A fundamental test of the Higgs Yukawa coupling at RHIC in A+A collisions

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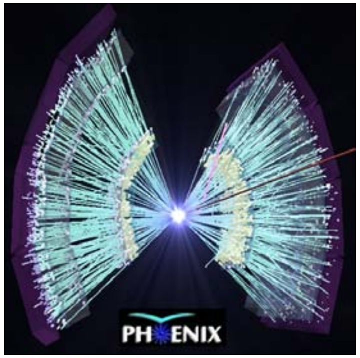
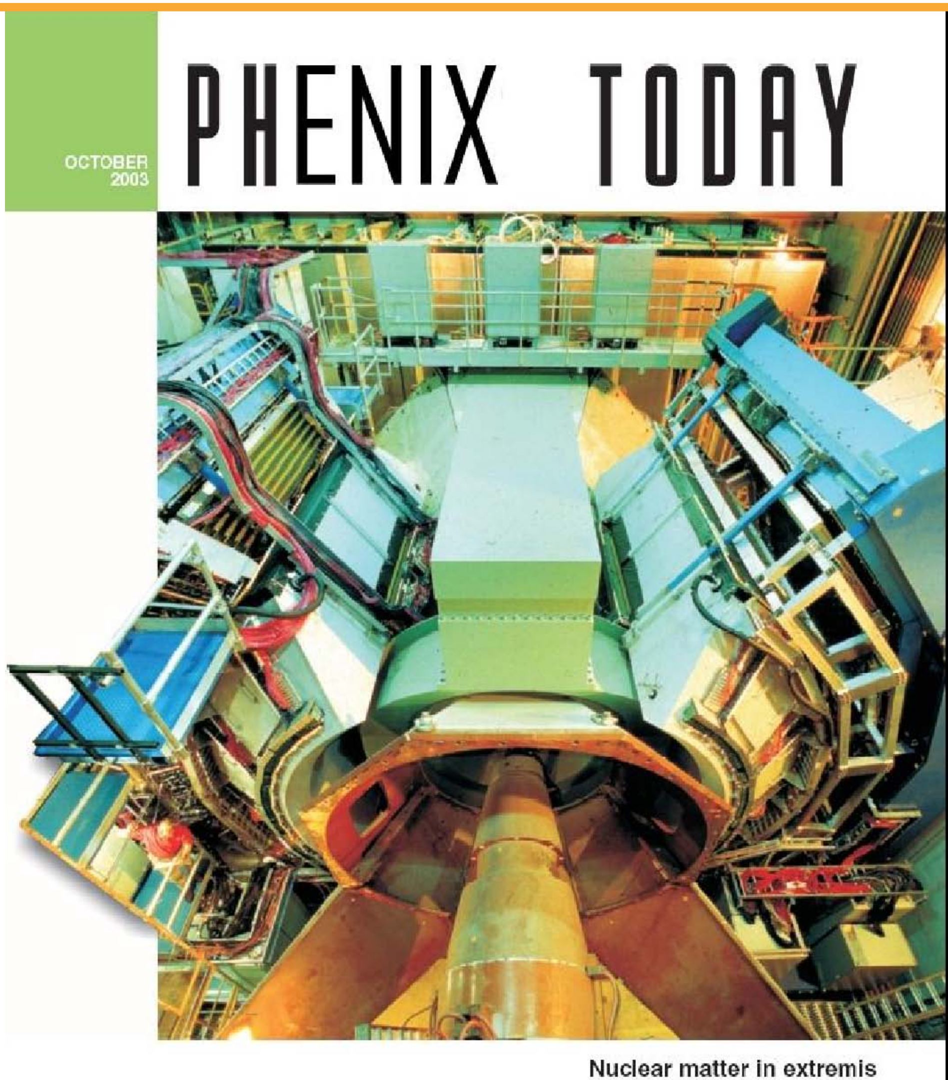
Upton, NY 11973 USA



WWND2010
Ocho Rios, Jamaica,WI
January 7, 2010

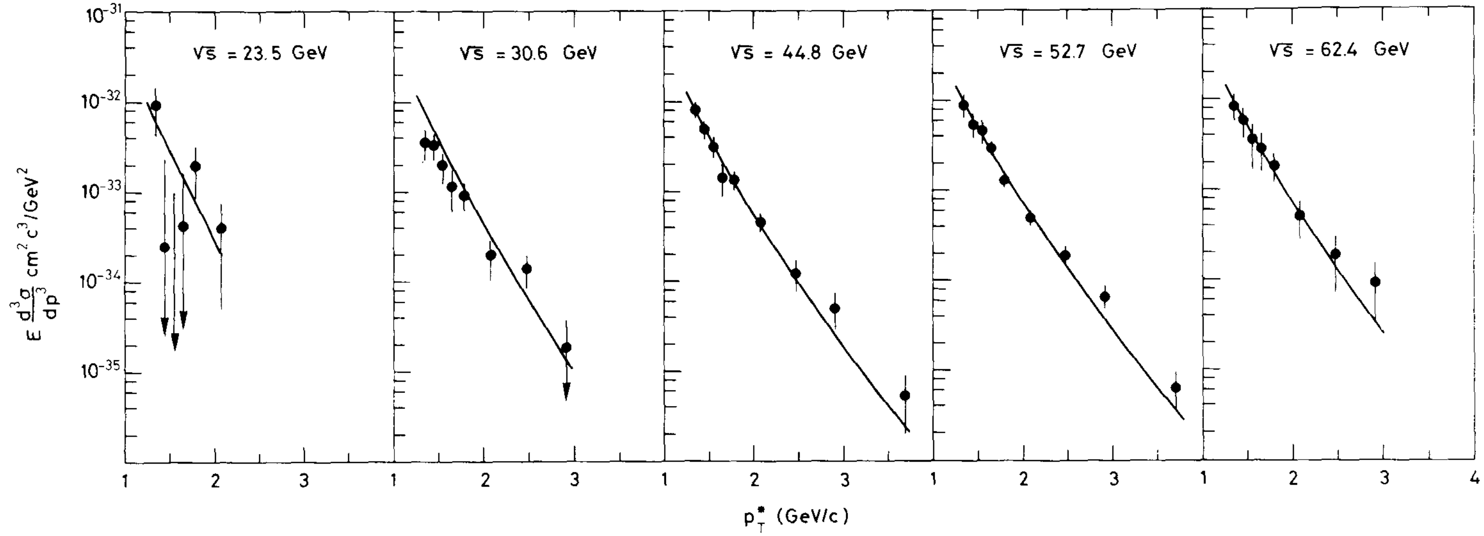
"Mike, is there a 'real collider detector' at RHIC?"---J. Steinberger



- **PHENIX is picturesque because it is not your father's solenoid collider detector**
- **Special purpose detector designed and built to measure *rare processes* involving *leptons and photons* at the *highest luminosities*.**

✓ *possibility of zero magnetic field on axis*
✓ *minimum of material in aperture 0.4% X_o*
✓ *EMCAL RICH $e^{\pm}$ i.d. and lvl-1 trigger*
- *γ π^0 separation up to $p_T \sim 25$ GeV/c*
- *EMCAL and precision TOF for $h^{\pm}$ pid*

CCRS-1974 Discovery of direct $e^{\pm} \sim 10^{-4} \pi^{\pm}$ at ISR not due to internal conversion of direct photons



CCRS PLB**53**(1974)212; NPB**113**(1976)189

Data points $(e^+ + e^-)/2$ lines $10^{-4} (\pi^+ + \pi^-)/2$

- Farrar and Frautschi PRL**36**(1976)1017 proposed that direct leptons are due to internal conversion of direct photons with $\gamma/\pi \sim$10-20% to e^+e^- ($d\sigma/dm \sim 1/m$) for p_T>1.3 GeV/c. CCRS looks, finds very few events, sets limits excluding this.

95% confidence level upper limits for a particle of mass m, or a mass continuum, which decays to e^+e^- with branching ratio B, at $\sqrt{s}$ = 52.7 GeV/c

Mass (GeV/c^2)	$B \frac{d\sigma}{dy}$ ($p_T^* > 1.3$ GeV/c) (cm^2)	Fraction of single electron signal
0.400	5.54×10^{-33}	0.064
0.500	8.37×10^{-33}	0.104
0.600	1.64×10^{-32}	0.178

p.s. these direct $e^{\pm}$ are due to semi-leptonic decay of charm particles not discovered until 1976, 2 year later: Hinchliffe and Llewellyn-Smith NPB**114**(1976)45

CCRS e/π Lepton/Photon SLAC 1975

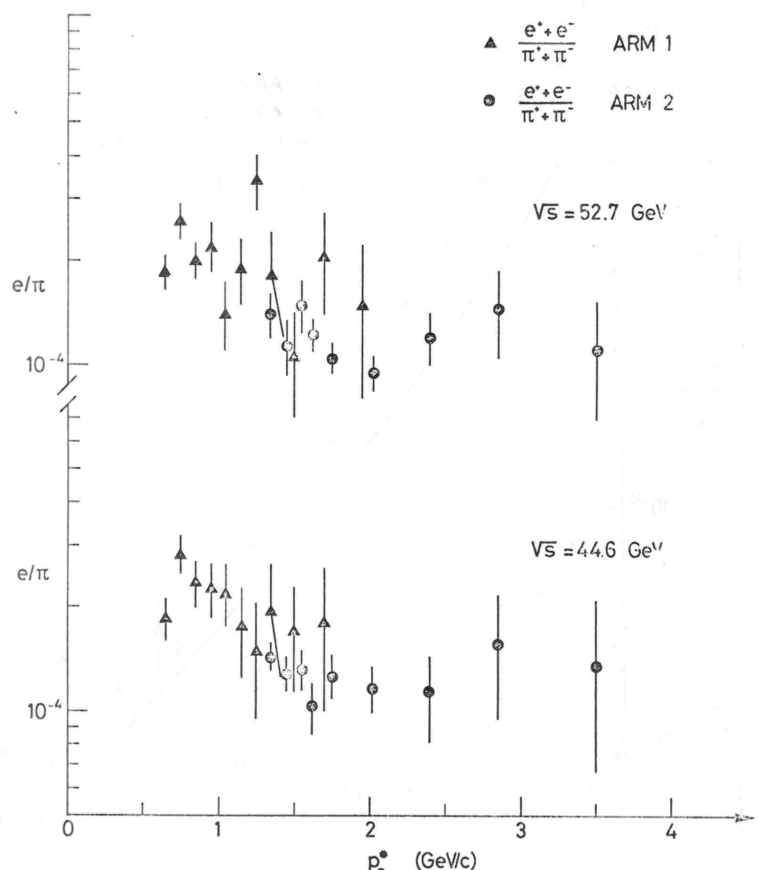


FIG. 6

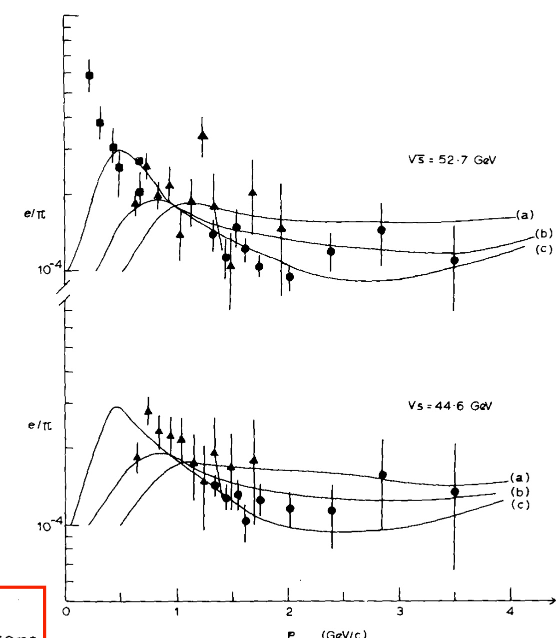
Nuclear Physics B114 (1976) 45–60

"CHARM" AS A POSSIBLE SOURCE OF PROMPT LEPTONS

I. HINCHLIFFE and C.H. LLEWELLYN SMITH
Department of Theoretical Physics, University of Oxford, England

Received 13 April 1976

We investigate the possibility that prompt leptons are due to the production and decay of charmed particles. The small x data is easily accommodated but there are serious difficulties at large x which we discuss. Consequences of the mechanism are also discussed.



