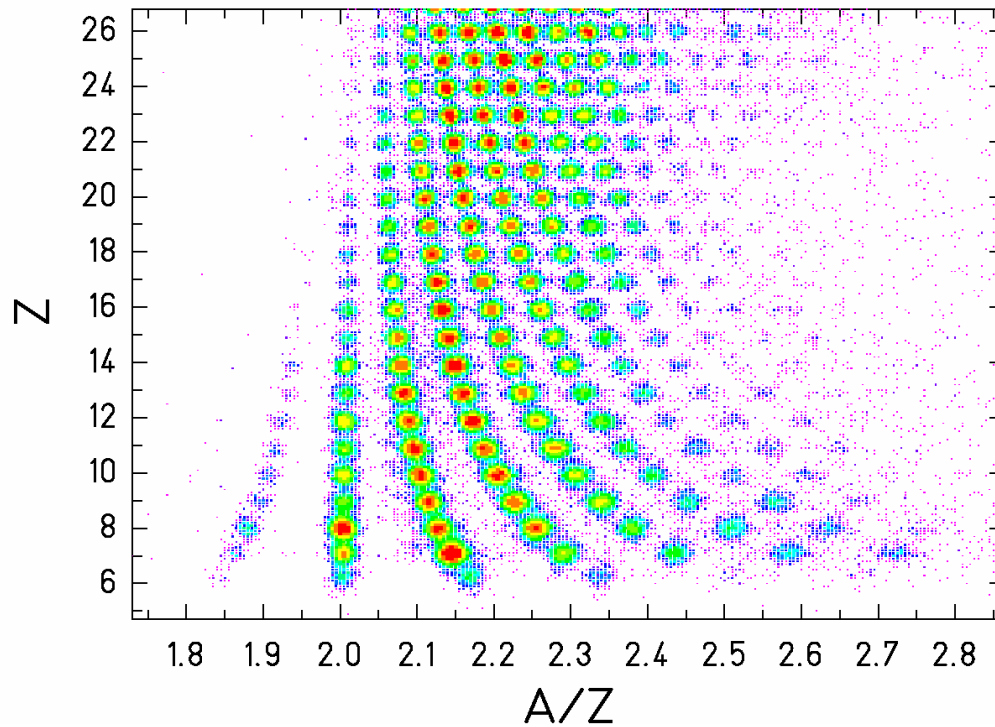
1 A GeV ^{238}U on proton
1 A GeV ^{238}U on titanium

measured at the FRagment Separator at GSI



Raw
experimental
data





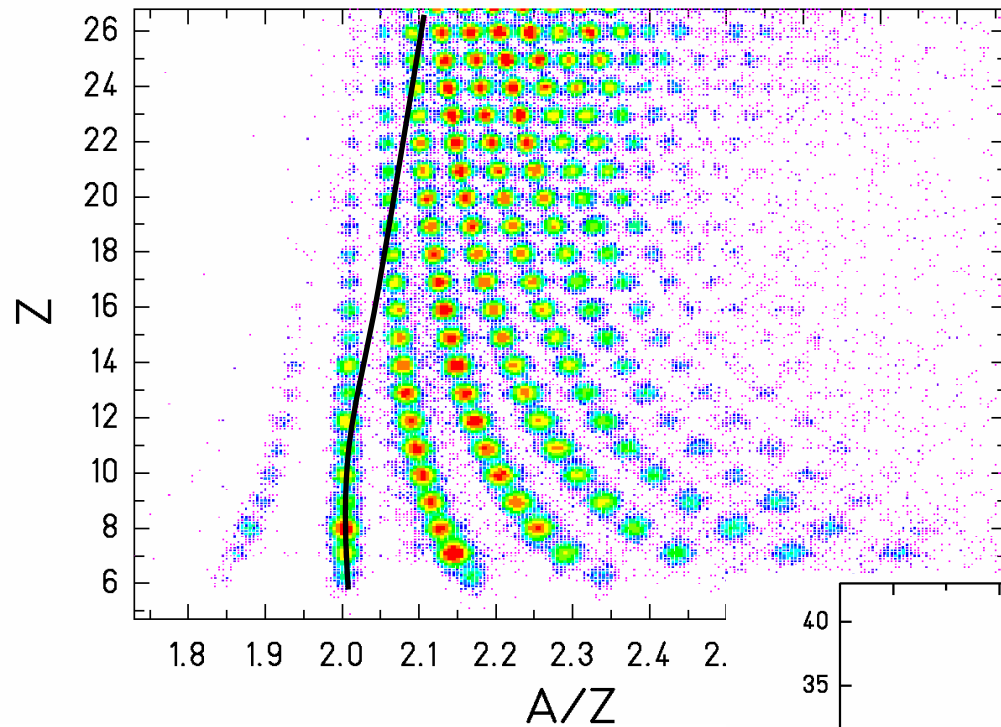
A complex even-odd effect

The structure appears as the **result of the condensation process** of heated nuclear matter while cooling down in the evaporation process

