

**Sir Chris at 70!**



**Sir Chris at 70!**

## CO-OPERATION AGREEMENT

between

THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH  
(CERN)

and

THE DEPARTMENT OF ATOMIC ENERGY (DAE)  
OF THE GOVERNMENT OF INDIA

### Article 10 Duration

This Agreement shall be in force for a period of five years from the date of its signature and will be automatically renewed for the same period unless six months' notice of termination is given by either party to the other.

Done at Geneva on 28 March 1991  
in two copies in the English language.

For the Department of Atomic Energy  
of the Government of India (DAE)

P.K. Iyengar  
Chairman, Atomic  
Energy Commission

For the European Organization  
for Nuclear Research (CERN)

C. Rubbia  
Director-General

## PROTOCOL

TO

THE 1991 CO-OPERATION AGREEMENT

between

THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH  
(CERN)

and

THE DEPARTMENT OF ATOMIC ENERGY (DAE)  
OF THE GOVERNMENT OF INDIA

### ARTICLE 13 Duration

1. This Protocol shall be in force for a period of ten years from the date of its signature, subject to a corresponding renewal of the Agreement. In case of non-renewal, the remaining amount in the India Fund will be utilised as per Article 3.3 (a). However, every three years the execution of the Protocol will be evaluated and the validity of the basic assumptions governing the Protocol will be assessed.
2. At least two years before the end of this period, the extension of this Protocol will be discussed with the aim of ensuring a continued access of Indian scientists to the CERN programme.

The present Protocol shall form an integral part of the Co-operation Agreement signed on 28 March 1991.

Done at Delhi, on 29<sup>th</sup> March 1996  
in two copies in the English language.

For the Department of Atomic Energy  
(DAE) of the Government of India

R. Chidambaram  
Chairman, Atomic Energy Commission and  
Secretary, Department of Atomic Energy

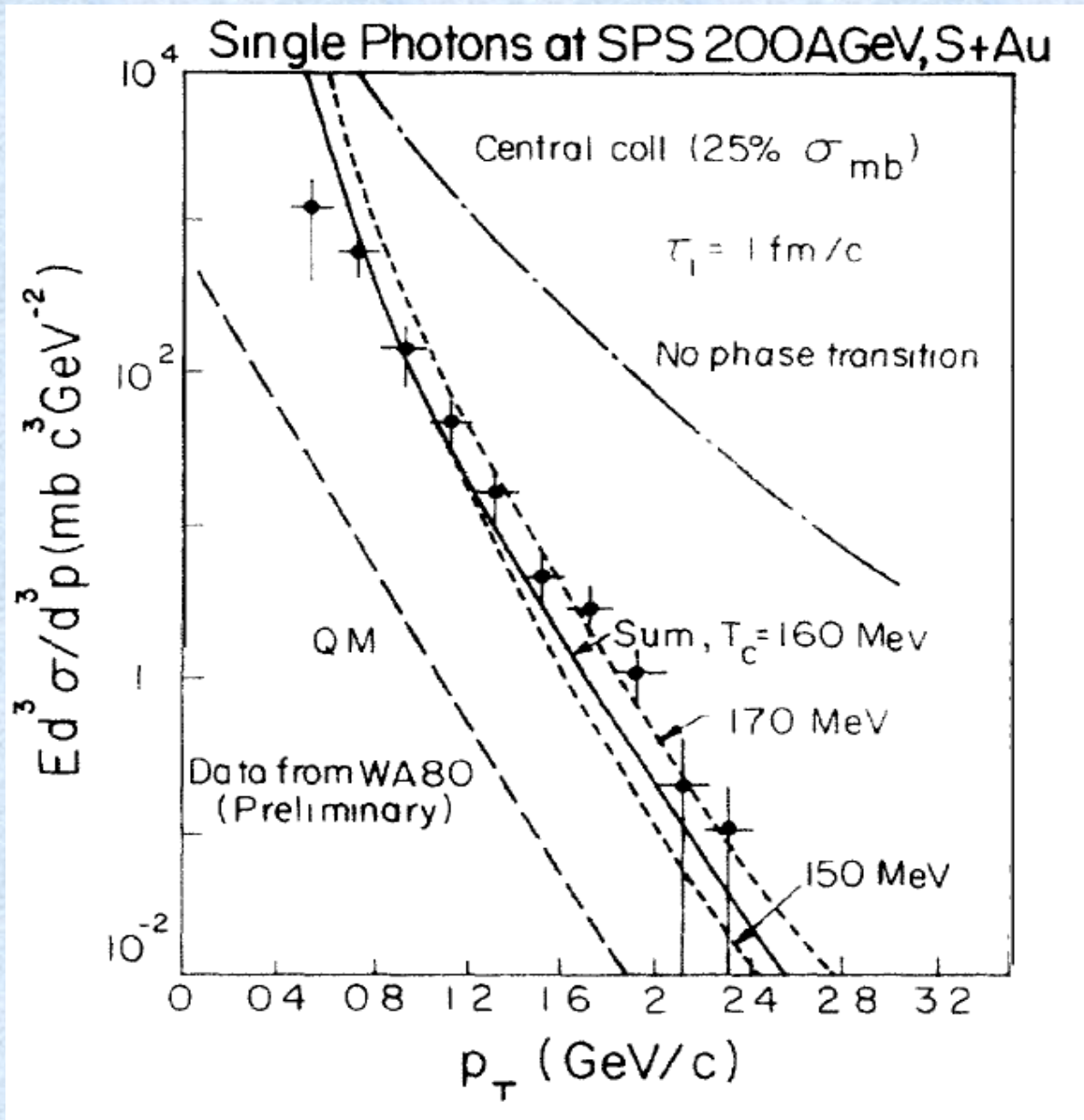
For the European Organization for  
Nuclear Research (CERN)

