# J/ψ SUPPRESSION AT SPS AND RHIC IN THE COMOVERS APPROACH

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NA50 DATA SHOW ANOMALOUS SUPPRESSION (i.e. EXTRA SUPPRESSION WITH RESPECT TO NUCLEAR ABSORPTION PRESENT IN pA)

$S_{abs}$ $(\sigma_{abs})$ $\sigma_{abs} \sim 4 \div 7$ mb

INTERPRETATIONS :

DECONFINEMENT : $n_{part}(b,s) > n_{critical}$ $\sigma_{abs} = \infty$

COMOVERS : $S_{co}(\sigma_{co})$ $\sigma_{co} \sim 1$ mb

$$S_{co}(b,s) = \exp\left[-\sigma_{co}\, N_y^{co}(b,s) \ln\left\{\frac{N_y^{co}(b,s)}{N_{pp}}\right\}\right]$$

NA50 DATA ON Pb Pb PRESENT TWO INTERESTING STRUCTURES AT $E_T \sim 40$ AND $E_T \sim 100$ GeV.

HINTS FOR DECONFINEMENT

STRUCTURE AT 40 GeV :

- NOT SO CLEAR WITH MB ANALYSIS

$$(J/\psi / DY)_{MB} = (J/\psi / MB)_{exp} \times (MB/DY)_{theory}$$

- NOT A NECESSARY CONSEQUENCE OF DECONFINEMENT

MOST MODELS FAIL TO REPRODUCE THE DATA AT LOW $E_T$

POSSIBLE ORIGIN : WRONG b ASSIGNEMENT DUE TO CONTRIBUTION TO $E_T$ OF INTRA-NUCLEAR CASCADE ( $E_T$ SHIFTED TO LARGER VALUES )

$$E_T^{NF}(b) = q\, N_{coll.}^{DPM}(b) + k\,[A - n_A(b)]\, 158\ \text{GeV}$$

$k = 1/4000$ , DETERMINED FROM THE BEST FIT TO THE $E_T - E_{ZDC}$ CORRELATION

RESULTS FIG 1 a, 1 b

STRUCTURE AT $E_T \sim 100$ GeV

MOST MODELS GIVE SATURATION AT LARGE $E_T$

POSSIBLE ORIGIN : $E_T \sim 100$ GeV IS CLOSE TO THE KNEE OF THE $E_T$ DISTRIBUTION AND $E_T(b)$ SATURATES. HOWEVER, $E_T$ KEEPS INCREASING DUE TO FLUCTUATIONS

$$F(b) = E_T / E_T^{NF}(b)$$

# PROPOSAL(S)

COMOVERS:

$$N_y^{co}(b,s) \rightarrow N_y^{co}(b,s) \cdot F(b)$$ CFK PRL 85, 2080

DECONFINEMENT:

$$n_{part}(b,s) \rightarrow n_{part}(b,s) \cdot F(b)$$ BDO PRL 85, 4020

(see also Hüfner, Kopeliovitch, Polleri)

IN BOTH CASES CHANGE OF CURVATURE AT THE KNEE OF THE $E_T$ DISTRIBUTION

THE EFFECT IS LARGER IN DECONFINING SCENARIO, BUT TOO LARGE SUPPRESSION BEFORE THE KNEE ($E_T \sim 80$ GeV). [WORSE WITH $(dN/dy)/n_{part}$ INCREASING WITH CENTRALITY]

LARGER SUPPRESSION AT RHIC WITH DECONFINEMENT

WITH COMOVERS SUPPRESSION IS UNDERESTIMATED IN LAST FOUR $E_T$ BINS Fig 1a

(THESE FOUR BINS ONLY KNOWN FROM MB ANALYSIS)

$J/\psi$ / DY VERSUS EZDC, SHOWS NO DISAGREEMENT WITH COMOVERS Fig 1b

(HOWEVER, NOT MEASURED FOR MOST CENTRAL BINS)

NOTE THAT ABOVE PROPOSAL ASSUMES STRONG CORRELATION BETWEEN DIMUON AND CALORIMETER REGIONS

PROPOSAL TO AVOID MOST OF THESE PROBLEMS

PLOT J/ψ /DY VERSUS dN/dy AT $y^* \sim 0$
(SAME AS FOR DIMUON TRIGGER)

ADVANTAGES:

1) NO INTRA-NUCLEAR CASCADE
2) $N_y^{co}(b) = dN/dy(b)$ MEASURED EXPER.
3) FLUCTUATIONS IN $N_y^{co}(b)$ GIVEN BY MULTIPLICITY DISTRIBUTION.

