n-^{3}He Analysis Outcome

Asymmetry Extraction From n-^{3}He Data: Part 1

Latiful Kabir

University of Kentucky

February 10, 2017

Outline

Data Analysis Algorithm

1. Divide the entire data set into several (contiguous) batches based on beam power stability.
2. Within each batch separate the runs as A and B groups based on RFSF state on dropped pulses.
3. Within each group, calculate raw asymmetry by considering two consecutive pulses. The yield is background subtracted and normalized by sum over all the detector signals.
4. Cut: Skip dropped pulse and pulses around it. Consider only 600 sequences with no dropped pulse within the sequence.
5. Fill in the histogram per wire for raw asymmetry over all the runs within each group. Get the mean of raw asymmetry from the histogram.
6. Within each batch combine A and B result using simple averaging. Divide by the geometry factor to get physics asymmetry for each wire.
7. Within each batch, considering either A or B group runs($\leftarrow$), calculate correlations and apply that to get correlation corrected physics asymmetry and its uncertainty for group A and B dataset.
$\rightarrow$ Using covariance of A and B, construct covariance for $\frac{1}{2}$(A+B)
8. Combine physics asymmetry from all the batches to get global physics asymmetry for the entire data set.

Why make A and B separation?

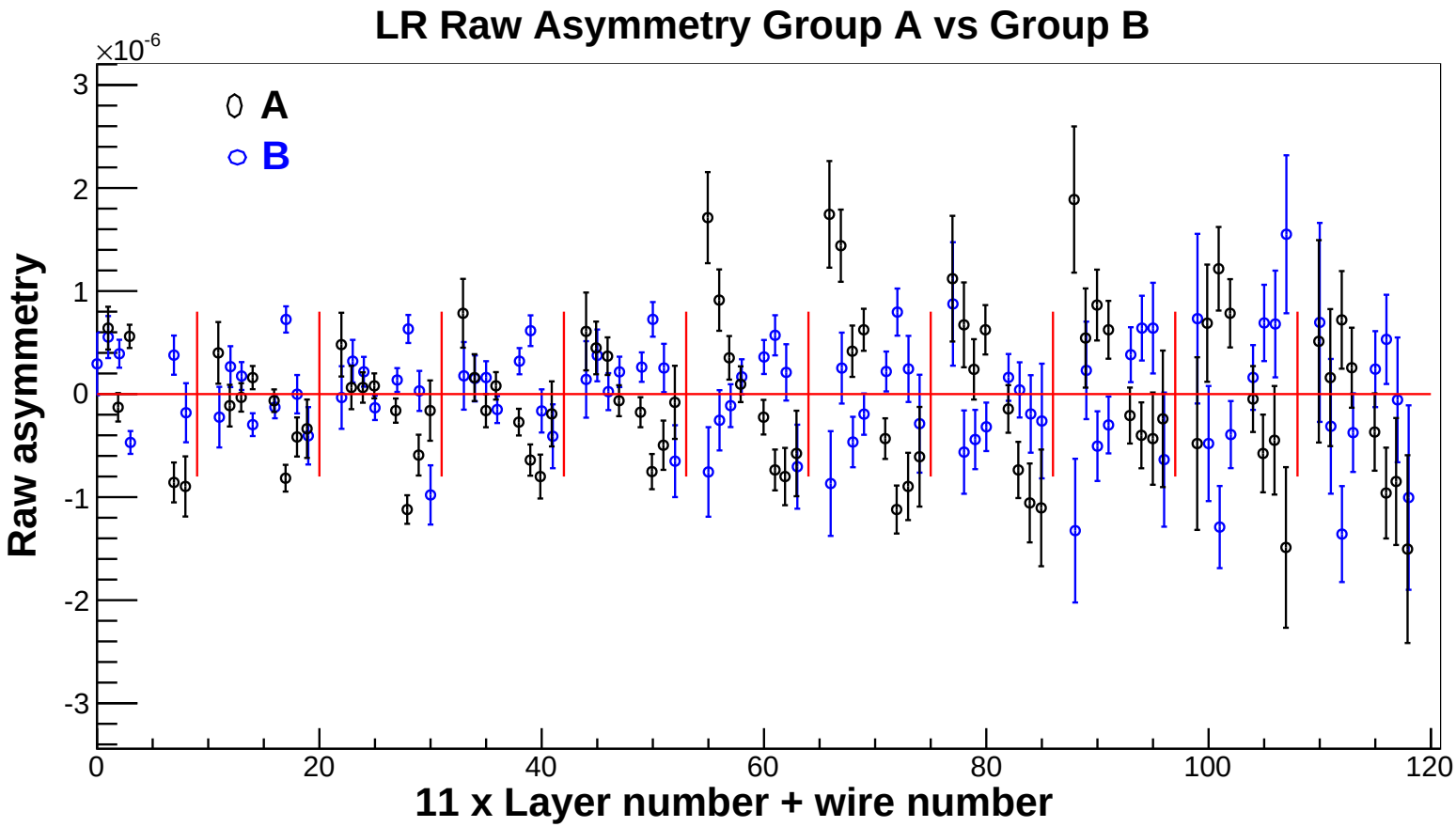


Figure: Raw asymmetry for entire LR data set : Group A vs Group B

Why make A and B separation?

