Background study and reconstruction efficiency in preparation for Run7 Au+Au data taking

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Outline

Summary

Double Hijing study
- Acceptance
- Occupancy
- Multiplicity

Reconstruction efficiency vs acceptance
- Signal extraction
- Acceptance and efficiency
- Some conclusions

Modifications to the cluster fit
- Embedding in double Hijing
- Embedding in Real Data
- Comparing Hijing and RD
- More conclusions

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Summary

Aim:

- Quantify how much disactivating more anodes lowers the acceptance (and occupancy) and possibliy increases the efficiency.
- Study if we can improve the efficiency when tunning the cluster fit.

Setup:

- Focus on North arm since it has the limiting efficiency. Variations in the acceptance is made desactivating anodes of station 0.
- Double hijing files were created merging 2 single hijing files, in 10% centrality bins.
- Pure jpsi were simulated and embedded in $\sim$10k double hijing events and $\sim$10k Au-Au events.

These slides show:

- Study of double Hijing: occupancy and multiplicity.
- Efficiencies embedding in double Hijing and RD (AuAu) with different anodes configurations.
- Efficiency after changing the cluster fit.

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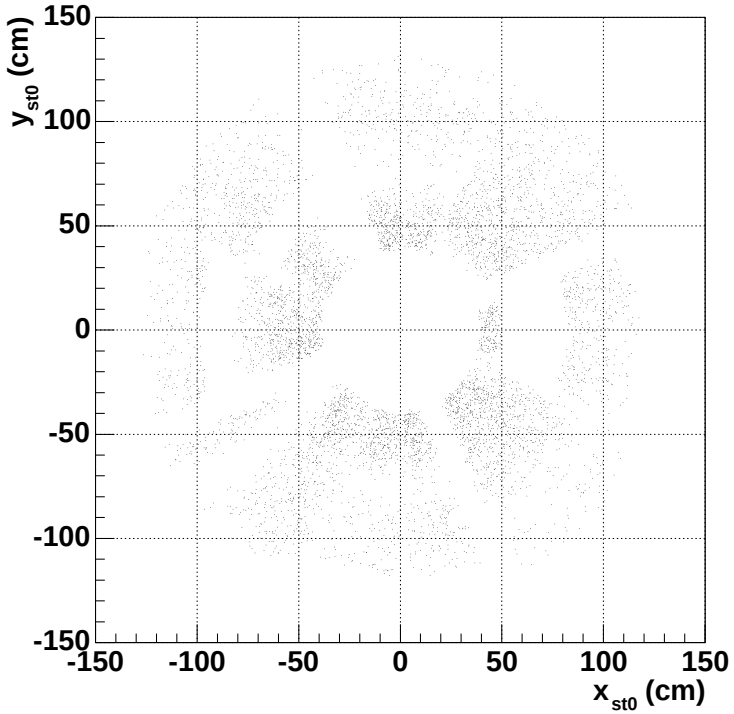
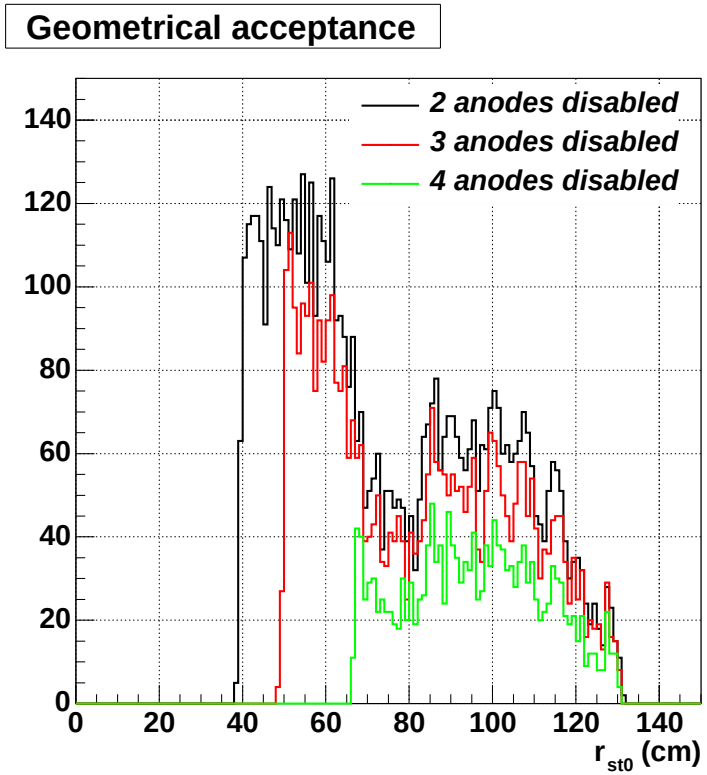
Radiographs, station 0

Radiograph wt 2 layers of anodes disabled



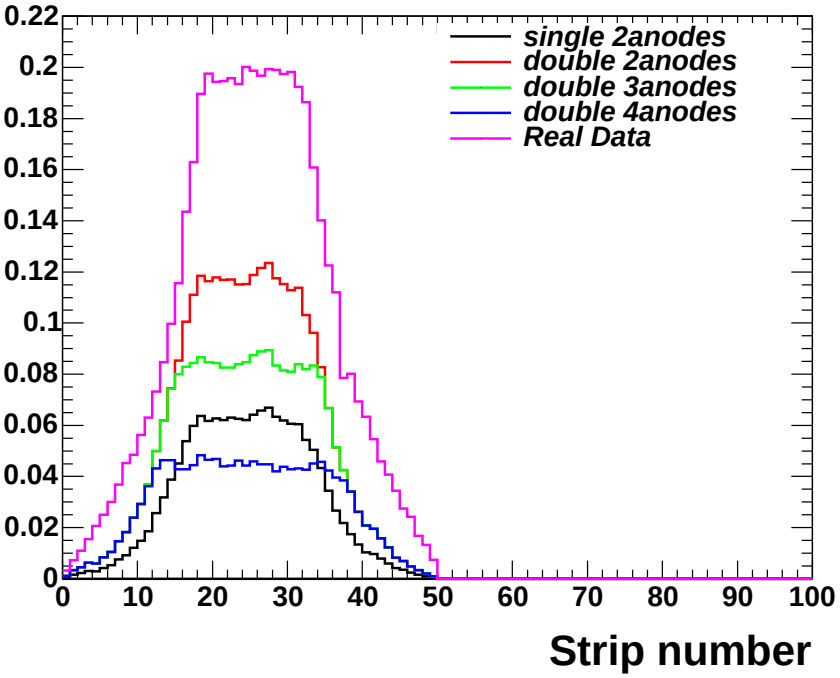
Radial hit distributions



- 2 anodes disabled : $r_{min} \simeq 40$; 2+4 wires disabled.
- 3 anodes disabled : $r_{min} \simeq 50$; +10 wires disabled.
- 4 anodes disabled : $r_{min} \simeq 66$; +16 wires disabled.

