

# Fin Size Consideration

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October 8, 2014

Polarimeter Group Meeting

# Beam Size Information

- There are three sources of beam size information: from the camera images (target length is 1 inch); from event bin plot (need to convert step counts to mm); from emittance measured at other places (IPM) and translate to the polarimeter locations.
- The camera information is not accurate, and it shows that loose targets can change shape in the beam.
- The emittance from other IPM: 8-10pi at injection, 15-25pi at flattop. One can calculate the beam sizes at the locations of polarimeters.
- From polarization measurements, we have correlation plot of target positions vs. event rate (per second). The beam size information can be get from there, too.

# The beam size is seen as the color changes (injection)

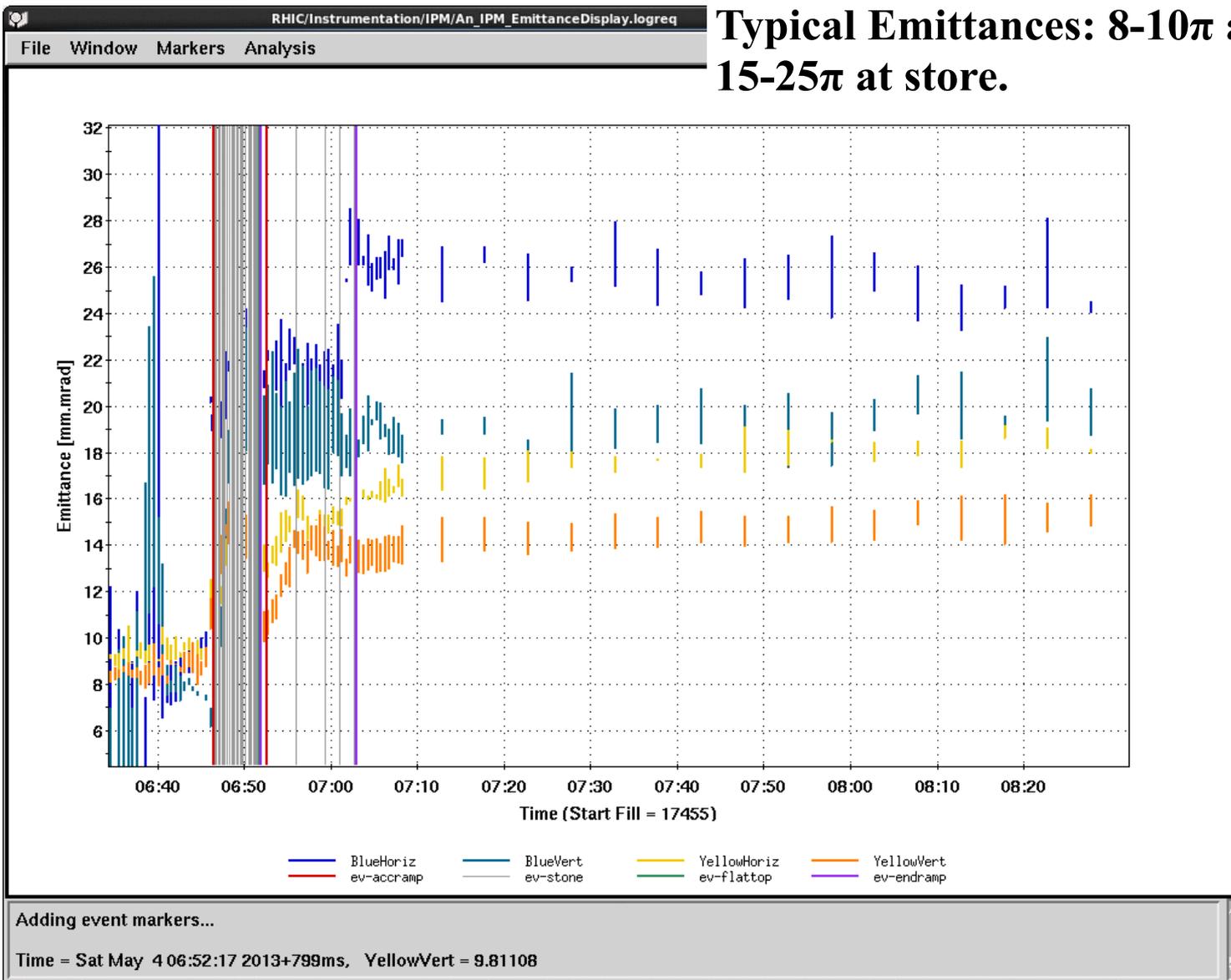


**The light spot is larger than the actual beam size(store)**



# Horizontal Emittance vs. Booster Input Intensity

Typical Emittances:  $8-10\pi$  at injection,  
 $15-25\pi$  at store.



