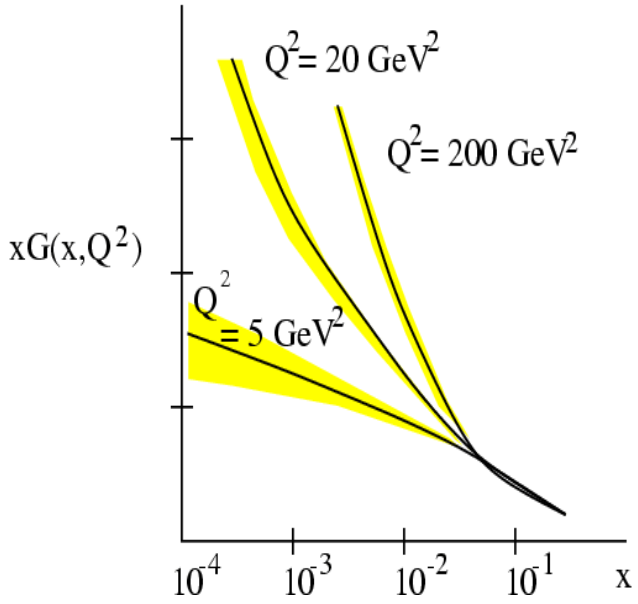
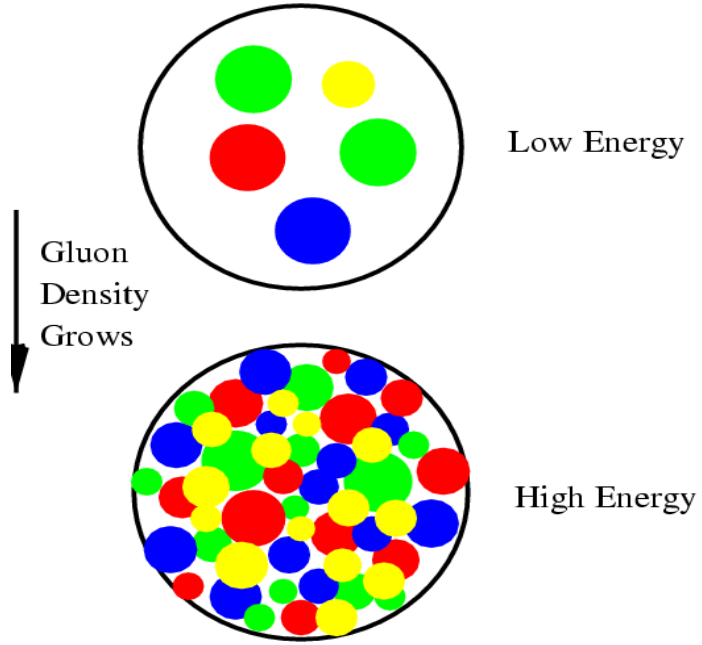
The Color Glass Condensate:

Physical Picture and Simple Questions



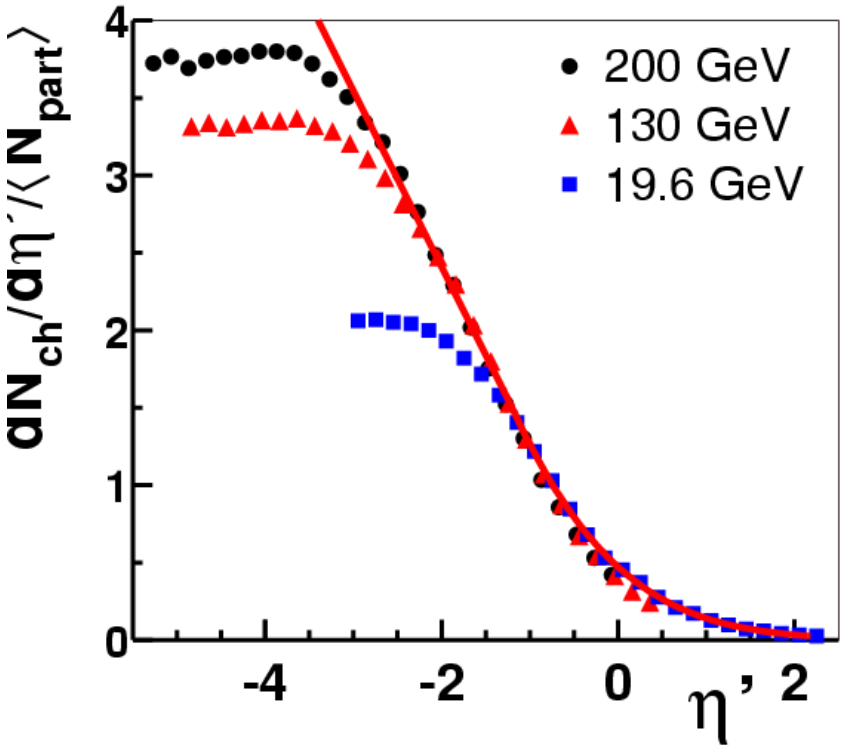


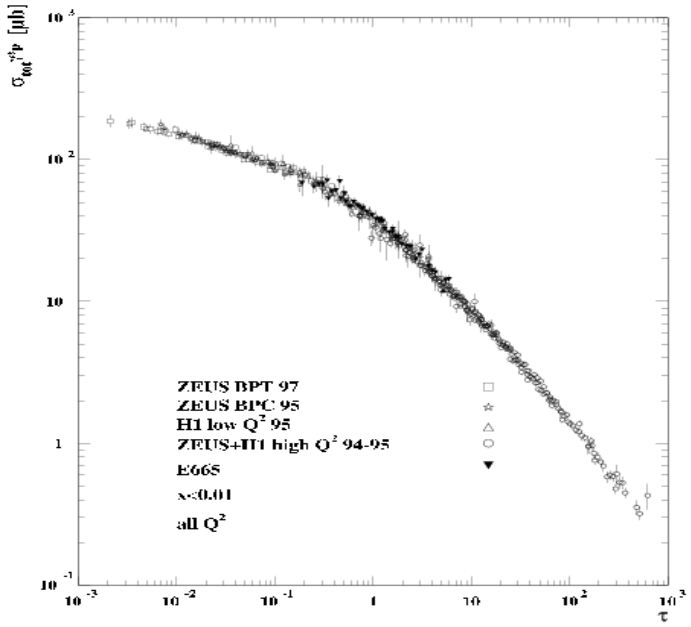
Density of gluons per unit area $\rho = \frac{dN}{dyd^2r_T}$

New momentum scale $Q^2_{sat} \sim \alpha_S \rho$

Weak Coupling!

Crucial Observations:





$\sigma_{\gamma^* p}$ vs Q^2/Q^2_{sat}

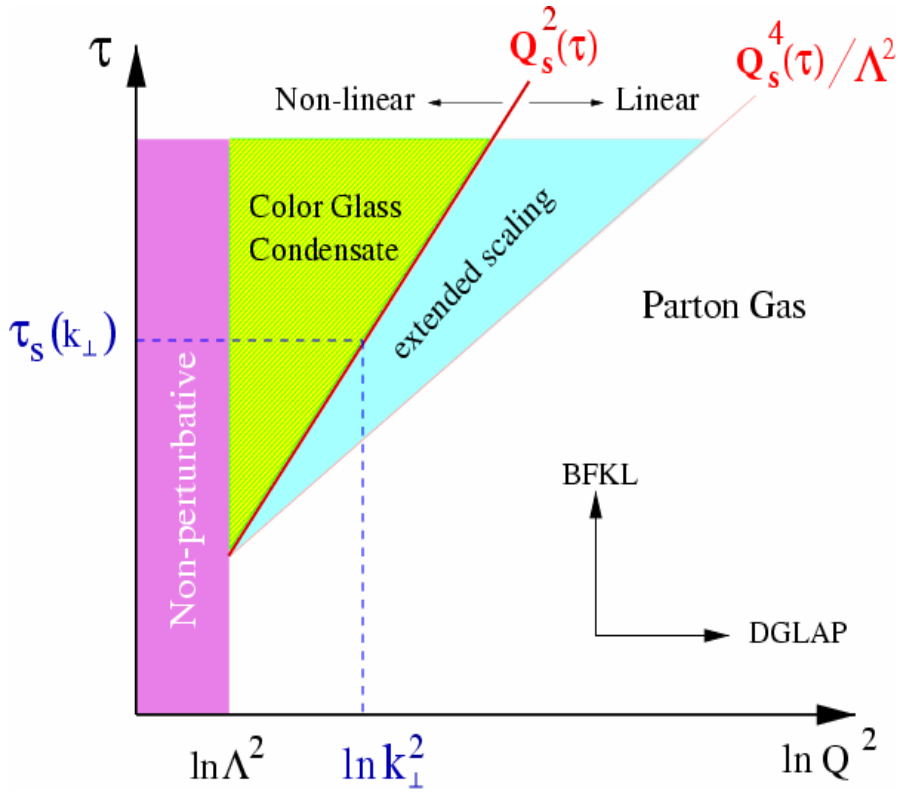
Limiting Fragmentation

Renormalization Group

Geometric Scaling in ep

$$F = Q^d F(Q/Q_{sat}(x))$$

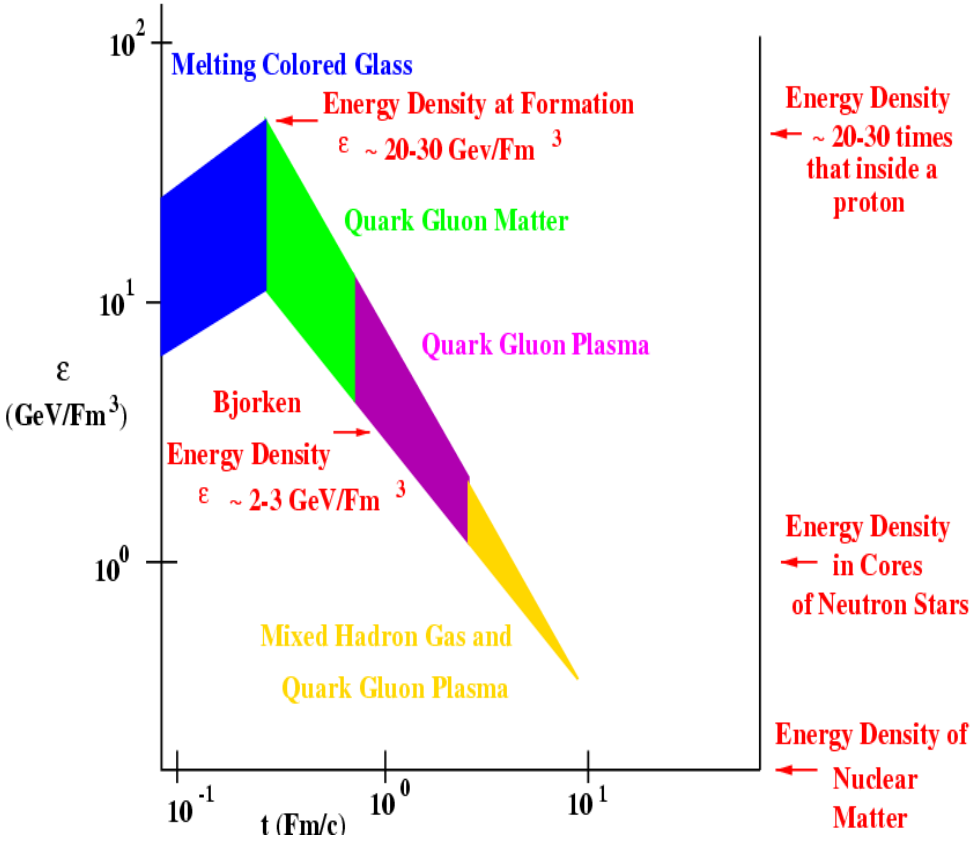
Phase Space of Interesting Physics

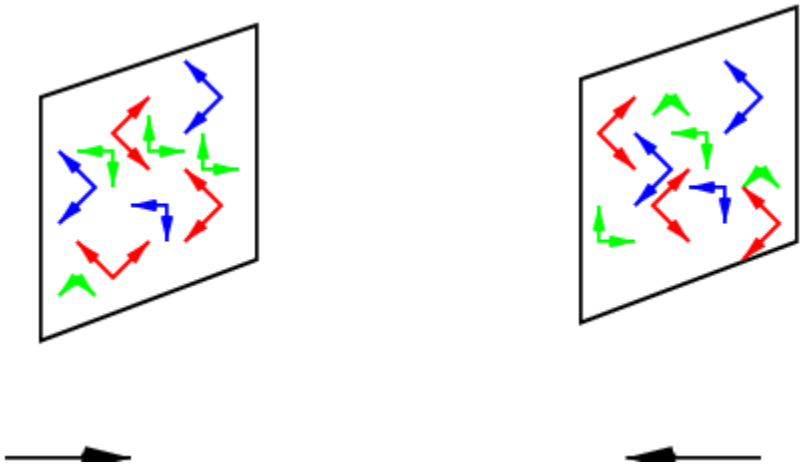


Small x: Potentially large region in Q

Matter has universal properties at small x:
Only variable is the saturation momentum!
Is this true?

