Latest progress on R value measurement

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Abstract

The nominal simulations are performed by pure Lund Area Law model, in which the `Luarlw.F` is revised at 25th July 2020. In this version, the production of $e^+e^- \to \pi^+\pi^-\pi^0$ events is suppressed instead of enhanced to realize a better statistical consistency at lower energies. The alternative simulation is performed by the Hybrid model, which is generated at 9th August 2020, after fixing a fatal bug in `EvtLunda.cc`. This bug leads double-counting in simulation due to the invalid veto attempt. Both these two distributions are normalized according to the survived events.

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CONTENTS

I. DETAIL COMPARISONS BETWEEN DATA AND LUARLW SIMULATIONS

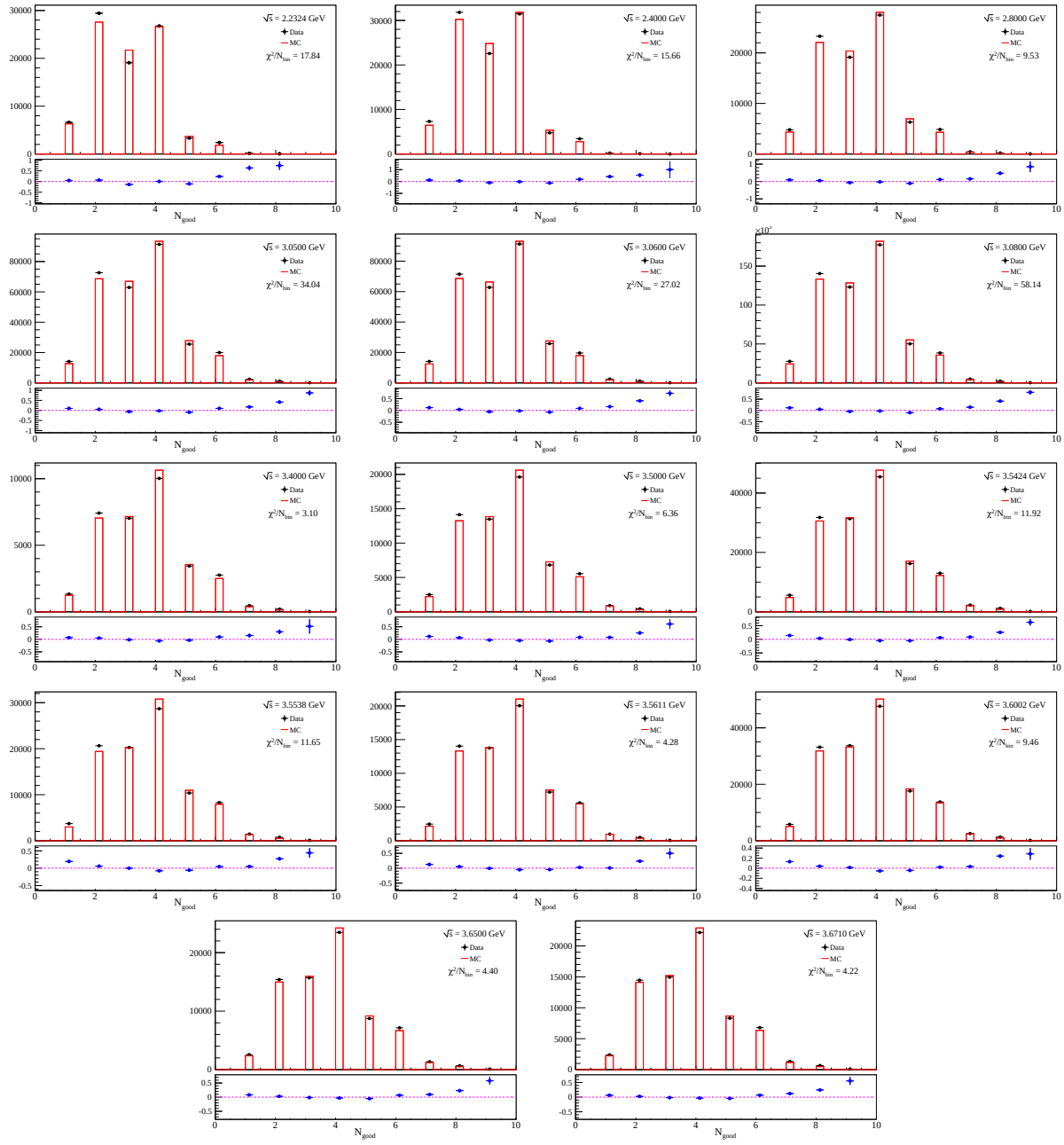

FIG. 1. The detail comparisons of $N_{\rm good}$ between 20200725 Luarlw MC and data.

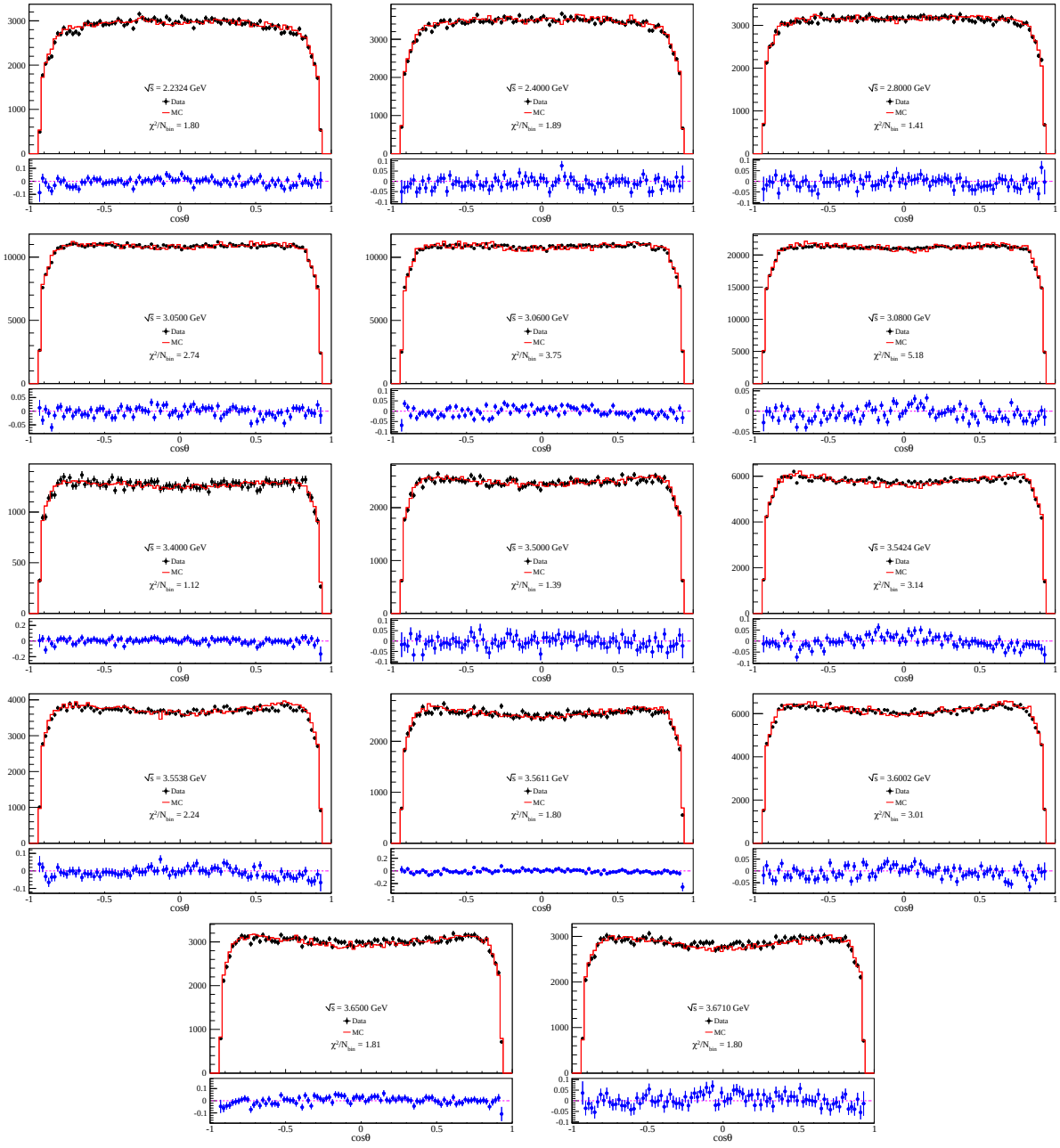

FIG. 2. The detail comparisons of *cosθ* between 20200725 Luarlw MC and data.

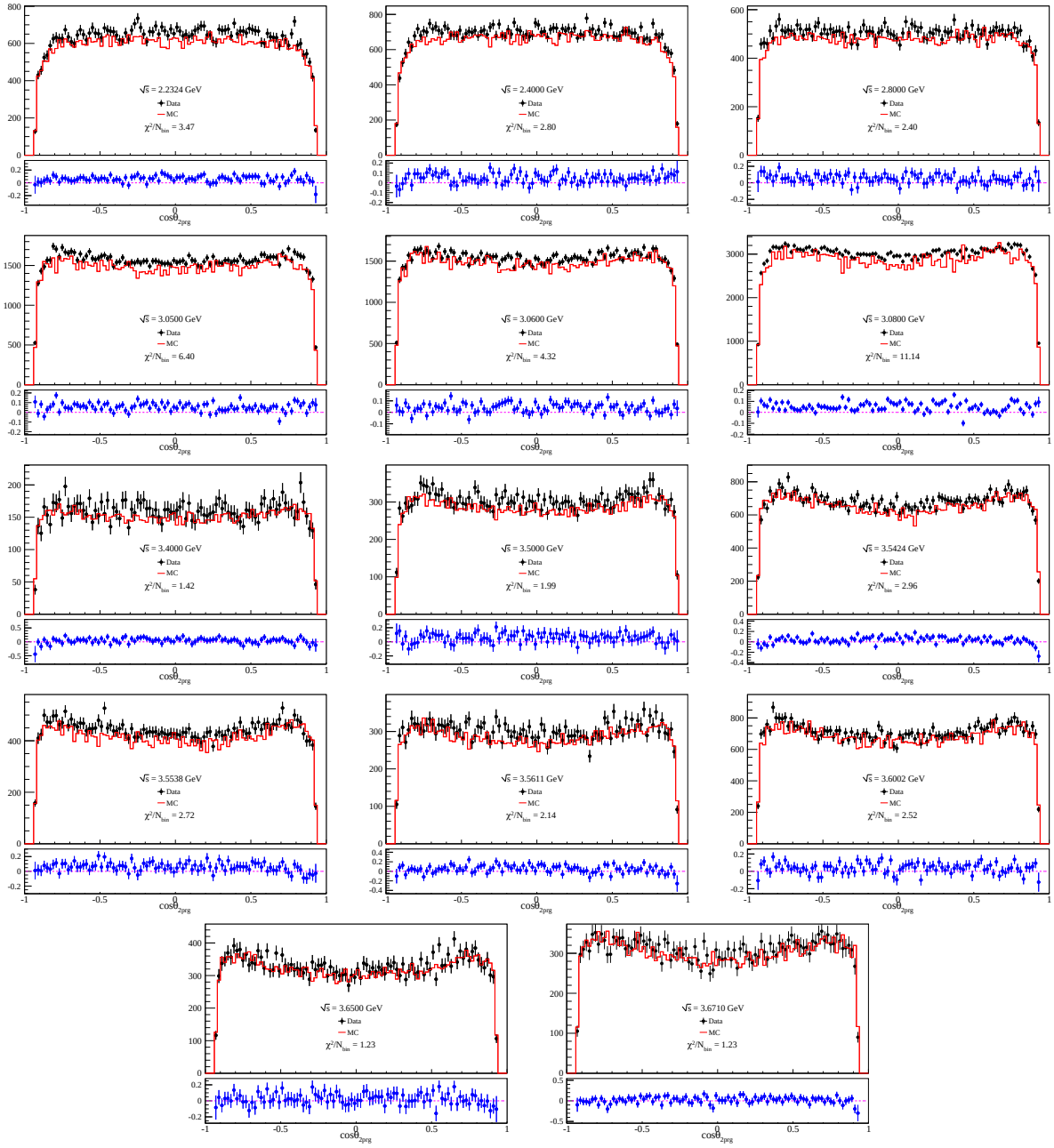

FIG. 3. The detail comparisons of $cos\theta_{2\mathrm{prg}}$ between 20200725 Luarlw MC and data.

