

EC Contract ERBFMGECT980102

"Development of a Combined Synchrotron Radiation and VUV Free-Electron Laser Facility"

Notes of an Informal Project Meeting, held at Williamsburg, USA, on the 19th August 1998.

Present -

Sincrotrone Trieste:	M. Marsi (MM), R.P. Walker (RPW)
CEA:	M.E. Couprie (MEC), L. Nahon, D. Nutarelli
CLRC Daresbury:	M.W. Poole (MWP)
Univ. Dortmund:	H. Quick, K. Wille
ENEA Frascati:	L. Giannessi

1. LAYOUT

RPW presented the latest optical cavity layout showing that with a suitable shielding wall modification it is possible to accommodate the 32.4 m cavity with both mirror chambers outside the shielding wall and also that : i/ the mirror chambers can be identical, and ii/ there is sufficient space for additional chambers both upstream and downstream for a future etalon and Brewster plate. The mirror to undulator centre distances then become 17.7 m (upstream mirror) and 14.7 m (downstream). This arrangement was accepted.

2. FRONT-END

RPW said that in order to shield the vacuum chambers and other front-end components from being hit by synchrotron radiation there must be an upstream mask. Allowing for construction and alignment tolerances would then reduce the effective aperture at the critical point (11.27 m from the undulator centre) to 36 mm, instead of the 39 mm mentioned at the 2nd Project Meeting. Accepting this value means that an existing shutter, stopper and valve can be used, otherwise these elements would have to be re-designed and built so risking a significant delay to the programme. With a Rayleigh length of 4 m, as previously chosen, the (aperture/w) at that point becomes 18.0. MWP suggested moving the front-end elements upstream. RPW replied that the space was reserved for possible future beamline photon beam monitors, and MM pointed out that even this modification would require a significant amount of time, as compared with using the existing frame. It was agreed to accept the aperture defined above i.e. an acceptance of 3.2 mrad.

3. OPTICAL CAVITY PARAMETERS

The optimization of the cavity parameters was discussed. MEC said that she would prefer not to change too often the mirror radii, since they are non-standard values and it will take time to get the quality of substrate required. Although orders should be placed soon, it was agreed that the decision on mirror radii was not so urgent, and that it would be discussed further at the next meeting (see below). In the meantime MEC agreed to proceed with the request for offers on the basis of the nominal 19 m and 16 m radii.

4. MIRROR HEATING

RPW presented results of calculations showing that the integrated synchrotron radiation power on the downstream mirror is 0.6 W at 350 nm and 4.1 W at 200 nm (1 GeV, 100 mA). However, integrating over the aperture defined by the mask, 47 mm, instead of the mirror diameter of 40 mm, these numbers increase to 1.4 W and 12.2 W respectively, showing that the power increases rapidly with increasing distance off-axis. MEC said that this confirms the need for a sapphire substrate rather than silica. RPW pointed out the difficulty in using the double-slits to shield the mirrors because of the square geometry and the relative distance between them. It was agreed that a shield directly in front of the mirror to protect the edges of the mirror would be ideal, but that this would have to be integrated with the holder since the mirrors are moveable over a distance of ± 5 mm. The need for water cooling of the support plate was discussed. MWP said that since the plate is moveable this might be difficult but he agreed to consider this and to report at the next meeting. Even without water cooling, the need for a good thermal contact

between the shield and the support plate was considered essential. MEC said that In/Ga will be tested soon at SuperACO and she also proposed that the new mirror support should be tested at SuperACO.

5. MIRROR MOTIONS

RPW noted that according to the table presented at the last Project Meeting the X and Y motions of the mirrors were not the same. He said that according to his calculations a repeatability of 0.1 μ rad and 2 μ m was acceptable for both X and Y, but he also questioned how a 2 μ m repeatability could be achieved with the indicated 2.5 μ m resolution. MWP agreed to circulate a revised table as soon as possible.

6. UNDULATOR PARAMETERS

RPW said that he did not yet have all of the relevant data to allow a choice of block sizes for the FEL undulator to be made. He agreed to send a brief note with the relevant parameters as soon as possible to enable a final decision to be made.

7. FEL PAPER

The draft paper to be submitted to the FEL Conference was discussed. Although there were some reservations it was agreed to present the paper for the refereed part. RPW will distribute a final draft for comments before submission.

8. NEXT MEETING

MEC suggested that the next Project Meeting should allow a full 2 days for discussions, however no suitable date could be found before mid November. In view of the urgency to discuss various items connected with the mirror chambers, including the thermal problems, it was agreed to hold a separate 1-day meeting dedicated to this topic. The 1st of October was suggested, at LURE. MWP agreed to confirm the availability of N. Bliss before a final decision is made. A possible date/location for the next Project Meeting could be at Trieste in connection with the accelerator physics period that will be dedicated to FEL mode tests, either the 19th/20th November or the 30th November/1st December. RPW agreed to check on the streak-camera installation programme and to keep everyone informed of developments.

SUMMARY OF MAIN DECISIONS:

- accept 32.4 m cavity layout
- accept existing front-end elements and effective 3.2 mrad aperture

SUMMARY OF MAIN ACTIONS ARISING FROM THIS MEETING:

before the next meeting :

- confirm availability for a meeting on the 1st October (CLRC)
- revise table of mirrors motions (CLRC)
- report on choice of undulator block dimensions (ST)

for discussion at the next meeting :

- consider cooling of mirror support (CLRC)
- consider methods of attaching and shielding the mirrors (ALL)
- consider choice of Rayleigh length (ALL)

R.P. Walker, Trieste, 24th August, 1998