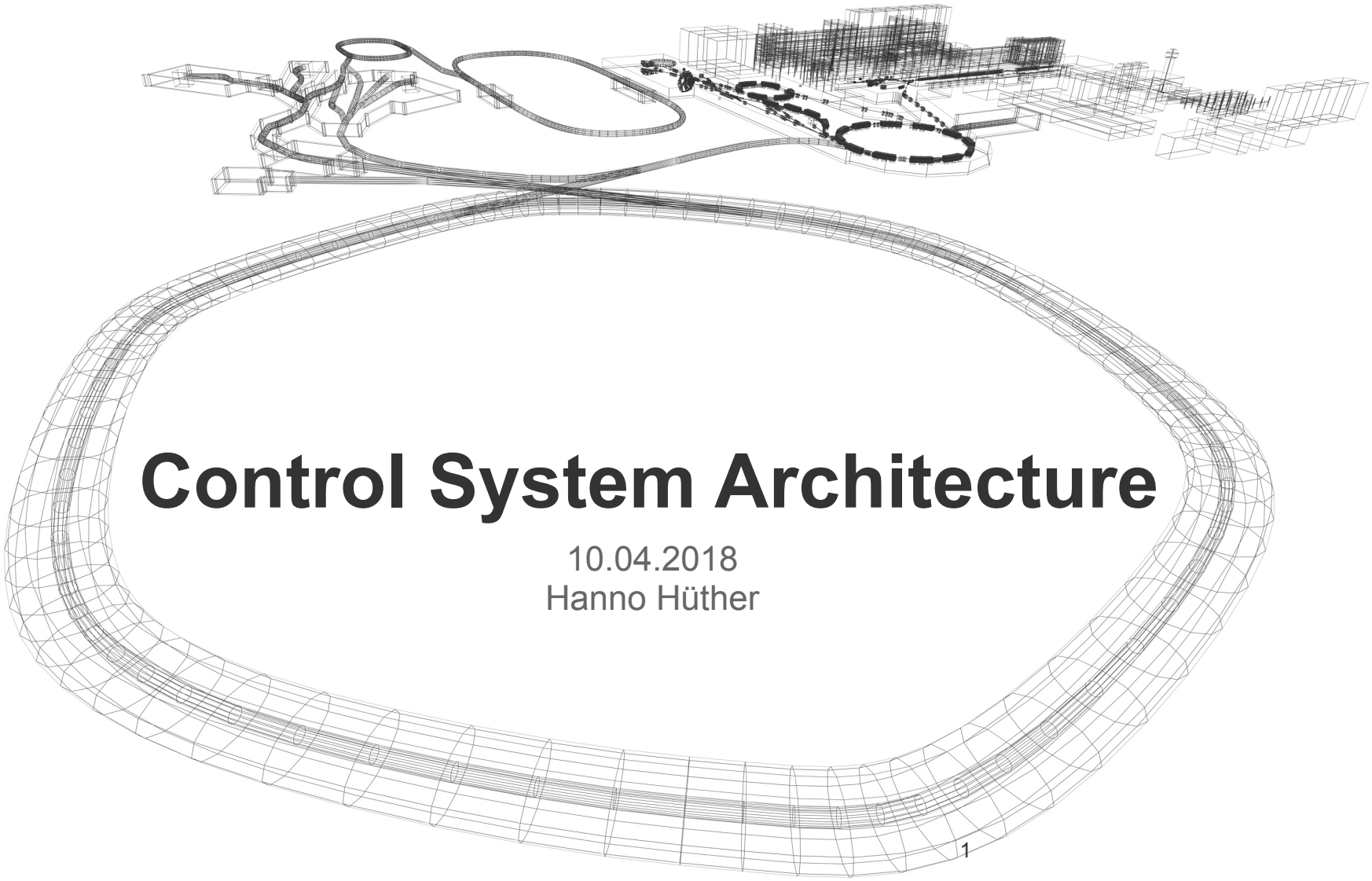


Control System Architecture

10.04.2018

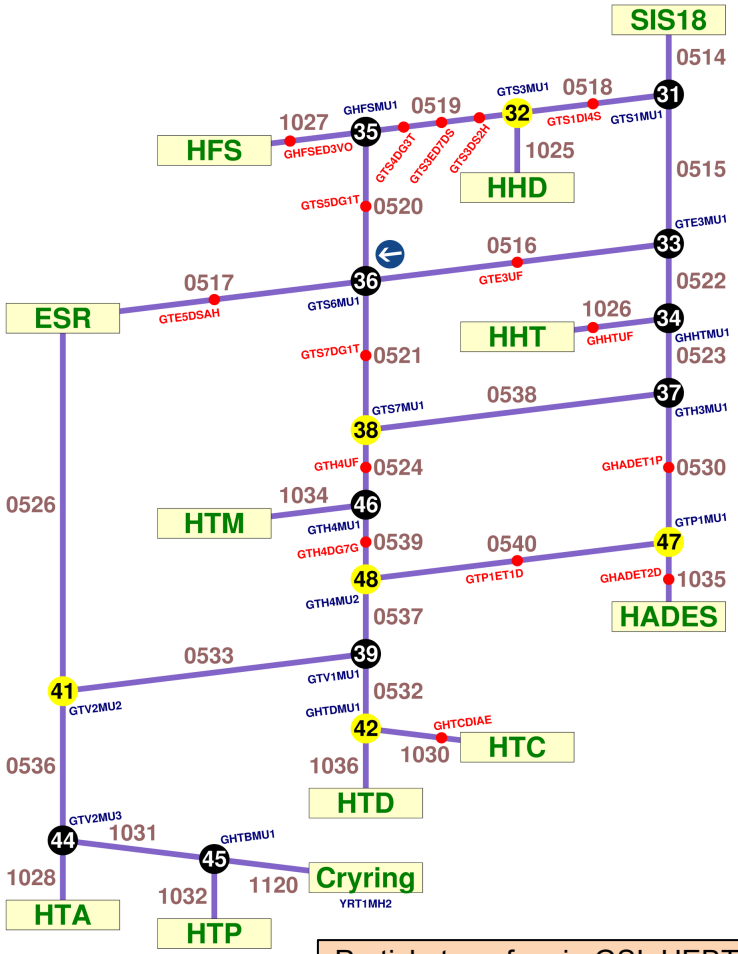
Hanno Hüther

Motivation and Approach

- Question
  - What happens between the application and the hardware?
- Implication
  - It would be helpful for Operators to know what's going on behind the scenes
- Challenge
  - Explain system architecture of (a part) of the control system in a way that the information provided is useful for commissioning and operating
- Idea
  - Explain some of the most common use cases by the systems involved and the data flows between them

Terminology (I)

