

Magnetic Measurement Activities planned for LHC at CERN

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LHC Commissioning with Beam and further Exploitation

FiDel [Field Description of the LHC] :

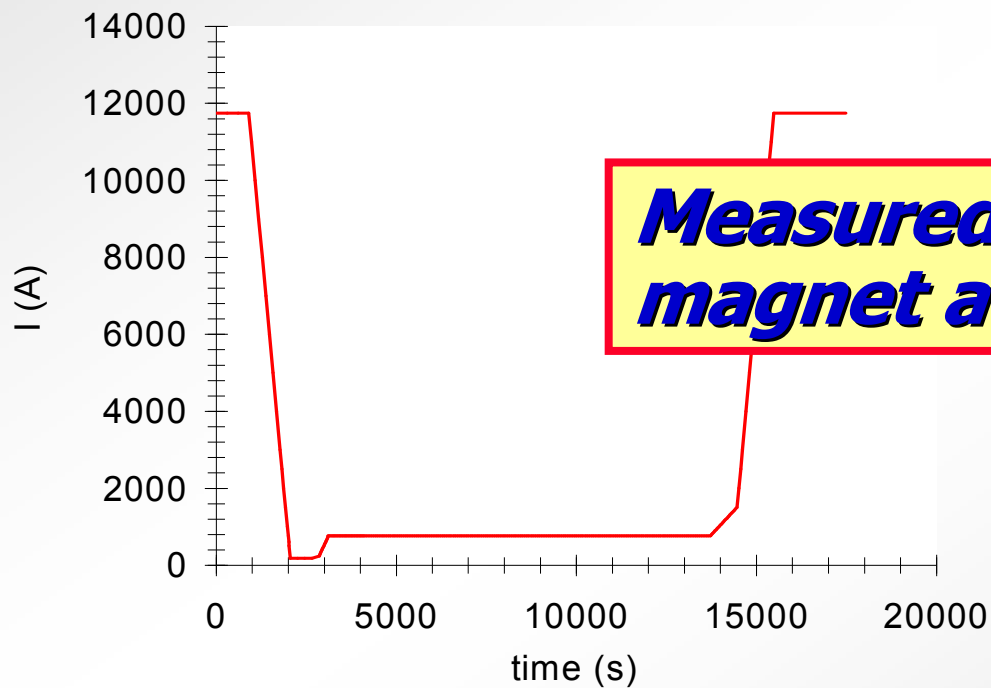
use accumulated data and filter them to :

- ◆ **To drive the current supplies according to beam optics needs [LSA]**
- ◆ **To simulate the current machine in MAD [Wise]**