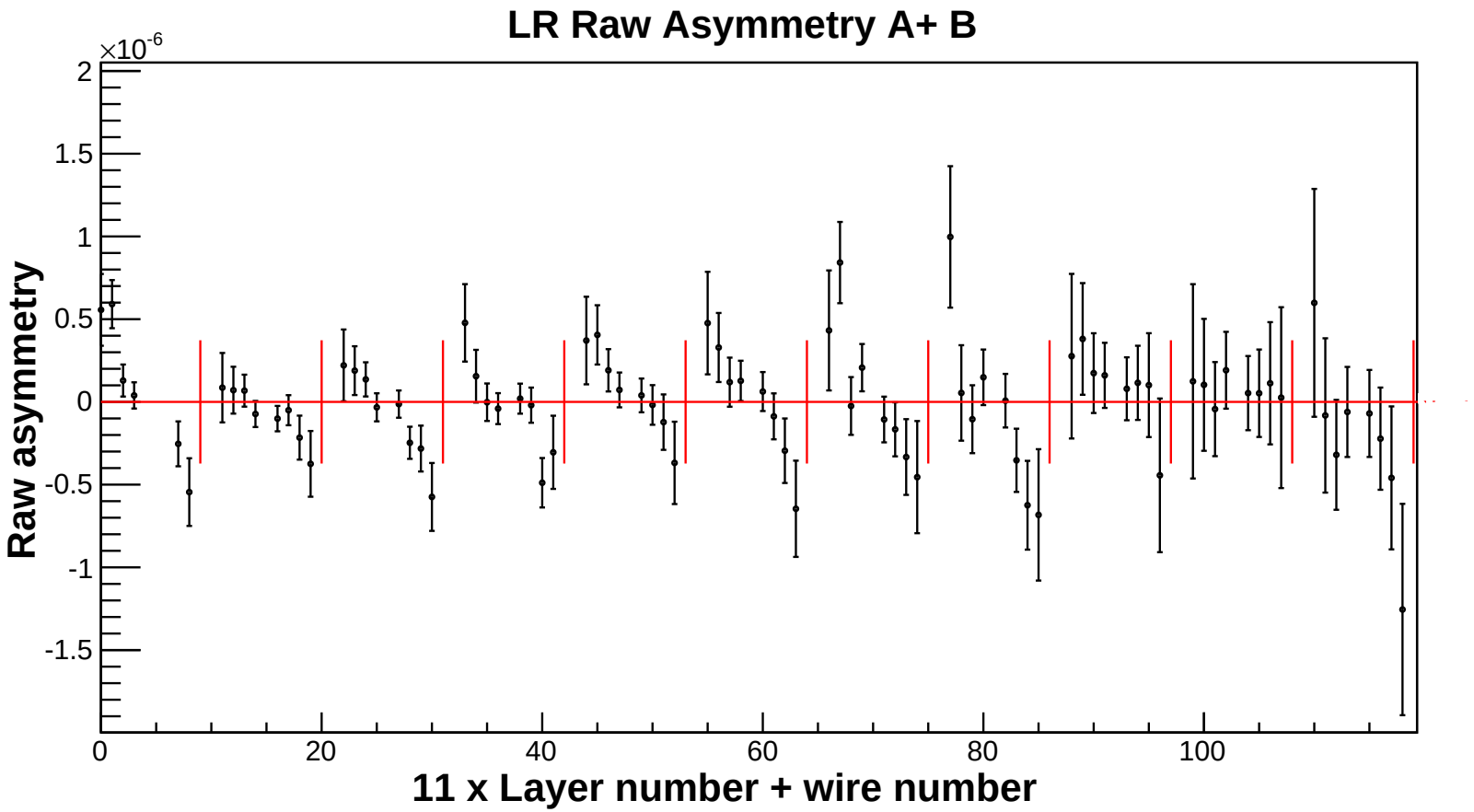


Figure: Raw asymmetry for entire LR data set : Group A + Group B

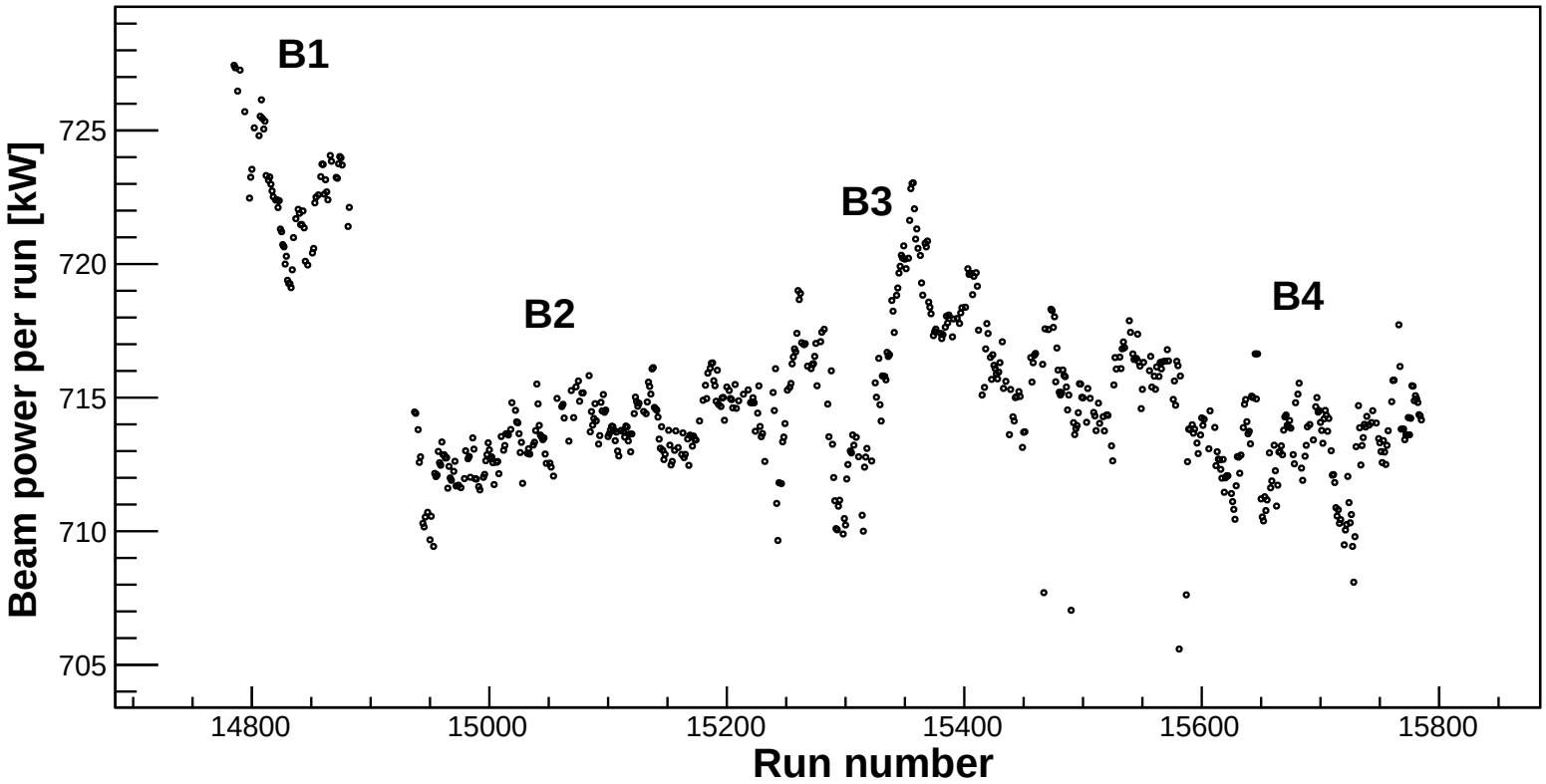
LR Asymmetry: Data Summary

Summary :

– Run ranges : 14785 - 15860
– Number of runs analyzed : 738
– Batches :

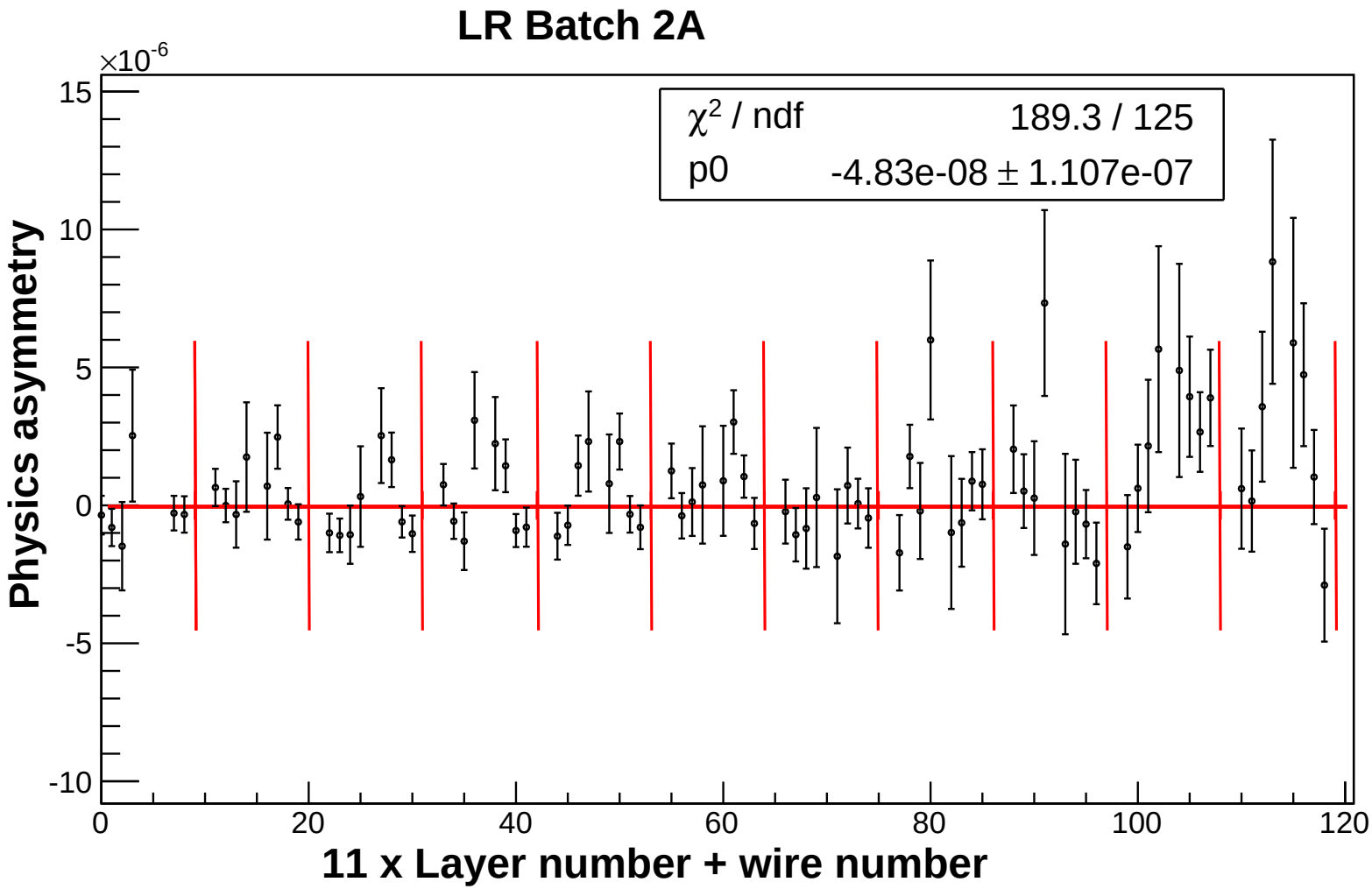
Batch-1 : 14785 - 14880
Batch-2 : 14881 - 15235
Batch-3 : 15236 - 15520
Batch-4 : 15521 - 15785
Batch-5 : 15786 - 15860