AT SPS WA98 HAS MEASURED $dN^{ch}/dy$ VERSUS $n_{part}$. ALSO AT RHIC

IN DPM ONE CAN COMPUTE A(b) AND B(b):

$$\frac{dN}{dy}(b) = A(b)\, n_{part}(b) + B(b)\, n_{coll}(b)$$

THE RATIO B/A INCREASES WITH $\sqrt{s}$ FIGS 2a,b.

J/ψ SUPPRESSION VERSUS dN/dy:

AT SPS NA50 DIMUON TRIGGER $0 < y^* < 1$
IF dN/dy MEASURED IN $0 < y^* < 1$, ONE COULD PLOT J/ψ / DY VERSUS dN/dy

PREDICTIONS AT SPS AND RHIC, FIGS 3,a,b

( PREDICTION AT RHIC USES SAME NUCLEAR ABSORPTION AS AT SPS — WHICH IS TRUE IN OUR MODEL, BUT IS STRONGER AT RHIC IN KOPELIOVITSH)

# CONCLUSIONS

$J/\psi$ SUPPRESSION AT SPS CAN BE EITHER DECONFINING PHASE TRANS. OR COMOVERS

COMOVERS INTERACTION IS NOT A CONVENTIONAL HADRONIC MECHANISM:

- NOT SEEN IN $pp$ OR $pA$
- $\sigma_{co}$ COULD BE SMALLER AND HAVE NO EFFECT IN AB
- AT THE EARLY STAGES, DENSITIES ARE VERY HIGH AND WE DEAL WITH A PRE-HADRONIC SYSTEM ($\sigma_{co}$ IS JUST AN EFFECTIVE AVERAGE CROSS-SECTION)

RHIC DATA CRUCIAL FOR INTERPRETATION

COMOVERS:

- NO STRUCTURE BEFORE THE KNEE
- AT THE KNEE: $(J/\psi/DY)_{AuAu}/(J/\psi/DY)_{pp} \sim 0.1$

DECONFINEMENT:

- STRUCTURE(S) BEFORE THE KNEE? DEPENDS ON THE MODEL
- AT THE KNEE: $(J/\psi/DY)_{AuAu}/(J/\psi/DY)_{pp} \simeq 0.05$ SIGNIFICANTLY SMALLER

- RAPIDITY DEPENDENCE VERY DIFFERENT AT SPS AND RHIC (Kopeliovich + Polleri)
- $J/\psi$ IS A MOST INTERESTING SIGNAL!

