

Forward Physics at RHIC

May 14

Hamilton Seminar Room –Chemistry Dept

Forecasts and Expectations for the Future Workshops

JWQiu, M. Perkekamp, R.Seto (organizers)

Richard Seto

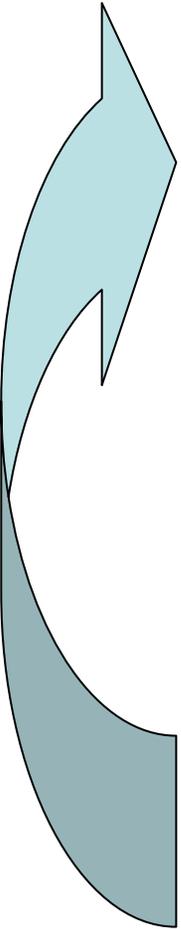
UC, Riverside

RHIC & AGS Annual Users' Meeting

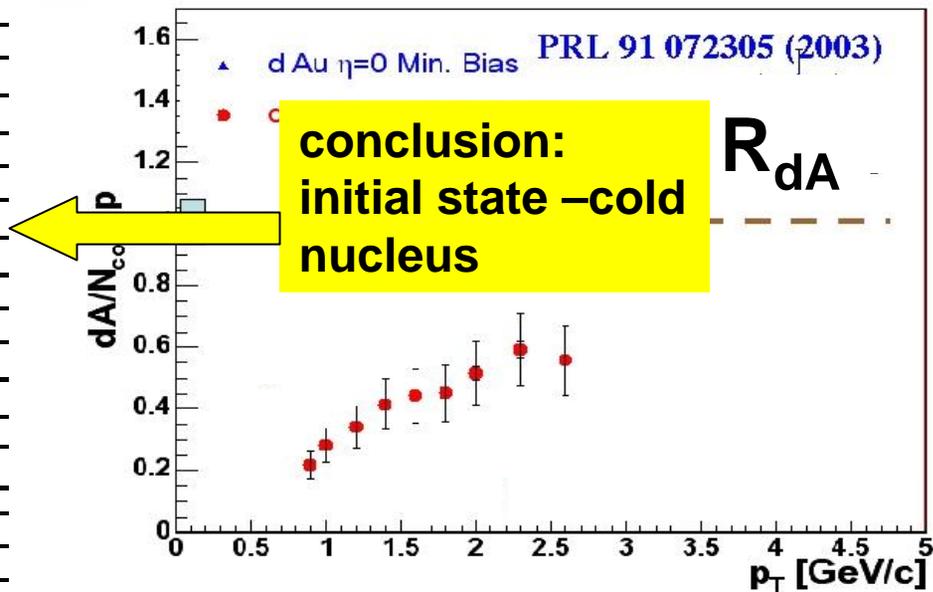
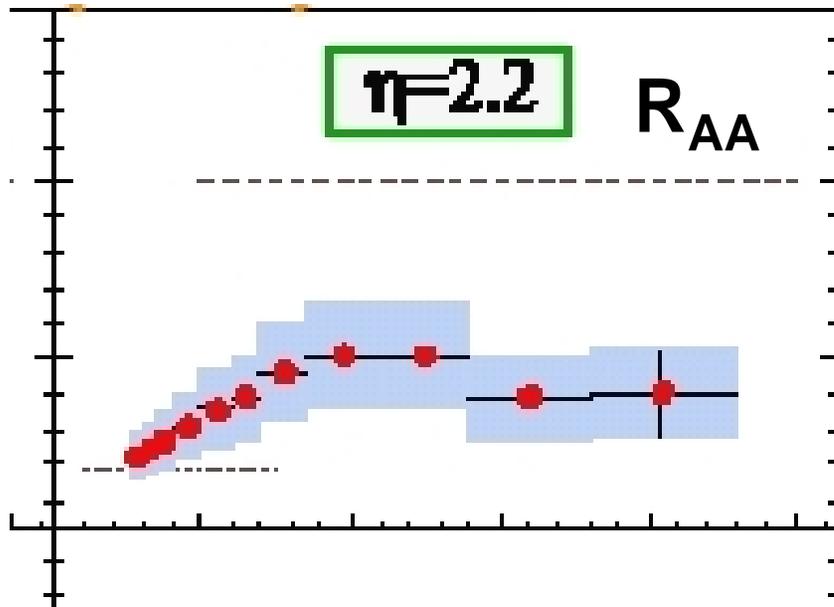
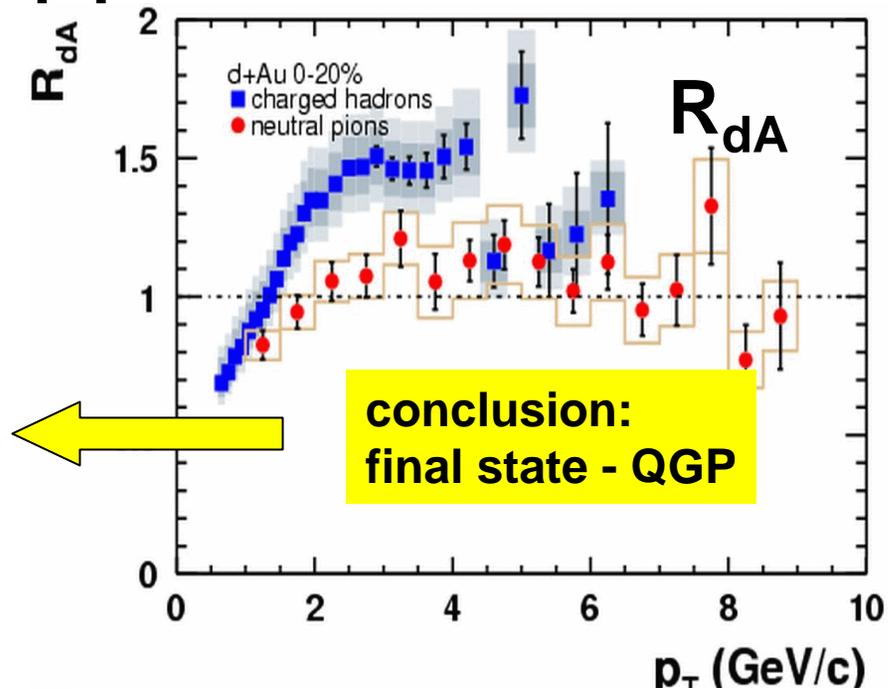
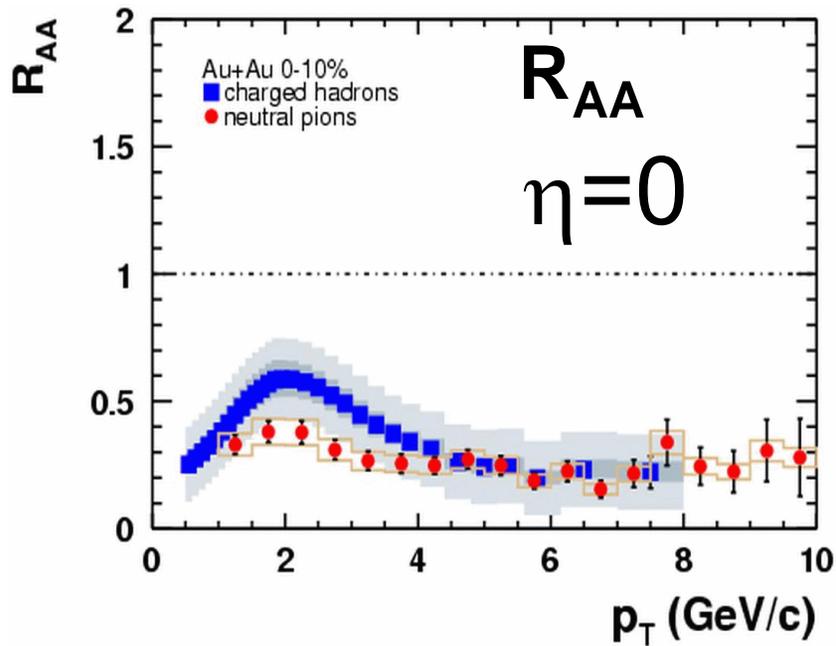
May 10 - 14, 2004 BNL

