G^0 PC Installation and Beam Studies

Stephanie Bailey

Riad Suleiman

Presentation Outline

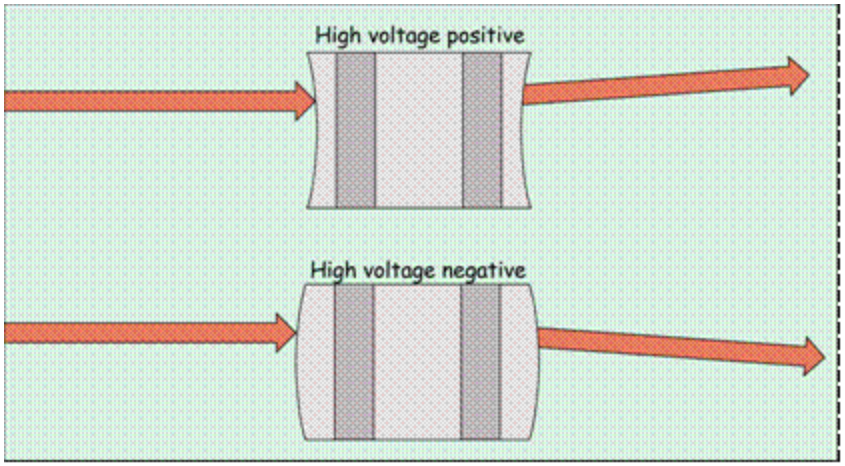
- Pockels Cell Installation (Injector)
- Electron Beam Studies (up to 100 KeV)
- Electron Beam Studies (up to 5 MeV)
- Electron Beam Studies (up to BSY)

Pockels Cell Installation (Injector) January 14-20, 2006

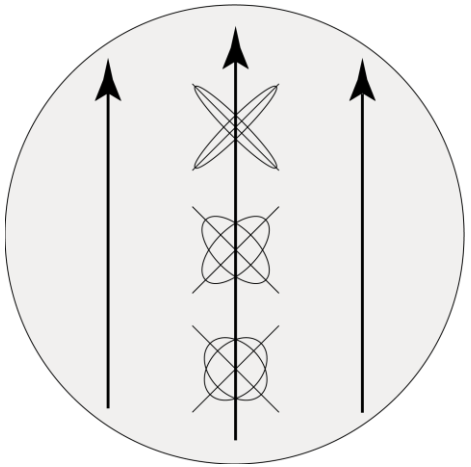
- What did we accomplish?
  - Characterized Intensity Asymmetry (IA) Cell: $\lambda/4$, 20°
    - Measured dependence of intensity loss on waveplate angle : 1.24%/ ° (25% at 20°)
    - Measured dependence of intensity asymmetry on voltage : 30.10 ppm/V
  - Aligned Pockels Cell (PC)
    - Degree of linear polarization = 4.88%
    - Degree of circular polarization = 99.88%
    - Minimized x and y position differences.

Pockels Cell Installation

- Steering Effects
  - PC can act like voltage controlled lenses
  - If beam is off-center, it can be steered.
  - Helicity correlated position differences result



- Birefringence Effects
  - The presence of a gradient in the phase introduced by the PC will result in varying linear polarization across the photocathode.
  - Helicity correlated position differences result.



Pockels Cell Installation Results January 14-20, 2006

Steering (LP OUT)	IHWP IN	IHWP OUT	Goal
Δx	0.11 ± 0.017 μm	-0.07 ± 0.019 μm	< 0.1 μm
Δy	-0.16 ± 0.010 μm	0.10 ± 0.011 μm	< 0.1 μm
Δcharge	-103.1 ± 9.51 ppm	74.83 ± 12.35 ppm	

Birefringence (LP IN)	IHWP IN	IHWP OUT	Goal
Δx	7.39 ± 0.017 μm	-3.34 ± 0.016 μm	< 6 μm
Δy	3.88 ± 0.009 μm	-4.27 ± 0.009 μm	< 6 μm
Δcharge	1.56E4 ± 157 ppm	-2.54E4 ± 169 ppm	

Electrical Pickup	
Δx	0.008 ± 0.016 μm
Δy	-0.004 ± 0.009 μm
Δcharge	0.043 ± 1.24 ppm

w/ photocathode 3X larger in injector

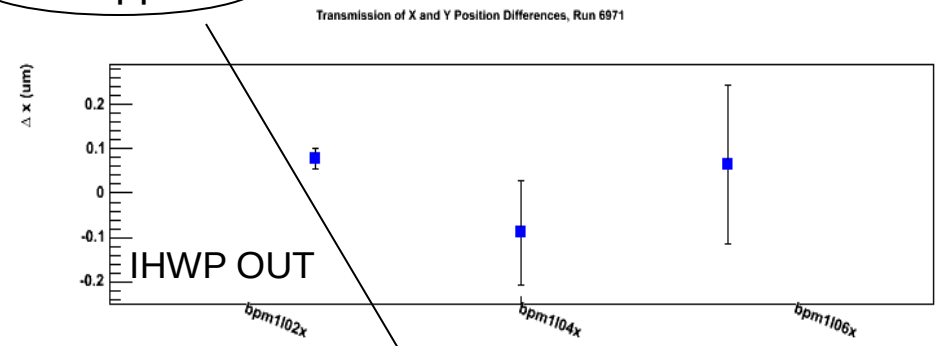
w/ photocathode 20X smaller in injector

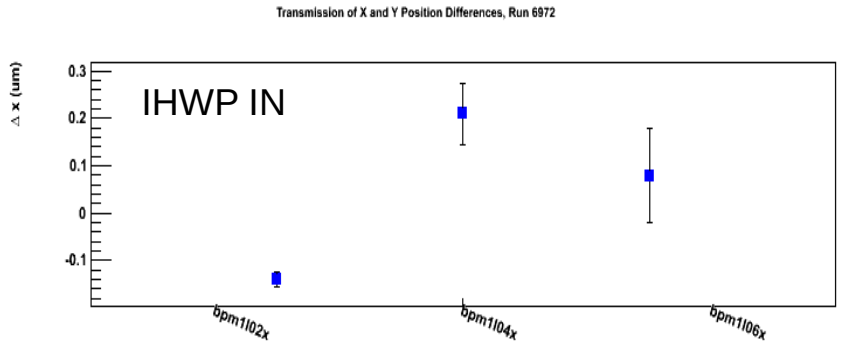
Injector	Happex
Δx	< 0.3 μm
Δy	< 0.3 μm
Δcharge	

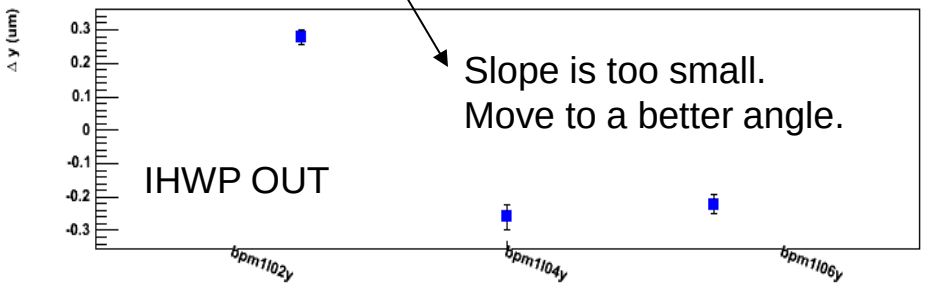
Electron Beam Studies (up to 100 KeV)
January 28, 2006 (80 μA, Wien = 0°)

