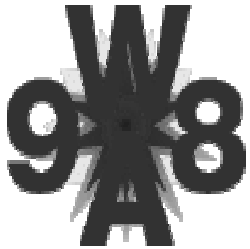


Direct photon search in p/π induced reactions at $\sqrt{s}$ =17.3 GeV

by M. J. Mora Corral, SUBATECH (Nantes)
for the WA98 Collaboration

EPS HEP2001, 12 July

Why?: Photons in Heavy Ion Collisions

Photon sources:

- **Hard**

initial parton-parton collisions modified by nuclear effects

- **Thermal**

nuclear matter in thermal equilibrium

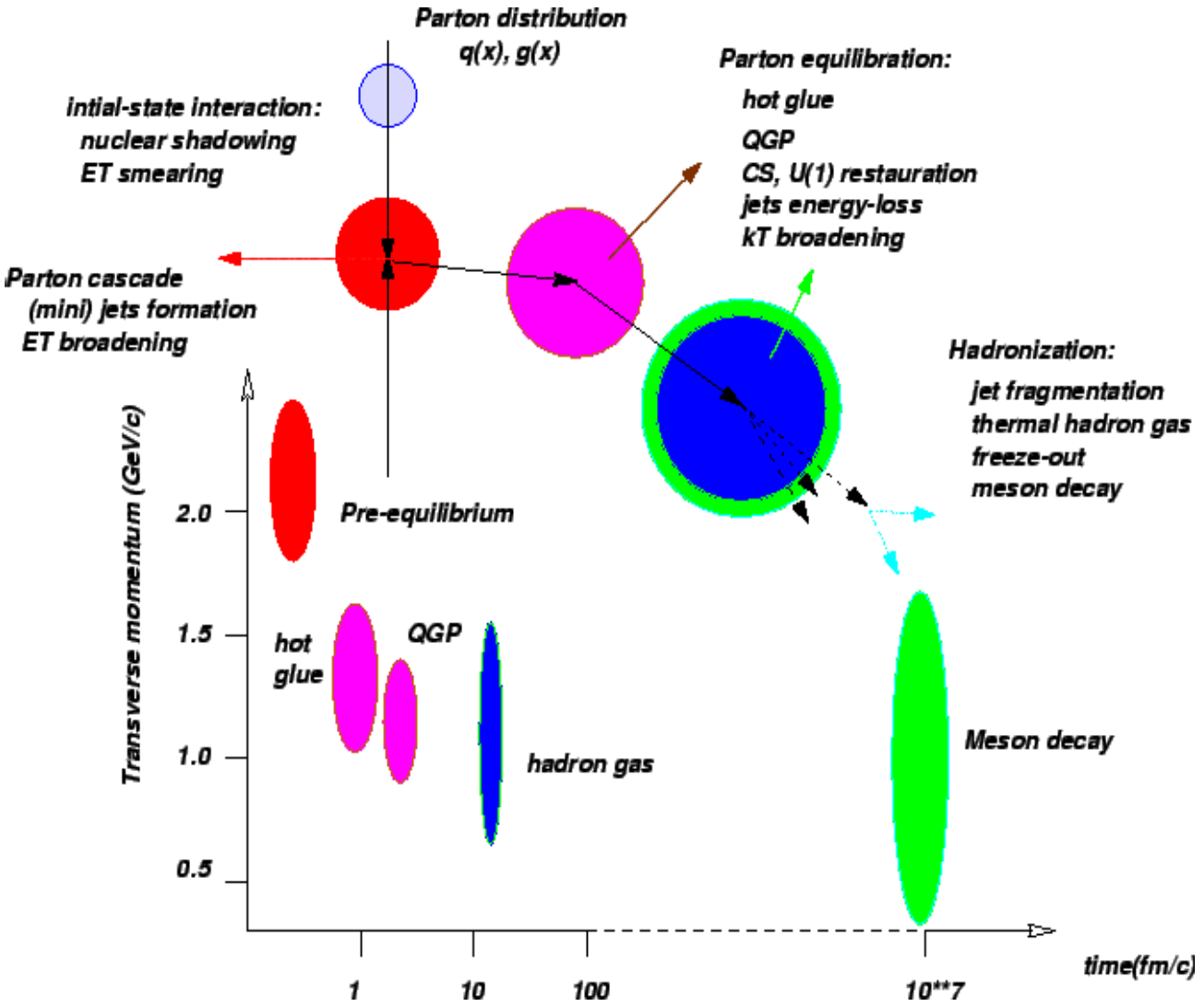
  - Hadron Gas

  and (if ever...)

