Electron impact cross section data of plasma edge related compounds

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EURATOM Assoziation

FWF

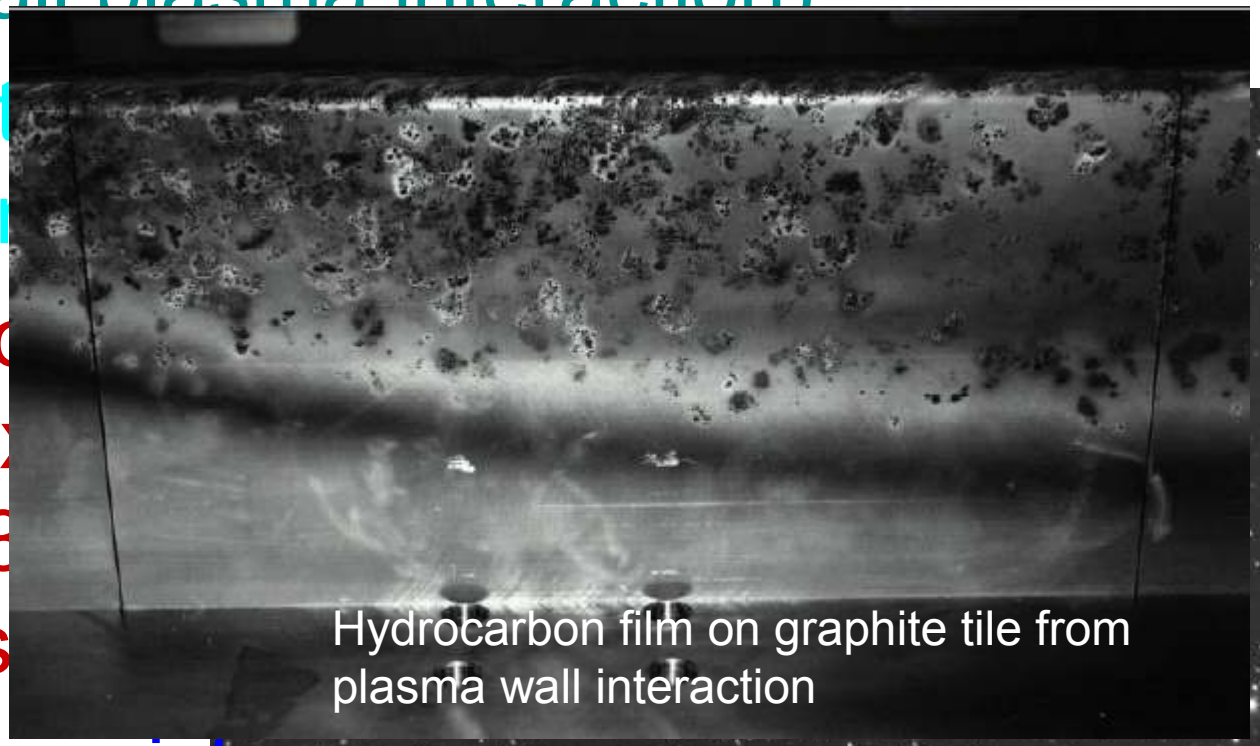
CNPq
Conselho Nacional de Desenvolvimento Científico e Tecnológico

Fusion-related research activities

- Electron molecule collisions:
  - Energy-differential cross sections of KER.
  - High-resolution electron beams for close-to-threshold measurements and study of temperature effects;
  - high-resolution electron beams for electron attachment studies;
- Molecule-surface collisions.
- Electron-ion collisions (theory and experiment).
- Quantum-chemical calculations of exotic molecules (BeC etc).