9AM – 4PM

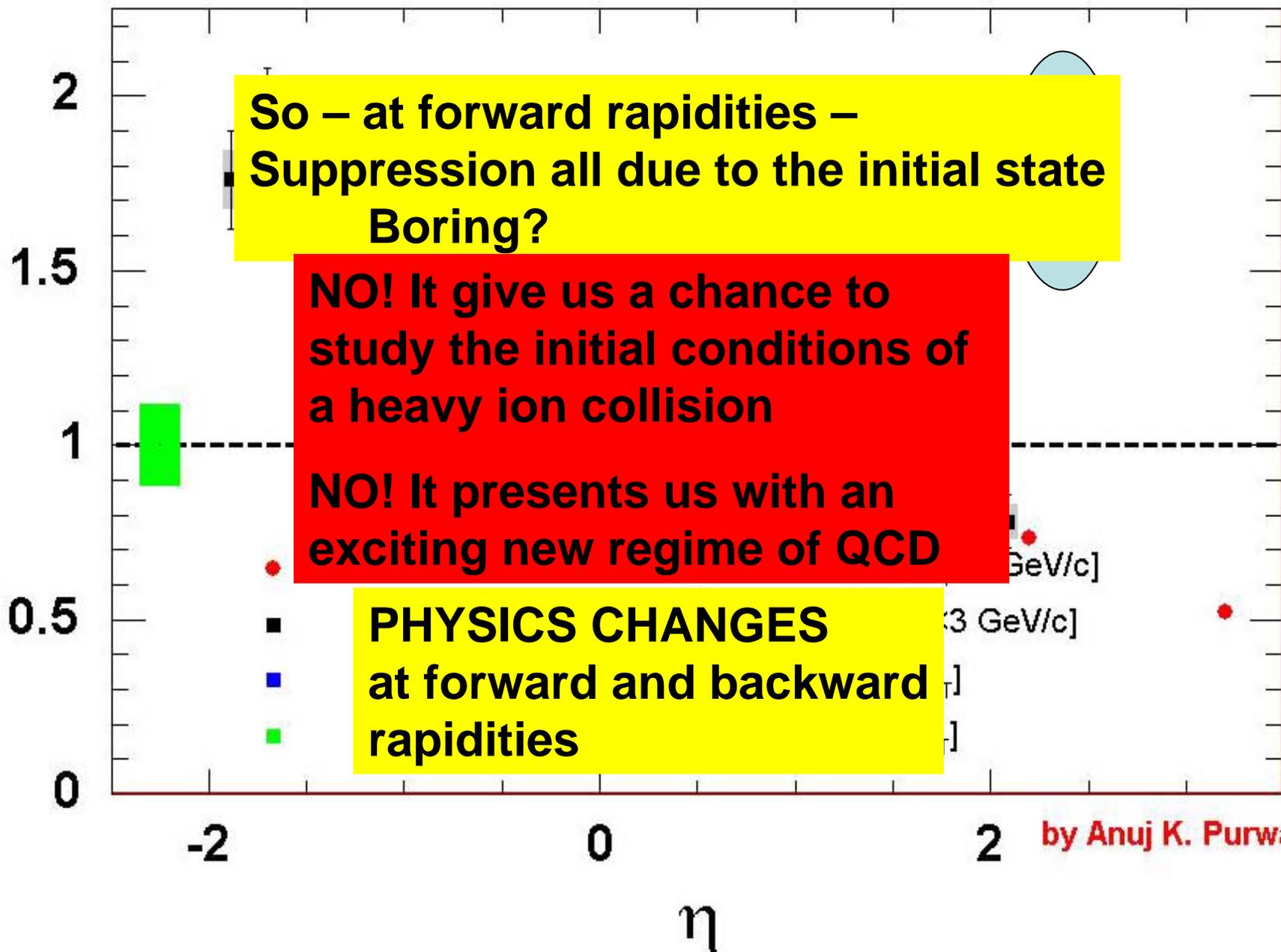
General considerations

- 
- We are now assessing [s?QGP or NOT?] Suppose we got it?
 - Do we understand it?
 - What is it?
 - How is it made?
 - **What are the initial conditions?**
 - Unexpected importance of:
