

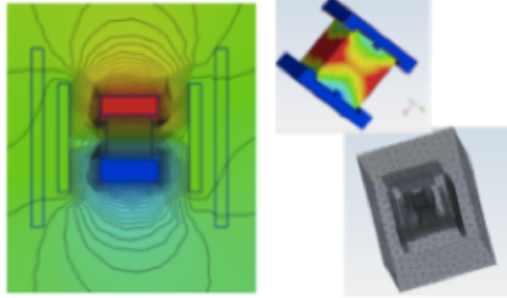
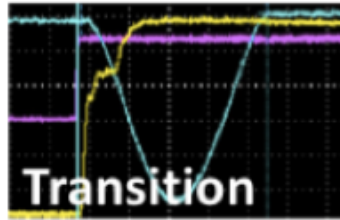
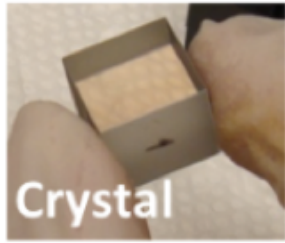
RTP Cell Plan

12/11/2018

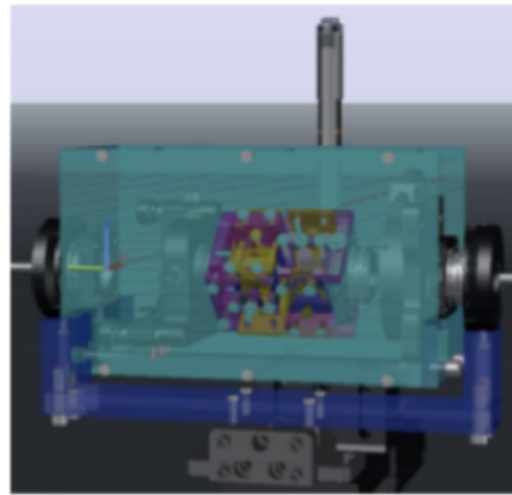
Caryn Palatchi

Reminder: RTP Cell 8HV system

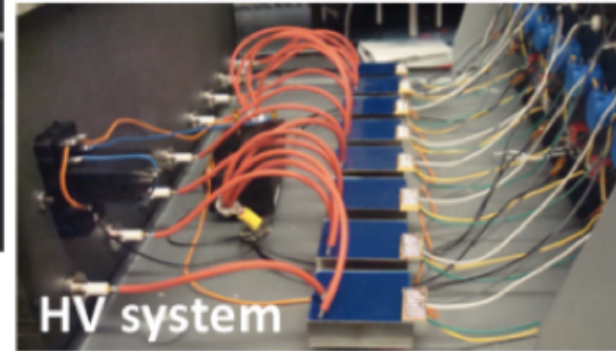
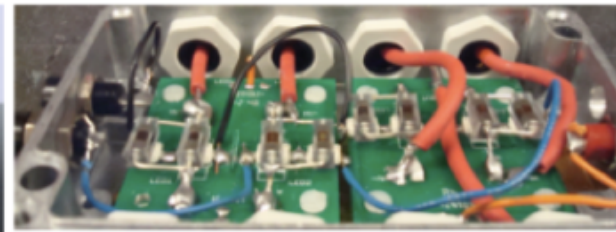
opto-driver: transition 7-12us



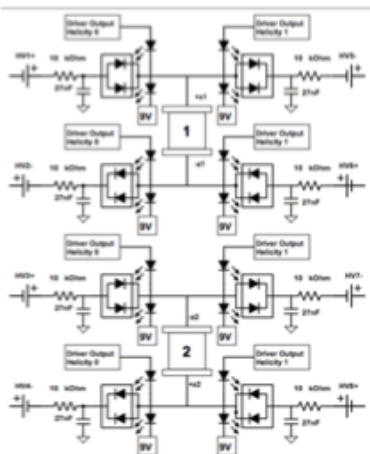
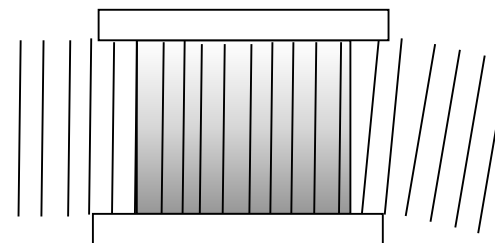
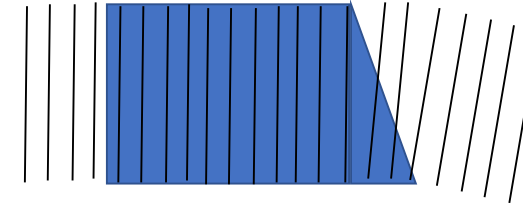
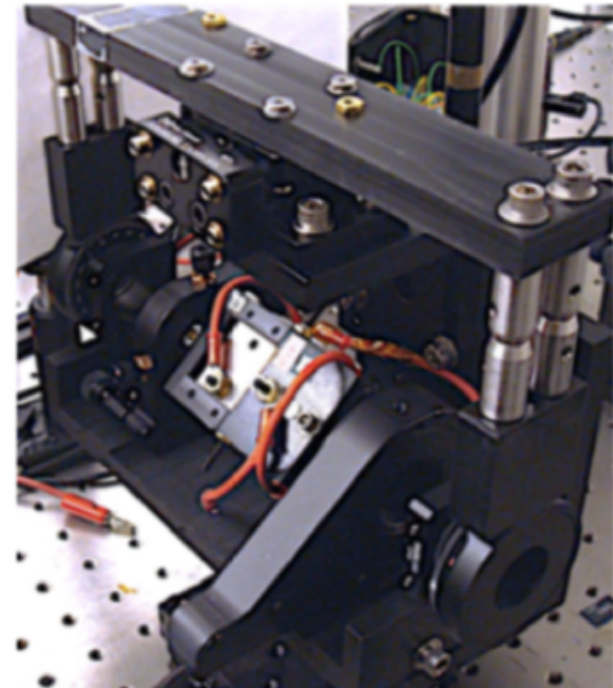
Field Modeling



