# ２粒子相関法を用いた
# PYTHIAによるjetのシミュレーション

宇宙史拠点実習,最終報告会

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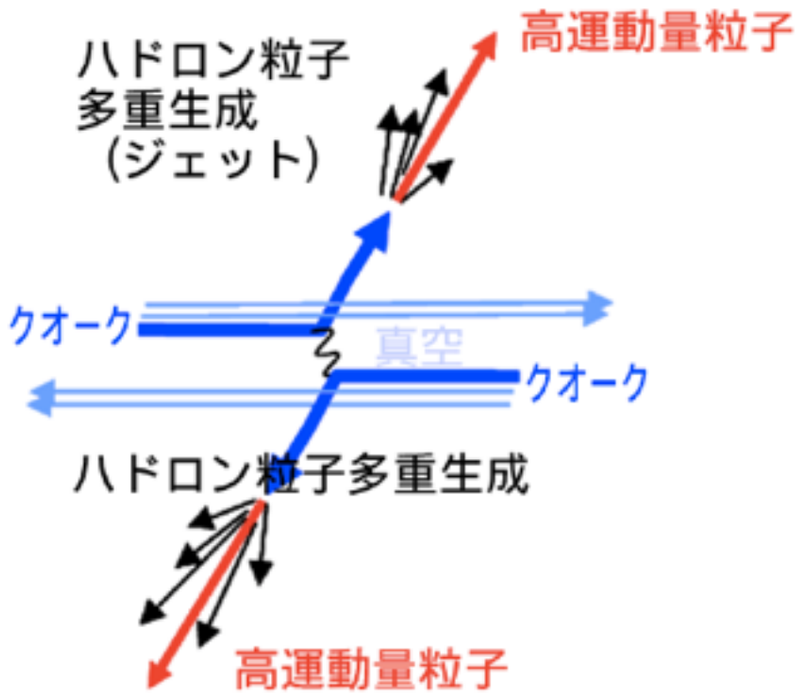
# ジェット

✓ パートンの２体散乱
✓ 高い運動量を持ったパートン対が180°反対方向へ進む
✓ フラグメンテーション(ハドロン化)