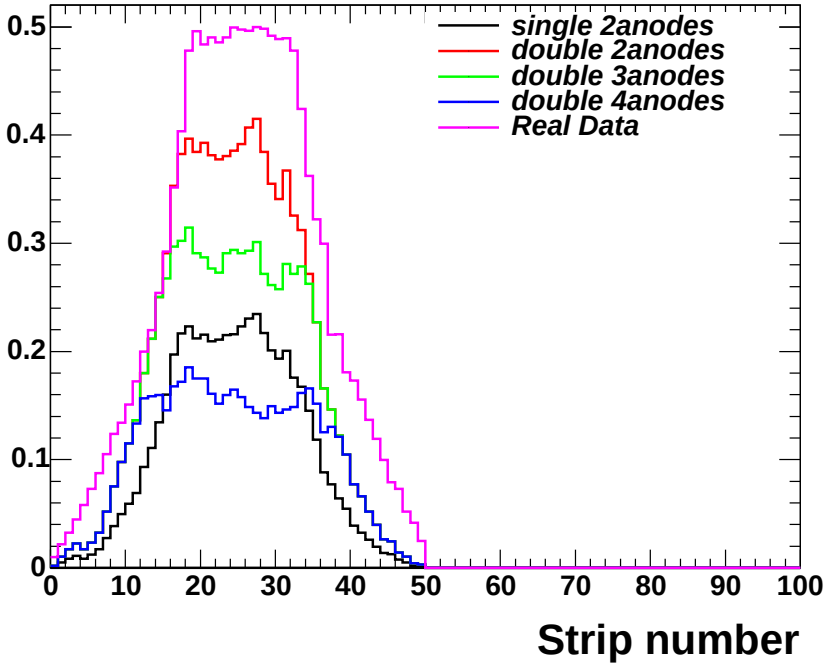
Occupancy, cathode=1

Min Bias



	mean	max
single hijing, 2 anodes	3.1%	6.3%
double hijing, 2 anodes	5.8%	11.7%
double hijing, 3 anodes	4.7%	8.5%
double hijing, 4 anodes	2.9%	4.5%
Real Data	10.1%	19.7%

Centrality [0; 10%]

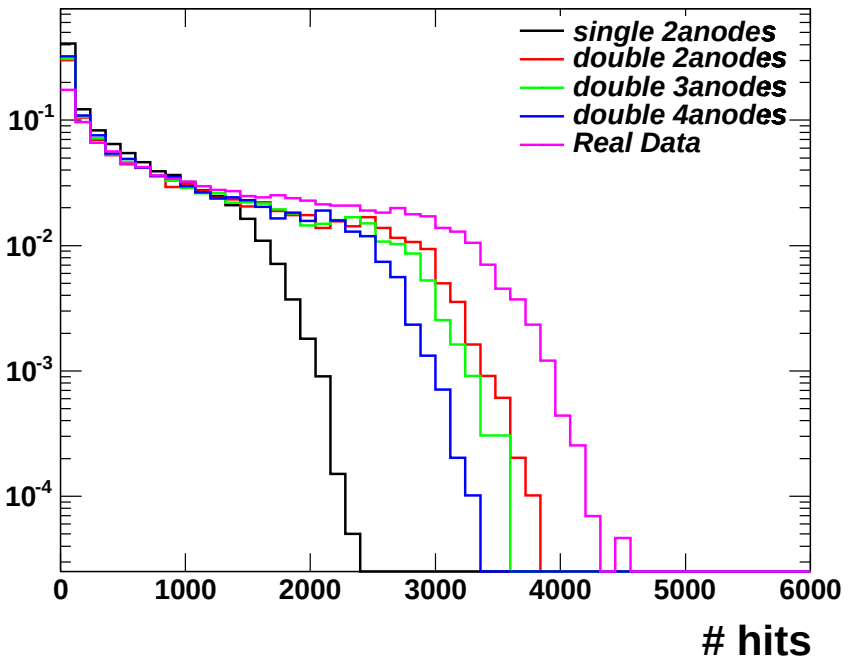


	mean	max
single hijing, 2 anodes	10.54%	21.51%
double hijing, 2 anodes	19.24%	38.28%
double hijing, 3 anodes	15.97%	28.15%
double hijing, 4 anodes	10.36%	15.38%
Real Data	26.14%	49.29%

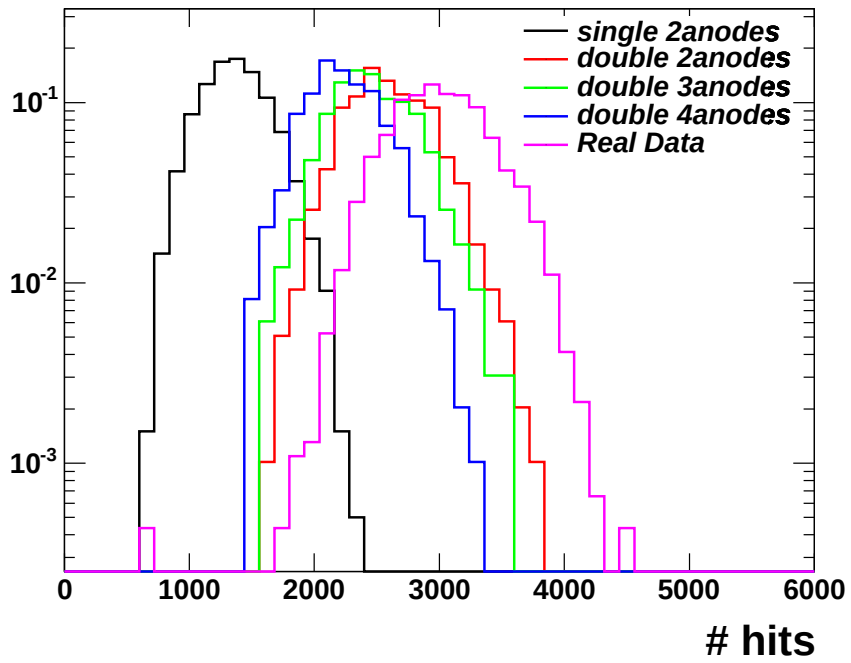
Occupancy in double Hijing $<$ RD, but close.
Drop of $\sim$ 30% ($\sim$ 26%) in minbias (10% central) of the max occupancy when disactivating the 3rd layer of anodes.

Multiplicity

Min Bias



Centrality [0; 10%]



	mean	max
single hijing, 2 anodes	399.87	2200
double hijing, 2 anodes	771.19	3800
double hijing, 3 anodes	726.82	3600
double hijing, 4 anodes	657.29	3300
Real Data	1104.07	4300

	mean
single hijing, 2 anodes	1373.01
double hijing, 2 anodes	2598.09
double hijing, 3 anodes	2462.96
double hijing, 4 anodes	2237.82
Real Data	3011.14

Multiplicity in double Hijing $<$ RD, but close.
Drop of $\sim 5\%$ in the max multiplicity when disactivating anodes.

