



# The Forward Proton Detector at D0

-- Relative Alignment of the Dipole Spectrometer --

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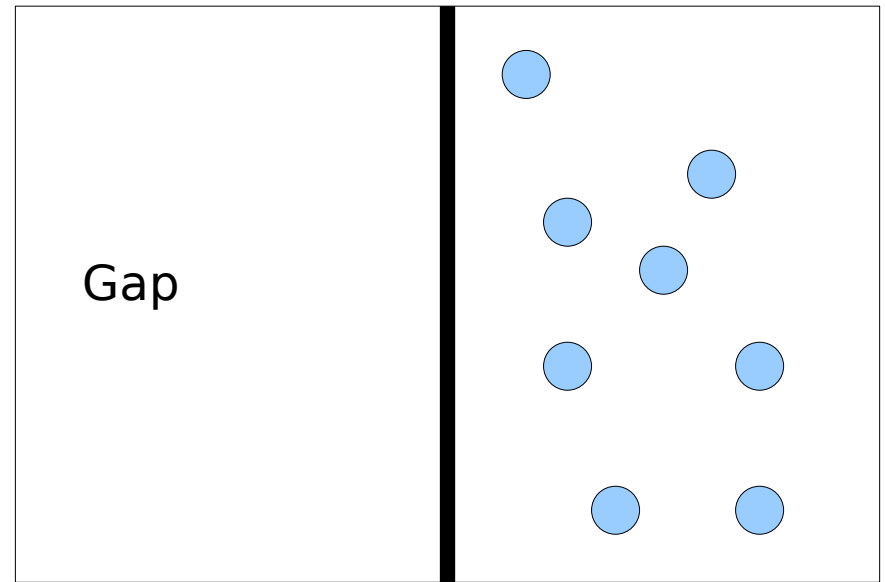
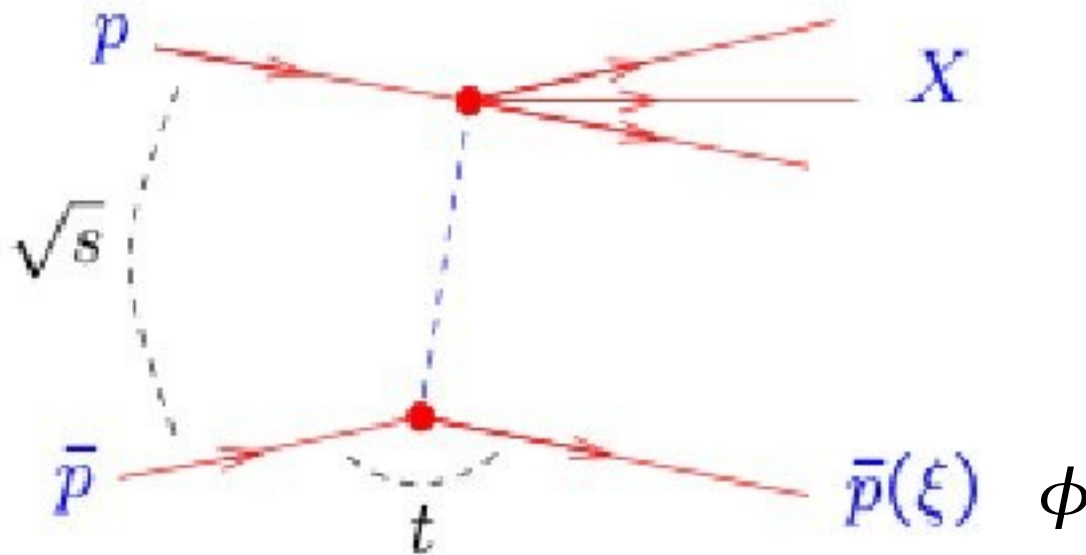
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Co-advisor: Vitor Oguri



Single Diffraction:

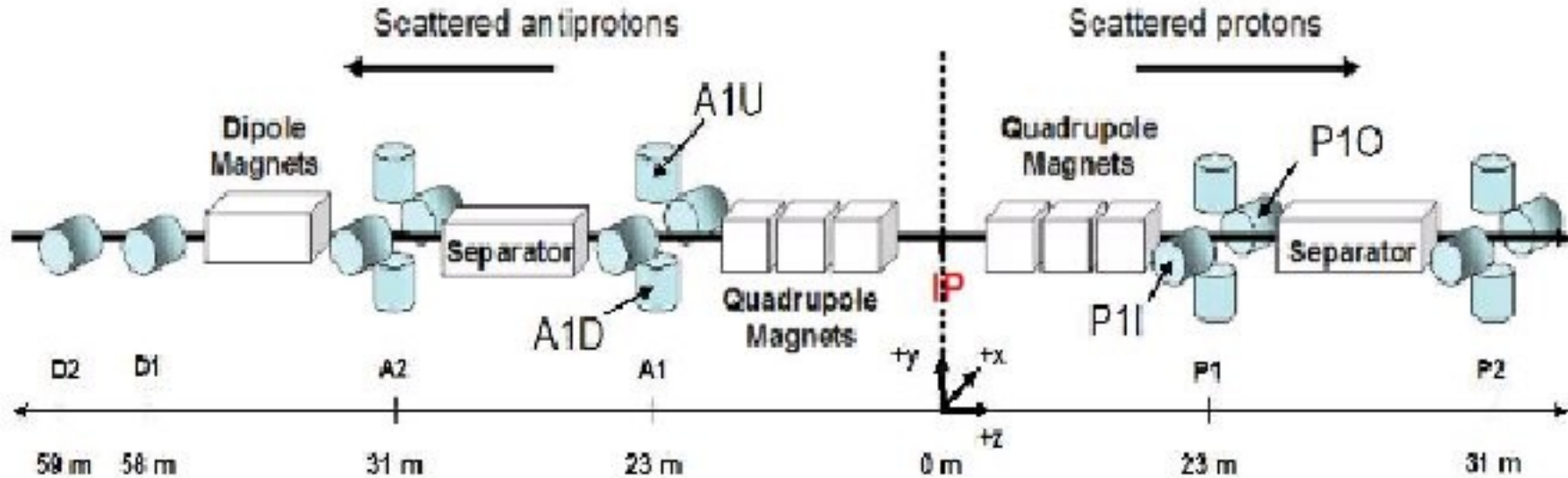
Topology:



$\eta$



# 18 Roman pots that form 9 momentum spectrometers



scattered antiprotons side ==> AU, AD, AI, AO and **DIPOLES**  
 scattered protons side ==> Pu, PD, PI, PO

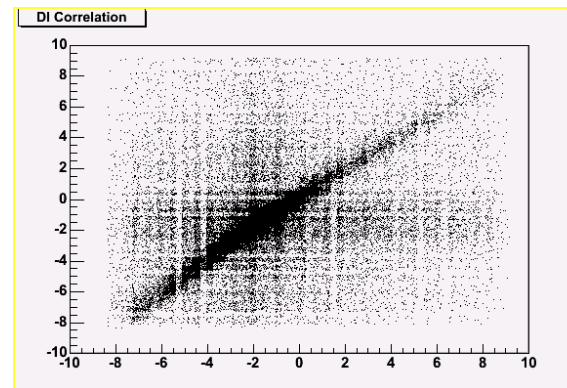
$$\xi = 1 - x_p = 1 - \frac{p_f}{p_i}$$

frac. proton mom. loss

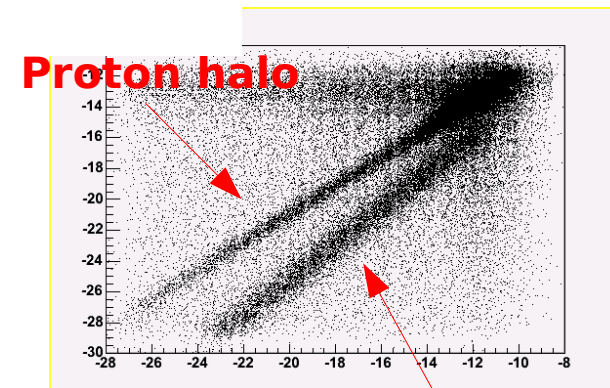
$$t = (P_{beam} - P_f)^2$$

4-mom. transfer squared

Vertical Correlation:

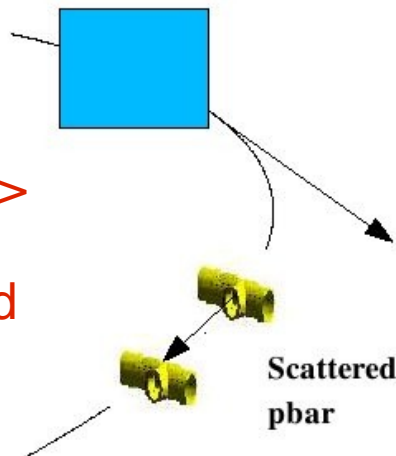


Horizontal Correlation:



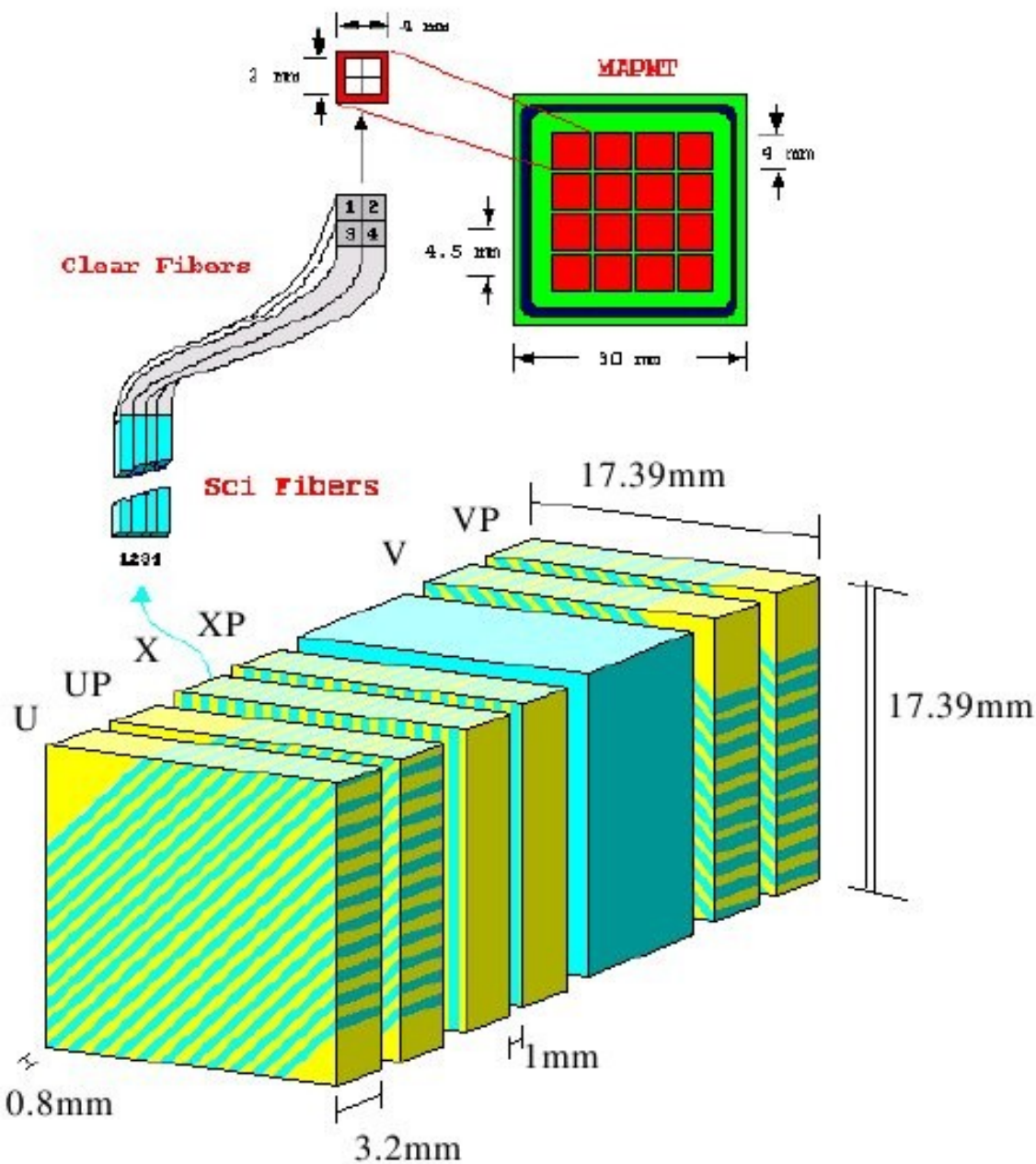
**Signal**

Dipole detectors placed behind the dipole magnet ==> good separation between signal and halo





# FPD Detector



- U and V planes at 45 degrees from X plane and 90 degrees between each other;

- coincidence between 2 fibers in 2 layers of a plane defines a segment;

- coincidence between 2 segments in 2 planes defines a hit;

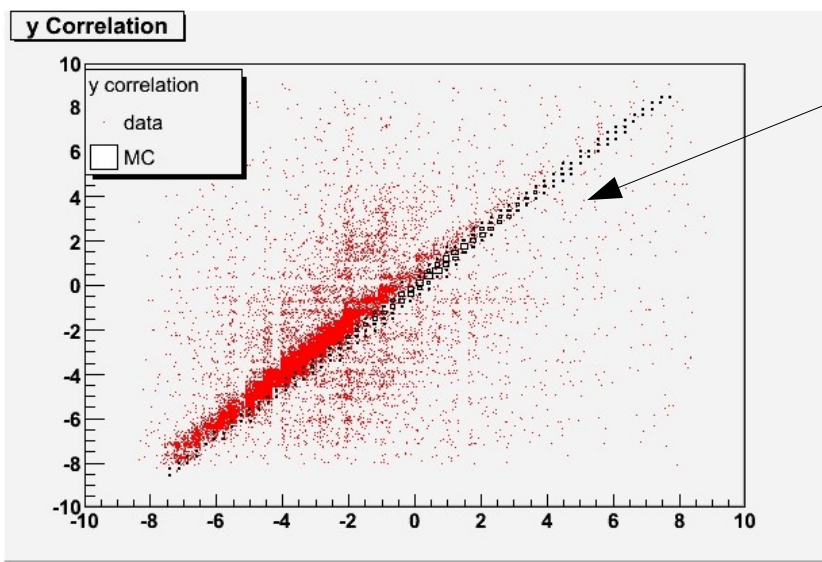
- coincidence between 2 hits in 2 detectors ( spectrometer ) defines a hit;



# Dipole Correlation and Hit Maps

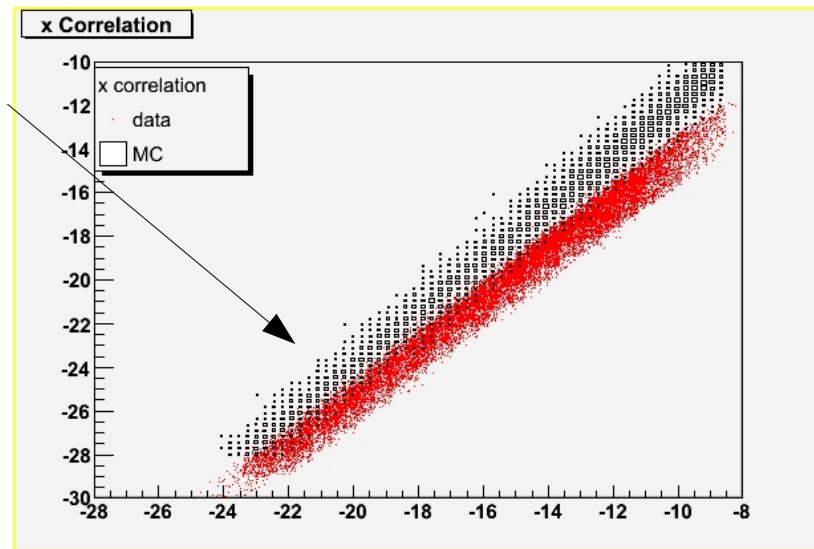


Vertical Correlation:

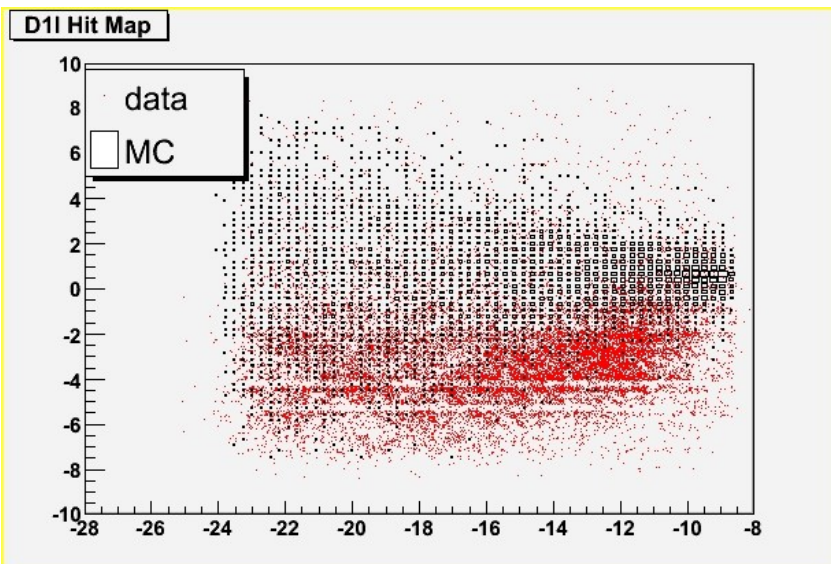


Signal band  
data vs. MC

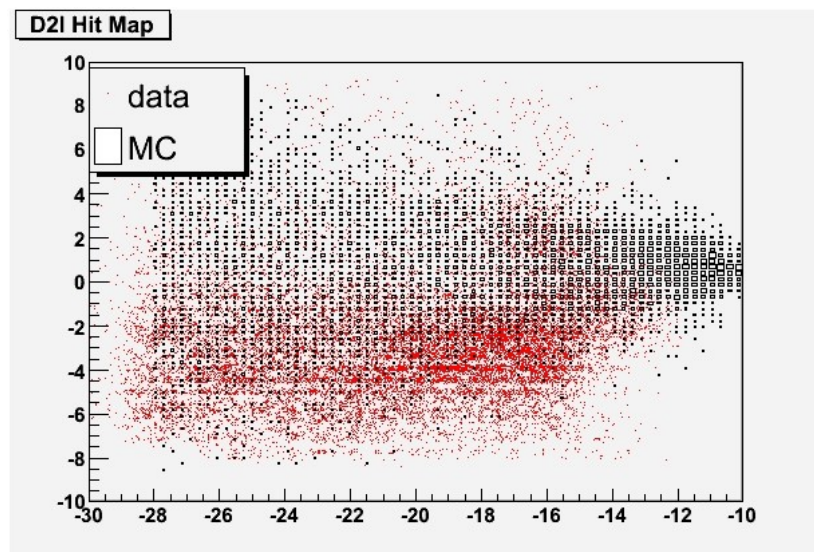
Horizontal Correlation:



hit map for D1I detector:



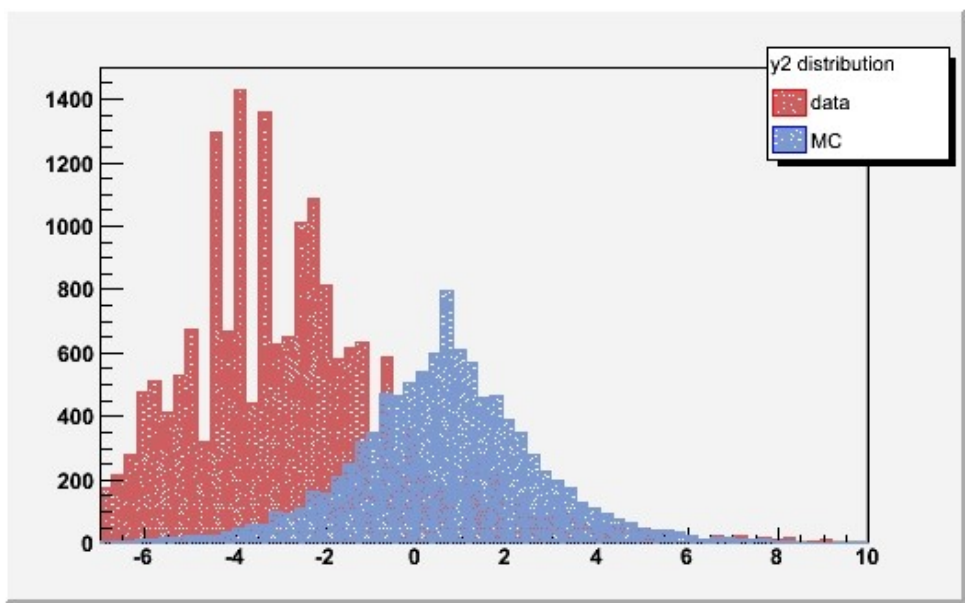
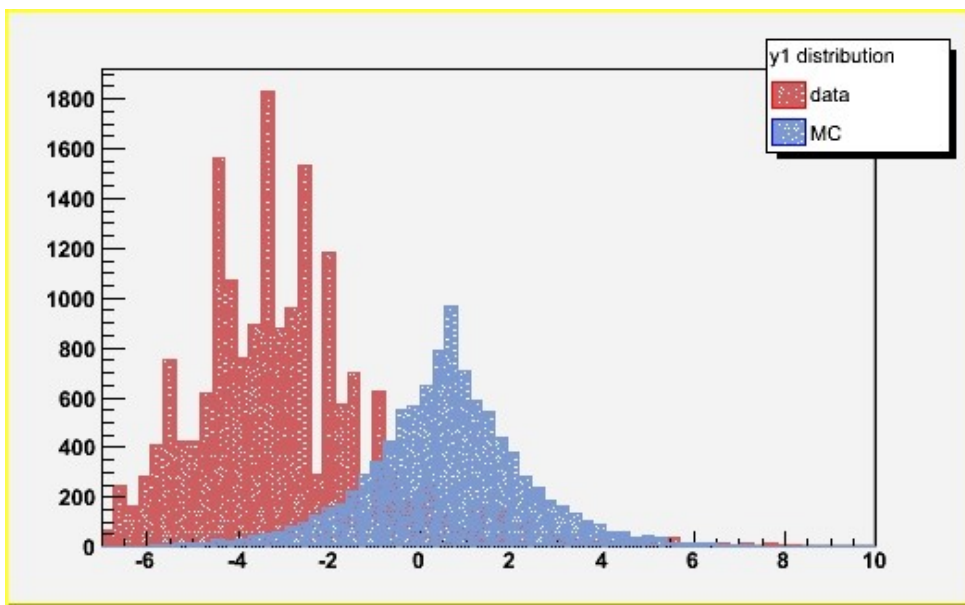
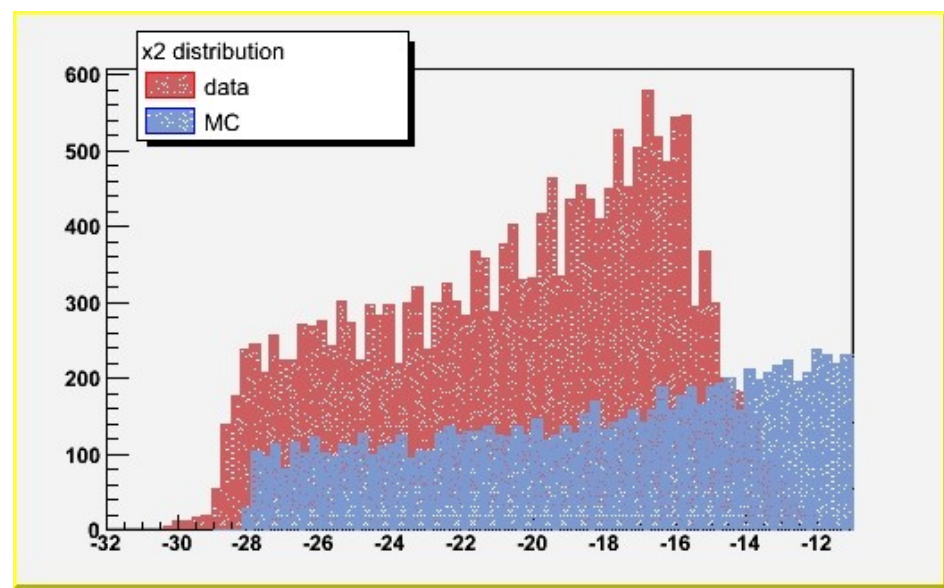
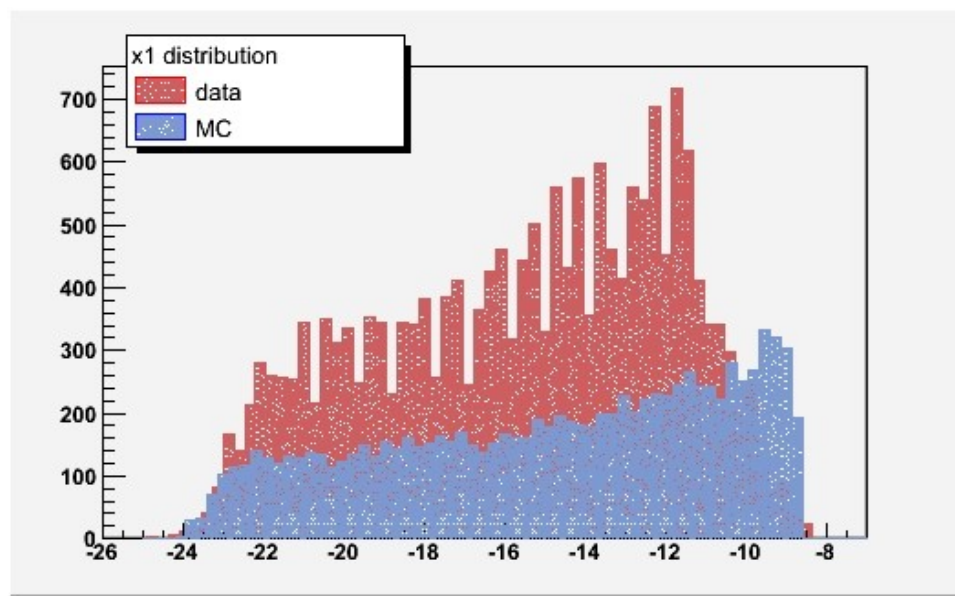
hit map for D2I detector:



Data points are shifted in comparison with the Monte Carlo ==> align detectors with respect to each other – **relative alignment.**



# Compare x and y distributions' mean values for data and MC and apply adjustments on hits to each detector



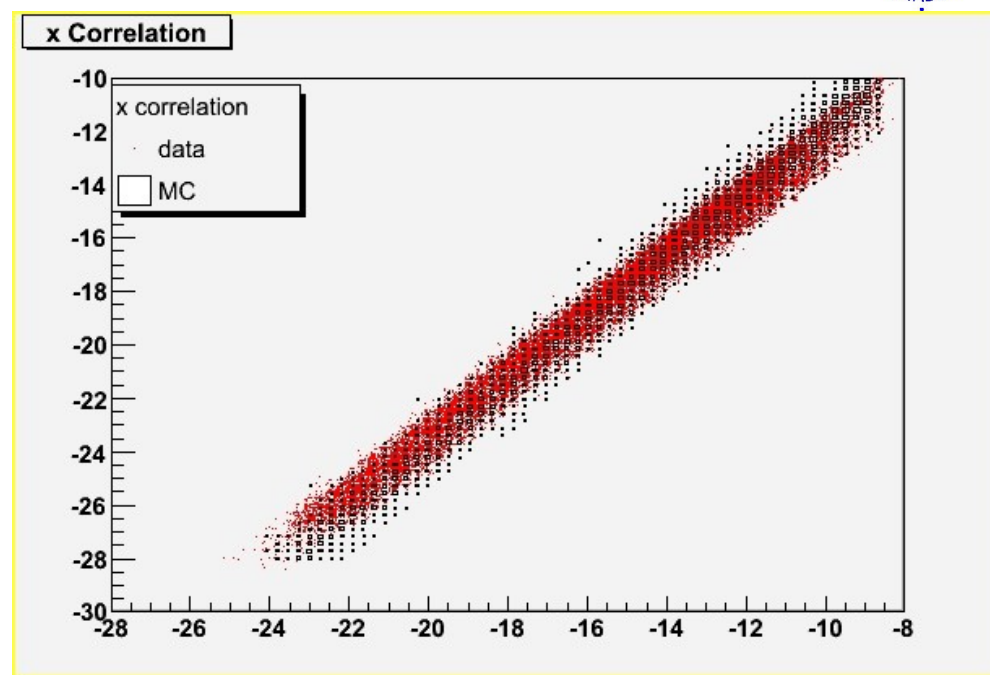
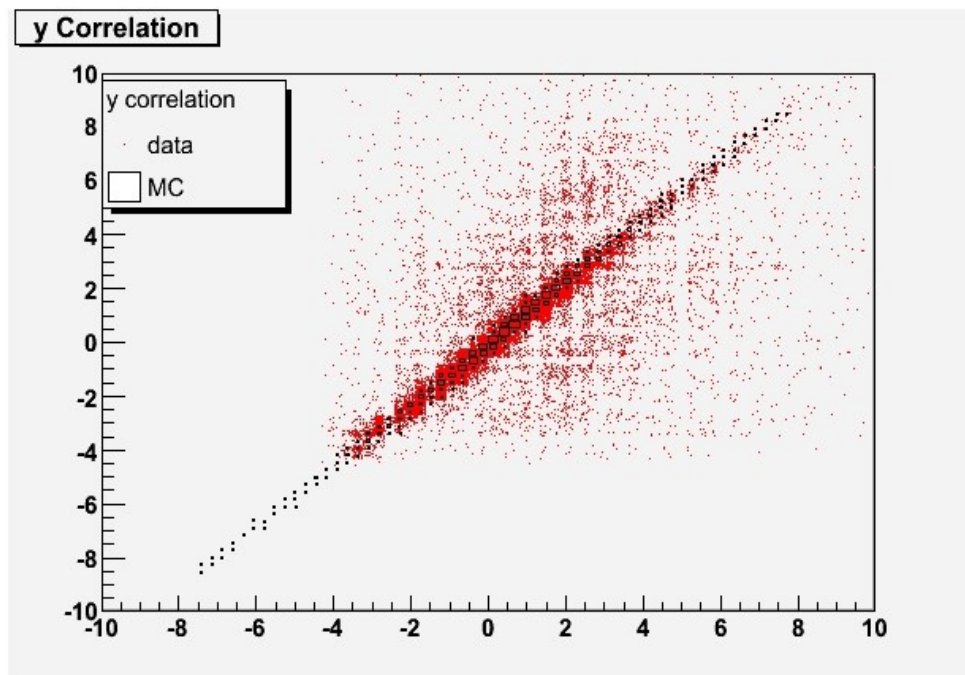


