

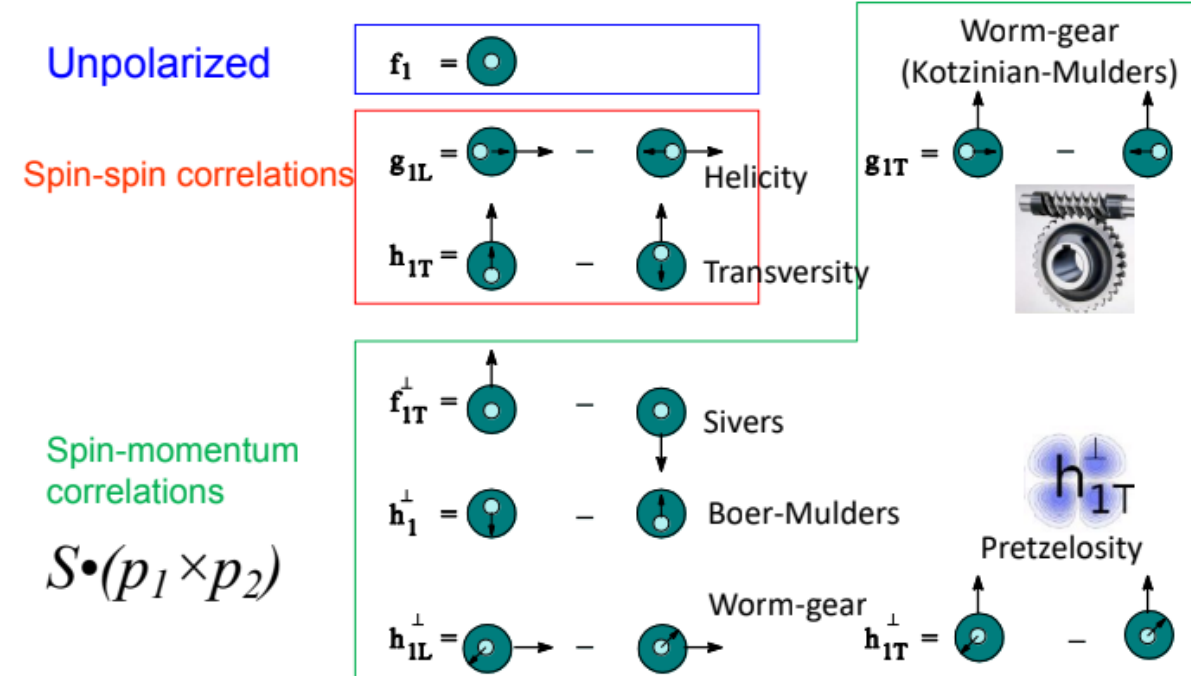
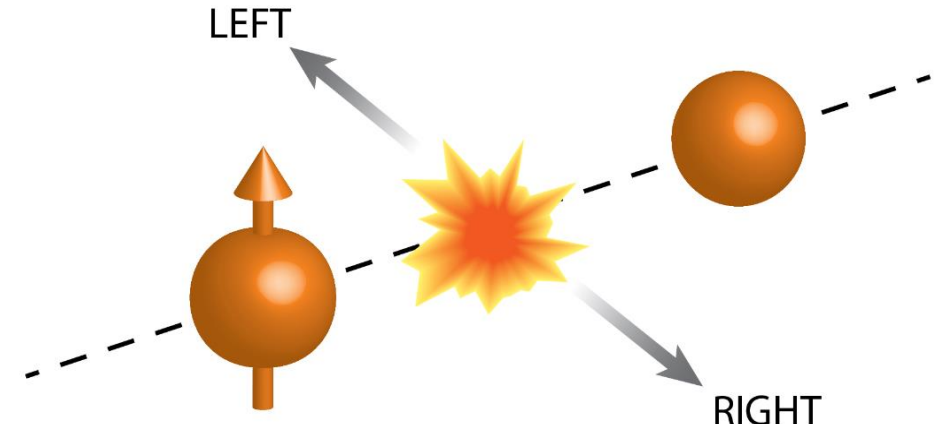
Preparations for spin physics at sPHENIX