Beam power distribution for LR data

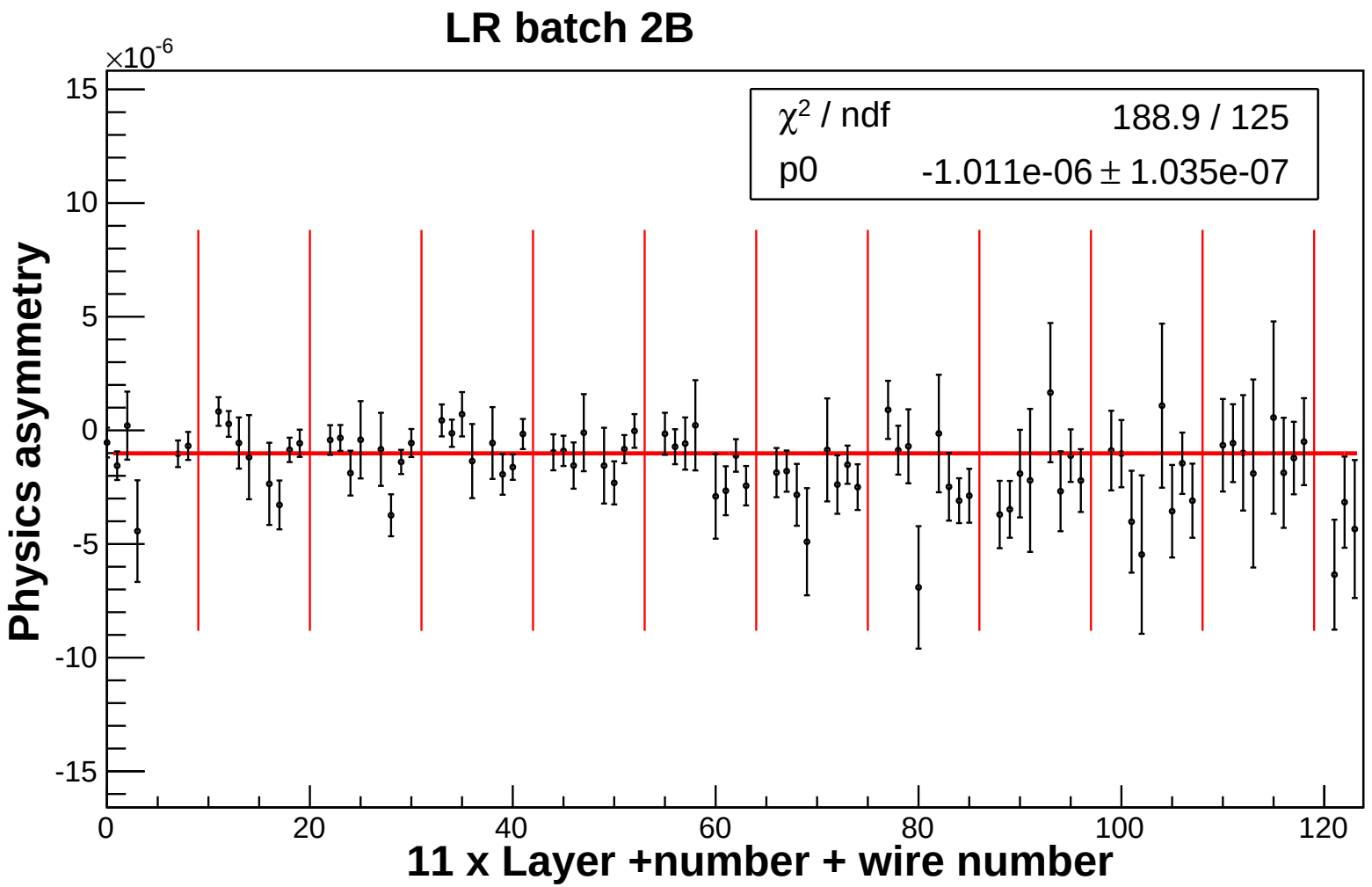


Note : Dropped pulses have been excluded while calculating beam power.

