Physics Validation Methods

AI TOWNHALL 2021

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Fidelity of synthetic data

- Our aim in training an AI (e.g. a GAN) is to use it as a particle event generator.

- The fidelity of the synthetic data has to be validated with appropriate metrics.

- The extraction of observables from synthetic and real data can be compared.

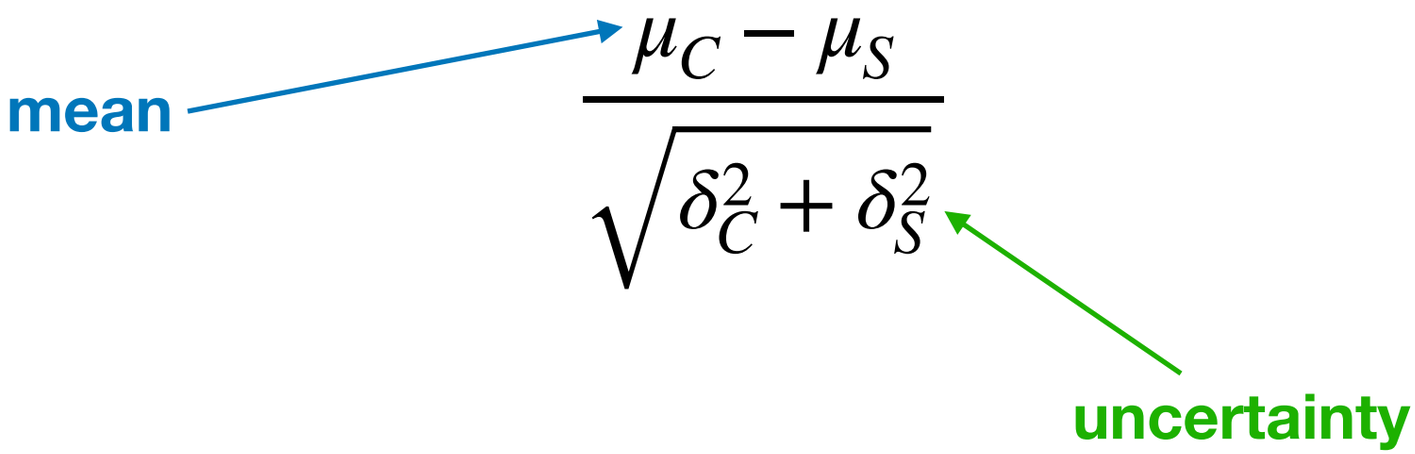
- One needs to establish a way to quantify the compatibility.

Moments of two-pion photoproduction

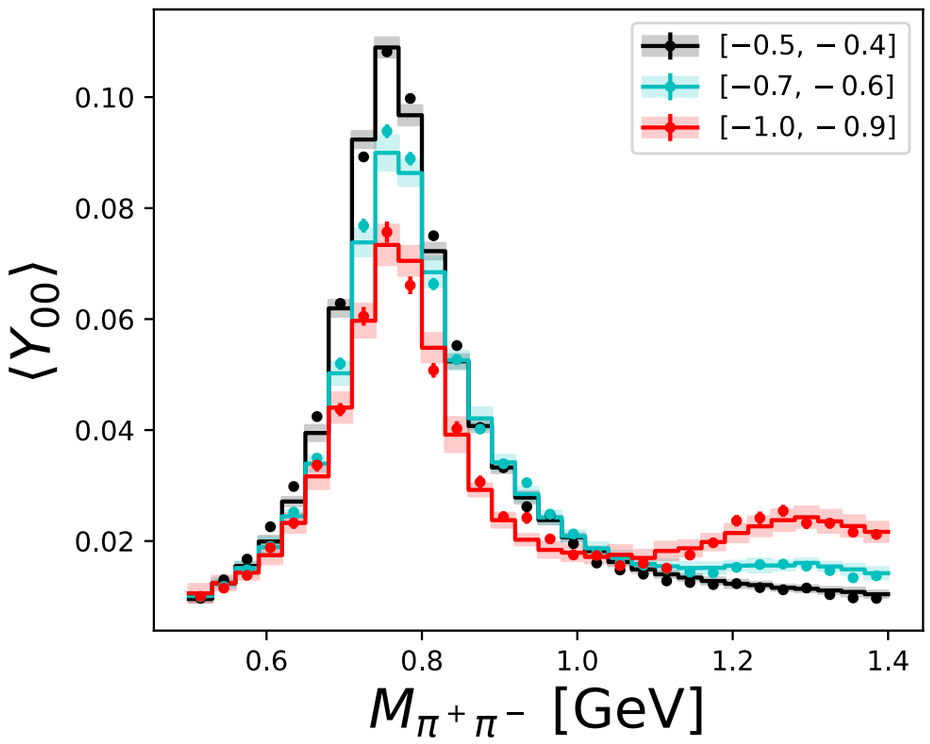
We compare the moments from CLAS data (C) with those from synthetic data (S):

