

# MIPP Secondary Beamline

A look from “the other side”

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# Building a complete model

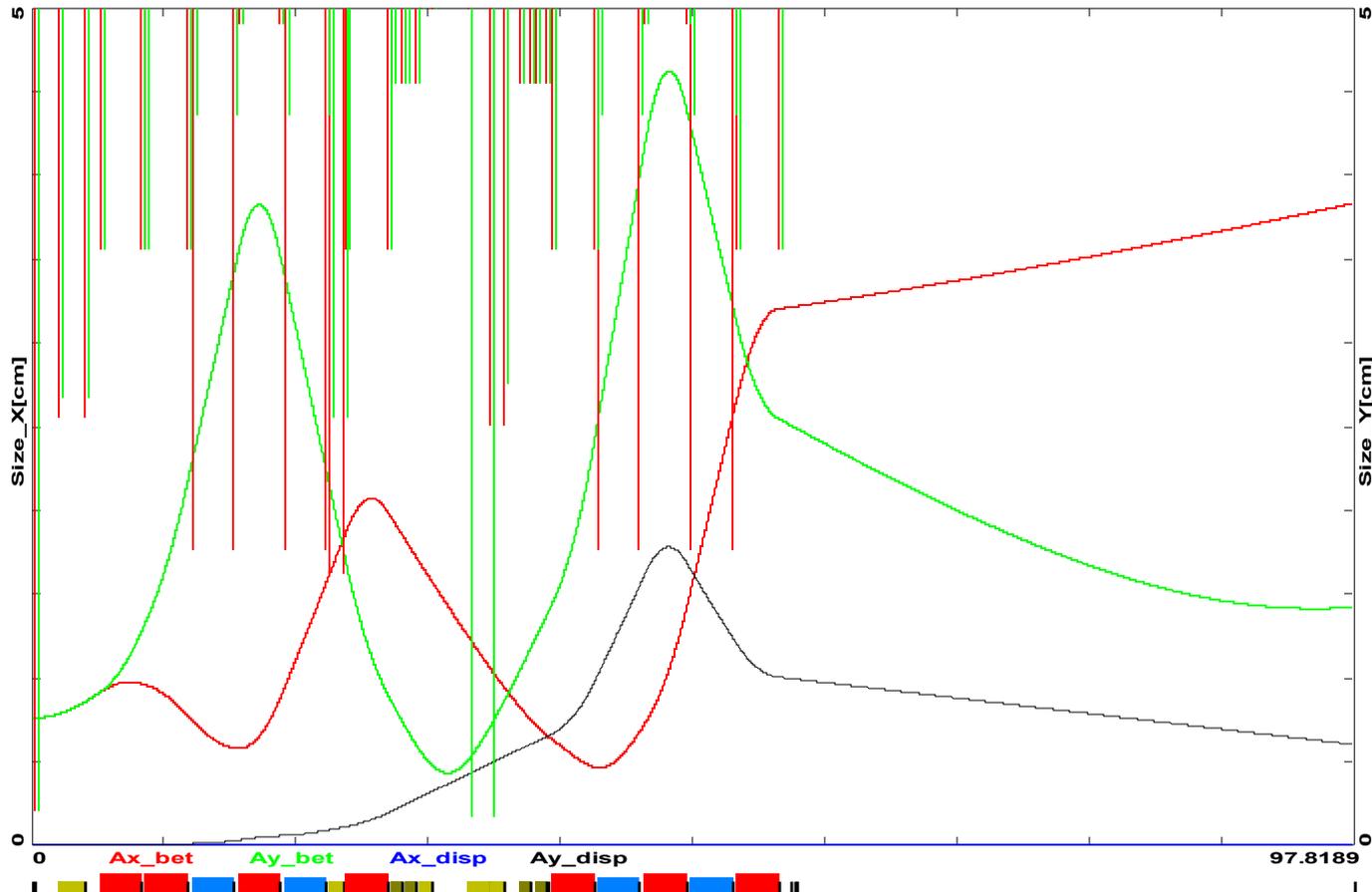
- Use OptiM to study transport from primary to secondary targets
  - <http://www-bdnew.fnal.gov/pbar/organizationalchart/lebedev/OptiM/optim.htm>
- Double checked that magnet positions are where survey says they are
- Use TD's magnet measurements to get  $I(B)$  dependence for dipoles and  $G(I)$  dependence for quadrupoles
  - <http://tdserver1.fnal.gov/AcceleratorSupport/MIPP>
- Take into account apertures in scrapers and magnet pipes

