



Improving Fast Orbit Feedback Performance through Simulink-Based Modelling

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1. Simulink in the Diagnostics group
 - A. Group activities
 - B. Applications
 - C. FOFB and Matlab History
2. FOFB and Matlab nowadays
 - A. In other Synchrotrons
 - B. In our Synchrotron

1 - Simulink in the Diagnostics group

A - Group activities

❖ Small group in ASD :

- 4 engineers
- 3 technicians

⚠ Small group but often working in collaboration with colleagues from Beam Dynamics, Insertion Devices & Magnets, Radio Frequency or Accelerator Control Unit

❖ In charge of diagnostics systems :

- 320 BPMs (Beam Position Monitor)
- X-BPMs
- Striplines for filling pattern, cleaning
- CTs (Current Transformers)
- BLMs (Beam Loss Monitors)
- Cameras
- FOFB (Fast Orbit FeedBack)
- MBFB (Multi Bunch FeedBack)
- Scrappers
- Collimators
- Tune monitor...

1 - Simulink in the Diagnostics group

B - Applications

MATLAB :

- Cameras & BPMs control
- HDB data analysis and inspection

System Generator :
FOFB (like MBFB)

1 - Simulink in the Diagnostics group

C - FOFB and Matlab history

1. VHDL generation & simulation : Why did we stop ?

- We want to write it ourselves (and VHDL is fun)
 - To limit software and its problems dependency
 - Better FPGA resources management (but it takes more time)
 - To do versioning and compare VHDL files after changing them
 - Question of personal habits as well
- Institute-specific models, can not share easily like VHDL generic modules

2. **Simulation** : Why did we keep it ?

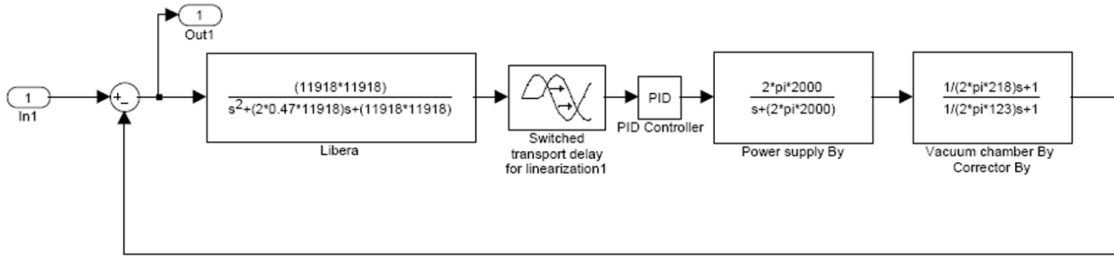
- Great because we can not do tests on the machine whenever we want
- Graphical user interface (compared to Python simulations)
- Great way to model complex systems like our machine
- Useful for PID and other blocs parameterization, Nichols & Bode for stability and sensitivity

- *Understanding of all of these feedback essentials*
- *Understanding of our machine behavior*

