Orbit Control Configuration

Legend:

C: Corrector Magnet

● RF Beam Position Monitor

P1,P2 : X-ray Beam Position Monitors

Q: Quadrupole

BM: Bending Magnet

ID: Insertion Device

Real-time Feedback System Parameters

Number of Correctors	38
Number of BPM's	160
Number of DSP's	42+
Number of IOC's	21
Update Rate	1.5 kHz

DC Orbit Correction Parameters

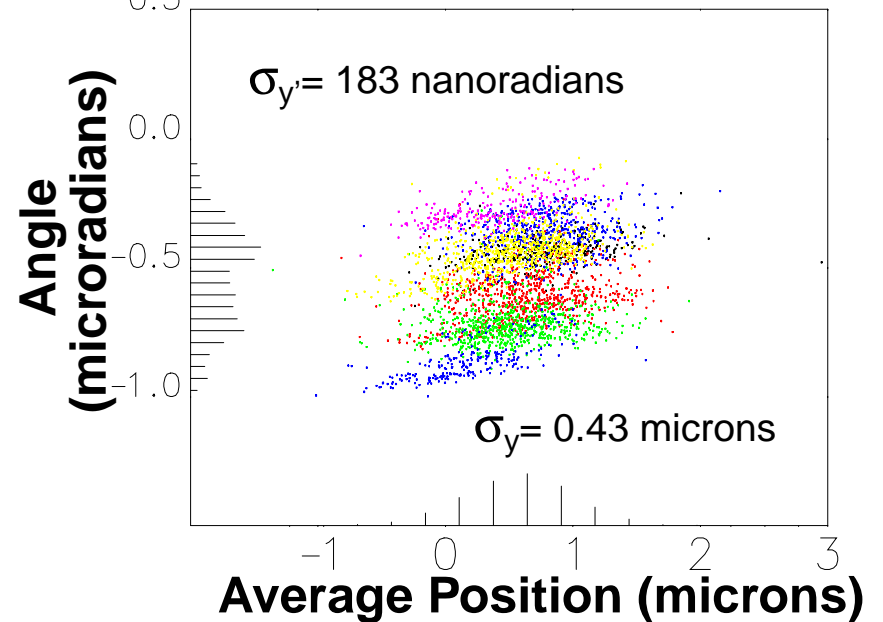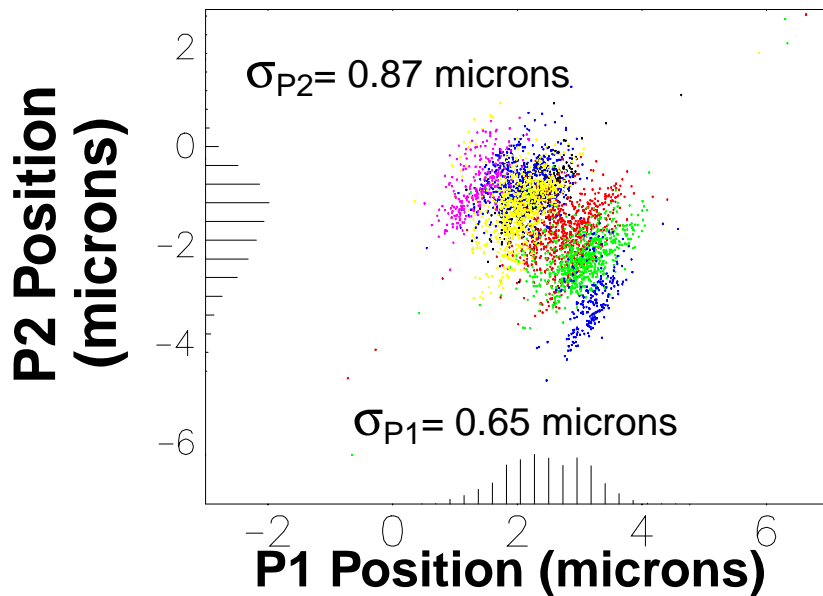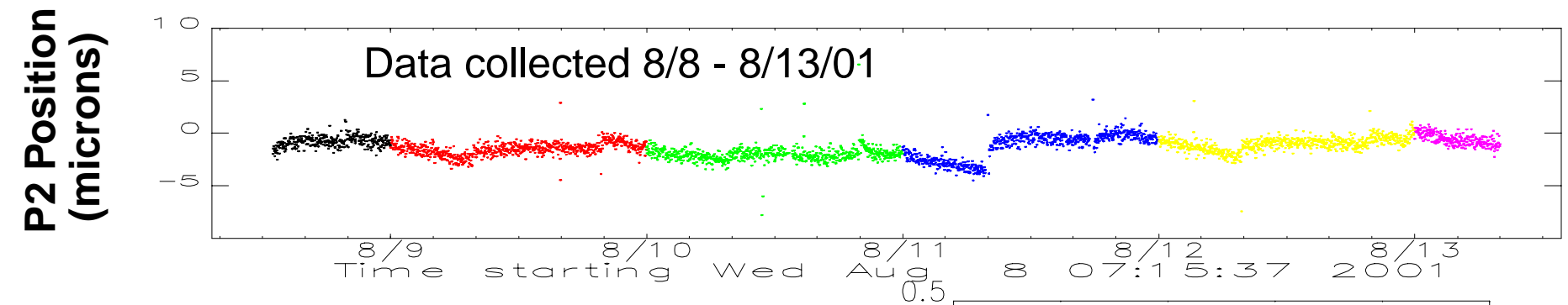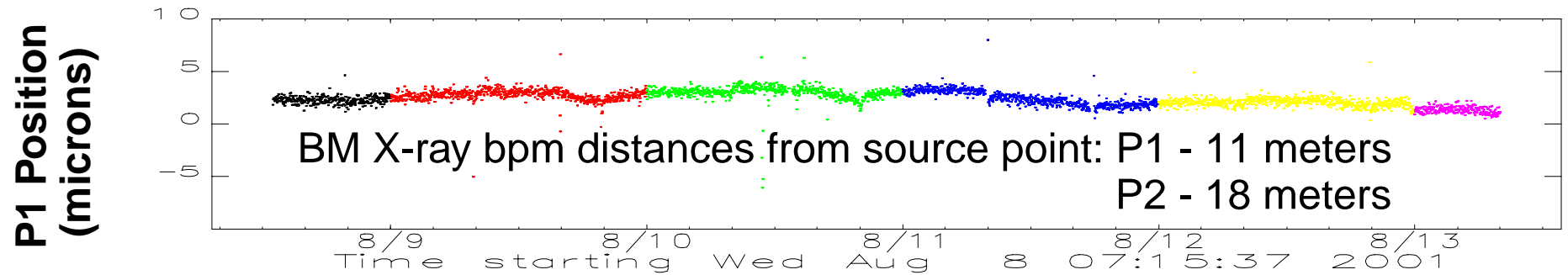|	
Number of Correctors	318
Number of RF BPM's	410
Number of BM XBPM's	38
Number of ID XBPM's	50
Number of IOC's	1
Update Rate	1.5 Hz

