Imperial College London

VBF Higgs to Invisible - Update

HIG-14-038, AN-14-243

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Overview

- Preapproval conditions:
  - Clarify documentation
  - Investigate tau veto
  - Get data cards approved by comb group
  - Closure tests
- Documentation clarified:
  - Lepton scale factors referred to in section 4.2
  - Top scale factor use clarified in W background section
- Other points addressed in below slides

Tau veto

- Added tau veto to signal region
- Background estimate reduced by 5 events ($\sim 1\%$)
- No change in signal yield
- Gain much smaller than 8% systematic on tau ID efficiency
- We propose not to add a tau veto

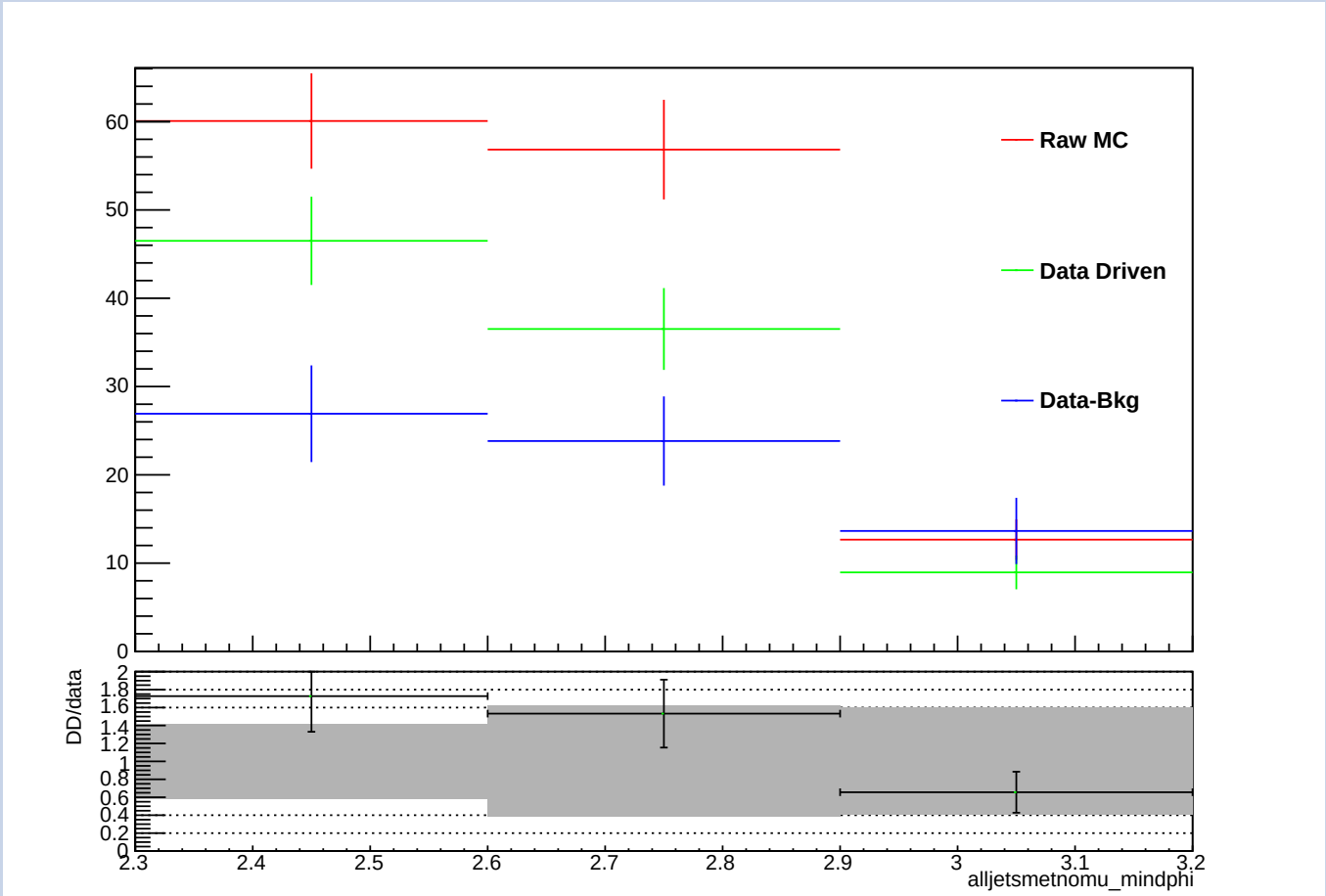
Datacard approval

- Comb group suggested using gmN uncertainty for low stats Z control region
- Current dummy "observation" in datacards is just expected background
- On changing to gmN prefit expected limit goes from 0.38 to 0.42
  - postfit to dummy "observed" limit goes to 0.39
- Difference between postfit and prefit is odd as the "observed" and expected number of events is the same
- Artefact of poor behaviour of asymptotic for prefit gmN uncertainties
- Ran expected limit with full toys, result is 0.39
- Cards given green light by Nick