RHWP = 0°

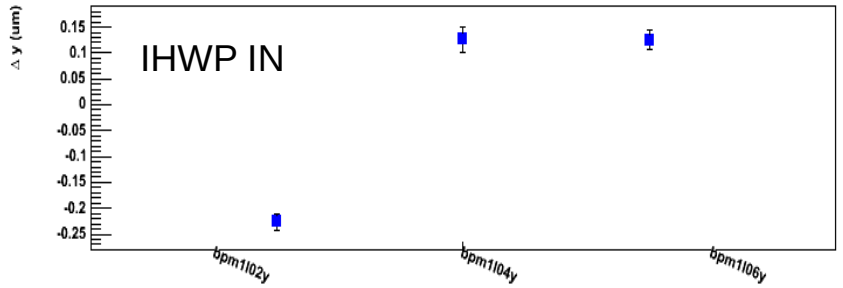
-8.6 ppm/V

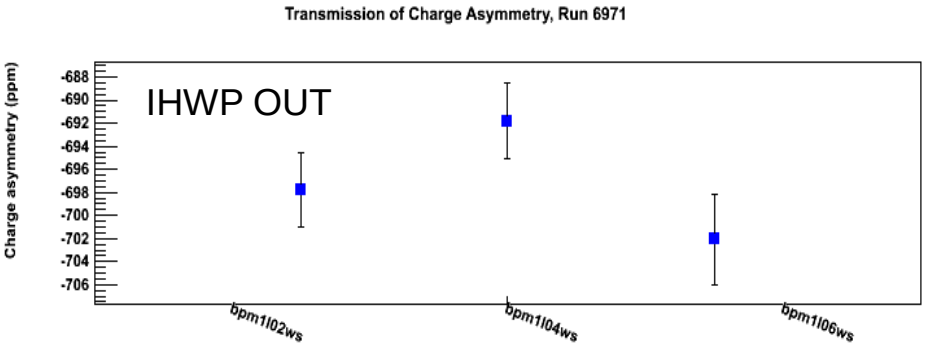


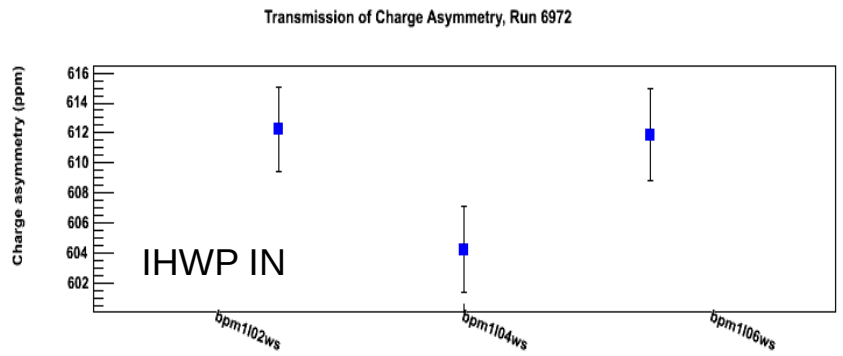




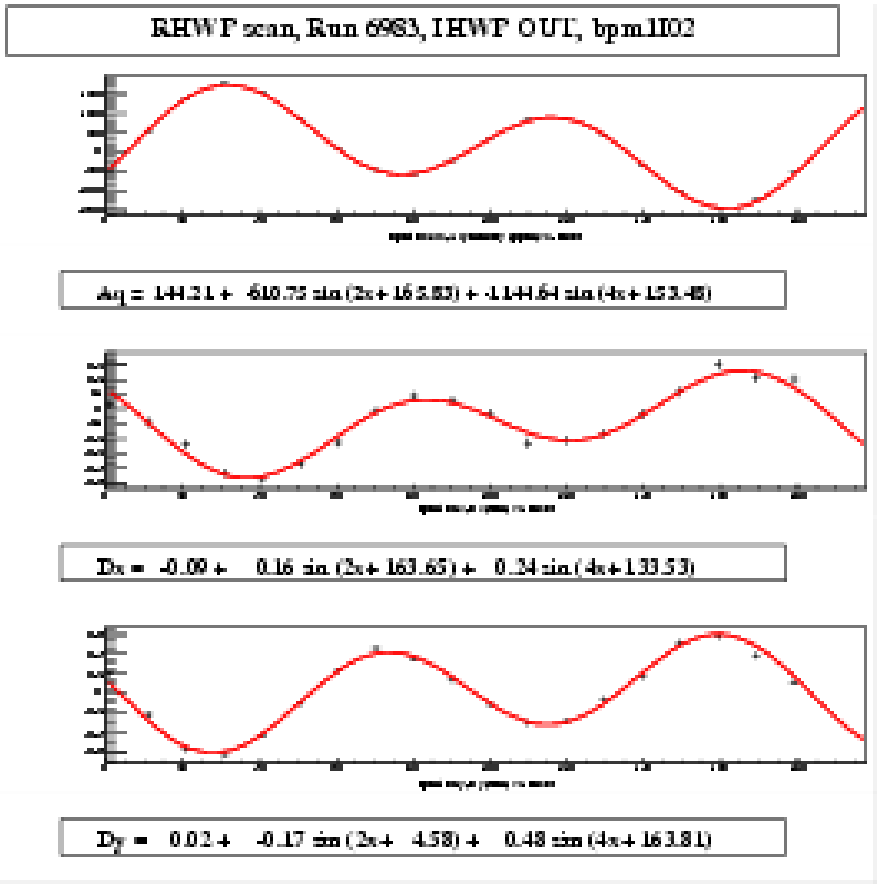
Slope is too small.
Move to a better angle.

