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«EMR-based Control of POver systems for Proton Synchrotron (POPS) accelerator»

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Context and Objective

2

EMR and MCS of the System

3

Simulation of the System



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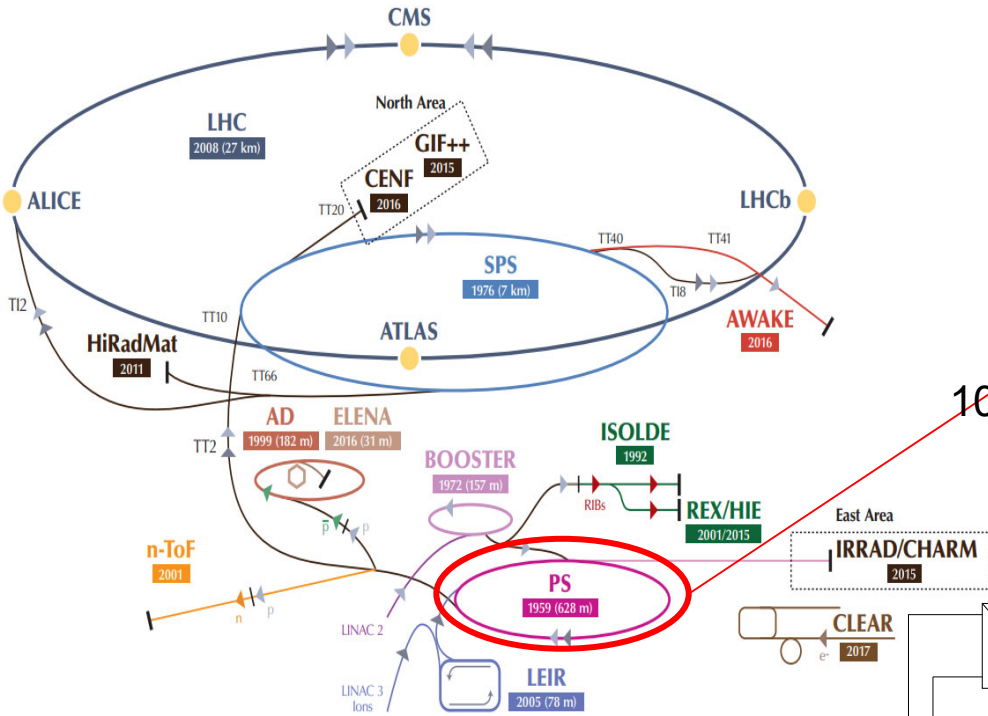
« Context and Objective »