  - Quark-gluon-plasma

- **Freeze-out**

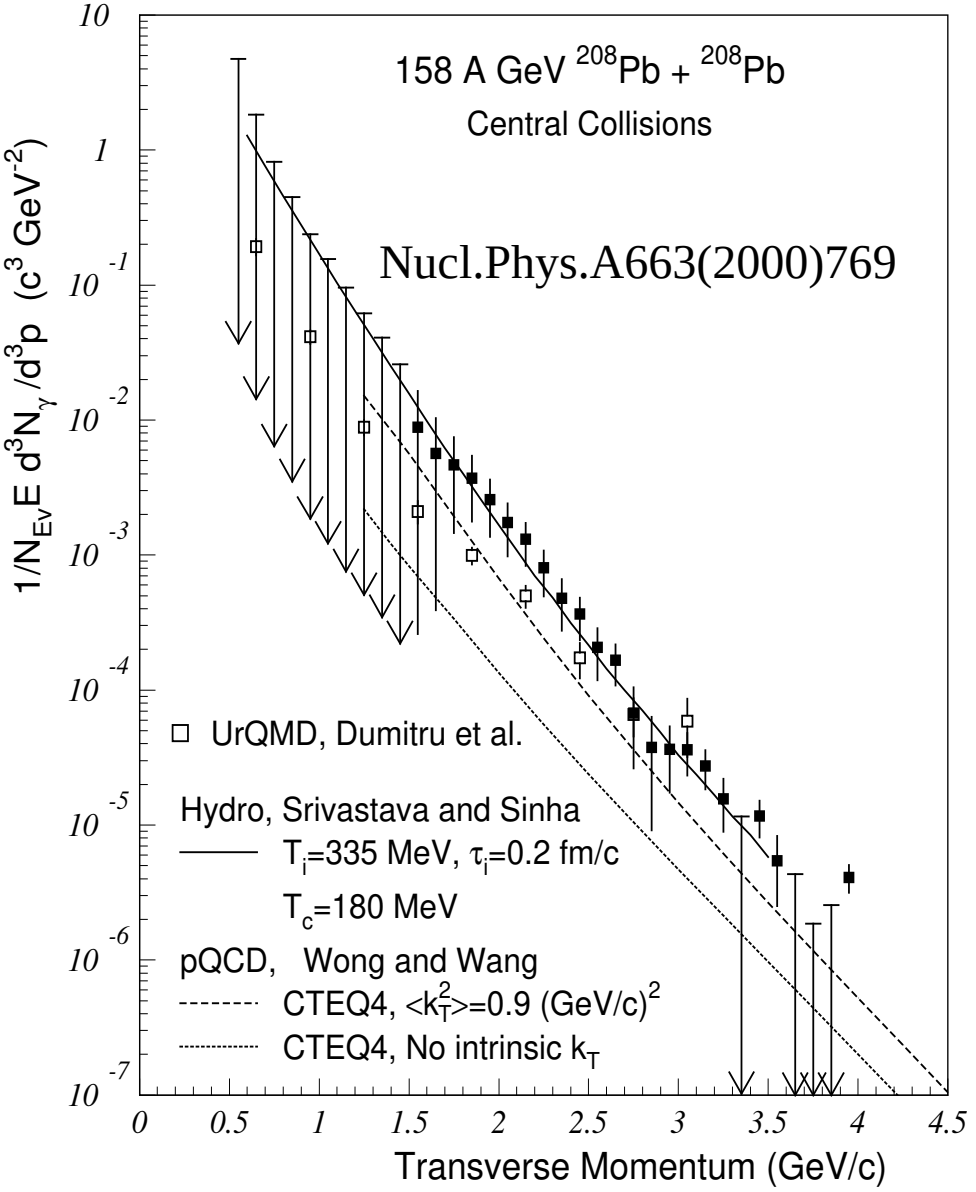
meson decays



DIRECT PHOTON :

