

# Updates on Simulation and Reconstruction in the updated nHCal at epIC

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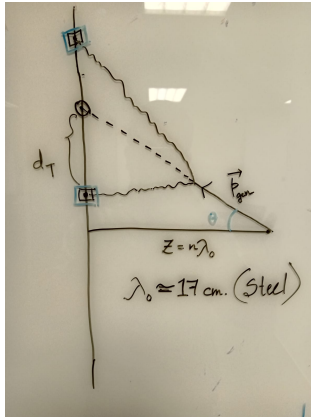
Czech Technical University in Prague

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1. Investigated shower size in order to estimate parameters for clustering algorithm.
  - ▶ Neutrons are generated using the particle gun of ddsim
  - ▶ 1 neutron/event, 100k events and  $E=5$  GeV
  - ▶  $130^\circ < \theta < 177^\circ$
2. Performed a basic QA of simulation campaign.

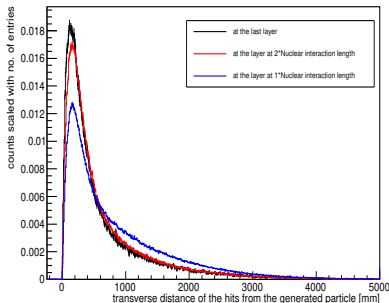
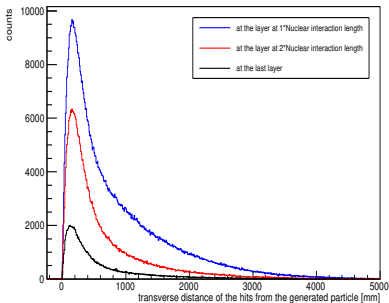




Distribution of  $d_T$  has been studied in the following slides.



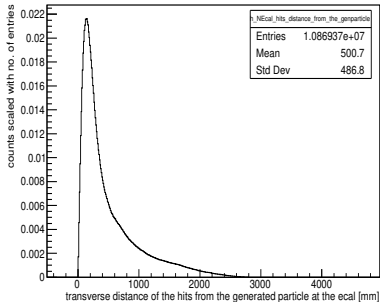
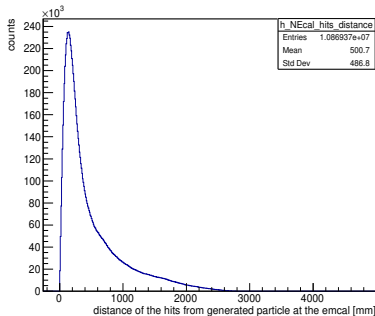
# Transverse size of the shower at different layers at nHCal



1. The shower is very wide, fraction of hits within 30cm is:
  - ▶ 31.21% at 1  $L_0$
  - ▶ 41.74% at 2  $L_0$
  - ▶ 41.74% at the last layer
2. Shower is very wide due to many interactions starting in nECal material.



# Transverse size of the shower at the ECal



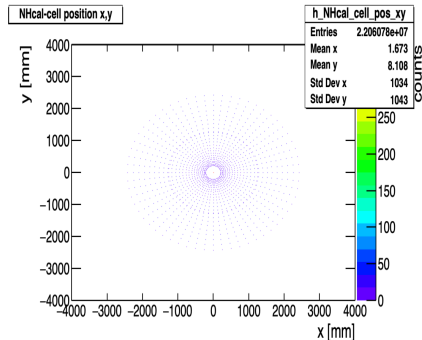
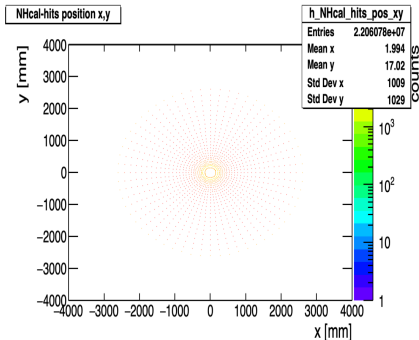
All the hits are at  $z = -1840$  mm. and Percentage of distances that fall within 30 cm turns out to be 49.86% at the Ecal.