 - Particle ID is surprisingly important even at high pt
 - Forward (backward) rapidities different than central
 - system is not Bjorken

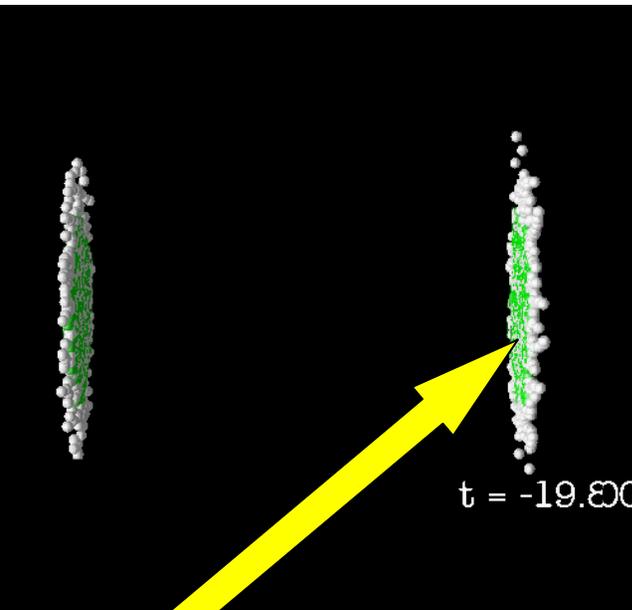
high pt suppression !



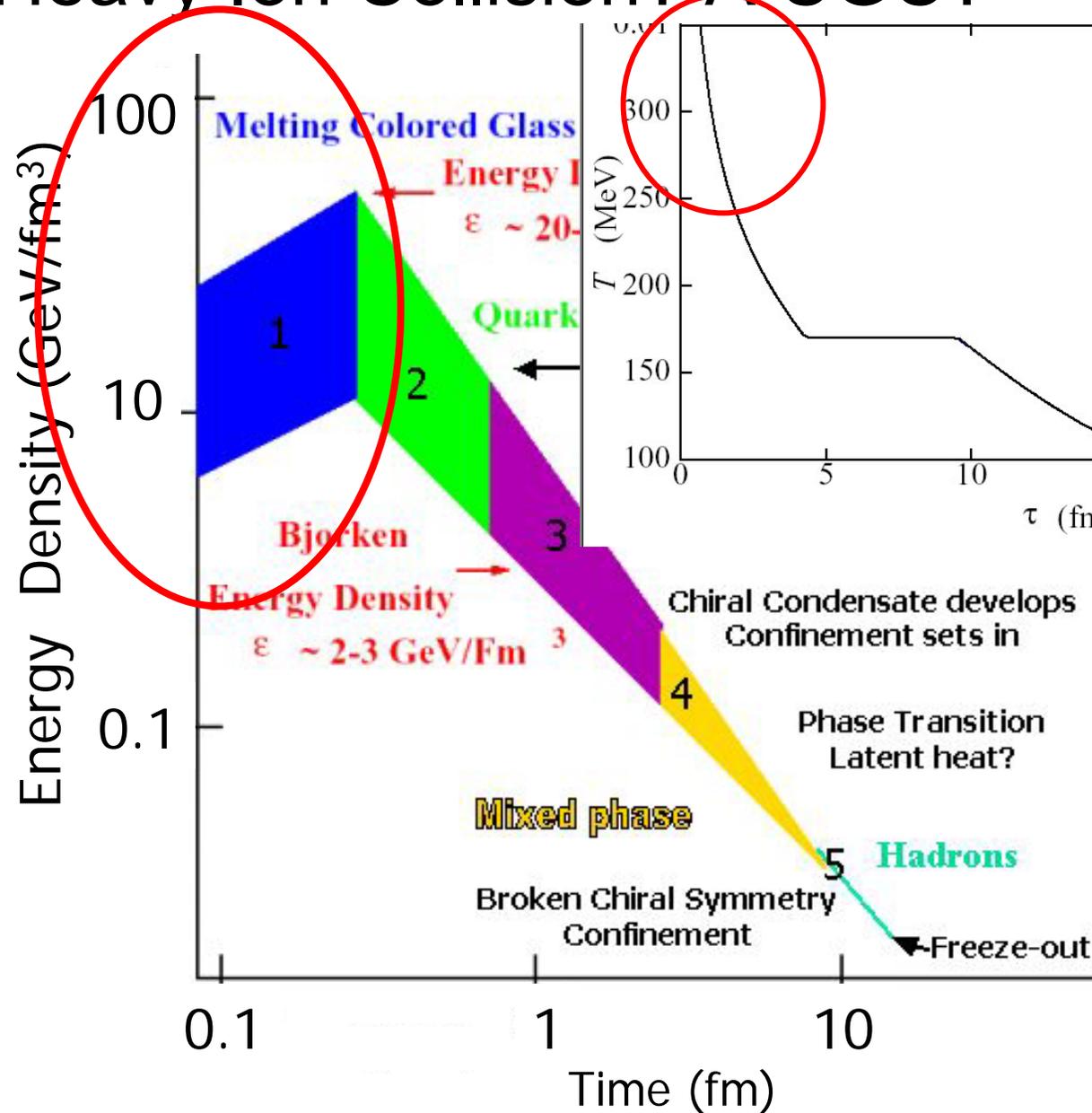
Hadron R_{CP} [0-20%]