Photon excess beyond those photons from long-lived meson decays

Why?: WA98 PbPb direct photons



- **Direct photon** excess found in PbPb at $\sqrt{s}$ = 17 GeV.
- Which origin?

  thermal radiation??.
- **Evaluate first the hard contribution**

Theory :

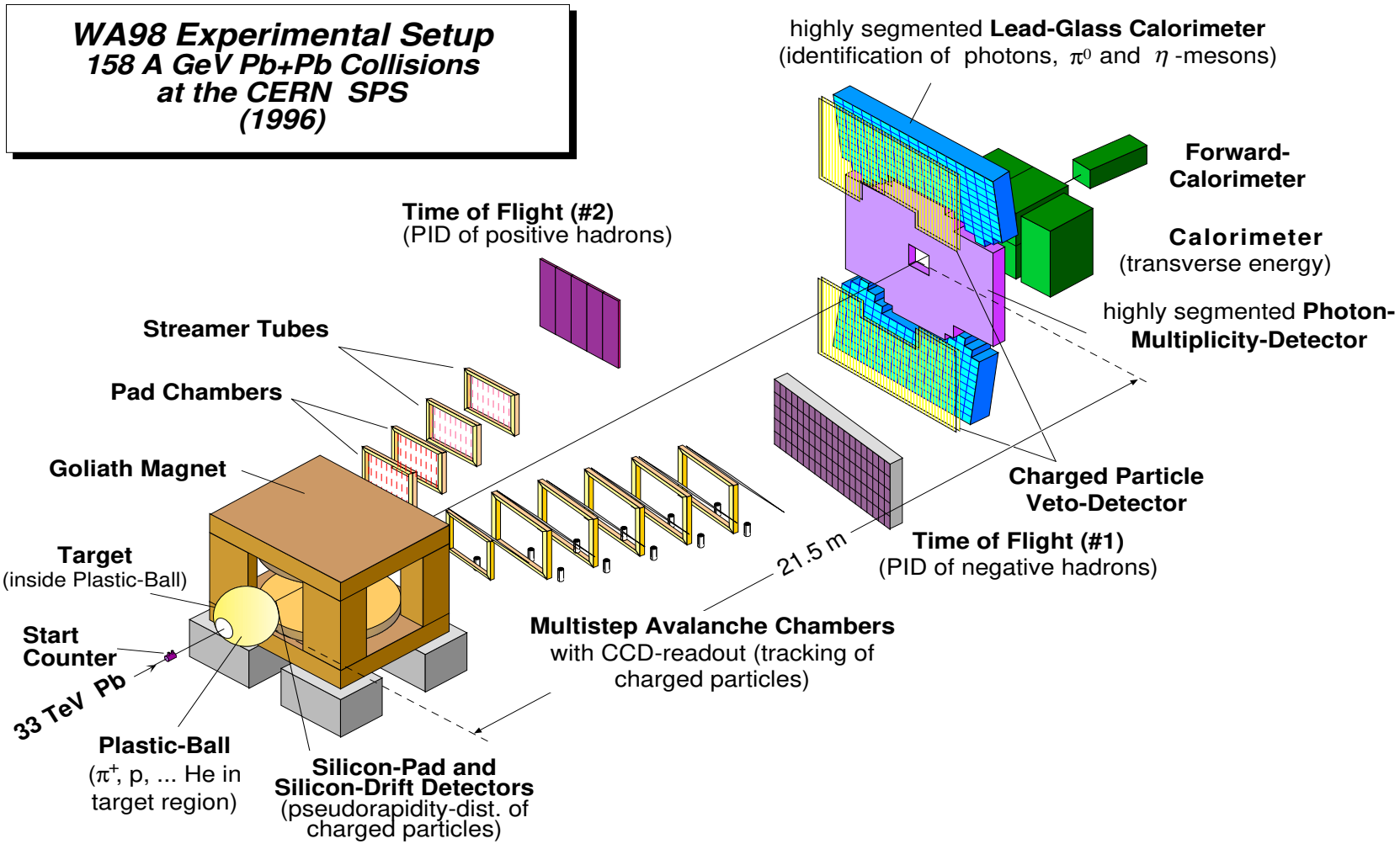
pQDC uncertainties: low pt, nuclear effects (intrinsic kt, Cronin effect, final state effects).