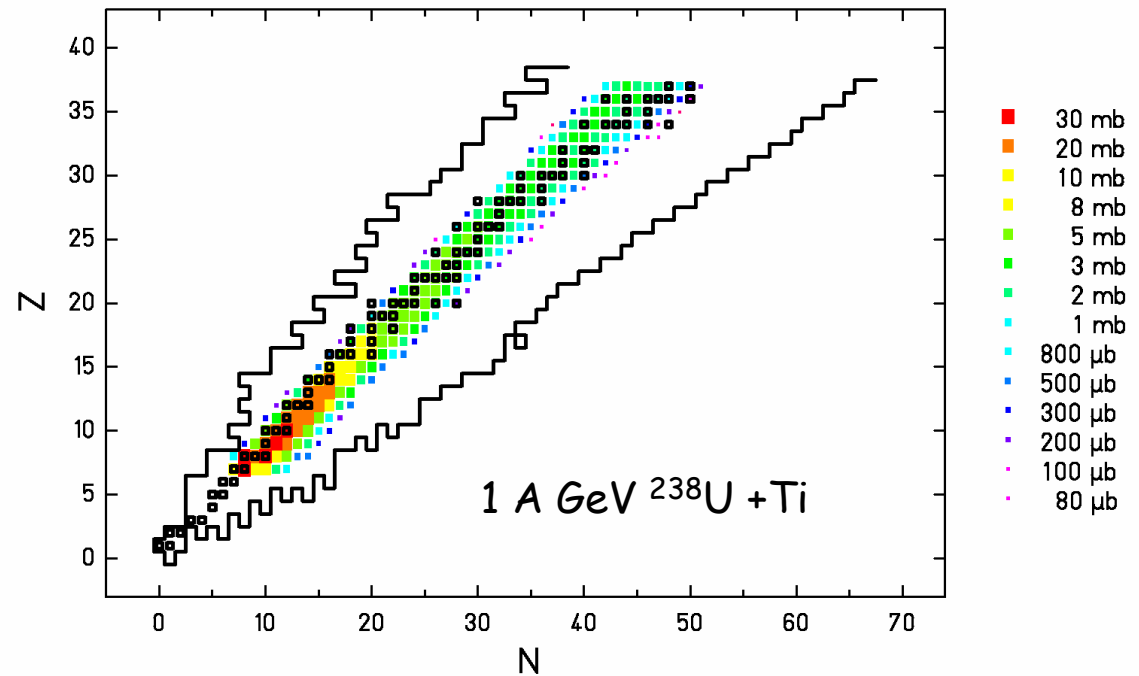
The results are a manifestation of the **passage** from the **liquid phase** to the **superfluid phase**

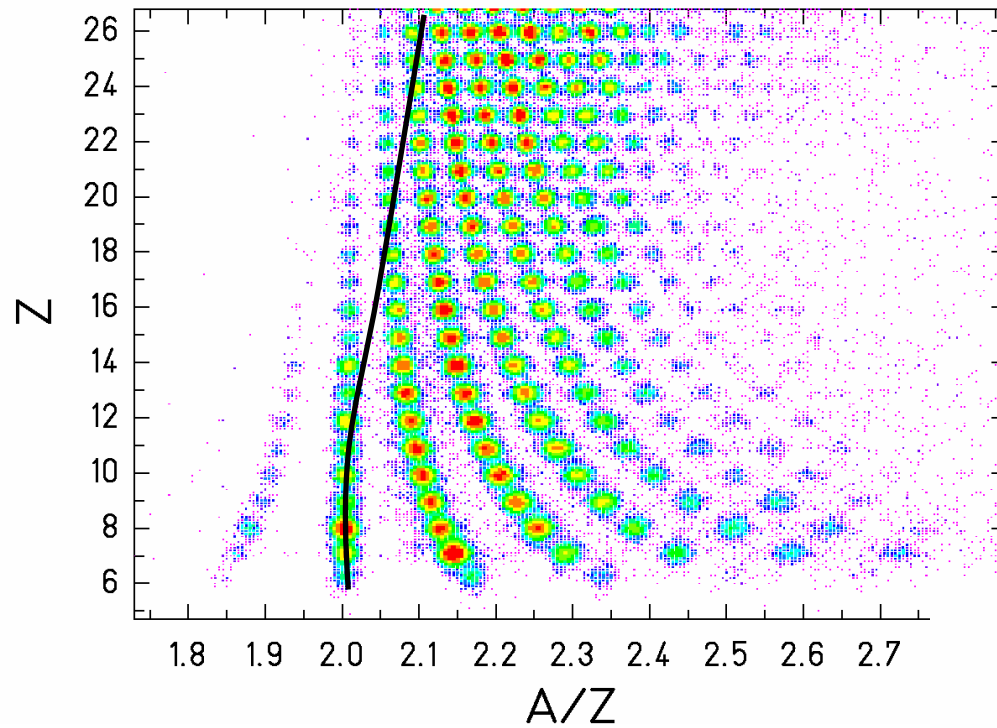
Essential requirement for this investigation: charge and **mass resolution**
(→ **high-resolution magnetic spectrometer**)

