PHENIX W→ μ measurements from the 2013 data-taking period

R. Seidl,[*1] Y. Goto,[*1] T. Iguri,[*1,*3] Y. Imazu,[*1] M. Kim,[*1,*4] C. Kim,[*1,*5] T. Moon,[*1,*6] T. Murakami,[*2] J. Murata,[*3] T. Nagashima,[*1,*3] I. Nakagawa,[*1] S. Park,[*1,*4] ,W. Saito,[*1,*3] K. Tanida,[*1,*4] and I. Yoon[*1,*4]

The parity violation of the weak interaction accesses only left-handed particles and right-handed antiparticles. In longitudinally polarized proton-proton collisions one therefore can acess fixed helicities of the quarks and antiquarks involved in the production of real W bosons. Furthermore the charge of the produced W predominantly selects the quark and antiquark flavors involved. W^+ are mostly generated by a u and anti-d quark while W^- are mostly generated by a d and an anti-u quark. The PHENIX experiment has the capabilities to detect Ws inclusively through their electron and muon decays at central and forward rapidities respectively. In the 2013 data taking period RHIC was entirely run with polarized protons at center of mass energies of $\sqrt{s} = 510$ GeV to finish the RHIC W program[1]. In PHENIX all major muon trigger upgrades installed and commissioned over the last several years as well as the forward vertex tracker FVTX were fully operational for this run. Furthermore PHENIX implemented various improvements in the operation of the detector to increase the data taking efficiency without sacrificing quality. In a limited vertex region (more can be used for the forward W analysis) a total luminosity of about 146 pb^{-1} were accumulated with average longitudinal beam polarizations of 54%, which is close to five times the data accumulated in the previous year with comparable polarizations. The accumulated figure of merit for single spin W asymmetries are displayed in Fig. 1 for the three most recent 500 or 510 GeV data taking periods.

Having developed the $W \rightarrow \mu$ analysis already in the previous two years, most of the offline quality assurance is finished and the analysis to the single spin asymmetries relevant to access the sea quark polarizations in the nucleon is close to be available to the public. One aspect relevant in this analysis and in particular the extraction of W production cross sections is the evaluation of the overall trigger efficiency for candidate events found to be likely W signal events in a MC and data based W likelihood calculation. As various muon triggers cover only certain rapidity ranges these trigger efficiencies need to be obatained independently for various rapidity bins, detector arms and muon charges. Fig. 2 shows the total trigger efficiencies after weighting each according to their relative contribution to the final W candidate event sample.

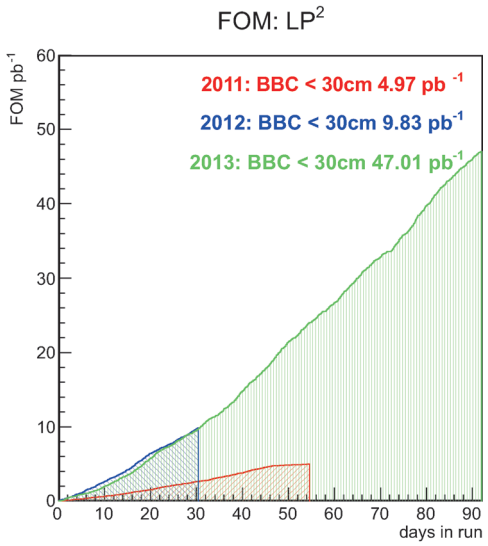

Fig. 1. Figure of merit P^2L accumulated in PHENIX as a function of the day in the run relevant to the forward W analysis. The different colors correspond to the 2011 data taking (red), 2012 (blue) and 2013 (dark green).

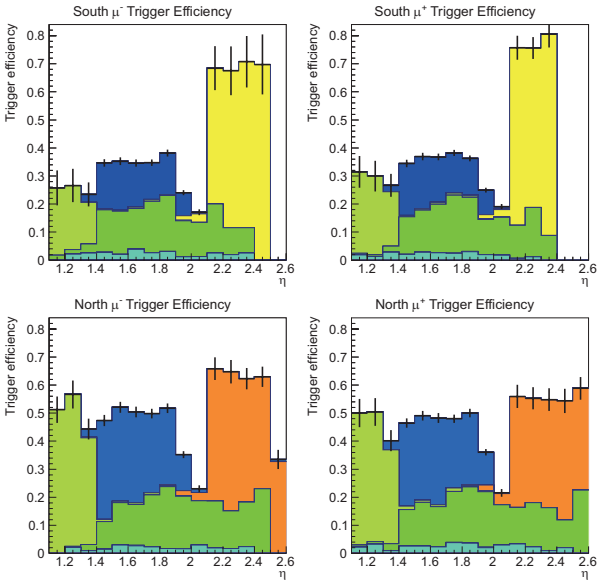

Fig. 2. Overall trigger efficiencies separated by muon arm and charge as a function of rapidity. Various individual trigger contributions are shown as histogram stack.

*1 RIKEN Nishina Center
*2 Department of Physics, Kyoto University
*3 Department of Physics, Rikkyo University
*4 Department of Physics, Seoul National University
*5 Department of Physics, Korea University
*6 Department of Physics, Yonsei University

References

1) E. C. Aschenauer *et al.*, arXiv:1304.0079 [nucl-ex].