Data :

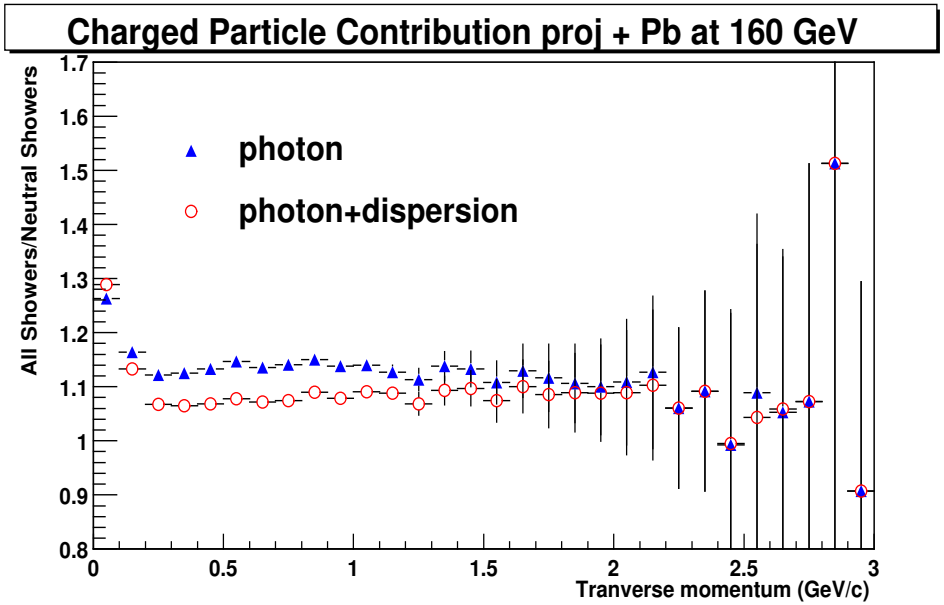
Existing pp and pA data to be scaled

WA98 pPb data
at same energy

How?: WA98 Experiment : Setup

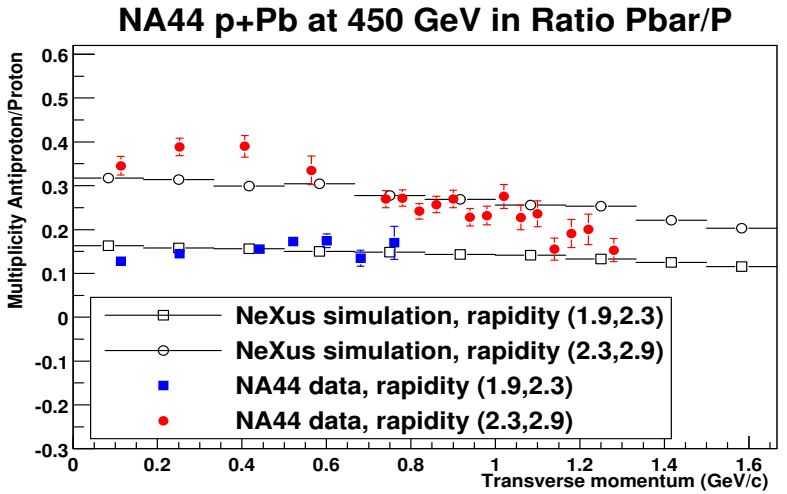


What?: Photons : identification and contamination



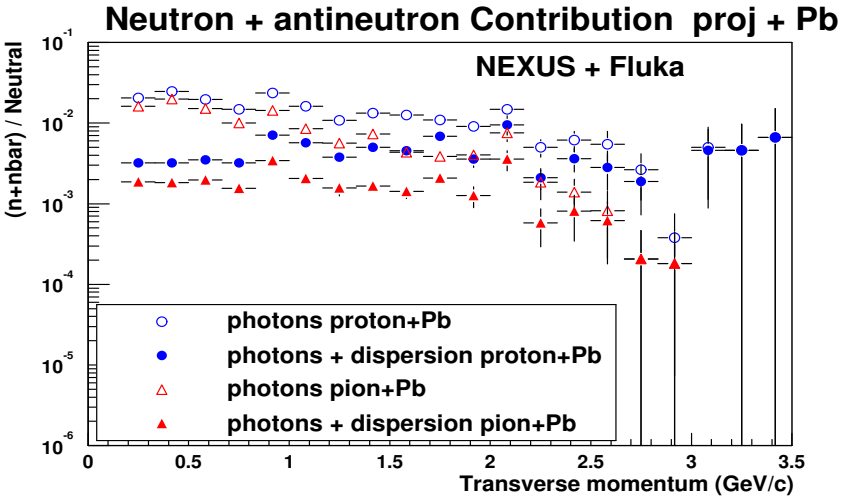
- Charged particles (7~13%)

