Injector feedback

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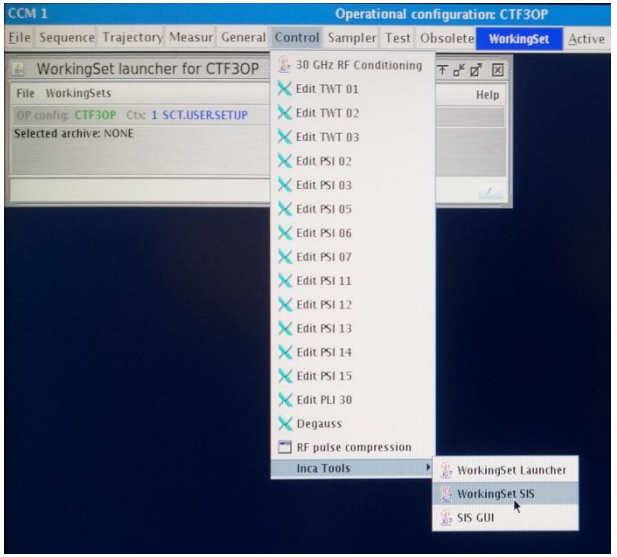
Concept

- **Beam based feedback to increase beam phase stability and potentially beam current stability**
- **Stabilizing of BPR0290S and BPR475W average in time**
  - **by shifting MKS02-PLOOP and MKS03-PLOOP**

Implementation

- **It is running as a standalone SIS application**
  - **http://wikis.cern.ch/display/SIS/CTF-FEEDBACK-SIS**
- **In Control/Inca Tools there is WorkingSet SIS**
  - **In the really bottom line you find knob to steer the injector feedback**

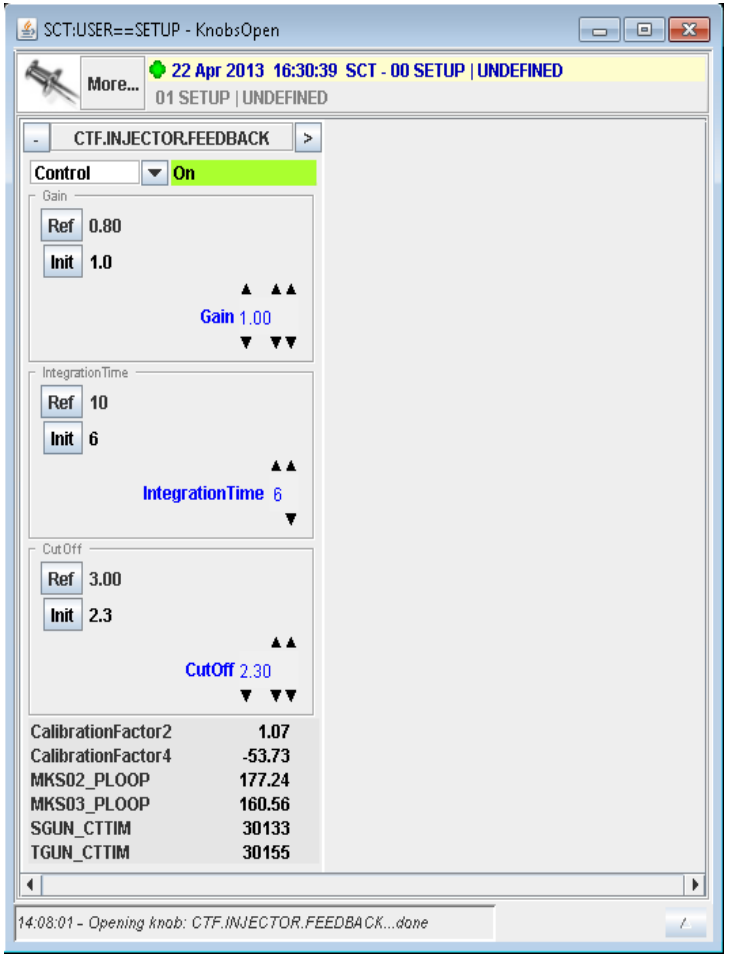


How it works?