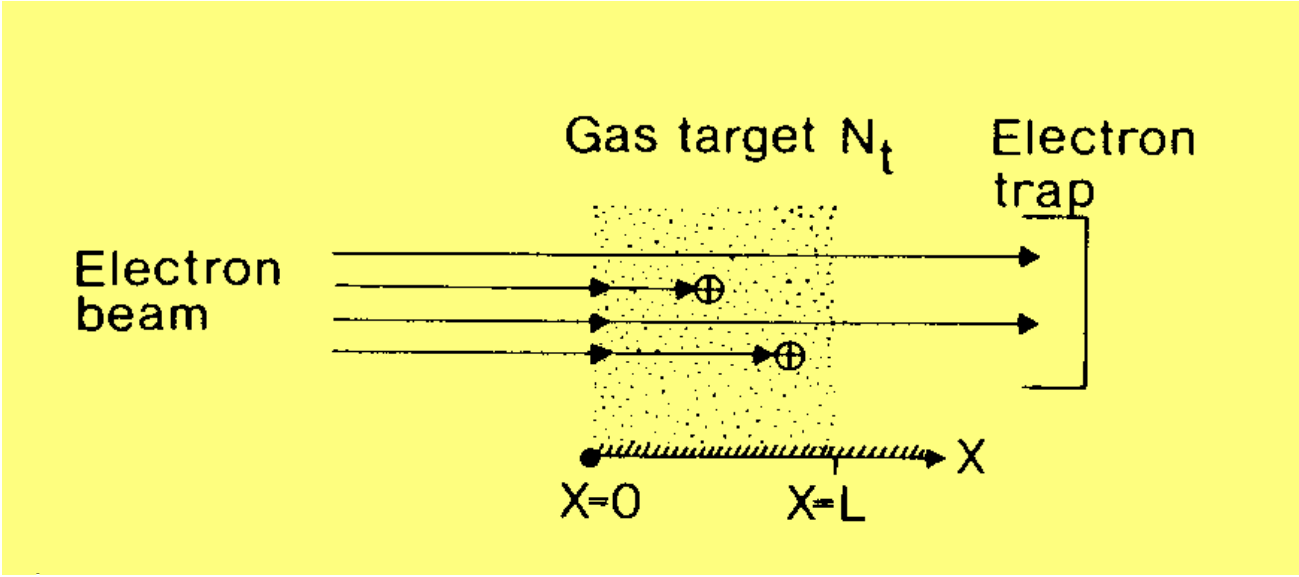
Motivation for Hidrocarbons

- Prototype of polyatomic molecules
- Formed in the edge region of fusion plasmas (wall plasma interaction)
- Cometary at
  medium (sy
- Concentrati
  of earth is e
  the year 203
  automobiles
- Radiation chemistry



Hydrocarbon film on graphite tile from plasma wall interaction

Necessary conditions in order to obtain accurate ionization cross sections from: $i_{ion} = i_e N_t L \sigma$



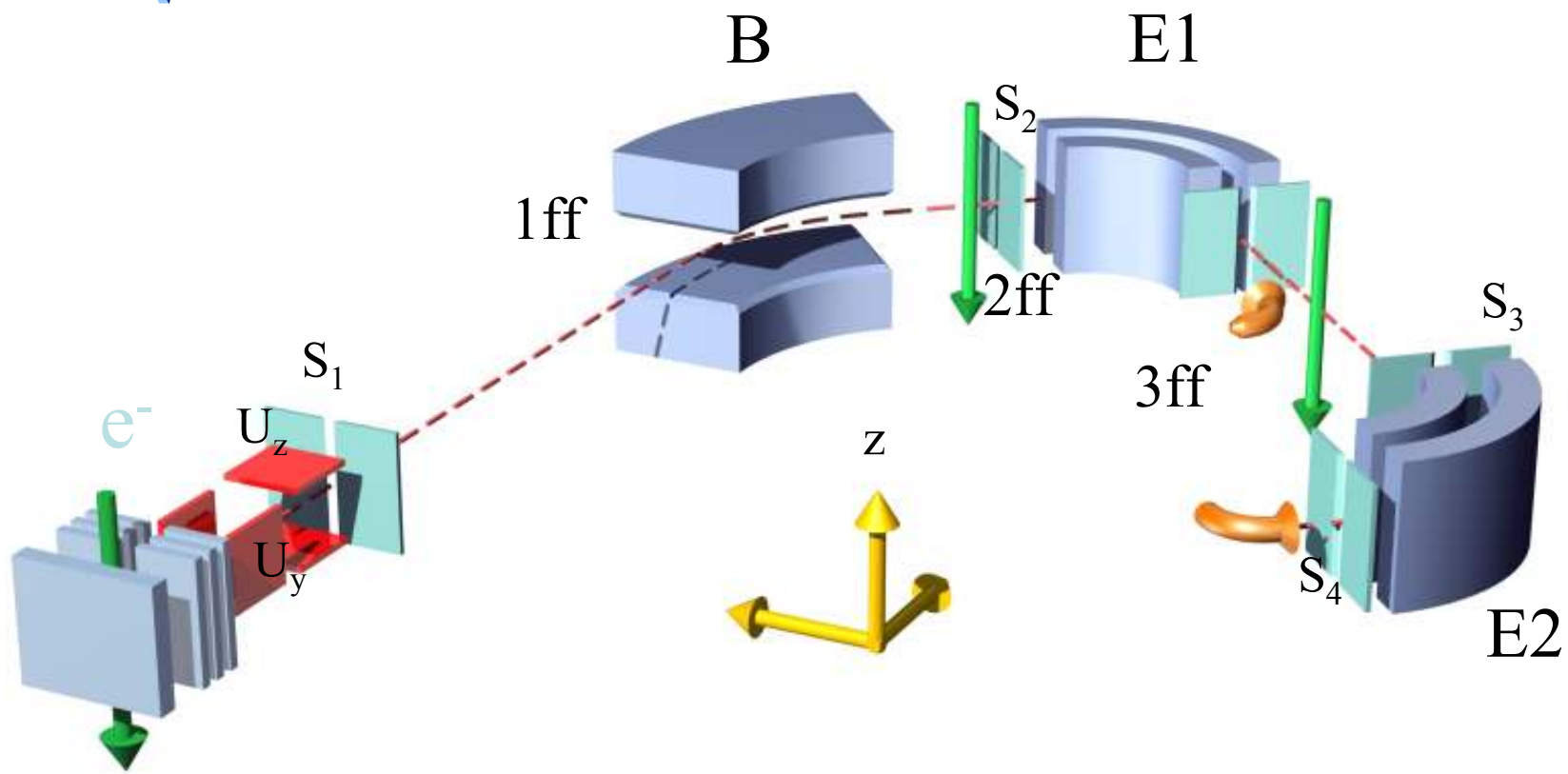
i_{ion} : Collection of known fraction of ions