EMR-based Control of POPS accelerator

- Context -

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CERN accelerator complex

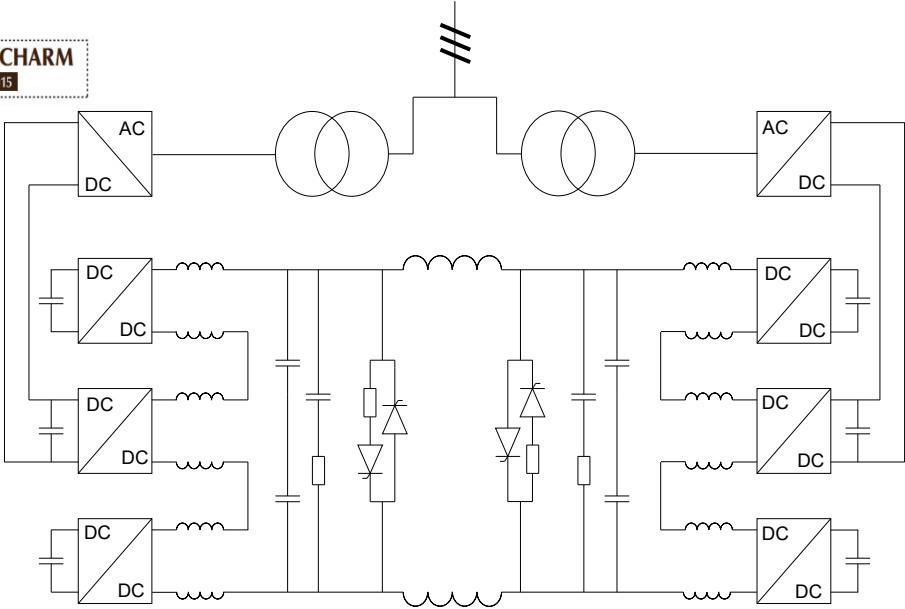


Proton Synchrotron



101 series magnets all along the accelerator + 6 storage capacitors

Centralized supply system for the magnet



EMR-based Control of POPS accelerator

- Objective -

5

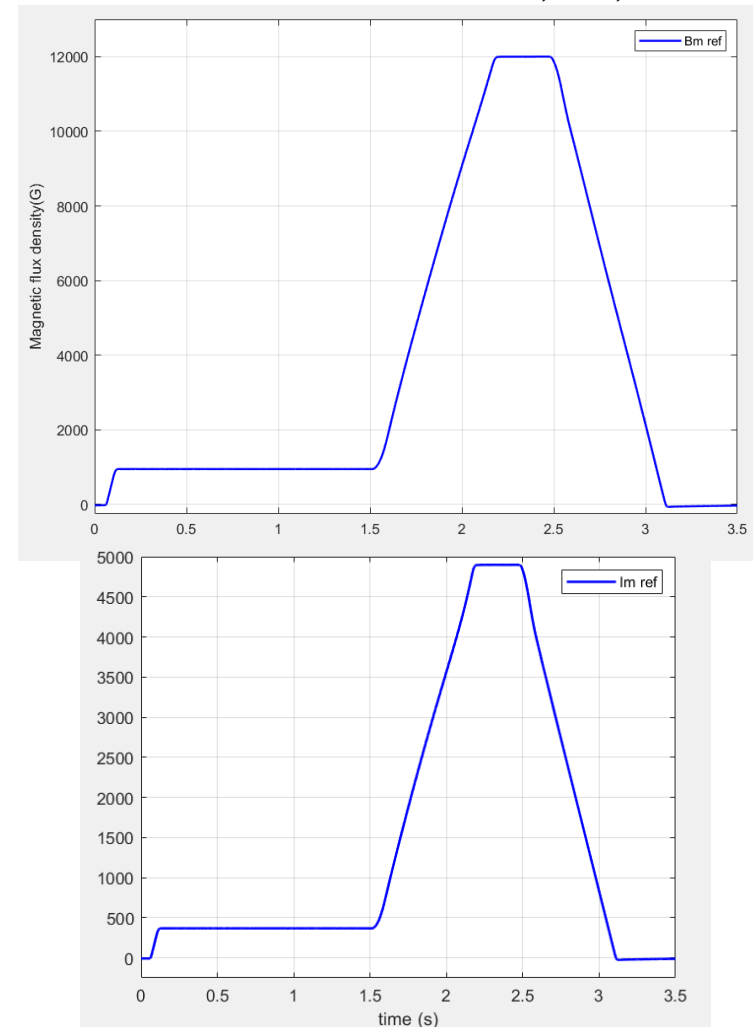
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Magnets control requirements:

- Complex supply system
- Injection phase
- Trapezoidal wave with a 12 kG Flat top
- Maximal current of 5.5 kA
- Maximal voltage of 10 kV
- 3.2s period
- Repetition every 3.5s 24h/24h
- Instantaneous error of 1.2 Gauss,
- 100 ppm during flat top
- Capacitors charged at 5000V at the end of a cycle

Other Requirements:

- Redundancy
- Energy savings



High current / slow dynamics
Ultra-high accuracy



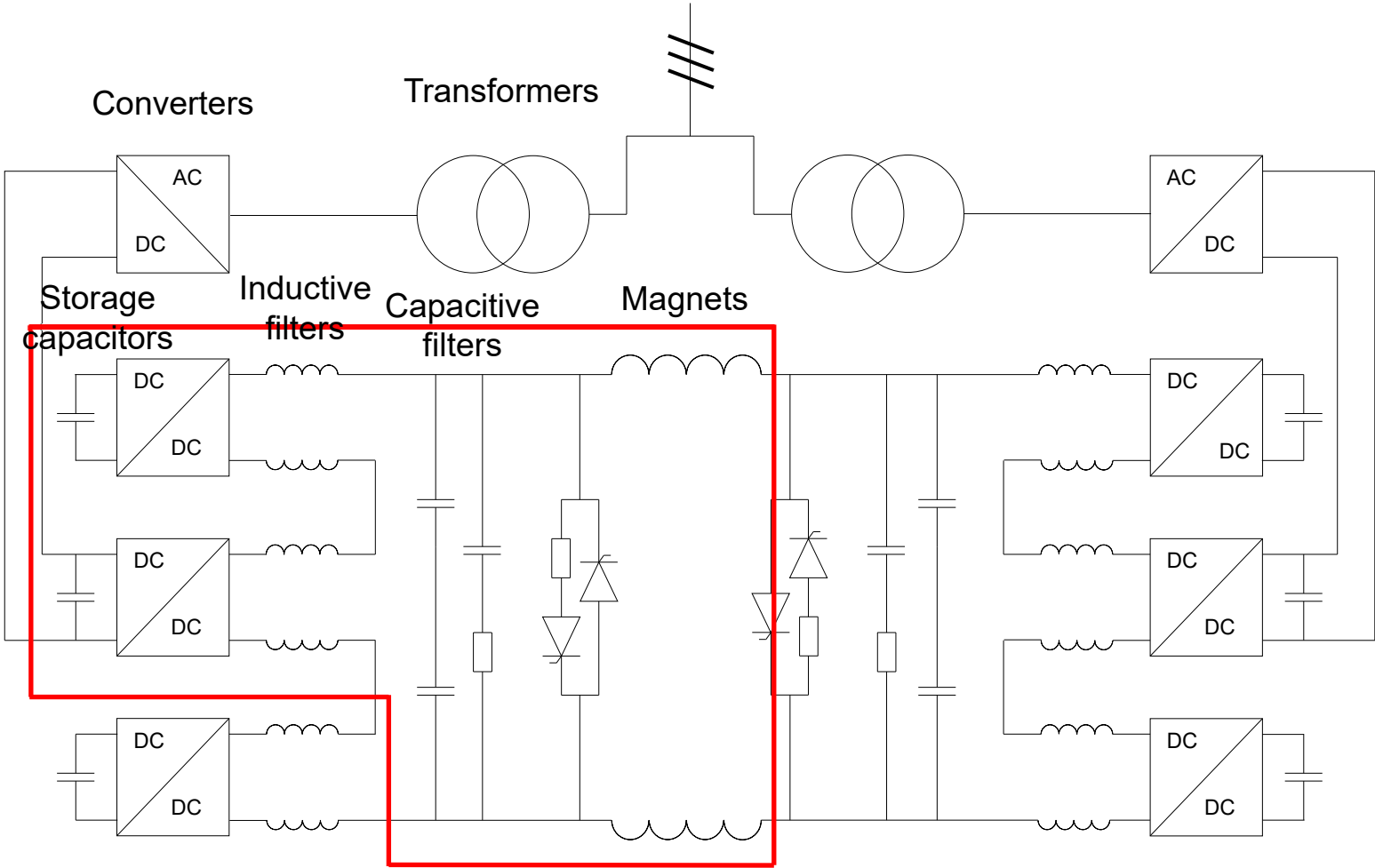
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« EMR and MCS of the system »