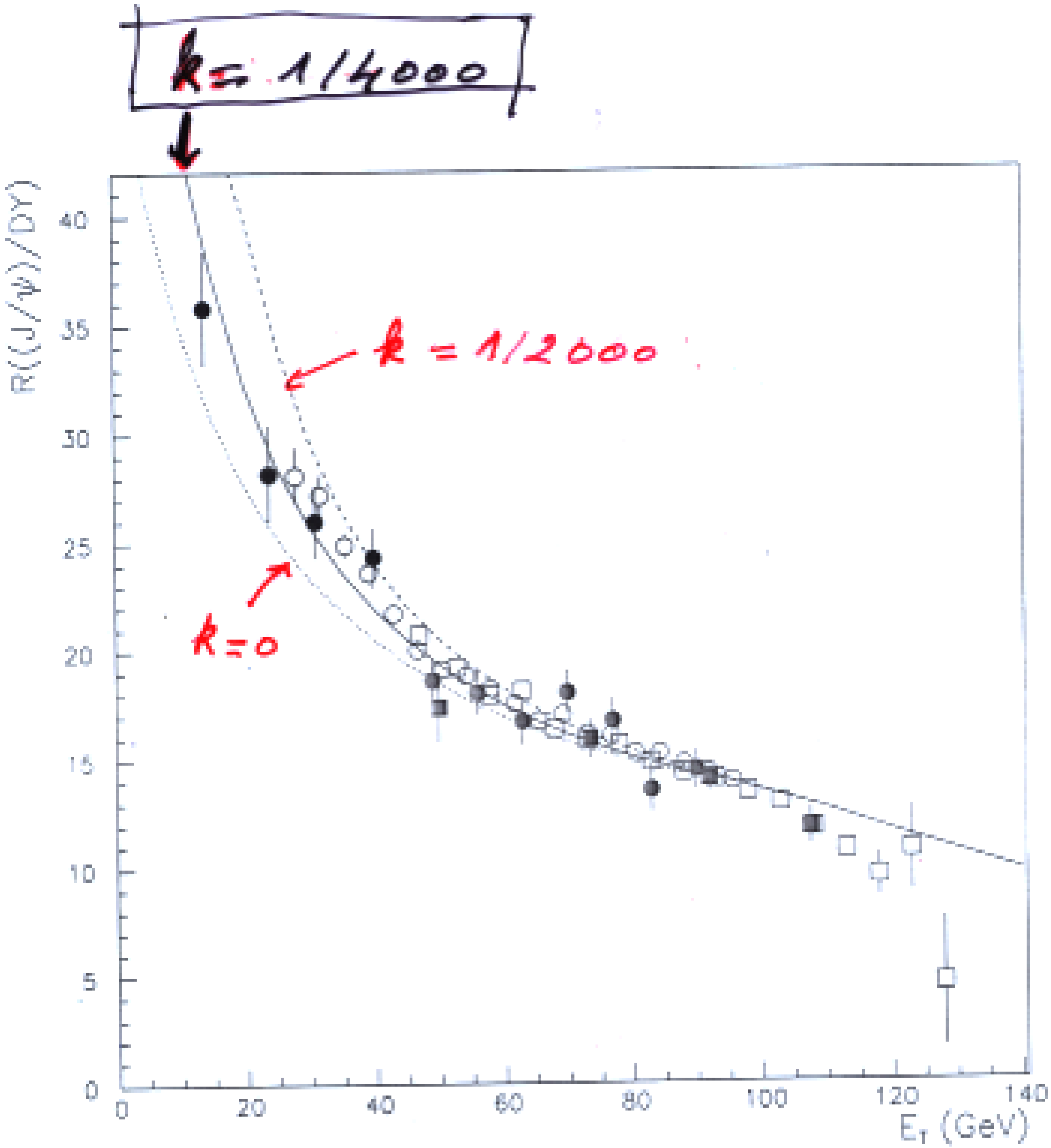


Fig 1a., Capella, Ferreiro, Kaidalov
PRL 85, 2080 (2000)