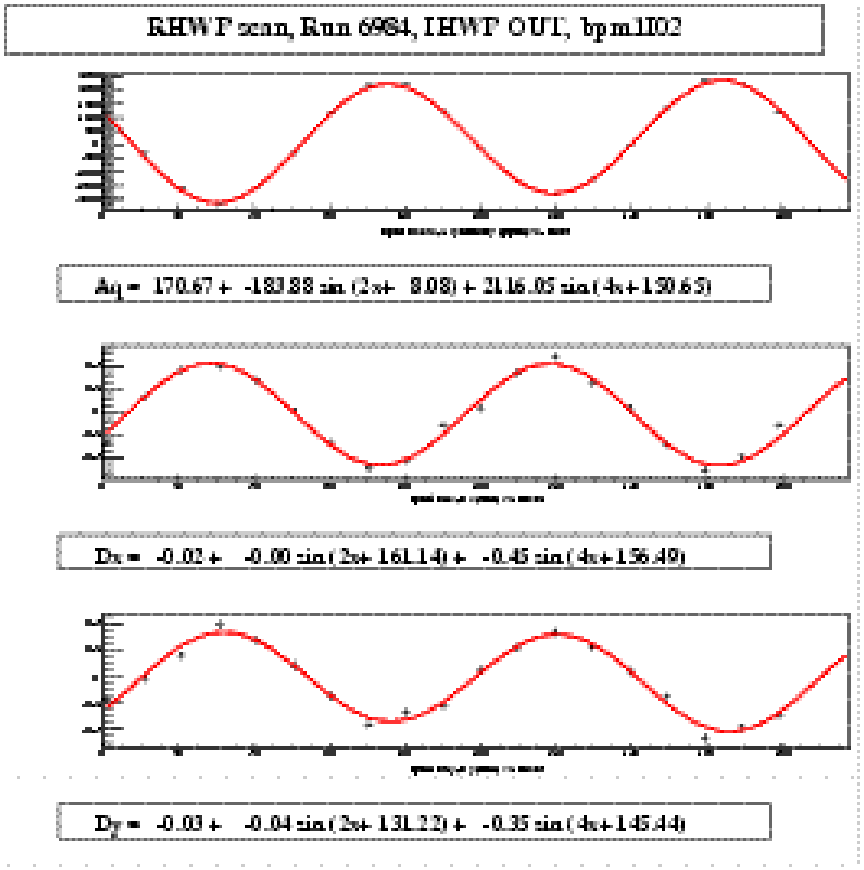




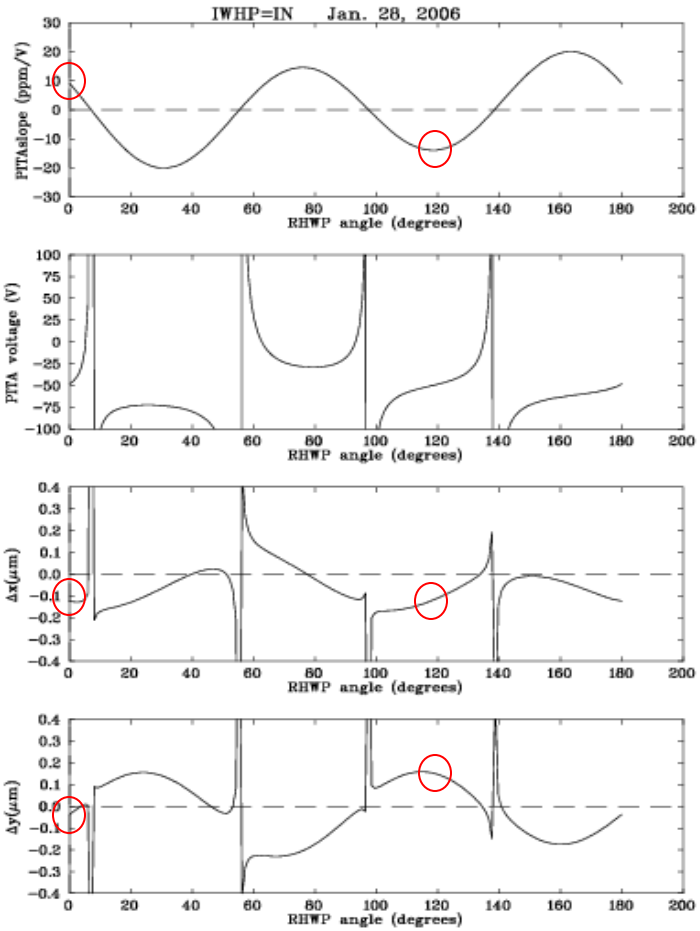


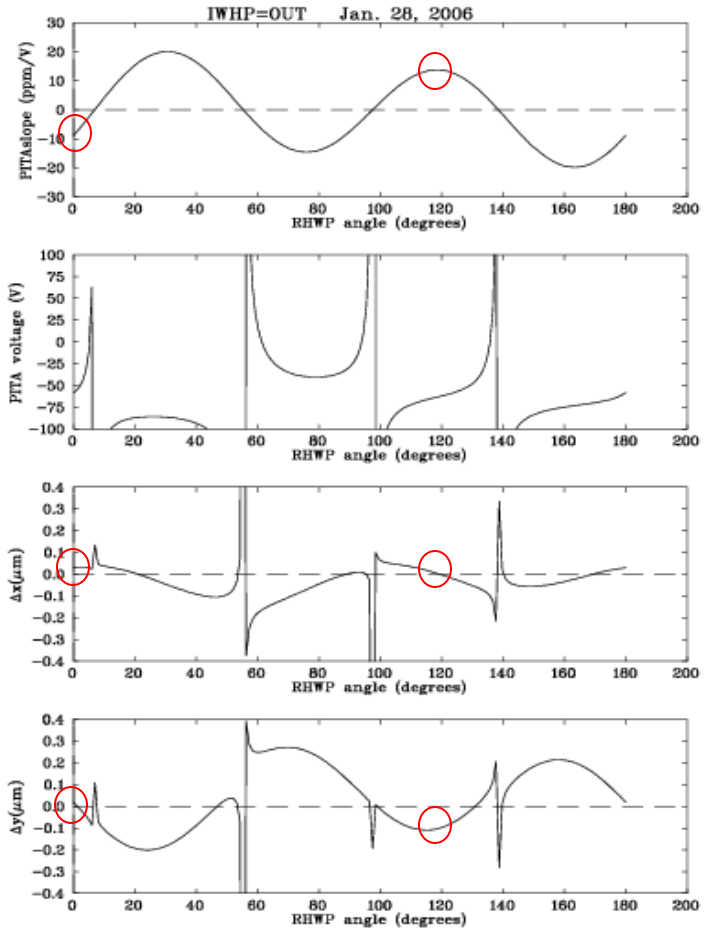
Electron Beam Studies (up to 100 KeV) January 28, 2006 (80 μA, Wien = 0°)





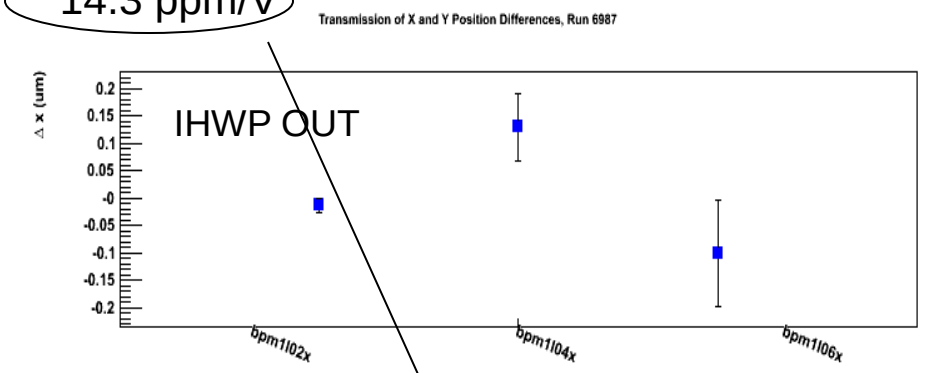
Electron Beam Studies (up to 100 KeV) January 28, 2006 (80 μA, Wien = 0°)

