

Proposal for the PHENIX Nosecone Calorimeter An Overview

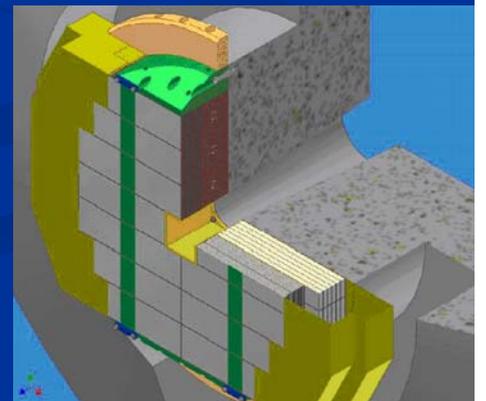
Richard Seto

BNL

March 14, 2006



R. Seto



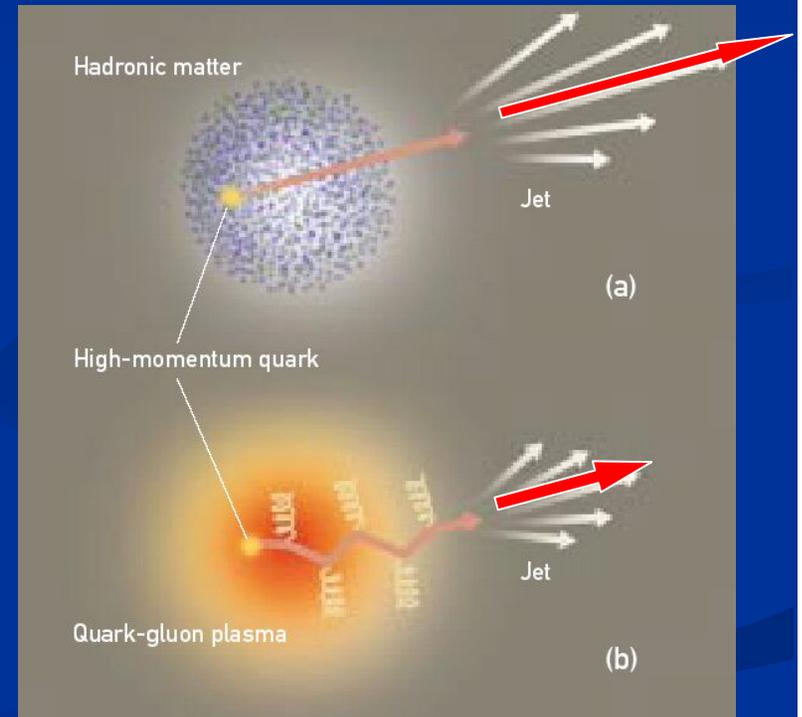
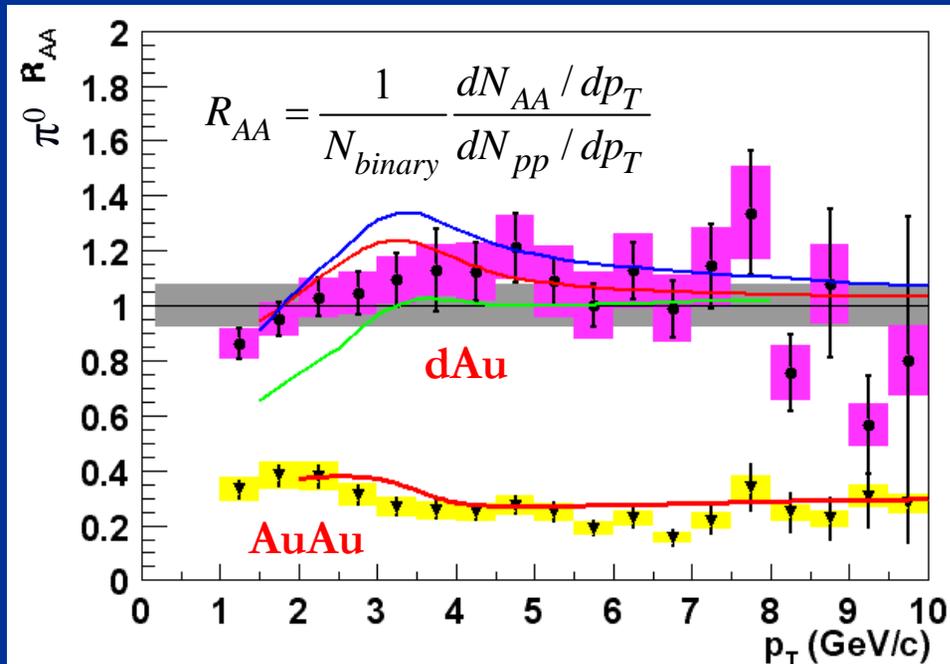
What we have learned at PHENIX: the sQGP