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Motivation

- Transverse momentum dependent (TMD) PDFs and FFs encode spin-momentum correlations between hadrons and constituent partons
 - Needed to describe large transverse single spin asymmetries, A_N
 - Accessed in p+p observables with hard and soft scale

$$A_N = \frac{\sigma_L - \sigma_R}{\sigma_L + \sigma_R}$$

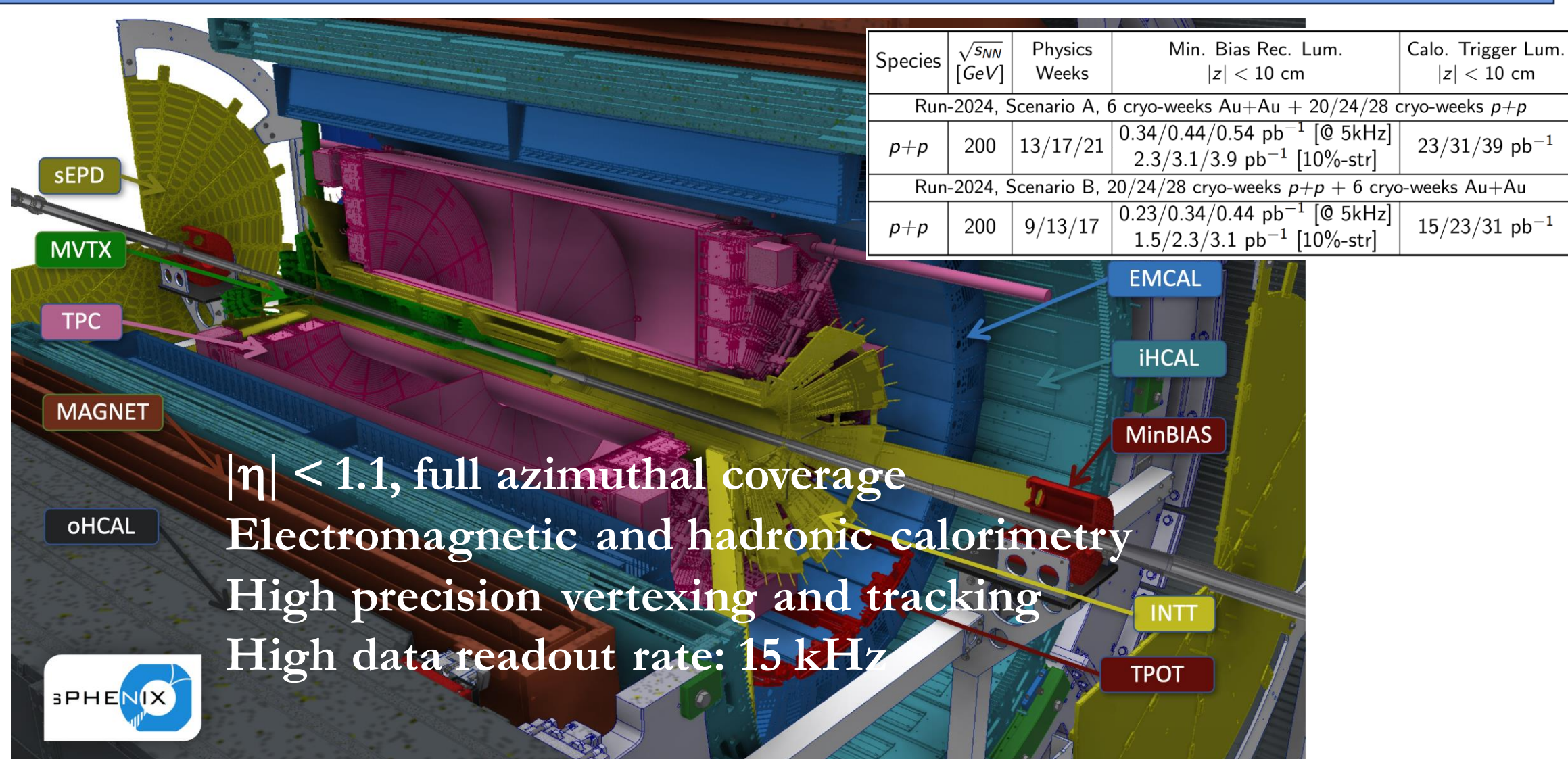