C. H. Llewellyn Smith  
Director-General

March  
1996



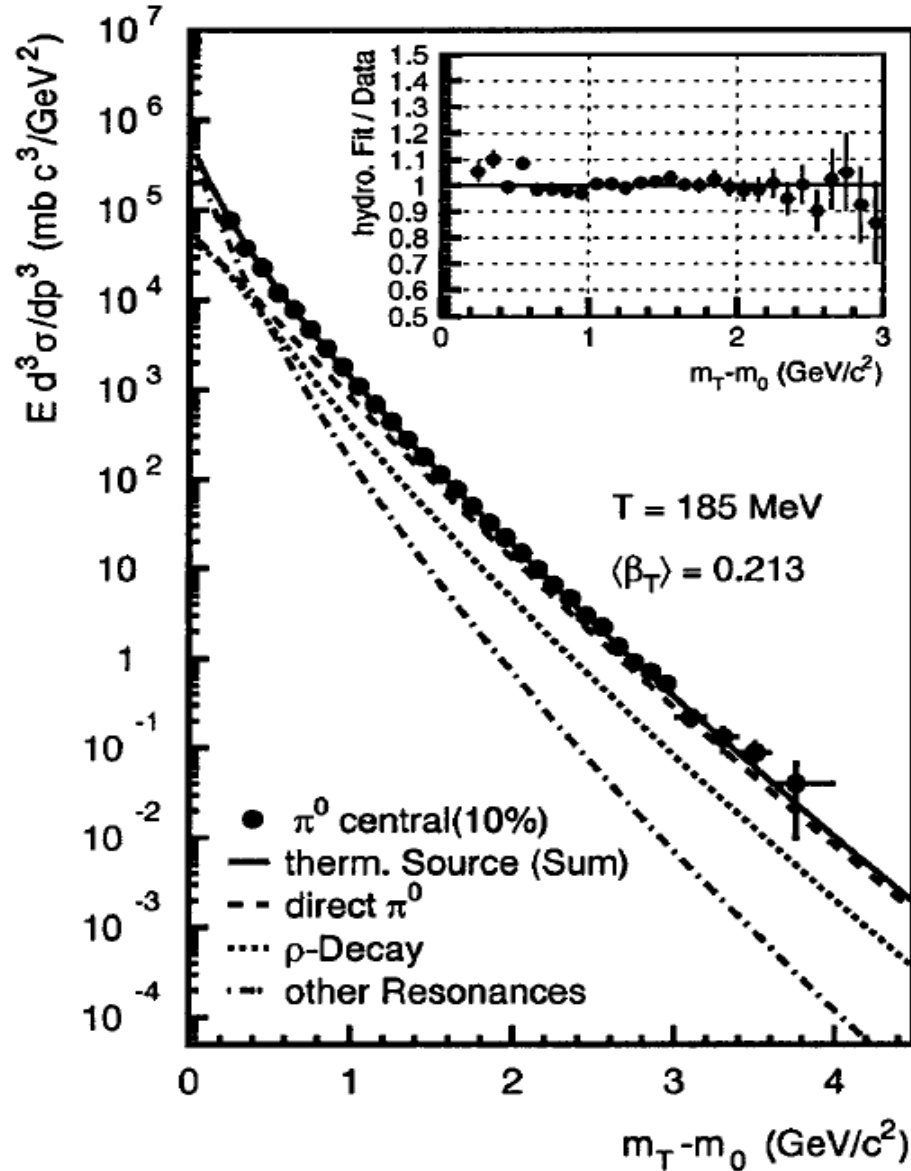
**Director General, CERN, 1994-1999**



$T_i = 203 \text{ MeV}$   
 $T_c = 160 \text{ MeV}$   