- ▶  $\pi^-$  from Geometry version 22.10.0 epic brycecanyon



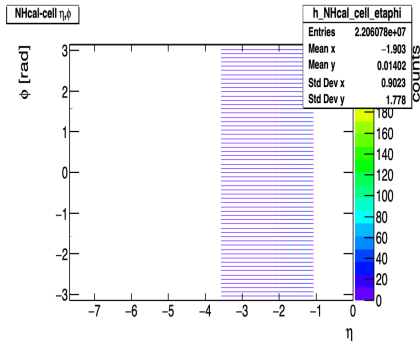
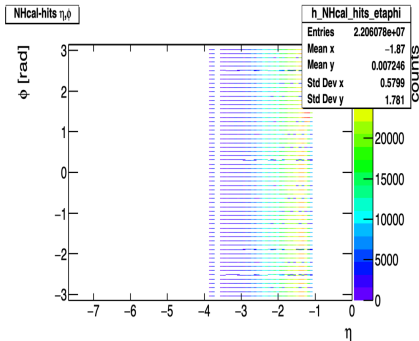
# Position of the Reconstructed Hits and the Cells



Some of the Hits are placed outside the center of segmentations.  
 $R_{min}$  and  $R_{max}$  for the cells are at 215 mm, and 2425 mm and those of the hits are at 155 mm and 2605 mm.



# Position of the Reconstructed Hits and the Cells

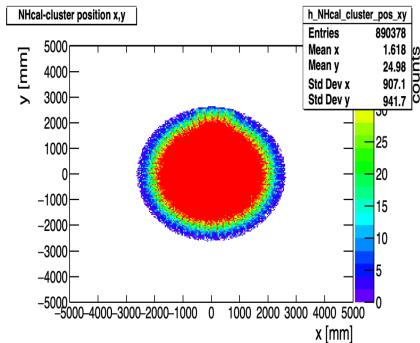


$R_{min}$  and  $R_{max}$  for the cells are at 215 mm, and 2425 mm, and those of the hits are at 155 mm and 2605 mm. And the change in the  $R_{min}$  (60 mm) in the inner region has been clearly captured here.

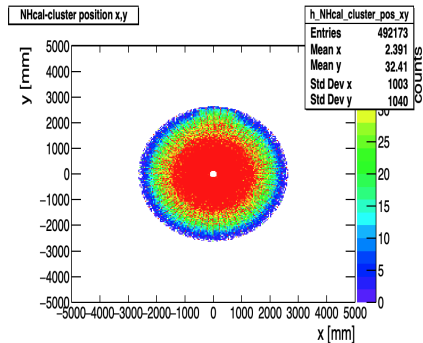




# nHCal cluster position



eicrecon

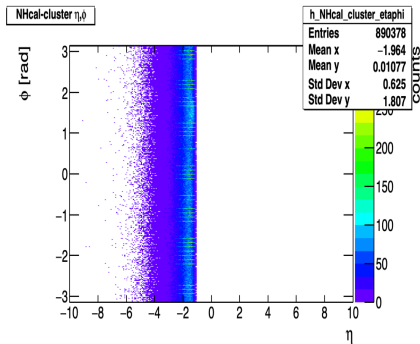


juggler

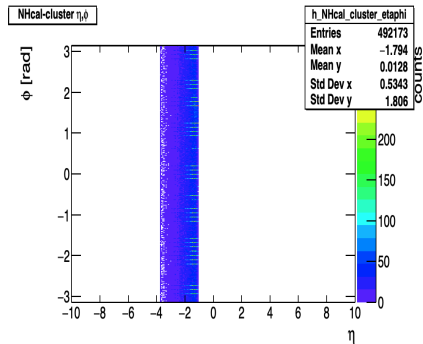
- Eicrecon showing clusters even in the region inner to the nHCal.



# nHCal cluster position



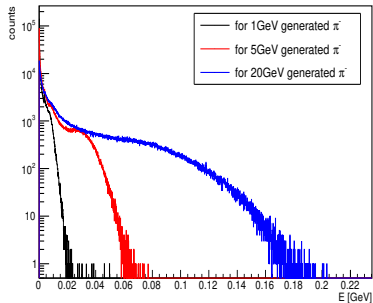
eicrecon



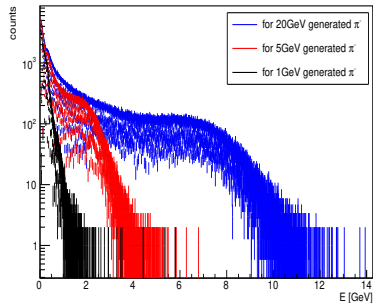
juggler

- Eicrecon showing clusters even in the region inner to the nHCal.



