

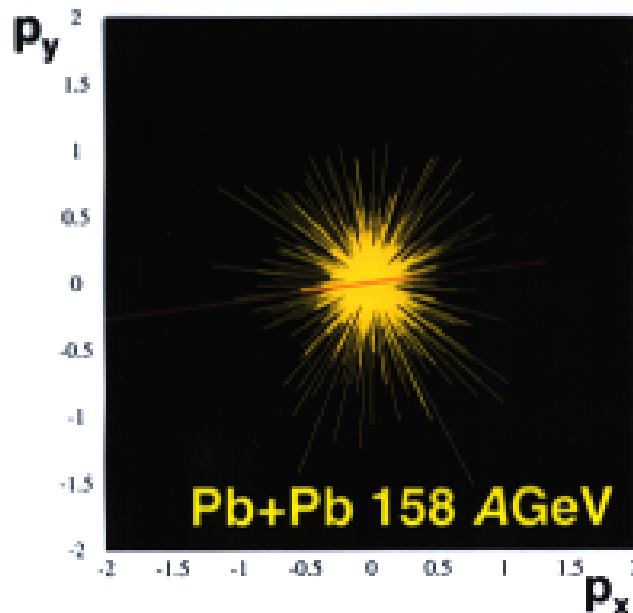
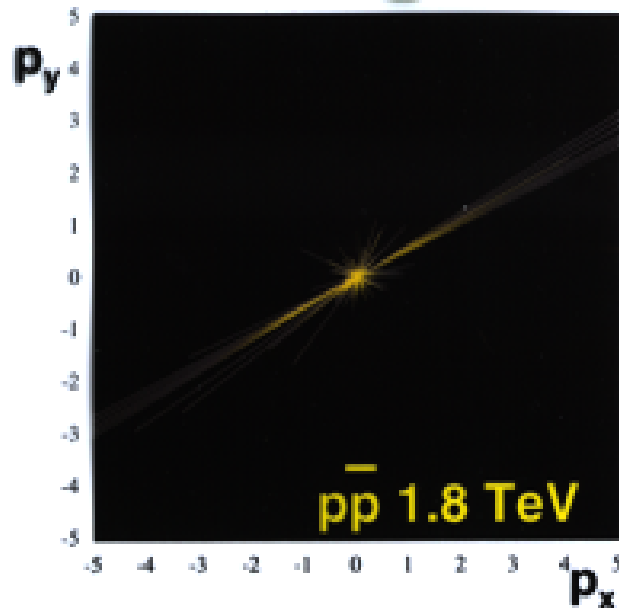
# Angular Correlations of High Momentum Photons at 158 AGeV p+A and Pb+Pb Collisions

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for  
the WA98 Collaboration

# Angular Correlations



- Hard scattering products considered good probe of properties of matter in early stage of collision

- becomes very important at RHIC

- analysis of high  $p_T$  hadrons good tool

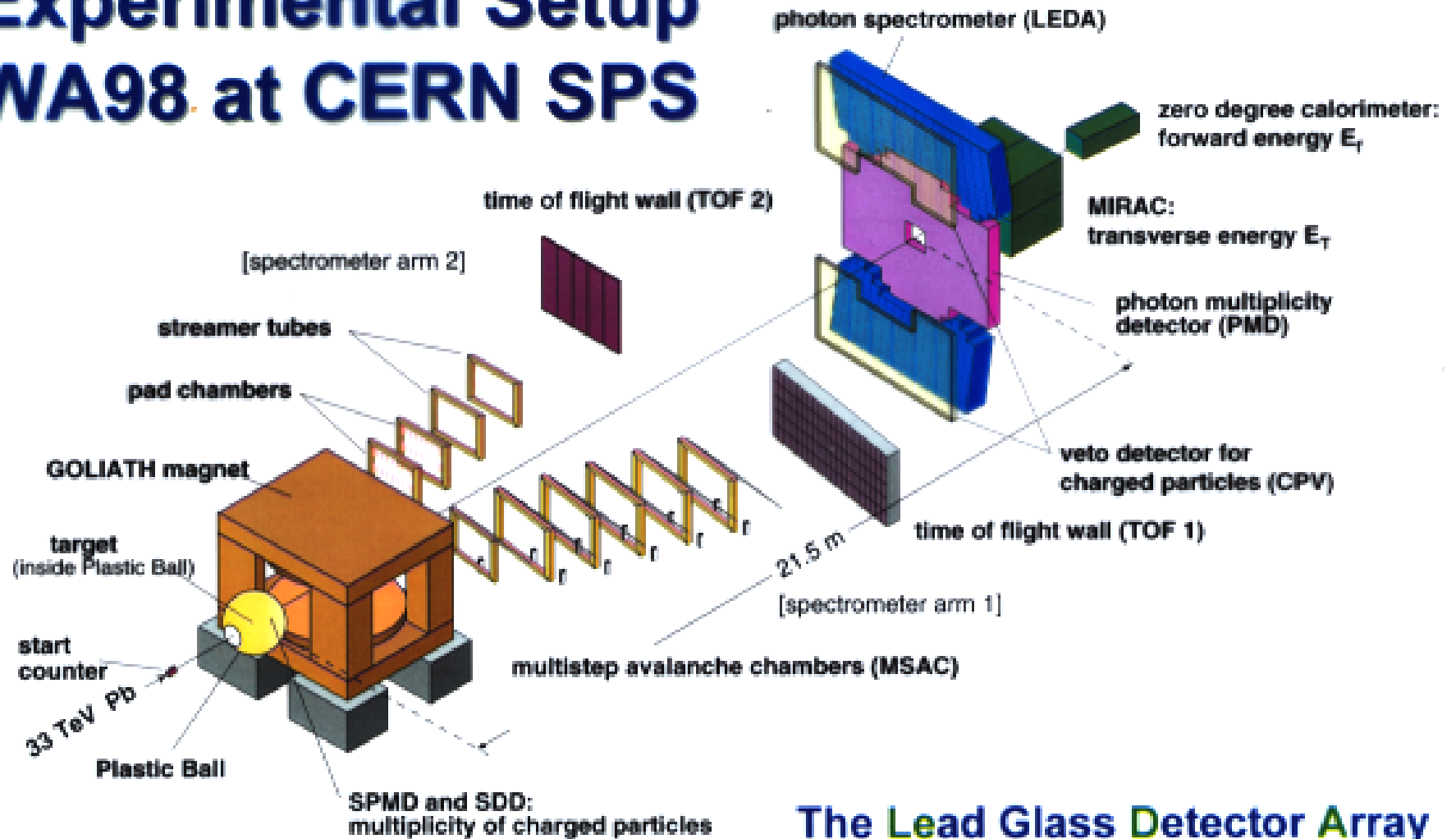
- study of angular correlation: search for jet like structures

