<u>Scientific report of the STSM of Bruno Manil at KVI (Groningen) on the following subject:</u> Study of the fragmentation processes of multiply charged adenosine-5'-monophosphate (AMP)

The usual technique to study theses fundamental processes involved in interactions of keV ions with small DNA bluiding blocks are collisions studies on e.g. gas phase nucleobases[1] [1, 3]. More complex systems were not accessible in gas phase collisions by this method, since they are subject to fragmentation upon thermal evaporation. Using an electrospray ionization (ESI) system, we have recently performed collision induced dissociation (CID) experiments on a gas phase protonated nucleotides: adenosine-5'-monophosphate anion (AMP^-)[2]. However, the CID technique mainly induces fragmentation of weakly bound components in larger macromolecular systems.

To extend information obtained by this technique, the advantages of using slow multiply charged ions as a tool of excitation compared to photons, electrons and neutral atoms, are based on the ultra-short interaction time (fs), the variable potential energy (several eV to keV) and the kinetic energy (keV to hundreds of keV) carried by the projectiles. The immediate ionisation of the target can be achieved by the dominant electron capture mechanism. A substantial amount of kinetic energy of the projectile, from several eV to several 100 eV, can be transferred to the internal degrees of freedom of the target leading to a large variety of fragmentation channels.

One of the innovative contributions of this project is to combine, for the first time, the technologies of highly charged ions from ECR ion source and the ESI source, which are now both accessible at the KVI infrastructure. In the experimental set-up, the molecules are than stored in an RF trap and subsequently irradiated with ions extracted from the beam line. Fragmentation is studied by means of time-of-flight spectrometry of the ions extracted from the RF-trap.

During the first day of my mission at Groningen, which corresponds to the starting of the experiment, we tested several dilutions of the biomolecules in the solution used in the ESI source, with the aim to optimize the intensity of the biomolecular ion beam. Later on, the different trapping parameters have been determined in order i) to obtain a maximum number of trapped primary molecular ions and ii) to find the best timing and synchronizing (with the atomic ion beam) parameters for the observation of the fragmentation processes. Finally, first fragmentation spectra of the AMP and adenosine (used to interpret more easily the fragmentation AMP pattern) have been measured and doubly charged fragments could be observed.

The problem of the background subtraction must be still clarified. Futures experiments will be planned with this aim.

Caen, the 12th October 2007,

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[1] de Vries et al., Eur. Phys. J. D **24** (2003) 161; de Vries *et al.*, J. Phys. B **35** (2002) 4373 ;J. Coupier et *al.*, Eur.Phys. J. D **20** (2004) 459; B. Manil et *al.*, NIM B **205** (2003) 666

[2] Liu et *al.*, Phys. Rev. Lett. **97** (2006) 133401