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- Studied system -

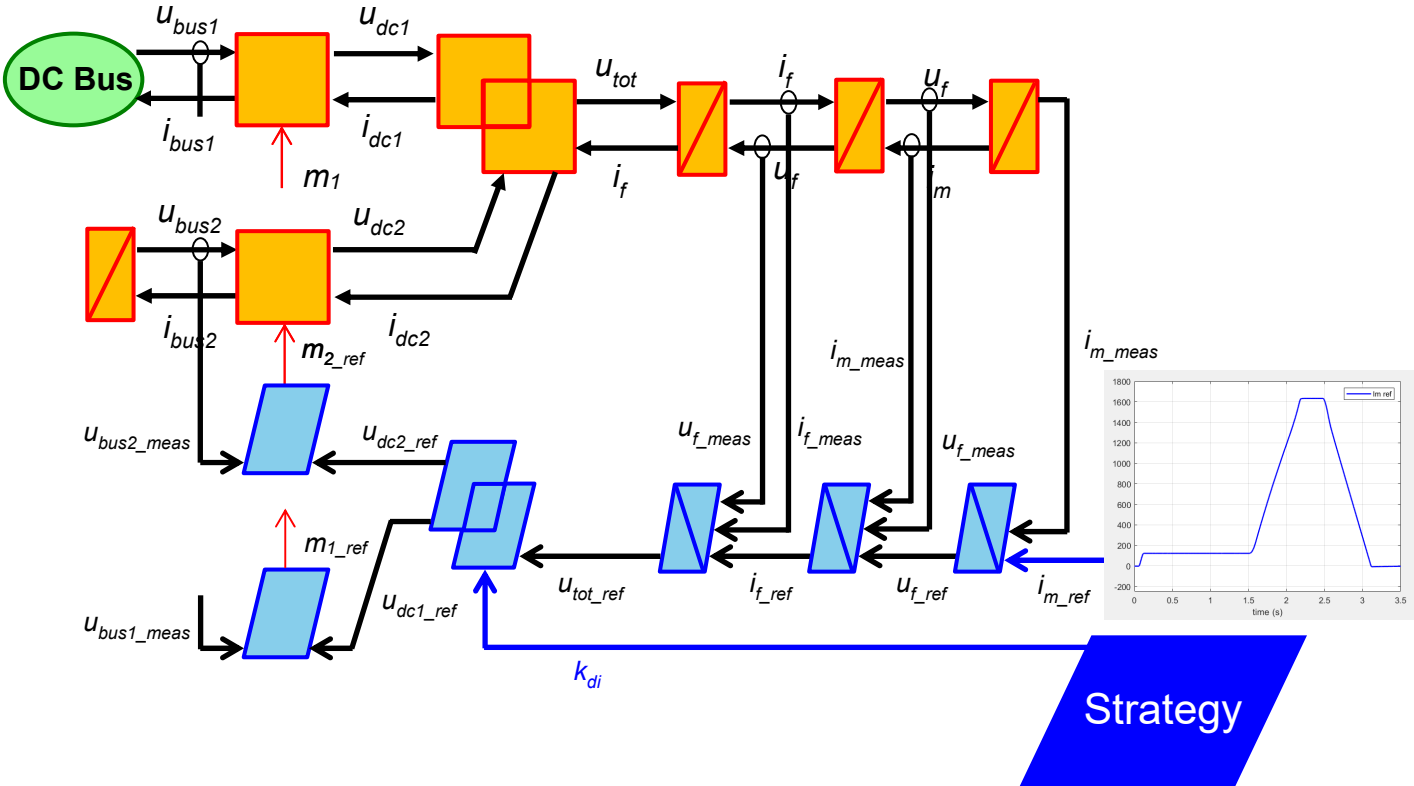
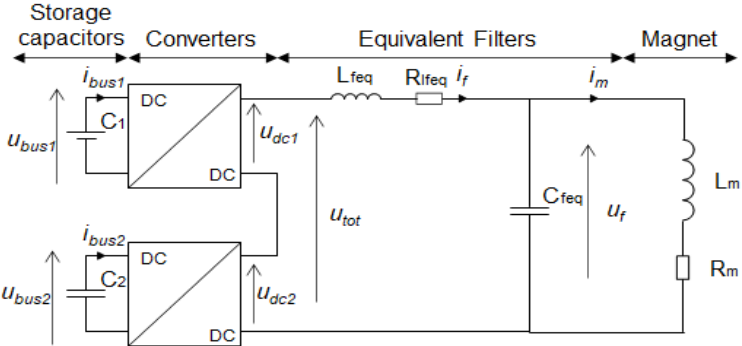
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- EMR of the system -