parison of the central region data with our fit; ▲ 90° arm 1 ref. [19], ● 90° arm 2
30° ref. [21]. The theoretical curves are $\rho\omega\phi$ and ψ including (a) D(2.2) → K$e\nu$,
K$e\nu$, (c) D(1.8) → K*$e\nu$.

Large x data: We are aware of experiments with 28 GeV [26], 300 GeV [27] and 400 GeV [28] protons at various non-zero values of $x = 2p_e/\sqrt{s}$ up to nearly one (it is hard to discern any smooth connection between the different data). These are all "zero degree" experiments but, because of multiple scattering, all receive contributions from muons produced with transverse momenta up to 400 MeV or more. Since phase space increases like p_T, appreciably values of e/π are possible in the central region despite the sharp drop as

Bourquin-Gaillard (1976)-the first cocktail

Nuclear Physics B114 (1976) 334–364

A SIMPLE PHENOMENOLOGICAL DESCRIPTION OF HADRON PRODUCTION

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J.-M. GAILLARD
Laboratoire de l'Accélérateur Linéaire, Orsay, France
CERN, Geneva, Switzerland

Received 13 May 1976

The inclusive production distributions of the non-leading particles in pp collisions are fitted by a simple general formula. The contributions from the ρ^0, ω, ϕ, and J/ψ decays to the direct lepton spectra are calculated. Possible contributions from the semi-leptonic decay of the conjectured charmed meson are discussed.

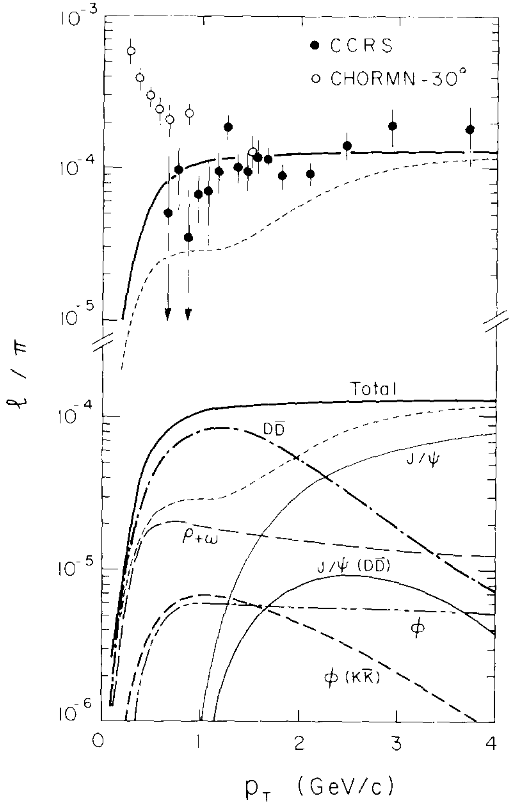

Fig. 17. The contributions of the various decays to the ℓ/π ratio as a function of p_T for $\sqrt{s}$ = 53 GeV and θ = 90°. In the top part of the figure the data points are compared to the sum of the contributions with DD (full curve) and without (dashed curve). For p_T < 1.3 GeV/c the CCRS points correspond effectively to an average between the 53 GeV and 45 GeV data.

note: "conjectured charm meson" whose discovery was published in August1976 PRL37(1976)255 [but received 14 June 1975!!!!]

What about those low p_T points that don't fit. Does that remind you of something?

One of the STARs of 1976-CHORMN-30^o

Volume 60B, number 5 PHYSICS LETTERS 16 February 1976

EXPERIMENTAL OBSERVATION OF A COPIOUS YIELD OF ELECTRONS WITH SMALL TRANSVERSE MOMENTA IN pp COLLISIONS AT HIGH ENERGIES

L. BAUM, M.M. BLOCK, B. COUCHMAN, J. CRAWFORD, A. DEREVSHCHIKOV, D. DIBITONTO, I. GOLUTVIN, H. HILSCHER, J. IRION, A. KERNAN, V. KUKHTIN, J. LAYTER, W. MARSH, P. McINTYRE, F. MULLER, B. NAROSKA, M. NUSSBAUM*, A. ORKIN-LECOURTOIS**, L. ROSSI, C. RUBBIA, D. SCHINZEL, B. SHEN, A. STAUDE, G. TARNOPOLSKY and R. VOSS

University of California at Riverside, Riverside, Cal., USA
CERN, Geneva, Switzerland
Harvard University, Cambridge, Mass., USA
Sektion Physik der Universität, Munich, Germany
Northwestern University, Evanston, Ill., USA

Received 15 January 1976

Inclusive electron and positron emission have been observed for $\theta_{cm} = 30°$ and $s = 2800$ GeV^2 at the CERN Intersecting Storage Rings (ISR). Over the transverse momentum interval 0.2 GeV/$c < p_T <$ 1.5 GeV/c, electrons and positrons, which are equal in number within the experimental accuracies, appear to grow with respect to other particles (pions) approximately like $1/p_T$. We are unable to explain their number and p_T-dependence in terms of "conventional" mechanisms.

Lots of experiments not designed for the purpose wanted to get into the act. This is only one example, see Bourquin-Gaillard for more

A Typical Paper on charm c.1990

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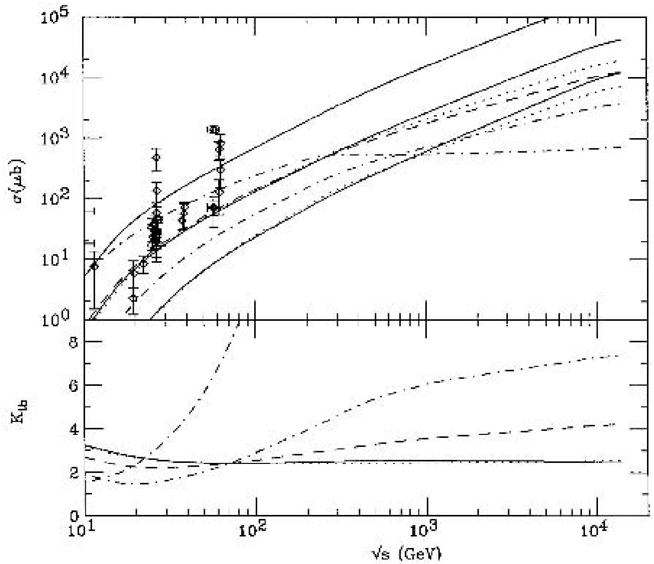
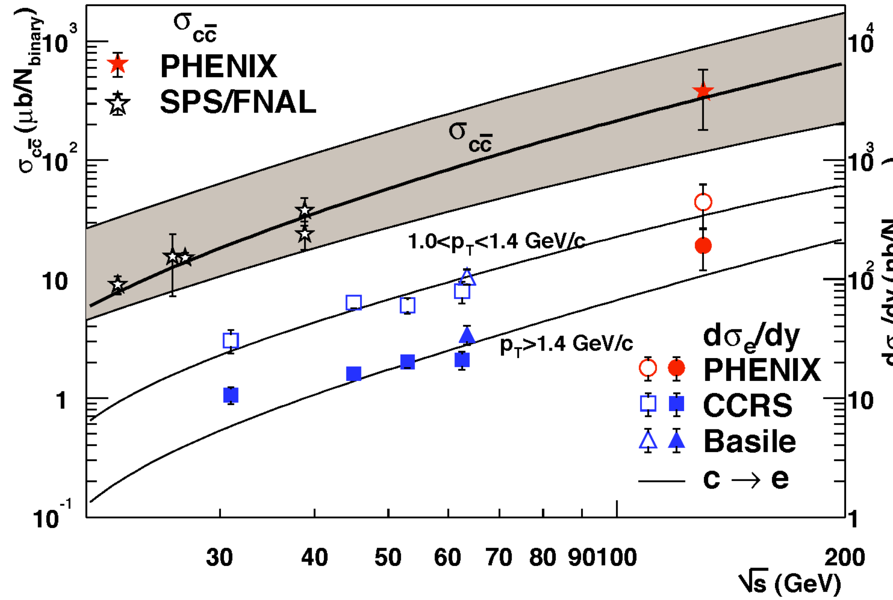


Fig. 3. The variation in $\sigma^{tot}_{c\bar{c}}(S)$ and $K_{th}(S)$ with parton density, m_c and μ. In (**a**) the three solid curves are calculated with MRS D −′ densities and $m_c = 1.2$ GeV, $\mu_R = m_c/2$ (upper); $m_c = 1.2$ GeV, $\mu_R = 2m_c$ (middle); and $m_c = 1.8$ GeV, $\mu_R = 2m_c$ (lower). The other calculations are with the GRV HO densities. The dot-dashed and dotted curves show $\mu = m_c/2$ and $\mu = 2m_c$. The upper set has ... urve is ... is MRS ... HO, ... HO,

e.g R. Vogt, ZPC**71**(1996)475
No citations to the experiments!
Tavernier RPP**50**(1987)1439
doesn't even cite CCRS since
1974 was before charm or J/ψ
were discovered.