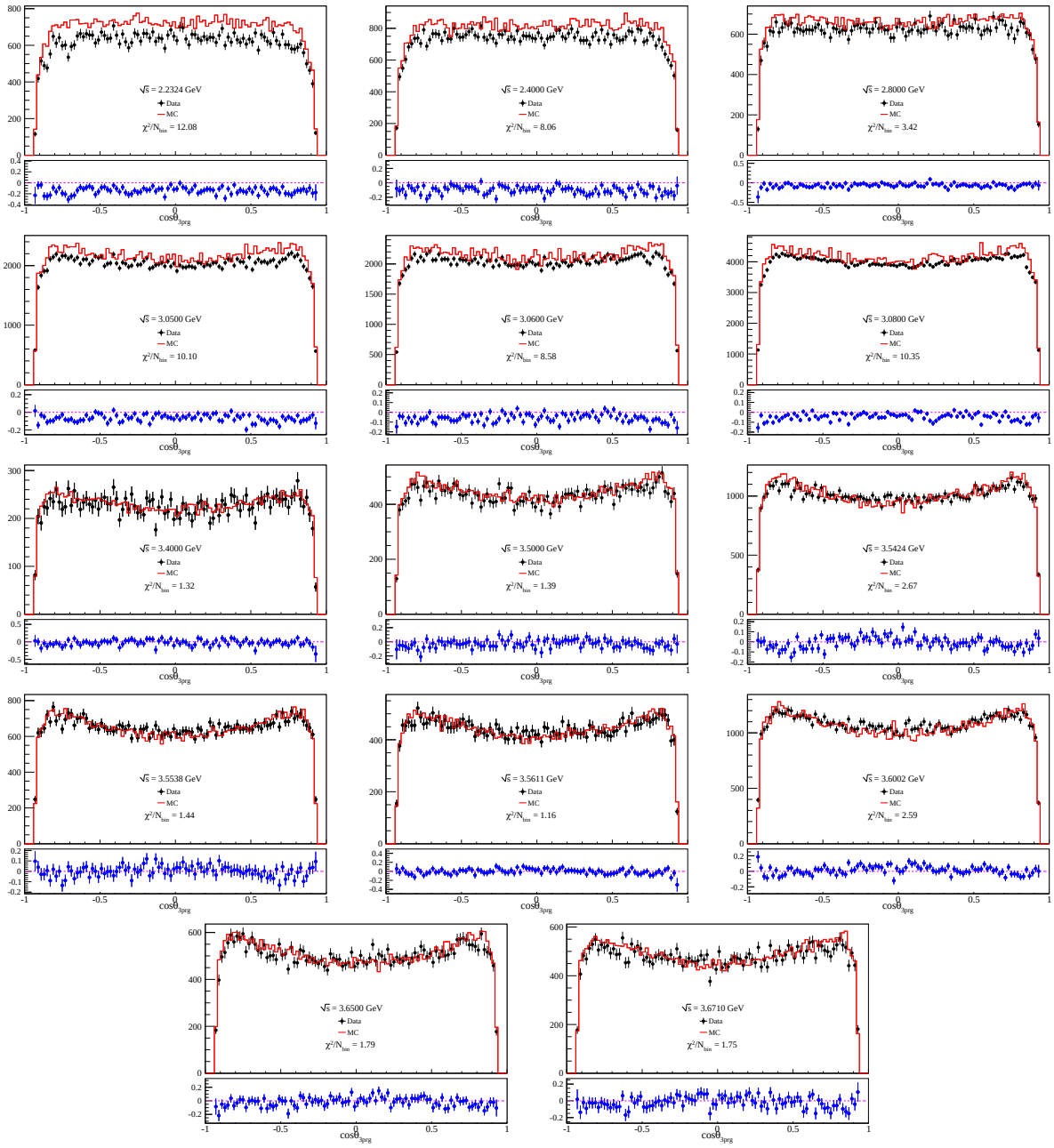

FIG. 4. The detail comparisons of $cos\theta_{3\mathrm{prg}}$ between 20200725 Luarlw MC and data.

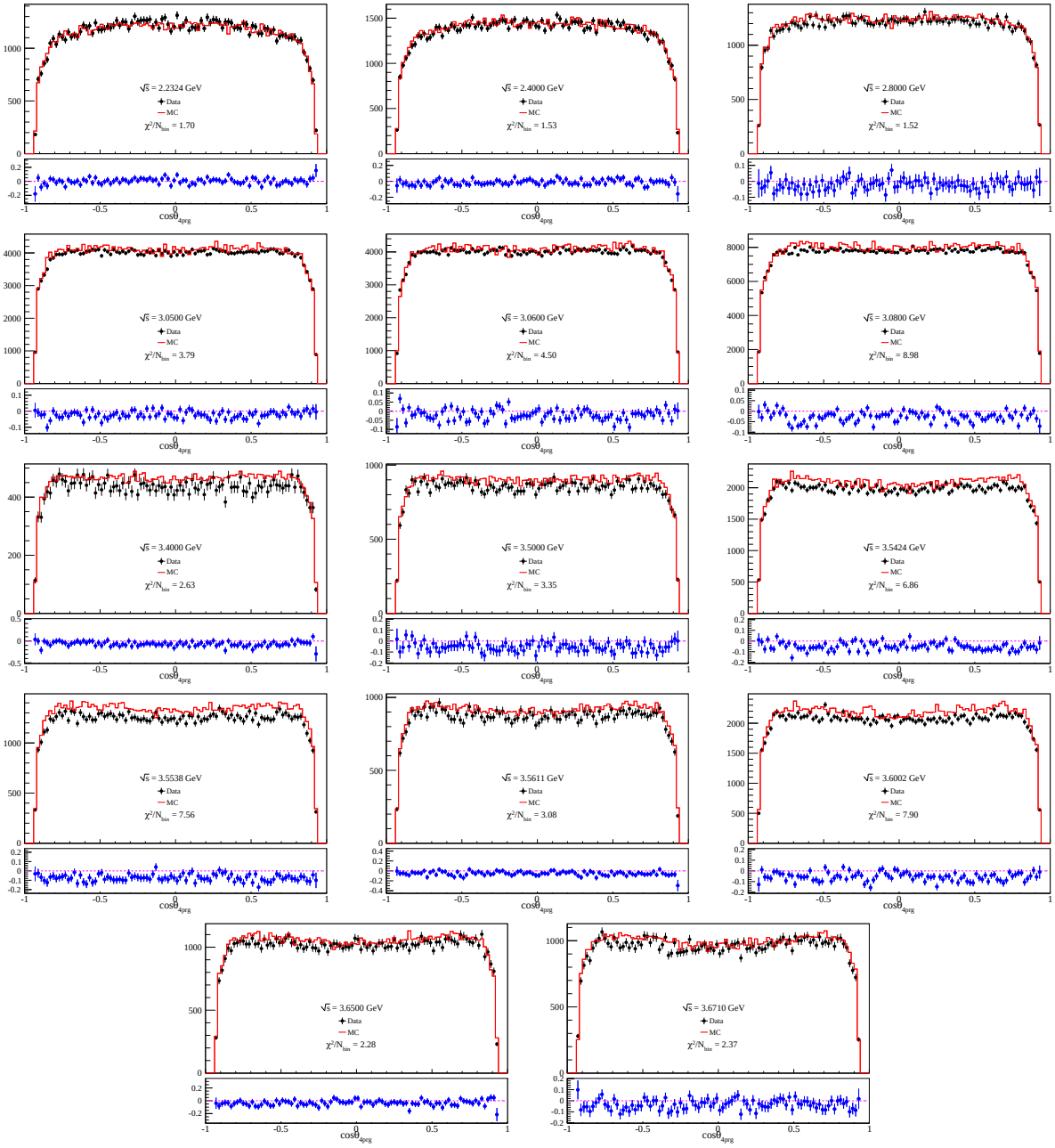

FIG. 5. The detail comparisons of $cos\theta_{4\mathrm{prg}}$ between 20200725 Luarlw MC and data.

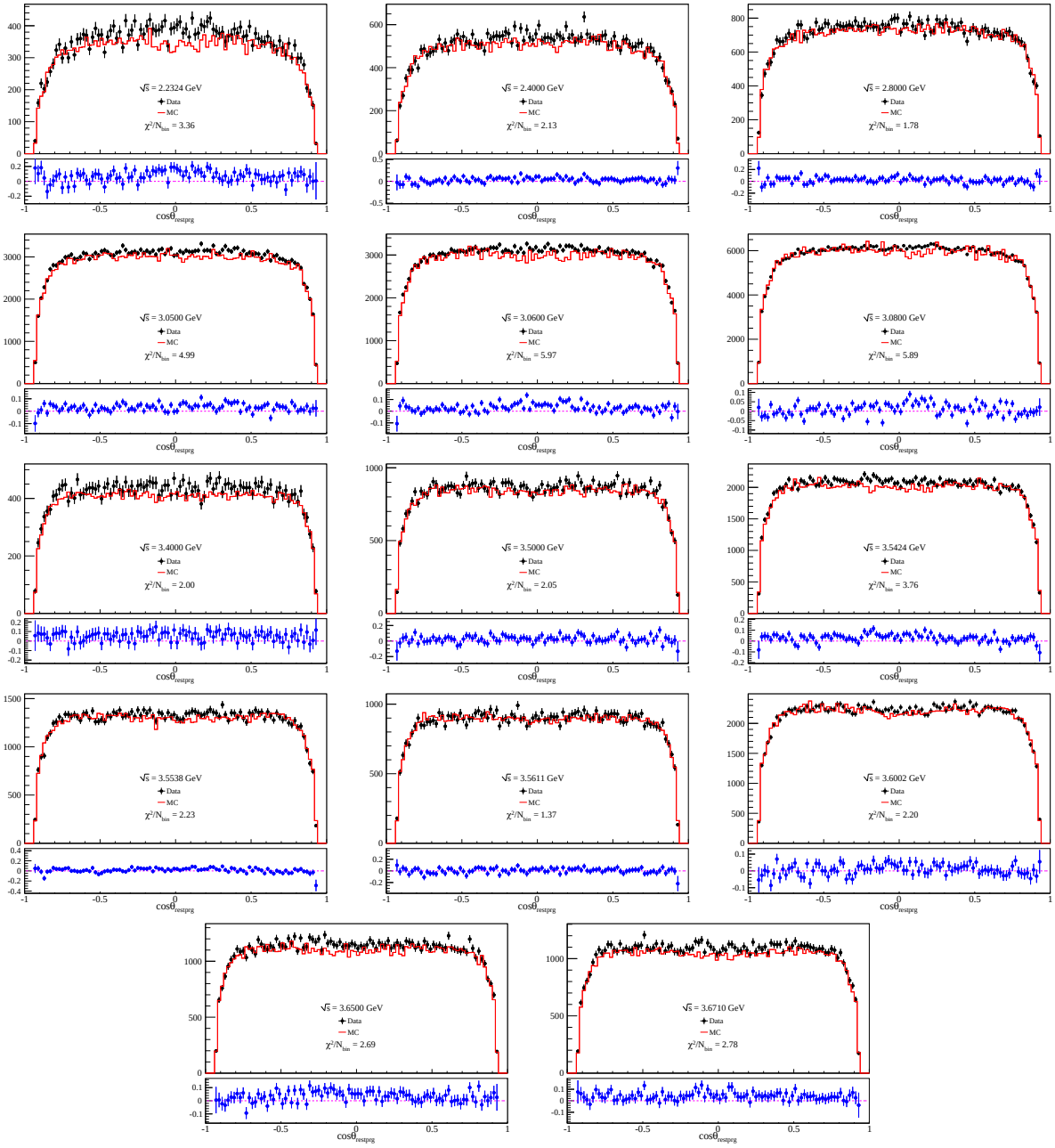

FIG. 6. The detail comparisons of $cos\theta_{\rm restprg}$ between 20200725 Luarlw MC and data.

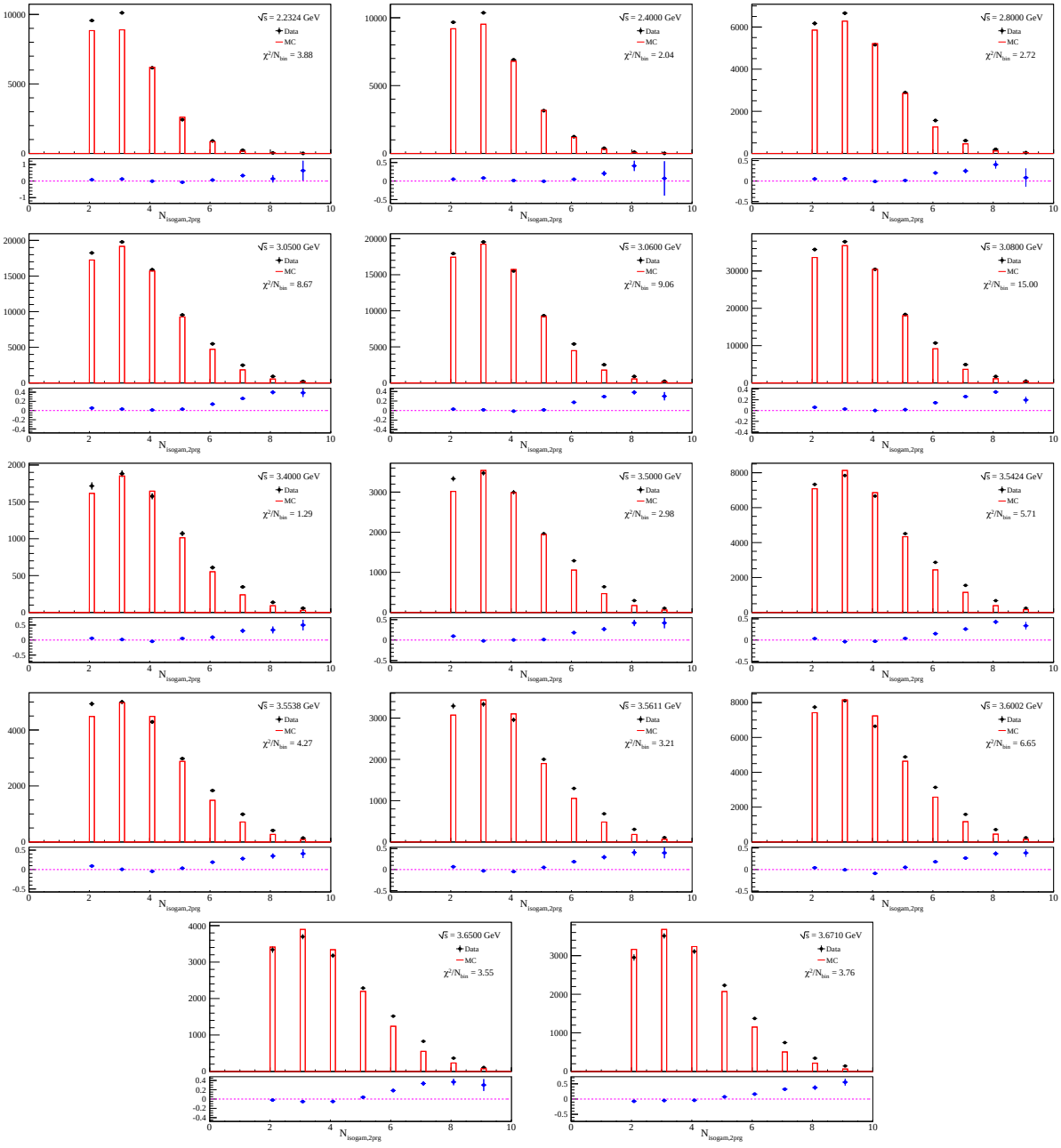

FIG. 7. The detail comparisons of $N_{\mathrm{isogam,2prg}}$ between 20200725 Luarlw MC and data.