 $T_f = 100 \text{ MeV}$

$\tau_i = 1 \text{ fm}$

## Pions from central collision

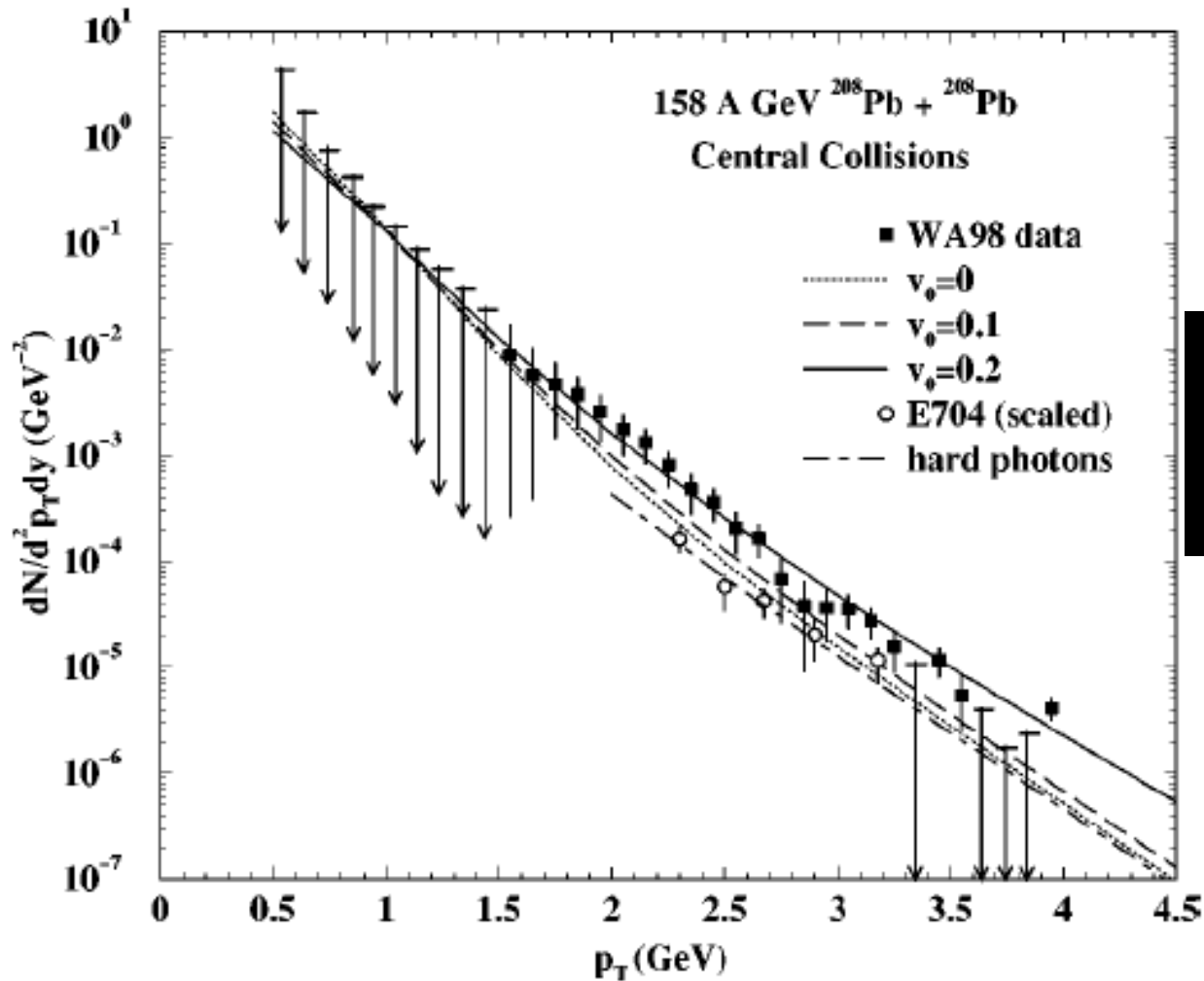


WA 98  
Collaboration  
SPS (Pb+Pb)

Freeze out  
(hydro)