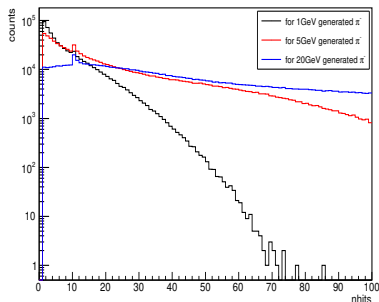


eicrecon

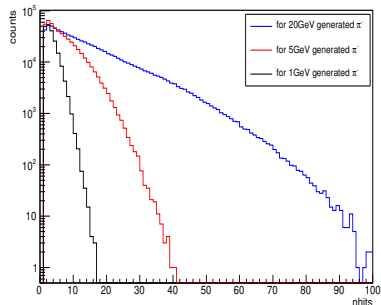


juggler





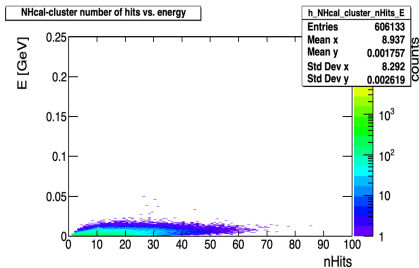
eicrecon



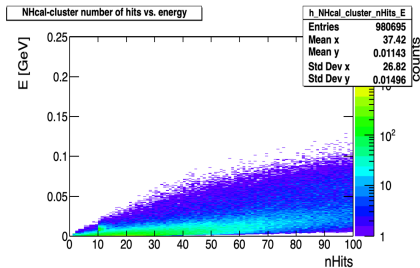
juggler



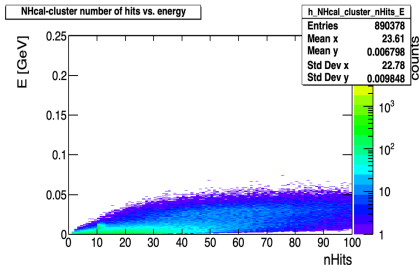
# nHCal cluster Energy vs. nHits



1 GeV



20 GeV

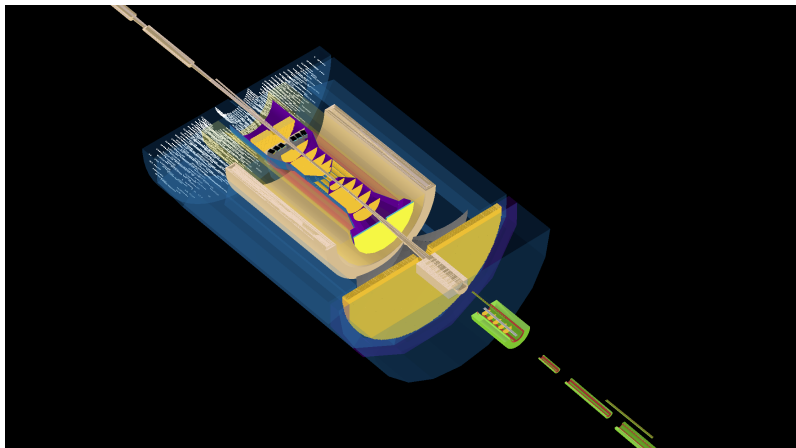


5 GeV

eicrecon



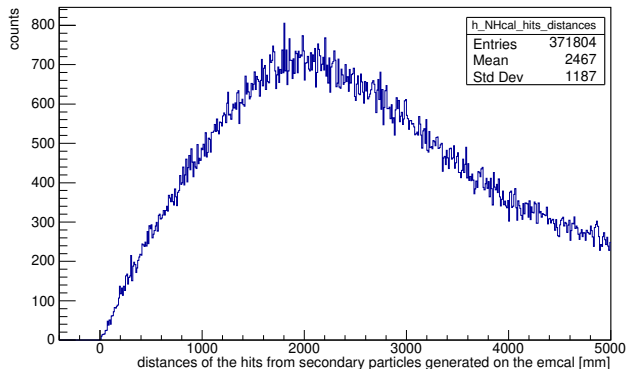
# Thank You



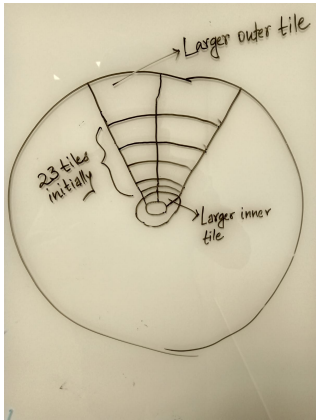
BACK UP



# Transverse distances of the hits at $2 \times$ interaction length in nHcal for secondary particles originating at the emcal

