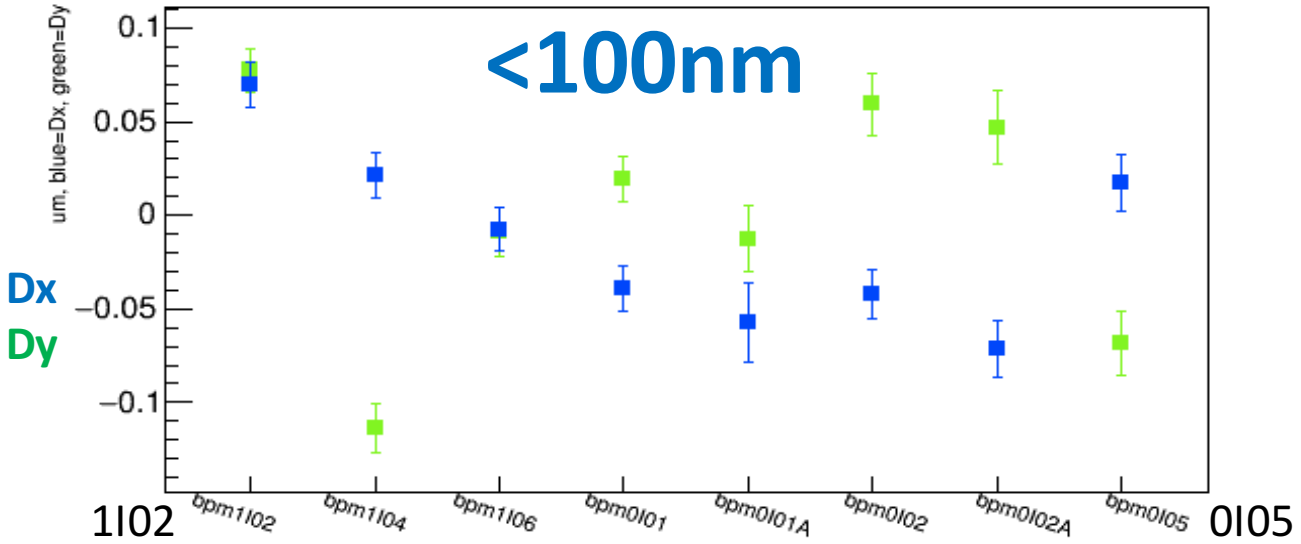
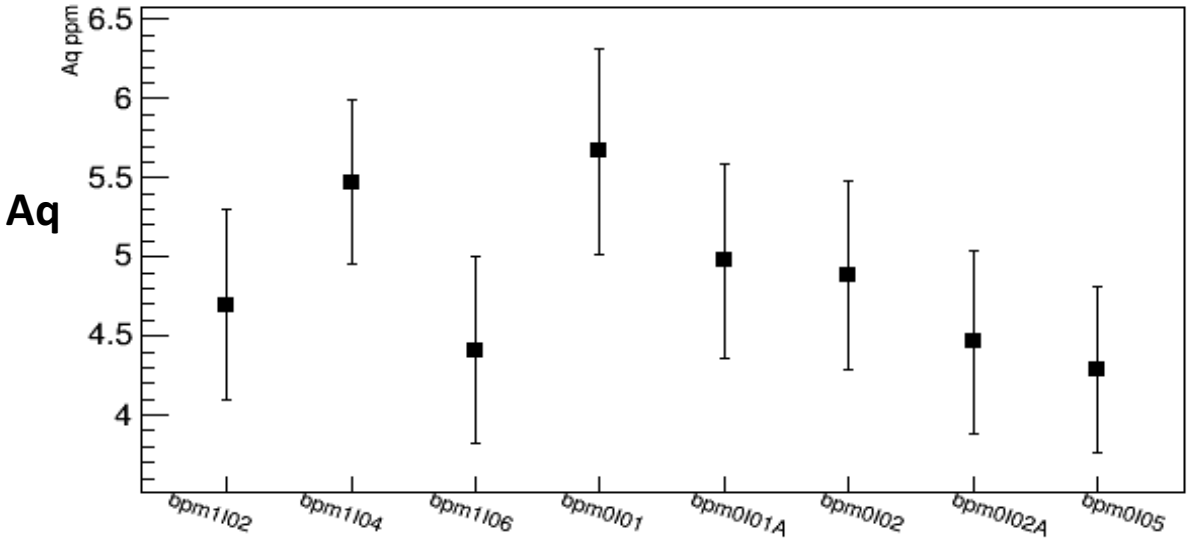
PQB