M. V. Ricciardi et al., Nucl. Phys. A 733 (2004) 299-318



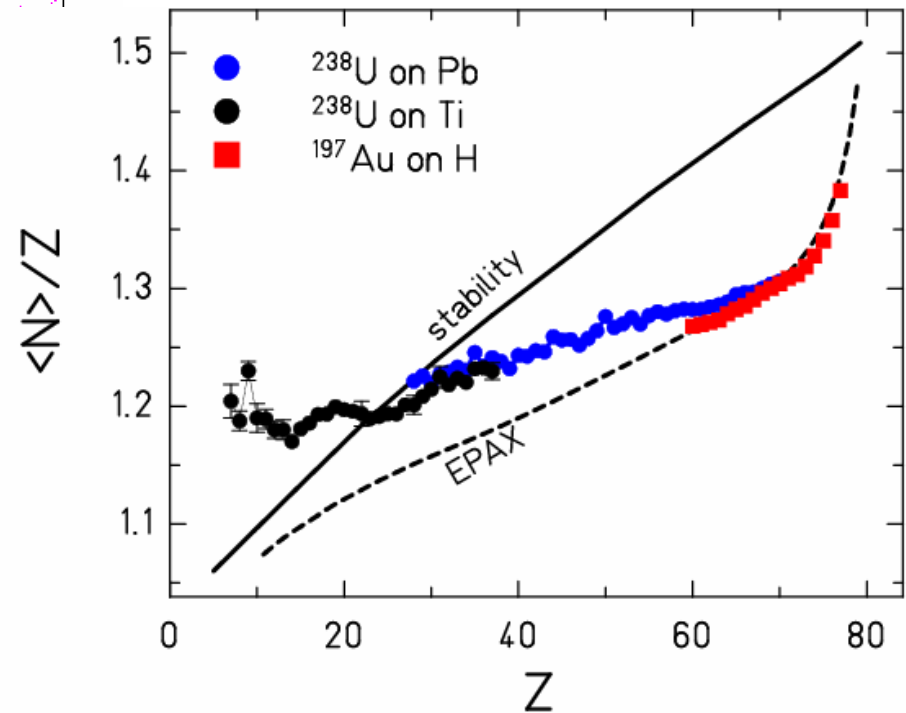
Neutron-rich nuclei

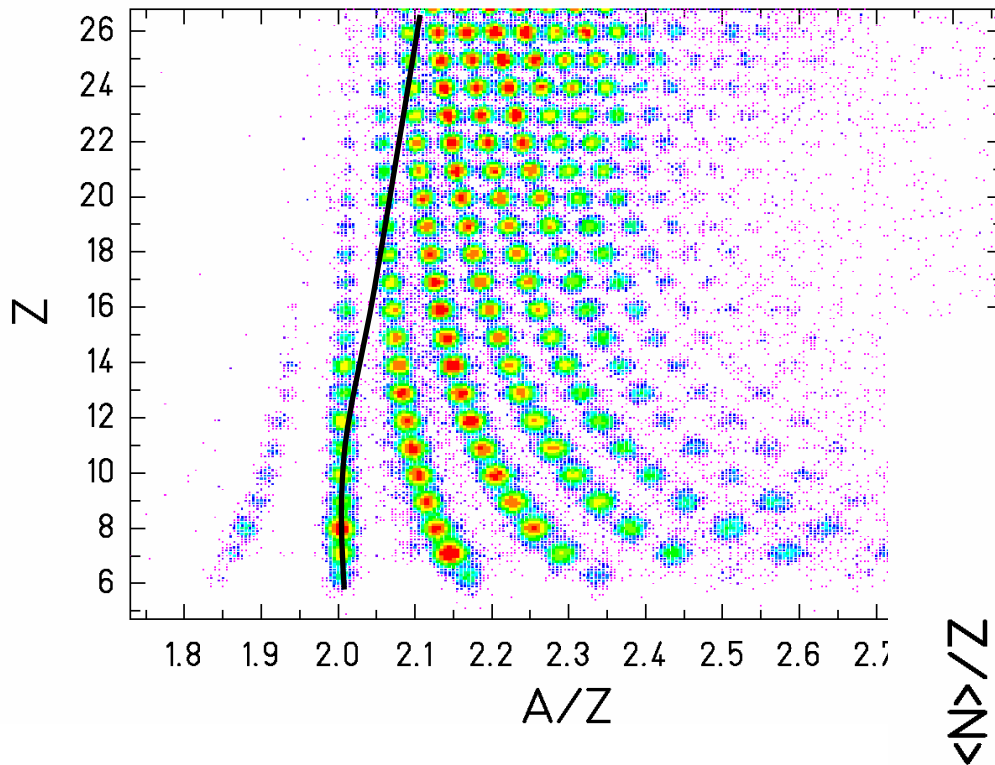




In more violent collisions the evaporation starts at lower excitation energies!