- modification of correlation?

→ „jet quenching“

search for  $\pi^0$ - $\pi^0$  correlations  
at  $\Delta\phi=180$

# Experimental Setup WA98 at CERN SPS

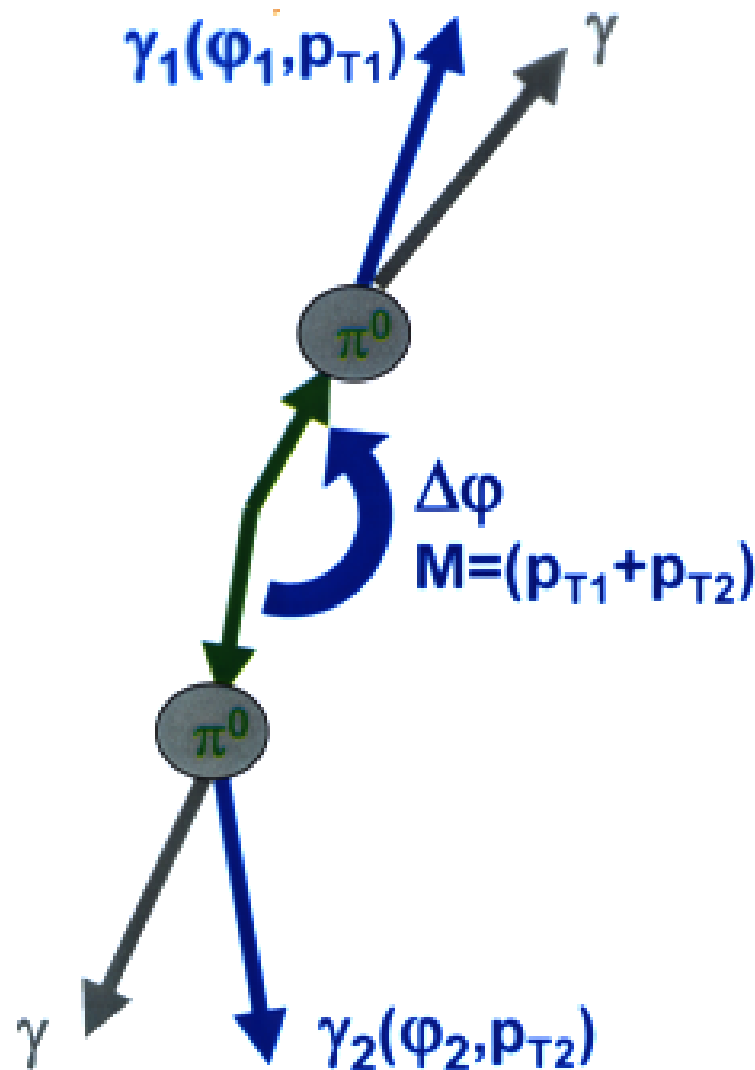


## The Lead Glass Detector Array

- 10080 leadglass modules

-  $2.4 < \eta < 3.0$

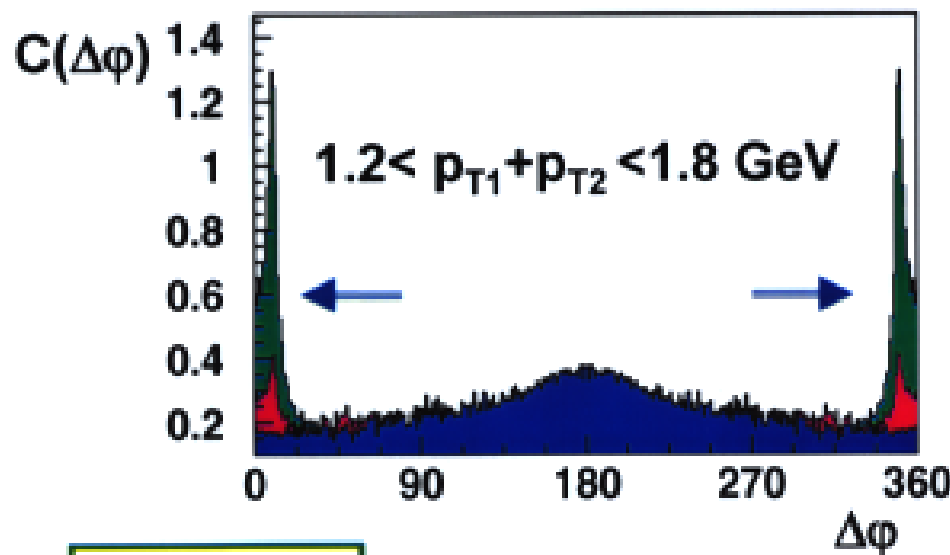
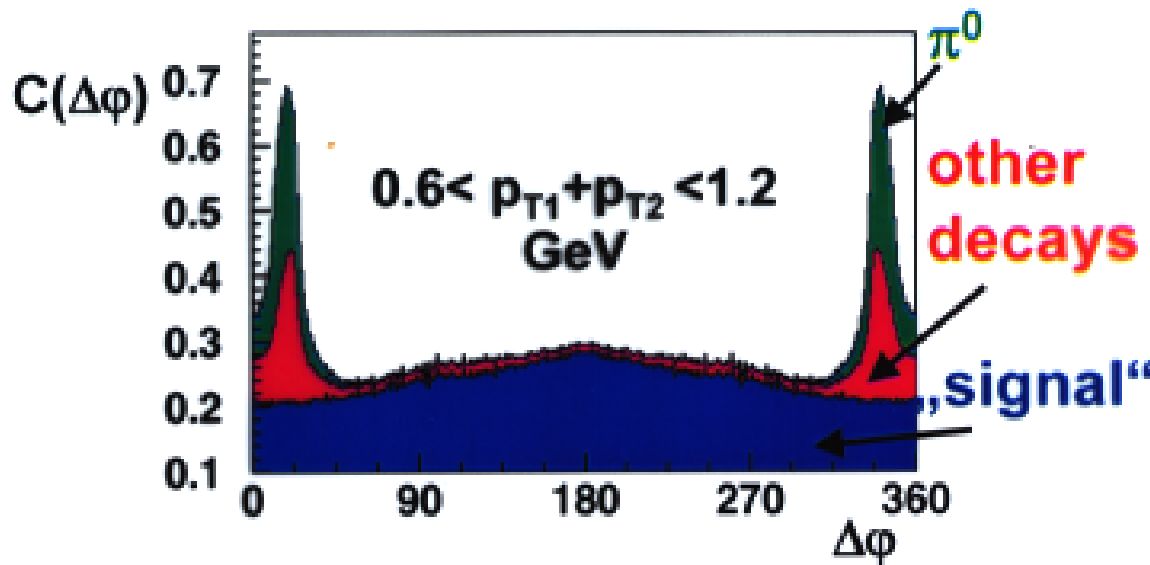
# $\pi^0\pi^0$ -correlations



- search for  $\pi^0\pi^0$ -correlations
  - individual  $\pi^0$  identification not possible
- measured by **correlation of decay  $\gamma$** 
  - all possible combinations
