Outline

NPLab internal meeting, Apr 12, Chong Kim

1. Contributions to PHENIX

- Took expert shift duties as an RPC expert
- Wrote RPC QA related base codes for online production

2. Analysis progress

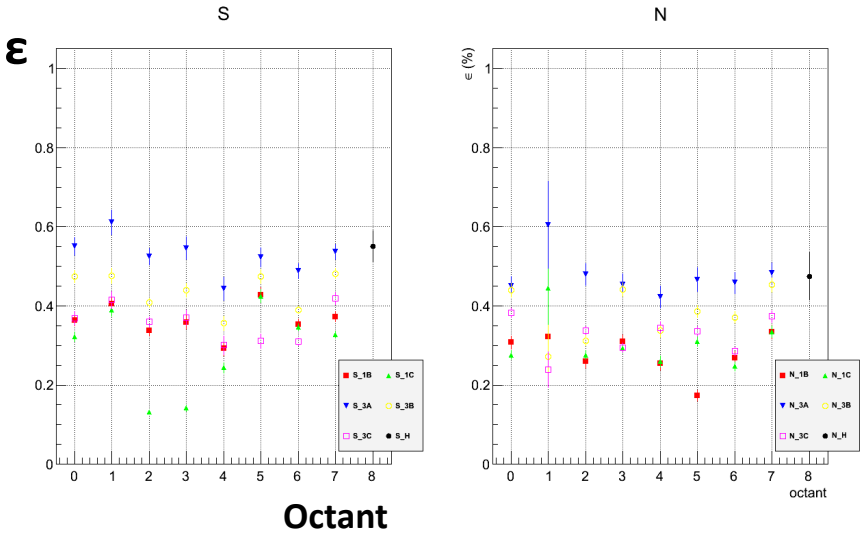
a. RPC efficiency (μ reconstruction efficiency, NOT performance)
   - Position determination by using MC
   - Luminosity weighted efficiency (for Run 12) calculated

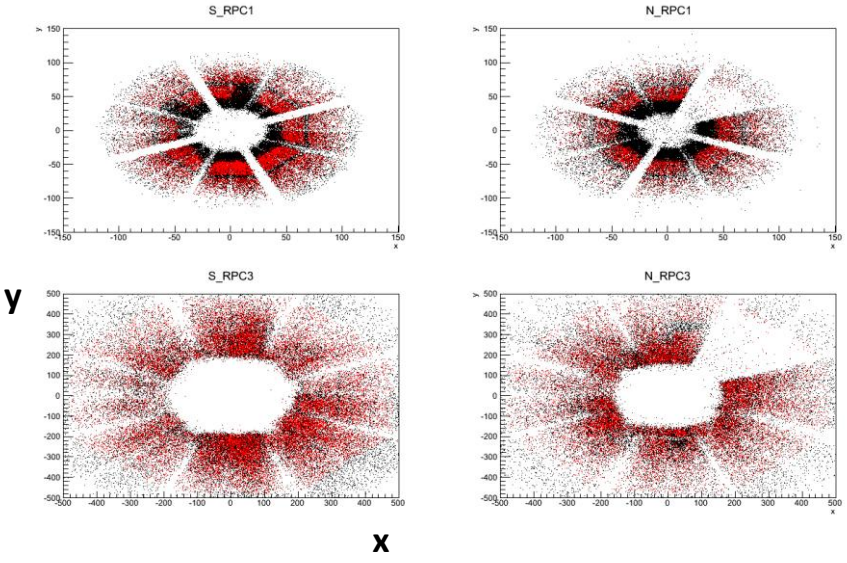
b. S/BG ratio (W, Run 12) by using MC embedding
   - Calculated W likelihood by using MC
   - Calculated PDFs (probability density function) by using obtained W likelihood
   - Performed unbinned maximum likelihood fit by using obtained PDFs

1. Contributions – Rpc QA

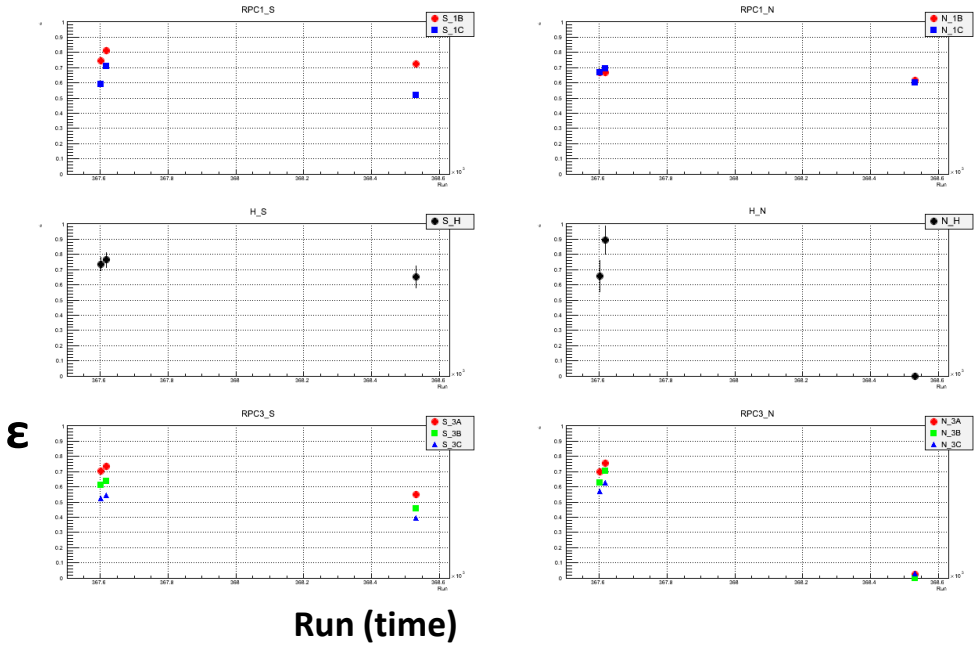
- Wrote QA codes for RPC before Run 13 started
  - Purpose: online production. Used for QA and status monitoring
  - Items: mainly rough efficiency and timing distributions
    - ε vs. Run (time)
    - ε vs. RPC segments
    - 2D efficiency for each arm/station
    - Peak timing vs. Run (time)
    - Peak timing vs. RPC segments
- Ralf modified base codes for current online production pages
  - Basic kinematic variables' distribution added