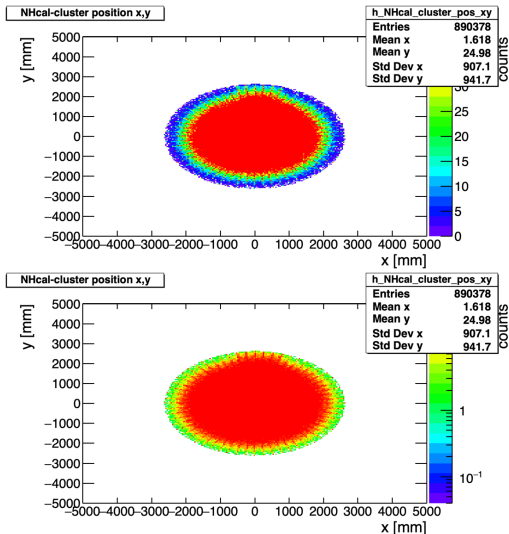




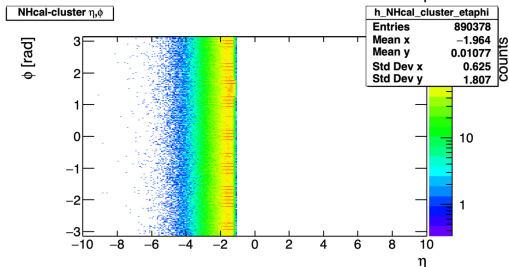
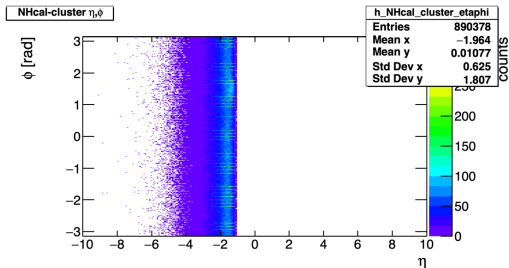




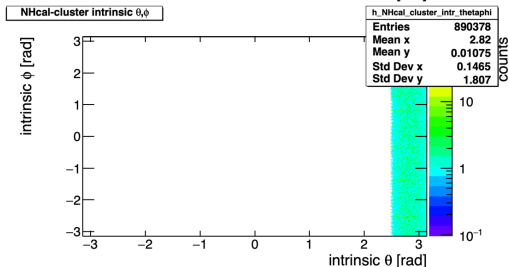
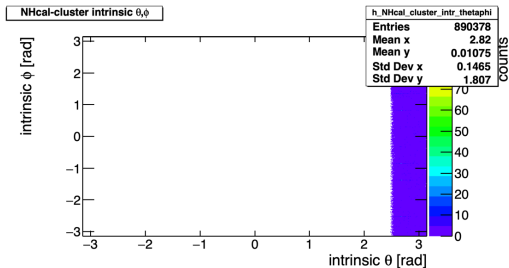
# Reconstructed nHCal cluster x-y distribution : Neutron Gun



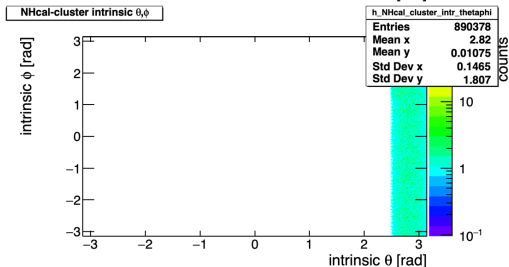
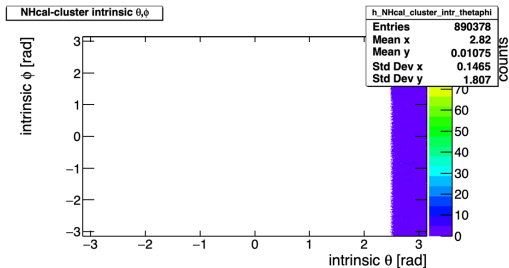
# Reconstructed nHCal cluster eta-phi distribution : Neutron Gun



