



# Velo

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# Outline

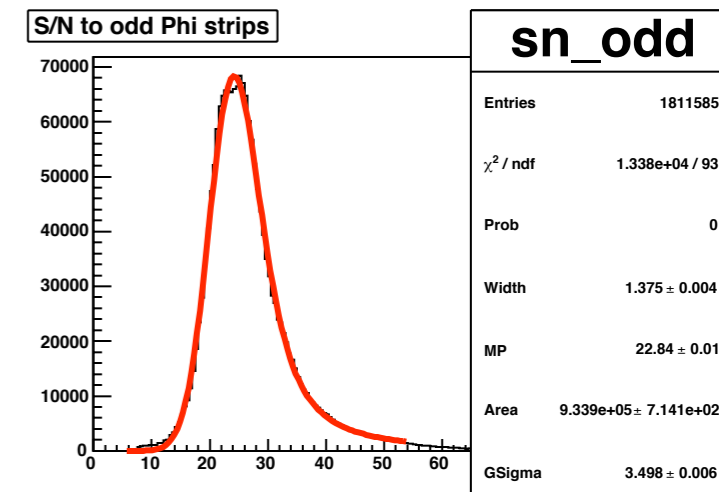
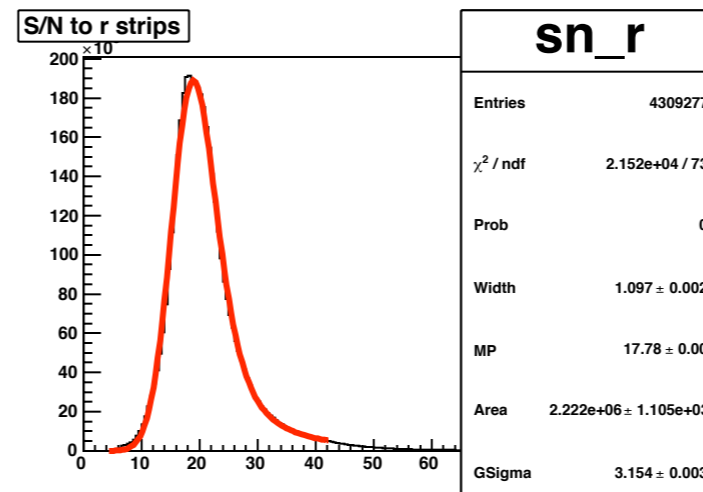
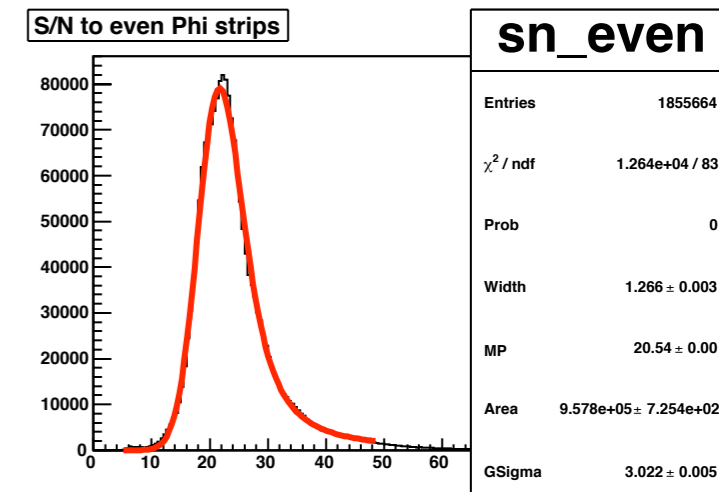
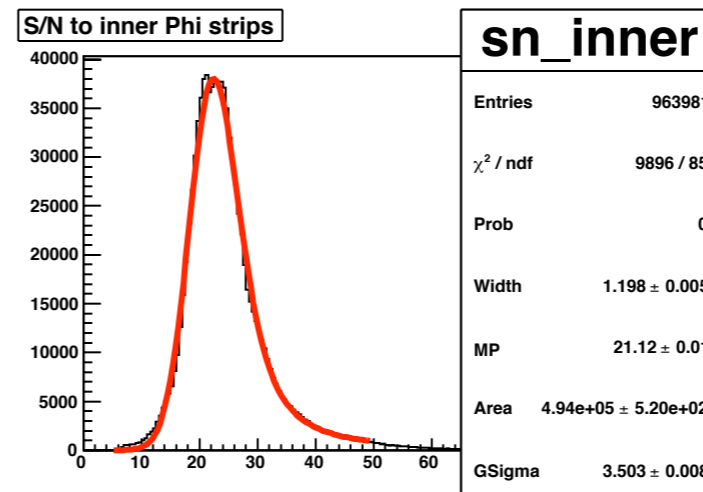
- S/N - James Mylroie-Smith
- Landau comparison with MC - David Hutchcroft & James Mylroie-Smith
- Gain & dEdX - Grant McGregor
- Occupancies - James Keaveney
- Efficiency - Slivia Borghi & Dermot Moran

# S/N

- specify 4 types of velo strips for S/N

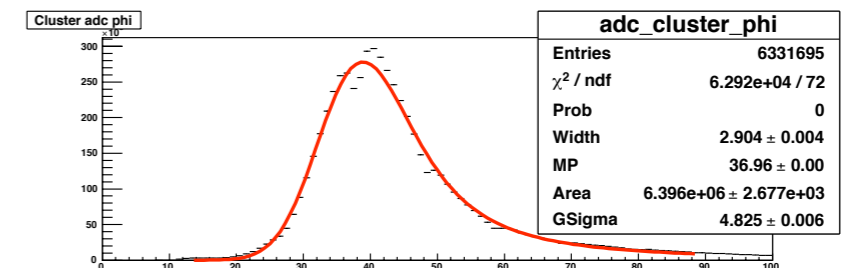
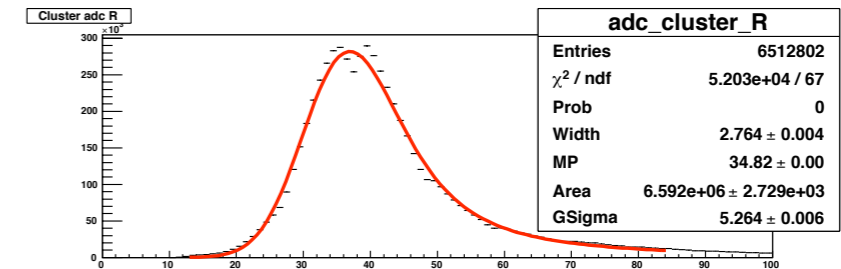
- R strips
- inner Phi strips
- outer Phi even strips
- outer Phi odd strips

Strips	S/N	MPV	Width
$\phi$ inner	21.12	35.54	2.04
$\phi$ outer even	20.54	36.63	2.18
$\phi$ outer odd	22.84	35.39	2.07
R	17.78	33.88	2.08