1. Contributions – Rpc QA

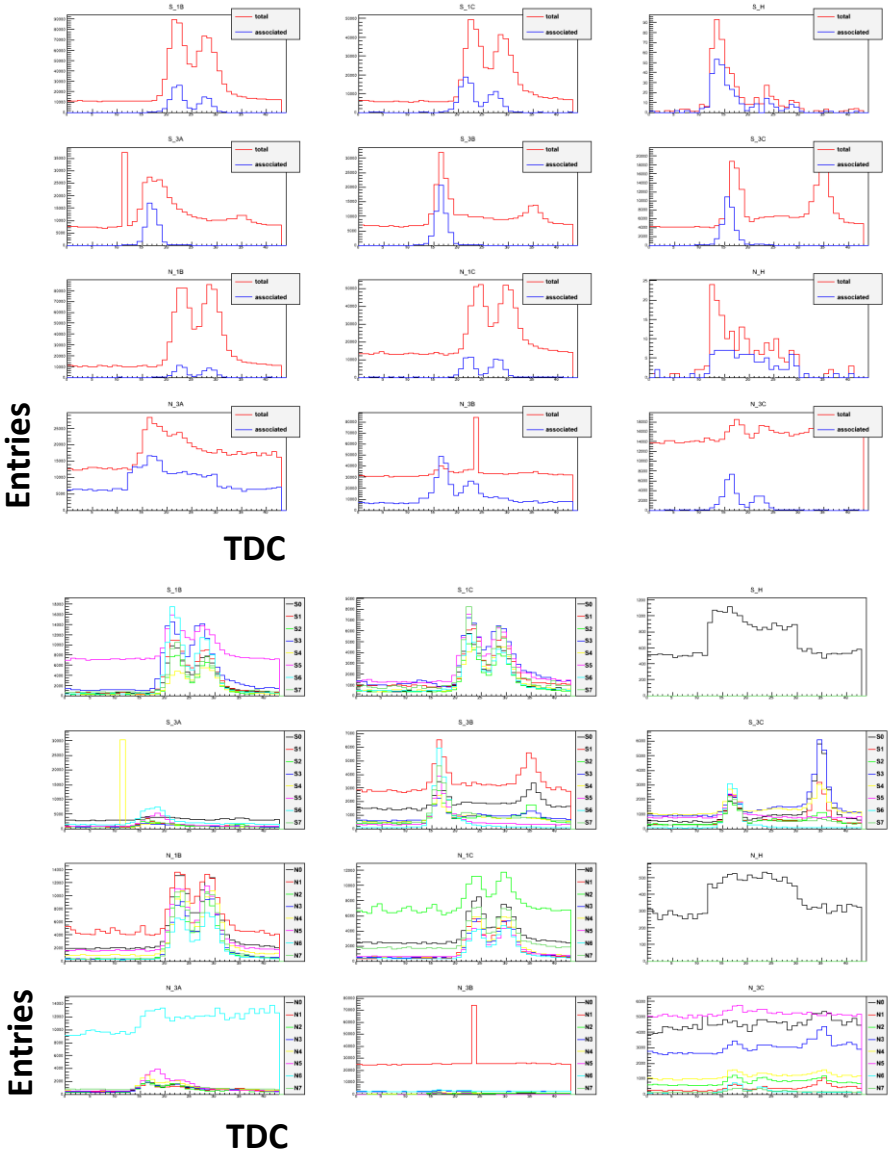




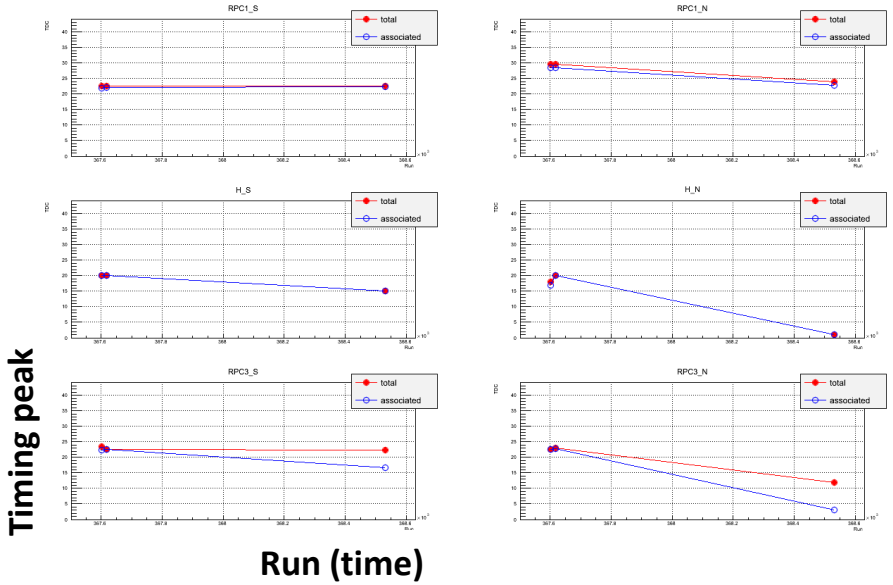
Results by raw code: efficiency



1. Contributions – Rpc QA

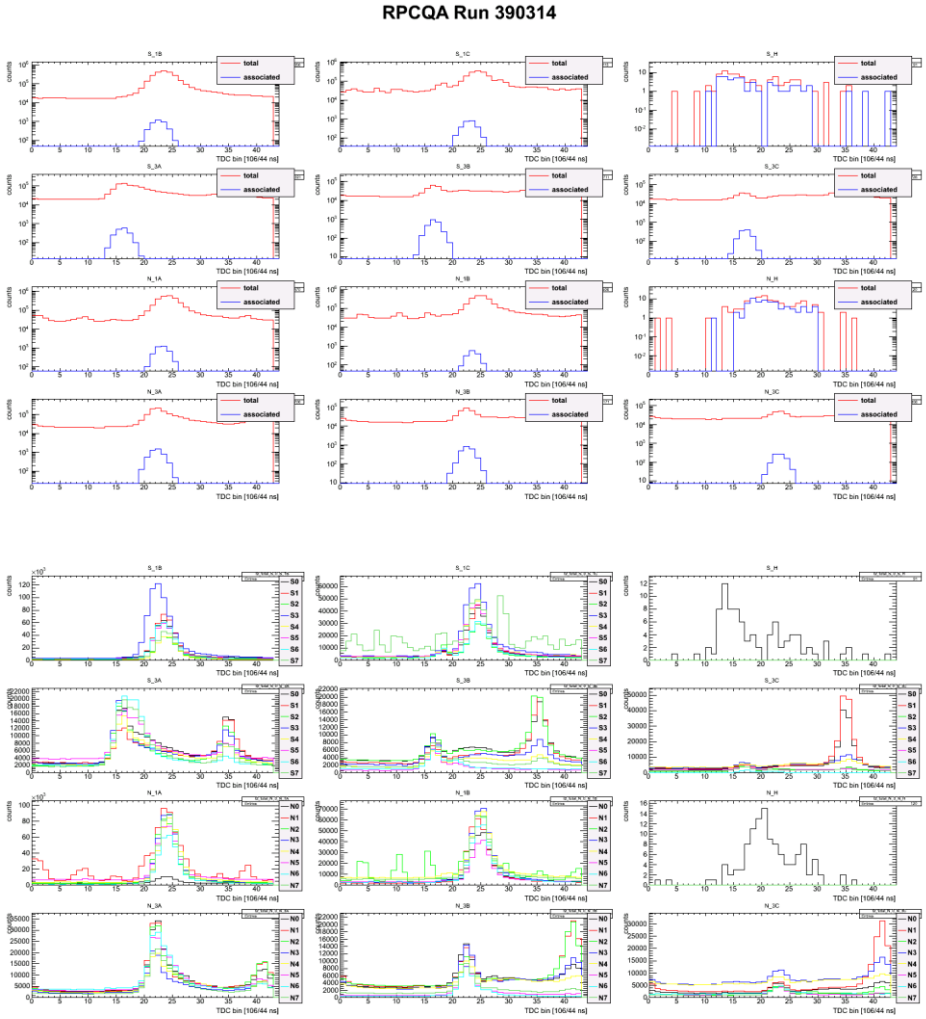


Results by raw code: timing



1. Contributions – Rpc QA

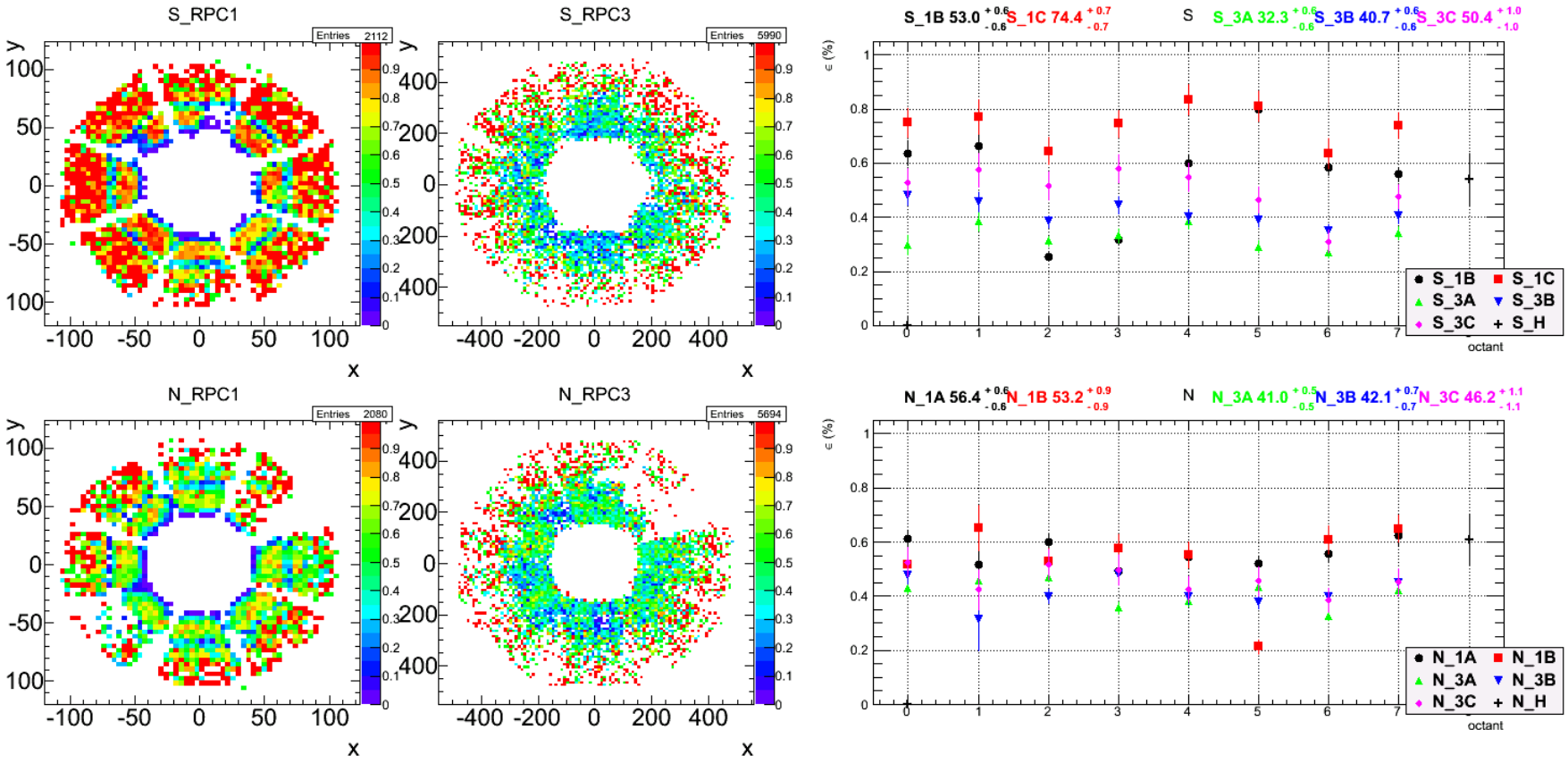
Current online production: RPC QA



1. Contributions – Rpc QA

Current online production: RPC QA

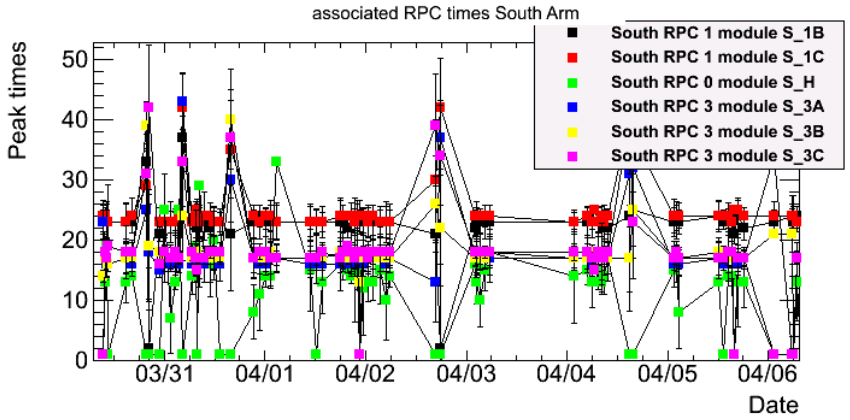
RPCQA Run 390314

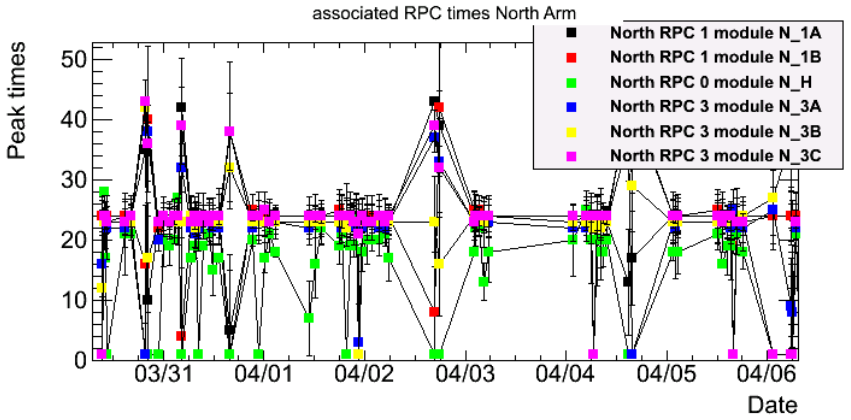


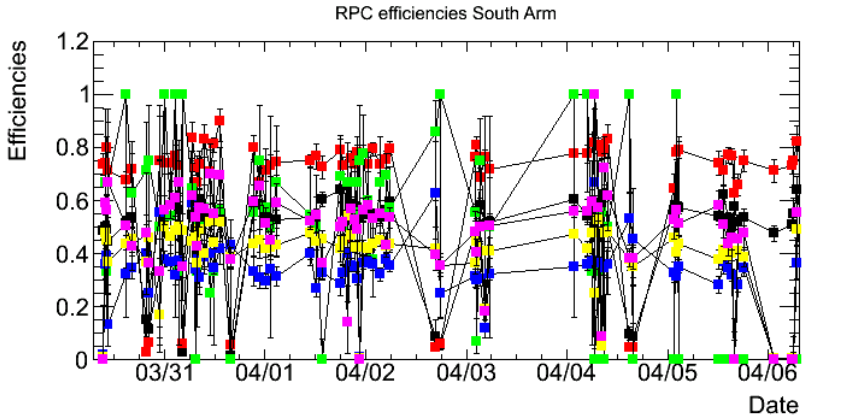
1. Contributions – Rpc QA

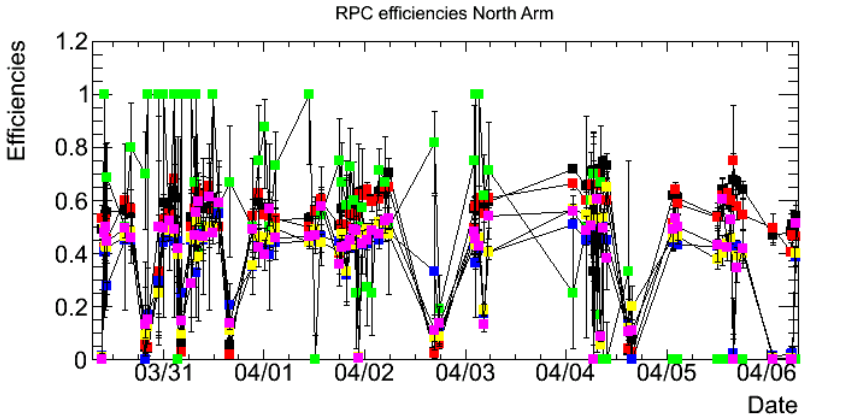
Current online production: RPC QA