- The medium created in gold-gold reactions equilibrates very rapidly on times scales ≤ 2 fm/c as indicated by comparisons of the collective motion of created particles and hydrodynamic model calculations. In fact, these calculations indicate that the medium after equilibration behaves like a nearly perfect liquid (low viscosity). In addition, the initial energy densities are extremely high, perhaps 2 orders of magnitude greater than an ordinary nucleus, far exceeding the energy density predicted for the phase transition by lattice calculations. This state of matter has been given the name Strongly Interacting Quark Gluon Plasma (sQGP)

How do we know?

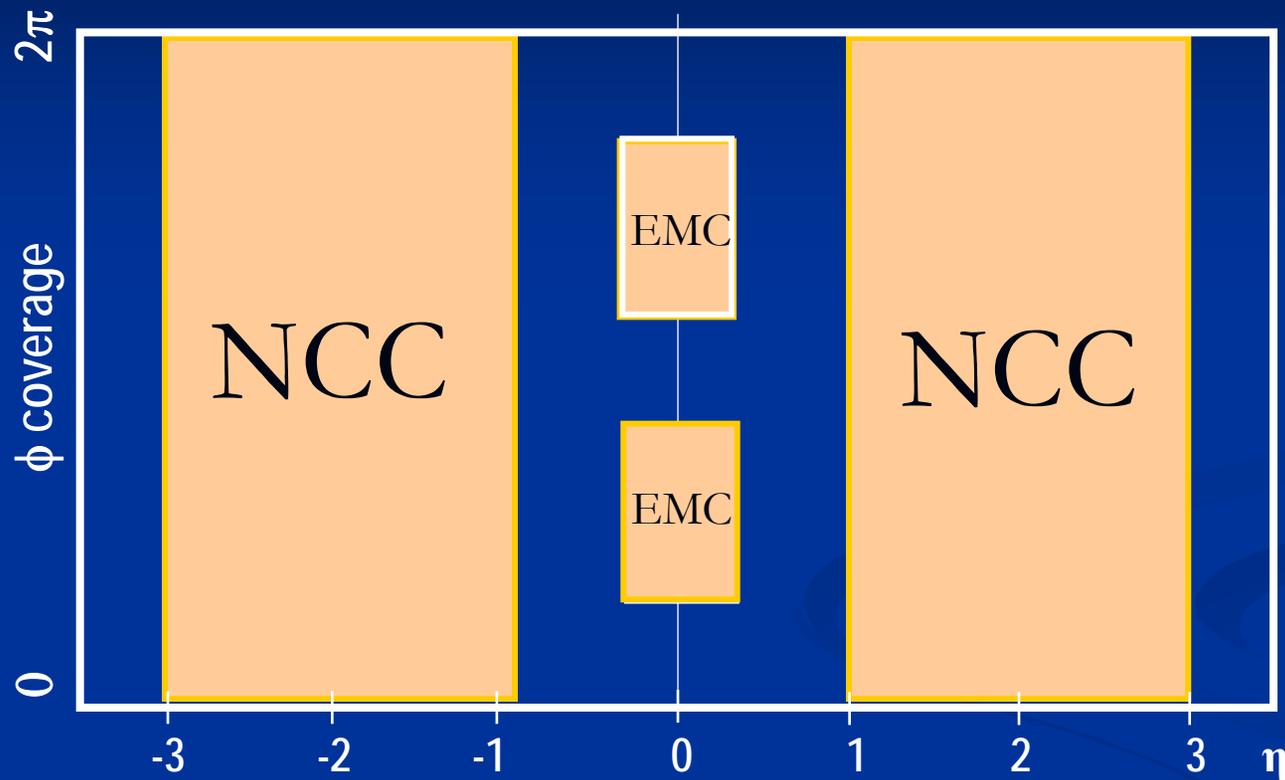
The PHENIX central EMCAL

- The central EMCAL has been one of the most important subdetectors in PHENIX