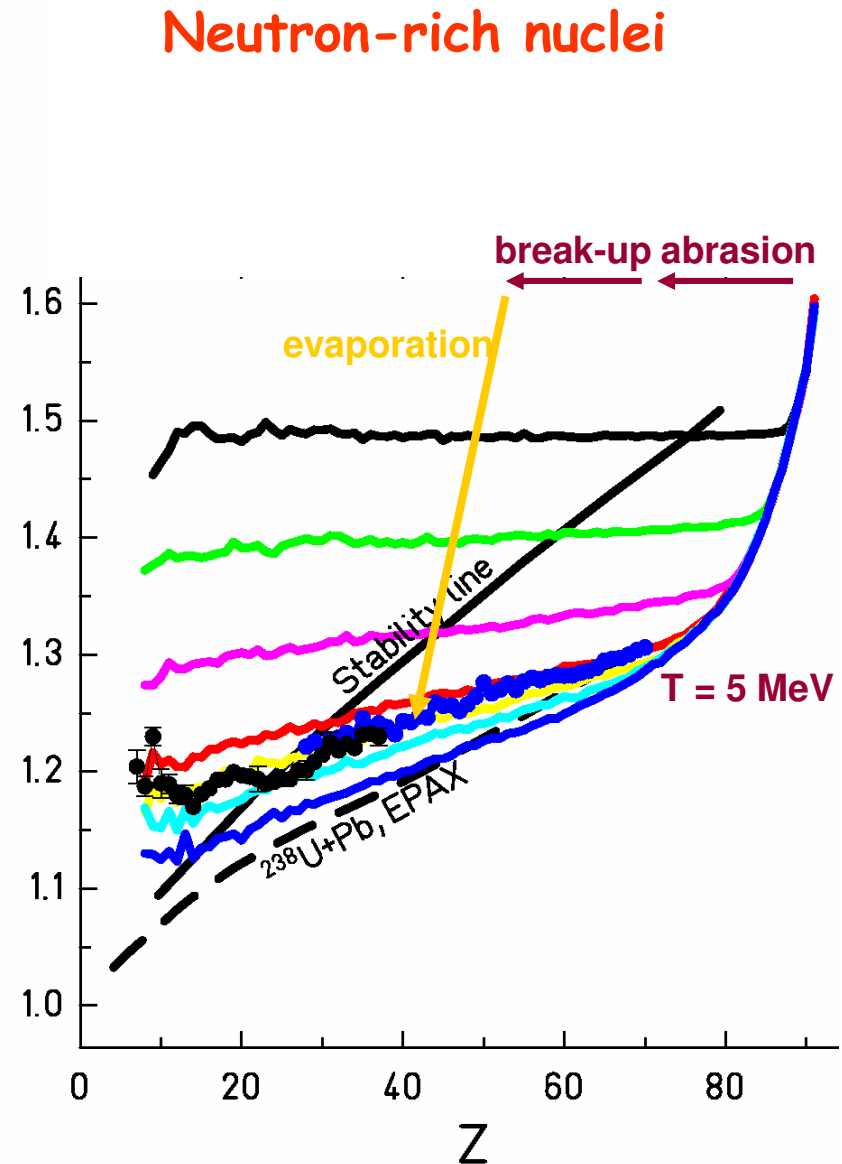
Neutron-rich nuclei

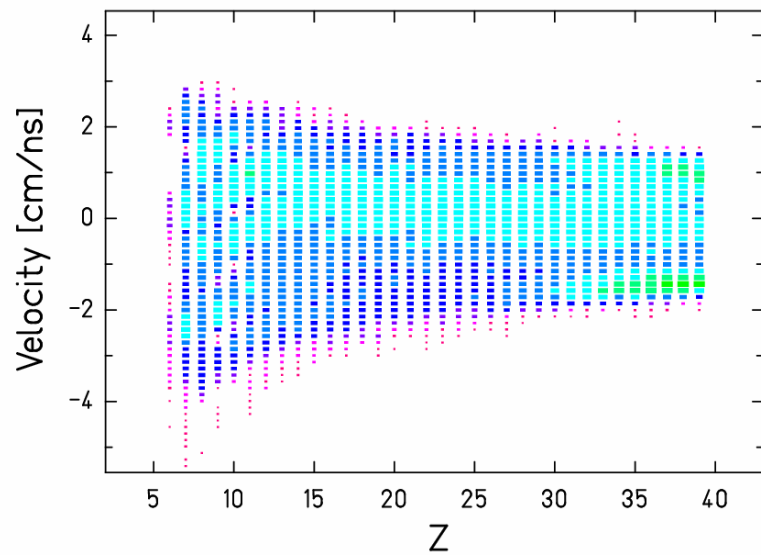
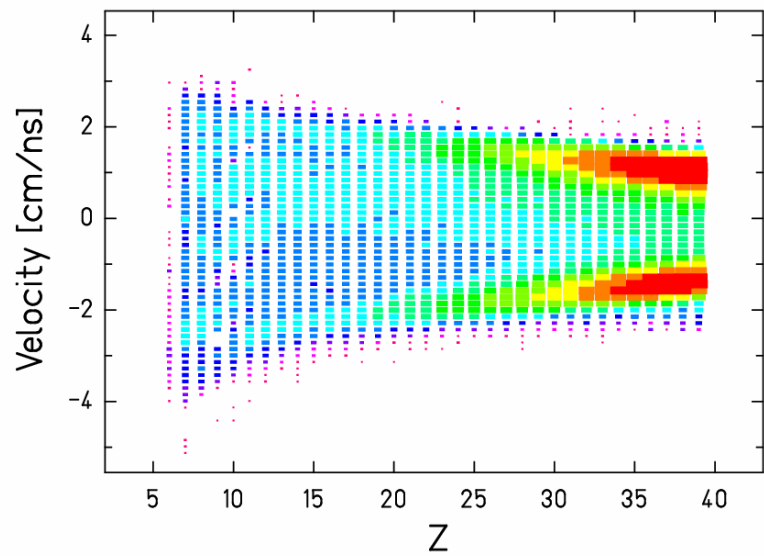