RPCQA Run 390314





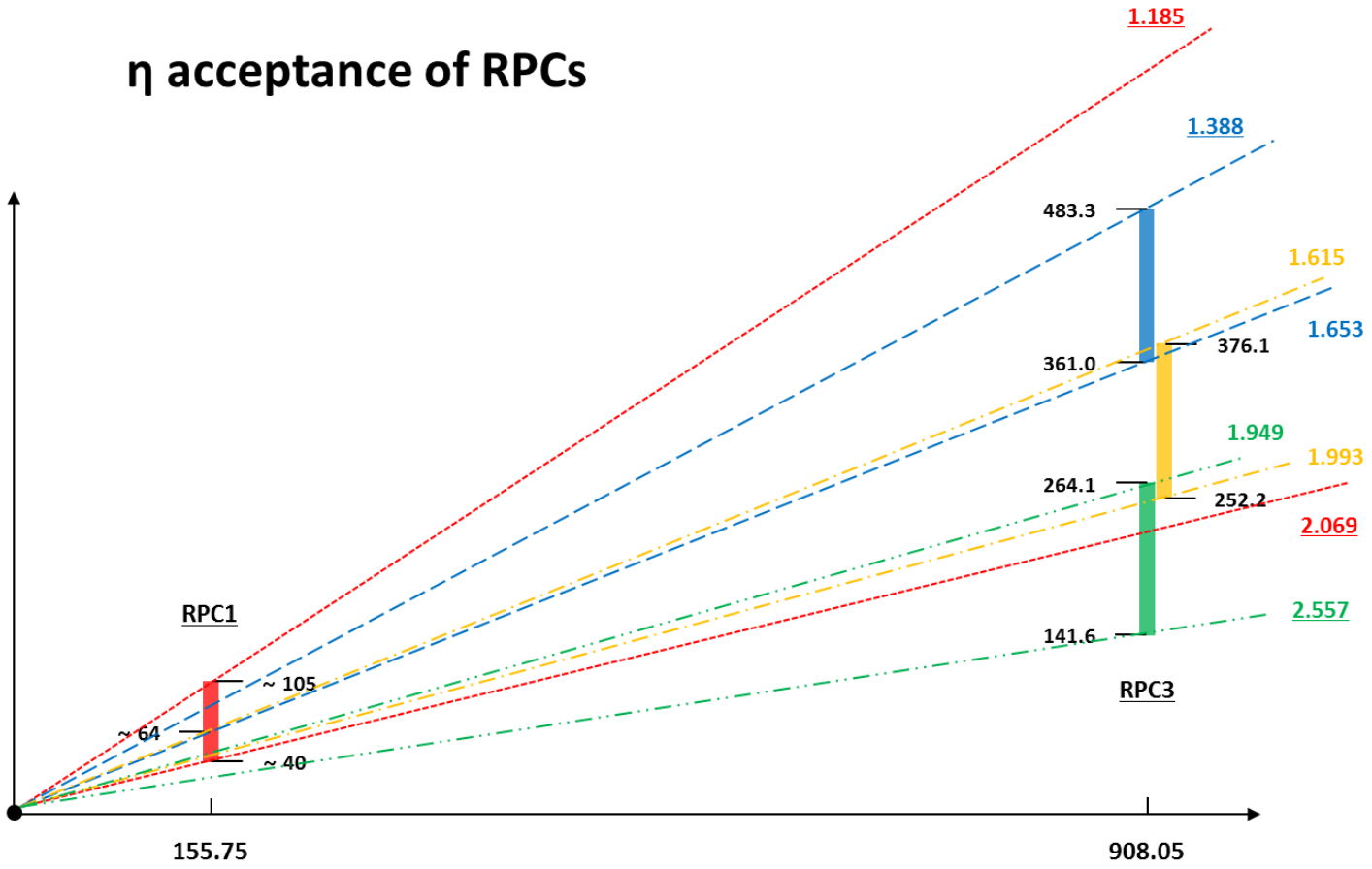




2. Analysis – a. RPC efficiency

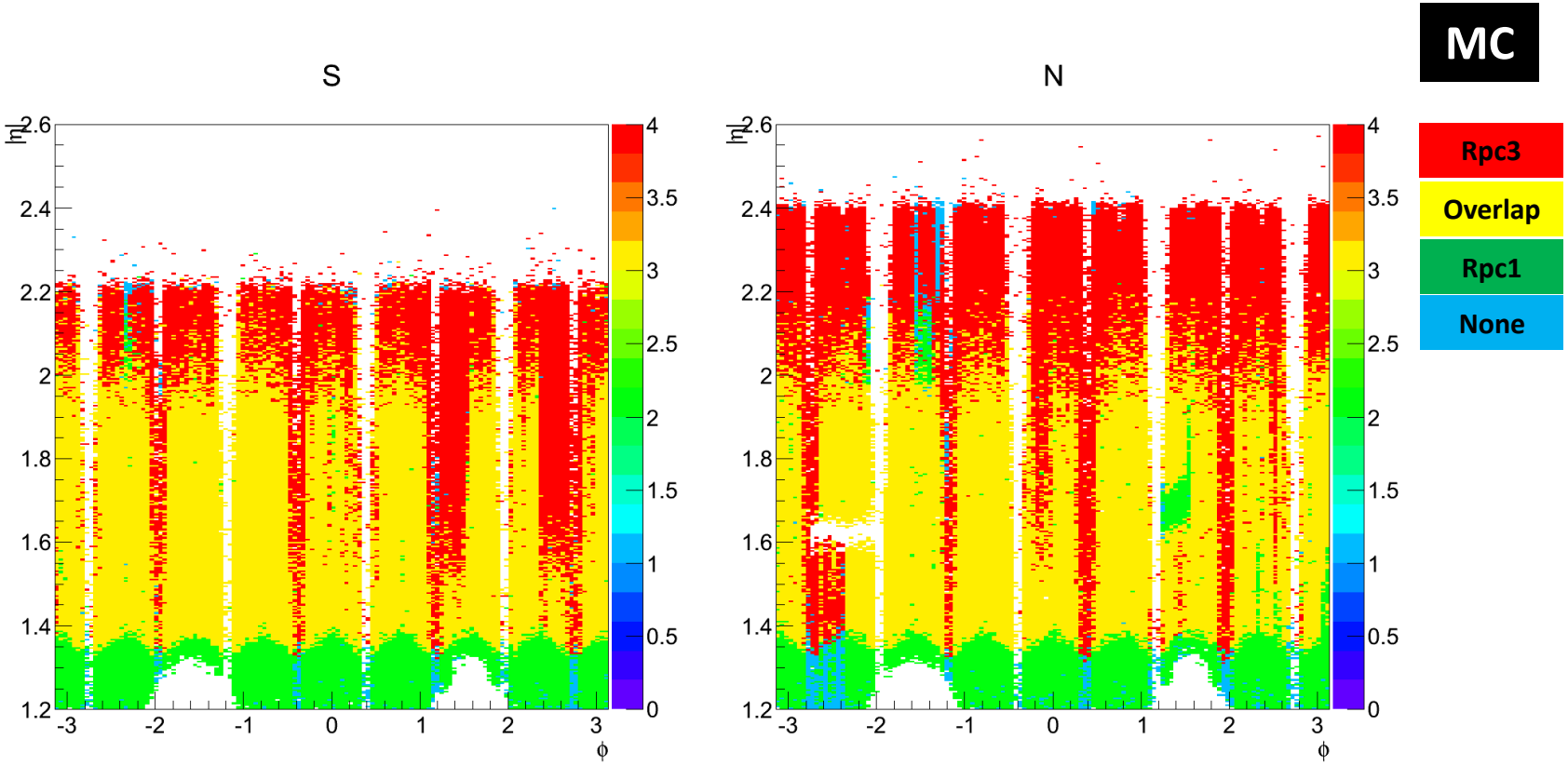
- Data: pp510GeV Run12 official pDSTs
- Rpc efficiency:
  - ε = (# of μ tracks w/ **RpcDCA < 15**) / # of μ tracks
    (**both numerator and denominator satisfy basic cuts**)
  - Basic cuts:
    - Evt_bbcZ < 30
    - p > 5
    - DG0 < 30
    - DDG0 < 10
    - lastGap = 4
    - triggerbit = SG1_MuIDLL1 (mostly, not always)
  - **RpcDCA**:
    - Rpc1: (RpcMatchVtx)Rpc1dca, (RpcMatchSt1)Rpc1dca
    - RPc3: (RpcMatchSt3)Rpc3dca, (RpcMatchMuID)Rpc3dca
  - Determined geometrical acceptance of each RPC station by using MC (next page)