# What model lacks

- $B(I)$  for correctors
- Survey data of magnet x and y positions
  - Need to do if we want to model quads kicking secondary beam

# Beam sizes in present 35 GeV tune

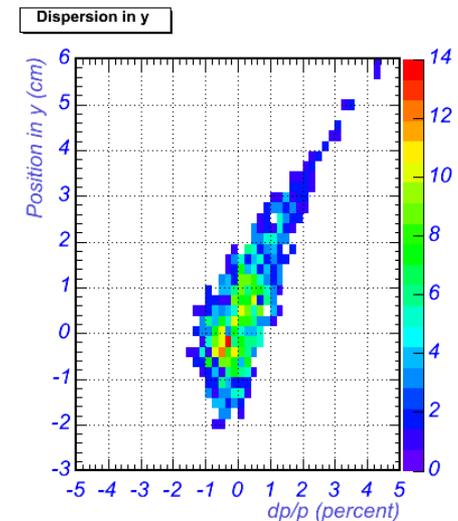
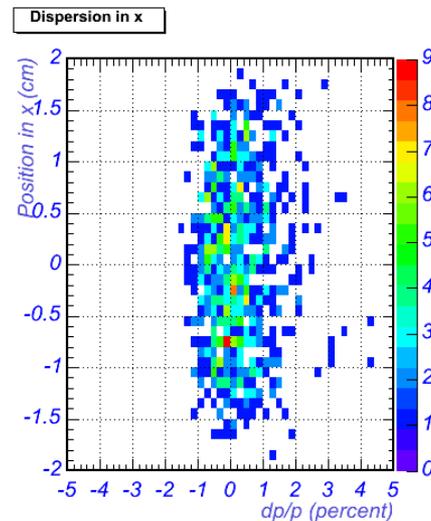
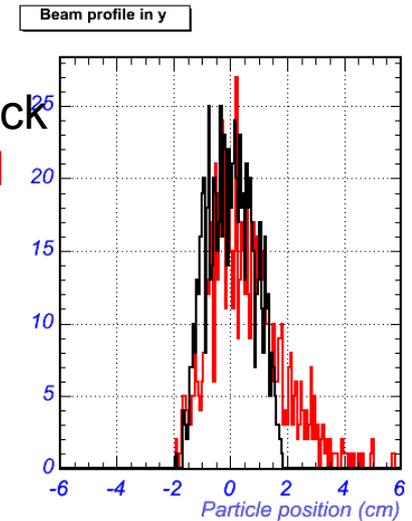
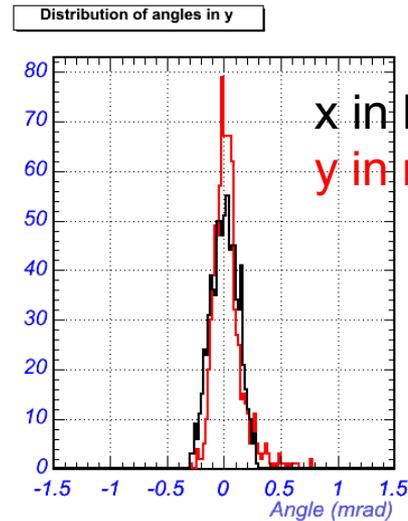
Mon Feb 21 23:54:02 2005 OptiM - MAIN: - C:\Optics\E907\carol30GeV.opt



