Latest progress on R value measurement

Weiping Wang[1a], Zhen Gao[1], Bingxin Zhang[2], Lipeng Zhou[2],
Ronggang Ping[2], Wenbiao Yan[1], Haiming Hu[2], Guangshun Huang[1], Zhengguo Zhao[1]

[1] University of Science and Technology of China, Anhui, China
[2] Institute of High Energy Physics, CAS, Beijing, China
(Dated: November 27, 2019)

Abstract

The nominal simulations are performed by LUARLW, in which the parameters are tuned at 1st. Nov. 2019, in which the transverse momentum is changed by revising parameter XAU(47) and XAU(49). The samples are generated at IHEP server rather than USTC. In new samples, the input hadronic cross section is changed to be consistent with the ISR-calculation-code. The polar angle distribution The distributions are normalized according to the survived events. The alternative simulation is performed by the Hybrid model, which is generated at Oct. 14th, 2019, after fixing a few mistakes in LUARLW component.

[a] Email: cloud13@mail.ustc.edu.cn

CONTENTS

I. LUARLW MC GENERATED AT 20191101

A. Effective energy spectrum in truth level

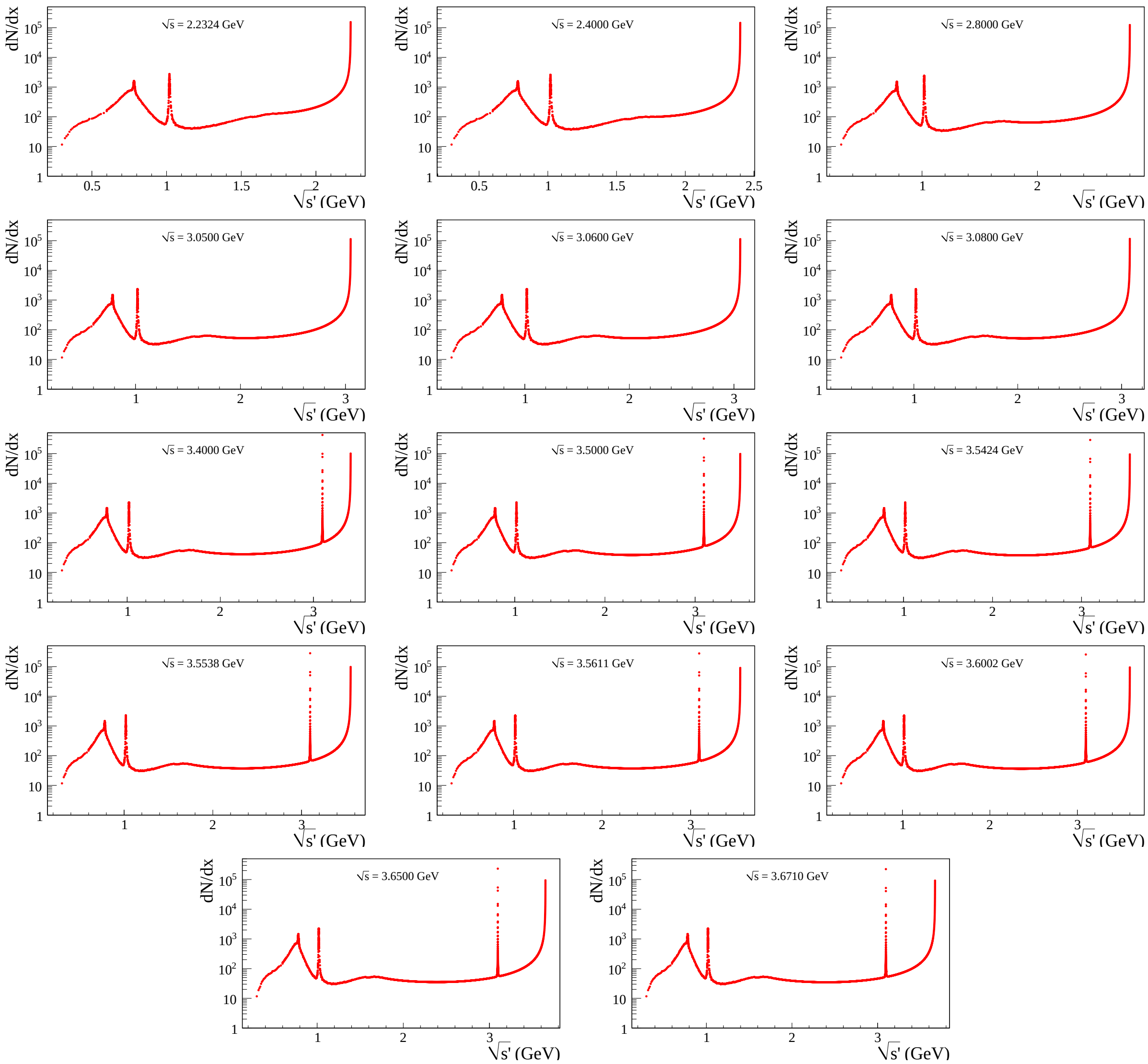

FIG. 1. The effective energy distribution of LUARLW simulation in truth level.

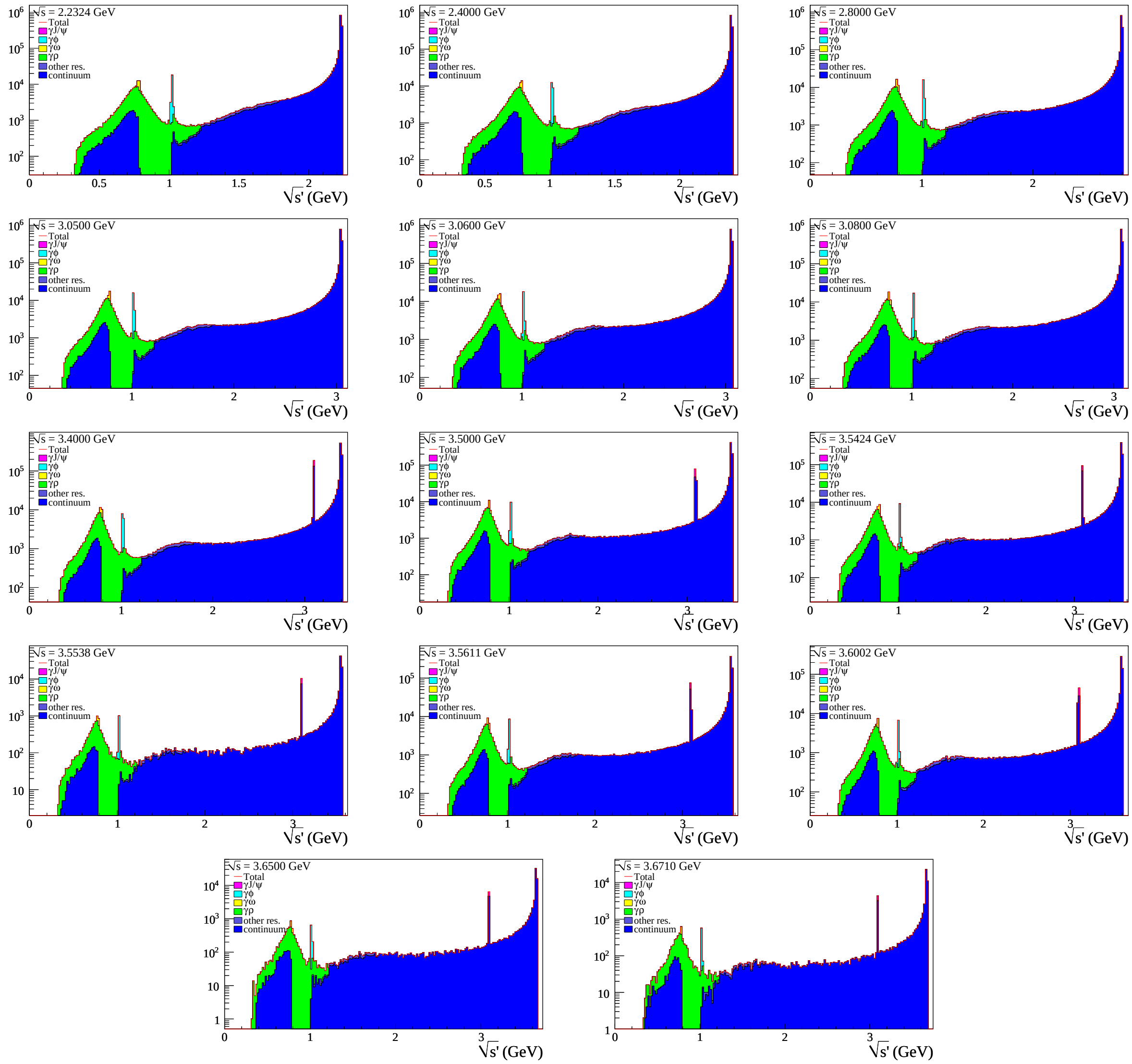

FIG. 2. The split effective energy distribution of LUARLW simulation in truth level.

