國家同步輻射研究中心
National Synchrotron Radiation Research Center

TPS Fast Orbit Feedback (FOFB) Upgrade from 10 kHz to 30 kHz updating rate

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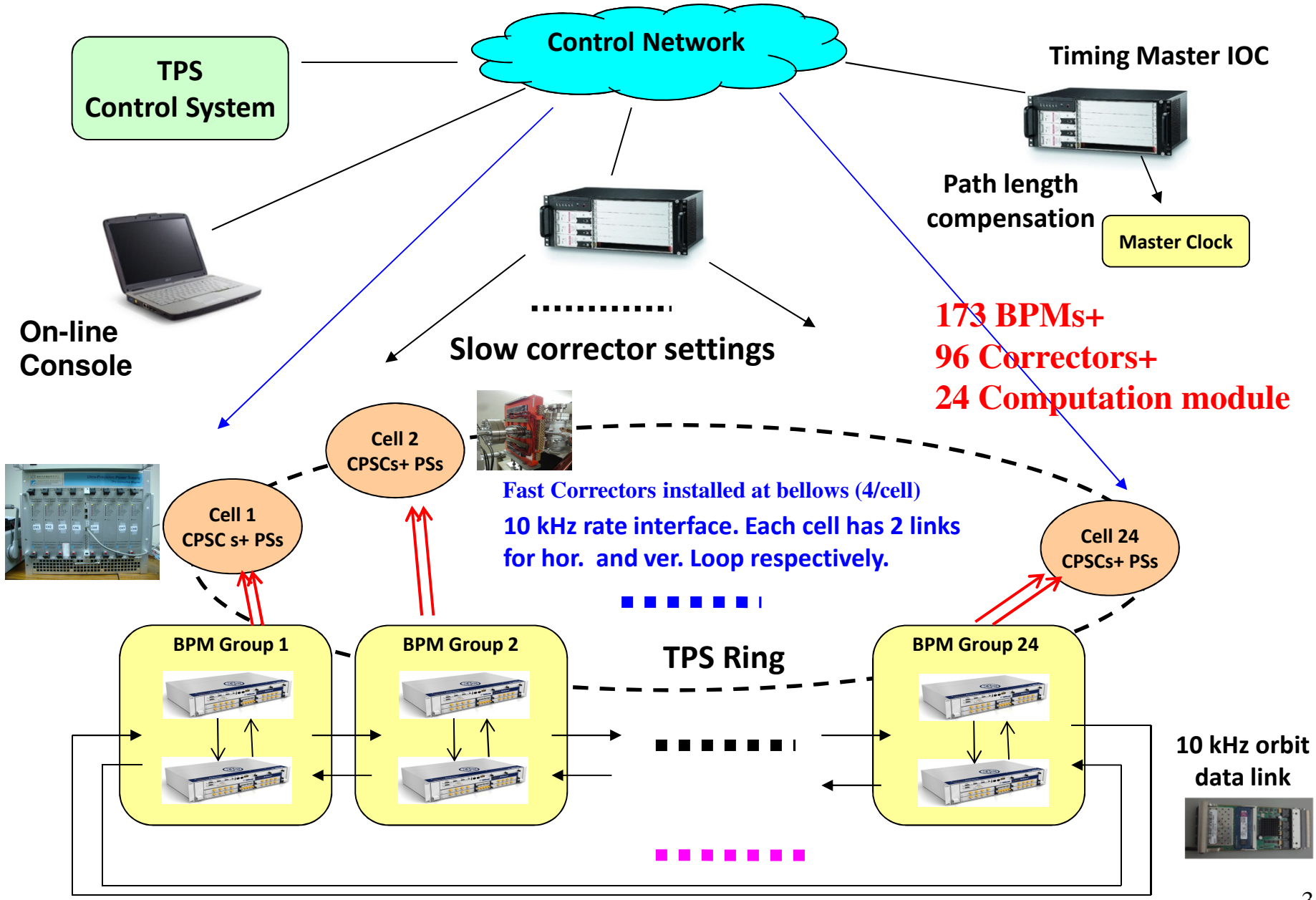
Outline

- **TPS FOFB Infrastructure**
  - **BPM/BPM electronics**
  - **Fast Correctors/ power supply controller**
  - **Computation modules**