Measured using CPV detector

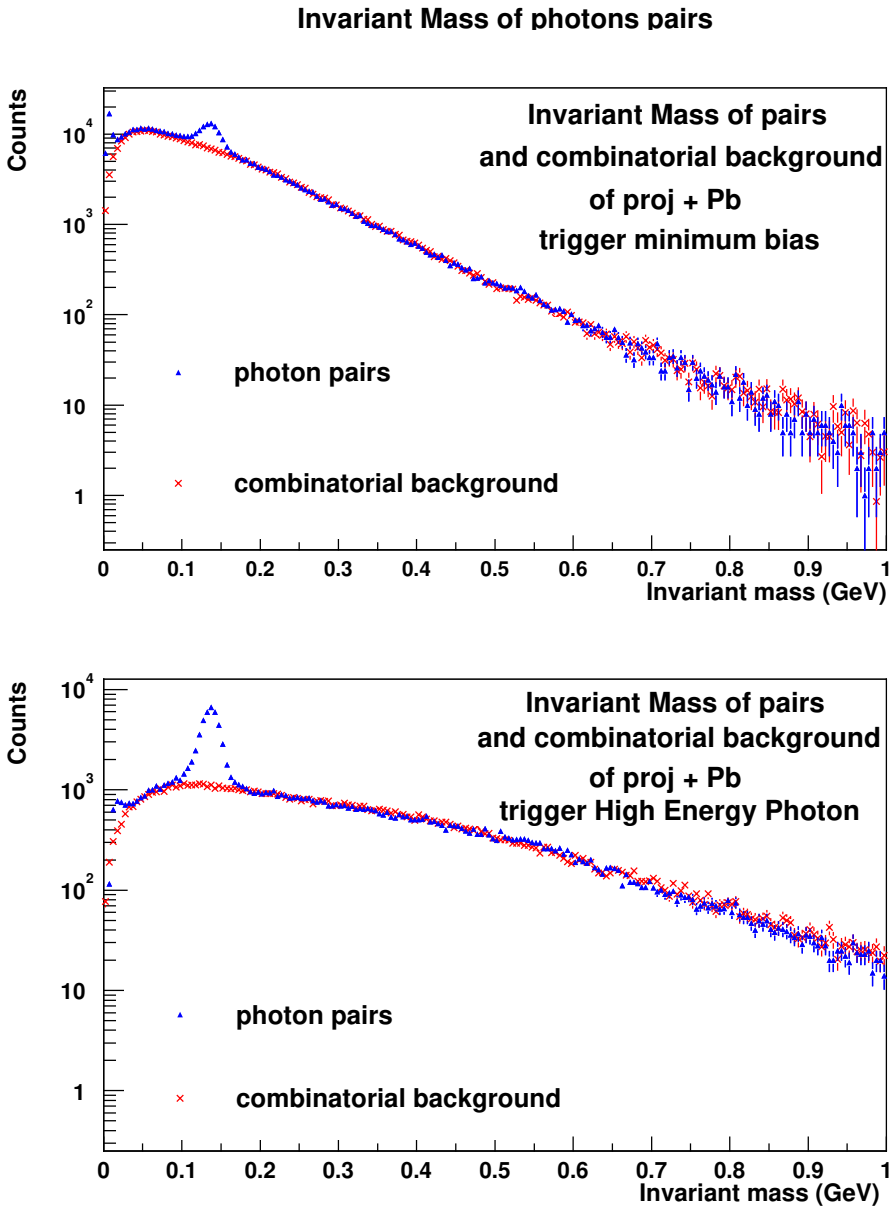


- Neutron and antineutron contribution (< 3%)

Estimated with NeXus generator and simulated LEDA response



What?: Decay photons : π^0

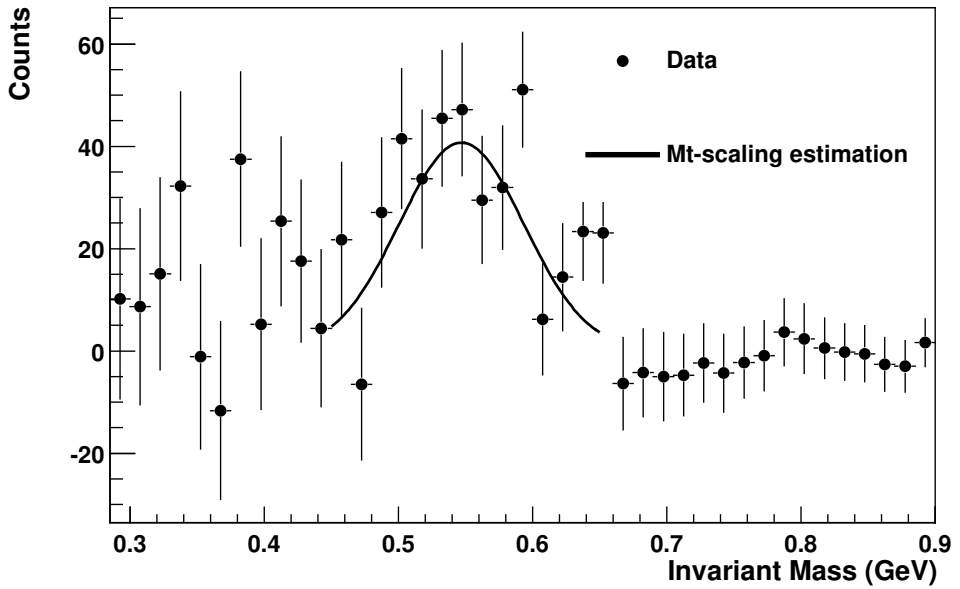


Backgroung γ comes mostly from neutral pion decay $\pi^0 \longrightarrow \gamma\,\gamma$ (98,8 %)

- Invariant mass identification.
- Combinatorial background subtraction (mixed event method).
- Detector and analysis efficiencies.