$\epsilon \sim 10-15 \text{ GeV}/\text{fm}^3$

What is proposed? the NoseCone Calorimeter



η coverage from 1 to 3
RHIC II – luminosity x10
PHENIX acceptance x10



Precision measurements possible

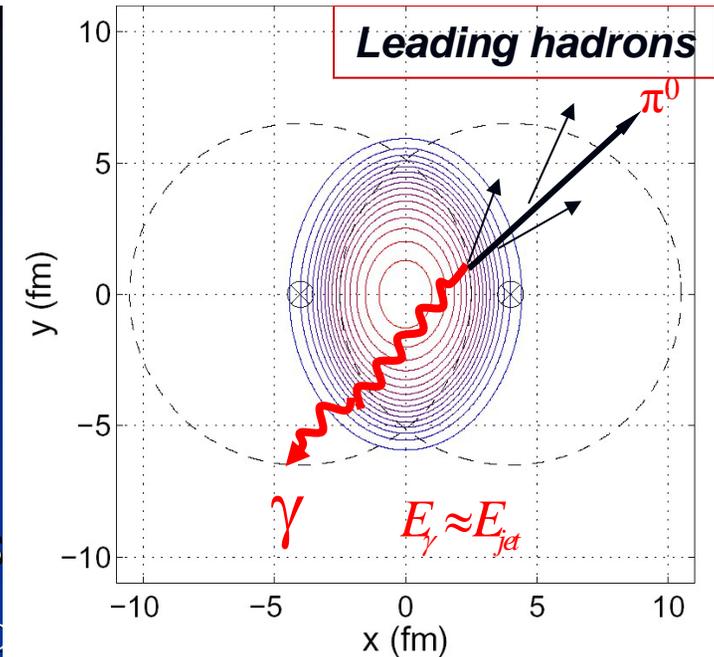
Note: Scope of DOE Proposal: 1 NCC

What is the Physics I?

QCD: Heavy Ion Physics and the sQGP

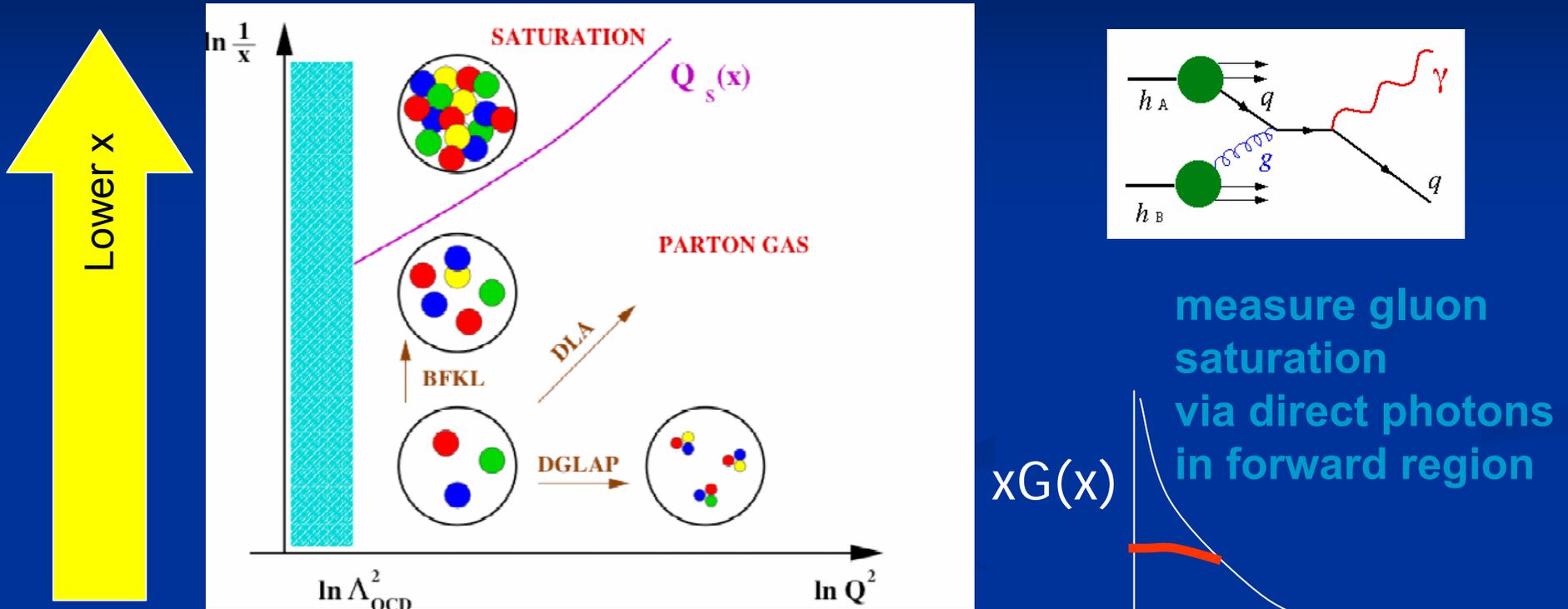
■ Heavy Ions

- Getting a picture of collision systems
 - This is why the CAT scan so important
 - Energy density (tomography) changes with rapidity →
large rapidity coverage
 - Calibrated probe: photon-jets – need **large acceptance**
- Understanding deconfinement, T_c
 - Recently lattice: J/ψ melts at $>T_c$
 - $\chi_c \rightarrow \gamma J/\psi$ – **must go to forward rapidity**
 - probably the only detector capable of doing this at RHIC