Adding event markers...

Time = Sat May 4 06:52:17 2013+799ms, YellowVert = 9.81108

# BPM (Q4) readings at injection and store( $\mu\text{m}$ )

| Fills | Date | YV         | YH      | BV      | BH       |
|-------|------|------------|---------|---------|----------|
| 17306 | 3/30 | -180->-100 | 300->0  | -400->0 | 400->100 |
| 17394 | 4/17 | -615->-100 | -200->0 | 300->0  | 200->100 |
| 17587 | 6/4  | -400->-100 | 50->0   | 400->0  | 50->100  |

The difference at injection is less than a mm. So we can ignore this effect.

# Beta functions at injection and store(m)

Pp-12-v2 lattice

| Beta Function           | Y1          | Y2         | B1         | B2         |
|-------------------------|-------------|------------|------------|------------|
| Beta <sub>x_inj</sub>   | 29.2 (24.0) | 30.4(25.1) | 19.5       | 18.8       |
| Beta <sub>y_inj</sub>   | 36.0 (34.5) | 34.5(33.4) | 15.9(13.7) | 16.9(14.4) |
| Beta <sub>x_store</sub> | 20.9        | 22.3       | 31.0       | 29.7       |
| Beta <sub>y_store</sub> | 29.6(25.8)  | 28.5(25.1) | 17.6(17.1) | 18.5(17.6) |

Pp13e-s4

| Beta Function           | Y1          | Y2         | B1         | B2         |
|-------------------------|-------------|------------|------------|------------|
| Beta <sub>x_inj</sub>   | 47.4 (50.2) | 50.0(53.0) | 30.7(29.5) | 29.7(28.3) |
| Beta <sub>y_inj</sub>   | 37.0(30.6)  | 36.0(31.3) | 17.9(31.1) | 18.7(34.1) |
| Beta <sub>x_store</sub> | 33.6        | 35.6       | 31.3(33.6) | 30.2(32.4) |
| Beta <sub>y_store</sub> | 30.3        | 31.3       | 38.2(36.7) | 40.4(39.2) |