2. Analysis – a. RPC efficiency



- All black numbers' unit are cm
- All η acceptance calculated by using readout strip's position
- Heights of RPC1 are rough estimation: RPC1 acceptance is NOT PRECISE!

2. Analysis – a. RPC efficiency

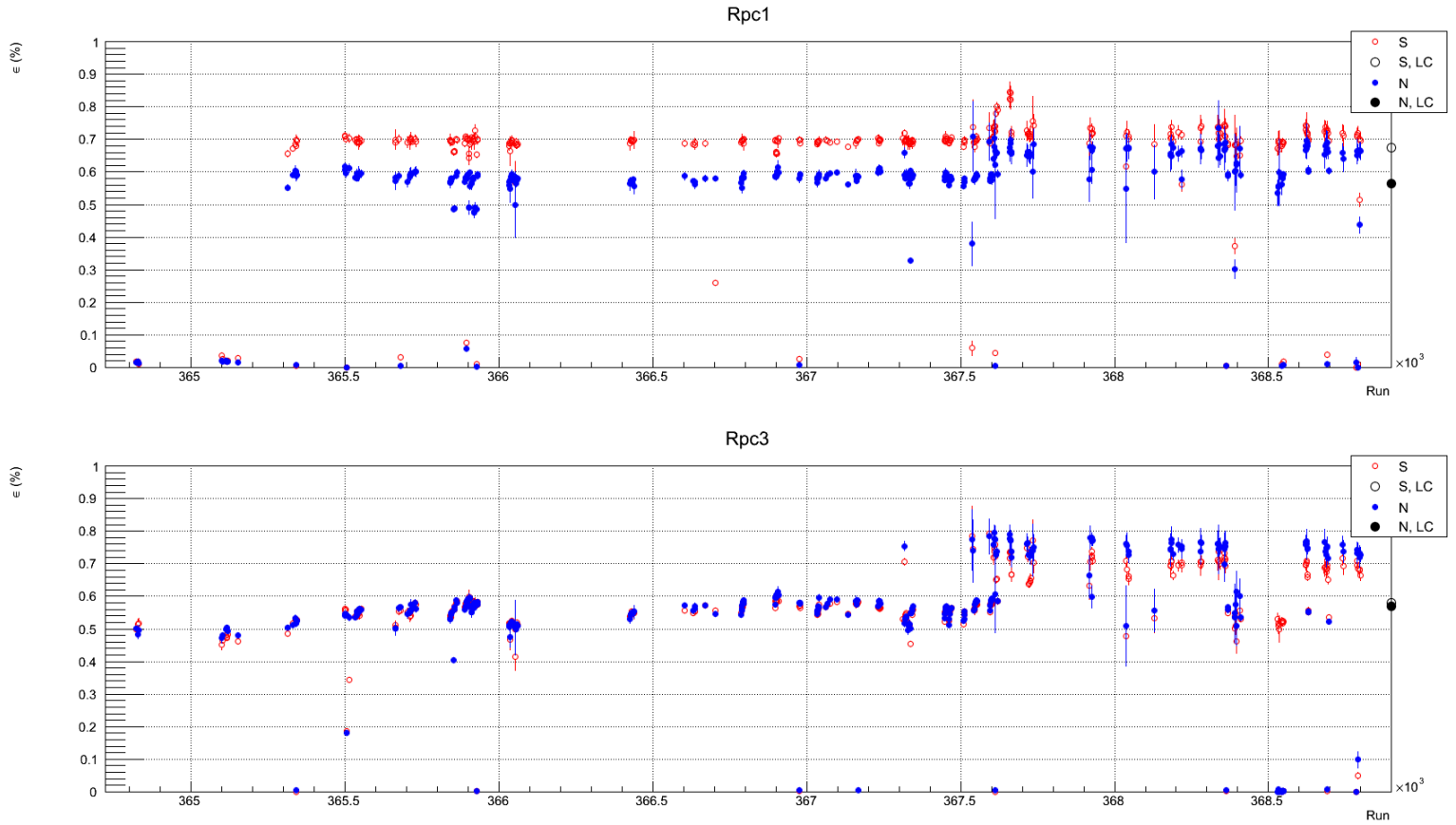


- Rpc position determination by MC:
  - None (Blue): none of conditions were satisfied
  - Rpc1 (Green): Rpc1dca cut satisfied, while Rpc3dca cut didn't
  - Overlap (Yellow): both (Rpc1dca and Rpc3dca) condition satisfied
  - Rpc3 (Red): Rpc3dca cut satisfied, while Rpc1dca cut didn't

	0 < Rpc1dcas < 15	0 < Rpc3dcas < 15
None	×	×
Rpc1	o	×
Overlap	o	o
Rpc3	×	o

2. Analysis – a. RPC efficiency

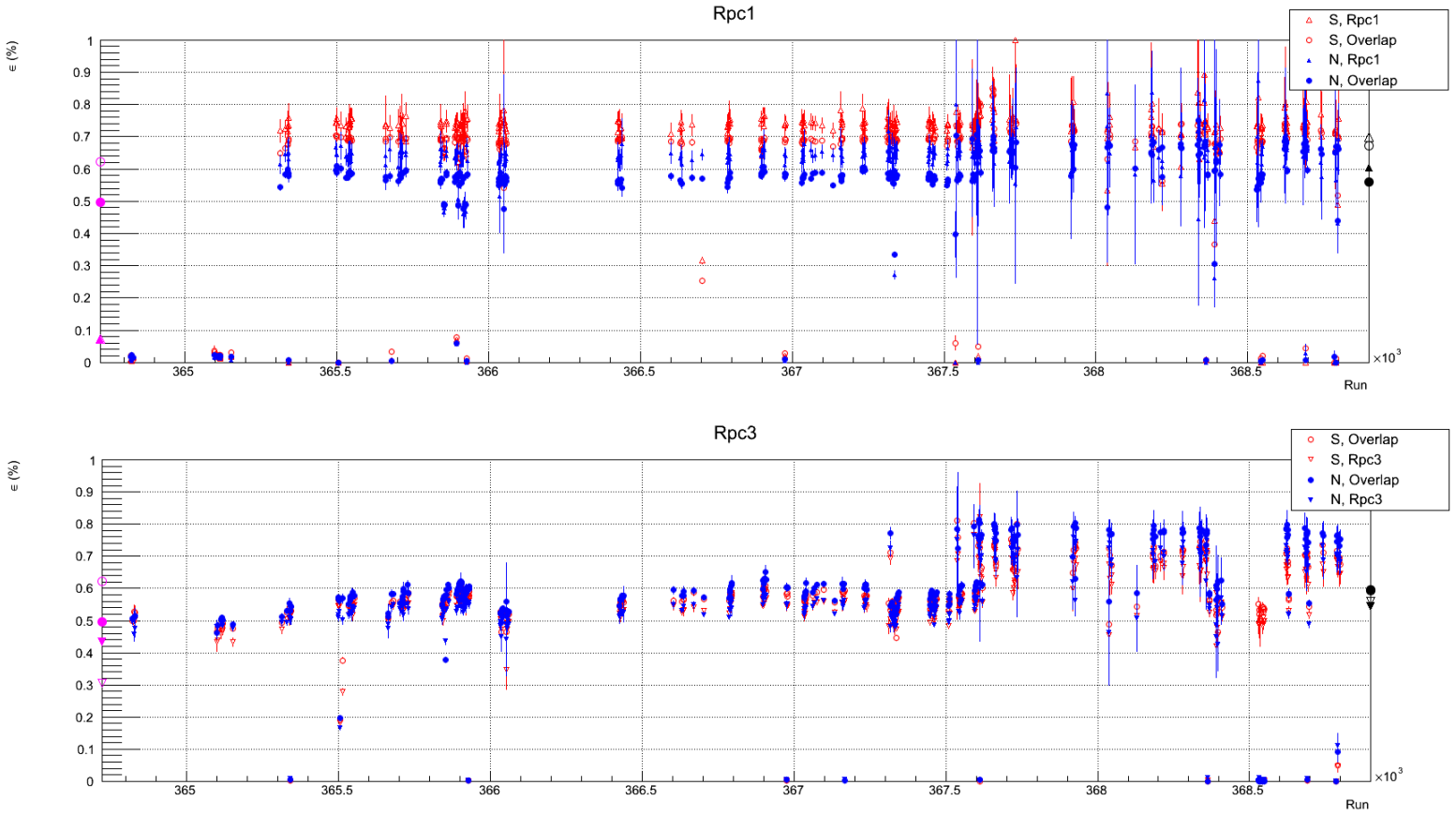
data



- Rpc efficiency vs. Run
  - Black markers (LC) indicate luminosity corrected efficiency