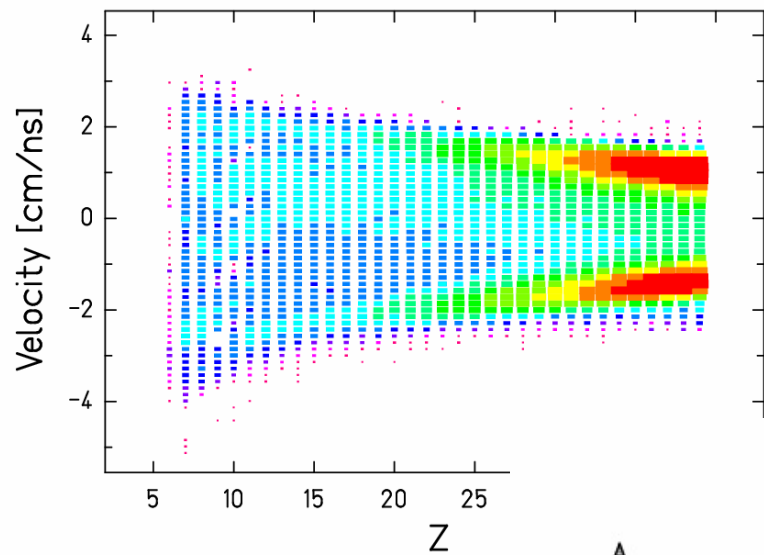


Mean N/Z -ratio + statistical-model code
 → freeze-out temperature (isospin thermometer)

Essential requirement for this investigation:
 Z and A resolution
 (→ high-resolution magnetic spectrometer)

