

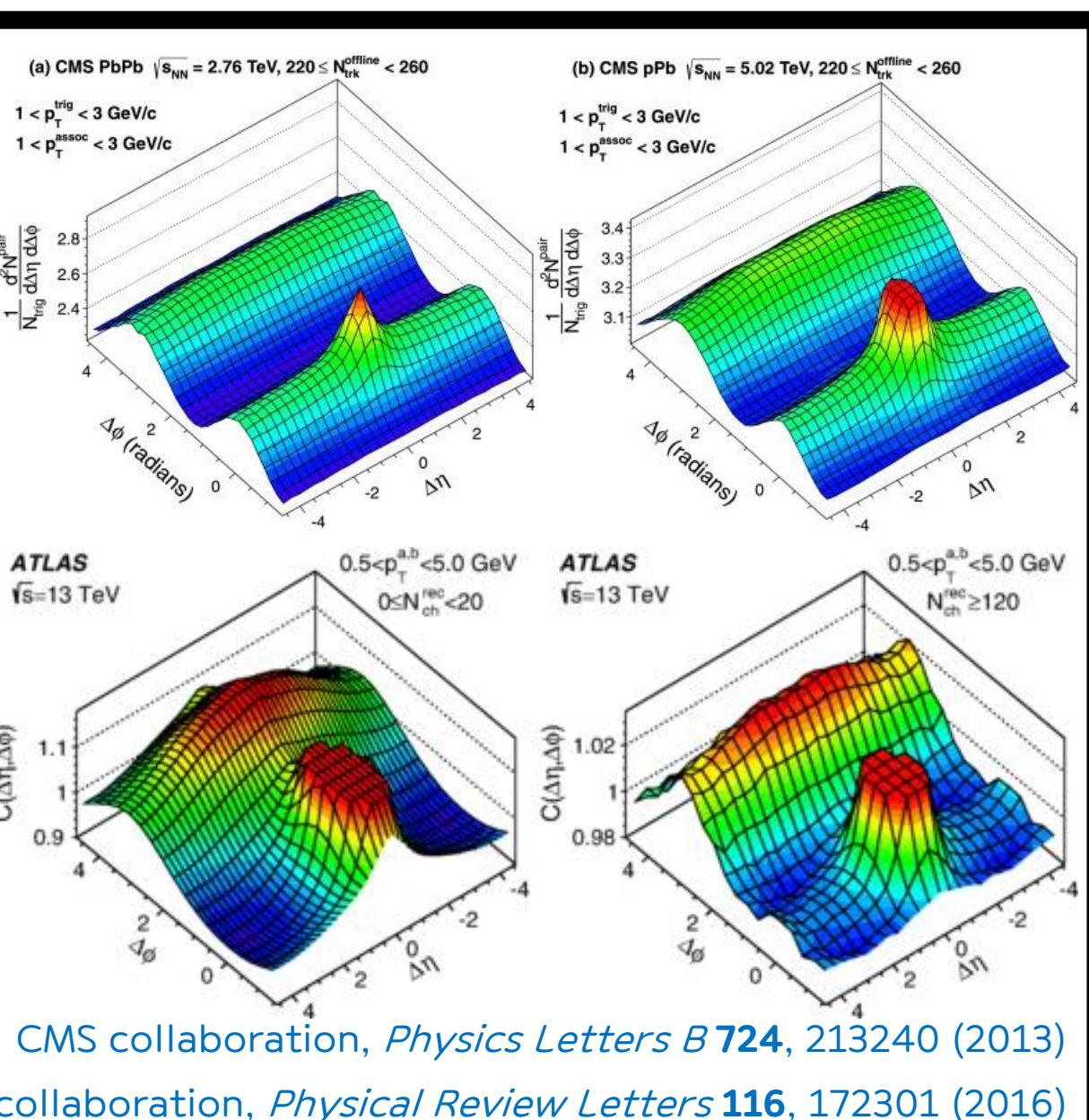
Understanding Ridge behavior via kinematics between jets and medium