- pair characterisation:  **$\Delta\varphi$ , pseudomass  $M = p_{T1} + p_{T2}$**
- combinatorial background of uncorrelated pairs: **event mixing**

$$C = \frac{\left. \frac{d^2N}{d\varphi_1 d\varphi_2} \right|_{p_{T1} + p_{T2}}}{\left( \frac{dN}{d\varphi_1} \frac{dN}{d\varphi_2} \right) \Big|_{p_{T1} + p_{T2}}}$$

# $\gamma\gamma$ -pairs

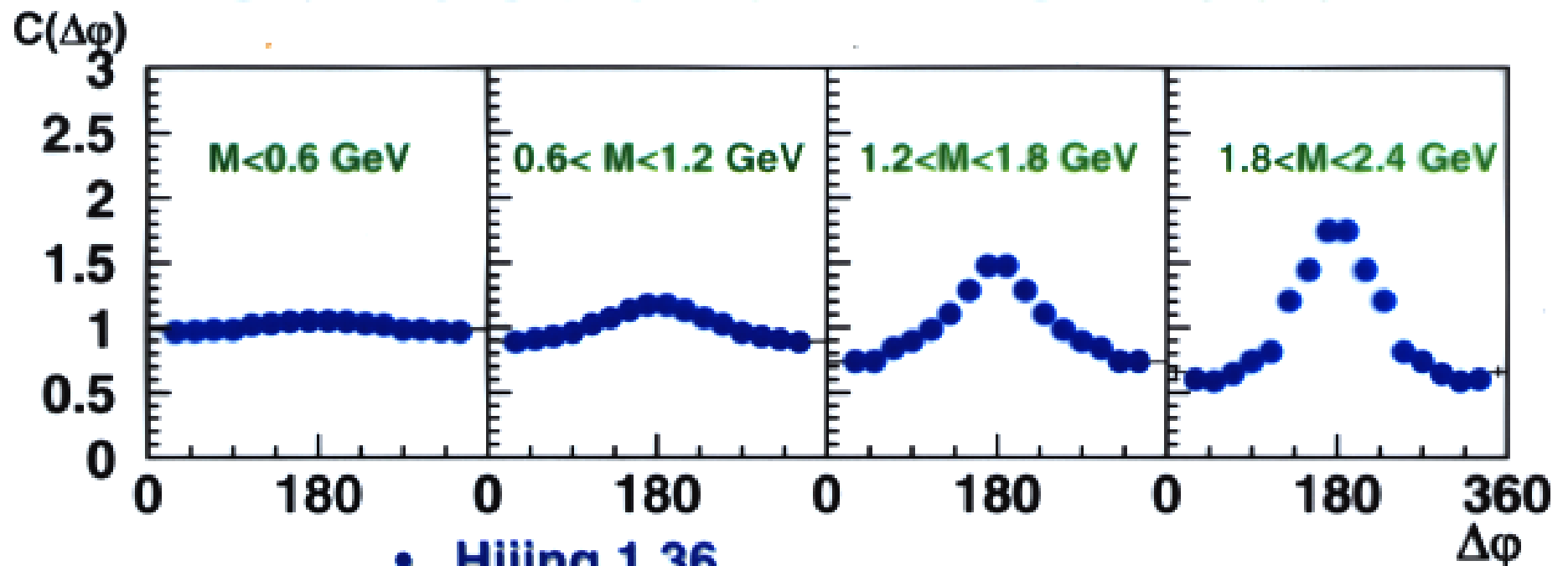


Hijing p+C

- two types of correlated pairs
- radiative decays
  - mainly  $\pi^0$
  - $\eta, \omega, \eta', \dots$
  - smaller opening angle with higher  $p_T$
- back-to-back correlations
  - „signal“ = different parents