$$T = 185 \text{ MeV}$$

$$\beta = 0.21$$

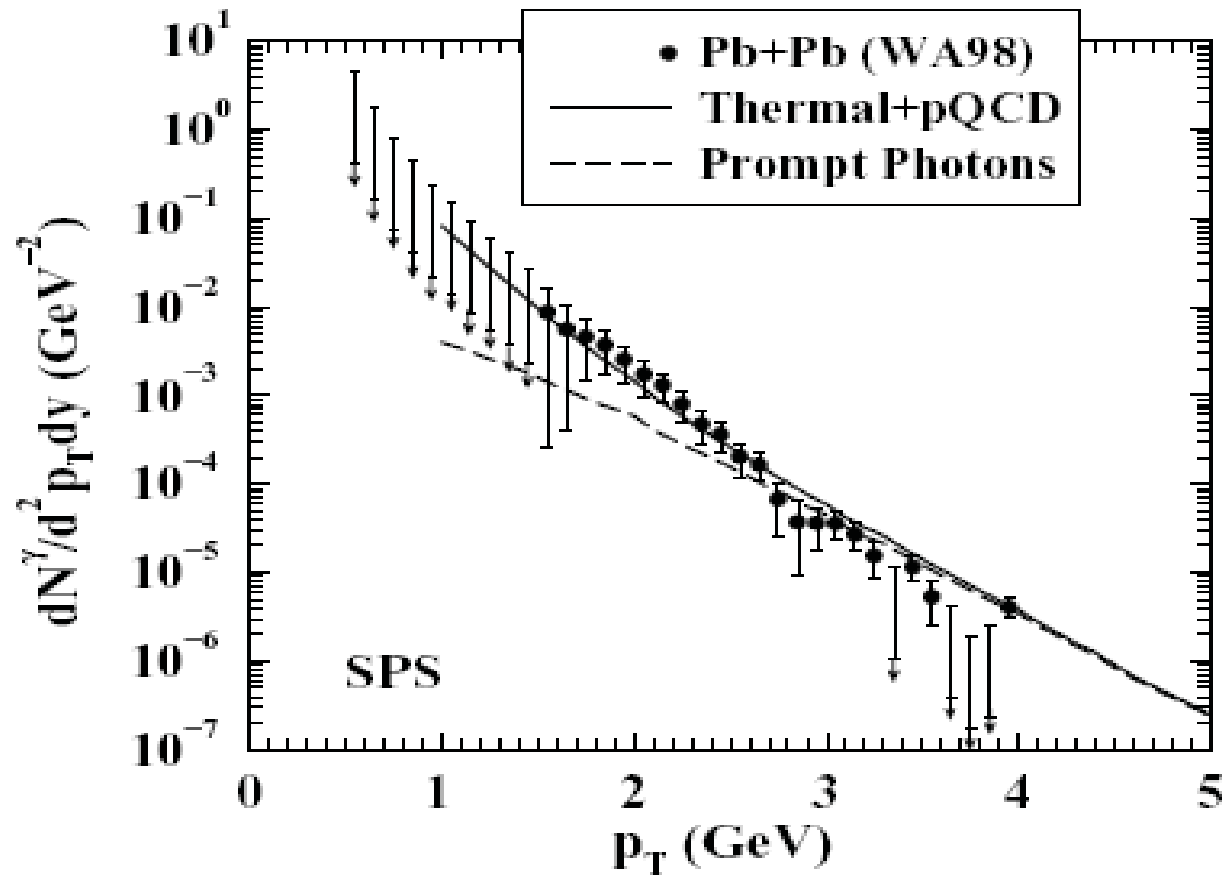


Prompt (hard)  
+  
Thermal photons  
with different  $v_0$

Phys. Rev. C, 63, 021901, 2001