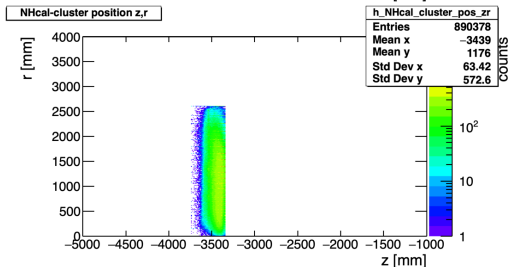
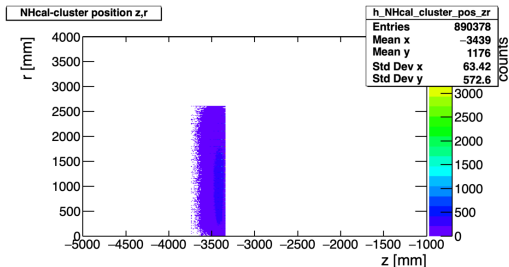
# Reconstructed nHCal cluster intrinsic $\theta - \phi$ distribution : Neutron Gun



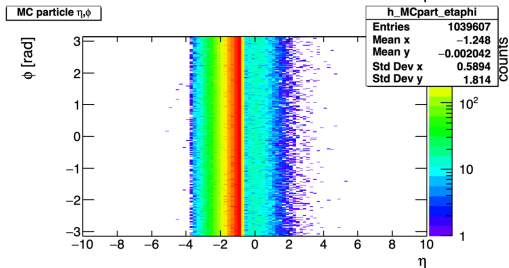
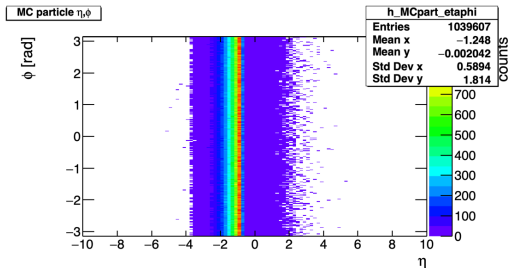
# Reconstructed nHCal cluster intrinsic $\theta - \phi$ distribution : Neutron Gun



# Reconstructed nHCal cluster r-z distribution : Neutron Gun

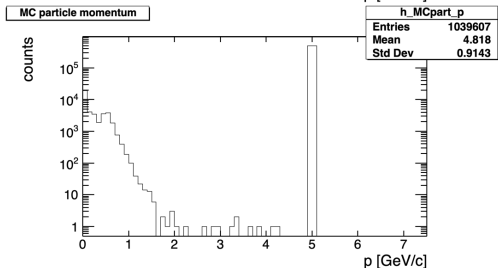
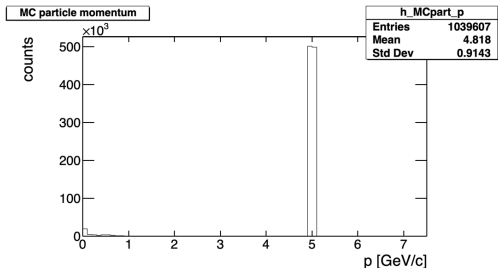


# $\eta - \phi$ distribution of MC particles : Neutron Gun

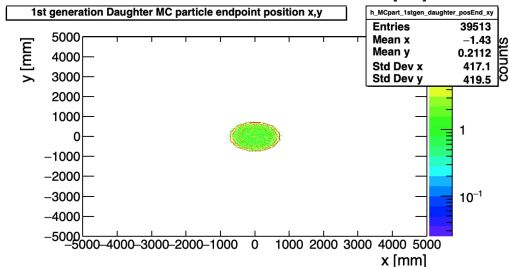
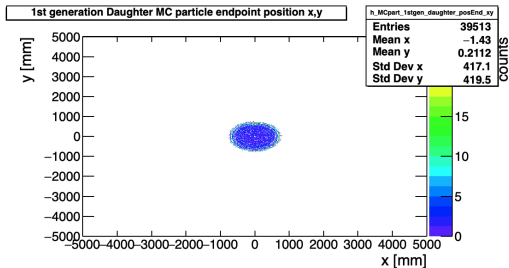




