

Operation summary of the RHICf experimet

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The RHICf forward (RHICf) experiment is an experiment that can provide information about soft QCD physics. One of the measurements in the RHICf experiment is the measurement of energy spectra of forward neutral particles. Another measurement in the RHICf experiment is the measurement of transverse single-spin asymmetry (A_N) of forward neutral particles. These measurements are expected to contribute to the determination of Feynman scaling and the production mechanism of forward neutral particles.¹⁾ The main detector in the RHICf experiment is the the LHCf detector that is an electromagnetic calorimeter used in LHCf experiment which is optimized for detecting π^0 s.²⁾ In addition to the RHICf detector, the data from the STAR ZDC, VPD, BBC, and Roman pot were read-out so that a combined analysis could be performed.

The RHICf experiment was performed from 21st June to 26th June in 2017 at STAR IR in RHIC. The RHICf detector was installed immediately in front of the west ZDC.³⁾ The RHICf detector consists of a large tower and a small tower so that π^0 can be detected more effectively. The RHICf experiment was performed using a horizontally polarized beam (radial polarized beam) and the detector location was adjusted at 3 different heights to extend the transverse momentum (P_T) measurement range:¹⁾ i) the height of the large tower center is the same as the height of the collision point (6 hours), ii) the height of the small tower center is the same as the height of the collision point (12 hours) and iii) the height of the small tower center is 24 mm greater than the height of the collision point (8 hours). The operation was completed with 3 kinds of triggers which enhance single showers, π^0 s. and high-energy electromagnetic (EM) showers⁴⁾ during 5 RHIC fills and the total run time was approximately 23 hours. Proton-proton collisions proceeded at $\beta^* = 8$ m and $\sqrt{s} = 510$ GeV with the radial polarization $P \sim 0.5$.

During the operation time, the monitoring system achieved stable polarization measurement with satisfactory precision, with a reasonably reconstructed π^0 invariant mass and correlation between STAR ZDC and the RHICf detector.⁵⁾ Figure 1 shows the reconstructed invariant mass of photon pair events showing a peak at the rest mass of π^0 from quick offline data analysis in the operation time. The peak location is slightly different from the true π^0 mass because the energy calibration was not perfect in the quick analy-

sis. Figure 2 shows the accumulated number of events during the operation time.

The RHICf experiment was completed successfully under a stable beam condition with STAR detectors and the data showed a reasonable π^0 mass spectrum with sufficient statistics and correlation with STAR ZDC as expected.

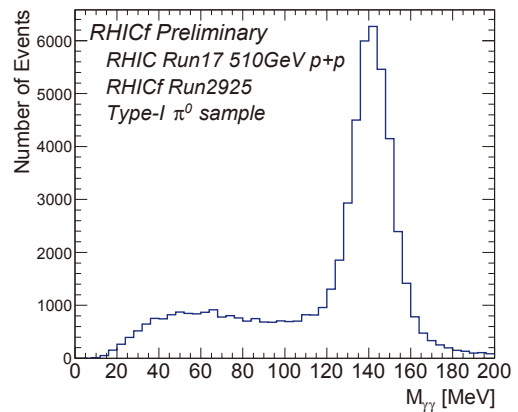


Fig. 1. Reconstructed π^0 mass with data.

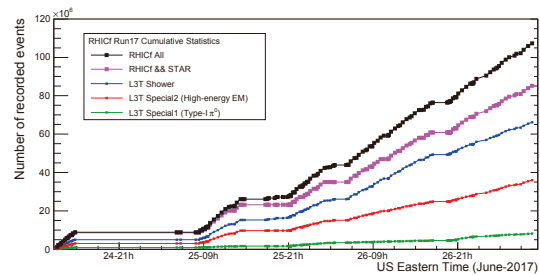


Fig. 2. Black: accumulated events recorded by 3 kinds of triggers, Magenta: accumulated events recorded by coincidence among STAR detector triggers and LHCf triggers, Blue: accumulated events recorded by shower trigger only, Red: accumulated events recorded by π^0 trigger only, Green: accumulated events recorded by high EM trigger only.

References

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