CAD design

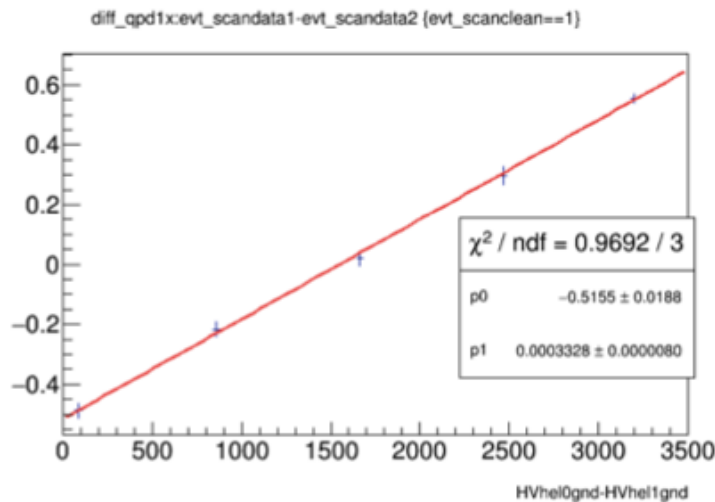


HV system



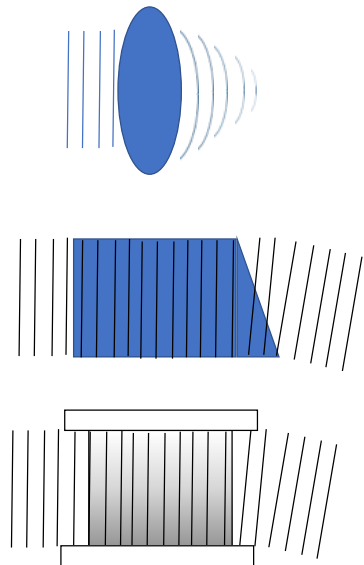
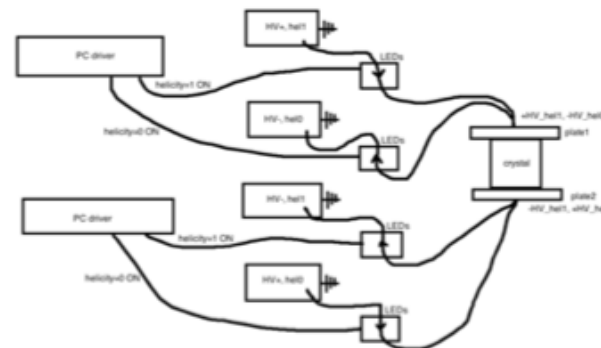
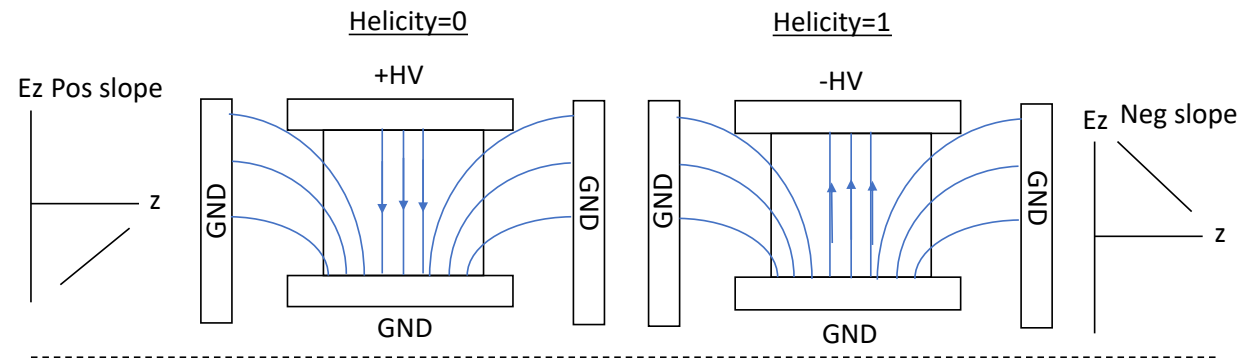
Reminder: Position Difference Feedback

- Recall with RTP we also have the ability to control steering position differences with our 8HV system: “PITA-pos voltages”
- Was able to run feedback on bpm1I04 (injector) and minimize it’s position differences