- TMDs are related to the collinear twist-3 correlation functions
 - Directly accessed in p+p processes with hard scale

$$A_N \propto \sum_{a,b,c} \phi_{a/A}^{(3)}(x_1, x_2, s_\perp^1) \otimes \phi_{b/B}(x') \otimes \hat{\sigma} \otimes D_{c \rightarrow C}(z)$$

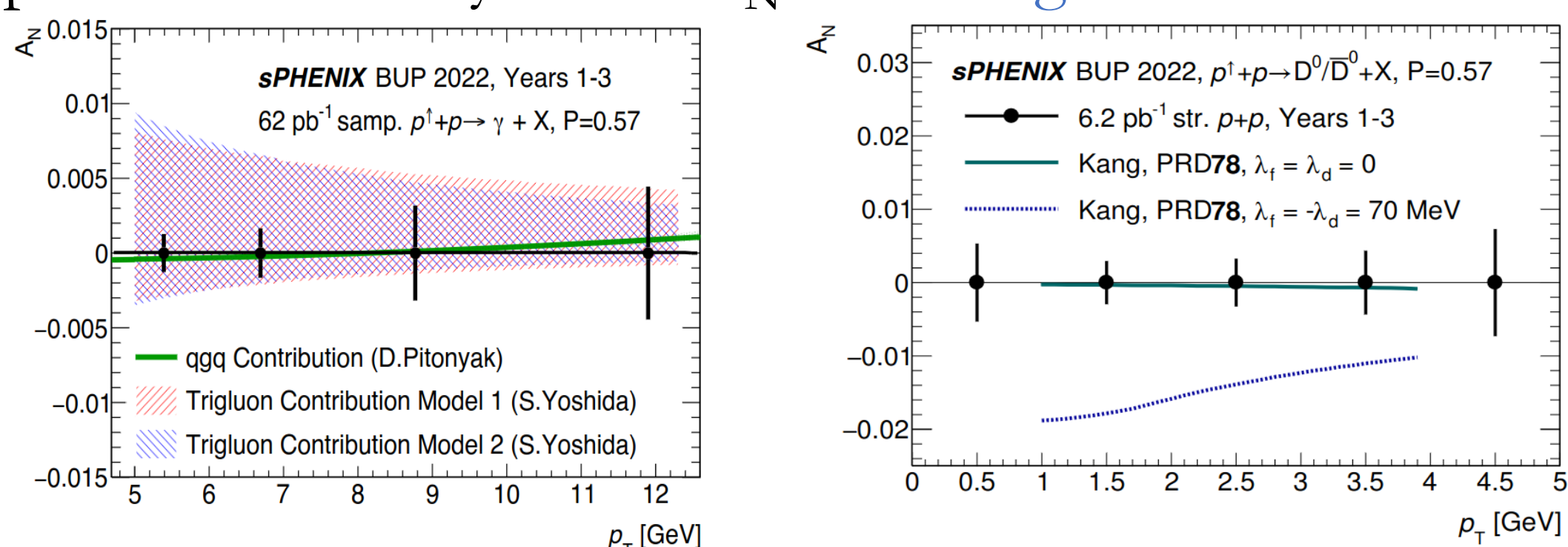
Twist 3 correlation function of polarized proton
 Twist 3 correlation function of unpolarized proton
 Twist 3 fragmentation function
 Transversity Distribution