10/20/2017

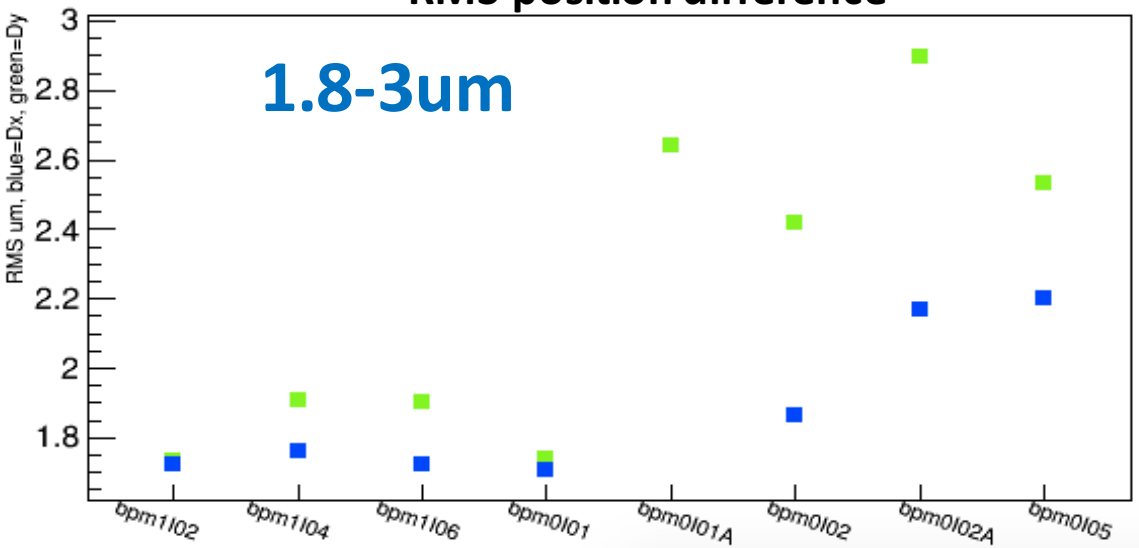
RTP results after a couple hours walking



