STATUS OF THE METROLOGY LIGHT SOURCE*

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Abstract

For more than 25 years, the Physikalisch-Technische-Bundesanstalt (PTB) uses synchrotron radiation at the storage rings BESSY I and II for photon metrology in the spectral range of UV to X-rays. Since decommissioning of BESSY I (1999), there is a shortcoming in the spectral range of UV and EUV wavelength due to the higher electron energy of BESSY II. Thus, in 2003, the Metrology Light Source (MLS), was approved, a low energy electron storage ring as central instrument in the future Willy Wien Laboratory [10] [11].

Design, construction and operation of the MLS are realized by BESSY, based on the PTB requirements for a permanent accessible radiometry source, optimized for the spectral range between UV up to VUV.
The MLS is tunable in energy between 200MeV and 600MeV, designed for currents between 1pA up to 200mA. A 100 MeV racetrack microtron is used as injector.

The civil construction of MLS in the close vicinity to BESSY is nearing completion. The first MLS components are installed in spring 2006, commissioning of the microtron is scheduled for summer 2006, while commissioning of the storage ring will start in spring 2007. Regular user operation will begin in January 2008. Status and overview on the construction of the MLS are given.

INTRODUCTION

More than 15 years of efforts became awarded by the approval of the MLS in June 2003. Several experts' reports [1],[3] and a dissertation [2], resulted in the technical design report [4] for the MLS, a storage ring for dedicated use for radiometry. Additionally the MLS will be the first machine designed and prepared for low α operation based on octupole correction scheme, for production of coherent synchrotron radiation in the far IR and THz region[5],[6].

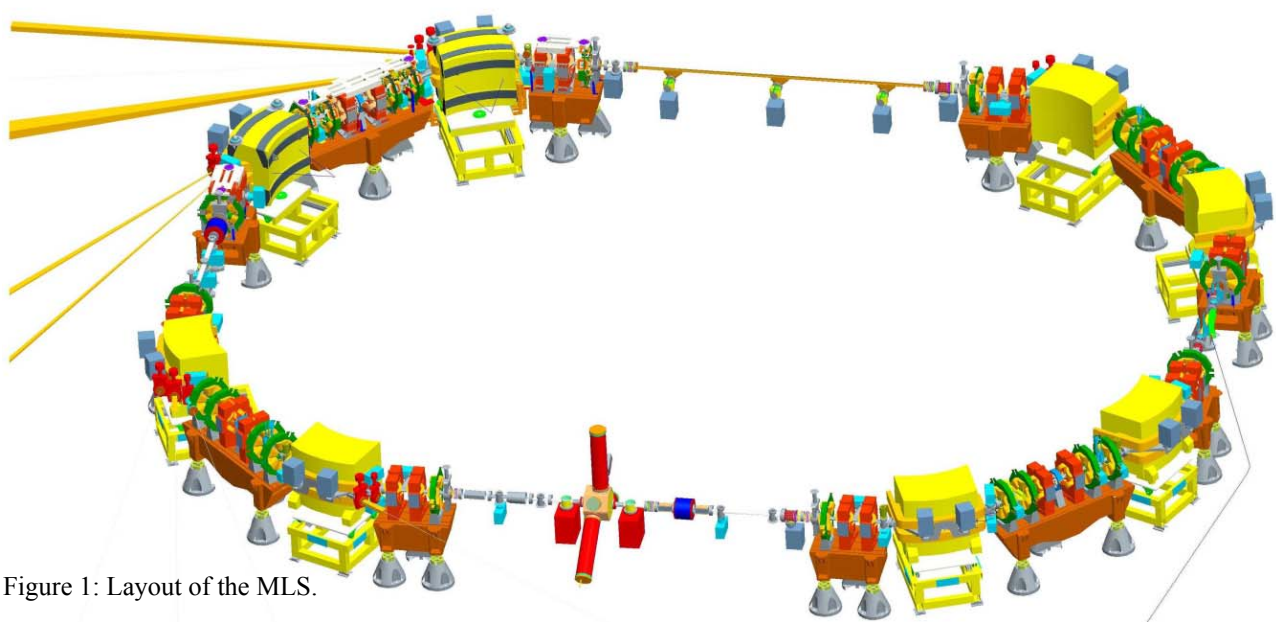

Figure 1: Layout of the MLS.

Figure 2: A 360° panorama view in the MLS Bunker. Status of 15.05.2006: Only the Girder supports are installed

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MAIN MLS PARAMETERS

Table 1: The main parameters of the MLS.

Circumference	48 m
Lattice	Double bend achromat
Electron energy	200 MeV up to 600 MeV
Beam current	1electron up to 200 mA
Injection	100 MeV racetrack microtron
MLS budget	10 Million €
Straight sections	2 x 6 m and 2 x 2,5 m
Emittance	≤ 100 nm rad
Harmonic number	80

BASIC CONCEPT FOR THE MLS

To minimise investment costs as well as operational cost the concept was to utilize synergetic effects based on the close vicinity to BESSY.

