



Max-Planck-Institut
für Plasmaphysik

Use of virtual actuators in ASDEX Upgrade control

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³ see A. Kallenbach et al, Nuclear Fusion 57 2017 102015²

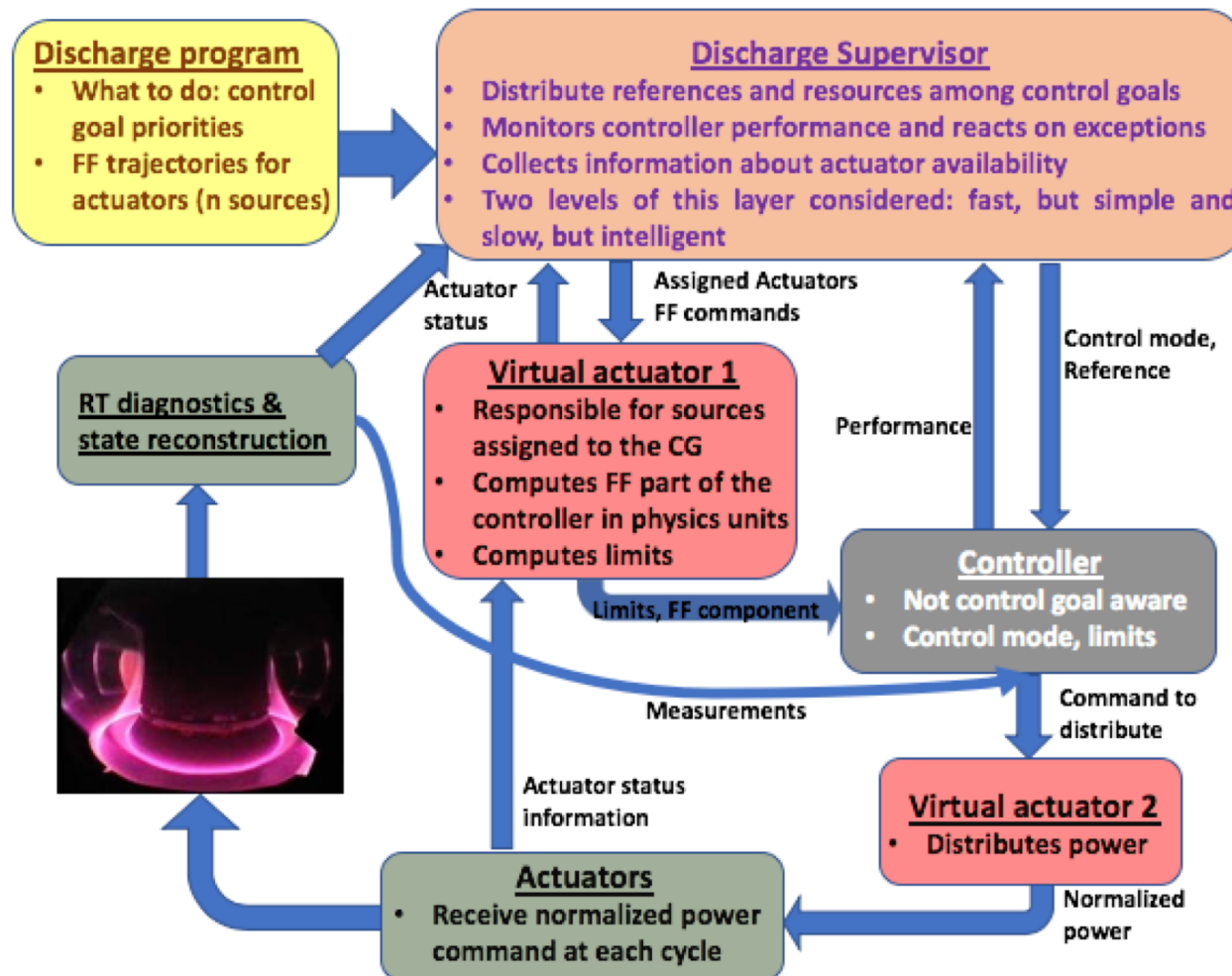
⁴ see H. Meyer et al, Nuclear Fusion 57 2017 102015

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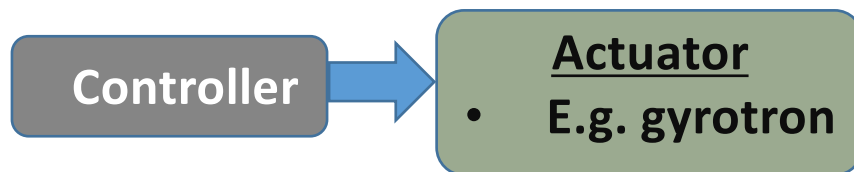
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Bigger picture: envisioned discharge control system