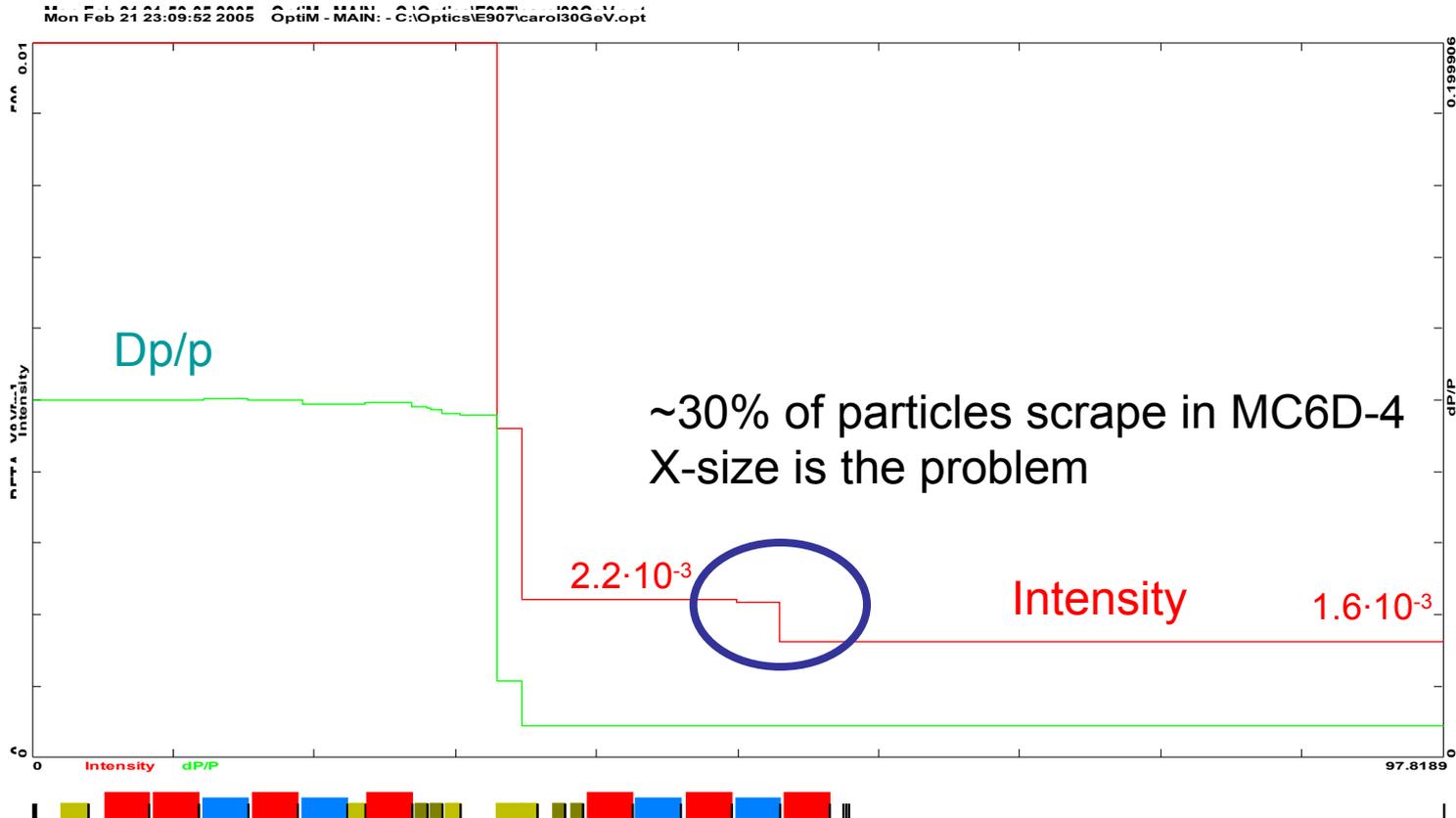
Red tall boxes - Quads  
Blue average boxes - Dipoles  
Small khaki - scrapers

# Tracking is similar to what MIPP sees

- We want to know what particles get through
- 500k particles with  $dp/p=10\%$  tracked through the model
- Particles that scrape are considered lost
- Experiment can measure all quantities shown