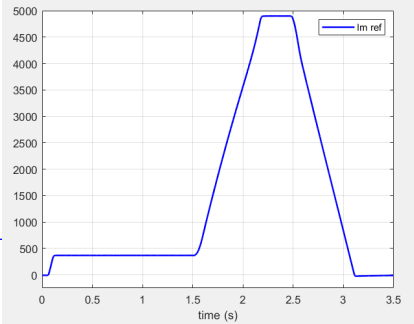
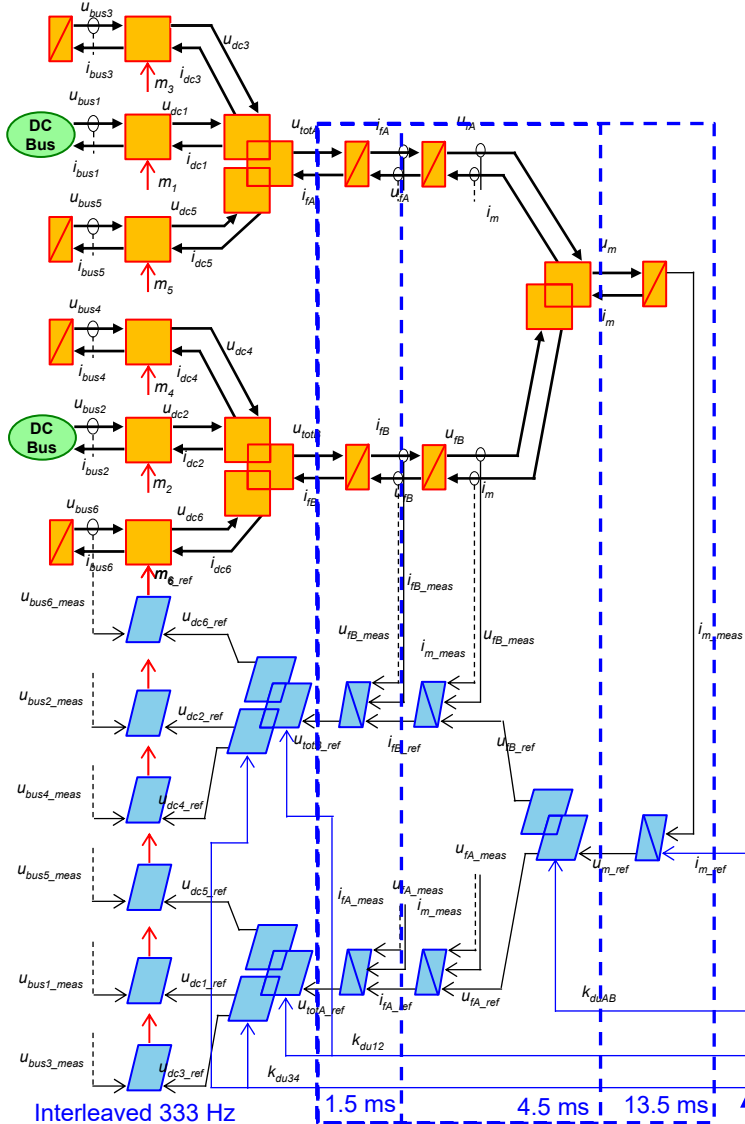
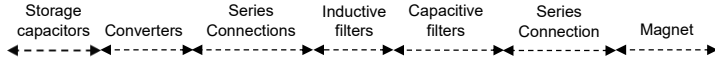
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- EMR of the system -