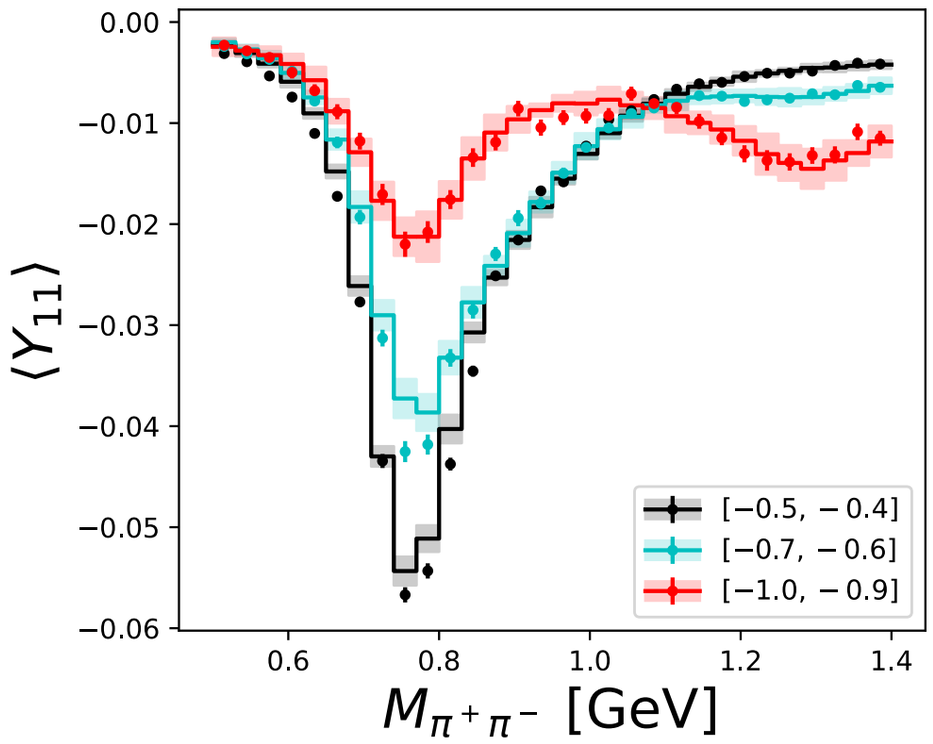
$$< Y_{LM} > = \sqrt{4\pi} \int d\Omega_\pi \frac{d\sigma}{dt\, dM_{\pi\pi}\, d\Omega_\pi} Y_{LM}(\Omega_\pi)$$

