Update of Straws L1

UNIVERSITÀ DI PISA

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Collaboration Meeting

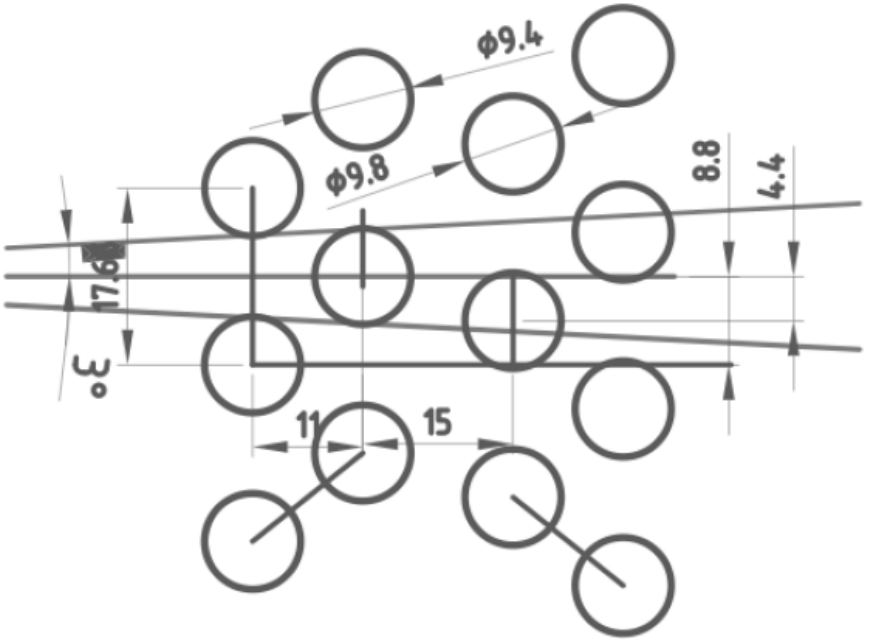
01/09/2014

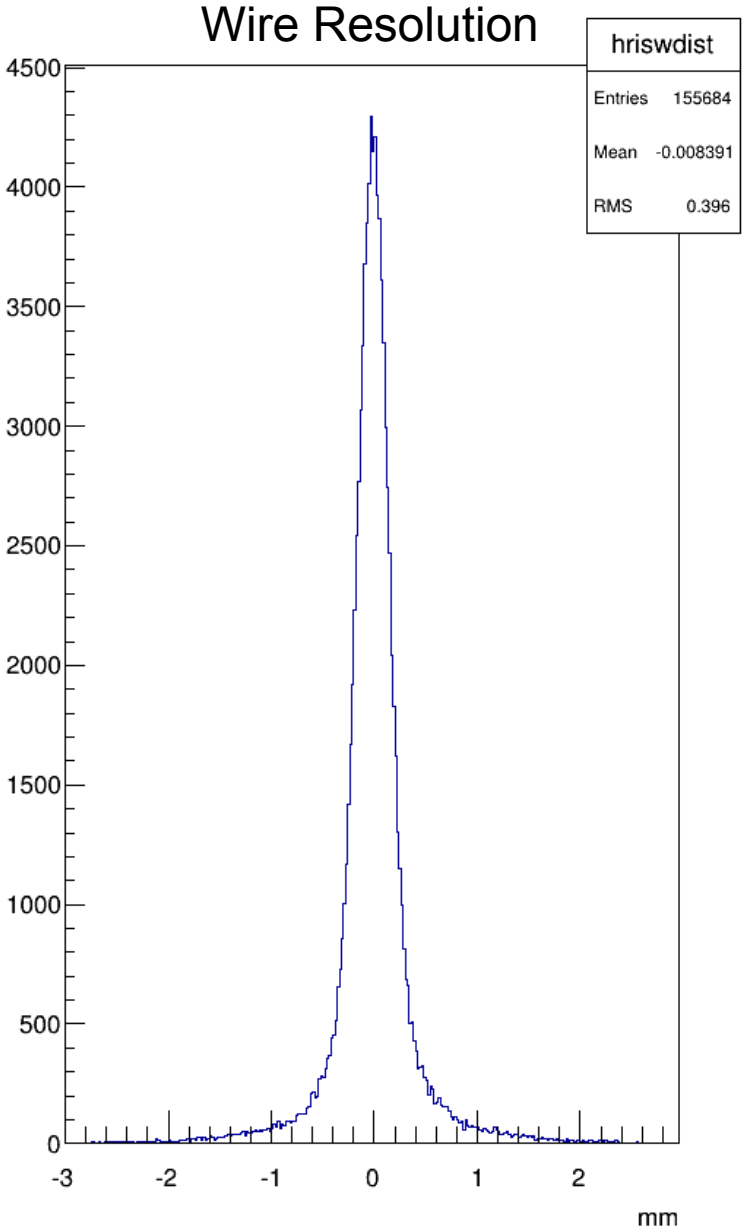
Data and Parameters

- I use data files of signal and main decays generated with NA62MC and selected with Bruno Angelucci L0
- New paramertic MC Straw Response (made by Ruggero)
- σ(Trealing Time) = 40 ns
- Data generated with a MC Straw Time windows of 300 ns to study the effects of accidentals

1° clustering

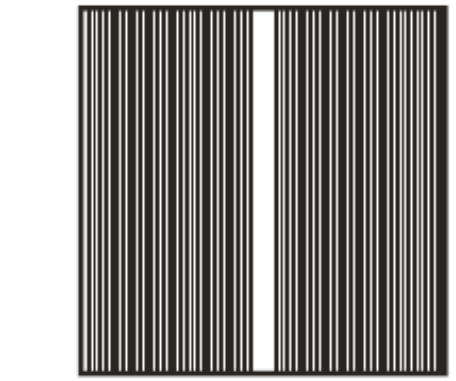
- Clustering inside the view
- 2 point per cluster:
  looping on first 2 layers and second 2 layers
- fine coordinate hit
- Cluster coordinate is the average between the fine coordinate of the two straws



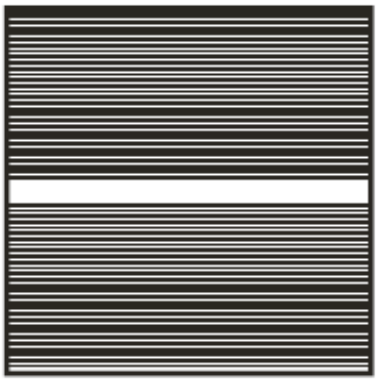


2° clustering

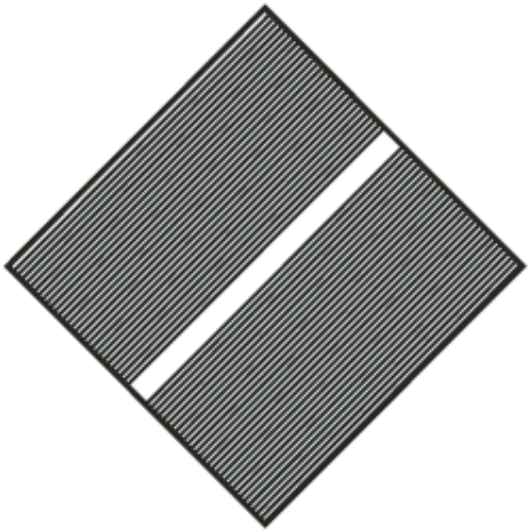
- Clustering inside the chamber
- At least 3 views per cluster
- using the remaing hits to make additional cluster with only 2 views could involves too many fake cluster and increase execution time



