Working Meeting on Science with and the Instrumentation for Small Quantum Systems at the European XFEL

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First Outcome of SQS-Workshop

Aarhus, Oct 29-31, 2008

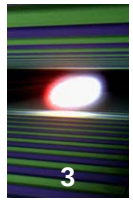
SQS – Small Quantum Systems –

Investigation of atoms, ions, molecules and clusters in intense fields and non-linear phenomena

- General Organization at SASE 3
- Specific Equipment for SQS Instrument

- Present situation
- Points of discussion
- Further Actions
- Next Deadlines

SASE3 Characteristics

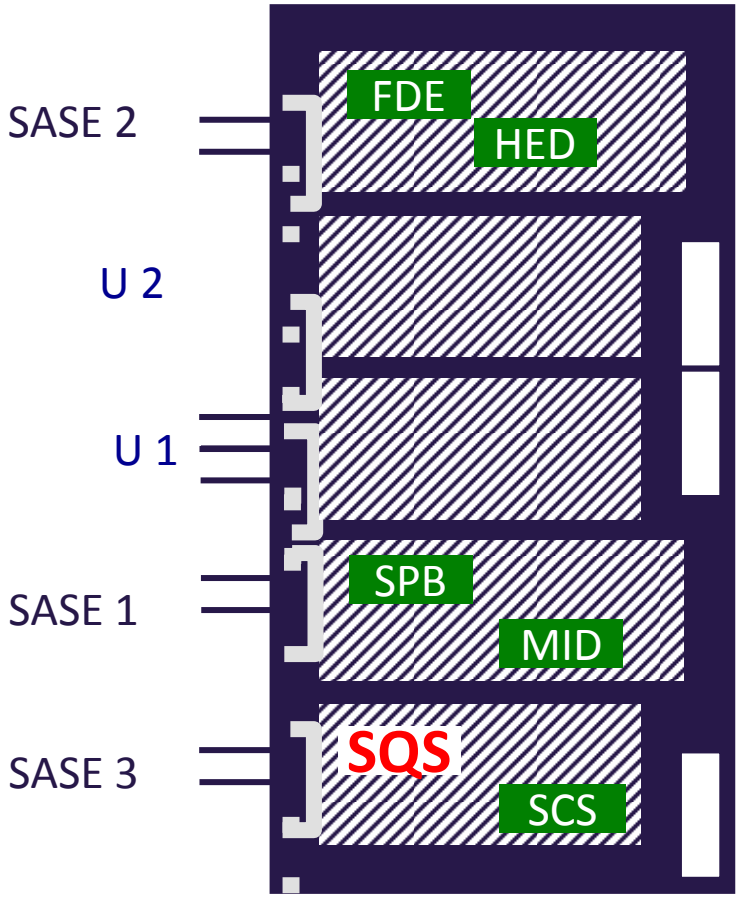


SASE 3 **planar device for linear polarization**

- designed for tunability range ~4
  - ⇒ 0.775 – 3.1 keV @ 17.5 GeV
  - ⇒ 0.250 – 1.0 keV @ 10 GeV
- 'conventional device'
  - ⇒ **higher reliability for commissioning & operation**
- magnetic length 105 m, saturation (3.1 keV, 19 mm) ~88 m
- R&D on possible upgrade scenarios has started

Distribution of First Instruments

Source	Photon beam line characeristics
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



General Organization of SASE3

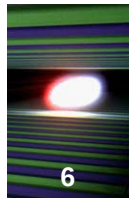
Possibility of beam distribution in 2 branches

- High flux beamline
- High resolution beamline

Points of discussion

- Flexible endstation
- Sharing with SCS (Workshop Villigen, June 2–4, 2009)
- Need of high resolution ($\Delta E / E > 1000$)
- Space redistribution at and around SQS

SQS Instrument



General equipment provided by XFEL

- Pump-Probe Laser

TDR: 1. high rep.rate, low pulse energy:

<50 fs, 0.1-3 mJ; >100 kHz, (pref. 1 - 5 MHz)

2. low rep.rate, high pulse energy:

<=30 fs, 1 mJ - 10 J,10 Hz

- Beam diagnostics

pulse energy, timing, spectral distribution etc.