# Adjustments applied to both detectors:



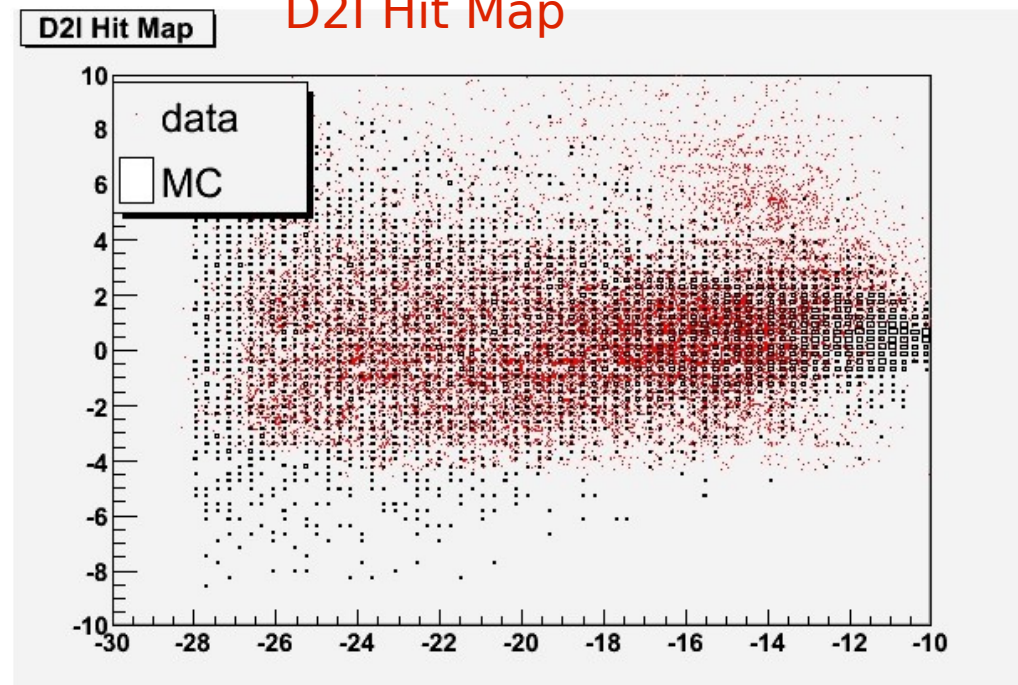
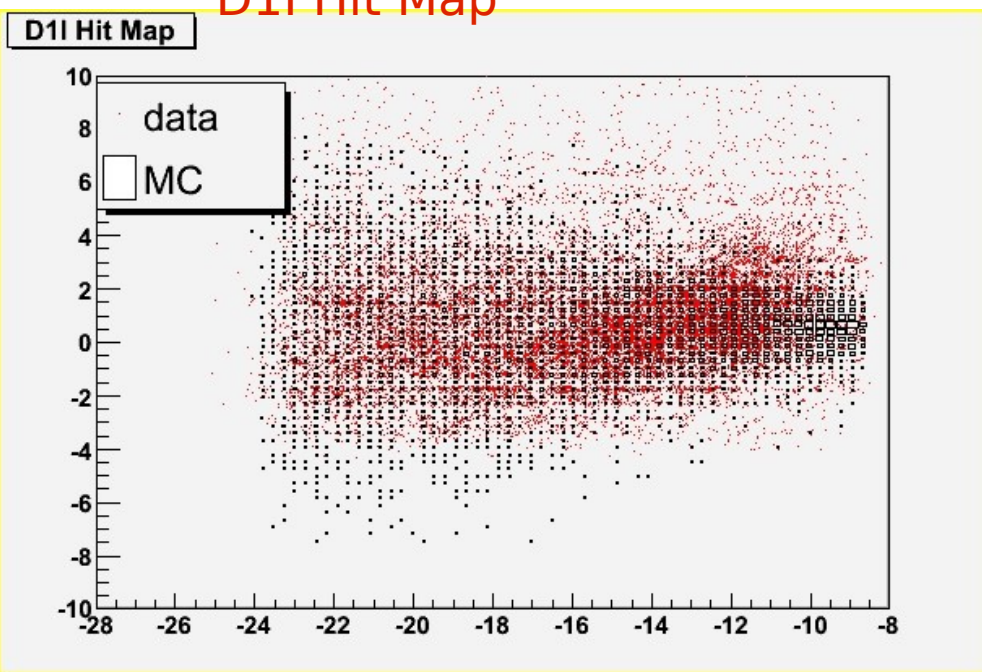
Vertical Correlation