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Strategy



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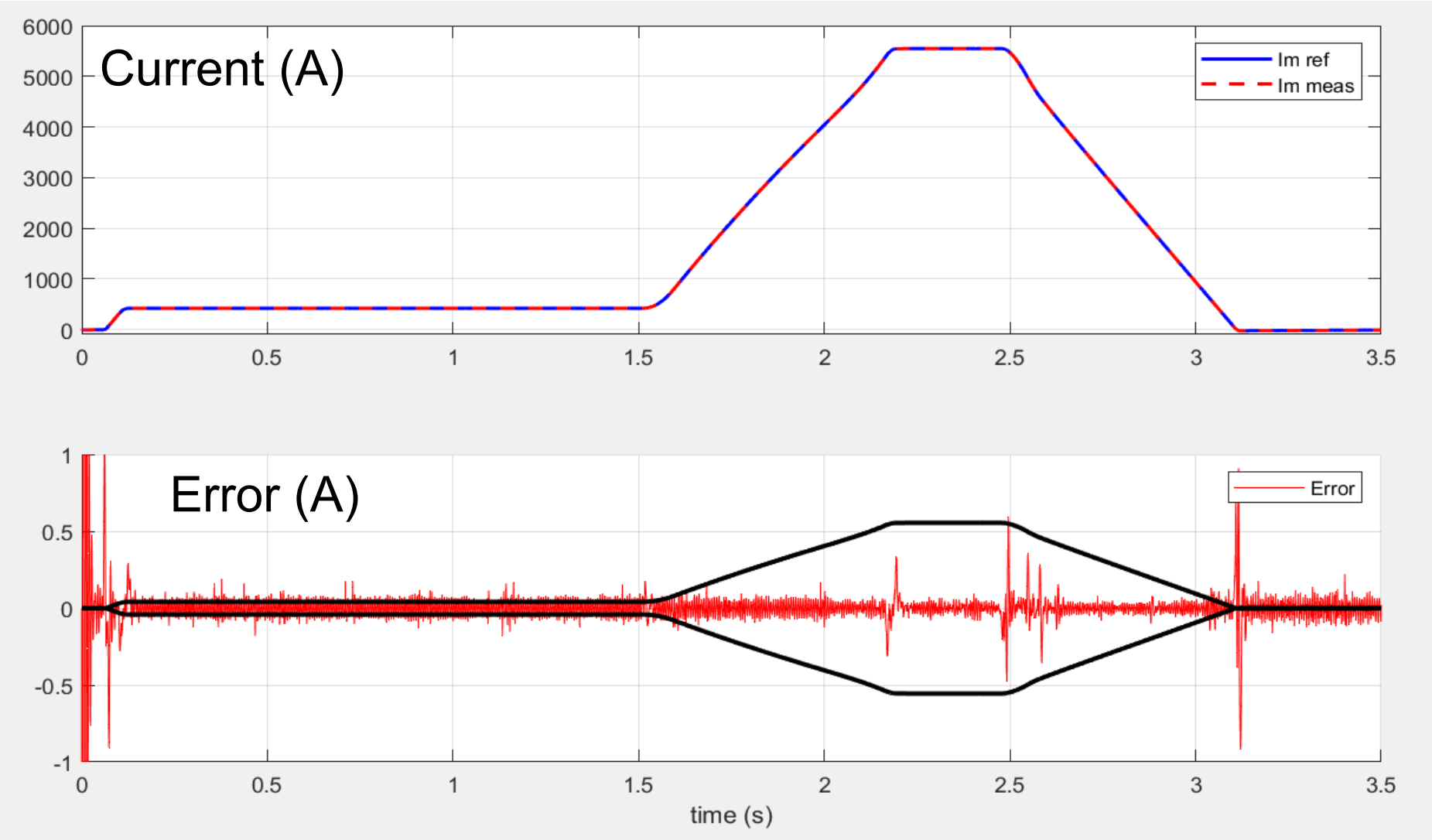
« Simulation of the system »