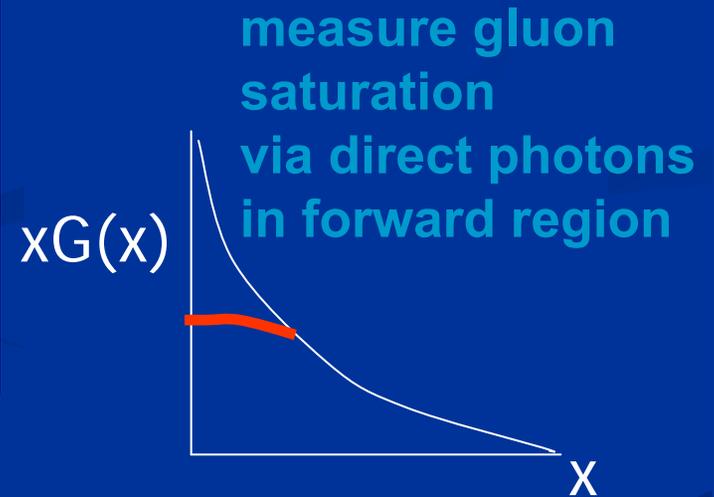
What is the Physics II?

QCD: Proton Nucleus Physics and the Colored Glass Condensate



More saturation at Lower x
 $y \sim \log(1/x)$
 Lower $x \rightarrow$ forward rapidity

In talk by K. Barish



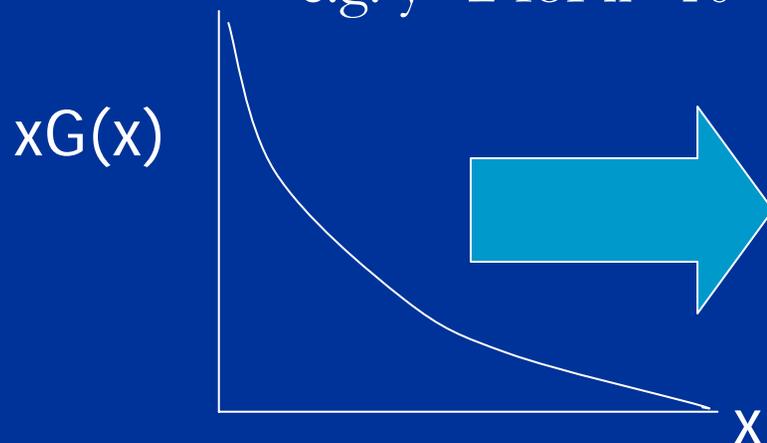
The Colored Glass Condensate:
 The Initial Condition for Heavy
 Ion Collisions?

What is the Physics III?

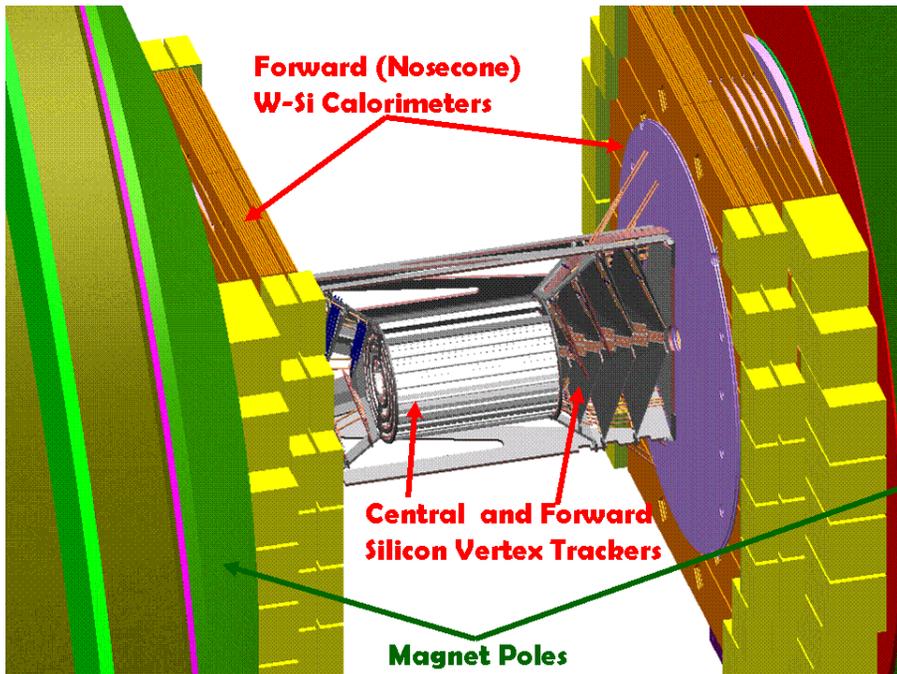
QCD: polarized pp collisions and the Spin of the Proton

