THE MAX IV FACILITY

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Abstract

The MAX IV facility is a planned successor of the existing MAX facility. The planned facility is described below. It consists of two new synchrotron storage rings operated at different electron energies to cover a broad spectral region and one linac injector. The linac injector is also meant to be operated as a FEL electron source. The two rings have similar low emittance lattices and are placed on top of each other to save space. A third UV light source, MAX III, is planned to be transferred to the new facility.

INTRODUCTION

The user profile at MAX-lab calls for a broad spectral range to be covered by the synchrotron radiation sources. The MAX III ring [1], presently under construction, will cover the low photon energy part. Two similar rings, placed on top of each other, will cover the soft X-ray region and the X-ray region respectively. The spectral region ranges from some 5 eV up to 30 keV with undulator radiation. The two latter rings have the same magnet lattices [2], and all rings use the same injector. A total of 28 straight sections for high brilliance insertion devices operating at different electron energies can thus be offered in this way. The additional cost for multiple rings in terms of buildings and injectors is marginal.

As the full energy injector a warm S-band SLEDed linac is chosen to allow for topping up injection. A synchrotron could naturally make the work as well, but the linac can also work as the electron source for coherent radiators.

The MAX IV facility can not be housed at the existing MAX laboratory. The new facility has to go to another site. The idea is to operate the existing and new facilities partly in parallel for some time before the present MAX-lab can be closed and MAX III transferred to the new facility.

STORAGE RINGS

The MAX III lattice has been described in some detail in ref. [1] and the lattice of the two other rings in ref. [2]. All three rings utilizes the magnet technology introduced at the MAX III ring where all magnets are machined out from solid iron blocks, which also work as girders. This magnet technology makes the construction of several rings economically feasible.

A small emittance lattice is calling for a large number of magnet cells and strong focussing magnets. This is in this case achieved by a small magnet bore radius of 1 cm and integrated magnet functions in the same items. The lattice functions are given in fig. 1 and the most important parameter values in table 1.

The X-ray ring will in the first phase be equipped with two superconducting, multipole wigglers [3] and four superconducting undulators. These insertion devices will have quite a pronounced impact on the emittance of the ring. This emittance is presented in the table below with the emittance for the naked lattice within brackets.

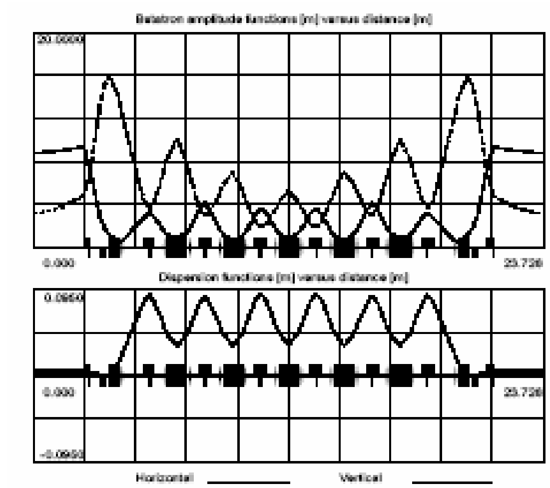

Figure 1: Machine functions for the MAX IV rings.

Table 1. MAX IV rings

	Hard X-ray	Soft X-ray
Energy (GeV)	3	1.5
Current (A)	0.5	0.5
Emittance (nm rad)	0.8 (1.2)	0.3
Circumference (m)	287	287
Nr of supercells	12	12
Length of straights (m)	4.6	4.6
RF (MHz)	100	100

The 100 MHz RF systems now being introduced at MAX II and MAX III [4] will prototype the systems for the soft and hard X-ray rings. These systems, consisting of commercial RF transmitters and pretty simple cavities seem to offer a highly modular and economic solution.

The soft and hard X-ray rings will be prepared for superconducting, small gap undulators. This is done by the introduction of soft ends of the dipoles flanking the straight sections yielding a reduced heat load in the cold bores of the undulators.

The performance of the light sources is presented in fig. 2.

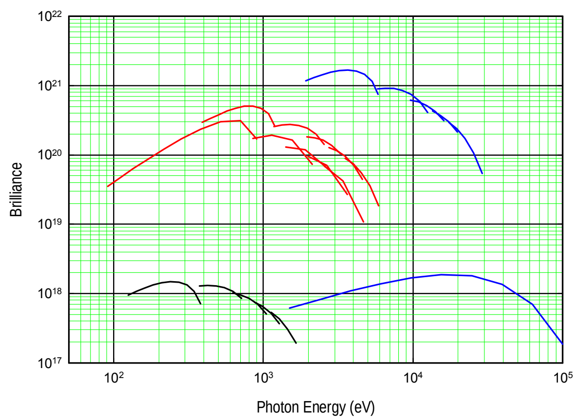

Fig. 2. Brilliance curves for the MAX IV rings.
Blue curves: MAX IV X-ray ring
Red curves: MAX IV soft X-ray ring
Black curves: MAX II ring

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COHERENT RADIATION

A similar linac system as used for the MAX-injector [5] can be used for the linac injector. One klystron station equipped with SLED cavities will then feed two 5 m long linac sections. The total energy gain per unit will then be 200 MeV so a total number of 17 units is foreseen to allow for some energy margin.

The exact type of coherent radiation source is not yet decided on. We are today facing several promising candidates for coherent radiation production like SASE (including self-seeding) and Cascaded Seeded High Gain Harmonic Generation to mention a few. So far, the idea is to incorporate the necessary infrastructure in terms of accelerators and experimental halls in the present MAX IV design.

ACKNOWLEDGEMENTS

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