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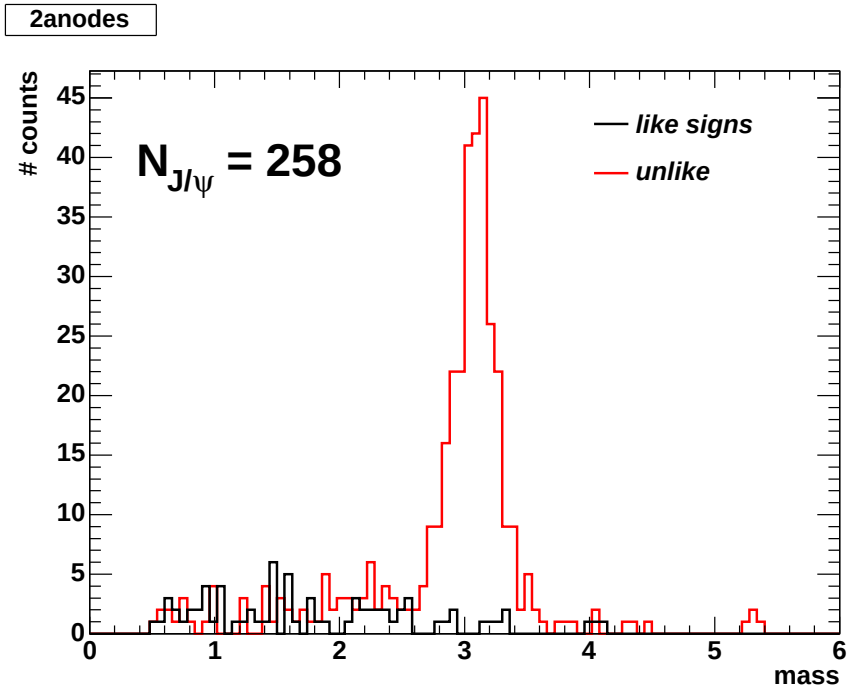
Signal extraction

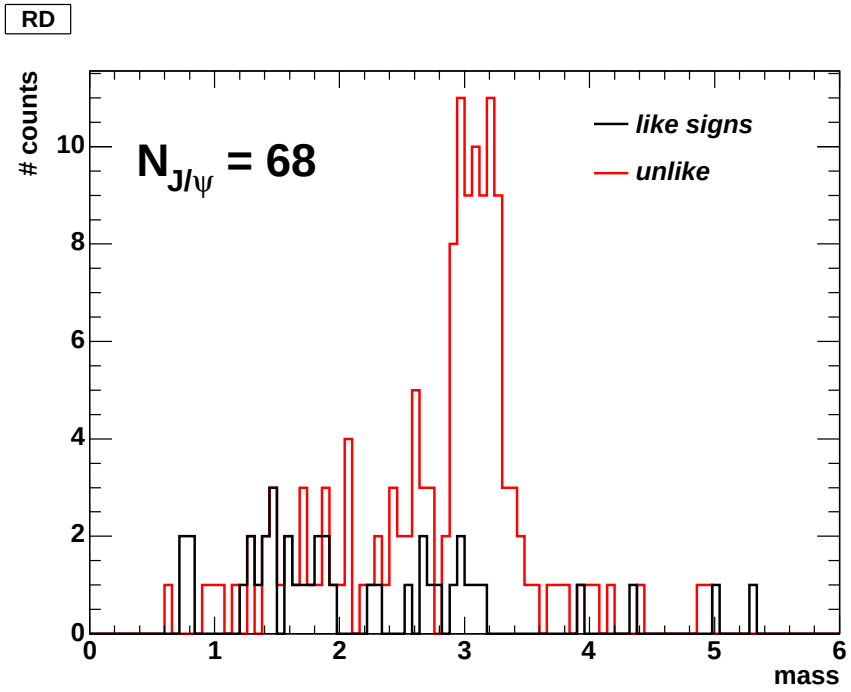
Centrality

- Double hijing files are created merging 10 files in each of the 10 centrality bin. The centrality is decided on the impact parameter in hijing.
- On RD, the centrality bins are made cutting on Evt_bbcCentralityByClock : this explains why the peripheric bin only contains 3.3% of the events.

Jpsi counts, centrality bin [0, 10]%

Exemples of mass distributions:



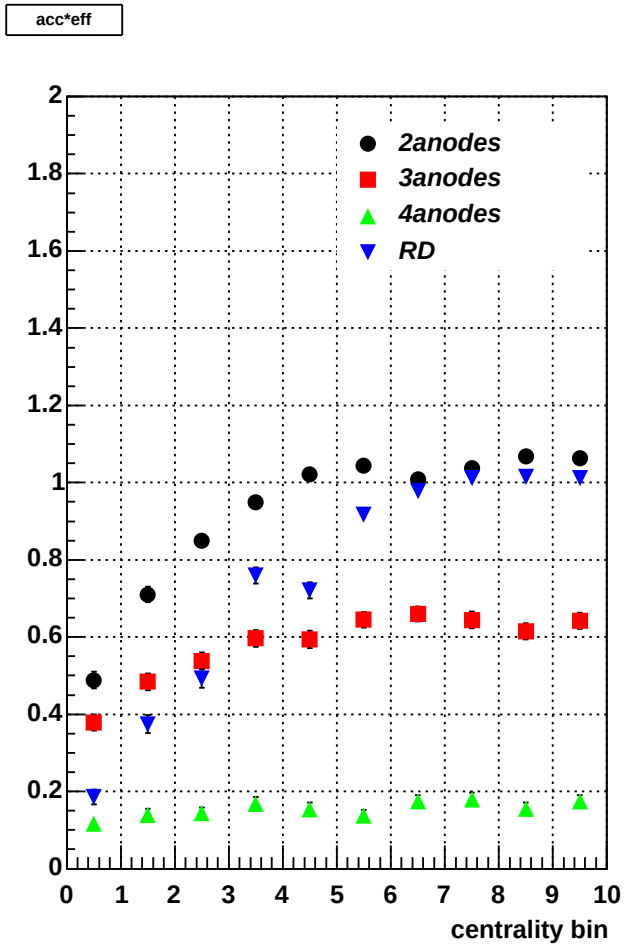


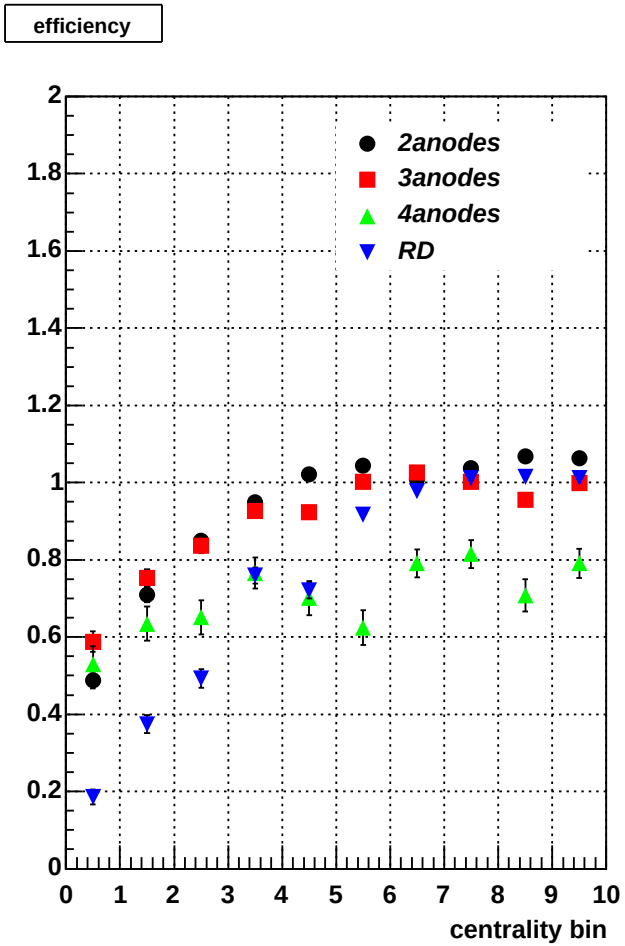
The number of JPsi is extracted from a gaussian fit after substracting the like signs spectrum from the unlike one.

Acceptance and efficiency vs centrality

$$accep \times eff = \frac{\#Reco_Jpsi_Embedded}{\#Reco_Jpsi_Simul_Ref_2anodes} \qquad efficiency = \frac{\#Reco_Jpsi_Embedded}{\#Reco_Jpsi_Simulated}$$

The $acc \times eff$ is measured using the 2 anodes configuration as a reference.