# Beam Sizes at injection and store(mm)

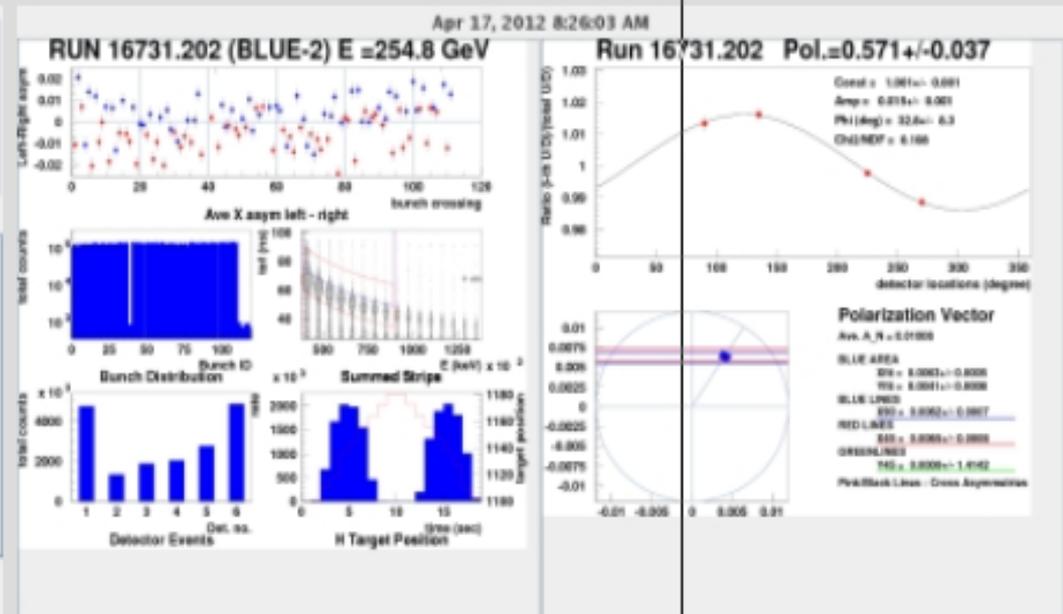
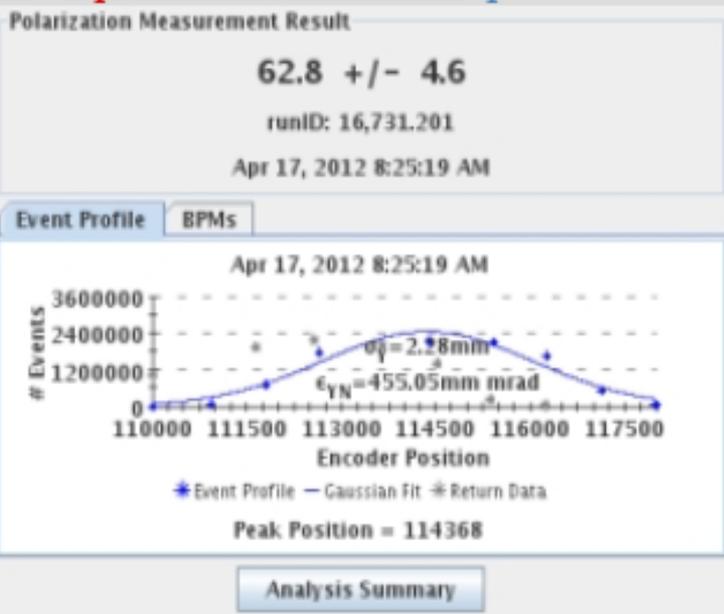
Pp13e-s4

| Beta Function           | Y1    | Y2    | B1   | B2   |
|-------------------------|-------|-------|------|------|
| Beta <sub>x_inj</sub>   | 11.21 | 10.88 | 8.36 | 8.19 |
| Beta <sub>y_inj</sub>   | 8.62  | 8.50  | 8.59 | 8.99 |
| Beta <sub>x_store</sub> | 4.58  | 4.44  | 4.44 | 4.37 |
| Beta <sub>y_store</sub> | 4.22  | 4.29  | 4.61 | 4.80 |

These are with emittance of  $10\pi$  at injection and  $25\pi$  at store. These are smaller to the ones extracted from polarization measurements.

# B2V1 Target Measurement

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## Polarization For Blue 2 V Target1: 62.8 ± 4.56