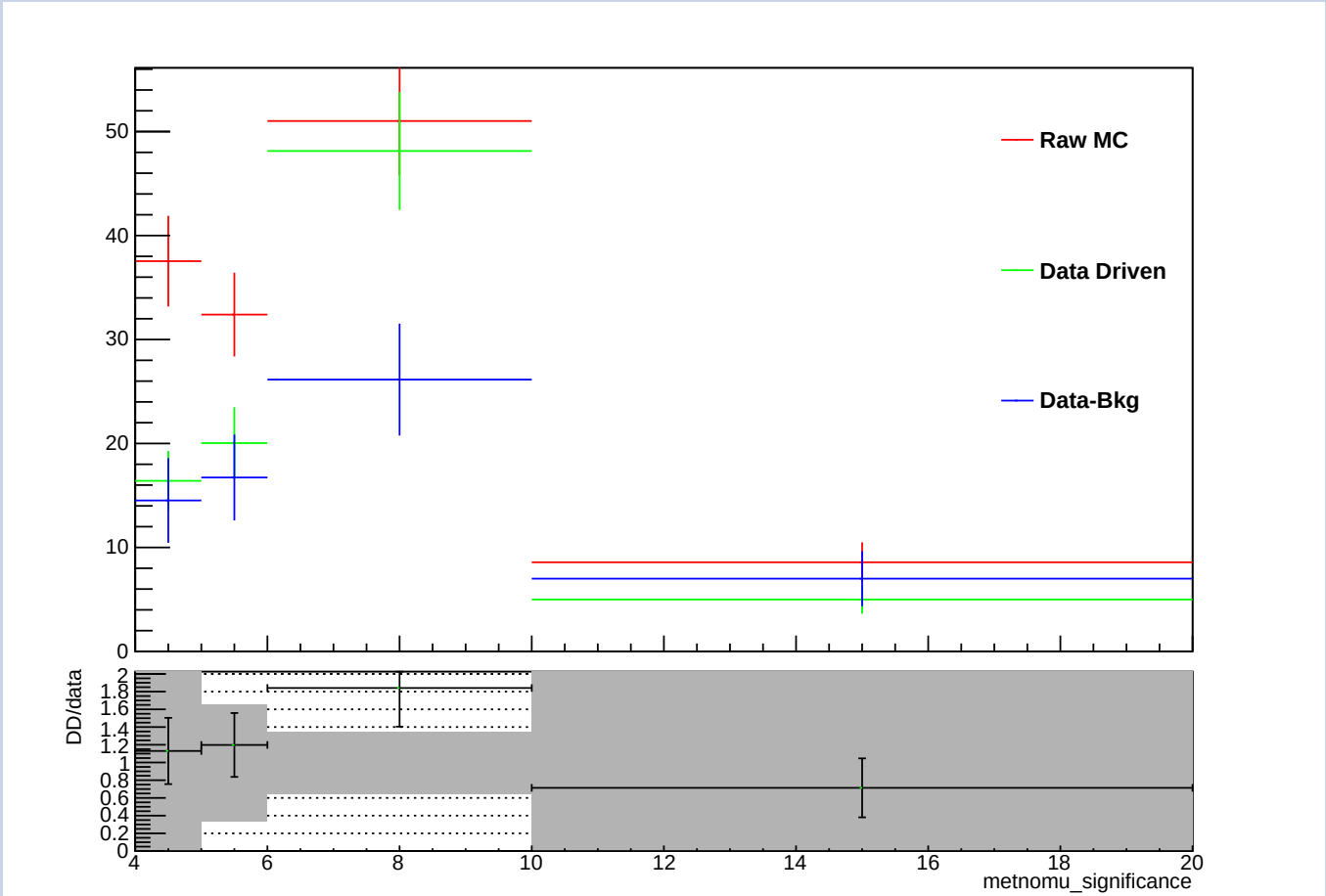
Closure Test Procedure

- Want to validate background in a region close to the signal region
  - QCD or signal contamination prevent use of most areas
- Predict yield in other control regions using munu control region
- Three entries in plots on next few slides:
  - Raw MC: MC estimate in control region under study
  - Data: Observed yield in control region under study
  - Data-Driven: Raw MC multiplied by data/MC scale factor from munu region
- Data driven scale factor is calculated bin by bin
- Band in ratio plot is systematic error on Data-Driven/Data ratio
  - Indicative only as correlations present