A fairer comparison from
PHENIX PRL**88**(2002) 192303

Note that CCRS (1974) and Basile, NuovoCimentoA**65**(1981)421 agree with each other and theory

Fixed target finally got it right with Si VTX

From J.A.Appel ARNPS **42**(1992)367

HADROPRODUCTION OF CHARM 371

2. A BRIEF HISTORY OF MEASUREMENTS

The early years of open charm hadroproduction were limited by the capability of detectors in the face of difficult experimental conditions. Among the difficulties (still faced today) are (*a*) the small fractional charm production cross section (one $c\bar{c}$ pair event per 10^3 interactions, typically), (*b*) the high multiplicity of particles in the charm events, and (*c*) the small branching ratios to specific final states (typically 1–10%). As it turned out, many of the more reliable early measurements were indirect. Among these were the observations of prompt leptons resulting from the semileptonic decays of charm particles. Most of these early experiments had goals other than charm production and decay as their primary motivation. Nevertheless, leptons with intermediate transverse momentum have been interpreted to come from charm decay. Electrons and muons were observed at rates of 10^{-4} to 10^{-3} of the charged pion at fixed-target and collider energies. Muons and neutrinos were also measured in beam dump experiments. The physics results, charm cross sections times average branching ratios, were extrapolated from total observed lepton rates under varied experimental conditions. These observed rates typically included much larger numbers of leptons from photon conversions or decays of particles containing strange, not charm, quarks.

HADROPRODUCTION OF CHARM 375

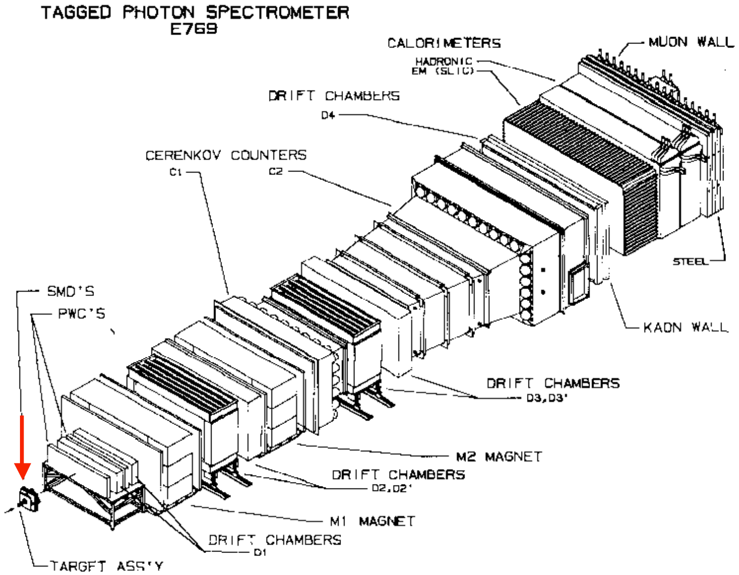


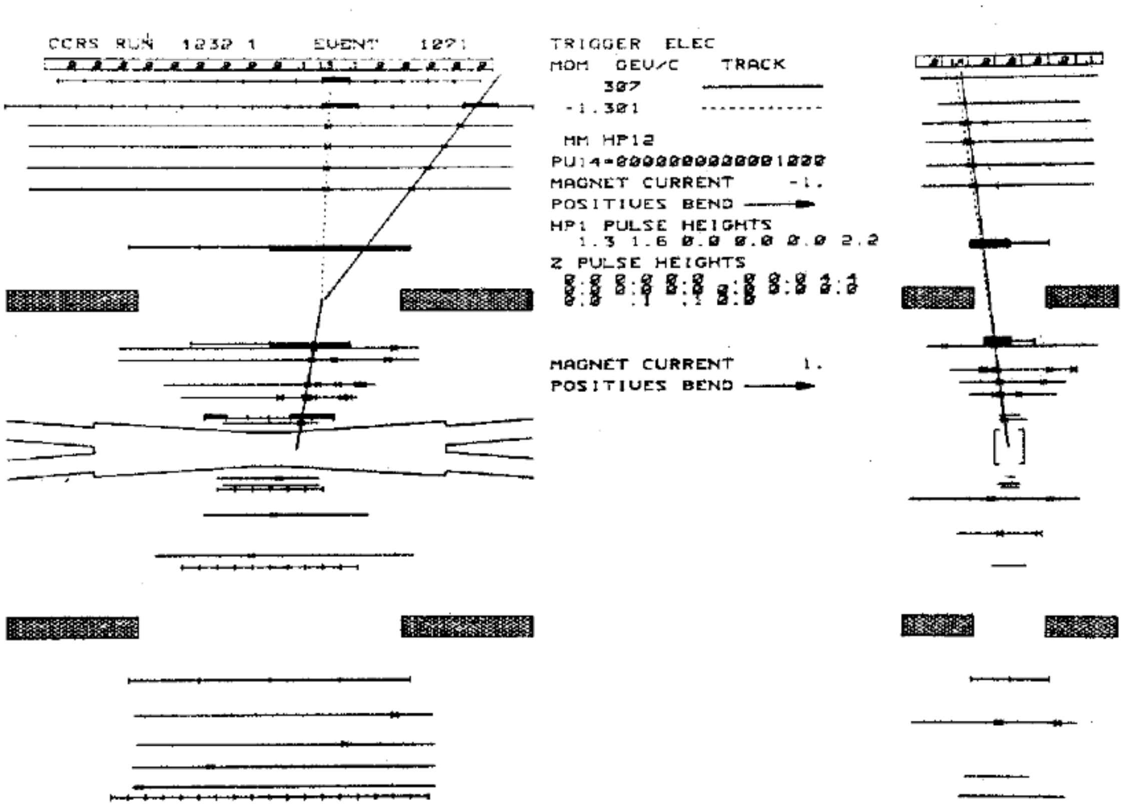
Figure 2 The Fermilab Tagged Photon Spectrometer, a typical apparatus for multi-particle detection in a fixed-target experiment.

stream tracking to that achieved with the higher precision tracking near the target. Wire chamber tracking has poor position resolution compared to solid-state devices, but comparable angular resolution.

The limited spatial extent of the precision trackers limits the size of the useful target. Thus, these experiments all have small luminous re-

Zero field on axis avoids losing one e± from a pair

From CCRS PL**B53**, 212 (1974) Discovery of direct e± at the CERN-ISR (S.N.White's thesis)



F.W. Büsser et al. / Electrons at the ISR

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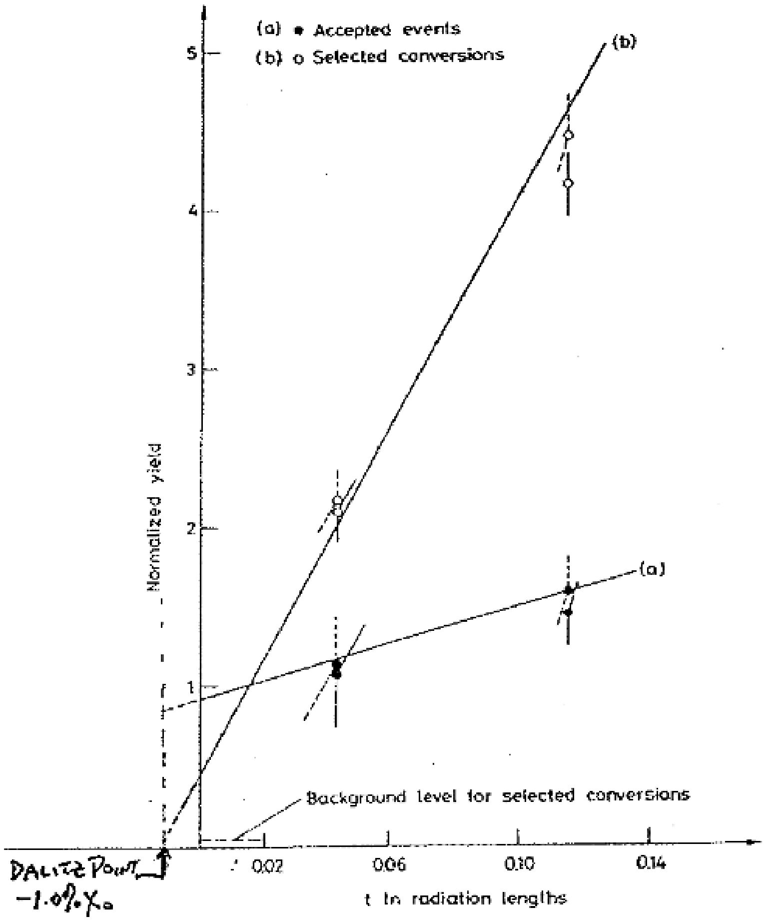
Fig. 2. Example of an identified e^+e^- pair event, which opens up in the magnet.

Zero field on beam axis is best for this measurement can detect or reject conversion or Dalitz pairs before they open and watch them open in bending plane of magnet which is off the axis.

Converter run separates photonic from non-photonic e$^{\pm}$

From CCRS PL**B53**, 212 (1974) Discovery of direct e$^{\pm}$ at the CERN-ISR (S.N.White's thesis)



- Background is measured in the signal channel single e$^{\pm}$ and not calculated from measured pairs.
- Low mass e$^+$e$^-$ pairs are detected so can calculate their negligible contribution to the signal. Selected conversions extrapolate to 0 at the Dalitz point to check the method.

✓ Probability of internal + external conversion per photon is

$$\frac{e^-}{\gamma} = \frac{e^+}{\gamma} = \frac{\delta_2}{2} + \frac{t}{\frac{9}{7}X_0}$$

where $\delta_2/2$=Dalitz (internal conversion) branching ratio per photon=0.6% π^0, 0.8% for $\eta\rightarrow\gamma\gamma$. Extrapolates to zero for a photonic source at the Dalitz point [essentially same for π^0 and(η)]