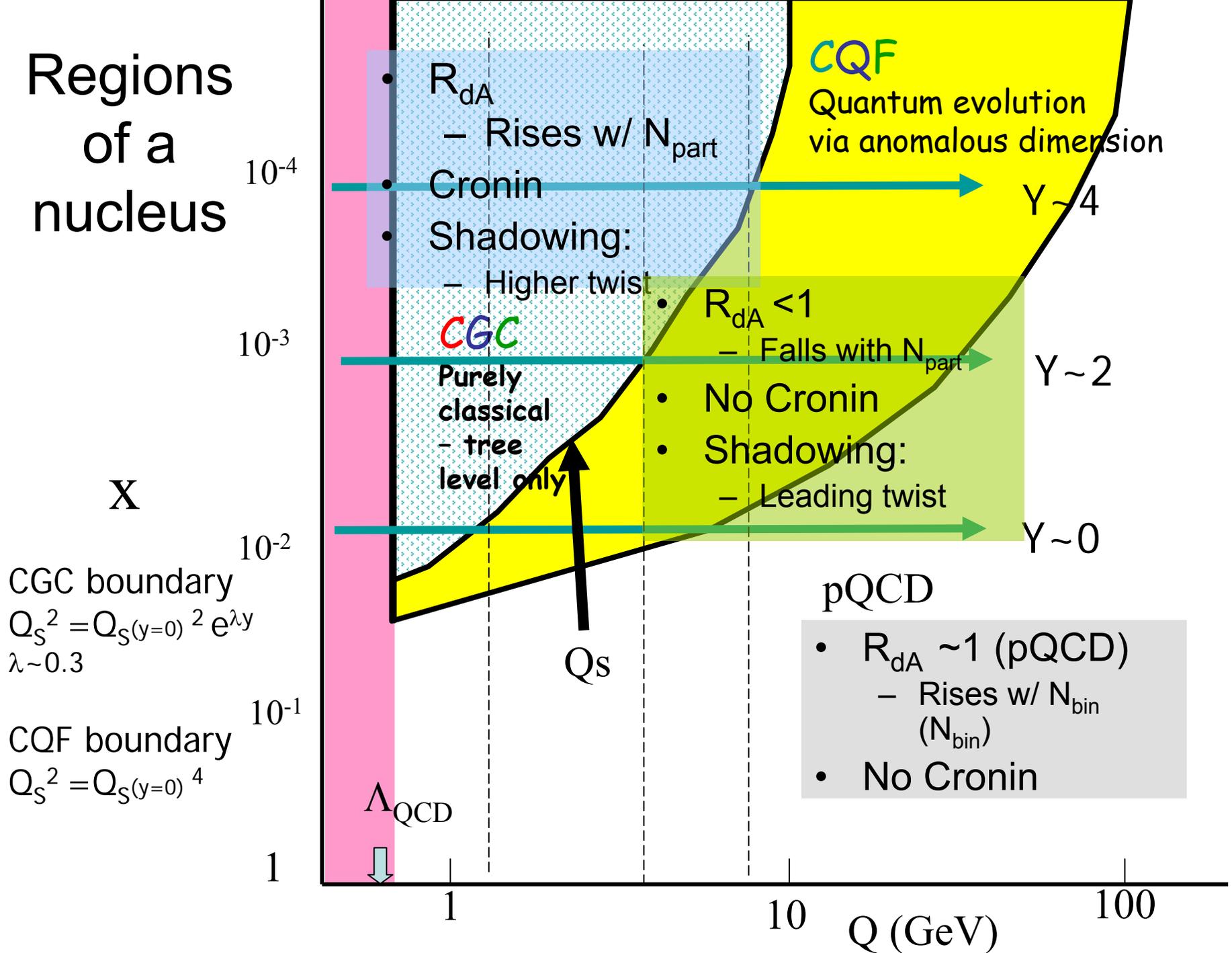
dAu: What is the Initial State of a Relativistic Heavy Ion Collision? A CGC?