**radiative decays  
main problem  
in analysis of exp. data**

# Correlations in the Model



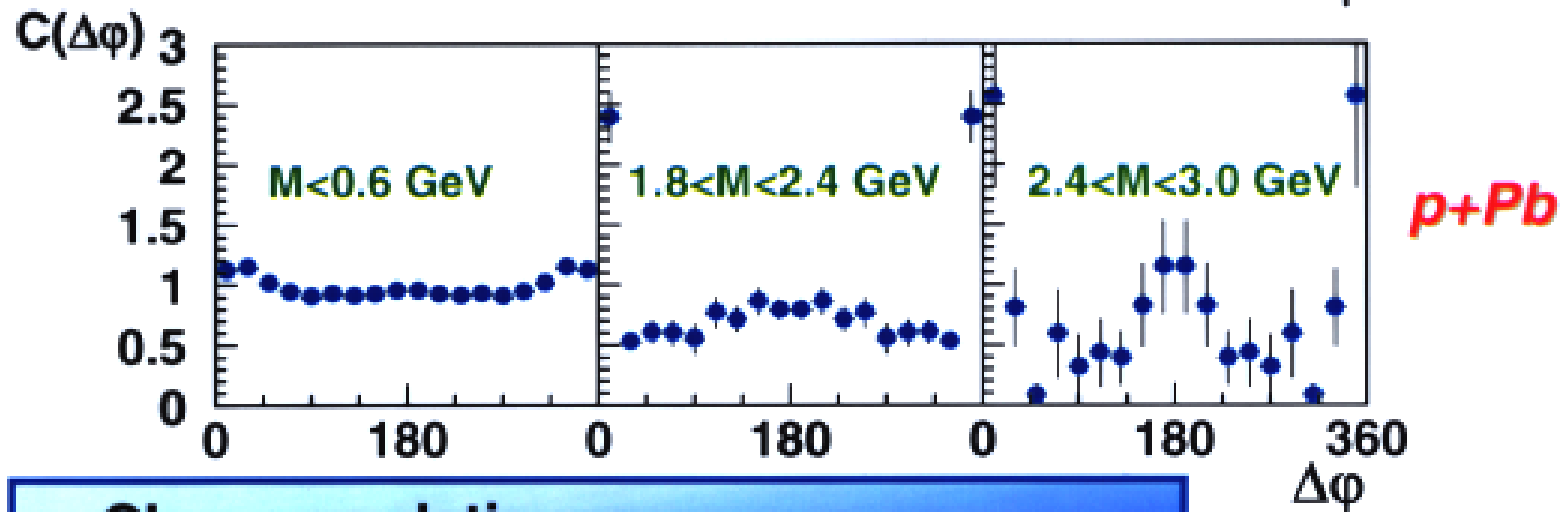
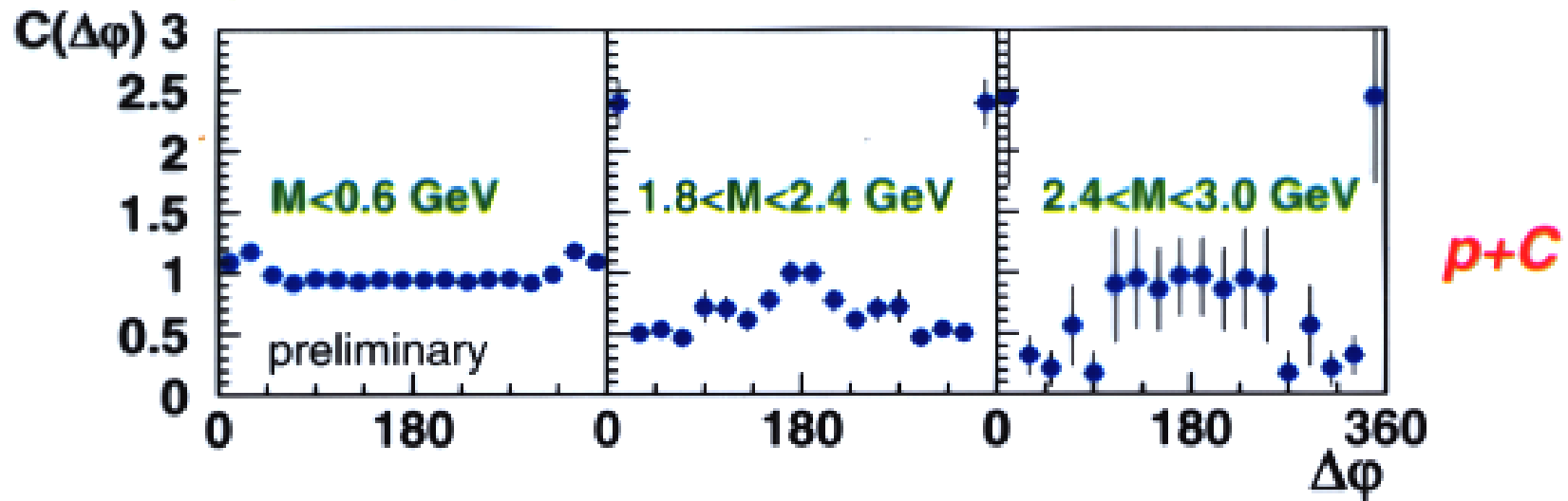
- Hijing 1.36
- analysis similar to exp. data
  - detector acceptance included

