Ultra-Peripheral Collisions

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• Physics in 2000-2001
• Physics prospects till 2004
• RHIC II Assumptions
• $\gamma A$
• $\gamma \gamma$
• A new detector?
Physics 2001

- Topology Trigger
  - ~ 10,000 $\rho^0$
    - 50 X year 2000 sample
- Minimum Bias Trigger
  - ~ 4,300 $\rho^0$
    - 10 X year 2000 sample
- FTPC
  - forward tracks

- Physics:
  - $\rho^0$ cross sections
    - $\sqrt{s}$ scaling
  - $\rho^0$ interference
    - wave function collapse
  - $f_2(1270)$ ?
    - $\gamma\gamma$ produced resonance
  - $J/\Psi$ - handful of events ?
  - $e^+e^-$ pairs
  - 4-prongs
    - $\rho^*(1450/1700)$
      • spectroscopy
      • absorption

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2002 -2004 Prospects

- BBC (+ MWC?)
  - ~ X5 trigger purity
- Higher Luminosity
- More selective min-bias trigger
- Hope for 10X data
- Calorimeter in trigger
  - final states with neutrals
  - high efficiency J/ψ (?)
- MWC (?): can be used as veto and positive trigger

- Physics (partial list)
  - ρ° ρ°
    - correlated production
  - J/ψ, ψ’ (?)
    - gluon shadowing
  - meson spectroscopy
RHIC II assumptions

- 40x luminosity
- Fast readout
  - >> few Hz UPCs to tape
- Improved Particle ID
  - TOF
  - Microvertex detector
    - open charm
  - full calorimetry
γA at RHIC II

- $\rho^0 \rho^0$
  - correlated (stimulated) decay
- $\rho^0 \rho^0 \rho^0$
- high statistics J/$\psi$, $\psi'$ (?)
  - high statistics gluon shadowing
- Y production (with lighter nuclei)
  - shadowing at higher $Q^2$
- meson spectroscopy
  - search for exotic ($J^{PC}=2^{-+}$) mesons
  - search for charm hybrids (ccg)
  - study vector meson-nucleon interactions
- photo-production of open charm
  - Gluon shadowing
γγ at RHIC II

- meson spectroscopy
  - search for exotic mesons (STAR Note 243)
  - charmonium spectroscopy (η_c, χ_s, etc.)
  - search for charm hybrids (c_c)
- γγ → baryon pairs (ΛΛ, etc): baryon form factors
- γγ → τ^+τ^-: decay angle correlation, EPR paradox studies
- γγ → c_c
  - surprisingly, k factors are small and controlled for this reaction
  - requires complete DD reconstruction (low efficiency)
  - measurement of charm quark mass
Triggers Used

L0

- Minbias (ZDC coincidence): AA → A*A* X, X=ρ, ee, f₂,….
- Topological: Coincidence in North-South CTB (no requirement in ZDC). Mainly AA → AA X. Low efficiency (10% for ρ) and very noisy ~1/500
- Topological with ZDC: Very clean but very low efficiency

Topology trigger used with L3

Improving trigger will have a great impact
$\rho$ $p_T$ and $y$ Acceptance and Efficiency

From $\rho$ MC sample

2 Tr, $q=0$, $|z|<200$ cm, $r<15$ cm

+ P4 Trigger

$|y_\rho| < 1$
A New Detector?

- A Detector able to trigger and see low $p_T$ tracks would be beneficial for UPC.
- SVT could bring the $p_T$ cutoff. Could a detector trigger in that area? SVT? A Scintillator Fiber Barrel?
  - ee is seriously limited by low acceptance
  - Final states with low Kaons will improve ($\phi \rightarrow KK$)
  - Background rejection: coincidence CTB and small radius fast detector
Conclusions

- UPC can greatly benefit from high luminosity.
- A detector to trigger low $p_T$ tracks could greatly enhance topology trigger and some areas of the program ($\phi$, $e^+e^-$).
- Completion of current upgrades (EMC, TOF, microVertex) would open new channels.