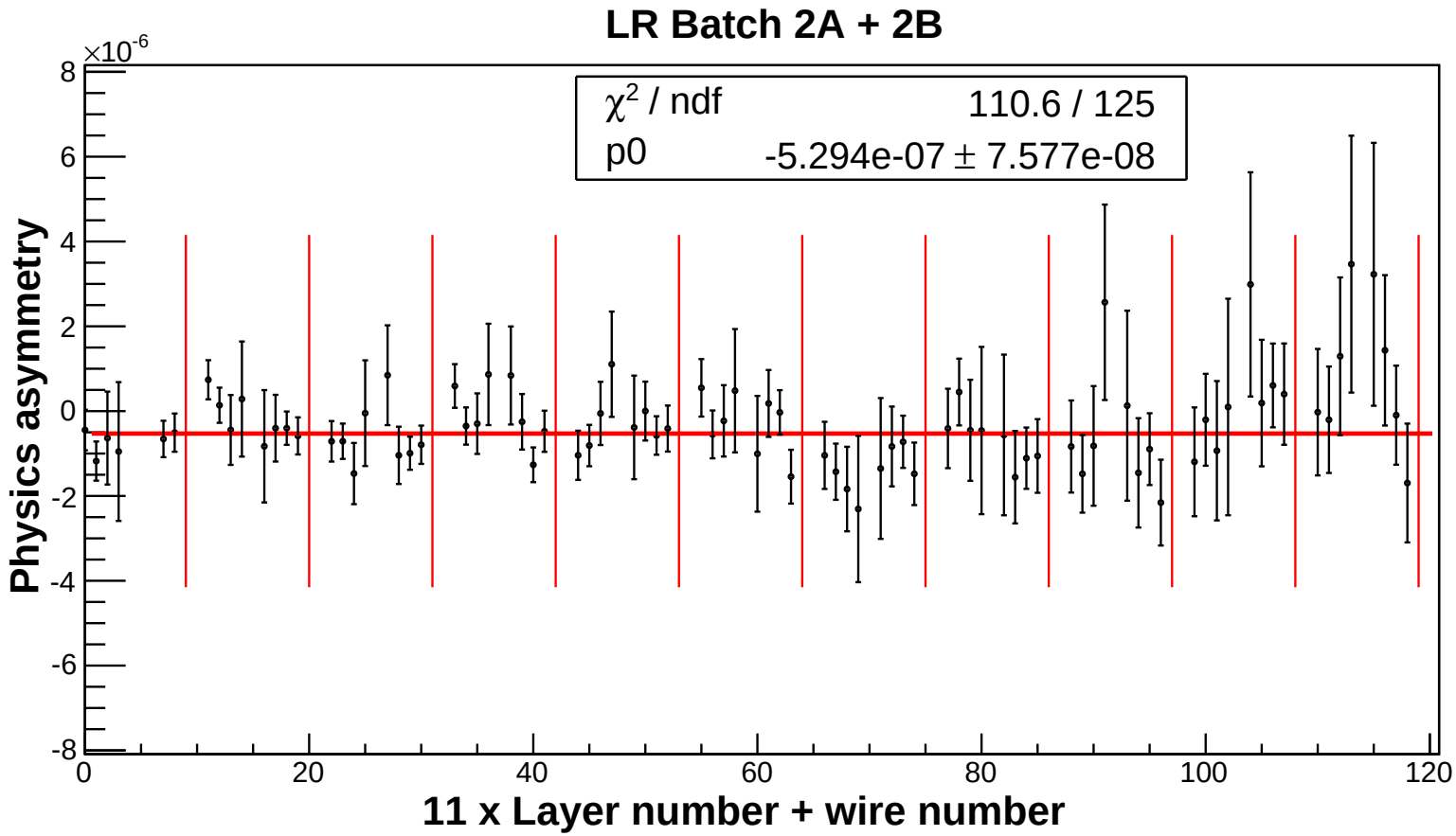
LR Physics Asymmetry from Batch 2A



LR Physics Asymmetry from Batch 2B



LR Physics Asymmetry from Batch 2A+2B



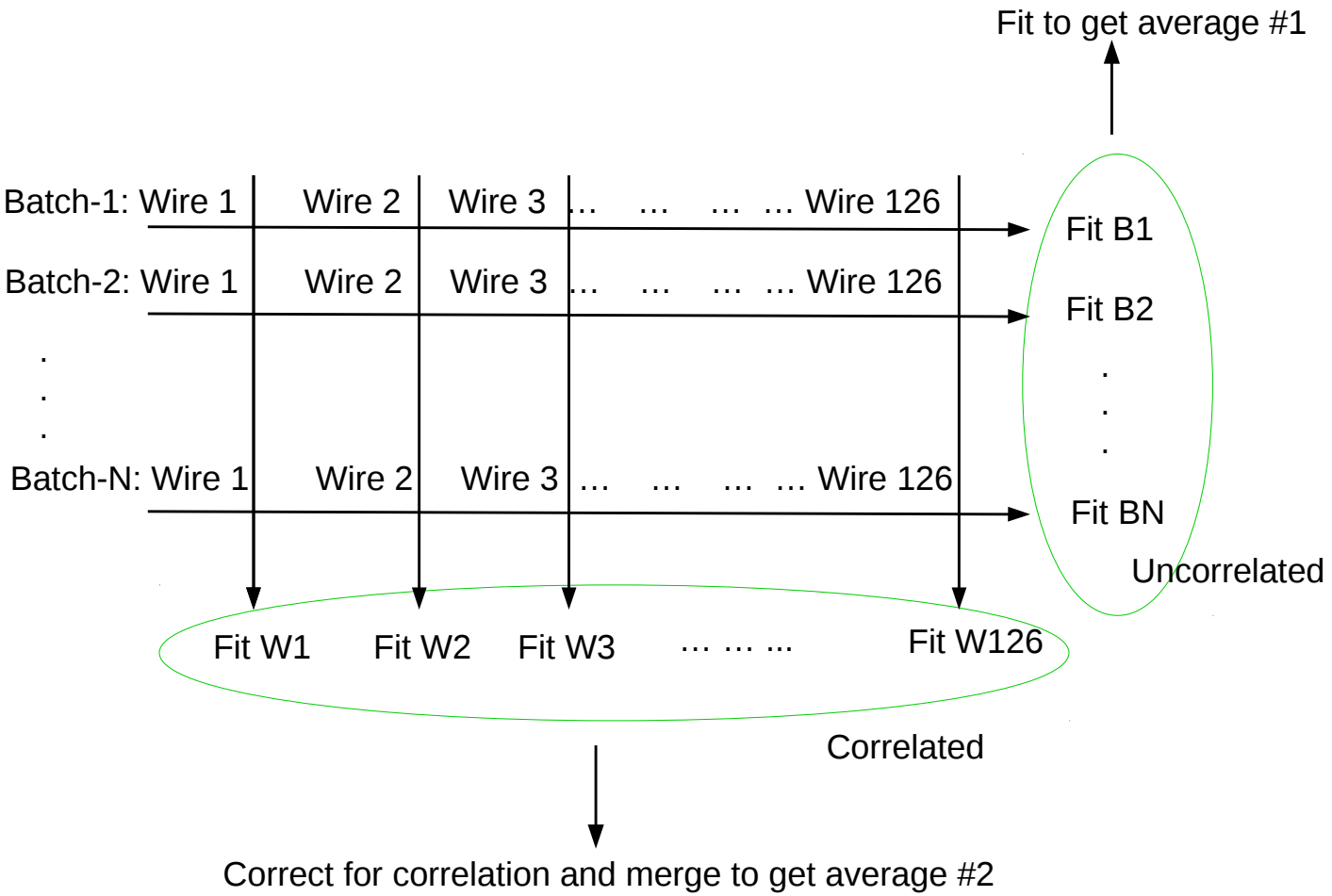
— If we apply correction for correlation and combine all wires we get:
A_{LR} = (-5.35 $\pm$ 1.19)$\times$ 10^{-7} (For Batch 2)

LR asymmetry from different batches

Batch#	Physics Asymmetry		Physics Asymmetry A + B		Physics Asymmetry (Correlation Corrected)	
	Group:A	Group : B	A $\pm\Delta A$	χ^2/ndf	A $\pm\Delta A$	χ^2/ndf
#1 (64)	-0.56 $\pm$ 1.78	-7.89 $\pm$ 2.09	-4.23 $\pm$ 1.37	113.58/125	-3.81 $\pm$ 2.15	113.96/125
#2 (208)	-0.48 $\pm$ 1.1	-10.11 $\pm$ 1.03	-5.29 $\pm$ 0.76	110.64/125	-5.35 $\pm$ 1.19	113.77/125
#3 (197)	0.91 $\pm$ 1.07	-10.60 $\pm$ 1.12	-4.85 $\pm$ 0.78	141.08/125	-5.09 $\pm$ 1.22	150.37/125
#4 (195)	3.93 $\pm$ 1.09	-8.63 $\pm$ 1.12	-2.35 $\pm$ 0.78	132.35/125	-2.72 $\pm$ 1.22	130.19/125
#5 (57)	4.81 $\pm$ 2.08	-9.92 $\pm$ 2.27	-2.55 $\pm$ 1.54	131.04/125	-3.69 $\pm$ 2.42	147.85/125
#6 (166)	-1.46 $\pm$ 1.30	-4.28 $\pm$ 1.26	-2.87 $\pm$ 0.90	109.46/125	-3.44 $\pm$ 1.39	117.17/125
#7 (163)	-13.00 $\pm$ 1.10	4.61 $\pm$ 1.05	-4.20 $\pm$ 0.76	115.51/125	-3.97 $\pm$ 1.17	106.85/125

Note : Asymmetries and their errors are presented in 10^{-7}.