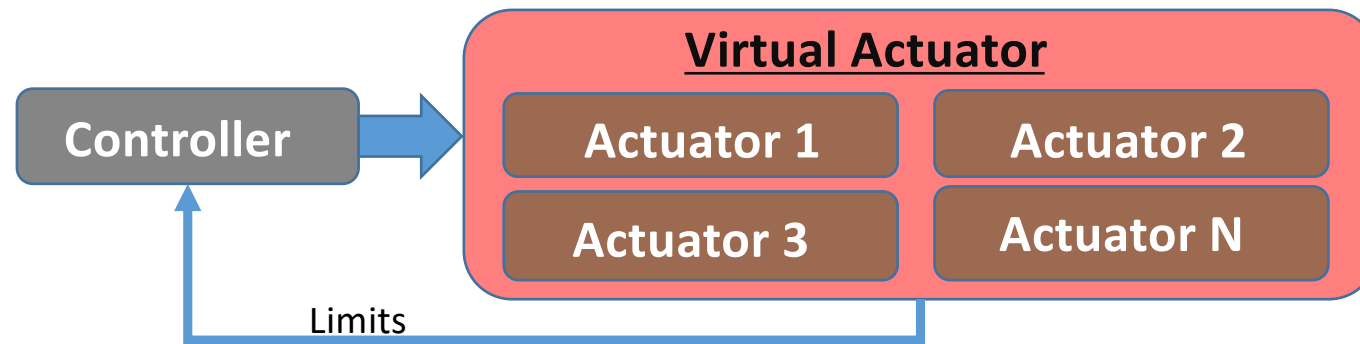


Virtual actuator: concept

- To achieve some control tasks (such as β control), one needs more power than available in one actuator
- Historically, we used just one actuator per task



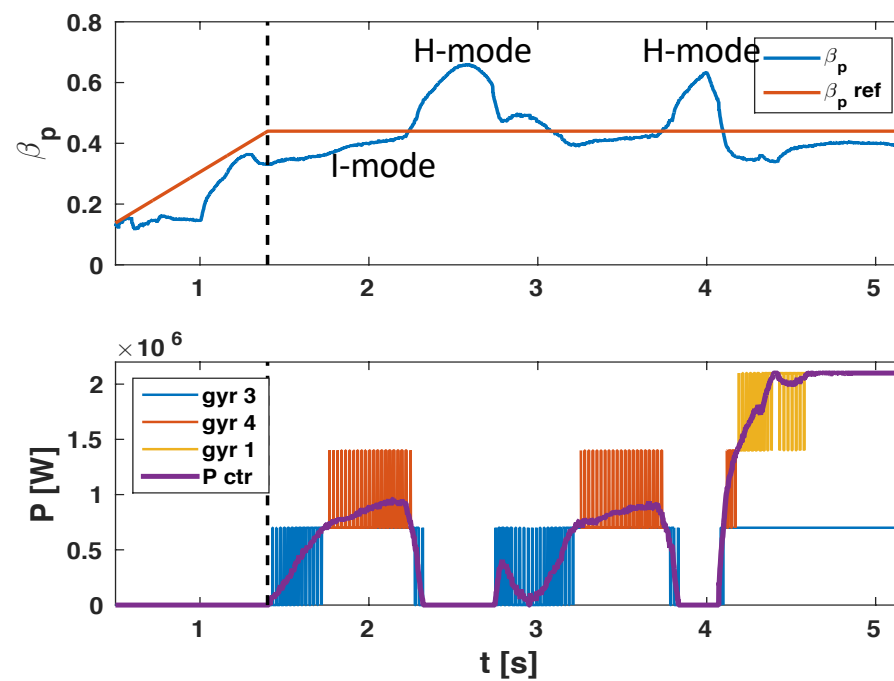
- **Virtual actuator:** Combine several actuators sorted by priority for one control goal



- One actuator can be just in one virtual actuator to keep the structure clear

Virtual actuator in AUG operation

- Implemented for all 8 ECRH gyrotrons
- Gyrotrons supplied from the pulse schedule sorted by priority
 - Virtual actuator check availability and if needed also power deposition
 - Power distributed to available gyrotrons pointing to the right location
- Example: β_p control by ECRH
 - Keep discharge in I-mode
 - Virtual actuator with 3 gyrotrons



What can you see in the poster P1-10?



- More details about the virtual actuator concept
- More AUG applications
 - β control by ECRH
 - T_e profile control
 - Keep T_e profile in case of:
 - Density or impurity content change
 - NBI source change from radial to tangential
 - **Disruption avoidance** [see B. Sieglin et al, Rapid prototyping of advanced control schemes in ASDEX Upgrade, Tuesday 11:20]
 - Keep plasma away from disruptive zone