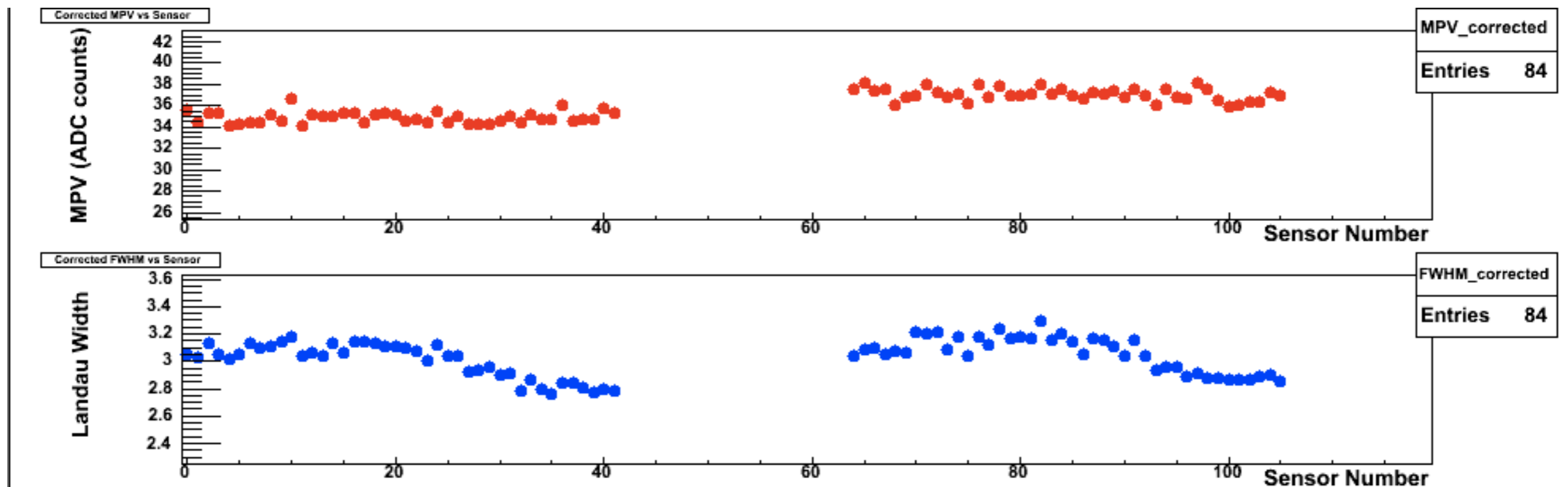


# Cluster ADC

- Data from all 15mm velo opening runs
- Landaus for all sensor are monitored



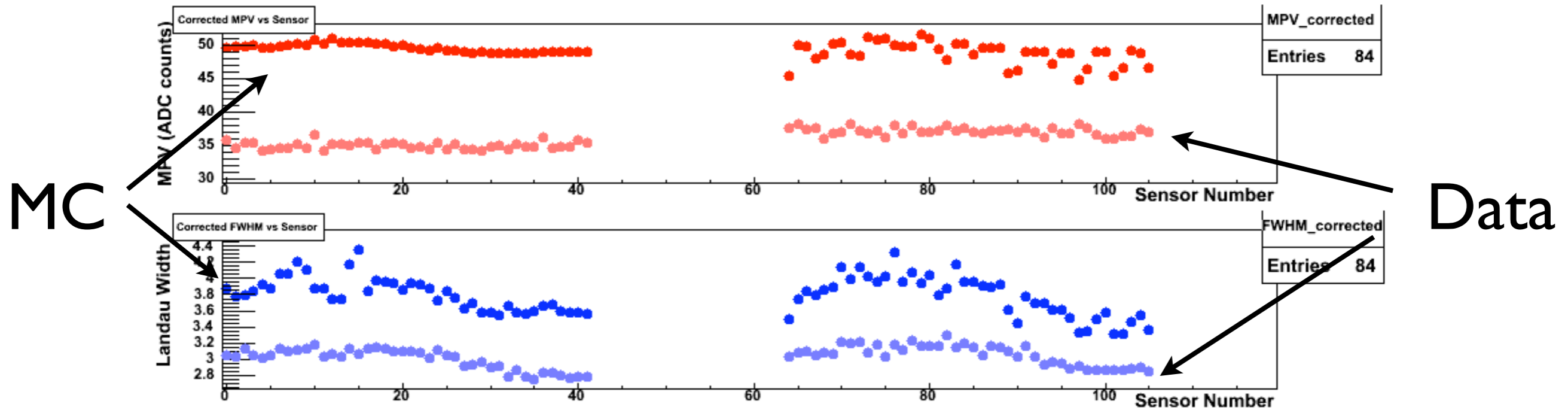
- MPV(R) = 34.82 ADC counts
- MPV( $\phi$ ) = 36.96 ADC counts



# MC comparison

- MPVs of Landaus over estimated in MC

	MC	Data	Ratio
MPV	48.42	35.60	1.36
Width	3.06	2.46	1.24
Gaussian $\sigma$	5.90	4.74	1.24



