Run 13 BEMC calibration systematic error calculation

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Notes

- We plan to use the tower method for now for the run 13 BEMC calibration for the purpose of releasing W AL preliminary results.

- We plan to have more investigation on 2x2 cluster method later.

- Systematic errors were calculated for tower method.

Parameters

- Trigger bias
- Low momentum cut dependance
- TDR (ΔR) cut dependance
- Time dependance
- Luminosity (ZDCx) dependance
- Crate dependance

Systematic Uncertainty Summary

	Systematic Error Period 1	Systematic Error Period 2
Trigger bias	1.4%	1.2%
Low momentum cut	0.7%	0.7%
TDR (ΔR) cut	< 0.5 % ==> 0	< 0.5 % => 0
Time dependance	0.8%	< 0.5 % ==> 0
Luminosity dependance (ZDCx)	< 0.5 % ==>0	< 0.5 % ==>0
Crate dependance	1.2%	1.3%
Eta dependance	will not consider as systematic	will not consider as systematic
Total	2.1%	1.9%

- Totals added in the quadrature

Trigger Scheme Systematic

- Impact on E / p from HT and non HT trigger events
- Consider 3 different scenarios, take <E / p> over all the Eta rings.

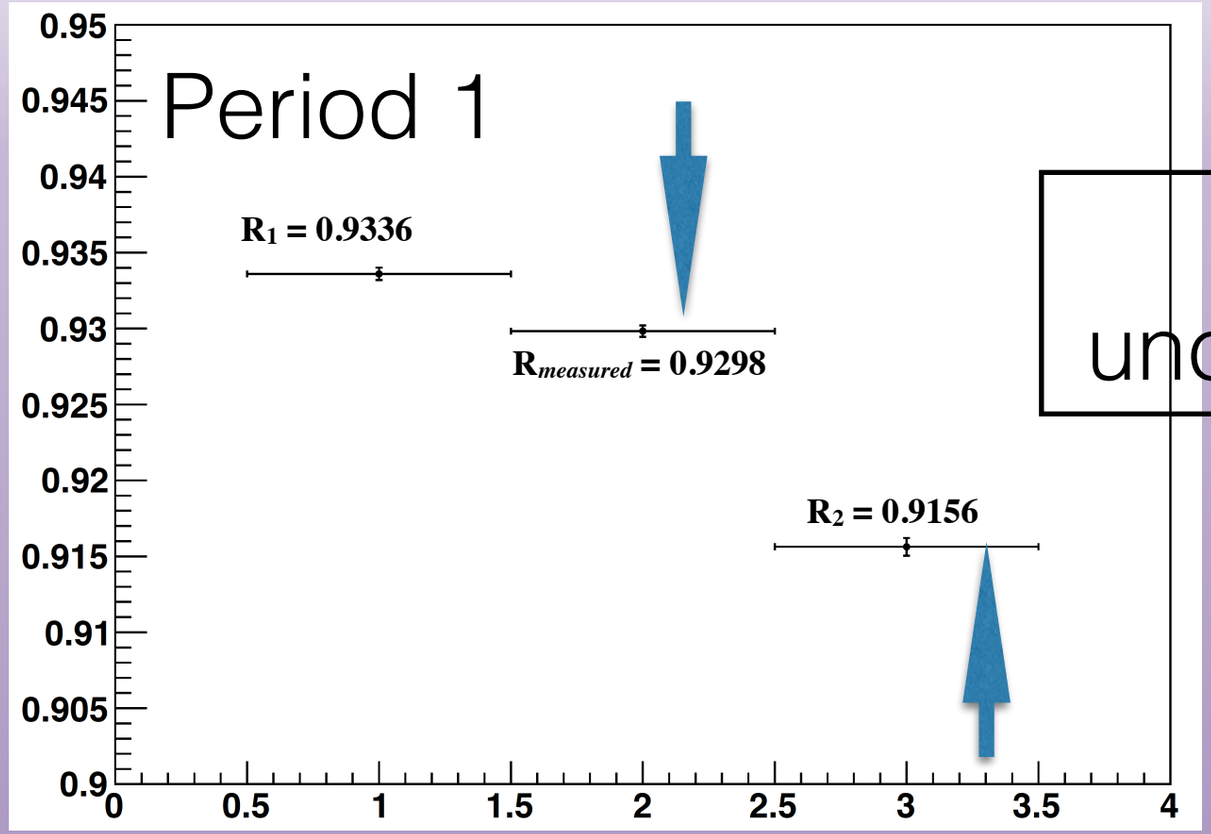
  1. Only non HT trigger events : JP2->didFire(), (0<P<10) GeV : <E / p> = R_1

  2. Only HT trigger : BHT3->didFire(), (0<P<3) GeV : <E / p> = R_2

  3. Both nonHT and HT (this is the trigger option used for the E /p calibartion) : JP2->didFire(), (0<P<10) GeV || BHT3->didFire , (P < 3) GeV : <E / p> = R3 = $R_{meausred}$

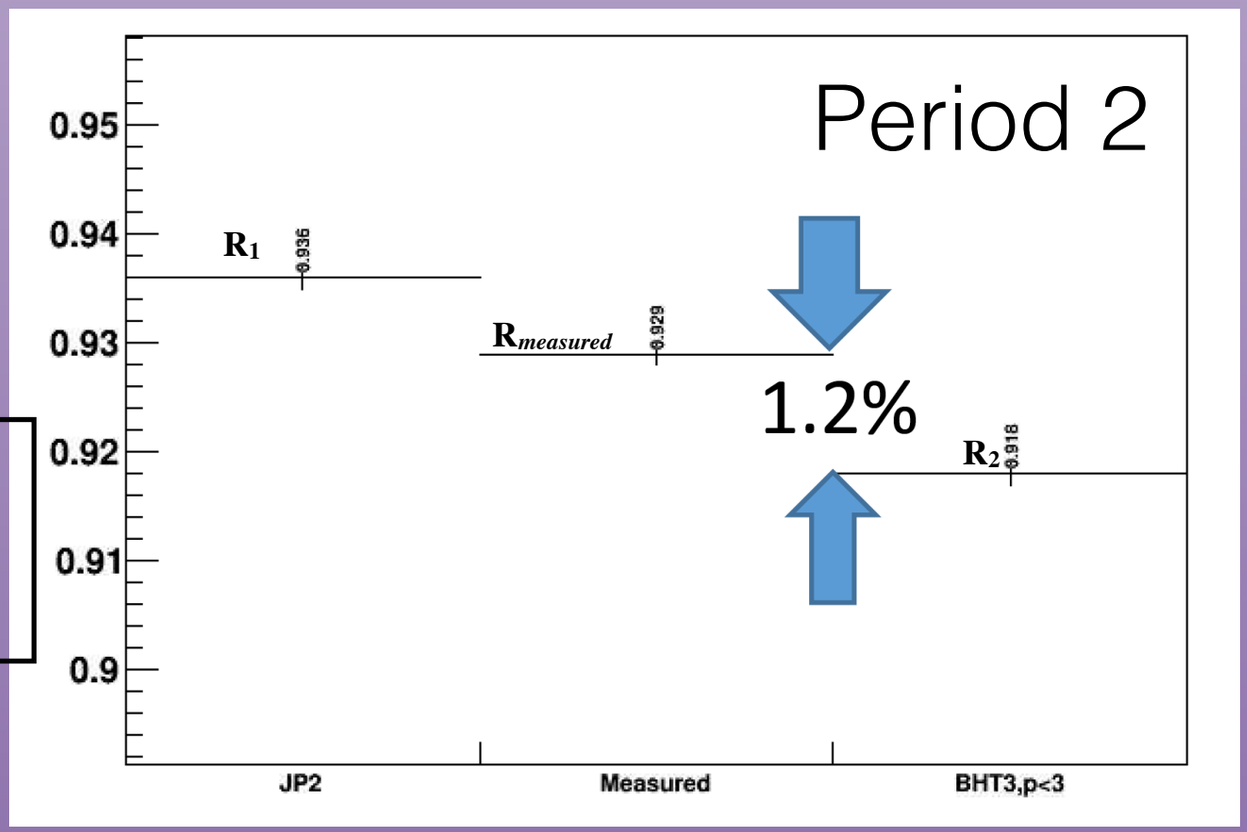
- Take the largest difference between $R_{measured}$ and R_is as the uncertainty from trigger scheme