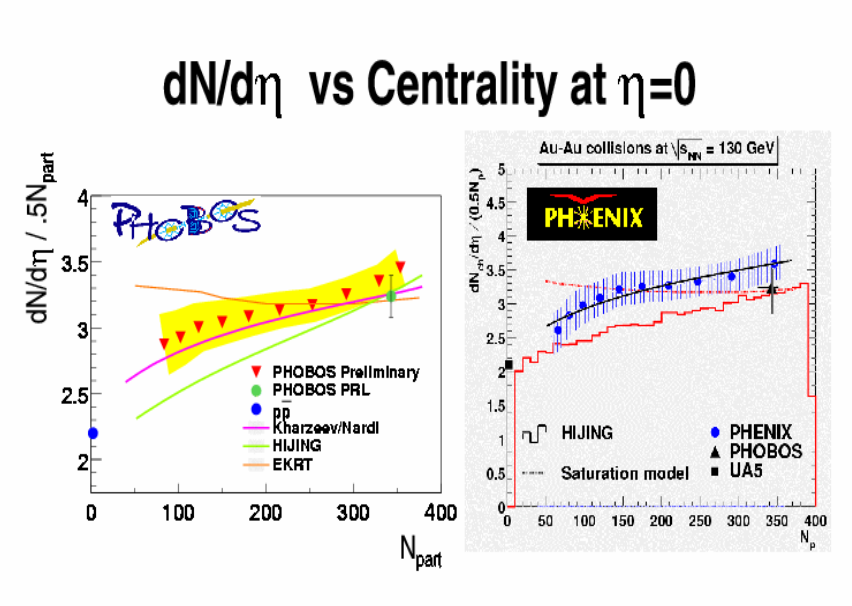
CGC Makes the Gluons in Hadron-Hadron Collisions

