

W Meeting Updates

01/10/2018

Next Steps: W Paper Publication

- Finalize Cuts
- Paper Draft Status
- Analysis Note Status
- Next?
 - Agree on steps / tasks to move forward along with timeline
 - Provide brief summary to Oleg / Carl
 - Circulate analysis note / paper draft among PA's with deadline for comments
 - Send analysis note and paper draft to SPIN PWG for comments
 - Request GPC

Key Points : Final Cuts

- New cuts provide 10% better precision for $W A_L$ than preliminary cuts.
- The level of agreement between data and MC with new cuts is consistent with that of preliminary cuts.
- The results with new cuts (central values of A_L for both W^+ and W^-) are consistent within statistical uncertainties with preliminary cut results.
- Systematic uncertainties are calculated.
- We suggest to use new cuts as final cuts.

Answers to Jinlong's Points

- 1) **Remove away ET cut for period 2:** I still don't see a strong scientific reason to use awayET cuts for only period one. I don't think we want to go into "periods" in our paper. So, I strongly suggest we keep consistent cuts.
➡ Answer: The goal is to retain as much as statistics as possible at the same time obtaining reasonable data / MC comparison. One does not need to go into all the details of "two periods" in the paper. It is not unusual to treat portions of data in a analysis differentially based on various changes in detectors or accelerator conditions during the data collection.
- 2) **Tighten signed pt-balance cut and loosen near side cone cut:** I don't firmly object. But, I have been concerned in some degree by increasing ET cut, as I have expressed several times.
➡ Answer : We have shown that changes in above two cuts are perfectly reasonable.

Paper Draft Status

Paper Draft Writing Task Proposal

Devika: Complete draft available

- 1) Introduction / Motivation [about 3 paragraphs, 1 for introduction 2 for motivation]
- 2) What the letter is about / intro to dataset, RHIC, STAR [1-3 paragraphs]
- 3) Beam polarization/other

Amani: Complete draft available

- 4) Analysis
 - W reconstruction / cuts
 - Charge Separation
 - BG Estimation [Electroweak and QCD] Using simulation and data-driven method
 - Forward rapidity W reconstruction using EEMC and ESMD
 - Forward rapidity charge separation
 - Z boson reconstruction

Jinlong

- 5) AL calculation / Formula used
- 6) AL Combining method
- 7) Final Results [Run 13 / combined]
- 8) Systematic uncertainty

Devika: Complete draft available

- 9) Conclusion / Acknowledgement

Analysis Note Status

Contents

1	Introduction and datasets	1
1.1	Introduction	1
1.2	Data Sample	1
1.2.1	Beam Polarization	4
2	Embedded Simulation Samples	7
2.1	Introduction	7
2.2	MC Simulation Based on PYTHIA	7
2.3	Embedding Procedure	8
3	W^\pm and Z Boson Reconstruction Procedure	11
3.1	Event Selection	11
3.1.1	Trigger	11
3.1.2	Primary Vertex Selection	11
3.2	Isolated Candidate e^\pm Selection	12
3.2.1	Primary Track Selection	12
3.2.2	Track and EMC Cluster Matching	14
3.2.3	Isolation Cuts	16
3.2.4	ESMD Cut	17
3.3	W Candidate Event Selection	19
3.3.1	Signed p_T -balance Cut and away E_T cut	19
3.3.2	Charge Separation	19
3.4	Z Selection	
4	Background Study	
4.1	Electroweak Backgrounds	
4.2	Second Endcap Background for Barrel W	
4.3	Data-driven QCD Background for Barrel W	
4.4	Background Study for Endcap W	
4.5	Background Summary and Systematic Uncertainty	
5	Single-Spin Asymmetry Extraction	
5.1	Formulas of Single-Spin Asymmetry	
5.2	Background correction	
5.3	Wrong Charge Sign Correction	
5.4	Relative Luminosity	
5.5	Spin Sorted W Yields	
5.6	Results	
5.7	Single-spin asymmetry of $Z\gamma^*$ boson production	
6	Combination of 2013 Results with Published 2011+2012 Results	
6.1	Combination of 2011+2012 and 2013	
7	Theory Calculations	
7.1	Theoretical Frameworks used to calculate $W A_L$	
7.2	Polarized PDF Sets	
7.3	Unpolarized PDF Sets	
7.4	Uncertainty Bands	
7.5	Impact of 2013 $W A_L$ Results: Reweighting NNPDFpol1.1	
	Appendix A Reproducing Results and Code Documentation	
	Appendix B List of STAR Runs for 2013	
	Appendix C Parameters in Jet Reconstruction	

Backup

New Cuts vs Preliminary Cuts

Cut	Preliminary	New cut Period 1	New cut Period 2
2x2 ET	14	16	16
2x2 ET / 4x4 ET	0.95	0.96	0.96
2x2 / near Cone	0.88	0.82	0.82
signPT	14	16	16
away ET	11	11	100

Cut Study : <https://drupal.star.bnl.gov/STAR/system/files/userfiles/3475/wMeeting09-20.pdf>
https://drupal.star.bnl.gov/STAR/system/files/userfiles/3475/WAL_updates-11-05-17.pdf