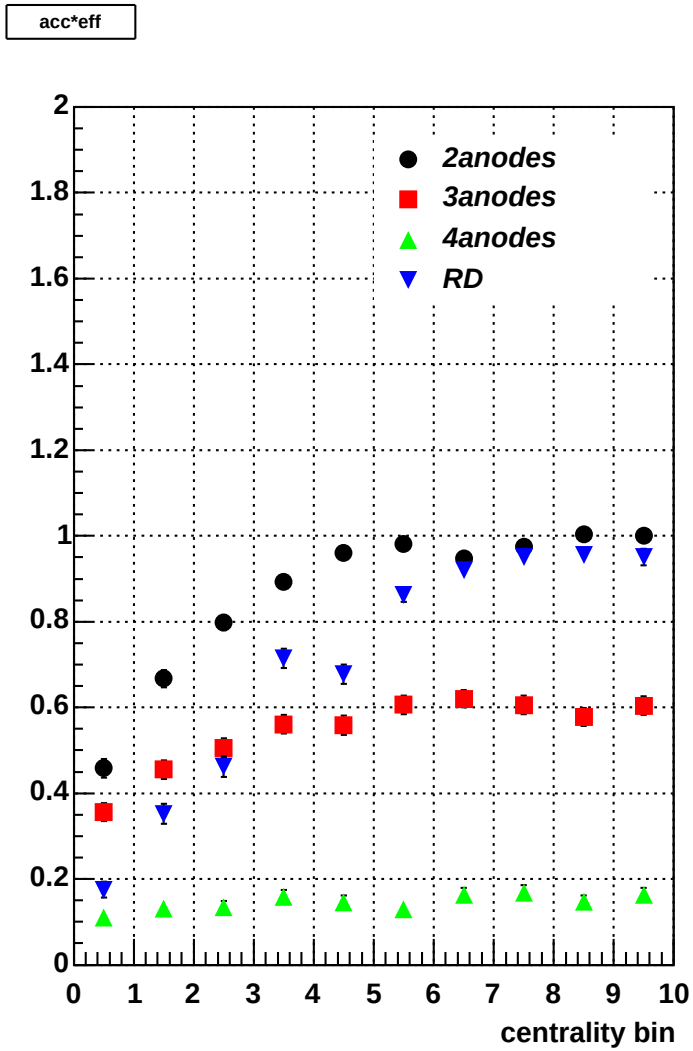


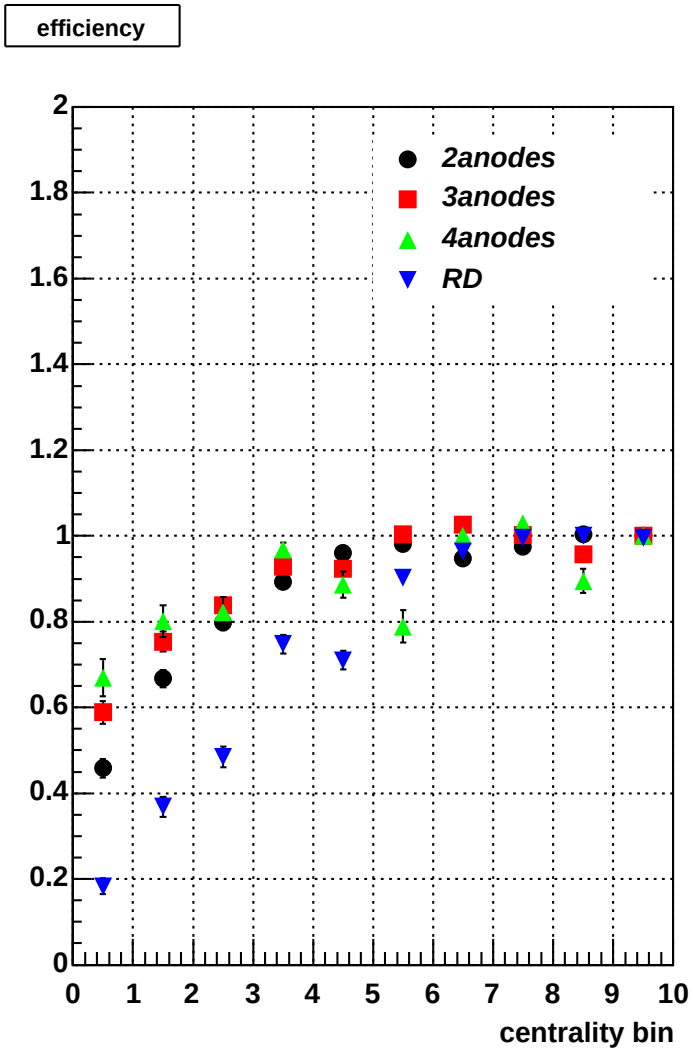


It seems that 4anodes configuration has a normalisation problem since peripheric bin efficiency lower than 1.
The plots will be normalized to the peripheral bin in the following slides.

Acceptance and efficiency vs centrality

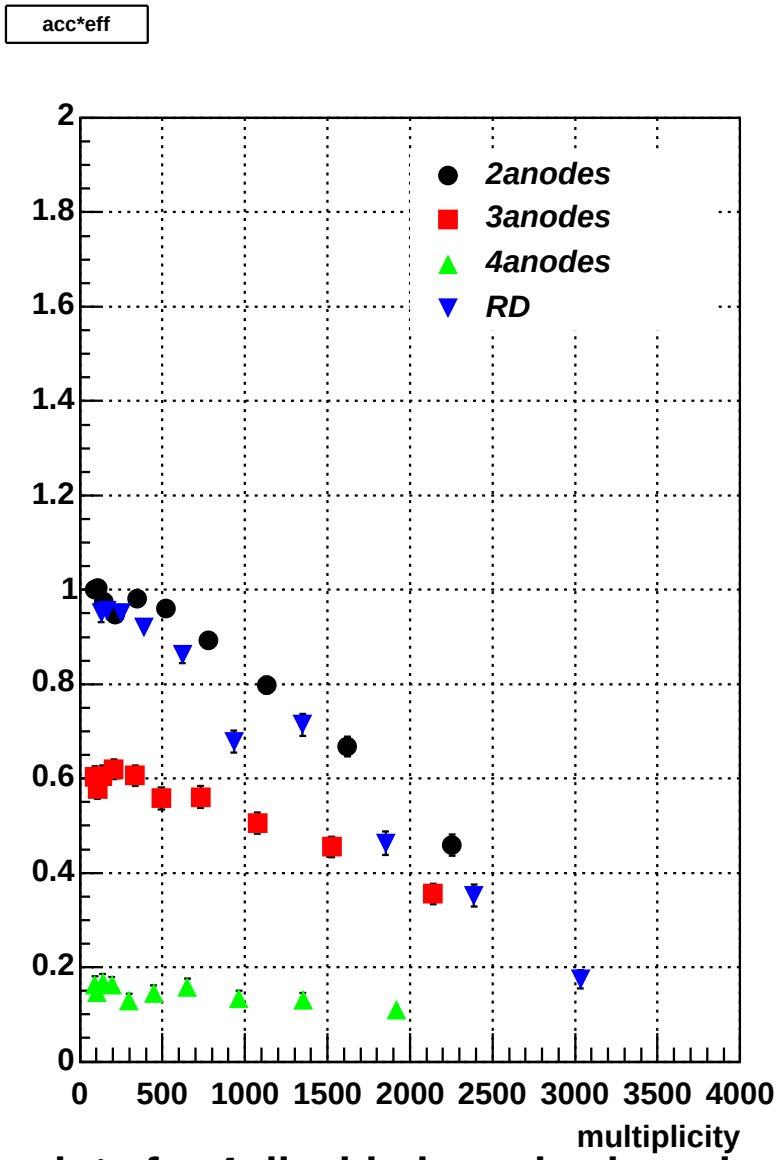
Normalised plots to peripherical effciciency bin:

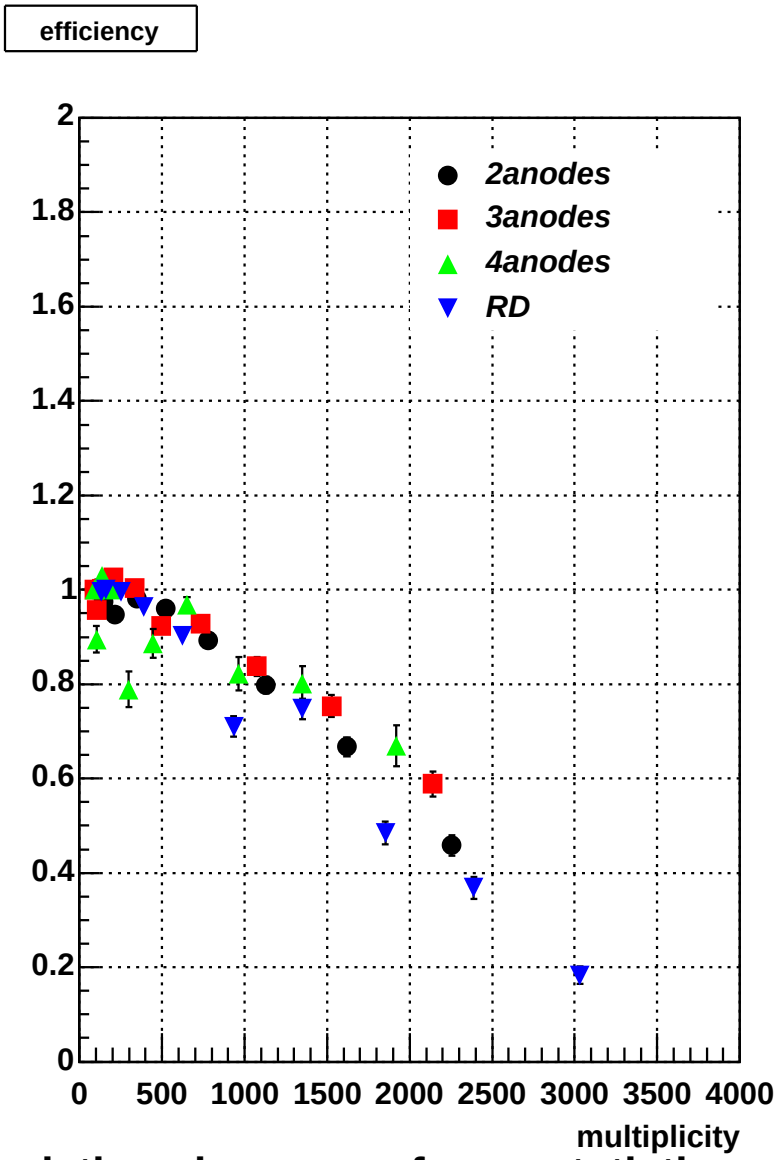




$\sim 40\%$ **is lost in the acceptance when disactivating more layers of anodes.**
Efficiency starts dropping for centrality smaller than 60%**.**
Central bin indicates $\sim 20\%$ **gain in the efficiency when desactivating 3 anodes instead of 2.**

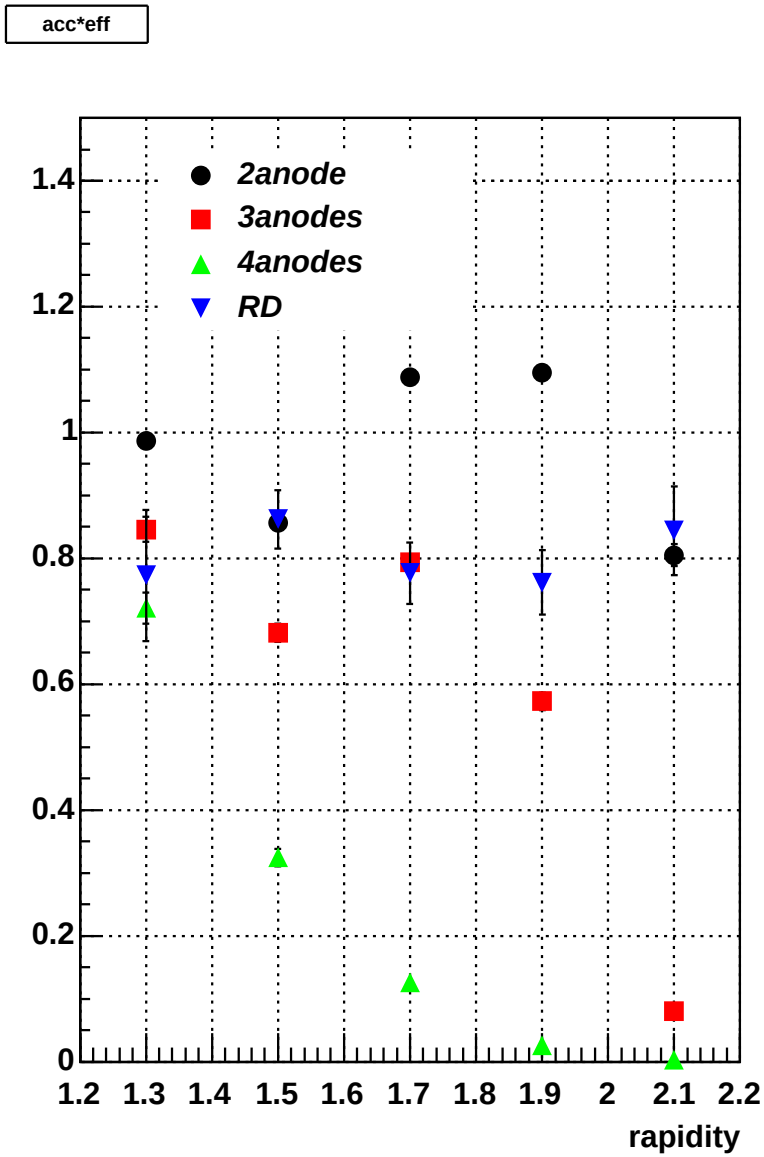
Acceptance and efficiency vs multiplicity