**ジェットの様子をシミュレーションで見てみよう**

✓ イベントジェネレータ：PYTHIA
✓ 陽子＋陽子衝突
✓ ２粒子相関
✓ pTカット,$\eta$ カット

# PYTHIA8

✔陽子＋陽子衝突

✔eCM = 14TeV

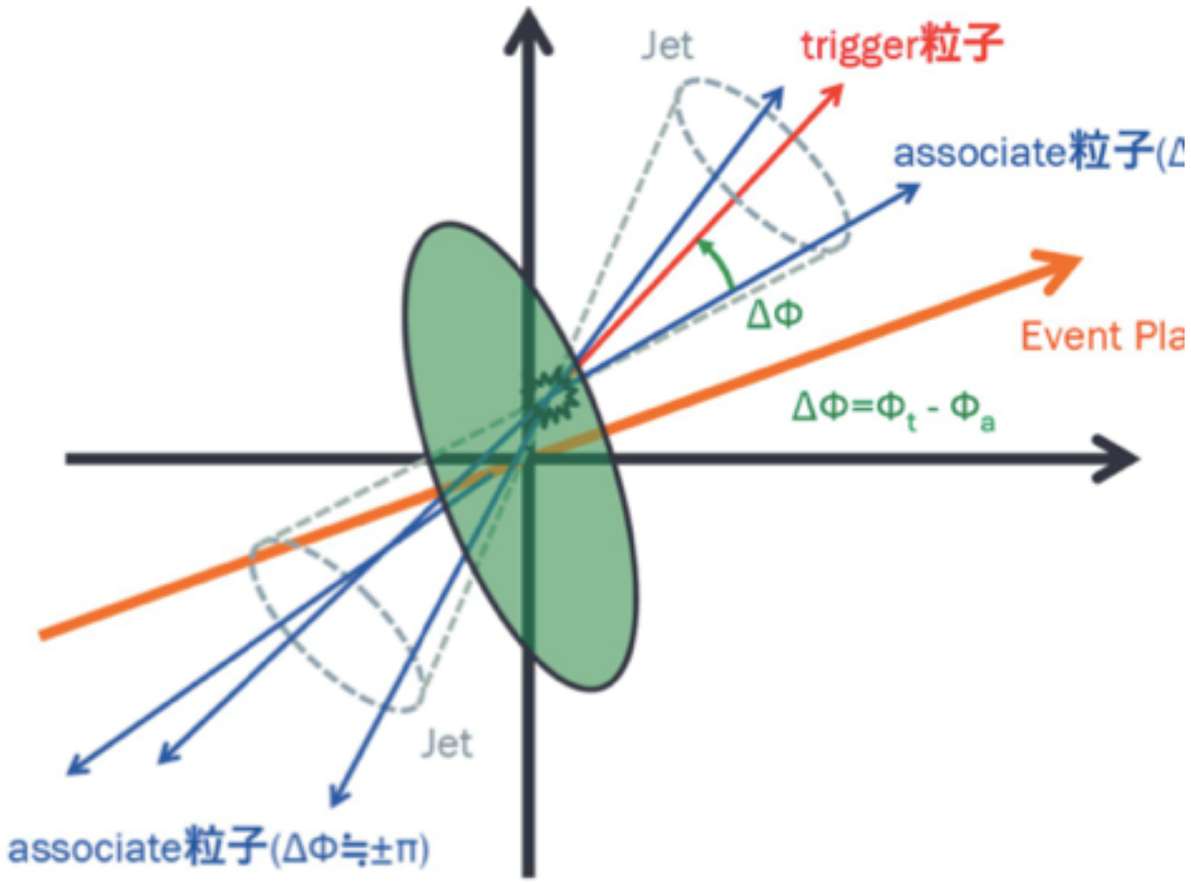
✔10000000イベント

✔検出器にかかる荷電粒子を選択

# 2粒子相関法

✓基準となるTrigger粒子
✓比較対象となるAssociate粒子
✓両者の差Δφ,Δη
✓全ての粒子の組み合わせ
✓同一イベント：real event
✓異なるイベント：mixed event
✓ real/mix 比

$$C(\Delta\phi, \Delta\eta) \equiv \frac{N_{\mathrm{mixed}}}{N_{\mathrm{same}}} \times \frac{N_{\mathrm{same}}(\Delta\phi, \Delta\eta)}{N_{\mathrm{mixed}}(\Delta\phi, \Delta\eta)}$$




Trigger粒子の条件を変えることで得られる分布が変わる

# goal

How the jet shape change with...

✓ pT region of trigger and associate particles

✓ $\eta$ region ...

# canvas layout

5×5＝25pad

Trigger

Associate

| pT(GeV) | 0.0~0.5 | 0.5~1.0 | 1.0~2.0 | 2.0~4.0 | 4.0~10.0 |
|---|---|---|---|---|---|
| 0.0~0.5 | | | | | |
| 0.5~1.0 | | | | | |
| 1.0~2.0 | | | | | |
| 2.0~4.0 | | | | | |
| 4.0~10.0 | | | | | |