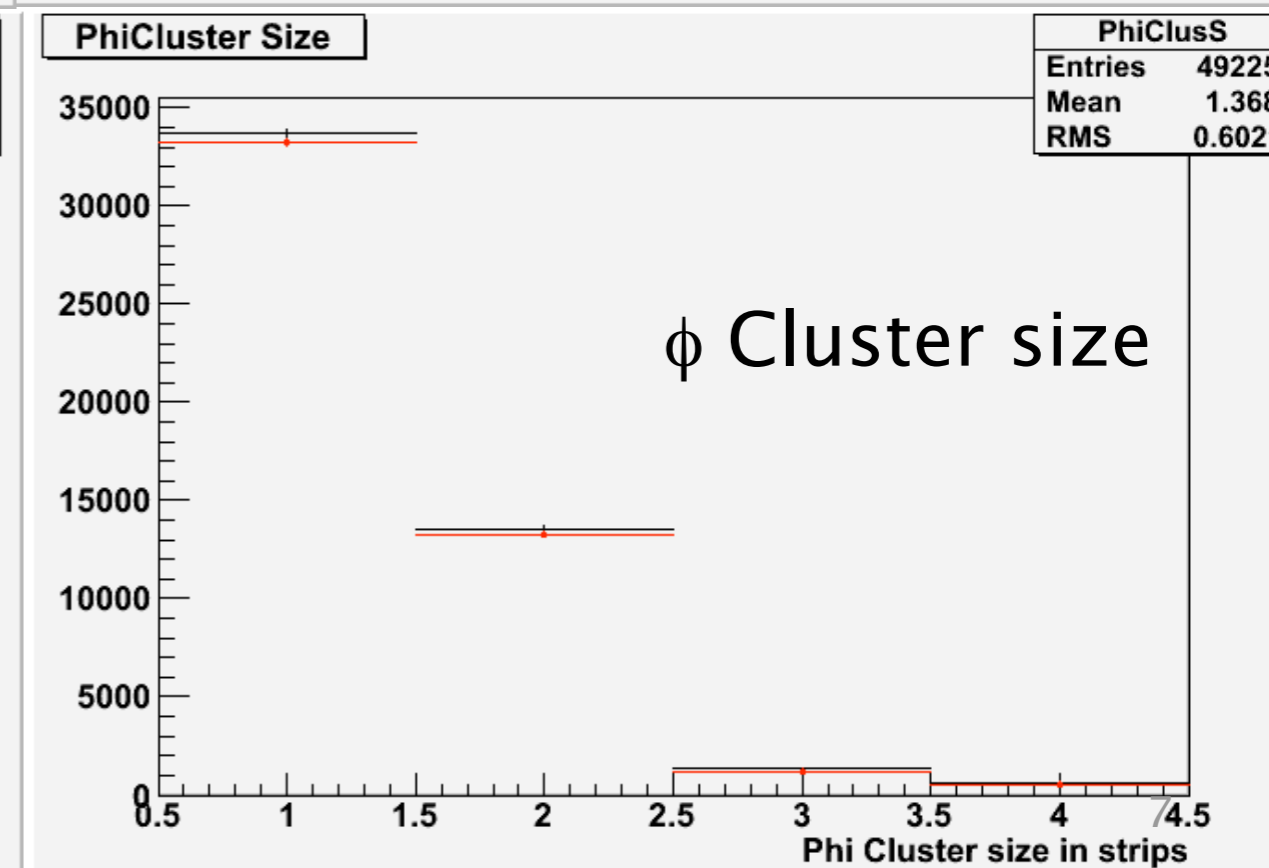
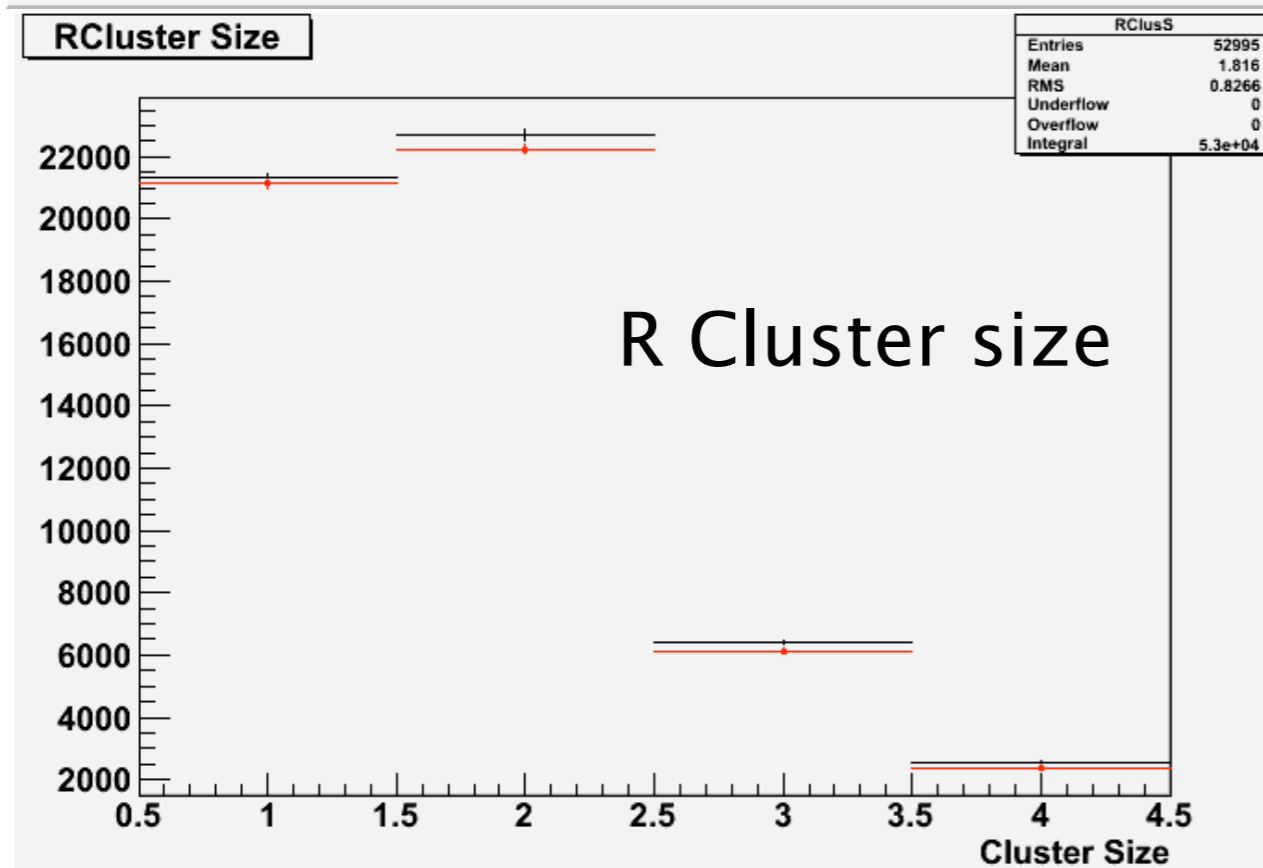