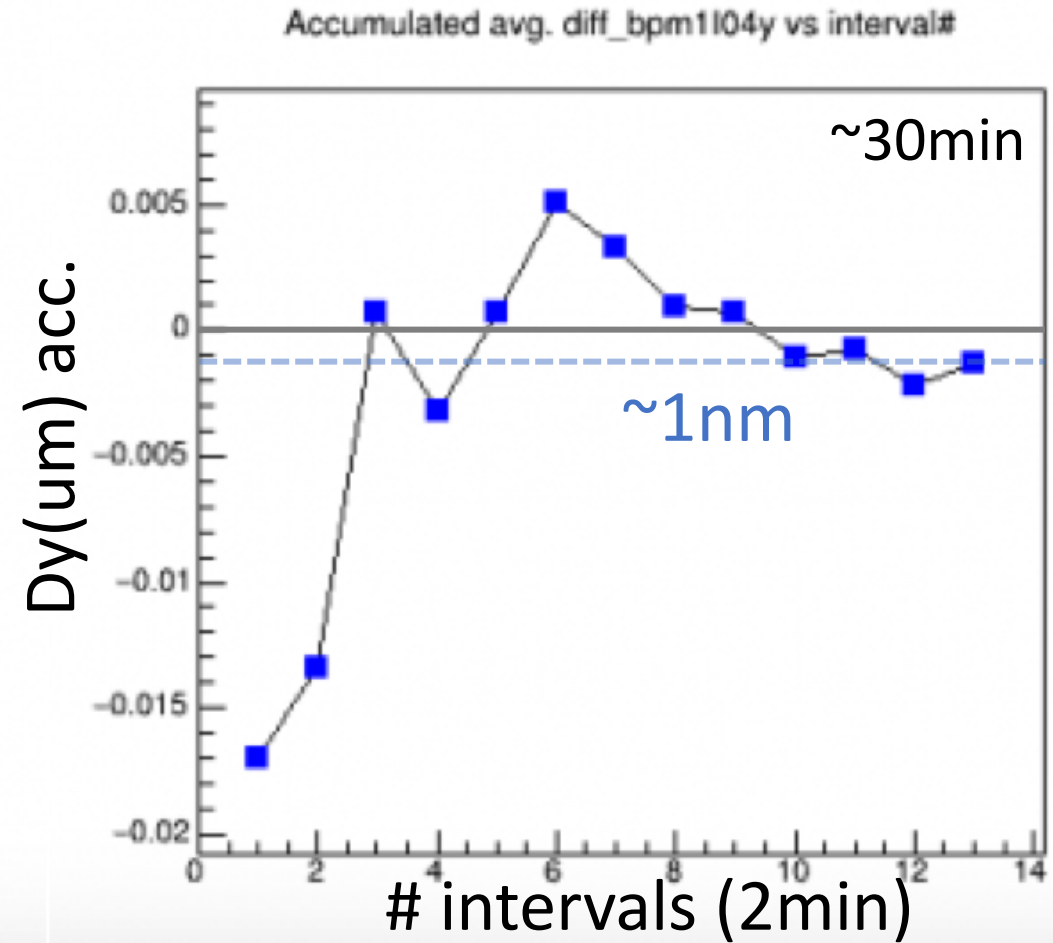
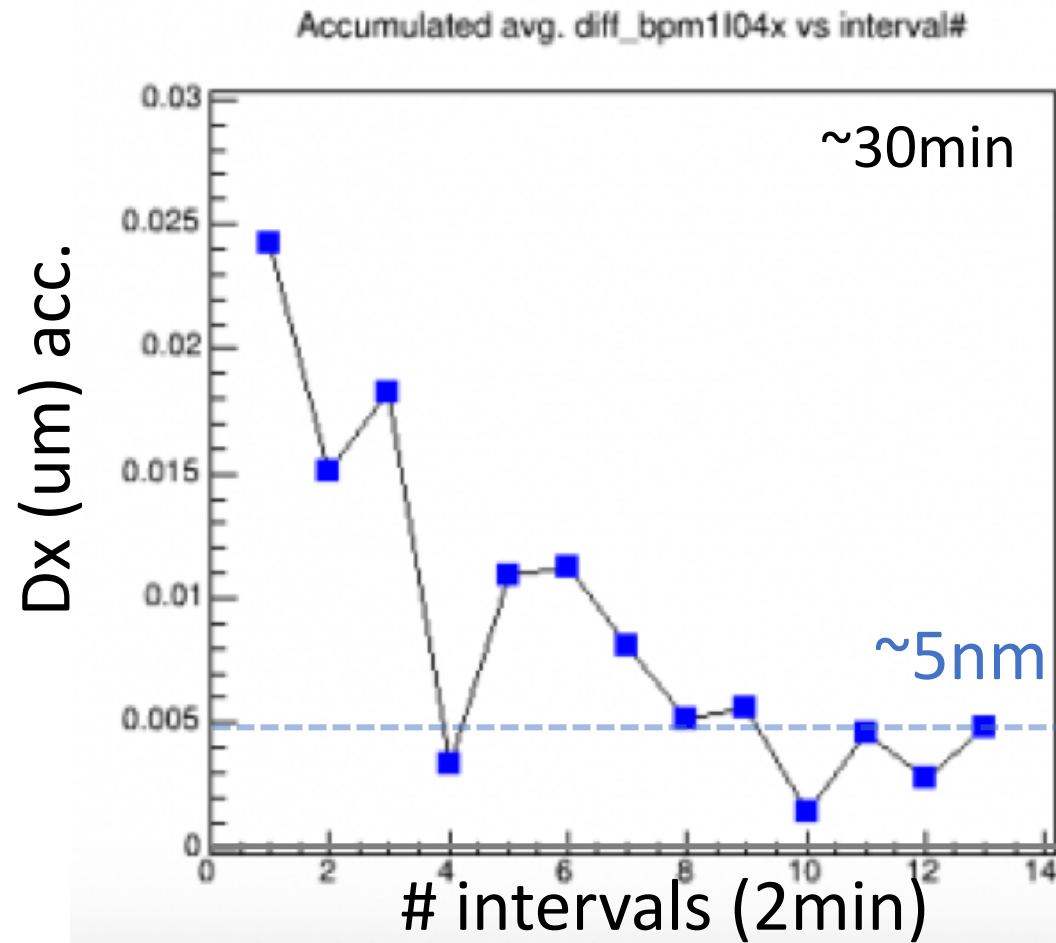


$$n_z = n_{z0} - 1/2 n_{z0}^3 r_{33} E_z$$

Run3143, qpd 70cm, Full metal jacket



Reminder: Position Difference feedback – near S2



Run4017_RHWP1000_IHWPout_1l04feedback_Dxconverge.png

Run4017_RHWP1000_IHWPout_1l04feedback_Dyconverge.png

BPM1104

Here's the new RTP EDM screen:

Here are the EPICS PV names for 8 DAC channels on the VMIC_1068:

IGL0I00C1068_DAC05

IGL0I00C1068_DAC06

IGL0I00C1068_DAC07

IGL0I00C1068_DAC08

IGL0I00C1068_DAC09

IGL0I00C1068_DAC10

IGL0I00C1068_DAC11

IGL0I00C1068_DAC12

/cs/opshome/edm/pol_source/RTPcell.edi (on opsl00)

RTP Cell Controls

RTP Cell Voltage Set (0-10 Volts)

V1	5.000	5.000	Hel +,Crystal 1, Pol +, Dir +z1,+U
V2	5.000	5.000	Hel +,Crystal 1, Pol -, Dir -z1,-U
V3	5.000	5.000	Hel +,Crystal 2, Pol +, Dir -z2,-V
V4	5.000	5.000	Hel +,Crystal 2, Pol -, Dir +z2,+V
V5	5.000	5.000	Hel -,Crystal 1, Pol -, Dir +z1,+U
V6	5.000	5.000	Hel -,Crystal 1, Pol +, Dir -z1,-U
V7	5.000	5.000	Hel -,Crystal 2, Pol -, Dir -z2,-V
V8	5.000	5.000	Hel -,Crystal 2, Pol +, Dir +z2,+V

