

# PQB Meeting

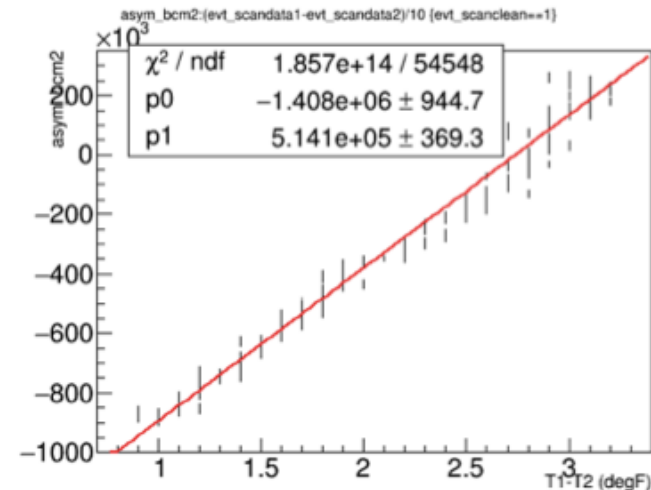
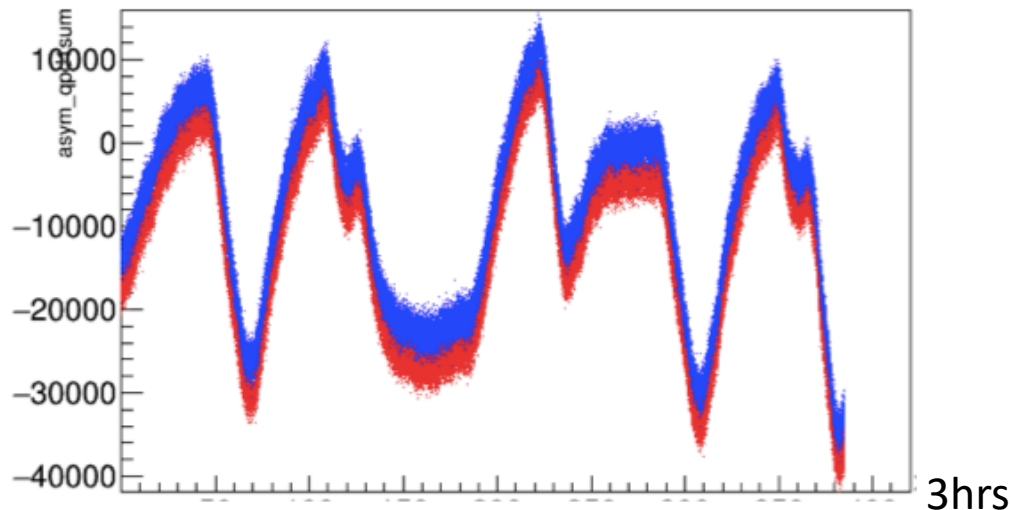
Caryn Palatchi 02/15/2018

## Previously Planned Improvements to RTP

- (1) Feedback
- (2) T Control
- (3) improved GND isolation

# Temperature Sensitivity – correct with V

- Fluctuates  $\pm 30\text{k}$  ppm, which is  $\sim 30\text{V}$  PITA adjustment
- $30\text{k}$  ppm corresponds to fluctuation of  $\sim 45\text{mKelvin}$  T difference between crystal pair
- Temperature induced birefringence well within PITAV induced birefringence adjustment range
- Intend to simply correct with voltage rather than trying to force two crystals to have milli-Kelvin temperature differences



# The MAIN Question

- We know we can stabilize  $A_q$  with feedback.
- When we stabilize  $A_q$ , how stable are the position differences in the injector?
- Basic Test – clamp down on  $A_q$ , minimize  $D_x, D_y$  with PITA posU/V, watch for several hours with feedback running....
- We want to know if we need to feedback on the position differences as well as  $A_q$

# Scheduling

- Schedule has RTP laser table work week of April 2-April 7 (weekends?)
- The week of April 8th is 100% dedicated to PQB beam studies, but unlikely there will be stable SRF, meaning 100% guaranteed for studies to fc#1/0I05, but beam to fc#2 is TBD. If fc#1 studies end early then ~1 day for the INJTWF tests.
- The week of April 16th possible RTP studies, + ~day to wrap up INJTWF test. 2-3 days of spin resonant cavity test. If SRF becomes stable try RTP to fc#2.