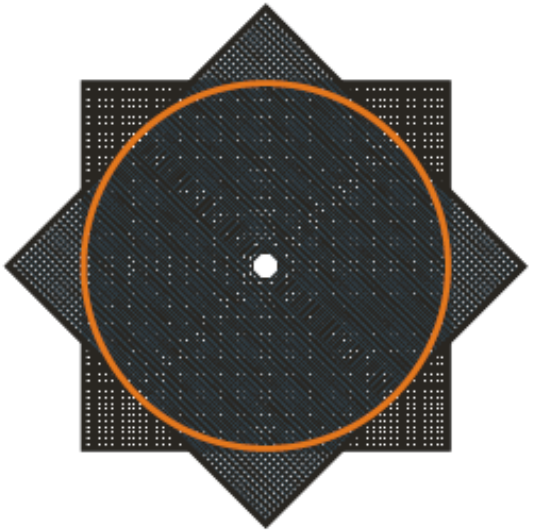
a) X Coordinate View



b) Y Coordinate View



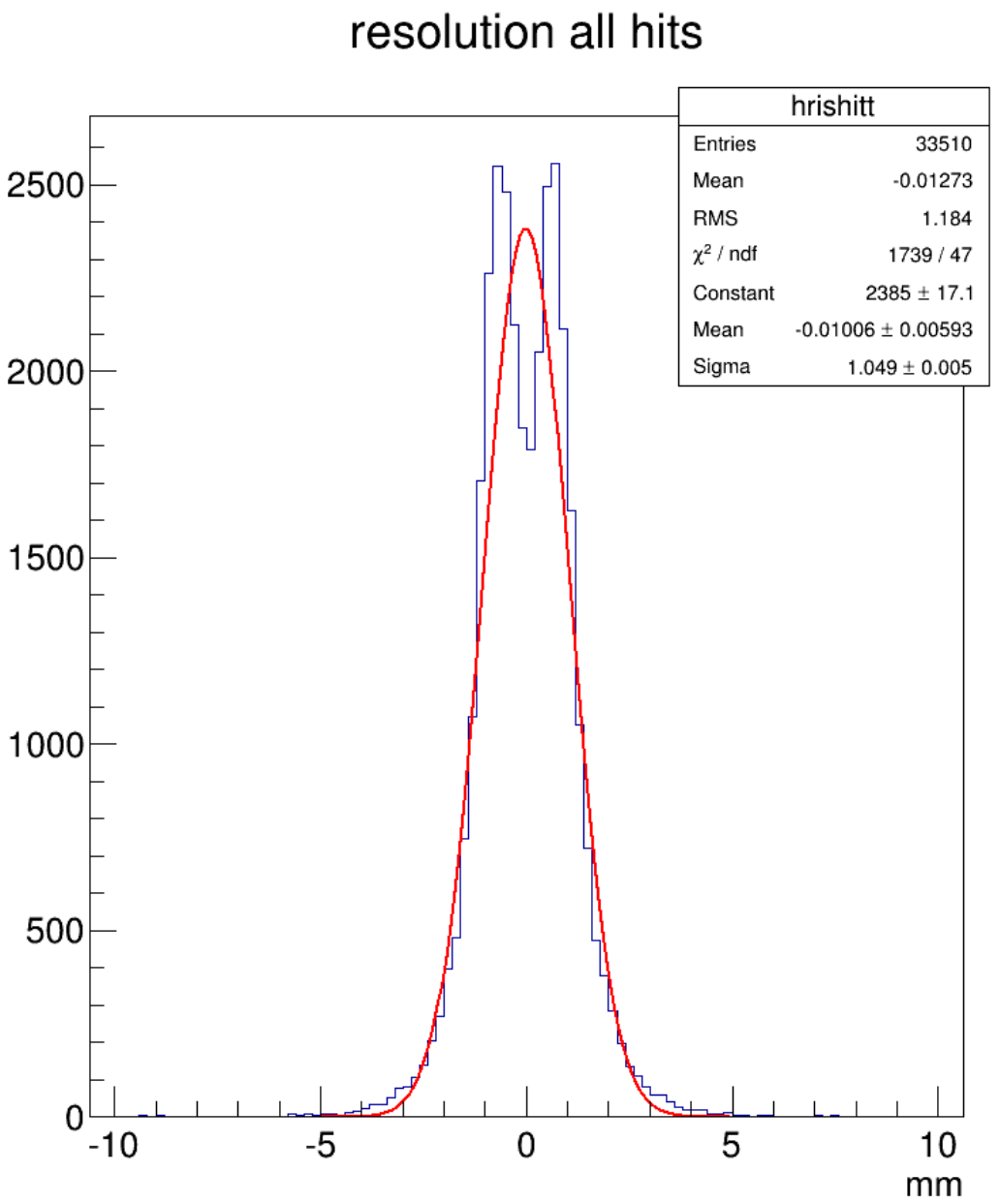
c) U Coordinate View



d) Overlay of four Views

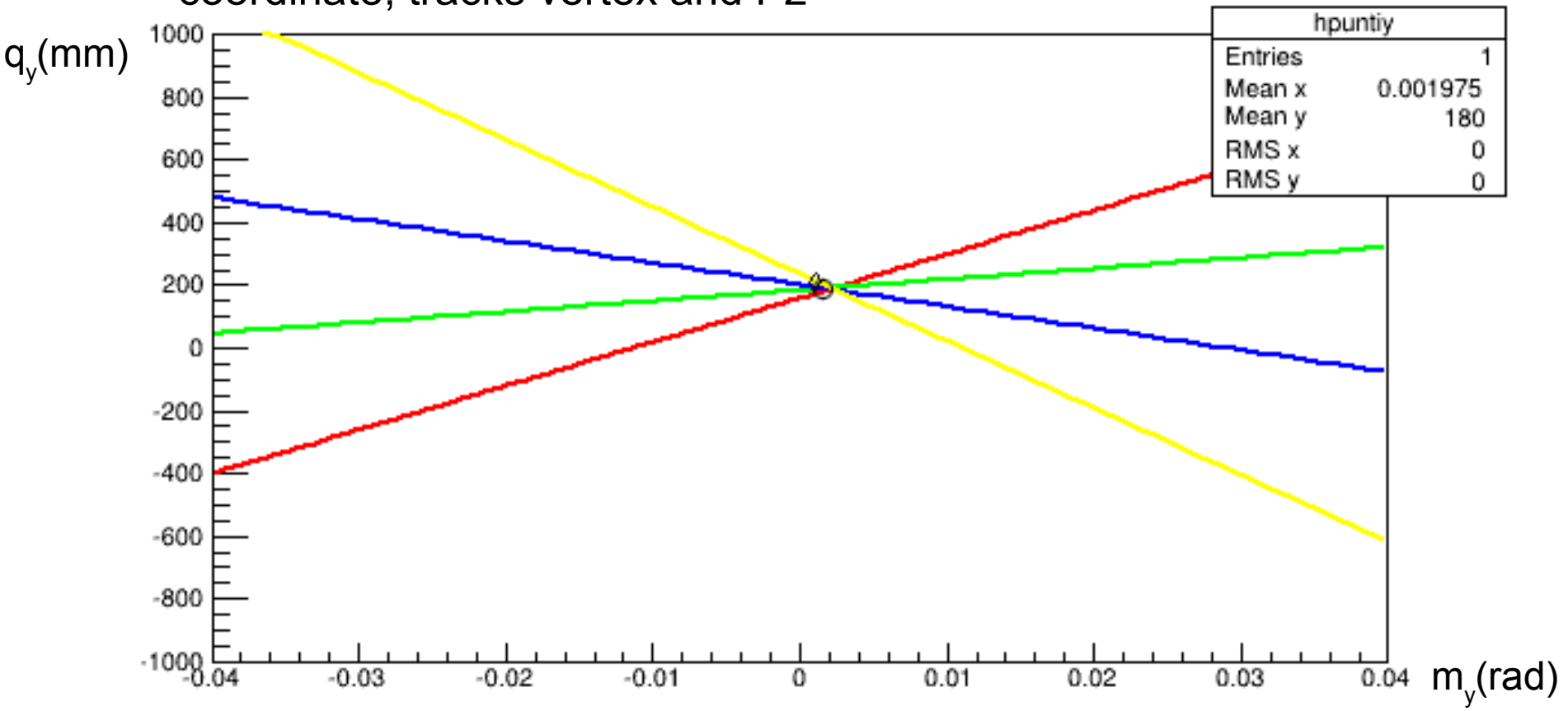
Cluster Resolution

to calcolate the resolution I use projection from decay point



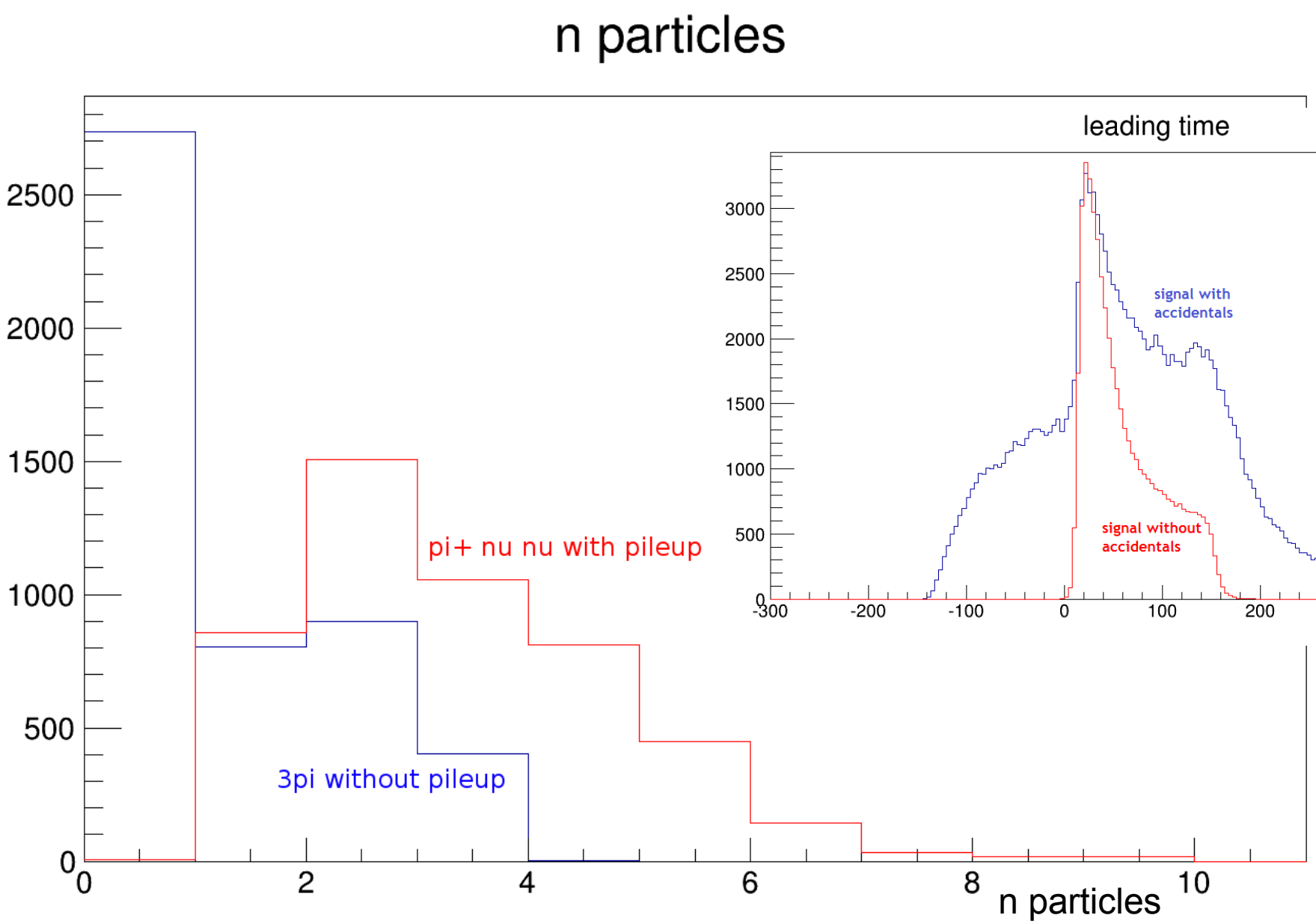
Pattern recognition

- Two-dimensional Hought transform:
  - points (y,z) → sheaf of straight lines (m_y,q_y): $y = m_y * z + q_y$
  - tracks is the intersection (m_y,q_y) of at least 3 straight lines
  - Resolution effects → we even look for intesection of 2 lines with an other line near
  - Pattern recognition used to calculate m_x and q_x of the two trackclets in X coordinate, tracks vertex and Pz

