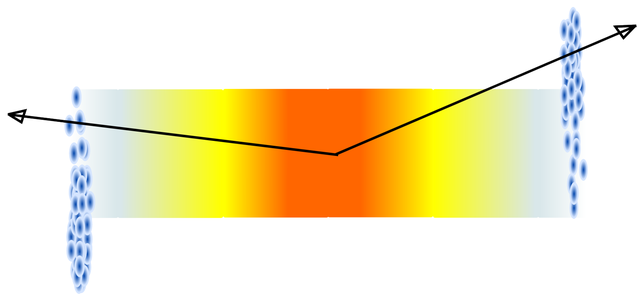
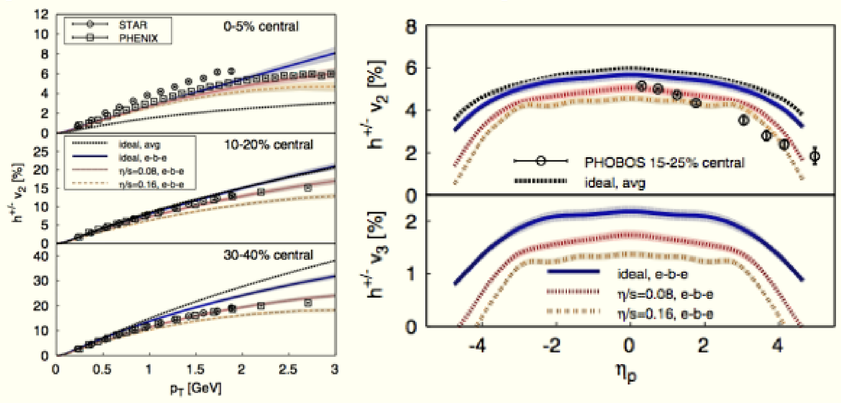
Initial state and 3D-hydrodynamic studies of heavy ion collisions with the proposed sPHENIX forward detector.

Cesar Luiz da Silva[1] for the PHENIX Collaboration
[1](slash@bnl.gov) Los Alamos National Lab

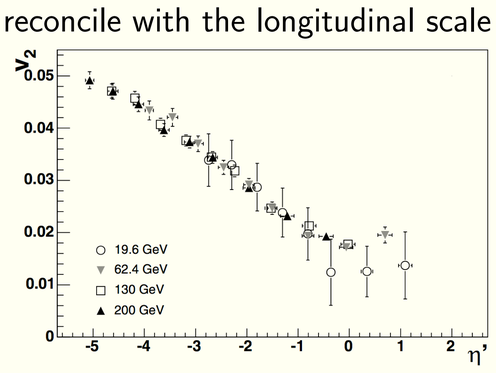


Challenges for 3D Hydro Models

- modern 3+1D viscous hydro model fit to mid-rapidity data fail to reproduce rapidity dependence [Schenke, Jeon, Gale, PRL106, 2011]



- how can hydro calculations reconcile with the longitudinal scale of the elliptic flow

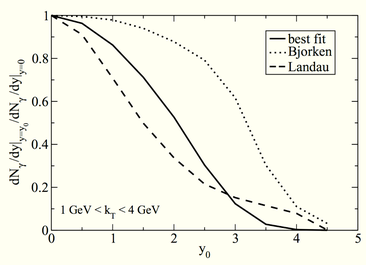


[PRL,94,122303, 2005] $\eta' = |\eta| - y_{beam}$

Initial state and expansion

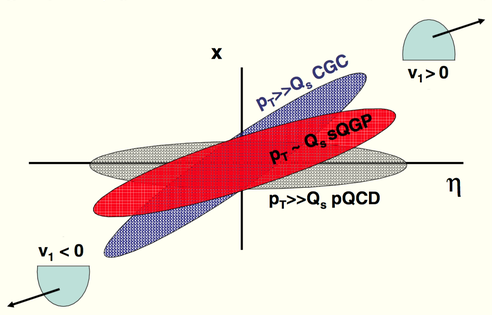
Bjørken: boost-invariant expansion
Landau: initial stopping and re-expansion
Glasma, CGC: color fields produces energy density uniform in rapidity

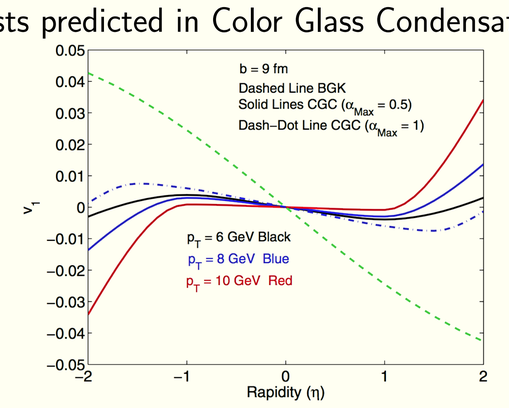
- rapidity dependence of thermal photon yield is sensitive to the way the medium expands



[Thorsten Renk, PRC71,064905, 2005]

- high p_T,η jets are affected by rapidity twists predicted in Color Glass Condensate