Figure 3: BESSY II site with MLS

1. Use of common infrastructure
   - High Quality mains grid and emergency generator
   - Helium recovery and pressed air systems
2. Operation and maintenance by BESSY staff.
   - One main control room
   - Common spare parts and maintenance equipment.
3. Reduction of cost by copying BESSY II equipment as there are:
   - The main diagnostics hardware
   - The basic design of the main magnets
   - Hardware and software for the control system

Nevertheless for some essential components it was necessary to turn off the BESSY product line as there are:

- The 100 MeV racetrack microtron
- The injection kickers and the septum
- The magnet supports and alignment
- The RF system

STATUS OF MAIN COMPONENTS

100MeV racetrack microtron

The design of the 100MeV racetrack microtron is based on the Aarhus (100 MeV) the ANKA (50 MeV) and the BESSY II (50 MeV) machines, but

- with new designed 180° Dipoles
- a full metal UHV vacuum system
- fluorescence screen beam viewer and fast current transformers for almost each turn

The microtron achieved 100MeV beam for the first time end of May and will be delivered in July.

Table 2: Main parameters of the racetrack microtron

Maximum energy	100 MeV
Puls current	>8 mA
Puls length	0,3 - 1,5 µs
Repetition-rate	10 Hz
Emittance	≤ 0.1 mm mrad
Max. bending-field	1.13 T

Injection

Four Delta like slotted pipe kicker magnets [7] and one air-cooled septum magnet are foreseen for the 100 MeV injection. These systems, as well as the transfer line from microtron to storage ring, are expected to be delivered in September 2006.

Main Magnets and Girders

The cast iron girders with machined surfaces on the top and the multipole magnets are produced with such narrow margins, that there is no need of adjustable elements in between to avoid problems due to vibrations and long-term misalignment.

All the girders and multipole magnets are delivered. The assembling started end of April 2006. The bending magnets are ready for FAT at the manufacturer site, and delivery is expected for July 2006 [3].

Figure 4: First assembled achromat girder in May

Cavity and RF system

A 500 MHz RF system is designed for the MLS. A new type of HOM damped normal conducting cavity [9] with ferrite damping antennas [8] will be used. A 80 kW cw RF-plant with IOT is ordered. All the RF components will be delivered in July and August 2006.

Vacuum system

Due to the severe vacuum requirement (5E-10 mbar) and the narrow space conditions in the storage ring, each of the four quadrants is baked out in an external oven at temperatures up to 250°C. Pumps and valves are already at MLS. The vacuum chambers are expected within the next three months.

TIME SCHEDULE

Due to budget requirements it was necessary to delay the delivery of some components as power supplies and injection to the end of 2006. This caused a delay in the commissioning of the MLS primary planed for January 2007, for two month. An additional delay of three months is based on the delay of the building and basic infrastructure.

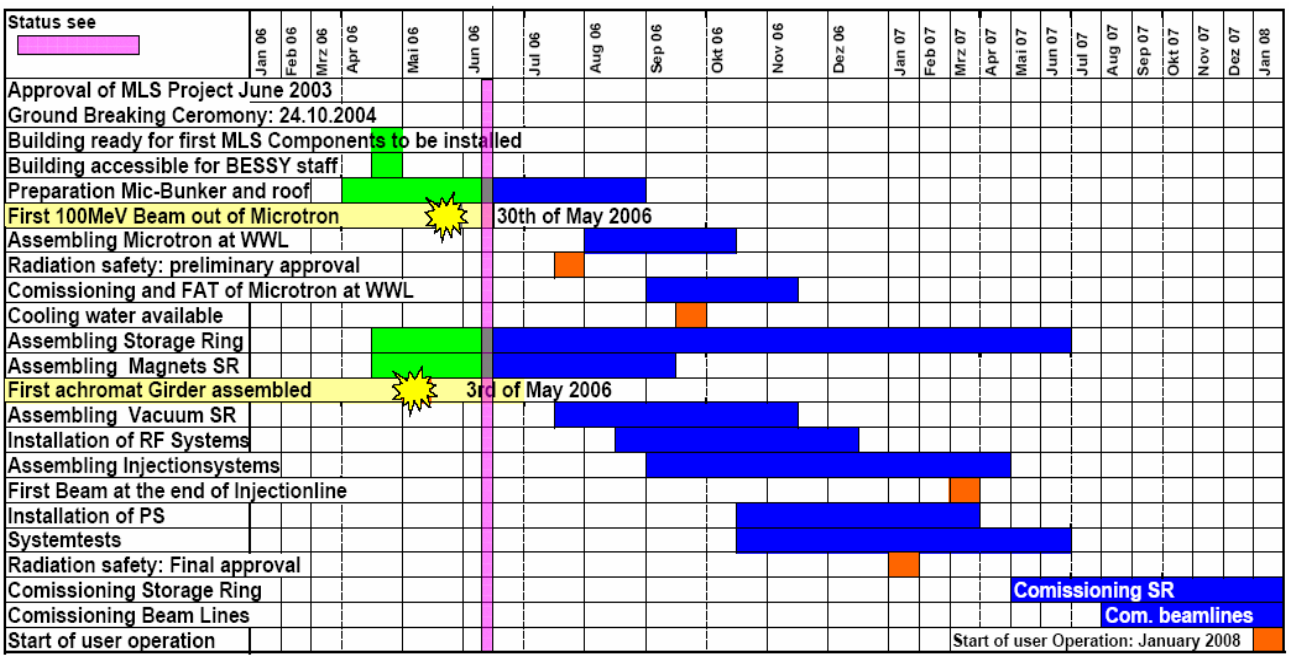

Figure 5: Current time schedule

SUMMARY

The status of the MLS of the PTB in Berlin will right now allow starting the installation of the microtron and the storage ring components. The main components are delivered or they are under construction and will be delivered within the next months. Despite the five month delay in the civil construction it seems to be possible to start the user operation in January 2008 in time.

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