$$\frac{t}{X_0} = -\frac{9}{7}\times\frac{\delta_2}{2} = -0.008\ (-0.010)$$

Conversion e± spectrum from Bethe & Heitler, Proc.Roy.Soc.A146(1934)83

Stopping of Fast Particles and Creation of Electron Pairs 107

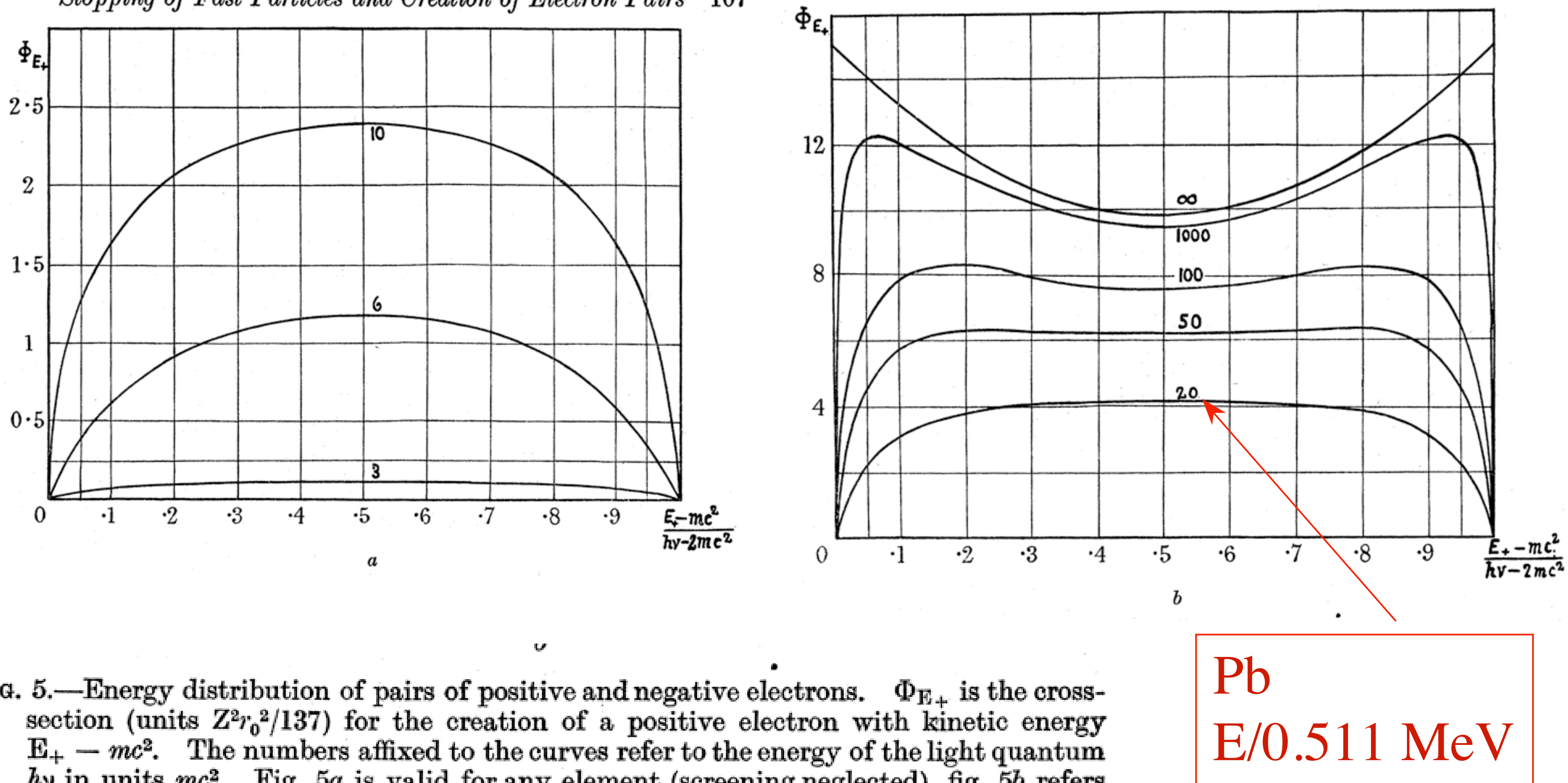


FIG. 5.—Energy distribution of pairs of positive and negative electrons. Φ_{E_+} is the cross-section (units $Z^2 r_0{}^2/137$) for the creation of a positive electron with kinetic energy $E_+ - mc^2$. The numbers affixed to the curves refer to the energy of the light quantum $h\nu$ in units mc^2. Fig. 5*a* is valid for any element (screening neglected), fig. 5*b* refers to lead.

J/Psi and direct $e^{\pm}$

First J/Ψ at ISR

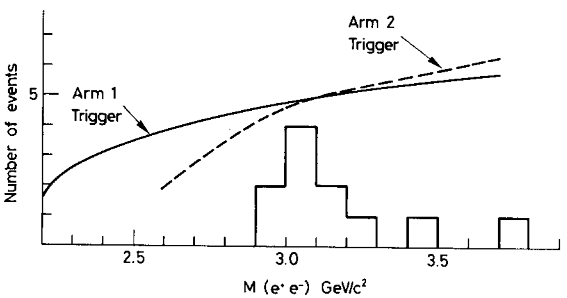
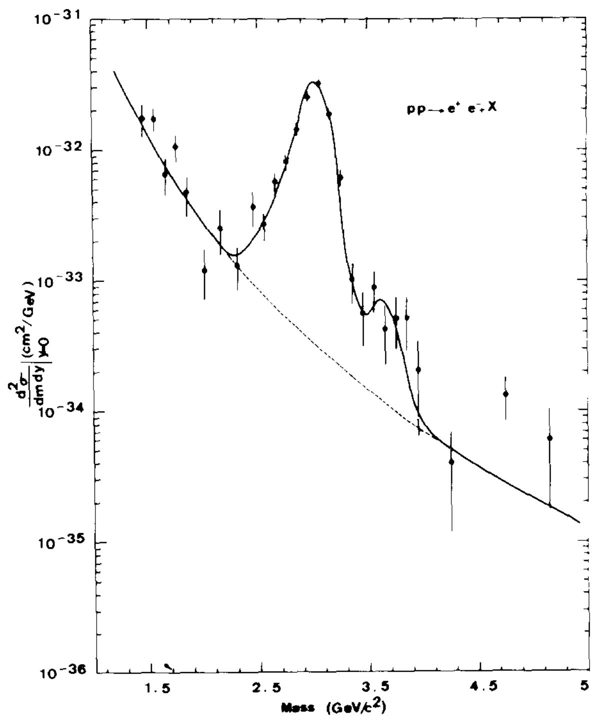


FIG. 2

Fig. 2. Invariant mass distribution for the observed e^+e^- pairs. The curves represent the shapes of the acceptance, as a function of the e^+e^- invariant mass value, for the Arm 1 and Arm 2 triggers, respectively.

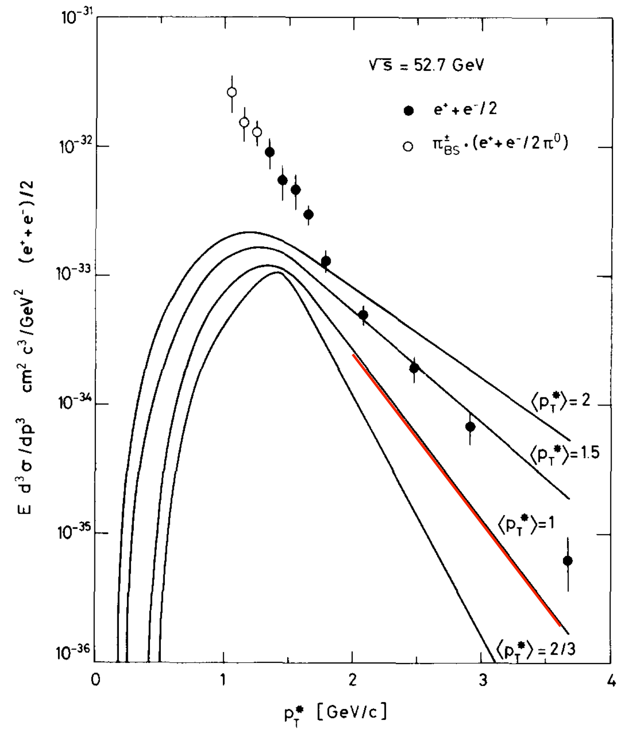
Best

A.G. Clark et al. / Electron pair production at the ISR



Not cause of direct $e^{\pm}$

F.W. Büsser et al. / Electrons at the ISR



CCRS PLB**56**(1975)482
2nd J/Ψ in Europe

CSZ NPB**142**(1978)29
$\langle p_T \rangle = 1.10 \pm 0.05$ GeV/c

CCRS NPB**113**(1976)189
direct $e^{\pm}$ not due to J/Ψ

Sam Ting Nobel Lecture 11Dec 1976

V. I was considering announcing our results during the retirement ceremony for V. F. Weisskopf, who had helped us a great deal during the course of many of our experiments. This ceremony was to be held on 17 and 18 October 1974. I postponed the announcement. for two reasons. First, there were speculations on high mass e^+e^-pair production from proton-proton collisions as coming from a two-step process : $p+N\rightarrow\pi+\dots$, where the pion undergoes a second collision $\pi+N\rightarrow e^++e^-+\dots$. This could be checked by a measurement based on target thickness. The yield from a two-step process would

increase quadratically with target thickness, whereas for a one-step process the yield increases linearly. This was quickly done, as described in point (iv) above.

Most important, we realized that there were earlier Brookhaven measurements [24] of direct production of muons and pions in nucleon-nucleon collisions which gave the μ/π ratio as 10^{-4}, a mysterious ratio that seemed not to change from 2000 GeV at the ISR down to 30 GeV. This value was an order of magnitude larger than theoretically expected in terms of the three known vector mesons, p, ω,φ, which at that time were the only possible "intermediaries" between the strong and electromagnetic interactions. We then added the J meson to the three and found that the linear combination of the four vector mesons could not explain the μ^-/π^- ratio either. This I took as an indication that something exciting might be just around the corner, so I decided that we should make a direct measurement of this number. Since we could not measure the μ/π ratio with our spectrometer, we decided to look into the possibility of investigating the e^-/x^- ratio.

Jim Cronin, another Nobel Laureate (but incorrect on this issue)

Proc 1977 Int. Sym. Lepton-Photon Interactions, Hamburg

HADRON INDUCED LEPTONS AND PHOTONS

James W. Cronin
Enrico Fermi Institute, University of Chicago
Chicago, Illinois, 60637 U.S.A.

ABSTRACT

A review of direct production of leptons and photons in hadron-hadron collisions is presented. Production of lepton pairs with large mass is well accounted for by the Drell-Yan process. The origin of direct single leptons is principally due to the production of lepton pairs. A dominant source of lepton pairs is at low effective mass, m < 600 MeV/c.

III. SINGLE LEPTON PRODUCTION

Since 1974 direct single lepton production has been the subject of intensive experimental investigation. The important qualitative observation has been that direct electron or muon production for $p_\perp > 1$ GeV/c and large c.m. angle is approximately 10^{-4} of pion production. We shall argue that a very large fraction of the observed single muons have their source as one member of a lepton pair. These sources are best studied in experiments in which both members of the pair can be observed, or if a neutrino accompanies the lepton that the neutrino is detected indirectly through an absence of total energy balance. We believe that in the future, experiments which observe only a single lepton are going to yield little new information. We have come to understand the single lepton problem only through the study of lepton pairs.

Cronin conclusions, then discussion:

V. CONCLUSIONS

1. The Drell-Yan mechanism provides a qualitative and nearly quantitative description for lepton pair production with mass > 4 GeV/c^2.

2. Direct single lepton production is consistent with a source which is lepton pair production. An important ingredient in this discussion is the existence of a significant low mass dilepton continuum which is an order of magnitude larger than expected from the Drell-Yan process.

3. A dedicated experiment will be required to establish definitively a significant direct photon yield induced by hadrons.