# Where do we scrape?



Red tall boxes - Quads  
Blue average boxes - Dipoles  
Small khaki - scrapers

# Look from “the other side”

- Instead of modeling forward transport, reverse the line and try to touch scrapers upstream of momentum collimator
- Available parameters
  - Quadrupole currents
  - $x_{\max}$ ,  $y_{\max}$ ,  $\theta_{x,\max}$ ,  $\theta_{y,\max}$ ,  $\varepsilon_x$ ,  $\varepsilon_y$ ,  $\beta_x$ ,  $\beta_y$ ,  $\alpha_x$ ,  $\alpha_y$ ,  $\delta_y$ ,  $d\delta_y/dz$
- Require
  - Focus on primary target to  $x=y=0.2\text{cm}$
  - Zero dispersion at primary target

# The problem is overdefined

- Parameters are not independent

$$x_{\max}^2 = \varepsilon \beta$$
$$\theta_{\max}^2 = \frac{\varepsilon}{\beta} (1 + \alpha^2)$$

- We set

$$x_{\max} = y_{\max} = 1.5 \text{ cm}$$

$$\delta_y = 0$$

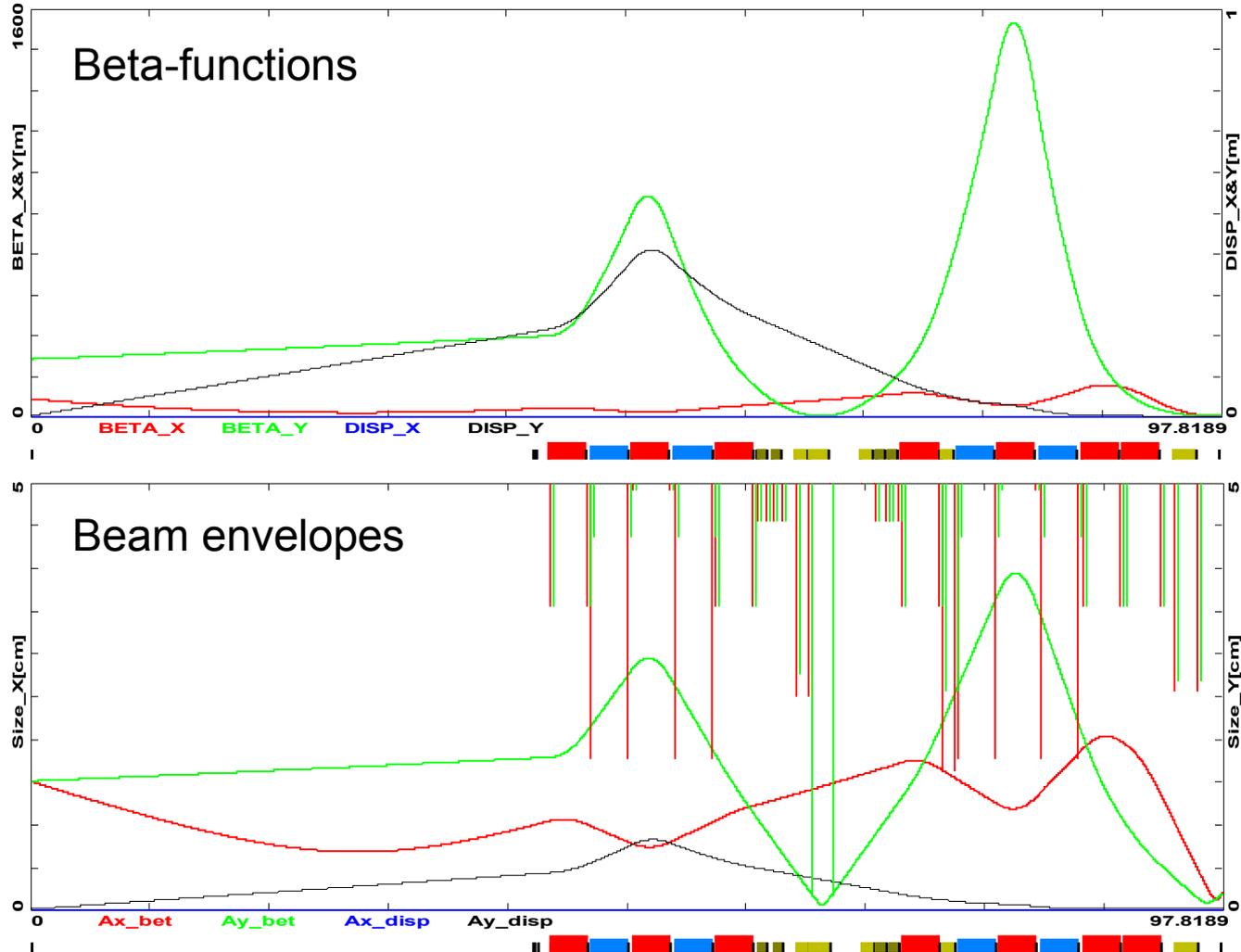
- We tweak

$$\theta_{x,\max} < 1 \text{ mrad}, \theta_{y,\max} < 1 \text{ mrad}, \alpha_x, \alpha_y, d\delta_y/dz$$

# Results

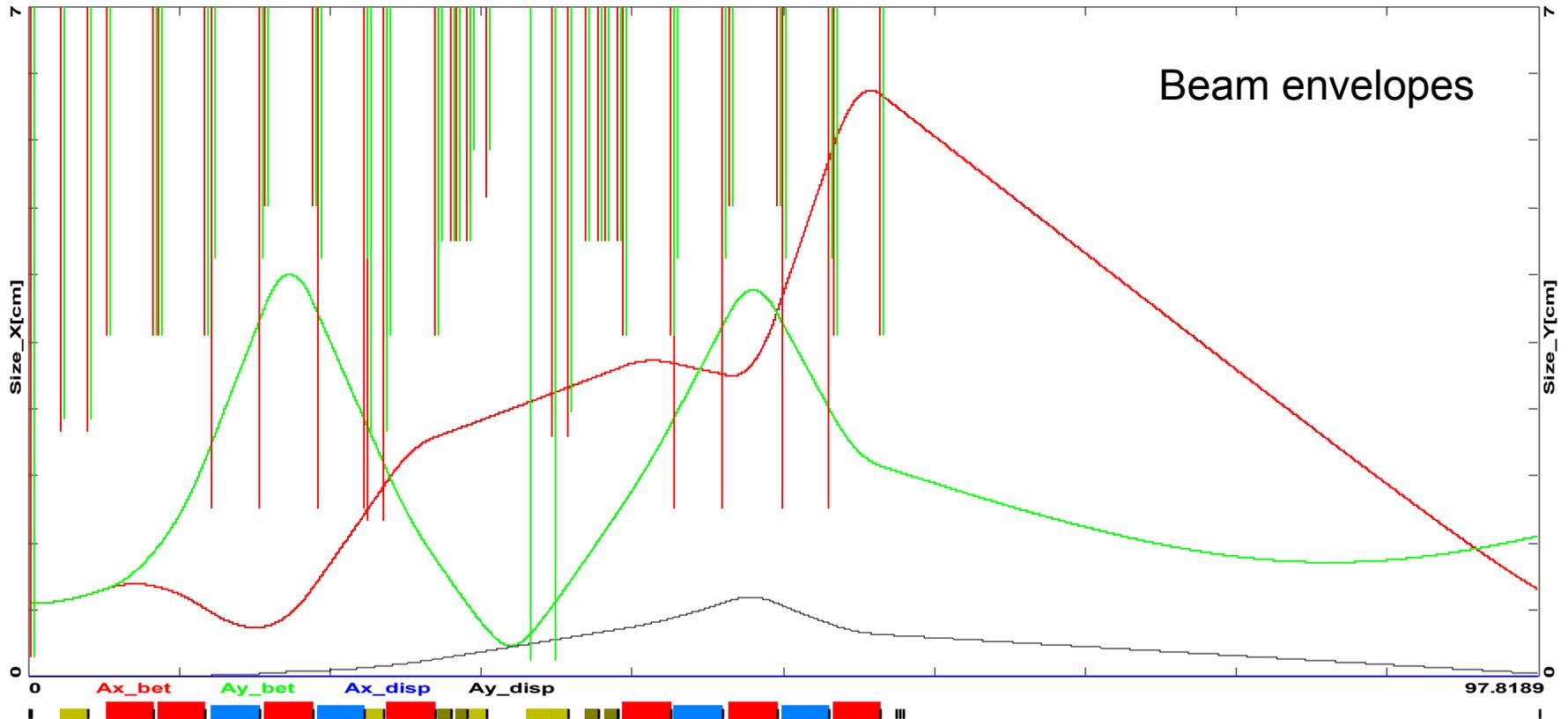
$$\theta_{x,\max}=0.5\text{mrad}, \theta_{y,\max}=0.1\text{mrad}, \alpha_x=2, \alpha_y=-0.9, d\delta_y/dz=5\cdot 10^{-3}$$