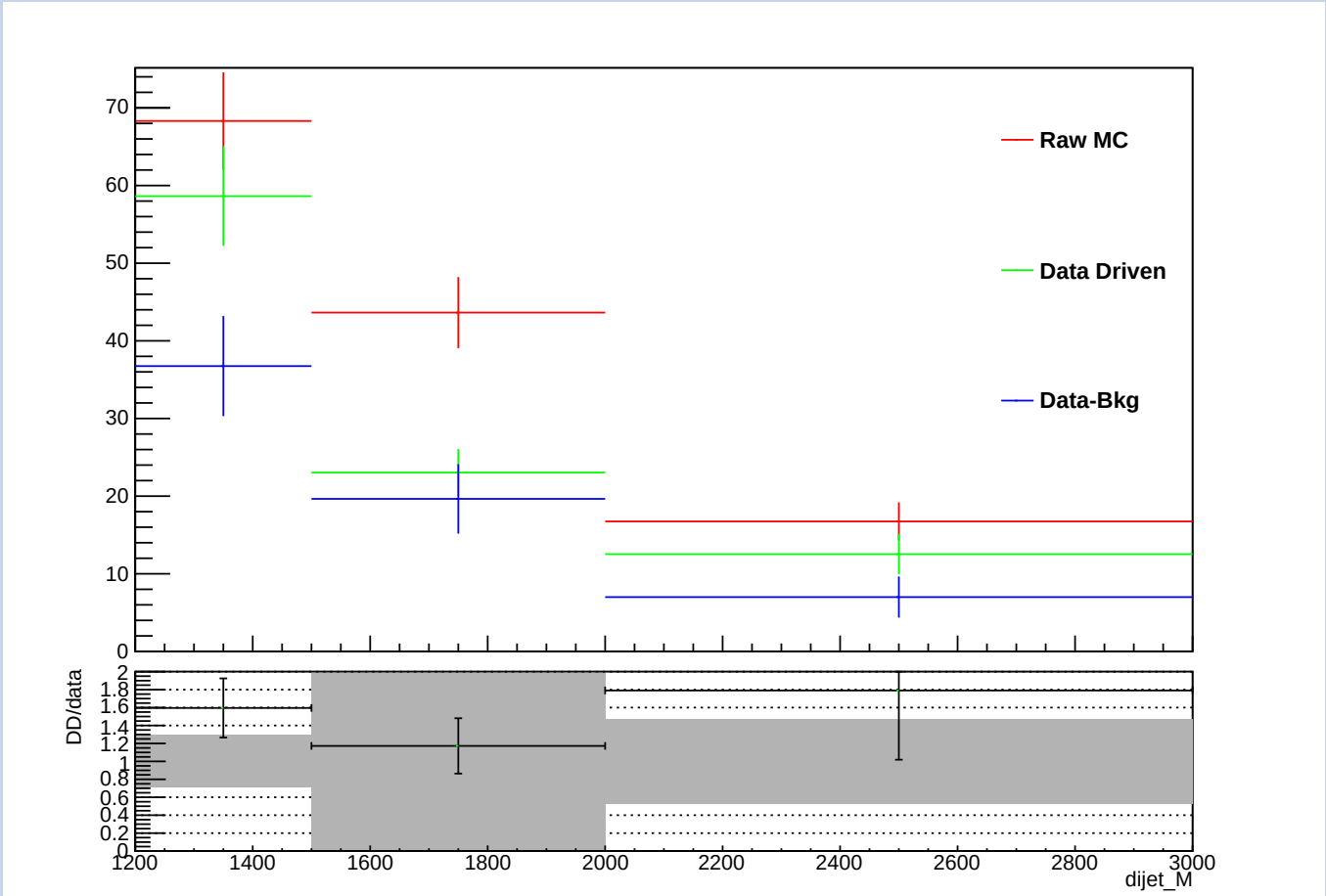
enu closure


Raw MC
Data Driven
Data-Bkg
DD/data
alljetsmetnomu_mindphi
0
10
20
30
40
50
60
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2

