Control System
Performance Improvements, Updates and New Features

Operator School 2020

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Agenda

- New Features, Updates and Limitations

    - Cross-system / Architecture

    - Applications: See Jutta's Presentation 🔗

    - LSA

    - Services

    - Front End / FESA

    - Timing

- Performance Improvements

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- **New Features, Updates and Limitations**

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- Performance Improvements

- Data Acquisition functionality for magnet power supplies
  - Acquiring setting and actual values for „ramped" magnet power supplies
  - Visualization via „Digitizer App"
  - Currently being tested, to be ready for dry run / beam time

- A4 reservation mechanism when requesting beam from SIS18 🔗

- Beam Production Chain Start Flag 🔗
  - Improved visualization of beam instrumentation data possible

- New Timing Events for experiment-controlled hardware

- Major performance improvements 🔗

  - General speedup

  - Trimming independent Patterns in parallel

  - „Bypass Trim" feature

  - More details in second part of presentation

- Code base merged with CERN

- Clean up / restructuring

  - Had to be partly postponed because of focus on higher priority activities. More effort is needed to reduce technical debt

- REST interface for reading settings e.g. via Python

- Interface to Archiving System that provides information on beam properties

- Sequencer

  - New multi-client-capable Sequencer Service

  - Experimental operation during coming beam time

  - Initial set of Sequences for usage during dry run and beam time currently in development

- Archiving System

  - Initial productive operation (20 TB storage)

  - DAVE: Under development at ACC, to be ready for beam time

- Beam Scheduling System (BSS)

  - Major performance improvements 🔗

  - Minor changes in handling requests
(see Jutta's presentation 🔗)

GSI

- New FESA3 release 7.1.0 🔗
  - Providing compatibility with Timing Release 6.0.0 "Fallout"
  - No changes are required to Designs or to code that uses the Saftlib API

- FESA Plugin now compatible to newer (2020) Eclipse versions 🔗

- Automatic comparison of setting and actual values for „pulsed" power supplies
  - Basic functionality implemented, still experimental

- Timing-controlled stepper motors at CRYRING
  - Tests ongoing, to be ready for beam time

- New spill abort mechanism for Cave A and Cave M
  - Testing ongoing, to be ready for beam time
  - "Old" mechanism as fallback

New Features, Updates and Limitations [5/5]
Timing

- Timing Release 6.0.0 "Fallout" 🔗

  – Stability fixes and improvements

  – Upgraded to new White Rabbit PTP Core v4.2

  – Upgraded White Rabbit Switches to v6

     ...

- White Rabbit UNILAC Pulszentrale 🔗

  – Available for experimental testing & development

- Bunch-to-Bucket System 🔗

  – Under development
  – Machine experiments during coming beam time

- Performance improvements in Data Master

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- **Performance Improvements**

Significant Performance Improvement Has Been Achieved by the Task Force

- Establishing a cross-department task force proved beneficial for defining goals, setting priorities and improving mutual understanding

- A scenario-based approach ensured that optimization was targeted at real-world use cases, results are verifiable and implementation could be carried out efficiently

- Optimizations implemented throughout the control system stack

- Final measurements to be performed during dry run, but preliminary results are very promising already

Comparison of Measurement Results*
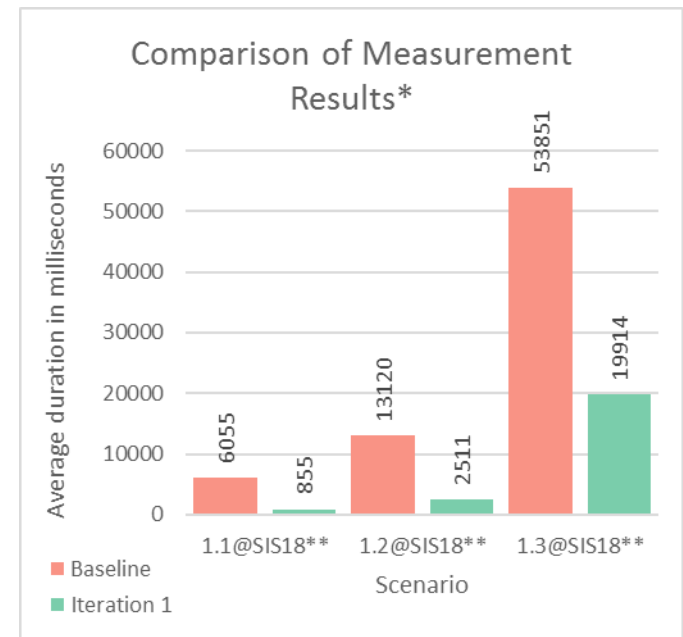
* Please keep in mind that due to changing system environments, measurement methods and external factors, measurement runs performed at different points in time are not fully comparable. Consequently, this diagram should only be considered a rough indicator of to-be-expected performance.