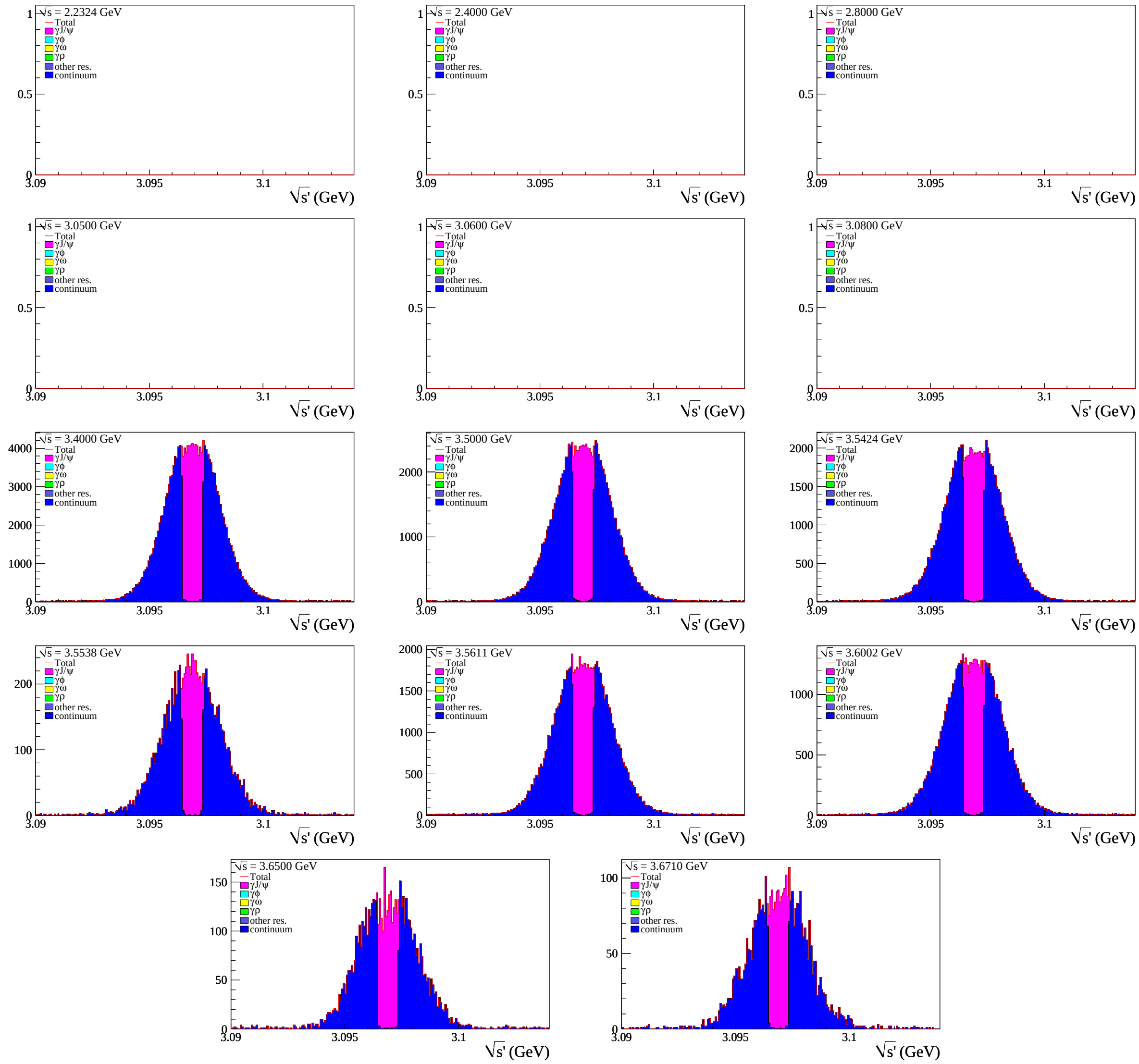

FIG. 3. The split effective energy distribution around J/ψ region of LUARLW simulation in truth level.