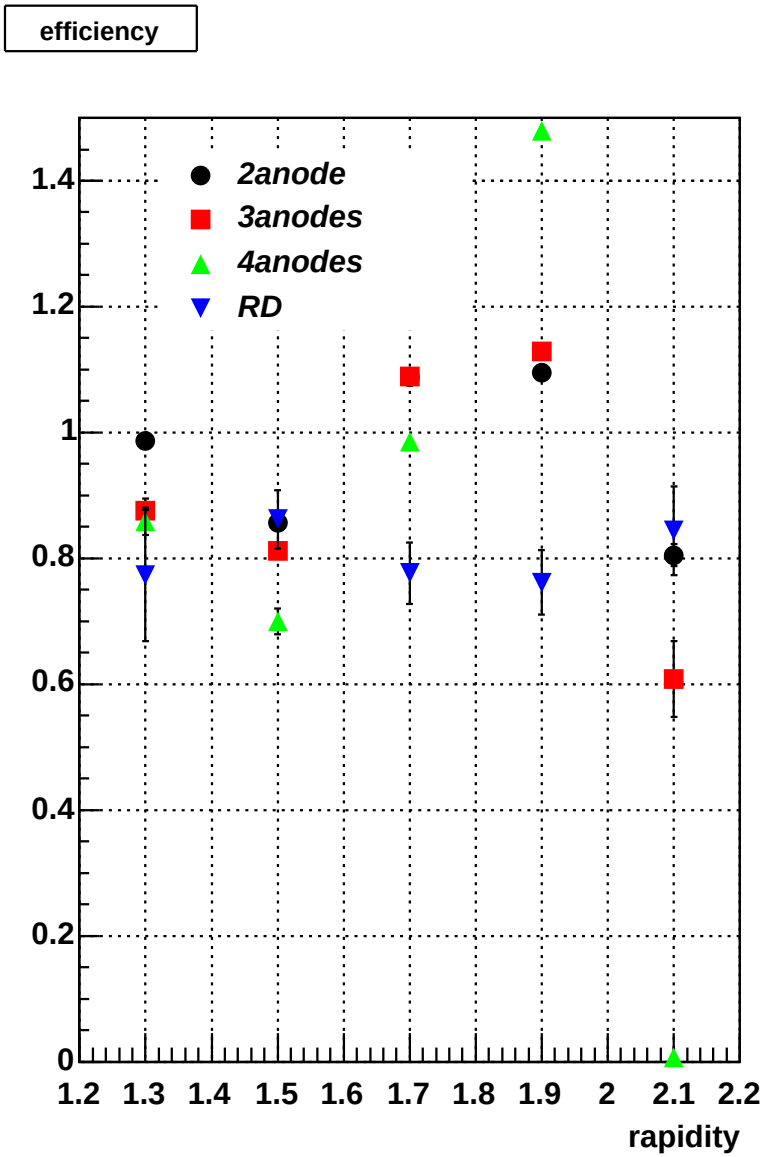




Some points for 4 disabled anodes have large variations because of poor statistics. The efficiency seems to be function of the multiplicity. Therefore, knowing the multiplicity, we have a direct measurement of the efficiency.

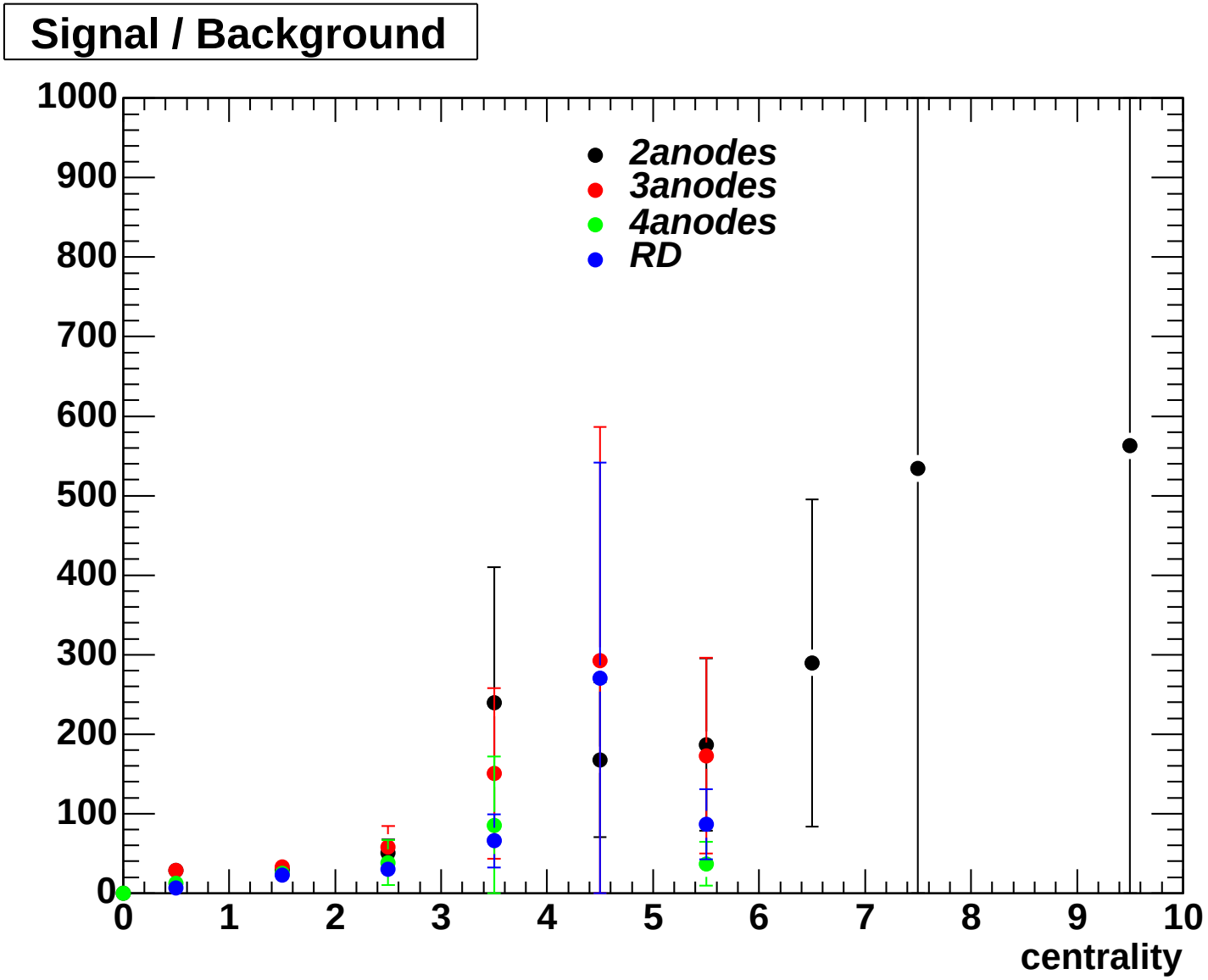
Acceptance and efficiency vs rapidity, min bias