Trigger Scheme Systematic

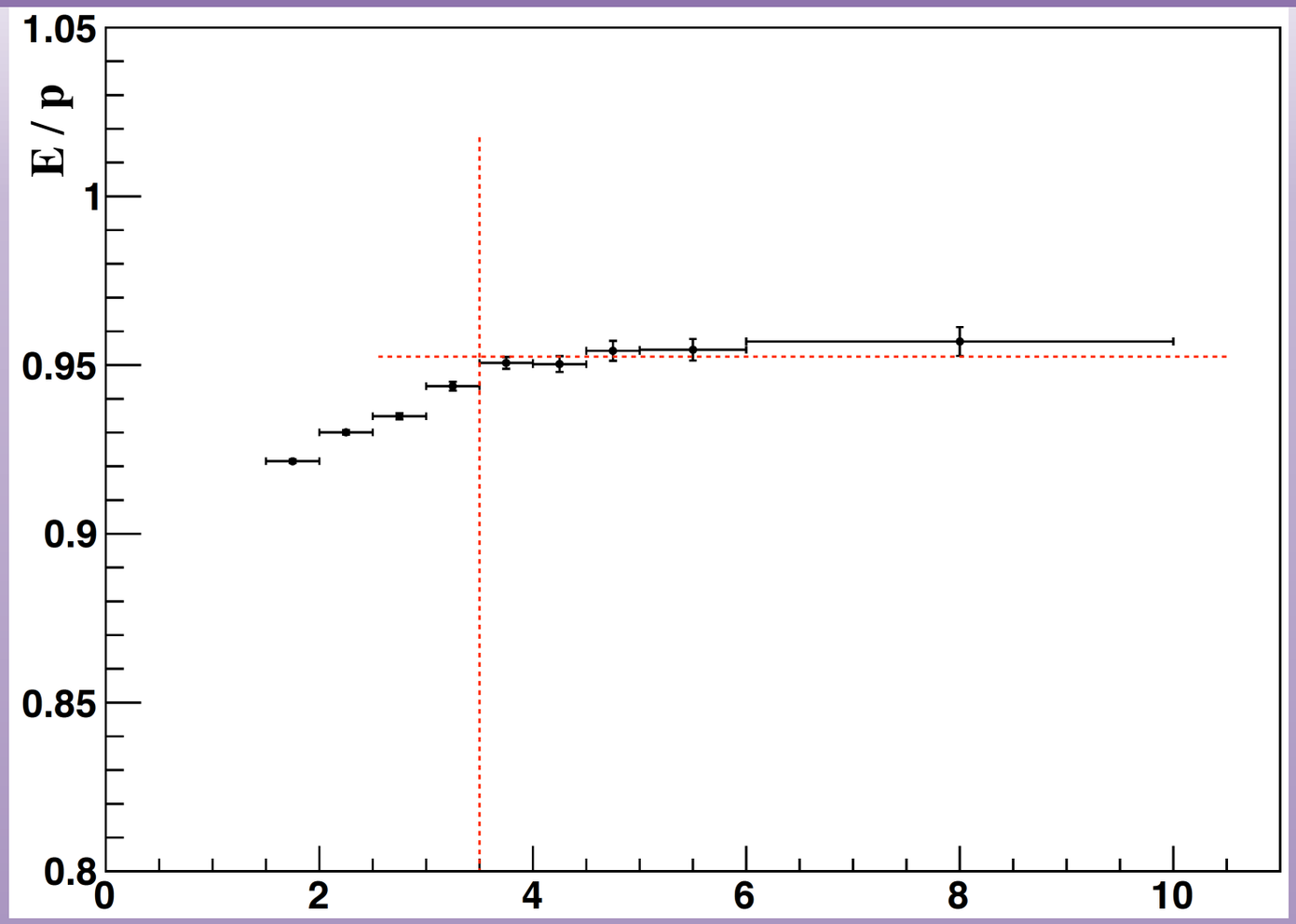


Systematic uncertainty = 1.4 %

Systematic uncertainty = 1.2 %

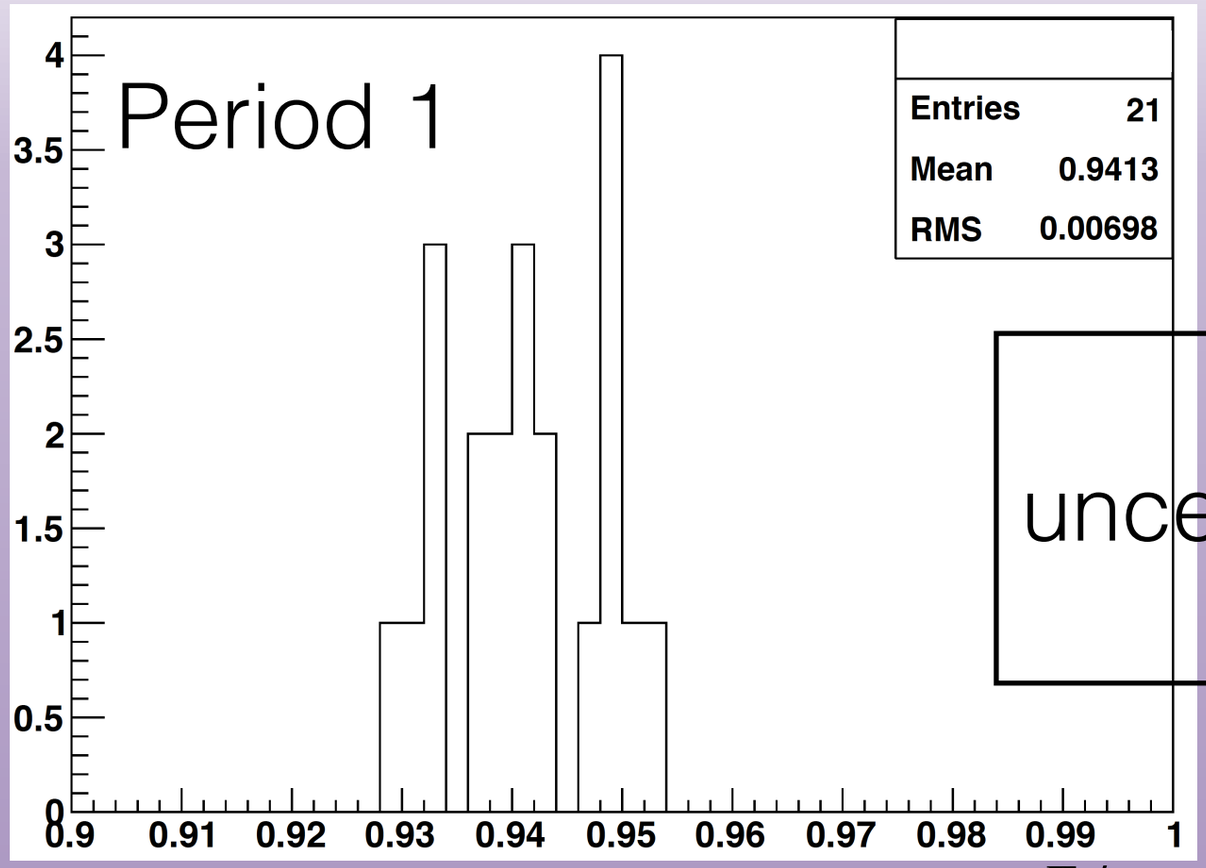


Low momentum Cut

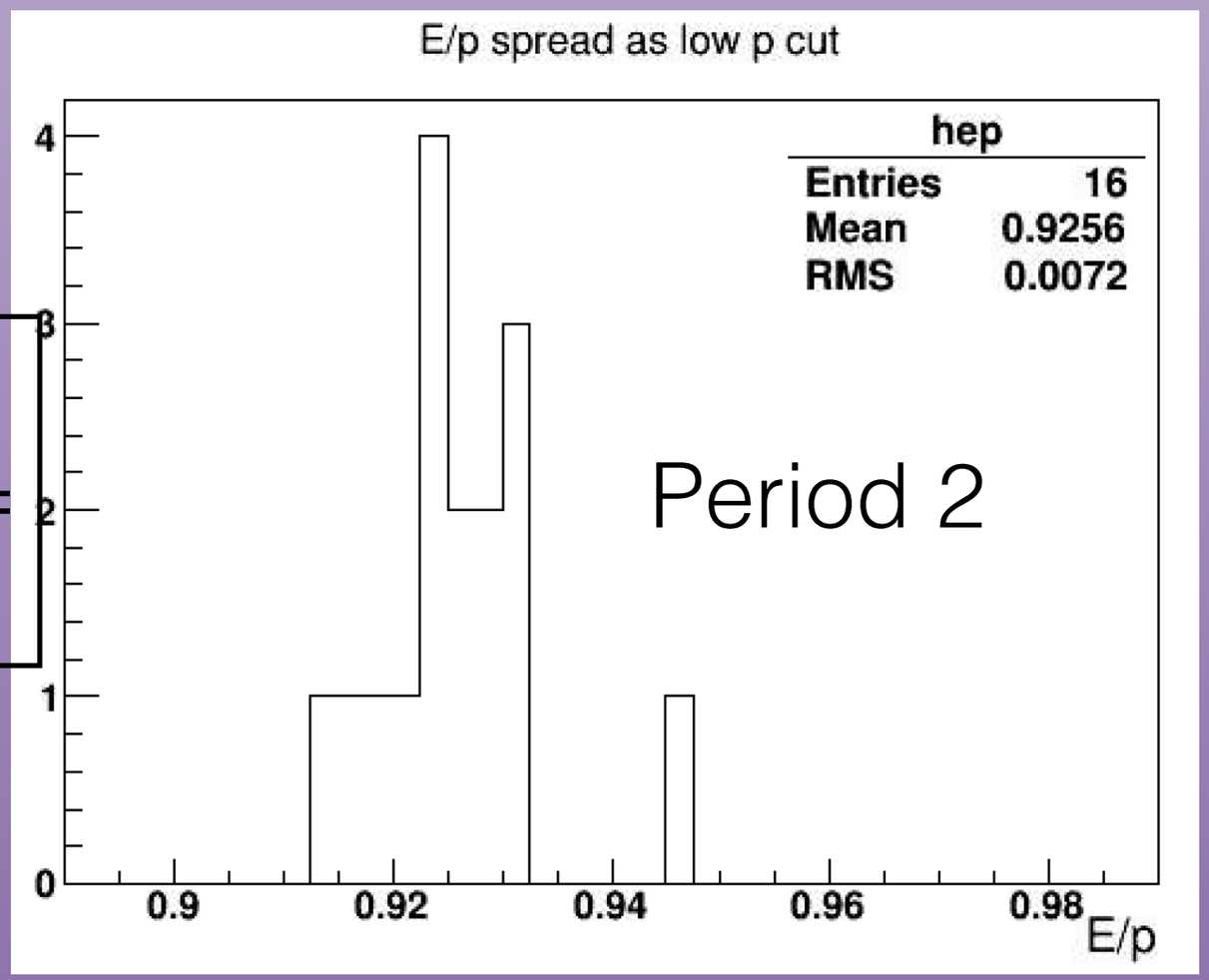


- E / p shows steady increasing behavior from 1.5 to 3.5 GeV and fairly stable behavior above 3.5 GeV.
- Vary low P cut from 1.5 GeV to 3.5 GeV
- Obtain <E / p> for whole detector between [Low P cut - 10 GeV]
- Assign RMS as the uncertainty.