What?: Decay photons : other mesons

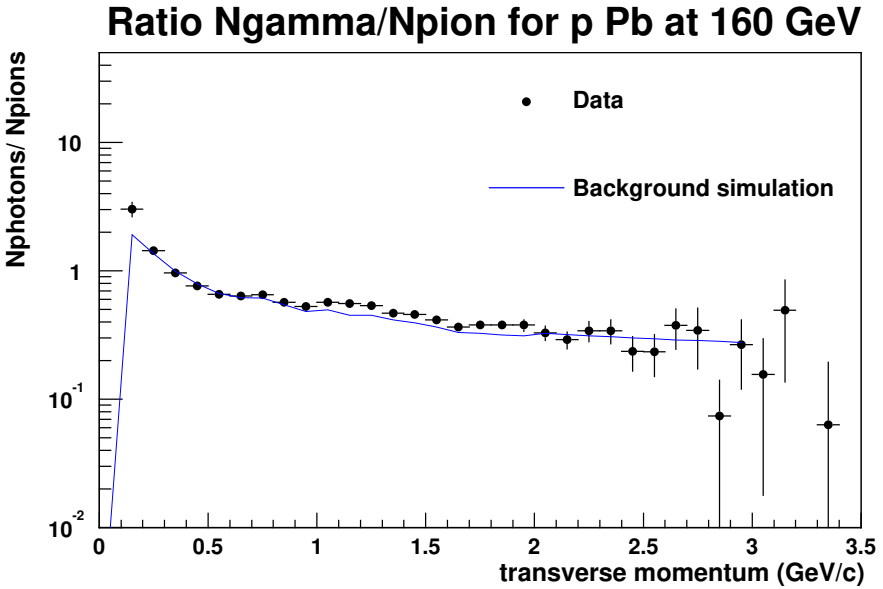
Meson Decay	Mass (MeV)	Branching Ratio
$\pi 0 \longrightarrow \gamma\,\gamma$	134,97	98,80%
$\eta \longrightarrow \gamma\,\gamma$	548,8	38,90%
$\omega \longrightarrow \pi 0\,\gamma$	783	8%
$\eta' \longrightarrow \rho 0\,\gamma$	958	30%
$\eta' \longrightarrow \omega\,\gamma$	958	3%
$\eta' \longrightarrow \gamma\,\gamma$	958	2,20%



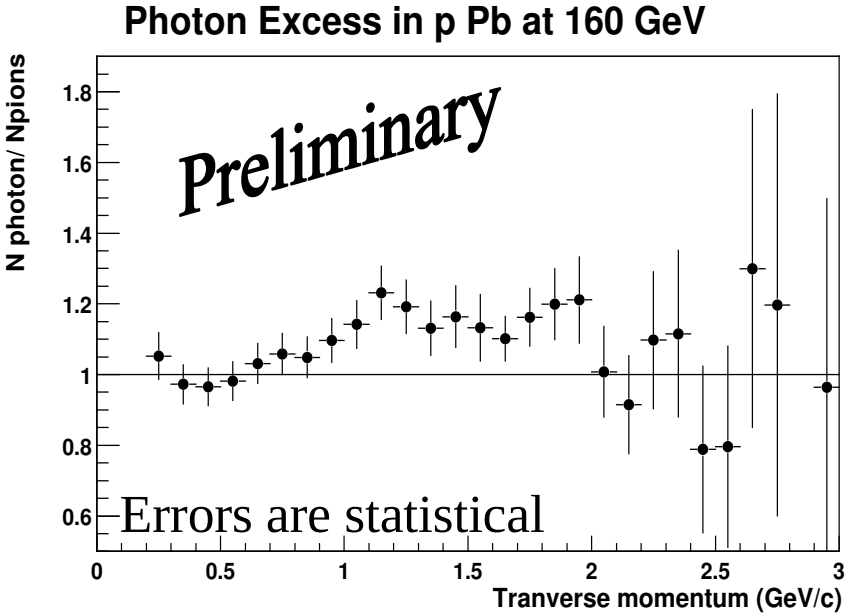
- Create **background photons** (decay photons)
  - π^0 measured
  - η measured and consistent with m_T-scaling
  - ω, η ', K^0 m_T-scaling

What?: Excess

Neutral pions	Photons
Data : π^0	Inclusive γs
Simul : π^0	Backgrd γs



$$\text{Excess} = \left(\frac{N_{gamma}}{N_{\pi^0}}\right)_{DATA} \Big/ \left(\frac{N_{gamma}}{N_{\pi^0}}\right)_{BACKGROUND\ SIMULATION}$$