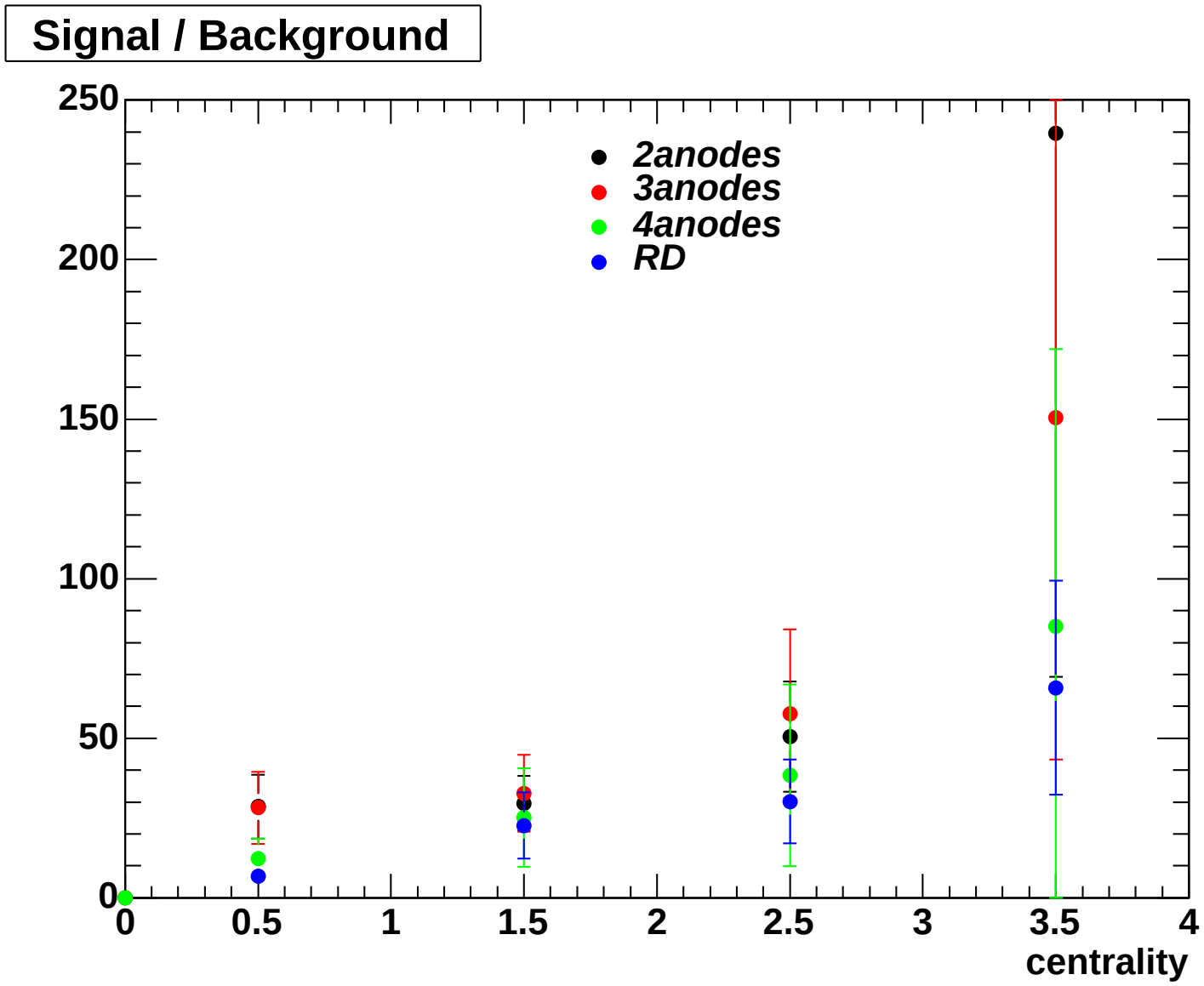
The $acc \times eff$ **drops for 3 and 4 anodes at high rapidity.**
The efficiency seems flat for all configurations.

Evolution of the signal over background



Not enough background to conclude...

Evolution of the signal over background ZOOM



Some conclusions

Study on double hijing and disabling anodes:

- Double Hijing still does not have enough multiplicity, but close.
- There are about 2 times more loss in acceptance than gain in efficiency when disactivating more anodes.
- The efficiency drops enough with central double hijing so that we should be able to see effects when testing code modifications.
- MC statistics is not high enough and not enough background to conclude on the signal over background depedence on centrality.

Suggestions

- Use run4 early data with 1 layer (?) of disabled anodes to run embedding in order to have a higher multiplicity point.
- We could take special data at begining of run7 with different anodes configurations to make quick embedding studies. See how RD behave compared to this study and take a final decision about desabling more anodes or not. Would need one run ($\sim$10 segments) for each configuration, to have enough statistics.

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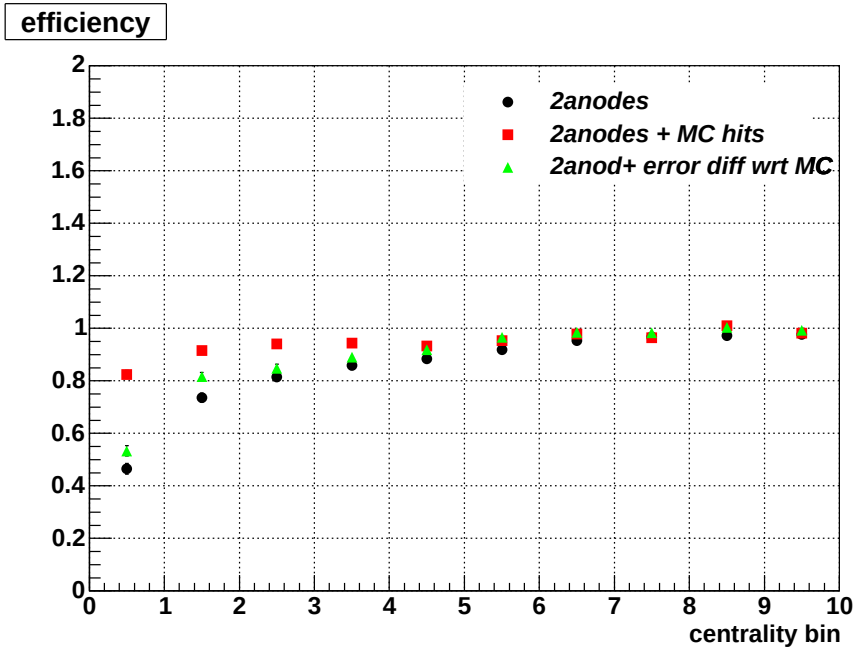
Modifications in the cluster fit

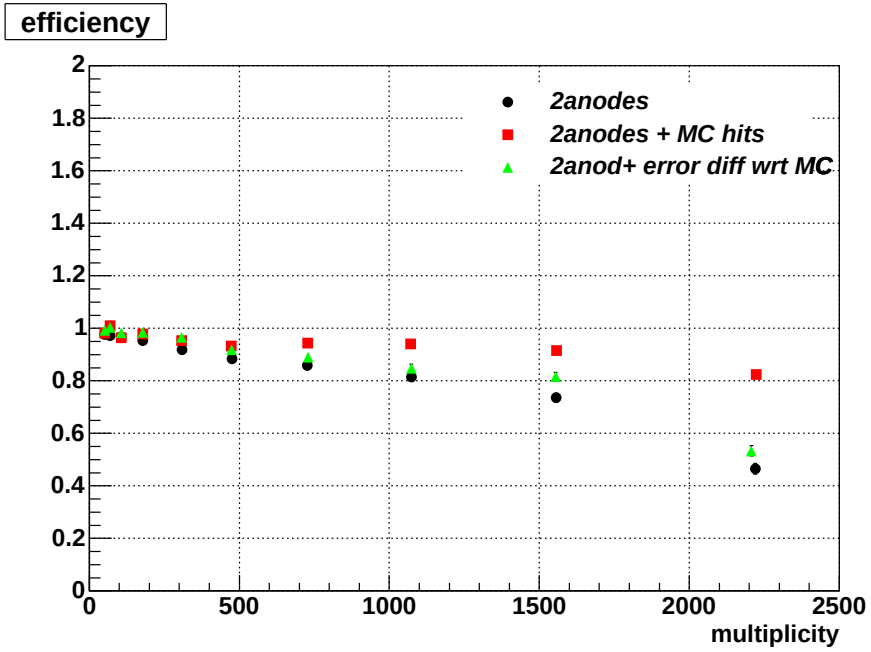
These slides study modifications in the cluster fit:

1/ Using perfect MC information for cluster coordinates smeared by 300 μm for non-stereo cathodes and 400 μm for stereo cathodes.