Hijing p+C

$$M = p_{T1} + p_{T2}$$

- Clear correlation
- stronger effect with higher  $M = p_{T1} + p_{T2}$

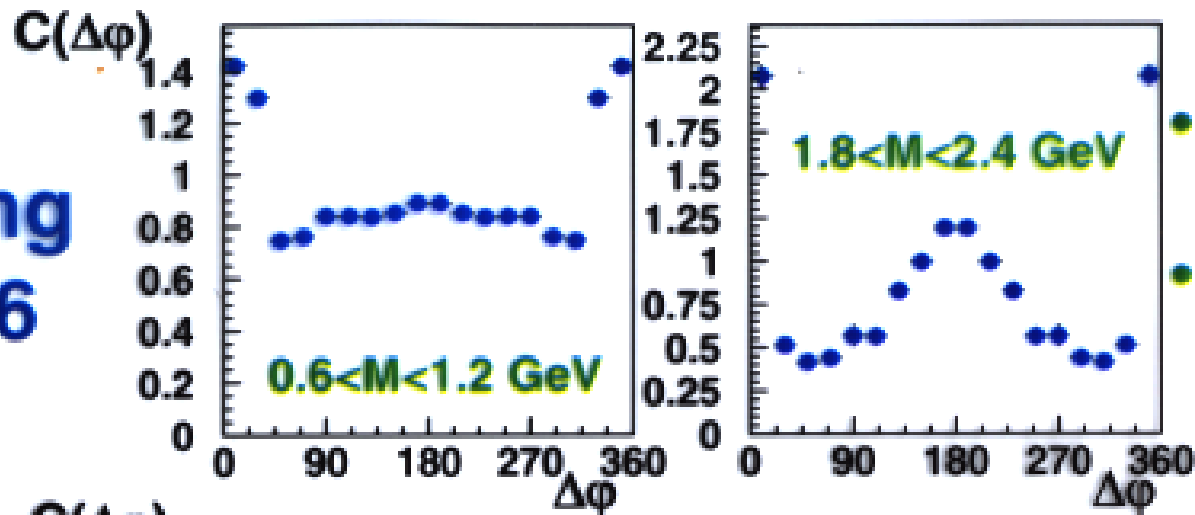
# Correlations in the Data



- Clear correlation
- stronger effect with higher  $M = p_{T1} + p_{T2}$

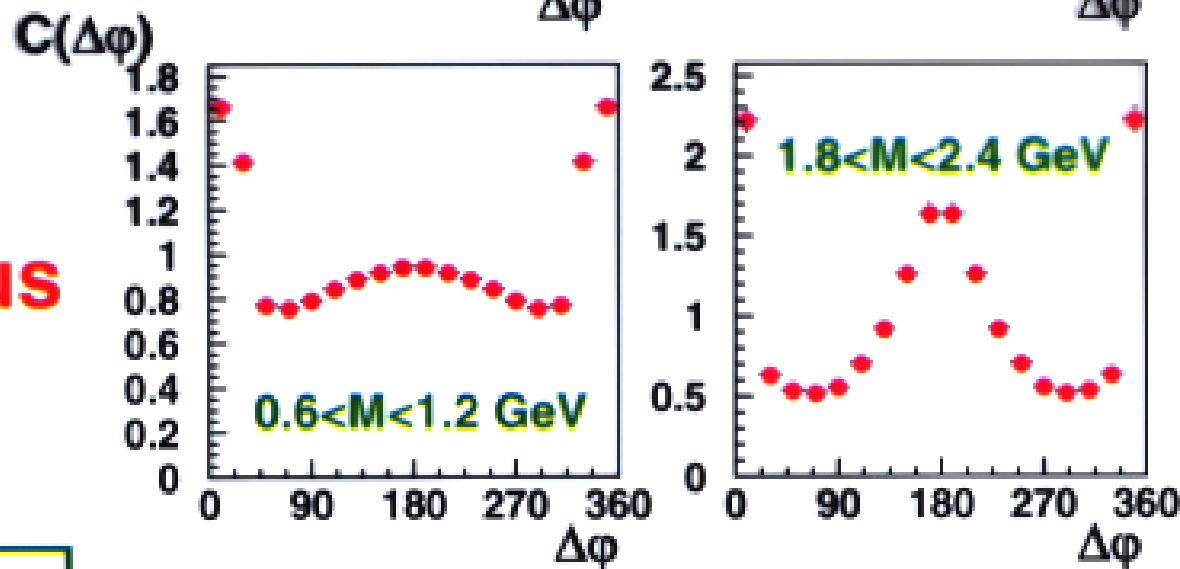
# Comparison Venus - Hijing

Hijing  
1.36



- Correlation in both models
- no hard-scattering in Venus

Venus  
4.12



$p+C$



# Moving on...

## Observation...

- Correlation in the data
- Stronger effect with higher  $p_T$
- Effect seen in Hijing, Venus (and Nexus)