Ridge structure

Introduction

AA collisions

- Explained by hydrodynamics
- Regarded as one of evidence for QGP



CMS collaboration, *Physics Letters B* **724**, 213240 (2013)
ATLAS collaboration, *Physical Review Letters* **116**, 172301 (2016)

pp collisions with high-multiplicity

- Reported from LHC
- Not enough to produce QGP

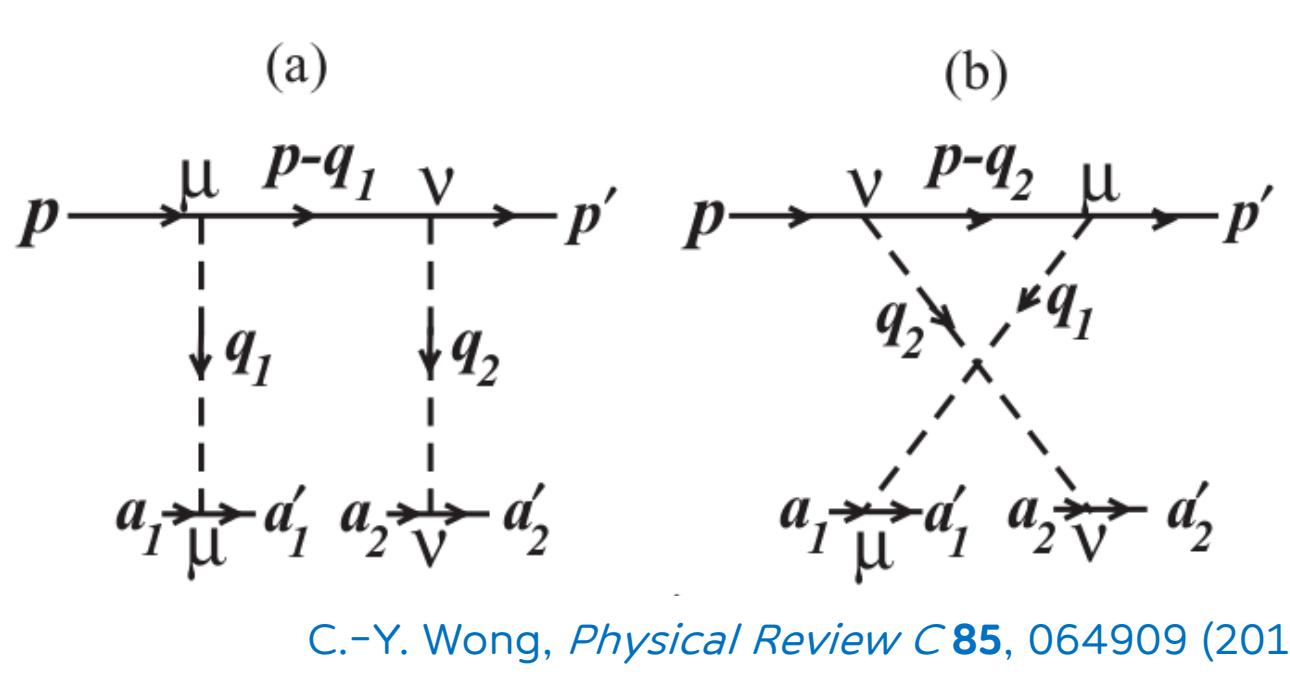
Try to understand via kinematics

- Interaction between jet & medium

Jet & Medium interaction

Energy loss mechanism for jet

- Collision
- Radiation
 - Photon (**Bremsstrahlung**)
 - Gluon



C.-Y. Wong, *Physical Review C* **85**, 064909 (2012)

