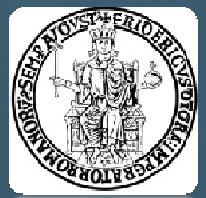
Federico II University
Industrial Engineering PhD School
"Innovative Technologies For Materials, Sensors And Imaging"

"Design Of The Ion Extraction System In A Reaction Microscope"

Speaker:

Marco Panniello



Introduction

Context: Antiprotons Recycler ring for differential cross section measurements.

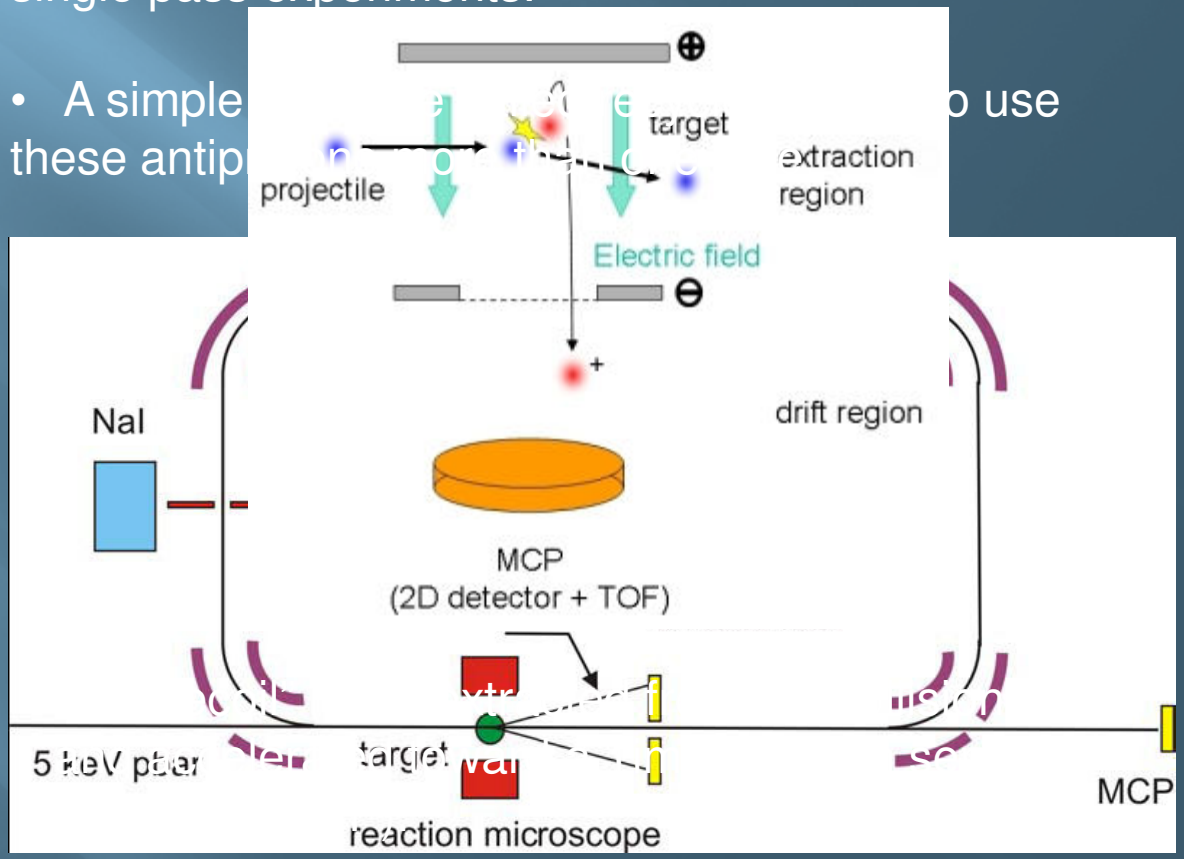
Purpose: Design of a suitable geometry for the recoil ion extraction system.