- **FOFB Performance**
  - **Bandwidth compare after upgrade**
  - **Short-term stability**
  - **Long-term stability**

TPS Fast Orbit Feedback System Infrastructure

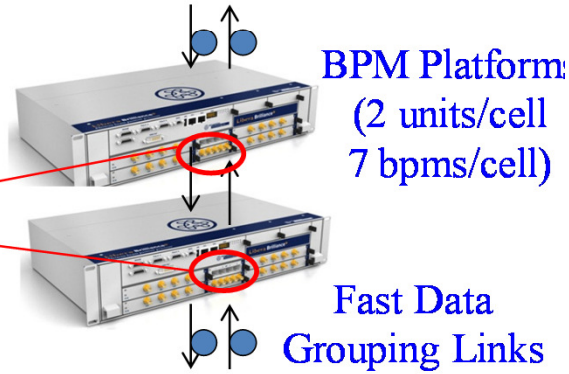


Major Components for FOFB in one cell

Fast Corrector (Installed at Bellows Site)

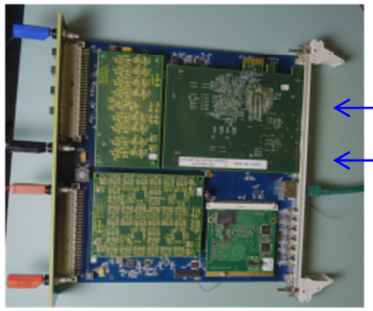
Fast Corrector Power Supply (Fast)

BPM Platform

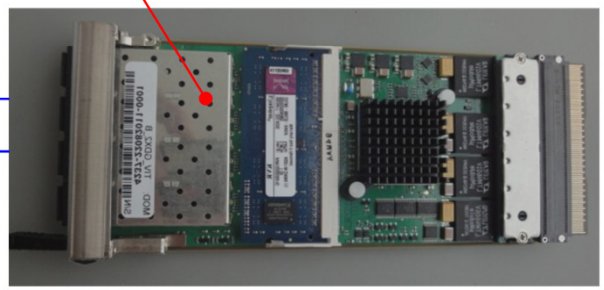


BPM Platform
(2 units/cell
7 bpms/cell)

Fast Data Grouping Links



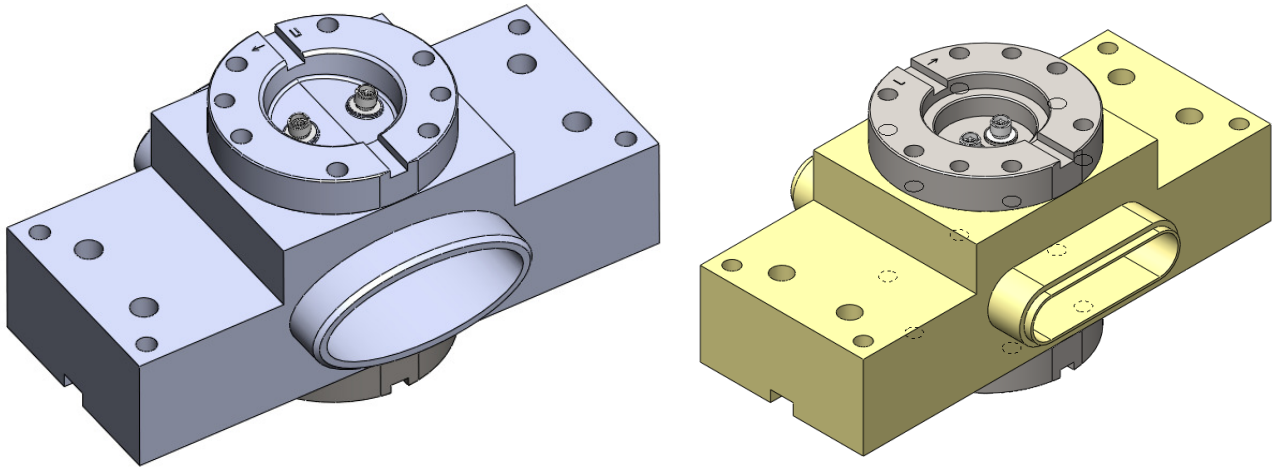
Fiber Link



Corrector Power Supply Controller
(EPICS IOC with Fast Setting FPGA Design)