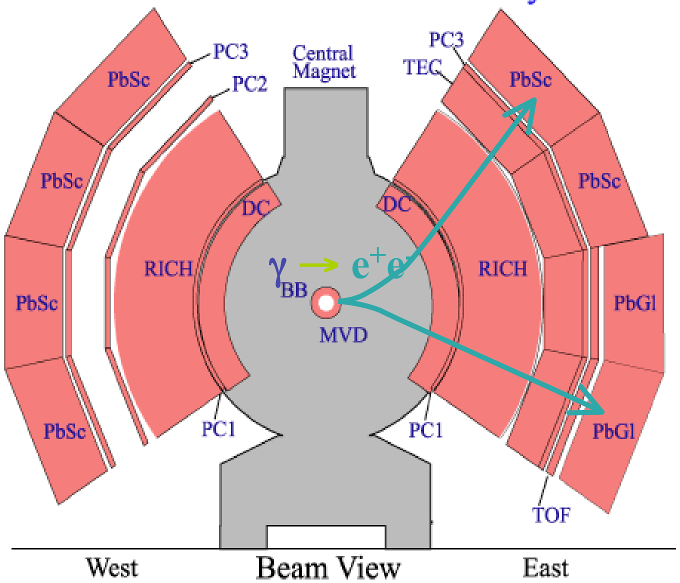
DISCUSSION

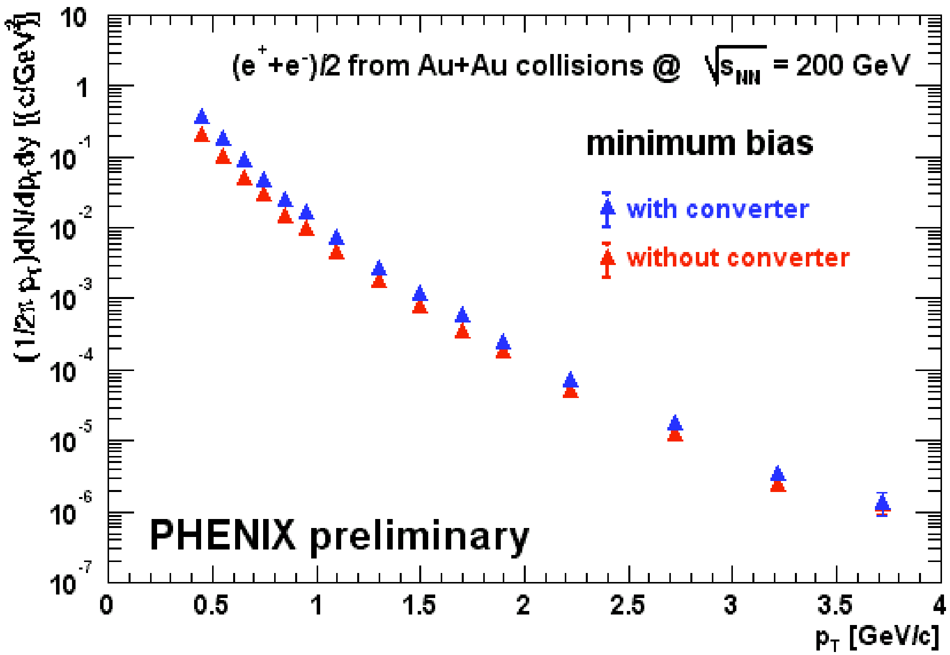
M.J. Tannenbaum, Rockefeller University: With reference to explaining ISR single electrons from Fermilab data at $x_F > .15$: First of all, the CCRS experiment made a great effort to eliminate low mass electron pairs ($M_{ee} < 0.50$ GeV/c^2) but allowed a continuum of $d\sigma/dm$ $1/m$ or flatter to explain all the single electrons observed; secondly, the crucial parameters in the lepton pair cross section relevant to explaining the ISR(CCRS) single electrons are the width of the rapidity plateau and $d^2\sigma/dmdy|_{y=o}$, the value of the cross section on the plateau. The Fermilab measurements at $x_F > .15$ do not give these values and thus are irrelevant in trying to explain the ISR data. Thus, while it might seem reasonable that the dilepton continuum could explain all of the single electron signal, it is by no means proved.

J.W. Cronin: While technically it is true that the measurements of the CP(II) group do not correspond to the kinematic region observed in the CCRS experiment (Ref. 24), we do have some experience with continuity. The extrapolation of the CP(II) group was based on a constant cross section in rapidity between $x_F = 0.15$ and $x_F = o$. I insist on my main point, however, that in fact we learn little from the single lepton measurements alone. To "prove" that pairs explain the CCRS signal, pair measurements will have to be made at $x_F \sim o$.

MJT-people who try to measure single leptons become the world's experts on η Dalitz decay, see erratum M.R.Jane et al, PLB73(1978)503, a correction of the branching ratio quoted in their original eta-dalitz (form factor) measurement, PLB59 (1975)103.

QM02 PHENIX AuAu 200 GeV charm via e±



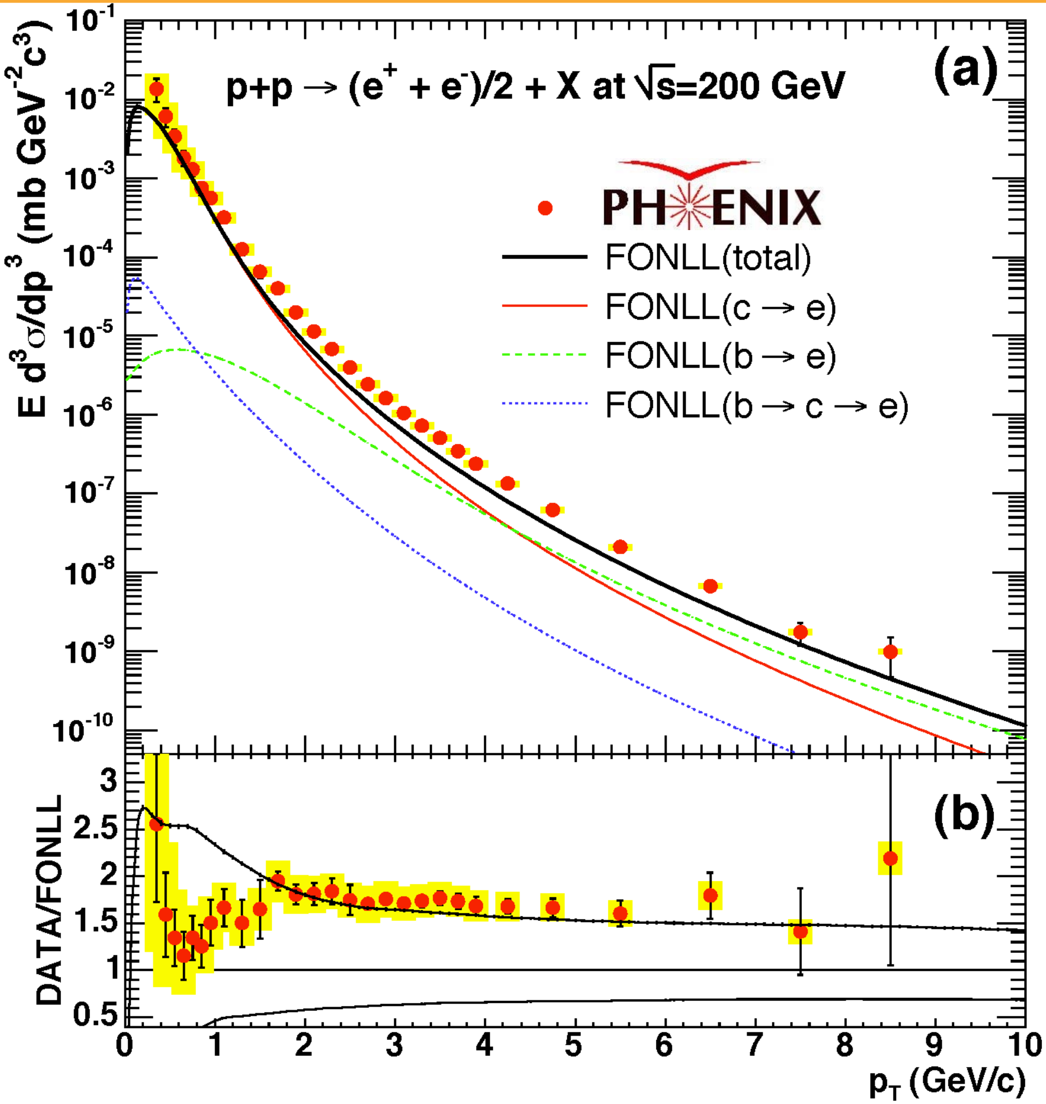


- Some data with 1.7 % X_0 converter added
- converter only affects photonic component

- converter effect is much greater at low p_T, indicating
  - ⇒ relatively much larger photonic component at low p_T
  - ⇒ relatively smaller phtonic (i.e. larger non-photonic) component at higher pT (i.e. charm)

Reduced systematic erros.

Charm via direct single e in p-p collisions

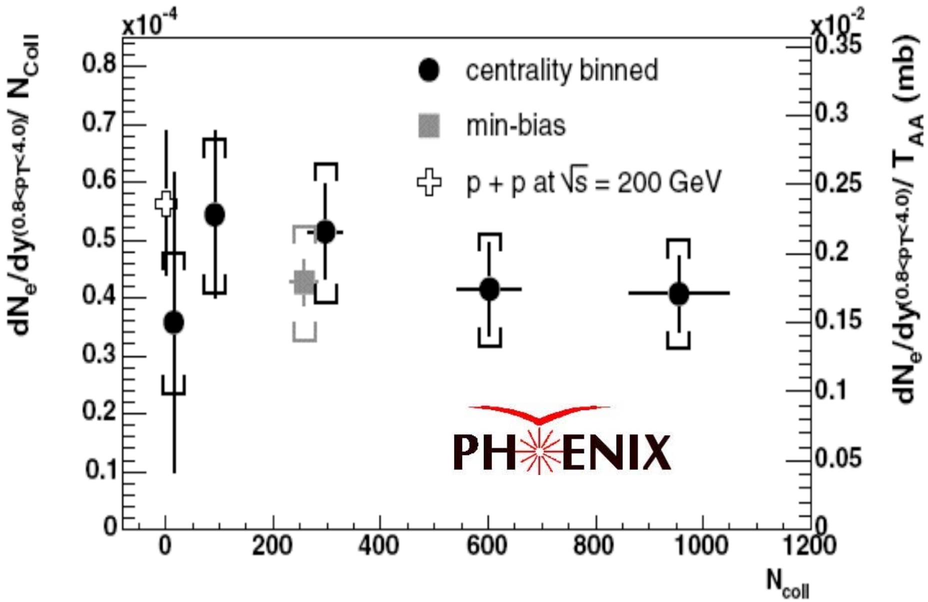


PHENIX PRL**97**(2006)252002

Beautiful agreement of e± with *c b* production in p-p

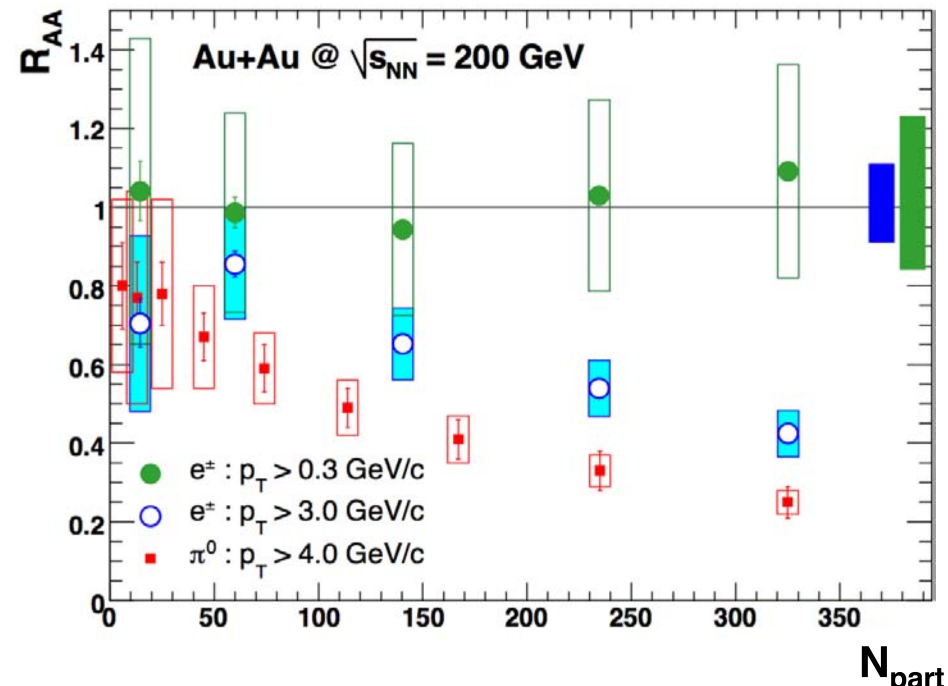
In Au+Au, total production of charm is pointlike but p_T spectrum shows suppression