Thermal photons with  $T_i=200$  ,  $T_f=120$  MeV

## Direct Photons : SPS (Pb+Pb)

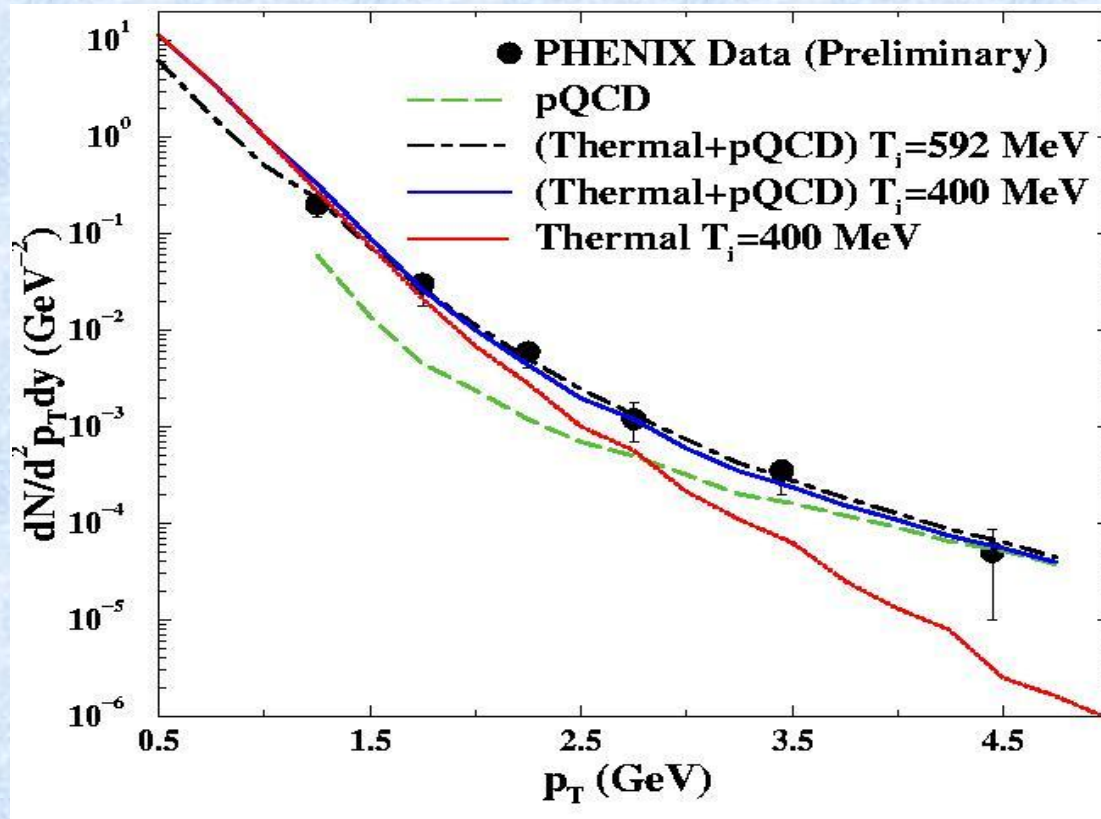


PHYSICAL REVIEW C **82**, 034901 (2010)