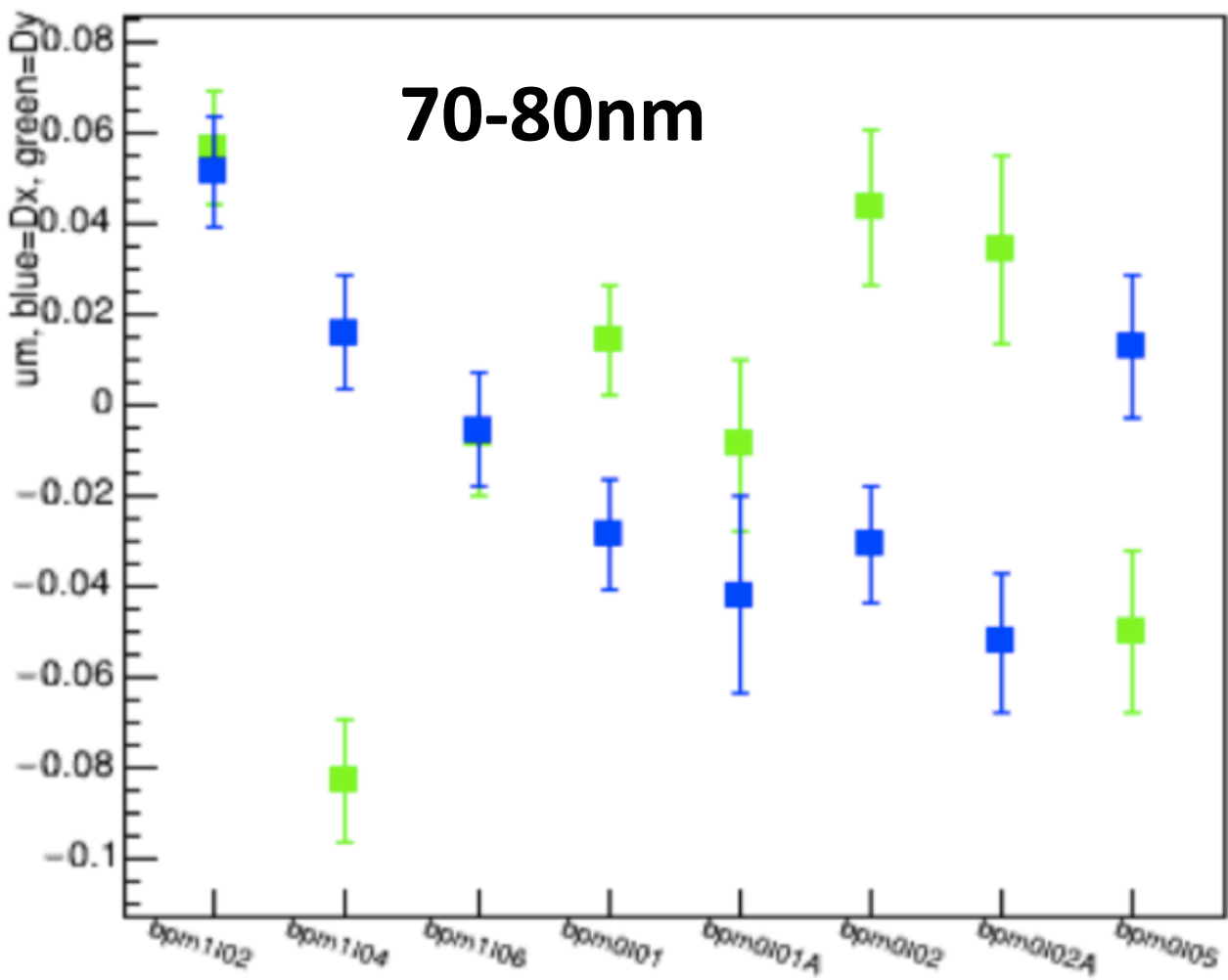
| Week Off | Other | INJ Cryo  | INJPSS  | S&A | PSS Cert | Bubble Install | Bubble | PQB        | BROCK     |
|----------|-------|-----------|---------|-----|----------|----------------|--------|------------|-----------|
| 26-Mar   |       | 2K        | RA      | x   | >3pm     | Install day    |        |            |           |
| 2-Apr    |       | ?         | RA      | x   | >3pm     | Install day    |        | RTP Laser  |           |
| 8-Apr    |       | 4K trans. | INJ=FC1 |     |          |                |        | RTP/INJTWF |           |
| 16-Apr   |       | 4K trans. | INJ=FC1 |     |          |                |        | Float      | Beam (DS) |

