sPHENIX Forward Upgrade Studies Status/Plans

Joe Seele

(RBRC)

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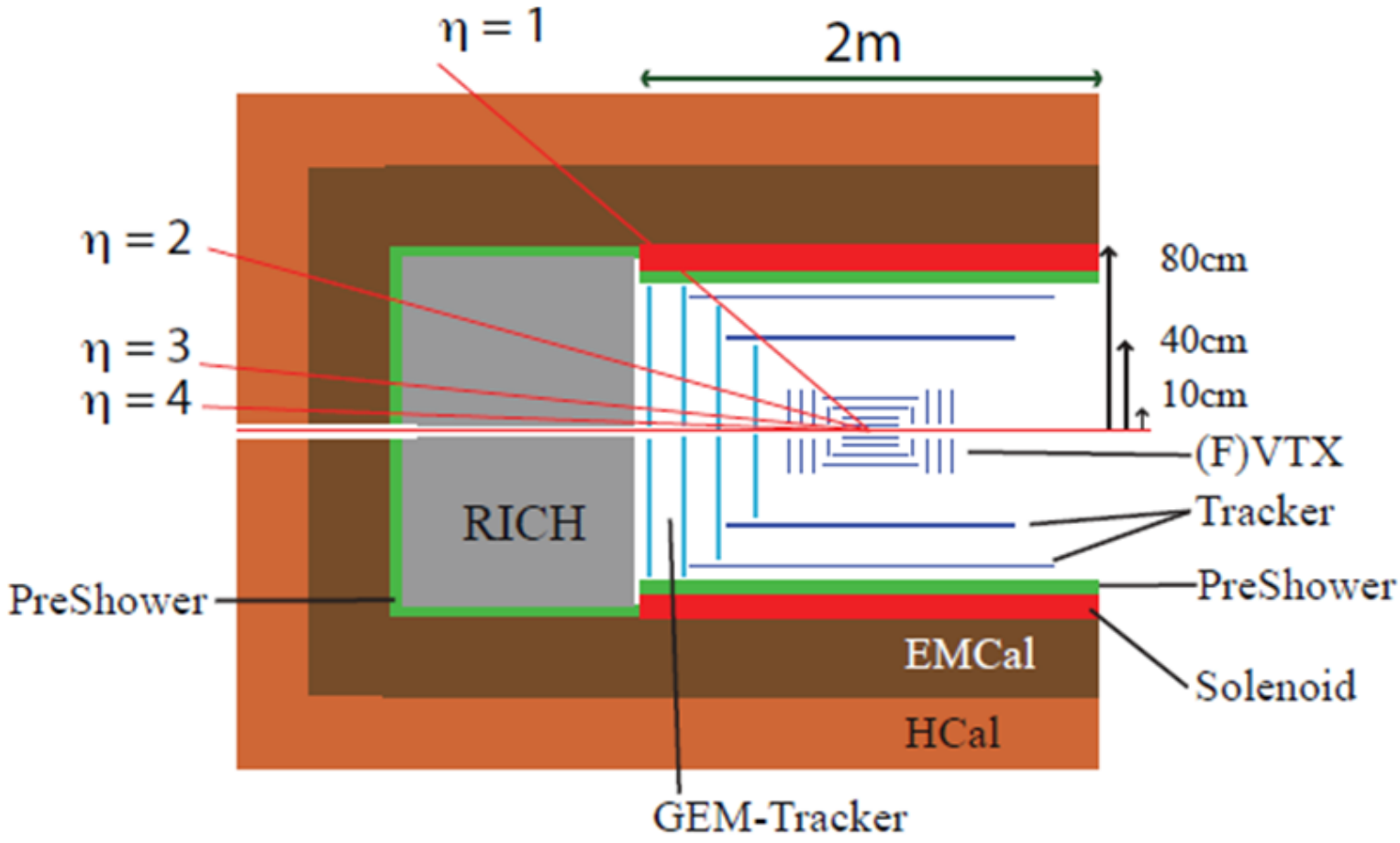
sPHENIX Toy Model



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"Goals" for a spin/forward program

- Transverse Spin Phenomena
  - Solve a long standing "problem" (what causes the large forward A_ns)
  - Measure transversity, spin related FFs
  - Is our theory even correct? TMD factorization is an open issue.
- Longitudinal Spin Phenomena (gluons, sea quarks)
  - Extend the A_{LL} measurements to lower-x (not dramatically lower though)
  - Higher stats and lower background W measurements
- Cold Nuclear Physics
  - CGC, Saturation physics

Need a good forward+central spectrometer to do this

Measurements of Interest

- Jets (dijets) over full sPHENIX acceptance
- Identified particles (in forward direction) – high momentum (and low momentum?)
- Identified particles in jets (jet substructure)
- Very high momentum identified electrons/positron
- Electrons/positrons from secondary vertices
- Isolated gammas

What do we need?

- Good jet energy resolution
- Good jet pointing resolution over barrel and forward detectors
- Good (low mass) tracking and momentum resolution
  - measuring in jets so must rely on tracking detectors for momentum reco
- PID of hadrons in jets
  - Need to consider jets going through a RICH/ ToF
- Good e/pi separation up to as high as possible in momentum
- Good gamma/pi0 separation

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Ongoing Studies

- Need to efficiently evaluate and evolve designs
- Tracking
  - Have developed codes to swim tracks through any field/ tracking design to quickly evaluate a forward system
- Particle occupancy/density in jets in across forward region
  - What is the segmentation of calorimetry that is needed for good jet position resolution?
- Triggering
  - Triggering for spin is very different, we will probably need a multi-level hardware+software system
- Is EmCal + jet rejection good enough for e/pi separation?
  - Maybe for DY. Probably for Ws. HF?
- How do we turn sPHENIX into ePHENIX?

Conclusions

- Many of the studies are just beginning (have only met twice) - Have a dedicated meeting every two weeks on Tuesday at 8pm
- People have committed to studying the needs/ sensitivities of various measurements/quantities
- Next steps are to really outline what are the required resolutions (momentum, pointing, energy)
- As studies progress we (spin/forward groups) need to articulate a clear physics message

Backup Slides

Physics Processes of Interest

1. DY at forward rap – A_N sign reversal as test of TMD factorization, A_{LL} for sea quarks
2. W/Z at forward rap - A_N, A_L
3. Heavy flavor - A_N, deltaG through c-cbar, b-bbar, onia, etc
4. Jets at forward rap - Inclusive jets (A_{LL} for glue, A_N for sivers), dijets (similar to inclusive for long., Sivers for trans), particle+jet (flavor struct.), particle in jets (Collins, FFs)
5. Gammas at forward rap - Direct photons across rap, photon+jet, Sivers, Boer-Mulders,
6. Dihadron IFF - Flavor separated transversity
7. Forward identified particles - SSAs in forward direction, inclusive A_{LL}s, particle +jets,
8. p+He3 - Repeat all/most of the above measurements to get neutron info.
9. d+Au – Jet broadening, forward heavy flavor and other measurements related to gluon saturation
10. Heavy Ion - ?

We want to build a detector to decisively answer a number of physics questions. Need to fully articulate the questions as well as provide measurements to answer them.

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