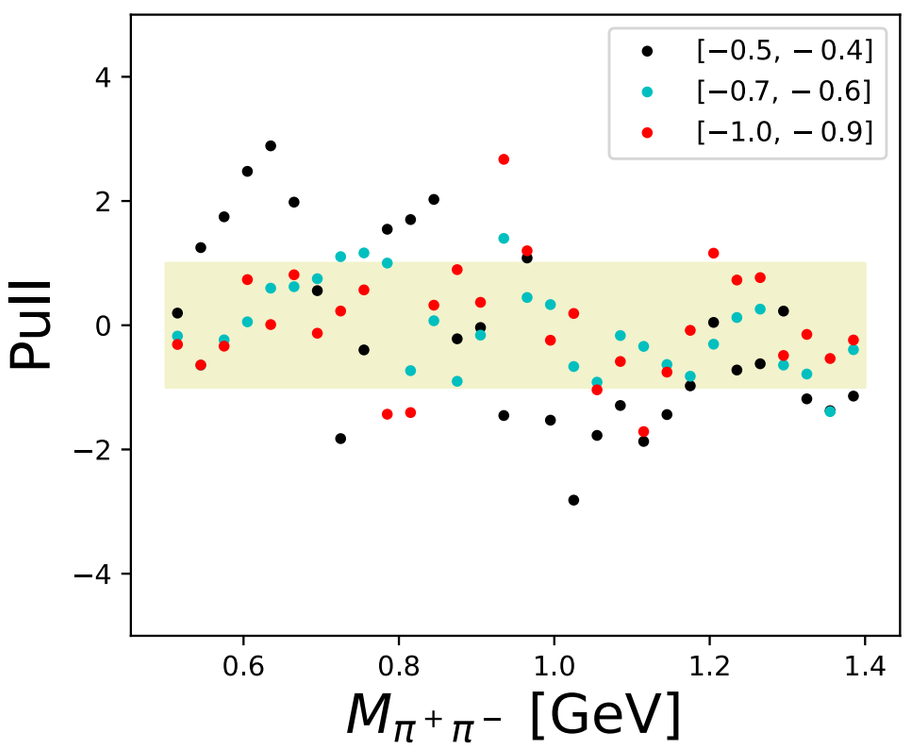
The compatibility is quantified with the help of the pull distribution:

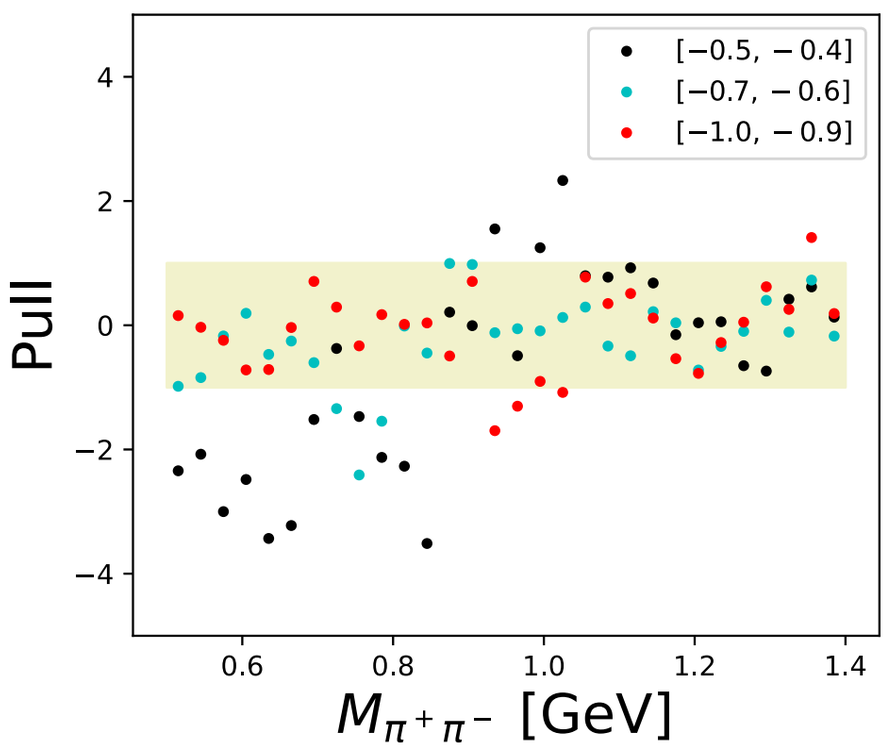


Synthetic vs real - in a nutshell









Conclusions

- The agreement within errors shows that synthetic data copy the original data.

- They preserve the physics information.

- We can extract the underlying physics without loss of information.