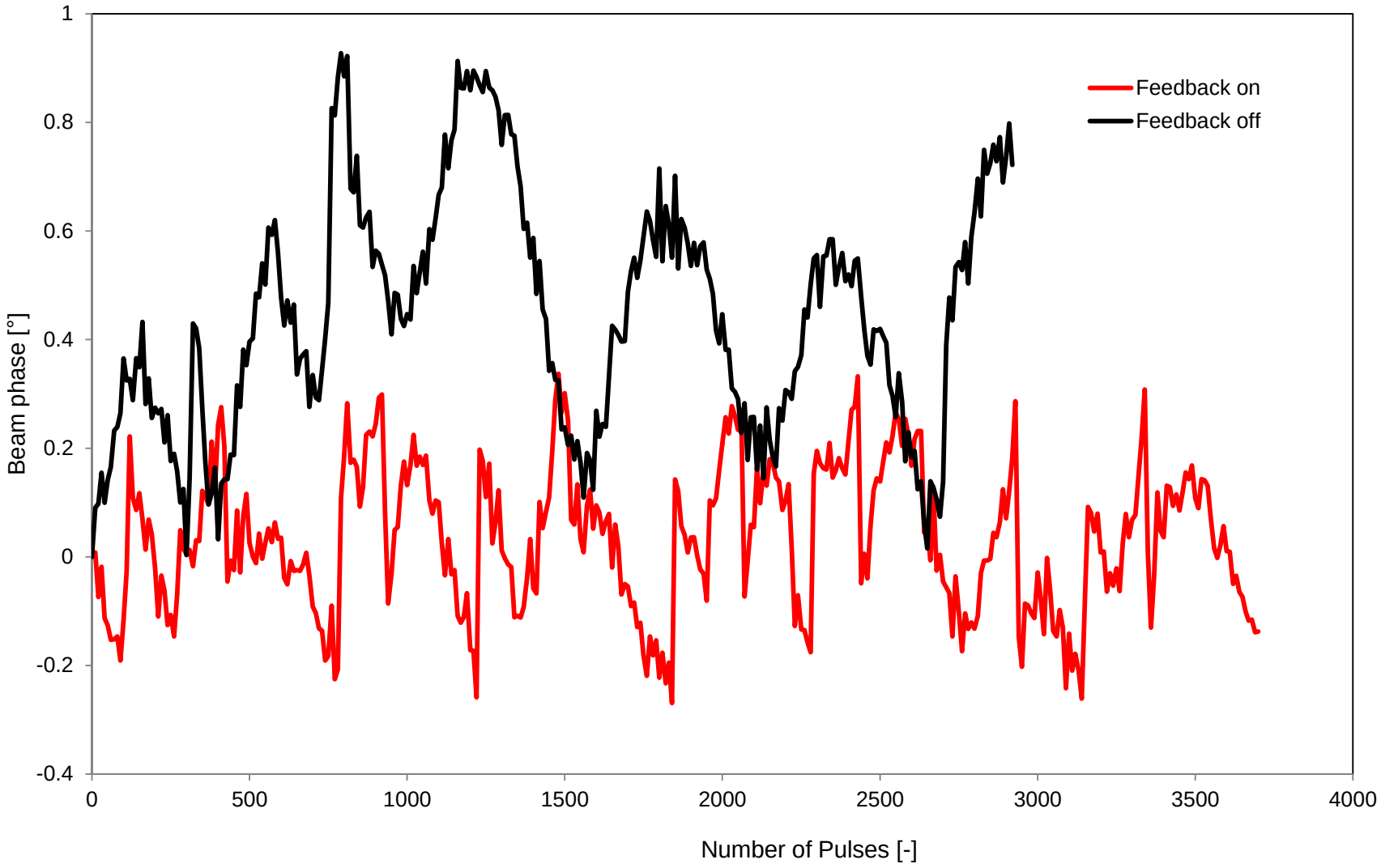
- **Feedback is calculating average of BPR traces for every pulse and is keeping it at the constant level (set point)**
  - **Averaging over several pulses is used to avoid noise**
- **In case BPRs are drifting away the klystron phase is shifted**
  - **To know how much the phase should be shifted there is calibration procedure which measures the response of BPRs to klystron phase shift**
- **Feedback has priority to change klystron 2 and 3 phases**

How to work with that?