Based on previous study

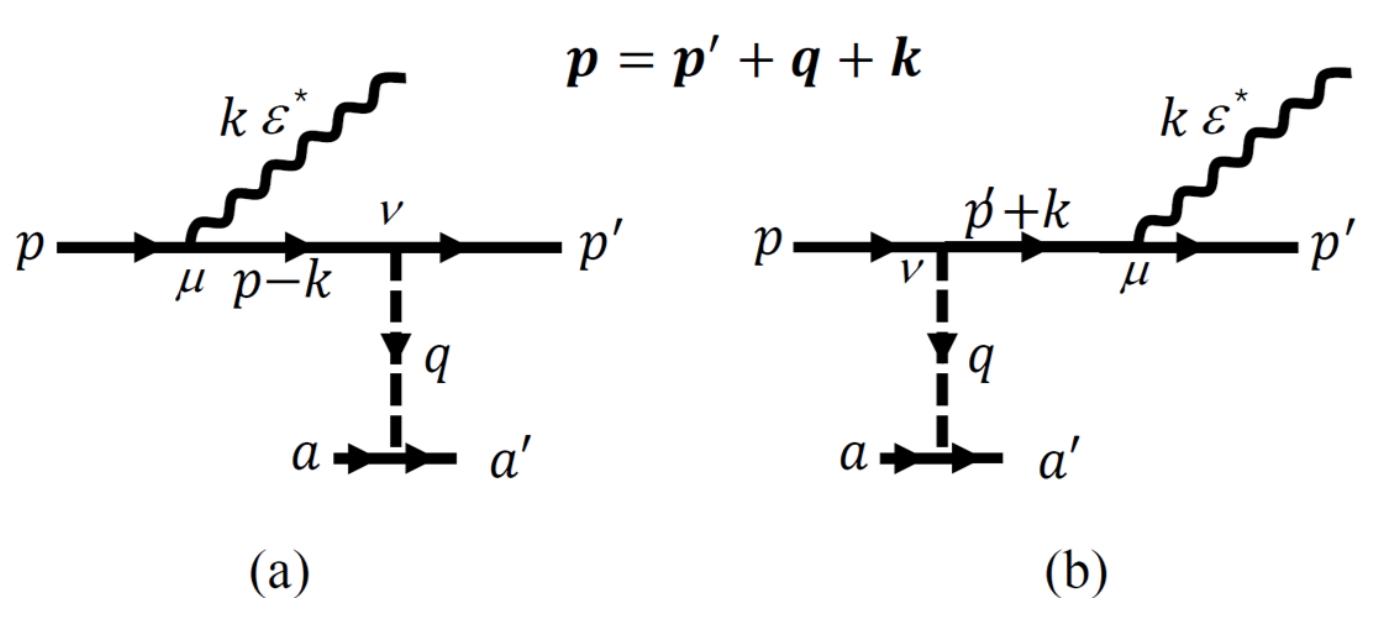
$$d\sigma \sim |\mathcal{M}_{(a)} + \mathcal{M}_{(b)}|^2 = |\mathcal{M}_{(a)}|^2 + |\mathcal{M}_{(b)}|^2 + (\text{interference})$$