2 – FOFB and Matlab nowadays

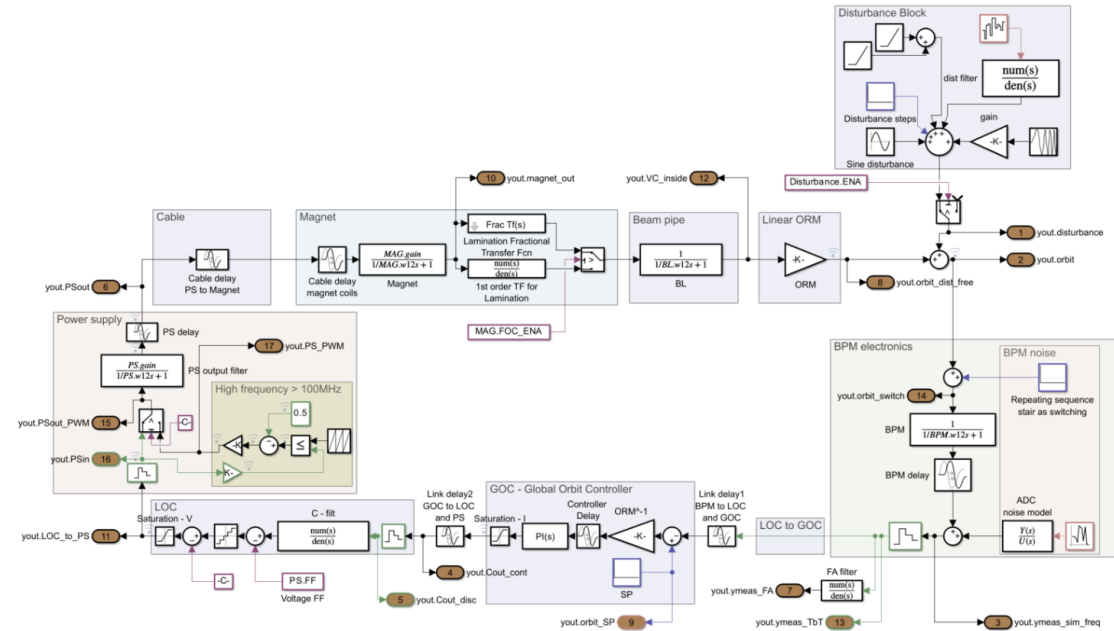
A – In other Synchrotrons

SIMULINK FOR FOFB SIMULATIONS

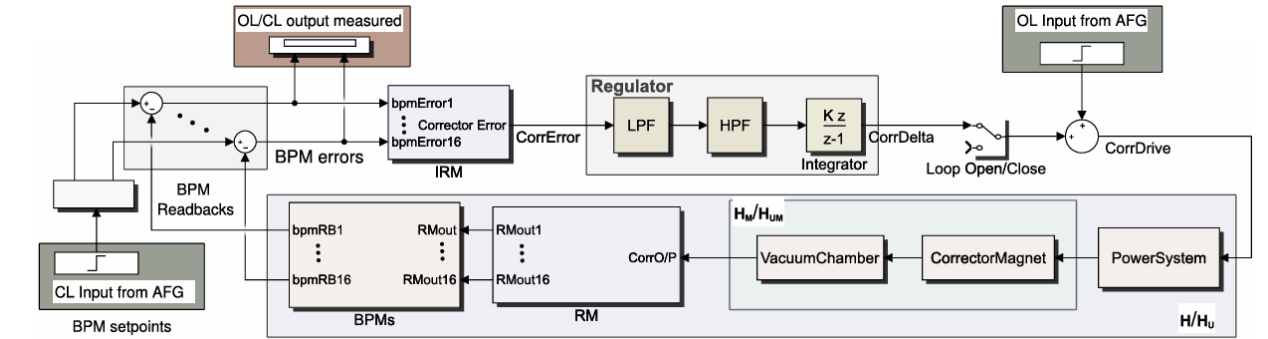
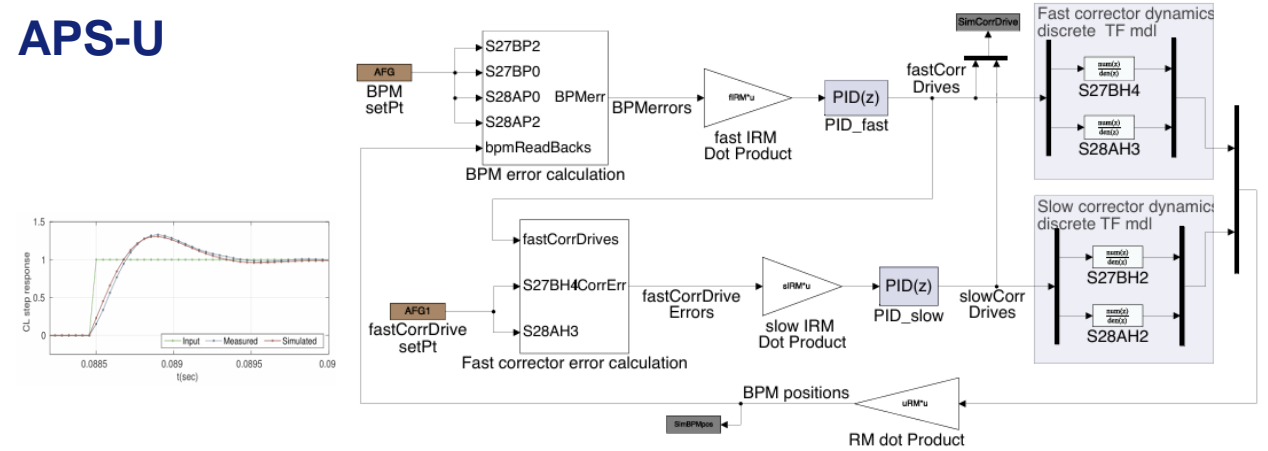