### Measurement Specifications

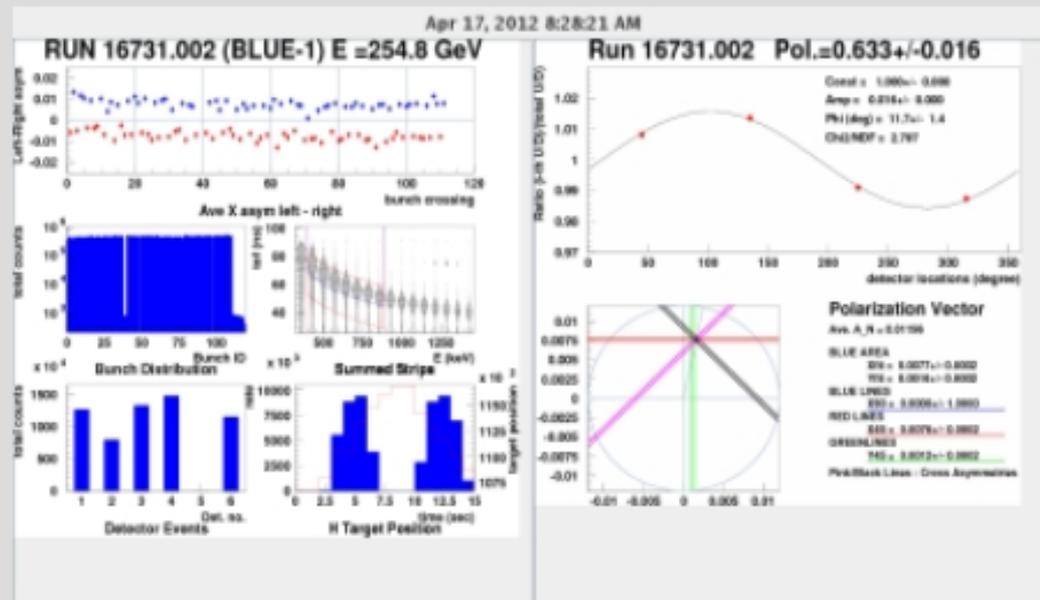
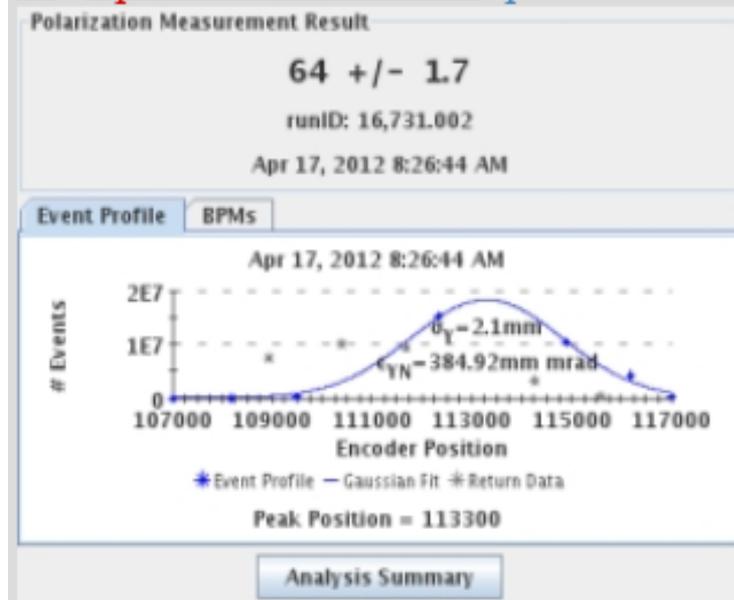
|                                               |  |                                              |
|-----------------------------------------------|--|----------------------------------------------|
| Store Energy (254.83) Before Physics Declared |  | Blue Beam Intensity: 164.59x10 <sup>11</sup> |
| Start Position: 110000                        |  | Cavity Voltage: 68.67kV                      |
| Velocity: 1000                                |  | End Position: 118000                         |
| Events Done: 17,541,413                       |  | Peak Position: 114368                        |
|                                               |  | Elapsed Time: 18s                            |

Status: Reading Data Finished.

-Auto entry via PolarServer through polarControl

# B1H3 Target Measurement

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## Polarization For Blue 1 H Target3: $63.98 \pm 1.66$ Measurement Specifications