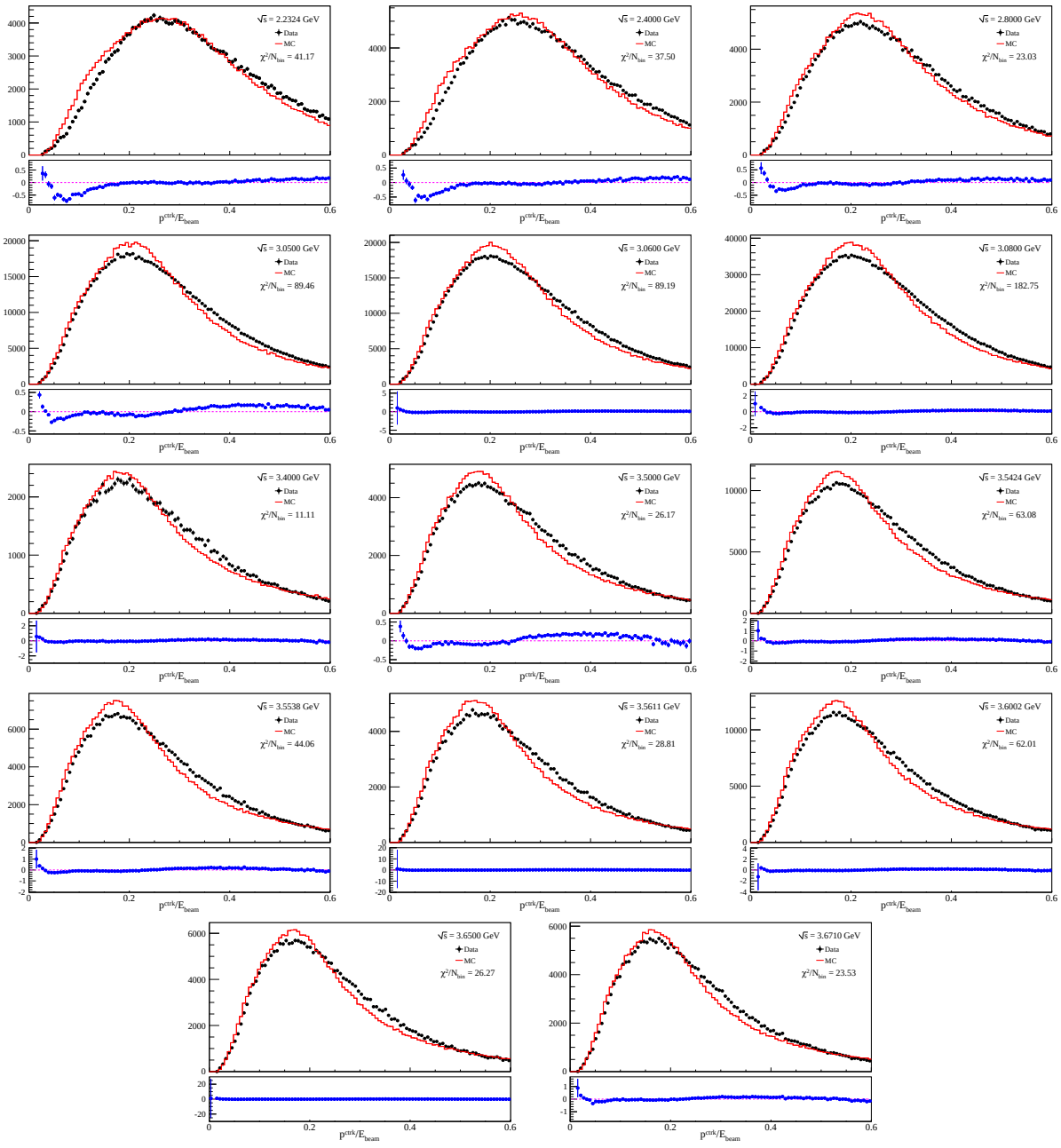

FIG. 8. The detail comparisons of $p_{\rm ctrk}$ between 20200725 Luarlw MC and data.

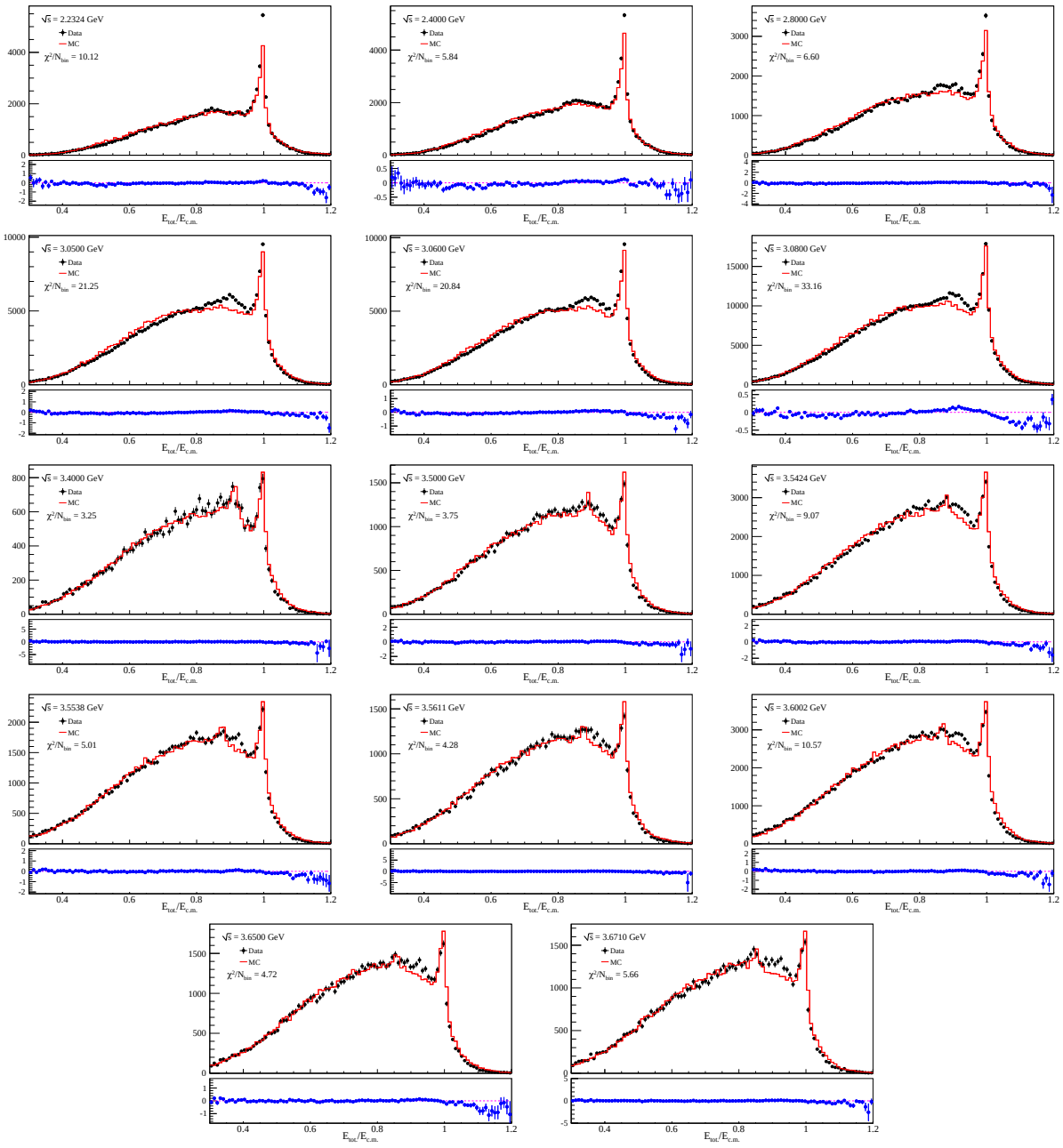

FIG. 9. The detail comparisons of $E_{\rm tot.}$ between 20200725 Luarlw MC and data.

FIG. 10. The detail comparisons of N_γ between 20200725 Luarlw MC and data.

FIG. 11. The detail comparisons of N_{π^0} between 20200725 Luarlw MC and data.

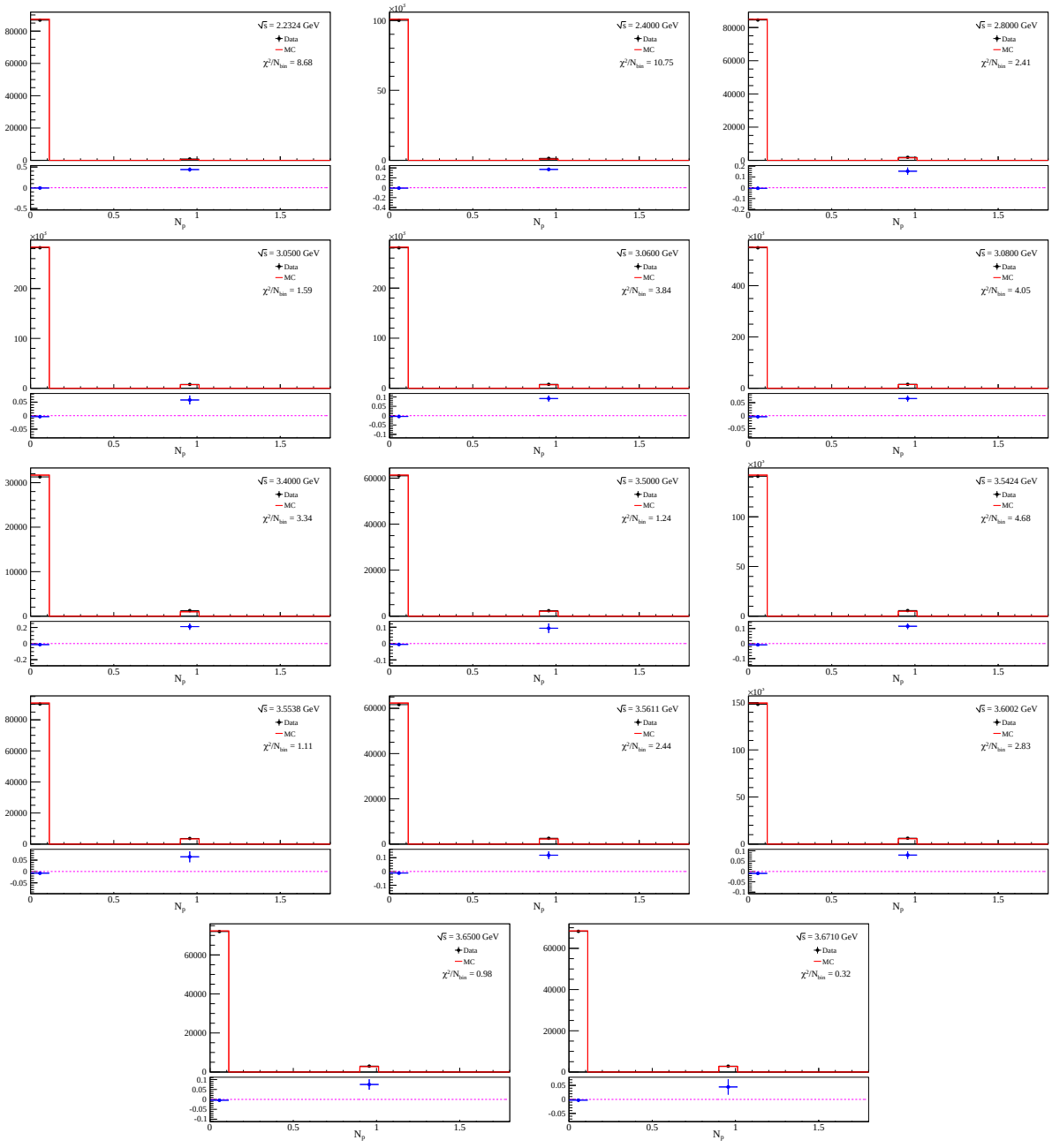

FIG. 12. The detail comparisons of N_p between 20200725 Luarlw MC and data.