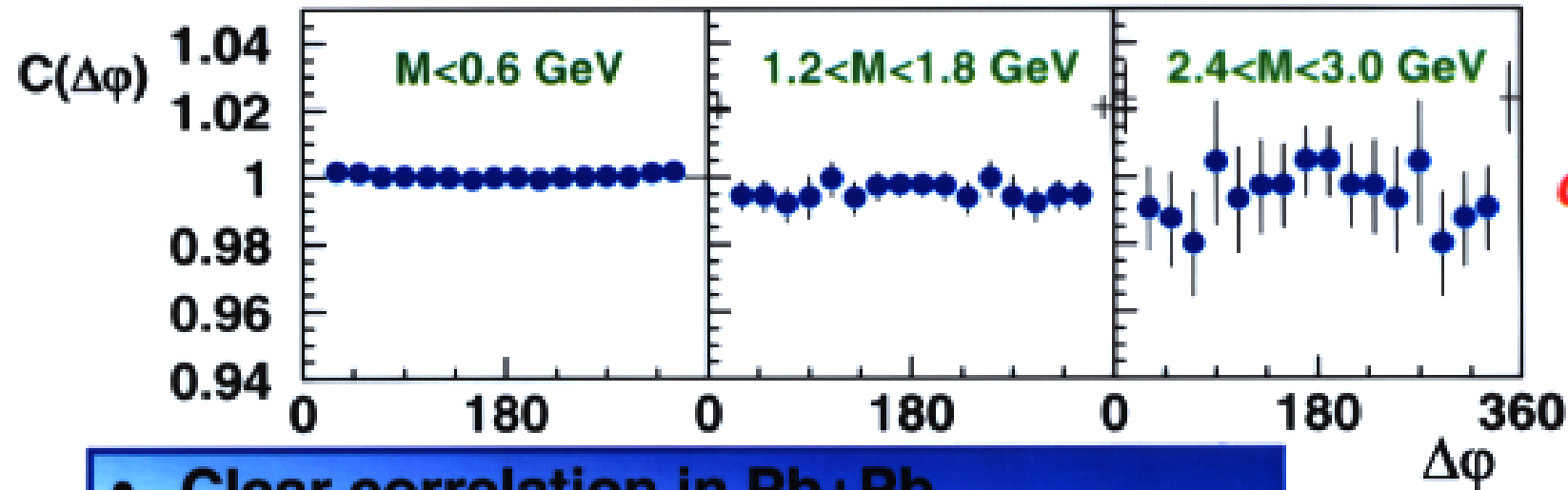
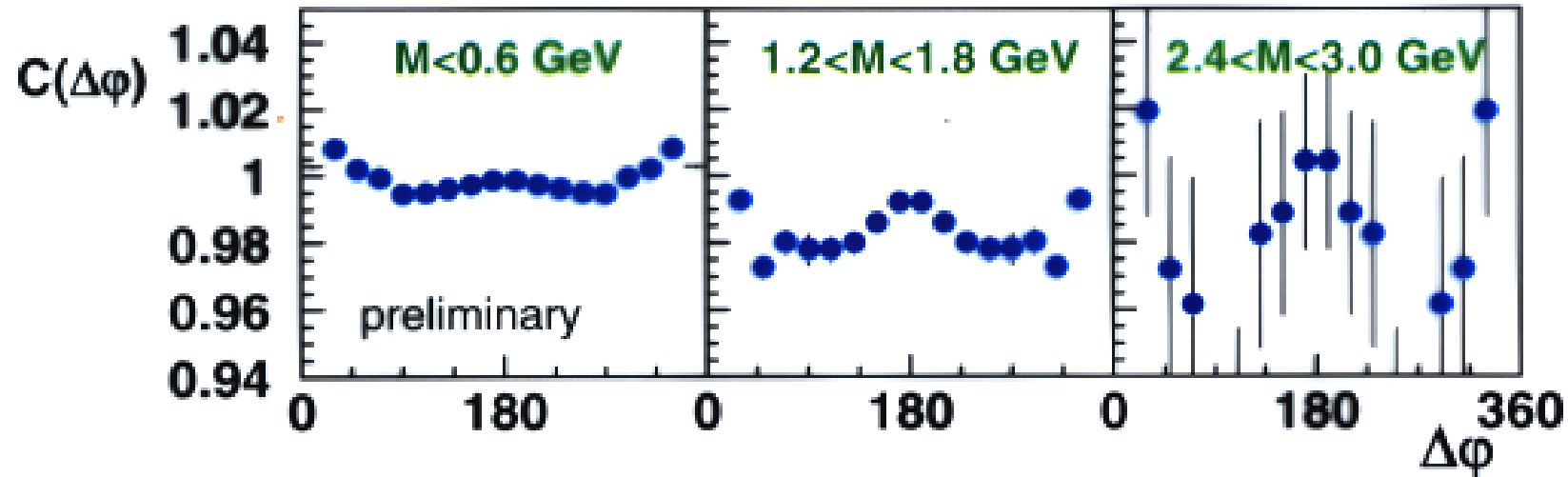
## Assumption...

- Correlations originate from **direct** production of  $\pi^0$  in **single binary collisions**
- Contains information about
  - Ratio of directly produced to rescattered particles

## Direction...

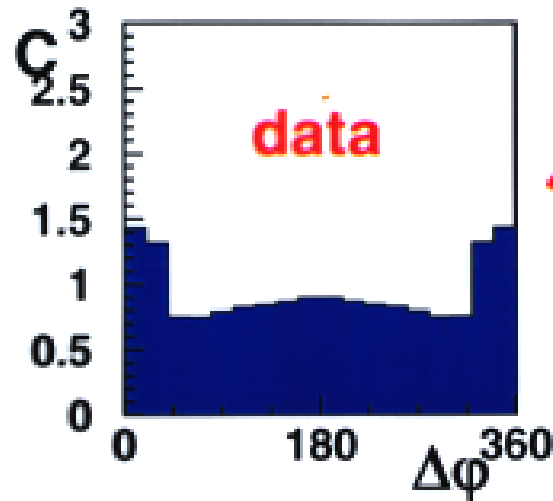
- Use normalization from p+A
- Study in heavier systems