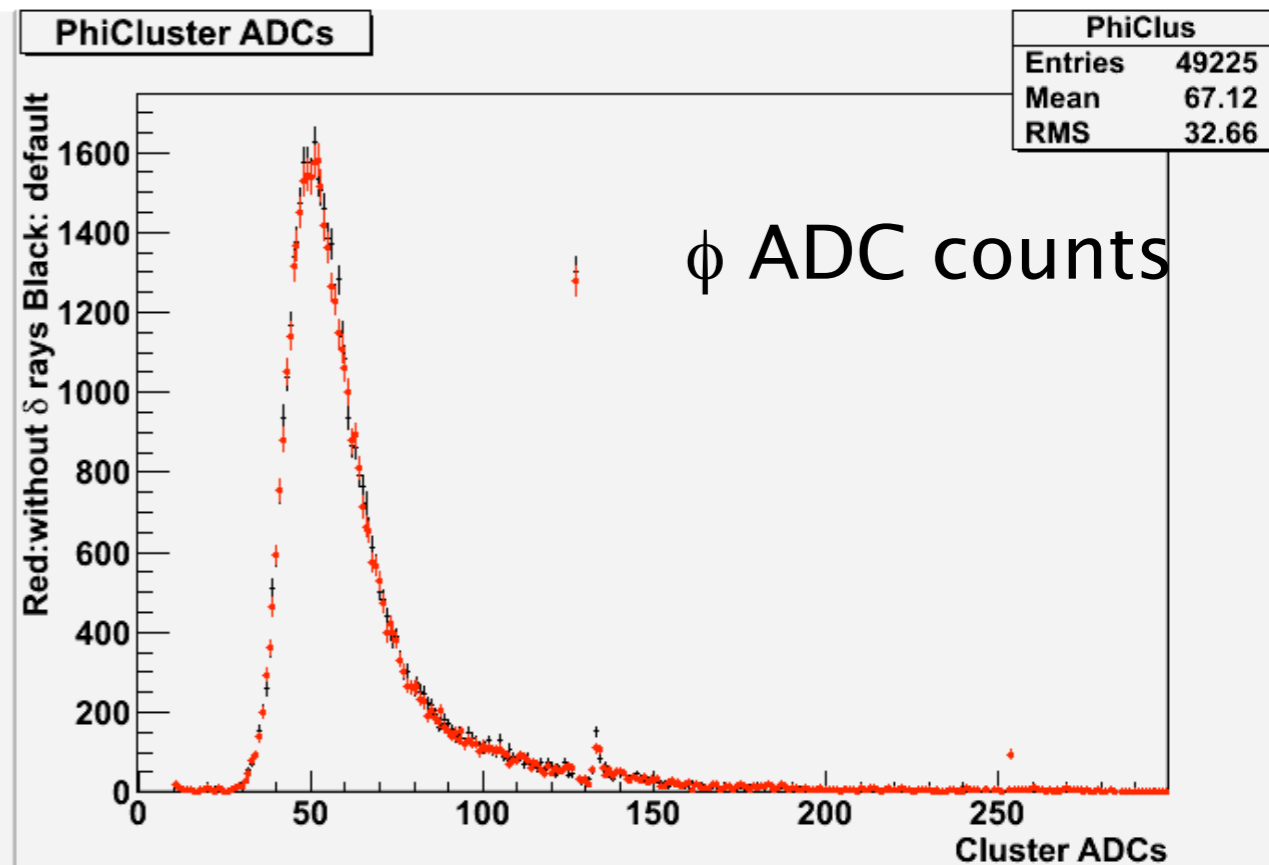
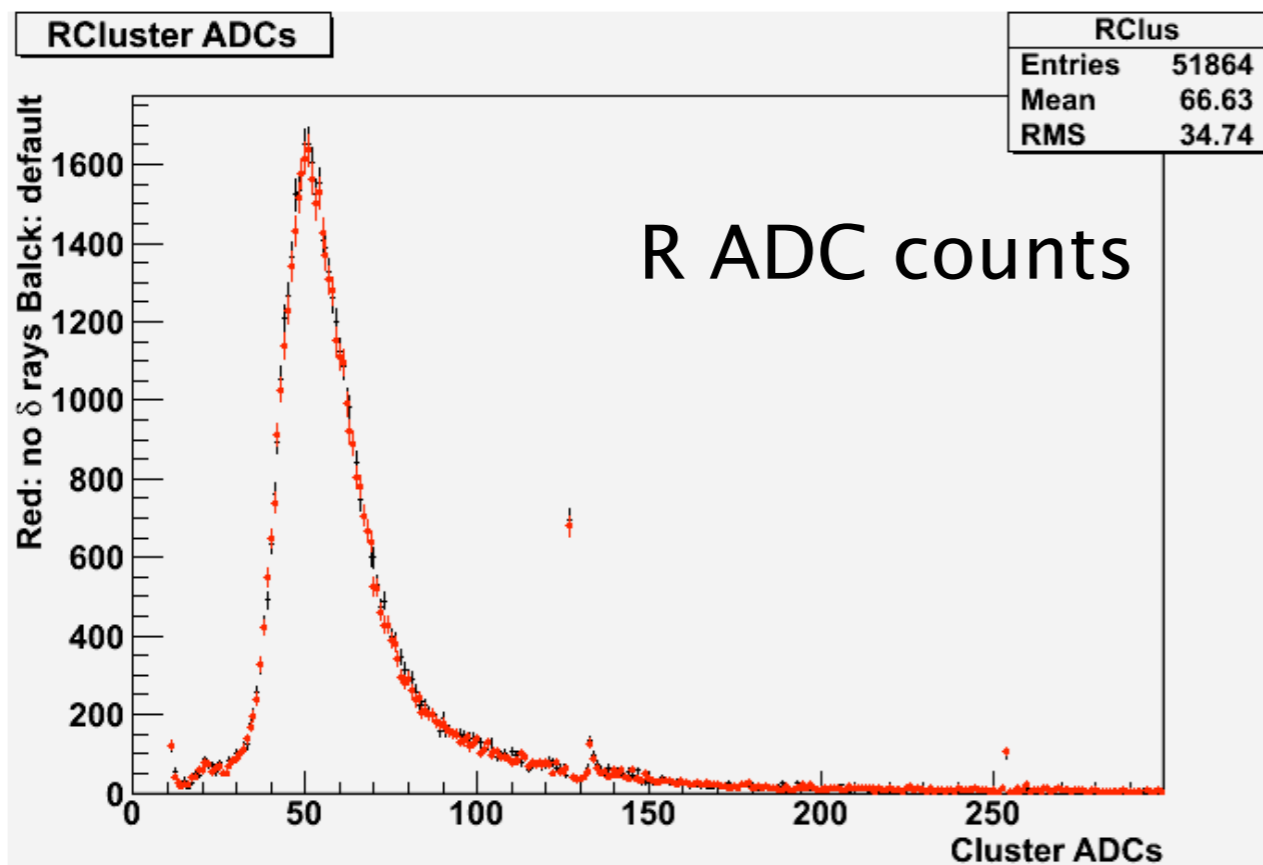
# $\delta$ rays