- Collision between jet & medium partons

- Collective motion
 - Medium partons aligned along the jet

Bremsstrahlung process

- Might interfere constructively
- Explain Ridge structure

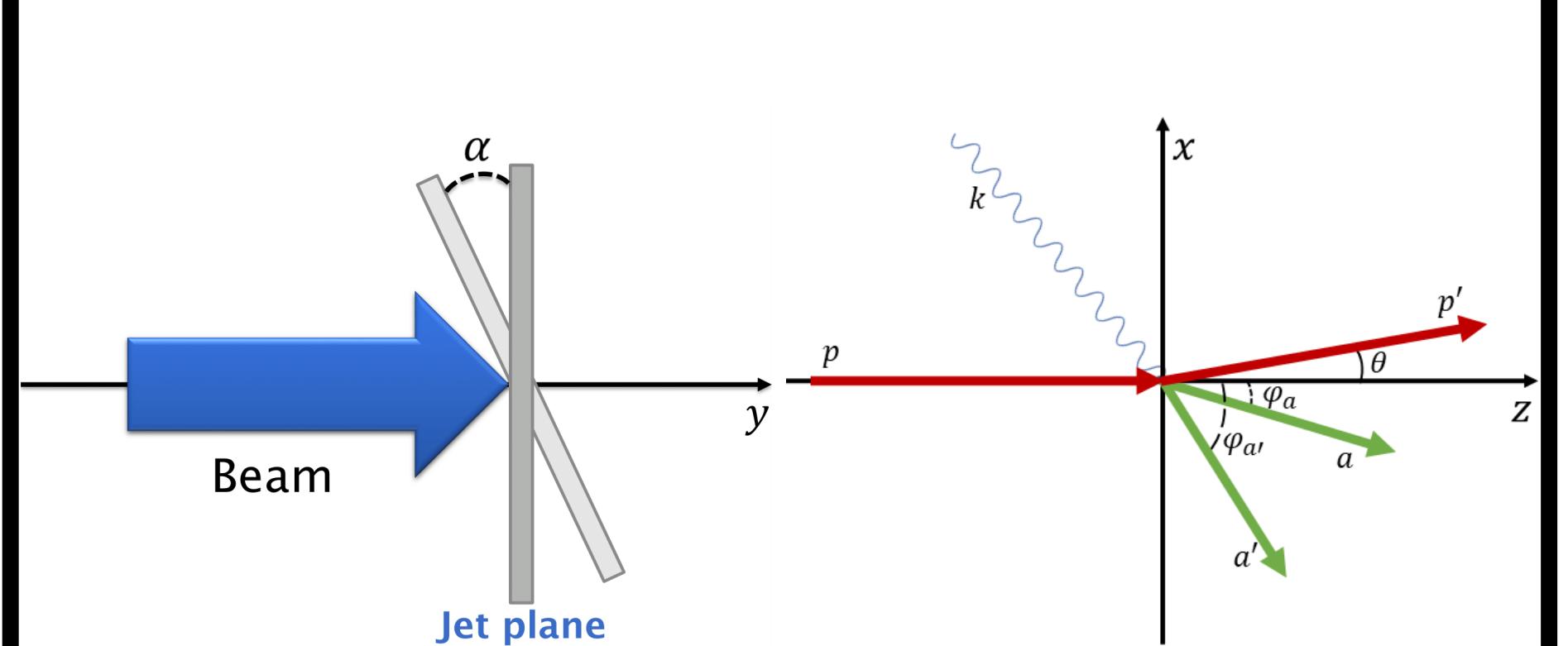


(a) (b)

Coordinate

Assumption

- Jet plane is perpendicular to the beam



Correlation

In experiment

$$C(\Delta\eta, \Delta\varphi) = \frac{S(\Delta\eta, \Delta\varphi)}{B(\Delta\eta, \Delta\varphi)}$$

In theory

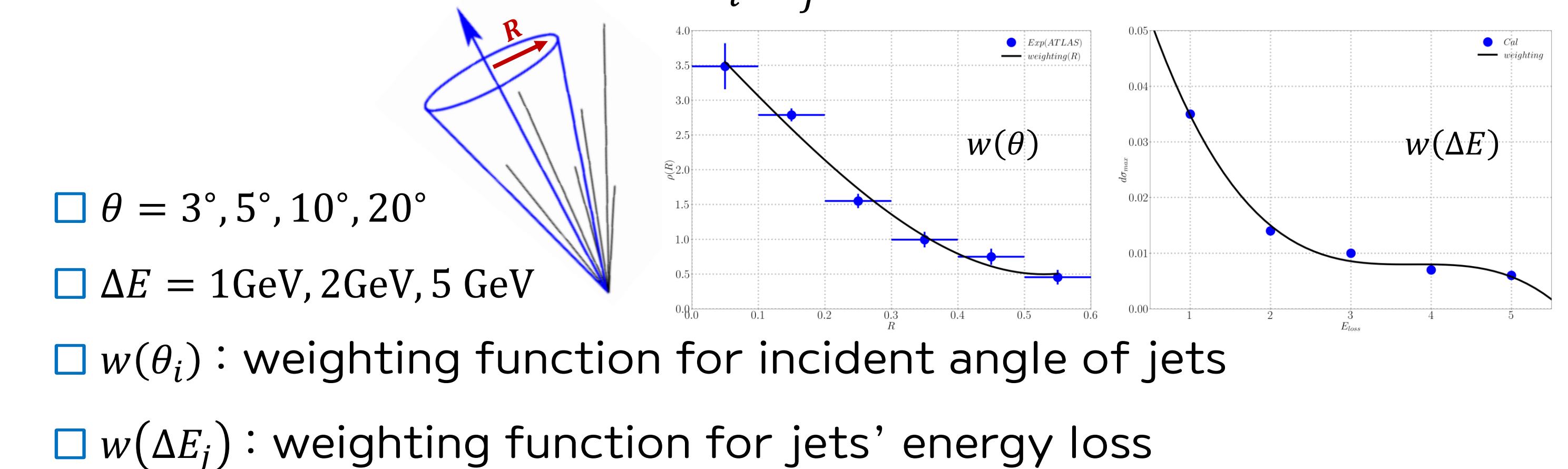
$$C(a_1, a_2) = \frac{P_f(a_1, a_2)}{P_i(a_1) \cdot P_i(a_2)}$$

$$\text{After interaction with jet particle} = \frac{P_f(a_1) \cdot P_f(a_2)}{P_i(a_1) \cdot P_i(a_2)}$$

$$\text{Before interaction with jet particle} = \frac{P_f(a_1) \cdot P_f(a_2)}{P_i(a_1) \cdot P_i(a_2)}$$