Low momentum Cut

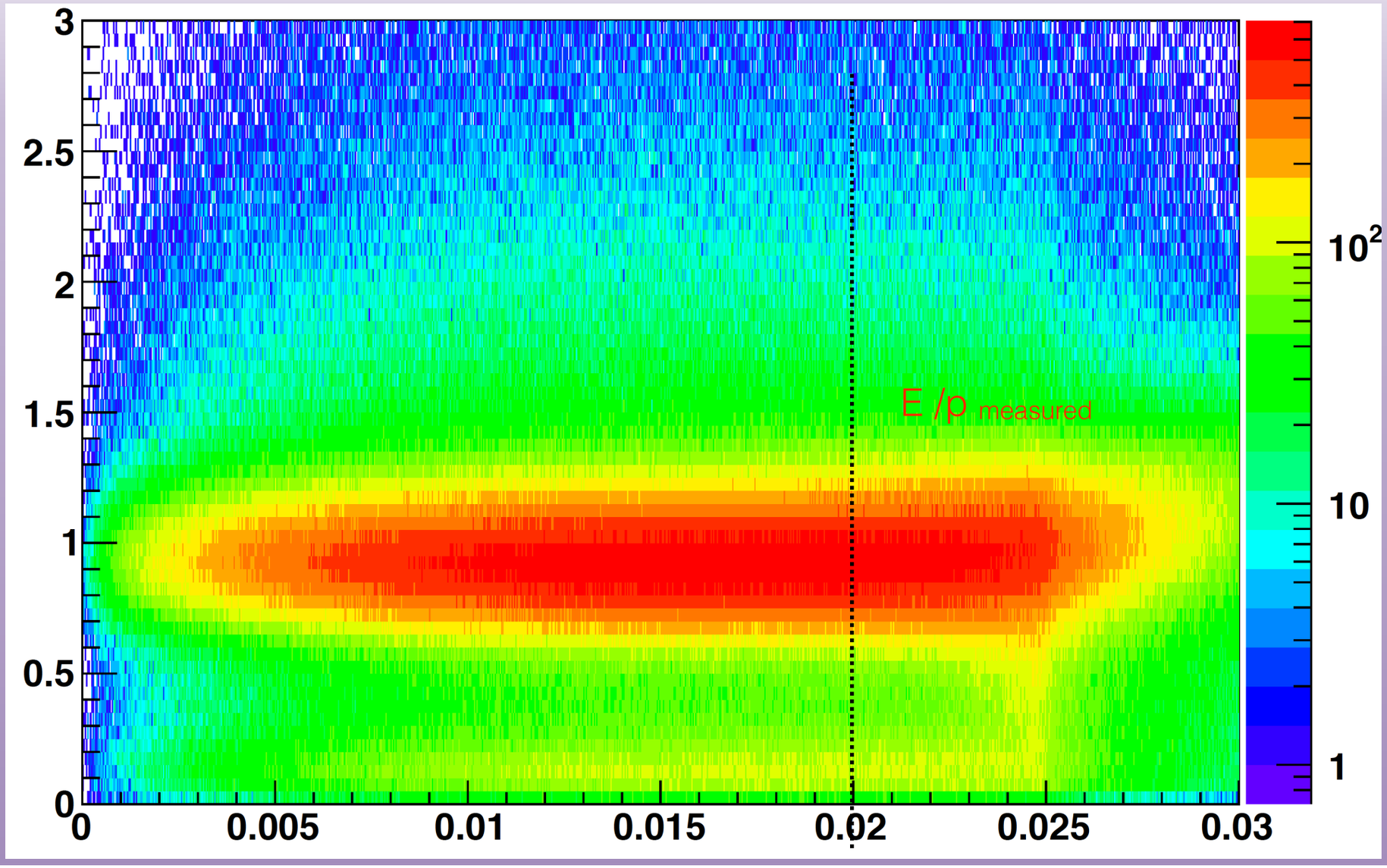


Systematic uncertainty = RMS = 0.7 %



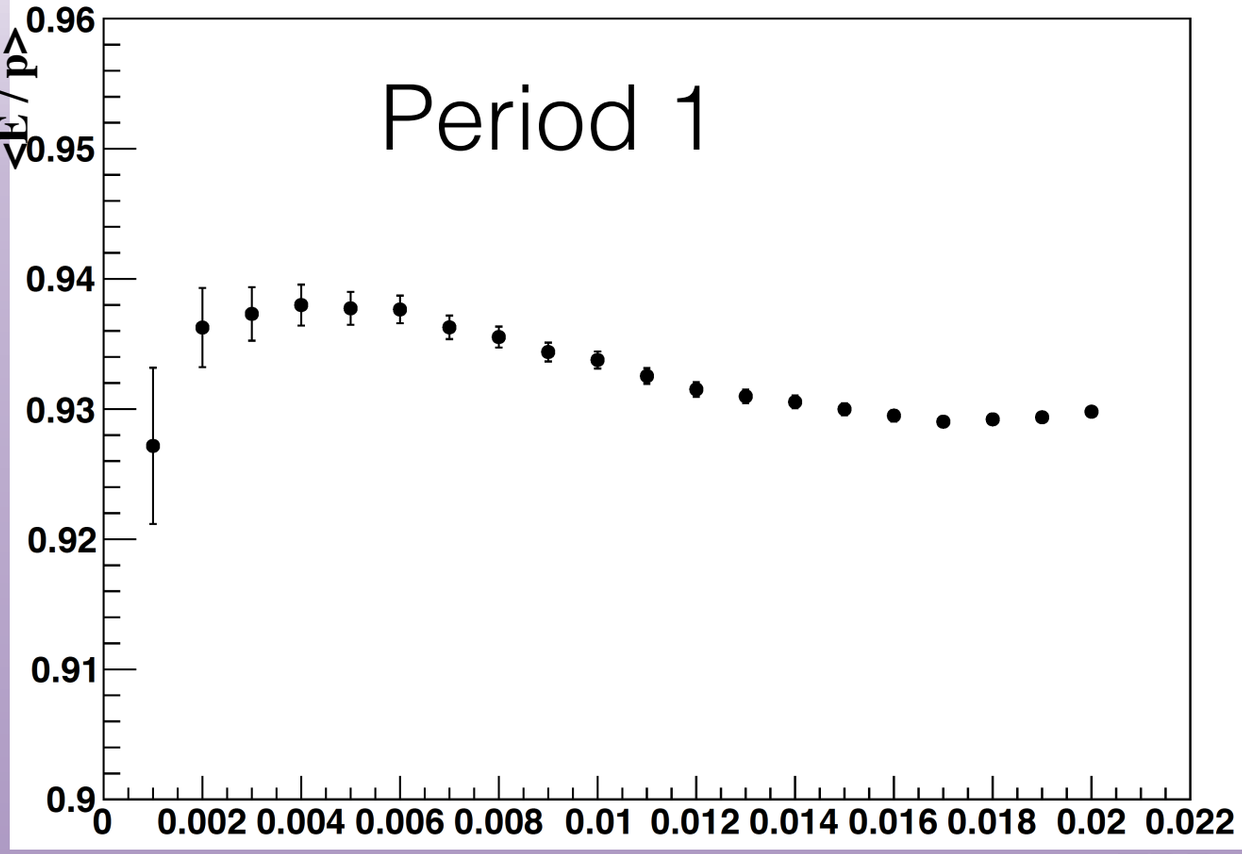
Systematic uncertainty = RMS = 0.7 %

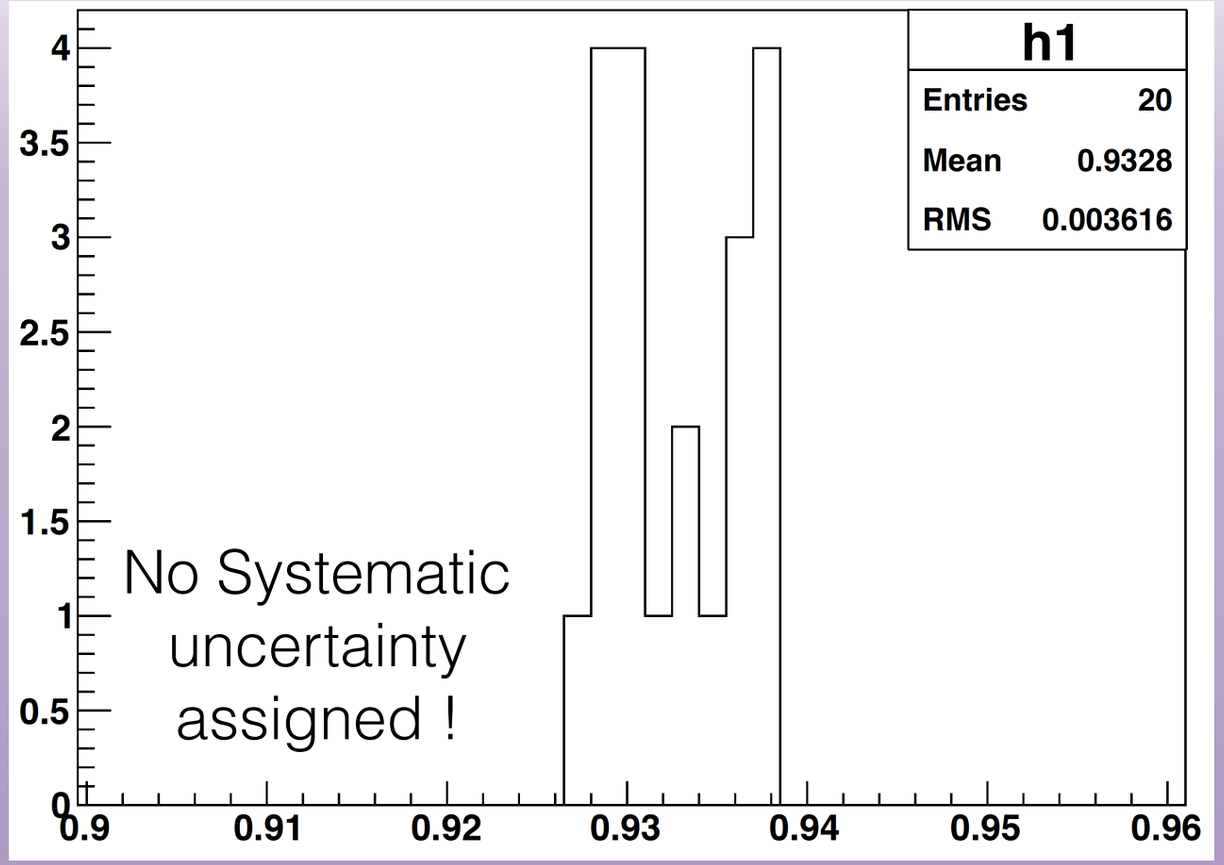
Upper TDR cut



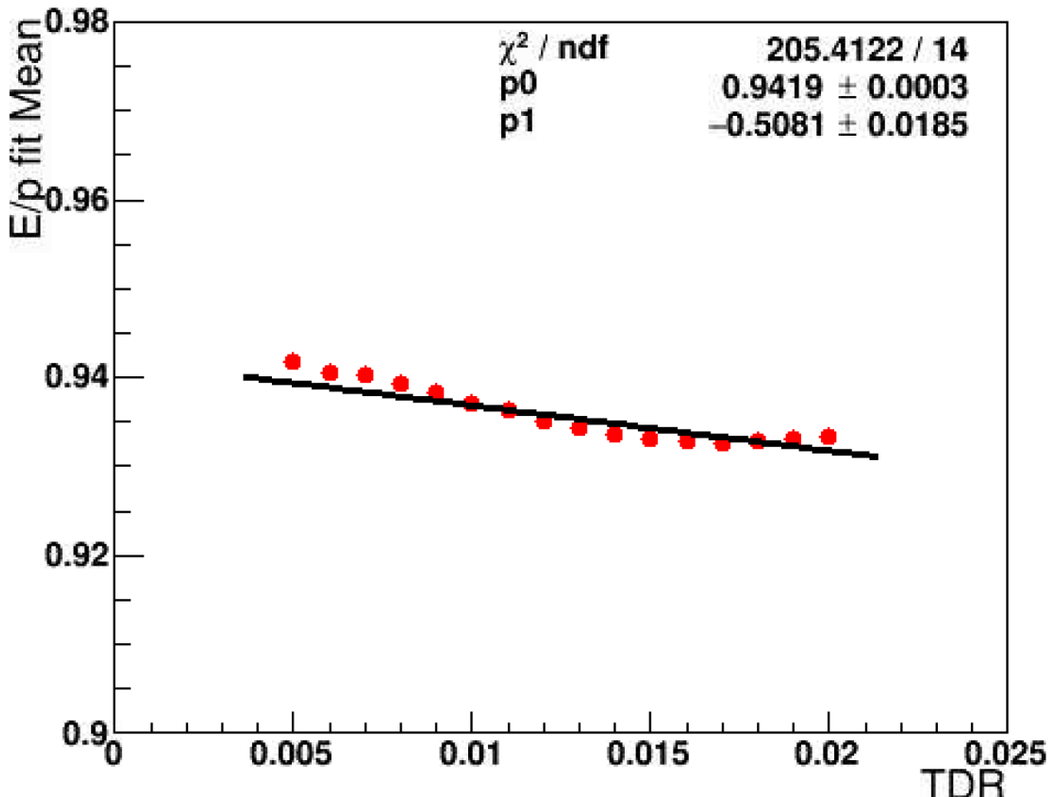
- Vary Upper TDR cut from 0.001 to 0.02 .
- Obtain <E / p> for all the rings varying upper TDR cut between
- Assign RMS as the uncertainty.