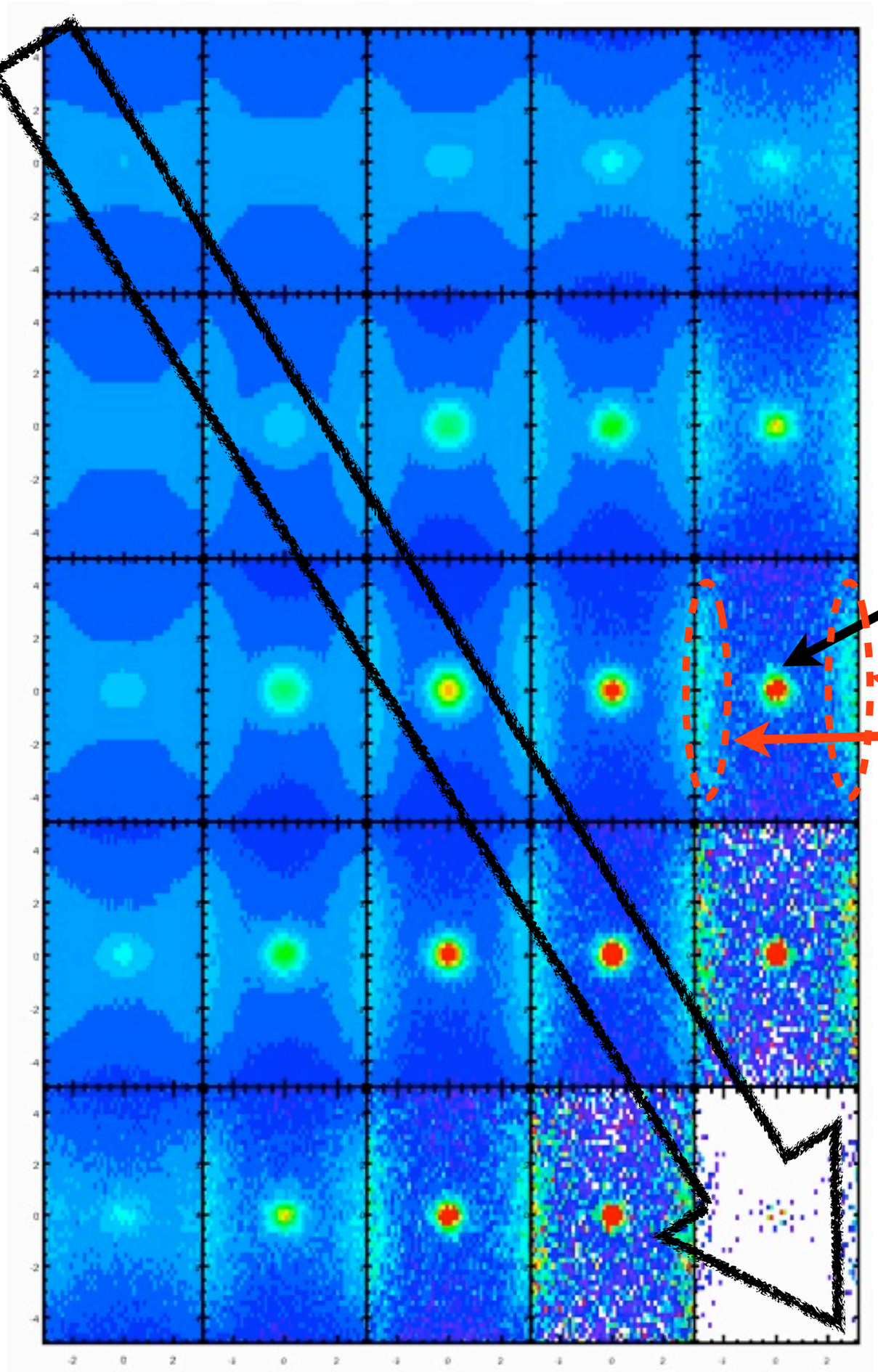
10 million event

# C2 distribution

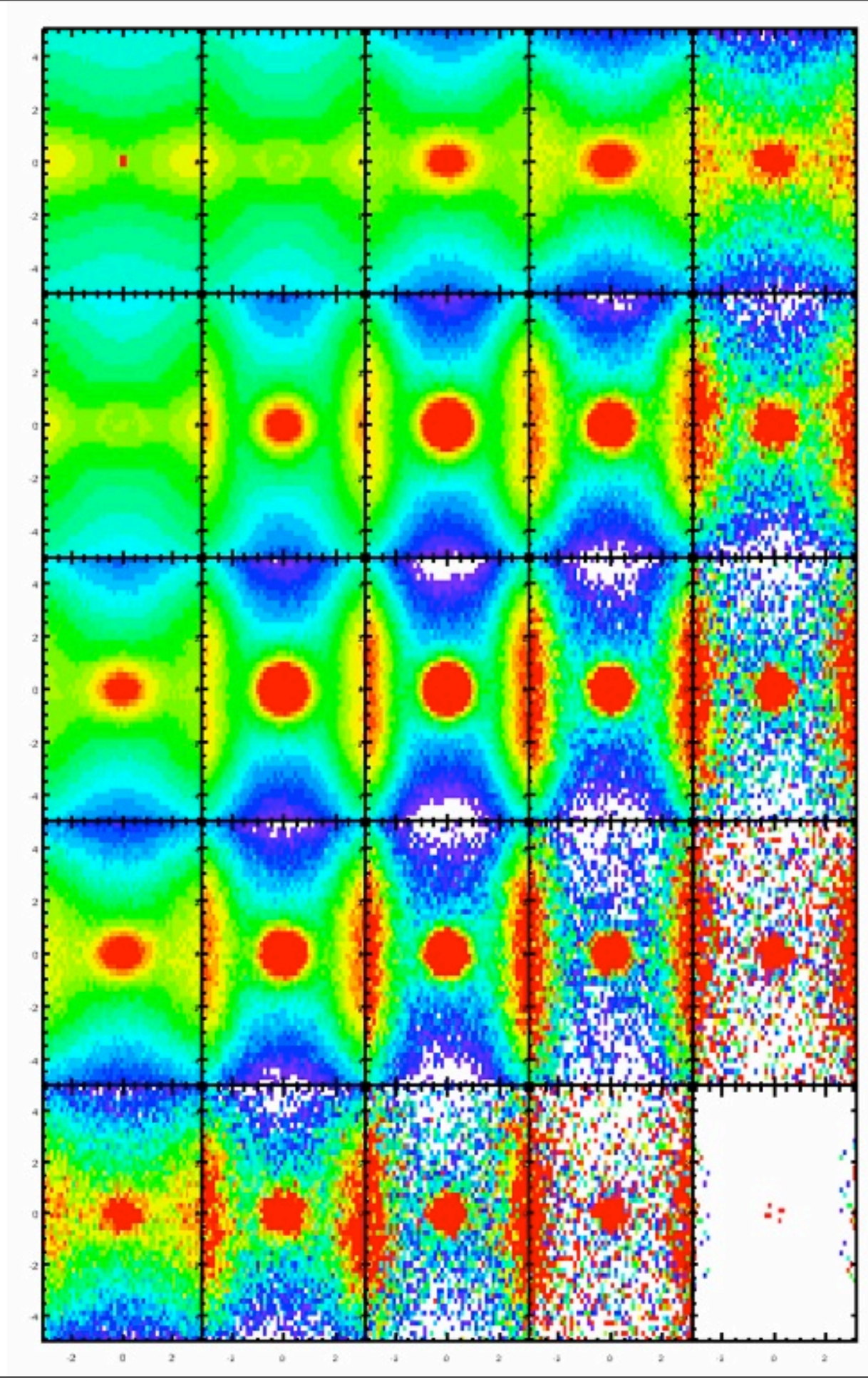
$\Delta\phi$ : $-\pi \sim \pi$

$\Delta\eta$ : -5~5

C2 : 0.5~3.0




✓if we pick up high pT pairs,
✓no correlation pairs(with jet) reduce
✓we can see more clearly the jet