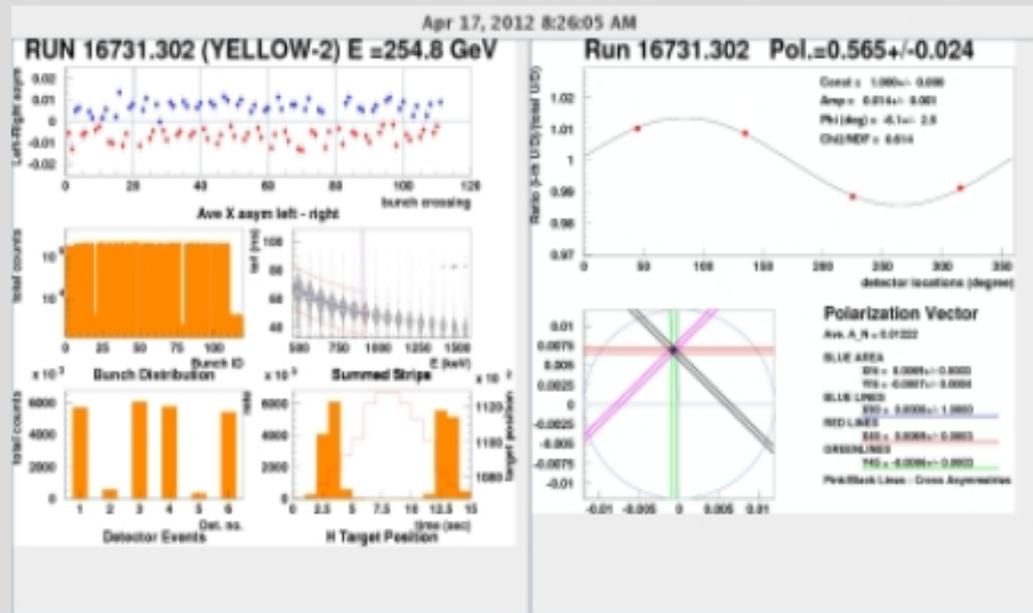
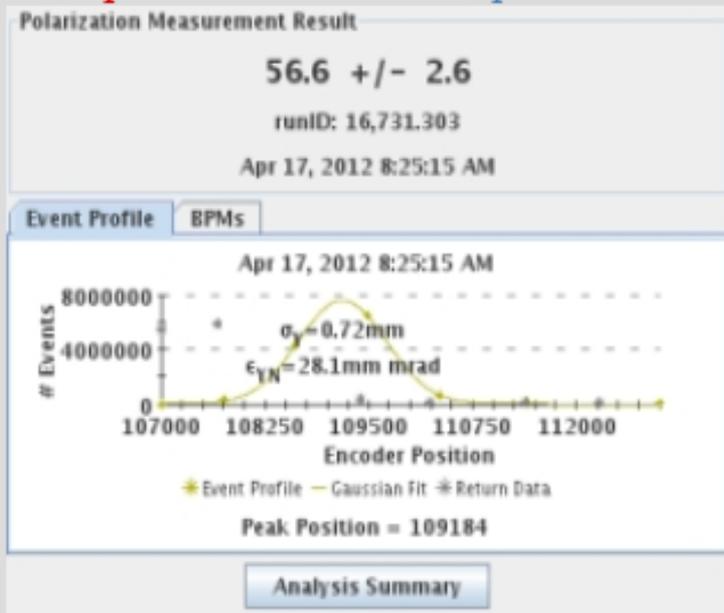
|                                               |                                              |
|-----------------------------------------------|----------------------------------------------|
| Store Energy (254.83) Before Physics Declared | Blue Beam Intensity: $163.79 \times 10^{11}$ |
| Start Position: 107000                        | Cavity Voltage: 201.74kV                     |
| Velocity: 1500                                | End Position: 117000                         |
| Events Done: 60,380,009                       | Peak Position: 113300                        |
|                                               | Elapsed Time: 14s                            |

Status: W-WFD unreliable

-Auto entry via PolarServer through polarControl

# Y2H5 Target Measurement

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## Polarization For Yellow 2 H Target5: $56.6 \pm 2.6$ Measurement Specifications

|                                               |                                                |
|-----------------------------------------------|------------------------------------------------|
| Store Energy (254.83) Before Physics Declared | Yellow Beam Intensity: $155.61 \times 10^{11}$ |
| Start Position: 107000                        | Cavity Voltage: 65.34kV                        |
| Velocity: 1000                                | End Position: 113000                           |
| Events Done: 23,761,718                       | Peak Position: 109184                          |
|                                               | Elapsed Time: 14s                              |

Status: Reading Data Finished.

-Auto entry via PolarServer through polarControl

# Beam Sizes from Polarization Measurements

- We run target in the range of 10000 counts at injection and 7000 counts at store. We got events from almost all of them. With 733/mm conversion, these are 13.6mm and 9.5mm, respectively.  $(25.4-13.6)/2=5.9$ mm is the number we should use for the fin radius, instead of currently used 12.7mm (0.5 inch).

# Conclusion

- We should proceed with 5.9 or 6mm fin radius.
- Jorg is going to carry some simulation to see how big difference is expected between the two.