APS Real-time Feedback System Architecture
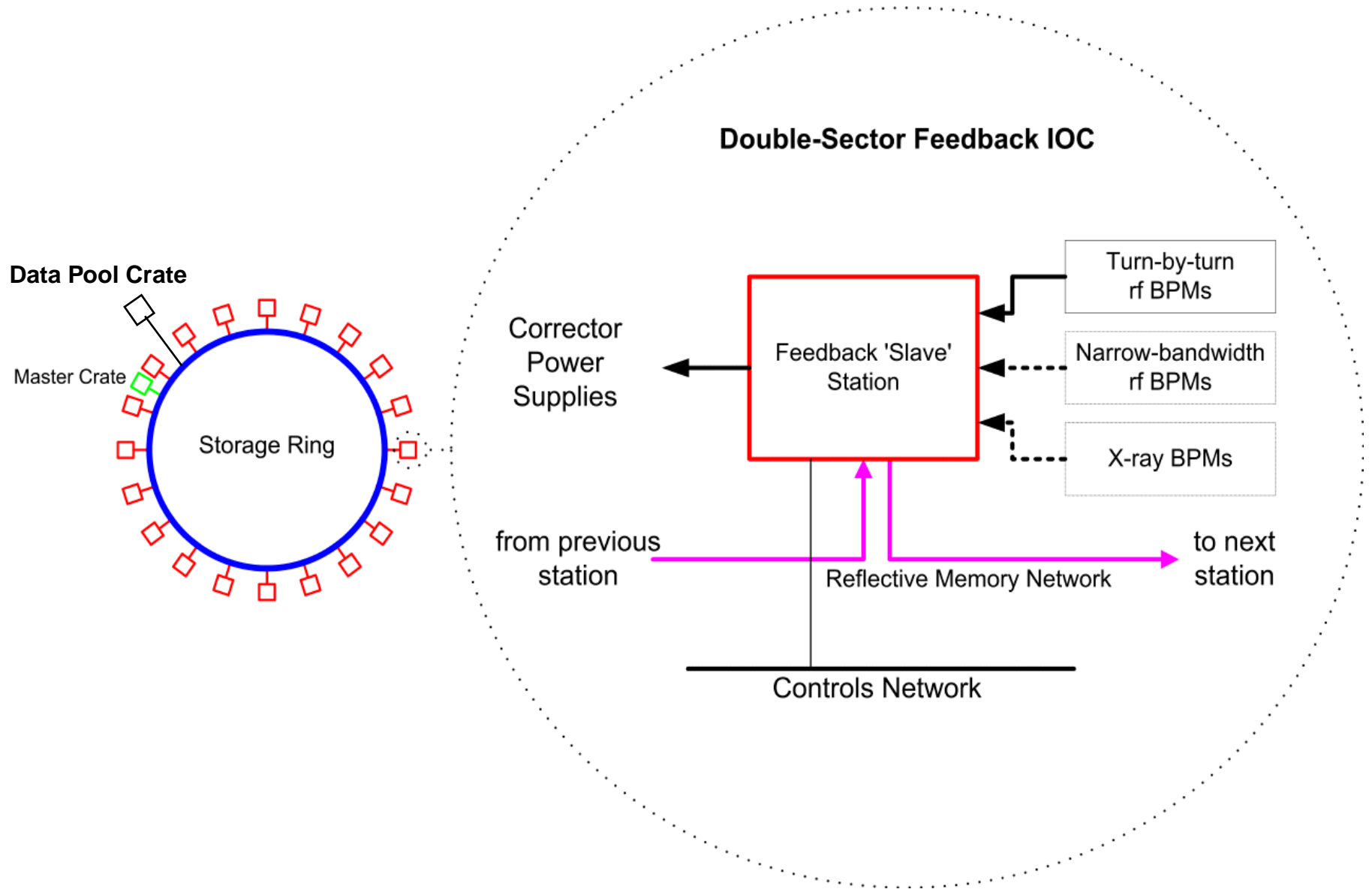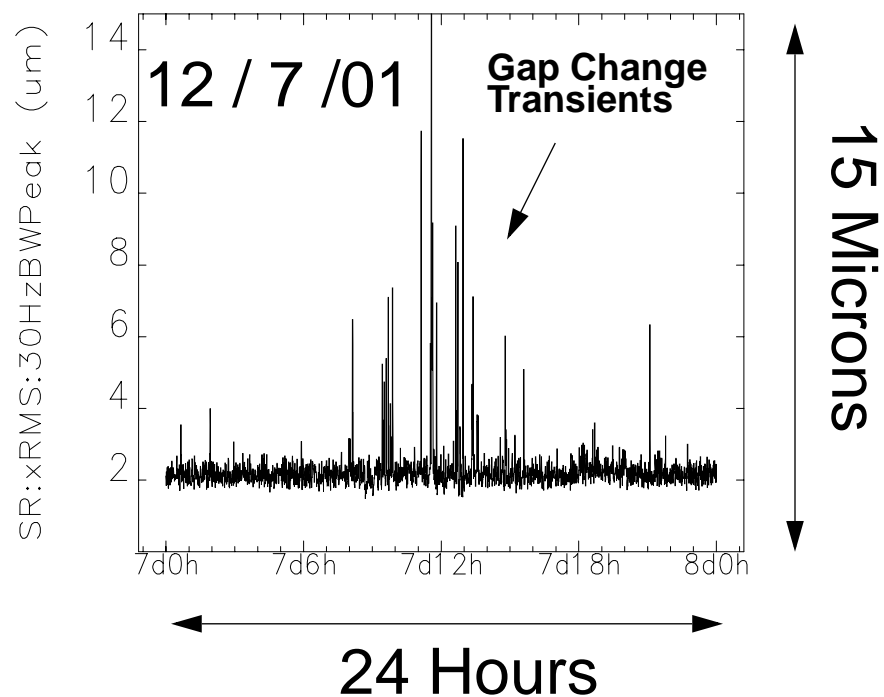
Recent Progress in Orbit Stability