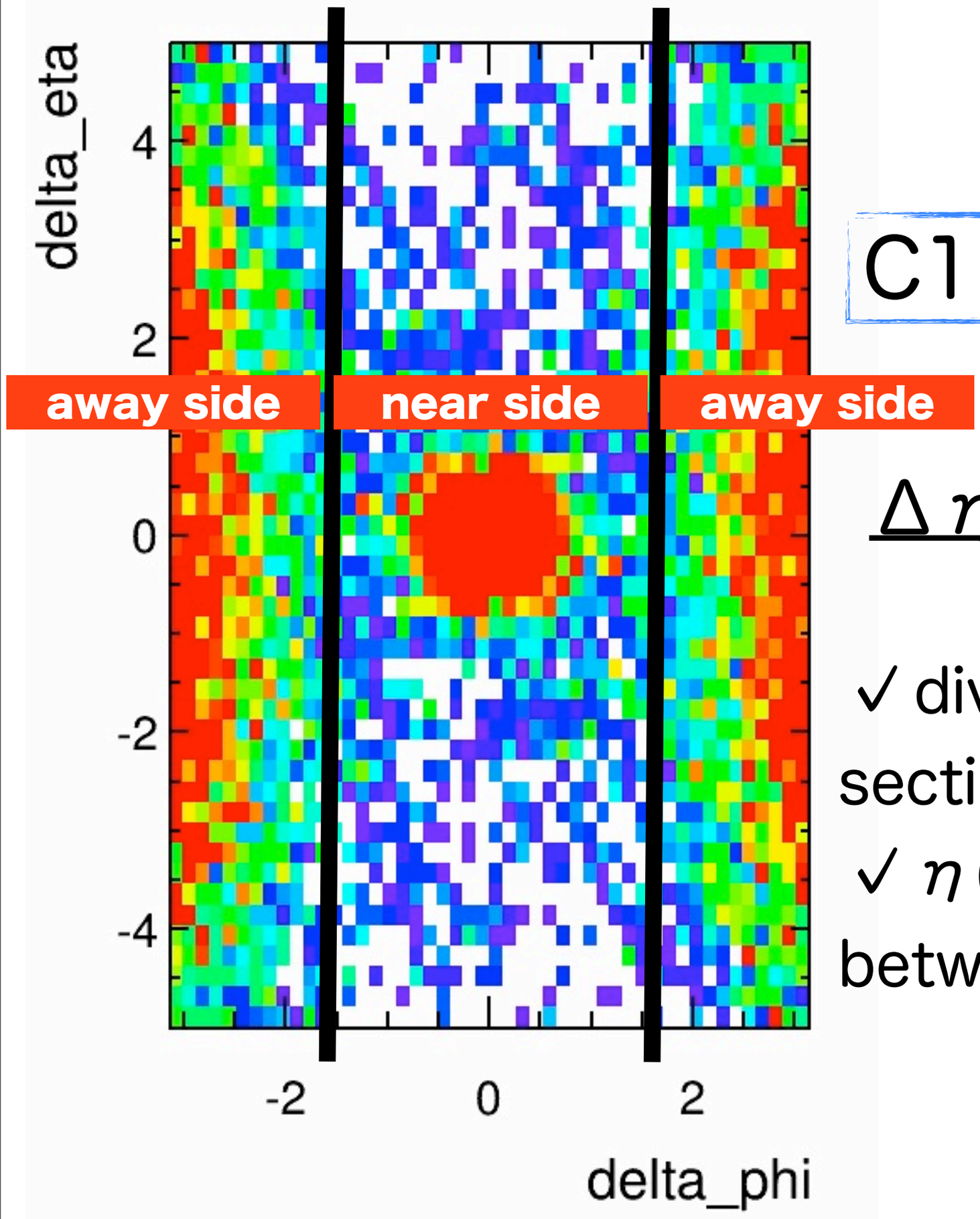
# C2 distribution

$\Delta\phi$: $-\pi \sim \pi$

$\Delta\eta$: -5~5

C2 : 0.8~1.2

**✓if we pick up high pT pairs,**
**✓no correlation pairs(with jet) reduce**
**✓we can see more clearly the jet**




C1($\Delta\eta$) distribution

$\Delta n = n(\text{tri}) - n(\text{aso})$