2. Analysis – a. RPC efficiency

data



- Rpc efficiency vs. Run w/ separated η region
  - Purple markers indicate portion of data amount to the whole (both stations share overlap (circle) region)

2. Analysis – a. RPC efficiency

- Intermediate summary
  - Calculated μ reconstruction efficiencies for both RPC stations
  - Not finished completely, but it looks goal is not very far either

- Intermediate to do
  - Still ‘Jump’ like behavior need to be understood:
    - Cross check by Sangwha and Ralf confirmed same Jump like behavior
    - Sangwha confirmed MuID prescale related problem
    - Tested various trigger set, include/exclude SG1 triggers

2. Analysis – b. S/BG ratio

- Got S/BG ratio for Run 12 W → μ preliminary request
- Input:
  - Data:

    pp510 Run 12, official pDSTs,
    (total 311 runs)
  - Luminosity:

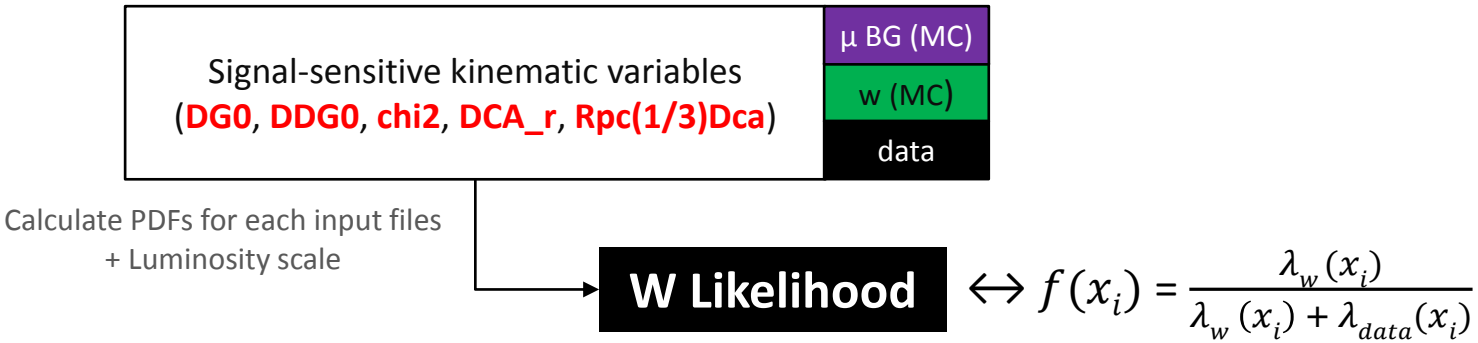
    South - **42.8 pb $^{-1}$** , North - **43.4pb^{-1}**
    taken with either
    SG1&1D&BBCnovertex or
    SG1&RPC3&BBCnovertex triggers
  - MC (w signal + μ BGs): produced by Ralf

μ MC produced ('high' condition)

Process	# of gen. events	Cross section (mb)	L (pb^{-1})
direct photon	6400 M	5.32×10^{-2}	120.3
onium	28680 M	0.135	212.4
openbottom	1532 M	7.30×10^{-3}	209.9
opencharm	107190 M	0.571	187.7
w	99.3 M	1.66×10^{-6}	59819.3
whad	81 M	1.66×10^{-6}	48795.2
wjet	8.2 M	1.20×10^{-6}	6833.3
wtau	82 M	1.66×10^{-6}	49397.6
z	63.9 M	1.59×10^{-5}	4018.9
zjet	8.2 M	1.02×10^{-6}	8039.2

2. Analysis – b. S/BG ratio

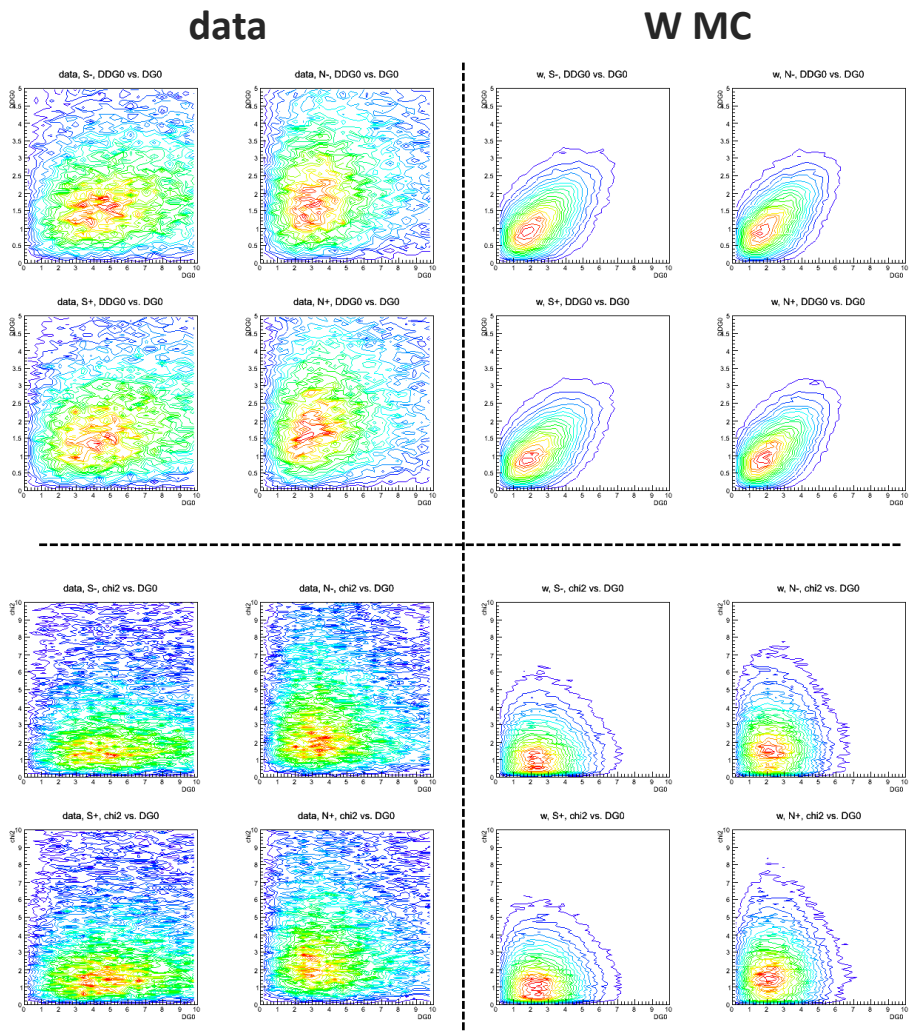
- **Process of unbinned maximum likelihood fit:**



- Input (continue):
  - Data
  - W (signal): PYTHIA + PISA
  - μ BG: PYTHIA + PISA
    (corrected by cross section estimated with dimuon mass spectra analysis in Run 11)

2. Analysis – b. S/BG ratio

Sample of signal sensitive kinematic variables' distribution



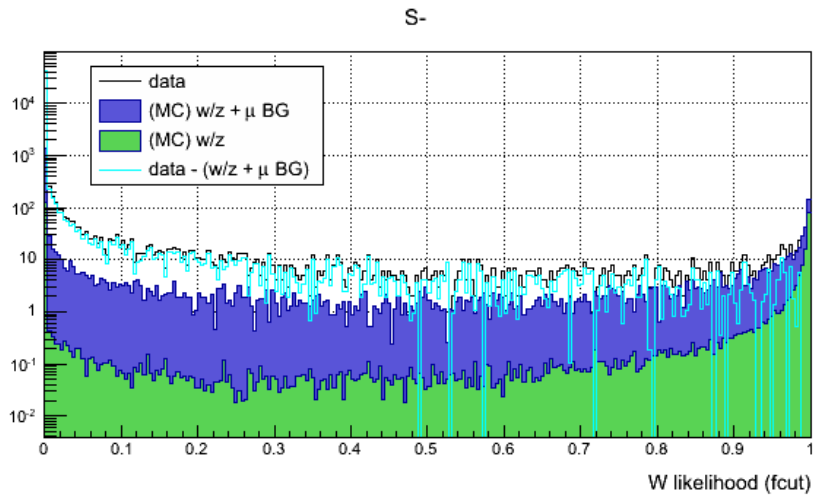
- Basic cut:
  - $16 < p_T < 60$
  - DG0 < 20.0
  - DDG0 < 9.0
  - Chi2 < 20.0
  - (0 < Rpc1Dca < 100) **OR** (0 < Rpc3Dca < 100)
    (at least one of two RpcDCA satisfy condition)
  - lastGap = 4