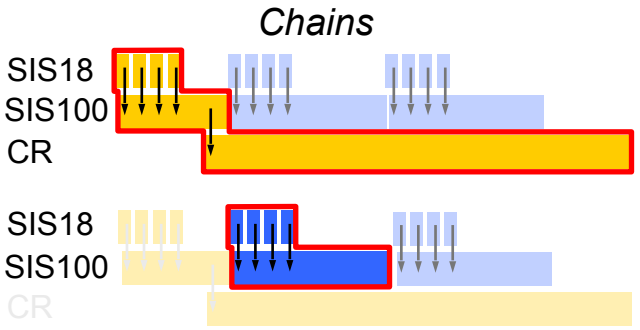
- Particle Transfer
  - Section of accelerator with identical timing
- Beam Process
  - Temporal section within a Particle Transfer with specific purpose (e.g. injection, ramp, extraction, transfer, ...)
- Parameter
  - Physics or hardware quantity
  - Associated with a device
- Setting
  - Value of a parameter



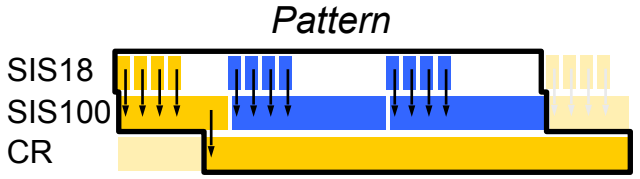
Particle transfers in GSI_HEBT: from forking point to forking point

Terminology (II)

- Beam Production Chain (BPC)
  - Organizational structure to manage parallel operation and beam transfer through FAIR accelerator facility
  - Defines sequence and parameters of beam line from the ion-source up to an experiment

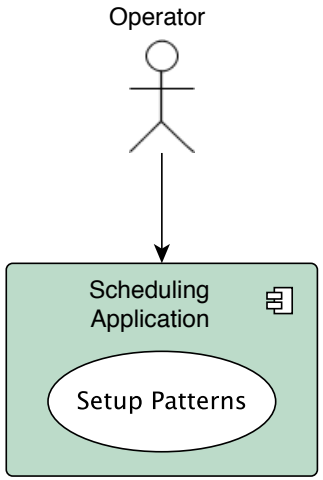


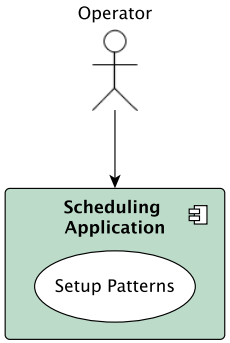
- Pattern
  - Grouping of Beam Production Chains that are executed periodically

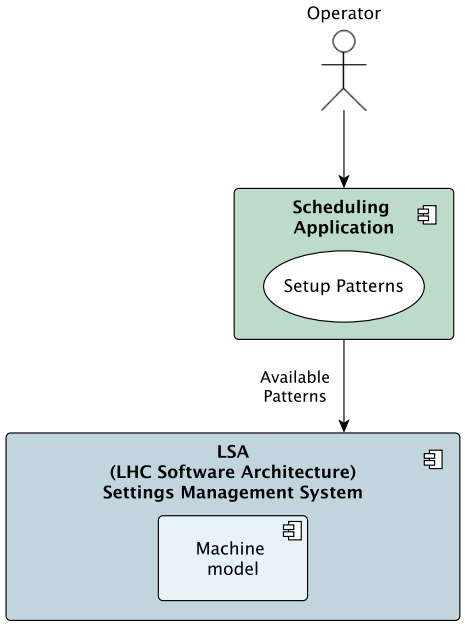


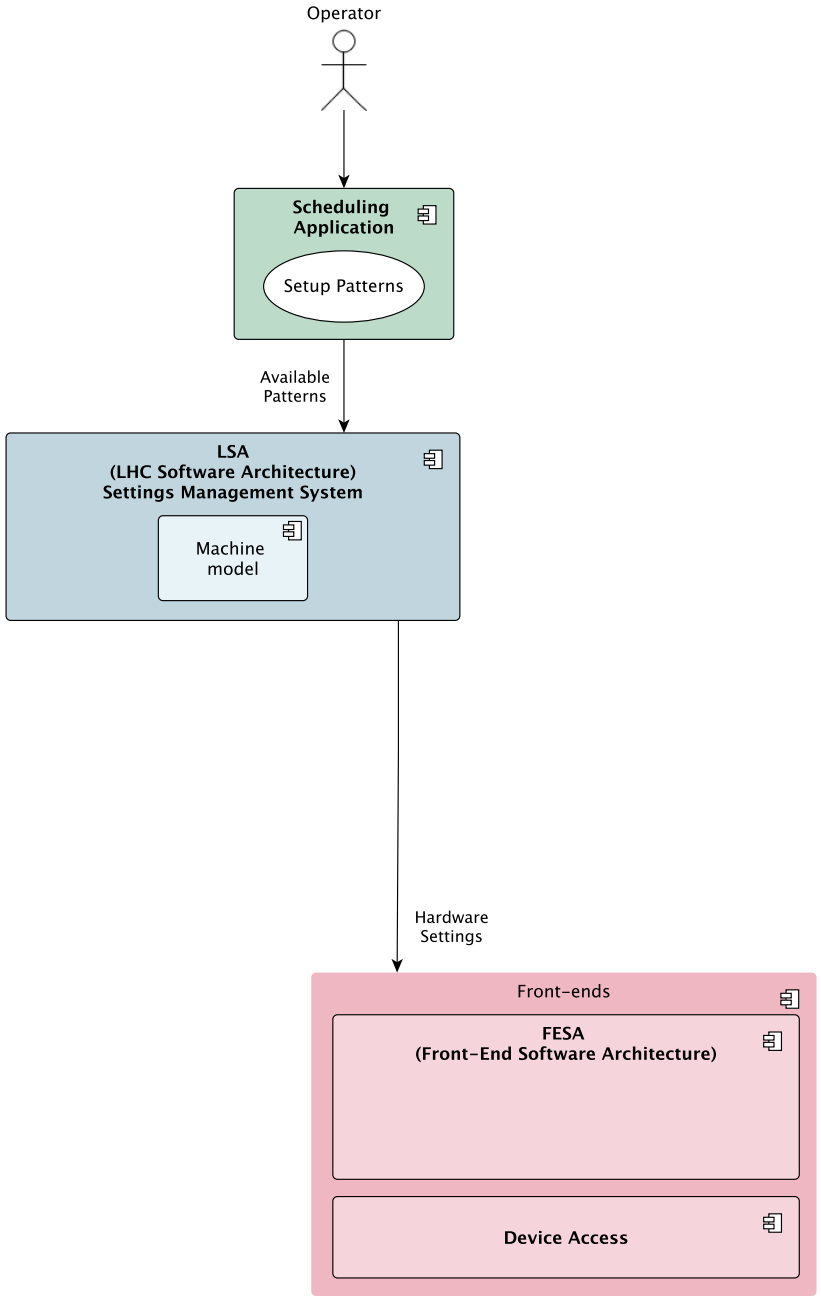
- For 2018
  - One BPC per Pattern
  - Multiple Patterns in Round Robin