Recoil Ion Momentum Spectroscopy

- high precision device
- more appropriate for coincidence measurements than energy or momentum dispersive spectrometers.
- Evolutions:
  - COLTRIMS (Cold Target RIMS);
  - Reaction Microscopes.

The Recycler

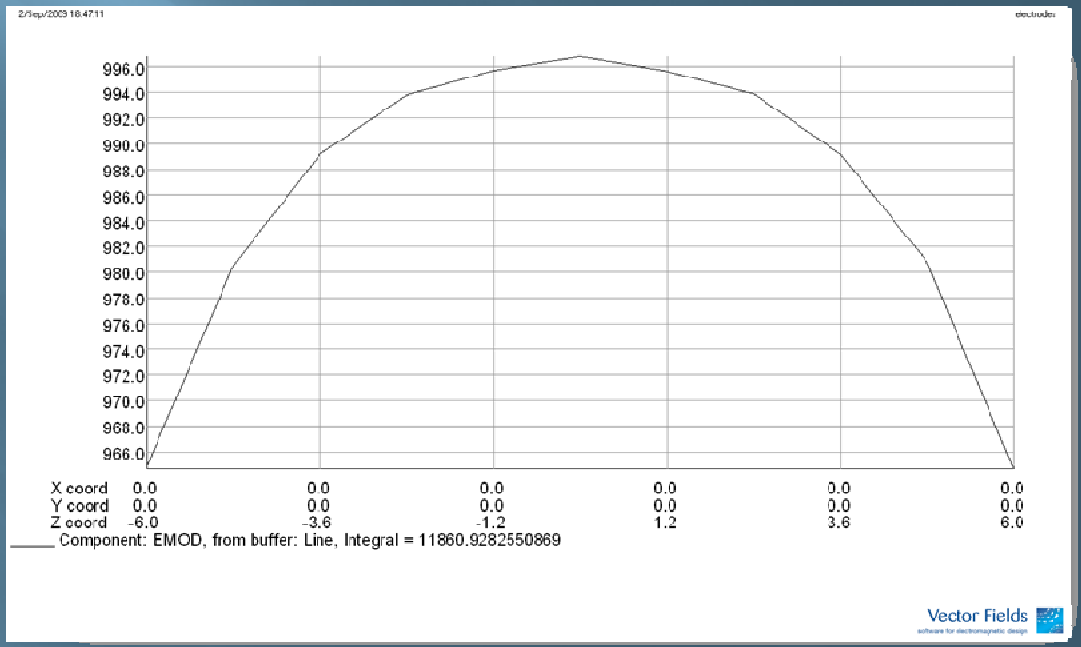
- The projectile hits the target gas molecules generating an atomic reaction. The most common effect is the target ionization.
- The projectile type is antiproton, currently used for single pass experiments.
- A simple … o use these antip…
-