Data Reduction



Fit Along Batches

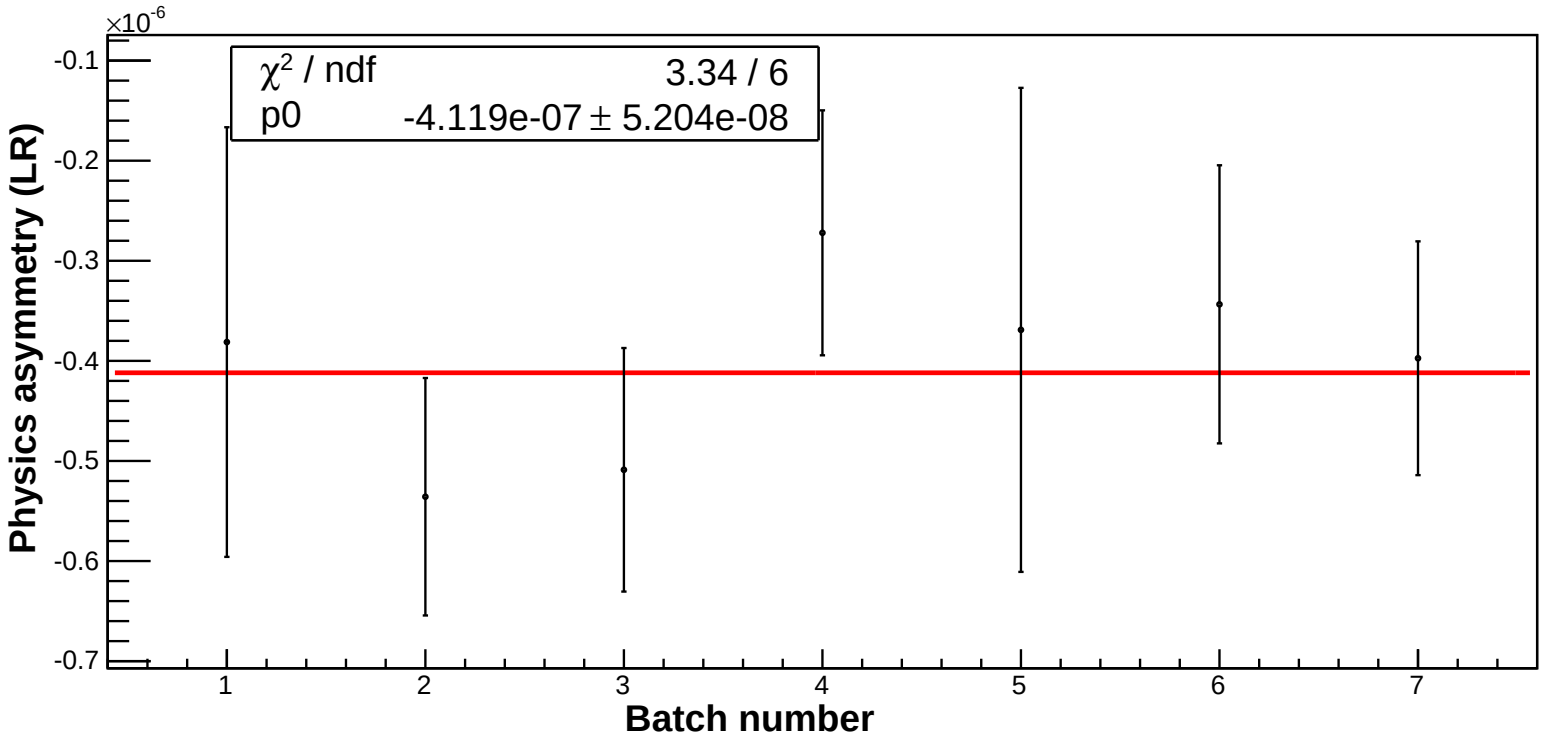


Figure: Average LR physics asymmetry over all batches

Fit Along Wires

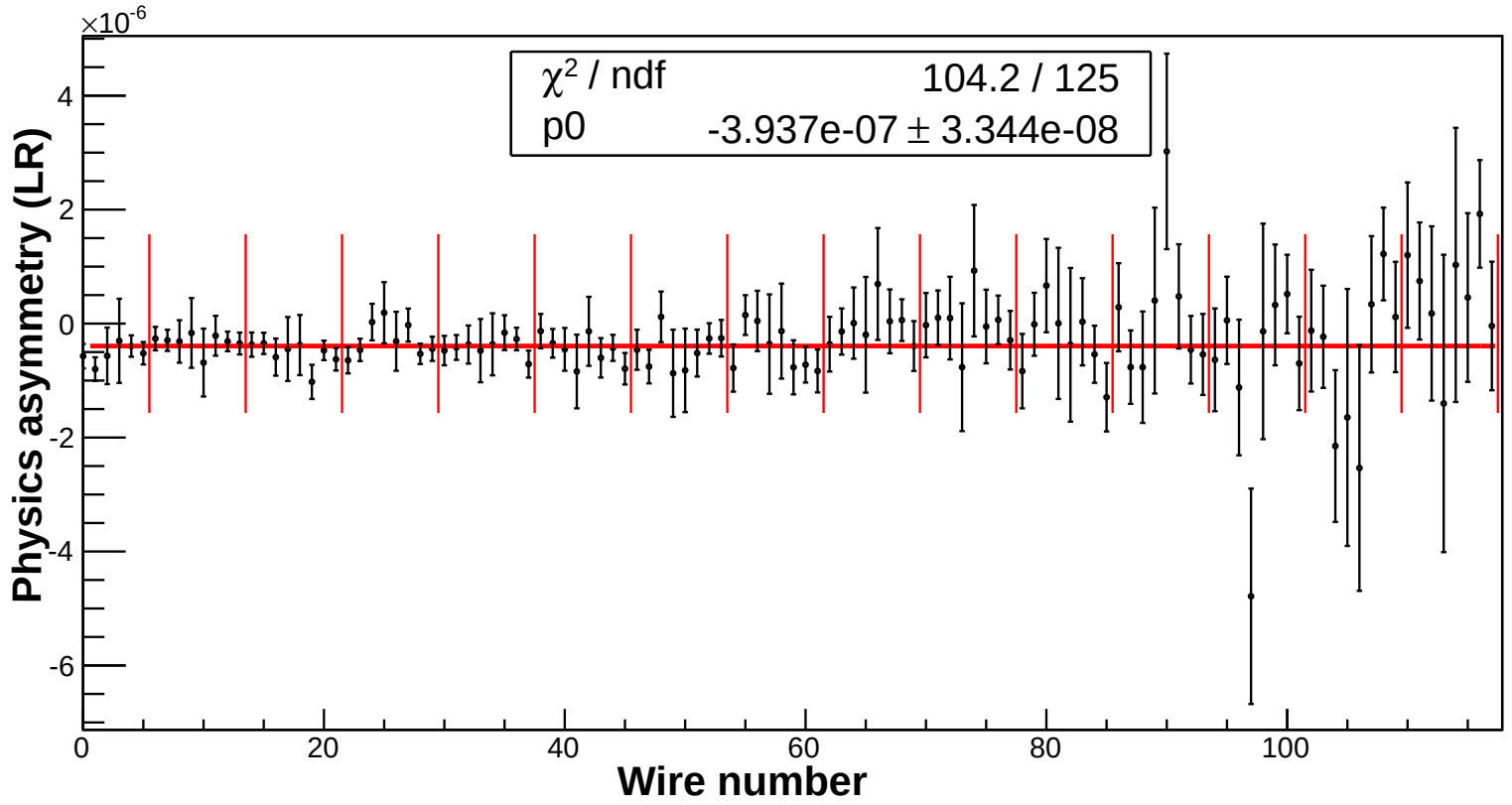
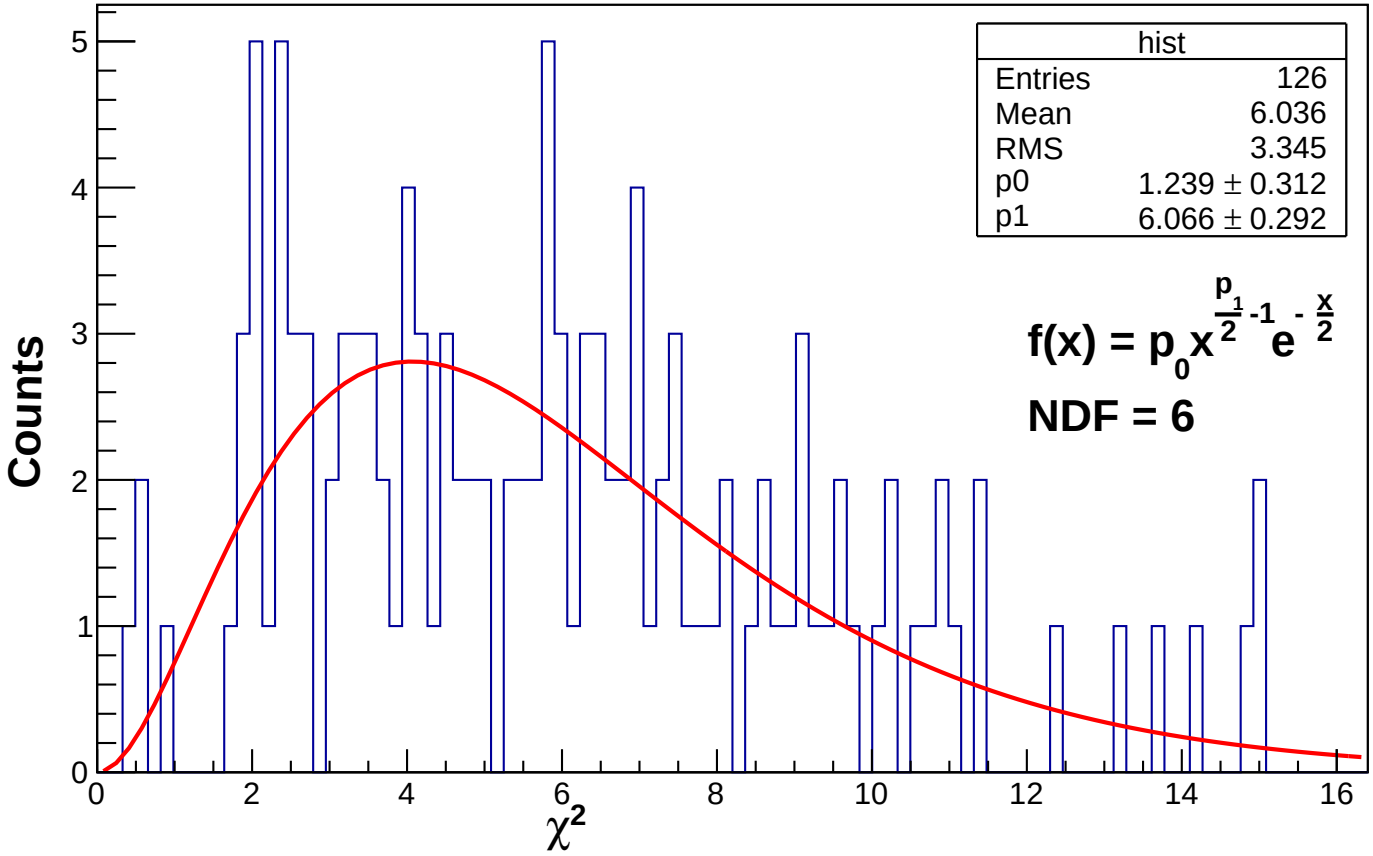