# Correlations in Pb+Pb

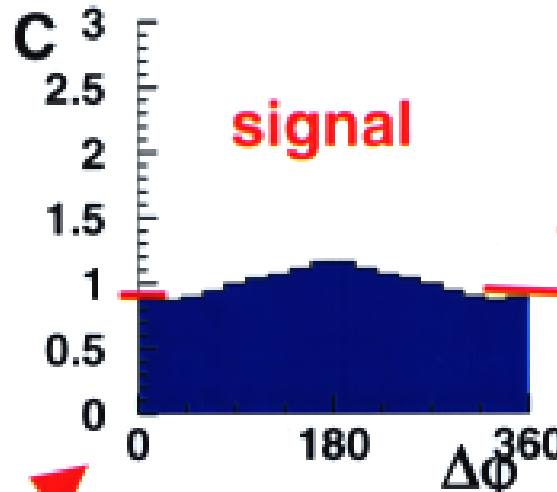


- Clear correlation in Pb+Pb
- stronger effect with higher  $M = p_{T1} + p_{T2}$
- stronger effect in peripheral events

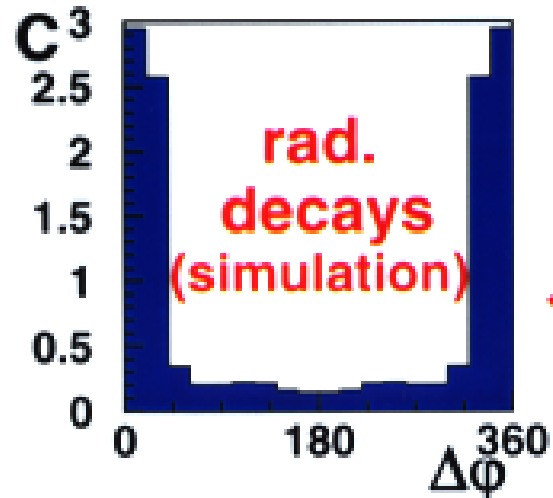
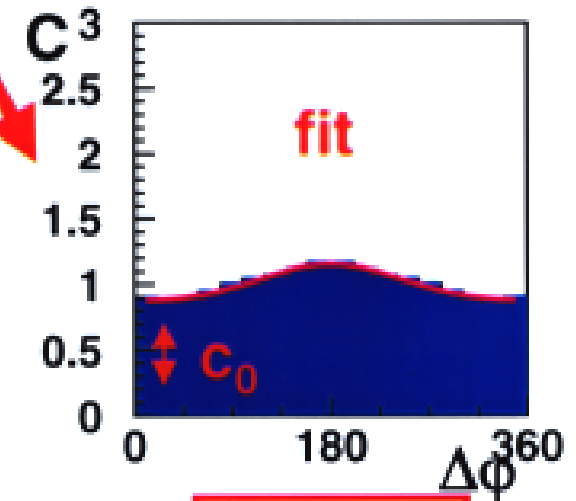
# Extraction of the Signal



assume const signal  
at small  $\Delta\phi$



fit:  
gauss+const.



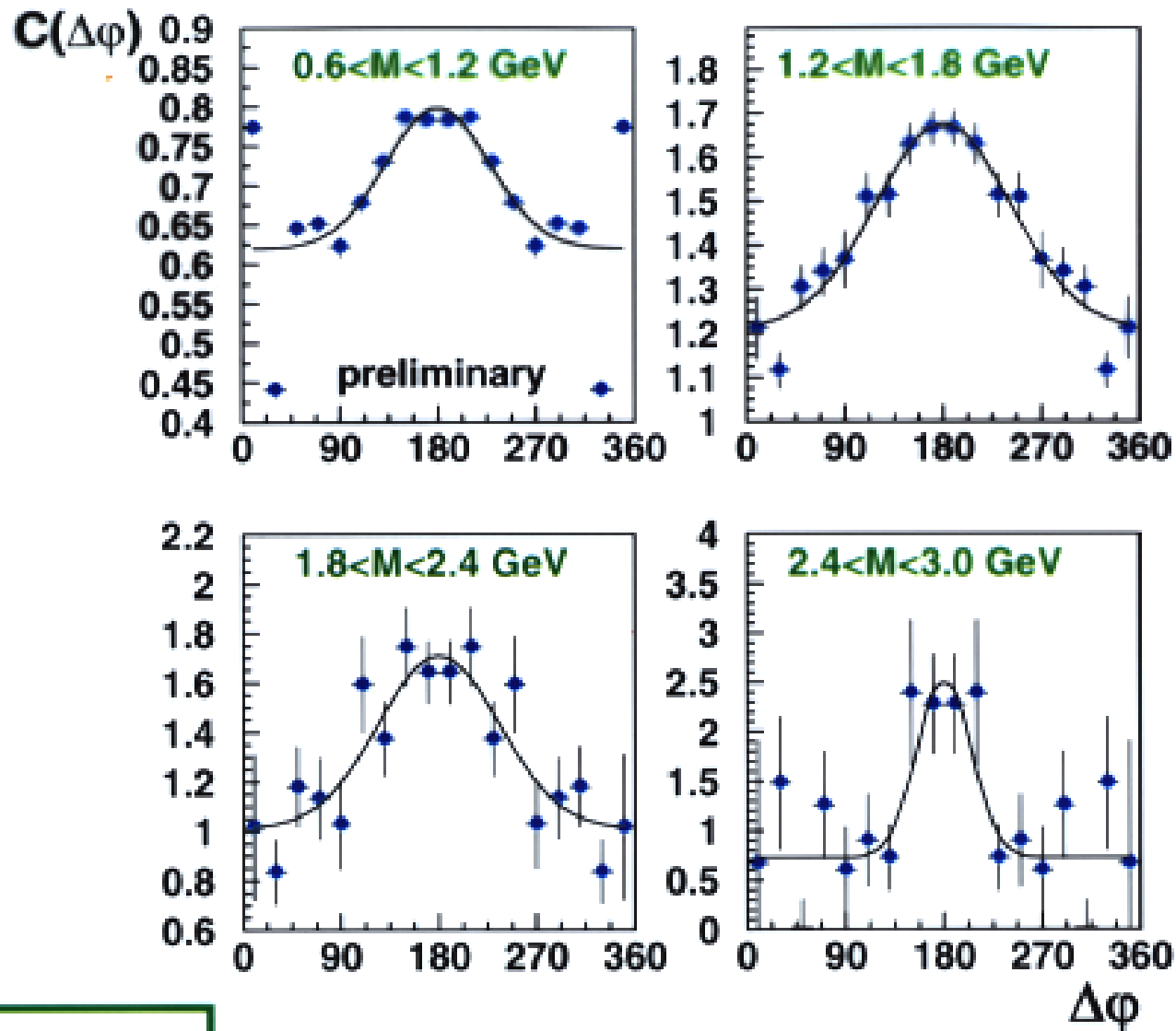
$$c(x)_i = \text{data}_i - x \cdot \text{dec}_i^{\text{sim}}$$