✓ divide $\eta$(trigger) into 6 section between -3.0~3.0

✓ $\eta$(associate) is picked up between -5.0~5.0

# away side

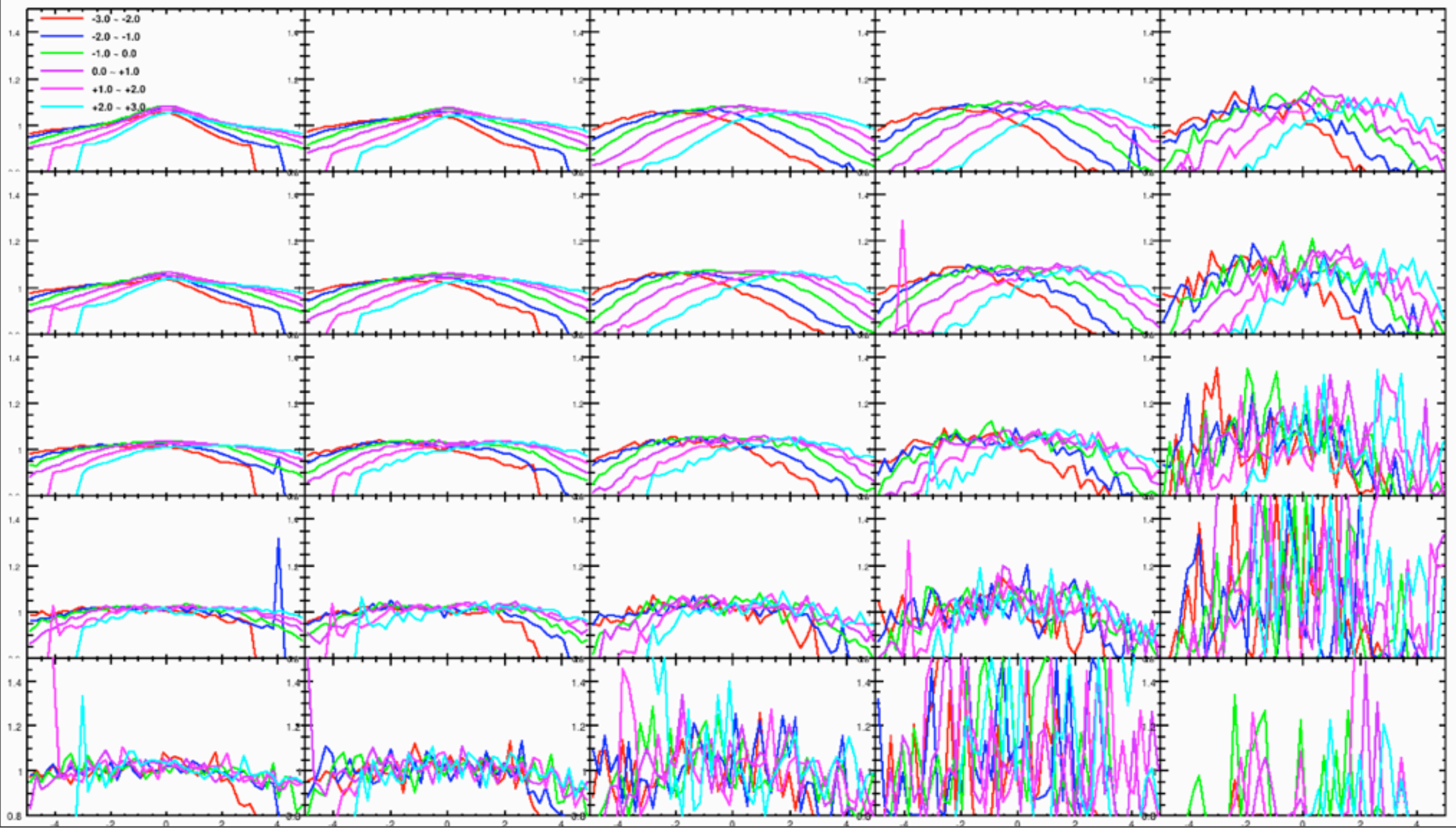
- -3.0~-2.0
- -2.0~-1.0
- -1.0~0.0
- 0.0~1.0
- 1.0~2.0
- 2.0~3.0

✓ Different colors represent the difference of $\eta$ range.

✓ Limit the $\eta$ range of trigger particles to -3~3, and divide 6 section 1.0step