EMR-based Control of POPS accelerator

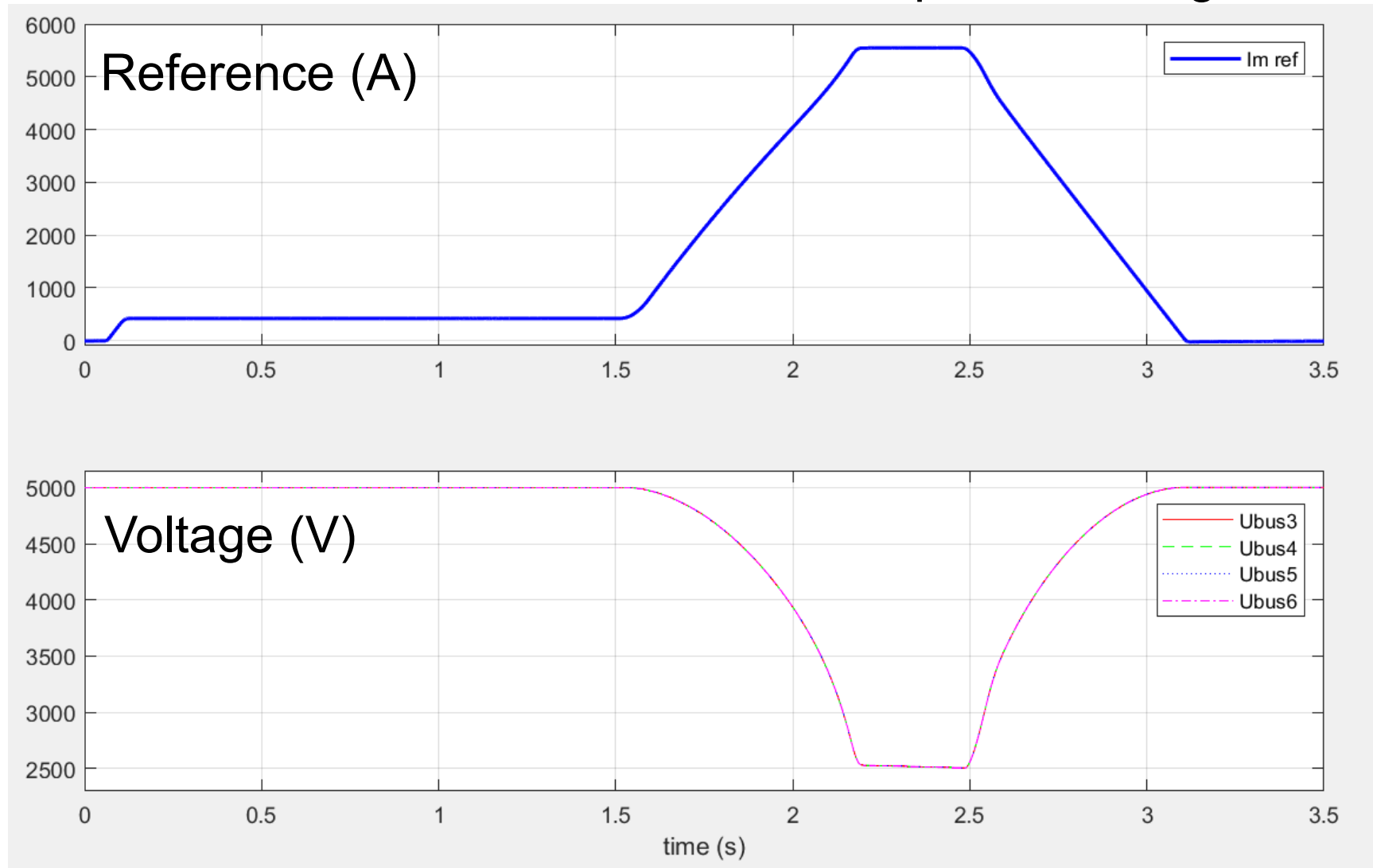
- Simulation of the system -

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Reference and measure of the current and its error