$T_i=200$  ,  $T_f=120$  MeV



## Direct Photons : RHIC (Au+Au)

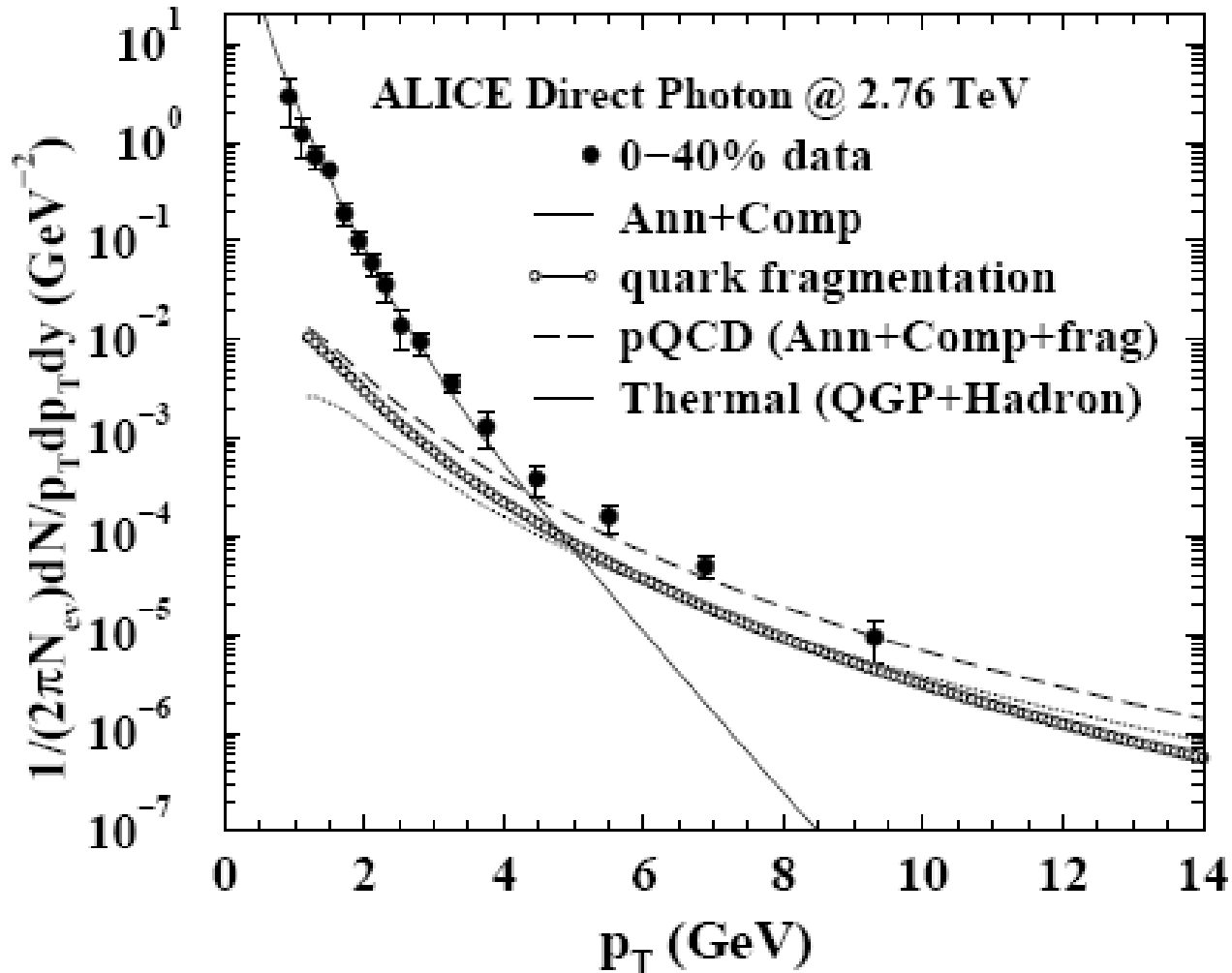


$$\sqrt{s_{NN}} = 200 \text{ GeV}$$

J. Phys. G, 34, 871, 2007

Thermal photons:  $T_i=400$  and  $T_f=120 \text{ MeV}$   $\tau_i = 0.2 \text{ fm}$

