

LHC: Physics overview

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- Physics opportunity?
 - Thoroughly discussed 1980 →
- Evolution in 5-10y?
 - I will look back!
- Specific detector capabilities?

acap!

$$\frac{5500}{200} = 27,5$$

remarkable results
already from here!

1. Physics opportunity?

The big ratio

27.5

gives rise to big effects:

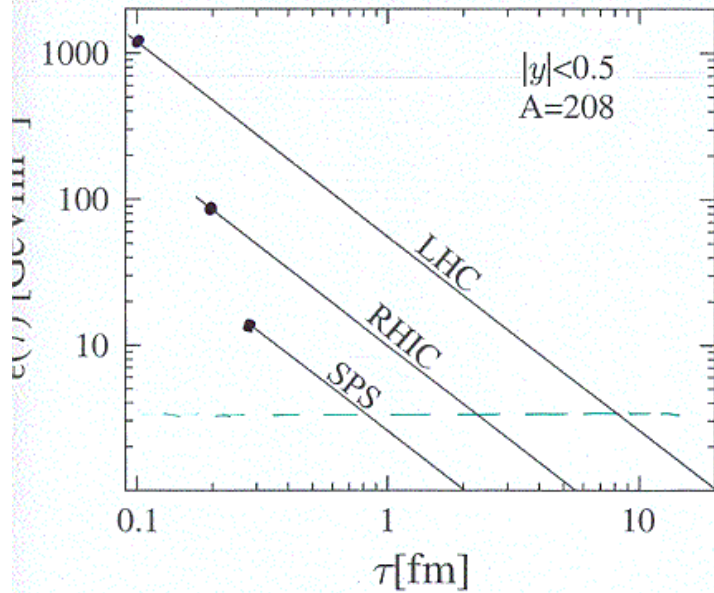
hotter

longer-lived

bigger

theorists' prejudices!

Hotter, longer lived:



Adiabatic expansion!

$$\frac{1}{\tau_i} = Q_s = 0.2 \text{ GeV } A^{0.12} \sqrt{s}^{0.2}$$

Most surprising: RHIC in agreement with this naive (?) picture

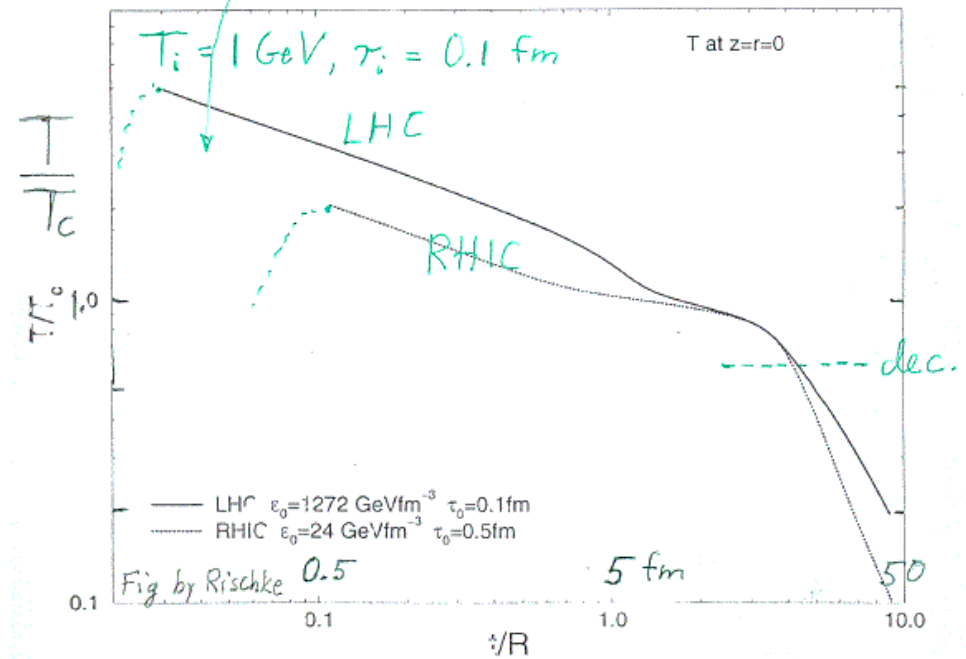
$$\frac{\eta}{s} = \text{small} \stackrel{?}{=} \frac{1}{4\pi}$$

N=4 SUSY YM

LHC?

