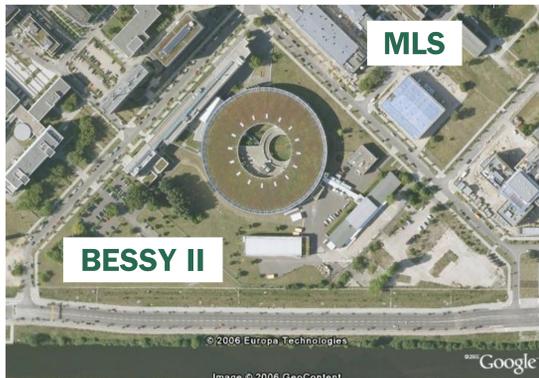
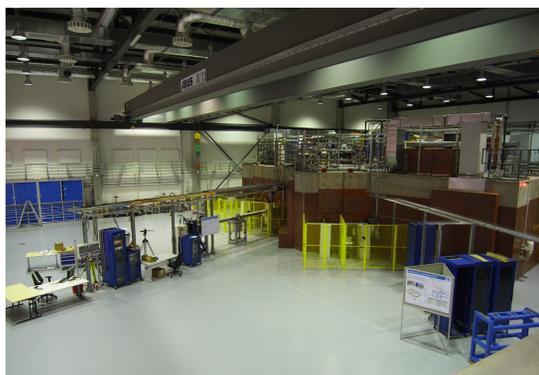


## Introduction

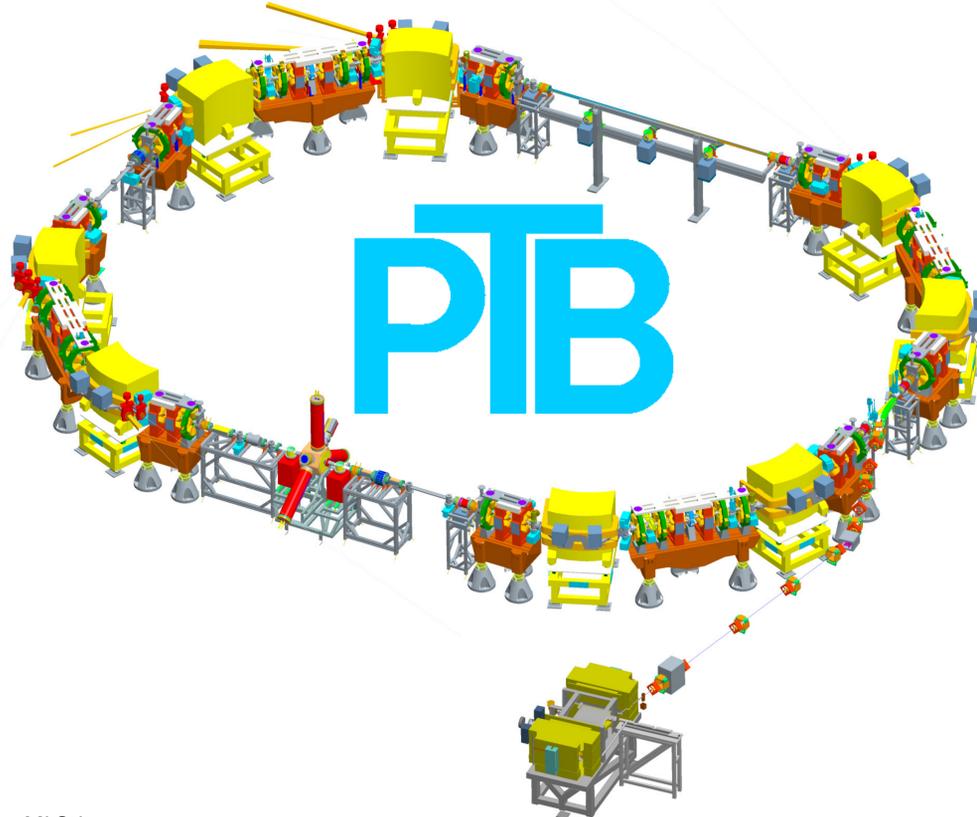
For over 25 years, the Physikalisch-Technische-Bundesanstalt (PTB) uses synchrotron radiation at the BESSY I and II storage rings for photon metrology (UV to X-rays). Since BESSY I was decommissioned in 1999, there is a shortcoming in the spectral range of UV and EUV. In 2003, the Metrology Light Source (MLS) was approved, a low energy electron storage ring for the future Willy-Wien-Laboratory.



MLS near BESSY II in Berlin-Adlershof



Experimental Hall with Synchrotron Bunker



MLS Layout

## Strict Design Requirements

A tight budget and limited manpower require synergetic effects:

- Common control room
- Reuse of BESSY II hard- and software solutions wherever possible
- Common spare parts and maintenance equipment

## Hardware Choices

- Operator consoles and servers: Linux (Debian GNU/Linux) on PC hardware
- 100 MBit/s ethernet on twisted pair (1 GBit/s between switches, fibre uplink)
- Front-end controllers (IOCs): PowerPC-based VME-CPU's (MVME2100) in 3x7slot full-size crates (Wiener)
- CAN field bus wherever possible
- Power Supplies: CAN link to 24bit highly stable converter card in the power supply
- PLCs: CAN link
- Scopes: VXI-11
- Sig. Generators: VXI-11 / Agilent Box / GPIB
- Ion pump currents: microIOC LOCO (cosylab)
- BPM system: in-house analog front-end to VME A/D-converters (BESSY II clone)

## Software Choices

- EPICS revision 3.14
- TCL/TK launcher (BESSY II clone)
- Operator panels: edm (many panels generic or generated)
- Orbit feedback and physics applications: BESSY II clone (ported to Linux)
- Archiving: Channel Archiver
- Snapshots: BURT (with BESSY II GUI)
- Reboot save/restore: AutoSaveRestore
- Alarm handling: ALH
- Event logging: CMLOG

## MLS Main Parameters

Lattice structure	Double-bend achromat
Circumference	48 m
Length of straight sections	2 x 6 m, 2 x 2.25 m
Injector	100 MeV racetrack microtron
Electron beam current	1 pA to 200 mA (1 to 2 x 10 <sup>11</sup> electrons)
Electron energy	200 MeV to 600 MeV
Injection energy	100 MeV
Max. field of bending magnet	1.3 T
Characteristic photon energy	12 eV to 314 eV
Natural emittance (600 MeV)	100 nm rad
Source size (1σ at 600 MeV)	250 μm (h) x 200 μm (v)
Budget	10 Mio. €

## Conclusions

**Building a control system for a small, but complete facility still needs a lot of effort.**

**Strict requirements create a unique situation: All parts are known, now there's a chance to "do it right this time".**

**Improvements for the MLS control system are applied back to BESSY II with great success: MLS has been a perfect test bed.**

## Major Improvements

- **Signal naming convention**  
Enforces the creation of obvious and browsable signal names
- **New revision control system: Darcs**  
Distributed, interactive, change-based
- **New deployment mechanism: rsync-based**  
Any IOC can be rolled back to any version ever deployed – optimized disk usage
- **Soft IOCs**  
Extensively used for all ethernet-based IO and virtual devices