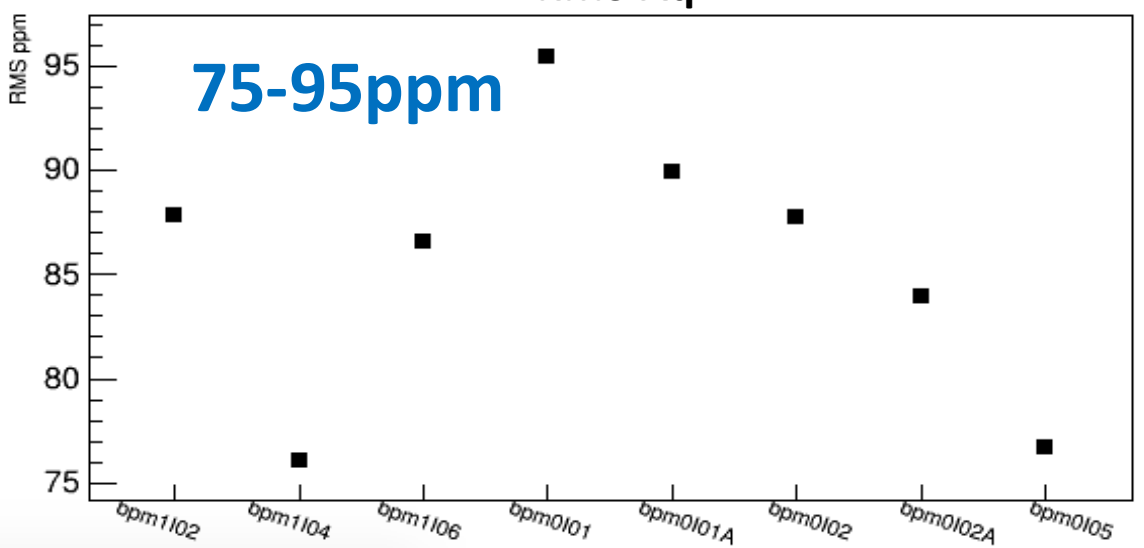


240Hz, octet, Mtree

RMS position difference



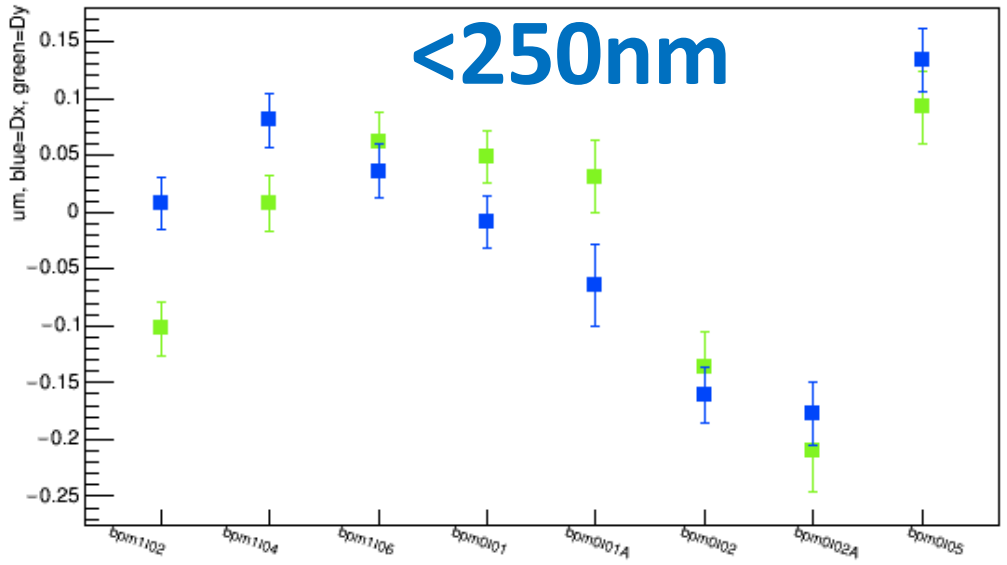
RMS Aq



RTPcell_Run3331_ebeamWalking_IHWPout_S1RHWP24_PITA54p5PITAposU12p69PITAposV70p98

KD*P 9/1/2017

IHWP=0, Run 3445, 1

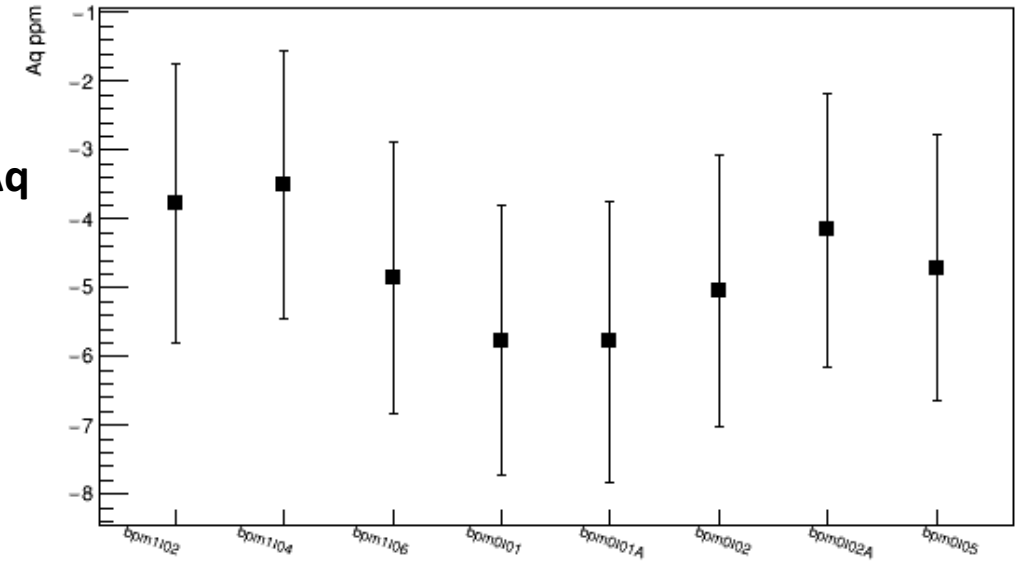


<250nm

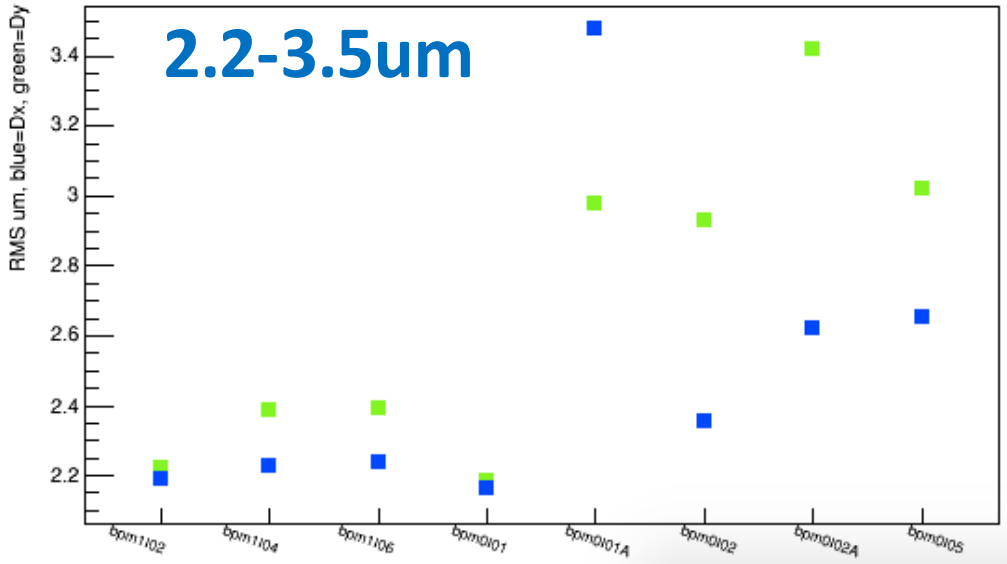
Dx
Dy

IHWP=0, Runs 3445, 1

Aq

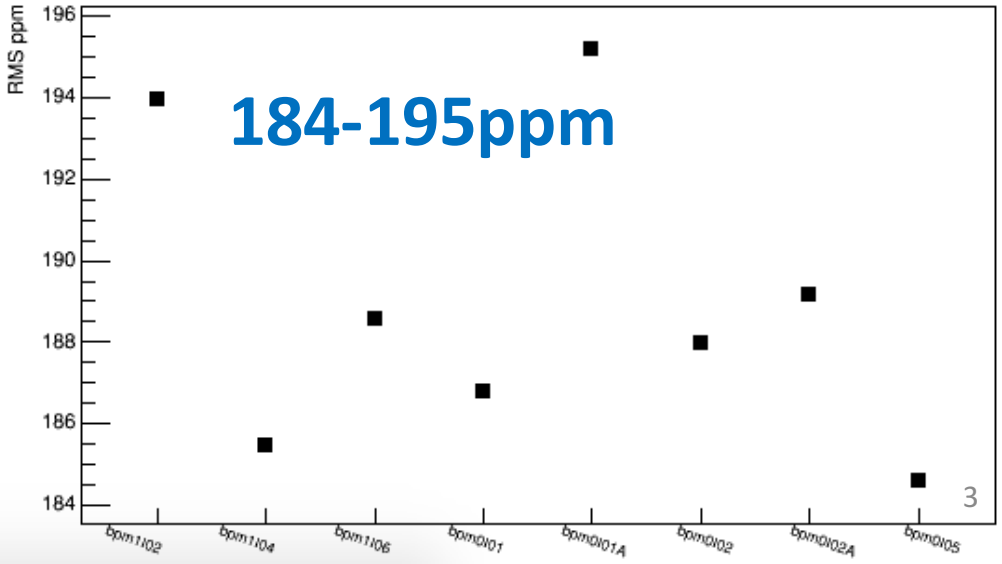


RMS position difference



2.2-3.5um

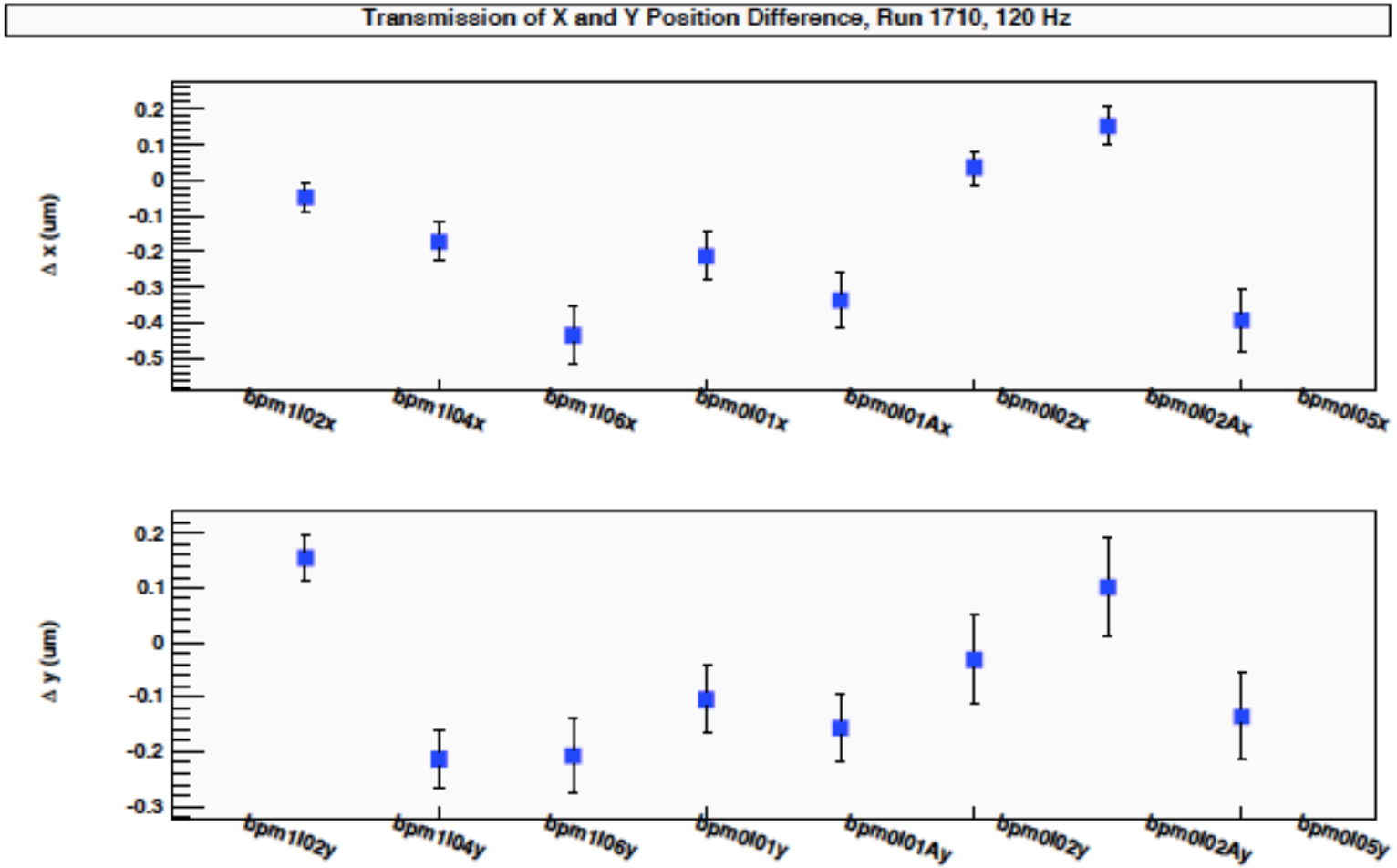
RMS Aq



184-195ppm

Compare to PREXI

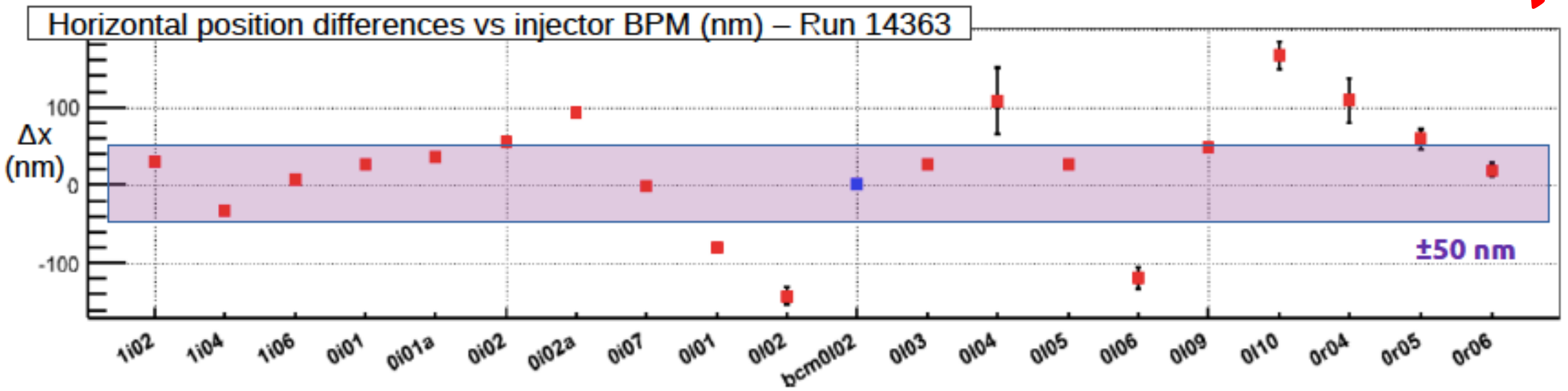
~200-300nm



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

Compare to Qweak