$$f(x) = \sum_{i=1}^3 c_i(x) - \langle c(x) \rangle$$

$$f'(x) = 0$$

$$\frac{\sigma}{A/c_0}$$

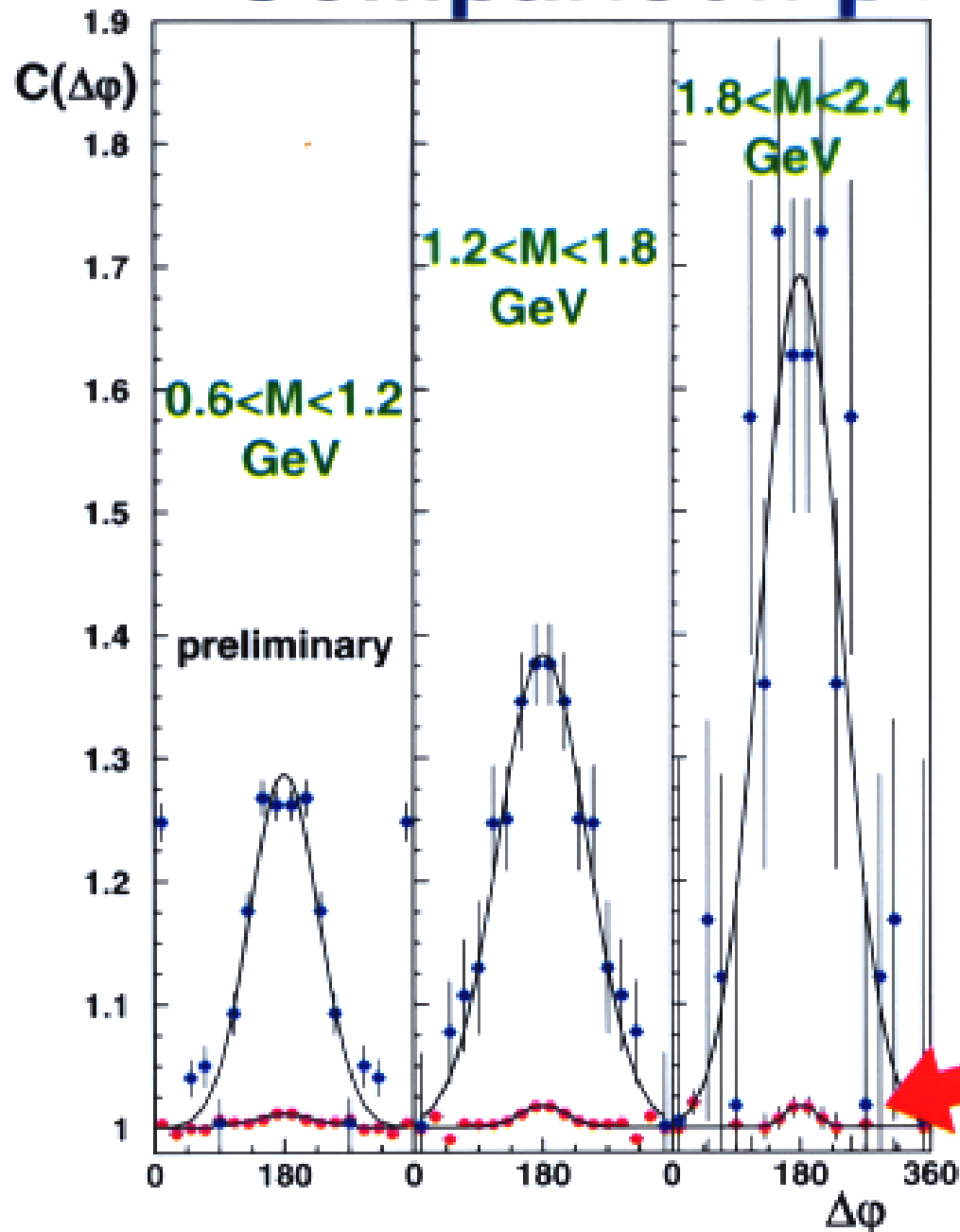
# Signal p+Pb



p+Pb Data

work in progress

# Comparison p+Pb and Pb+Pb



- Very weak effect in Pb+Pb compared to p+Pb
  - Why?
    - # of binary collisions? (combinatorics, trivial)
    - Rescattering ?
    - (Jet quenching) ??
  - Further effects?
    - Flow ?
    - ...
- ➡ quantitative analysis to follow

Pb+Pb  
peripheral

# Summary

- **Back-to-back correlations of  $\gamma$ -pairs observed at SPS**
- **Strong correlation in p+A**
- **Weaker correlation in peripheral Pb+Pb events**
- **Almost not visible in central Pb+Pb collisions**
- **Correlation increasing with higher  $p_T$**
  
- **Qualitatively seen in event generators Hijing, Venus**
- **Tool to study production of directly produced particles**
  - **Related to minijets?**
  - **Quantitative study under way**
- **Valuable information for similar study at RHIC energies**

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