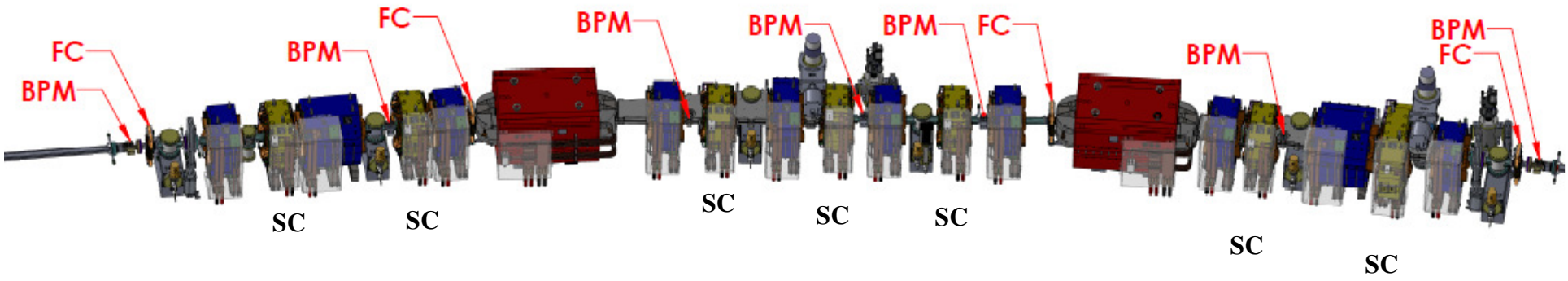
FOFB computation modules
(also grouping data)

Beam Position Monitor



One cell

BPM*7
Fast corrector*4

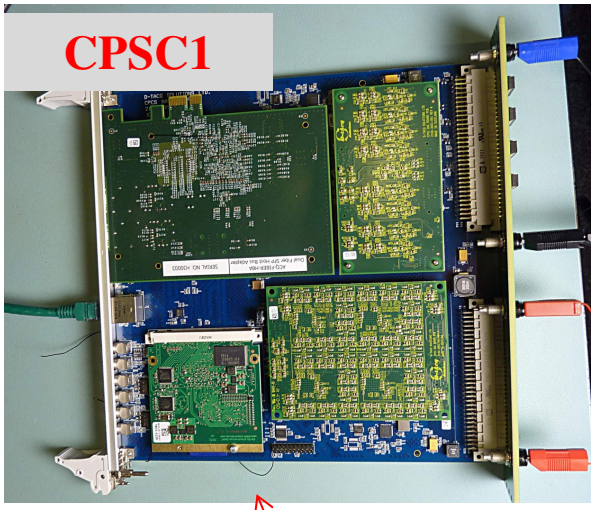


Slow corrector*7

BPM electronics – Libera Brilliance +

Storage Ring : 48 platforms +173 BPM modules
(Booster: 18 platforms + 60 BPM modules)

TPS fast Corrector Power Supply Controller



CPSC1 :

20 bit DAC+ 24 bits 32 channels ADC

Functionalities:

- Support waveform readings
- Support orbit feedback
- Support waveform play
- Support synchronize setting

…

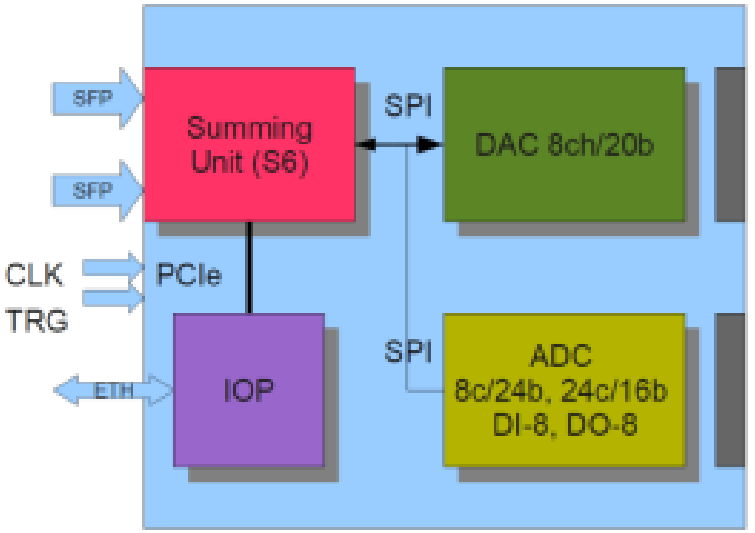
CPSC2: (low cost solution)