Geometry Under Consideration

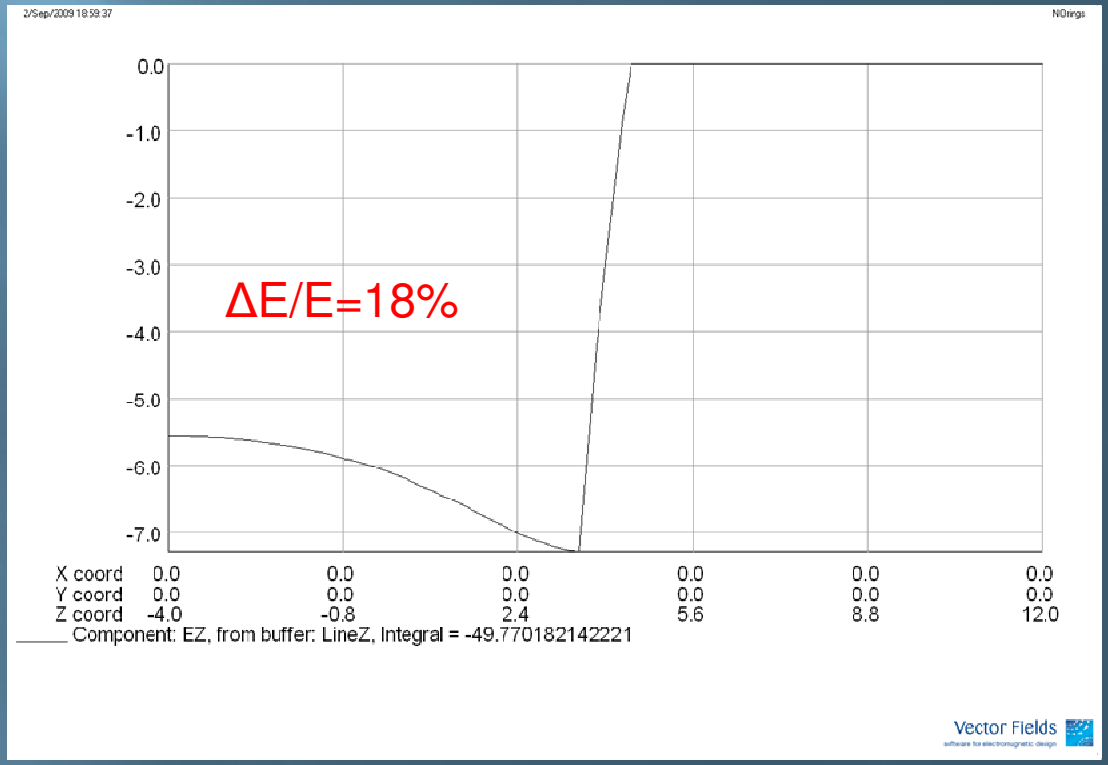
- Introduction
- Development
  - R.I.M.S.
  - The Recycler
  - Working Principle
  - Geometry U.C.
  - T.F.C.
  - Homogeneously
  - Catch & Resolve
  - Resolution
  - Suitable Geometry
- Conclusions

A simple structure that grants the homogeneous field on Detector axis can be taken as a basic idea.



Time Focusing Condition

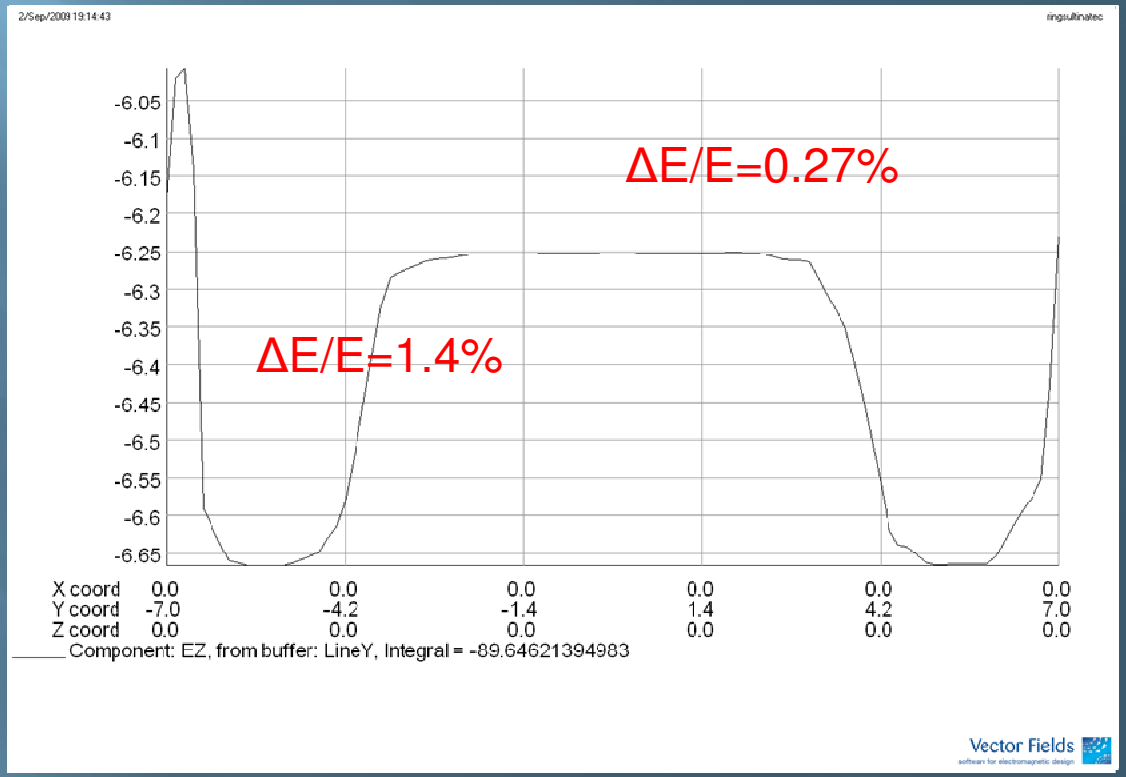
- In the real case we have not a point like volume source, so we have to take in account the consequent time jitter