Quarter Wave Voltage

V L/4 0.000

Alpha Voltage

V a,1 0.000

V a,2 0.000

PITA Voltage

V PITA,1 0.000

V PITA,2 0.000

Alpha Position U/V Voltage

V apos,U 0.000

V apos,V 0.000

Delta Position U/V Voltage

V dpos,U 5.000

V dpos,V 5.000

OFF ON

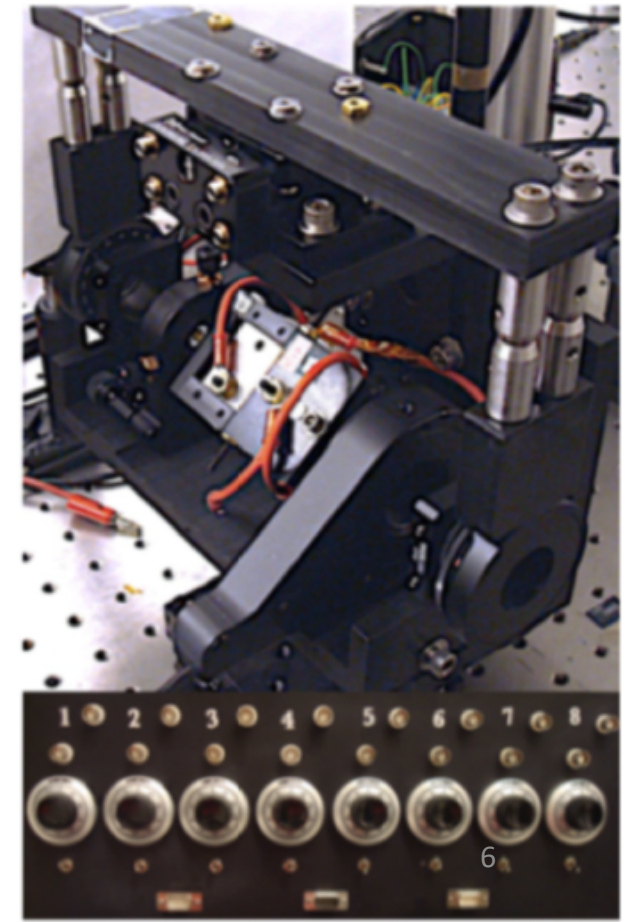
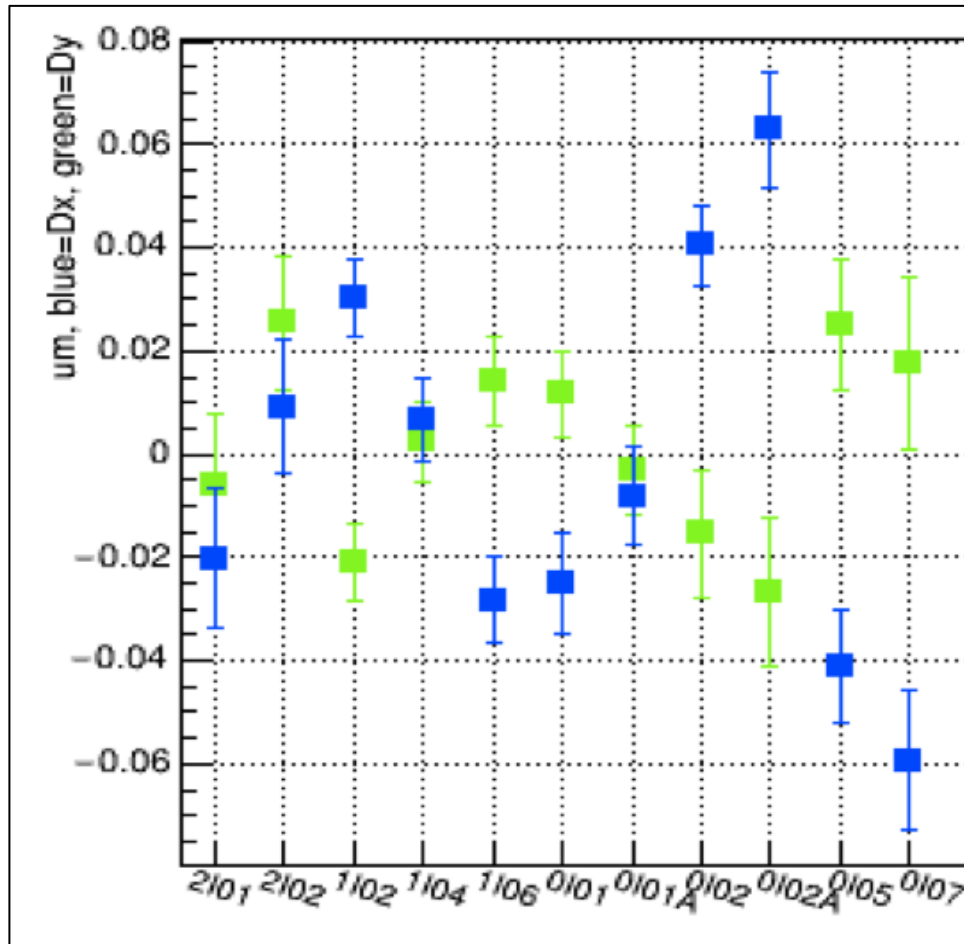
Main RTP Cell
On / Off

Green = ON

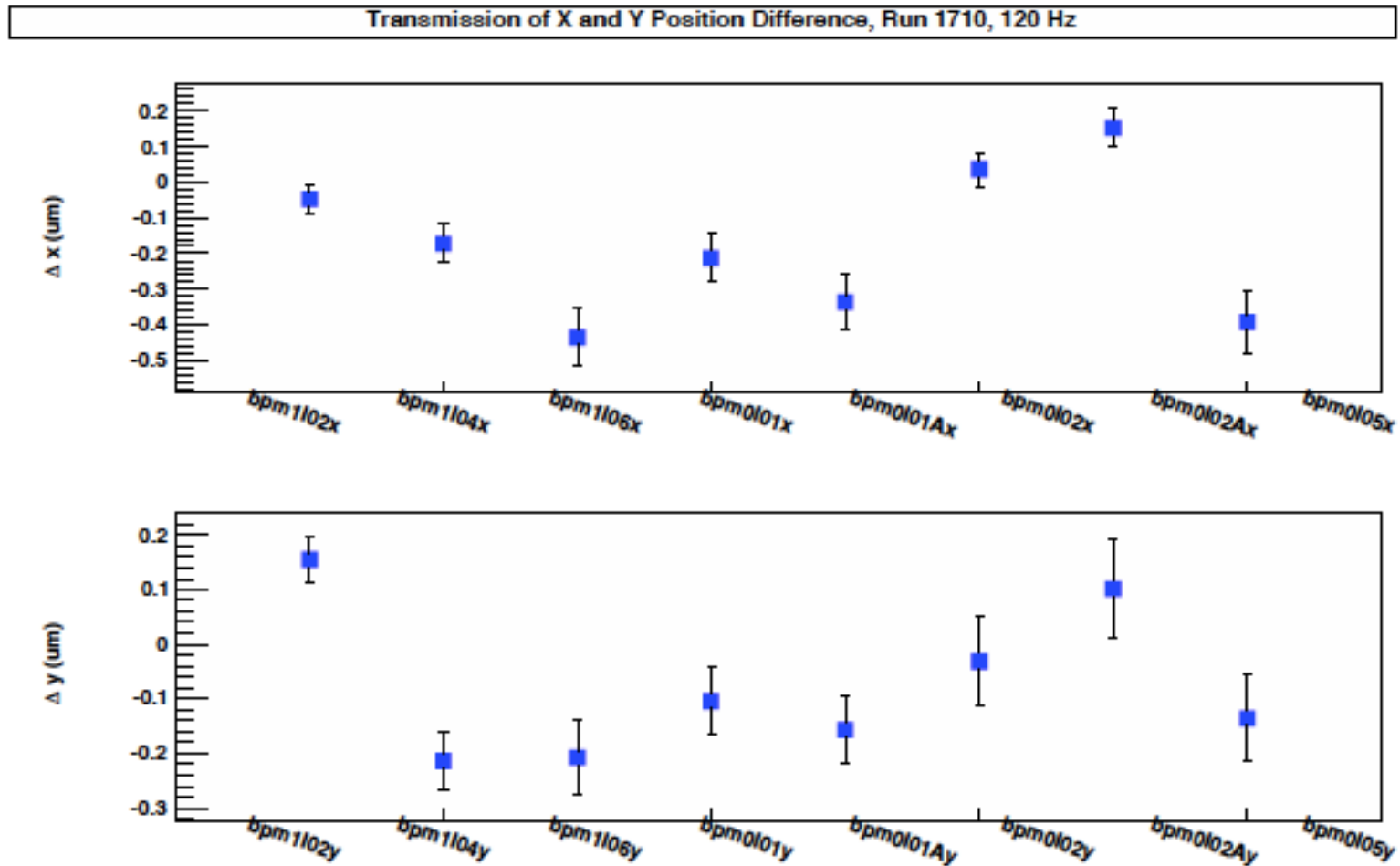
Reminder: RTP to FC1 (July 2018)