$\sigma_{abs} = 4.5\,mb \quad \sigma_{co} = 1\,mb$

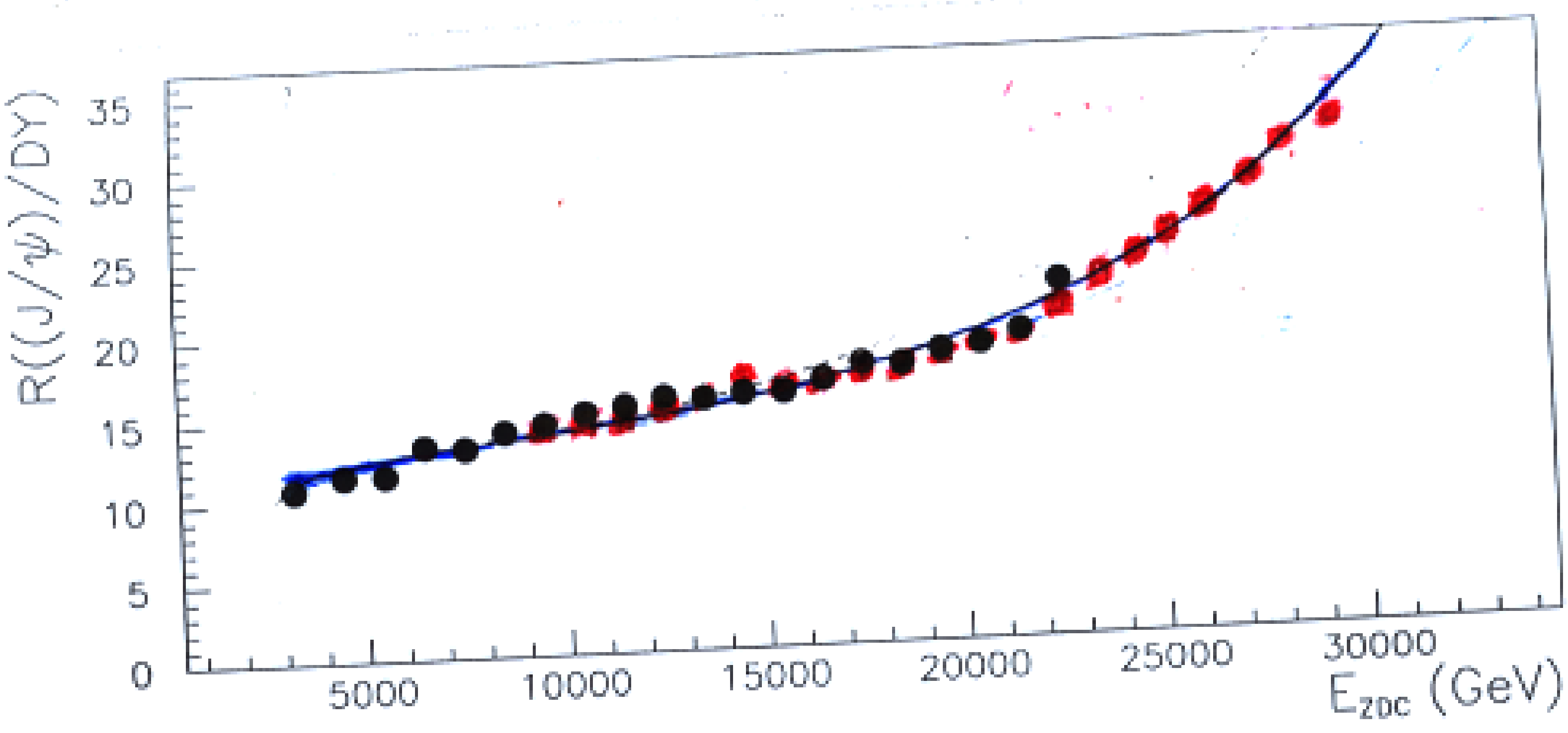


FIG 16

NA50: ■ Pb-Pb 1998 MB ● PbPb 1996 MB

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CONCLUSION ON LOW $E_T$ (LARGE EZDC):

- MODELS WHICH UNDERESTIMATE R VERSUS $E_T$ PROBABLY OK FOR R VERSUS EZDC.
- MODELS WHICH REPRODUCE R VERSUS $E_T$ WELL, SHOULD FAIL TO REPRODUCE R VERSUS EZDC