1) Orbit correction duty cycle has increased from 0.4 Hz to 1.5 Hz, resulting in a factor of 5 reduction of insertion device gap change transient effects.

2) Additionally, progress toward insertion device x-ray beam position monitor feedback coupled with feedforward on insertion device gap is imminent, which is expected to improve long term (several days) pointing stability to better than 0.5 microradians rms. (Not possible without Decker displacement)

3) New orbit restoration software has increased the speed and accuracy of reproducing steering following major lattice change, e.g. low vs. high emittance, singlets vs. hybrid fill pattern.

4) Refinement in RF beam position monitor timing ("bunch cogging") has been very successful during studies. This should eliminate top-up-related orbit transients, in addition to eliminating the "missing bunch" number 24. Twenty-four uniformly-spaced bunches (154 ns spacing) has been successfully tested in low-emittance top-up mode with good beam stability.

Plots showing < 200 nanoradian rms vertical beam stability over a 5 day period
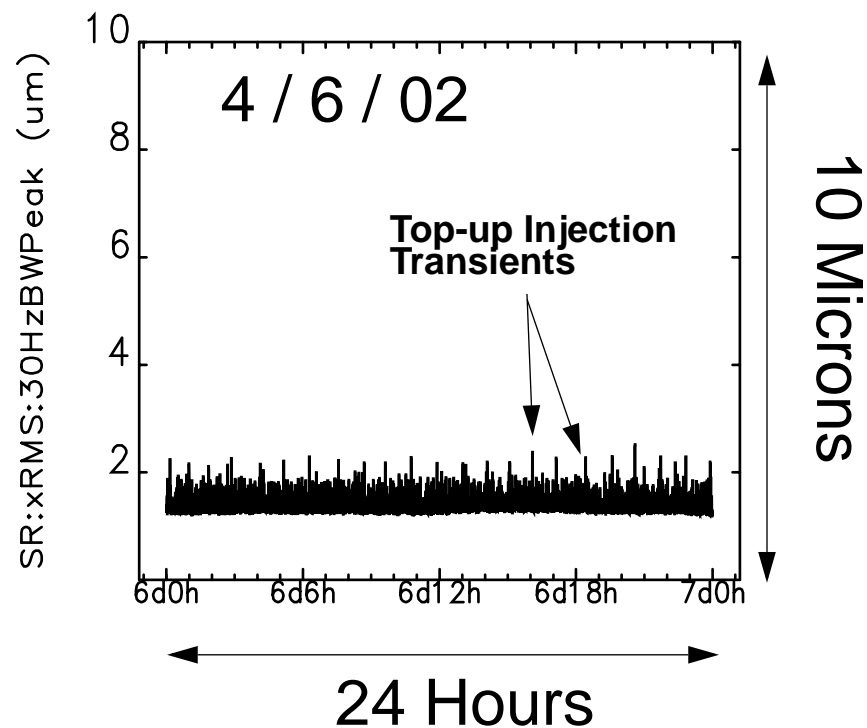## Colors indicate data for individual days

BM X-ray bpm distances from source point: P1 - 11 meters
P2 - 18 meters

Data collected 8/8 - 8/13/01

$\sigma_{P2}= 0.87$ microns

$\sigma_{P1}= 0.65$ microns

$\sigma_{y'}= 183$ nanoradians

$\sigma_{y}= 0.43$ microns

Effect of Increased Orbit Correction Update Rate on 24-hour Horz. RMS Beam Stability 0.1-30 Hz