B. Effective energy spectrum in detector level

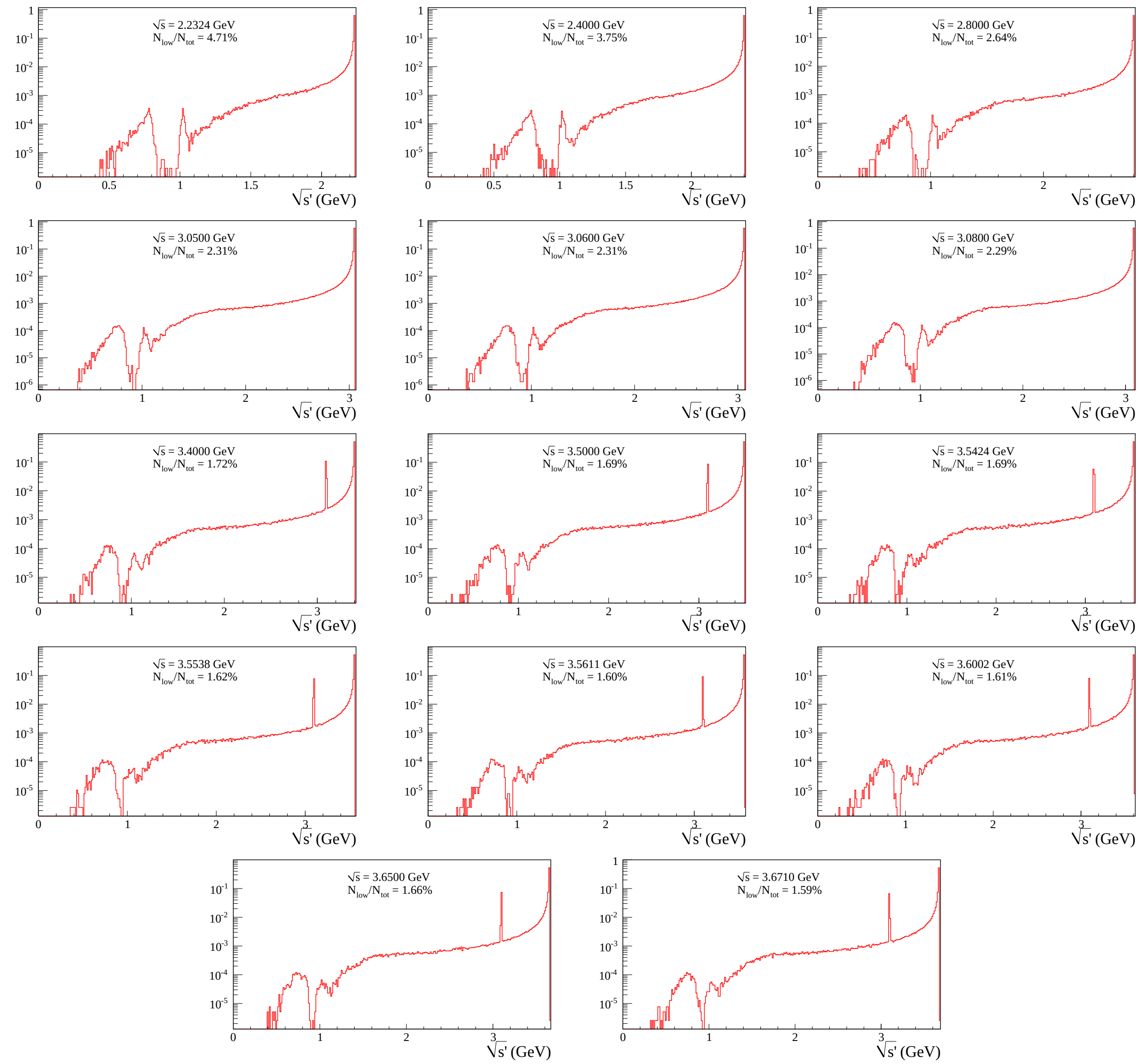

FIG. 4. The effective energy distribution of LUARLW simulation, where the $N_{\rm low}$ is the number of survived events with $\sqrt{s'} < 1.780$ GeV in LUARLW MC samples, while the $N_{\rm tot} = N_{\rm MC}^{\rm sur}$ is the total number of survived events.