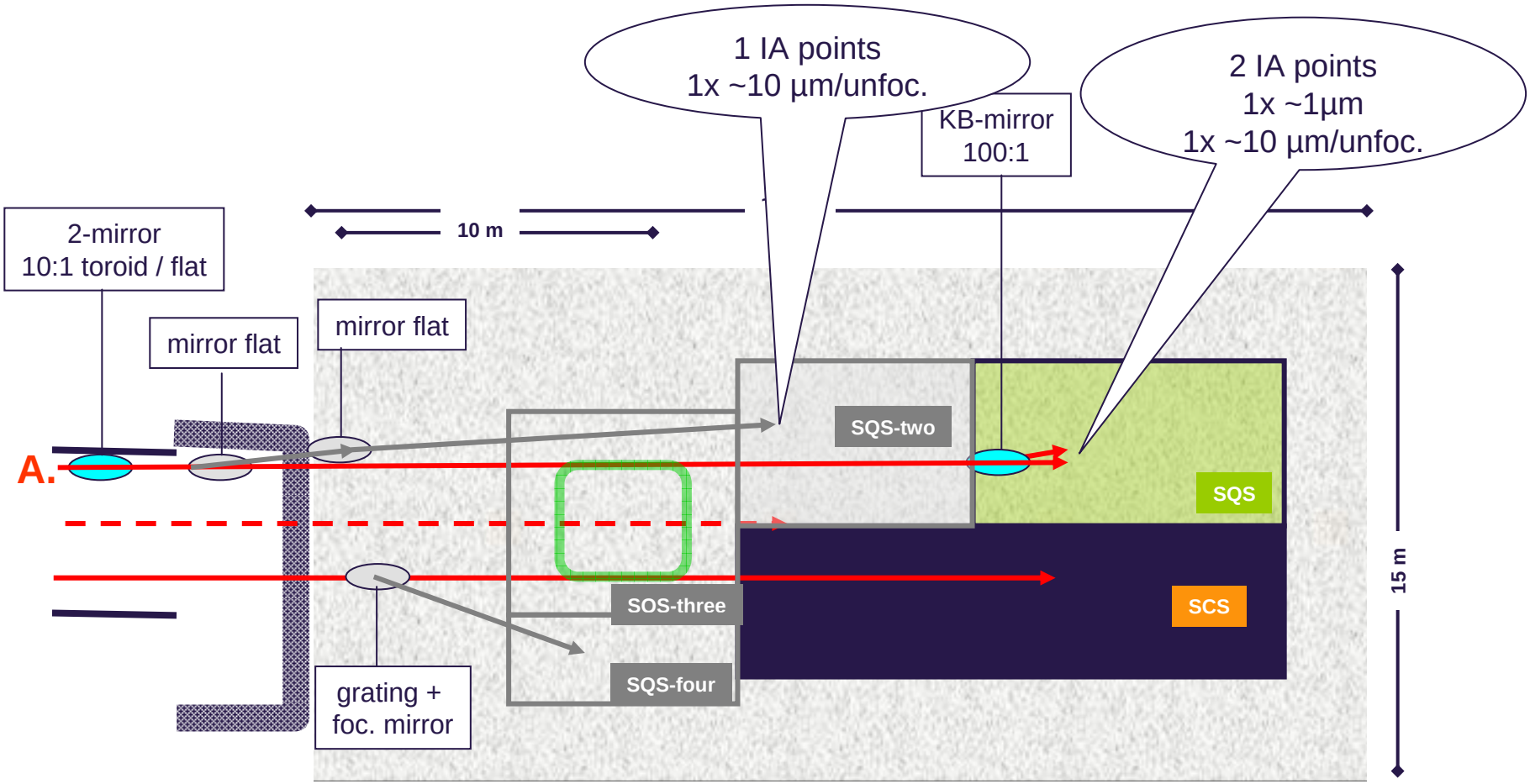
detailed definition of requirements

- Endstation for gas phase experiments

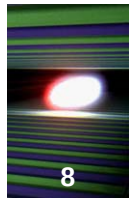
versatile chamber for « standard » experiments

- high-resolution TOF, VMI, COLTRIMS, Thomson parabola
- 2D-photon pixel detector (to be discussed)

Possible layout instruments at SASE 3



SASE3 Instruments



- SQS — 1 hutch, 2 focal points (~1 µm + 10 µm/unfocussed), toroid+flat mirror, fs laser

- all following optional depending on funding:

- SQS-two — 1 hutch, 1 focal point (10 µm/unfocussed), 2 additional flat mirrors, take-off from SQS ~20-40 mrad → ~ 30-60 cm !!!!, option for roll-on user instruments (no perm. instrument)
- SQS-three — 1 hutch, no focussed beam, ion storage ring (~4x4 m^2), inter-section with high intensity and mono. beam (if possible)
- SQS-four — 1 hutch, focussed, monochromatic beam for traps

SASE3 Instruments

Specific equipment provided by users

- Refocusing mirror (< 1 μm)
- Ion traps, ion storage ring
- Target handling

Points of discussion

- Detailed identification of specific needs:
  - mirror
  - targets (molec. jet, cluster, electrospray etc.)
- Integration of ion storage ring

→ Organization of SQS
Space requirements
Funding

SASE3 Instruments

Specific equipment: Laser systems

1) **Alignment Laser**

- adiabatic alignment

  1-10ns, >10mJ, > 100 kHz (burst mode)

- non-adiabatic alignment

  10-100fs, 1-10 mJ, > 100 kHz

2) **High-resolution laser**

→ Definition of characteristics
Funding
Space requirements / Installation

Program

14:00 – 14:05	Introduction	(XFEL Project Team)
14:05 – 14:25	Presentation of the final report	(WG1)
14:25 – 14:45	Presentation of the final report	(WG2)
14:45 – 15:00	Basic concept of the SQS instrument	(XFEL Project Team)
15:00 – 15:20	Coffee break	
15:20 – 15:45	"High repetition rate pulse-train lasers synchronized to XFEL"	(Ingo Will, MBI Berlin)
15:45 – 17:00	General discussion of the SQS concept, sample environment requirements, equipment provided by the users, possibilities of extra funding, etc.	
17:00 – 17:10	Conclusions, information	