- Where is the spin of the proton?
 - Idea: Measure the gluon spin contribution ΔG
 - ΔG may be dominated by contributions from low- x where gluons are most abundant
 - $y \sim \log(1/x)$ So low x is forward rapidity

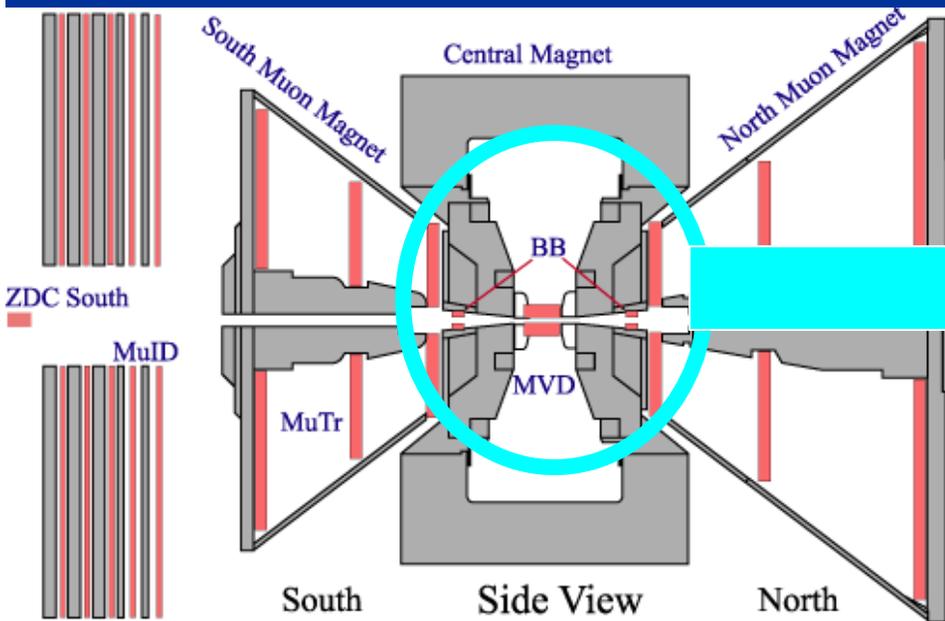
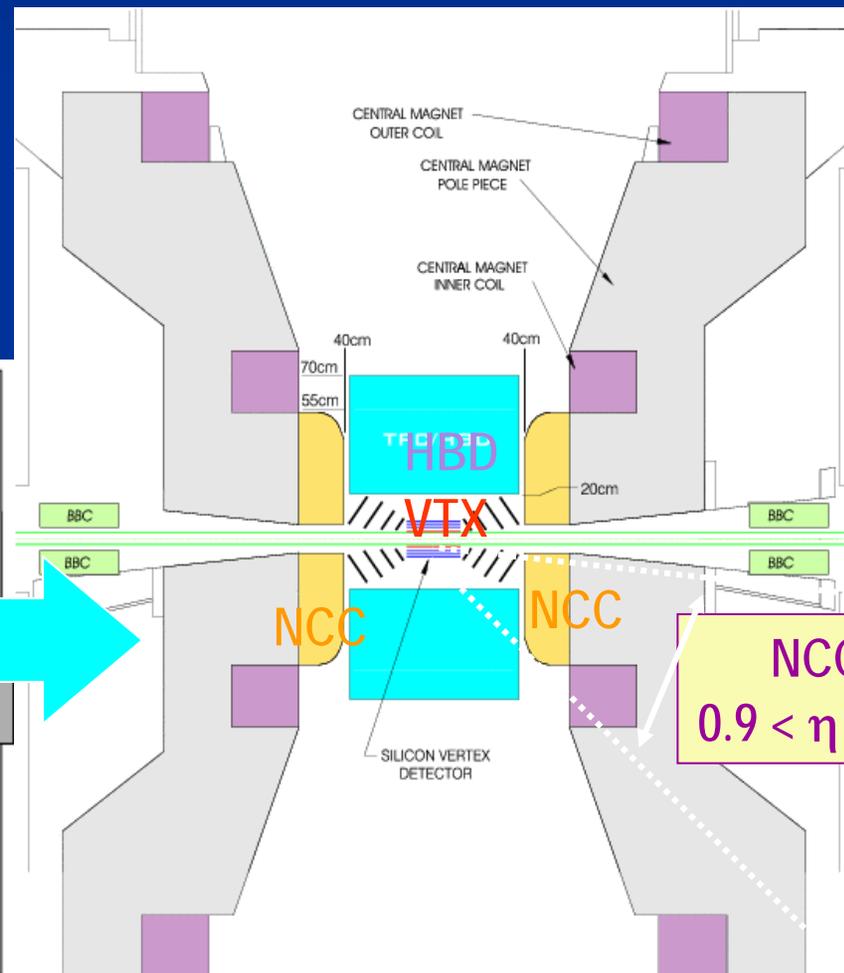
e.g. $y \sim 2$ for $x = 10^{-2}$