x2



Kargiantoulakis Thesis

Figure 4.19: Horizontal position differences on successive injector BPMs. The purple band corresponds to ±50 nm of position differences.

- Qweak diff = (pos0-pos1)/2
- Prex diff =pos0-pos1

~100nm

- Note: laser spot size on cathode was 0.5mm for run1, 1mm for run2
  - Implies 4sigma = sqrt(2/ln2) FWHM = 1.7mm for 2nd half of run,
  - **Qweak run2 had 2X smaller laser spot-size than what we have now**

PREX checklist – KD*P

- Reproduce August 2017 laser beam configuration & PC alignment, Dx,y <250nm
  - waist(2sigma): wx=0.825mm, wy=0.94mm @PC
  - divergences: dw/dz x 0.51mrad, y 0.66mrad @PC
  - cathode 4sigma x 2.9mm,y 3.1mm Vert, steering lens 2m, eff. throw to cathode ~2.015m
- Steering lens change to reduce spot-size to that of Qweak run #2
  - FHWM 1mm, implies 1.7mm 4 sigma

PREX checklist - RTP

- Reproduce August 2017 laser beam configuration & PC alignment, Dx,y <100nm
- Steering lens change to reduce spot-size to that of Qweak run #2, Dx,y < 50nm
- Stability – Feedback & Tcontrol (in progress)

MOLLER checklist

- Helicity Board - Linesynch and 'trigint-tet' (30) at 960Hz
- ADC faster (so can handle 2kHz), *Faster* feedback system (so can handle 2kHz)
- Helicity pickup – ground loops, etc. from inj room appear to contribute ~20nm to some bpm singnals. REDUCE.