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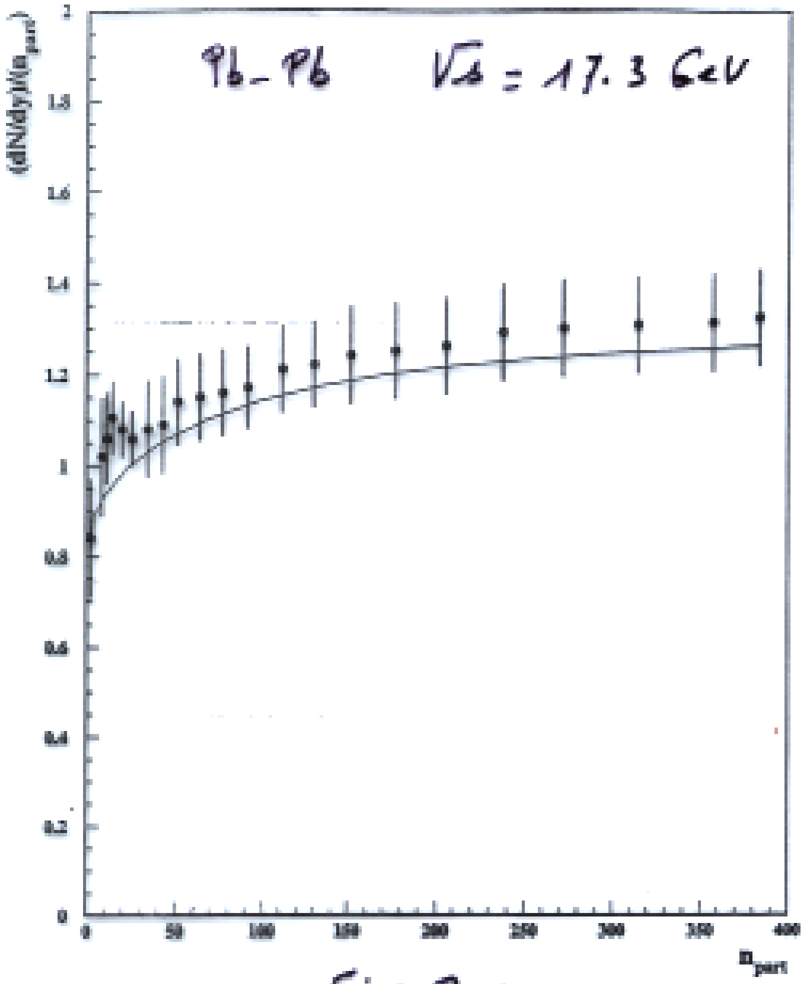