Go to Forward Rapidity



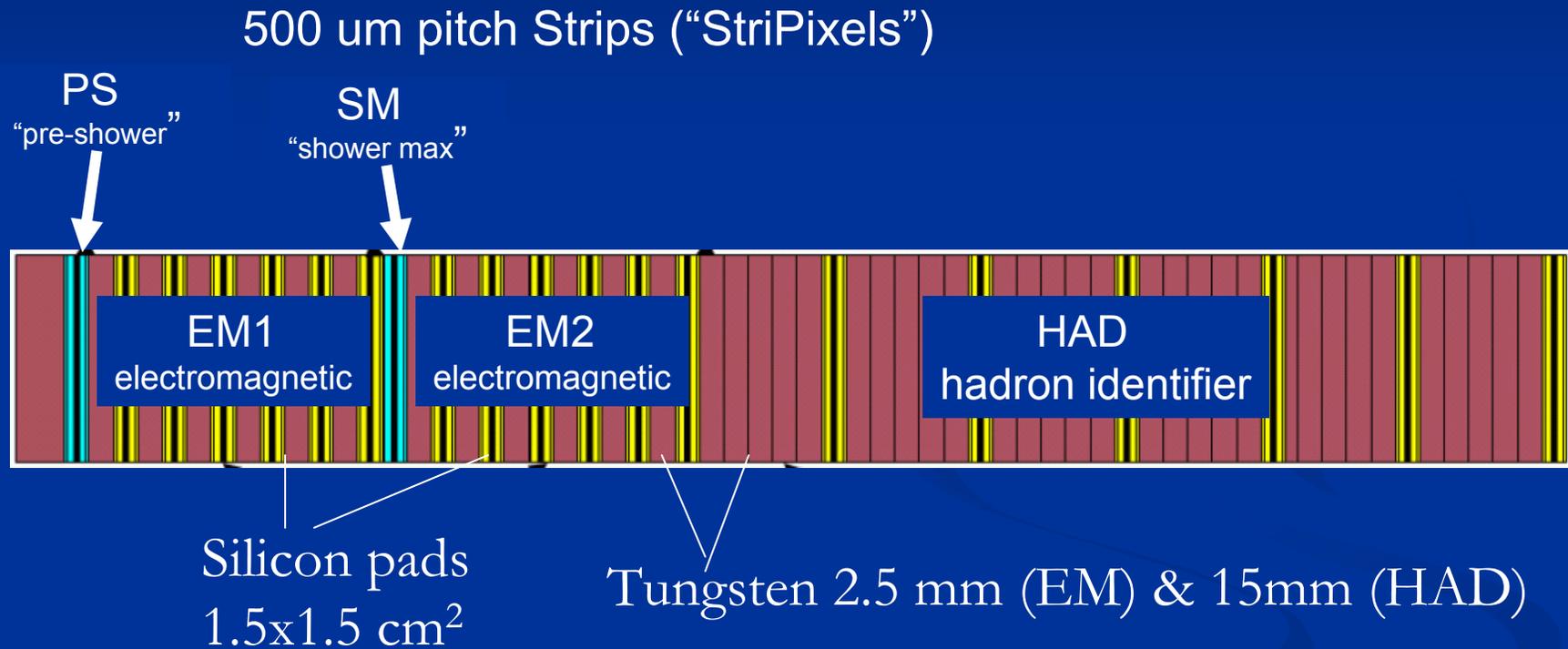
Where is it?



NCC
 $0.9 < \eta < 3.0$

What is it?