- Isolate RTP drive system GND
- Reduce spot-size asymmetries by further 2-10X for 1-5% aperture clipping effects on Dx,y

Extras

Spot Sizes – history

August 2017

- waist(2sigma): wx=0.825mm, wy=0.94mm @PC
- divergences: dw/dz x 0.51mrad, y 0.66mrad @PC
- cathode 4sigma x2.9mm,y3.1mm Vert, steering lens 2m, eff. throw to cathode ~2.015m

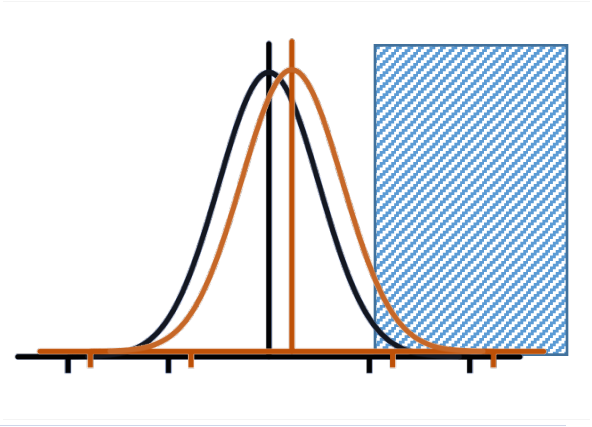
PREX1

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

Qweak run#2

- Pos diff inj ~100nm
- laser spot size on cathode was 0.5mm for run1, 1mm for run2
- Implies 4sigma = sqrt(2/ln2) FWHM = 1.7mm for 2nd half of run,
- **Qweak run2 had 2X smaller laser spot-size than what we have now**