Use Case 1: Setting up Patterns




Operator
Scheduling Application
Setup Patterns


Operator
Scheduling Application
Setup Patterns
Available Patterns
LSA
(LHC Software Architecture)
Settings Management System
Machine model


Operator
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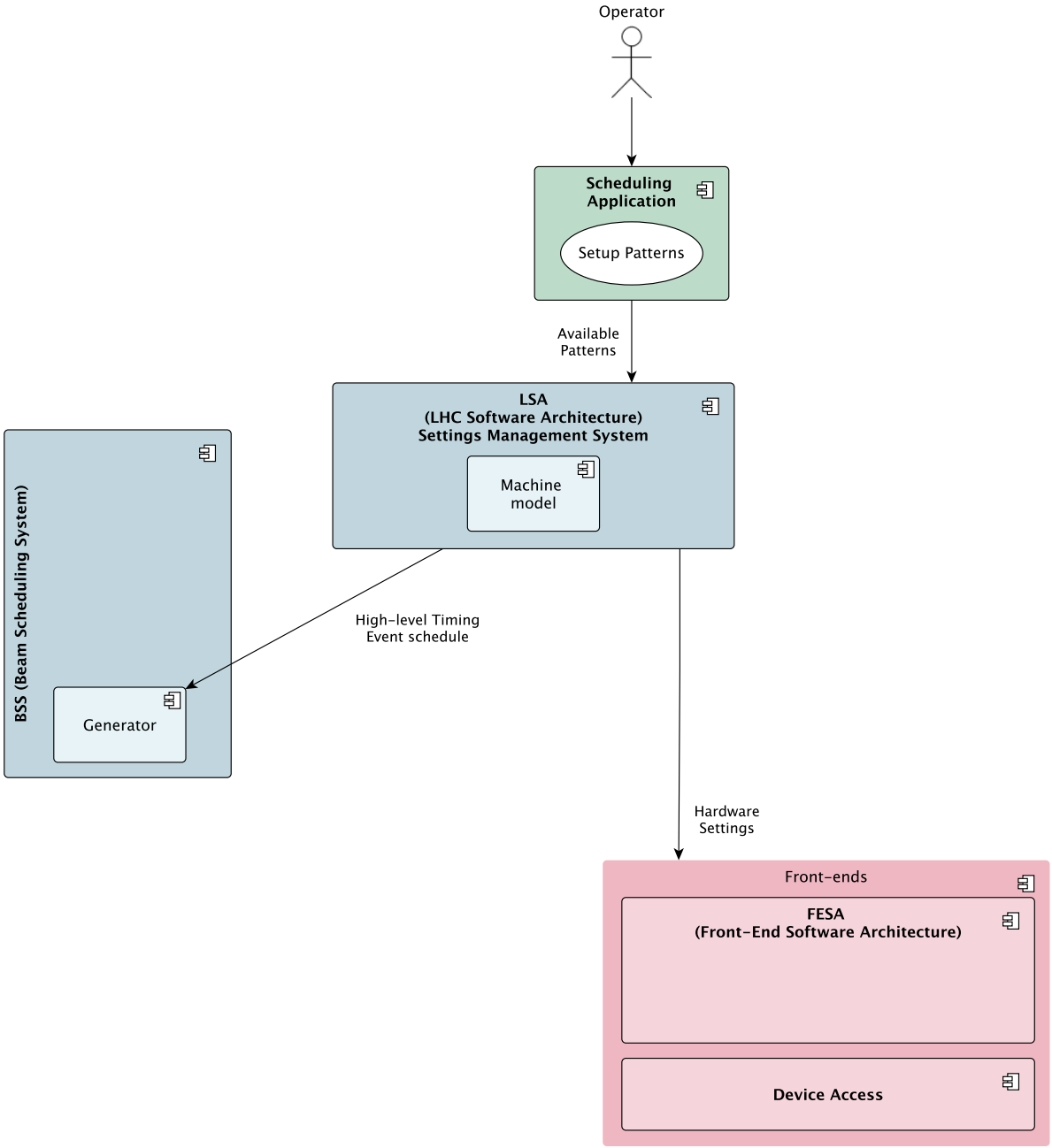
Available Patterns
LSA
(LHC Software Architecture)
Settings Management System
Machine model
Hardware Settings
Front-ends
FESA
(Front-End Software Architecture)
Device Access