** Baseline measurements are available for scenarios 1.1 to 1.3 at SIS18 only.

All TFP meeting minutes, technical documentation and results are available in the Controls Wiki (ACC account needed).

- General speed-up

  - Internal optimizations and cross-system restructuring (LSA / BSS) led to significantly reduced trim times: improvement of ~75% on average compared to the baseline measurements accoring to intermediate measurements

- Timing schedule is only supplied when it has actually changed

- Trimming multiple Patterns simultaneously

  - It is now possible to trim more than one Pattern at the same time. Practically, this means that trimming SIS18 Patterns for different beams as well as ESR and CRYRING Patterns don't block each other anymore

- „Bypass Trim"

  - Example and more info on following slide...

New Expert Feature: „Bypass Trim"

- When trimming „normally", LSA waits until the affected Pattern has finished executing, then applies the trim and restarts the Pattern

- „Bypass Trim" allows trimming settings that are scalar on the device level (e.g. current for a „pulsed" magnet) while the Pattern is running

- Target use case: ESR is preparing beam for CRYRING. The operator wants to make an adjustment to the extraction beamline. There is enough time, so (s)he decides to do a Bypass Trim and the change becomes active for the current Pattern execution

- Worst case if misused: Beam loss for the current Pattern execution because of inconsistent settings. Settings become consistent again for the next execution „automatically"

- Don't use it if in doubt. It's a separate button which has to be acti-vated in Parammodi via the menu bar (see Jutta's presentation ✐). When you don't click the new button, everything behaves as before.