i_e : Total collection of electron current

N_t : Accurate number density determination

L : Path length known for electron orbits

Total, partial and differential cross sections:



$AB + e \rightarrow AB^+$

$\rightarrow A + B^+ + KER$

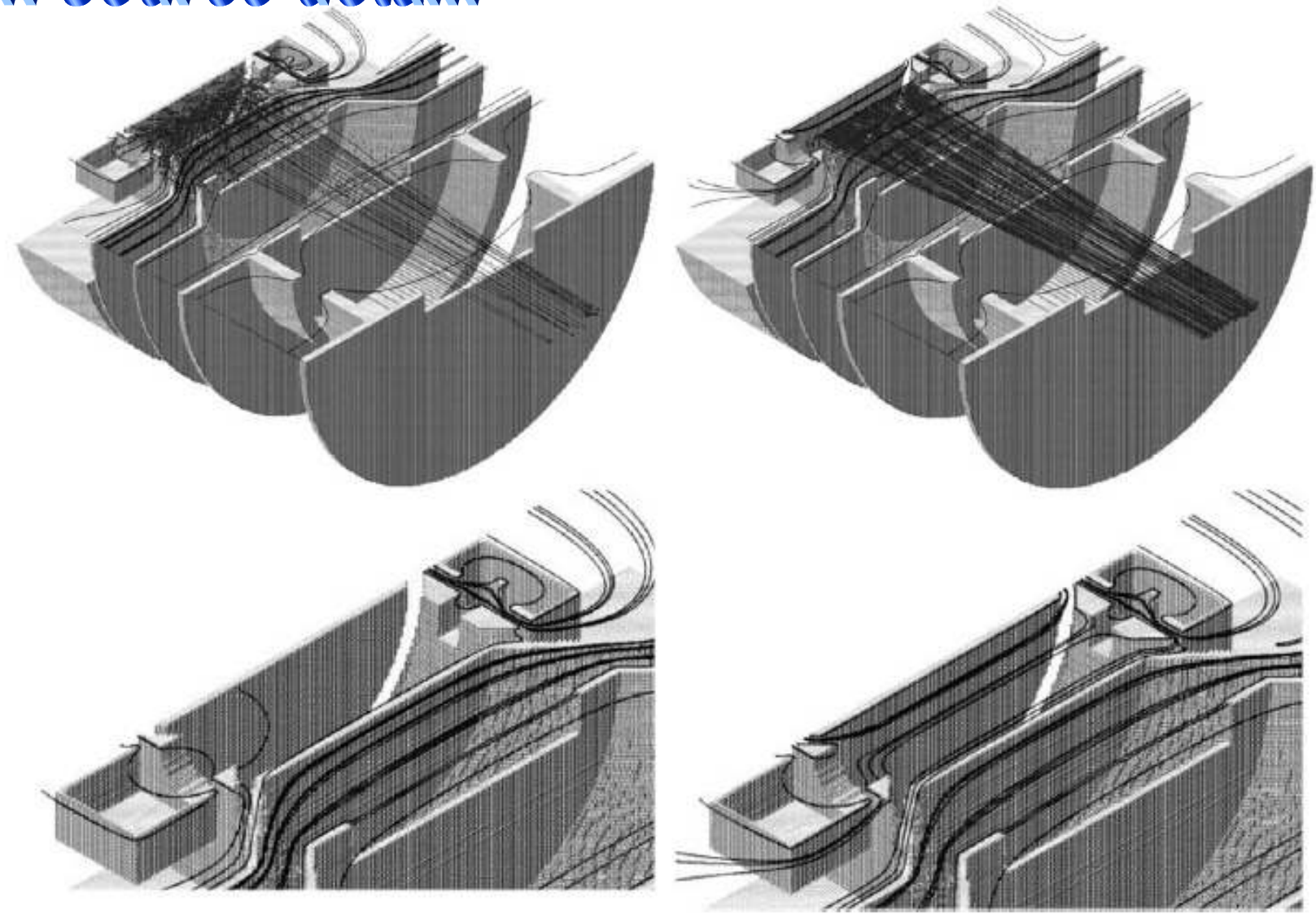
$\rightarrow A^+ + B + KER$

$AB^+ + e \rightarrow (AB^{++})^*$

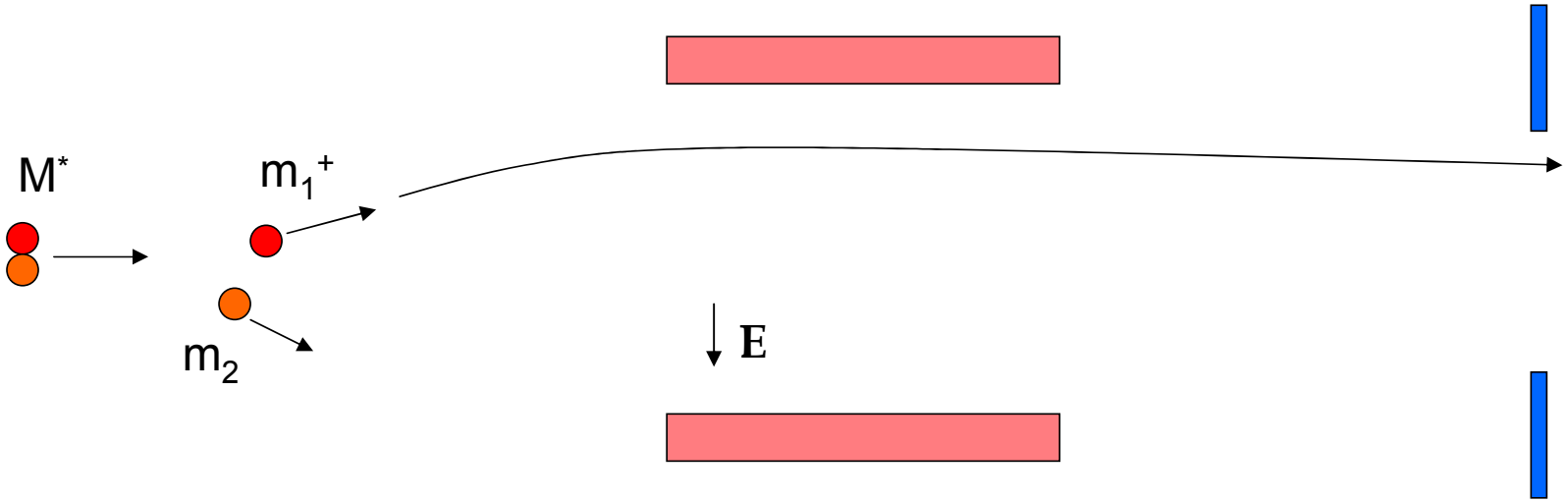
$\rightarrow A^+ + B^+ + KER$

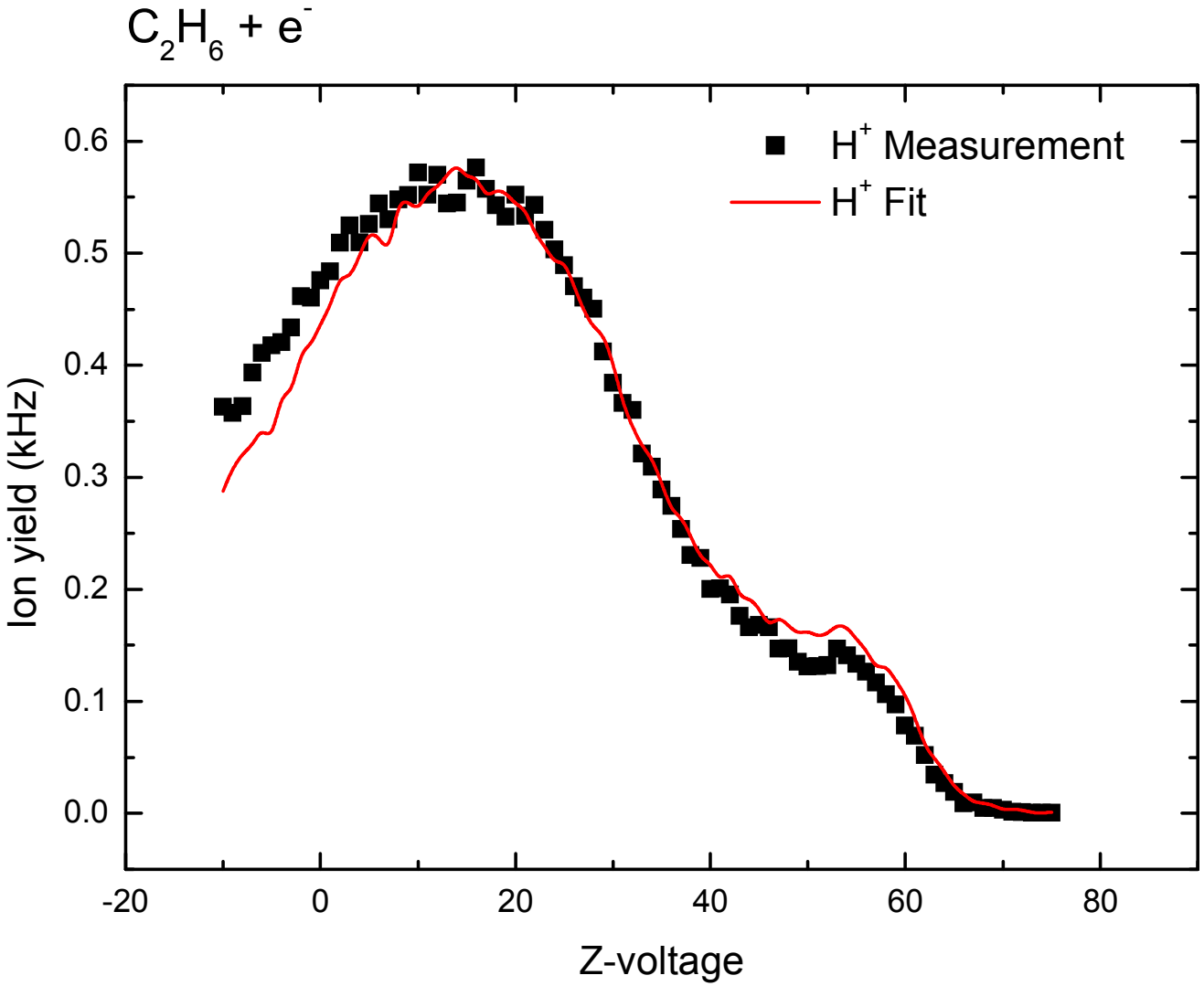
$\rightarrow A^+ + B + KER$

Ion source detail:

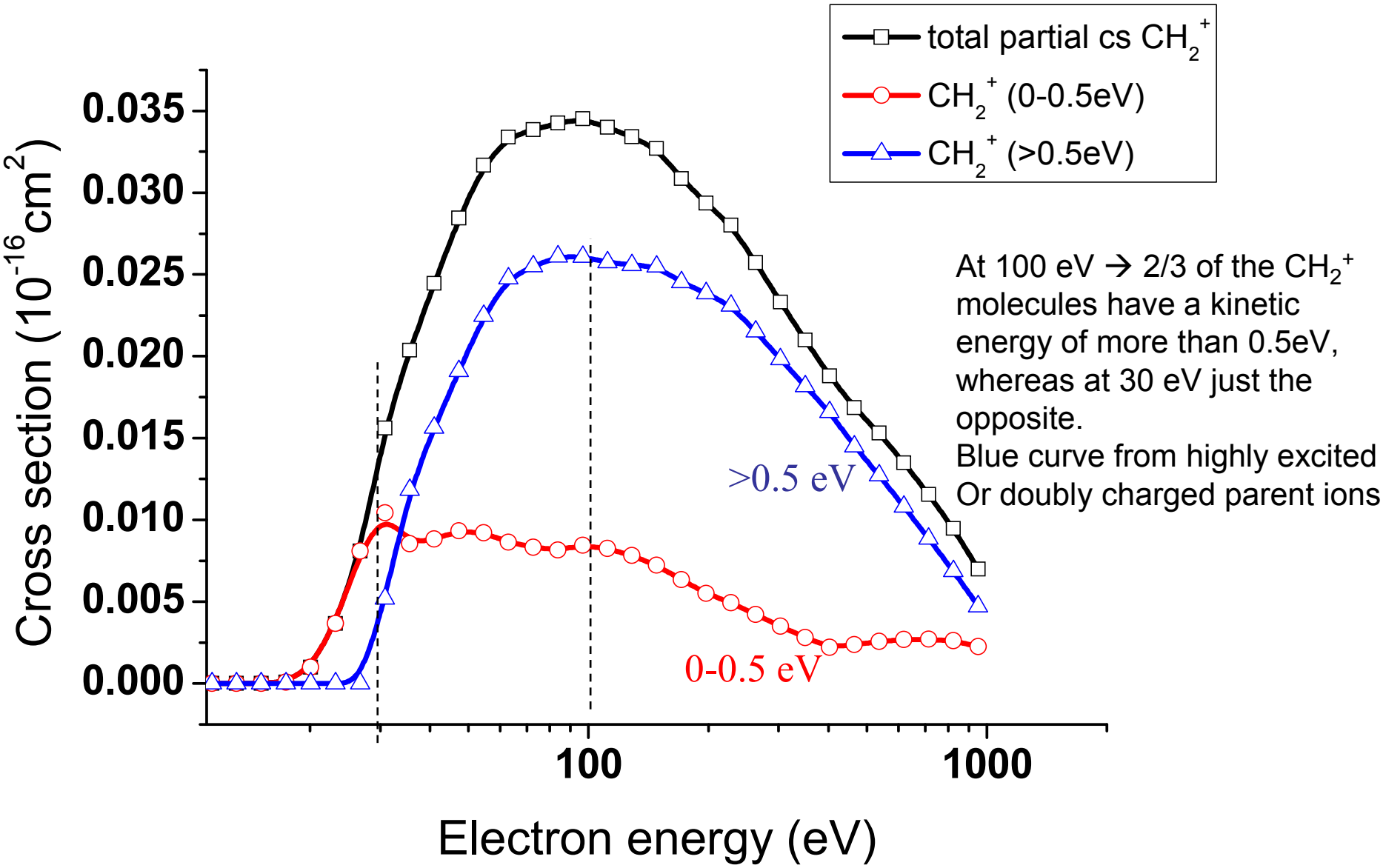


Z-profiles:



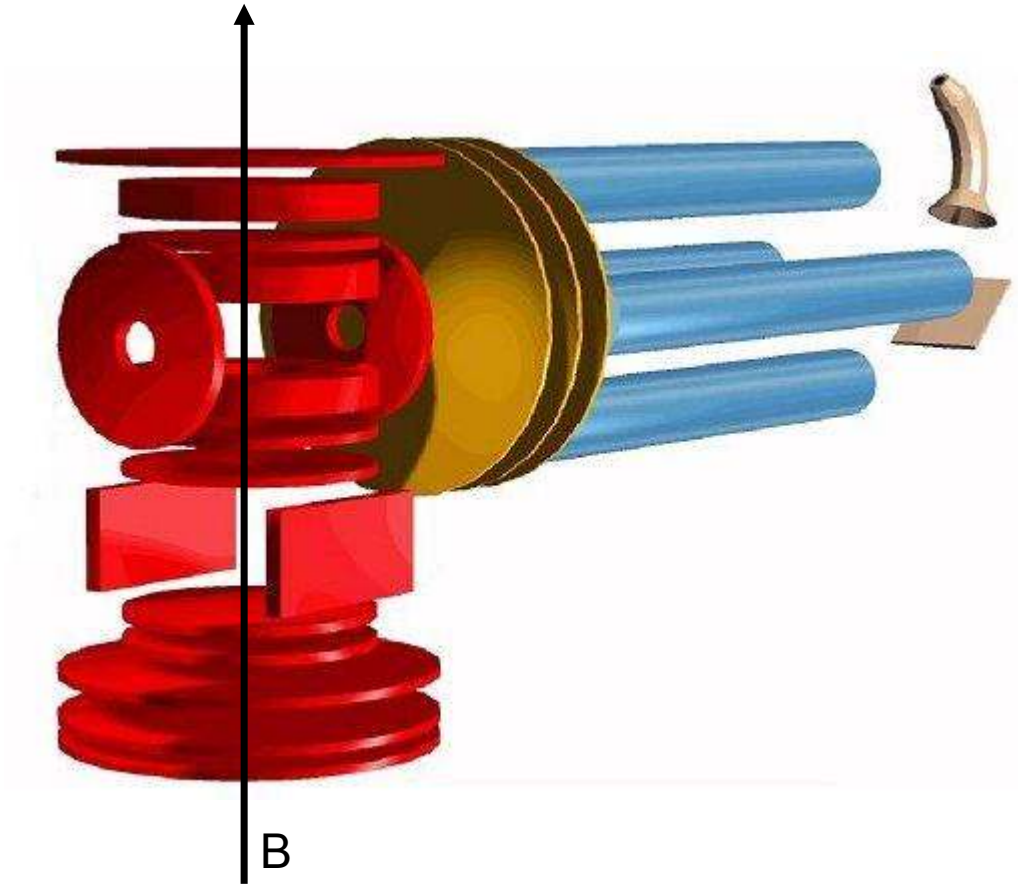

$C_2H_6 + e^-$
H^+ Measurement
H^+ Fit
Ion yield (kHz)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
-20
0
20
40
60
80
Z-voltage