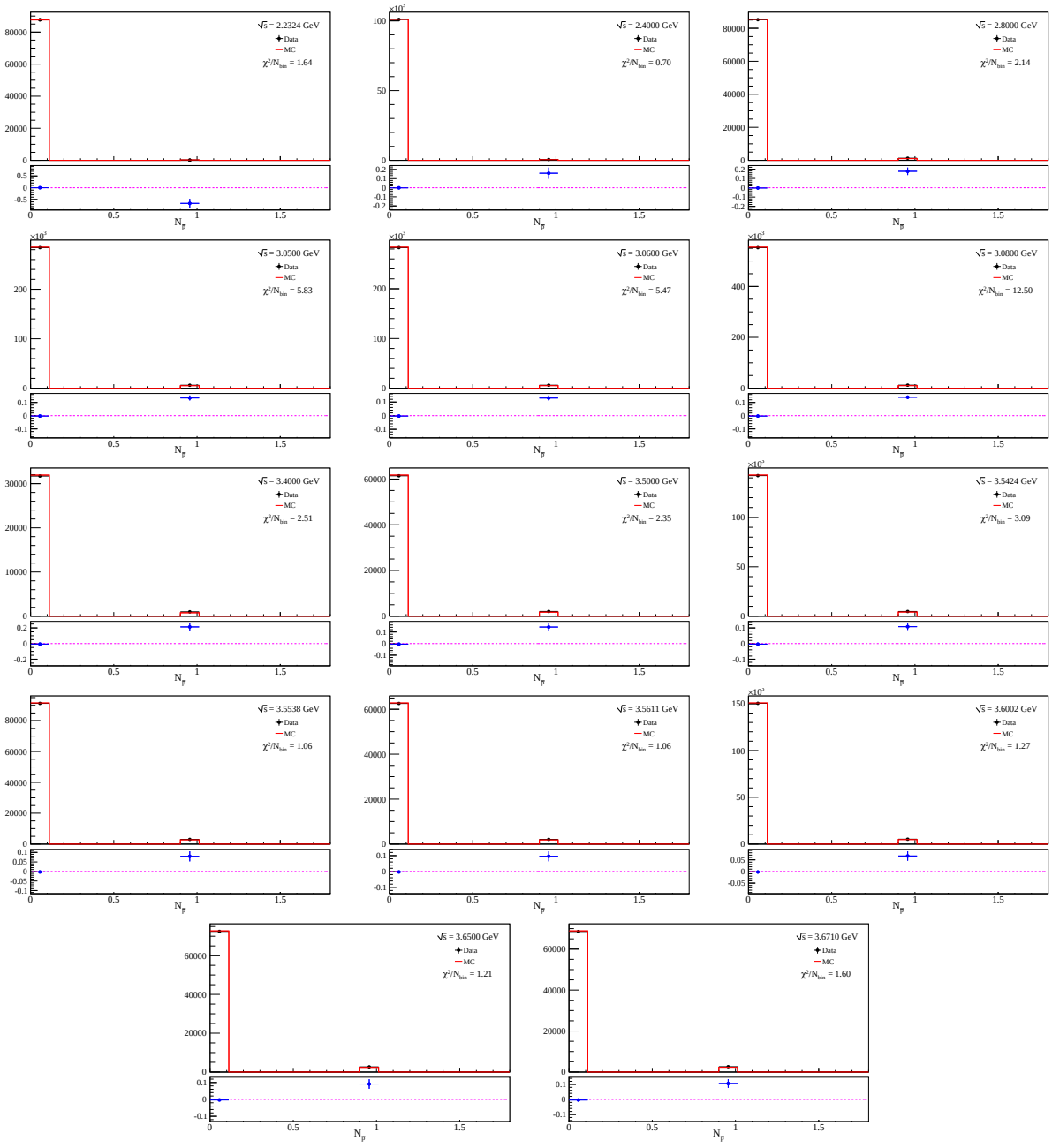

FIG. 13. The detail comparisons of $N_{\bar{p}}$ between 20200725 Luarlw MC and data.

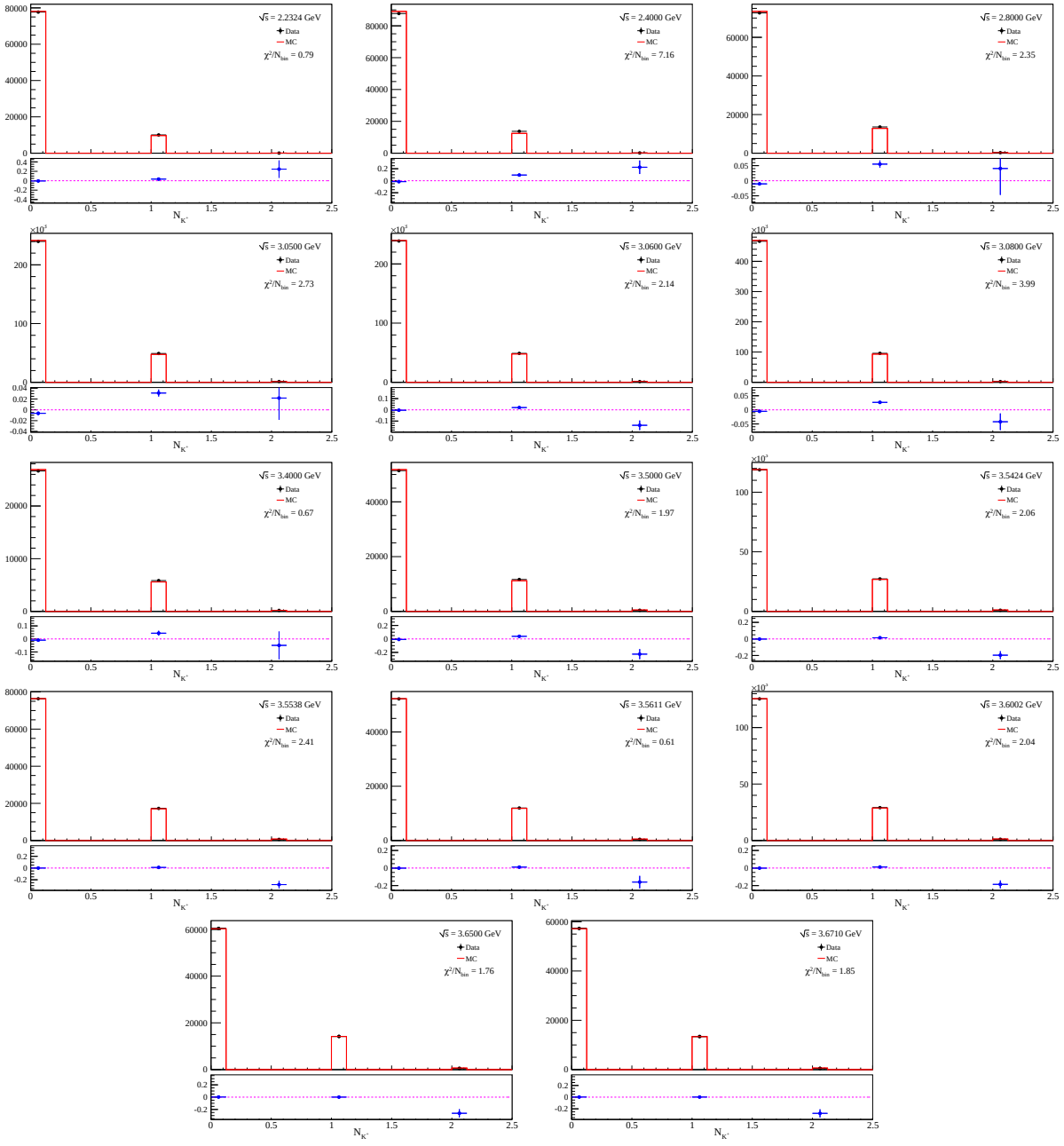

FIG. 14. The detail comparisons of N_{K^+} between 20200725 Luarlw MC and data.

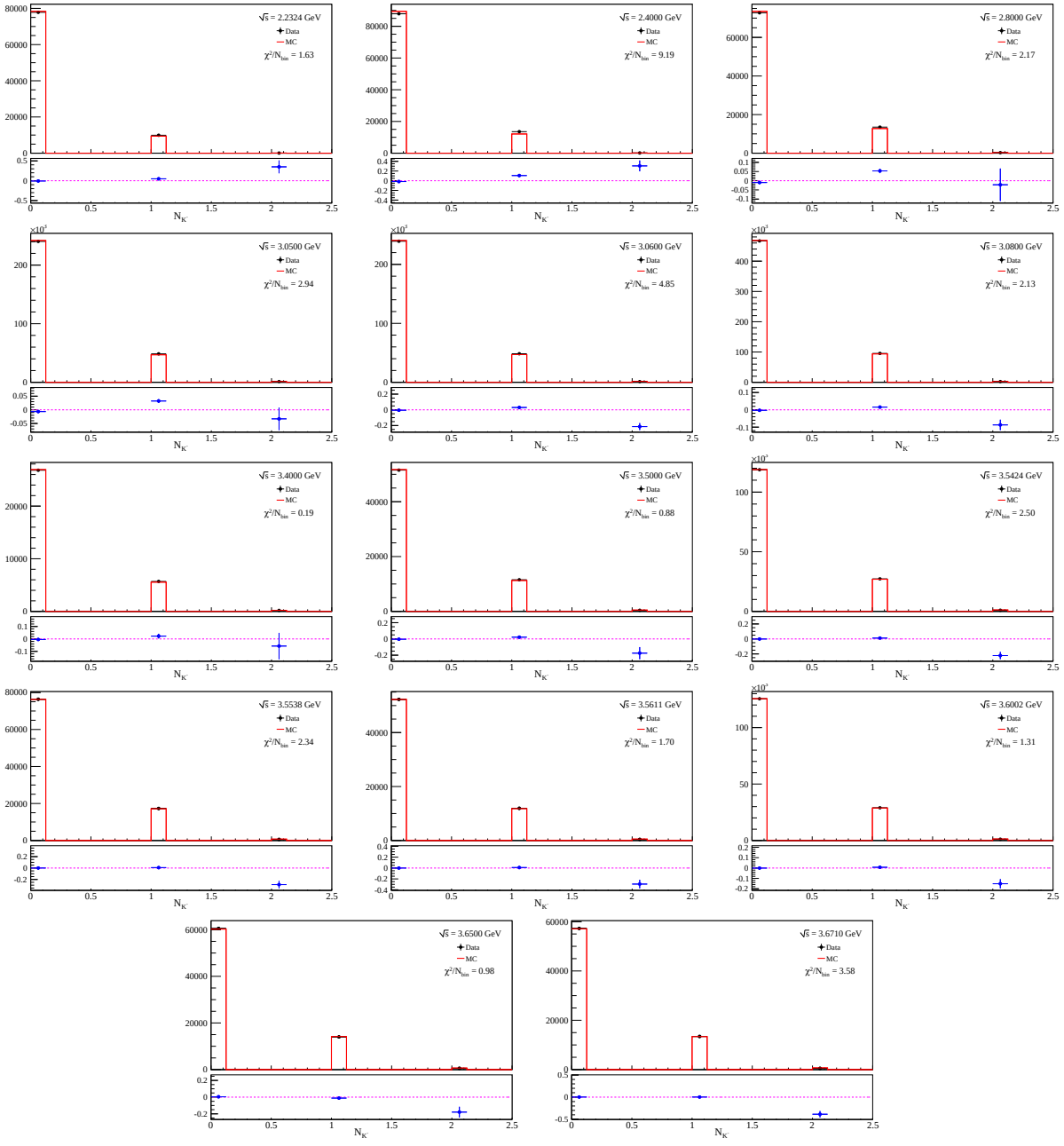

FIG. 15. The detail comparisons of N_{K^-} between 20200725 Luarlw MC and data.

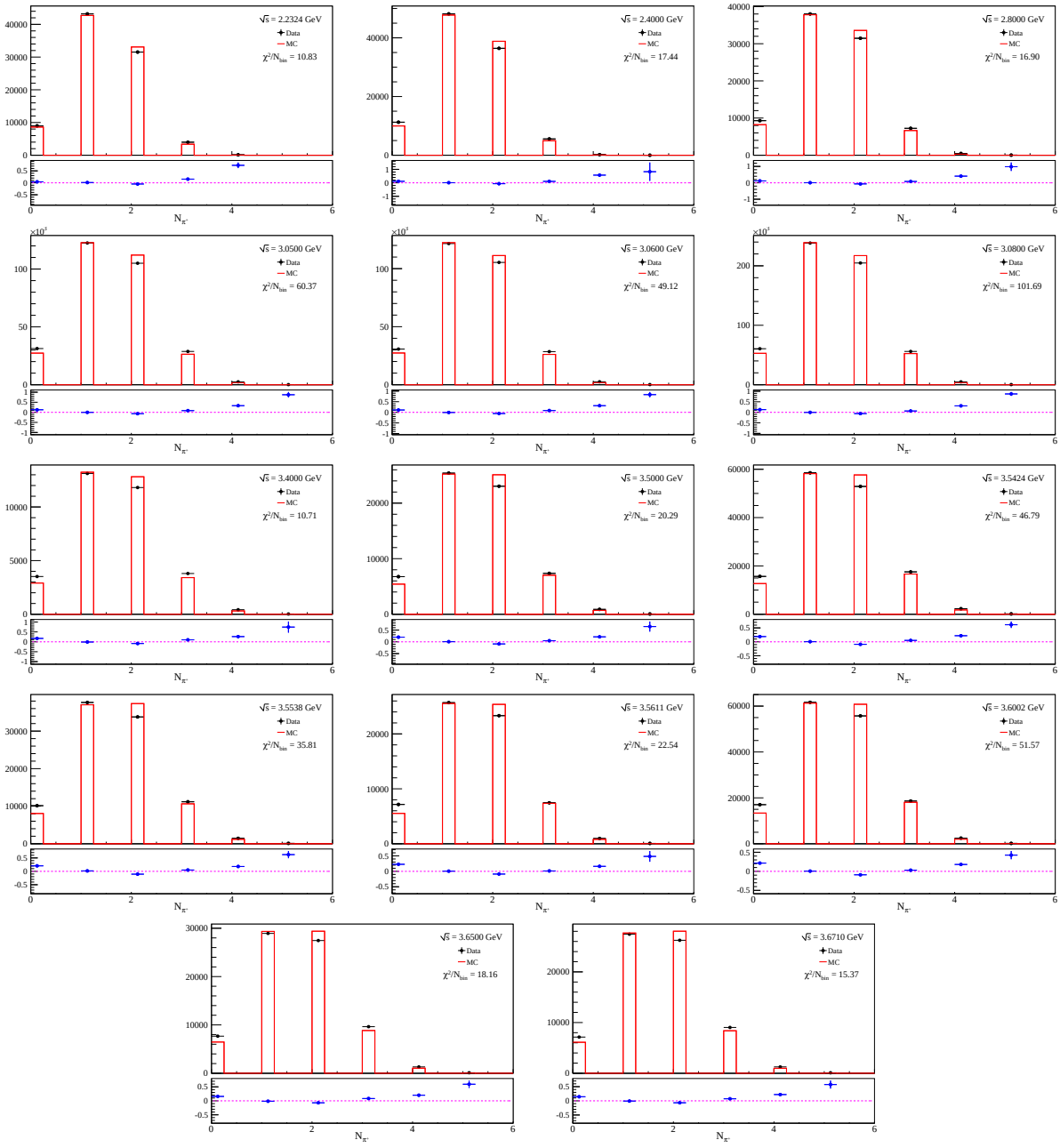

FIG. 16. The detail comparisons of N_{π^+} between 20200725 Luarlw MC and data.