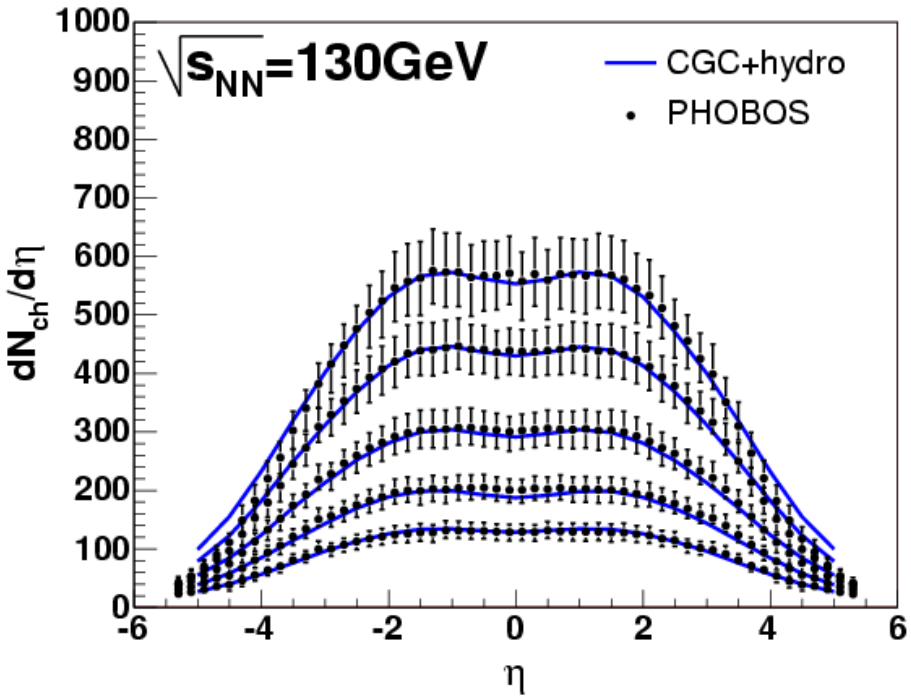




Initial Conditions for QGP
Multiplicity largely preserved

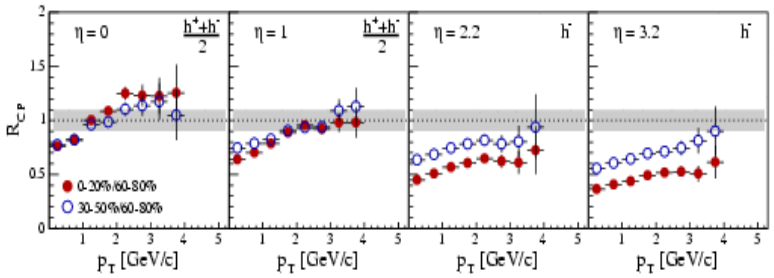
Describes Multiplicity as Function of Centrality and Rapidity

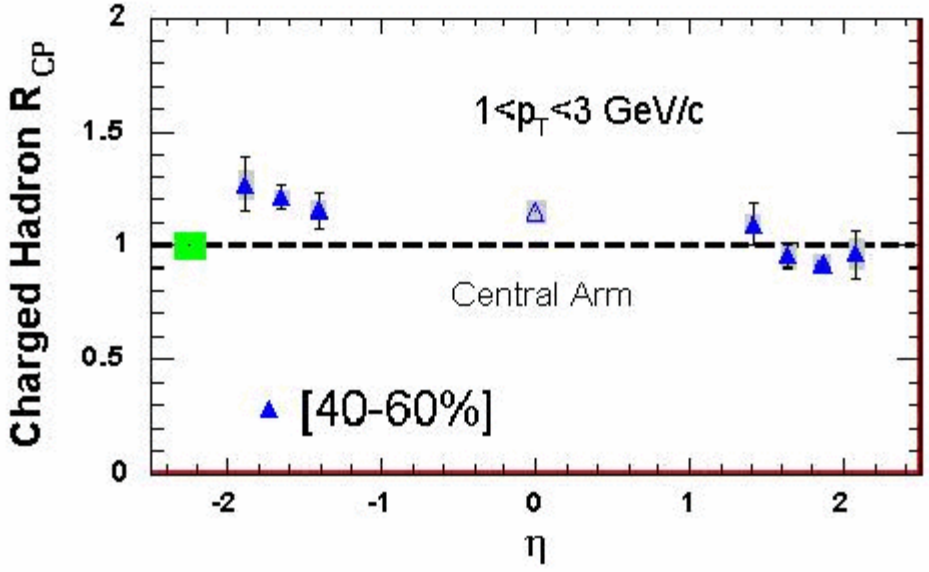




At LHC energies:
Modifications from N participant scaling
Deviations from limiting fragmentation
pp, pA and AA studies all crucial
Large coverage in x, forward physics

