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Solaris as a new class of low energy and high brightness light source

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In the light sources the main figure of merit for users is a high brightness of the synchrotron radiation. However, the brightness strongly depends on the horizontal and vertical emittance of the circulating electron beam in a storage ring. Over decades the lattice design of the storage rings has evolved and the natural emittance has been significantly reduced up to few nanometers. Recently the new generation of diffraction limited light sources has been considered [1-7] and designed [8-11] allowing for further reduction of the emittance up to picometers. One of such an example is the MAX IV 3.0 GeV storage ring in Lund, Sweden [4,8], that is now under commissioning. The concept of diffraction limited lattice design uses the multi bend achromat (MBA) cells, since the natural emittance decreases with the increase of dipole magnets number to the third power. Other way to achieve the natural emittance reduction is to increase damping partition number. This can be achieved by designing combined function magnets with strong focusing.

Solaris, which is a replica of the MAX IV 1.5 GeV storage ring, although is not using the MBA lattice, has many of the technological innovative concepts used for ultra-low emittance storage rings. As such, Solaris uses a single solid iron block containing all the multipole magnets of the double bend achromat [12]. The iron block has accurately machined pole profiles of the gradient bending magnets, the quadrupole/sextuple magnets and multipole corrector elements. The magnet is its own girder allowing for very fast and smooth installation. The use of small magnet gaps brings the benefit of high fields but requires vacuum chambers of high mechanical accuracy and distributed pumping. Recently, Solaris light source was constructed in Krakow, Poland and the commissioning of the storage ring has started in May 2015 [13,14]. After 2 weeks of optimisation the first light at the bending magnet beamline front end was observed. After 7 months of commissioning good performance of Solaris synchrotron has been achieved. The injection to the storage ring occurs at 525 MeV and the beam is ramped up to the final energy of 1.5 GeV. The optics has been corrected close to the design one. Solaris is operating at the working point of (11.22, 3.15) and the corrected chromaticity of (+0.89, +0.9). The stored electron current in the storage ring is increasing (Fig1). Recently, 511 mA of current was possible to store at the injection energy.

The vacuum system of storage ring is still under conditioning. After 28 Ah of beam cleaning the lifetime at 100 mA is 3h. In April 2016 the UARPES undulator has been tested and put into operation, which required some optics adjustment. The UARPES beamline commissioning has started. Within this presentation the current status of Solaris facility and the commissioning results will be presented.

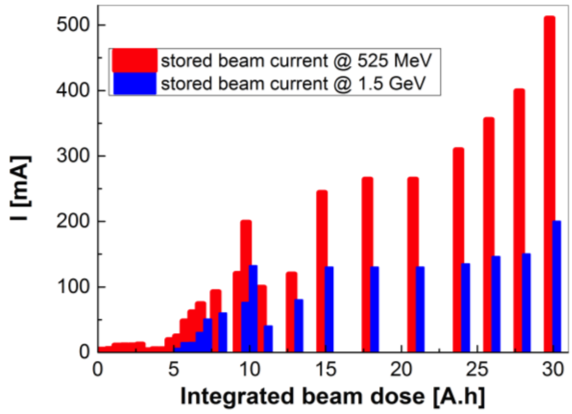

Figure 1. The stored beam current vs. integrated beam dose.

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