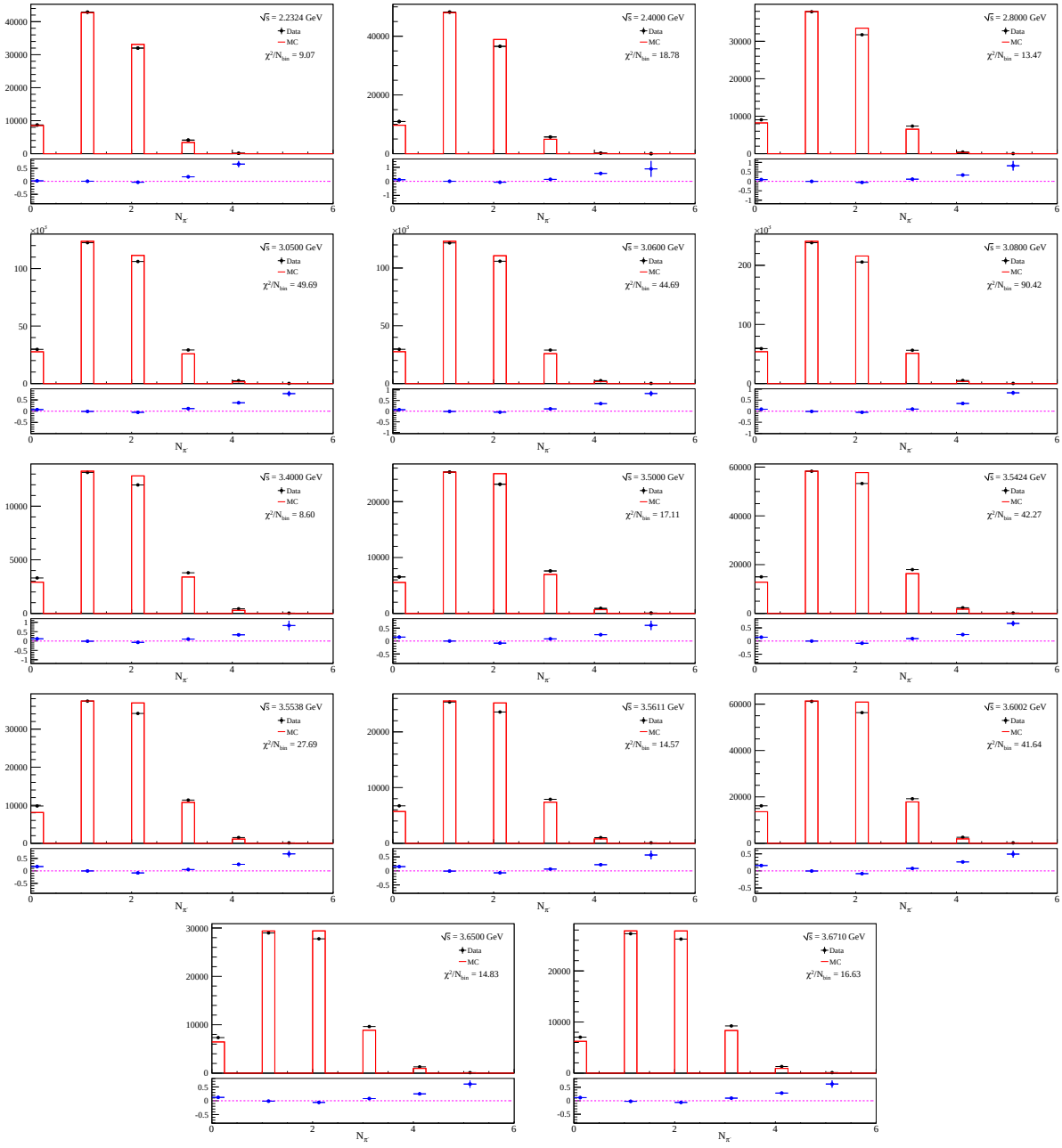

FIG. 17. The detail comparisons of N_{π^-} between 20200725 Luarlw MC and data.

II. COMPARISONS OF RESULTED R VALUES WITH LUARLW SIMULATIONS

The deviations of detection efficiencies and R values:

TABLE I. The comparison of $\varepsilon_{\rm had}$ values measured by different simulations.

$\sqrt{s}$ (GeV)	v20200725 $\varepsilon_{\rm had}$ (%)	v20200531 $\varepsilon_{\rm had}$ (%)	$\Delta_{\rm rel}$ (%)
2.2324	65.81	64.24	2.39
2.4000	68.28	66.91	2.01
2.8000	72.38	71.65	1.00
3.0500	73.60	72.76	1.14
3.0600	73.70	72.87	1.13
3.0800	73.77	72.80	1.31
3.4000	74.82	74.05	1.03
3.5000	75.04	74.20	1.12
3.5424	75.25	74.55	0.93
3.5538	75.45	74.58	1.15
3.5611	75.12	74.56	0.75
3.6002	75.55	74.67	1.16
3.6500	75.37	74.69	0.91
3.6710	75.60	74.75	1.12

TABLE II. The comparison of R values measured by different simulations.

$\sqrt{s}$ (GeV)	v20200725 R value	v20200531 R value	$\Delta_{\rm rel}$ (%)
2.2324	2.204	2.258	-2.45
2.4000	2.194	2.239	-2.05
2.8000	2.198	2.220	-1.00
3.0500	2.234	2.260	-1.16
3.0600	2.233	2.258	-1.12
3.0800	2.256	2.286	-1.33
3.4000	2.302	2.326	-1.04
3.5000	2.305	2.331	-1.13
3.5424	2.298	2.319	-0.91
3.5538	2.312	2.339	-1.17
3.5611	2.318	2.335	-0.73
3.6002	2.312	2.339	-1.17
3.6500	2.338	2.359	-0.90
3.6710	2.388	2.415	-1.13

III. DETAIL COMPARISONS BETWEEN DATA AND HYBRID SIMULATIONS

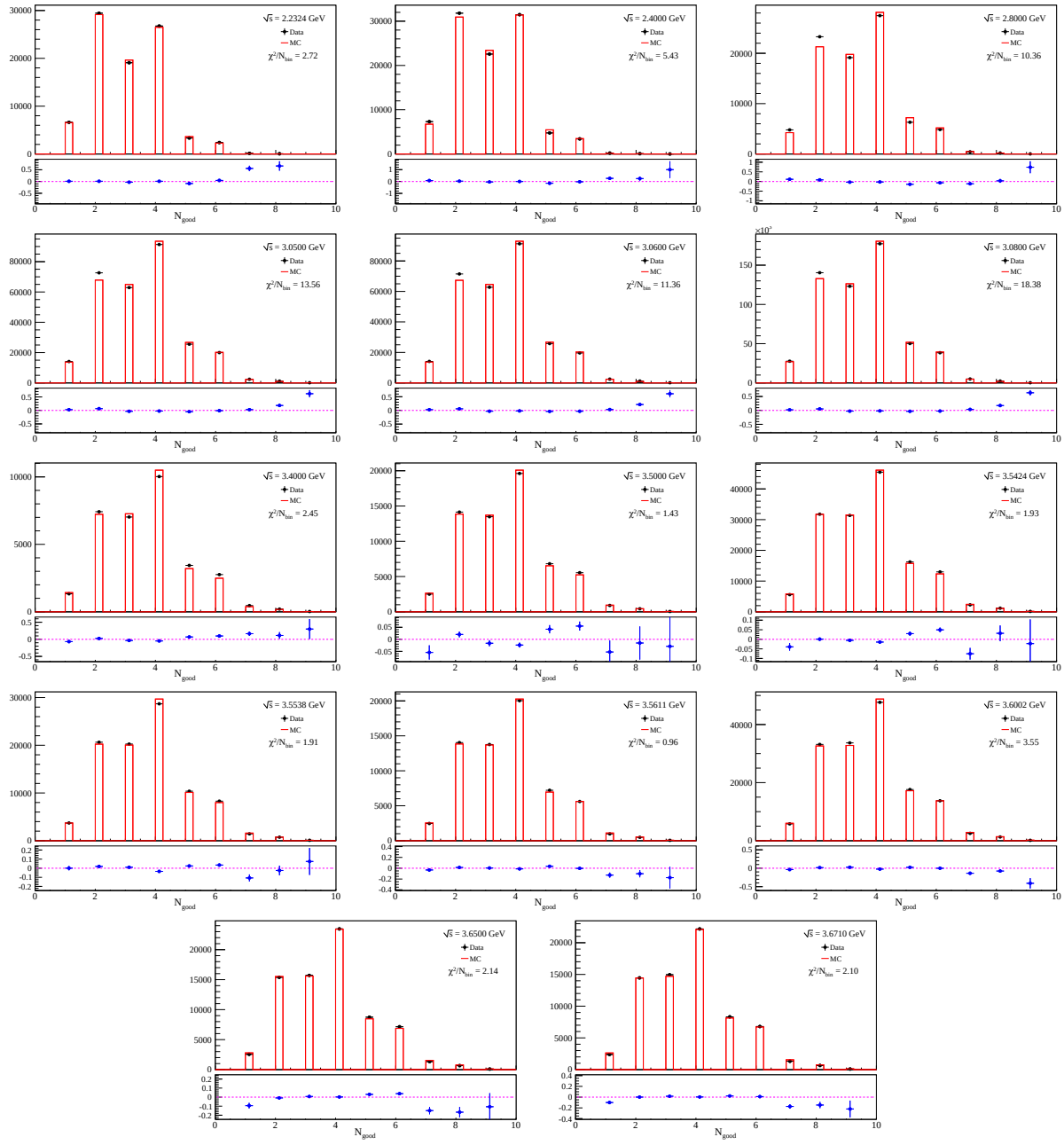

FIG. 18. The detail comparisons of $N_{\rm good}$ between 20200809 Hybrid MC and data.

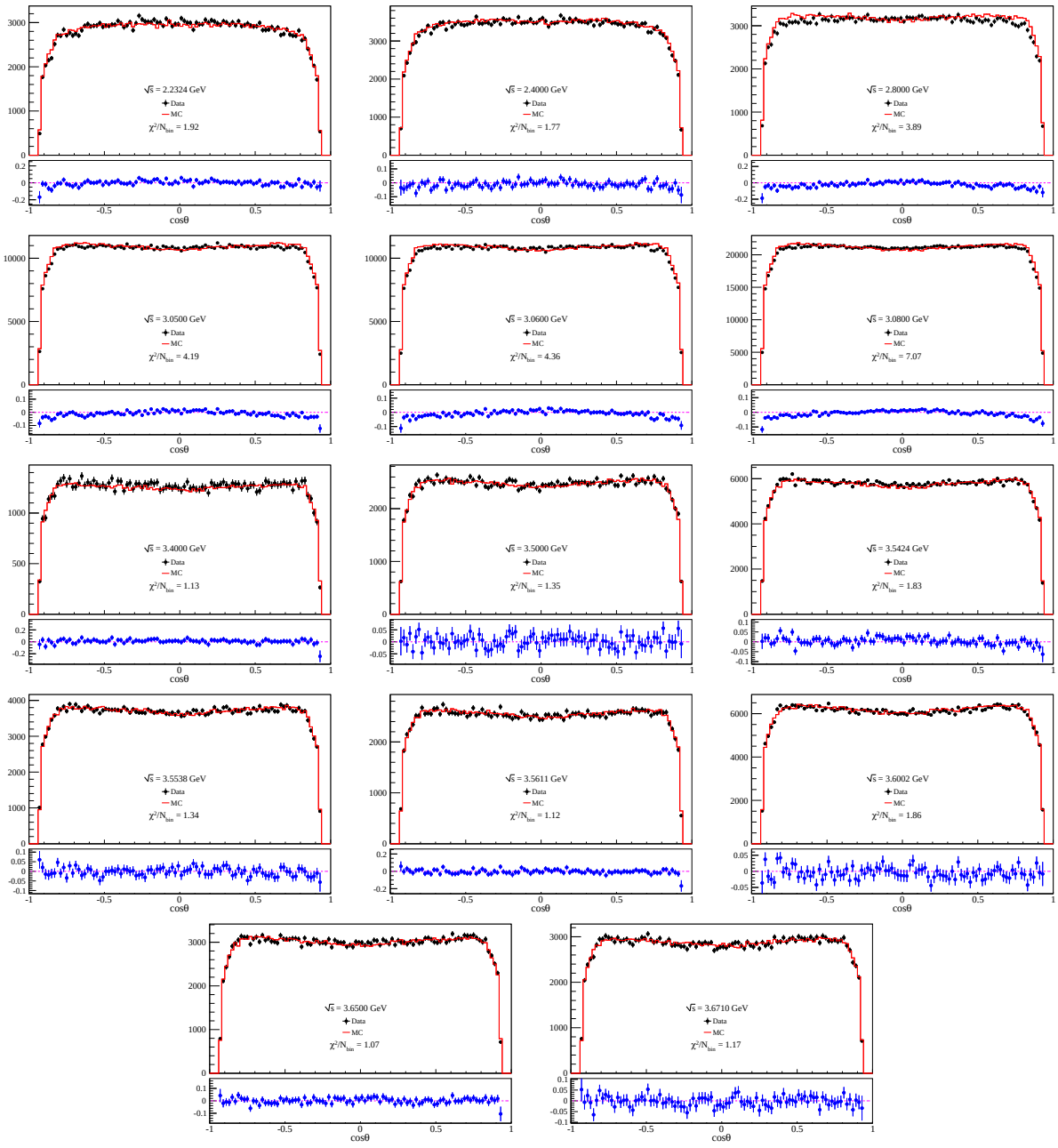

FIG. 19. The detail comparisons of $cos\theta$ between 20200809 Hybrid MC and data.