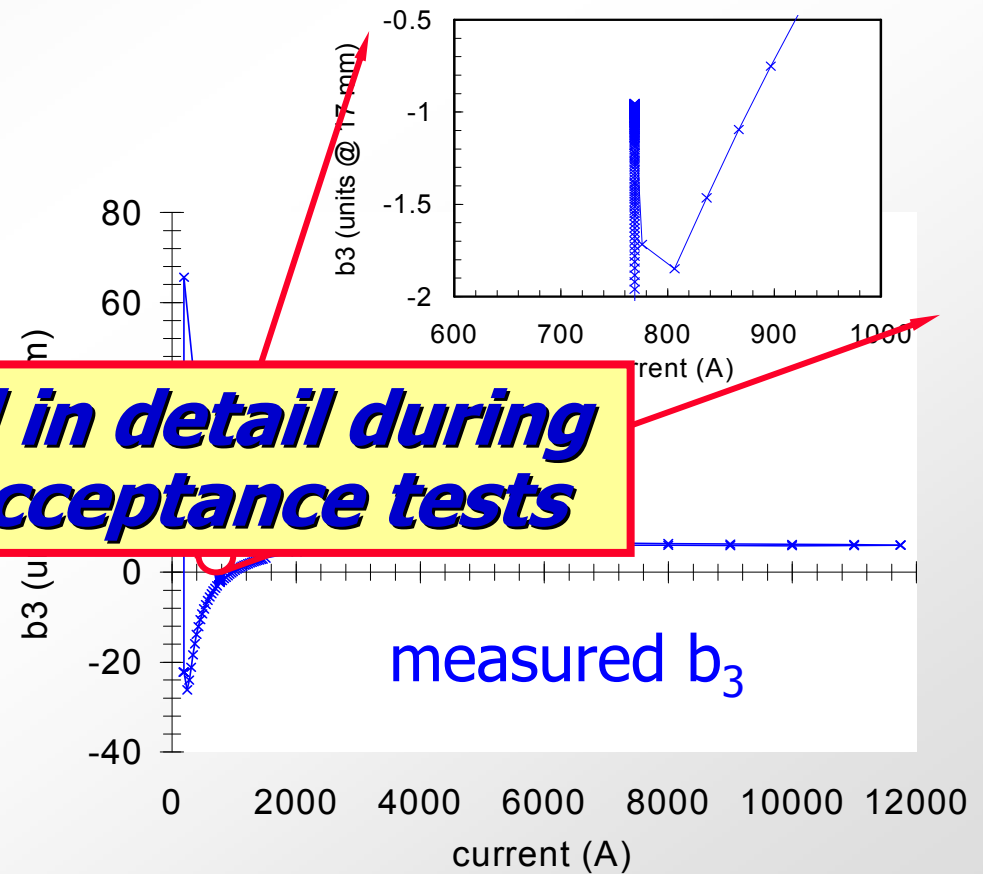


A typical LHC operation cycle

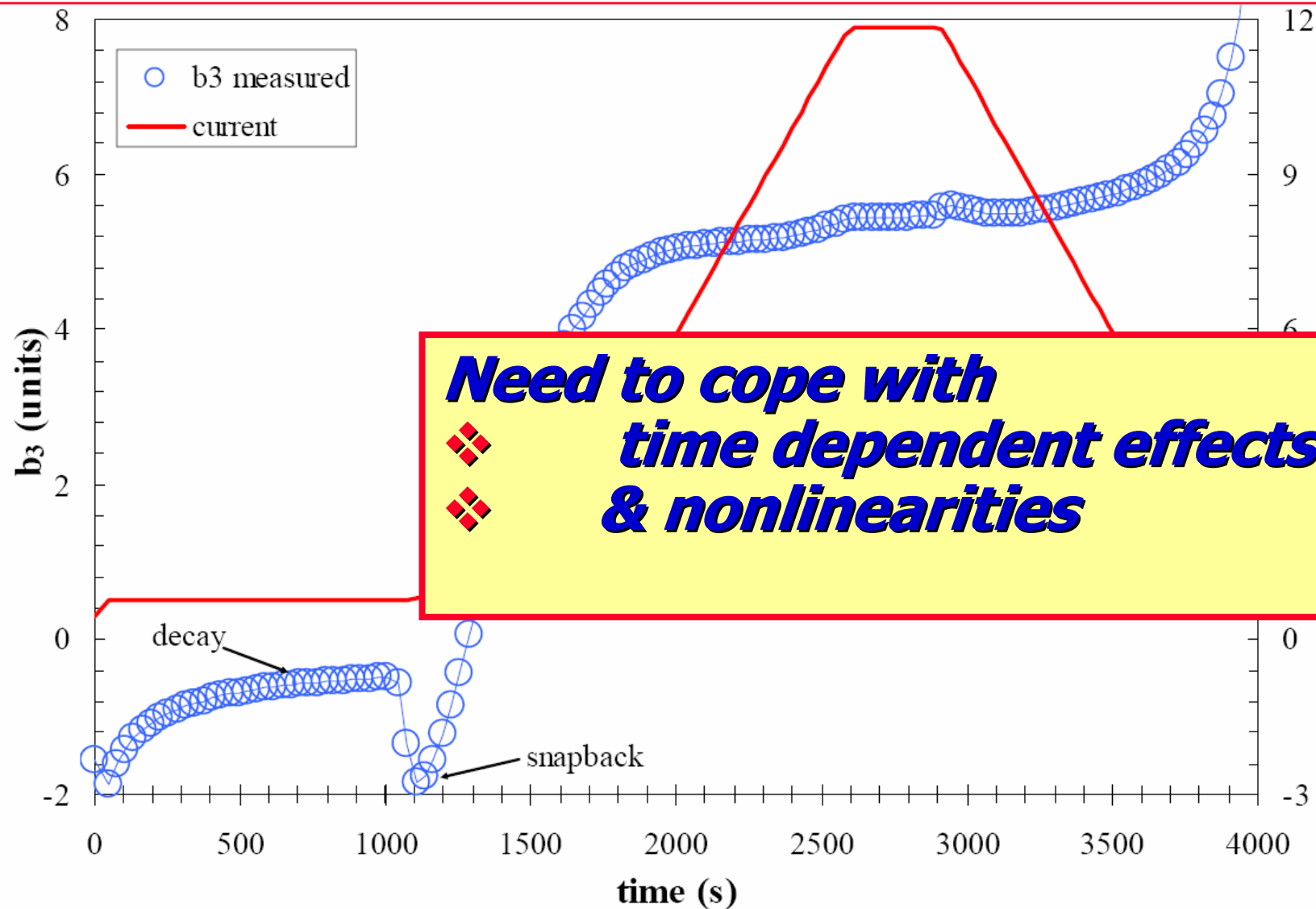
operating current



Measured in detail during magnet acceptance tests



The Sextupole Term of MB during LHC Cycle



Components Entering in the FiDeL Description

Static (DC) Components: these are steady-state in nature and are reproducible from cycle-to-cycle provided the magnet is cycled with the same procedure. Static components are solely dependent on the excitation current and include:

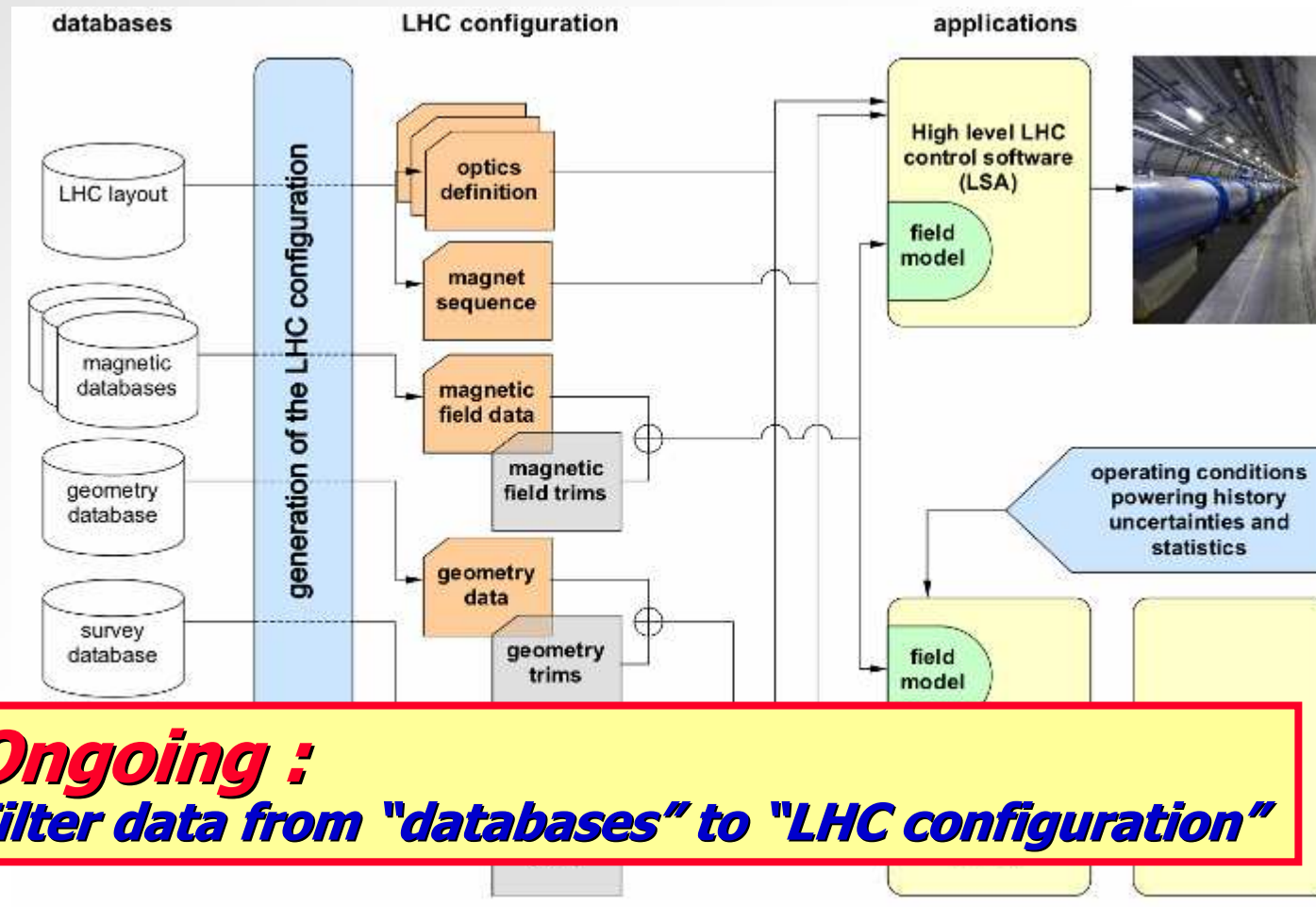
- ◆ a. geometric contribution (Cn geometric).
- ◆ b. DC Magnetisation Contribution (Cn MDC).
- ◆ c. Saturation contribution (Cn saturation).
- ◆ d. Displacement contribution (Cn deformation).
- ◆ e. Residual Magnetisation Contribution (Cn residual)]

Dynamic (AC) Components: These components are both current and time dependent and are not reproducible from cycle-to-cycle. They include:

- ◆ a. Decay (Cn decay).
- ◆ b. Snap-back (Cn snap-back).
- ◆ c. Coupling-Currents (Cn MAC).

FiDeL : FIeld DEscription for the LHC

Operation of the machine based on a mathematical model (**FiDEL**: FIeld DEscription for the LHC) able to predict integrated strength and harmonics based on magnet current value and history.



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Ongoing : 1st Tracking Test performed in SM18 Test Hall

Maintain $b_3(t) = 0$ during acceleration cycle on a MB with MCS corrector

!! Requires still a lot of tuning !!

For Spring 2008, simulate in SM18 & be ready for :

$B_1(t)$ to keep equal between the 8 LHC sectors

Tune constant to 0.003 during acceleration cycle $\Rightarrow B_2/B_1$ to 0.5 Unit

Drive all main magnets (MQX, MQY, MQM, D0) and correctors



LHC Commissioning with Beam : Still needed

FAME [Fast Measuring Equipment]

**Tool needed to measure multipoles on Magnets in SM18
with enough bandwidth**

Includes :

- ◆ **15 m shaft rotating at 3 to 10 Hz [O. Dunkel talk]**
- ◆ **FDI : Fast Digital Integrator [J. Garcia]**
- ◆ **New acquisition software [M. Buzio]**

MIFI : Measurement to Improve FiDeI

- ◆ **Scaling laws for**
Different maximum energies
Different durations for physics, pre-injection, and injection plateaus

Announcement

CAS [CERN Accelerator School]

In Spring 2008

Topics :

- ◆ **Magnetic Measurement**
- ◆ **Normal Conducting Magnets**
(Design, Manufacturing)