Operator
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LSA
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Generator
High-level Timing
Event schedule
Hardware Settings
Front-ends
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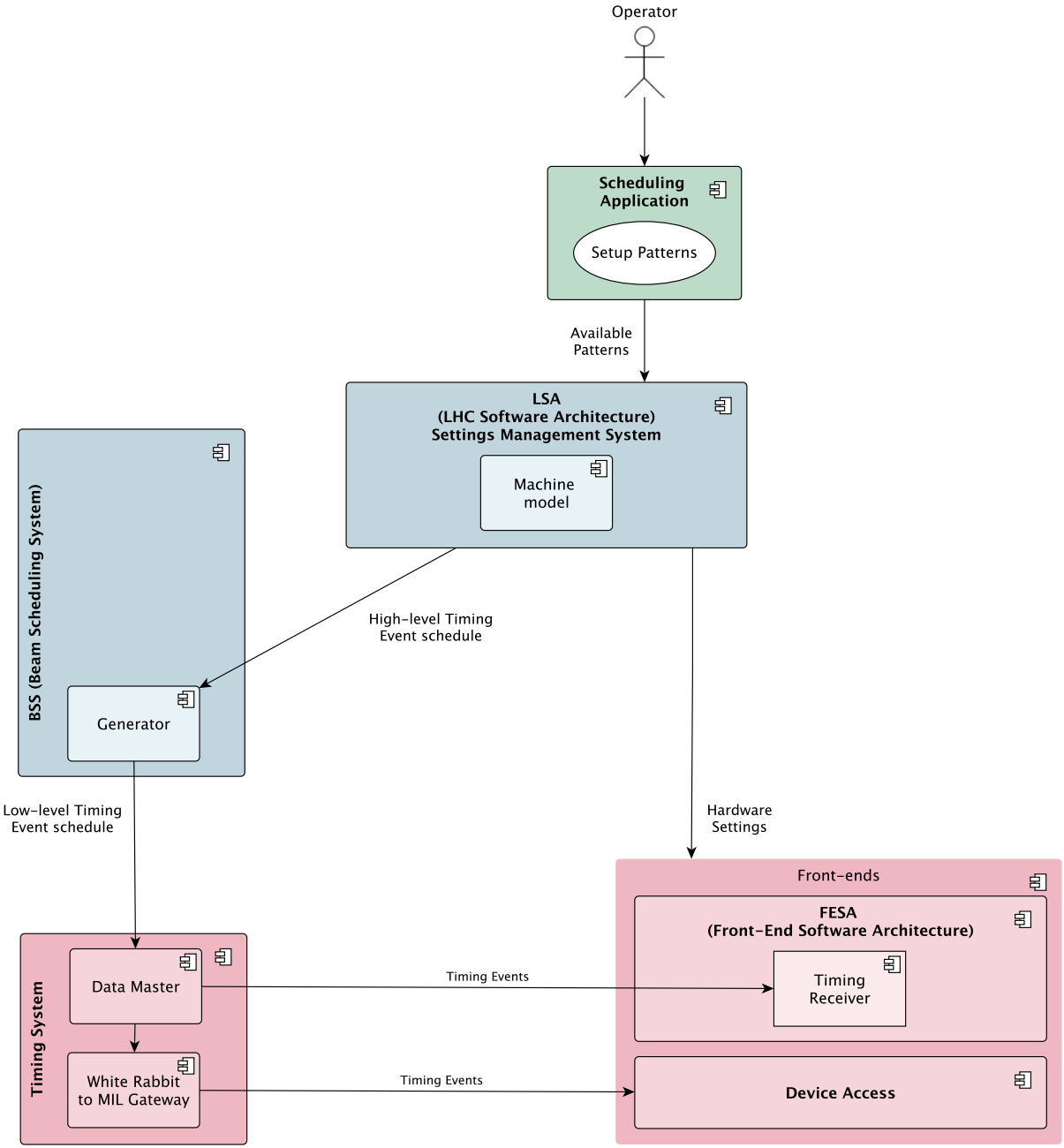
Operator
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Low-level Timing Event schedule
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FESA
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Timing System
Data Master
White Rabbit to MIL Gateway
Timing Events
Timing Events