- total charm yield determined from integral of single electron spectrum
  - ✓ charm decay dominant source of intermediate p_T electrons



PRL 94, 082301 (2005)

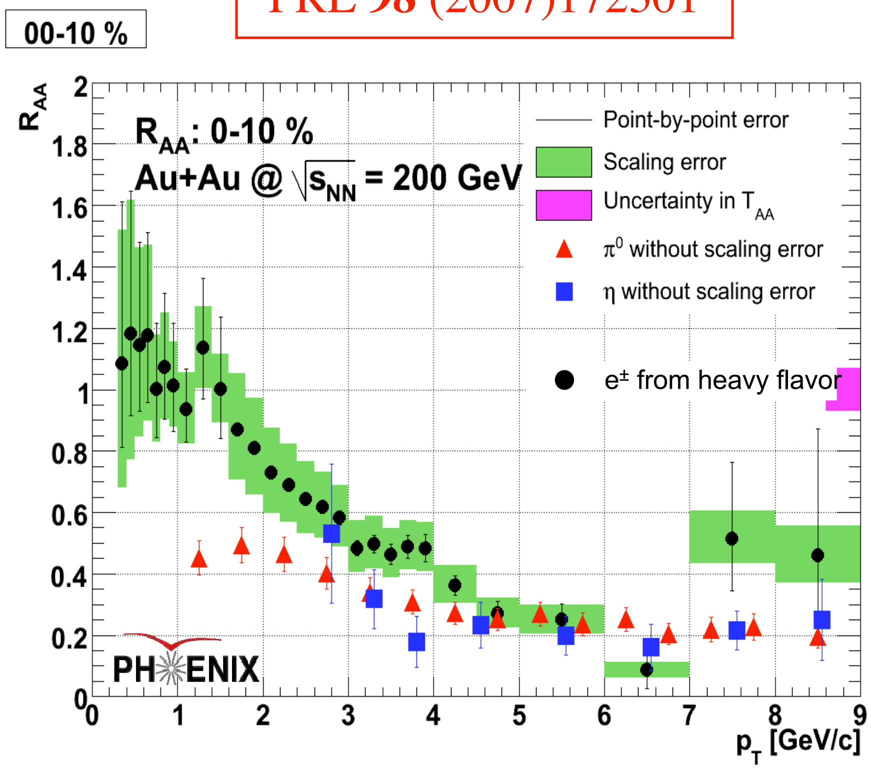
- not only high p_T π^0 from light quarks and gluons but also very heavy quarks lose energy trying to escape system: very opaque

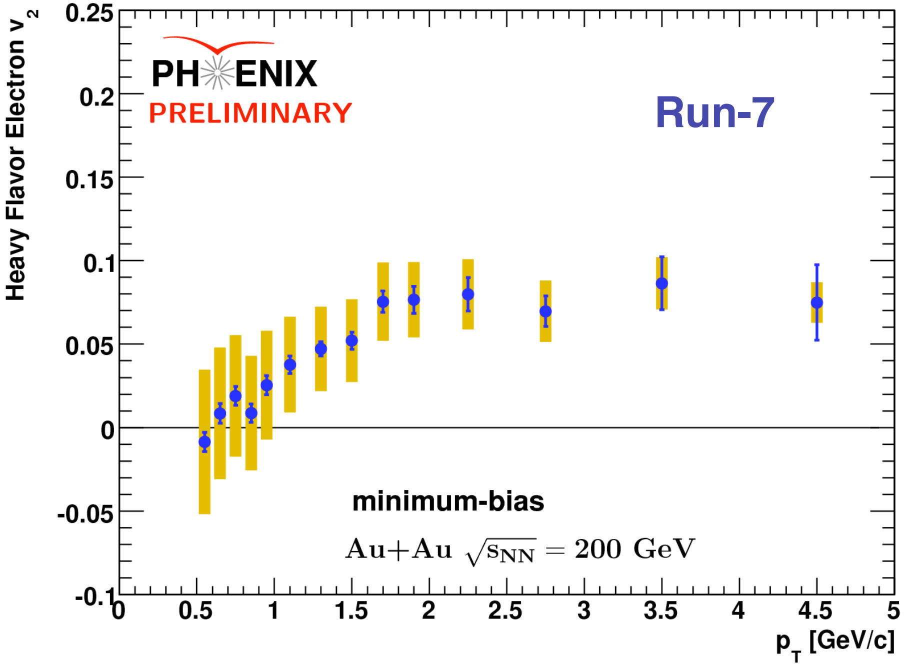


PRL 98, 172301 (2007)

Direct e± in Au+Au indicate a theoretical crisis

Au+Au PHENIX
PRL **98** (2007)172301





- heavy quarks suppressed the same as light quarks, and they flow, but less.
- This disfavors the hypothesis of energy loss by gluon bremsstrahlung in medium
- BUT--There are other very fundamental ideas which could explain the effect

From CERN Courier, September 2007

- I read an article "Yukawa's gold mine" by Nino Zichichi taken from his talk at INPC 2007 in Tokyo, Japan, in which he proposed: "We know that confinement produces masses of the order of a GeV. Therefore, according to our present understanding, the QCD 'colourless' condition could not explain the heavy quark mass. However, since the origin of the quark masses is still not known, it cannot be excluded that in a QCD coloured world (i.e. QGP), the six quarks are all nearly massless and that the colourless condition is 'flavour' dependent."

  - Higgs doesn't give quarks mass
  - QCD isn't flavor-blind

  !!!

- MJT: "Wow! Massless *b* and *c* quarks in a color-charged medium would be the simplest way to explain the apparent equality of gluon, light and heavy quark suppression indicated by the equality of R_{AA} for π^0 and direct-single $e^{\pm}$ in regions where both *c* and *b* quarks dominate."

Why would I be so quick to believe Zichichi?

Proc. 12th ICHEP, Dubna 1964

MUON-PROTON ELASTIC SCATTERING AT HIGH MOMENTUM TRANSFERS *

R. Cool, A. Maschke
Brookhaven National Laboratory, USA
L. Lederman, M. Tannenbaum
Columbia University, USA
R. Ellsworth, A. Melissinos, J. Tinlot, T. Yamanouchi
University of Rochester, USA
(Presented by J. TINLOT)

We have studied the elastic scattering of negative muons from liquid hydrogen at momentum transfers of 550 MeV/c to 1050 MeV/c ($q^2 = 7$ to 26 fermi^{-2}), using a detecting array of spark chambers and scintillation counters. The experiment was performed at the AGS accelerator of the Brookhaven National Laboratory, and the runs were divided into three stages, of the proton in an aluminum plate spark chamber. One also measures the directions of the recoil proton and the recoil muon. This is equivalent to measuring three independent angles, from which one can infer for each event the value of k, and still overdetermine the scattering event by two degrees of freedom. This redundancy is used to select true scattering

ДИСКУССИЯ — DISCUSSION

A. Zichichi

In connection with the problem of observing the production of intermediate bosons, I would like to mention that we have been studying at CERN two schemes:

1) $\bar{p}+p \to W^+ + W^-$, $W^- \to e^- + \nu_e$, $W^+ \to \mu^+ + \nu_\mu$ $\Big\} \to \mu^\pm, e^\mp$.

This process is described by the following Feynman diagram

Notice that this process is proportional to α^2 where α is the electromagnetic coupling constant.

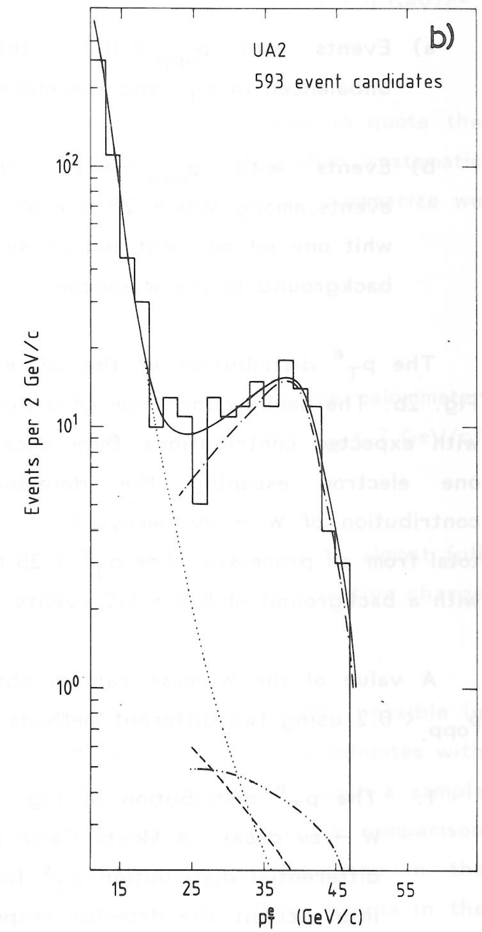
2) The second proposal studied would use the internal target of the proton synchrotron with 10^{12} protons per pulse incident onto the target. The process would be $p + \left(\frac{p}{n}\right) \to W^\pm +$ anything. We would observe the μ's from W-decays. By measuring the angular and momentum distribution at large angles of K and π's, we can predict the corresponding μ-spectrum. We then see if the μ's found at large angles agree with or exceed the expected number. A supplementary check can be made by measuring the polarization of these μ's. The polarization indicates the origin of these μ's. Notice that the cross section for this process goes with $\sqrt{g}$, where g is the β-decay coupling constant.