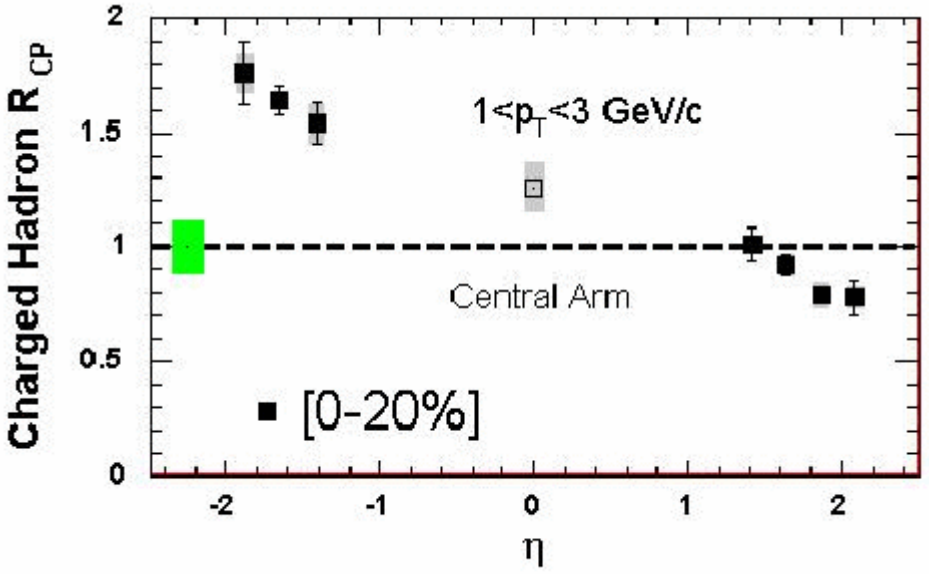
An Example: Rcp in dAu at RHIC





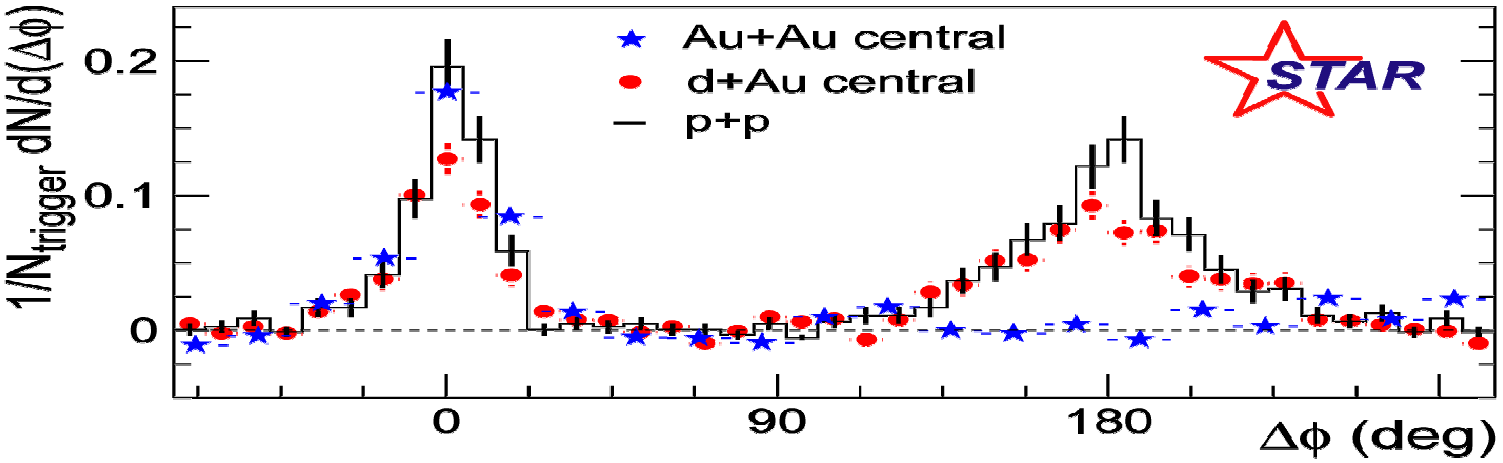
Detailed theoretical studies
of Cronin ratio
Dependence on pT
Large range in pT important
Expect strong dependence on y

Color Glass Condensate
provides theory of shadowing



Is shadowing a leading twist effect?

Jet Physics



Forward backward correlations:
CGC has intrinsic scale!

Can one verify geometric scaling for jets?
Q dependence of gluon distribution function?
Is the gluon distribution determined by DGLAP evolution of quark distributions the same as that directly measured?
Can one determine heavy flavor content at small x?

Pomerons and Odderons:

Pomeron: C even, 2 gluon exchange
Odderon: C odd, 3 gluon exchange
Pomeron: Imaginary part of T matrix
Odderon: Real part

Odderon:
Simplest multi-gluon generalization of pomeron
Much recent theoretical work
No conclusive experimental evidence

Developing Theoretical Story:

Fluctuations are important:
Evolution equations from low density to high density
are fluctuation dominated.

Event by event studies with wide coverage in x and/or pT?
What are predictions for fluctuation spectra in observables?

Summary and Conclusions:

Color Glass Condensate:
Unified theoretical framework for strong interactions
Universal form of hadronic matter
Qualitatively and semi-quantitatively successful

But:
Not yet experimentally compelling
Like early religion: Believers, Heretics and Pagans
RHIC, LHC eRHIC have potential to turn this religion into science

and I most strongly believe that this will happen