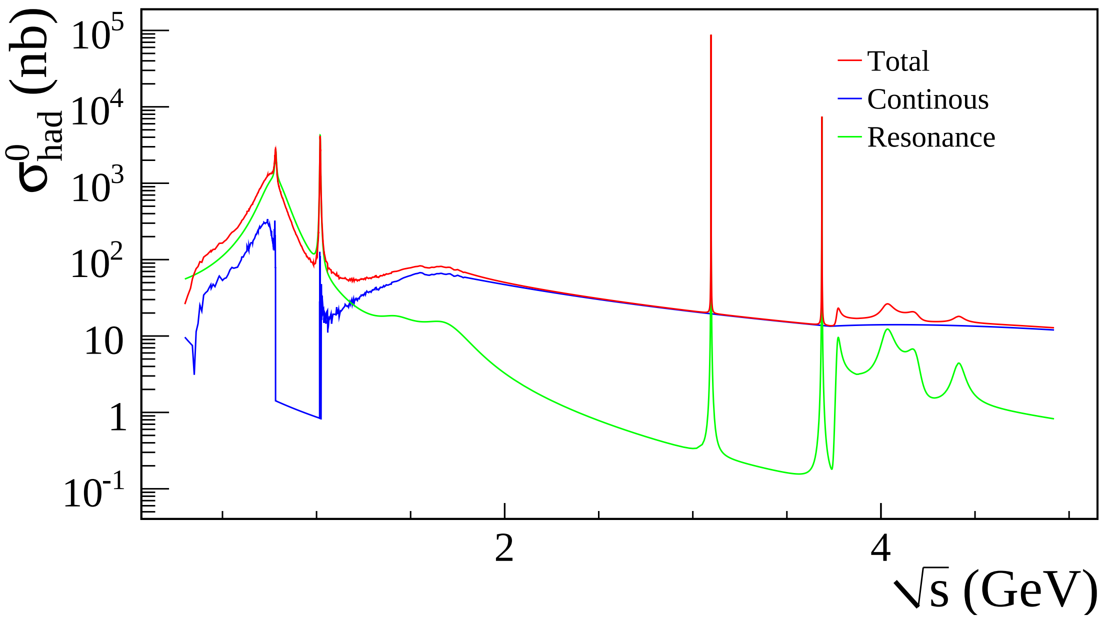

FIG. 5. The σ^0_{had} used in LUARLW simulation, which is divided into continuum and resonance parts.

In this plot, the total cross sections $\sigma^0_{\mathrm{had}}(s)$ with $\sqrt{s} < 1.780$ GeV is cited and thereby fixed from PDG directly, while that with $\sqrt{s} > 1.780$ GeV is obtained from adding $\sigma^0_{\mathrm{con}}(s)$ and $\sigma^0_{\mathrm{res}}(s)$. At all the energy region, the $\sigma^0_{\mathrm{res}}(s)$ is parameterized by Breit-Wigner functions for all involved resonance states, whose mass and width parameters are cited from latest PDG summary.

When $\sqrt{s} < 1.780$ GeV, the $\sigma^0_{\mathrm{con}}(s)$ is unknown, since the pQCD theory is not available. To simulate continuum events at this energy region, we extracted the $\sigma^0_{\mathrm{con}}(s)$ according to:

$$\sigma^0_{\mathrm{con}}(s) = \max\{0, \sigma^0_{\mathrm{had}}(s) - \sigma^0_{\mathrm{res}}(s)\}. \tag{1}$$

Note that in this plot, to display the cross section in log scale, we temporarily assign those vanished $\sigma^0_{\mathrm{con}}(s)$ values to be $0.01/\sigma^0_{\mu\mu}(s)$. In our simulations, they are exactly equals zero, which means that there is no continuum event generated at this energy region.

When $\sqrt{s} > 1.780$ GeV, the $\sigma^0_{\mathrm{con}}(s)$ is calculated according to pQCD theory.

Our event selection criteria will remove most of the generated $\gamma_{\mathrm{ISR}}\rho$, $\gamma_{\mathrm{ISR}}\omega$ and $\gamma_{\mathrm{ISR}}\phi$ events. However, a few events generated with Lund area law (according to the $\sigma^0_{\mathrm{con}}(s)$, i.e. the residual cross sections shown in blue curve in Fig. 4) are reserved. The effective energy spectra shown in Fig. 3 exactly reflect this fact.