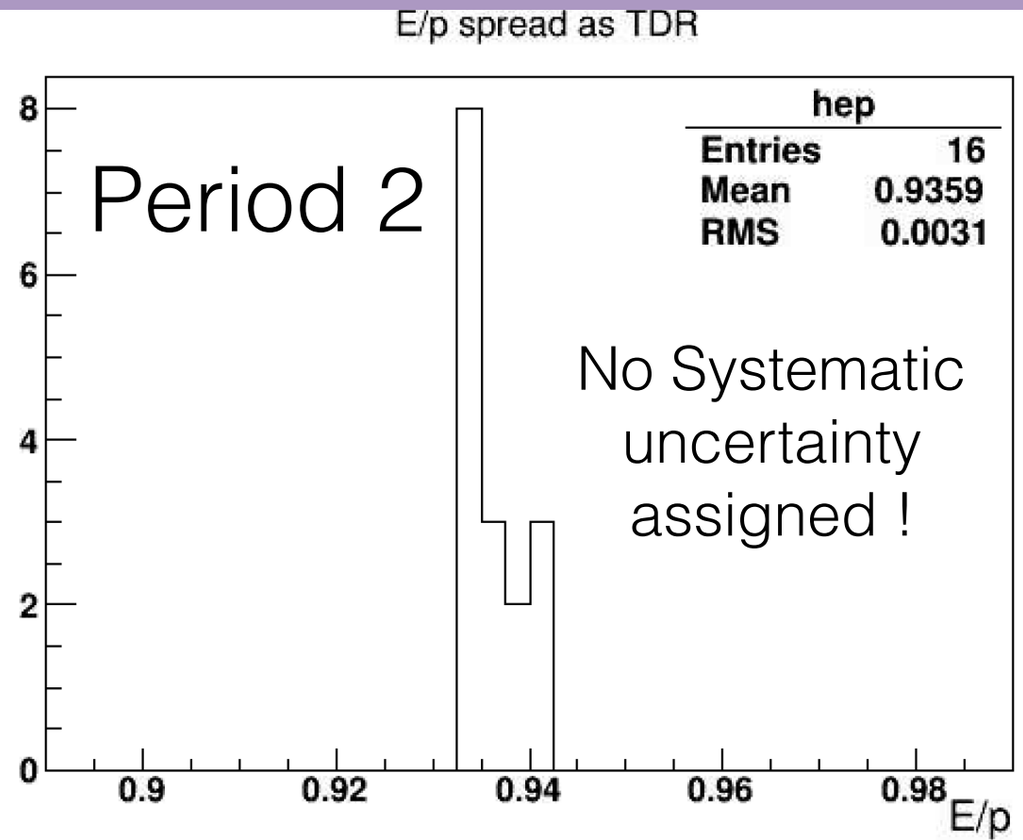
Upper TDR cut dependance





TDR **<E / p>**

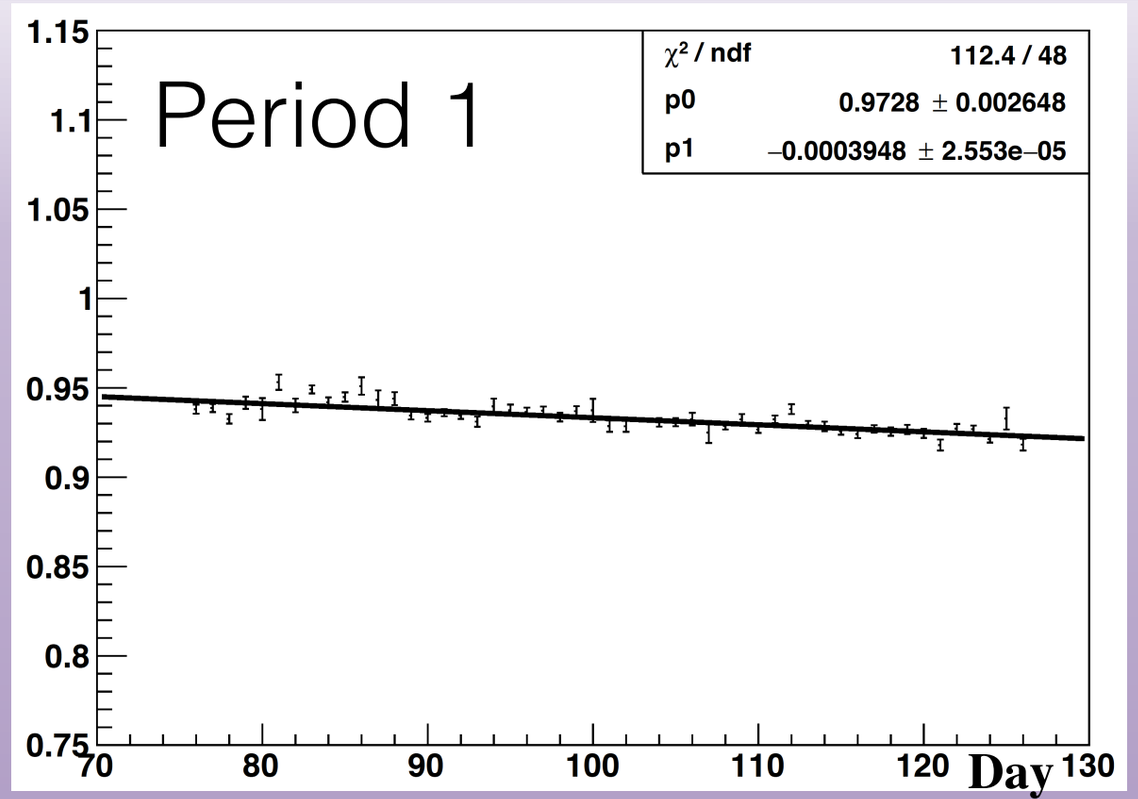


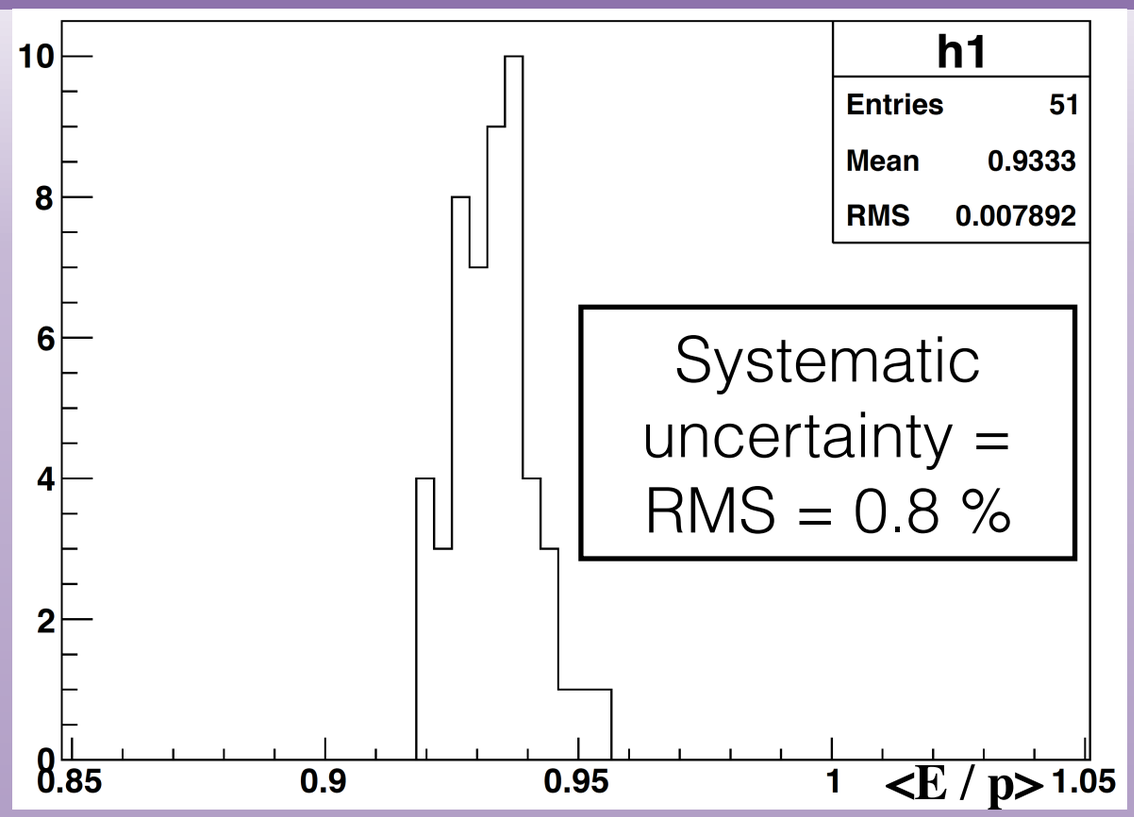


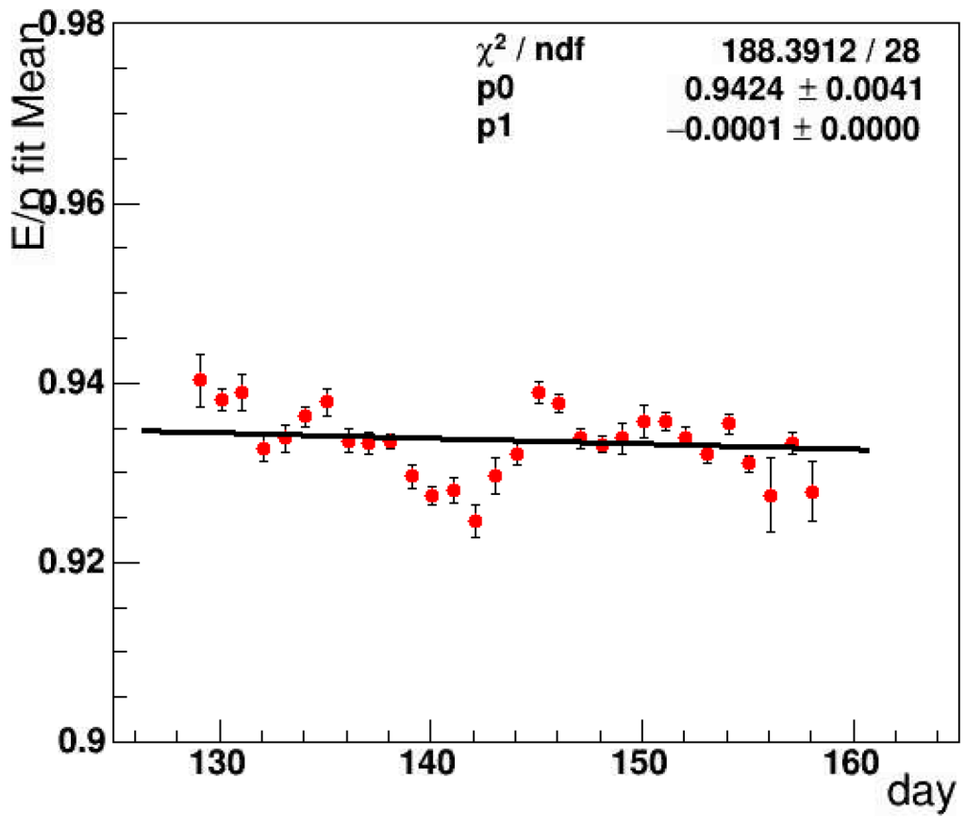
Time Dependance

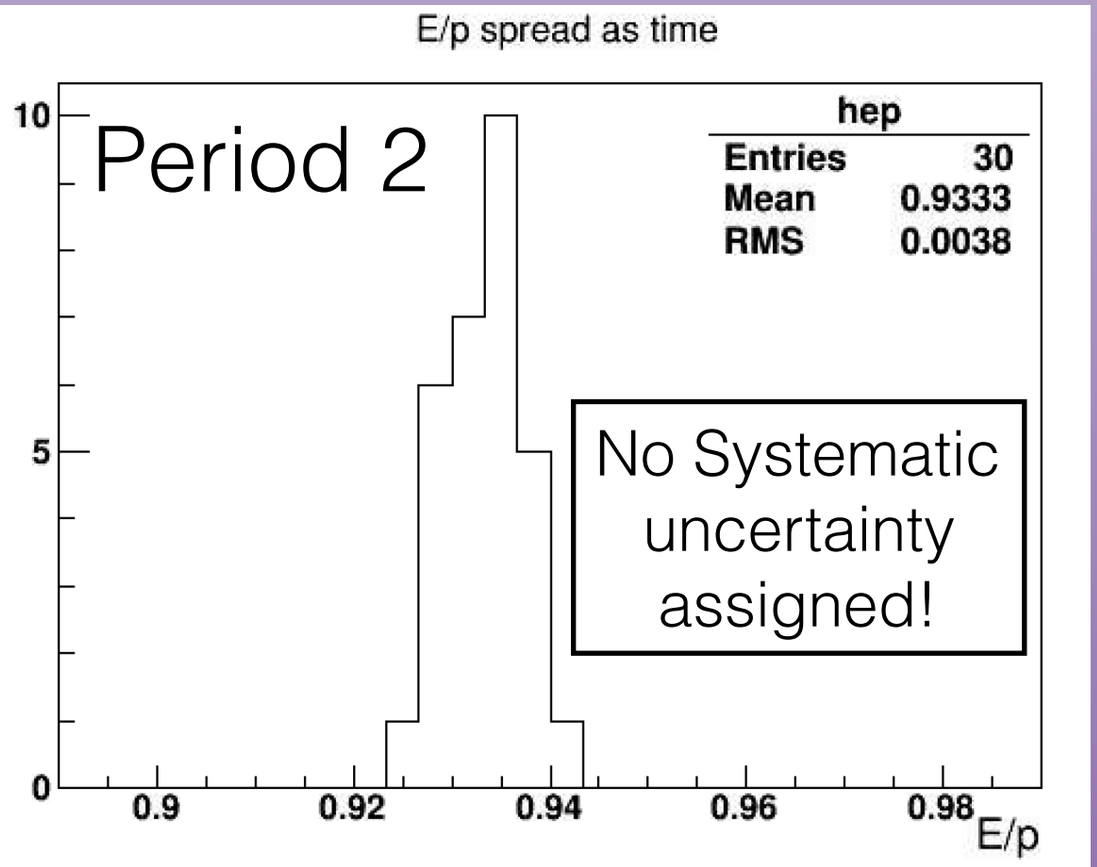
- < E / p> was calculated per day for the whole detector.
- Spread is to assign as the uncertainty.

Time Dependance







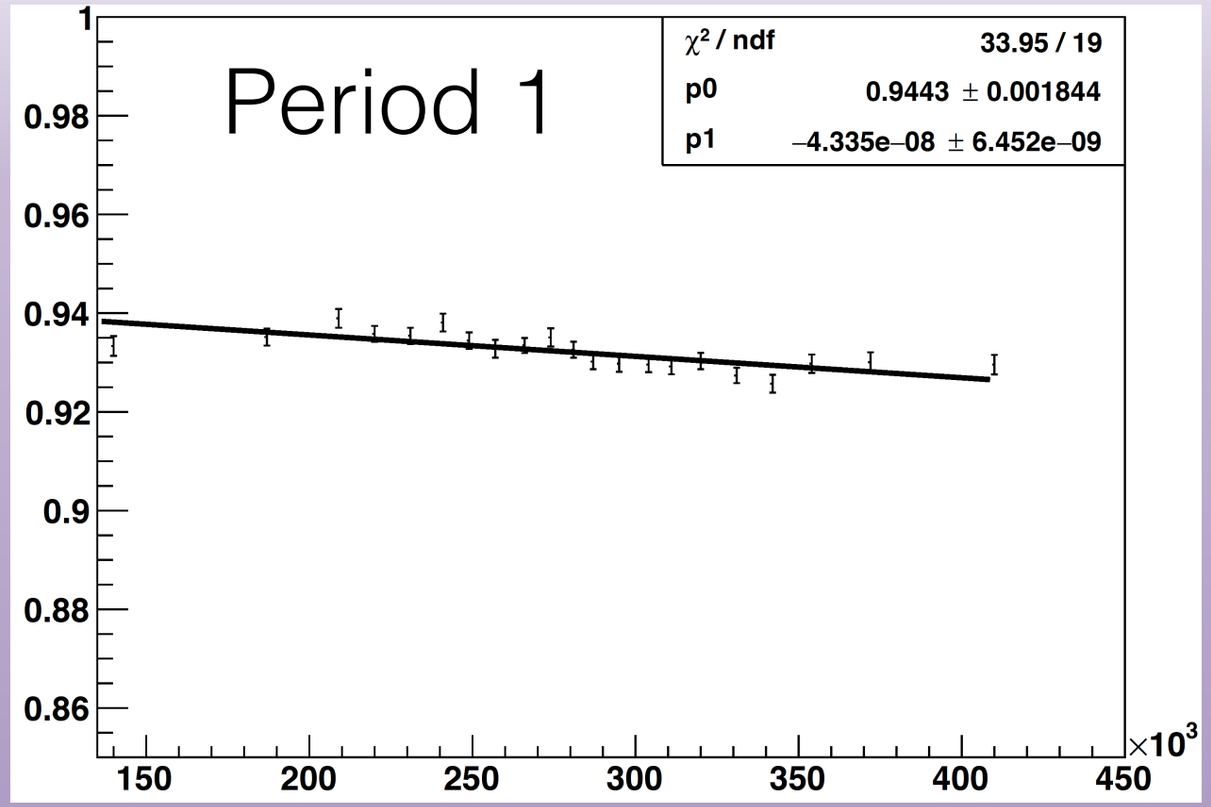


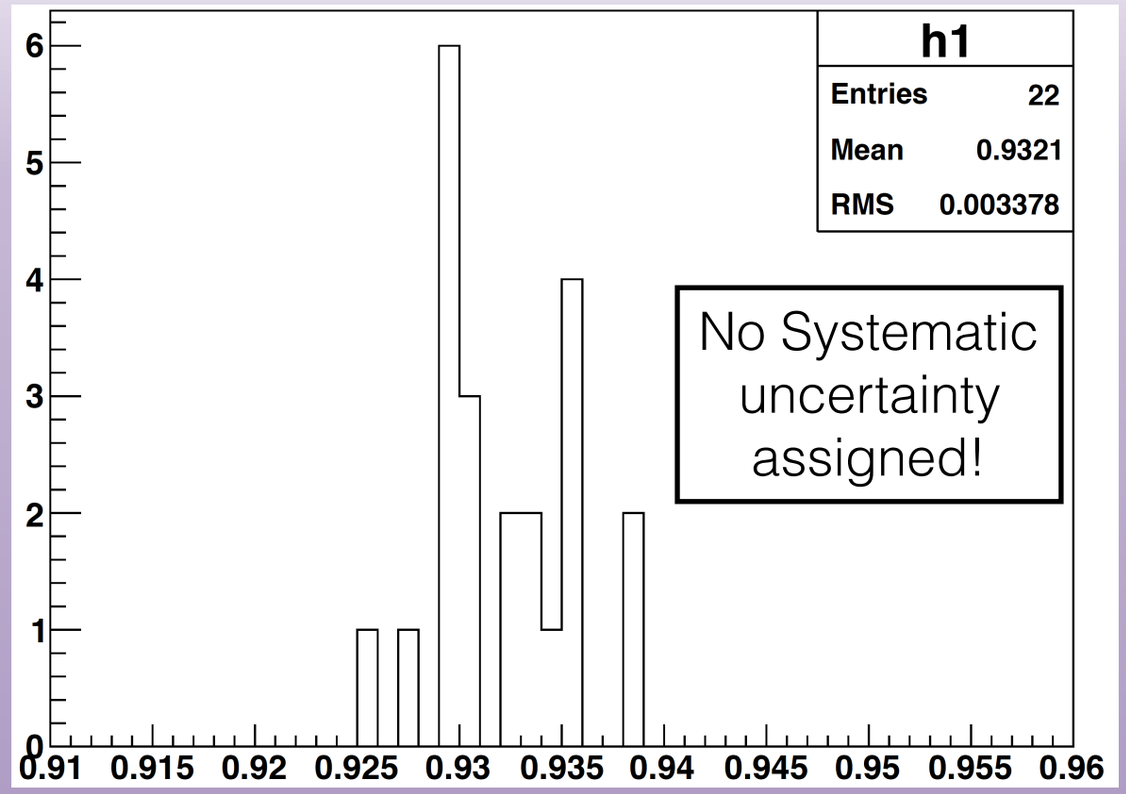
Luminosity (ZDCx) Dependance

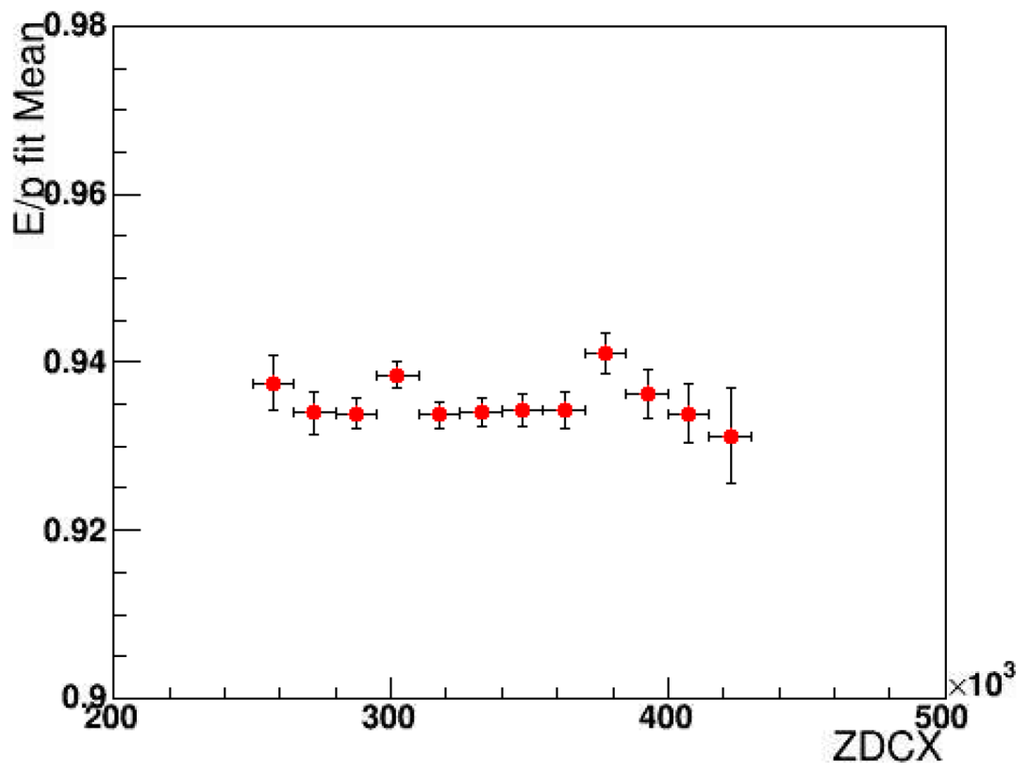
- < E / p> was calculated for the whole detector by dividing data set for several ZDC ranges .

