

SQS XFEL Workshop Aarhus October 29-31, 2008
Report from Working group I: Gas Phase instrumentation

Local Organizers:

Hendrik B. Pedersen and Lutz Lammrich,
Department of Physics and Astronomy

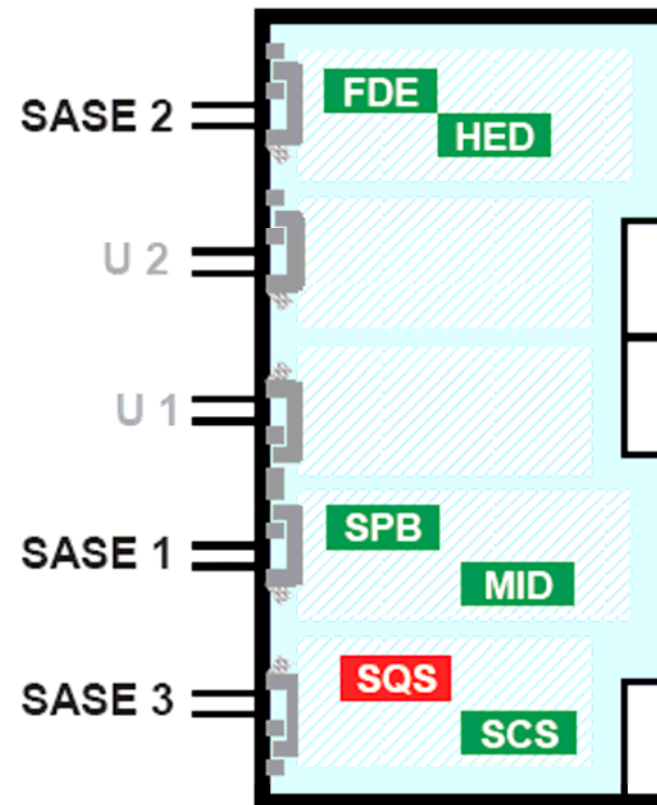


Plenary talks

	SESSION I: X-ray FELs and Small Quantum Systems	
14.45-15.15	Thomas Tschentscher Status of the European XFEL and plans for a SQS instrument	
15.15-15.45	John Bozek AMO Science at the LCLS - Instrumentation and First Experiments	
15.45-16.15	Coffee/Tea	
	SESSION II: Gas phase experiments	
16.15-16.45	Thomas Möller Ultrafast processes of clusters in intense X-ray beams	
16.45-17.15	Robert Moshhammer Atomic and molecular fragmentation in intense XUV laser fields	
17.15-17.45	Michael Meyer Pump-probe experiments in the XFEL regime	
17.45-18.15	Henrik Stapelfeldt Laser aligned molecules as sample holders for FEL experiments	
18.15-18.45	Daniel Rolles Multi-particle correlation measurements on atoms, molecules and nanoparticles	
18.45-19.15	Kyoshi Ueda Atomic, molecular and cluster science using X-ray FELs	
19.30-	Buffet dinner	
		SESSION III: Experiments with ion beams
	09.00-09.30	Stefan Schippers Photon-Ion experiment with hard X-rays: From PETRA III to the XFEL (Merged-beam technologies)
	09.30-10.00	Andreas Wolf Photon induced fragmentation in molecular systems studied with fast beam imaging
	10.00-10.30	Mats Larsson Experiments with stored ion beams
	10.30-11.00	Coffee/Tea
		SESSION IV: Experiments with trapped particles
	11.00-11.30	José R. Crespo López-Urrutia Soft x-ray laser spectroscopy
	11.30-12.00	Alexander Dorn Tracing ultra-fast many-electron processes in the super-brilliant light of the XFEL via high-resolution MOTRIMS
	12.00-12.30	Todd Ditmire Strongly coupled ion plasmas probed with the XFEL
	12.30-13.30	Lunch