$T(\tau)$:

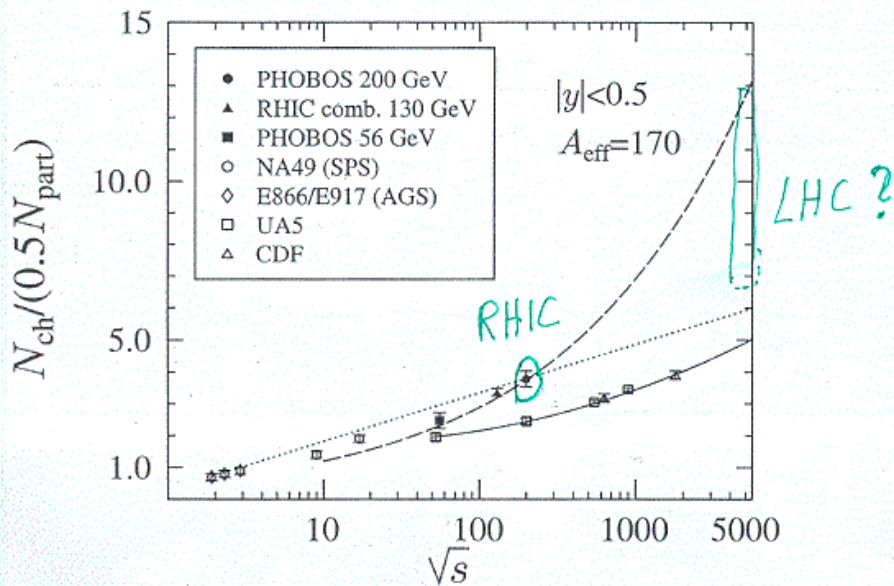
- more "hard probes" at LHC
- "non-equil. signals"



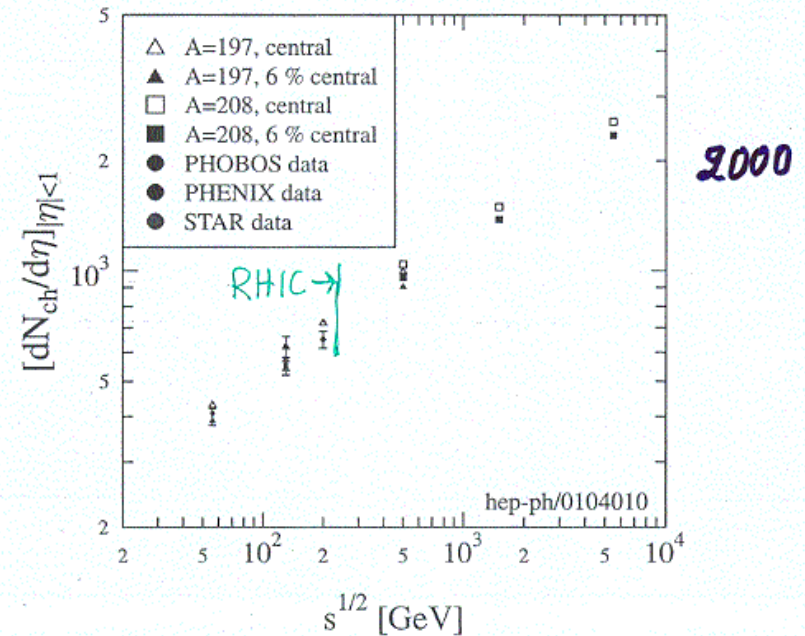
- if late thermalisation, one has to hit the same curve
- RHIC & LHC may be very similar at decoupling at $z=0$, but different earlier!

Bigger (in N_{ch}):

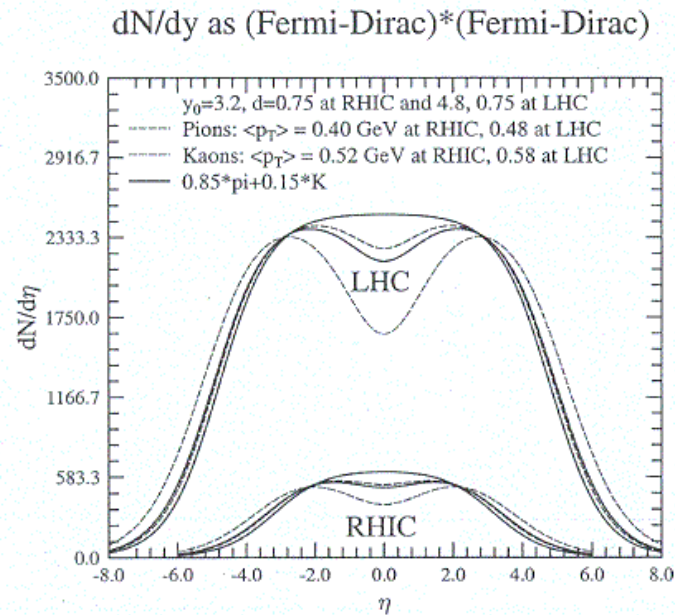
This is soft QCD, no way
to make a reliable reproducible
generally accepted prediction!