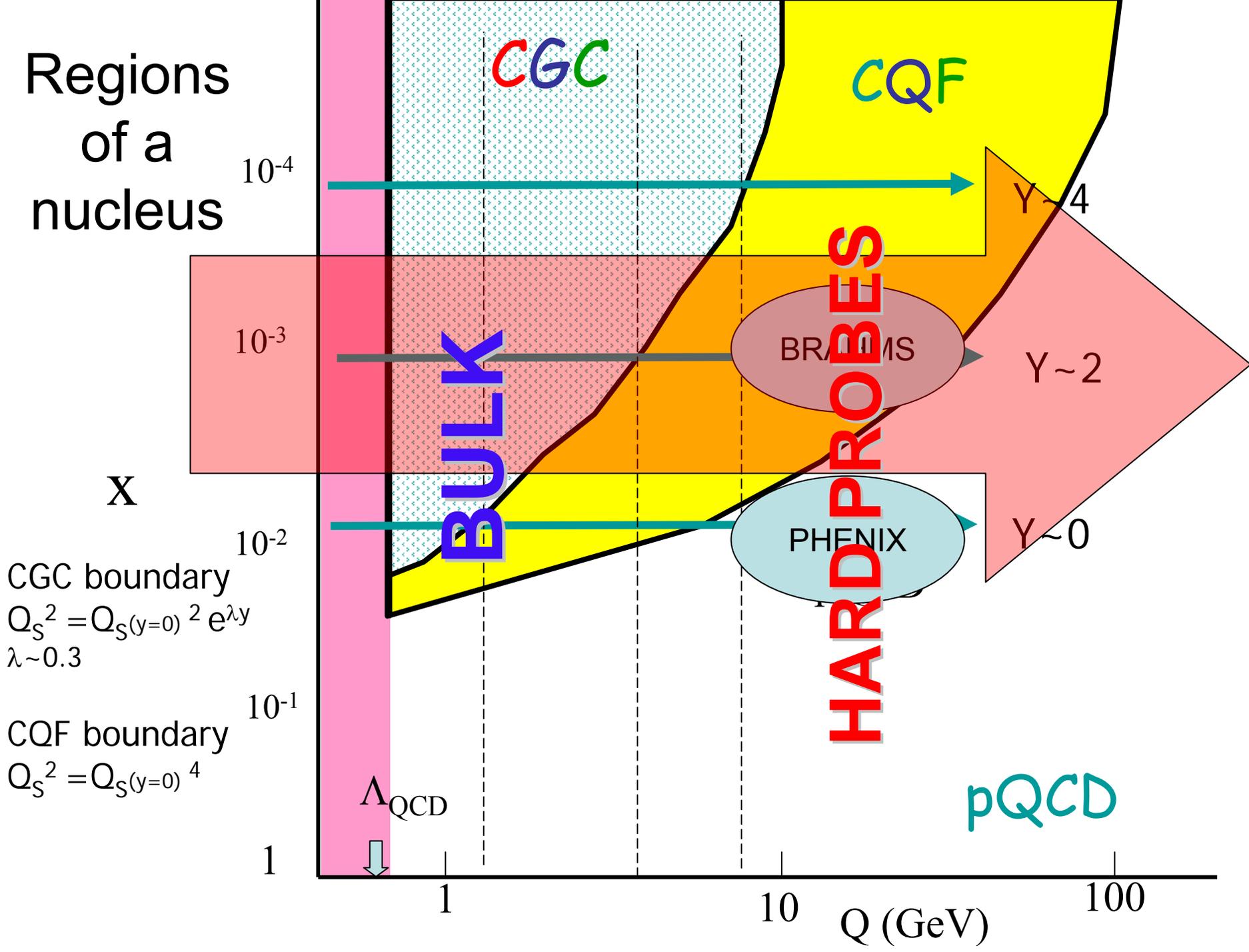
High density saturated gluons
Property of initial state



Regions of a nucleus



Regions of a nucleus



Our speakers

- Theory – setting the stage
 - Theoretical understanding of low x physics **J.W.Qiu**
 - Connections between pQCD and Saturation (the CGC)
 - Novel phenomena in pA at low- x **M. Strickman**
 - quark and gluon shadowing
 - double parton scattering
 - using the nucleus to study transverse nucleon structure
 - particle production – proton fragmentation
 - inelastic coherent diffraction
 - The CGC an introduction and Why I think it is the initial condition at RHIC **L. McLerran**

Our speakers

- Experiments

- Forward Physics at STAR **G. Rakness**
- Future of elastic scattering at RHIC **W. Guryn**
- Low-x what we know (HERA etc) **B Surrow**
- eRHIC: The collider, the detector and low x issues **A. Deshpande**
- The RHIC experiments - what they can do **K Barish**

How do you experimentally see saturation?

- Gluons at low-x

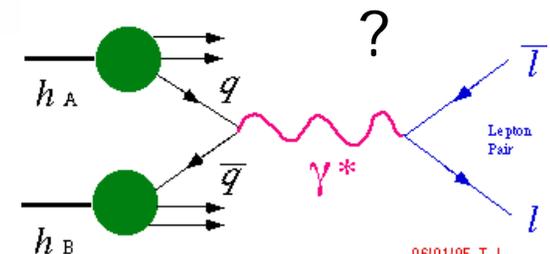
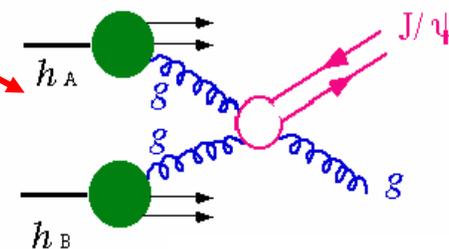
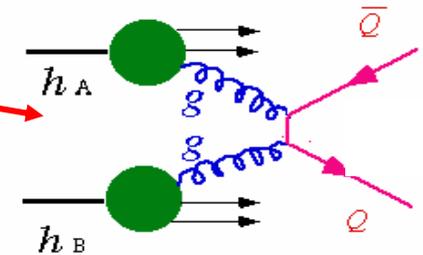
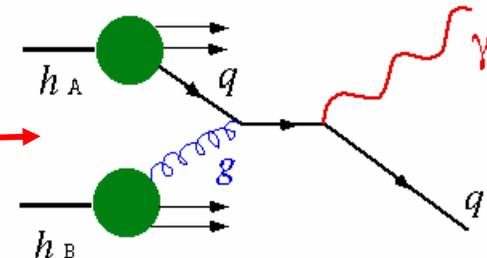
- pA

- $\gamma^* \rightarrow \mu\mu, ee$
 - Direct photons
 - Open Charm
 - hadrons
 - J/ψ production
 - correlations

- $X \sim 1$ to 10^{-4} (evolution)

- $Q^2 \sim 1$ (saturation) to 50 (pQCD)