Location of the SQS instrument

Source	Photon beam line characteristics
SASE 1	FEL radiation ~12 keV High coherence Spontaneous radiation (3 rd , 5 th harmonics)
SASE 2	FEL radiation 3-12 keV High time-resolution Spontaneous radiation (3 rd , 5 th harmonics)
SASE 3	FEL radiation 0.25 – 3 keV; High flux FEL radiation 0.25 – 3 keV; High resolution



Working Group I: Gas Phase Instrumentation

Session I - Experimental techniques I
Thursday 14.00 – 15.30

14.00 Introduction

Th. Möller / M. Meyer

14.10 Experiments on Nano-Particles

E. Rühl

14.30 X-ray Femtochemistry on small molecular systems

T. Laarmann

14.50 Studies on Clusters

T. Ditmire

15.10 X-Ray Fluorescence

D. Rolles

Session II - Experimental techniques II

16.00 Time-resolved Pump-Probe experiments

J. Costello

16.20 Non-linear Processes in the X-ray regime

J. Marangos

16.40 Molecular Alignment and Orientation

H. Stapelfeldt

17.00 Velocity Map Imaging

M. Vrakking

17:20 Coltrims

R. Moshhammer

Report Working group I

[*www.phys.au.dk/SQS-workshop-xfel/WGI_report.pdf*](http://www.phys.au.dk/SQS-workshop-xfel/WGI_report.pdf)

**Summary of Working Group I: "Gas Phase Instrumentation"
at the International Workshop on Science with and Instrumentation for Small Quantum
Systems at the European XFEL**

The "First International Workshop on Science with and Instrumentation for Small Quantum Systems at the European XFEL" was held in Aarhus (Denmark) from October 29th to 31st, 2008. After several plenary talks giving an introduction into the field, the details were discussed in two working groups with the aim to determine the requirements for future experiments at the European XFEL and to define the instrumentation for the SQS (Small Quantum Systems) endstation. Working Group I, coordinated by M. Meyer (Orsay) and Th. Möller (Berlin), was dedicated to techniques and instrumentations for experiments on neutral gas phase targets.

The discussion started with several short presentations covering the broad range of scientific interest of the community and summarizing the present state-of-the-art as well as the future needs for particular studies. The following topics were treated in detail:

- Experiment on nano-particles (E. Rühl, Berlin)

Summary :

Gasphase Instrumentation

- define **one** versatile instrument
- open beam port for special instruments
- energy range 250 eV- 2500 eV
important K-edges: C, N, O, Ne, S, Ar?
- requirements X-ray beam
 - repetition rate as high as possible
 - variable polarization

Issues

Requirements

- focusing optics sub micron focus
- detectors: high resolution tof, VMI, COLTRIMS, 2D-photon pixel detector, Thomson parabola
- lasers (pulse energy, pulse length fs, ps)
 - pump probe, alignment
 - x-ray pump x-ray probe
- vacuum requirements $<10^{-9}$ mbar, diagnostics (x-rays), diagnostics (lasers)...