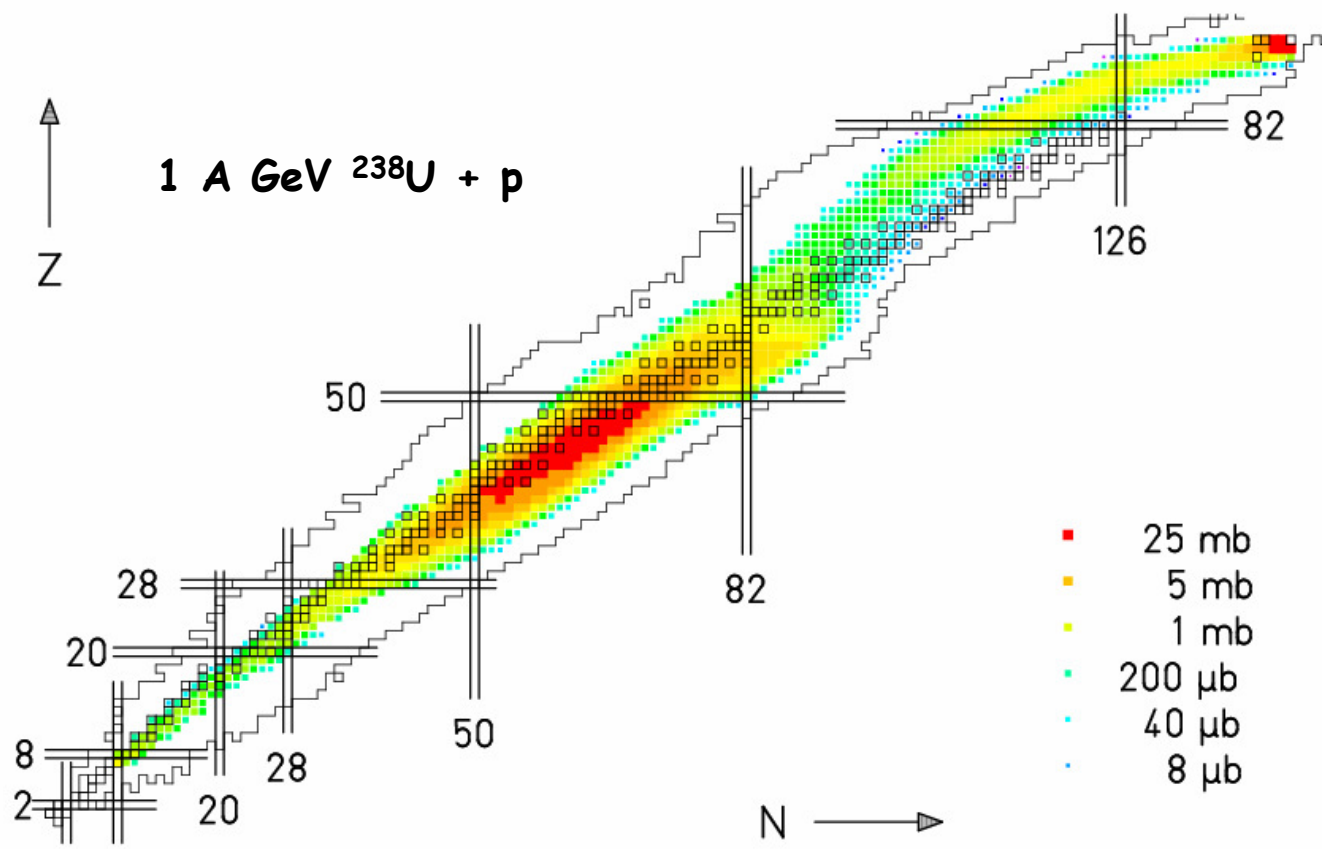


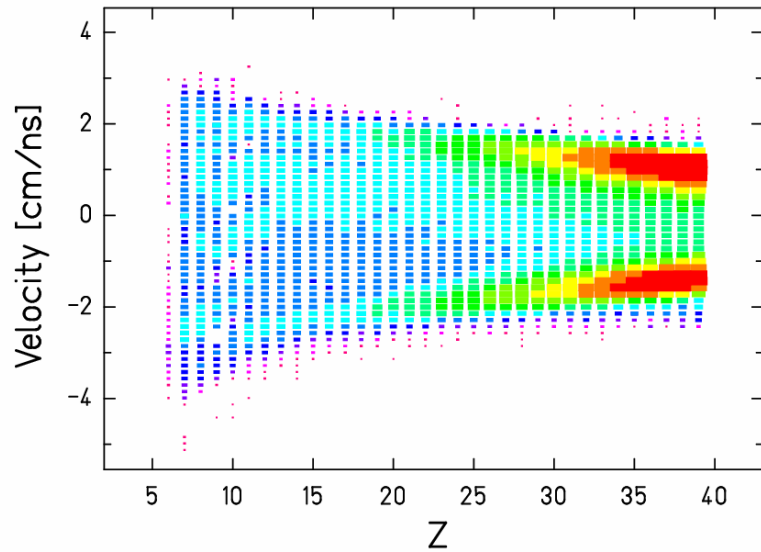




Fission

1 A GeV ^{238}U + p



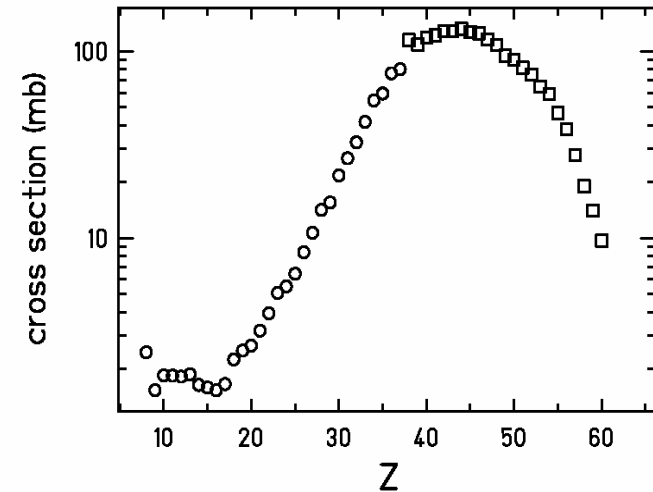
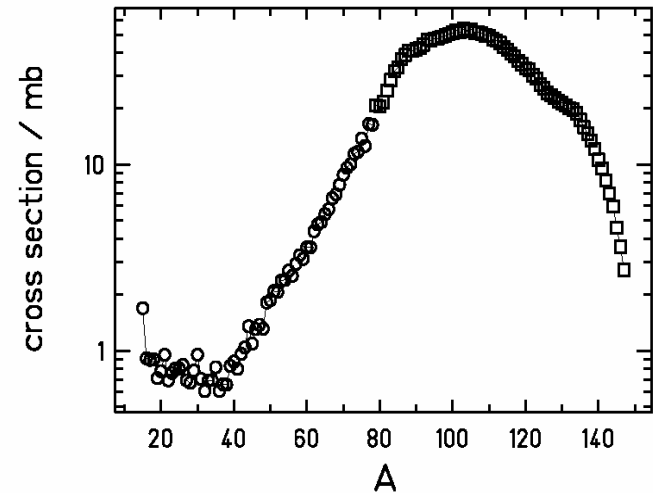


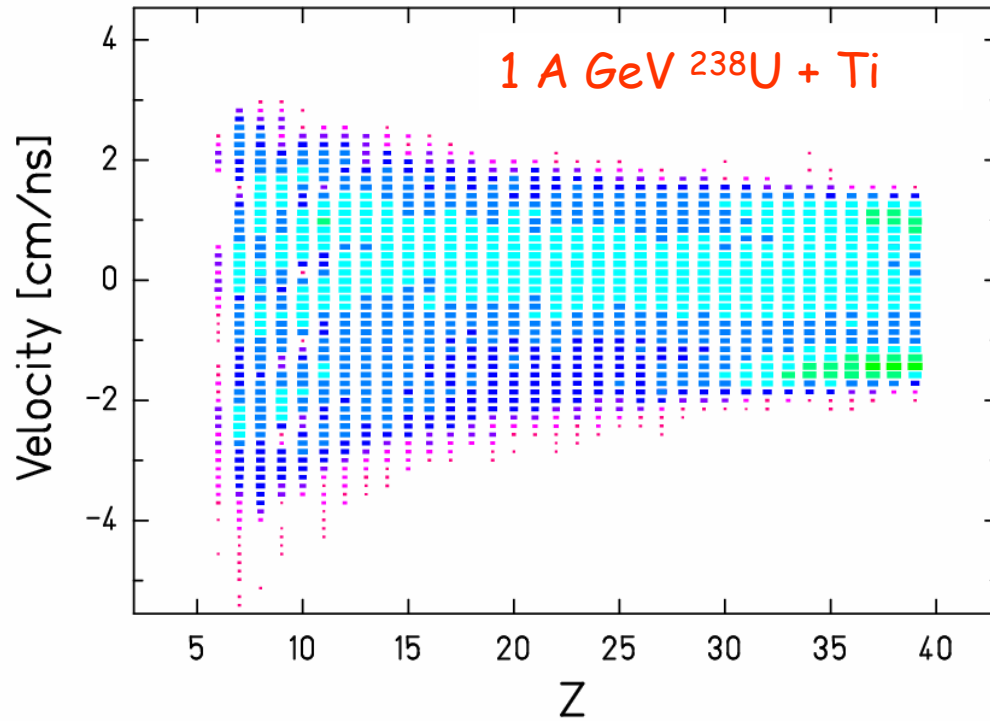
All the experimental signatures are consistent with the sequential **binary decay** of a fully equilibrated **compound nucleus**