# New Spot Size Asymmetry +BPM Info

- BPMs- The first 8bpms in the injector beamline are M15-mini's, not M15's. Their calibration factors are 13.7mm, not 18.8mm. So, all parity experiments which showed position differences in the injector are off by a factor of 0.7 in the 130keV region.
- Spot Size Asymmetry - There are 4 wire channels in a bpm. At present only 3 linear combinations of those channels are assessed to examine beam I,X,Y. There is a 4th linear combination which produces an independent variable which can be examined. This combination is proportional to the elliptical component of the spot size (aka the breathing mode).

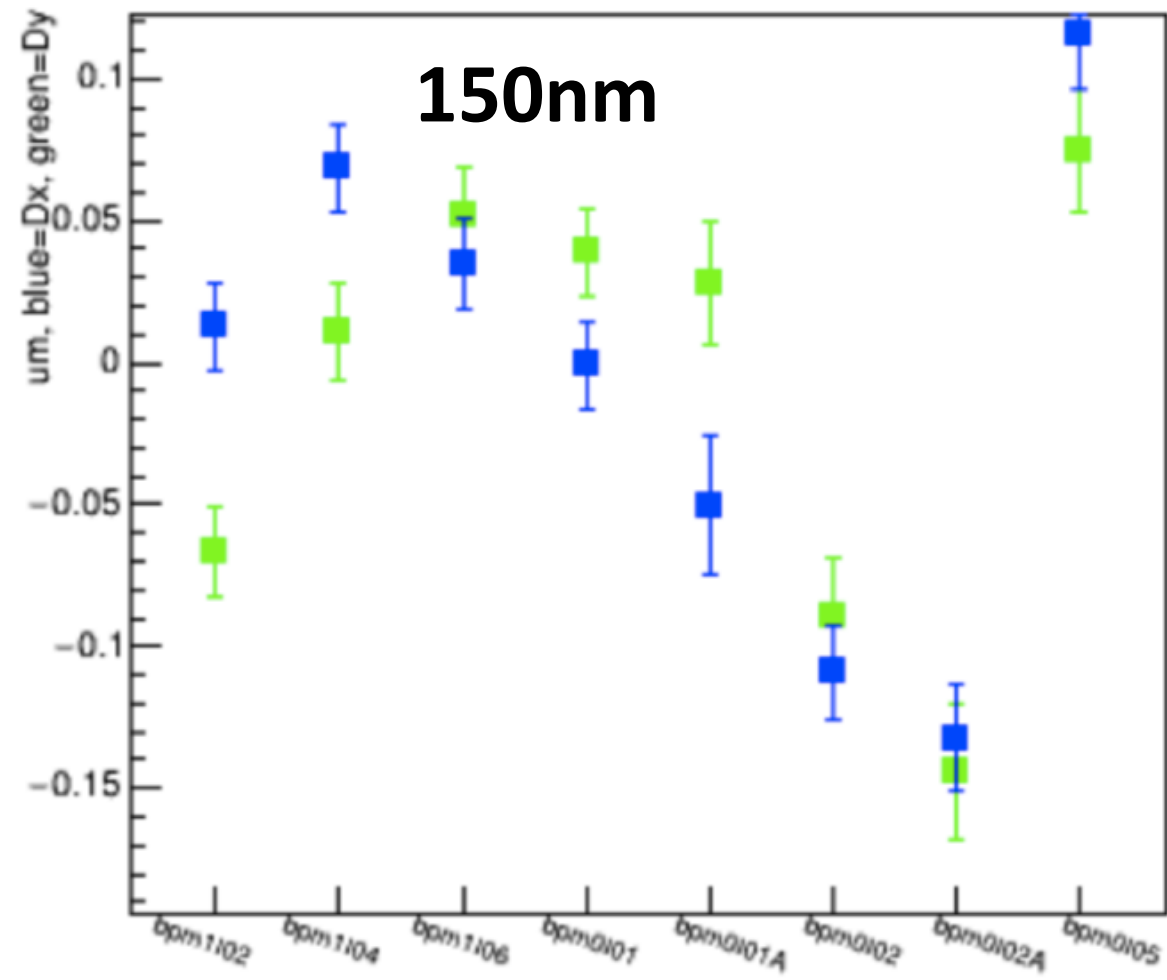
# RTP - 240Hz, octet, Run3331

IHWP=0, Run 3331, evl\_scardata1[0]=1209\*4&&evl\_scardata2[0]=7100\*4&&evl\_scardata3[0]=4



# KD\*P - 240Hz, octet

IHWP=0, Run 3445, 1



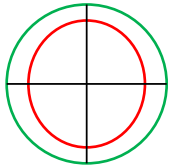
# Introducing new parameter

$$\epsilon = \frac{\sigma_x - \sigma_y}{\sigma_x + \sigma_y} = \frac{a^2}{8\sigma^2} \frac{xp + xm - yp - ym}{xp + xm + yp + ym} - \frac{x^2 - y^2}{4\sigma^2} = bpmelli - bpmecorr$$

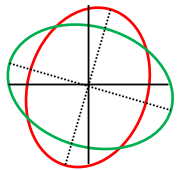
$$A_\sigma(\theta) = A_{circ} + A_{elli} \cos(2(\theta - \theta_0)), \quad A_{elli} = \Delta\epsilon/2 \approx \frac{x\Delta x - y\Delta y}{\sigma^2}$$

$a = 2\kappa$ ,  $\kappa = 13.7mm$  for M15-mini      $\sigma$  is the  $e^-$  beam spot size.