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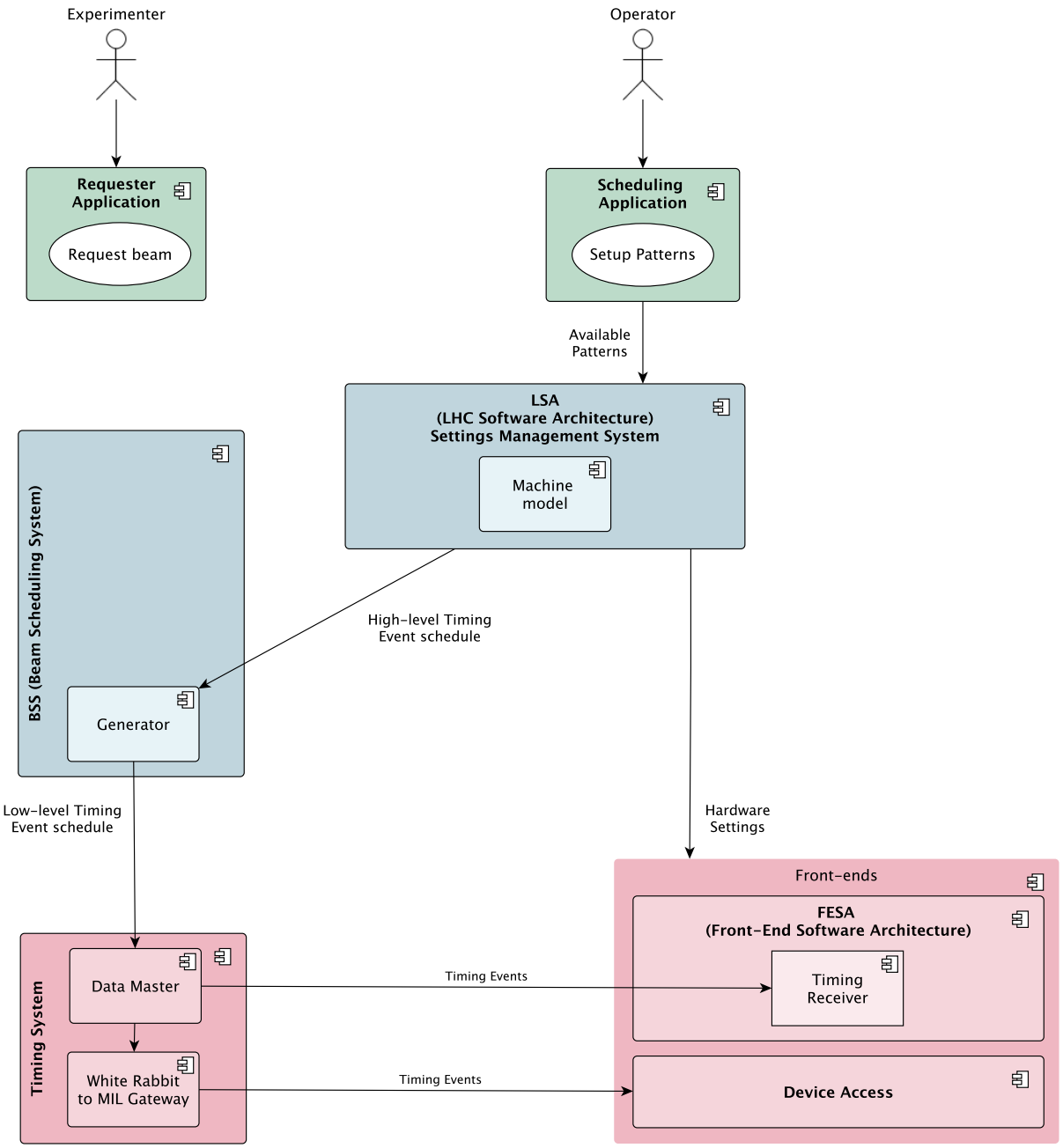
Experimenter
Operator
Requester Application
Request beam
Scheduling Application
Setup Patterns
Available Patterns
LSA
(LHC Software Architecture)
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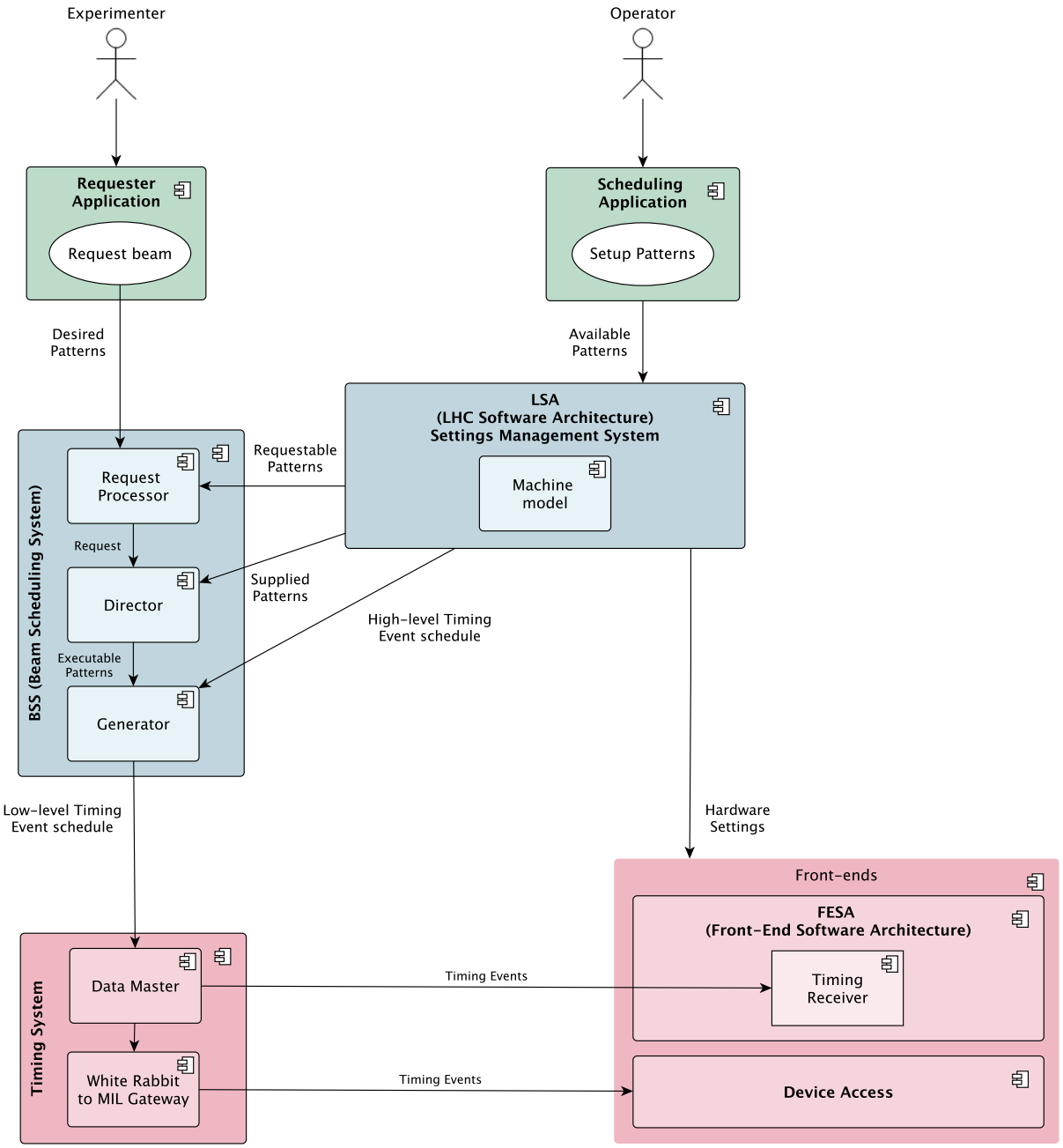
Experimenter
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Request
Director
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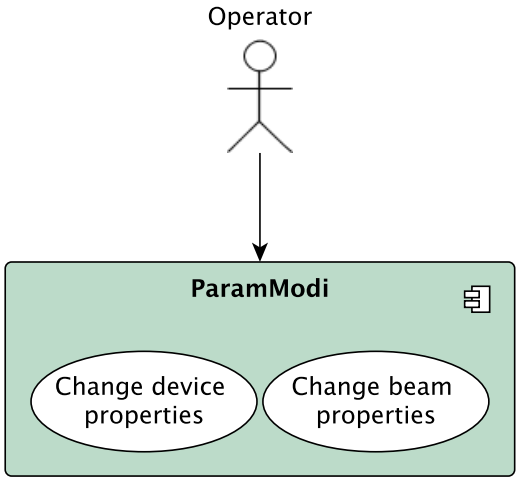
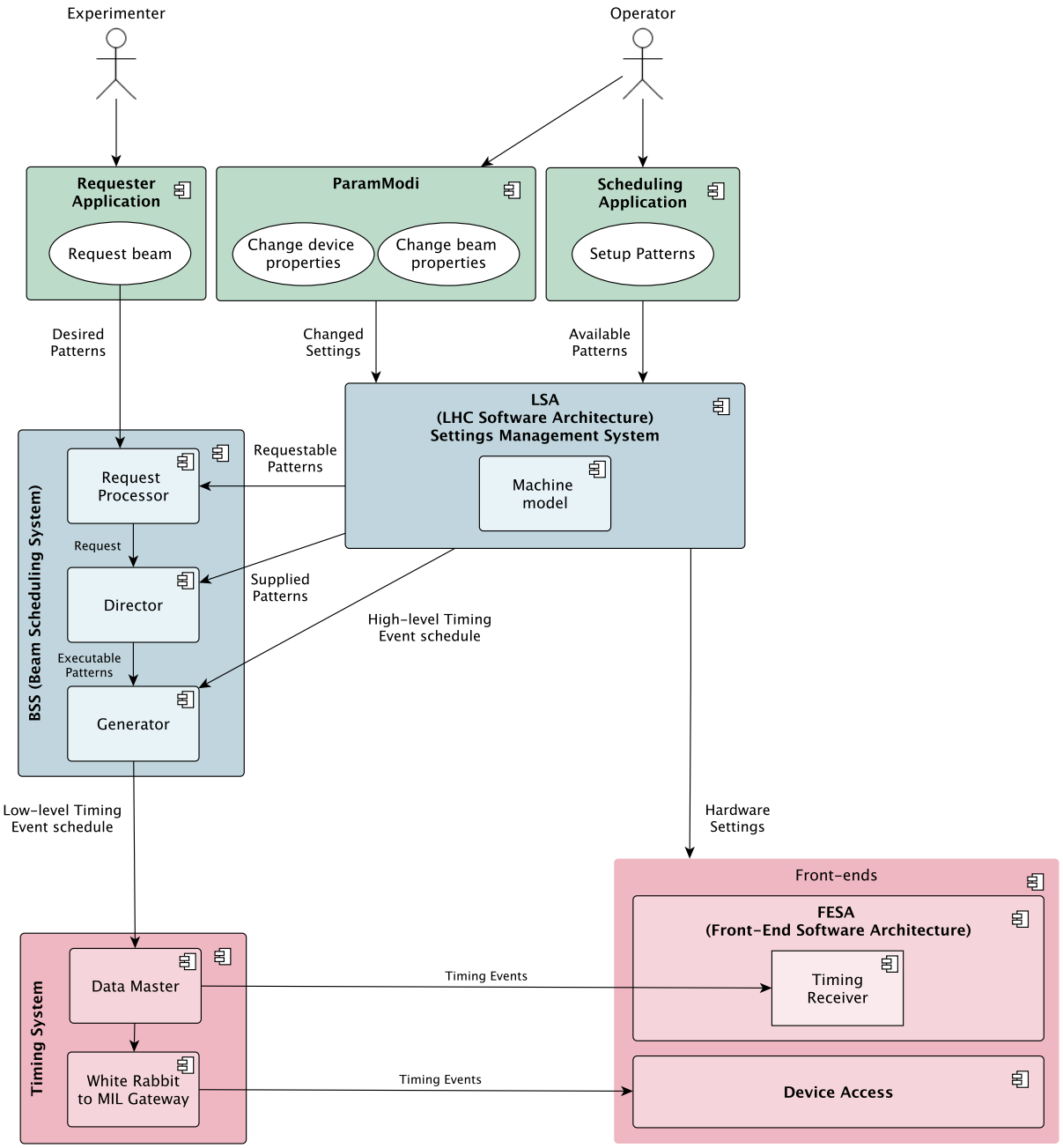
Timing Events
Device Access