sPHENIX Detector

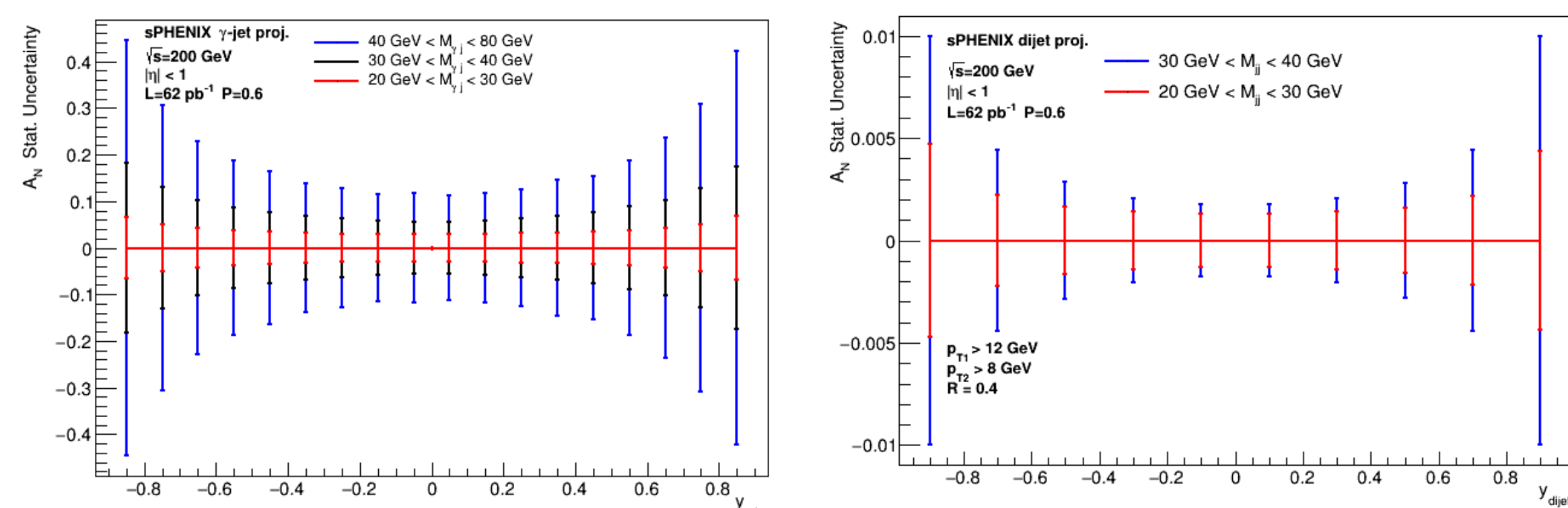


Transverse Spin at sPHENIX

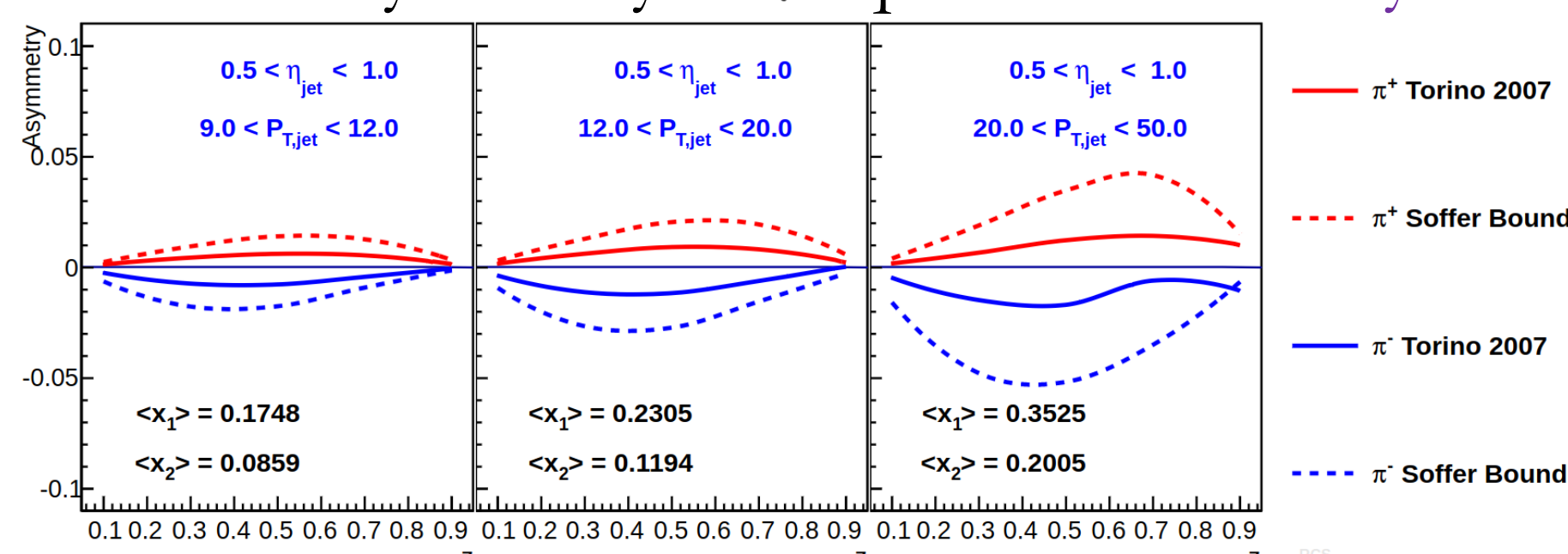
- Direct photon and heavy