Definition of an instrument

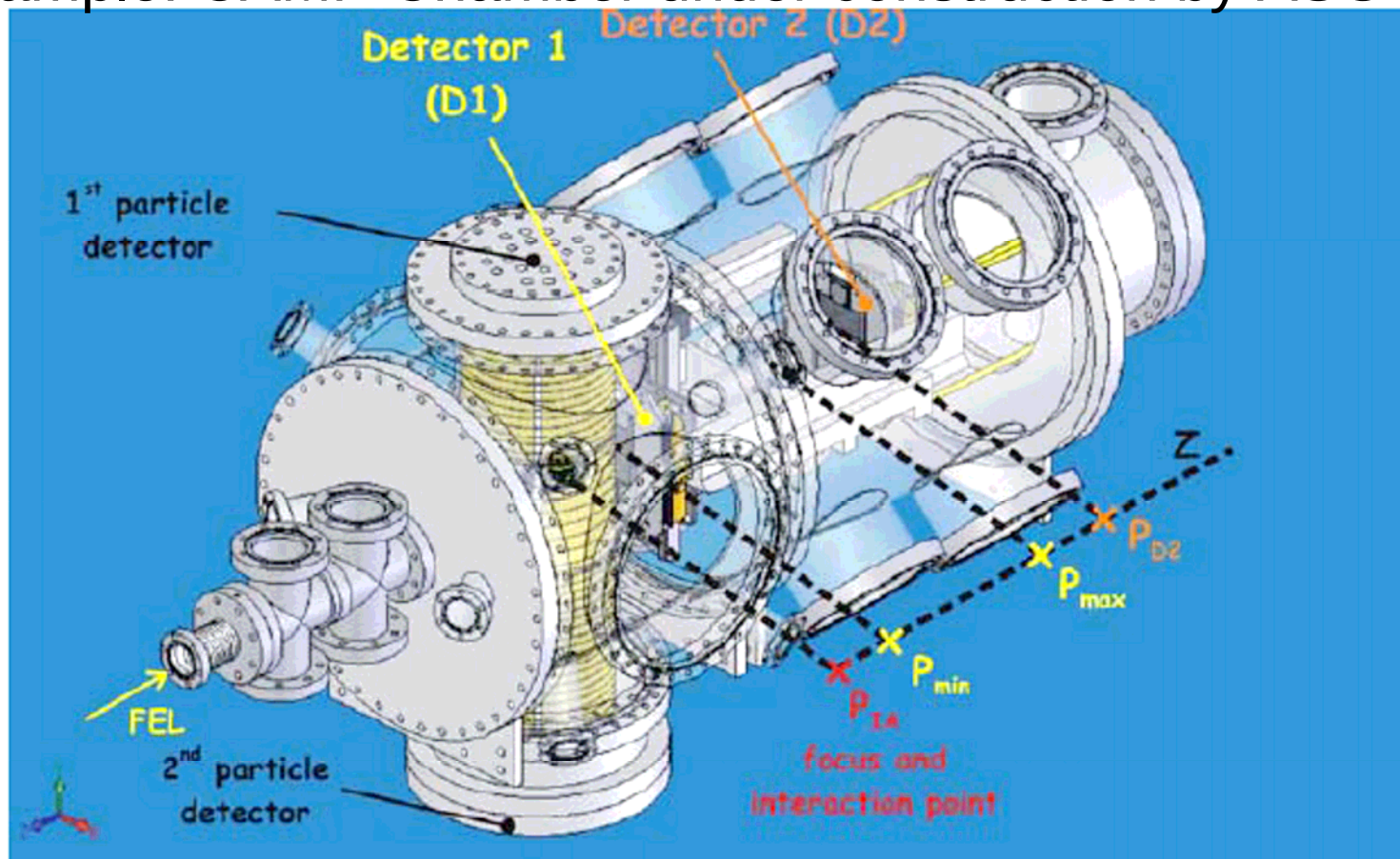
Discussion/working groups

- targets/sample: gas jets, electrospray...
- lasers
- detectors/chamber

Flexible experimental chamber

Modular Design:

Example: CAMP Chamber under construction by ASG MPG



To be discussed in detail

- **Laser installations for alignment and pump-probe**
 - Adiabatic alignment would be
Temporal width of 100 ps to a few ns,
Pulse energies of some mJ in order to get intensities of more than 10^{11} W/cm²
 - Non-adiabatic (dynamical) alignment would be
Temporal width of some 10 fs to some 100 fs,
Pulse energies of some mJ to get intensities of more than 10^{13} W/cm²
- **Target preparation: gas jets, cluster sources, electrospray etc.,**
- **Definition of the particle detectors, specification of the pixel detector and of the chamber for the fixed endstation**
- **monochromator ?**