2/ Using real fit positions, but setting the error to be the difference between the true MC hit and the fit position

Embedding in double Hijing, 2 anodes disabled

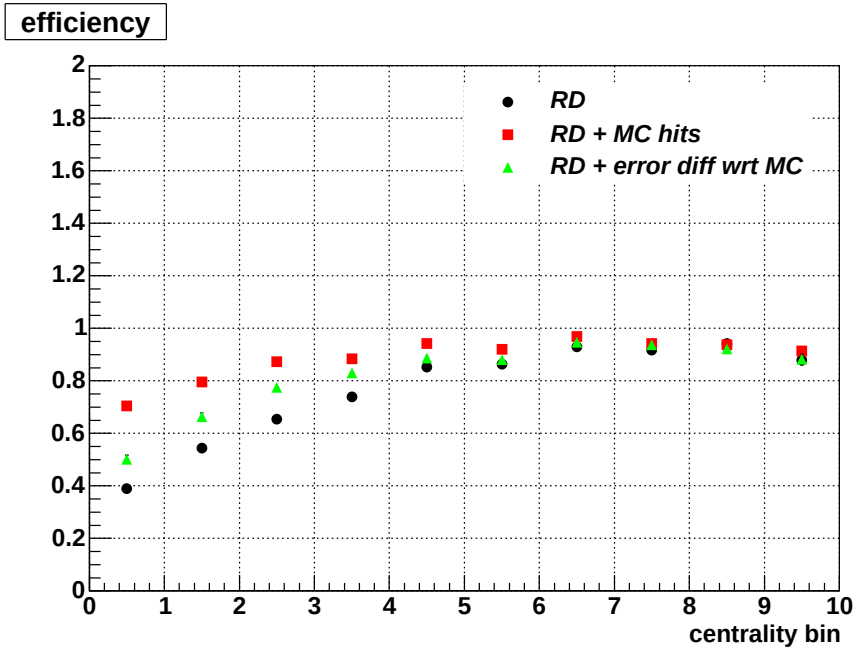


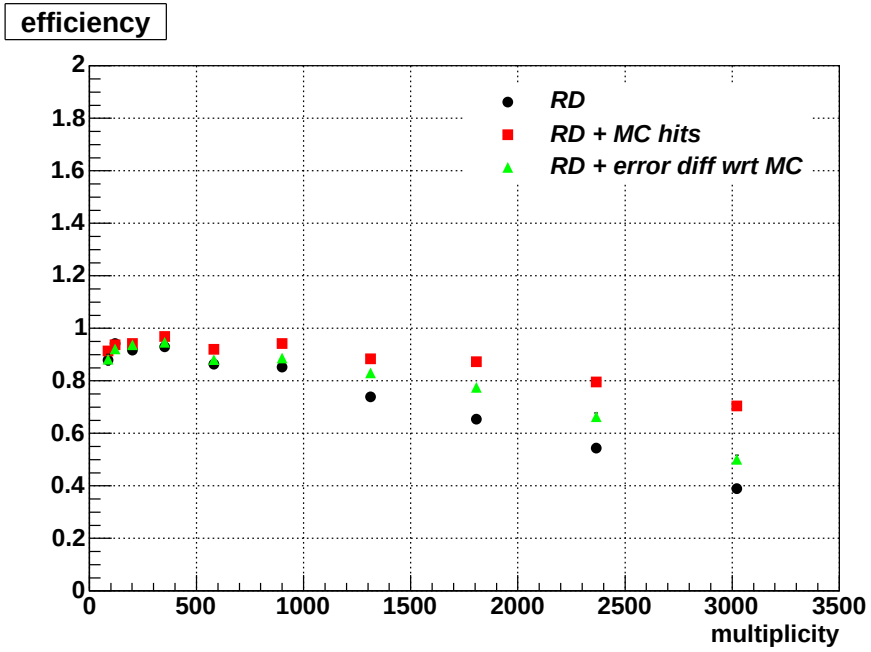


- The embedding was done in the acceptance when 2 layers of anodes are disabled.
- In red, true MC hits are used when there are associated MC hits, smeared by 300 μm (400 μm) for cathodes with perpendicular (stereo) strips.
- In green, the error is set to the difference between the true MC hit and the fit position.

The efficiency is a a lot better when using MC true information.
It is slightly better when changing the error.

Embedding in Real Data

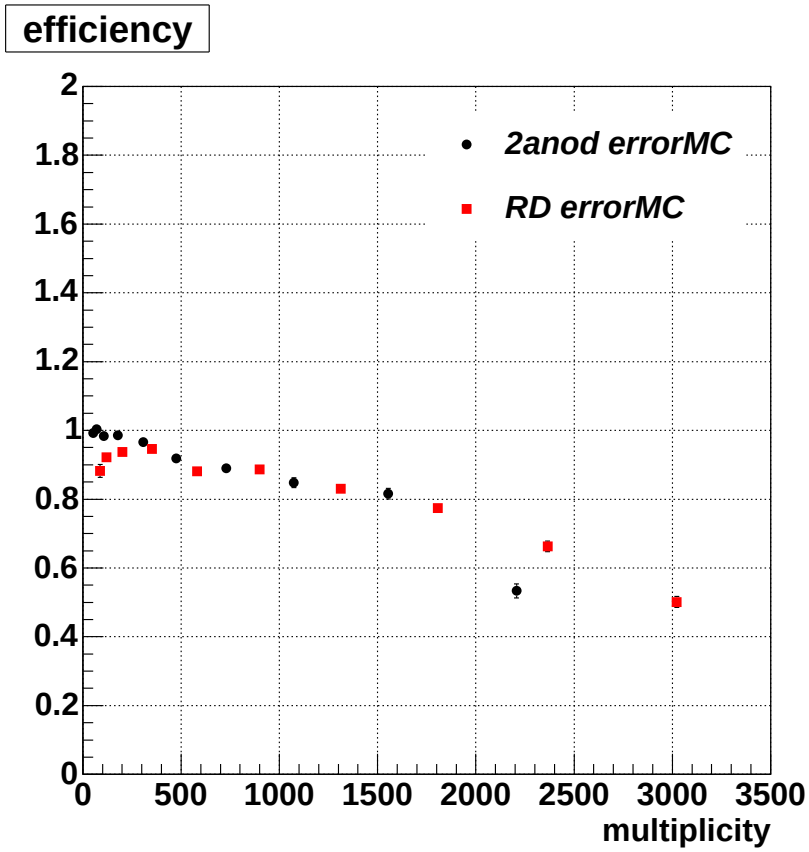




- The embedding was done in run4 real data..
- In red, true MC hits are used when there are associated MC hits (smeared).
- In green, the error is set to the difference between the true MC hits and the fit position.

The efficiency is a lot better when using MC true information.
It also improves of 25% when changing the error $\Rightarrow$ there maybe some efficiency to be gained by tunning the cluster fit errors so that they better reflect the cluster fit quality.

Comparing Hijing and RD



- We compare the efficiency using the difference between the true MC hits and the fit position as error in the cluster fit, when embedding in double Hijing and real data.
- In black, the embedding was done in double Hijing.
- In red, the embedding was done in RD.

More improvement is seen for RD at high multiplicity.
Maybe the central point for hijing is low because of stactistical fluctuations.

More conclusions

Summary

- The way errors are handled in the cluster fit may not be optimum.

To do:

- Rewrite the cluster fit error handling ?