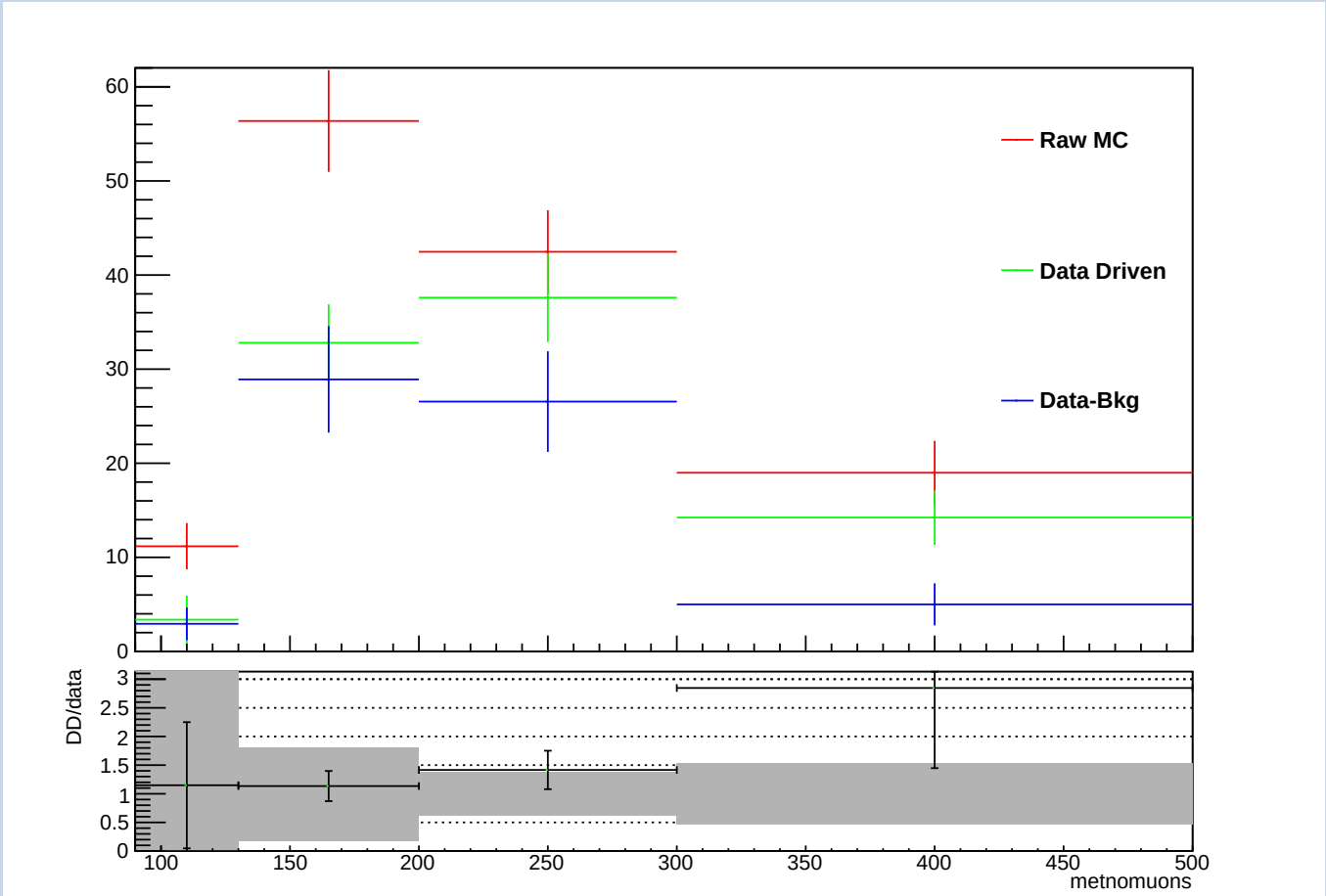
enu closure



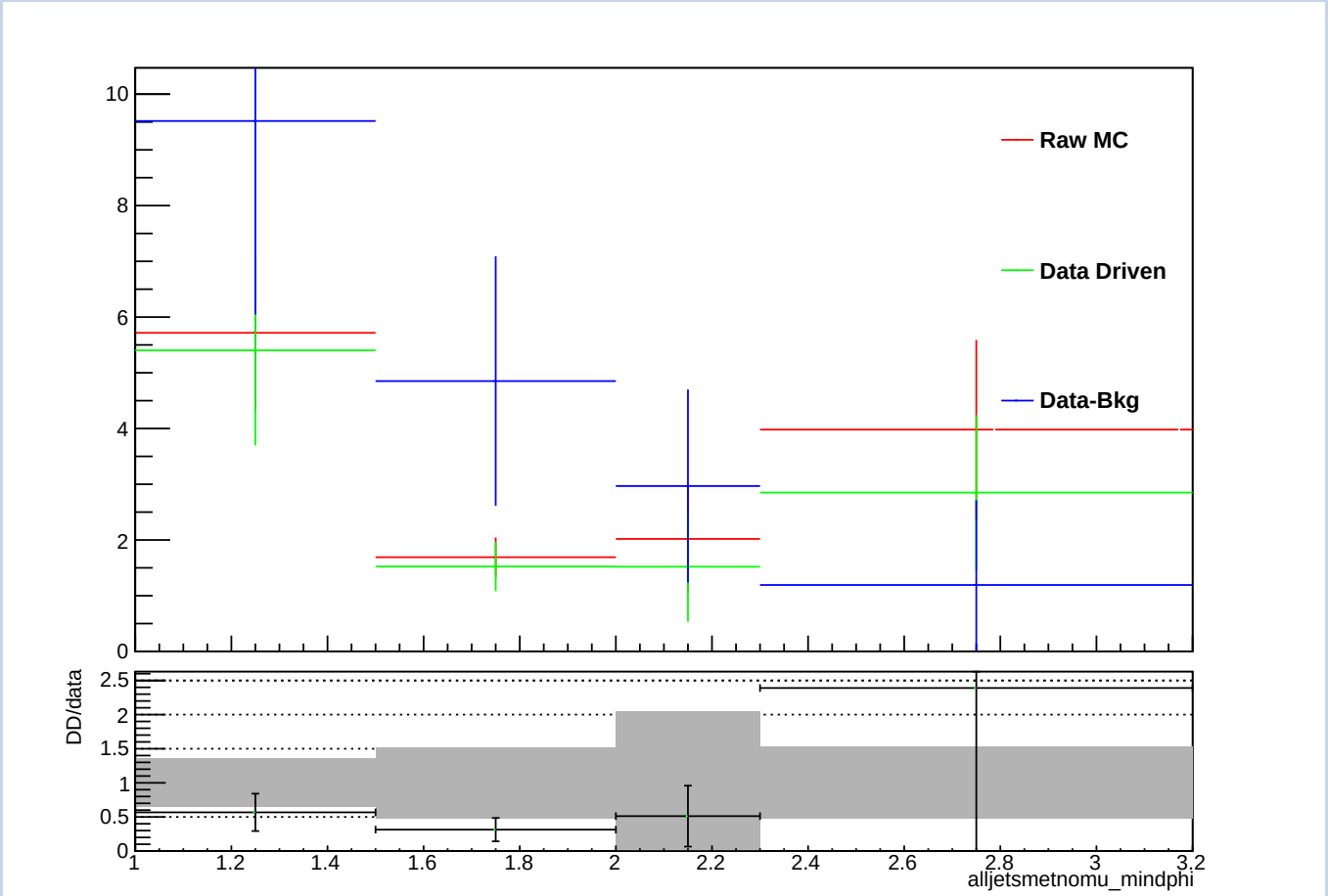
enu closure


Raw MC
Data Driven
Data-Bkg
DD/data
dijet_M
0
10
20
30
40
50
60
70
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000