Homogeneous Field

- Introduction
- Development
  - R.I.M.S.
  - The Recycler
  - Working Principle
  - Geometry U.C.
  - T.F.C.
  - Homogeneously
  - Catch & Resolve
  - Resolution
  - Suitable Geometry
- Conclusions

More difficult than you can expect…….



Acceptance vs Resolution

- A good acceptance needs a strongest field
- A good resolution needs a weaker field
- All depend by ion type and Spectrometer geometry

Resolution Considerations

spectrometer resolution limitations imposed by the detector

As example : 10V/10cm ;

Time resolution $\Delta t = 1ns$

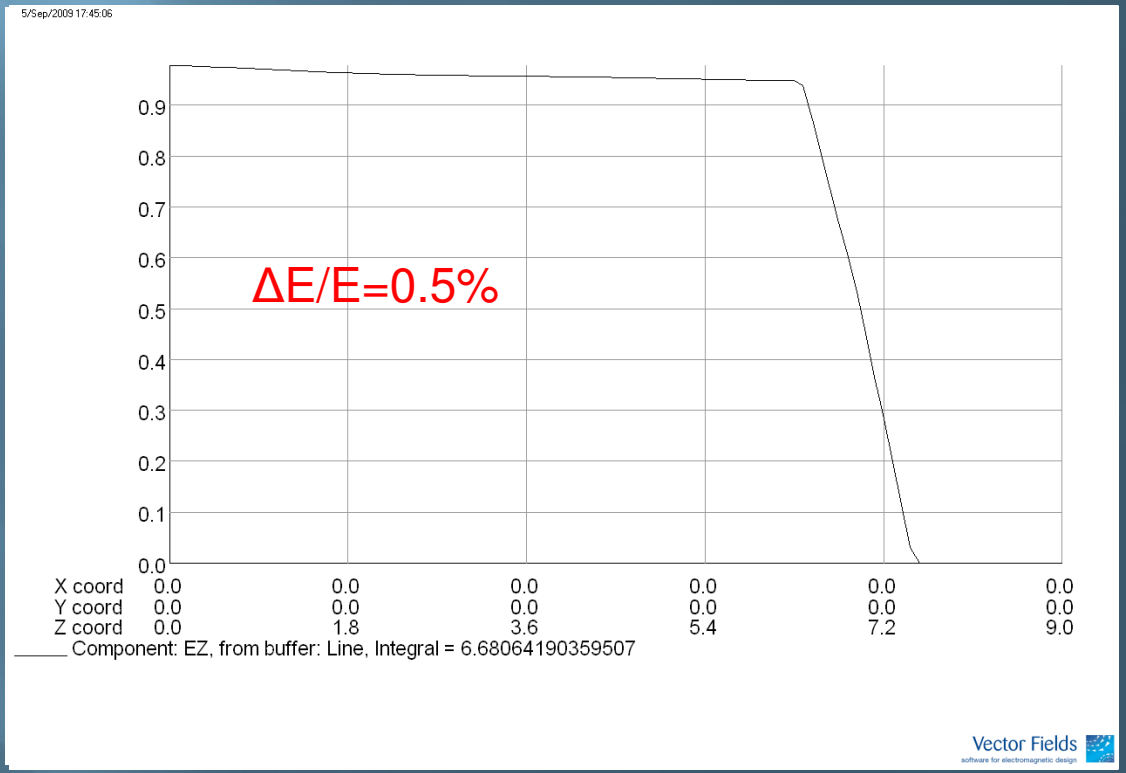
$$P_{//} = 8.042 \cdot 10^{-3} \frac{qU}{a} \Delta t = 0.01 \text{ a.u.}$$