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# Use new quad currents, same transport parameters as before

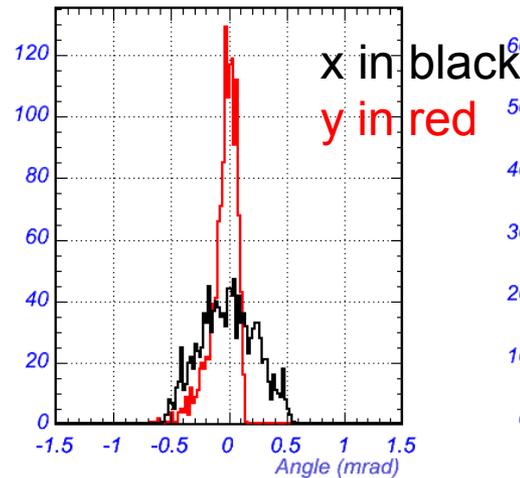
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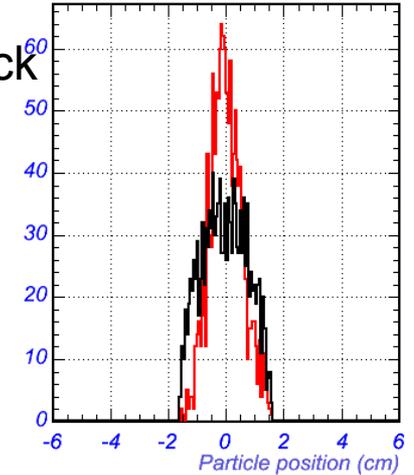
# What would experiment see?

- Profiles look similar
- Dispersion in  $y$  is somewhat less

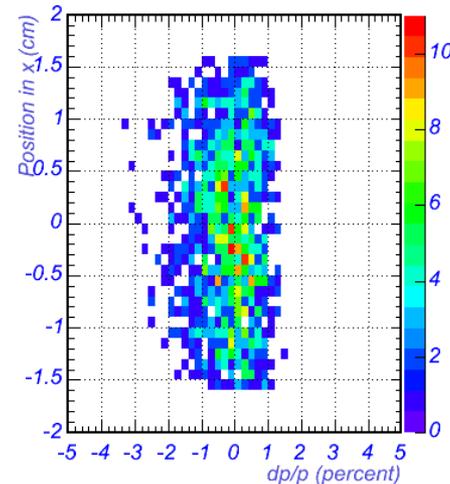
Distribution of angles in  $y$



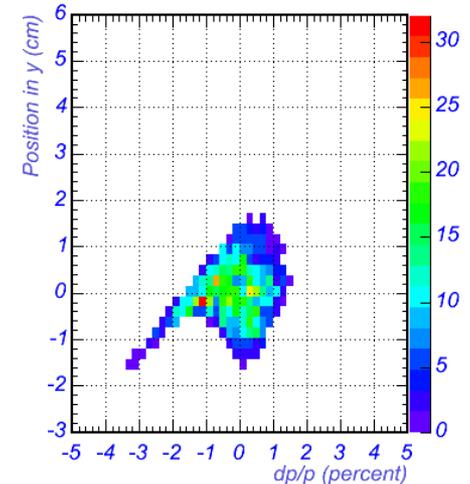
Beam profile in  $y$



Dispersion in  $x$



Dispersion in  $y$





# How experiment can help

- JGG gives us momentum of each particle
- Beam chambers 1,2,3 give us position in MC7
- Beamline model can be verified and better understood by using this data
  - Measure dispersion, its derivative,  $dp/p$ , 2-d profiles