✓ No limitation about associate particles range of $\eta$ :-5~5

✓ $-\pi < \Delta\phi < -\pi/2$



# away side

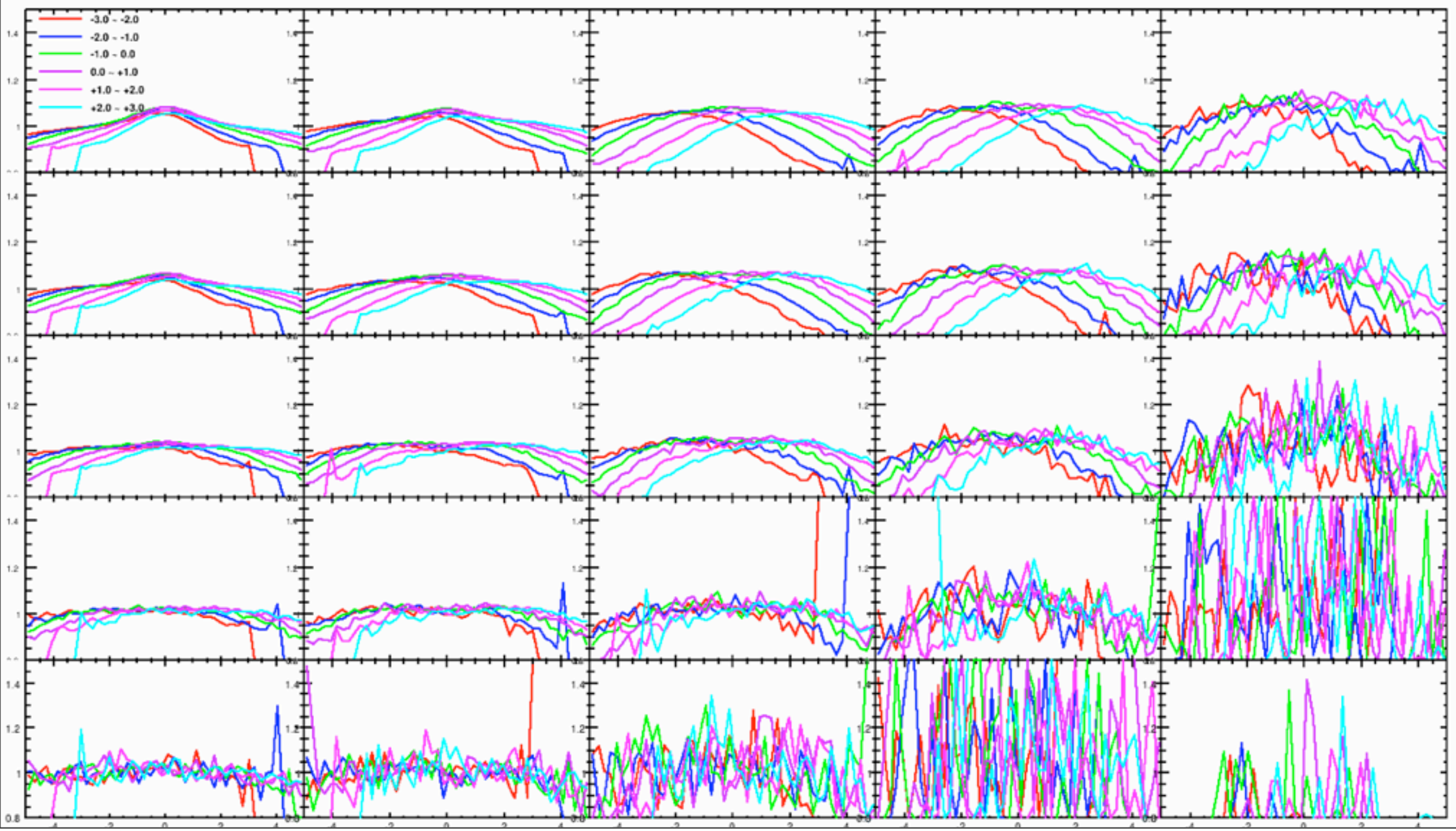
- -3.0~-2.0
- -2.0~-1.0
- -1.0~0.0
- 0.0~1.0
- 1.0~2.0
- 2.0~3.0

✓Different colors represent the different $\eta$ range.

✓Limit the $\eta$ range of trigger particles to -3~3, and divide 6 section 1.0step

✓No limitation about associate particles range of $\eta$:-5~5

✓ $\pi/2 < \Delta\phi < \pi$



# near side

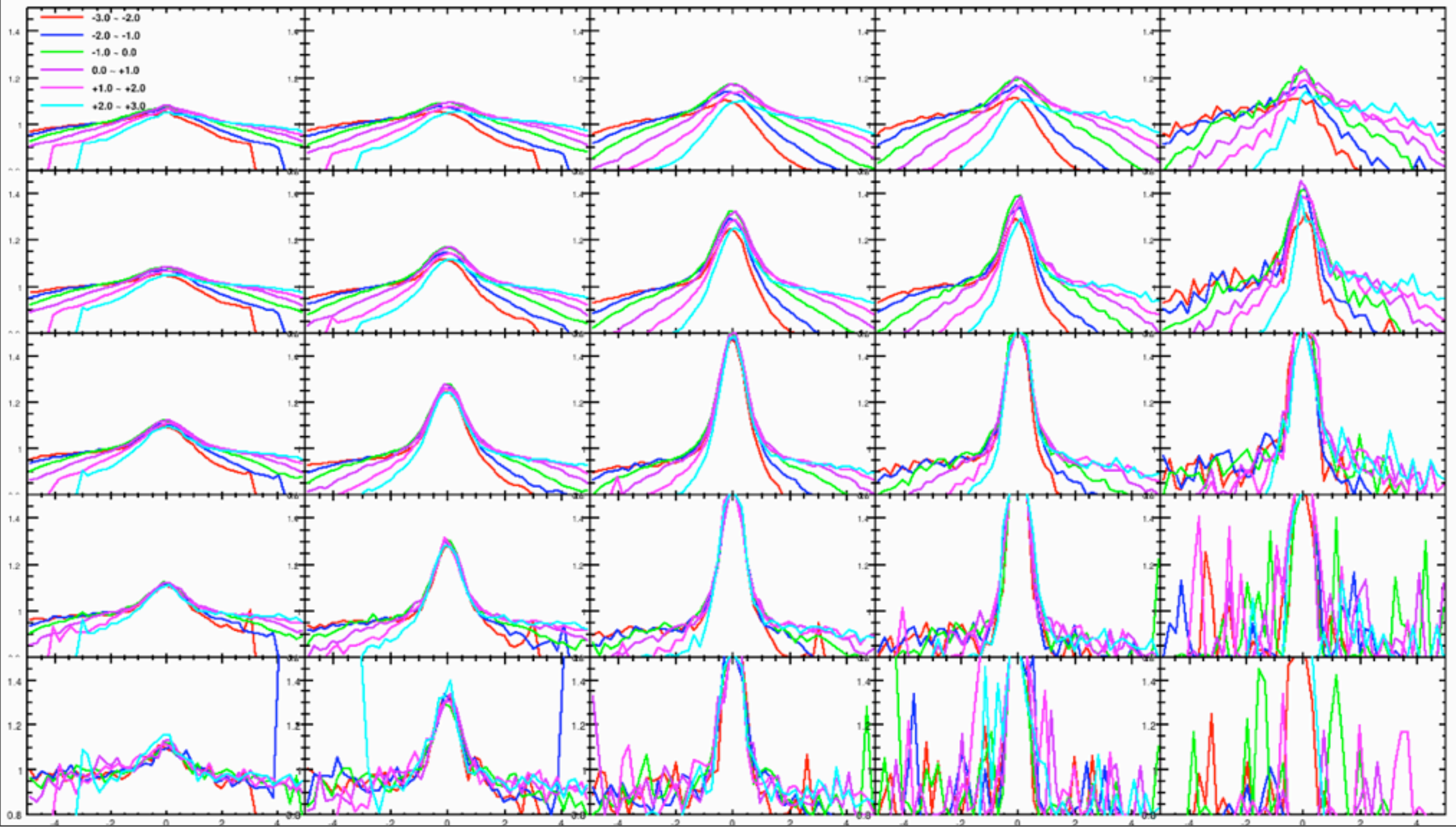
- -3.0~-2.0
- -2.0~-1.0
- -1.0~0.0
- 0.0~1.0
- 1.0~2.0
- 2.0~3.0