David

- No significant difference with  $\delta$  ray range changed from 10km to 5mm
- Using Gauss v38r1p1 generated 250 min bias events
  - Hacked VeloSim to optionally ignore MCHits from  $\delta$  rays
  - With  $\delta$  rays 53.0k R and 49.2k Phi clusters; with  $\delta$  rays removed 51.9k R and 48.2k Phi clusters
  - Slightly worse ghost rate (0.3% for Velo 3D tracks) with  $\delta$  rays on
- Modified the associator: but no difference to track association
  - To be submitted v. soon

Black : Gauss v38r1p1

Red same without  $\delta$



# Track resolutions after Kalman fit

	Removed $\delta$ rays		With $\delta$ rays	
Long tracks	Value	Error	Value	Error
Res x RMS ( $\mu\text{m}$ )	10.6	0.3	10.8	0.3
Res y RMS ( $\mu\text{m}$ )	10.5	0.3	10.3	0.3
$\Delta p/p$ ( $\times 10^{-3}$ )	7.8	0.3	7.6	0.3

On this sample of  $\sim 2.5\text{k}$  long tracks there is no evidence that the delta rays have any impact on the fitted track resolutions

The long track finding efficiency drops though:

Forward from 93.1% to 92.2%,

Matched from 90.9% to 90.4% and

Best from 94.7% to 94.5% for Long  $> 5$  GeV/c

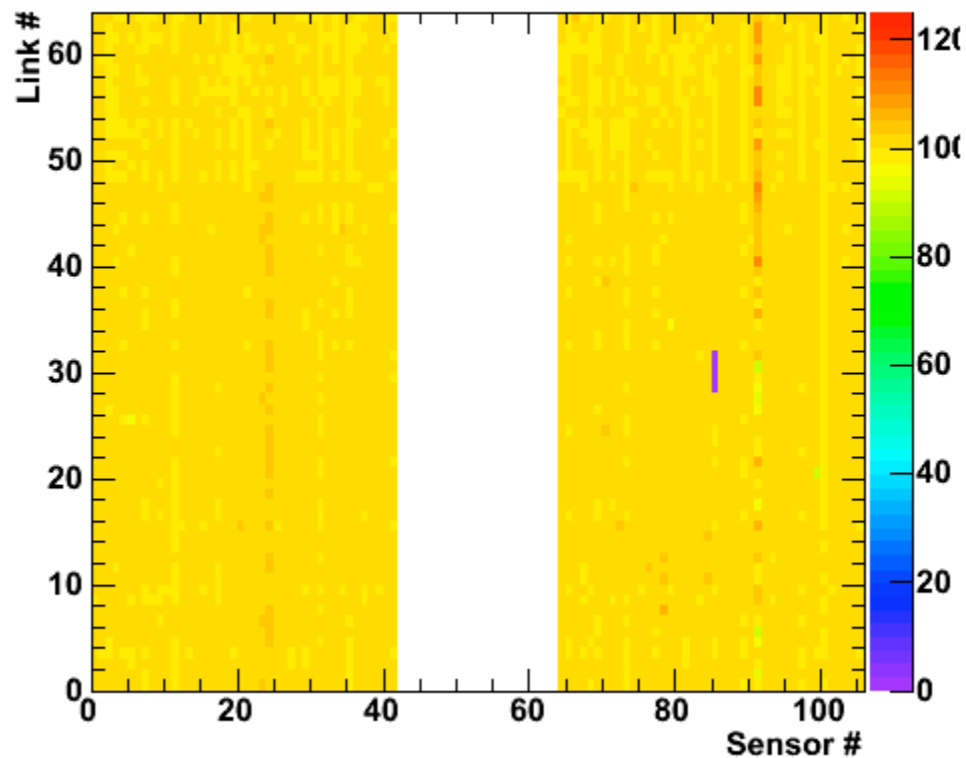


# Gain

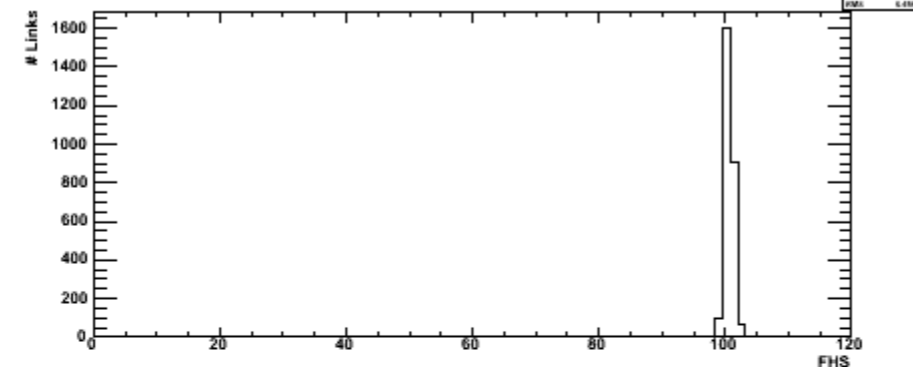
Grant

- Gain normalised by FHS.
- FHS is difference in ADC counts between high and low header values.
- Normalised to 100 in all sensors
- Gain was checked over running period and found to be stable for both R and Phi

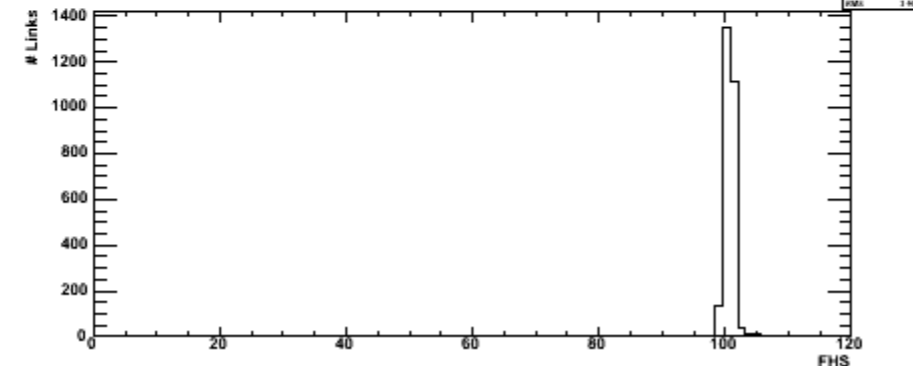
Unweighted summary of FHS



FHS Distribution (R sensors)

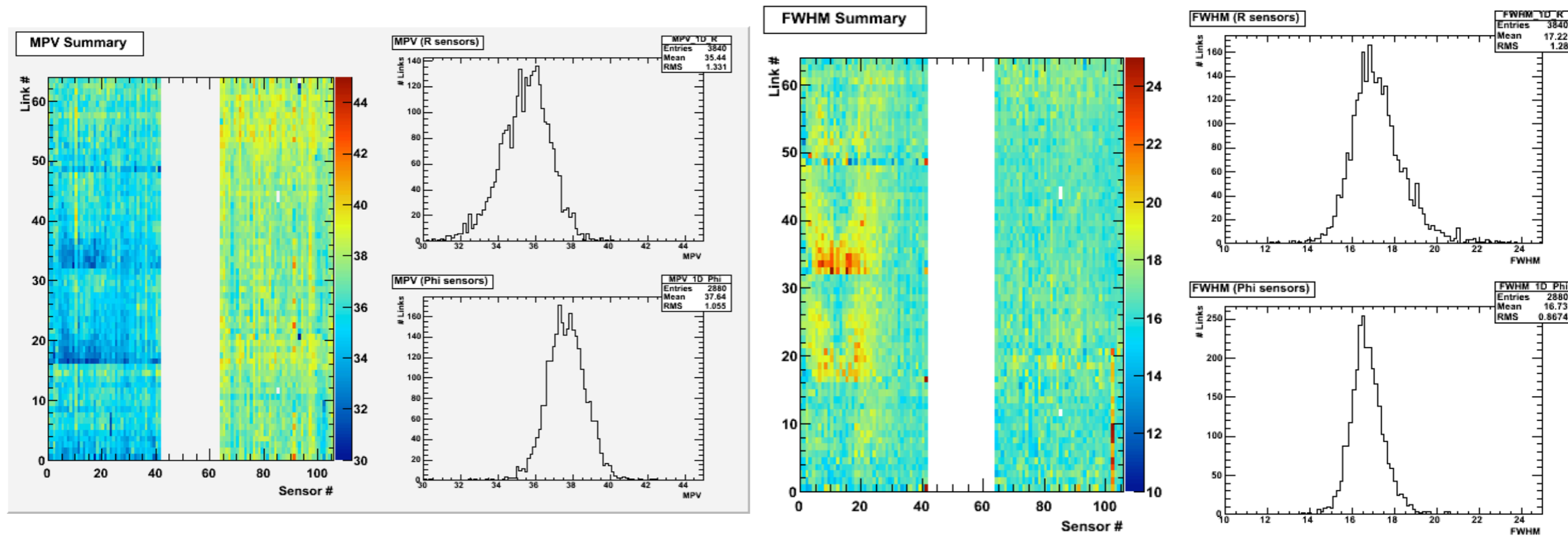


FHS Distribution (Phi sensors)