Fig 2a

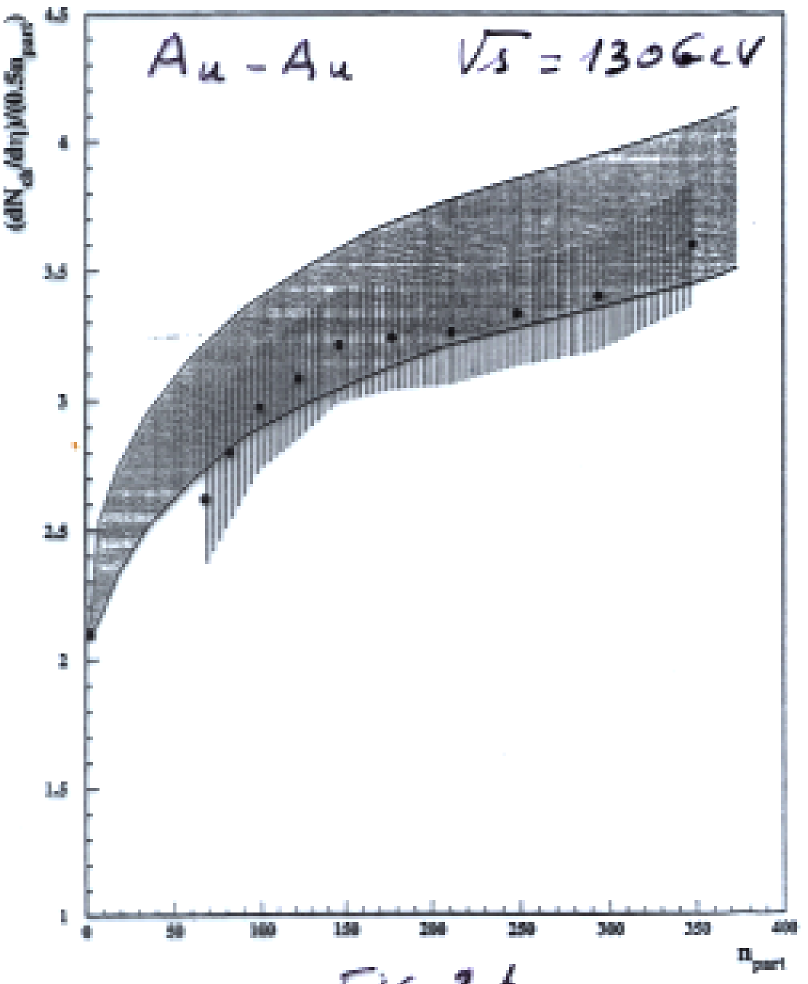


Fig 2b

A.C + E.G. Ferreiro + D. Sousa