✓ Different colors represent the difference of $\eta$ range.

✓ Limit the $\eta$ range of trigger particles to -3~3, and divide 6 section 1.0step

✓ No limitation about associate particles range of $\eta$ :-5~5

✓ $|\Delta\phi| < \pi/2$, c1 : 0.8~1.5



# near side

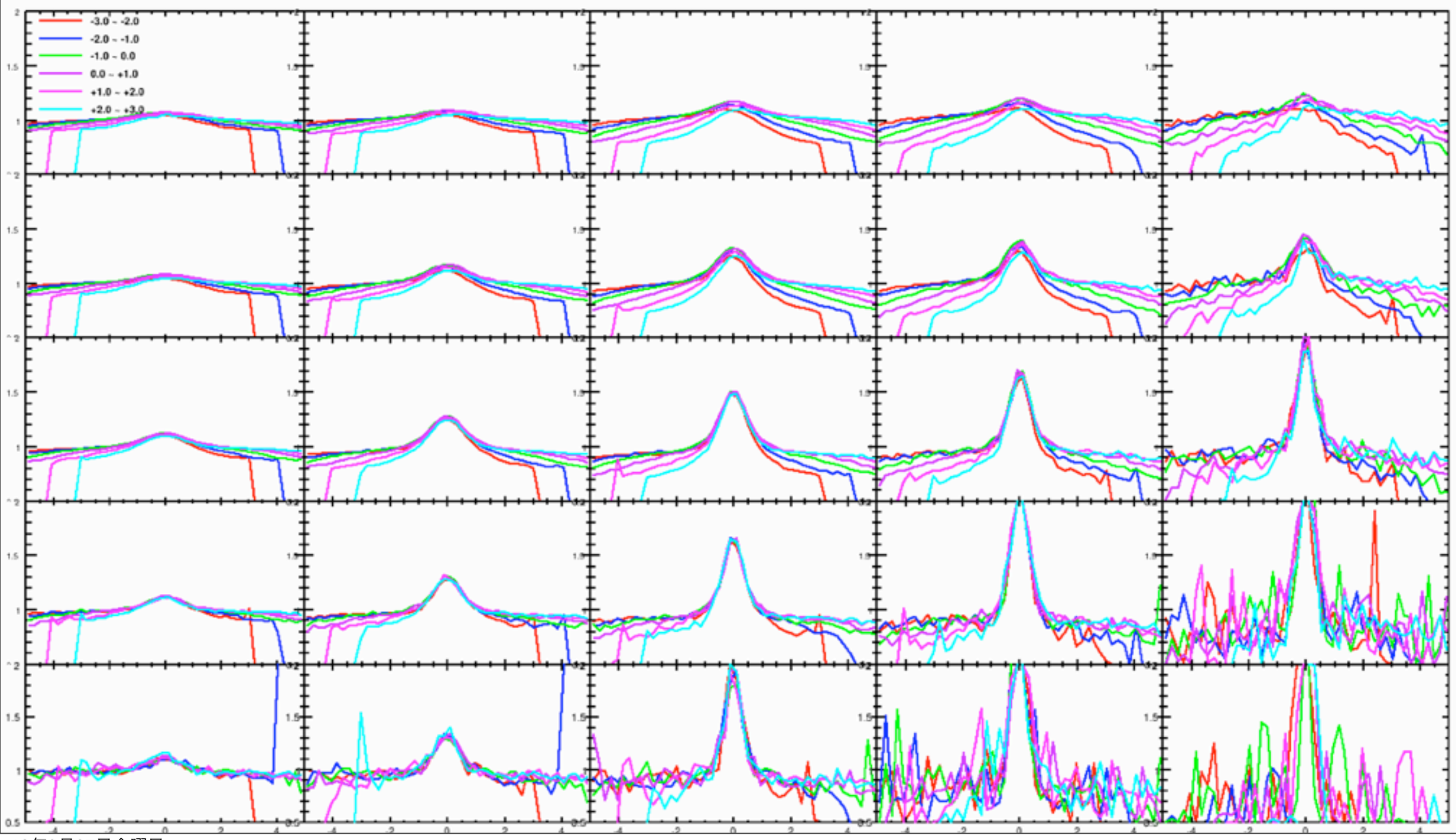
-3.0~-2.0
-2.0~-1.0
-1.0~0.0
0.0~1.0
1.0~2.0
2.0~3.0

✓ Different colors represent the difference of $\eta$ range.