Circ. mode



Elliptical term

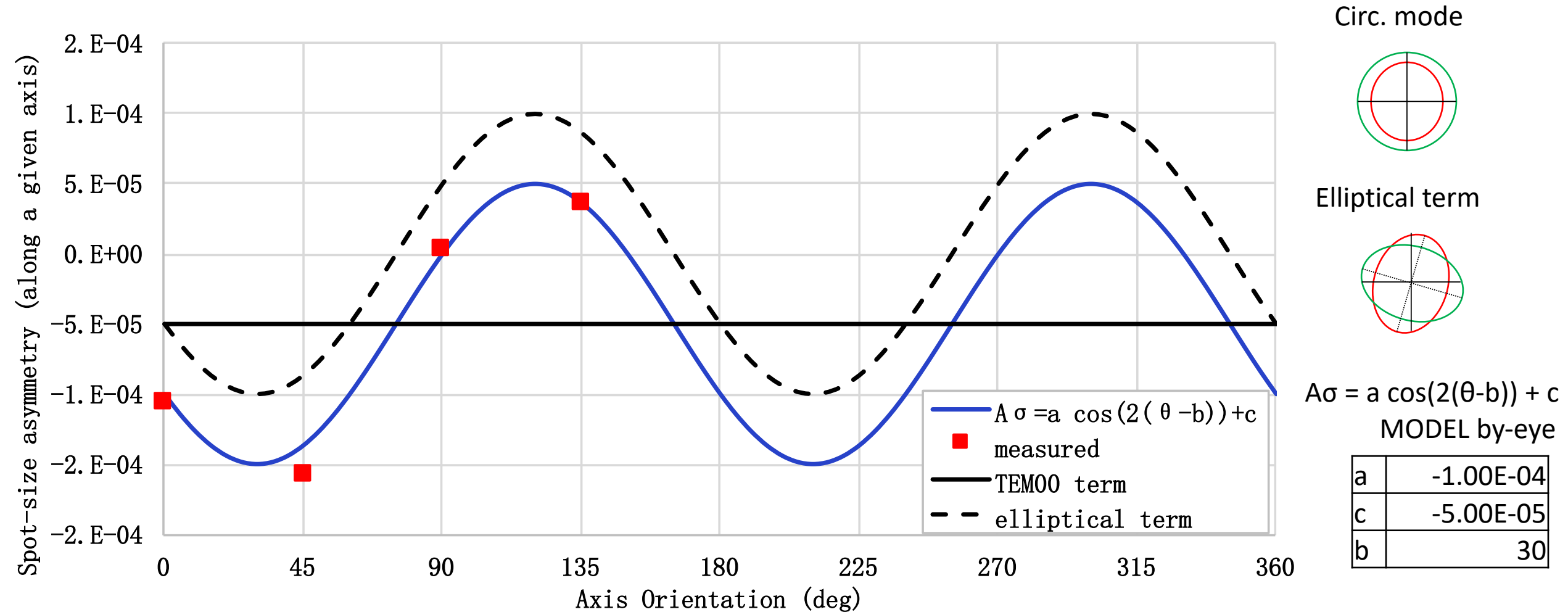


- Depending on the orientation of the spot-size asymmetry and the orientation of the bpm, some bpm's will be more sensitive to certain axes
- The overall spot size of the beam matters as a scale factor (used Elegant and scaled with laser spot size of 0.75mm at cathode)
- The correction term from position differences is smaller when the beam is better centered on a bpm