- Map out previous diagram

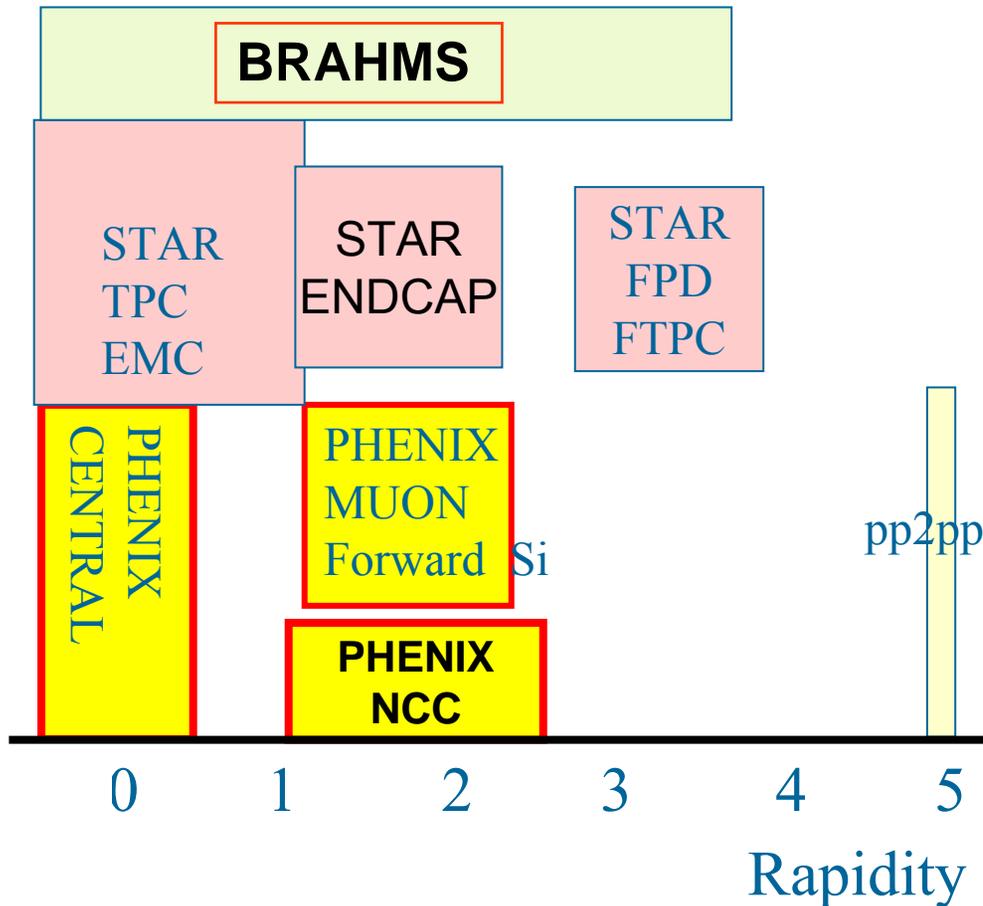


eA

- What we know about low- x
 - HERA and other expts.
 - B. Surrow
- eRHIC
 - future direction at BNL
 - A. Deshpande

RHIC suite of detectors

η coverage of forward spectrometers or calorimetry



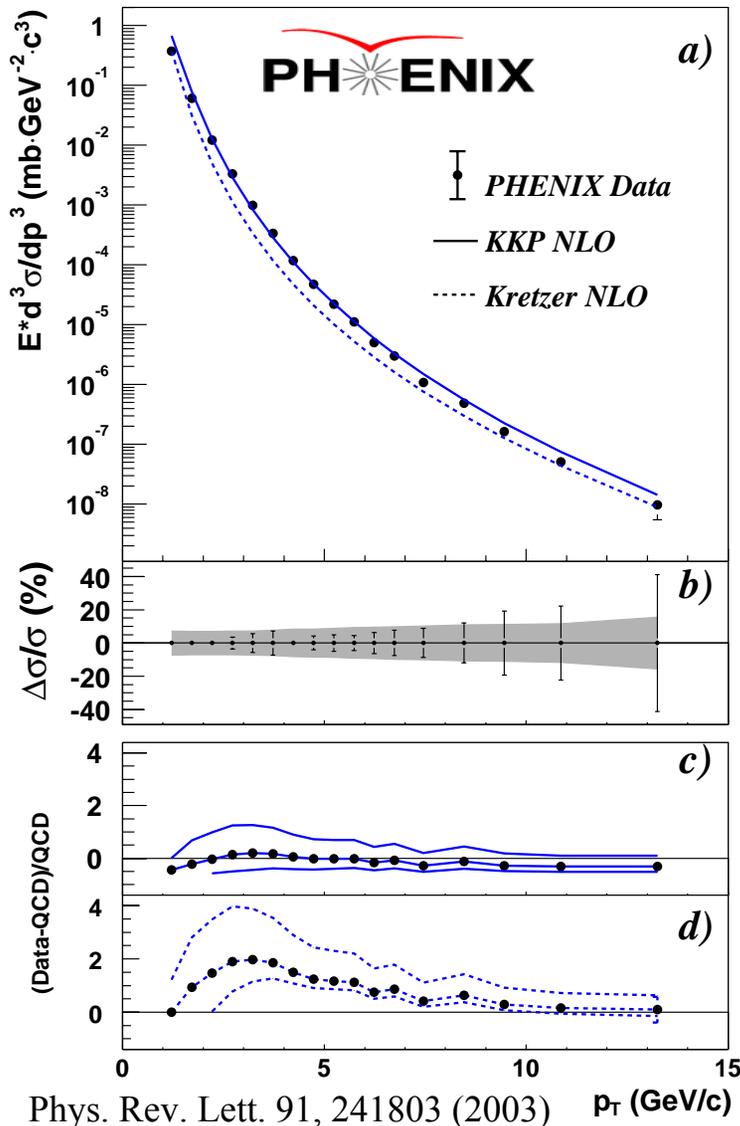
Good coverage
not all detectors are in!