Apertures – Calculation of Impact



- A few % losses typical
- Assume 1st few inj bpms see larger spot size (σ=1mm)
- Gaussian beam
- 5% clip + 1um pos diff + σ~1mm = 54ppm Aq *created by aperture*
- 10% clip + 1um pos diff + σ~1mm = 94ppm Aq *created by aperture*
- (1% clip + 2e-4 Aσ + σ~1mm = 34nm Dx *created by aperture) pure gaussian*
- 5% clip + 2e-4 Aσ + σ~1mm = 76nm Dx *created by aperture*
- 10% clip + 2e-4 Aσ + σ~1mm = 92nm Dx *created by aperture*
- *Note: Jay says 2-5% is realistic , ref pg 65 lab book*

Unplug DAC channels from IA box, Unplug Voltage output of IA box, PC HV off, 25uA							
@start:helicity fibers to laser table, helicity fibers to helicity magnets, no delay, Connected GND of PC to table							
bpm0l01		Aq(ppm)	eAq(ppm)	Dx(nm)	eDx(nm)	Dy(nm)	eDy(nm)
Average all delay16 runs, except 'everything off' run		**0.41**	*0.18*	**4.12**	*3.20*	**-18.98**	*2.90*
Average delayed runs <3641, 3640> to cancel PC pol. Effects.		**0.10**	*0.41*	**6.4**	*7.4*	**-14.5**	*6.6*
Average no delay runs <3637, 3638>		**0.51**	*0.39*	**1.0**	*7.0*	**-13.6**	*6.3*
Run3637- RHWP 0, no delay		**0.58**	*0.56*	**9.7**	*9.5*	**-6.7**	*8.5*
Run3638- RHWP 45deg+IHWPin, no delay		**0.44**	*0.54*	**-7.7**	*10.2*	**-20.5**	*9.2*
Run3639- RHWP 0, delay 16		**1.11**	*0.38*	**-8.9**	*7.3*	**-20.9**	*6.6*
Run3640- RHWP 0, delay 16, helicity fiber to magnets unplug		**1.43**	*0.48*	**-2.0**	*9.5*	**-13.6**	*8.6*
Run3641- RHWP 45deg, delay 16,helicity fiber to magnets unplug		**-1.23**	*0.66*	**14.8**	*11.2*	**-15.3**	*10.1*
Run3642- RHWP 0, delay 16, PC not grounded to table		**0.33**	0.64	**12.7**	10.0	**-26.1**	9.1
Run3643- "everything off run" ,Uplug helicity fibers to laser table		**-0.50**	0.51	**8.2**	10.1	**-5.0**	9.2
Run3639- Analyzed with delay 0, reporting delay is 16		0.09	*0.38*	-11.2	*7.3*	-5.6	*6.6*
Run3640- Analyzed with delay 0, reporting delay is 16		0.75	0.48	2.6	9.4	-2.8	8.5
Run3641- Analyzed with delay 0, reporting delay is 16		0.32	0.66	-4.2	11.2	2.7	10.1
Run3642- Analyzed with delay 0, reporting delay is 16		0.48	0.64	-17.7	10.0	-19.5	9.1
Run3643- Analyzed with delay 0, reporting delay is 16		0.24	0.51	-20.8	10.1	6.4	9.2
PC contribution : (Run3640-Run3641)/2		**1.33**	*0.41*	**-8.4**	*7.4*	**0.8**	*6.6*
DAQ electronics pickup: avg. all delay 16 runs, analyzed w/ 0delay		**0.37**	*0.24*	**-10.27**	*4.33*	**-3.74**	*3.93*
DAQ electronics pickup: Run3637-Run3639		**-0.53**	*0.68*	**18.7**	*12.0*	**14.2**	*10.8*
Helicity magnets pickup (ground loop):Run3639-Run3640		**-0.31**	*0.61*	**-6.9**	*12.0*	**-7.3**	*10.9*
PC grounding pickup: Run3640-Run3642		**1.10**	*0.80*	**-14.71**	*13.82*	**12.44**	*12.58*
Laser hut pickup anomolous : Run3642-Run3643		**0.83**	*0.82*	**4.51**	*14.22*	**-21.06**	*12.97*