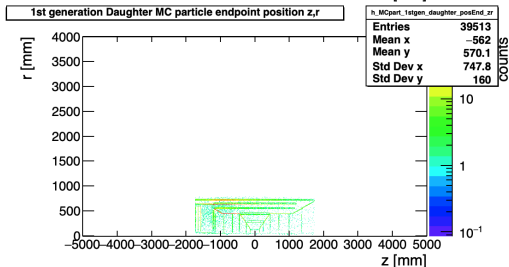
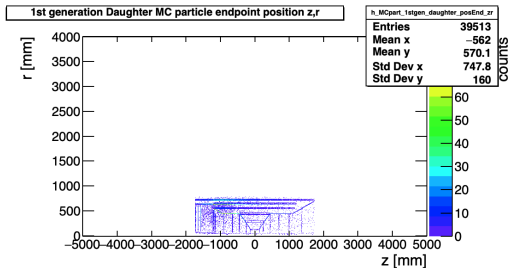
# Momentum distribution of MC particles : Neutron Gun



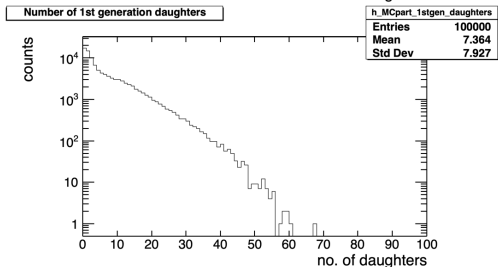
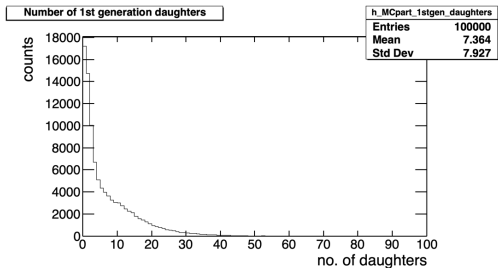
# End point of the 1st generation daughter MC particles : Neutron Gun



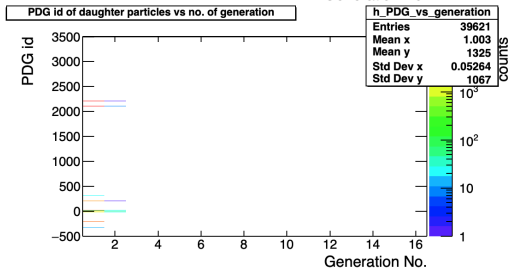
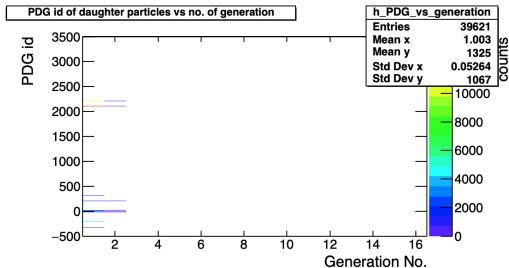
# End point of the 1st generation daughter MC particles : Neutron Gun



# Number of 1st generation daughter MC particles : Neutron Gun



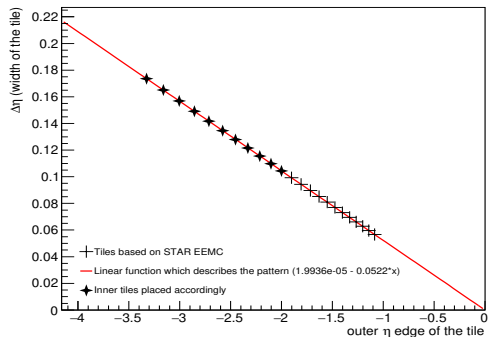
# PDG Id of daughter MC particles vs. Generation No. : Neutron Gun



- ▶ Let's find out what pattern is followed by the outer  $\eta$  edges and the  $\eta$  widths.
- ▶ Plot a graph of  $\eta$  width vs. outer  $\eta$  edges and fit it.
- ▶ A linear fit works reasonably well.
- ▶ We get the  $\eta$  width of the tile with outer  $\eta$  edge = -2 and so on.
- ▶ We place the tiles accordingly up to  $\eta = -3.5$ , which now corresponds to  $R = 19.9431$  cm.



# Solution



Current bins in R are defined as follows:

[ 19.9431 cm, 23.7336 cm, 28.0062 cm, 32.7836 cm, 38.0859 cm,  
43.9297 cm, 50.3297 cm, 57.2972 cm, 64.8401 cm, 72.966 cm, 81.6805  
cm, 90.9878 cm, 100.89 cm, 111.395 cm, 122.516 cm, 134.229 cm,  
146.58 cm, 159.546 cm, 173.155 cm, 187.424 cm, 202.377 cm, 218.019  
cm, 234.353 cm, 251.444 cm ]