The parts of the NCC



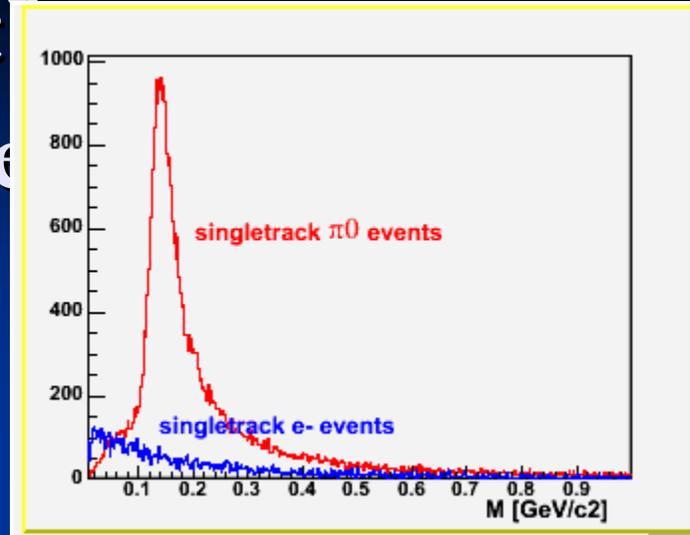
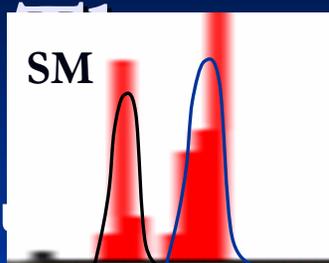
Depth: $42X_0$ ($1.6 \lambda_{\text{ABS}}$)

$$\frac{\Delta E}{E} = 4\% + \frac{18\%}{\sqrt{E}}$$

What is it

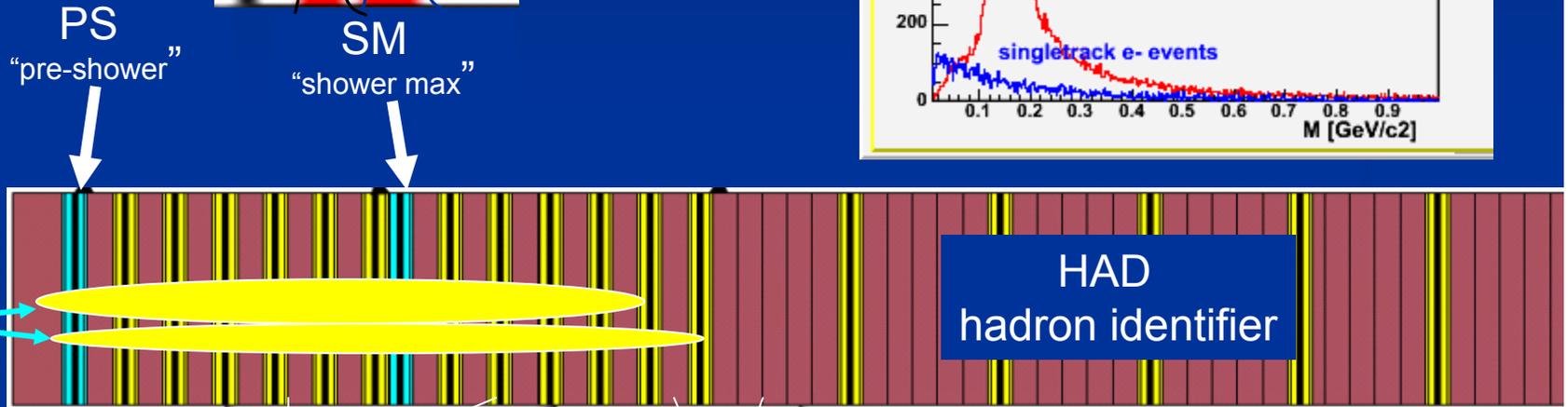
parts of the

The PS and SM
Detectors:
identifying π^0 s



500

s ("StriPixels")