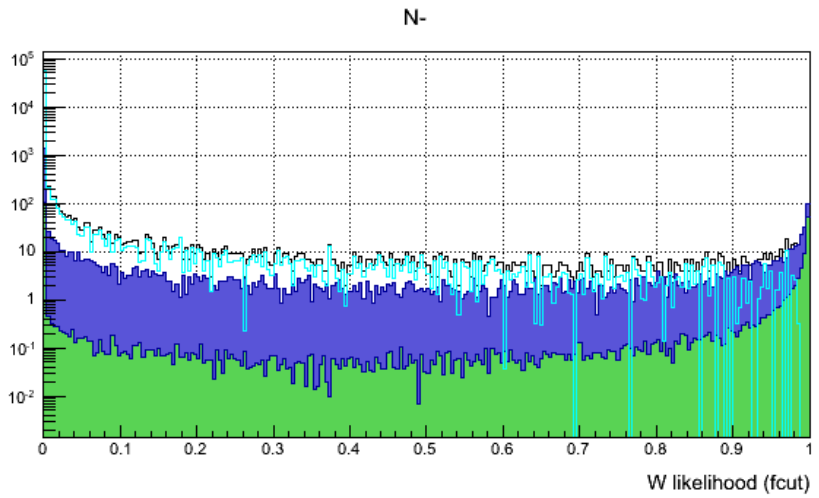
* Study is ongoing for applying RpcDca cut:

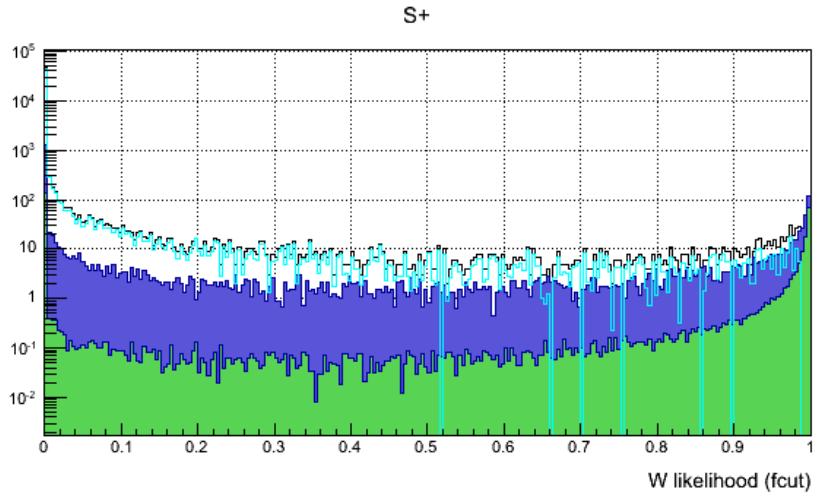
a. Rpc1Dca
b. Rpc3Dca
c. Rpc1Dca or Rpc3Dca (current set)
d. Smaller one between 2 RpcDca

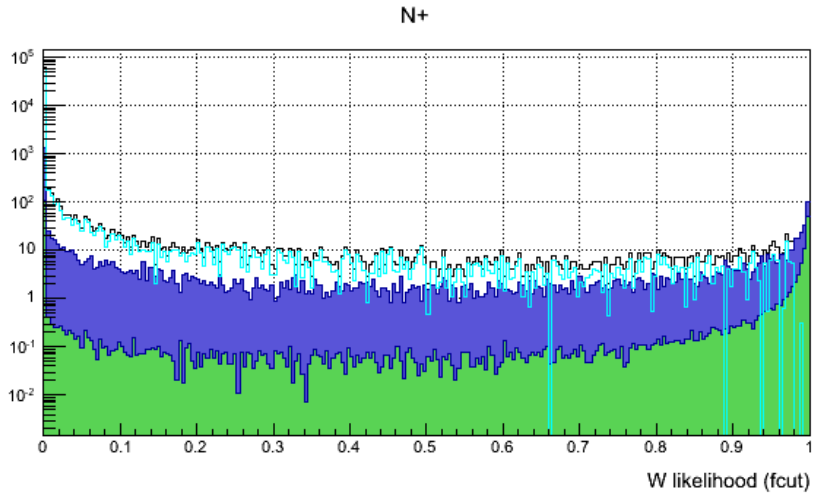
Top 8: DDG0 vs. DG0 / Bot 8 : Chi2 vs. DG0