- 2 new bpms 2I01, 2I02 just after the cathode
- Was able to minimize the overall <FC1 region to <70nm
- Need to see further down in beamline through 0L region when there is a decent transport configuration

$D_x < 70\text{nm}$
 $D_y < 40\text{nm}$

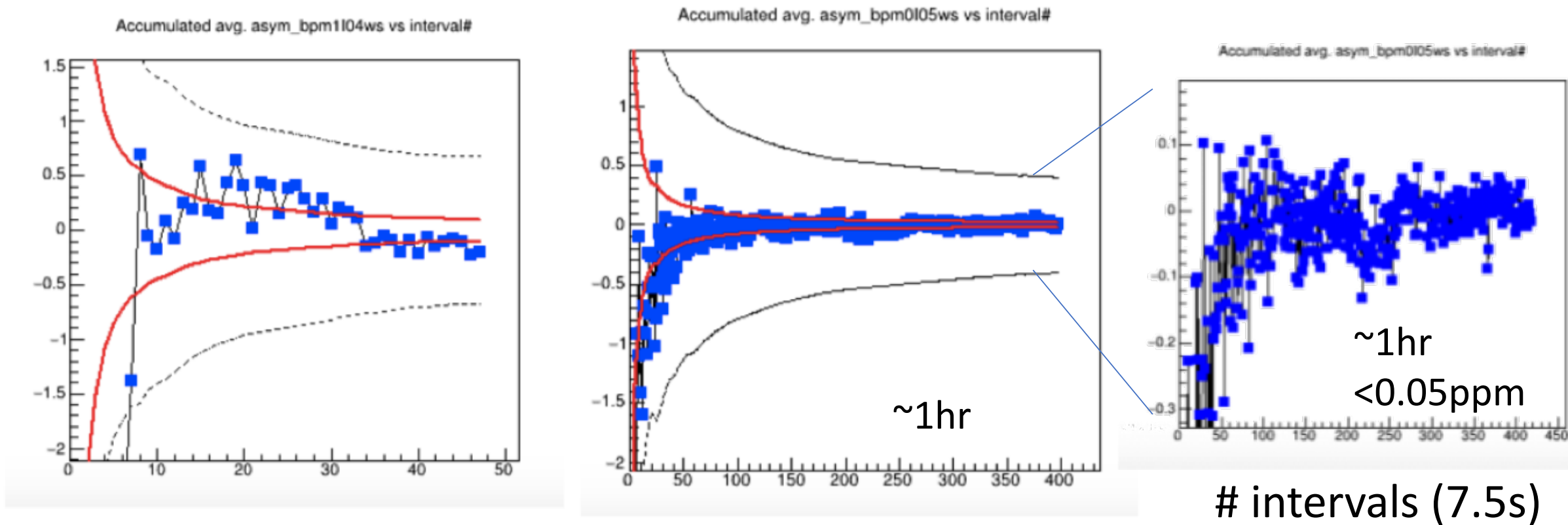


Where we want to be: PREXI injector data



- Pos. diff. inj. **~200-300nm**, Pos. diff. Hall **~30-100nm~60nm**, PREXI

Reminder: Aq slow drifts— correct with PITAV feedback



((a)) Run4109 S1 Aqfeed-
back 1I04, RHWP 67.5°

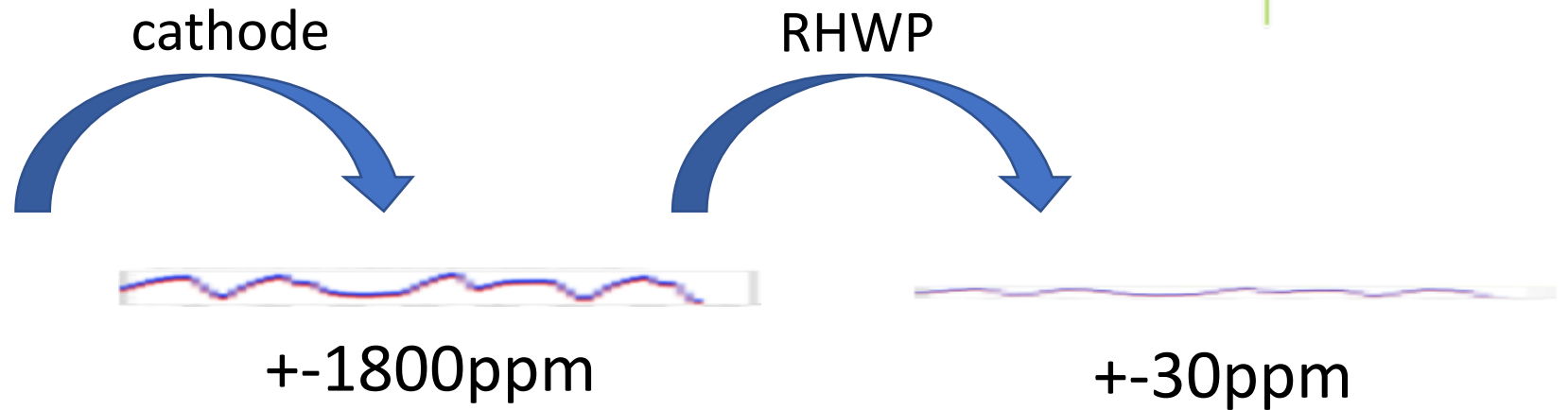
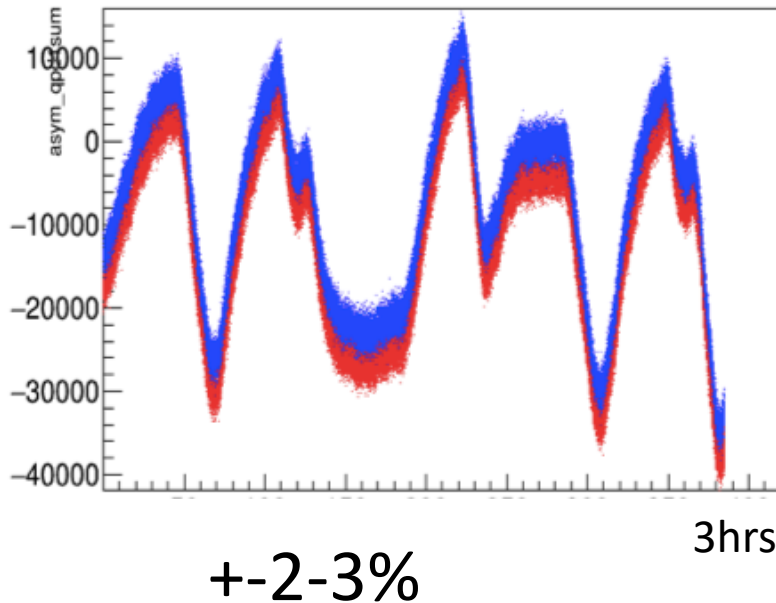
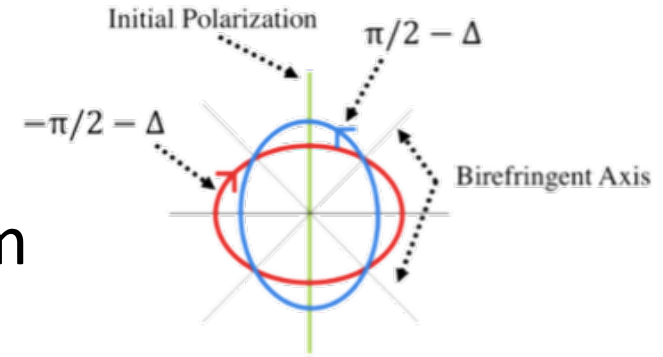
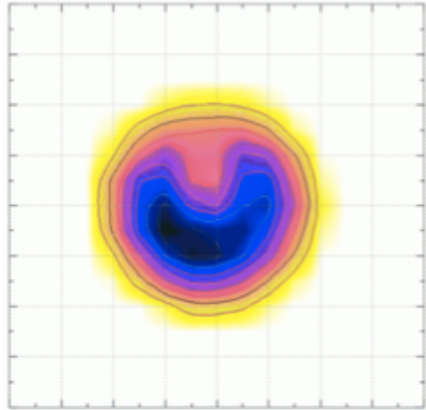
((b)) Run3972 Aqfeed-
backS2