Note: Cross checking
between detectors
has been a key
feature in the success
of the RHIC scientific
program

Redundancy is important

Inclusive π^0 cross section and NLO pQCD

Inclusive π^0 cross section



$\sqrt{s} = 200\text{GeV}$ and **mid-rapidity**

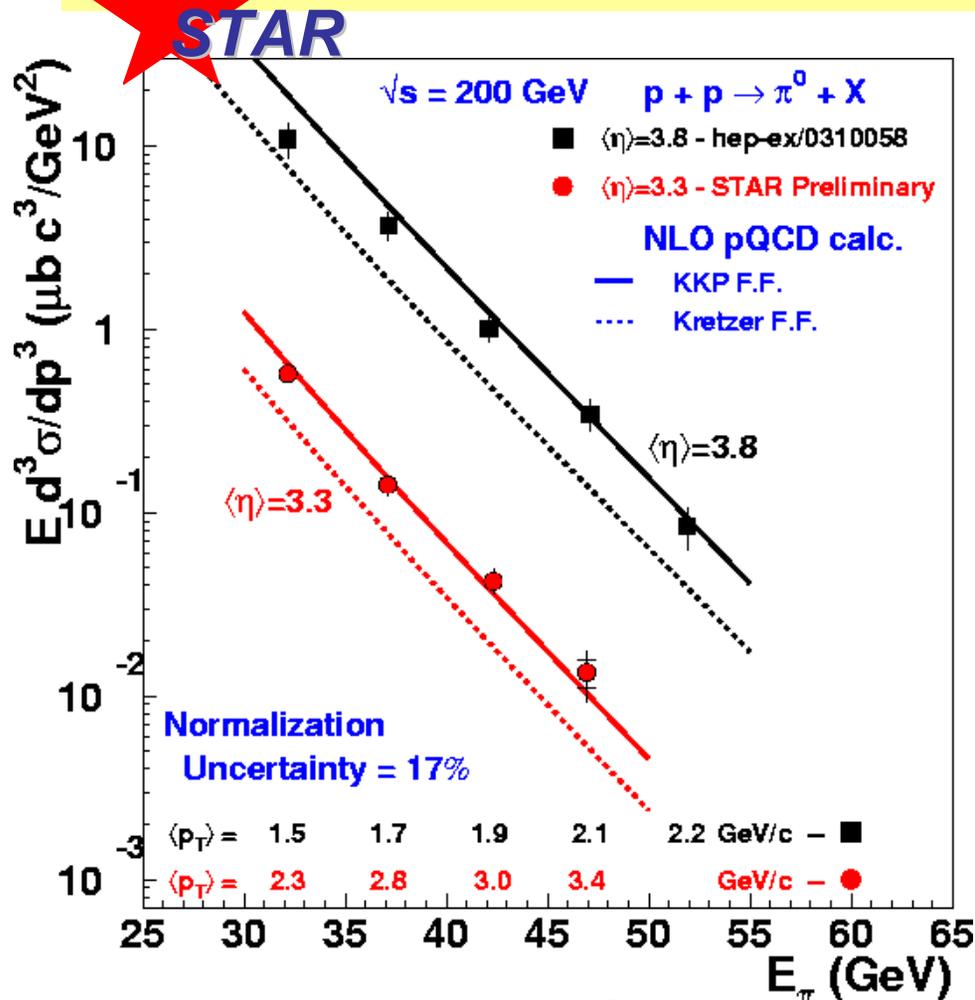
NLO pQCD works!

Does NLO PQCD

**work for forward
rapidity also??**

Forward π^0 Inclusive Cross Section

Greg Rakness



• STAR data

• $\langle \eta \rangle = 3.8$

• $\langle \eta \rangle = 3.3$

Does NLO PQCD

work for forward
rapidity also??

YES!