flavor $A_N \rightarrow$ tri-gluon correlation function



- γ -jet and dijet $A_N \rightarrow$ gluon and u/d flavor-dependent Sivers TMD PDF



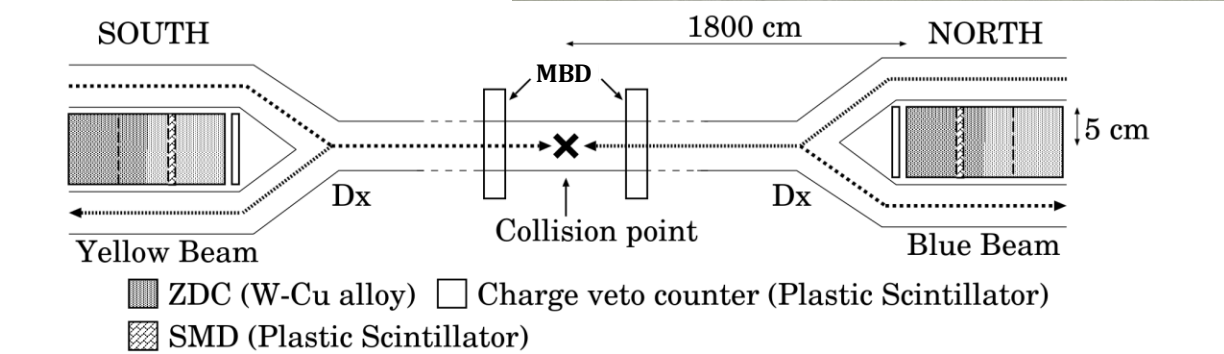
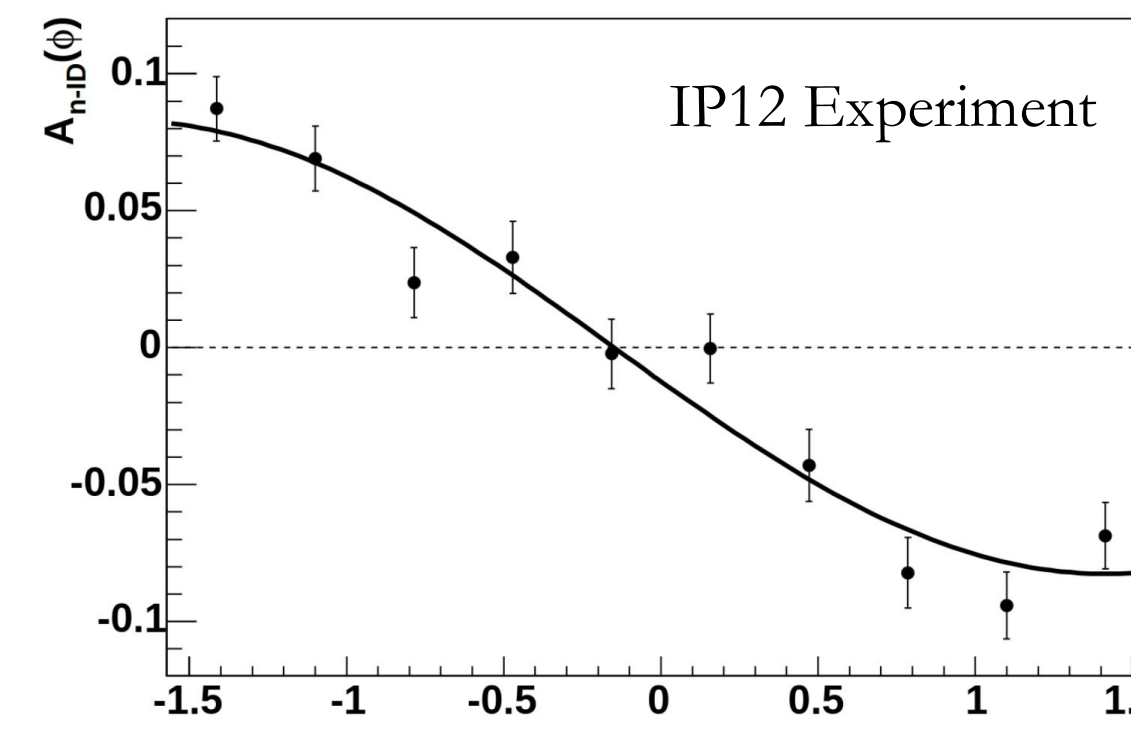
- Hadron-in-jet Collins asymmetry \rightarrow quark transversity distribution