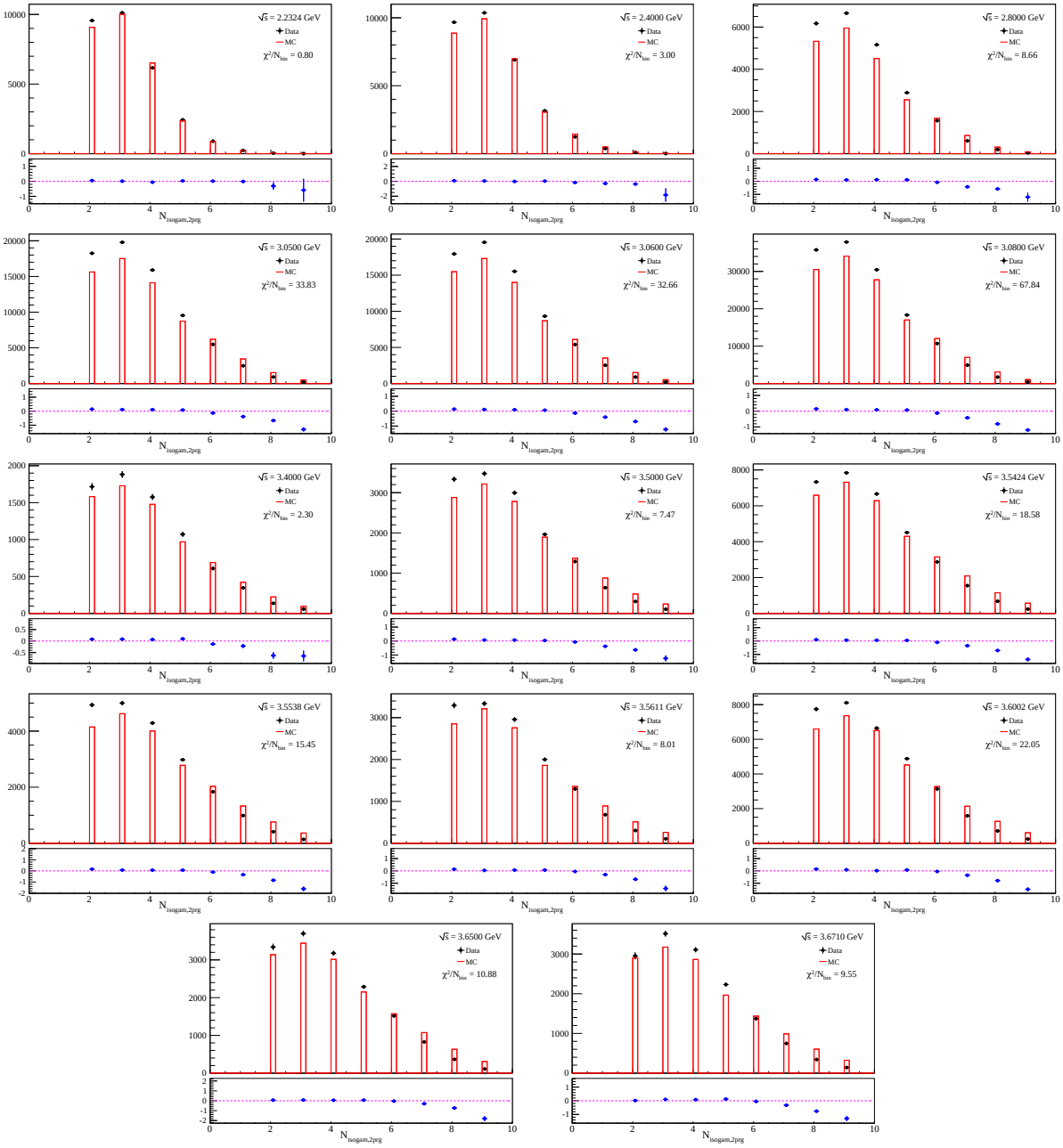

FIG. 20. The detail comparisons of $N_{\mathrm{isogam,2prg}}$ between 20200809 Hybrid MC and data.

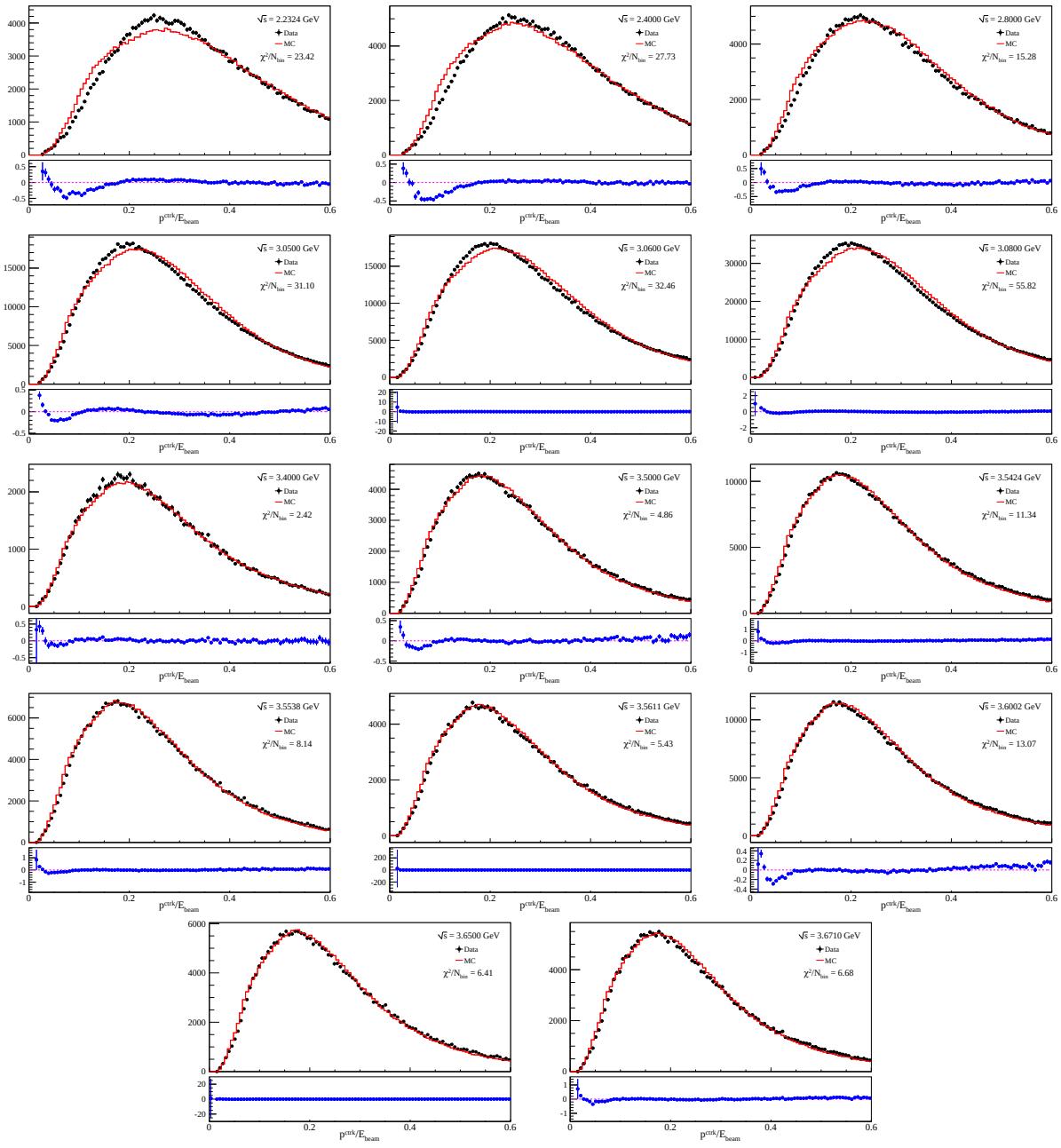

FIG. 21. The detail comparisons of $p_{\rm ctrk}$ between 20200809 Hybrid MC and data.

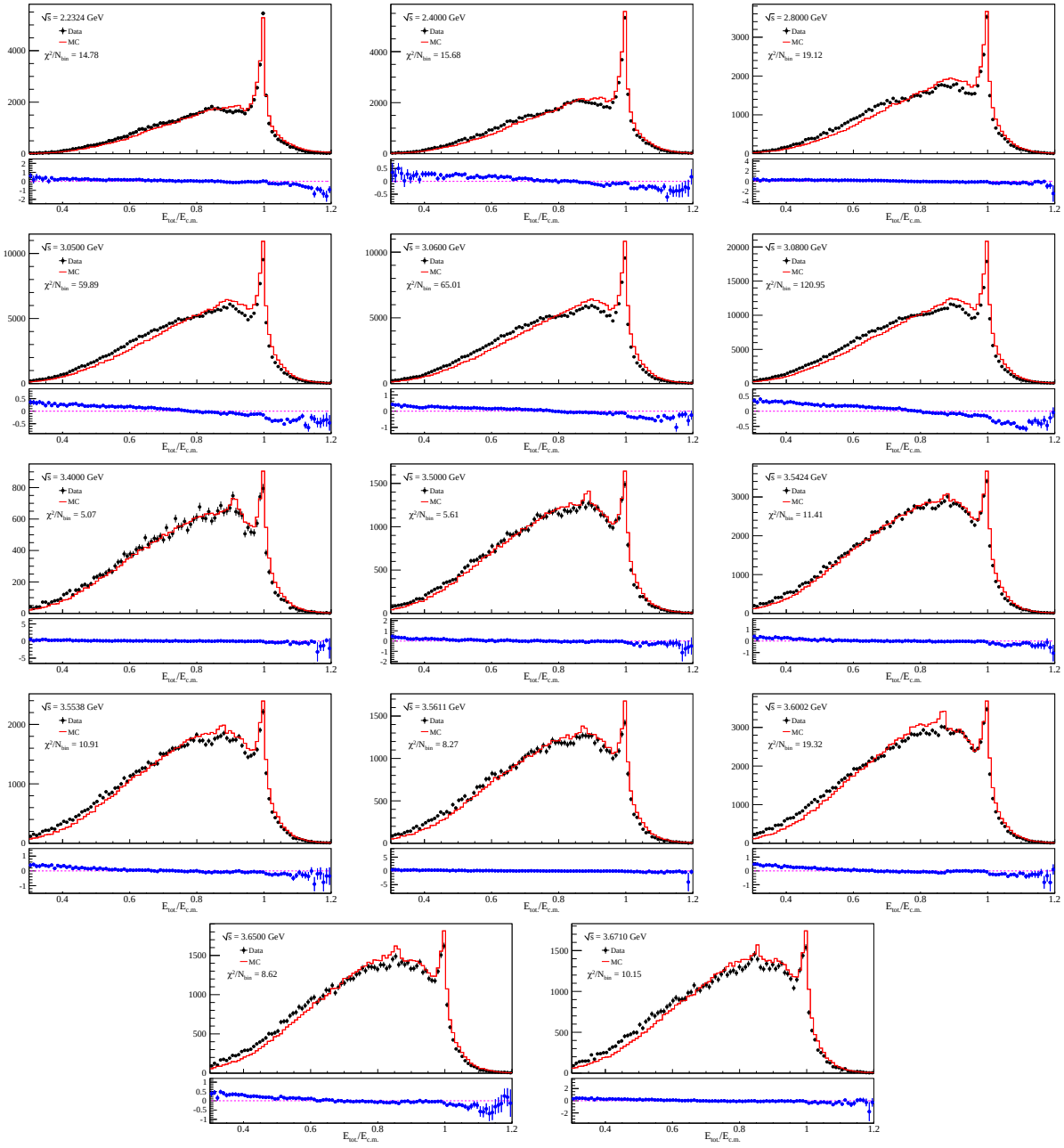

FIG. 22. The detail comparisons of $E_{\text{tot.}}$ between 20200809 Hybrid MC and data.

FIG. 23. The detail comparisons of N_γ between 20200809 Hybrid MC and data.

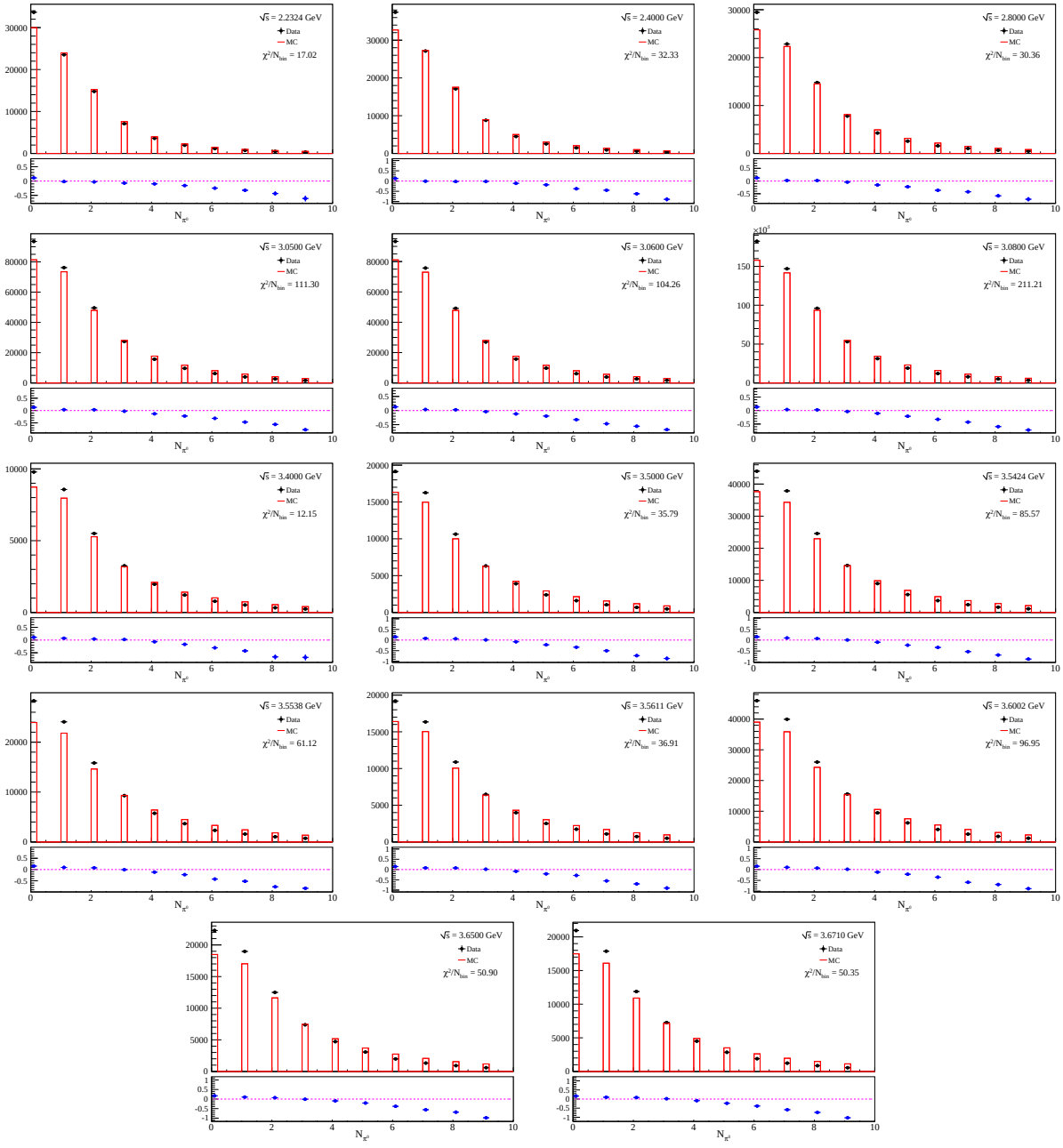

FIG. 24. The detail comparisons of N_{π^0} between 20200809 Hybrid MC and data.