B. Pontecorvo

I would like to use the fact that you are all tired in order to make a remark of linguistic rather than sicentific character. All the speakers used as notations for neutral leptons the letters ν_e and ν_μ. This seems to be a very convenient notation. On the other hand, the terms which are usually used for neutral leptons-electron and muon neutrinos (and even «electron and muon type of neutrino!»), are too cumbersome. True, sometimes for ν_e the word «neutrino» is used and for ν_μ, the word «neutretto». The last term, however, is not very satisfactory since the last thirty years lost of particle including strong interacting particles had been called that way. In addition, it seems to me that both types of neutral leptons should conserve in their «name» the root «neutrino», which is widely associated with the unique

3* 35

UA1,UA2, CERN 1983
W boson discovery

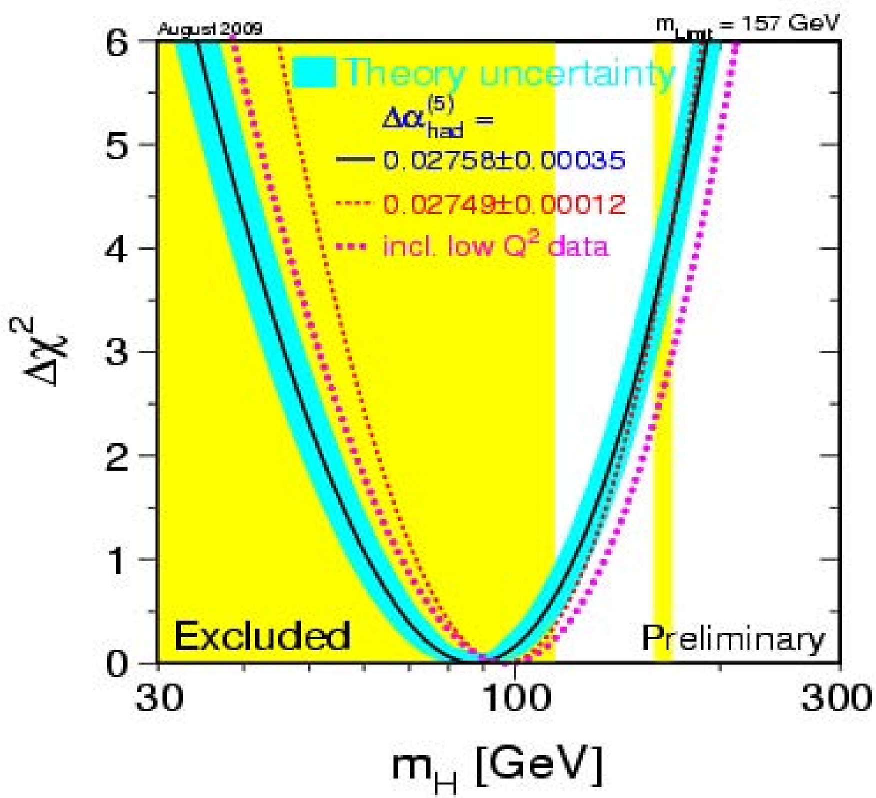


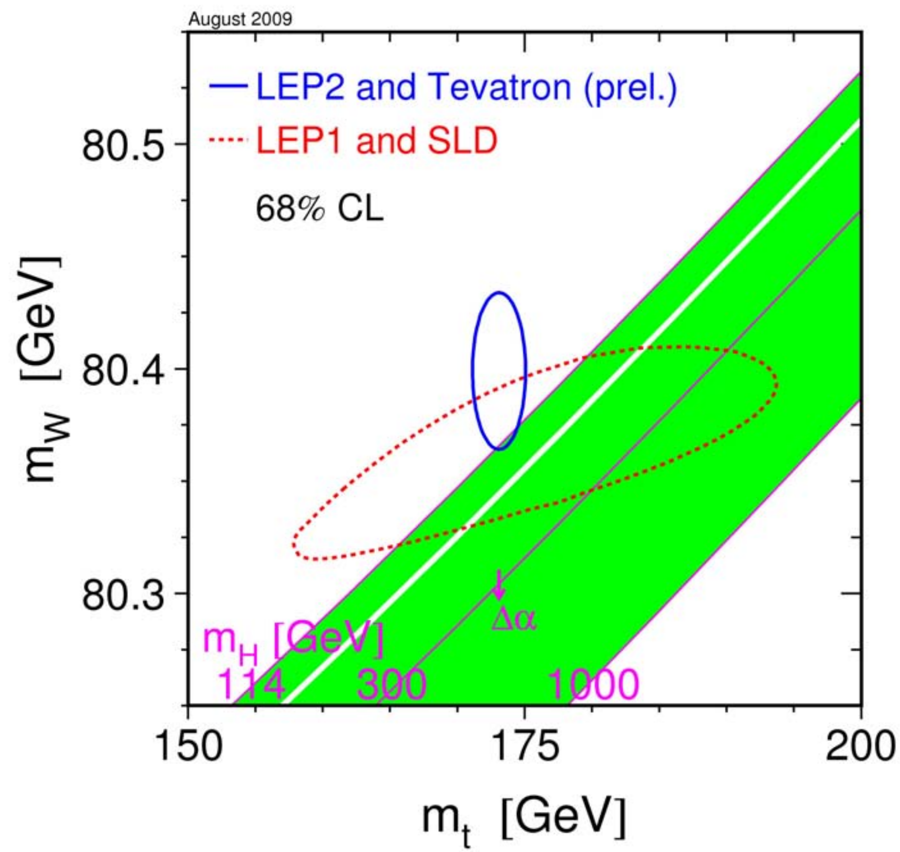
In my opinion Zichichi's idea is much more reasonable than AdS/CFT! How to prove it?

First, comments from some distinguished physicists:

- Stan Brodsky:"Oh, you mean the Higgs Field can't penetrate the QGP."
- Rob Pisarski: "You mean that the propagation of heavy and light quarks through the medium is the same"
- Chris Quigg (Moriond 08): "The Higgs coupling to vector bosons γ, W, Z is specified in the standard model and is a fundamental issue. One big question to be answered by the LHC is whether the Higgs gives mass to fermions or only to gauge bosons? The 'Yukawa' couplings to fermions are put in by hand and are not required." "What sets fermion masses, mixings?"

Does this affect the m_W-m_t-m_H relationship?

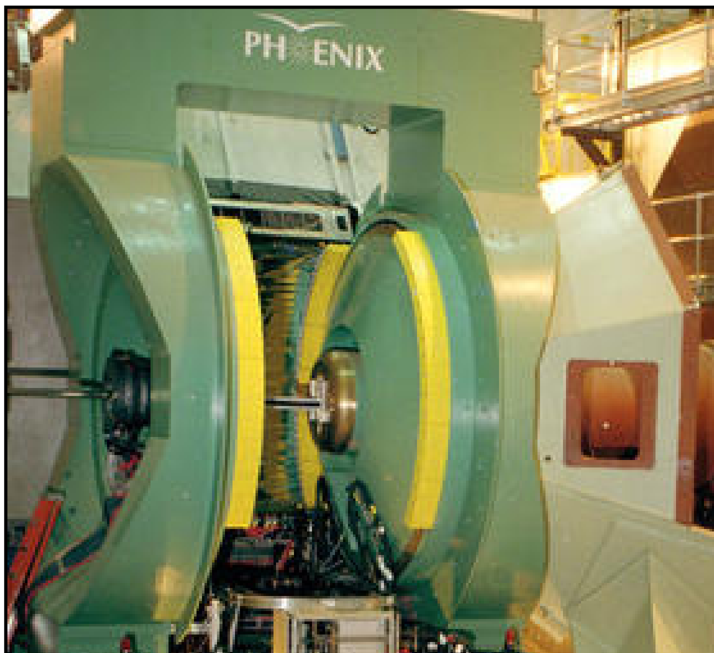


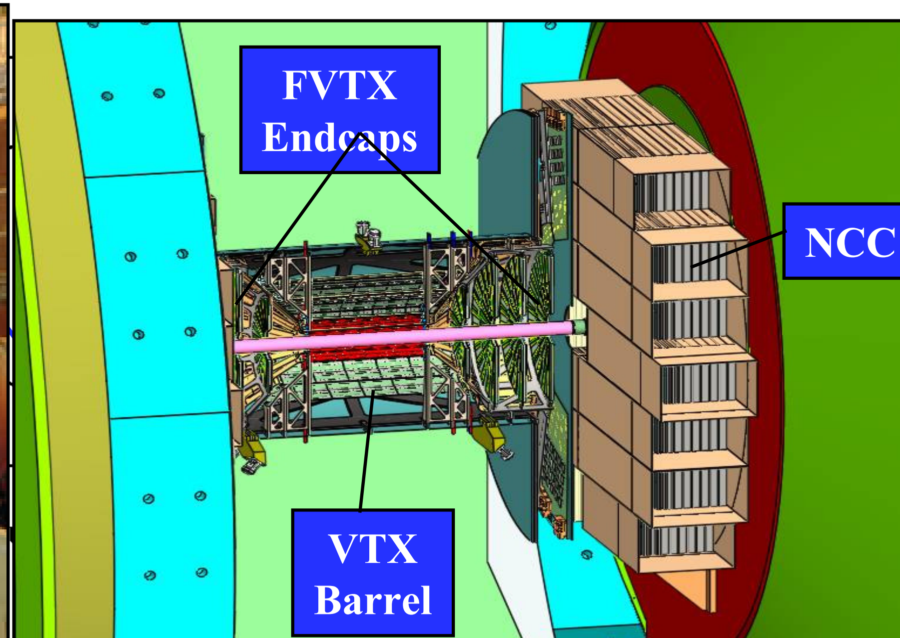


- Bill Marciano: “No change here if no Yukawa coupling; but there could be other changes” (?)