Jet distribution

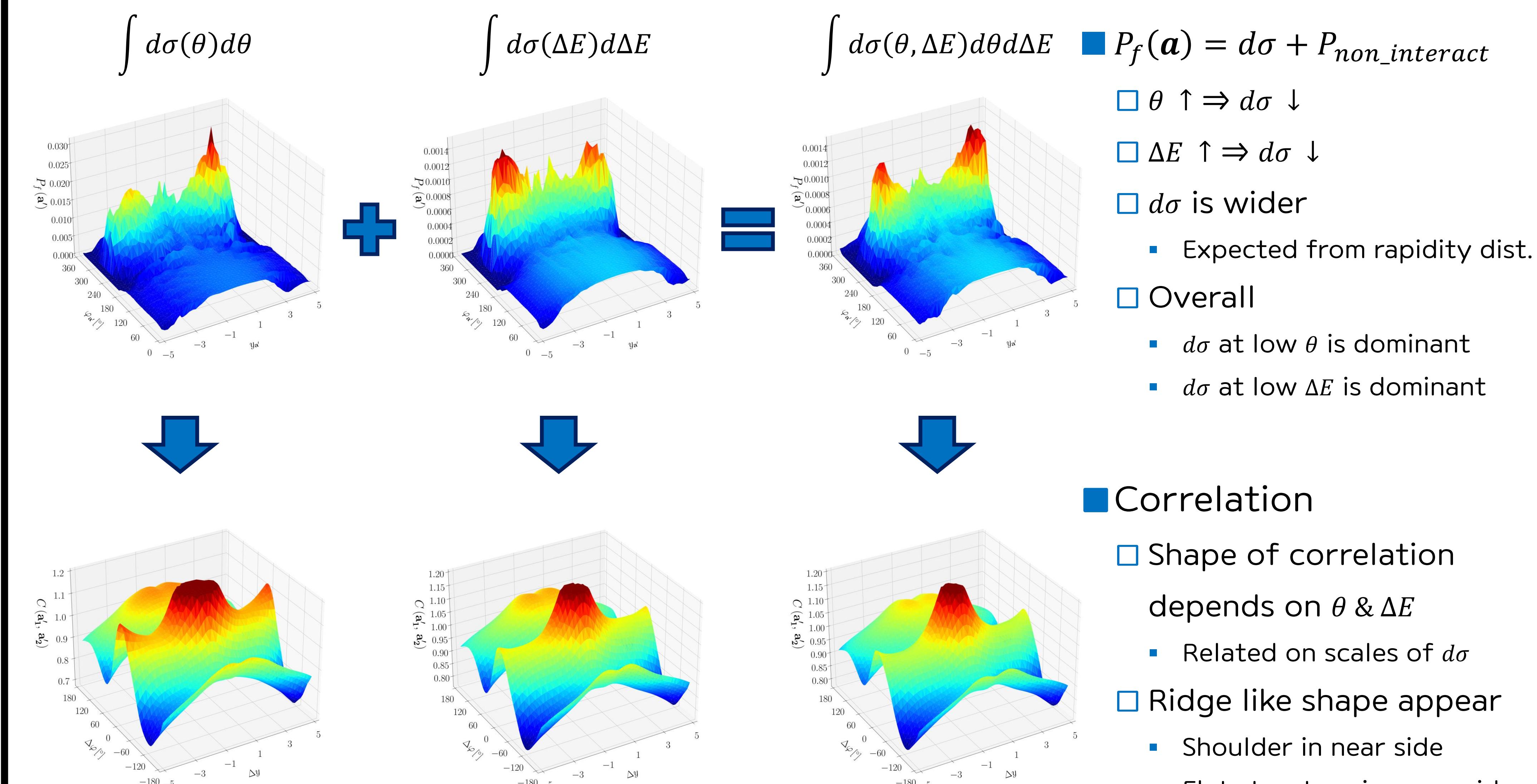
$$\int d\sigma(\theta, \Delta E) d\theta d\Delta E \rightarrow \sum_i \sum_j d\sigma(\theta_i, \Delta E_j) w(\theta_i) w(\Delta E_j)$$



Calculation

ATLAS collaboration, *Physical Review D* **83**, 052003 (2011)

$P_f(a)$ & Correlation



$$P_f(a) = d\sigma + P_{\text{non_interact}}$$

- $\theta \uparrow \Rightarrow d\sigma \downarrow$
- $\Delta E \uparrow \Rightarrow d\sigma \downarrow$
- $d\sigma$ is wider
 - Expected from rapidity dist.
- Overall
 - $d\sigma$ at low θ is dominant
 - $d\sigma$ at low ΔE is dominant