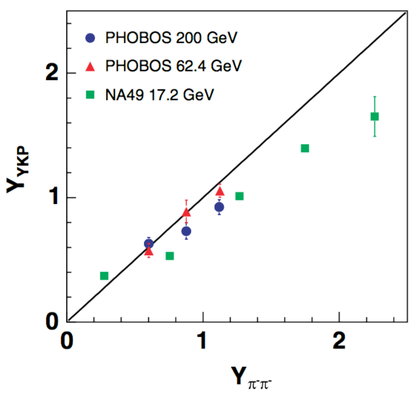


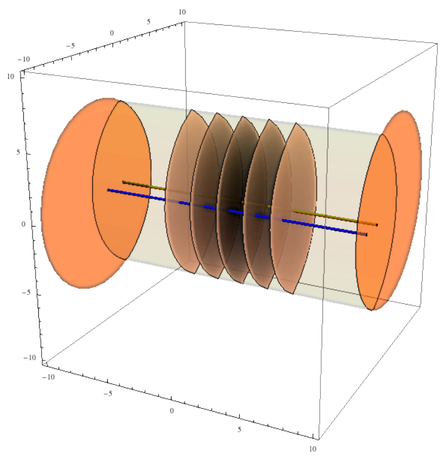


[A. Adil,M. Gyulassy,T.Hirano, PRD73,074006, 2006]

What can we explore in QGP by varying the rapidity ?

Local thermalization



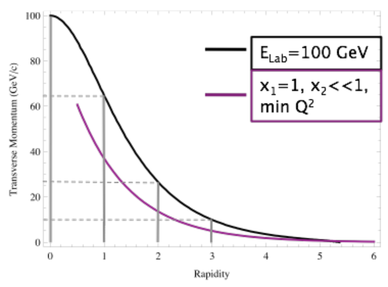


- Hanbury-Brown-Twiss measured by PHOBOS demonstrated local thermalization at RHIC where particles emitted at a given rapidity were produced by a source moving collectively at the same rapidity [PRC73,031901, 2006]

Bjørken-x

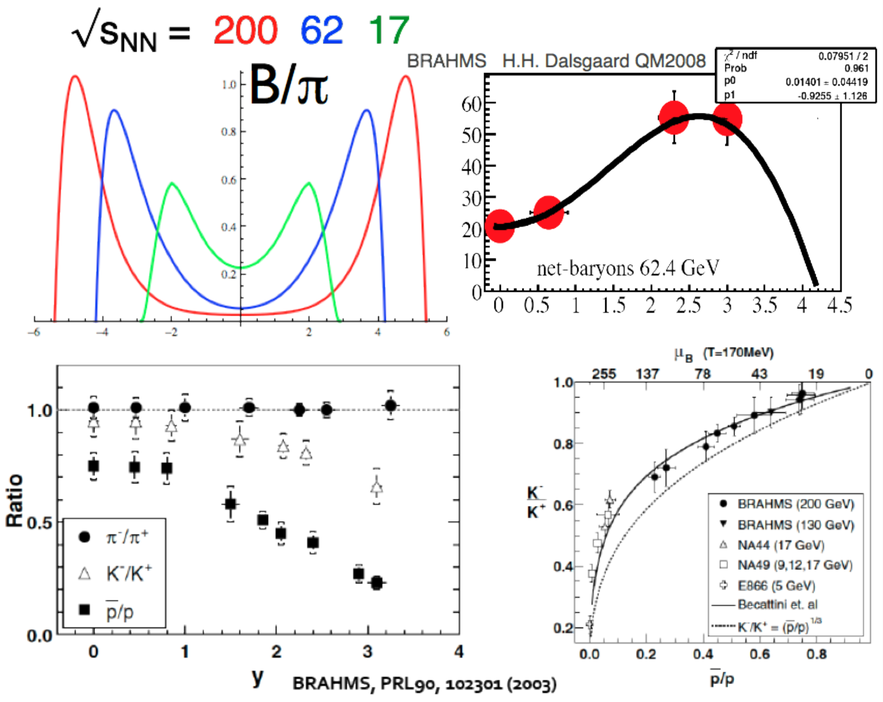
energy density

maximum p_T jet



Color screening length

net-baryon density



Forward sPHENIX Detector

- nothing is in scale, design is under rapid evolution
- idea to extend BRAHMS and PHOBOS measurements including
  - photons, π^0, η^0
  - electrons and muons
  - jet reconstruction
  - correlations with large rapidity gap (forward - central)
  - heavy flavor, D/B separation (FVTX)
  - high momentum resolution can allow identification of different states of quarkonia: J/ψ ,ψ' , Υ(1S), Υ(2S+3S)
  - Drell-Yan
  - high momentum K, π, p identification
- small rapidity part of the fEMCAl will be a re-stack of the current central arm PbGl and PbSc super modules
- piston spectrometer in $3 < \eta < 4$ aiming to provide tracking, calorimetry and muon ID in a Bjørken-x range as small as 5×10^{-4} in p+p and $p(d)$+A collisions
- extensive set of simulations have been carried on to study what is the rapidity range where occupancy is acceptable in A+A collisions
- this detector will also be part of the transition to ePHENIX

Work in Progress Design and Simulations ...