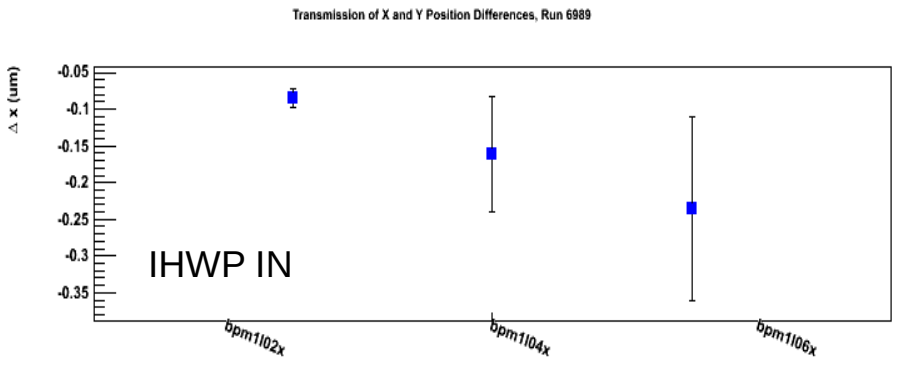


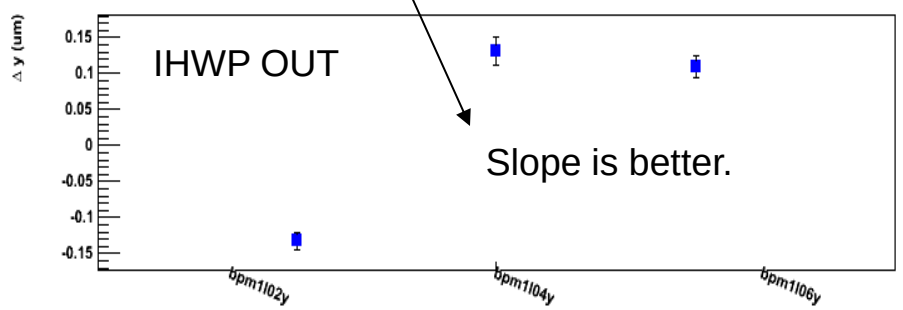


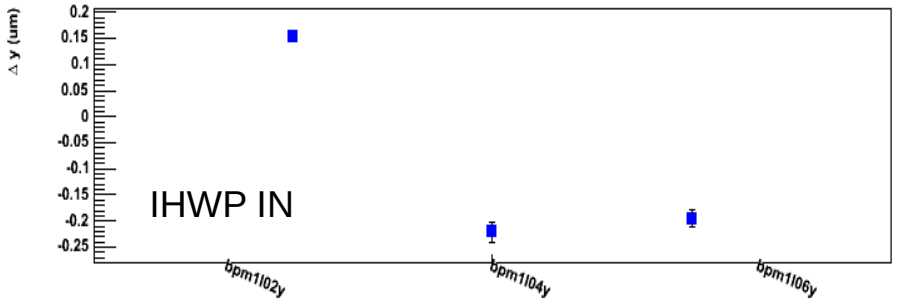
Electron Beam Studies (up to 100 KeV)
January 28, 2006 (80 μA, Wien = 0°)

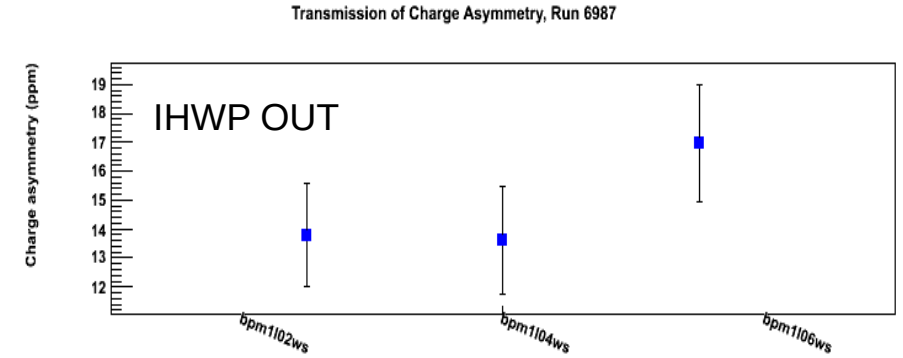
RHWP = 120°
14.3 ppm/V

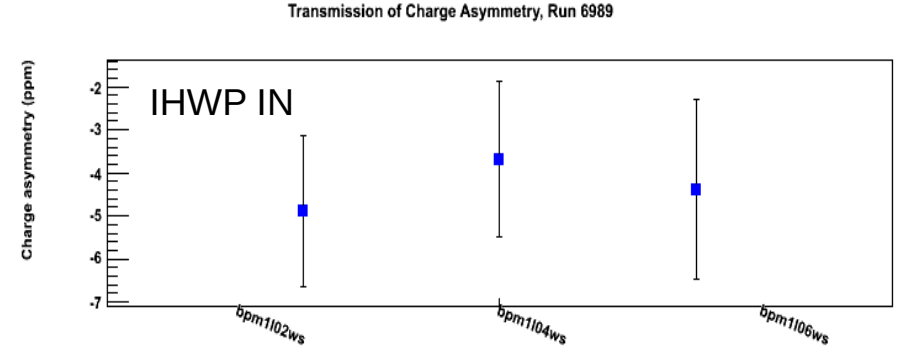










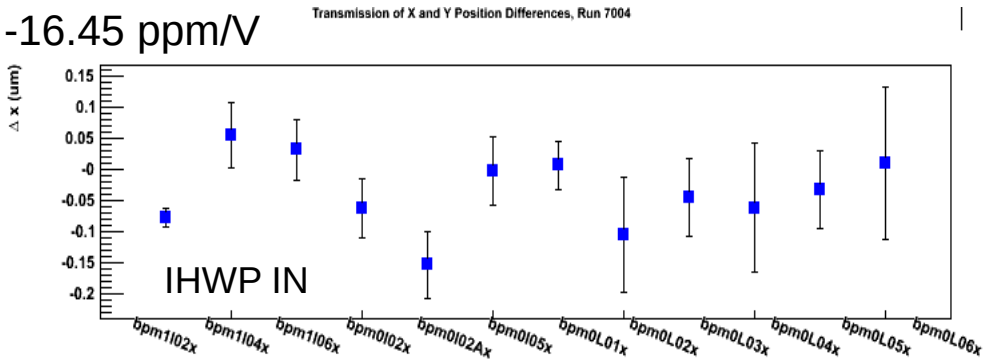


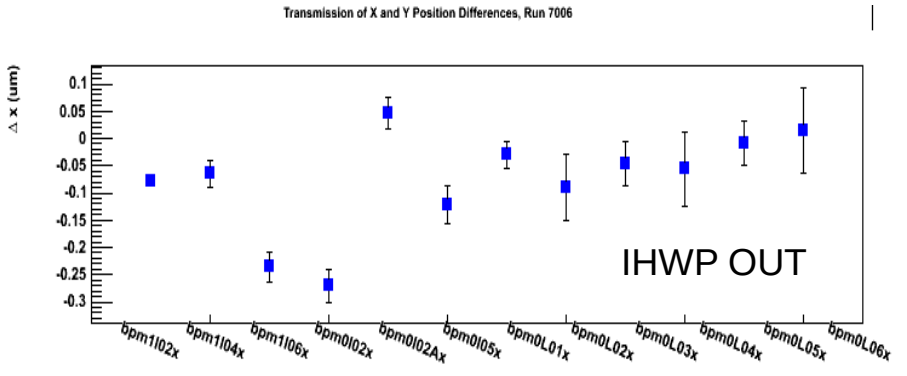
Electron Beam Studies (up to 100 KeV) January 28, 2006 (80 μA, Wien = 0°)

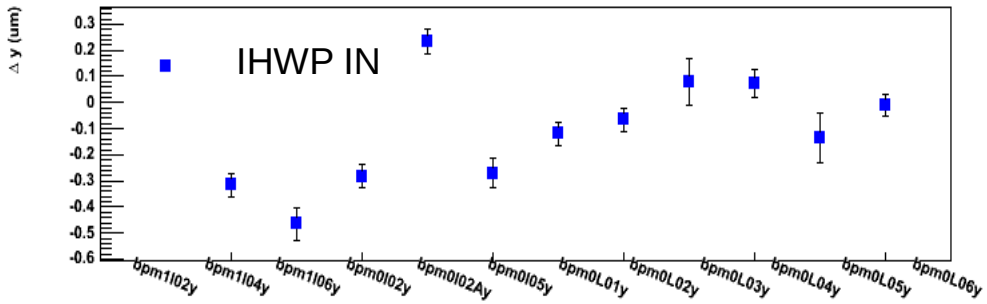
- Summary
  - All of the position differences are less than 0.3 um.
  - Charge asymmetry can easily be controlled with the size of the PITA slope.
- Intensity Asymmetry (IA) Cell
  - Measured dependence of intensity asymmetry on voltage : -24.26 ppm/V