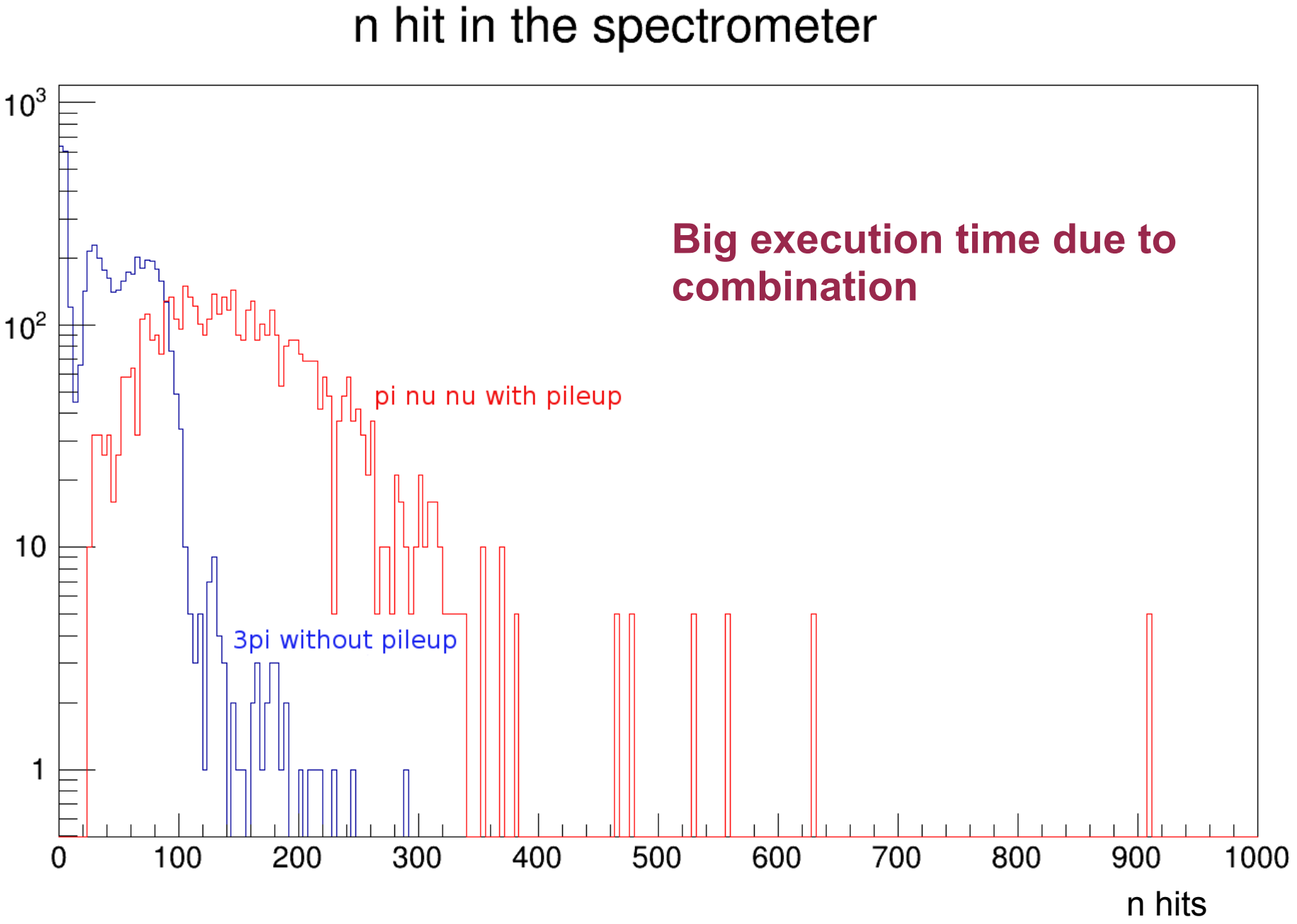


accidentals

- Straw time windows of 300 ns -> pileup of some events

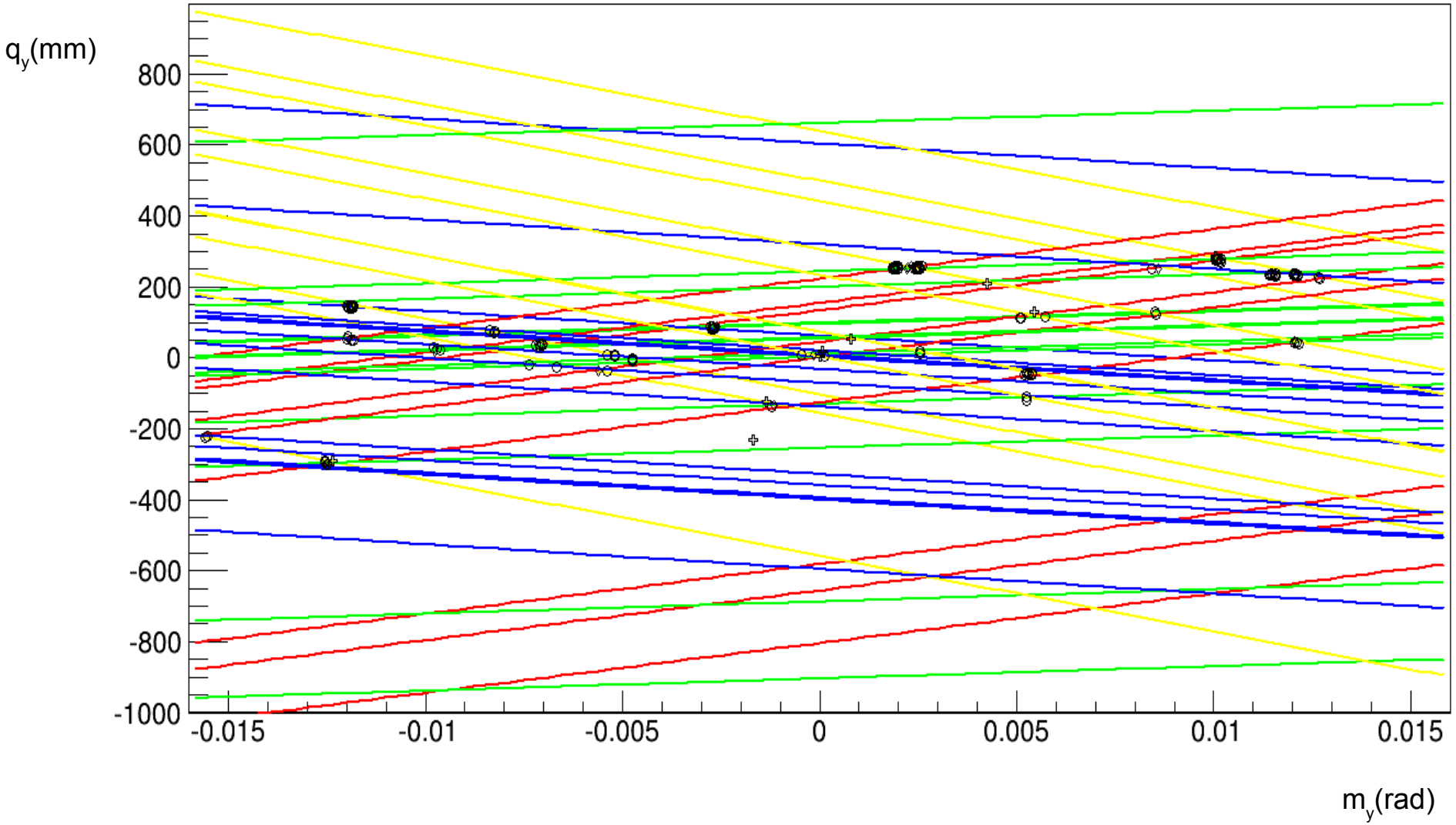


accidentals



accidentals

- An event with 10 particles



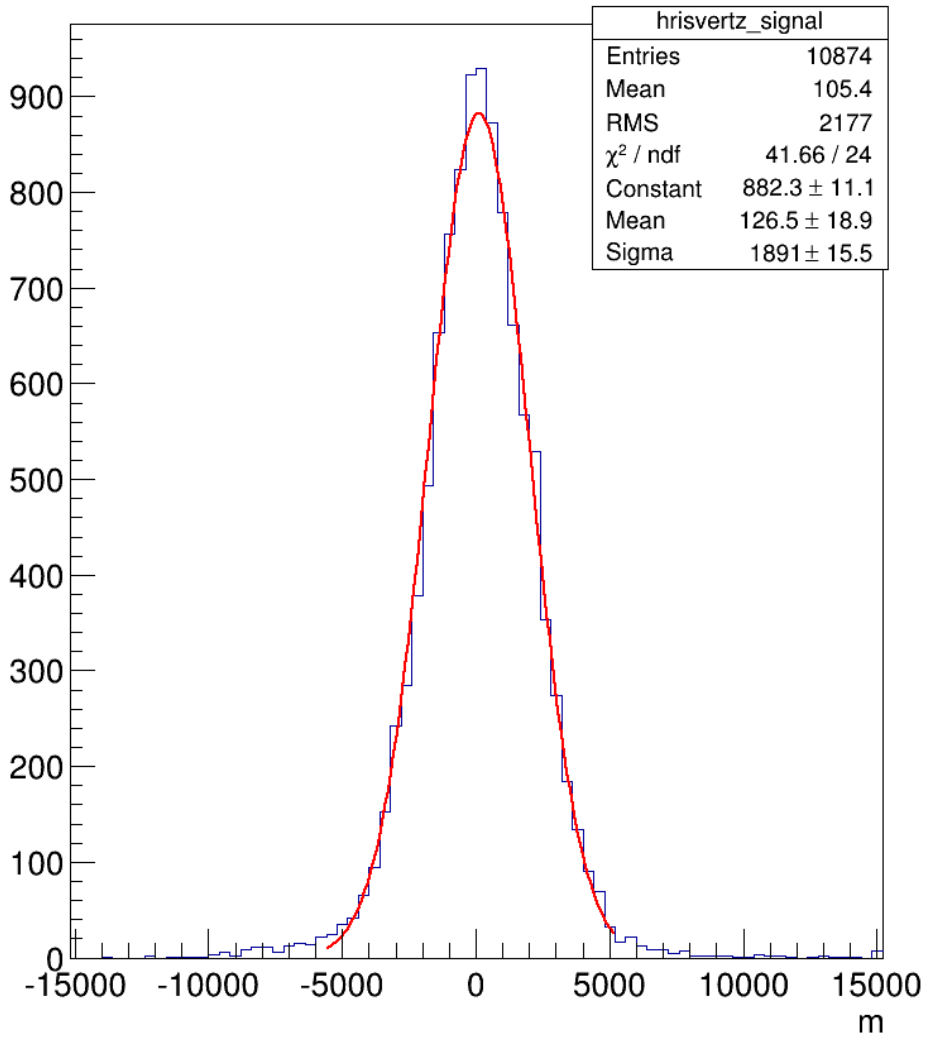
Pattern recognition 2

- To reduce fake track (due to combination) and to remove accidentals:
  - Use only Intersection of line from different chambers
  - Preliminary cut:
    - Cuts over Leading Time and Trailing Time
    - Sum of wire distance of the cluster two hit ~4,4 cm
    - Δq_x at the magnet inside ~2,6 cm
    - Track projections should be inside muv2 acceptance

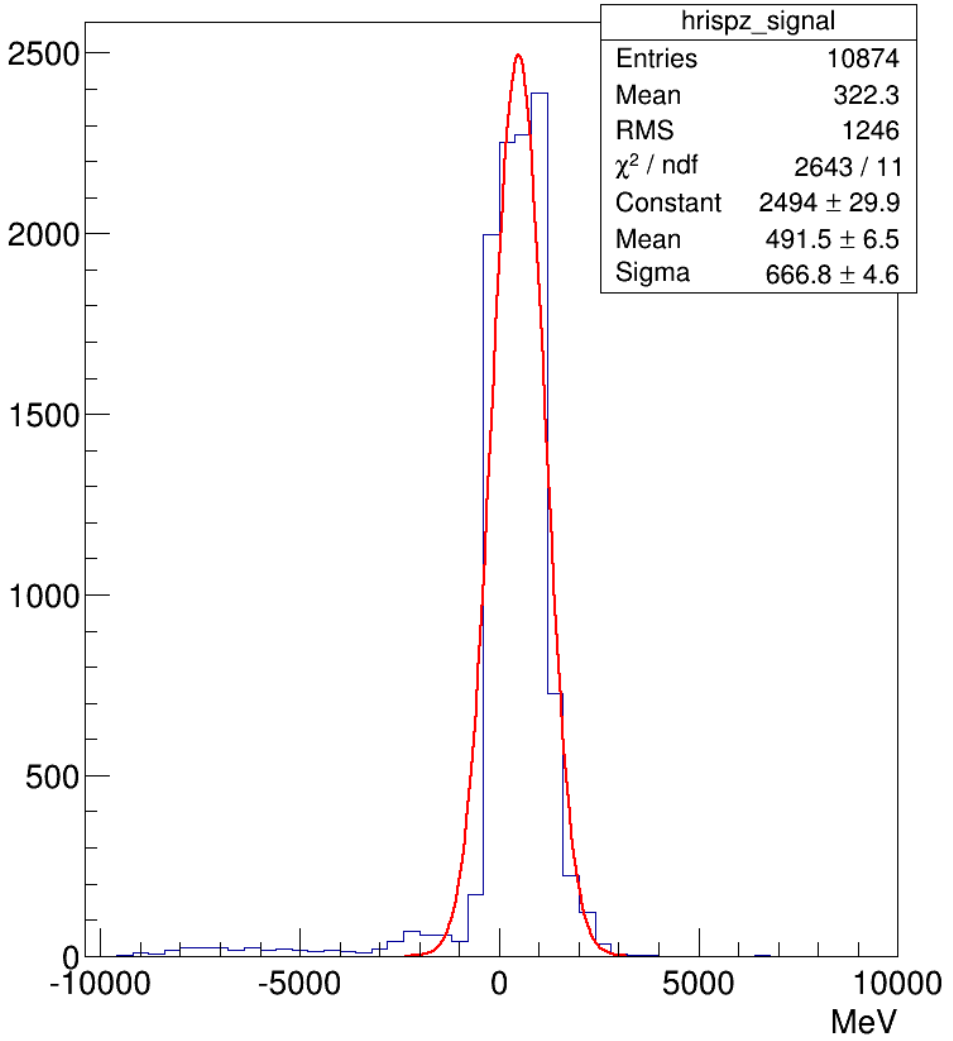
A note with all the details over algorithm and cuts will be ready soon