2.5 Second Update Rate

12 / 7 /01

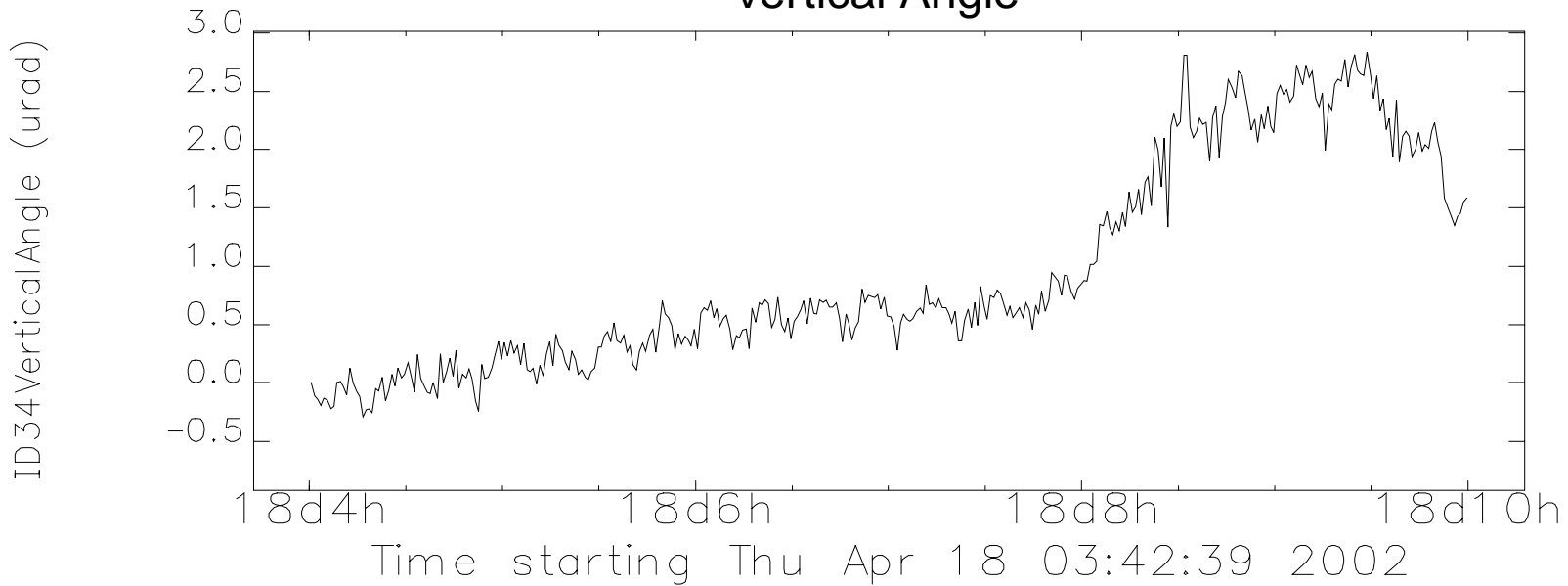**Gap Change Transients**

15 Microns

24 Hours

0.7 Second Update Rate

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Top-up Injection Transients

10 Microns

24 Hours

Horizontal Angle Derived from ID XBPM's

6 hours

3 μrad

ID34HorizontalAngle (urad)

Time starting Thu Apr 18 03:42:39 2002
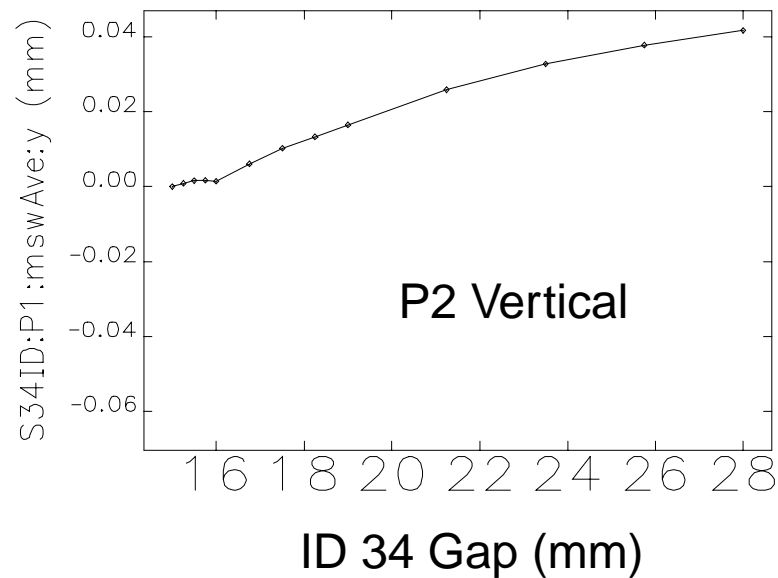
Vertical Angle