Spin Hardware

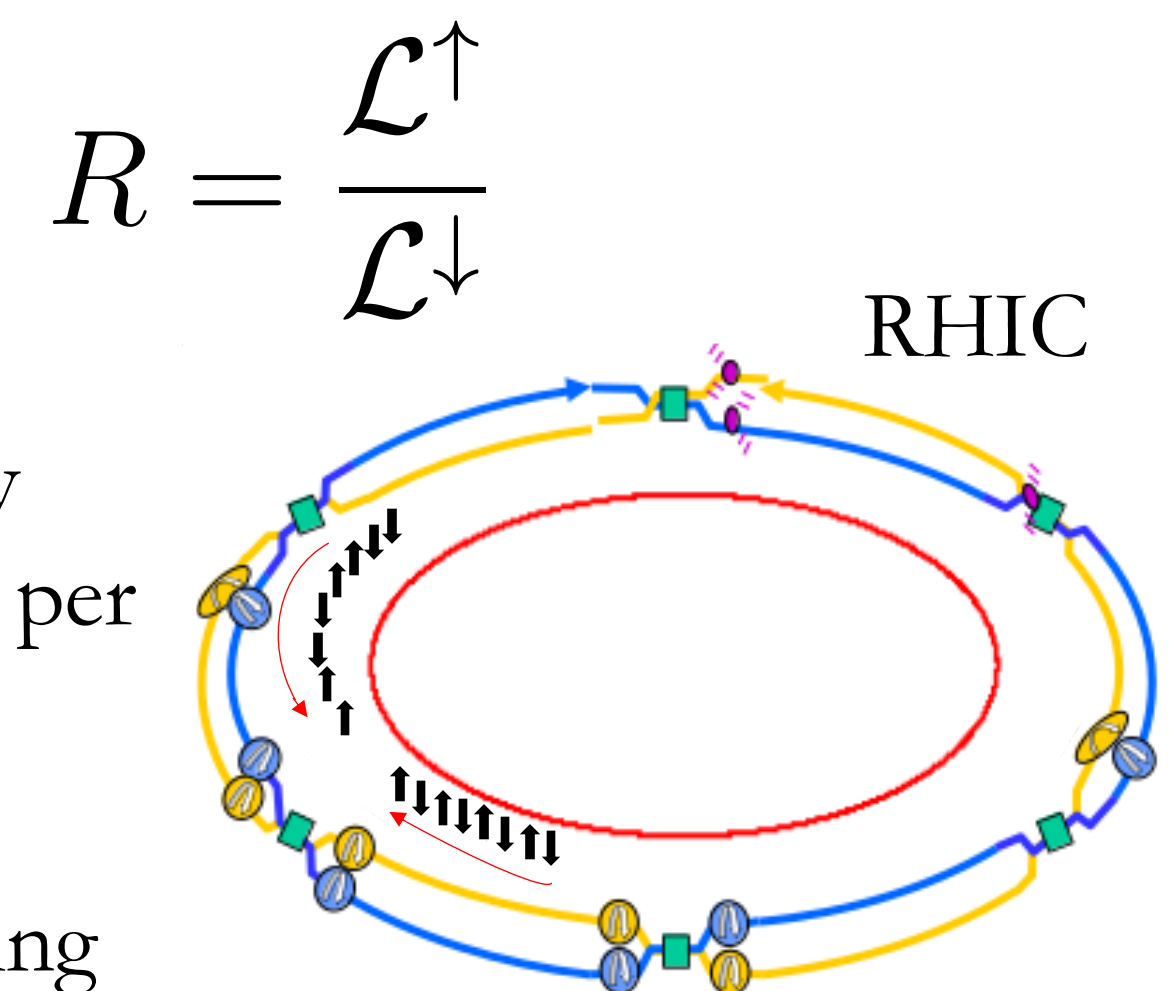
Local Polarimetry

- Monitor beam polarization at sPHENIX
- Zero degree calorimeter (ZDC) and Shower Max Detector (SMD) scintillating hodoscope measure known forward neutron A_N



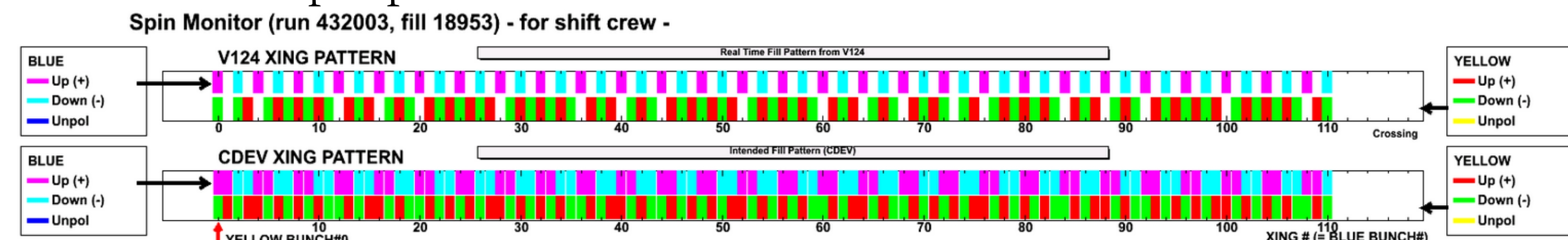
Relative Luminosity

- Correction for differences in luminosity between $p + p^\uparrow$, $p + p^\downarrow$
- In each fill, spin patterns determine how proton polarizations alternate up/down per beam crossing
- Scaler boards in MBD and ZDC count number of triggers in each bunch crossing