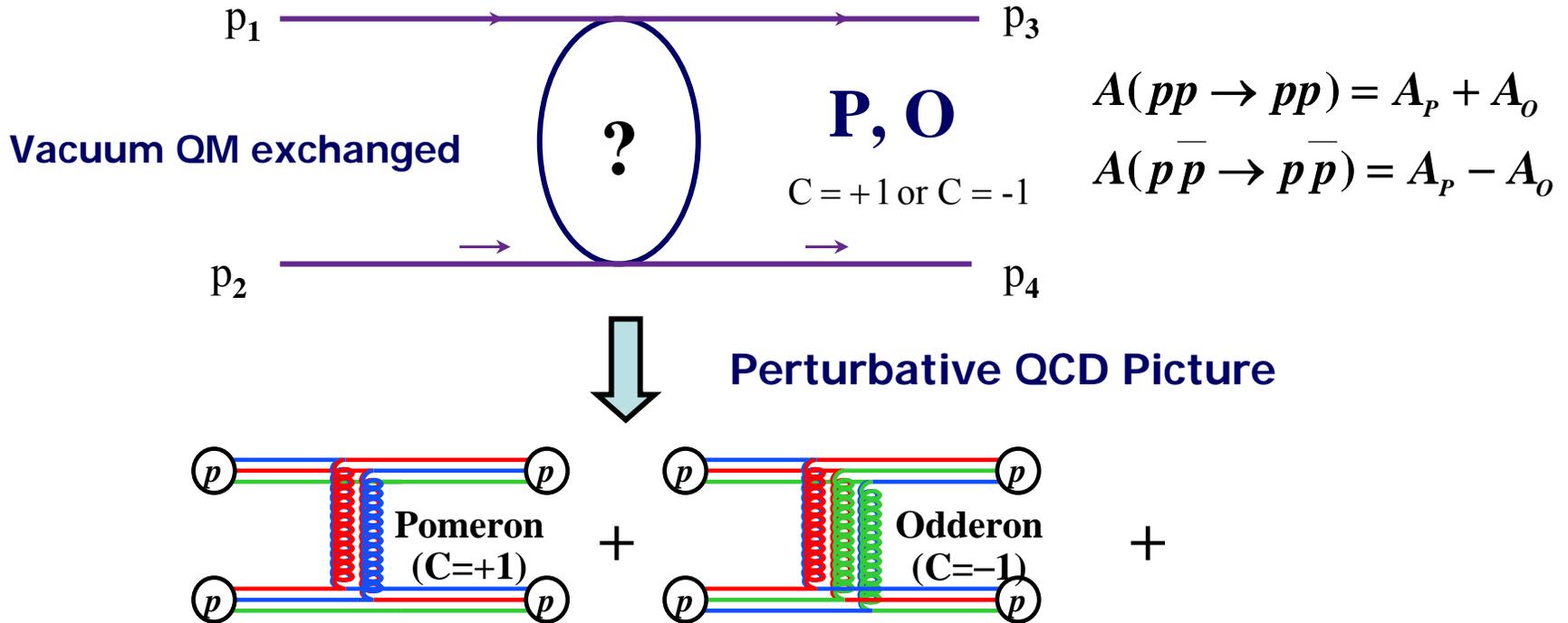
STAR data consistent with NLO

pQCD calculations

in contrast to data at lower \sqrt{s}

Future of Elastic Scattering at RHIC

Włodek Guryn



- We are proposing a comprehensive study of proton proton elastic scattering process in totally unexplored range of \sqrt{s} and $|t|$ to measure spin dependence of proton-proton elastic scattering.

In addition: The pp elastic scattering a strong relation to the rest of the RHIC program: both AA and spin

- **Number of binary collisions in AA:**
 - pp2pp will measure $\sigma_{inel} \approx 42 \text{ mb}$
 - **Nbinary** $\propto \sigma_{inel} T_{AA}$ (b)
- **Spin flip amplitude, ϕ_5 and polarimetry:**
pp2pp will measure if there is a hadronic spin flip contribution;
- **pp2pp will measure A_{NN}** which may have a contribution from the Odderon;
- **pp2pp will provide a cross check of the Luminosity by using the Coulomb method and comparing it to the van der Meer Scan**

Coverage $1 < \eta < 3$

Jets direction and energy

photons

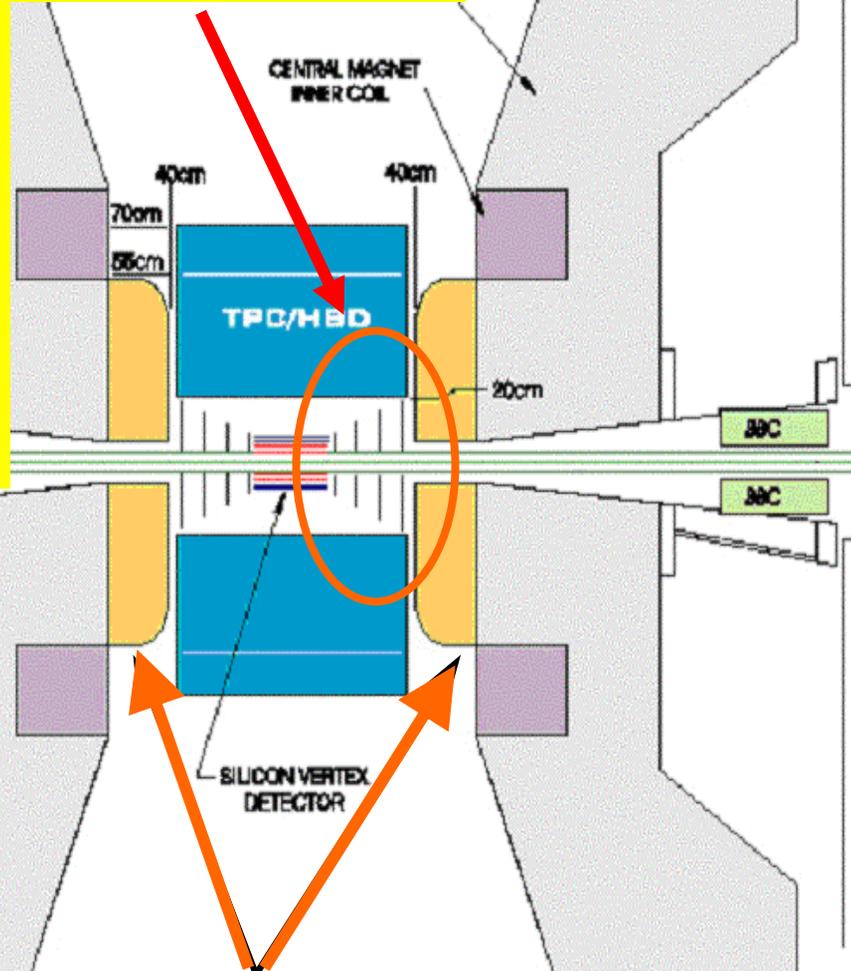
π^0 's

electrons

detached vertices for
charm and bottom

Forward Silicon
Tracking detectors

NIX



Central arm upgrades

Aerogel Counter-PID

RPC – for TOF

Barrel Silicon tracking

Hadron Blind Detector

–Datliz rejection

Nosecone Calorimeters

South

Side View

North

ZDC North

MuID