Figure: Physics asymmetry for each wire after fit

Fit Along Wires



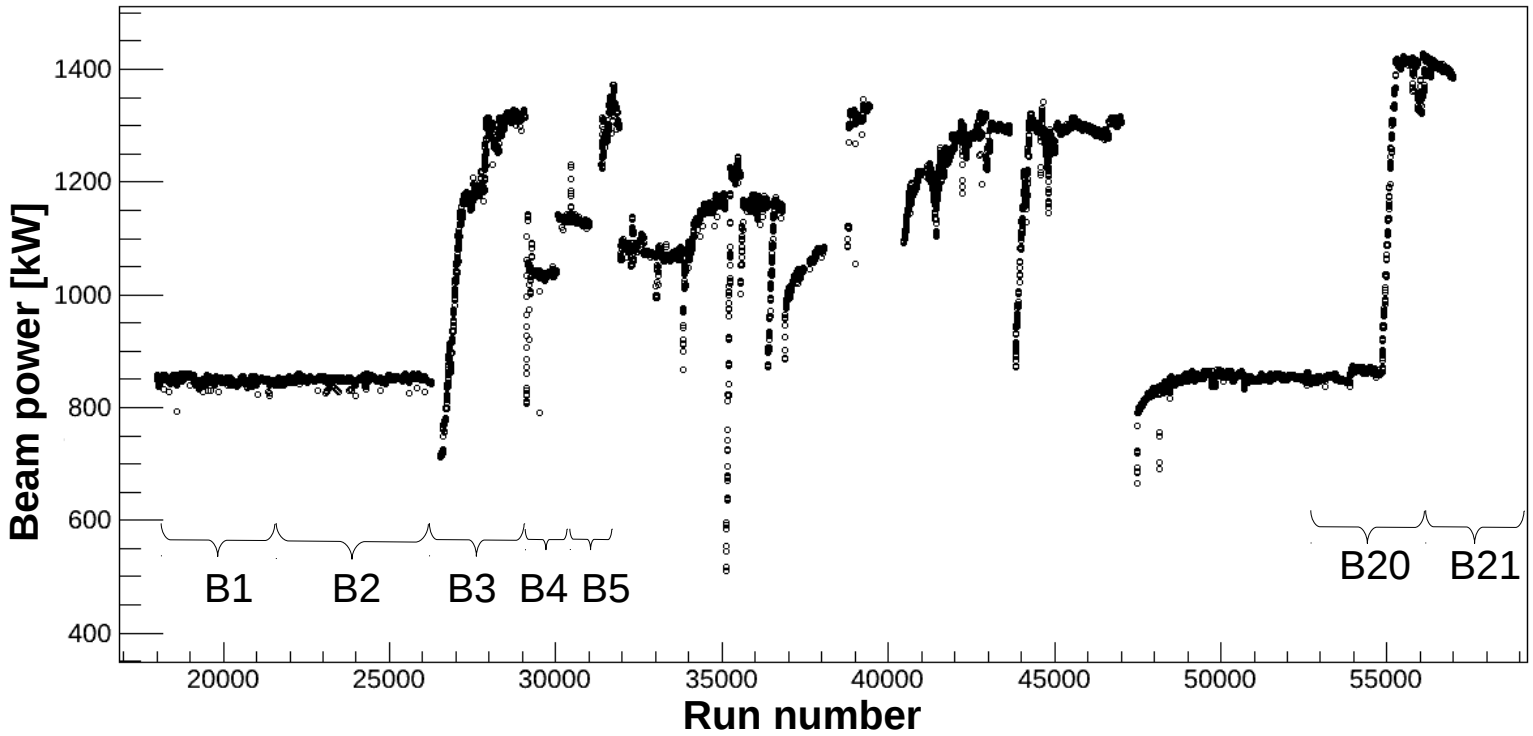
UD Asymmetry

UD Data Summary:

Run ranges : 18000 - 57000

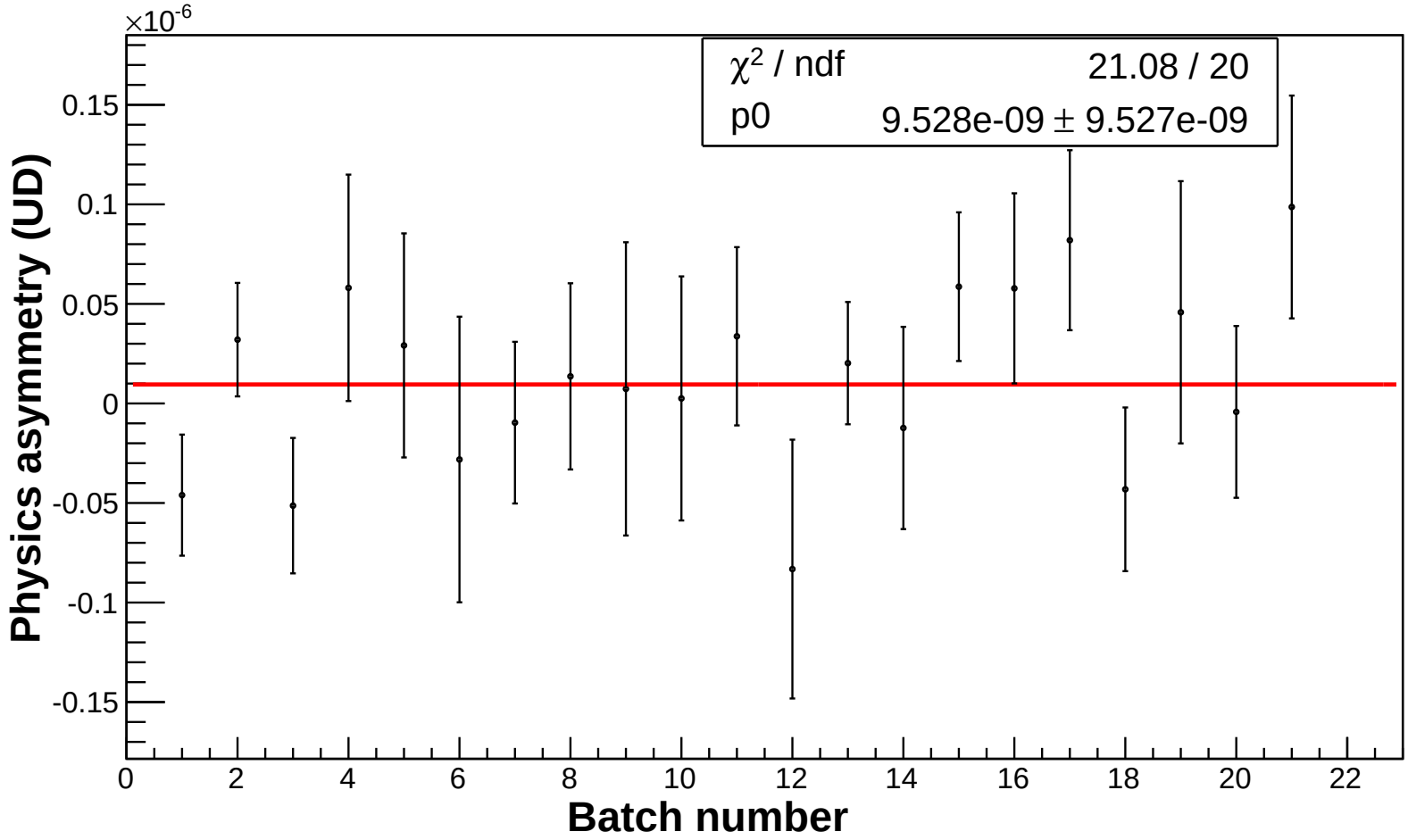
Batch -1 : 18000 - 22000
Batch -2 : 22001 - 26500
Batch -3 : 26501 - 29100
Batch -4 : 29101 - 30050
Batch -5 : 30051 - 31250
Batch -6 : 31251 - 31930
Batch -7 : 31931 - 33800
Batch -8 : 33801 - 35100
And more ... ...

Beam power distribution for UD dataset

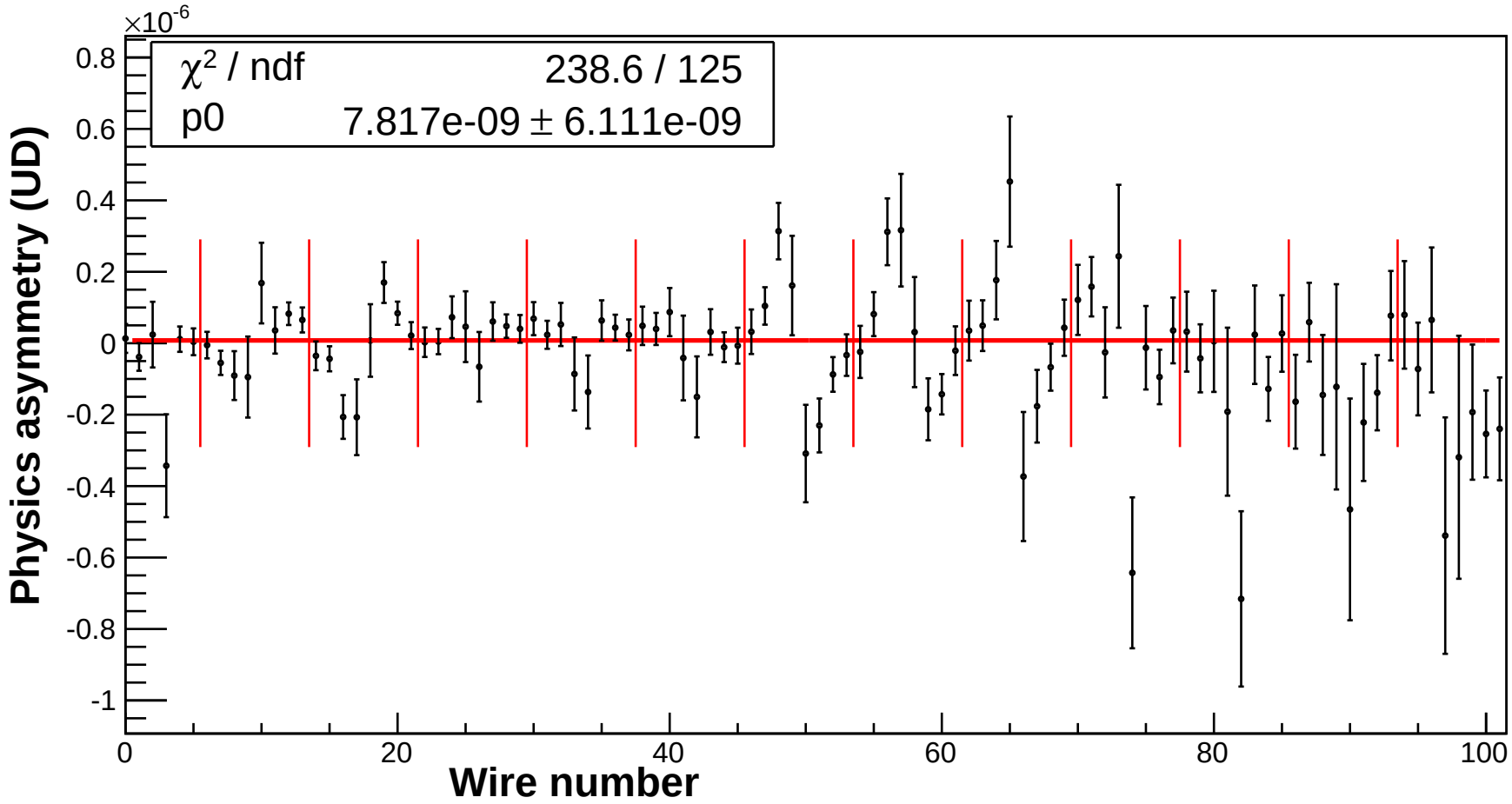


Note : Dropped pulses have been excluded while calculating beam power.