18 bit DAC+ 24 bits 16 channels ADC

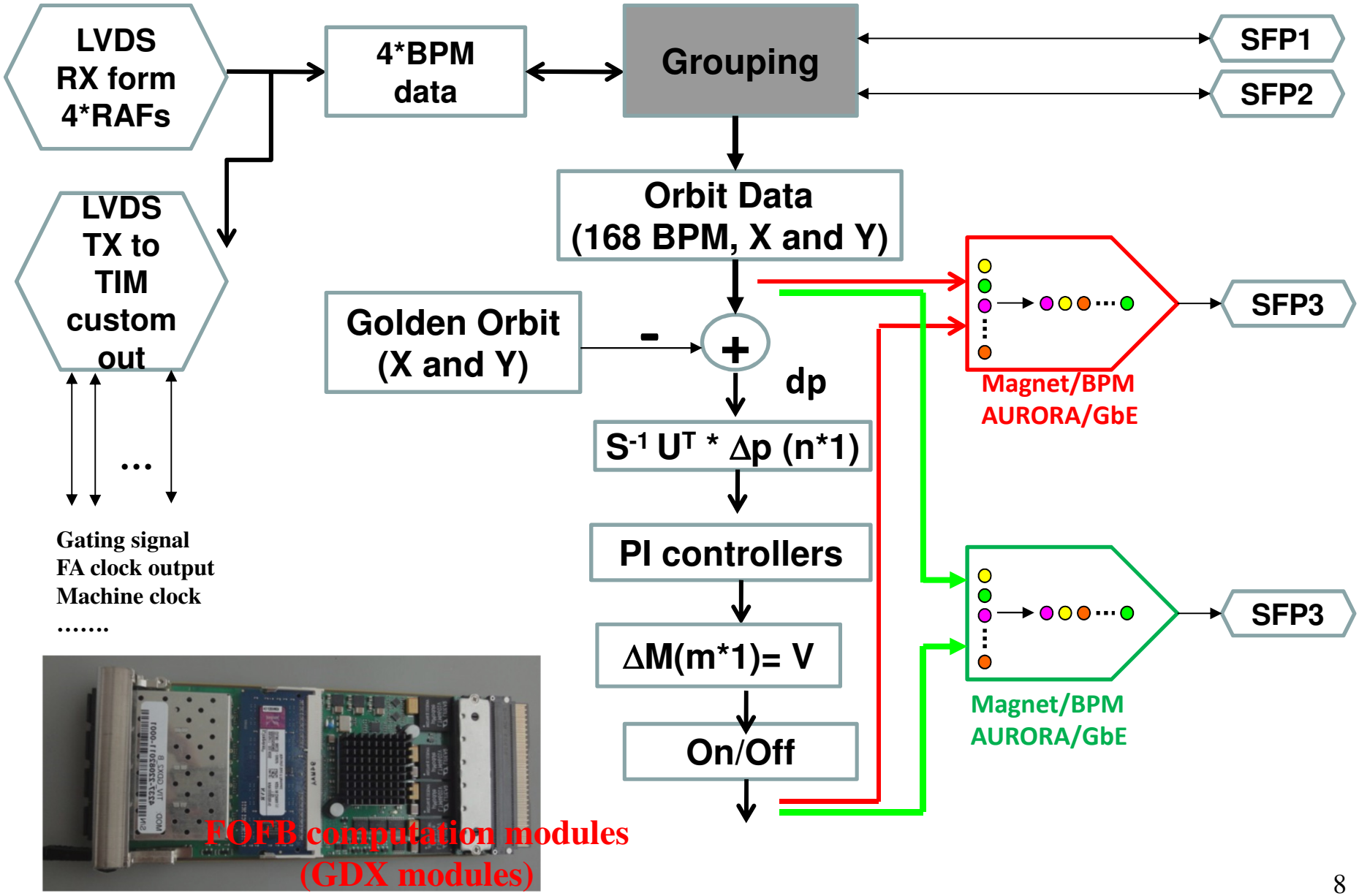
Some functionalities

Support 30kHz fast setting

Without Thermal Stabilize

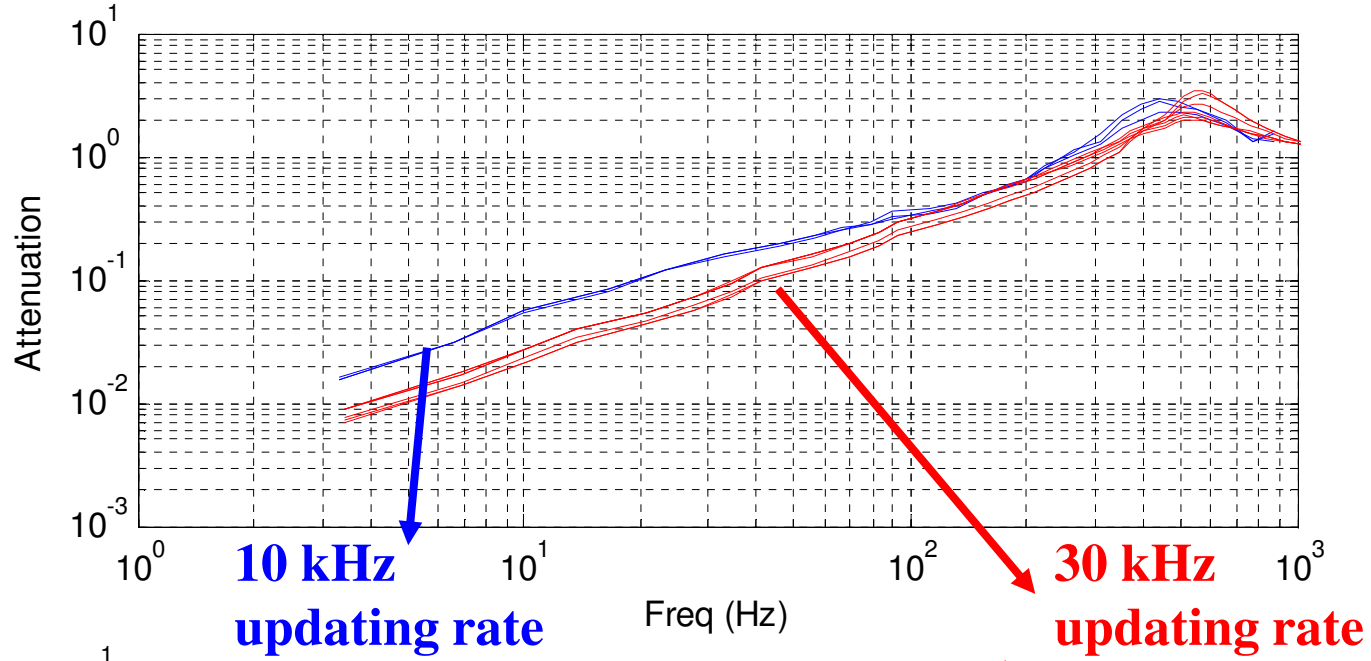


