

Prereport for

CH-3405

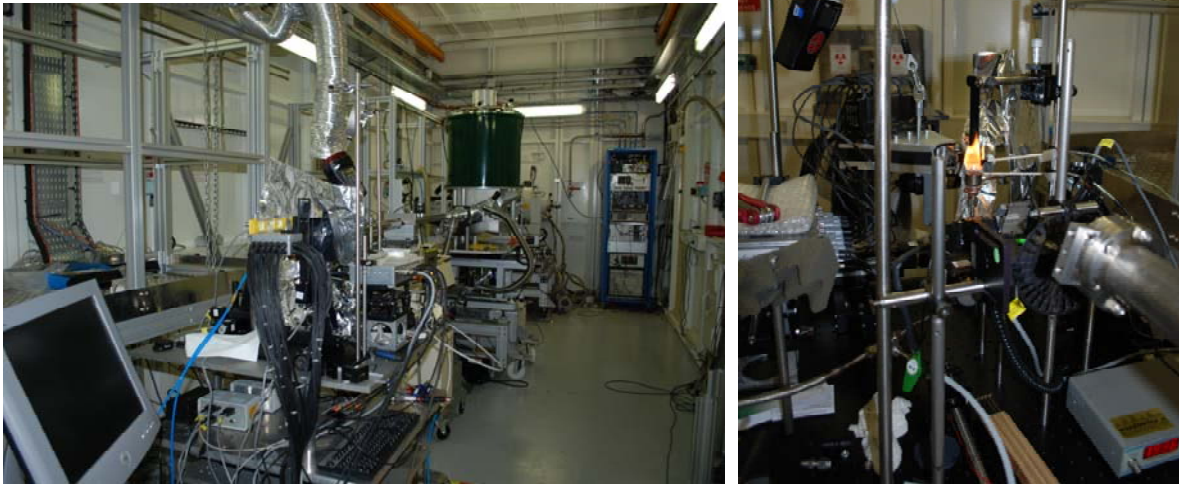
**“Size and structures of nanoparticles and soot precursors generated in gas-phase reactive systems:  
Structural dynamics sensing of small species through SAXS and WAXS”**

**Experiment days: November 30 –December 05, 2011**

**Beamline: ID-12, Beamline manager Dr. Fabrice Wilhelm**

**Experimenters: Frederik Ossler, Linda Vallengag, Division of Combustion Physics, Lund University,  
Sweden.**

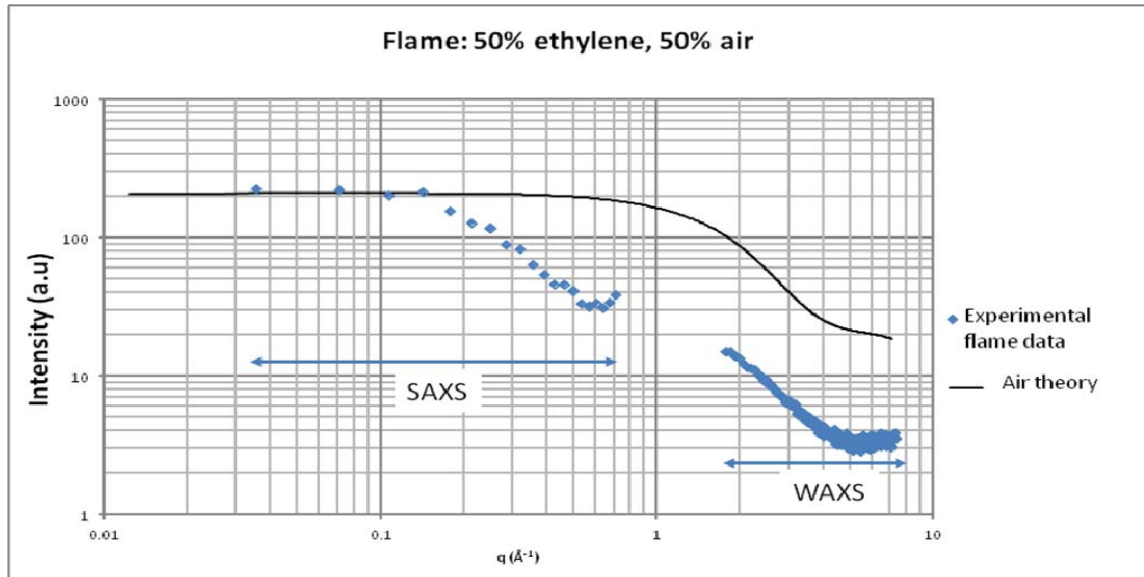
The experimental set-up including burner and detectors were brought from Lund and installed at the beamline ID-12 for the experiments. **Figure 1** shows the installed set-up. The time required for installing and adjusting the set-up according to the beamline settings was between 2 and 3 days.



**Fig.1:** Pictures of the experimental set-up including WAXS+SAXS detectors and a flame.

The absolute photon flux from ID-12 was calibrated for vertical polarization at the point of measurements. The fluxes were  $4.7 \times 10^{11}$  photons  $s^{-1}$  and  $2.2 \times 10^{11}$  photons  $s^{-1}$ , at respectively 7 keV and 8 keV photon energies. Experiments were mostly performed using vertically polarized X-ray radiation. For comparison measurements were also performed with horizontally polarized radiation.

Measurements were performed on different types of flames, including sooting ones. The results show that the system was working well. The data is being analyzed in detail and an extended report will be delivered in the future. **Figure 2** shows scattering data recorded from a non-sooting flame, where particle concentrations were low.



**Fig.2:** The blue symbols represent measured scattering intensities from a non-sooting flame using the combined SAXS and WAXS detections system. The WAXS detector was scanned between  $50^\circ$  and  $110^\circ$ . The black line shows the theoretical scattering intensity from air for comparison. The polarization of the X-ray beam was vertical.

It is very important to note that in the coming experiments the detection will be complemented with a new detector part that will cover the gap between SAXS and WAXS ( $0.7 \text{ \AA}^{-1} < q < 2 \text{ \AA}^{-1}$ ) seen in Fig.2. This will give us very important input on the dynamics of nanoparticles and molecules in the size range around 1 nanometer.

Concluding this pre-report we want to stress the very positive outcome of the campaign: The first sets of experiments were successfully made for vertically polarized radiation on flames. The polarization and photon flux were excellent as well as the general performance of the beamline and the technical support. The results are very encouraging for a continuation and developments of flame-based experiments at the beamline ID-12.

Lund, February 29, 2012

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