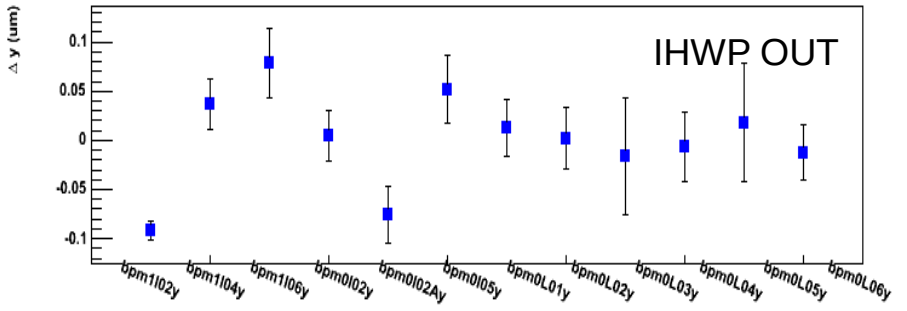
Electron Beam Studies (up to 5 MeV)
February 1, 2006 (20 μA,Wien = 90°)

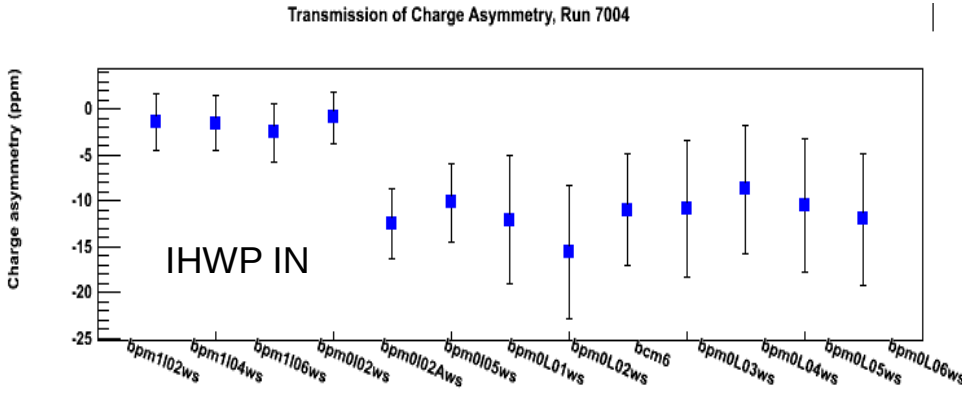
RHWP = 120°
-16.45 ppm/V

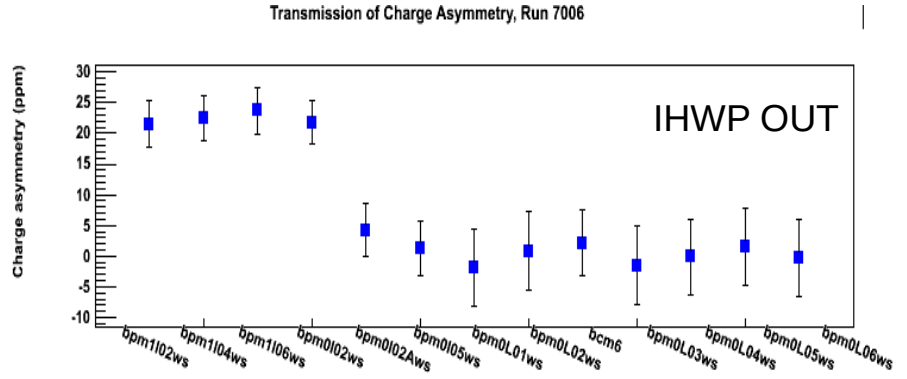












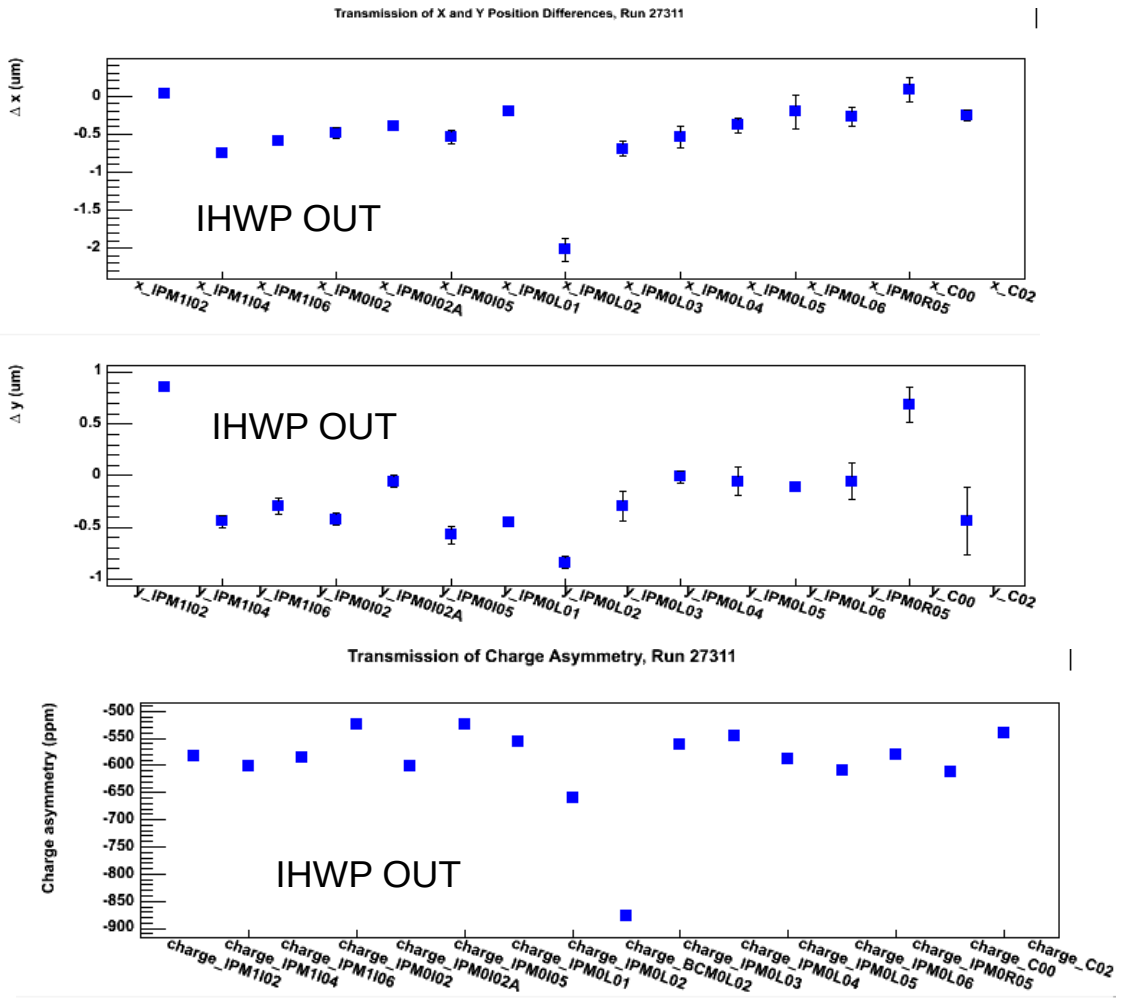
Electron Beam Studies (up to 5 MeV) February 1, 2006 (20 μA, Wien = 90°)

- Summary
  - Except for a few BPMs (Δy, IHWP = IN, KeV region) , all of the position differences are less than 0.3 um.
  - Charge asymmetry can easily be controlled with the size of the PITA slope.