- **Setup the beam you want to have**
  - **Make sure you are in linear region**
- **Turn on the feedback**
  - **First it will calibrate itself (1 minute), then it will keep the BPRs stable**
- **Conditions changed a lot (gun current, timing)**
  - **Calibrate**
- **Feedback will prevent your changes of klystron 2 and 3 phases**
  - **To do this: feedback has to be turned off**

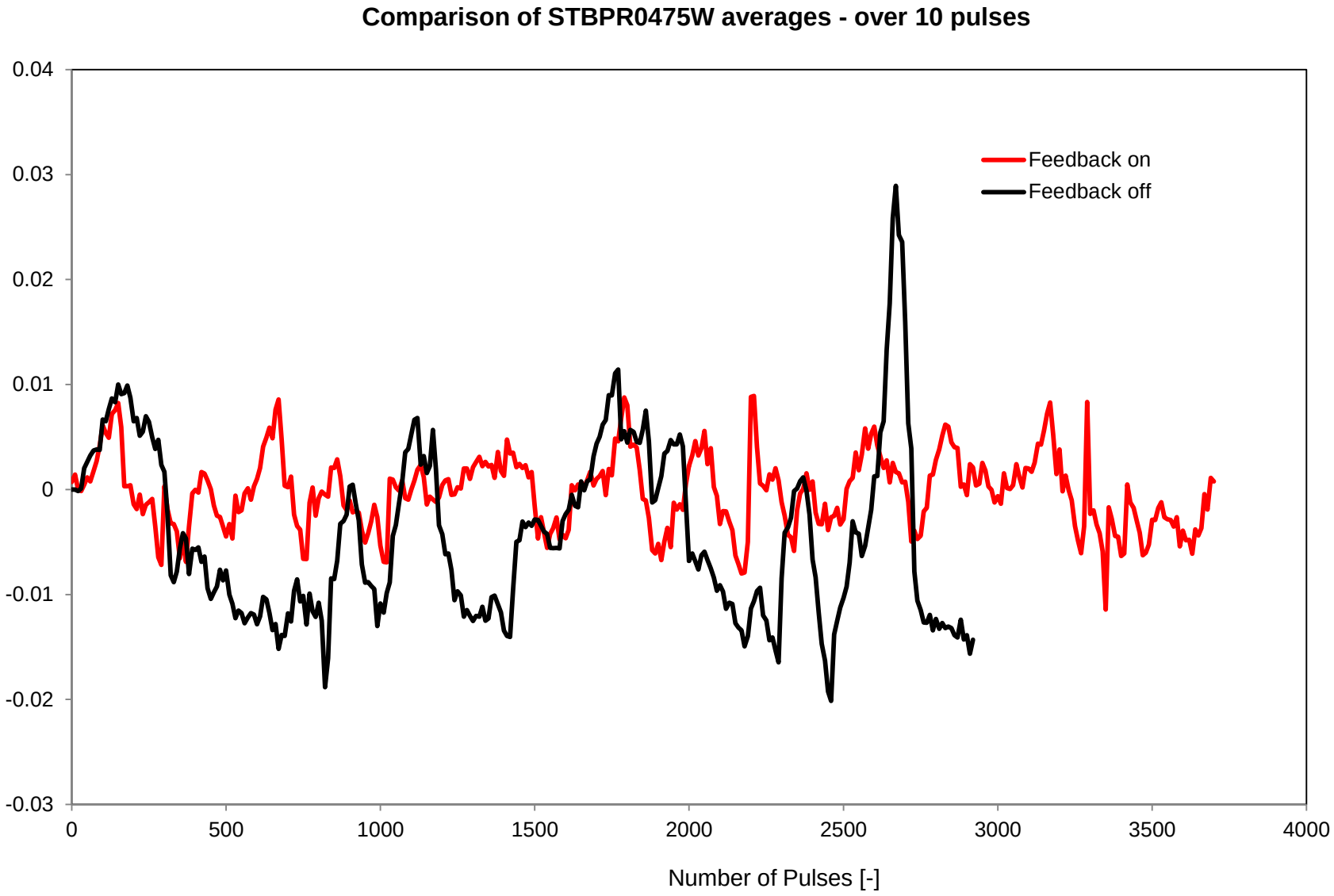