Track resolution

signal resolution z vertex



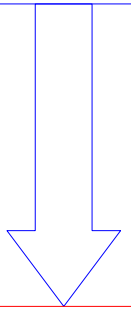
signal resolution pz



Z vertex sigma ~1,9 m
Pz sigma ~ 0,66 GeV

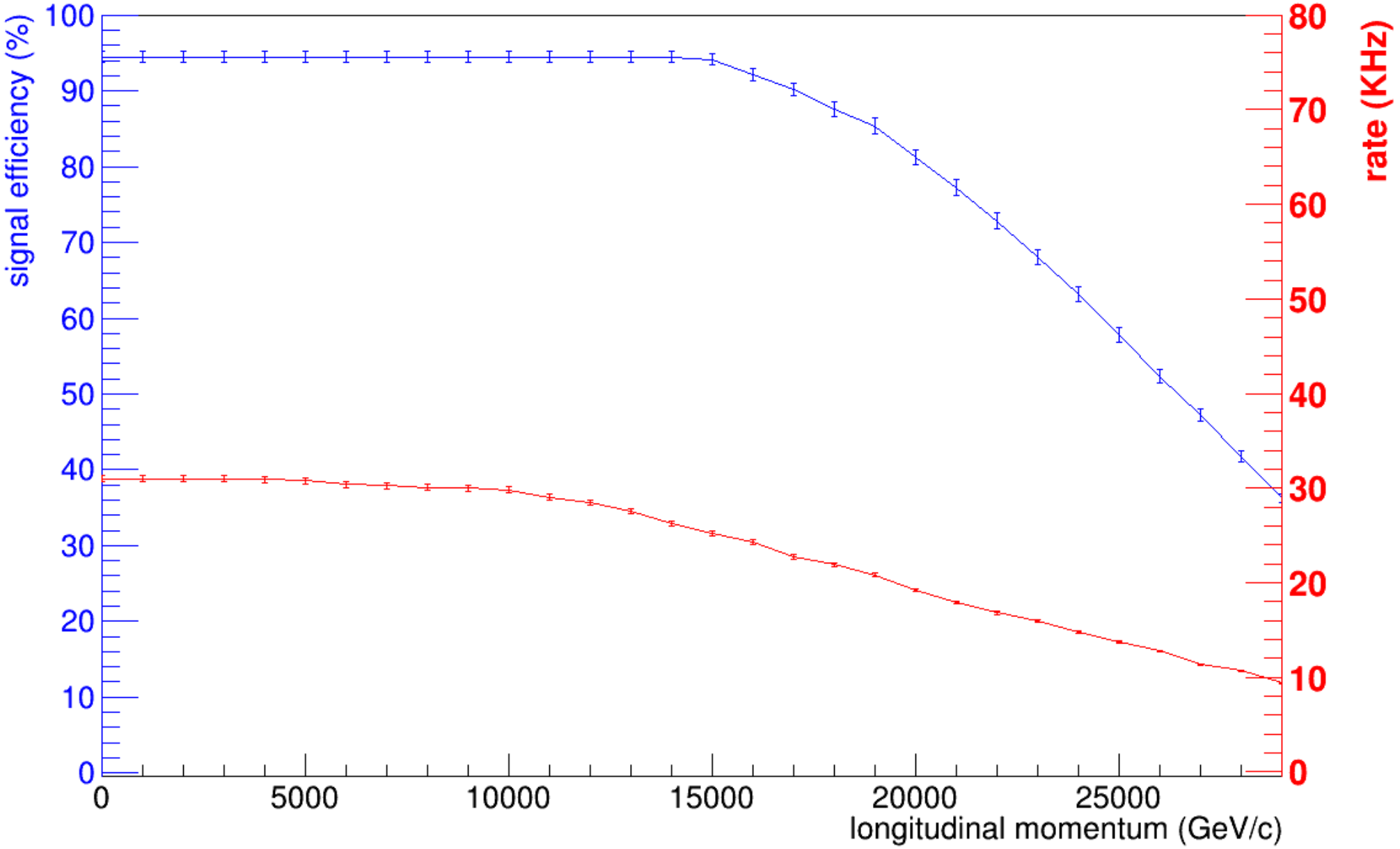
L1 STRAW cut

- 90 m < z vertex < 180 m from target
- 5 Gev < Pz < 40 Gev