Clear indications for fast **break-up** processes seem to be **absent**

Essential observables for this investigation:
 A , Z , velocity
 (→ **high-resolution magnetic spectrometer**)

Fission

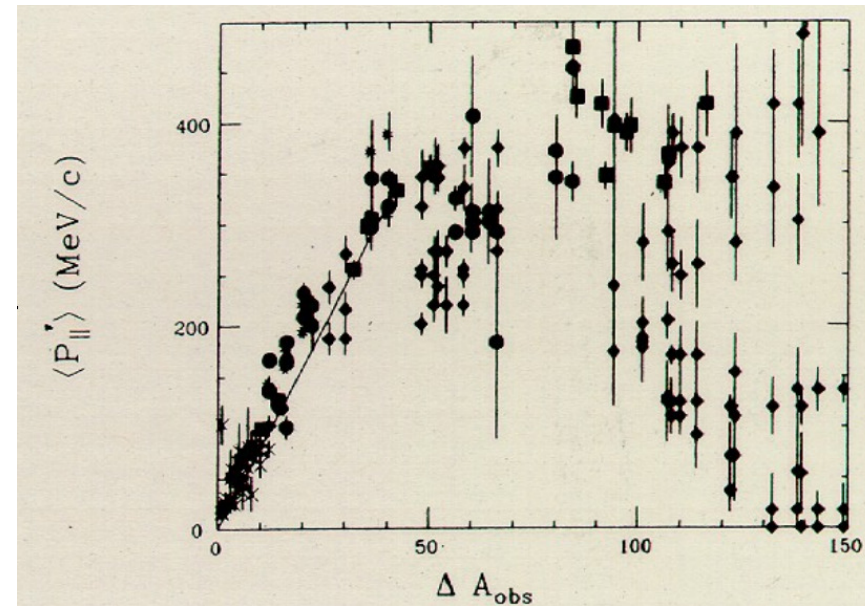


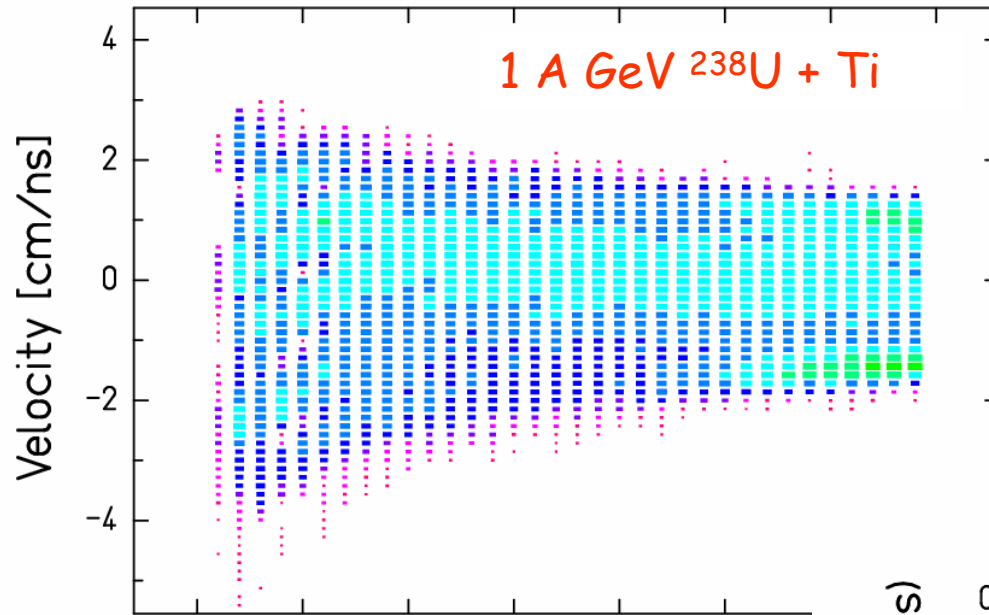


Morrissey systematics

D. J. Morrissey, Phys. Rev. C **39** (1989) 460

Acceleration of spectators





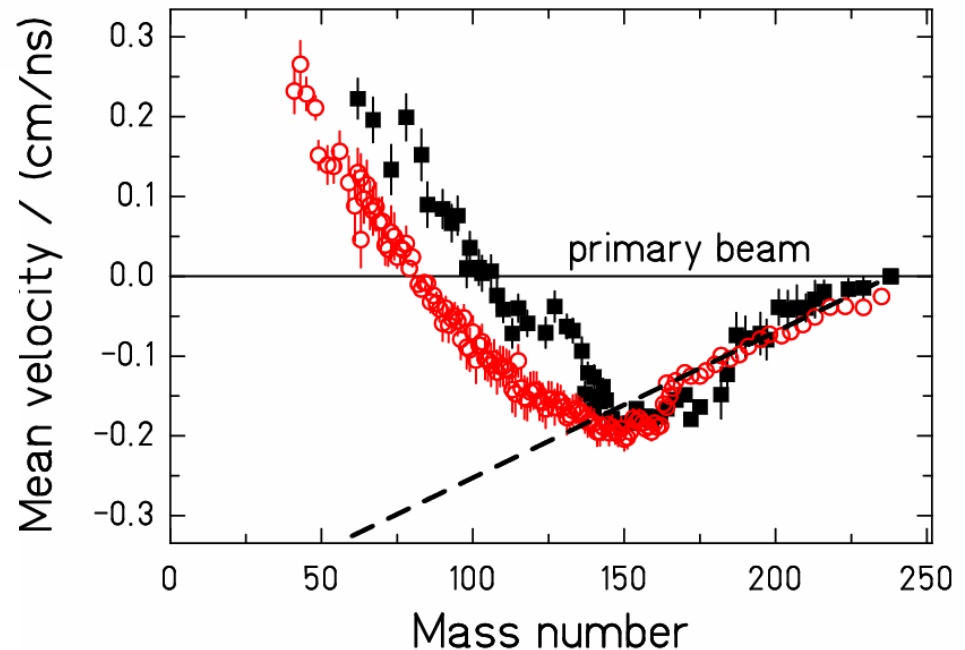
Experimental evidence for the response of the spectator to the participant blast