30 GeV
 π^0

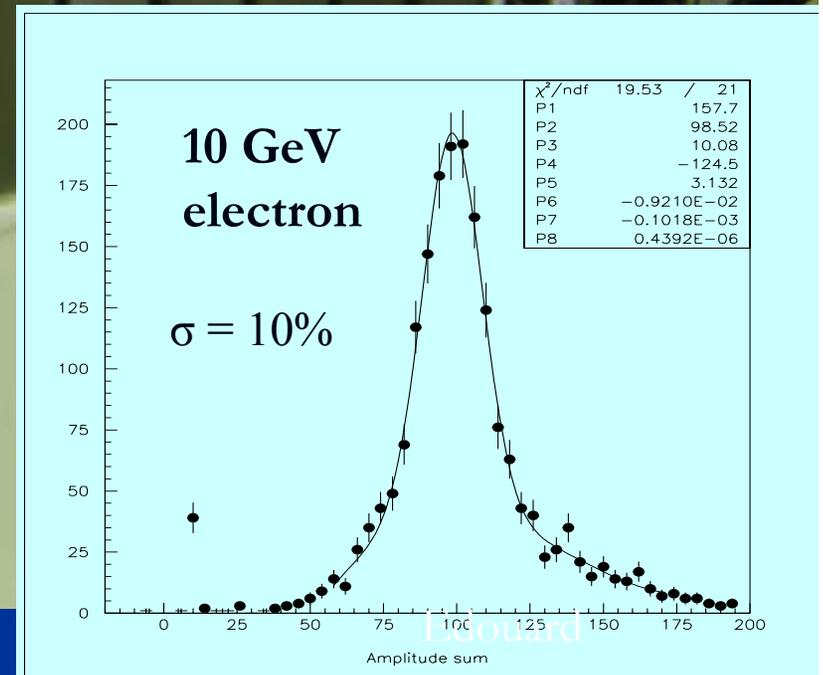
Silicon pads
1.5x1.5 cm²

Tungsten 2.5 mm (EM) & 15mm (HAD)

Depth: $42X_0$ ($1.6 \lambda_{\text{ABS}}$)

$$\frac{\Delta E}{E} = 4\% + \frac{18\%}{\sqrt{E}}$$

What has the NCC crew accomplished? Prototype in Test Beam at Protvino



3/12/2006

in talk by Edouard

R. Seto

How Much and When?

Schedule and cost

- Scope of proposal to DOE:
 - 1 NCC ~ \$4M
 - Begin Funding in FY2008
 - All Critical physics can be done with 1 NCC
- Complete Construction in 2010

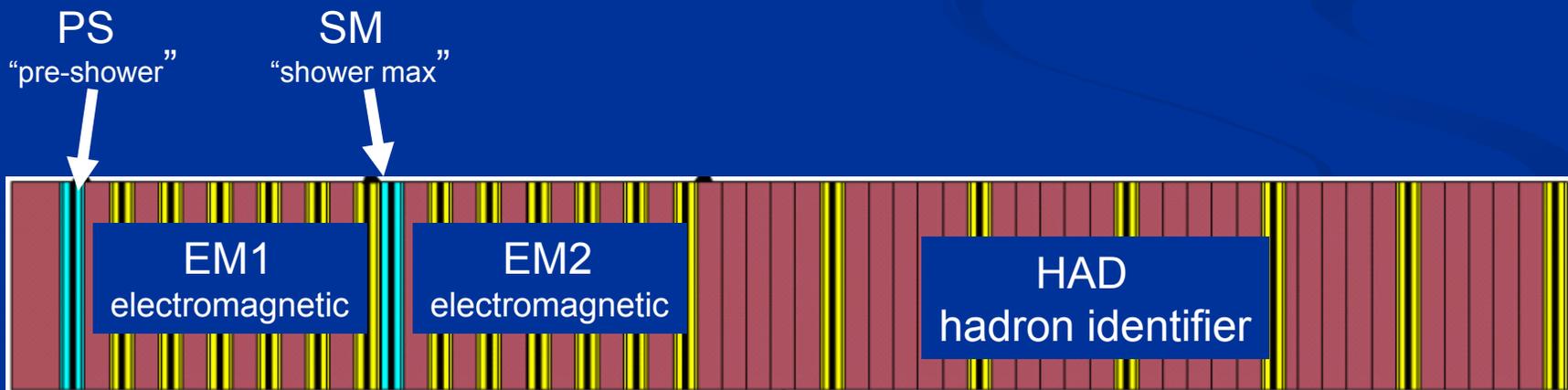


NCC - 2

- Build second NCC from Collaboration funds
 - Actively seeking funds from International Collaborators
 - Japan, Korea, Russia, Czech Republic, ...
- Added Benefits:
 - Factor $\times 2$ in rate for rare processes
 - Exploit muon spectrometer acceptance
 - in pA collisions, can study both sides simultaneously

Conclusion

- NCC provides an outstanding opportunity to address many of the most important questions in QCD
- Scope of proposal to DOE:
 - 1 NCC: ~\$4M
 - Begin Funding in FY2008



Review Schedule

- Overview of NCC project R. Seto
- Heavy ion physics K. Barish
- Spin physics E. Kinney
- Design of the NCC E. Kistenev
- Readout and electronics A. Sukhanov
- Integration and mechanics D. Lynch
- Management, cost, schedule R. Seto