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Current status of the DBA blocks alignment in the 1.5 GeV storage ring at Solaris

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National Radiation Center Solaris is the first synchrotron in Poland, located in Cracow. The facility is basing on the Swedish concept, designed by the MAX IV Laboratory [1,2], whereas Solaris storage ring is a replica of MAX IV 1.5GeV storage ring. The "heart" of the synchrotron comprises twelve integrated Double Bend Achromat magnets. A single achromat magnet is a novel design that merges sets of several smaller magnets, which constitute a magnetic lattice unit cell, closed in one block (see Fig.1). On one hand, this solution eases the installation of the storage ring, but on the other hand causes new problems unknown so far in the synchrotron technologies. This publication presents and focuses on one of the most important case – the survey of the storage ring components, focusing mostly on the DBA magnets. Their proper position [4] is extremely important, in order to get the most appropriate parameters of the electron beam and throughout this, the best parameters for the photon beam.

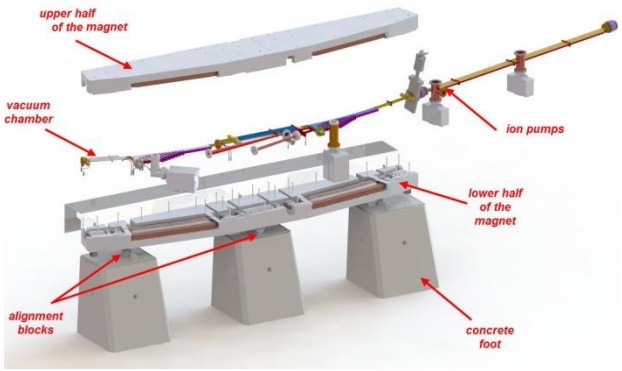

Figure 1. Double Bend Achromat Magnet (DBA) layout.

The Solaris storage ring alignment was a complexed procedure that has been divided into 3 steps: the survey of the building, rough and smooth alignment of the components. During the survey of the building, a detailed information about the behavior of the building has been provided. This data was used as a starting point to combine the theoretical 3D model of the building and the machine, with the real shape of the building and configuration of the machine. The reference network of the building was used to align both accelerating unit as also storage ring. A special attention has been put to, so called smooth alignment – a part of the survey that considers changes in the surrounding environment (e.g. air fluxes, temperature changes, ground stability, functionality of the devices etc.). Each iteration of the network adopts to the new conditions and can be easily measured also in accordance to the accumulated electron beam position inside the storage ring. The measurements shows that the storage ring is currently aligned within the range of ±120 μm RMS from the ideal orbit in horizontal plane, and ±60 μm RMS from the average high of orbit in vertical plane, i.e. Fig.2.

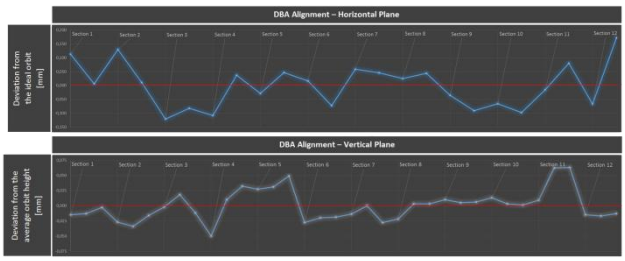

Figure 2. DBA alignment tolerances in horizontal (upper diagram) and vertical (lower diagram) planes.

The alignment is a complicated and arduous task that requires constant verification. In 2015 Solaris has stepped into commissioning phase [3,5], which revealed [6] that further survey of the machine is required, in order to get the photon beam with the most appropriate parameters. Small changes applied to the magnets position, can significantly influence the beam dynamics. In spite of a good coupling and fitting the theoretical 3D model into the real object, further measurements are planned in order to improve the parameters of the electron and photon beam.

[1] M. Johansson *Design of the MAXIV/Solaris 1.5 GeV storage ring magnets*, IPAC'11 San Sebastian WEPO016, 2430-2432 (2011). http://www.JACoW.org
[2] *MAXIV Detailed Design Report*, https://www.maxlab.lu.se/node/1136 (25 August 2010)
[3] A.I. Wawrzyniak, C.J. Bocchetta, et al, *First results of Solaris synchrotron commissioning*, Proceedings of IBIC2015, Melbourne, Australia - Pre-Release Snapshot 17-Sep-2015 10:30 WEDLA01
[4] J. Wiechecki, et al., *Mechanical aspects of installation of integrated magnets at Solaris synchrotron storage ring*, *Proc. SPIE* 9662, Photonics Applications in Astronomy, Communications, Industry, and High-Energy Physics Experiments 2015, 966234 (September 11, 2015)
[5] A.I. Wawrzyniak, et al., *Solaris Storage Ring Commissioning*, WEPOW029, IPAC'16, Busan, Korea, within these proceedings; WEPOW029
[6] J. Wiechecki, et al., *Impact of the DBA blocks alignment on the beam dynamics of the storage ring in Solaris*, WEPOW032, IPAC'16, Busan, Korea, within these proceedings; WEPOW032