# LHC energy: Pb+Pb

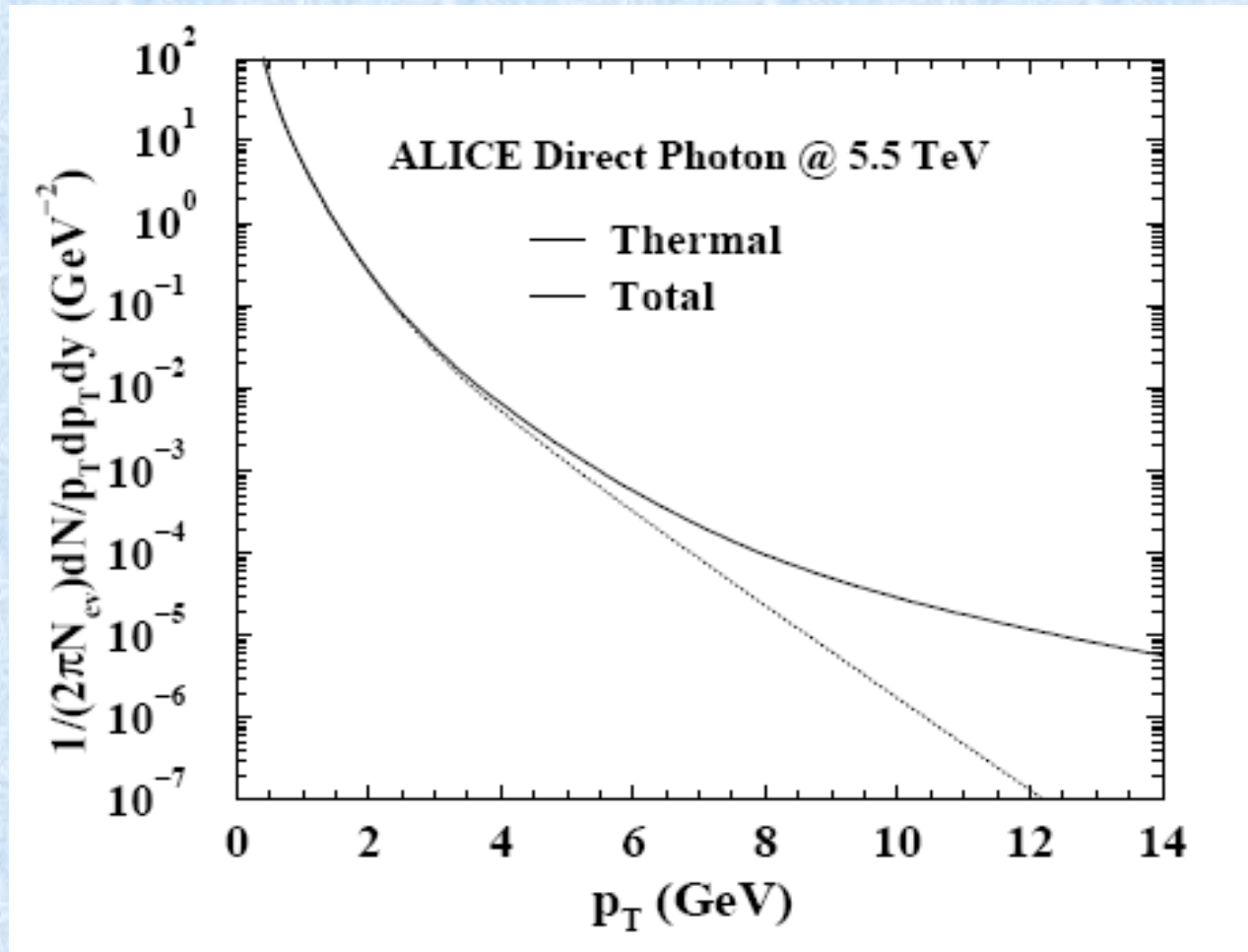


arxiv:1210.3993

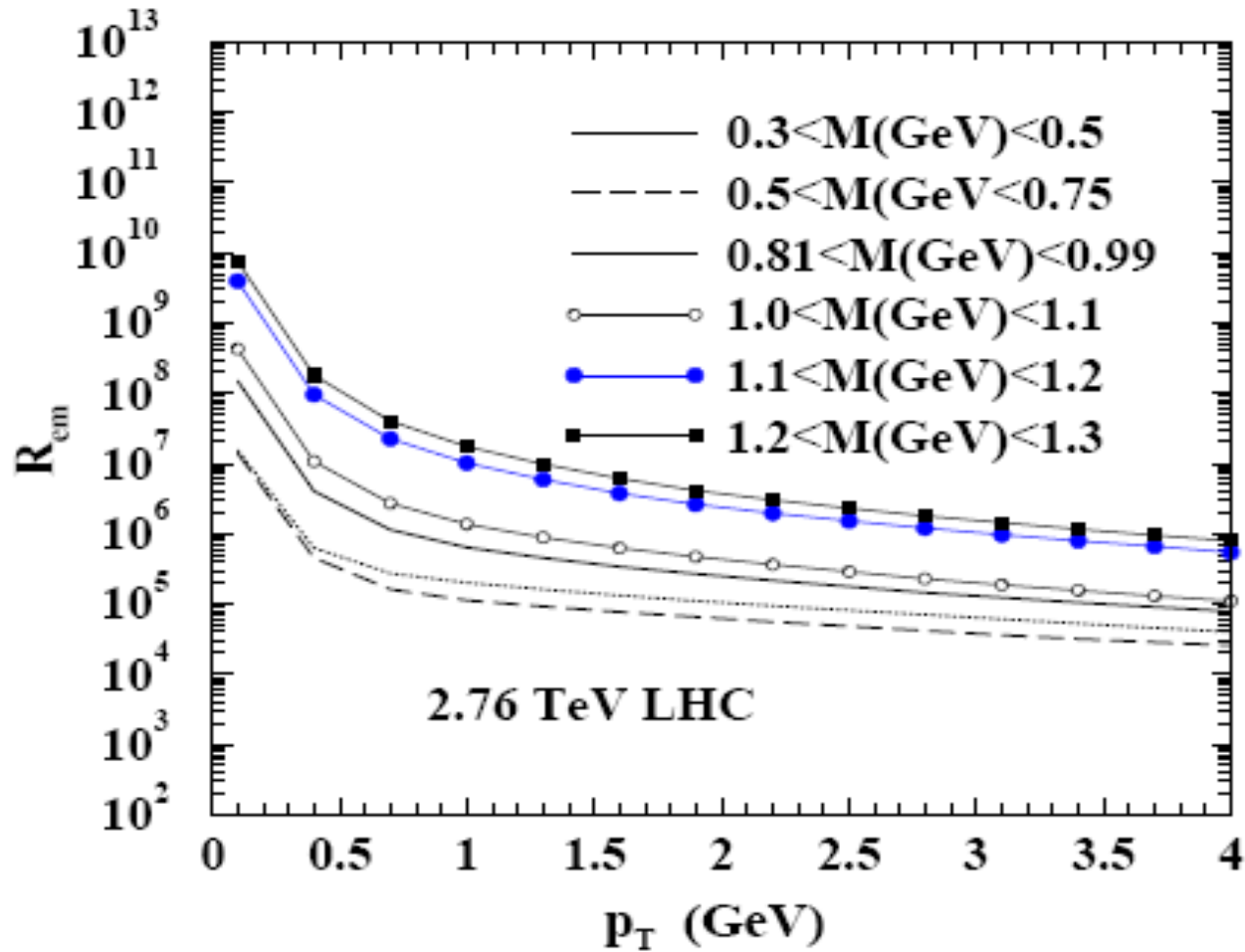
Thermal photons: With  $T_i=546$  MeV and  $T_f=113$  MeV

$$\tau_i = 0.1 \text{ fm}$$

## Prediction for 5.5 TeV (Pb+Pb)



# Ratio @ 2.76 TeV, LHC energy





*SINP and VECC Director Bikash Sinha and CERN Director-General Rolf Heuer signing the ISOLDE Protocols.*

**Monday, 22, June, 2009**

Beyond time.....!