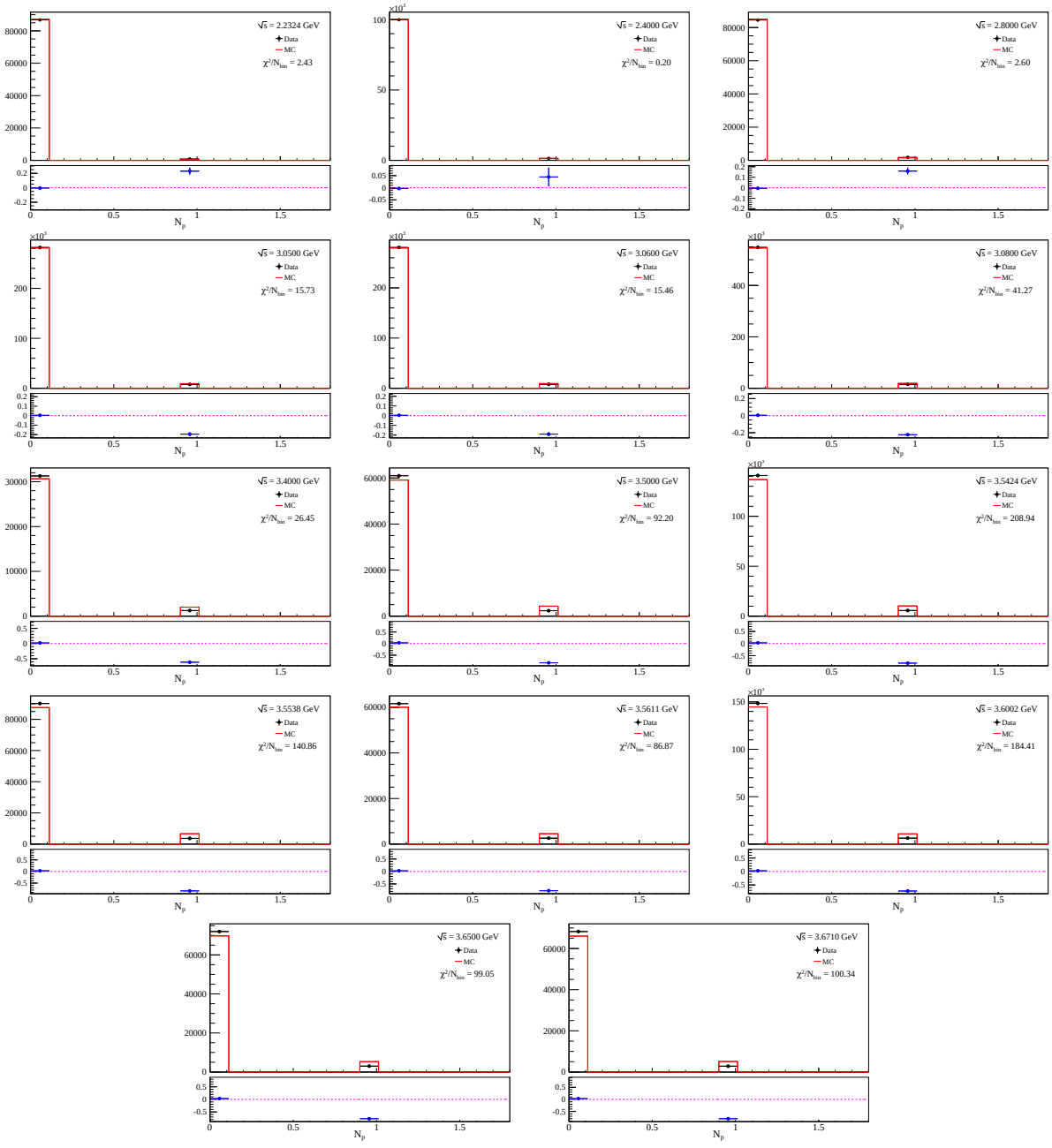

FIG. 25. The detail comparisons of N_p between 20200809 Hybrid MC and data.

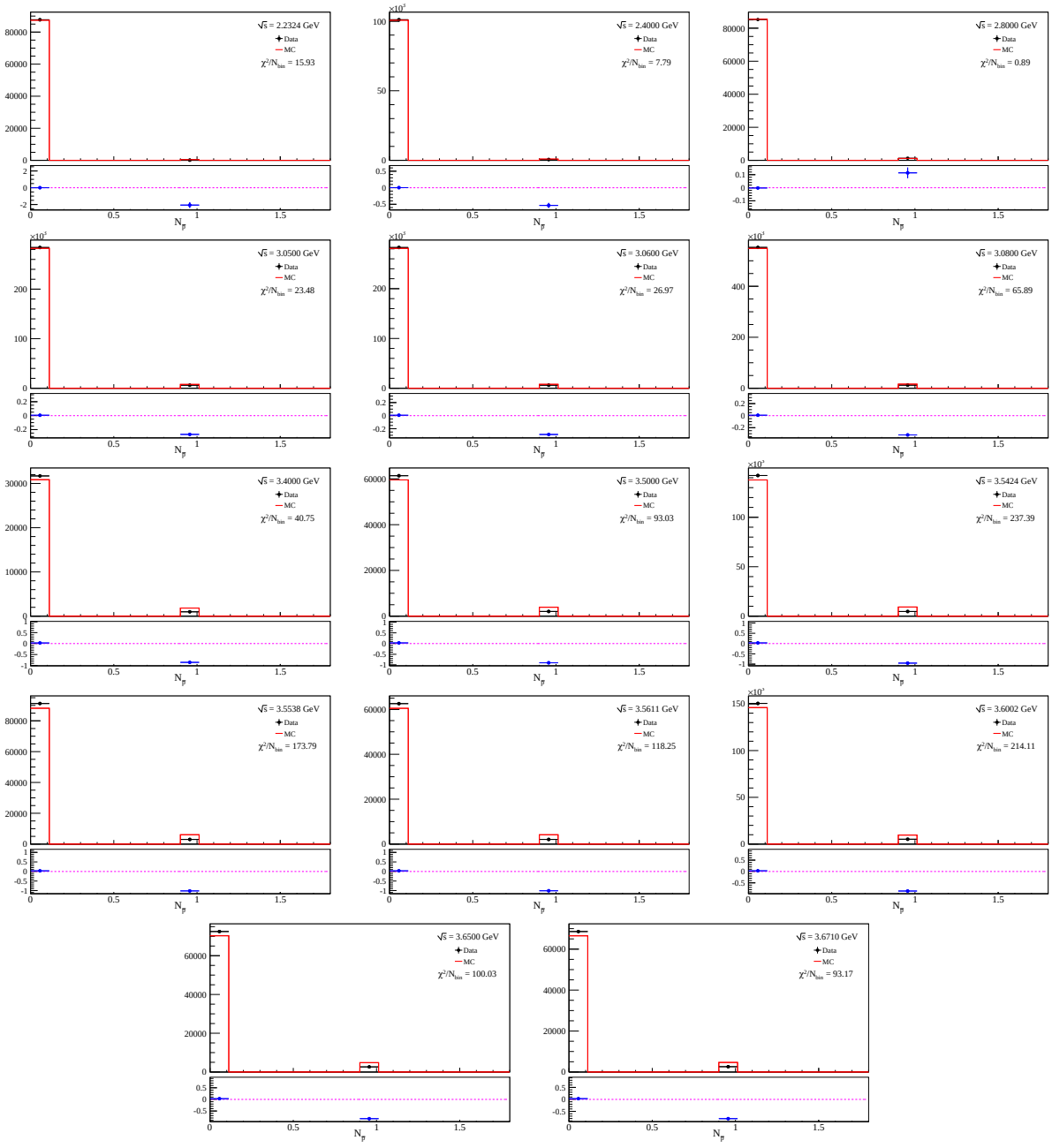

FIG. 26. The detail comparisons of $N_{\bar{p}}$ between 20200809 Hybrid MC and data.

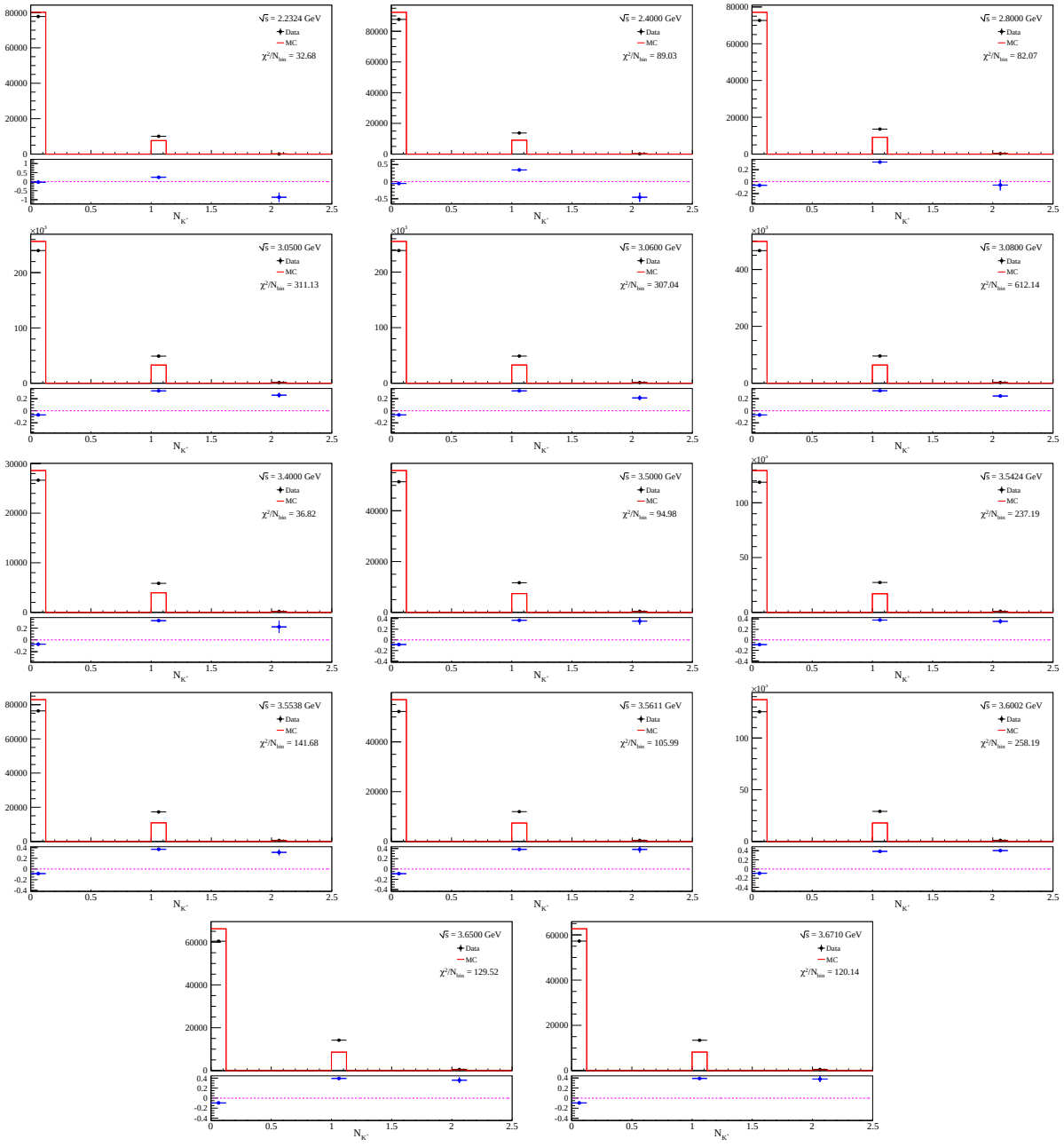

FIG. 27. The detail comparisons of N_{K^+} between 20200809 Hybrid MC and data.