Comparison STBPR0290S averages - over 10 pulses



$\sigma_{290Soff}$ = 0.24°

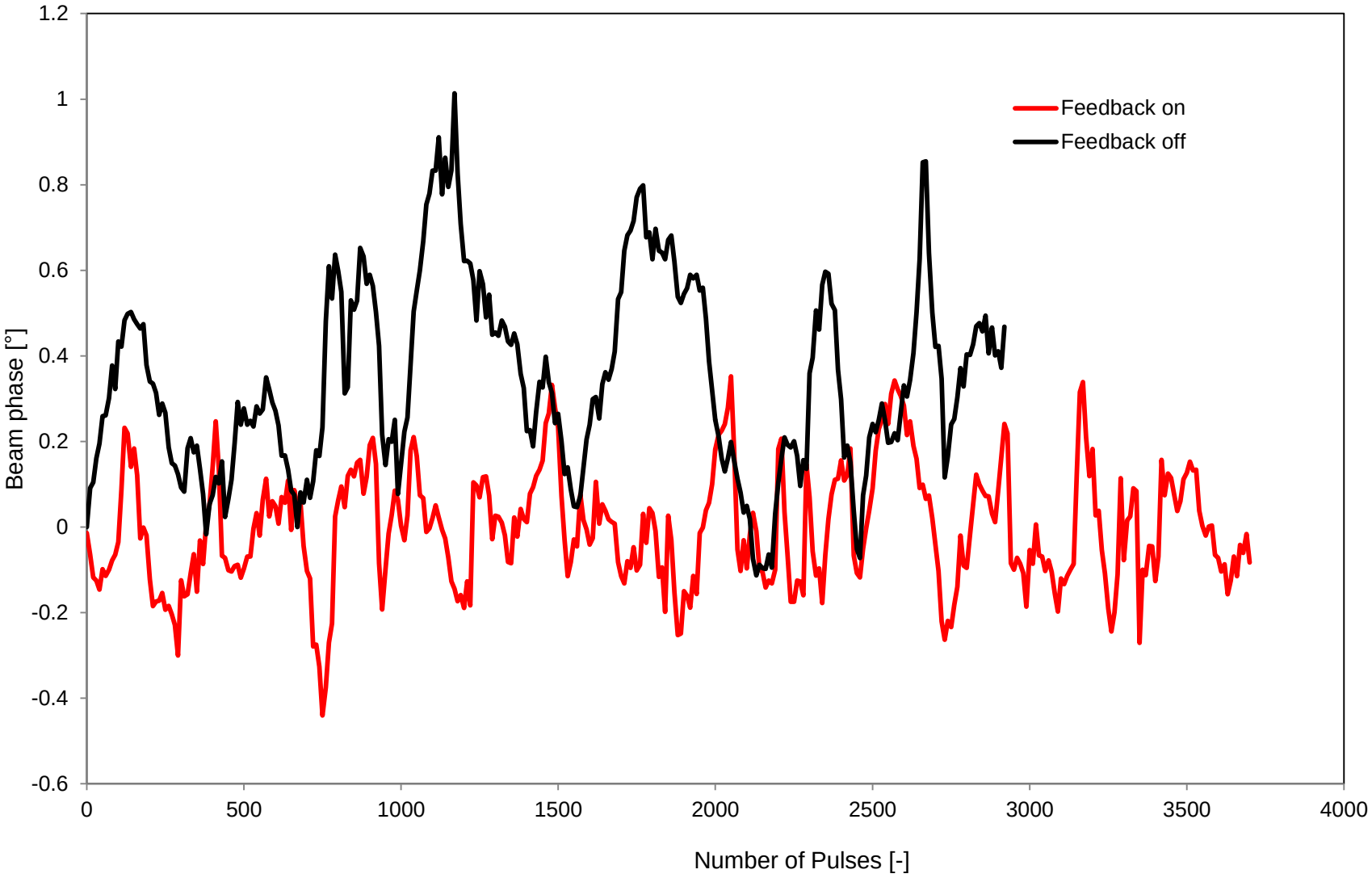
σ_{290Son} = 0.17°



$\sigma_{475Woff} = 0.0087$

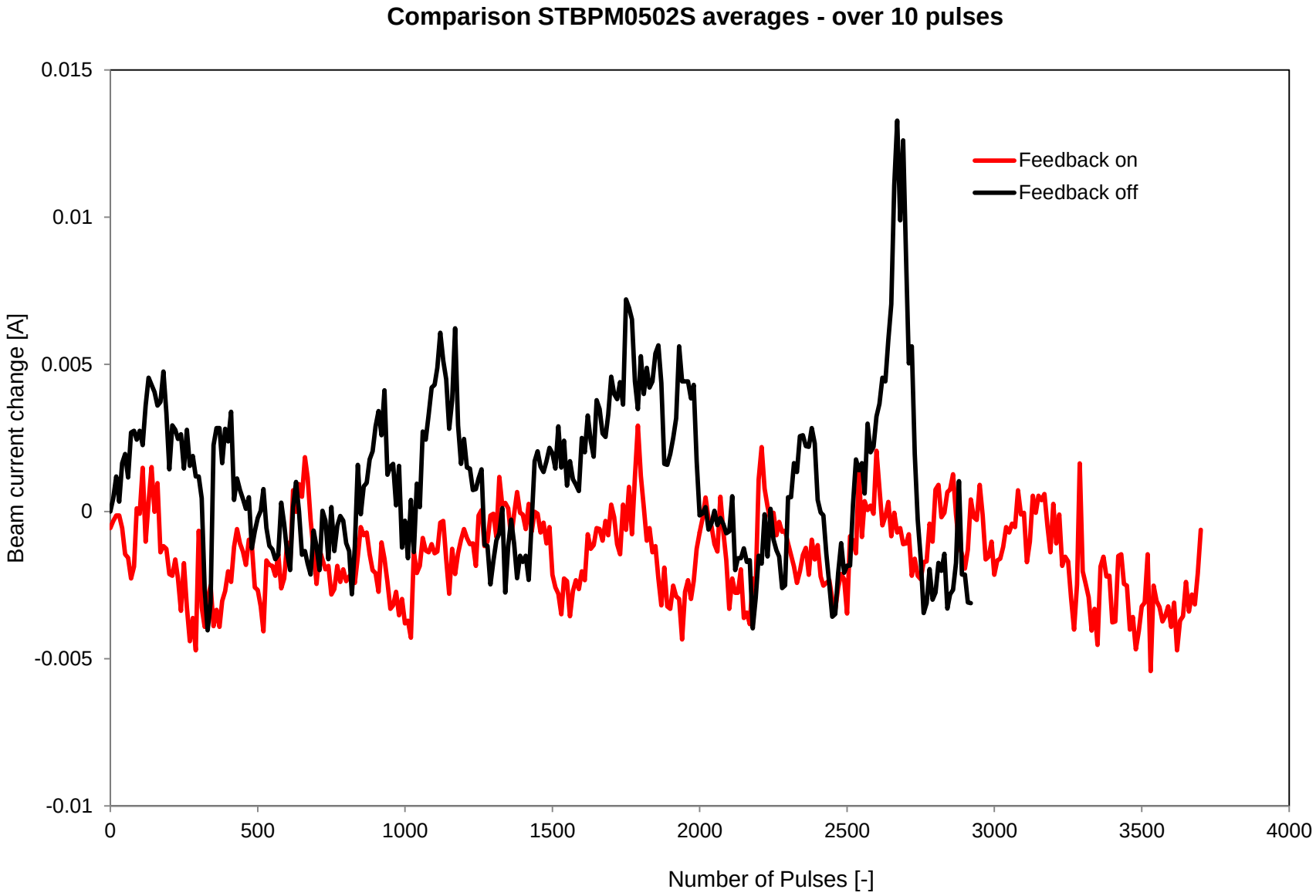
$\sigma_{475Won} = 0.0044$

Comparison STBPR0475S averages - over 10 pulses



$\sigma_{475Soff} = 0.24°$

$\sigma_{475Son} = 0.16°$



$\sigma_{502Soff}$ = 3.6 mA

σ_{502Son} = 2.4 mA

Summary and Conclusions

Ratios of standard deviations with feedback and without it

averaging	CL.STBPM0402S	CL.STBPM0502S	CL.STBPR0290S	CL.STBPR0290W
10 pulses	0.67	0.52	0.60	0.86
1 pulse	0.85	0.68	0.71	1.00
averaging	CL.STBPR0475S	CL.STBPR0475W	CT.STBPI0608H	CT.STBPR0532S
10 pulses	0.61	0.42	0.82	0.79
1 pulse	0.67	0.50	0.89	0.86

- **Feedback is clearly improving the beam phase stability for 3 GHz beam**
- **Some more features are being implemented**
- **The 1.5 GHz version is planned**

Thank you for your attention