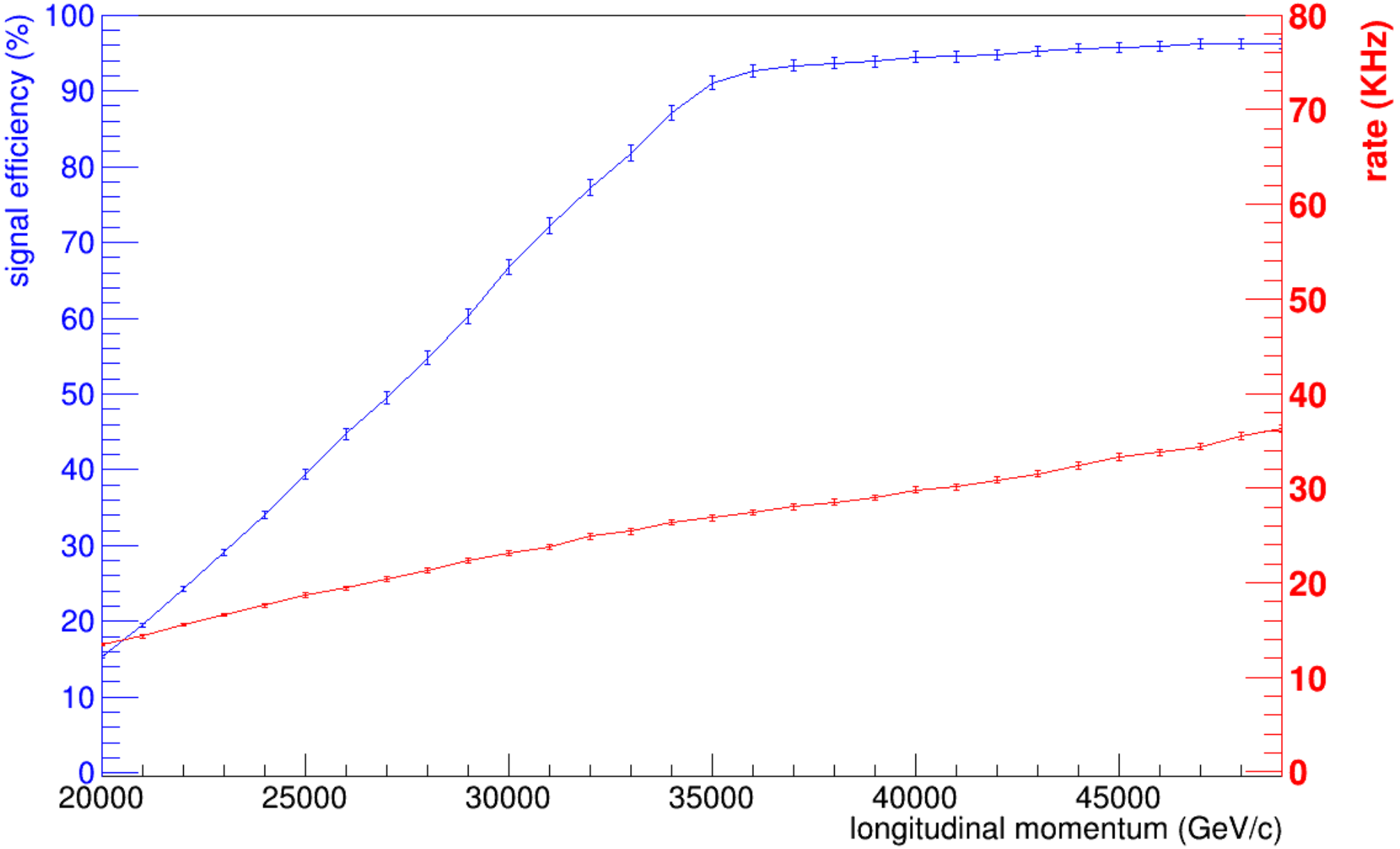


Signal efficiency = 94.2% , err = 0.7 %

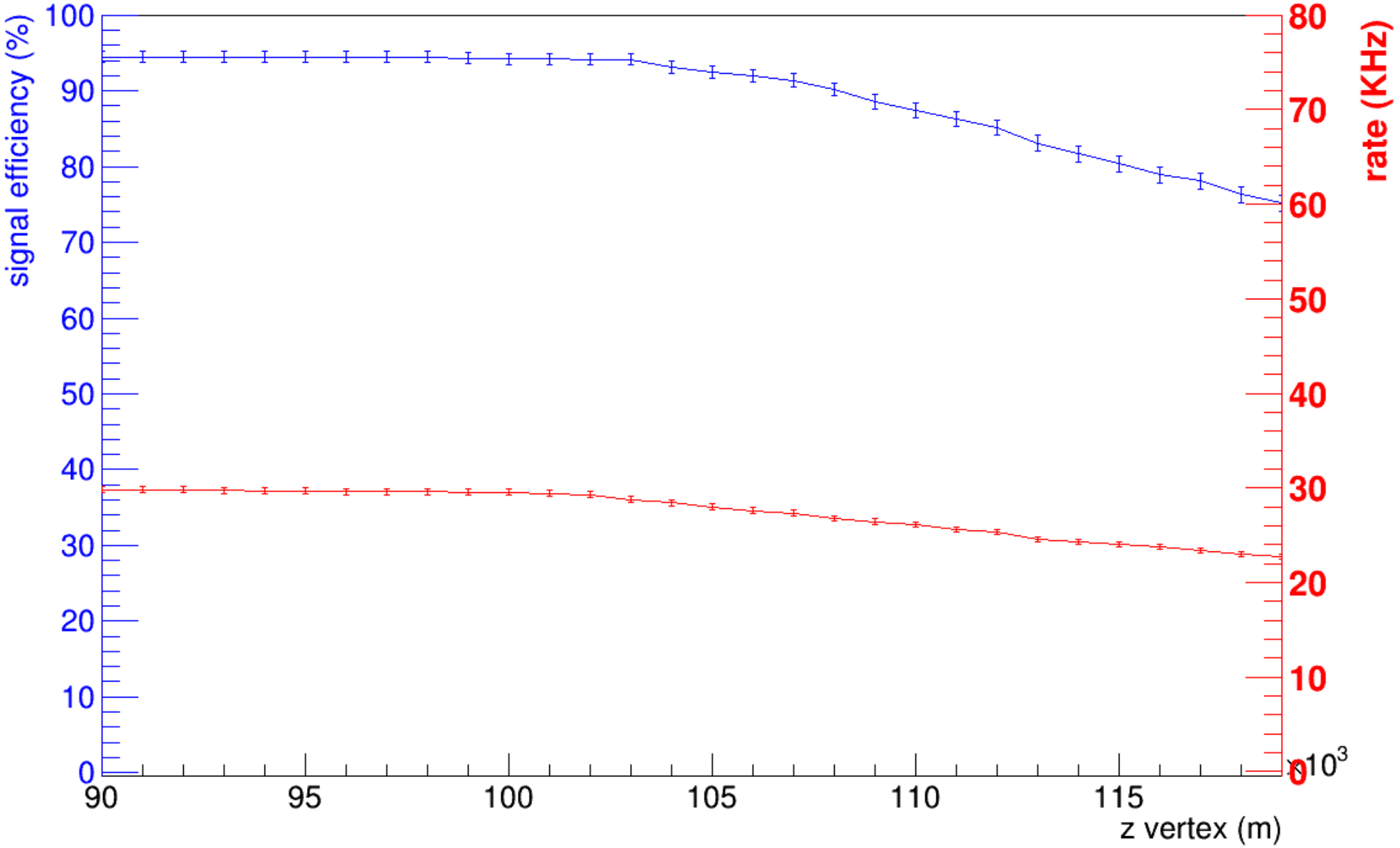
Pz cut


signal efficiency (%)
rate (KHz)
longitudinal momentum (GeV/c)
0
10
20
30
40
50
60
70
80
90
100
0
5000
10000
15000
20000
25000