# Gain Monitoring with Landaus

- Using Landaus for each link to examine normalisation

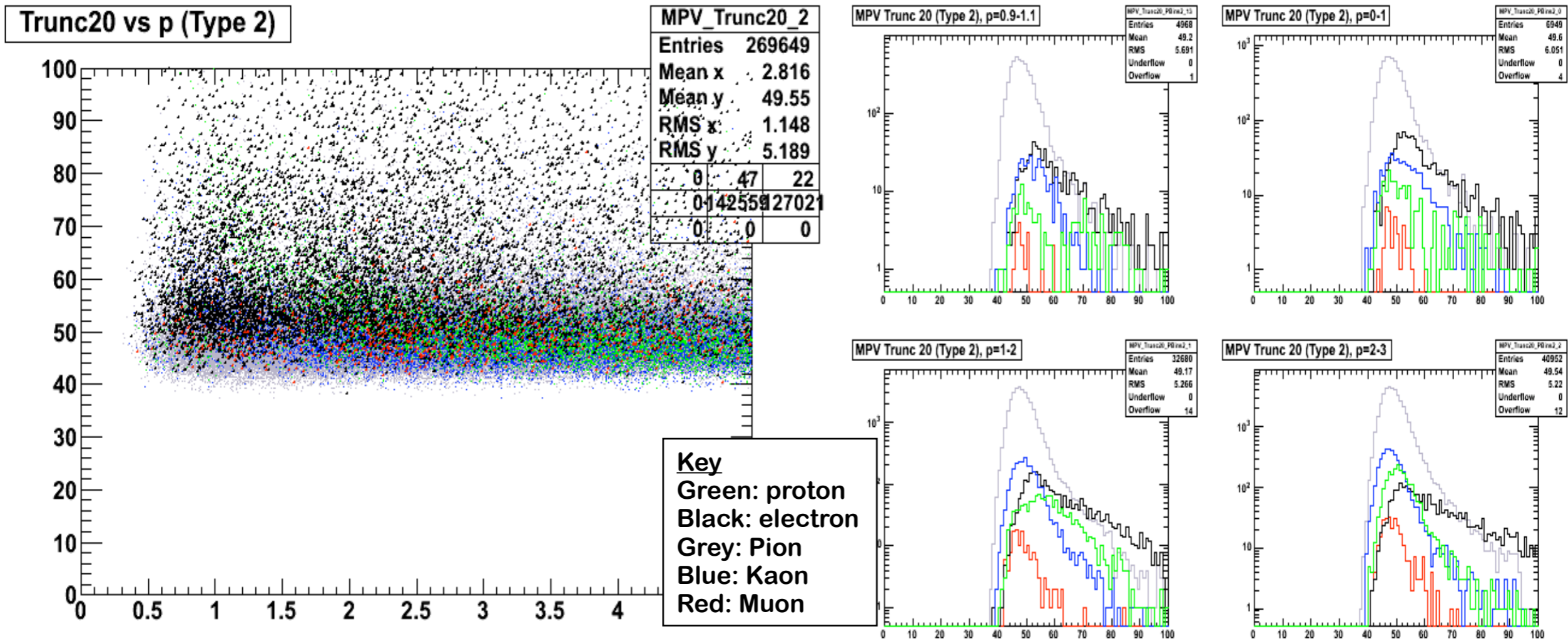


# dE/dx

- MC and first data studies of dE/dx
- Several methods considered
  - generalised mean, truncated mean, median
- Best results seem to come from truncated mean
- Truncated mean removes a percentage of hits from distribution and this results in a better estimate of the MPV

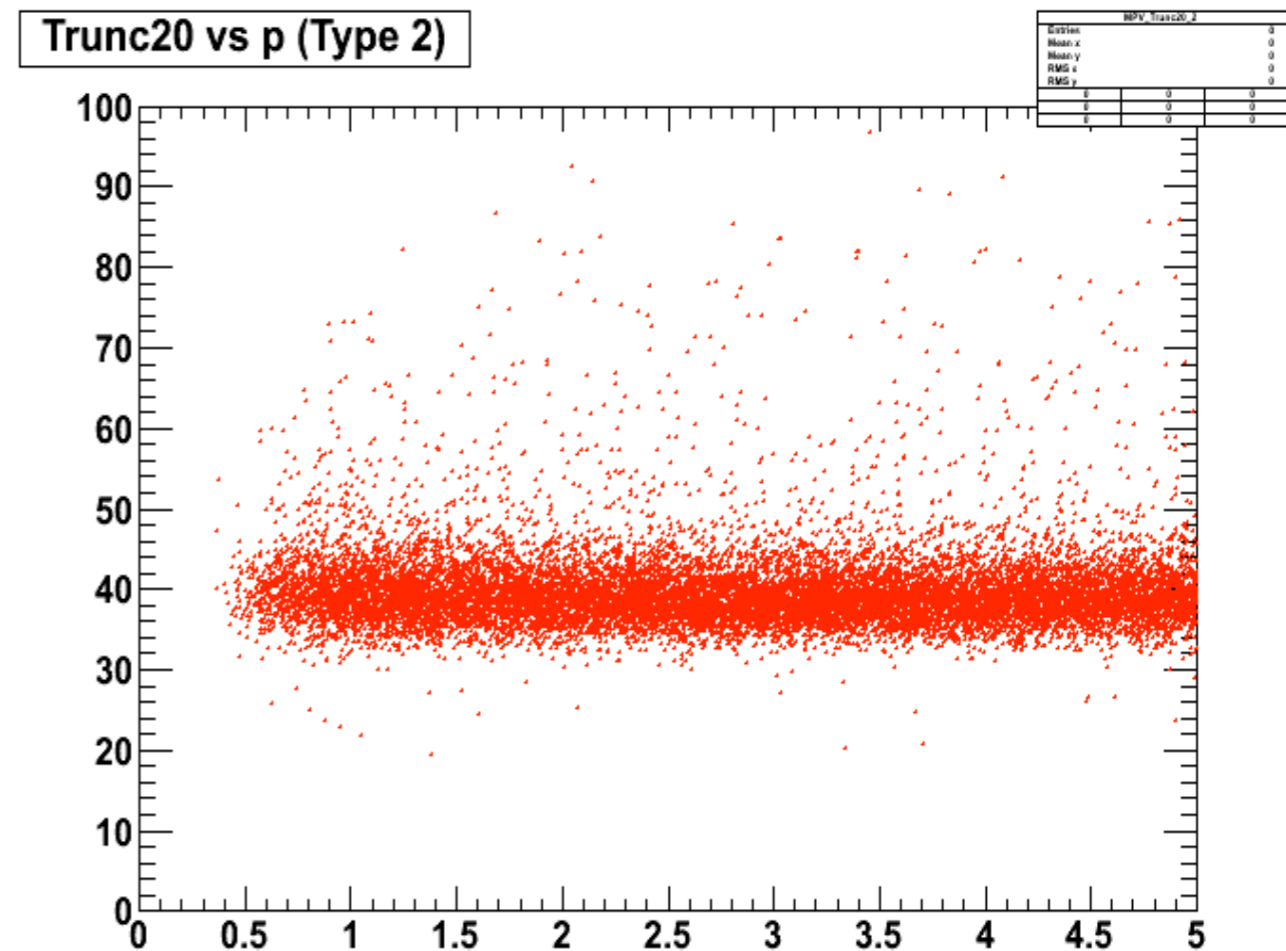
# MC Studies

- Require tracks with lots of velo hits
- Seems possible to do some PID at low momentum. More work needed.



# Data

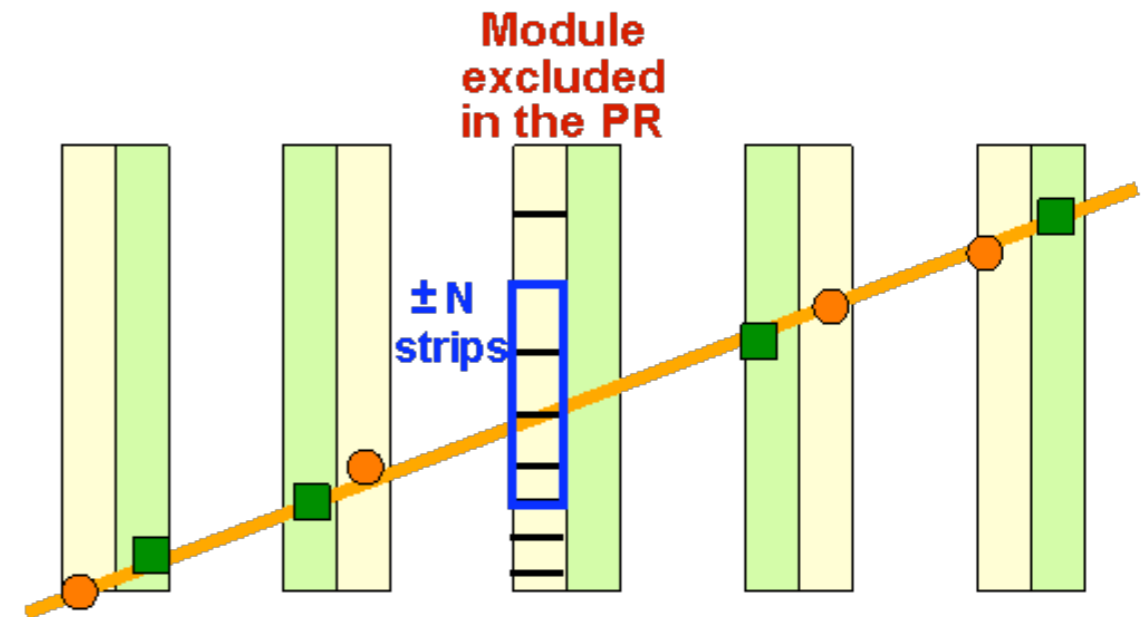
- From IM events taken ~52K tracks were usable for dE/dx
- No clear signs yet