According to some theoretical model, the momentum is selectively sensitive to the momentum dependence of the nuclear force

The longitudinal momentum is measurable with the required precision with high-resolution magnetic spectrometers

Acceleration of spectators

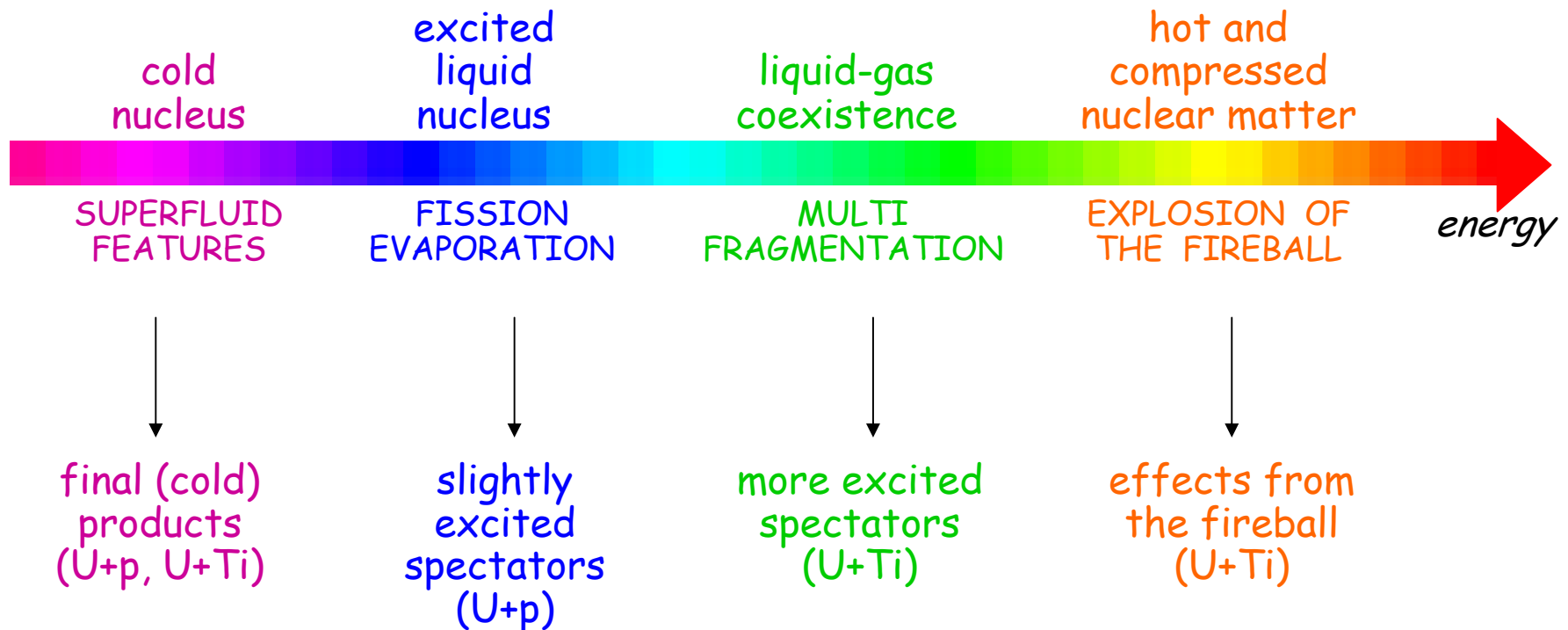
M. V. Ricciardi et al., Phys. Rev. Lett. 90 (2003) 212302



Conclusion

1 A GeV ^{238}U on p, Ti

High-resolution magnetic spectrometers: an excellent tool
to investigate the properties of nuclear matter



Acknowledgements

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