ALBA

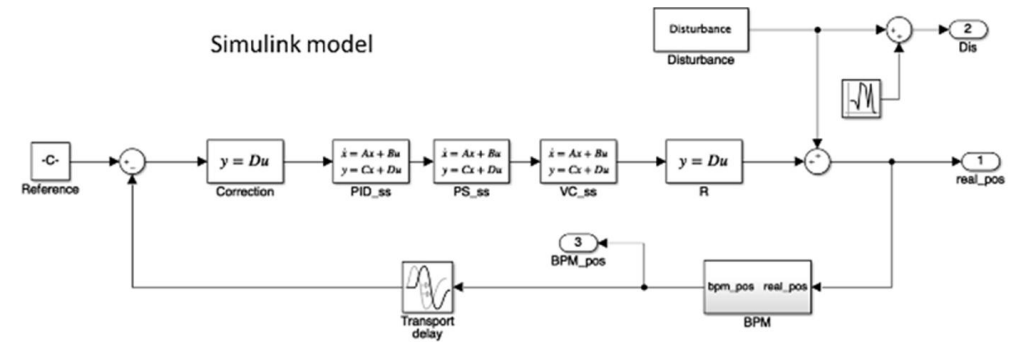
PETRA IV



APS-U



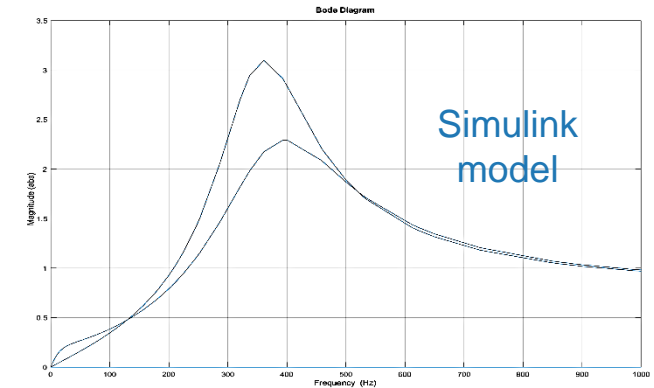
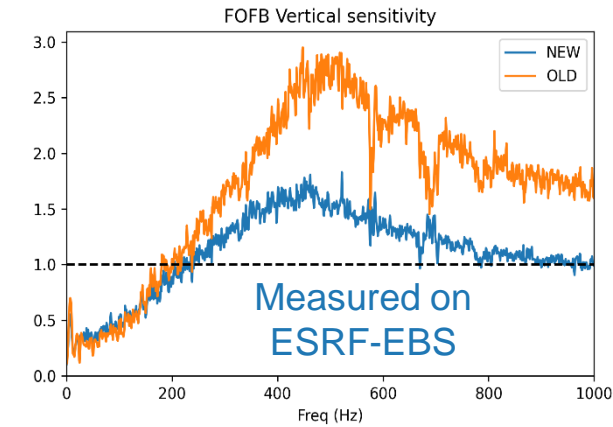
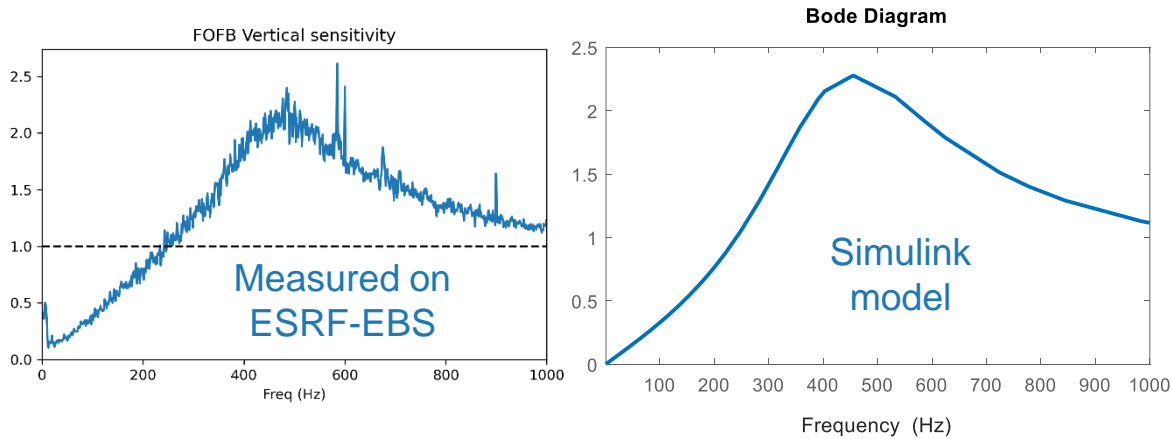
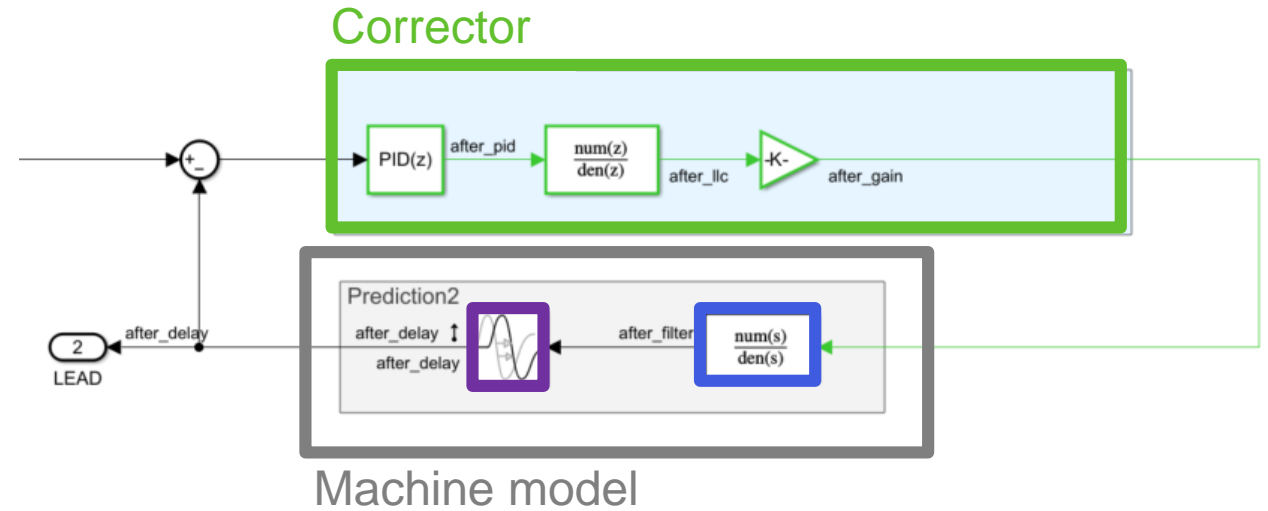
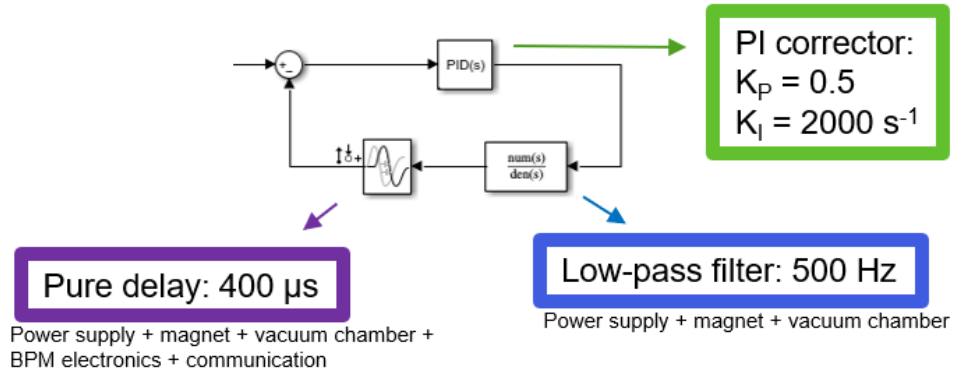
SILF



2 – FOFB and Matlab nowadays

B – In our Synchrotron

SIMULINK FOR ESRF FOFB



❖ Used to :

- Study machine behavior
- Find parameters role in our correction loop
- Understand unstable combinations
- Pre-determine optimized combinations for MDT (Machine Dedicated Time)

❖ Current difficulties :

- Too complex system that has to be simplified
- Software difficulties (personal experience) :
 - Data processing
 - FOMCOM toolbox
 - Stability issues in recent versions



Thank you for listening !

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