Friday, February 3, 2005

- Hall C laser unlocked.
- Matt and John did their best to put the Hall C beam back on the original line through the pockels cell and to the photocathode.
- We may see different helicity correlated asymmetries.

Electron Beam Studies (up to BSY) February 3, 2006 (687 MeV,10 μA, before Chao's accelerator matching)



Electron Beam Studies (up to BSY) February 3, 2006 (687 MeV,10 μA, before Chao's accelerator matching)

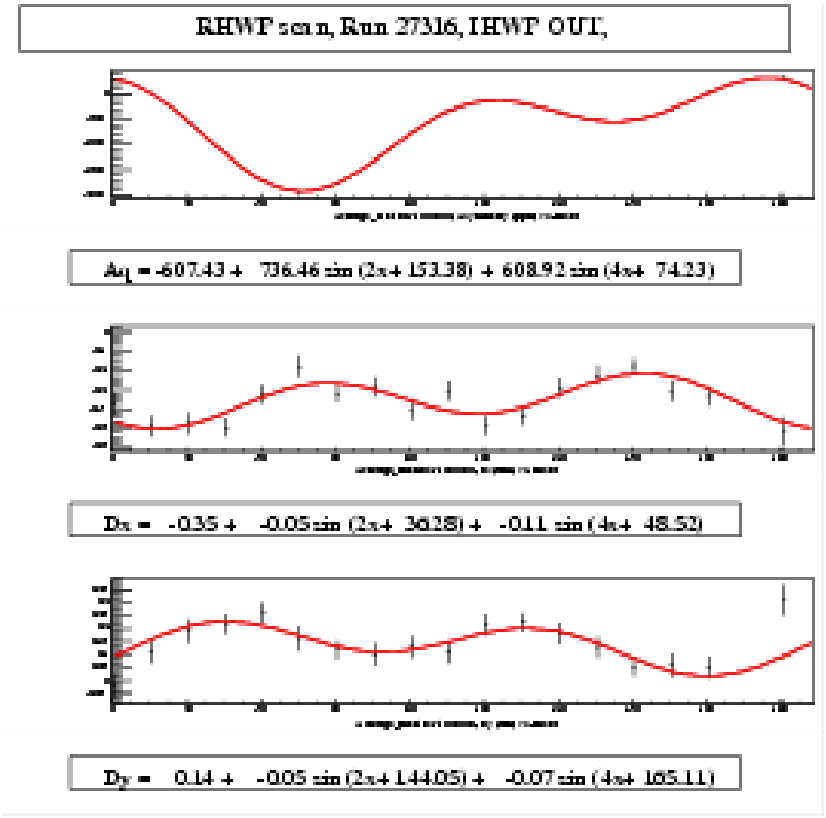
Helicity Magnet 1	Acharge (ppm/DAC)	Dx (nm/DAC)	Dy (nm/DAC)	Dr (nm/DAC)
IPM0L02	-0.003433	-0.872383	-24.5385	24.554
IPM0L03	0.0536761	-2.29109	-98.8084	98.835
IPM0L04	0.0938495	-1.41281	-48.442	48.4626
IPM0L05	-0.007856	22.5876	104.416	106.832
IPM0L06	0.0341993	77.3732	-20.8247	80.1266
IPM0R05	-0.144416	-48.2712	129.68	138.373
C00	0.0117434	0.553452	85.4744	85.4762
C02	-0.009203	-13.8294	-156.759	157.368

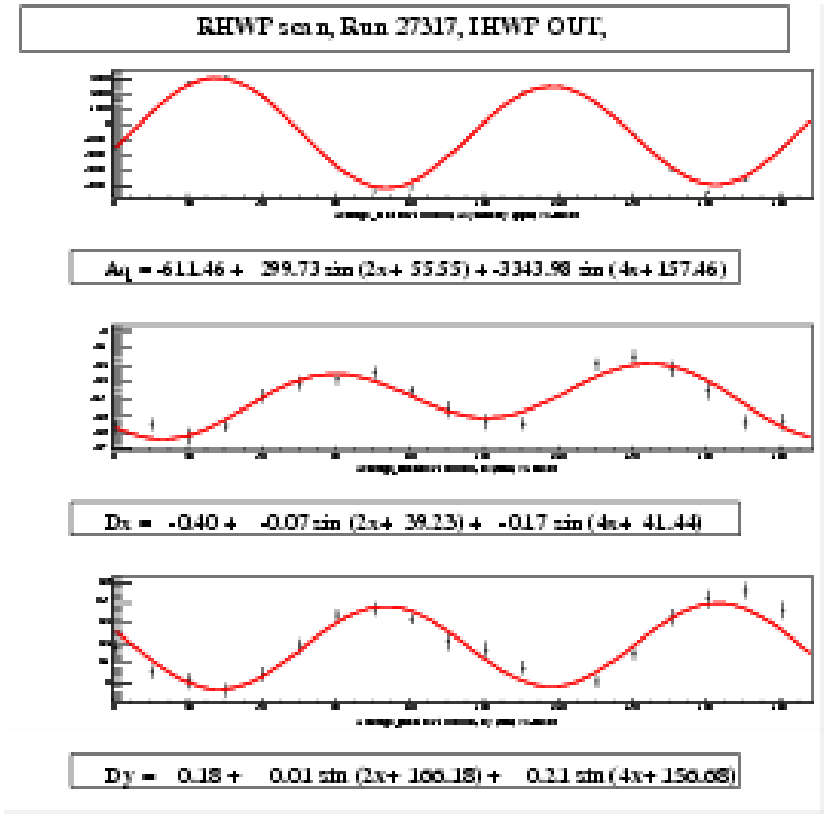
Helicity Magnet 2	Acharge (ppm/DAC)	Dx (nm/DAC)	Dy (nm/DAC)	Dr (nm/DAC)
IPM0L02	0.0015703	-0.0102487	-0.0127613	0.0163673
IPM0L03	0.0957199	-52.6789	-2.46317	52.7364
IPM0L04	-0.080346	-117.416	7.67588	117.667
IPM0L05	0.253593	-92.7996	-27.3001	96.7319
IPM0L06	-0.194966	-194.361	-26.7162	196.189
IPM0R05	-0.006093	-8.96365	-13.8981	16.538
C00	0.0306489	-7.05716	-11.5836	13.5641
C02	0.0342664	-20.4553	21.5791	29.7334

Helicity Magnet 3	Acharge (ppm/DAC)	Dx (nm/DAC)	Dy (nm/DAC)	Dr (nm/DAC)
IPM0L02	-0.000512	0.04519	-0.0053013	0.0454999
IPM0L03	0.0059059	0.295036	-11.3494	11.3533
IPM0L04	0.0877617	0.60545	-40.3682	40.3728
IPM0L05	-0.011126	9.73754	49.4728	50.422
IPM0L06	0.0335288	28.1656	8.18387	29.3305
IPM0R05	-0.040293	-10.5132	36.2874	37.7796
C00	-0.015963	0.158972	30.9919	30.9923
C02	-0.002008	-3.47308	-58.7319	58.8345