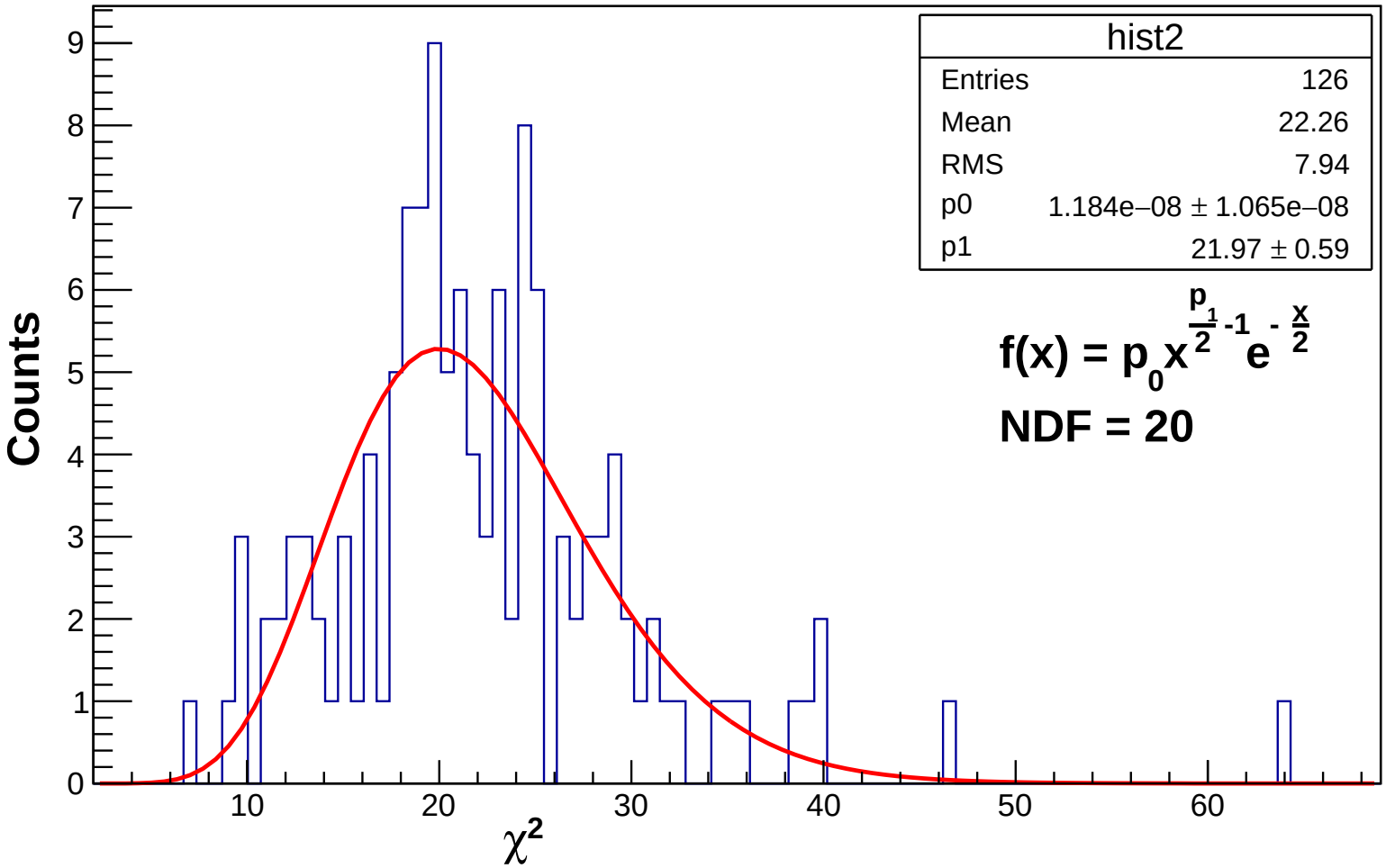
Fit Along Batches



Fit Along Wires

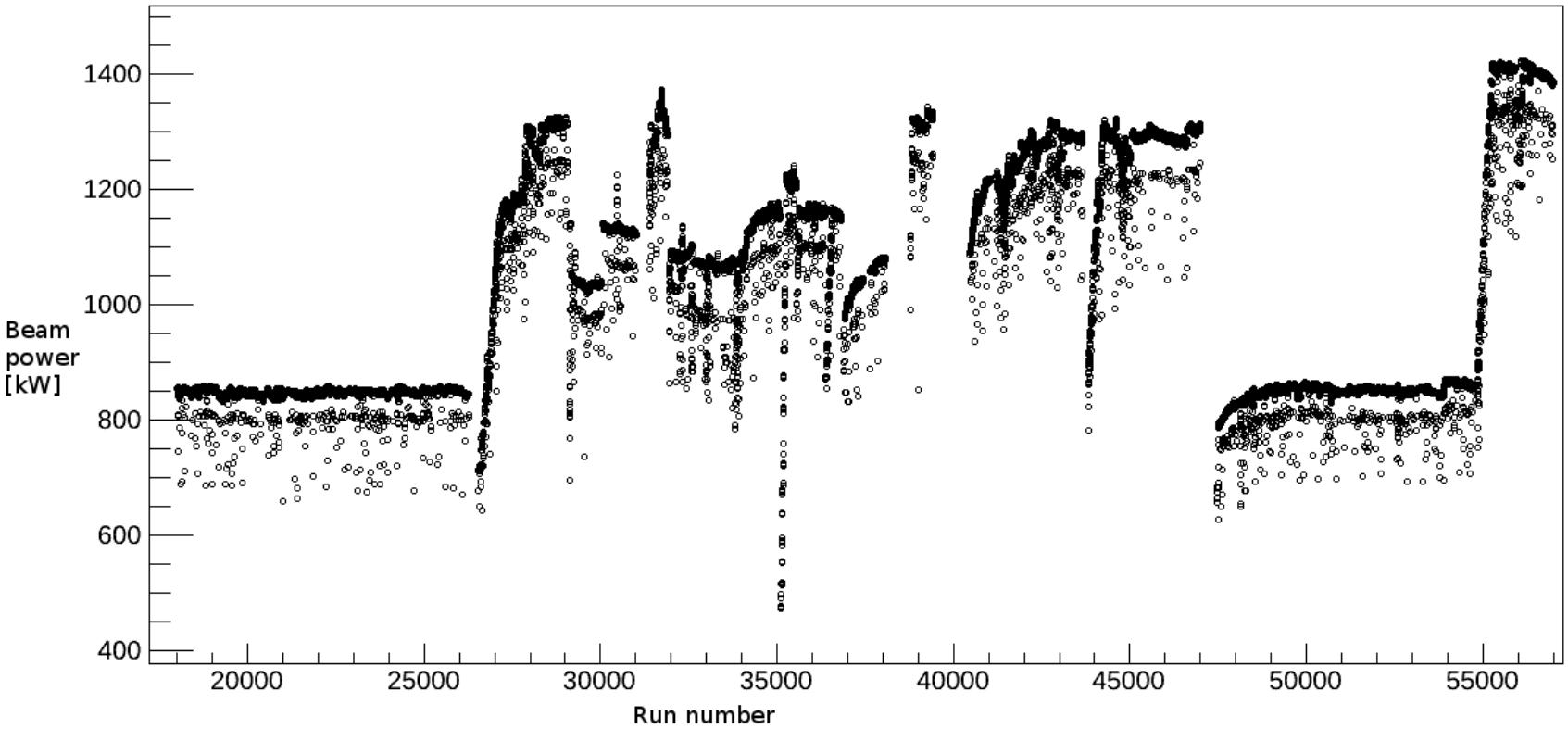


Chi square distribution from the fits



Backup Slides

Beam power distribution for UD dataset



Note : Beam power calculation includes all pulses (including dropped).

Correlation between wires: LR batch 2A correlation for physics asymmetry