# Cluster and tracking efficiency

- Cluster efficiency method

- Exclude one module from PR
- Extrapolate the track to the excluded module.
- Check if there is a cluster in  $\pm N$  strips near the extrapolated point



- Cluster finding efficiency:

extrapolated the tracks with hits in the two modules before and after the excluded one

- Tracking efficiency:

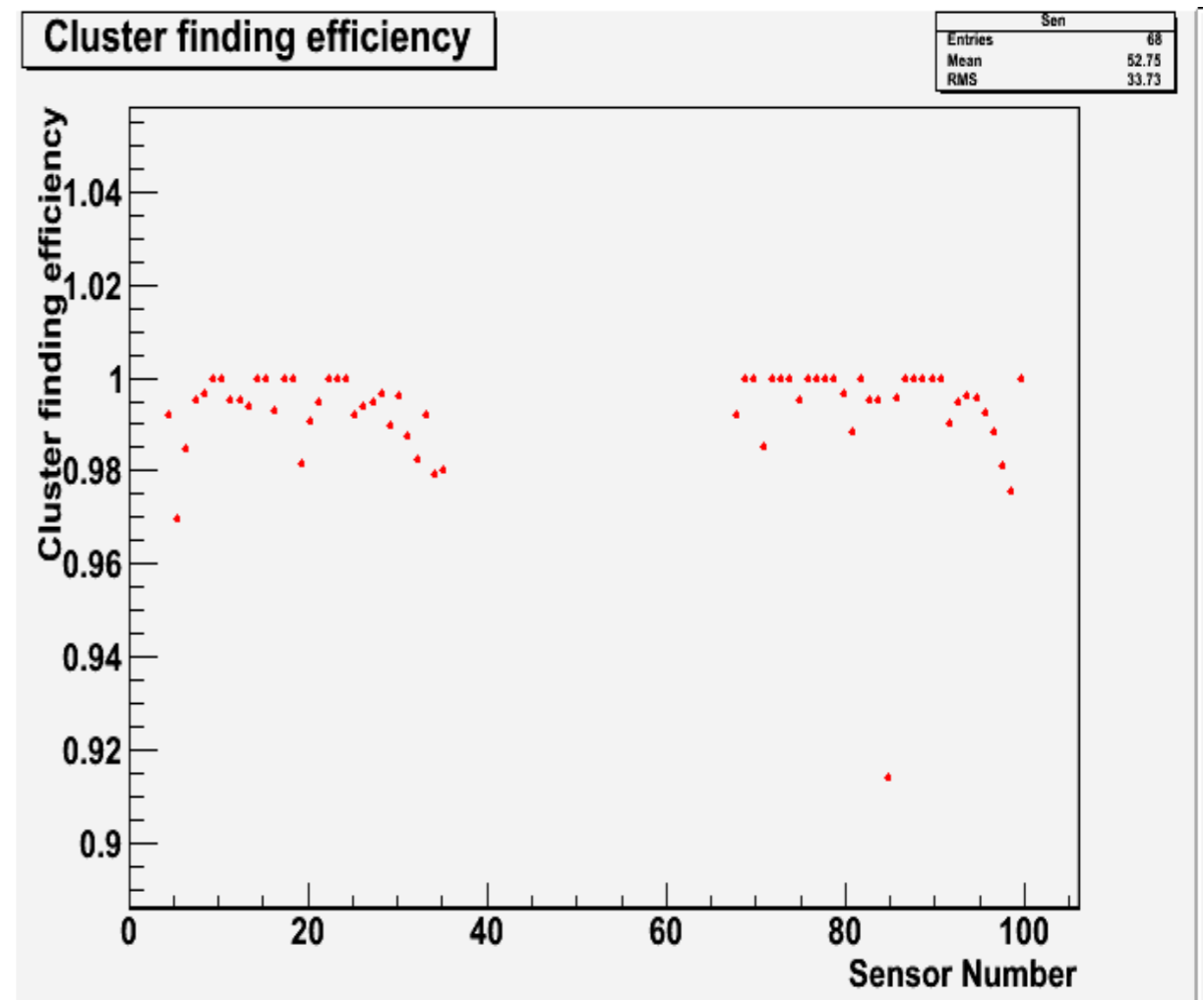
extrapolated all the tracks (only requirement 3 points per tracks)

**This method allows the study the cluster efficiency versus the HV**

**Silvia, Dermot, Chris & Stefano**

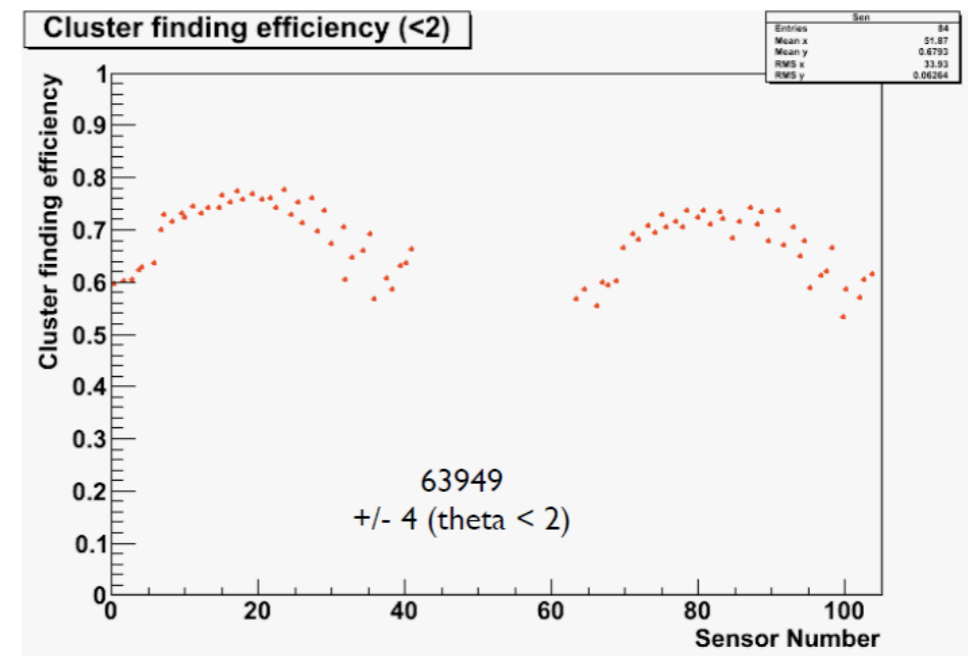
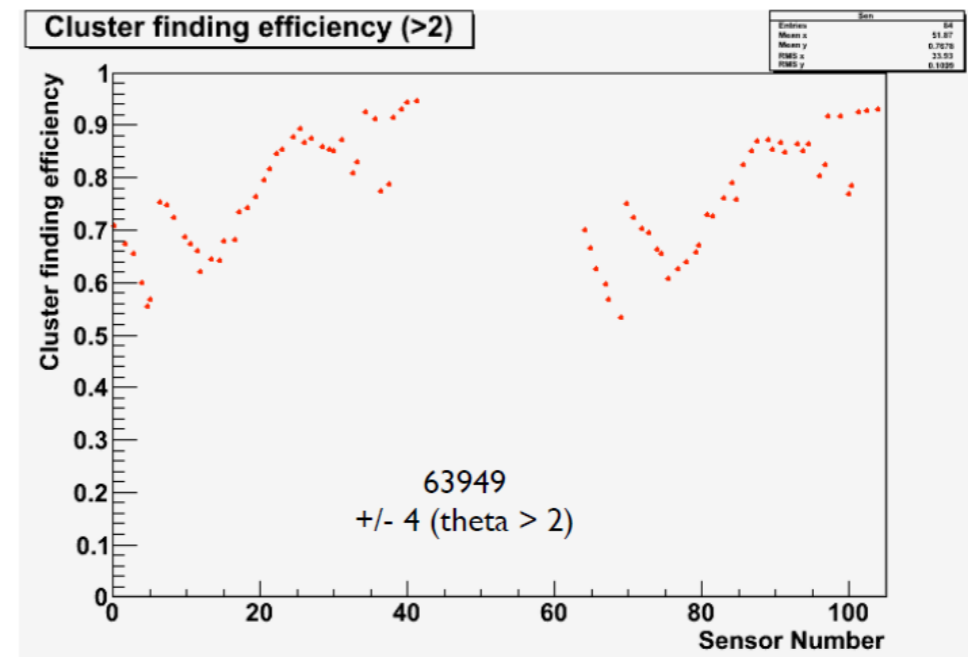
# Cluster finding efficiency