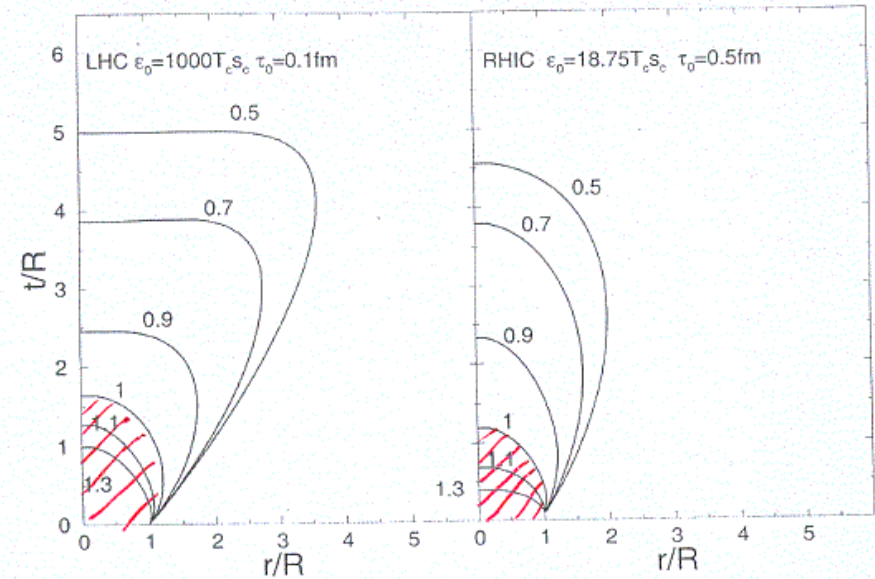
Converted to N_{ch} :



To rapidity distribution:

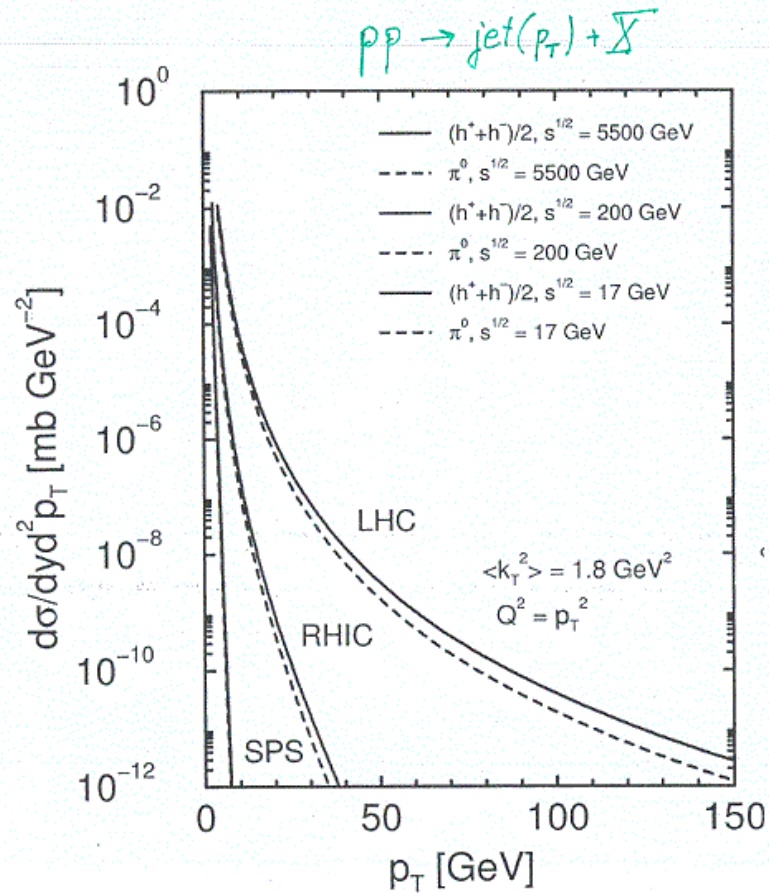


Bigger in size:

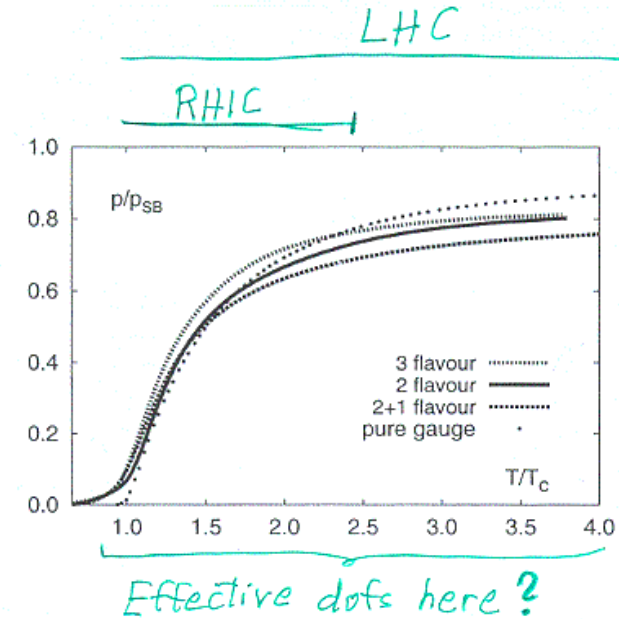


RHIC problem:
 will be more
 striking at LHC!
 understand
 HBT \Leftrightarrow hydro
 size
 lifetime

Bigger cross sections:



The goal should be to put error bars on the 1st principle prediction:
QCD EOS:

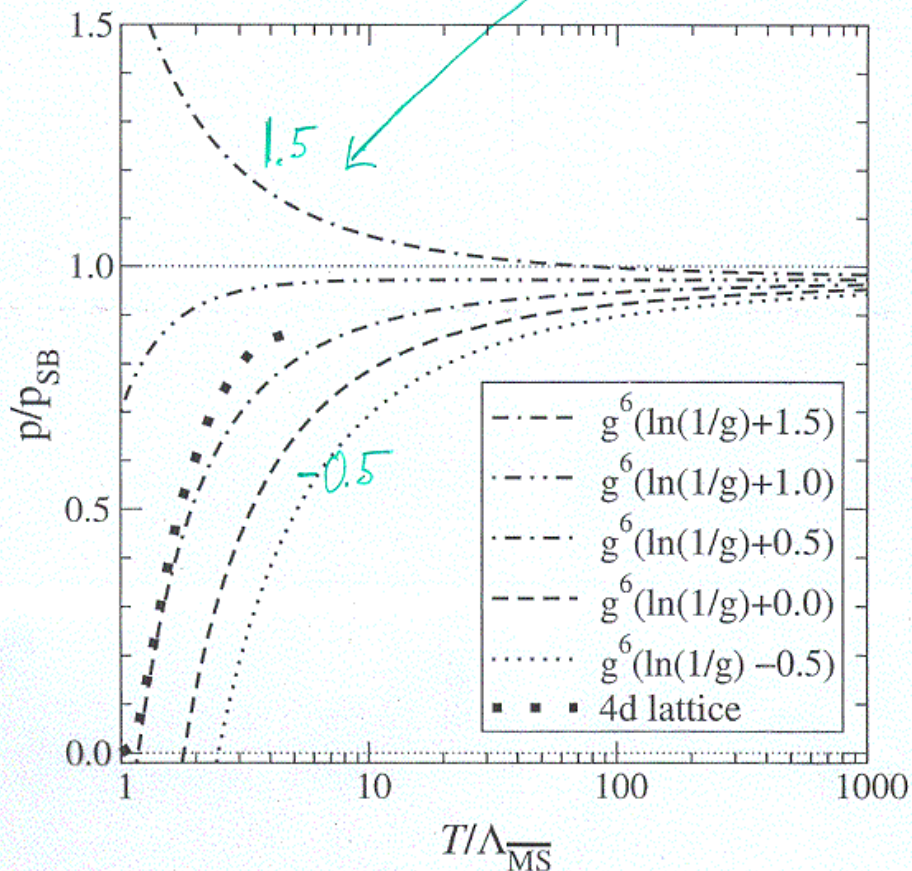


Total theory chaos: hadrons(T),
 q, g modes(T), monopoles, instantons,
 calorons, unstable gauge field configurations,
 colored bound states, giant collective
 vibrations, dynamics given by classical
 gravity (!) in some higher dim space....

At $T \gtrsim 1000 T_c$ theory under complicated! control but:

$$\frac{P}{T^4} = 1 + g^2 + g^3 + g^4 \ln g + g^5 + g^6 \ln g + \# g^6$$

effect of varying this # is huge!



2. Evolution; detectors

- Look back: LHC Committee in 1993-

ALICE LoI:

Comprehensive but for muons

Ecal, $|\eta| < 0.9$ $0 < \varphi < 2\pi$ under study

Muon arm was required by LHCC

Ecal disappeared from Tech. Prop. in 1995
cost/physics

CMS:

$\gamma \gamma' \gamma''$

ATLAS:

—

- Now: jets have (re)appeared with force

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At issue at this meeting is how to do jets + HI at LHC.

Opinion:

- The LHC HI exp. ALICE should be as comprehensive as possible
⇒ ALICE needs Ecal and should get it low p_T acceptance!
- Having several "smaller" exp's is very fertile (RHIC!)
- For hard facts on hard jets:
next talks