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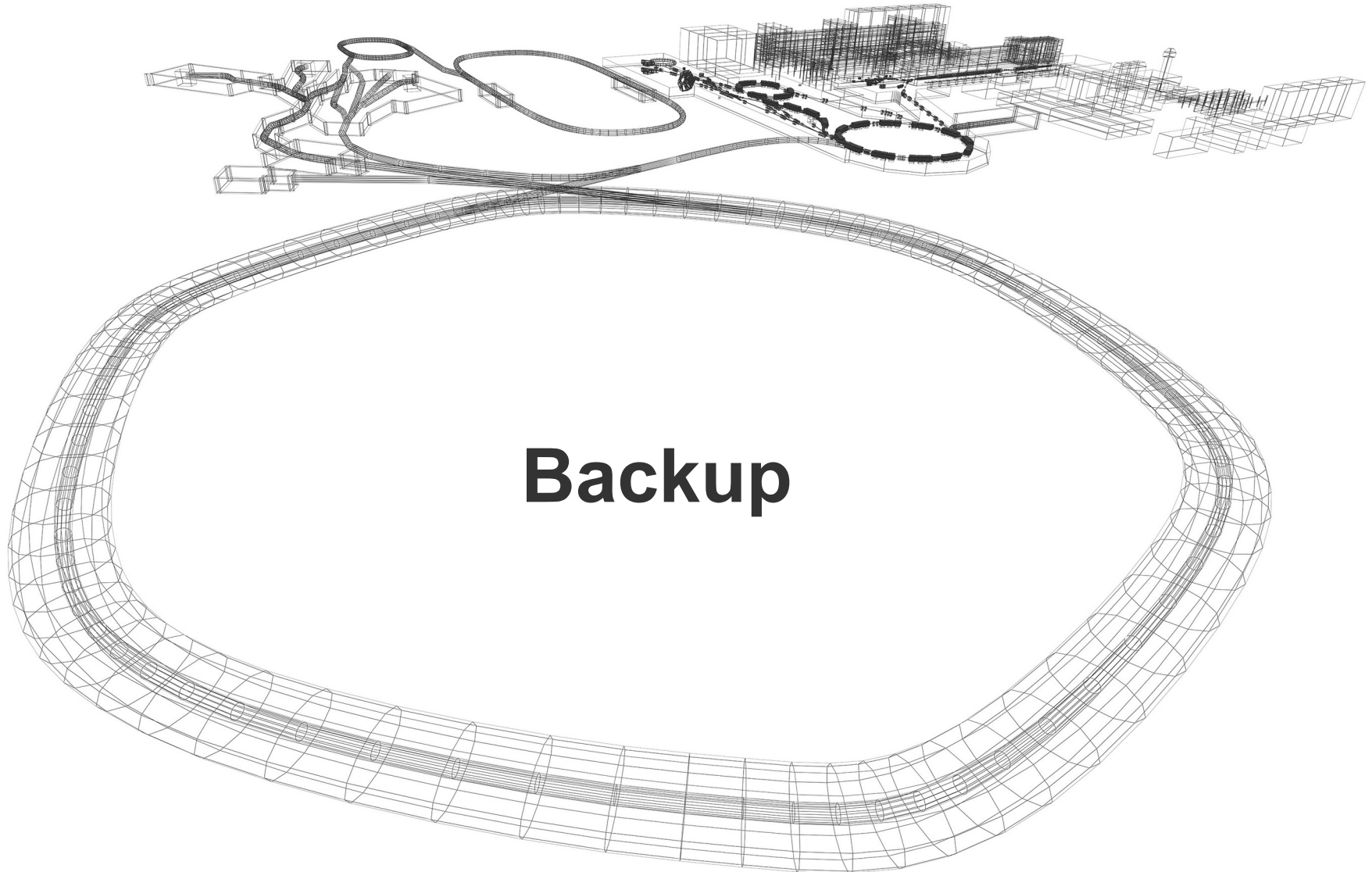
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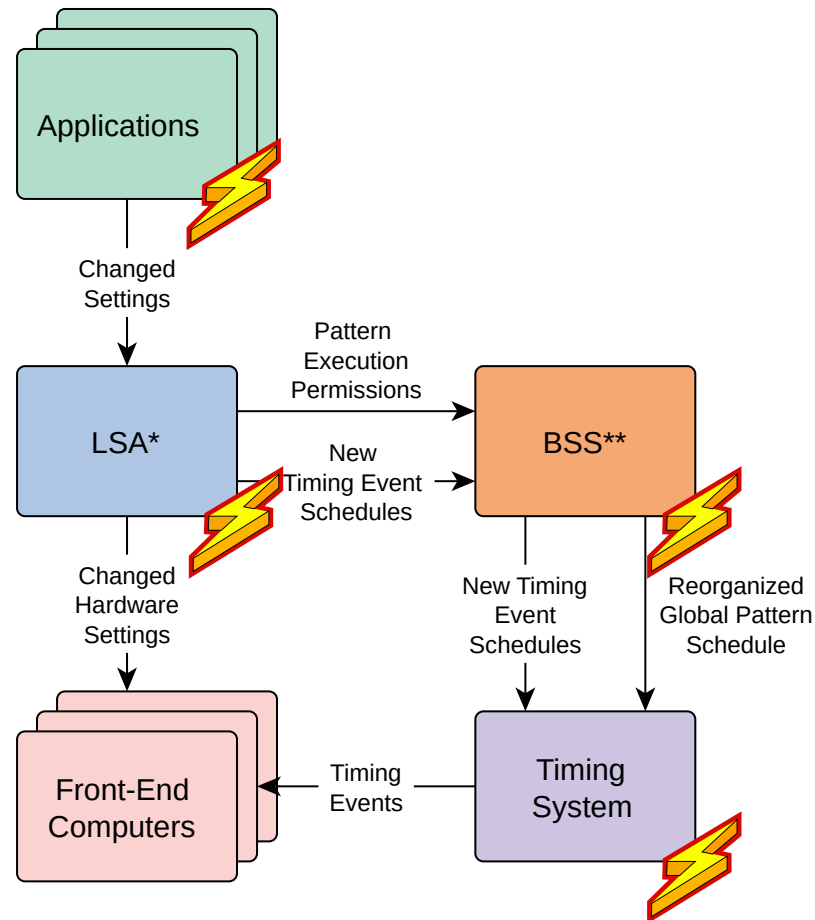
* LHC Software Architecture (Settings Management System)
** Beam Scheduling System