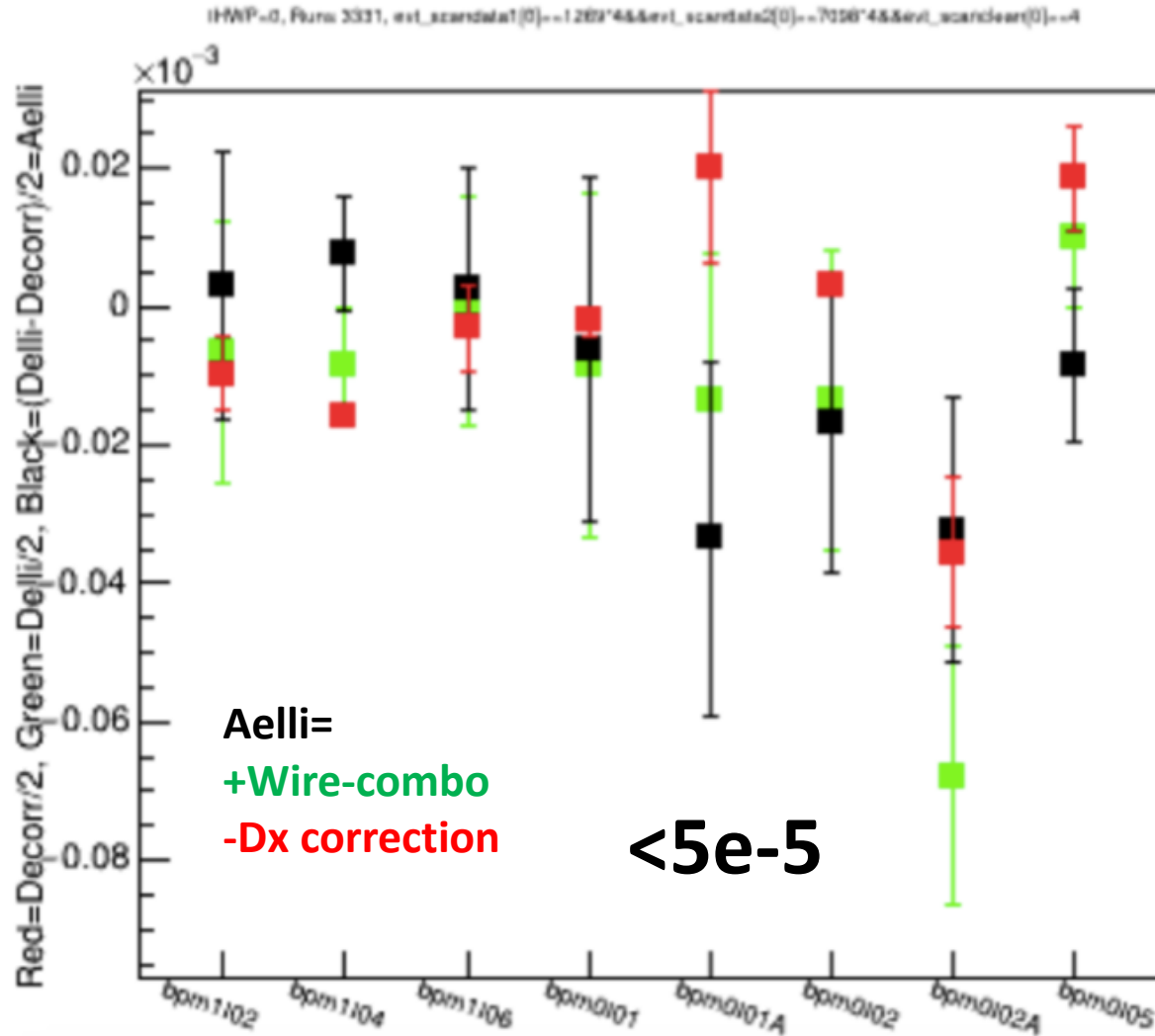
# Previously Estimated from laser table measurements....