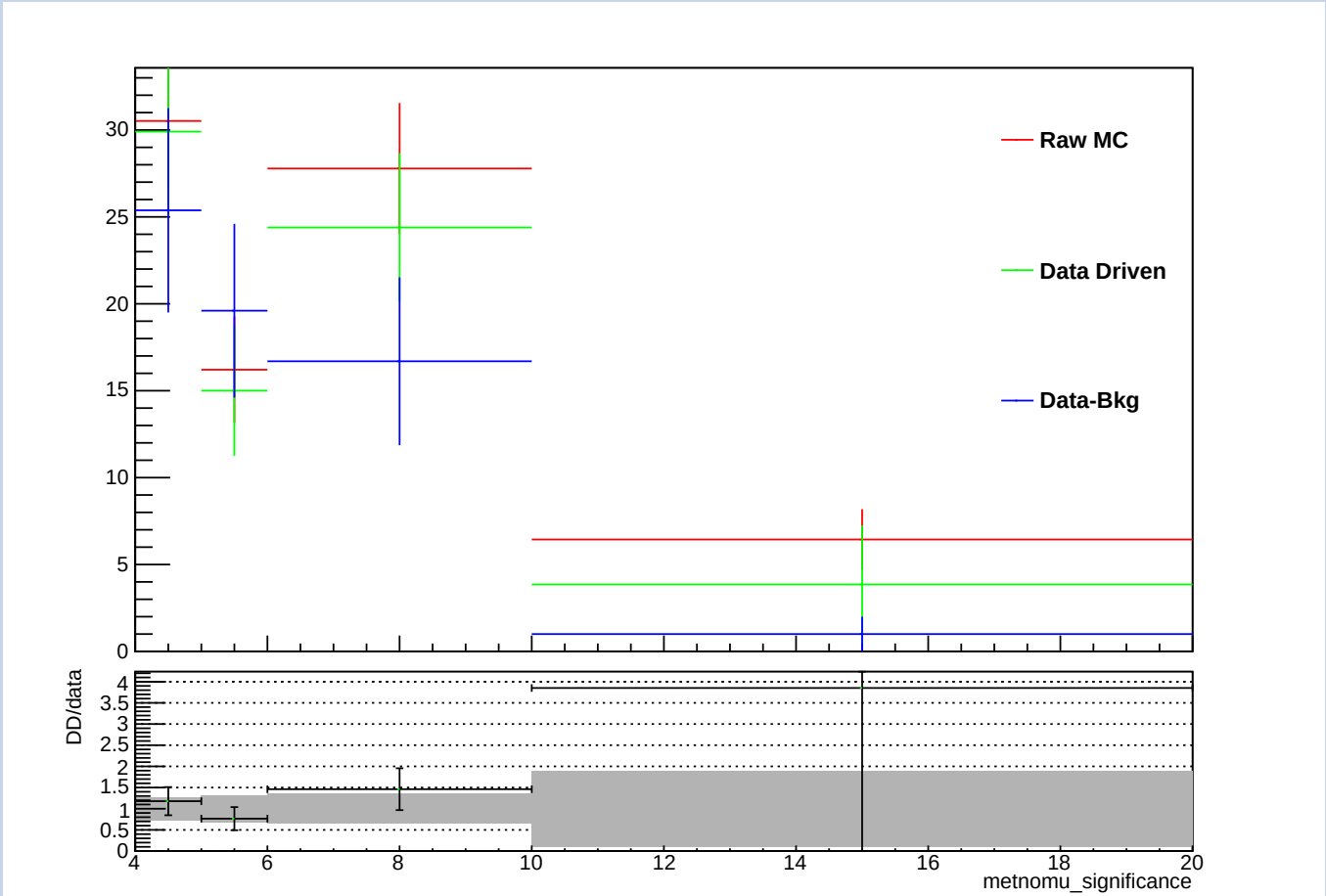
enu closure


Raw MC
Data Driven
Data-Bkg
DD/data
metnomuons
0
10
20
30
40
50
60
0
0.5
1
1.5
2
2.5
3
100
150
200
250
300
350
400
450
500