Figure 1-51: Run3972, Aq feedback, 0I05, RHWP 45°

Plan Sp19

Aq Stabilization – No Feedback Required

- NO FEEDBACK REQUIRED SETTINGS / SAFETY NET
- Aq on laser table: $\pm 2-3\%$
 - off cathode in S1: $\pm 1800\text{ppm}$
 - rotate RHPW to 1deg from S2: $\pm 30\text{ppm}$



KEEP THE HALLS HAPPY!

Schedule

- Jan2-10 : RTP laser table installation
- (Jan18-23): 1 shift with e-beam in injector
- Weekly-ish (short) beam studies during spring – check transitions
- Can submit an ALTIS for additional spring studies before PREX

Will for need Jan2-10 and Jan18-23

- Previous cml for injector CODA
- Pan version: ~/caryn/paninj2018/pan with diff_bpm..., Aelli, etc.
- Various pan-root file dependent macros to analyze data

Will for need Jan18-23

- Amali's pan-feedback (with Pos.Diff. fdbk) with new EPICS channels edited in

`#feedback control`

```
feedback PITA on 1 bpm1i04ws
feedback PITAPOSU on 16 bpm1i04y
feedback PITAPOSV on 16 bpm1i04x
```

Plan

- Jan2-10 : RTP laser table installation
 - Mark KD*P current position so reinsertable. Remove but keep connections.
 - Install/align RTP with 8HV system, RHWP scans
 - RTP will run with opto-driver (we have spare opto-couplers and LEDs) – set 30-40us transitions
 - Perform qpd and linear array measurements using PAN
- Jan18-23: 1 shift to.... (with PAN feedback)
 - Check beam noise (was very noisy during fall beam study)
 - For Spring running :set RHWP angle to S2 for Aq stability without feedback, send beam ALL the way down injector, set position differences to be small-ish
 - PREX conditions (70 uA, 500MHz): slight RHWP angle off S2. Send beam ALL the way down injector. run pos diff feedback and Aq feedback.
- During Spring:
 - Check Aq in HallA daily (CODA/PAN/JAPAN permitting)
 - Check transition times during weekly-ish beam studies
- Other Spring Activities:
 - Measure HallA pos diffs well and determine amount of adiabatic damping
 - When JAPAN can do Aq feedback, submit ATLIS for running PITA-V feedback
 - Submit ATLIS to do helicity pick-up assessment
 - Mott measurement
 - *Chopper scans for RTP – check longitudinal structure, exploration (polarization)*

Summary of pre-PREX Goals

- Run RTP for several months with e-beam – monitor it
- For spring, set RHPW such that Aq fluctuations <50-100ppm
- Get Position Differences in Injector <200-300nm
- Check Position Differences in Hall (hopefully adiabatic damping such that will have 30-100nm for PREX)
- Get Aq feedback (+Pos diff fdbk) working with 8 new DAC channels for RTP ...1st with PAN in January...then with JAPAN

EXTRAS

RTP cell Installation Jan 2019

- Laser: 50cm lens in b4 cell in usual place, keep 1-2m steering lens for 1-2m effective throw distance, either solid-state or opto-driver (will see). Find hall B,C,D sizes of beam (or put 50cm all the way past the combiner so all halls), check all hall beam not clipping
- Mark KD*P current position so reinsertable. Remove but keep connections.
- RTP on table, HV connections, DAC channels, driver, lid, (laptop from upstairs).
- Laser table alignment – RHPW scans
- e-beam: Spring running conditions (# uA, #MHz), set RHPW angle to S2 for Aq stability without feedback. Send beam ALL the way down injector.
- set up for PREX conditions (70 uA, 500MHz), slight RHPW angle off S2. Send beam ALL the way down injector. run pos diff feedback and Aq feedback.
- *Chopper scans for RTP – check longitudinal structure, exploration (other hall beams)*
- *Try for Moller conditions: run feedback for longer on different bpms, try using PC angle d.o.f*
- *Other:*
 - *Linear array measurements*
 - *Helicity pickup assessments*
 - *Mott measurement*