TPS Computation modules

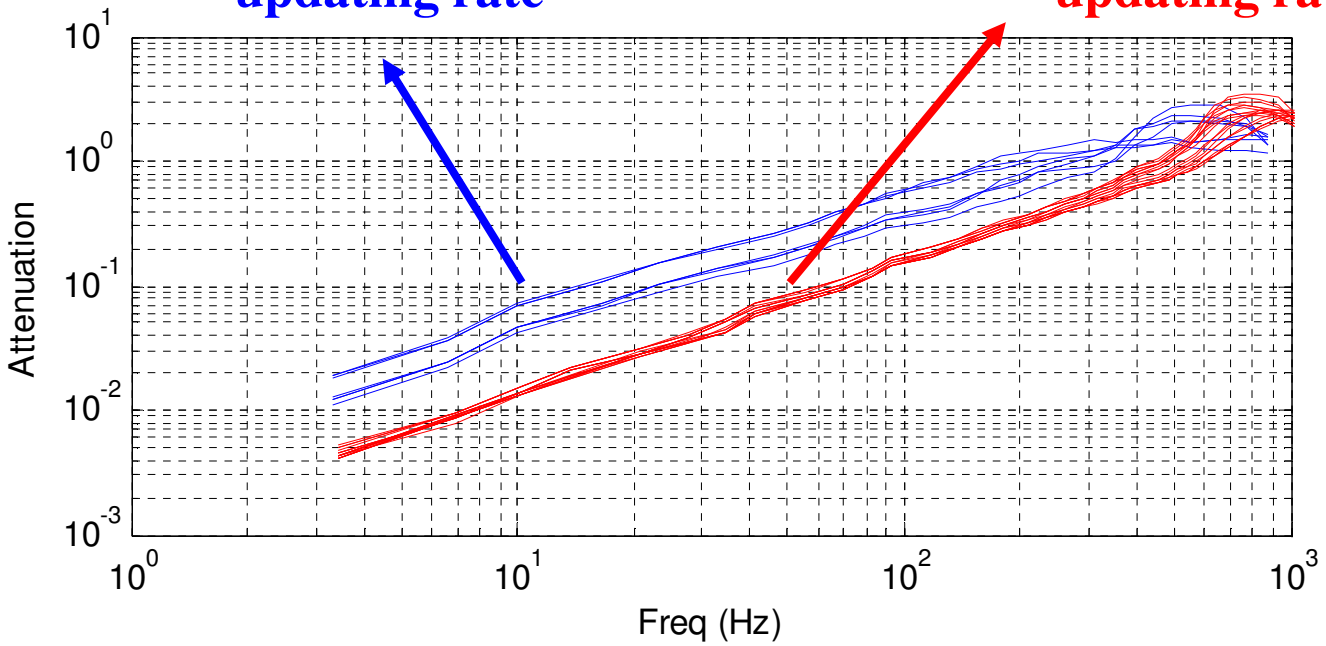


FOFB performance compare after upgrade

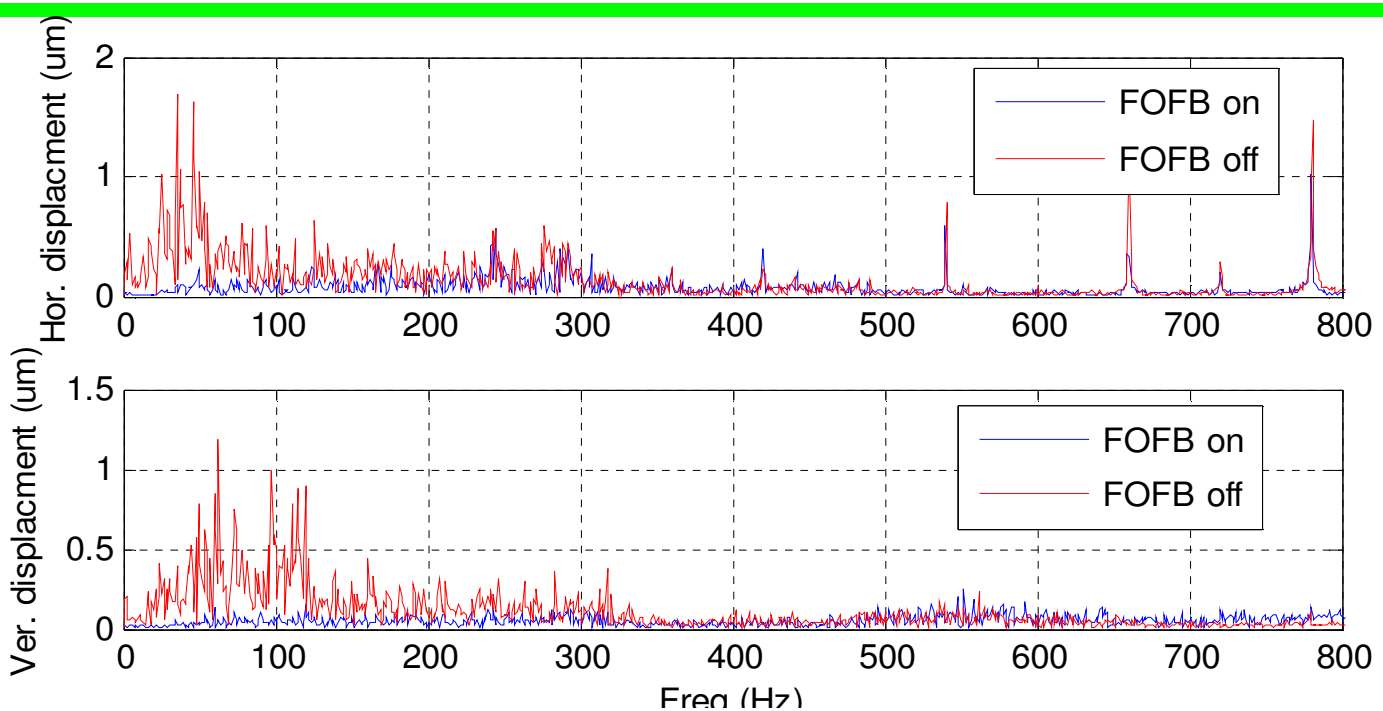
Hor. plane

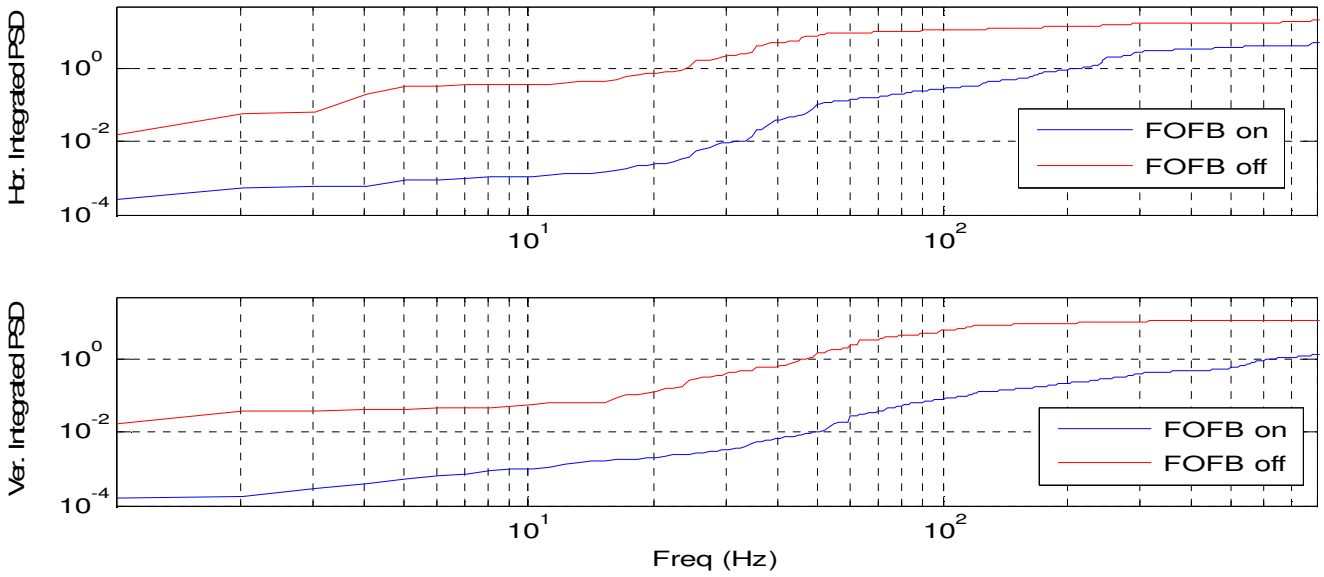


