Preface

This lecture covers the Feed Forward System at BESSY II. Parts of the infrastructure are also used for the undulator-interlock, which is covered in the 2nd part of the lecture.

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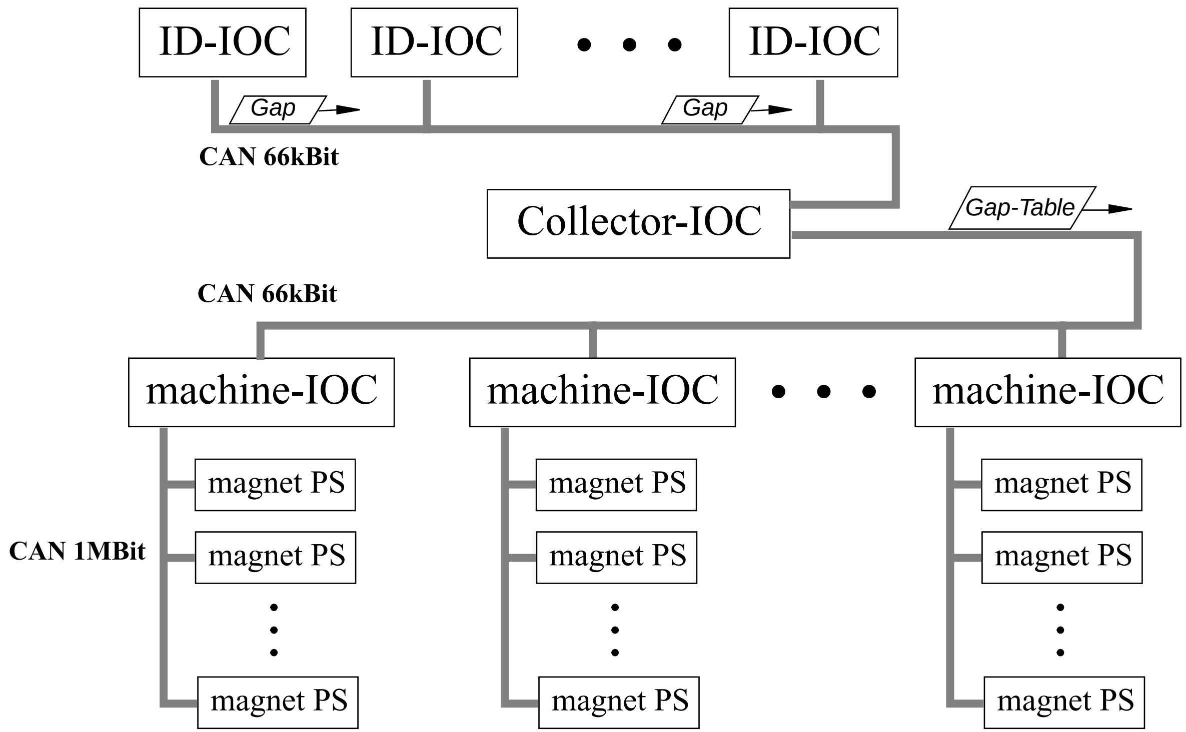
global feed forward, principle



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global feed forward, principle

- **Data flow**
  The current gap positions are transmitted from the ID-IOC to the collector IOC at a rate of 10Hz. The collector IOC assembles a complete table with all gaps of all ID's and sends this table to the machine IOCs at a rate of 10 Hz.
- **how the compensation works**
  each machine-IOC has a correction table for each insertion device. This table contains correction currents for selected gaps. For gaps not present in the table, the correction currents are linear interpolated. Example of such a table:

Gap of ID 1	PS 1	PS 2	...
15	0.01	0	...
18	0	0.03	...
20	-0.02	0.04	...
40	-0.03	0.05	...
...	...	...	...

Example: gap=17 leads to PS1 correction=0,003 and PS2 correction=0,02
These corrections are added to the normal settings of the power supplies.

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All corrections for a power supply are added to the set-value from the machine control system. Example:

`PS2 Set-Current= PS2 machine set-current + ID1 correction + ID2 correction + ...`

This setting is then sent to the power supply via the CAN bus.