Use Case 2: Changing Settings




Experimenter
Operator
Requester Application
Request beam
ParamModi
Change device properties
Change beam properties
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Desired Patterns
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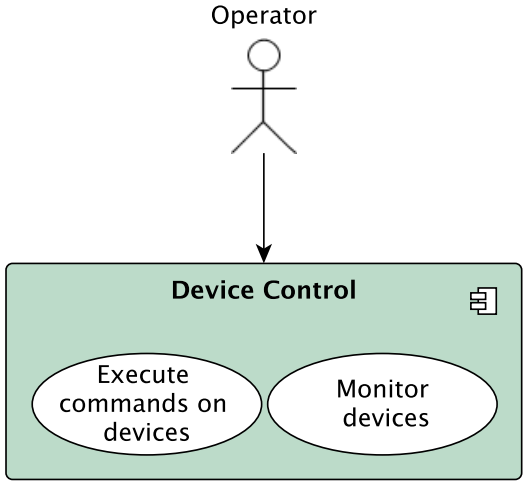
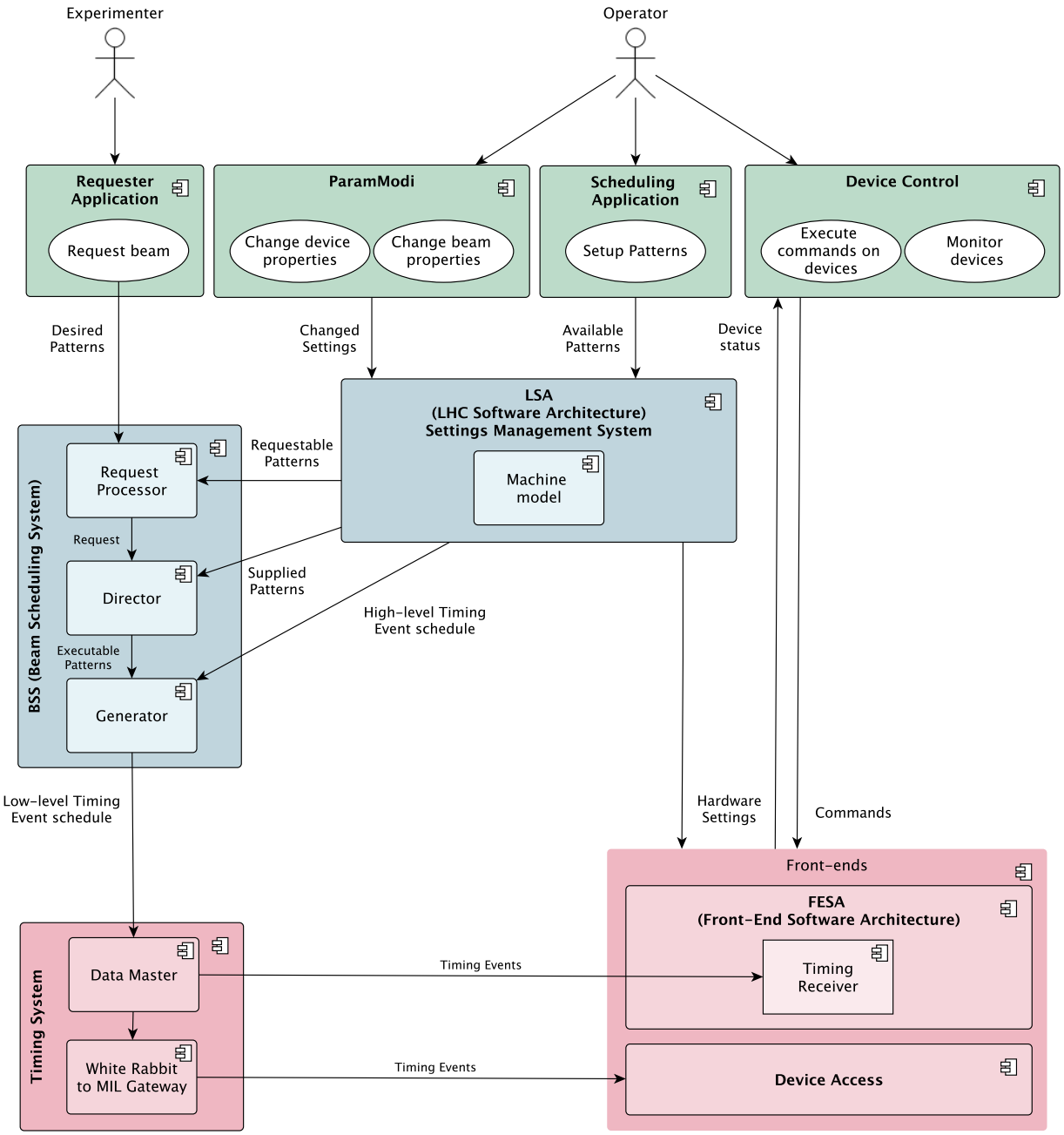
Use Case 3:
Device commands and monitoring