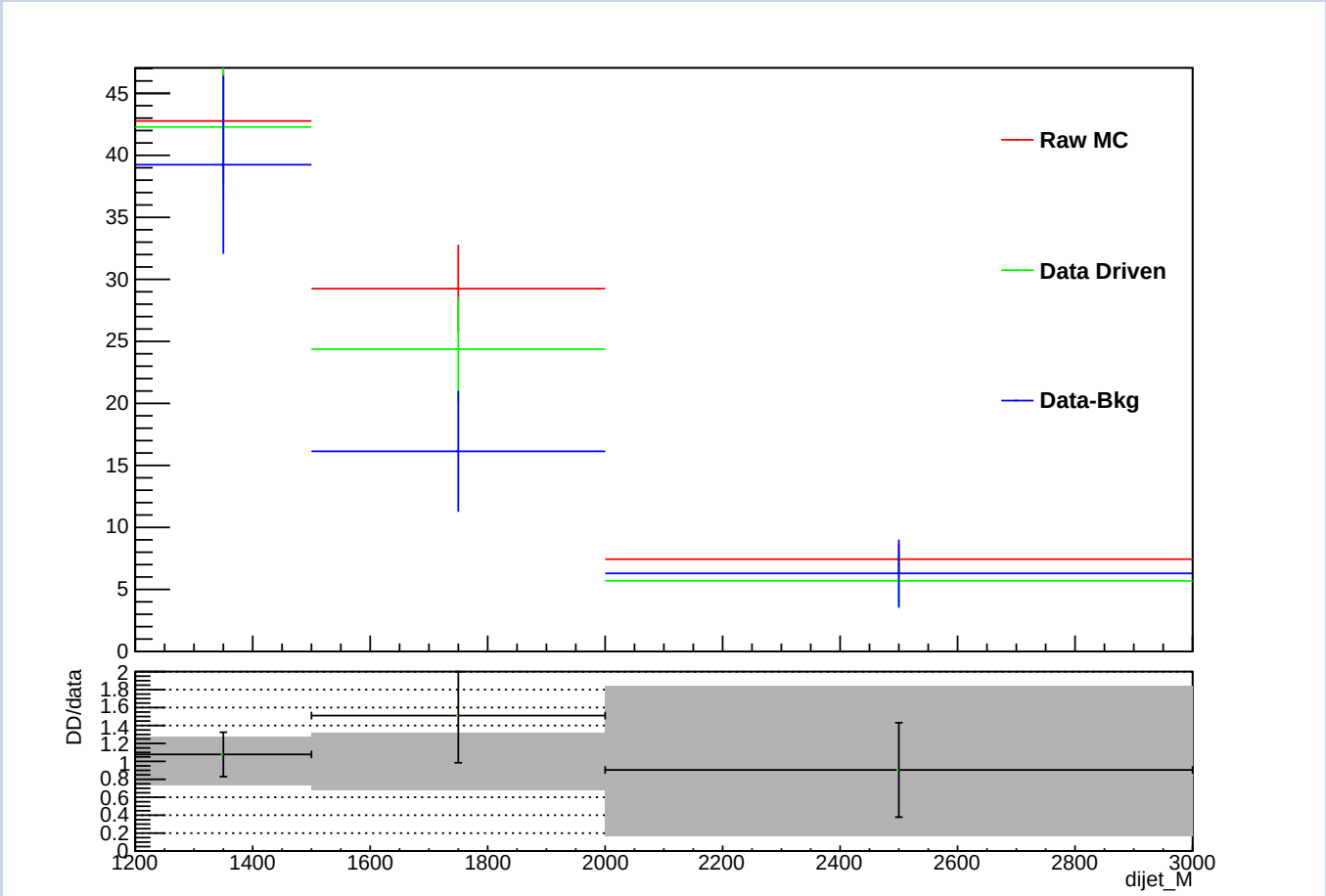
taunu closure



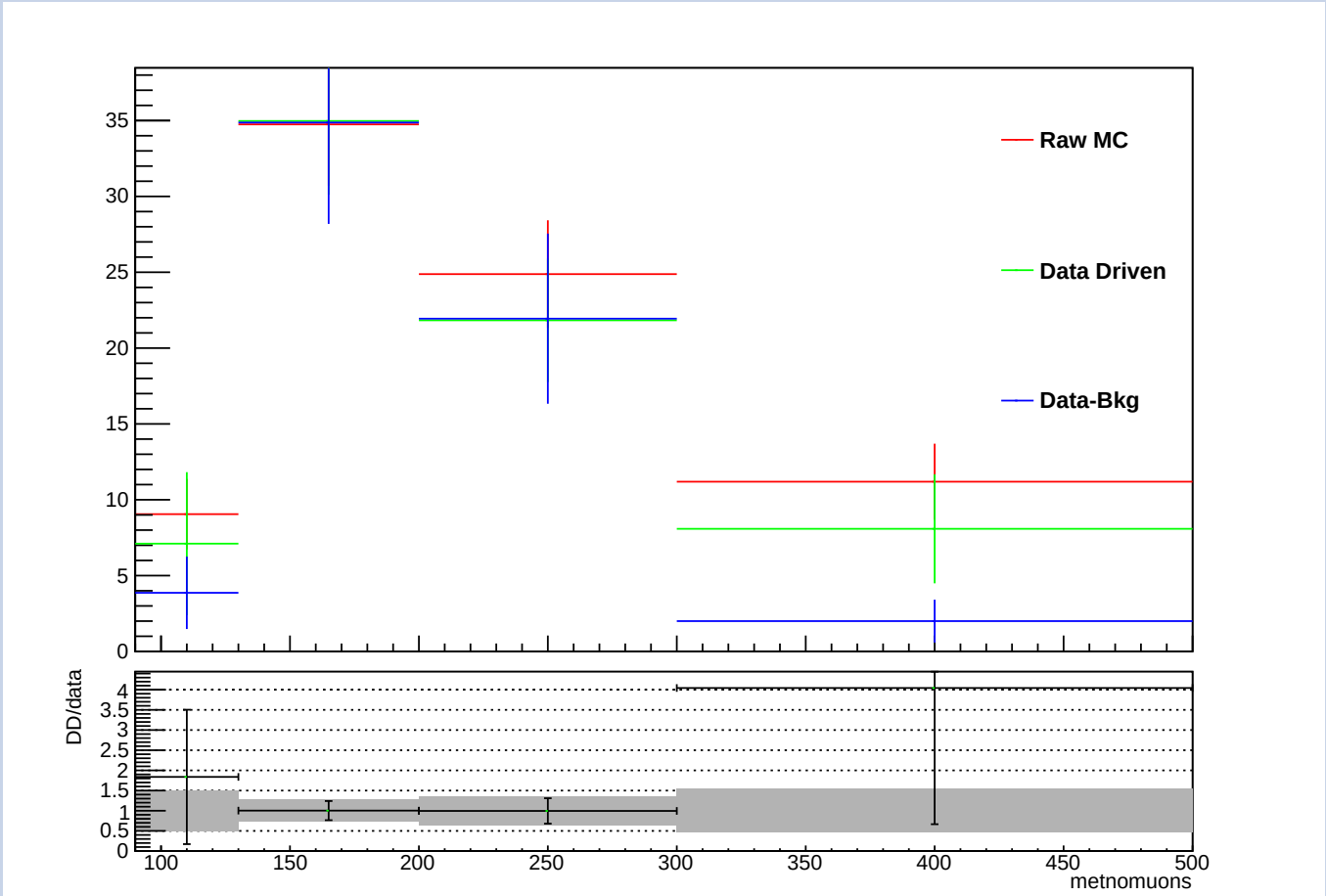
taunu closure



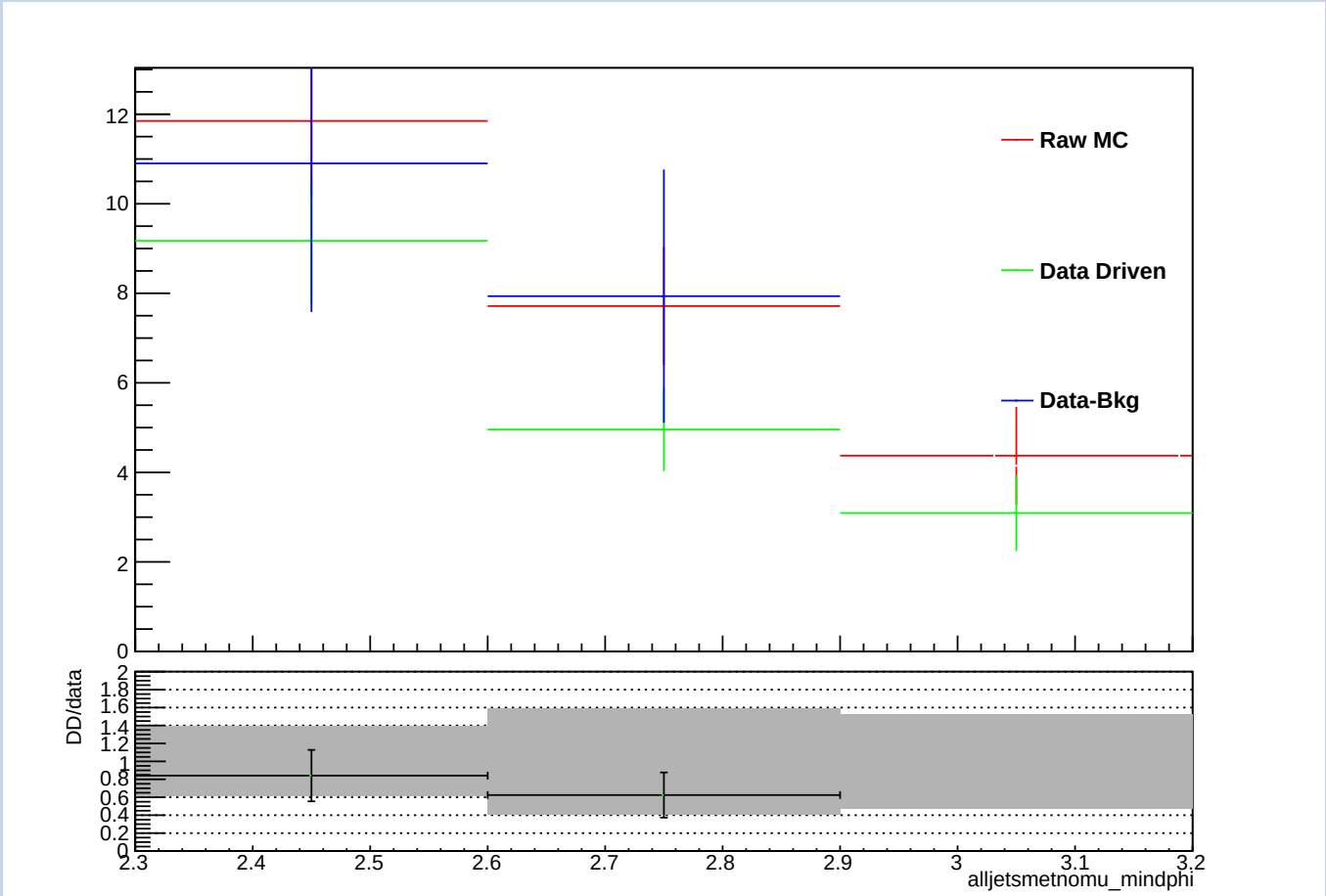
taunu closure



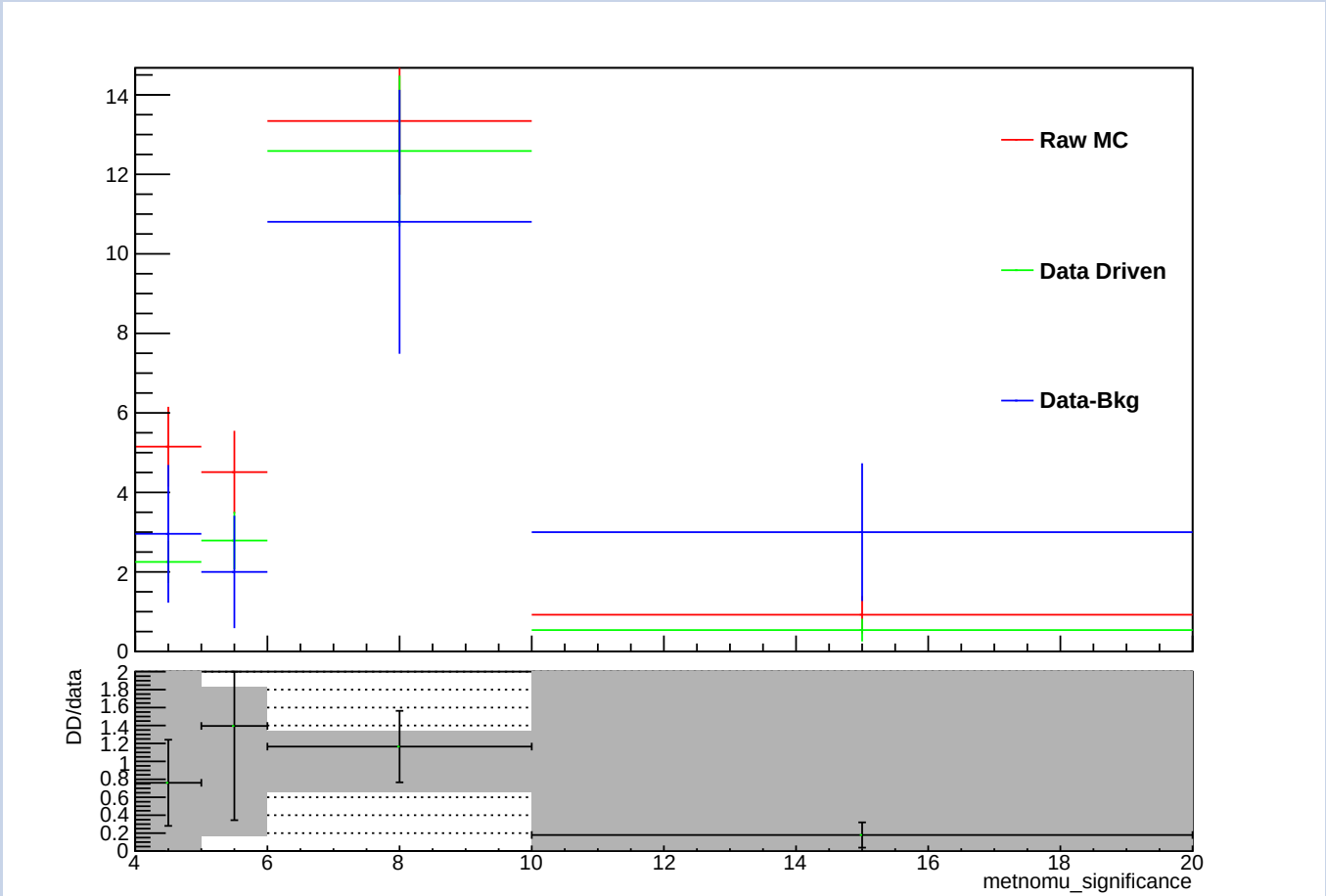