Reference and Evolution of the capacitor voltage

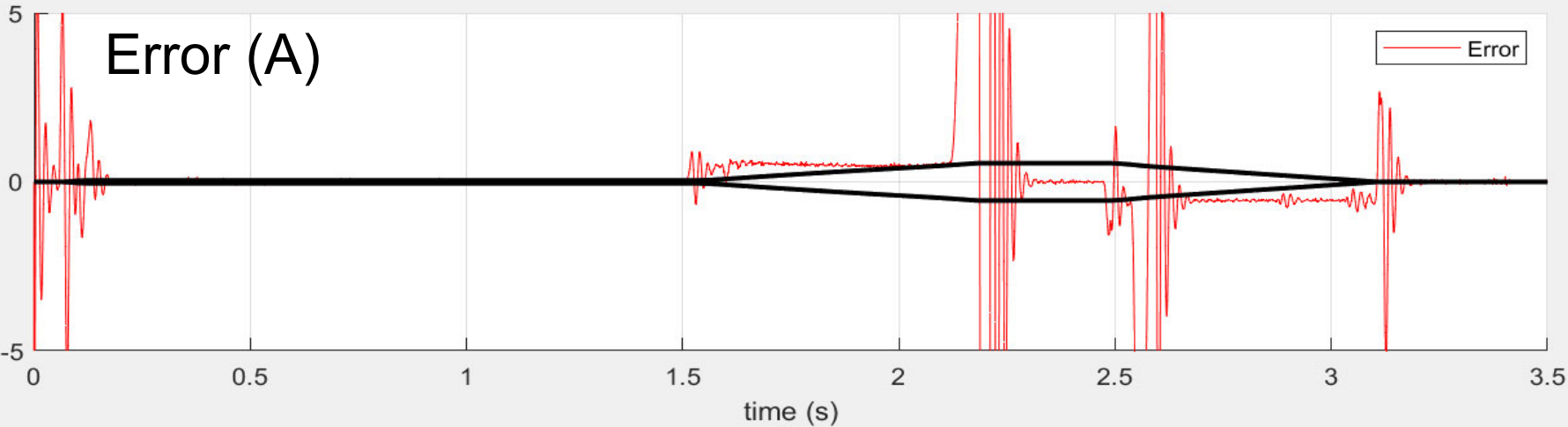
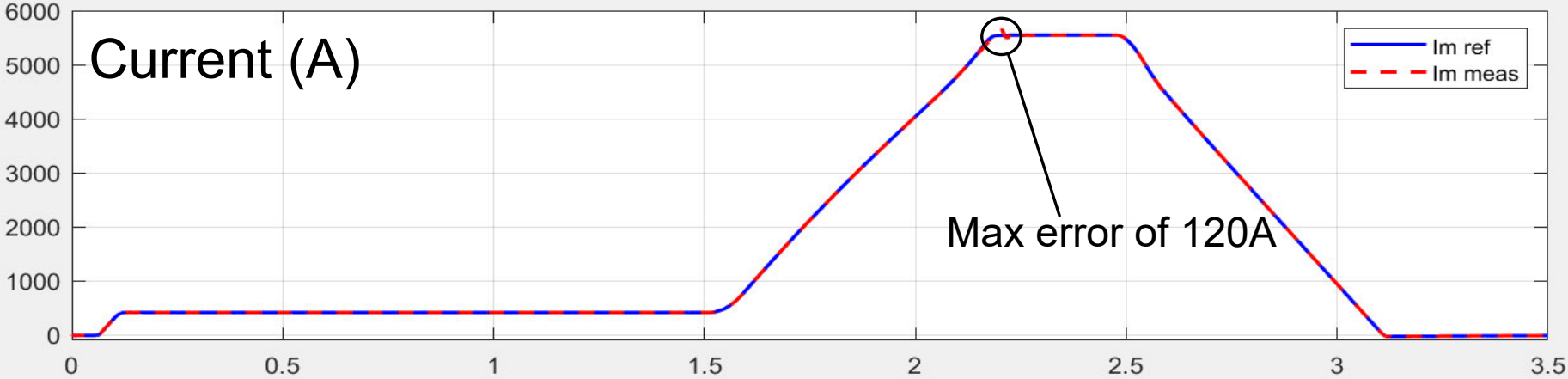


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- Simulation of the system -

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Importance of compensation
All optional sensor disabled



- EMR organizes well the system
- Short term:
 - Implement the PWM
 - Taking into account the magnet saturation
- Long-term :
 - Comparison with the control implemented @ CERN
 - Study of the new POPS