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Properties of the CAN Bus

- **robustness against electrical interference**
- **real-time capability, maximum latency time can be predicted on an installed CAN-bus network, a collision avoidance mechanism is used.**
- **multicast capability**
- **cheap bus-interface components are available**
- **long term availability of components due to wide usage in european and international car industry**
- **very low error-rate due to built in CRC check**
- **covers layer 1 and 2 in the ISO-OSI model**

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advantages of the design

- usage of the CAN bus gives a predictable latency time
- easy implementation of the protocol for ID-IOC <--> collector-IOC communication
- communication between beamline-control and accelerator control via a separate cable without routers or other network components in-between
- computation of correction-currents uses all machine-IOCs
- tables with correction currents are stored on IOCs, so they can easily be modified or downloaded even during operation of the storage-ring
- the collector-IOC distributes all ID-gaps at a fixed rate of 10Hz in parallel to all machine-IOCs (multicast capability of the CAN bus), so the feed-forward works synchronous

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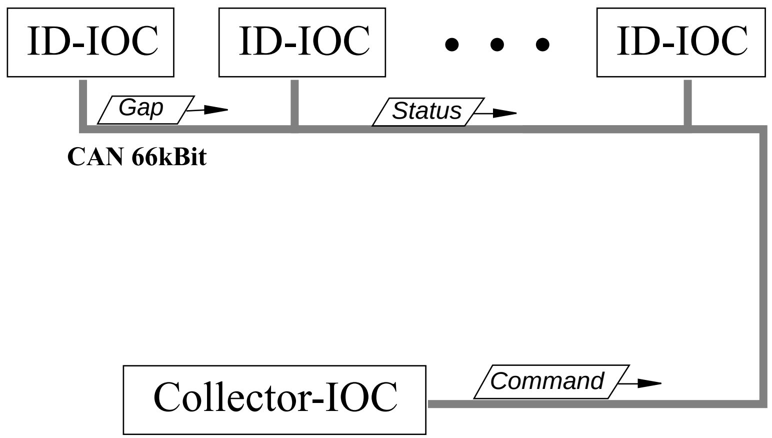
undulator interlock, principle

Tasks:

- movement of all IDs to „home position“ during injection
- movement of IDs to their previous position after injection
- locking of the IDs during injection



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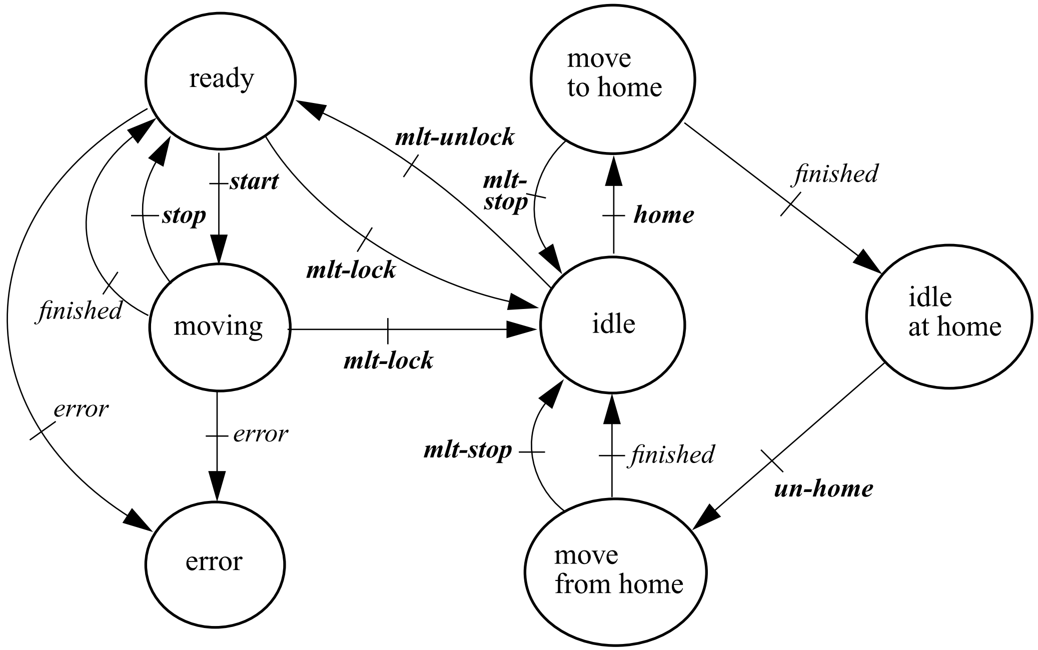
state transition diagram:



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