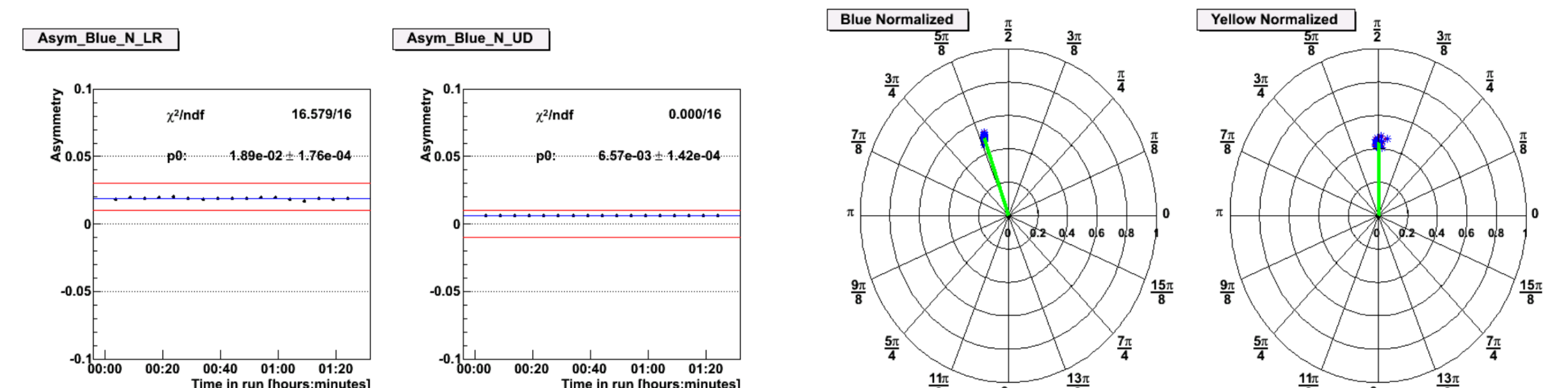
Online Monitoring

- Monitor spin patterns received from Main Control Room

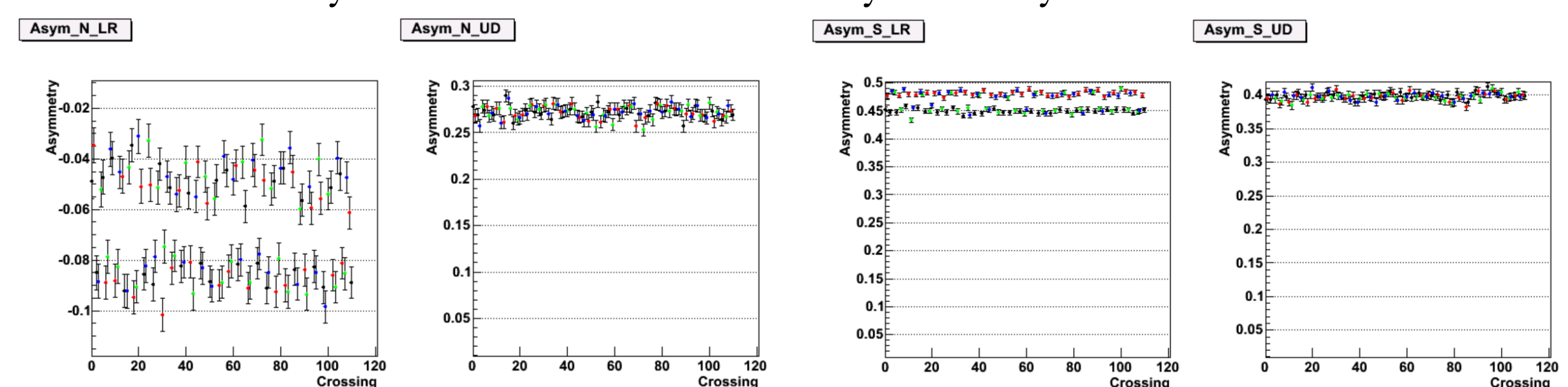


- Online local polarimetry from ZDC/SMD

- Raw neutron asymmetry from square root formula



- Bunch-by-bunch raw neutron asymmetry from SMD scaler counts



*Plots from PHENIX Run15 online monitoring

References

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