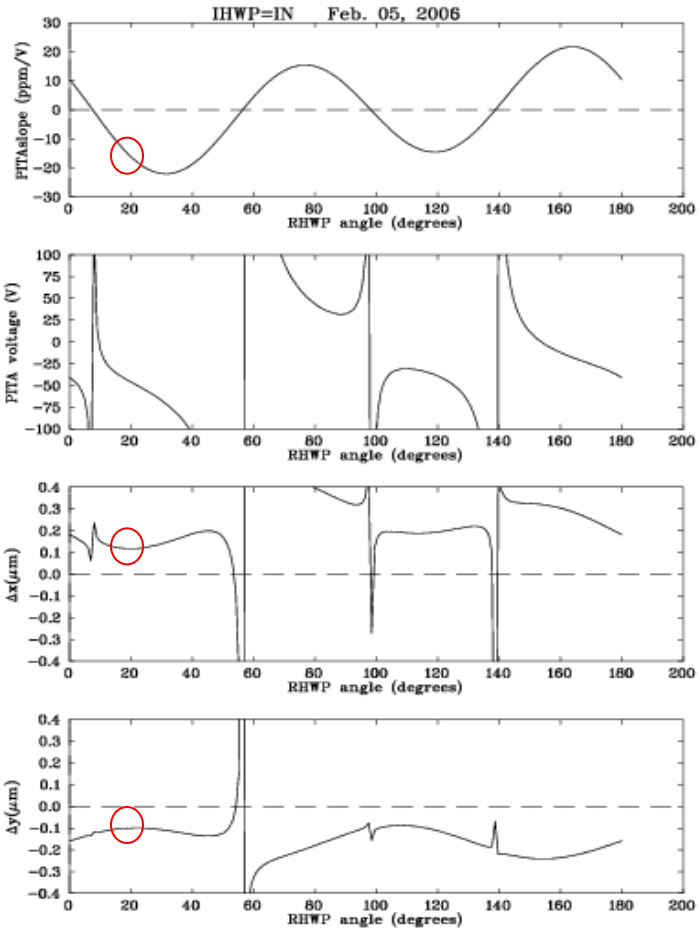
Helicity Magnet 1	Acharge (ppm/DAC)	Dx (nm/DAC)	Dy (nm/DAC)	Dr (nm/DAC)
IPM0L02	-0.002718	0.0257319	-0.0030425	0.0259112
IPM0L03	0.0124287	-11.8388	-0.574238	11.8528
IPM0L04	-0.029636	-49.7522	1.81475	49.7852
IPM0L05	0.0917529	-47.9147	-11.6929	49.3208
IPM0L06	-0.212072	-110.645	-12.2019	111.316
IPM0R05	0.0105658	4.82423	-8.96597	10.1814
C00	0.0127479	-5.29529	-6.86661	8.67124
C02	0.0186488	-9.2011	12.6821	15.6683

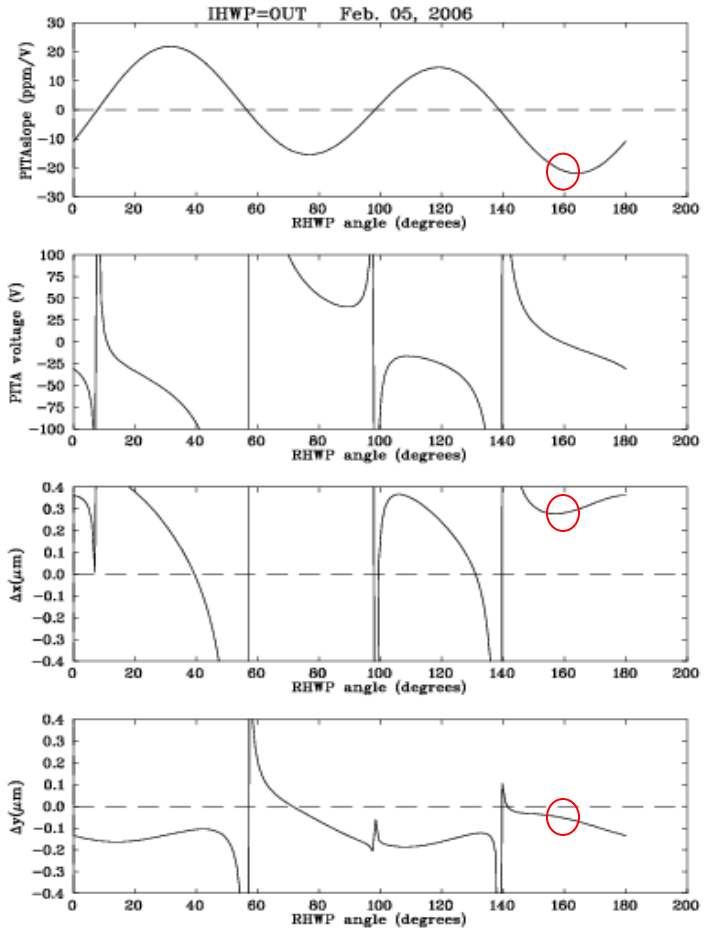
Electron Beam Studies (up to BSY)
February 5, 2006 (687 MeV, 20 μA, after Chao's accelerator matching)





Electron Beam Studies (up to BSY) February 5, 2006 (687 MeV, 20 μA, after Chao's accelerator matching)