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

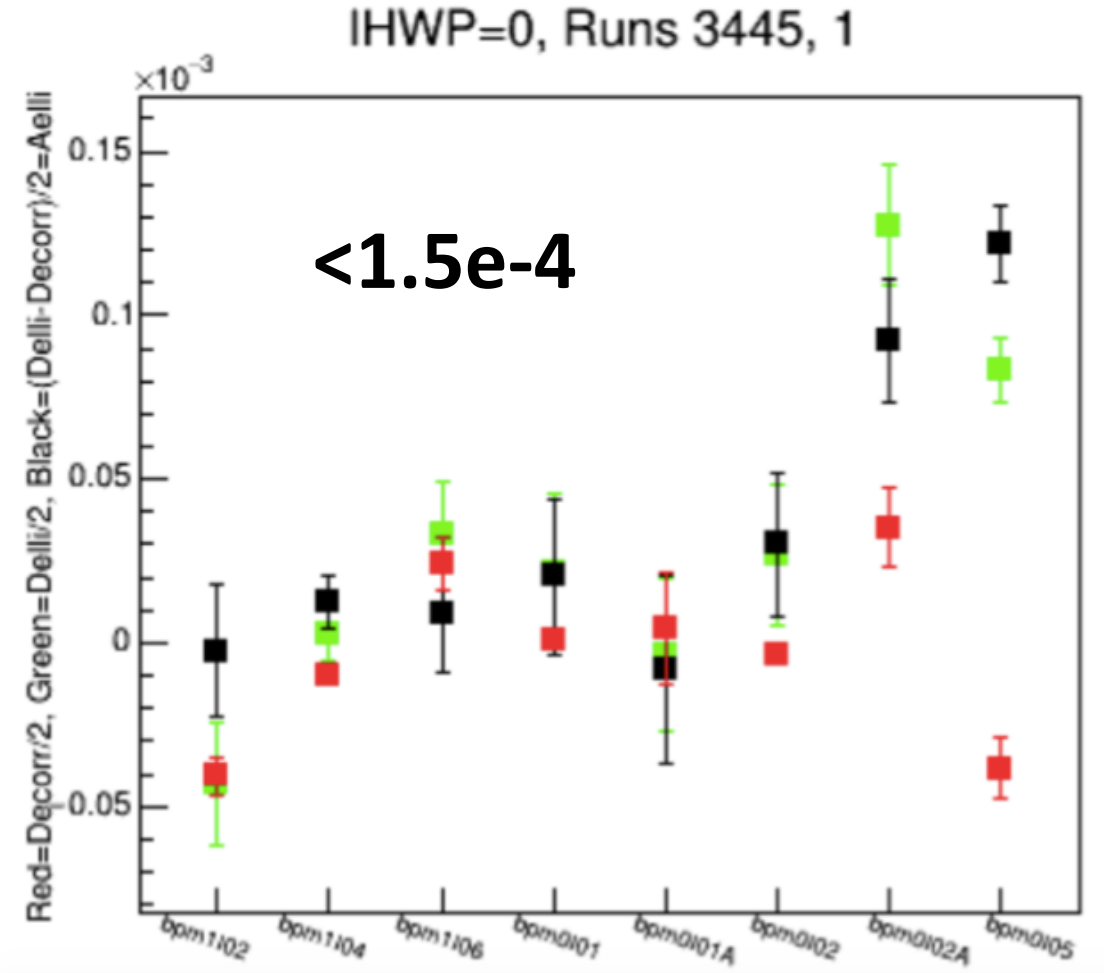


# Aelli Results

RTP - 240Hz, octet, Run3331



KD\*P - 240Hz, octet



# Better Test would be.....

- Make a big spot size asymmetry...
- (How? Put a 100% analyzer in and tilt the crystal)
- Measure the BIG spot size asymmetry with the linear array
- Confirm (or not) the BIG asymmetry with BPMs

# Plan (April 2weeks+bonus days)

- **Part1 (April2 week)**

- setup RTP on the laser table, test T control and Aq stability, feedback
- setup qpd, minimize position differences
- setup linear array, minimize spot size asymmetries

- **Part2 (April8 week)**

- Set up of injector beamline
- e-beam at 25uA/70uA up through OI05 region, current calibration run, PITA pos scans
- feedback on, iterate PITApos voltages to minimize pos diffs in OI05, iterate PITApos voltages to minimize pos diffs in a select OL region bpm.

- **Part3 – Spot Size Asymmetry test**

- ~~• e-beam at 70uA up through 5MeV region, current calibration run, PITA pos scans~~
- ~~• feedback on, iterate PITApos voltages to minimize pos diffs in OI05, iterate PITApos voltages to minimize pos diffs in a select OL region bpm.~~

- **Part4**– Grames Wien flip test: 3 configs (off, right, left) with 130 keV gun

# Before and After April Run....

- UVa work now: Feedback, GND isolation of RTP system
- Riad: DAC controls for RTP 8HV system ?
- After April run: Decide whether or not to take RTP out
- After RTP Studies (early may) replace gun with 200keV Gun

## July Plan

- Part1- if RTP needs put back in, reinstall and realign
- Part2 – injector beamline setup
- Part3 - Repeat Grames Wien flip test: 3 configs (off, right, left) after gun change
- Part 4 – Revisit of RTP stability testing/feedback