Horizontal Correlation



D1I Hit Map

D2I Hit Map

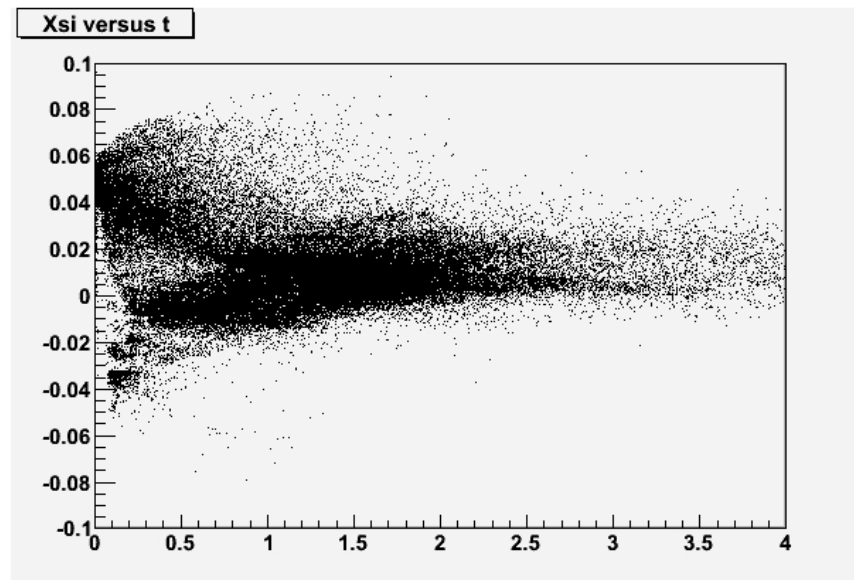
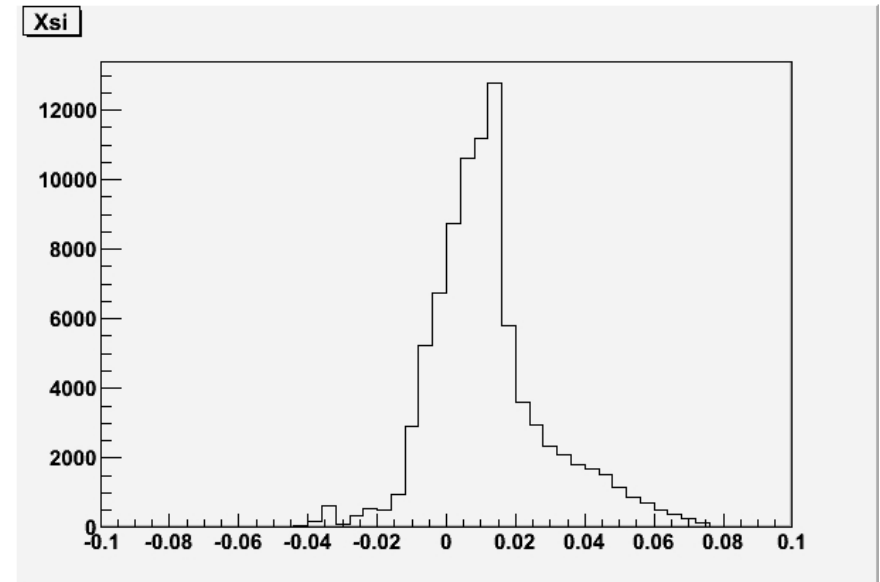
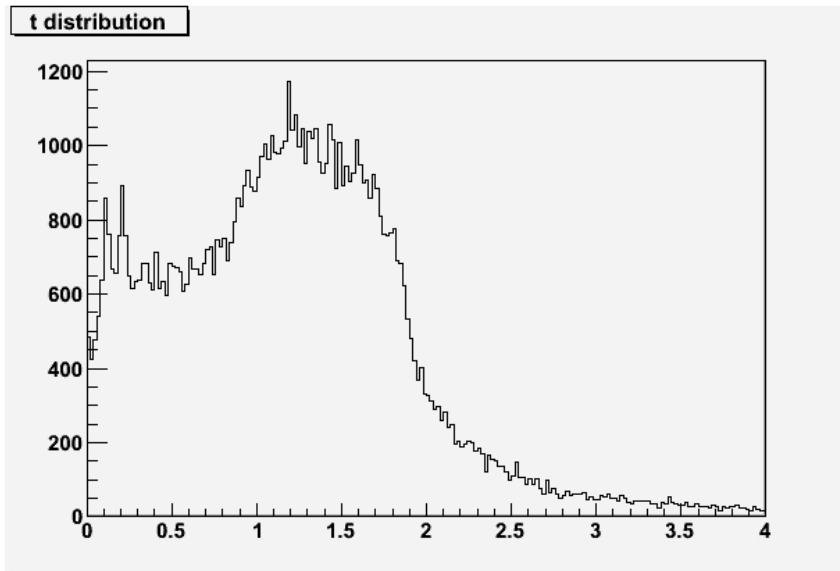




# Track Reconstruction – After Alignment

Take correlated hits and reconstruct it back to the Interaction Point, propagating it through the Beam Magnets, Drift Regions and Separators.