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ParamModi
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Execute commands on devices
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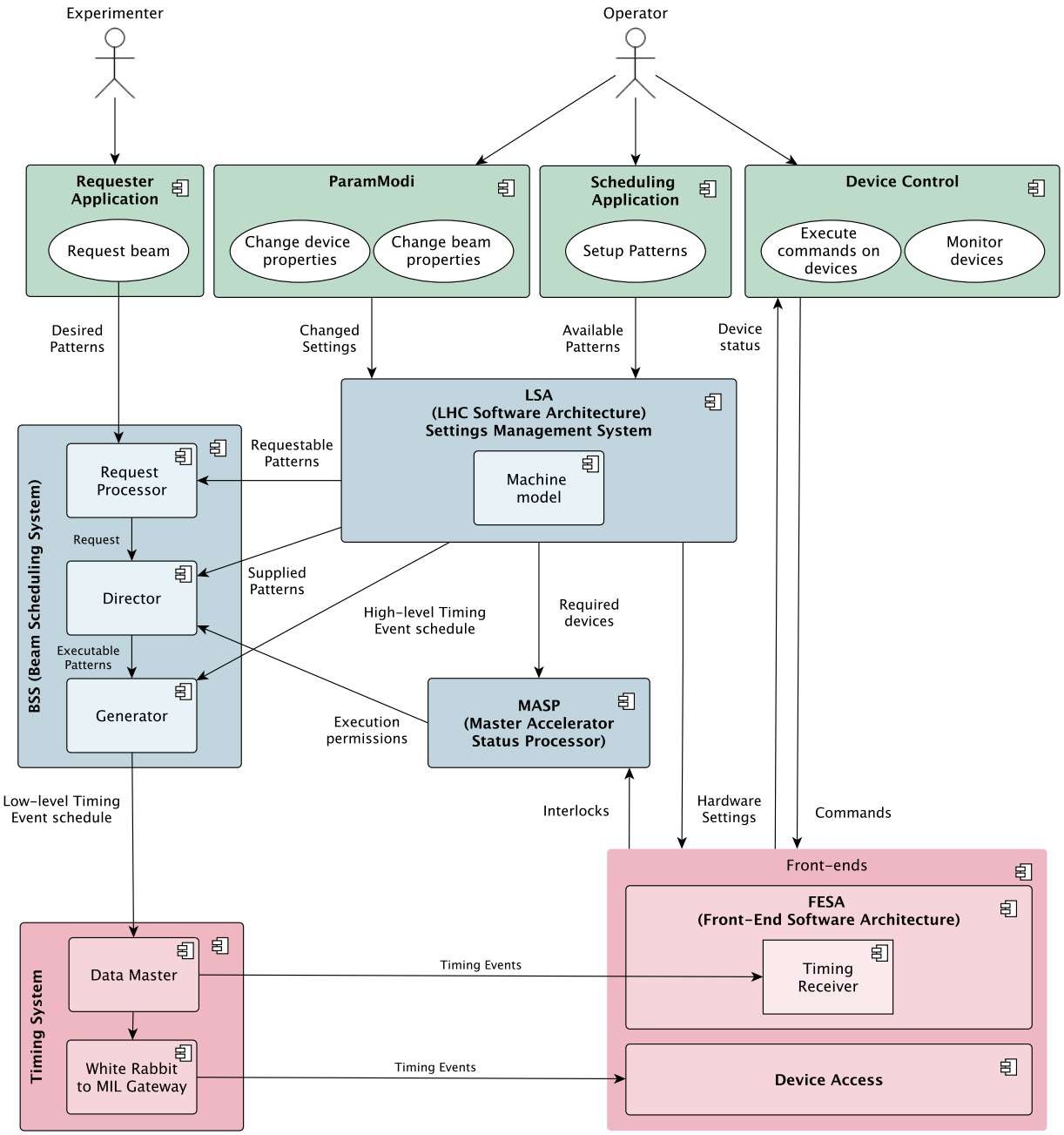
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MASP
(Master Accelerator Status Processor)
Execution permissions
Low-level Timing Event schedule
Interlocks
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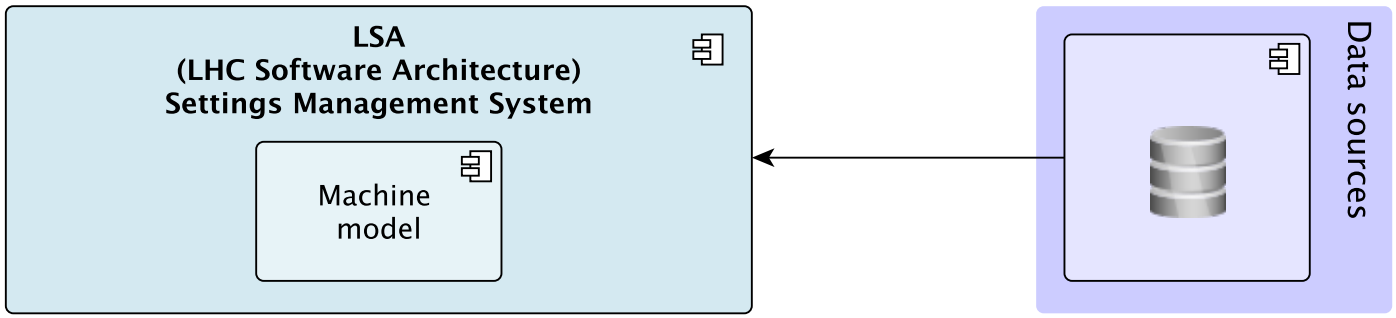
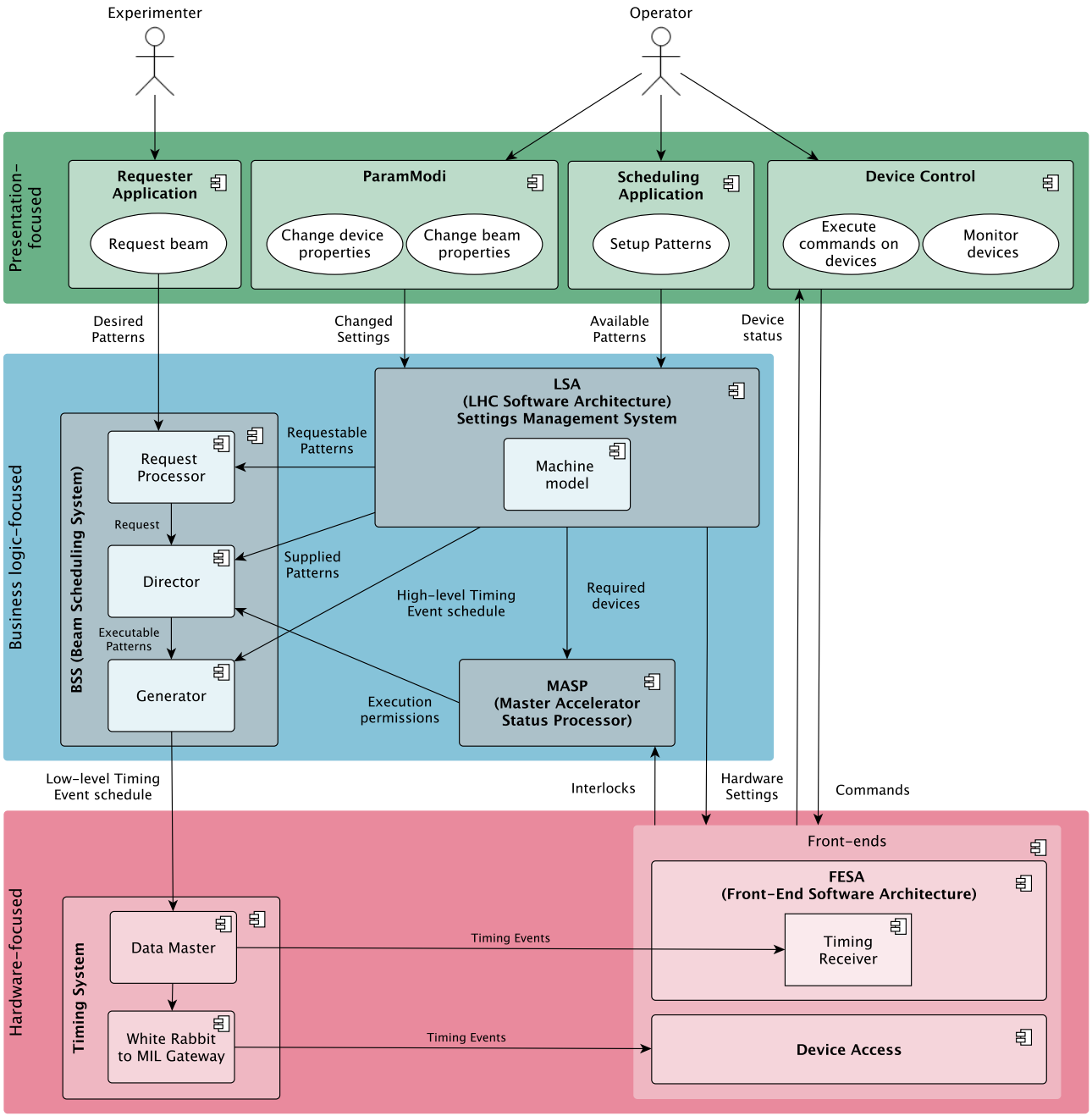
Use Case:
Device commands and monitoring