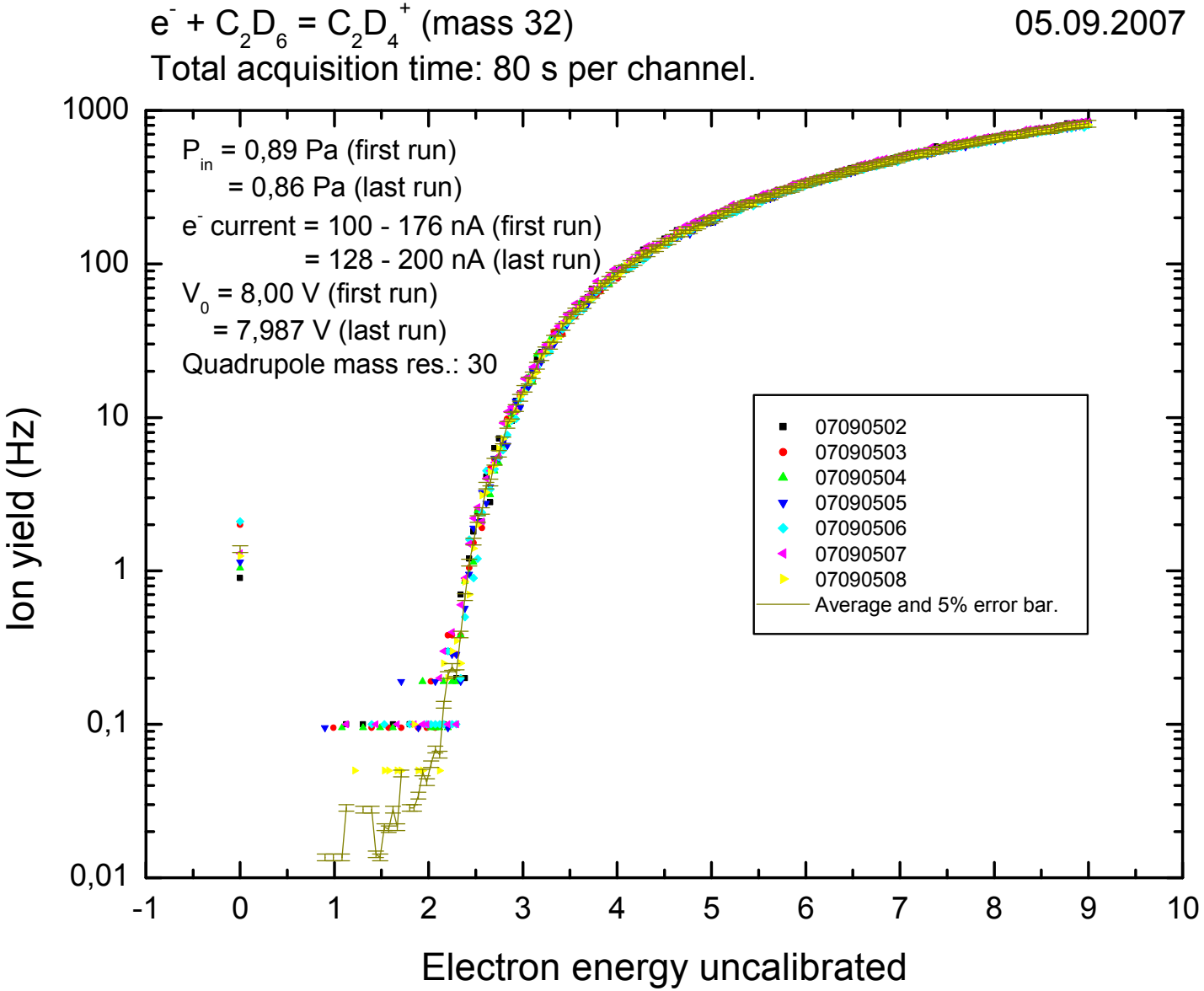
Example C_2H_2+e → CH_2^+



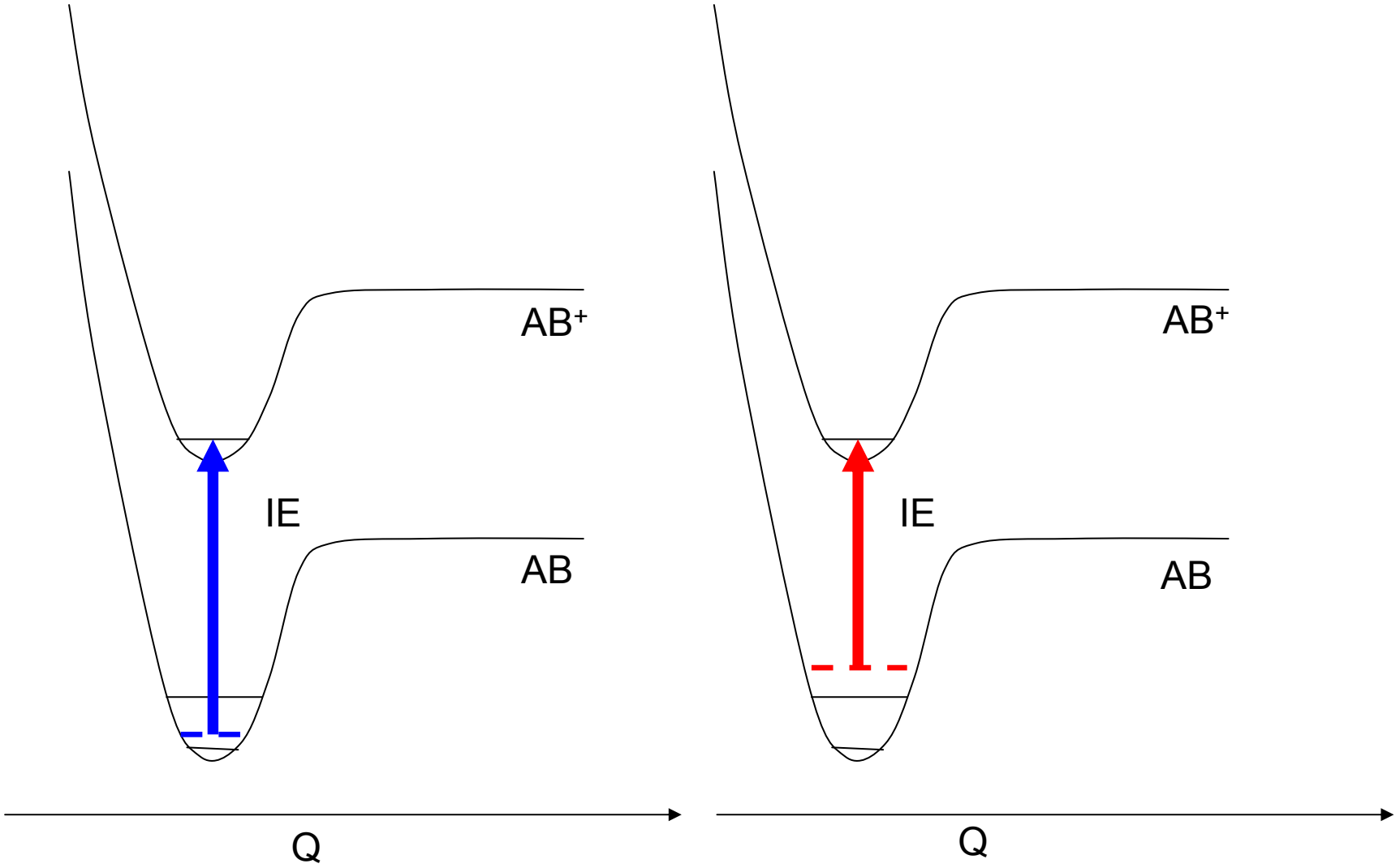
At 100 eV → 2/3 of the CH_2^+ molecules have a kinetic energy of more than 0.5eV, whereas at 30 eV just the opposite.
Blue curve from highly excited
Or doubly charged parent ions

High energy resolution:




e- + C2D6 = C2D4+ (mass 32)
05.09.2007
Total acquisition time: 80 s per channel.
Pin = 0,89 Pa (first run)
= 0,86 Pa (last run)
e- current = 100 - 176 nA (first run)
= 128 - 200 nA (last run)
V0 = 8,00 V (first run)
= 7,987 V (last run)
Quadrupole mass res.: 30
07090502
07090503
07090504
07090505
07090506
07090507
07090508
Average and 5% error bar.
Ion yield (Hz)
1000
100
10
1
0,1
0,01
-1
0
1
2
3
4
5
6
7
8
9
10
Electron energy uncalibrated

Temperature effects?



Conclusion

- Different apparatuses are used together to obtain more comprehensive data;
- Hydrocarbons as well as some isotope-substitute equivalents are being studied;
- Any special data request?

Thank you!