Get reconstructed  $\xi$  and  $|t|$

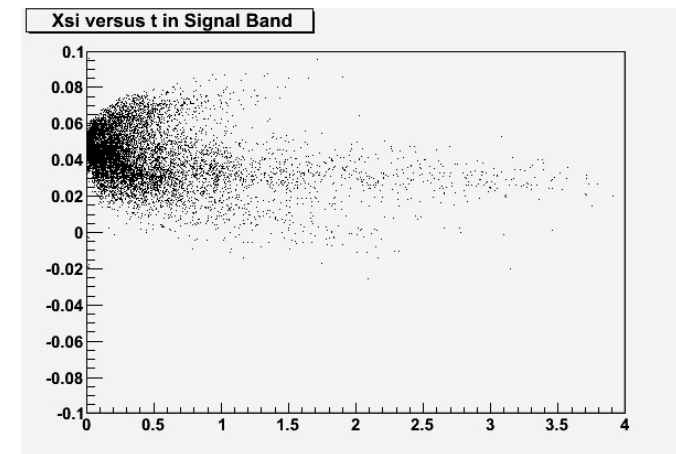
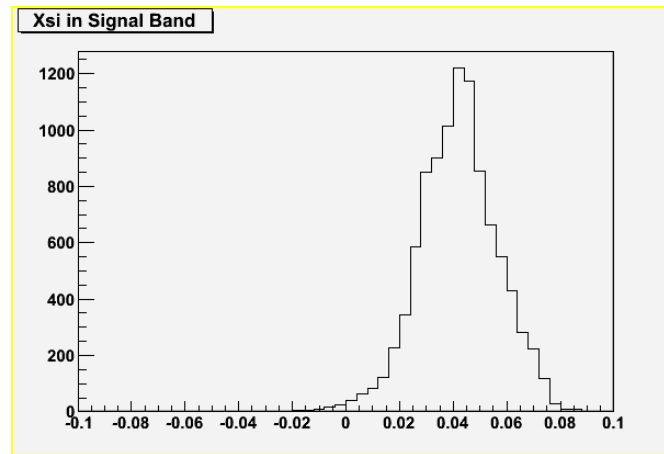
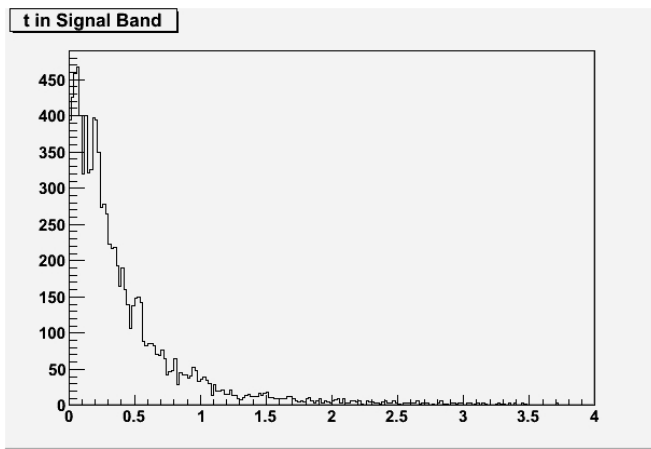




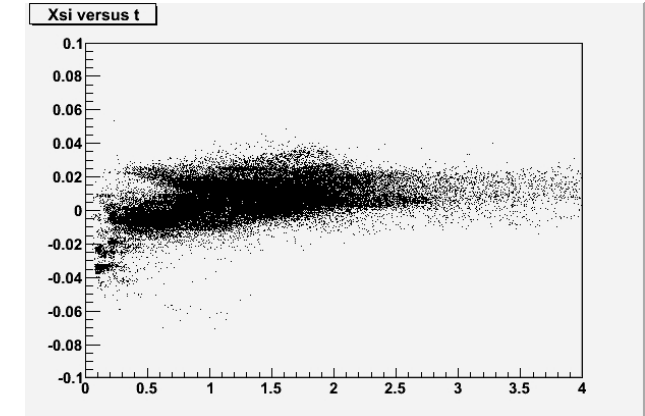
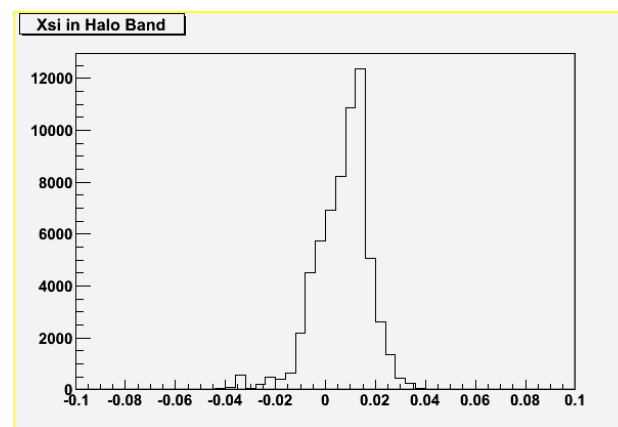
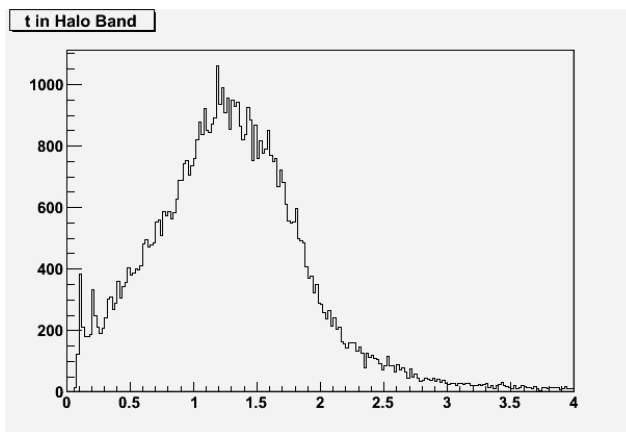
# Track Reconstruction – separation signal and halo



## Signal Band:



## Halo Band:



**Good separation between halo and signal**

**Before alignment tracks were not reconstructed for signal band!**





- **Dipole detectors aligned with respect to each other.**
- **Alignment of spectrometer with respect to beam was also done and will be shown at the Forward Proton Detector Meeting to be held at Universidade Federal do Rio de Janeiro, from April 10<sup>th</sup> to April 11<sup>th</sup>**

## **Aknowledgments:**