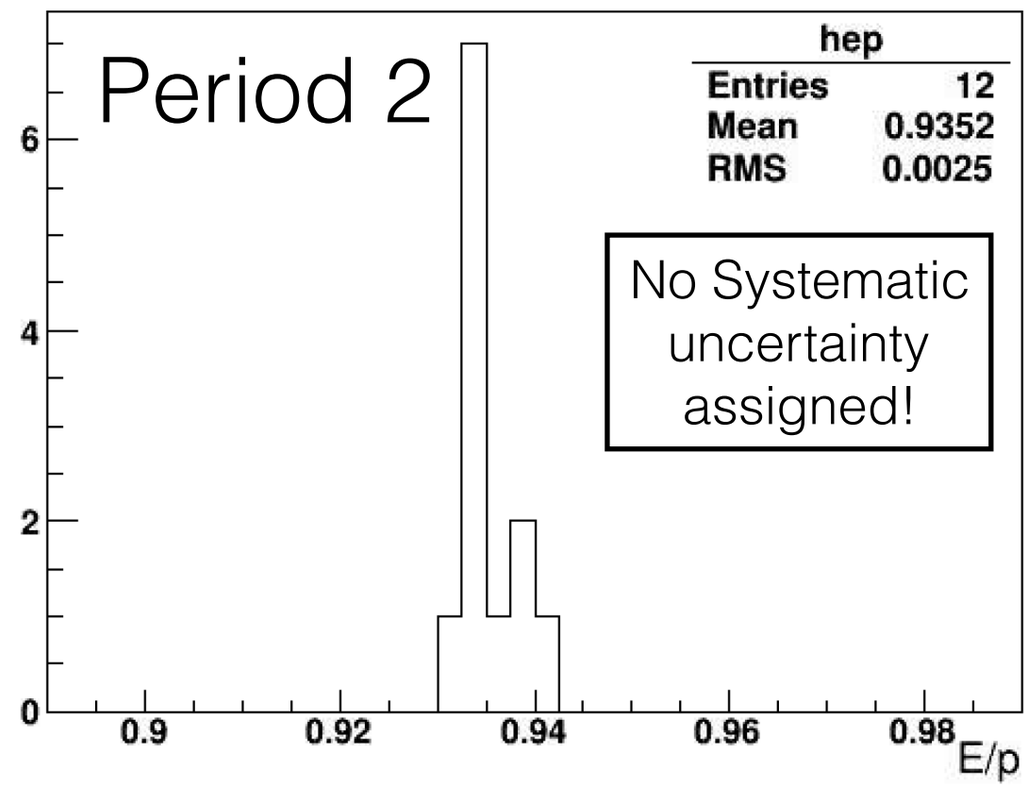
- Spread is to assign as the uncertainty.

Luminosity (ZDCx) Dependance





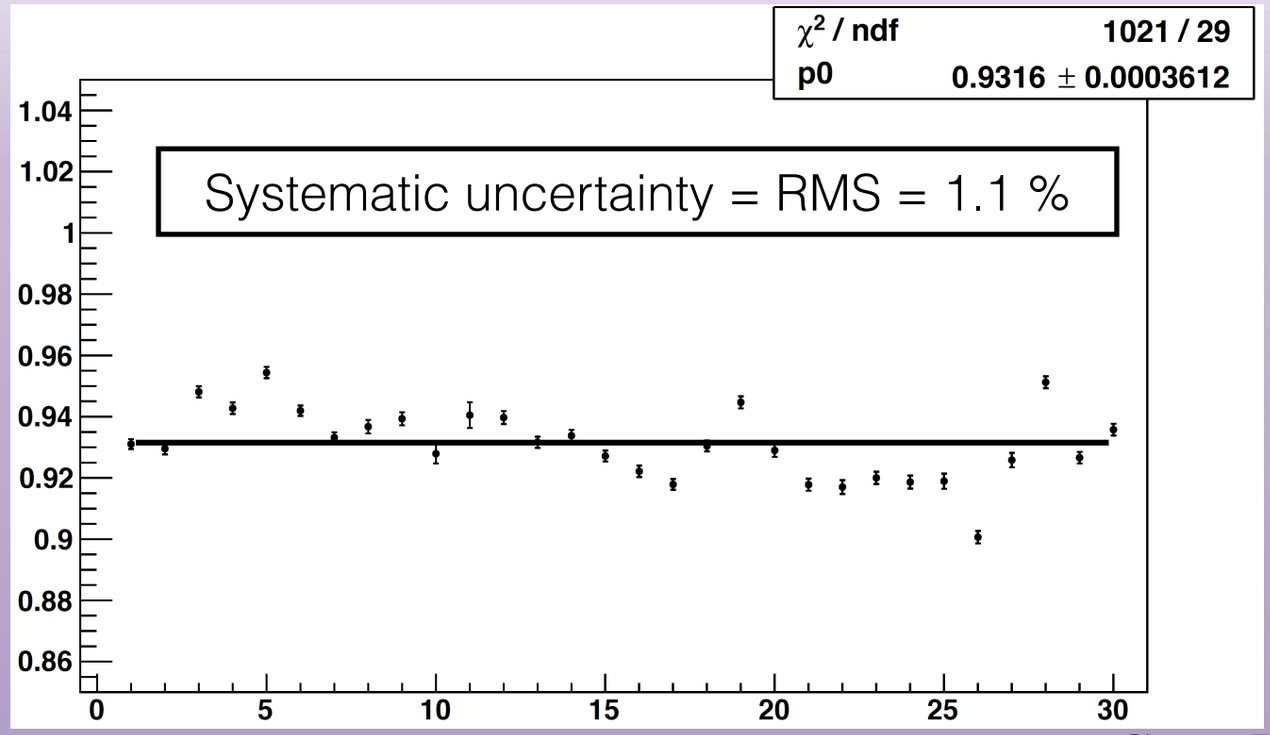


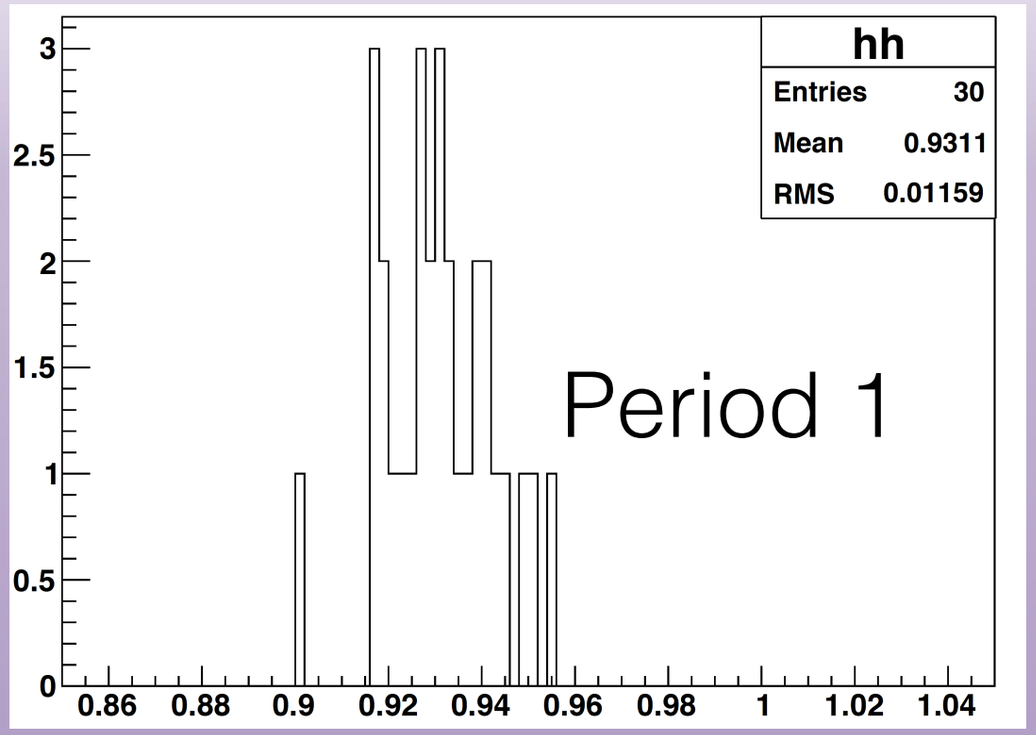


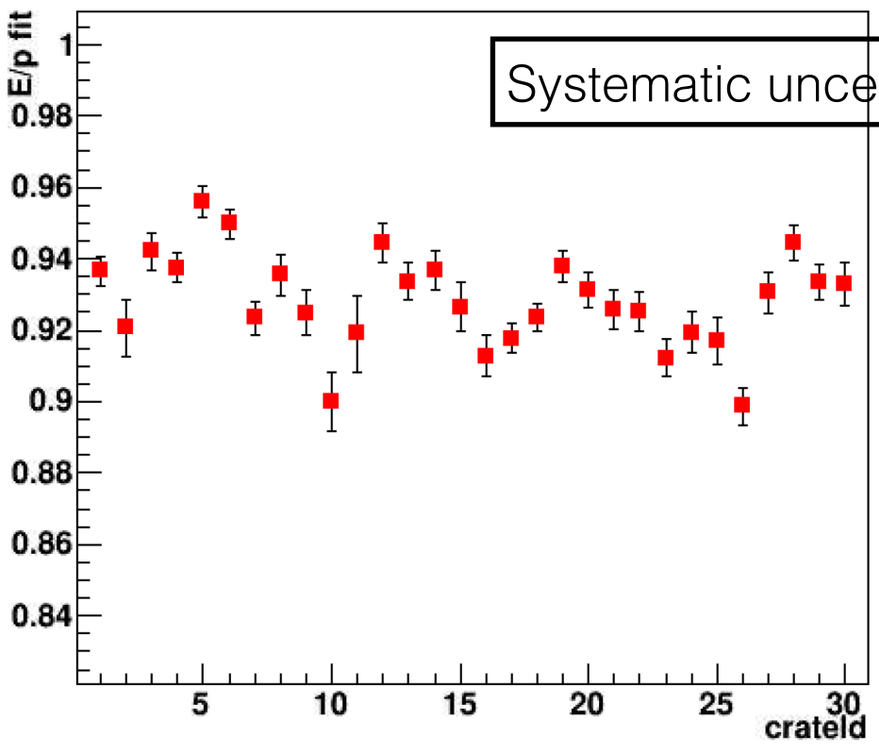
Crate Dependance

- < E / p> was calculated per crate .
- Spread is to assign as the uncertainty.