Position resolution $\Delta r = 0.1mm$

$$P_{\perp} = 11.6 \cdot \frac{r}{(2a + d)} \sqrt{qU \cdot M} = 0.02 \text{ a.u.}$$

Suitable Geometry

In addition we have problems depending on the spectrometer, in terms of dimension limitations.



Conclusions

After several simulation I reached a geometry
With these properties:

Length of acceleration region a = 7 cm

Potential U = 7 V

Maximum Transverse Momentum P = 8.7 a.u.
It guarantee an Acceptance of 4π

Transverse momentum resolution
0.02 a.u.

Longitudinal Momentum Resolution
0.01 a.u.

END

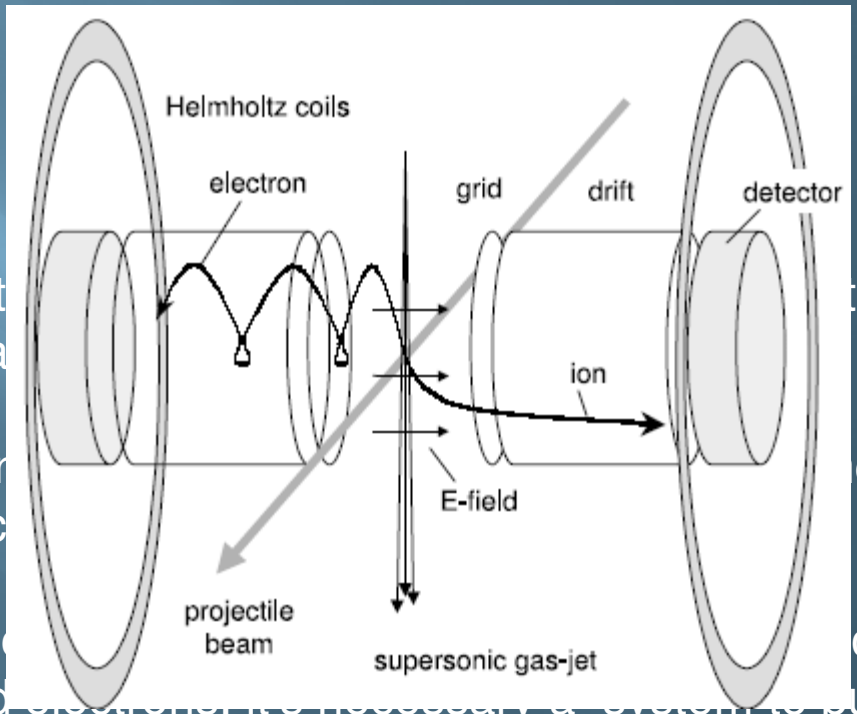
Grazie per l'attenzione

Marco Panniello

"You do not really understand something until you can explain it to your grandmother"

Albert Einstein

A Look Forward



- Det … to cha…
- Her… entum vec…
- Sin… of ions and … push them towards a detector.
- The electron trajectories are easily modified by small magnetic fields.
- It is possible to detect ions and electrons at the same time using both electric and magnetic fields