Ver. plane

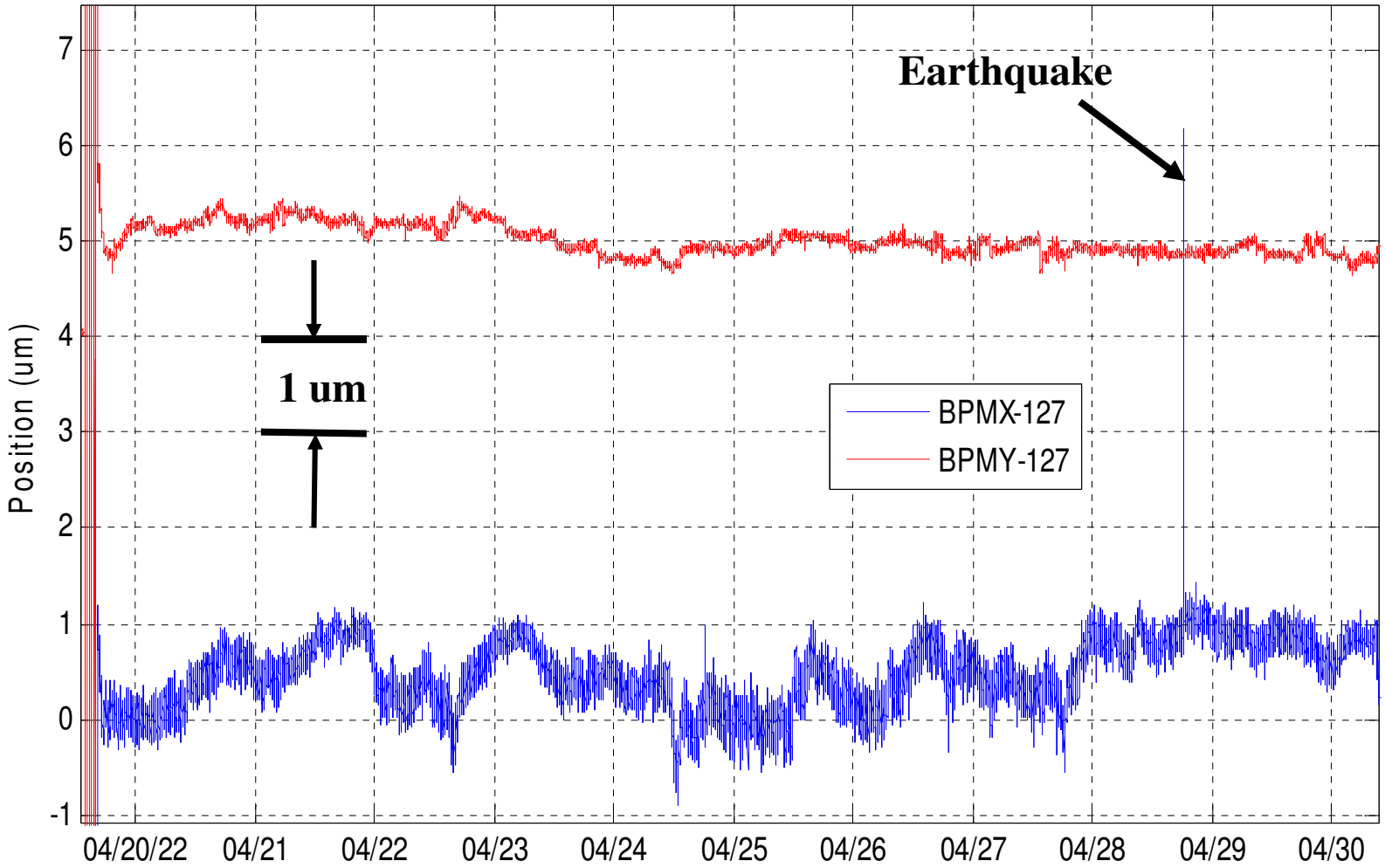


FOFB performance – Short-term Orbit Stability





FOFB performance – Long-term Orbit Stability (10 days)



Summary

- **TPS FOFB first delivered in 2016**
- **TPS FOFB upgrade to 30kHz in 2022**
  - **Ver. FOFB bandwidth is effectively increased from 250 Hz to 400 Hz.**
- **FOFB Performance**
  - ✓ **Short-term orbit stability**
    - **Vertical orbit stability 1Hz~1 kHz: ~1 um**
    - **Horizontal orbit stability 1Hz~300Hz: ~1 um**
  - ✓ **Long-term orbit stability (10 days) ~**
    - **Vertical: 1 um**
    - **Horizontal: 1.5 um**