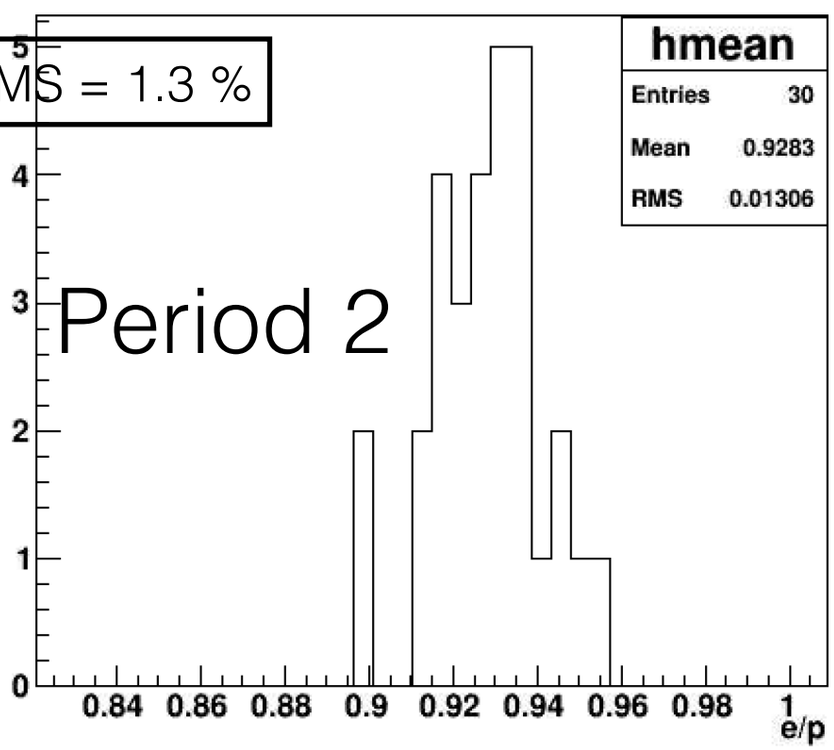
Crate Dependance



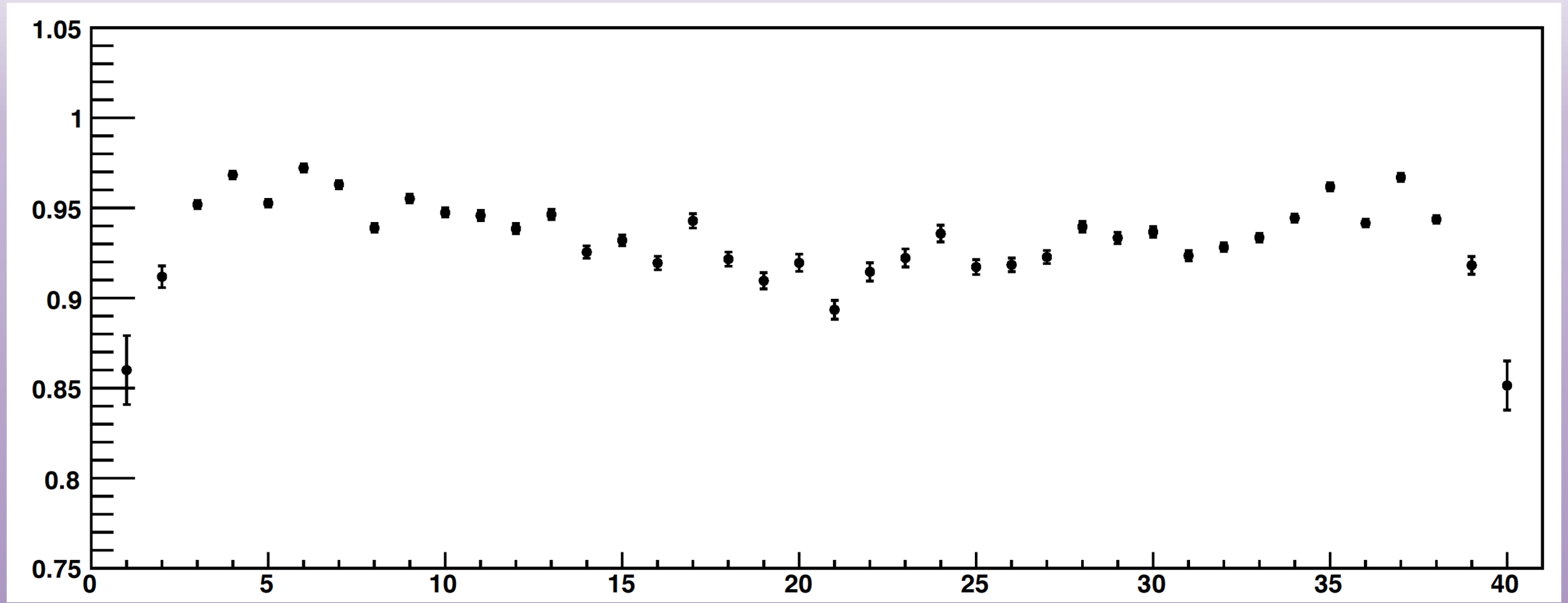




Systematic uncertainty =RMS = 1.3 %



Eta Dependance



- We obtain gain constant from E /p calculated per eta ring.
- Therefore Eta dependance of E / p would not considered as systematic.

Systematic Uncertainty Summary

	Systematic Error Period 1	Systematic Error Period 2
Trigger bias	1.4%	1.2%
Low momentum cut	0.7%	0.7%
TDR (ΔR) cut	< 0.5 % ==> 0	< 0.5 % => 0
Time dependance	0.8%	< 0.5 % ==> 0
Luminosity dependance (ZDCx)	< 0.5 % ==>0	< 0.5 % ==>0
Crate dependance	1.2%	1.3%
Eta dependance	will not consider as systematic	will not consider as systematic
Total	2.1%	1.9%

- Totals added in the quadrature

Run 12 pp 500 systematic

Type of Error	Inner Ring Value	Outer Ring Value
Global/Primary Tracks	0	0
e^+e^- Difference	0.9%	0.9%
Time Dependence	1.43%	1.43%
ΔR Dependence	0.67%	2.45%
Trigger bias	0.11%	0.11%
Crate effect	1.7%	1.7%
Rate Dependence	0	0
η Dependence	0	0
TOTALS (quadrature)	2.5%	3.43%

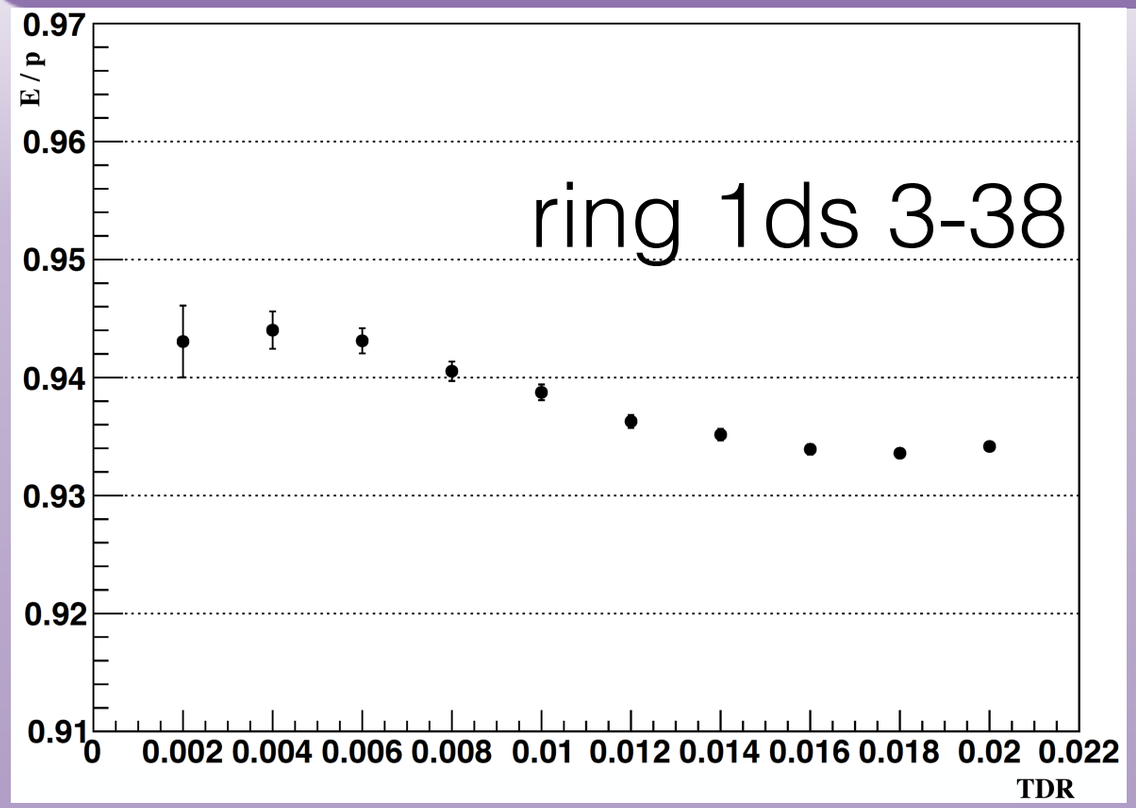
Conclusion

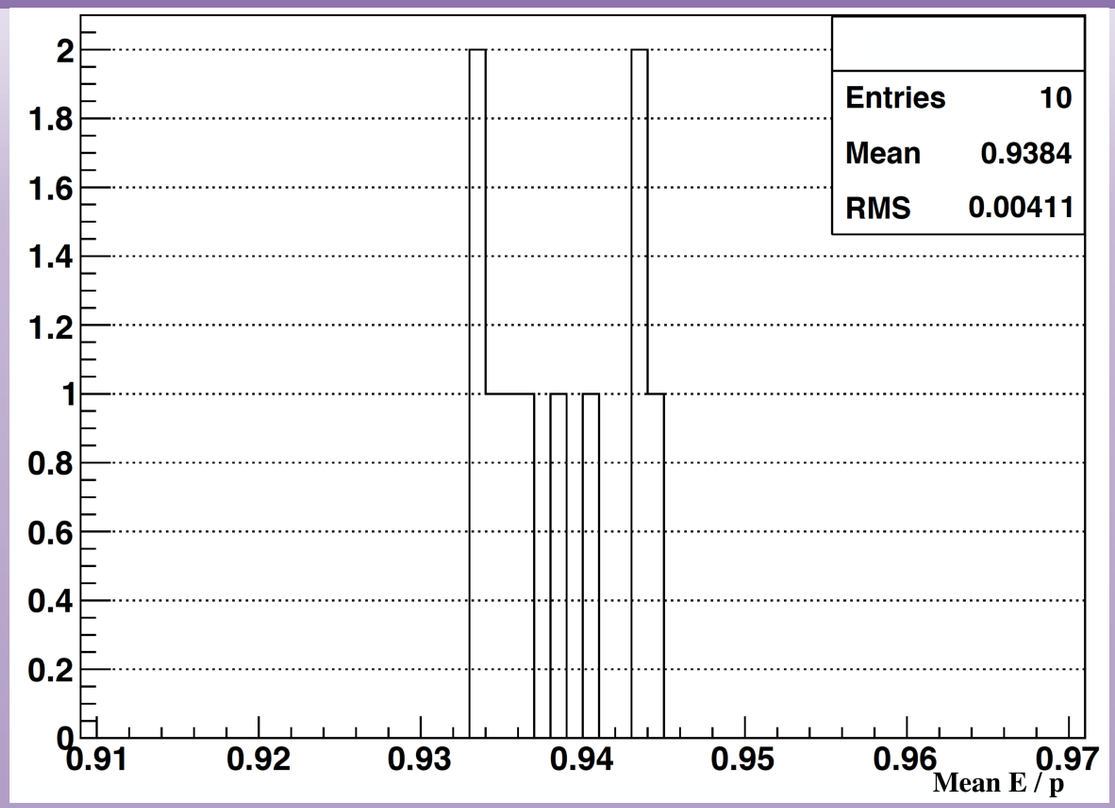
- Run 13 pp 500 GeV calibration evaluate systematic uncertainty of 2.1 % for period 1 and 1.9 % for period 2.

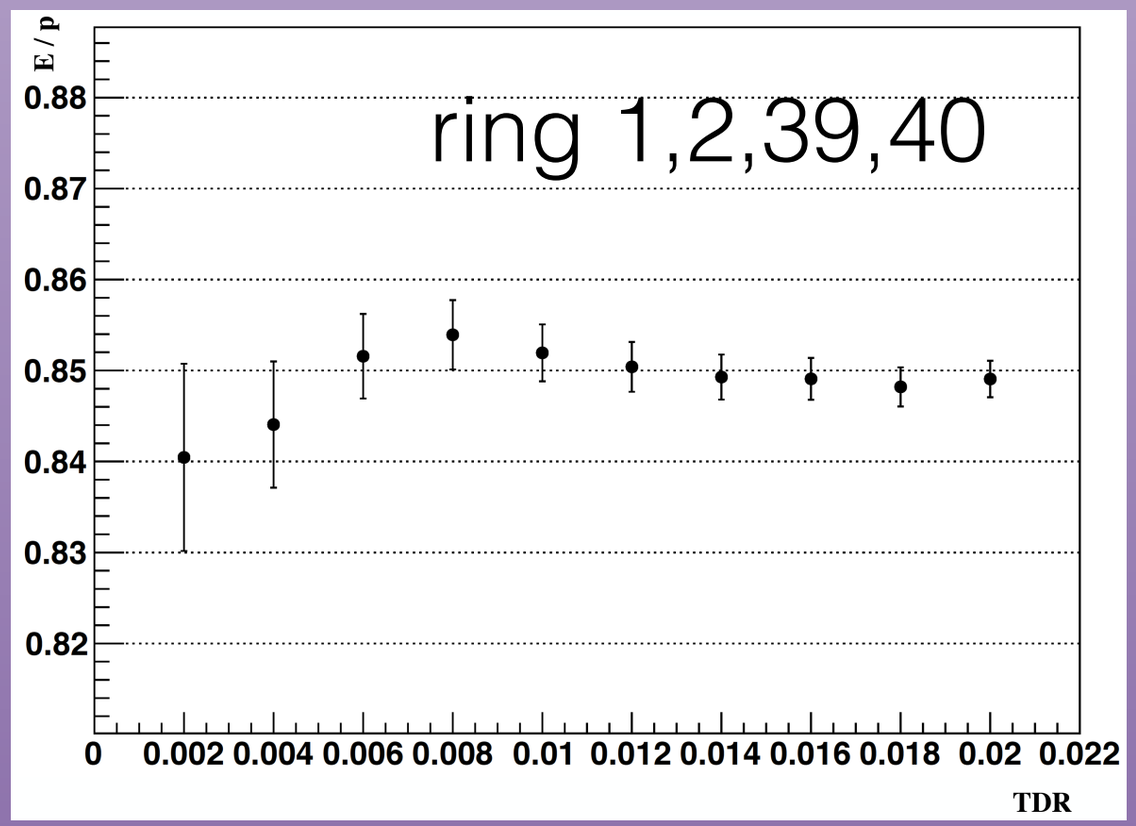
- Total systematic in run 6 is 1.6 % , 1.9 % in run 9 and 2.5 % for inner rings and 3.43 % for butter rings in run 12 .