taunu closure



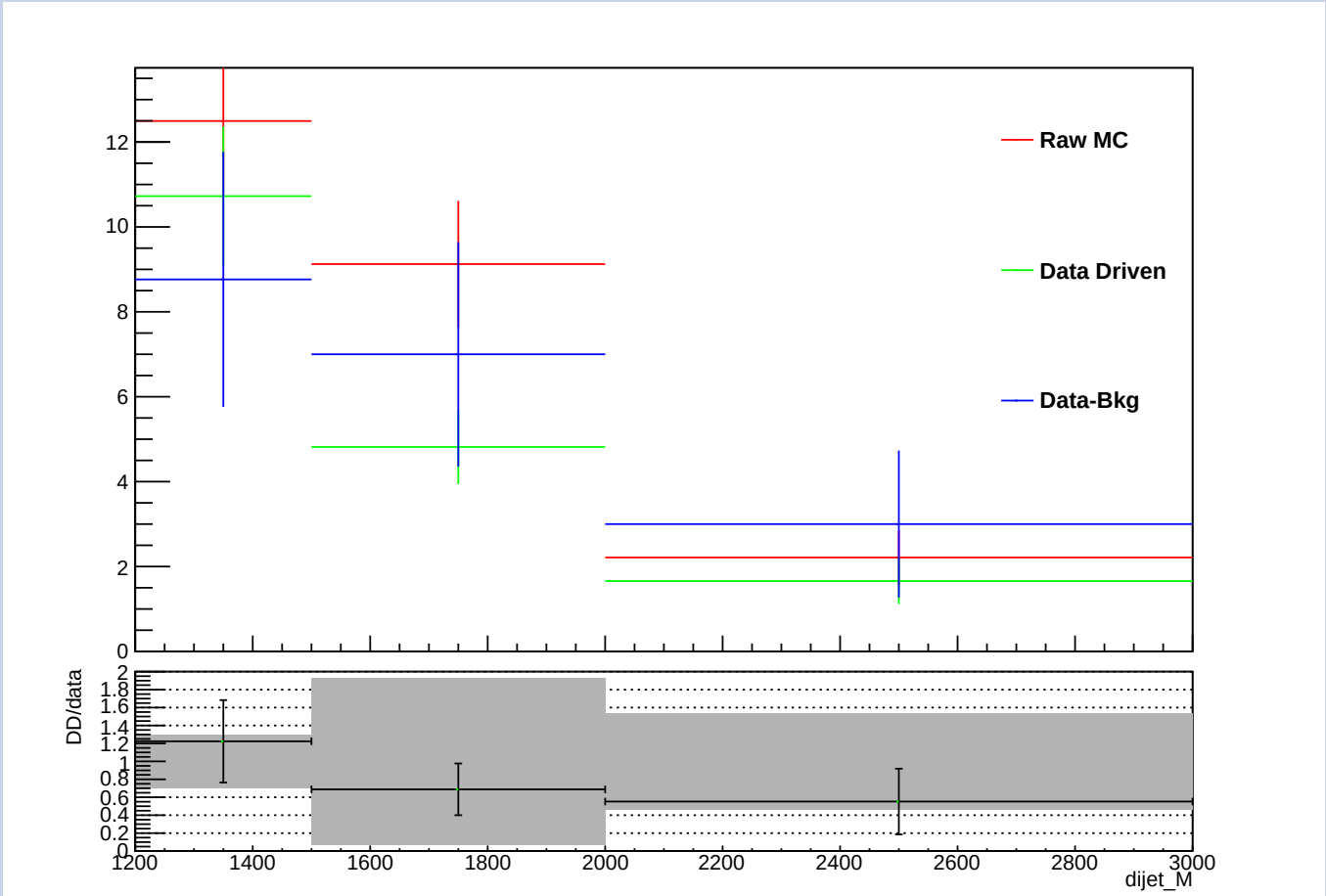
mumu closure



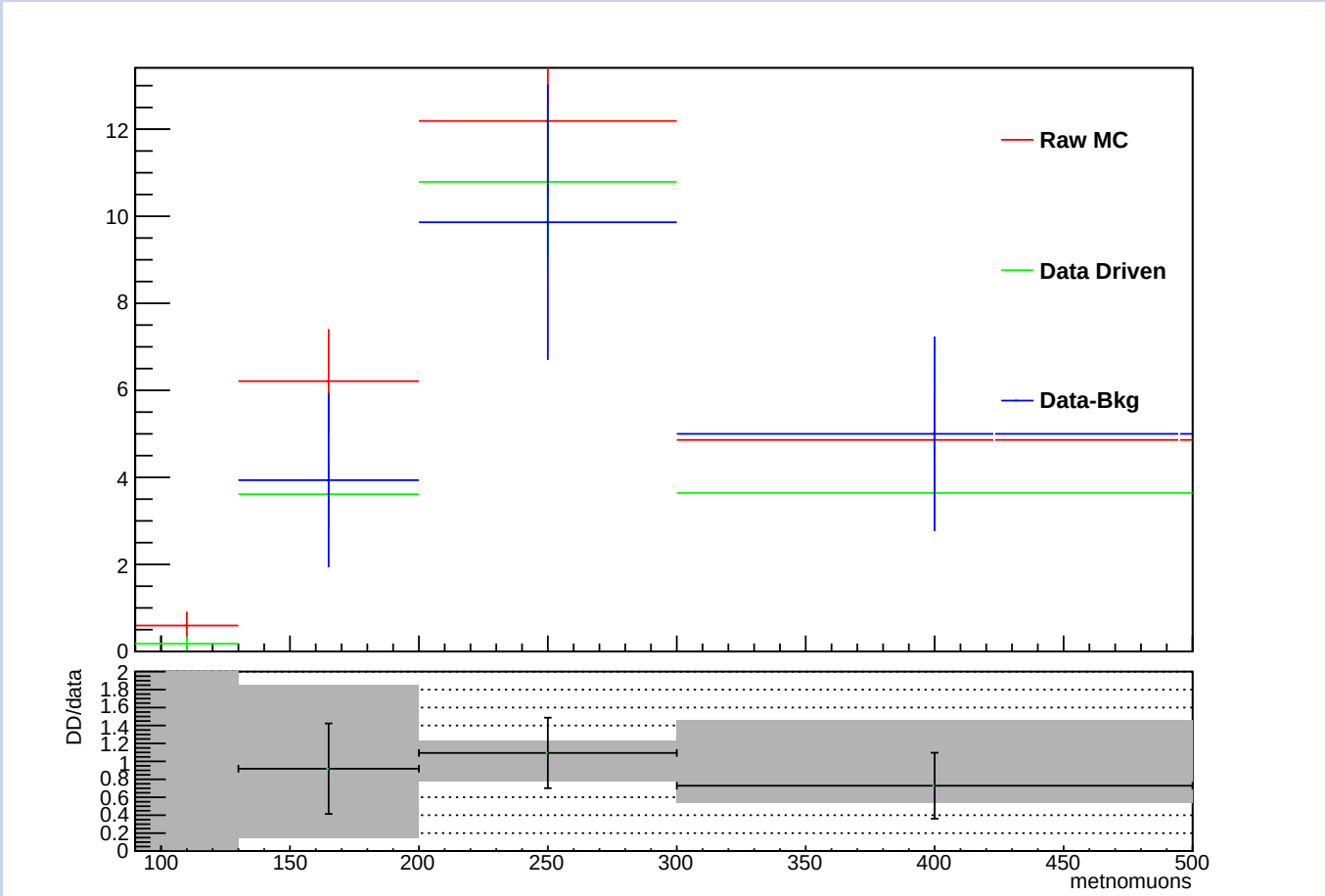
mumu closure



mumu closure



mumu closure



Closure Test Conclusion

- Majority of bins Data-Driven a lot closer to Data than Raw MC is
- Majority of Data-Driven/Data ratio points inside systematic band

Summary

- Answers to preapproval conditions presented
- We await instructions on next steps

Backup