Spring Plan

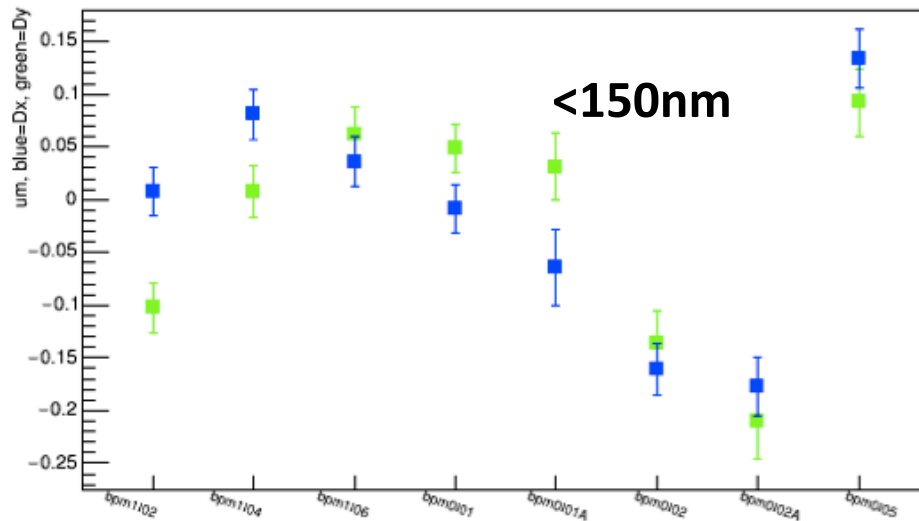
- Install RTP cell Jan 2019 (and acquire spare parts for everything)
- Run polarized beam with RTP during Spring 2019
- Do frequent checks of:
 - Aq
 - Transition times
 - (check position differences/adiabatic damping)
- Have the option of running with Aq feedback or NOT (so that other experiments don't have to rely on our feedback system during Spring)
- For PREX: Aq feedback with new DAQ system (new epics variables, japan) – may wish to try out upgraded feedback in Spring

Parity Quality for PREX/CREX

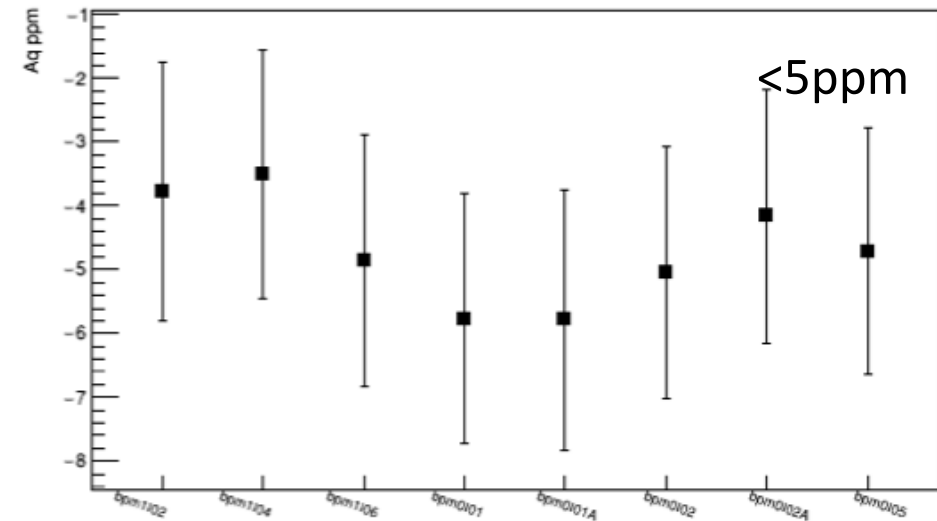
- **Do we have it?** For both KD*P and RTP, we've got the 130keV region down sub-PREX1 level, or even sub-Qweak level (with RTP)
- **What about the prebuncher?** We have been doing beam studies to find hunt for any phase issues surrounding the prebuncher. We have to make sure large pos diffs aren't being created, and that only moderate ones (<300nm, like PREXI) are there.
- **What about the noise?** *Aq widths and bpm widths look acceptable (except bpm0L02 in July 2018)*
- **Are the monitors working?** *We need to see the Hall A beam all the way through the injector (alone) to check the other bpps.* This will hopefully be done in mid-January 2019.