- Collision data with VELO at 15 mm, run 63949
- Efficiency evaluated looking for cluster in  $\pm 4$  strips around the extrapolated point
- Average cluster finding efficiency ~99%
- One sensor with low efficiency ~91%



# Tracking efficiency

- Collision data with VELO at 15 mm, run 63949
- Efficiency evaluated looking for cluster in  $\pm 4$  strips around the extrapolated point
- Angular cuts ( $\theta > 2$ ) to exclude the low angle tracks due to beam gas events
- Inefficiency under investigation (several contributions: the extrapolated error, ghost contribution, ...)



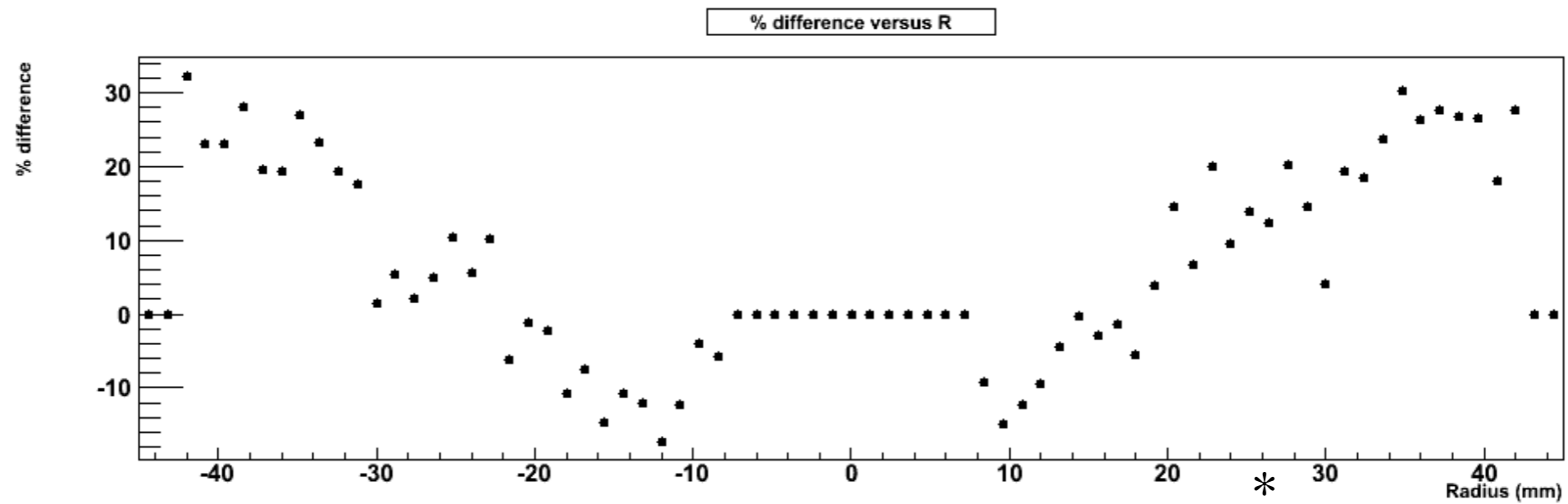
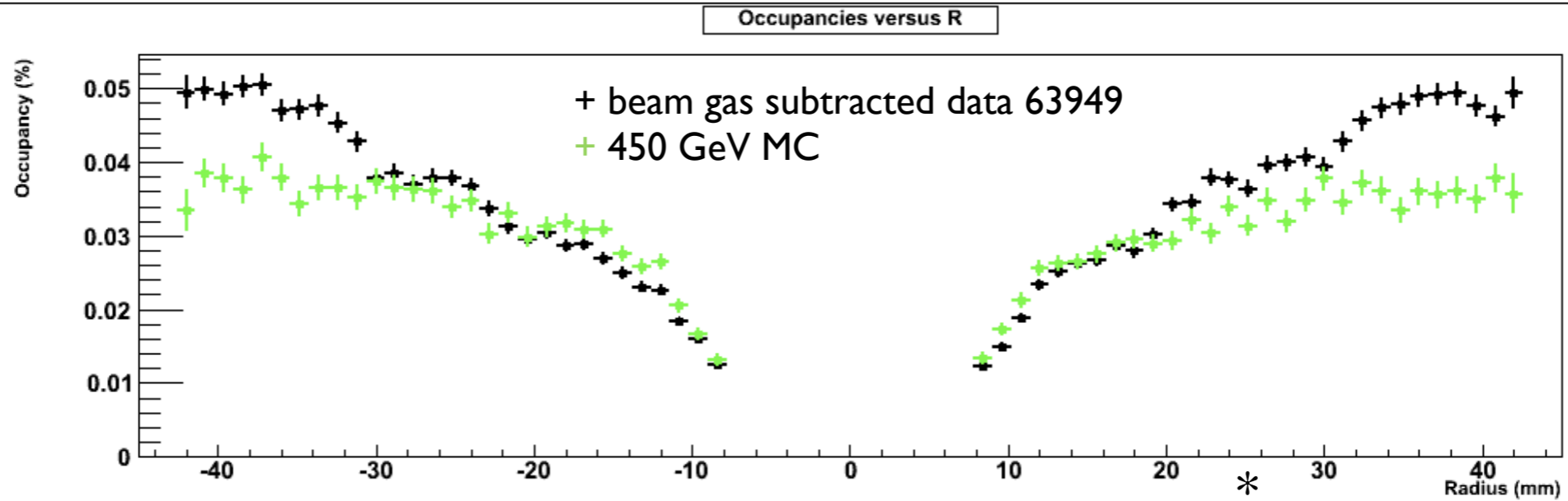


# Occupancy

James K.

- Comparison between 450GeV MC(Green) and data using run 63949
- Attempted to remove beam gas events by requiring  $> 1$  forward and backward track

# Occupancy Vs strip radial position - Data- MC comparison



\*strip radial position calculation assumes velo is closed

# Summary

- Velo has been working well
- MC needs tuning
- It has been stable over course of the runs
- Track and cluster efficiencies found but require some understanding