Correlation

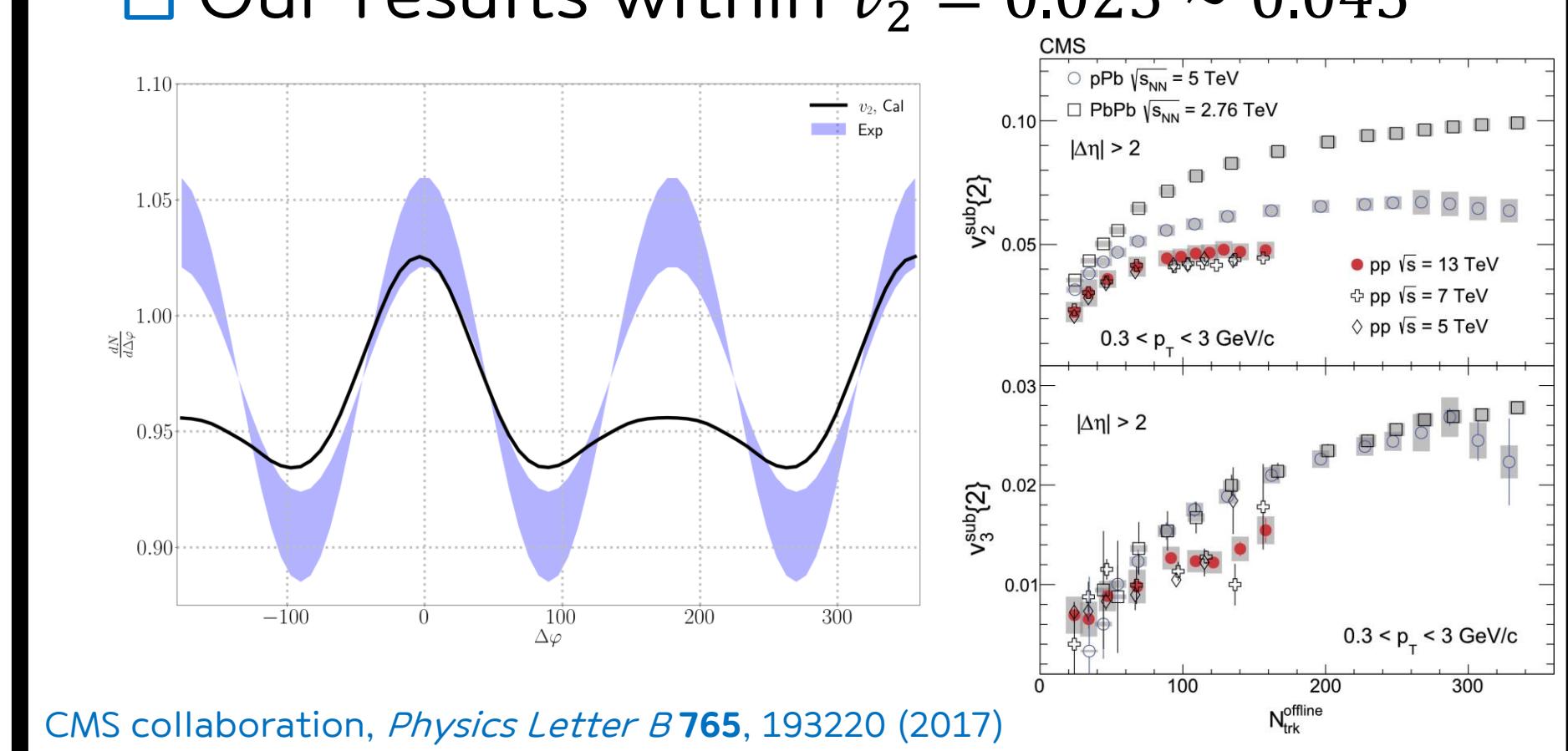
- Shape of correlation depends on θ & ΔE
 - Related on scales of $d\sigma$
- Ridge like shape appear
 - Shoulder in near side
 - Flat structure in away side

v_2

Calculate v_2 via

$$\frac{dN}{d\varphi} \propto 1 + 2 \sum_{n=1} v_n \cos n\varphi$$

- Our results within $v_2 = 0.025 \sim 0.045$



Summary & Outlooks

- Calculate correlation and v_2
 - Integrate $d\sigma$ for θ & ΔE
- Add gluon radiation