KD*P – Parity Quality Beam 9/1/17

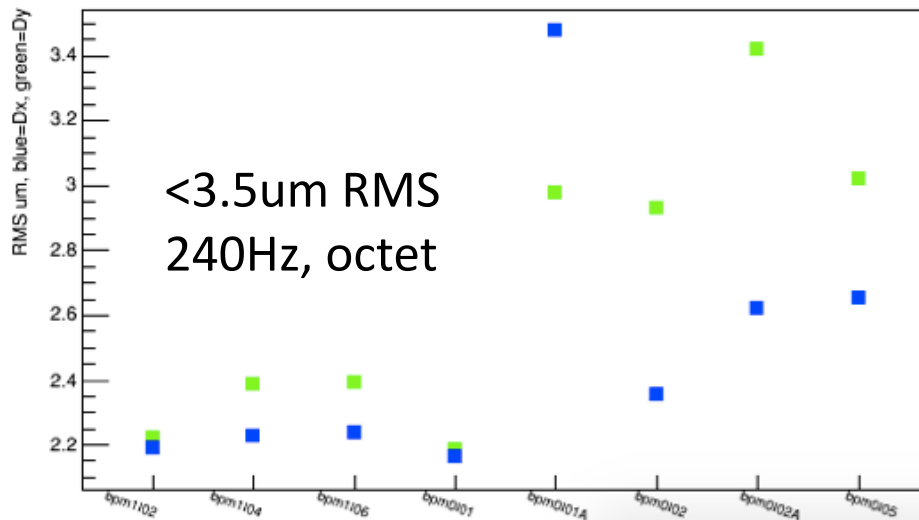
IHWP=0, Run 3445, 1



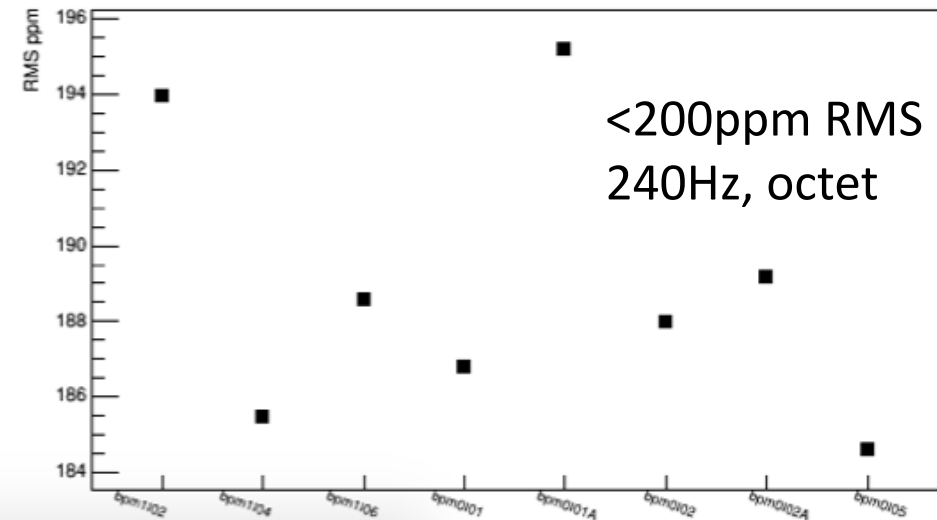
IHWP=0, Runs 3445, 1



IHWP=0, Run 3445, 1



IHWP=0, Run 3445, 1

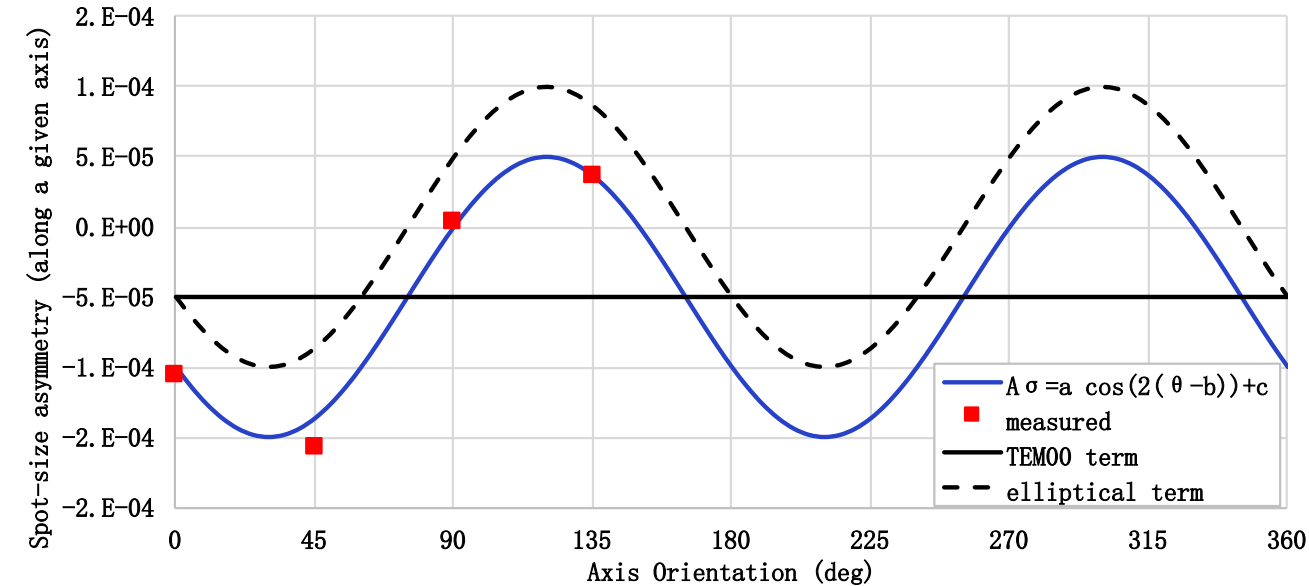


- These are smaller position differences than PREXI

RTP Spot Size Asymmetry

Laser table measurements

Spot-size Asymmetry off cathode, 6% analyzing along S1 (Ydirection)

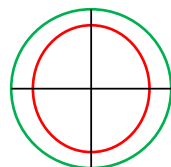


est. e-beam $A\sigma < 2e-4$

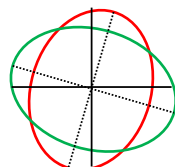
$$A\sigma = a \cos(2(\theta - b)) + c$$

a	-1.00E-04
c	-5.00E-05
b	30

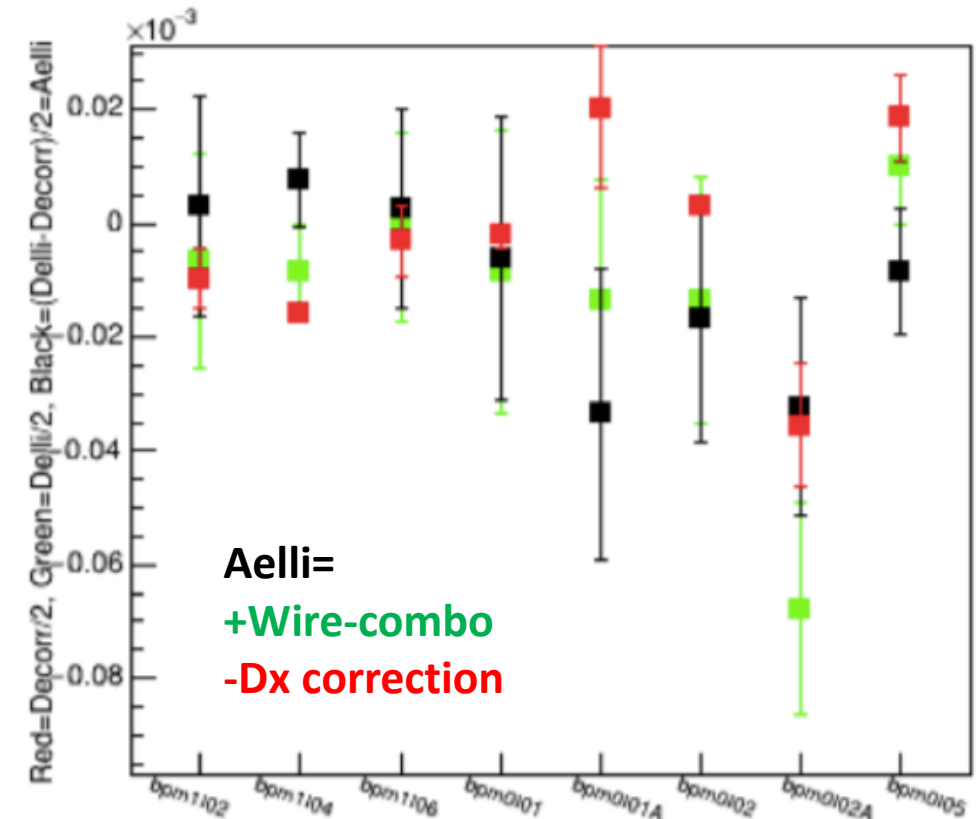
Circ. mode



Elliptical term



Using BPM wire combo to measure ***$A\sigma(\text{elliptical})$***



$A_{elli} < 5e-5$

RTP - 240Hz, octet, Run3331