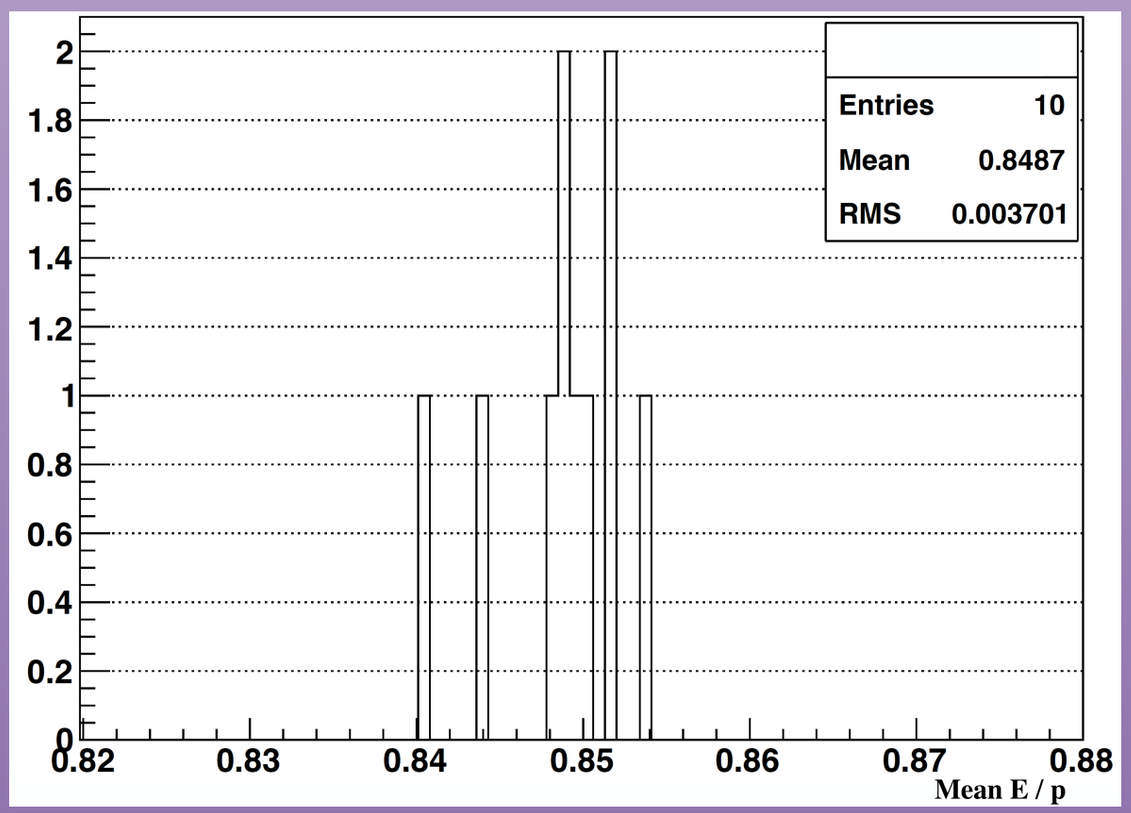
Backup

Upper TDR cut - Period 1 - BACKUP- inner, utter separatly

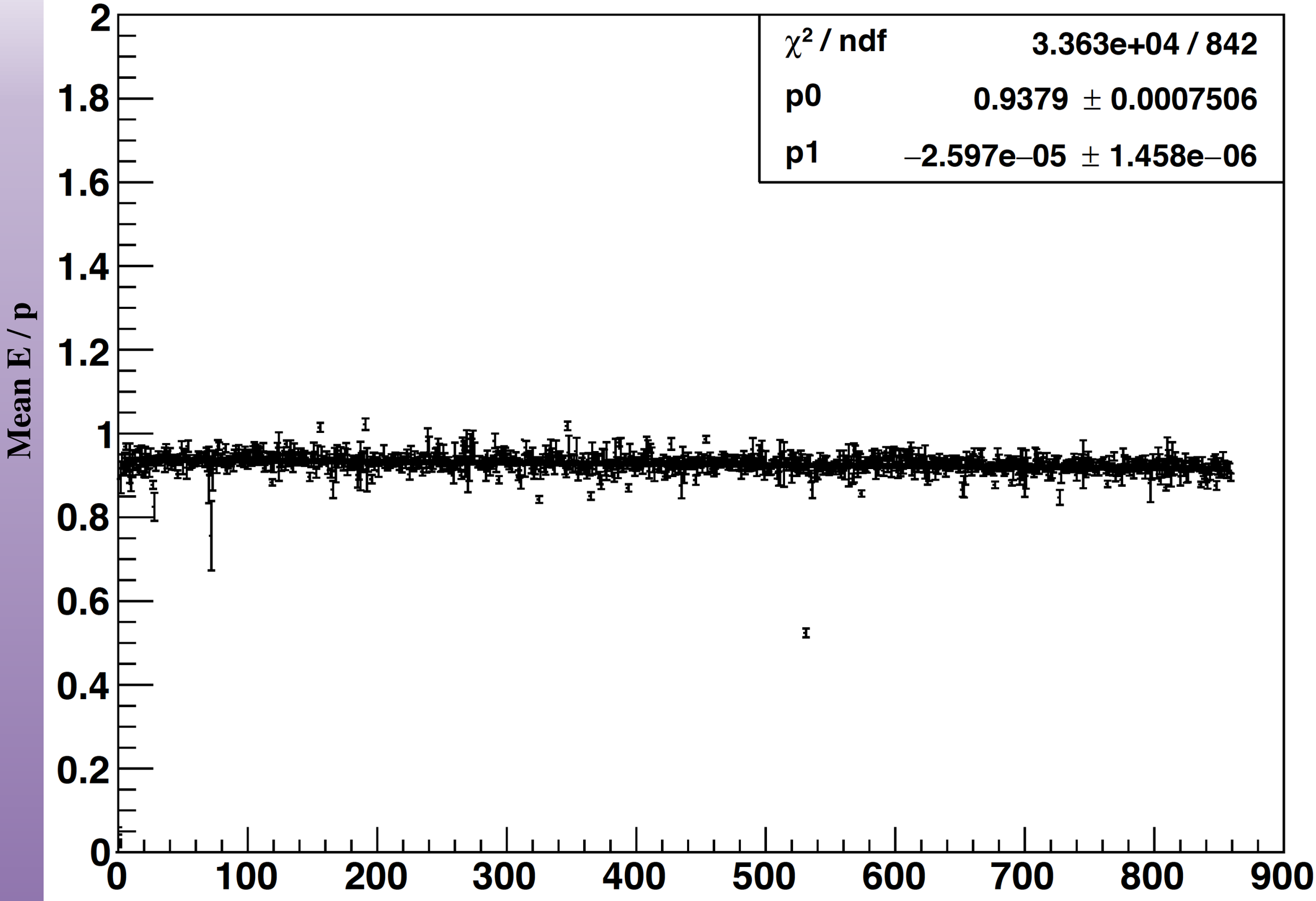






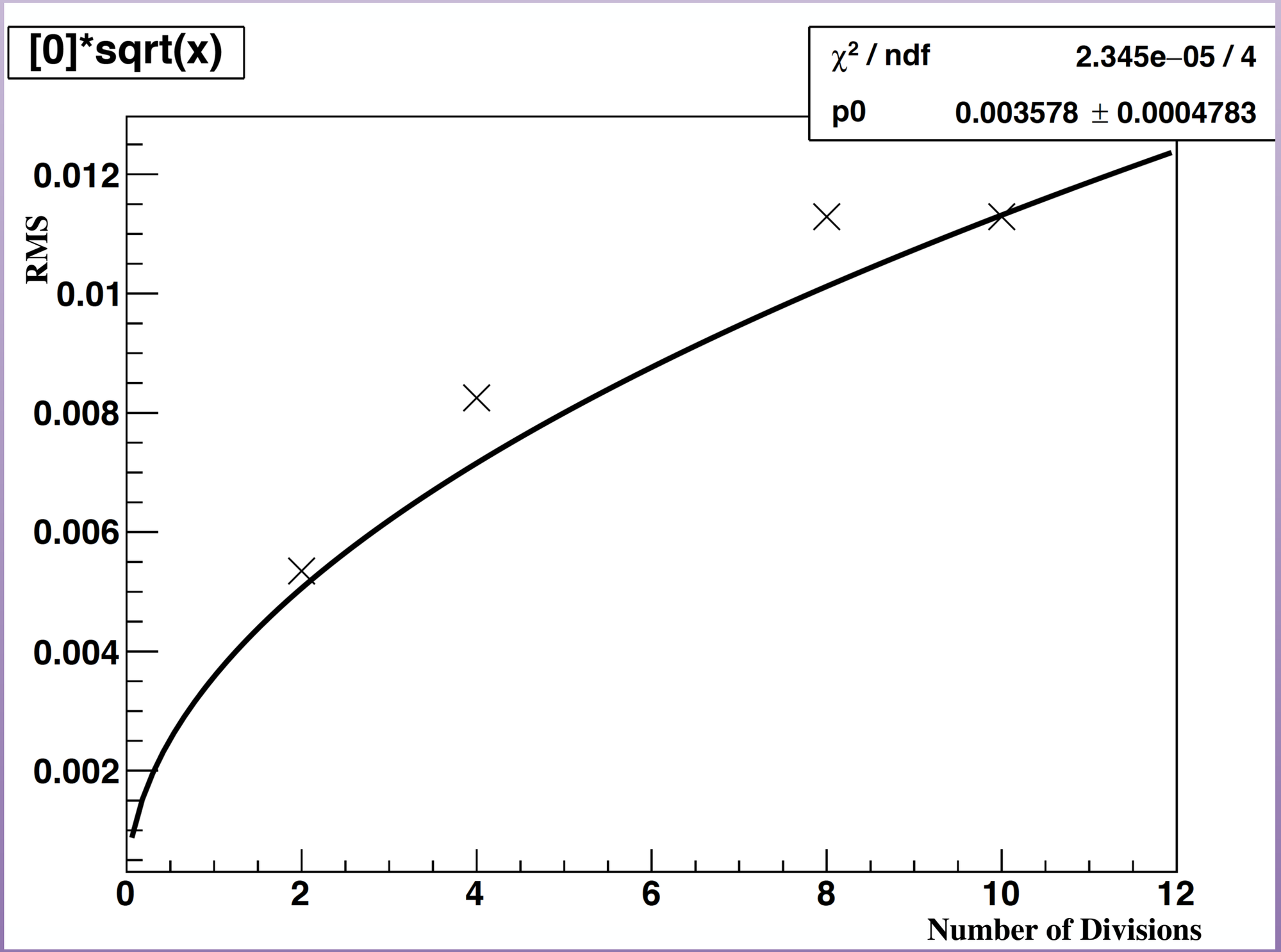


Time dependance per Run

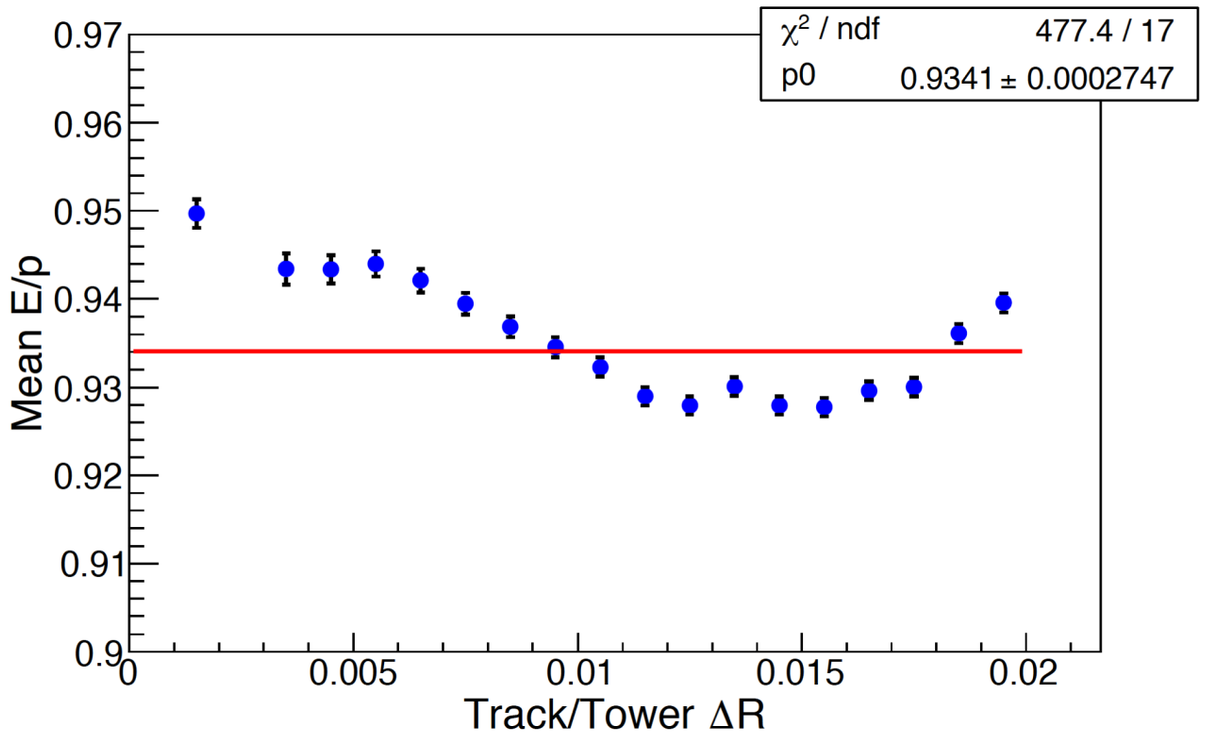


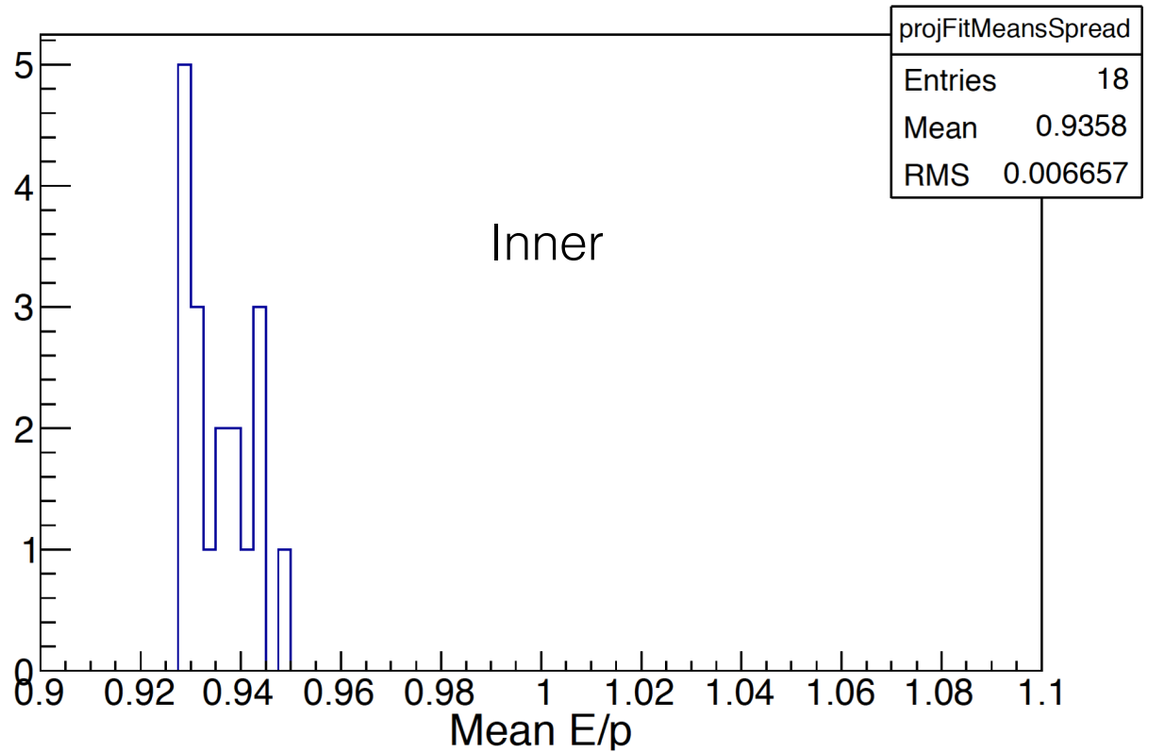
Luminosity dependance per run

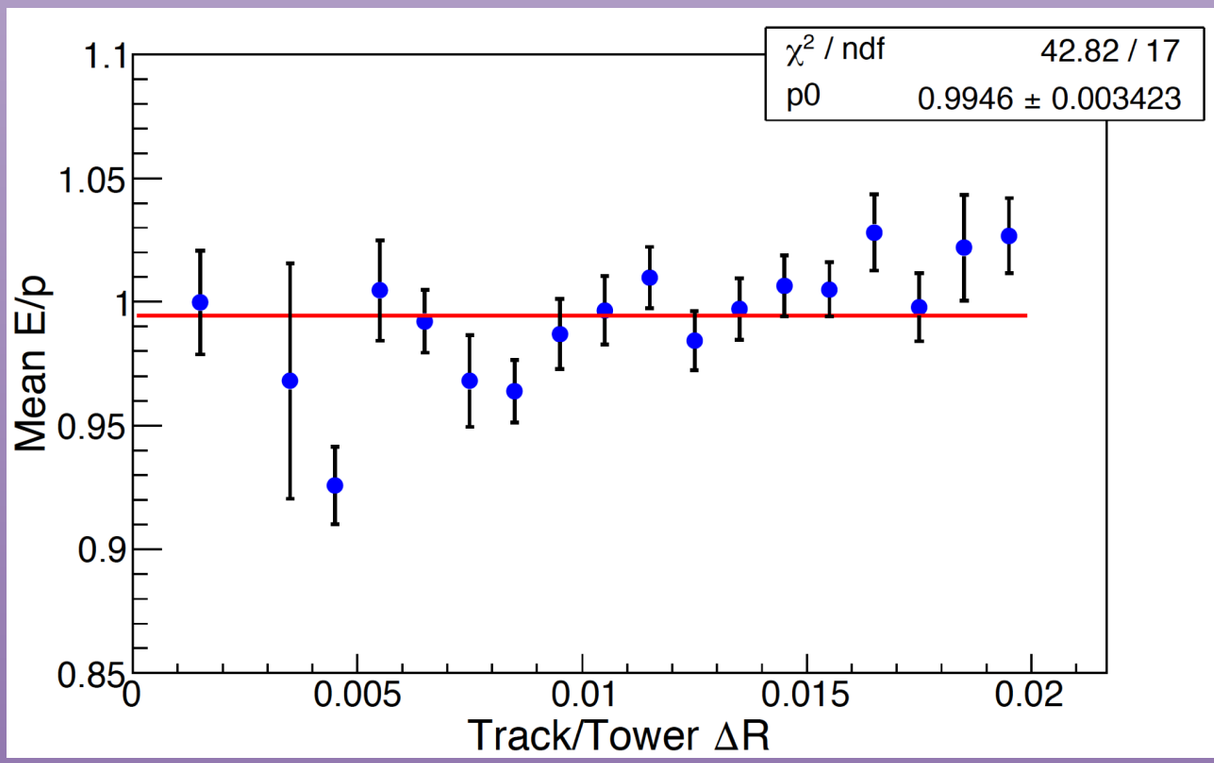
Eta Dependance - 2006 method

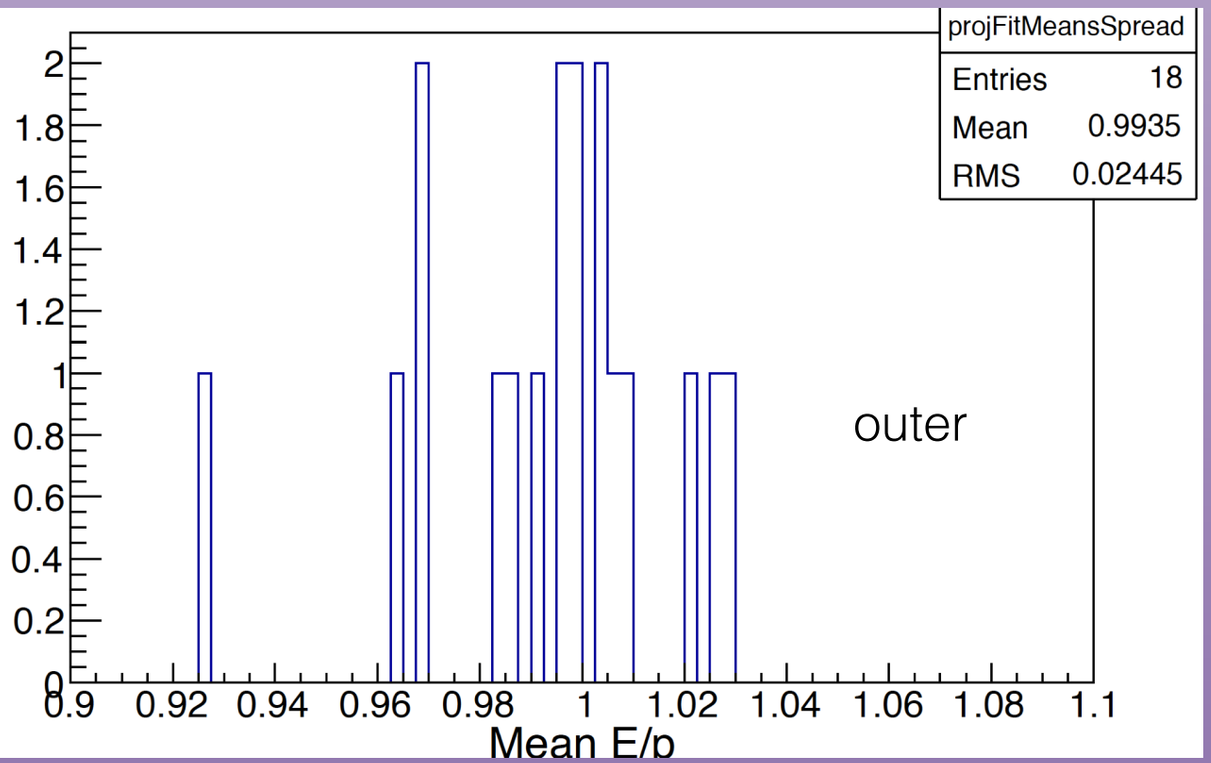


Run 12 TDR

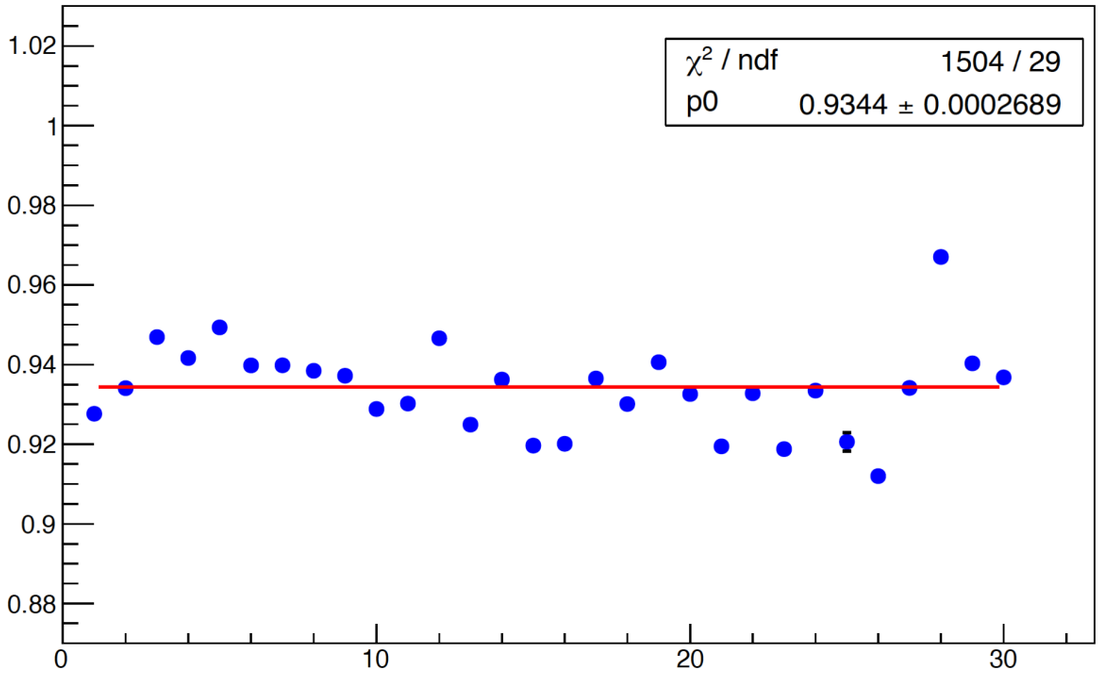

χ² / ndf 477.4 / 17
p0 0.9341 ± 0.0002747
Mean E/p
Track/Tower ΔR

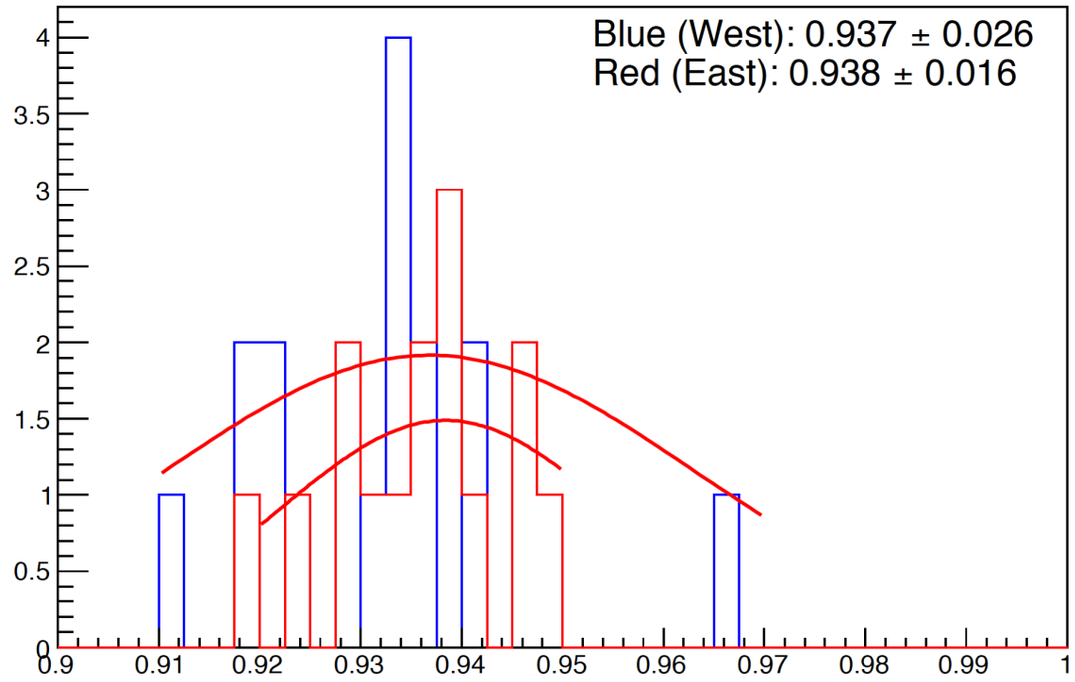

projFitMeansSpread
Entries 18
Mean 0.9358
RMS 0.006657
Inner
Mean E/p


χ² / ndf 42.82 / 17
p0 0.9946 ± 0.003423
Mean E/p
Track/Tower ΔR


projFitMeansSpread
Entries 18
Mean 0.9935
RMS 0.02445
outer
Mean E/p

Crate-to-Crate Effects





- Have a look at E/p split up by crates, and see if there is any overall differences and what the spread is
- Overall there seems to be some E/W differences in the structure, with a spread of about 1.7% or so over all crates (see backup)
- East/West comparison shows the mean is the same between east and west
- Maybe best to be safe and assign 1.7% systematic, the same as the spread in E/p