2. Analysis – b. S/BG ratio





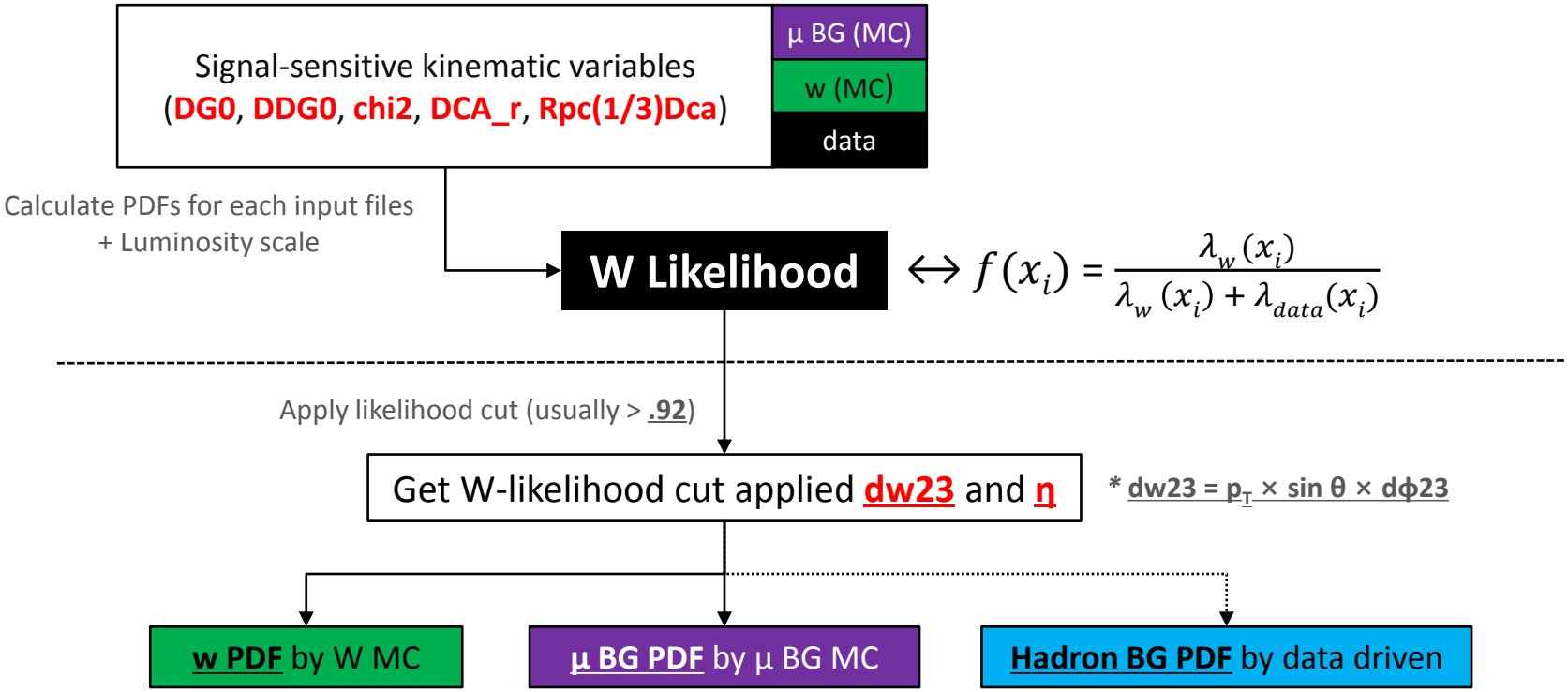




Obtained W likelihood distributions for each arm and charge

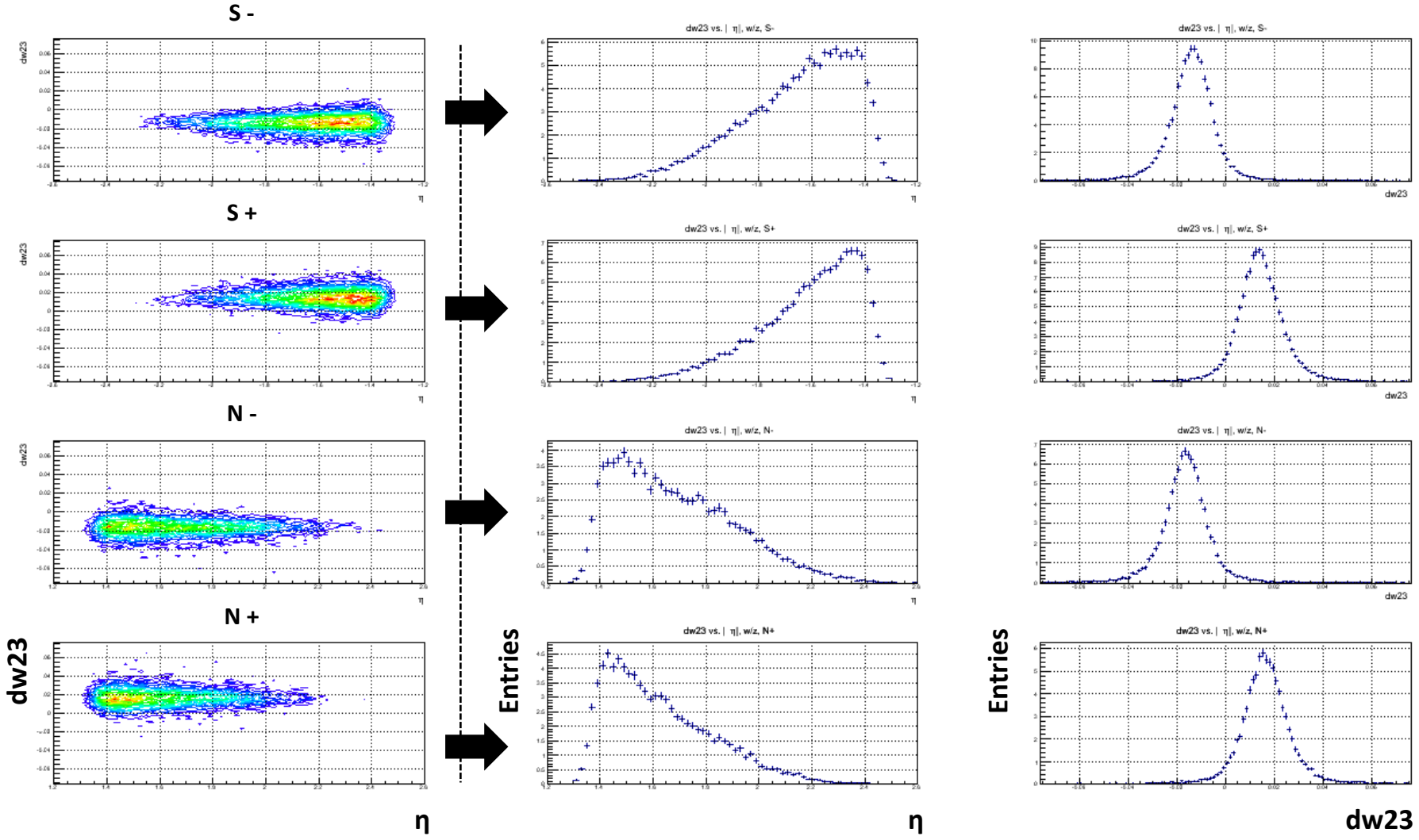
2. Analysis – b. S/BG ratio

- **Process of unbinned maximum likelihood fit:**



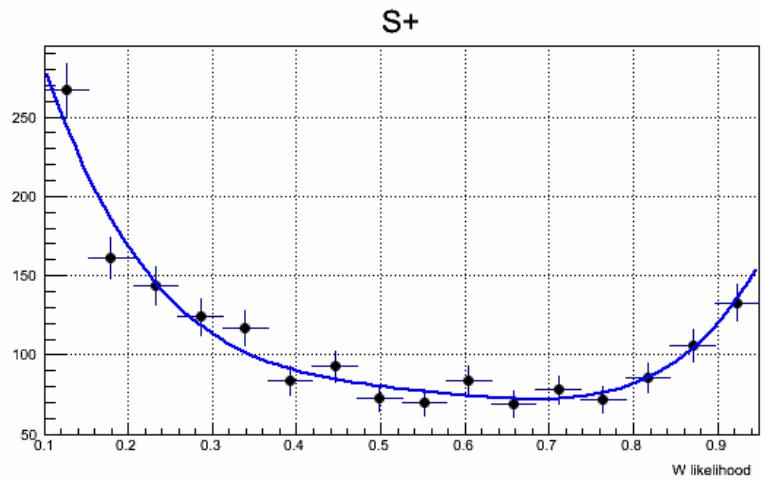
2. Analysis – b. S/BG ratio

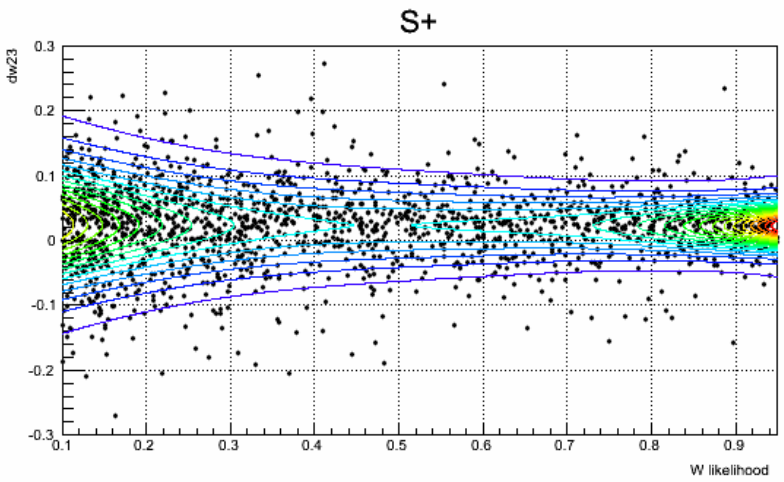
dw23 vs. η of W MC with W likelihood > .92 cut

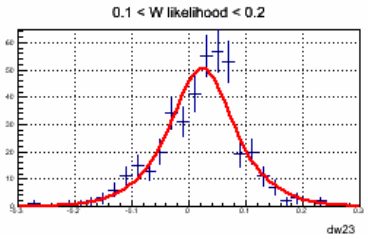


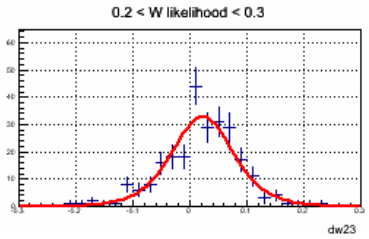
2. Analysis – b. S/BG ratio

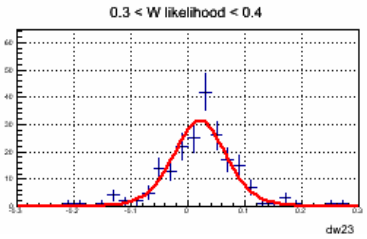
Data driven Hadron BG: extrapolate from low W likelihood region