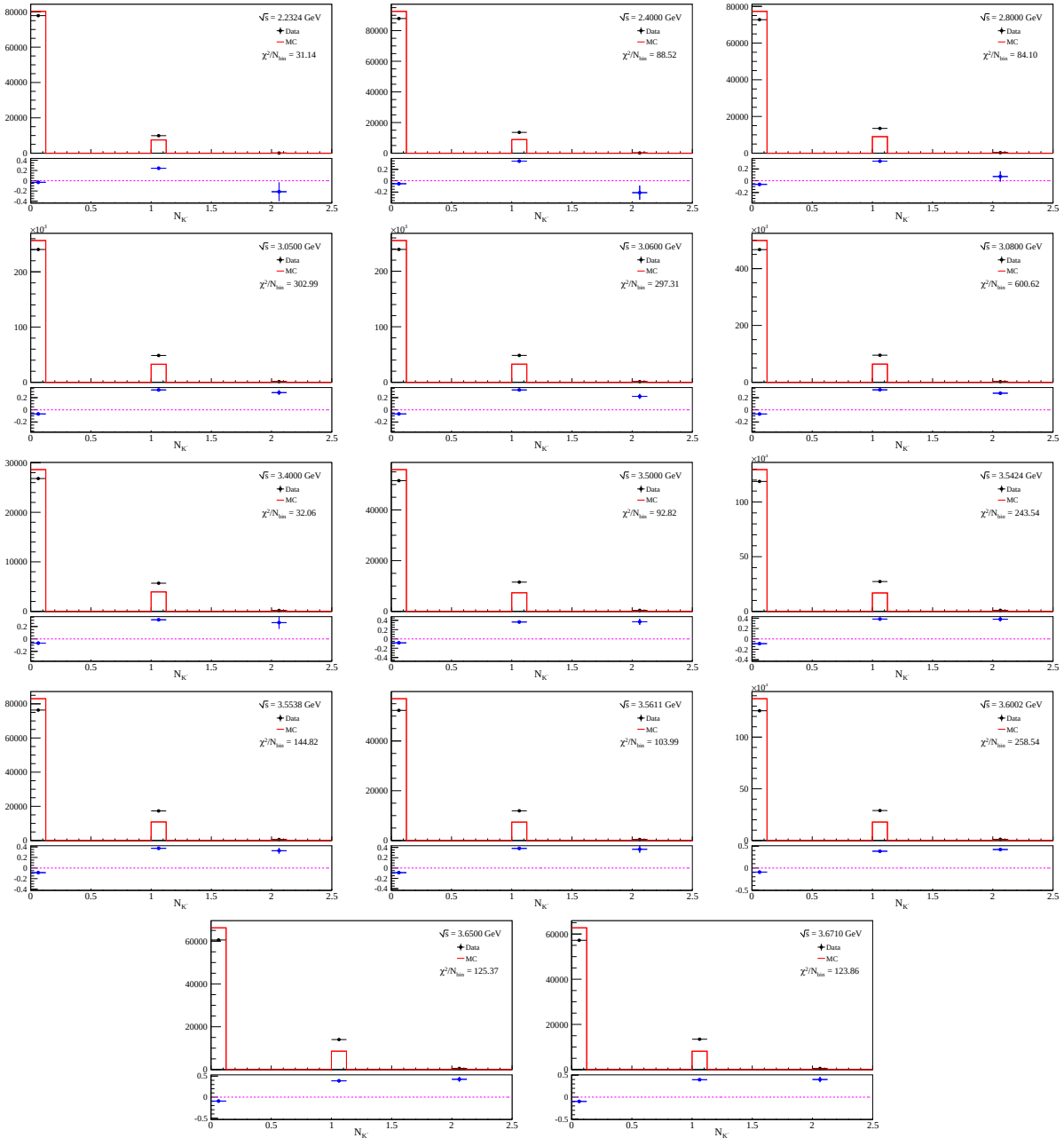

FIG. 28. The detail comparisons of N_{K^-} between 20200809 Hybrid MC and data.

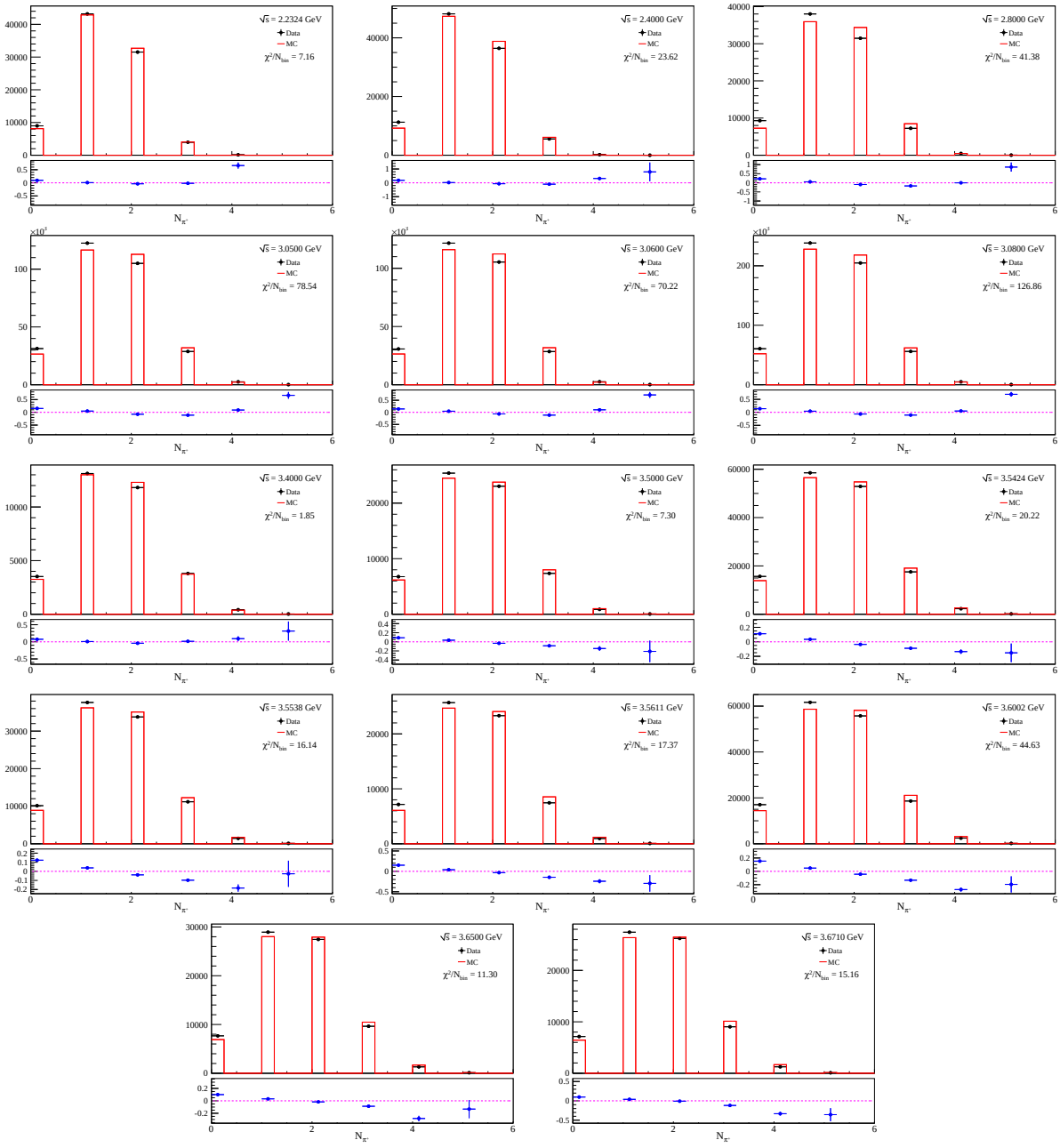

FIG. 29. The detail comparisons of N_{π^+} between 20200809 Hybrid MC and data.

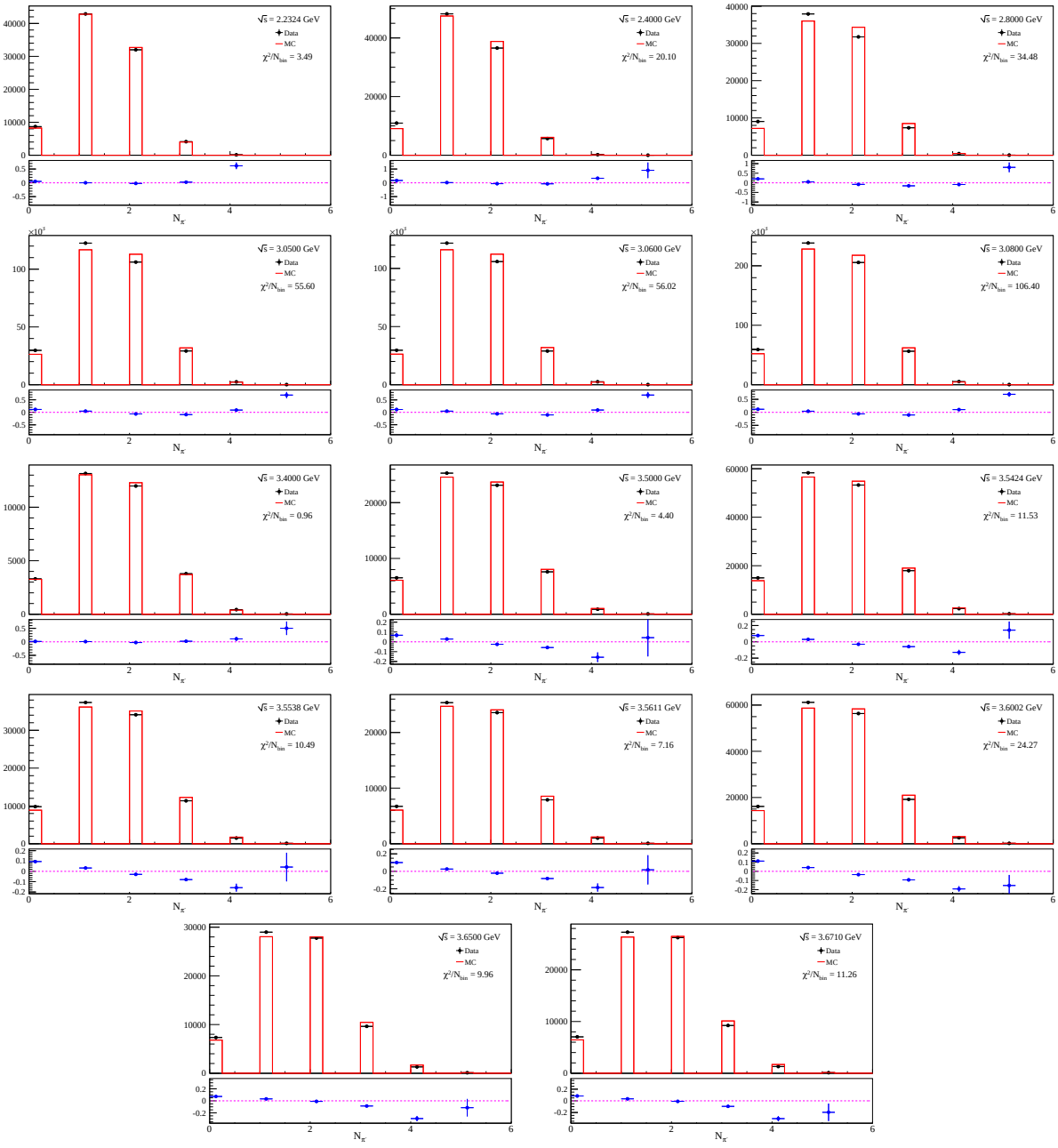

FIG. 30. The detail comparisons of N_{π^-} between 20200809 Hybrid MC and data.

IV. COMPARISONS OF RESULTED R VALUES WITH HYBRID SIMULATIONS

The deviations of detection efficiencies and R values:

TABLE III. The comparison of $\varepsilon_{\rm had}$ values measured by different simulations.

$\sqrt{s}$ (GeV)	v20200809 $\varepsilon_{\rm had}$ (%)	v20200608 $\varepsilon_{\rm had}$ (%)	$\Delta_{\rm rel}$ (%)
2.2324	65.40	63.59	2.77
2.4000	68.37	66.46	2.78
2.8000	73.25	71.29	2.69
3.0500	74.67	72.61	2.75
3.0600	74.58	72.56	2.71
3.0800	74.13	72.18	2.63
3.4000	75.36	73.45	2.54
3.5000	76.23	74.30	2.54
3.5424	75.96	73.65	3.05
3.5538	76.47	74.35	2.78
3.5611	76.35	74.28	2.72
3.6002	76.84	74.95	2.45
3.6500	77.00	74.70	2.98
3.6710	76.96	74.83	2.77

TABLE IV. The comparison of R values measured by different simulations.

$\sqrt{s}$ (GeV)	v20200809 R value	v20200608 R value	$\Delta_{\rm rel}$ (%)
2.2324	2.233	2.297	-2.87
2.4000	2.200	2.263	-2.86
2.8000	2.161	2.221	-2.78
3.0500	2.200	2.263	-2.86
3.0600	2.204	2.265	-2.77
3.0800	2.223	2.283	-2.70
3.4000	2.248	2.307	-2.62
3.5000	2.251	2.309	-2.58
3.5424	2.269	2.341	-3.17
3.5538	2.271	2.335	-2.82
3.5611	2.272	2.336	-2.82
3.6002	2.276	2.333	-2.50
3.6500	2.290	2.360	-3.06
3.6710	2.306	2.371	-2.82

V. COMPARISON BETWEEN LATEST LUARLW AND HYBRID

TABLE V. The comparison of efficiencies determined by different simulations.

$\sqrt{s}$ (GeV)	Luarlw $\varepsilon_{\rm had}$ (%)	Hybrid $\varepsilon_{\rm had}$ (%)	$\Delta_{\rm rel}$ (%)
2.2324	65.81	65.40	0.62
2.4000	68.28	68.37	-0.12
2.8000	72.38	73.25	-1.21
3.0500	73.60	74.67	-1.45
3.0600	73.70	74.58	-1.19
3.0800	73.77	74.13	-0.49
3.4000	74.82	75.36	-0.73
3.5000	75.04	76.23	-1.59
3.5424	75.25	75.96	-0.94
3.5538	75.45	76.47	-1.35
3.5611	75.12	76.35	-1.64
3.6002	75.55	76.84	-1.71
3.6500	75.37	77.00	-2.16
3.6710	75.60	76.96	-1.80

TABLE VI. The comparison of R values measured by different simulations.

$\sqrt{s}$ (GeV)	Luarlw R value	Hybrid R value	$\Delta_{\rm rel}$ (%)
2.2324	2.204	2.233	-1.32
2.4000	2.194	2.200	-0.27
2.8000	2.198	2.161	1.68
3.0500	2.234	2.200	1.52
3.0600	2.233	2.204	1.30
3.0800	2.256	2.223	1.46
3.4000	2.302	2.248	2.35
3.5000	2.305	2.251	2.34
3.5424	2.298	2.269	1.26
3.5538	2.312	2.271	1.77
3.5611	2.318	2.272	1.98
3.6002	2.312	2.276	1.56
3.6500	2.338	2.290	2.05
3.6710	2.388	2.306	3.43