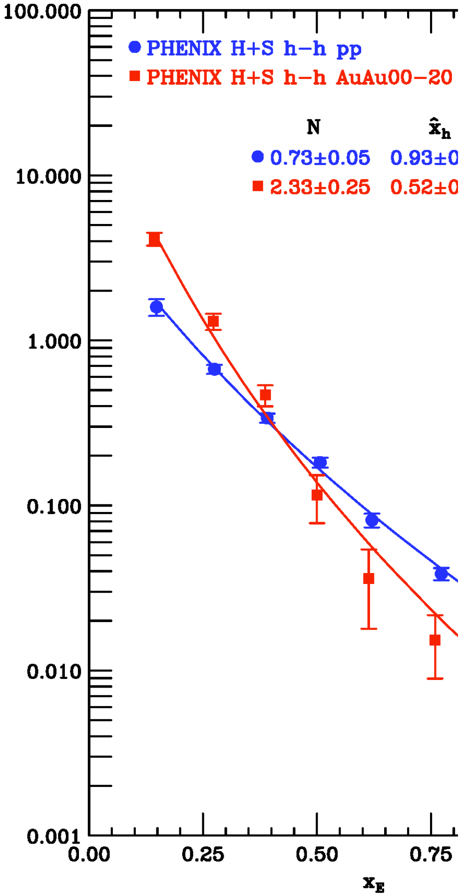
My Proposal:use the VTX to be installed in 2010

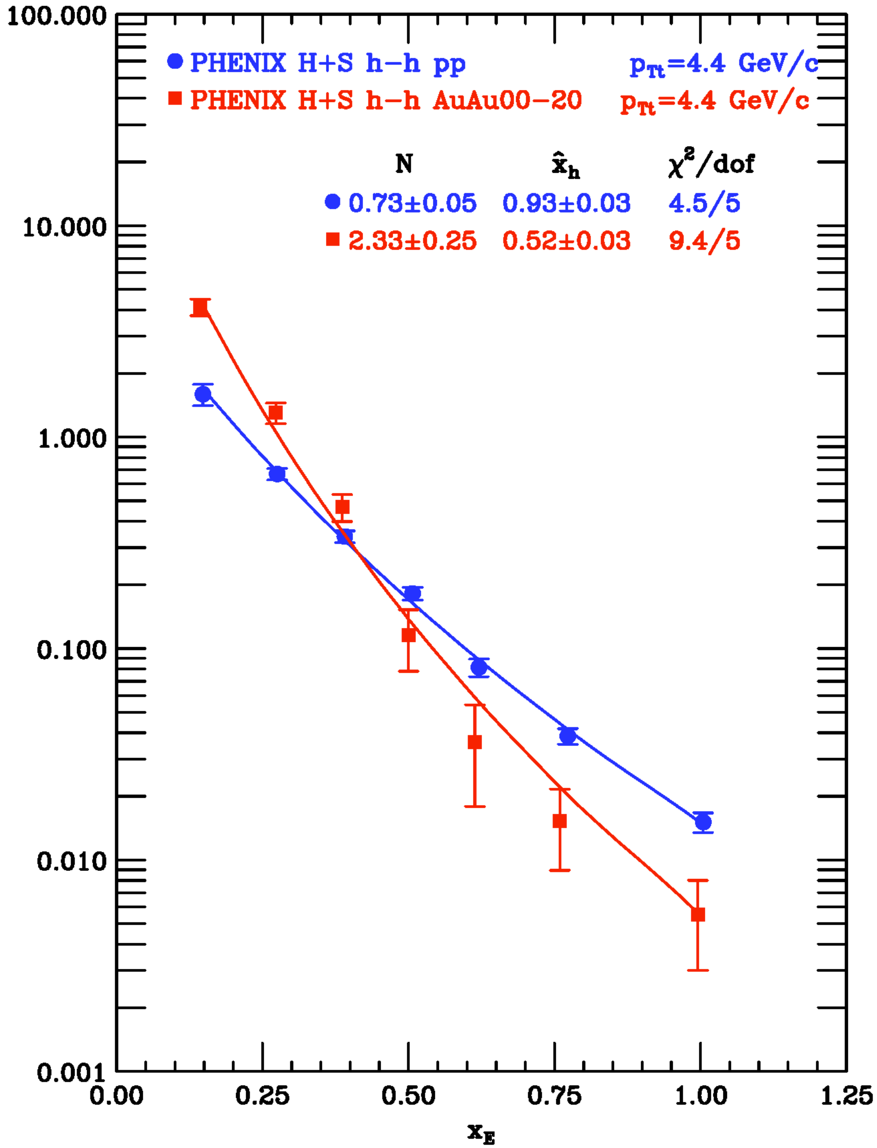
- Map out, on an event-by-event basis, the di-hadron correlations from identified $b-\bar{b}$ di-jets, identified $c-\bar{c}$ di-jets, and light quark and gluon di-jets, which originate from the vertex and can be measured with π^0-hadron correlations. These measurements will confirm in detail (or falsify) whether the different flavors of quarks behave as if they have the same mass in a color-charged medium.





$h^{\pm}$-$h^{\pm}$ correlations in Au+Au: Away-side yield vs $x_E \approx p_{Ta}/p_{Tt}$ is steeper in Au+Au than p-p indicating energy loss





$h^{\pm}(4<p_{Tt}<5 \text{ GeV/c})$--$h^{\pm}$

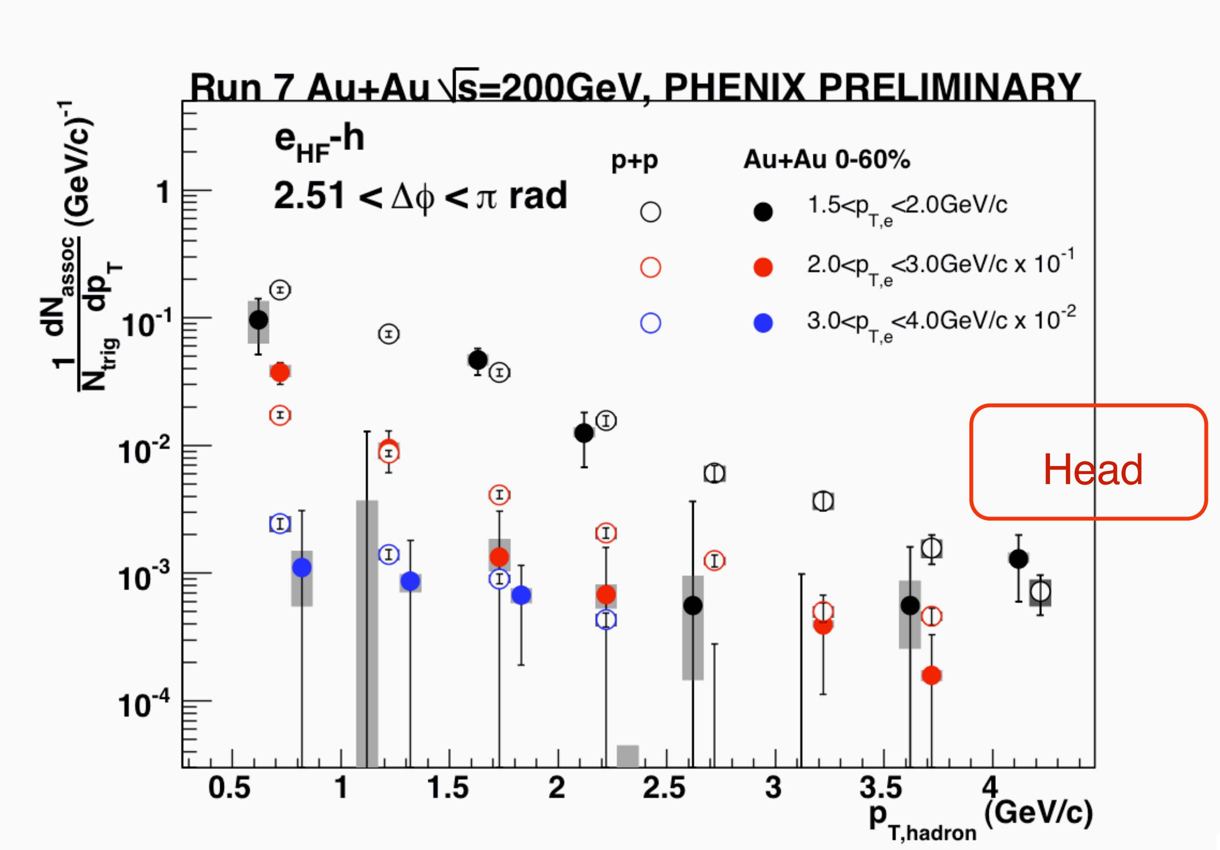
PHENIX AuAu PRC **77**, 011901(R)(2008)

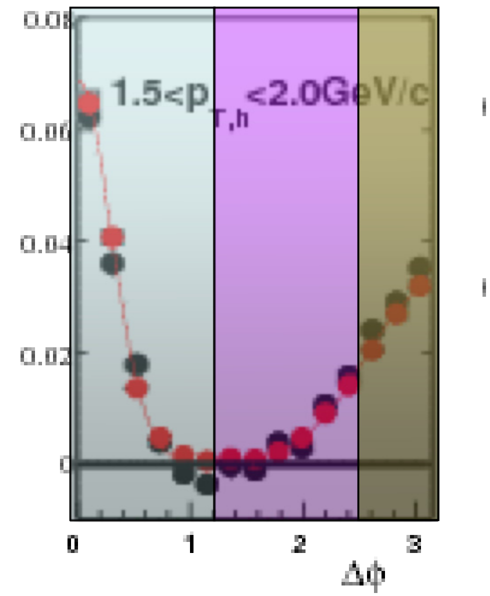
$$\approx N(n-1)\frac{1}{\hat{x}_h}\frac{1}{(1+\frac{x_E}{\hat{x}_h})^n}$$

Measured ratio of ... momenta $\hat{p}_{Ta}/\hat{p}_{Tt} \equiv \hat{x}_h$

$\hat{x}_h = 0.52 \pm 0.03$ ir... rgy relative to trigger jet.

e-h Yields in Au+Au--QM09





Per-trigger yields of non-photonic electron-hadron correlations for various Δφ ranges.

"Shoulder" identified as 1.25< Δφ<2.5

"Head" identified as 2.5 < Δφ < π

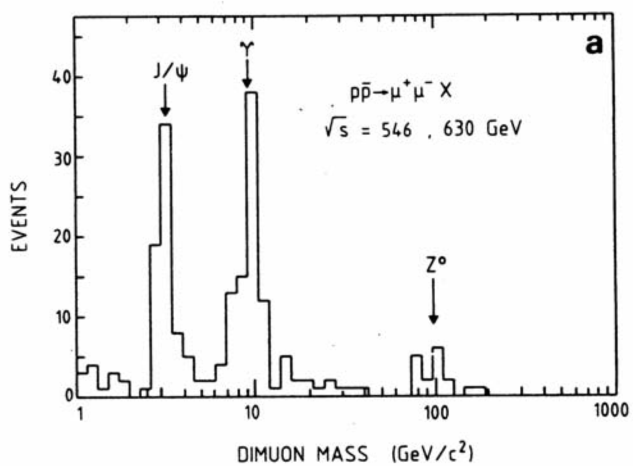
Discoveries at RHIC lead to many new open fundamental questions: Some even relevant to particle physics at LHC

How to discover the QGP c.1987

- The Classical road to success in RHI Physics: J/Ψ Suppression

The Road To Success in HEP

ETTERS B 5 March 1987



$p_T(\mu) \geq 3$ GeV/c, UA1 Phys. Lett. **B186**, 237 (1987)

The Road To Success in HIP

- Major background for e± detection is photons and conversions from π^0. but more importantly
- Need an electron trigger for full J/Ψ detection ⇒ EMCal plus electron ID at trigger level.
- High p_T π^0 and direct γ production and two-particle correlations are the way to measure hard-scattering in RHI collisions where jets can not be detected directly---> segmentation of EMCal must be sufficient to distinguish π^0 and direct γ up to 25 GeV/c (also vital for spin)
- Charm measurement via single e± (Discovered by CCRS experiment at CERN ISR)