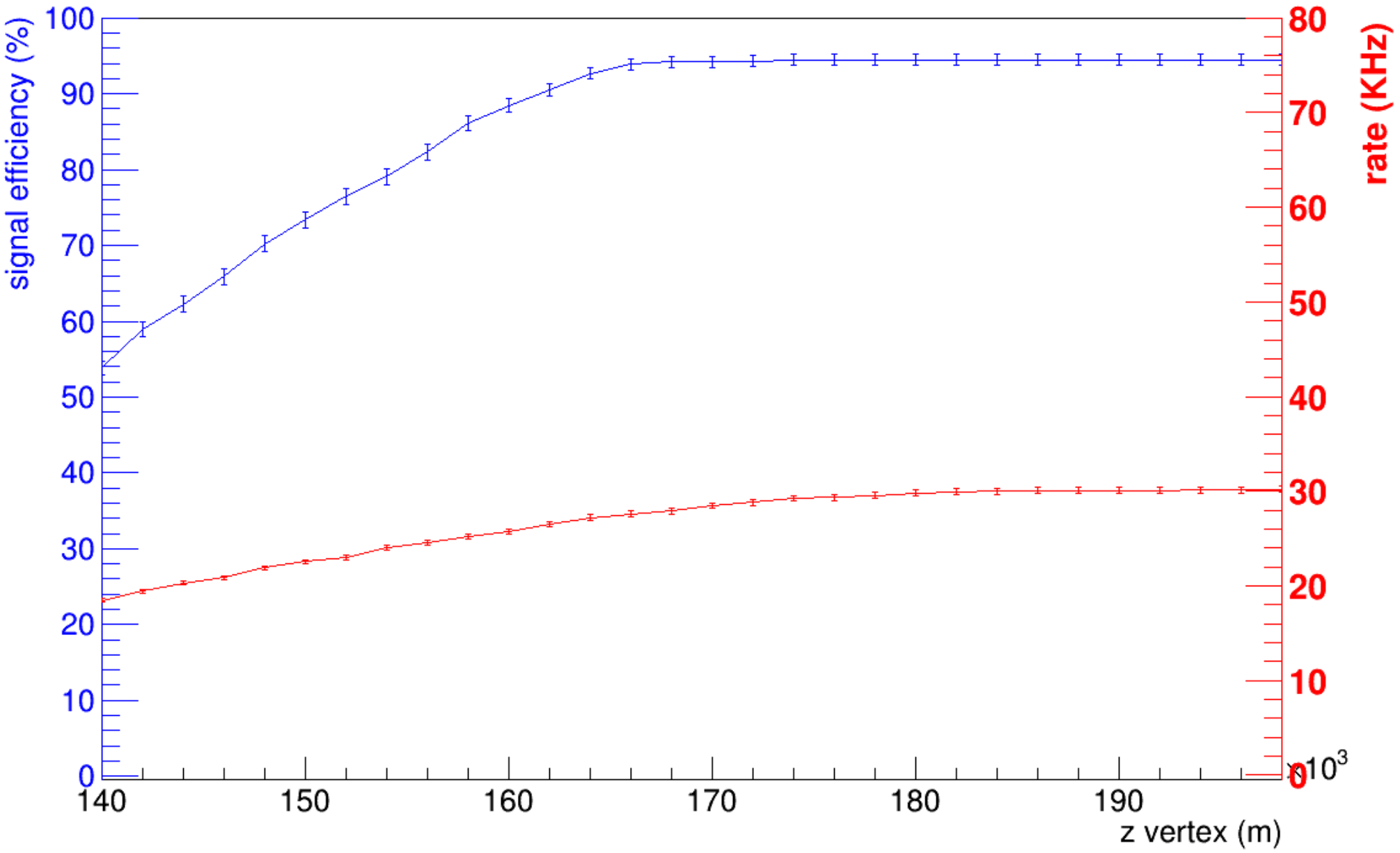
Pz cut


signal efficiency (%)
rate (KHz)
longitudinal momentum (GeV/c)
0
10
20
30
40
50
60
70
80
90
100
20000
25000
30000
35000
40000
45000

z vertex cut


signal efficiency (%)
rate (KHz)
z vertex (m)
$\times 10^3$
100
90
80
70
60
50
40
30
20
10
0
80
70
60
50
40
30
20
10
0
90
95
100
105
110
115

z vertex cut

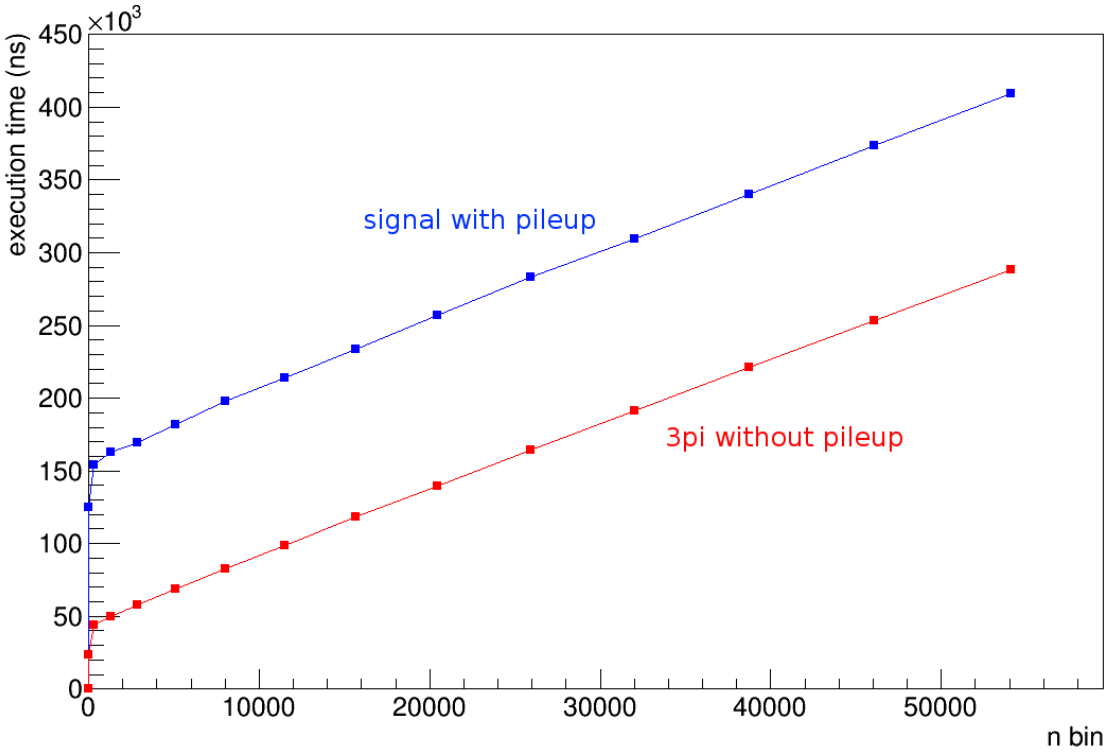

signal efficiency (%)
rate (KHz)
z vertex (m)
×10^3
100
90
80
70
60
50
40
30
20
10
0
140
150
160
170
180
190

Preliminary L1 Result

L0 rate with accidentals from Giuseppe Ruggero Note NA62-14-01 and from Bruno Angelucci Slide in this meeting

Process	rejection factor	Rate after STRAW L1 (KHz) using Giuseppe L0	Rate after STRAW L1 (KHz) using Bruno L0 rate
$K_{\mu 2}$	4,9	2,3	29,2
$K_{\mu 3}$	3,2	2,2	2,3
K_{e3}	2,6	5,1	12,9
$\pi^+\pi^0$	5,2	7,5	30,3
$\pi^+\pi^+\pi^-$	2,8	12,3	12,3
$\pi^+\pi^0\pi^0$	4,3	0,3	0,6
Muons upstream (90% confidence level)	>13,9	<1,6	<12,2
Beam π^+ (90% confidence level)	>4,8	<10	<15,9
total		<41,3	<115,7
Signal %		94,4 %	94,4 %

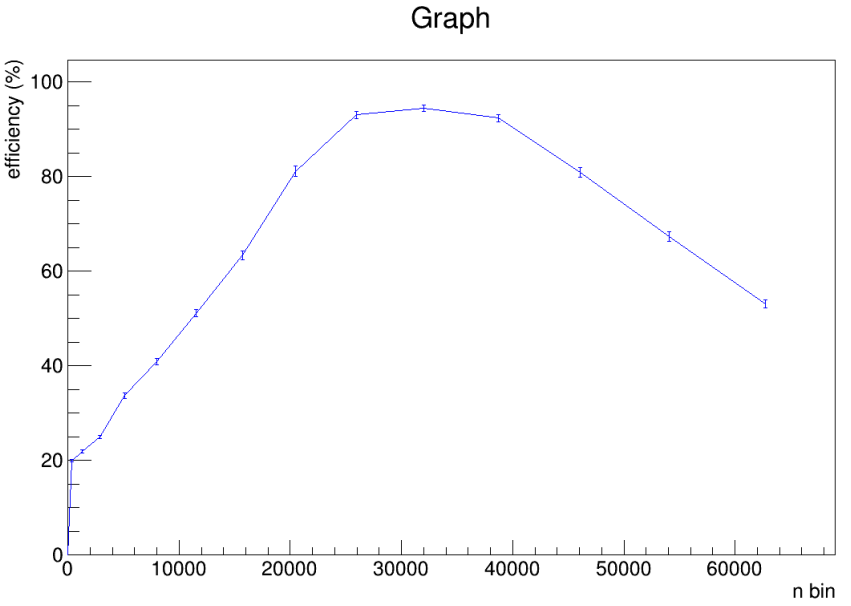
Execution Time



Big execution time that depend by the dimention of hought matrix on CPU

160 x 200 bin:

- 1° clustering= 84 µs
- 2° clustering= 41 µs,
- Pattern recognition = 186 µs



TO DO:
To implement algorithm on GPU