ID34VerticalAngle (urad)

Time starting Thu Apr 18 03:42:39 2002
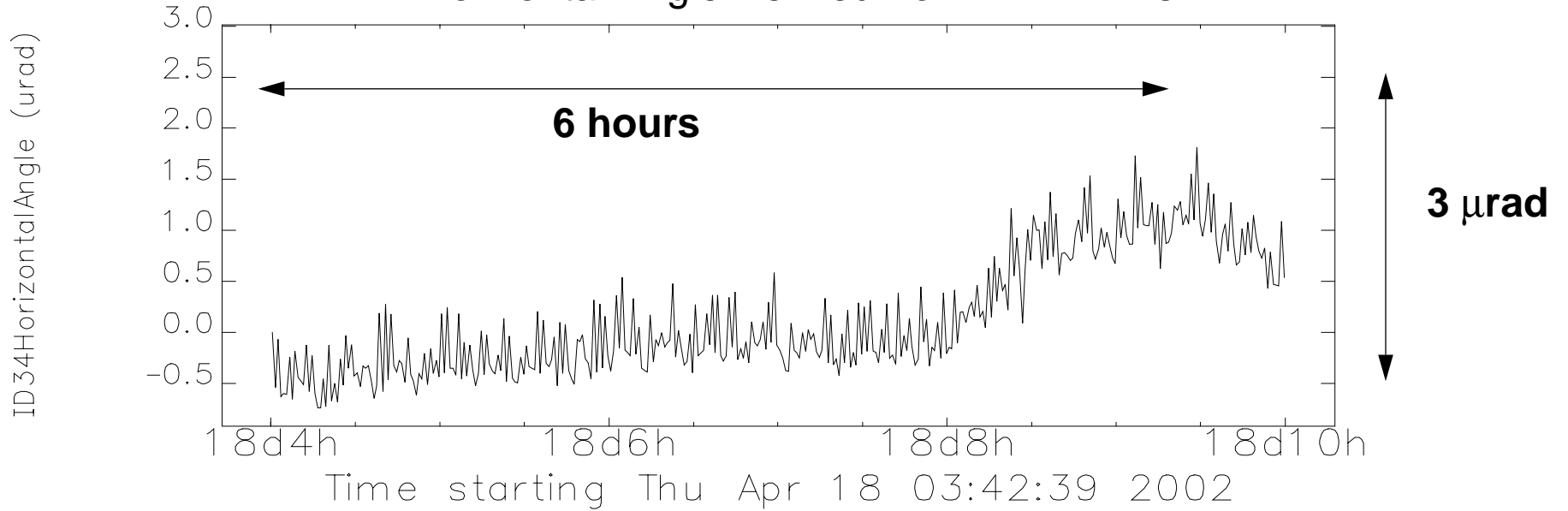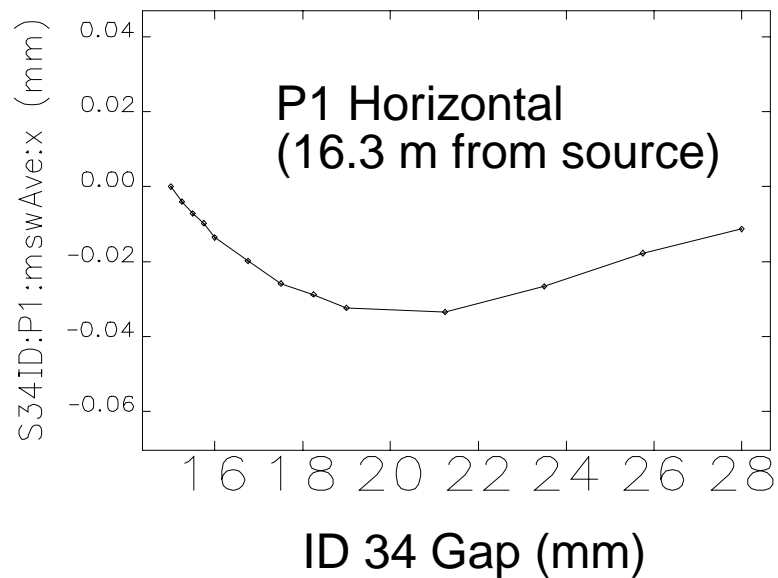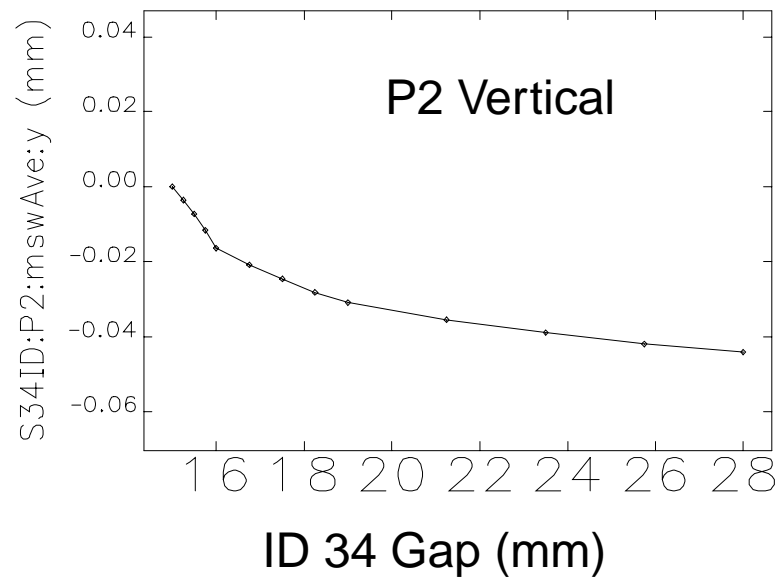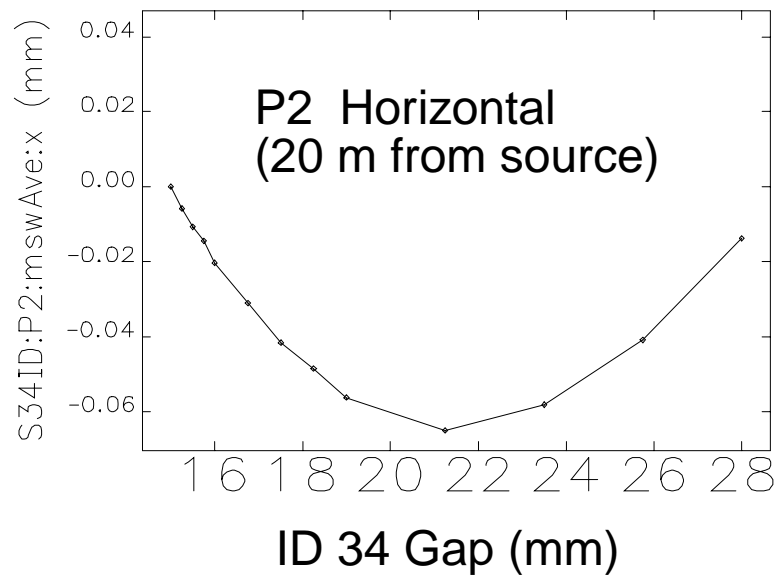
(34ID Gap = 26.78 mm)

Uncorrected Variation of ID XBPM Readbacks with Gap

Storage Ring Monopulse BPM Timing

Missing bunch

154 ns

Fast Triggers

P0   P0

Standard Gate

3.68 μsec

BPM Standard Trigger

Cogging Gate

3.68 μsec + 154 nsec

BPM Cogging Trigger