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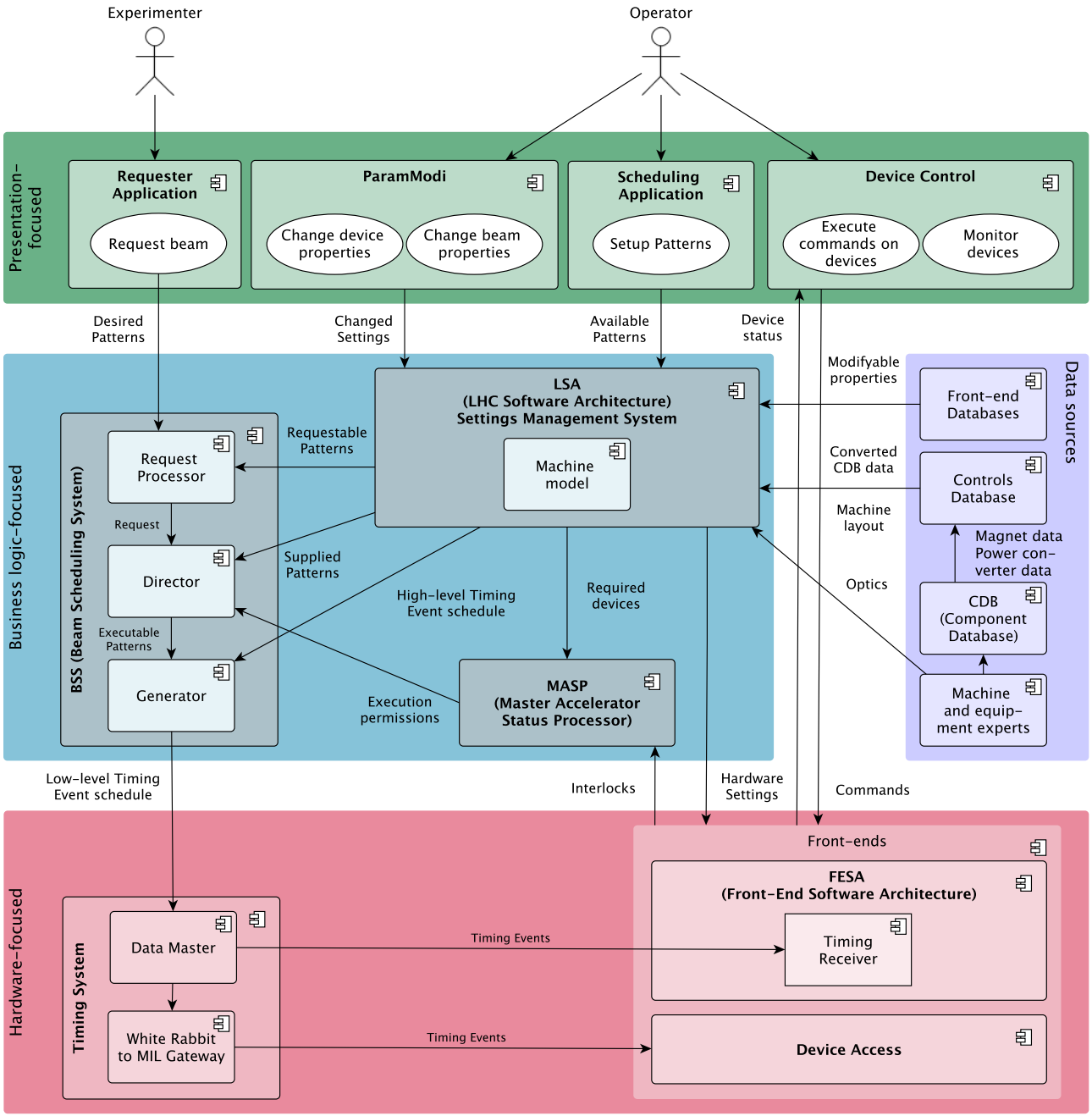
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Execution permissions
Modifyable properties
Converted CDB data
Machine layout
Optics
Data sources
Front-end Databases
Controls Database
Magnet data
Power converter data
CDB (Component Database)
Machine and equipment experts
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Thank you!

- Questions?