So what?: Excess comparison

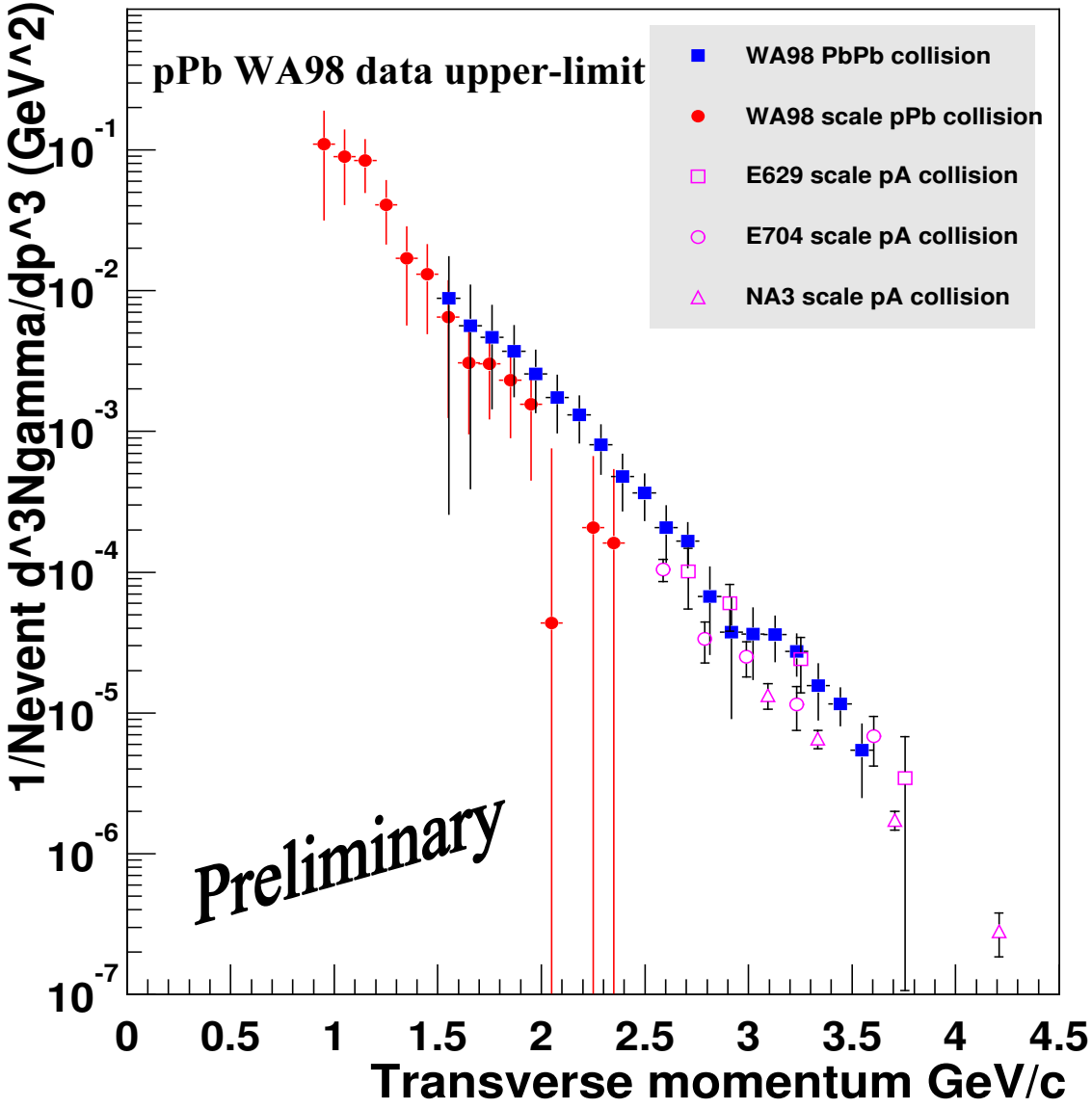
pA direct photons are hard contribution ⟹ Scaling to Pb Pb with number nuclear collisions

(Glauber calculation) :

3,7 collisions pPb

651 collisions central PbPb

Direct photons production



So what?: Conclusion

- WA98 collaboration has pPb data at same energy as PbPb.
- Direct photon production in pA system is crucial to establish a limit in thermal radiation for PbPb.
- Analysis of pPb data (still preliminary) hint to a direct photon excess.
- The hard photon contribution, scaled with number of collisions, is compared to PbPb direct photons.
- No WA98 stamped conclusions yet.

Theory friends be ready...