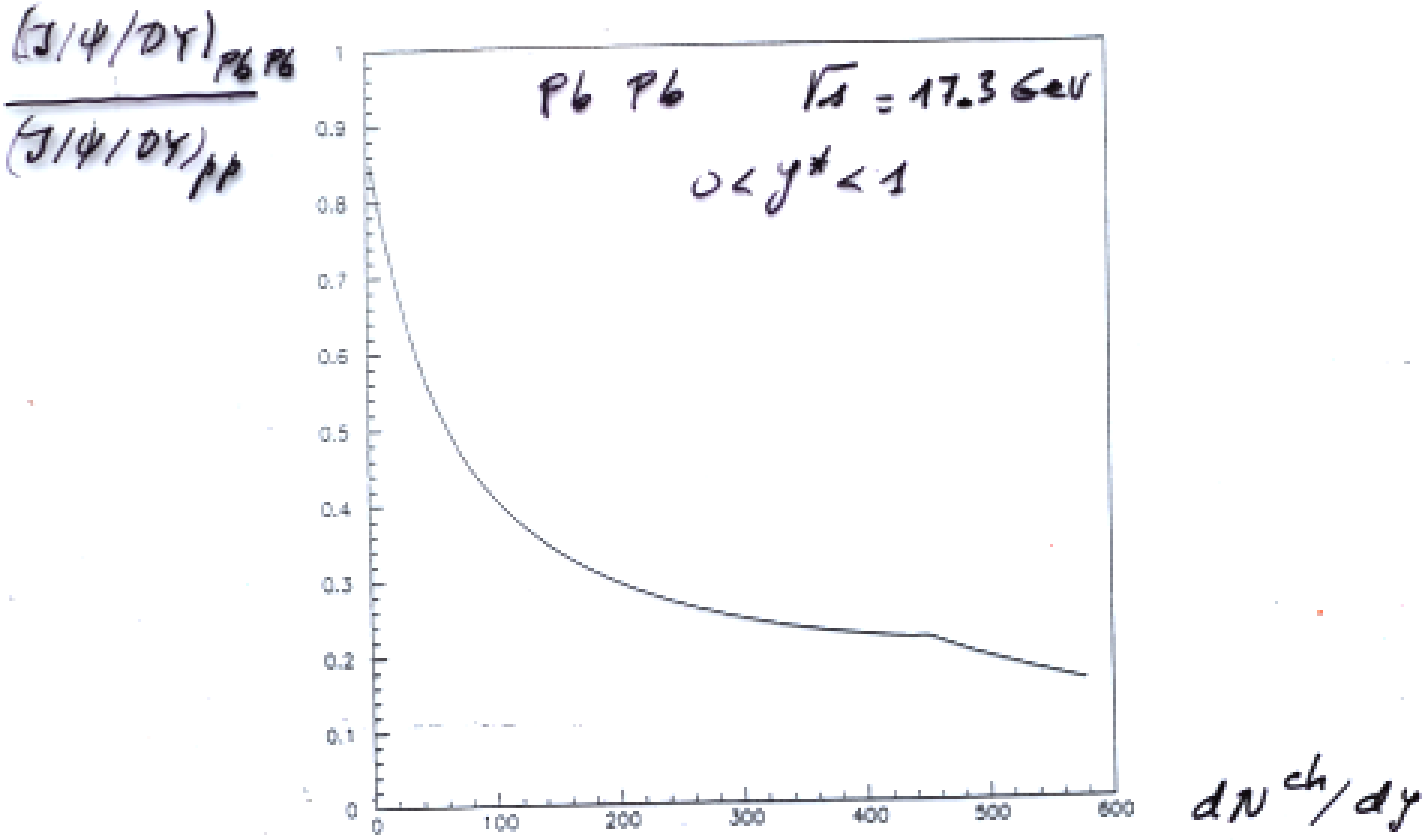


Fig 3a

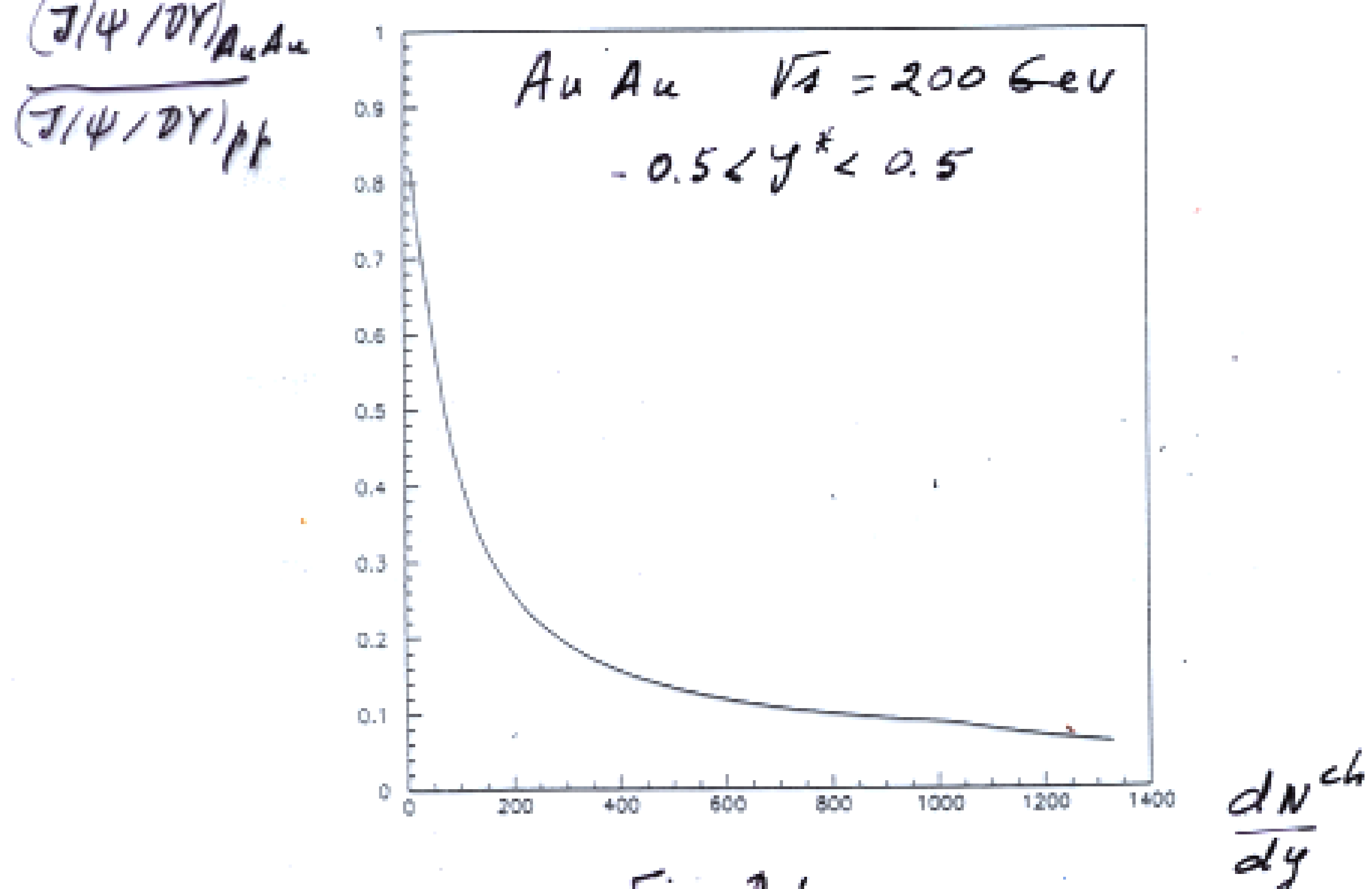


Fig 3b