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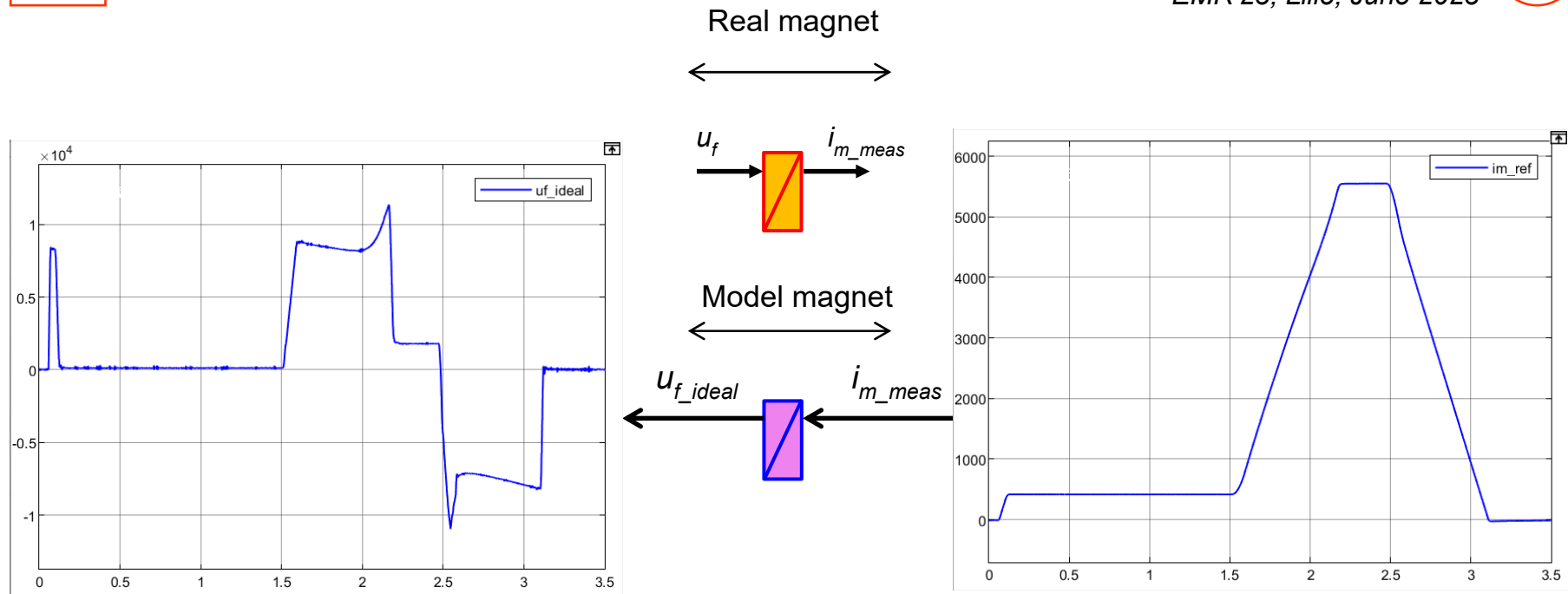
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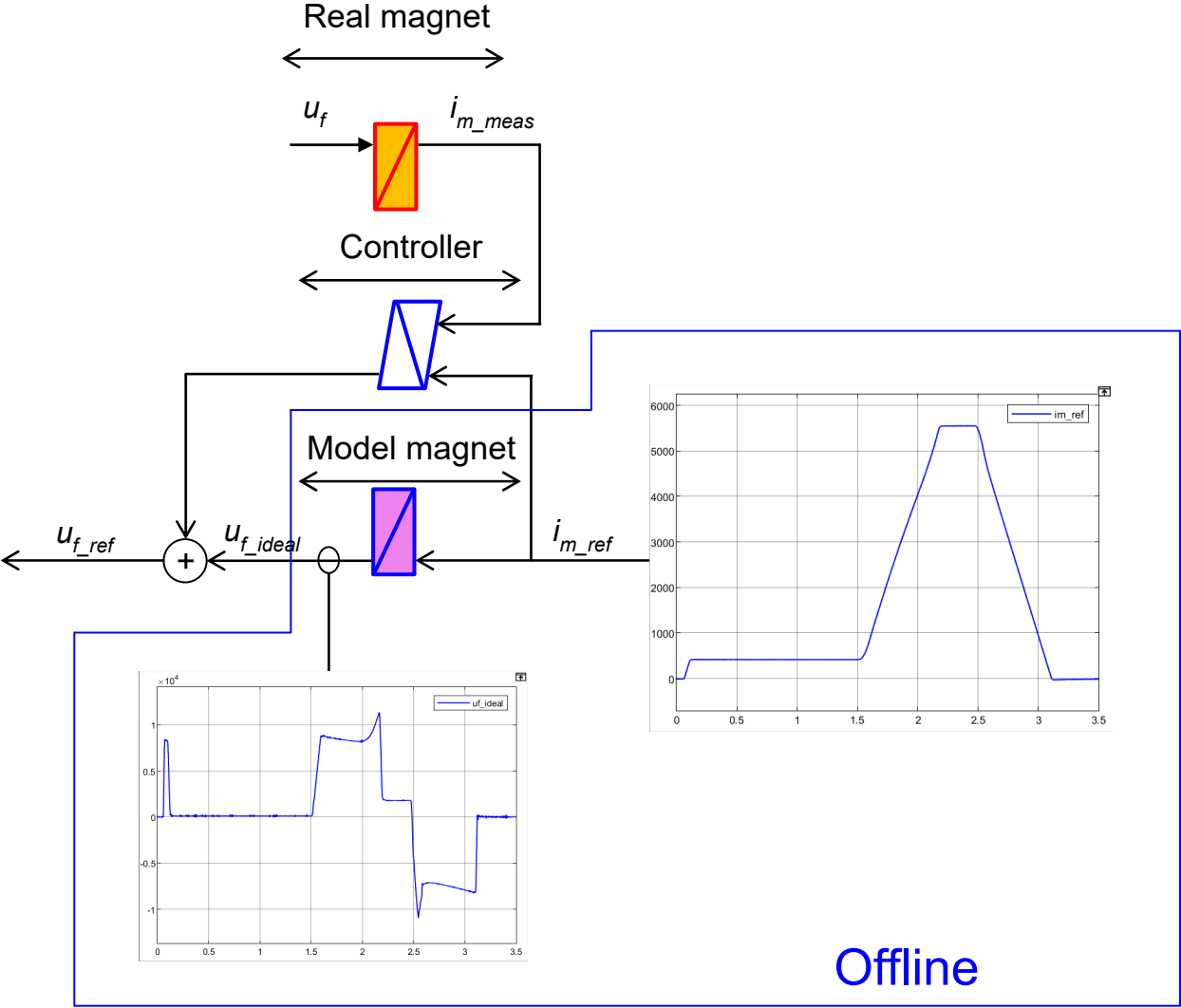
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True if we know the reference beforehand

$$u_{f_ideal} = L_m \frac{d}{dt} i_{m_ref} + R_m i_{m_ref}$$

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Offline

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- EMR of the system -

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