

Progress report

Performance of BSW magnets powering for PSB injection chicane

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Technical requirements (original)

- Absolute precision:
 - ±50 ppm during flat-top (starting from when beam is injected)
 - ±500 ppm during ramp-down
 - 125 Hz also applied at current rump-up
 - Amplitude:
 - BSW2, BSW3, BSW4: 3.4 kA
 - BSW1: 6.7 kA



t _{rise}	5 ms
t _{flat}	2 ms
t _{fall}	5 ms
t _{rep}	1.2 s



Standard controller approach

 Current controller (RST type) could not deliver sufficient absolute error of the current





Reference modification to achieve low error

 Iterative Learning Controller (ILC) applied to cope with the absolute error of the magnet current – reference adaptation method (currently offline)





Temperature drift effect on current

 Iterative Learning Controller (ILC) can be also applied to solve error due to temperature drift, or its simplified form (simple to implement and test)





Precision requirements revisited

- BSW1 delivers more that 97% of samples in "new" +/-125ppm spec. during flat-top second half (significant for injection)
- BSW4 delivers more that 93% of samples in "new" +/-125ppm spec. during flat-top second half (significant for injection)





Conclusions

- Iterative Learning Controller (ILC) is able to deliver low absolute error, including error due to temperature drift
- ILC doesn't have to be implemented in its sample-to-sample form heavy for the controller and implementation, but rather as a simple correction factor applied on the flat-top
- Achieved precision for BSW1 is in range of +/-150ppm (>97% in +/-125ppm spec.) for the 2nd half of the flat-top; and +/-240ppm over the entire current pulse
- Achieved precision for BSW4 is in range of +/-200ppm (>93% in +/-125ppm spec.) for the 2nd half of the flat-top; and +/-420ppm over the 2nd half of the current pulse
- Voltage measurement to be checked deeply for effect on current repeatability





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