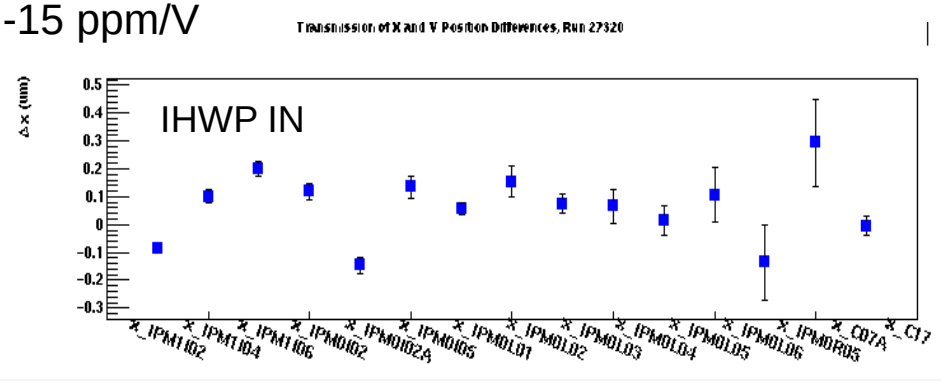


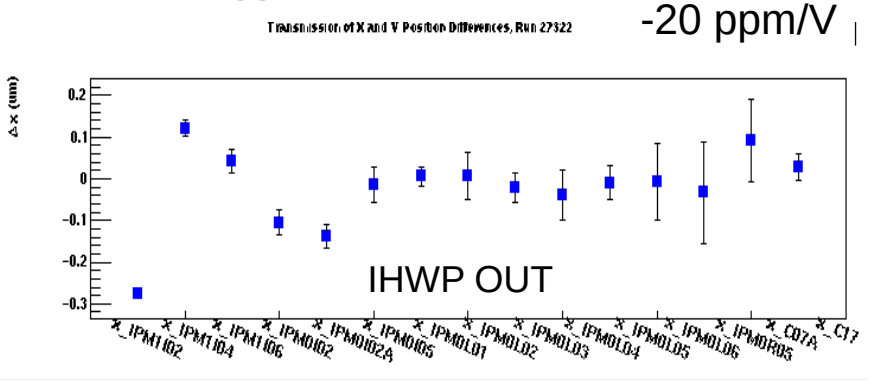


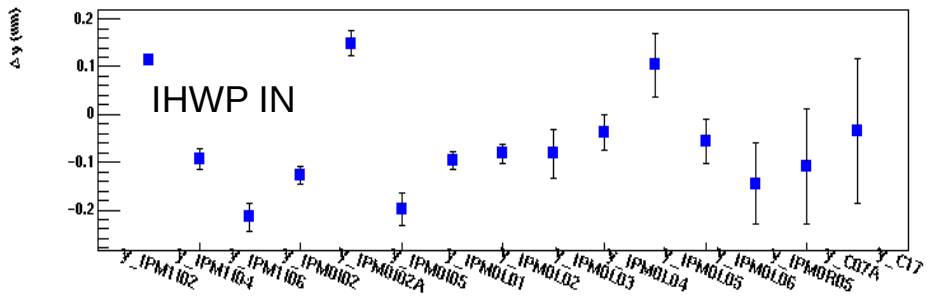
Electron Beam Studies (up to BSY)
February 5, 2006 (687 MeV, 20 μA, after Chao's accelerator matching)

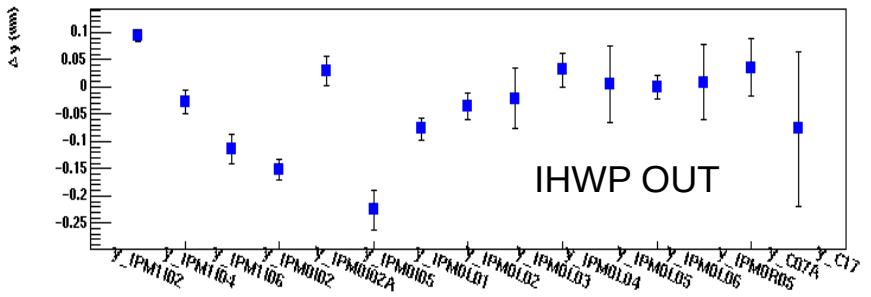
RHWP = 20°
-15 ppm/V

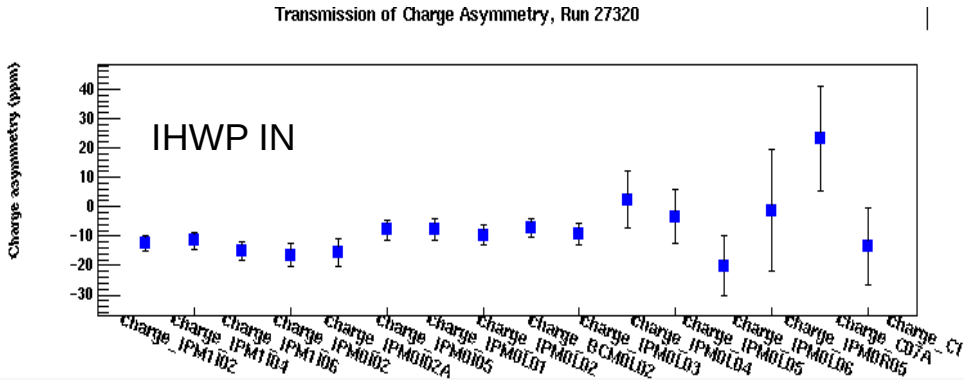
RHWP = 160°
-20 ppm/V

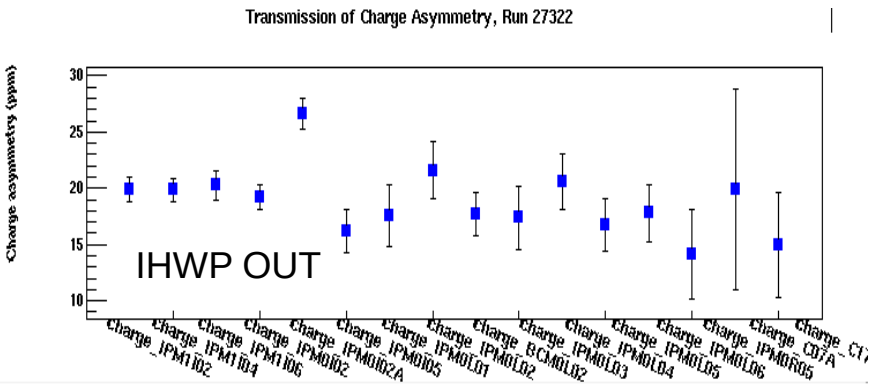












Electron Beam Studies (up to BSY)
February 5, 2006 (687 MeV, 20 μA, after Chao's accelerator matching)

Helicity Magnet 1	Acharge (ppm/DAC)	Dx (nm/DAC)	Dy (nm/DAC)	Dr (nm/DAC)
IPM0L02	0.0051003	0.00171373	-21.6751	21.6751
IPM0L03	0.091184	3.01375	-100.847	100.892
IPM0L04	-0.0448631	16.9218	-53.8091	56.4072
IPM0L05	-0.00185376	16.919	108	109.317
IPM0L06	0.0763492	42.602	-29.5328	51.8374
IPM0R05	-0.335827	-94.6854	-111.256	146.093
C00	0.197139	25.734	25.2873	36.0789
C02	-0.0680797	-20.3899	-97.9373	100.037

Helicity Magnet 2	Acharge (ppm/DAC)	Dx (nm/DAC)	Dy (nm/DAC)	Dr (nm/DAC)
IPM0L03	0.133659	-52.6707	-1.20848	52.6846
IPM0L04	-0.03016	-124.483	10.7418	124.946
IPM0L05	0.297792	-89.548	-70.3841	113.898
IPM0L06	-0.55208	-197.24	8.61662	197.428
IPM0R05	0.689838	207.921	56.1747	215.375
C00	-0.18368	-47.1711	5.73031	47.5179
C02	-0.16375	19.6503	2.29138	19.7835

Helicity Magnet 3	Acharge (ppm/DAC)	Dx (nm/DAC)	Dy (nm/DAC)	Dr (nm/DAC)
IPM0L03	0.010453	0.38292	-11.514	11.5204
IPM0L04	-0.05152	1.32636	-42.7387	42.7592
IPM0L05	0.057146	-6.87342	45.0561	45.5773
IPM0L06	-0.02864	-28.094	2.21448	28.1812
IPM0R05	0.09983	38.1954	3.19988	38.3292
C00	-0.01656	-7.97054	-5.75142	9.82895
C02	0.011828	5.36232	17.5815	18.3811

Helicity Magnet 4	Acharge (ppm/DAC)	Dx (nm/DAC)	Dy (nm/DAC)	Dr (nm/DAC)
IPM0L03	0.023567	-11.7667	-0.31647	11.771
IPM0L04	0.001137	-52.7913	2.06461	52.8317
IPM0L05	0.130143	-46.9921	-29.3458	55.4024
IPM0L06	-0.28843	-113.811	3.30909	113.859
IPM0R05	0.413657	126.139	25.7532	128.741
C00	-0.05165	-28.0833	4.02845	28.3708
C02	-0.07275	12.3287	-1.55732	12.4267

Electron Beam Studies (up to BSY)
February 5, 2006 (687 MeV, 20 μA, after Chao's accelerator matching)

- Summary
  - We see different helicity correlated asymmetries.
  - Steering offset ~0.4 um
  - Need to re-align Pockels Cell before run