BESIII reports new measurement of R ratio

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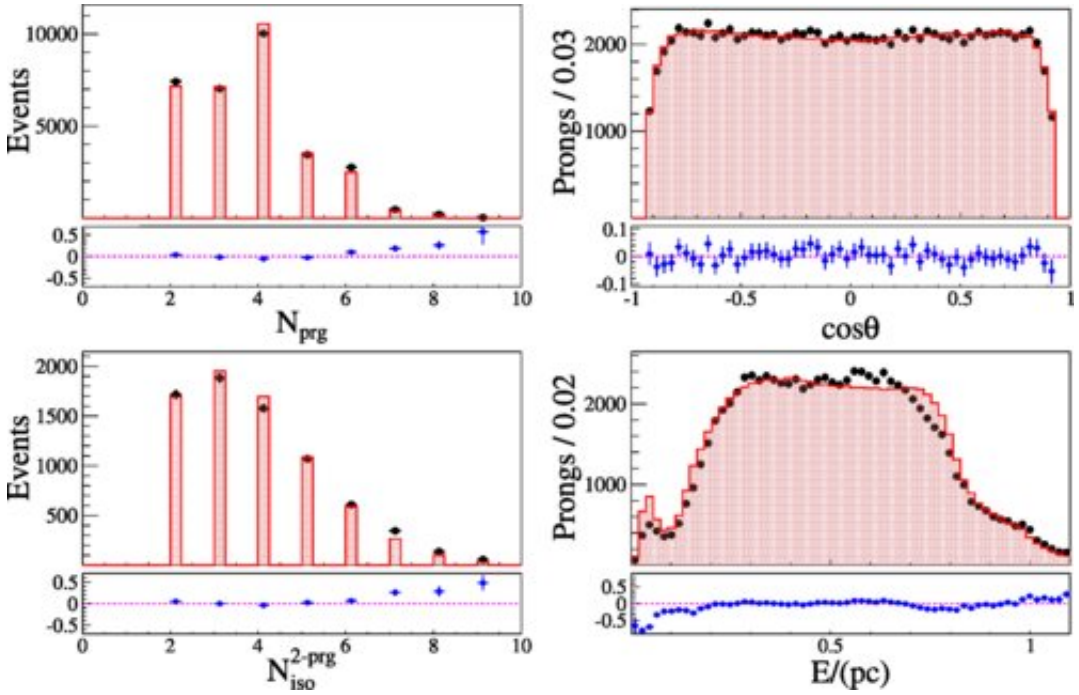

Comparison between data (black dots) and a simulation based on the luarlw MC generator (red histograms) at √ s = 3.4000 GeV . Here, N prg is the number of prongs, and N 2 - prg iso is the number of isolated photons in two-prong events. Track-level variables θ , E , and p stand for the polar angle, deposited energy in EMC, and MDC measured momentum of each prong. The MC simulation distribution is normalized to that in data by the ratio of the corresponding numbers of total events or tracks. The blue dots denote the relative differences. Credit: DOI: 10.1103/PhysRevLett.128.062004

The BESIII Collaboration has measured the R ratio in the low center-of-mass (c.m.) energy region. The results were published online in *Physics*

Review Letters.

The R value, defined as the ratio of the cross section at the lowest order between the inclusive hadronic process $e^+e^- \rightarrow$ hadrons and the QED process $e^+e^- \rightarrow \mu^+\mu^-$, is a very important quantity in particle physics. Precision measurements of the R ratio below 5 GeV contribute to the standard model (SM) prediction of the muon anomalous magnetic moment. The R ratio also contributes to the determination of the QED running coupling constant evaluated at the Z pole. This observable provides another precision test for the SM and is essential for electroweak precision physics programs at future colliders.

In this measurement, a total of 14 data points were used, with the corresponding c.m. energy ranging from 2.2324 to 3.6710 GeV. Taking advantage of the large data samples, the statistical uncertainty of the measured R ratio is less than 0.6%.

Plenty of effort was made to develop and investigate two different simulation models—the existing inclusive LUARLW generator and a new hybrid one that integrates a few exclusive generators by which inclusive hadronic event production from electron-positron annihilations is reproduced very well. The two simulation models give consistent detection efficiencies and initial-state radiation corrections, with a maximum total difference of less than 2.3%. An accuracy of better than 2.6% below 3.1 GeV and 3.0% above has been achieved in the R ratios, which is much improved from previous results at the level of 3~6%.

More information: M. Ablikim et al, Measurement of the Cross Section for $e^+e^-\rightarrow$Hadrons at Energies from 2.2324 to 3.6710 GeV, *Physical Review Letters* (2022). DOI: 10.1103/PhysRevLett.128.062004

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