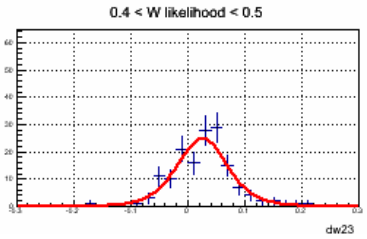


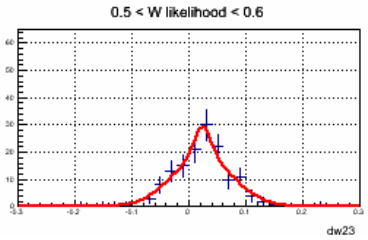


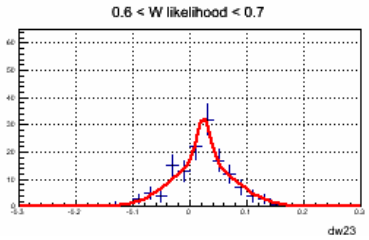


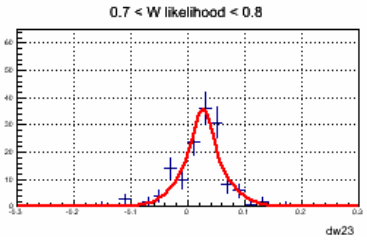


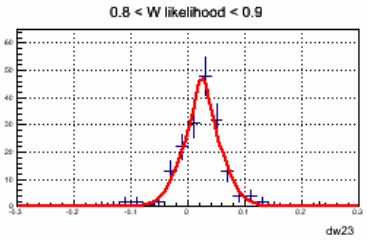






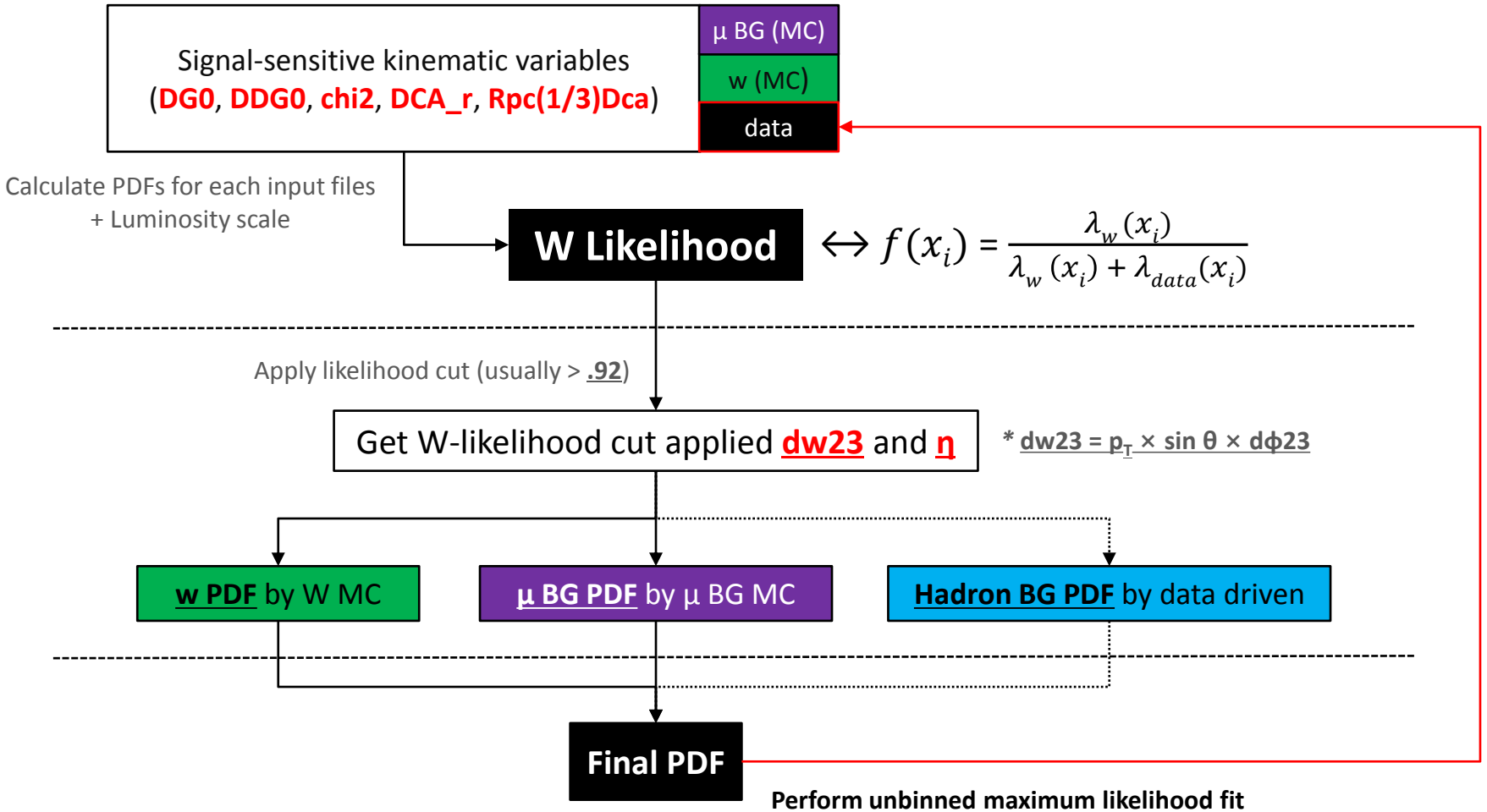




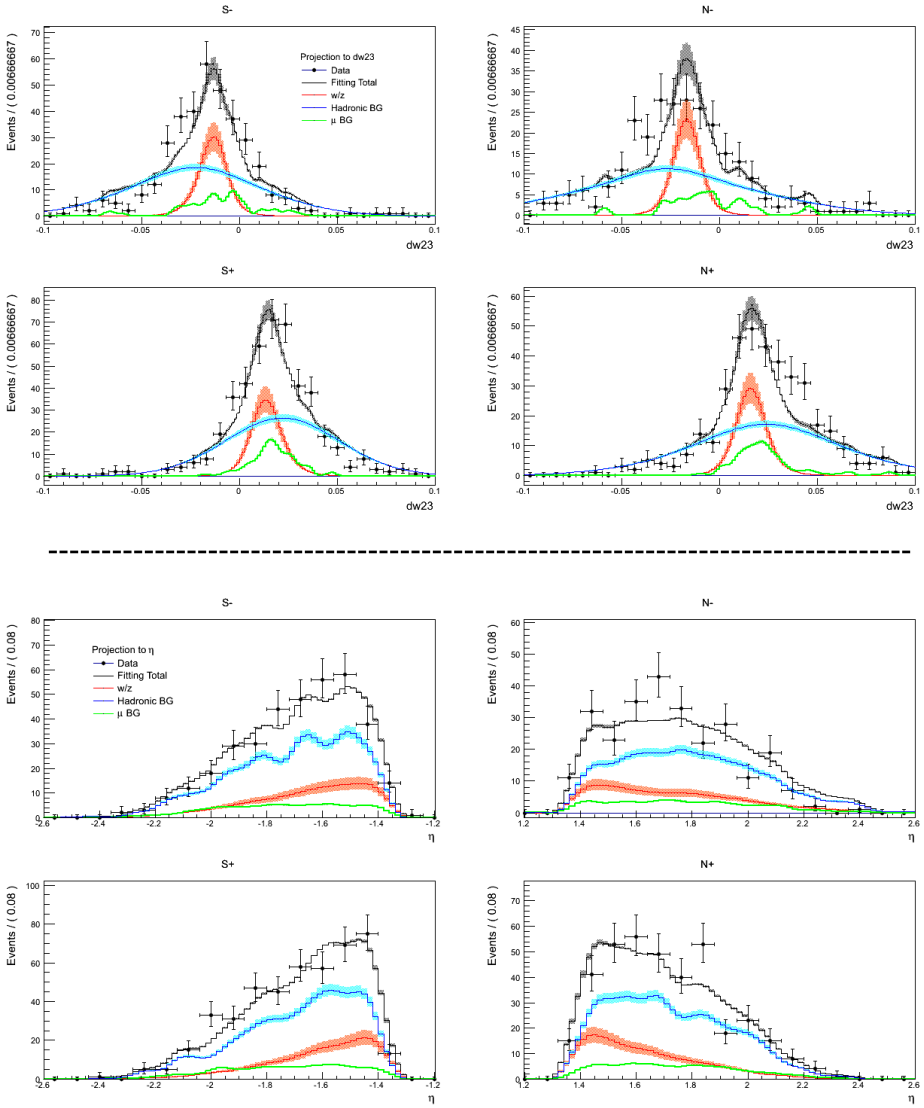


2. Analysis – b. S/BG ratio

- **Process of unbinned maximum likelihood fit:**



2. Analysis – b. S/BG ratio



Fit results

(16 < p_T < 60 (GeV), W likelihood > .92)

	W	H BG	μ BG (fixed)	S/BG
S -	116.674 + 17.992 - 7.294	193.888 + 20.273 - 19.285	48.2574	0.481832
S +	125.123 + 20.796 - 20.124	276.597 + 24.154 - 23.135	47.6711	0.385863
N -	41.424 + 12.574 - 11.848	177.270 + 17.337 - 16.449	48.9655	0.183103
N +	87.110 + 16.813 - 16.083	239.227 + 20.746 - 19.825	46.4522	0.304923

THIS IS NOT FINAL RESULTS !

2. Analysis – b. S/BG ratio

- Intermediate summary
  - Took S/BG ratio for Run 12 W → μ
  - Preliminary granted in this week

- Intermediate to do
  - First of all, I DO need to UNDERSTAND WHAT I DID
    - Followed exact trail and conditions from last run 11 analyzer
    - Source of error, tune factors properly to Run 12 conditions…
  - Test various RpcDCA conditions: final method need to be determined by test
  - Test 2 different set of MC

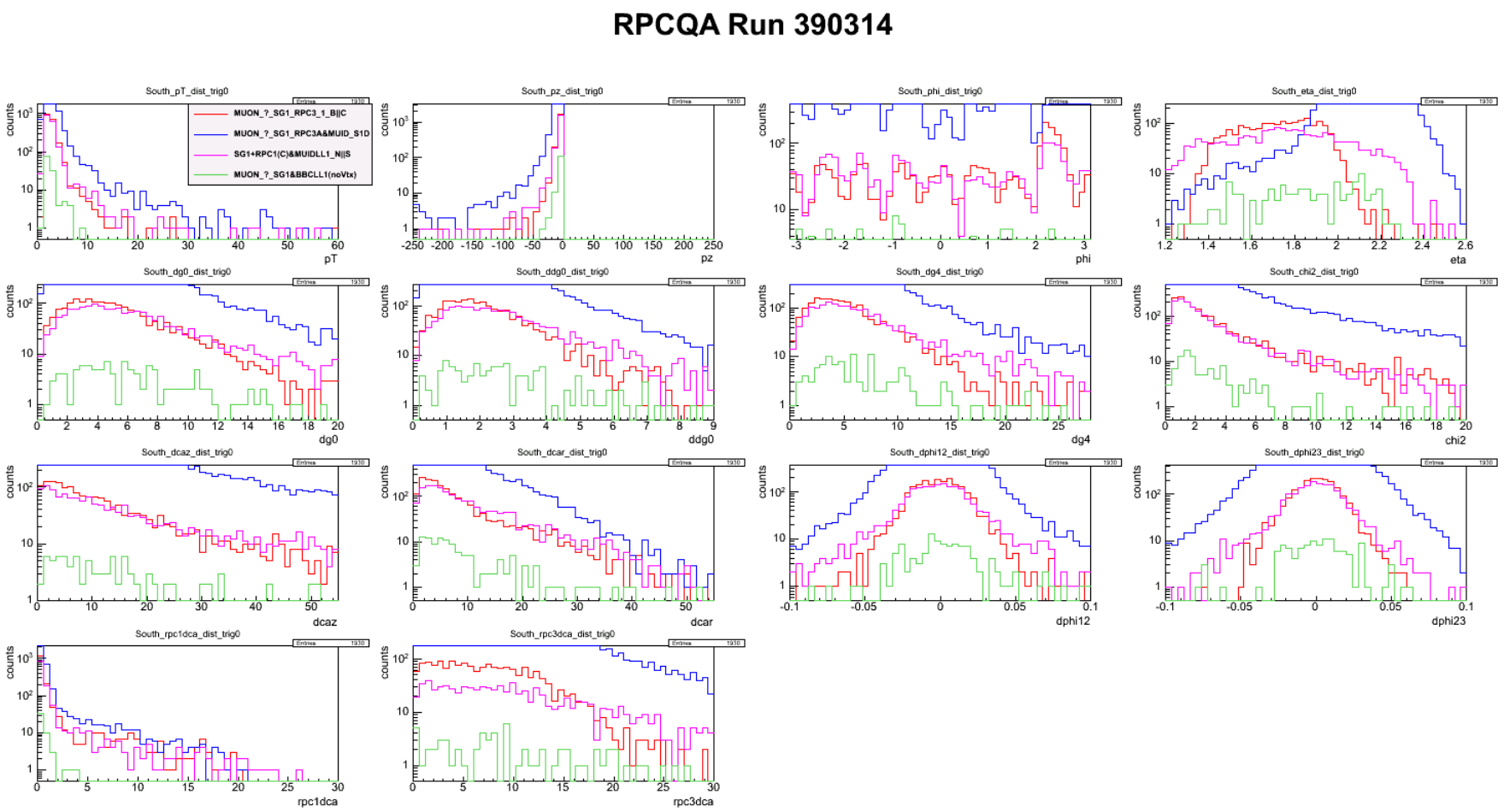
Summary and To do

- Summary
  - RPC efficiency: archived progress, modified position determination method
  - Run 12 W → μ: took S/BG ratio for preliminary

- To do
  - RPC efficiency: need to understand and resolve ‘Jump’ like behavior
  - Run 12 W → μ:
    - Test and confirm which RpcDCA condition should be used
    - Check two different types of MC iuput

Backup

Kinematic variables' distribution: South



Backup

Kinematic variables' distribution: North

RPCQA Run 390314