✓ Limit the $\eta$ range of trigger particles to -3~3, and divide 6 section 1.0step

✓ No limitation about associate particles range of $\eta$ :-5~5

✓ $|\Delta\phi| < \pi/2$, c1 : 0.5~2.0



# near side

- -3.0~-2.0
- -2.0~-1.0
- -1.0~0.0
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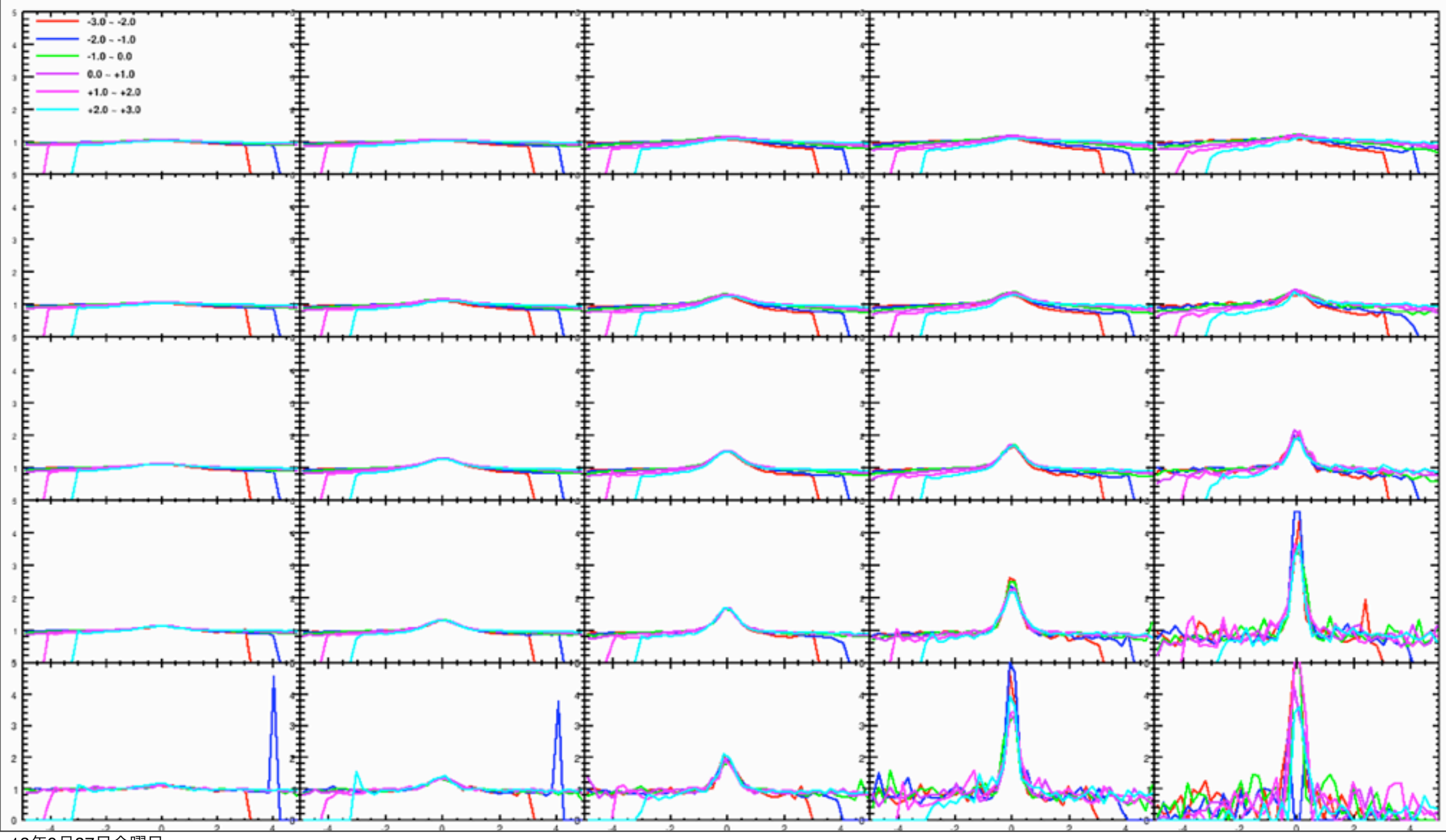


# summary

✓ I simulated p+p collision(14TeV) using PYTHIA

✓ I analyzed the jet shape by two particle correlation

✓ various cut of pT, $\eta$

✓ multiplicity dependence ← **now**

✓ jet quenching, Q-PYTHIA

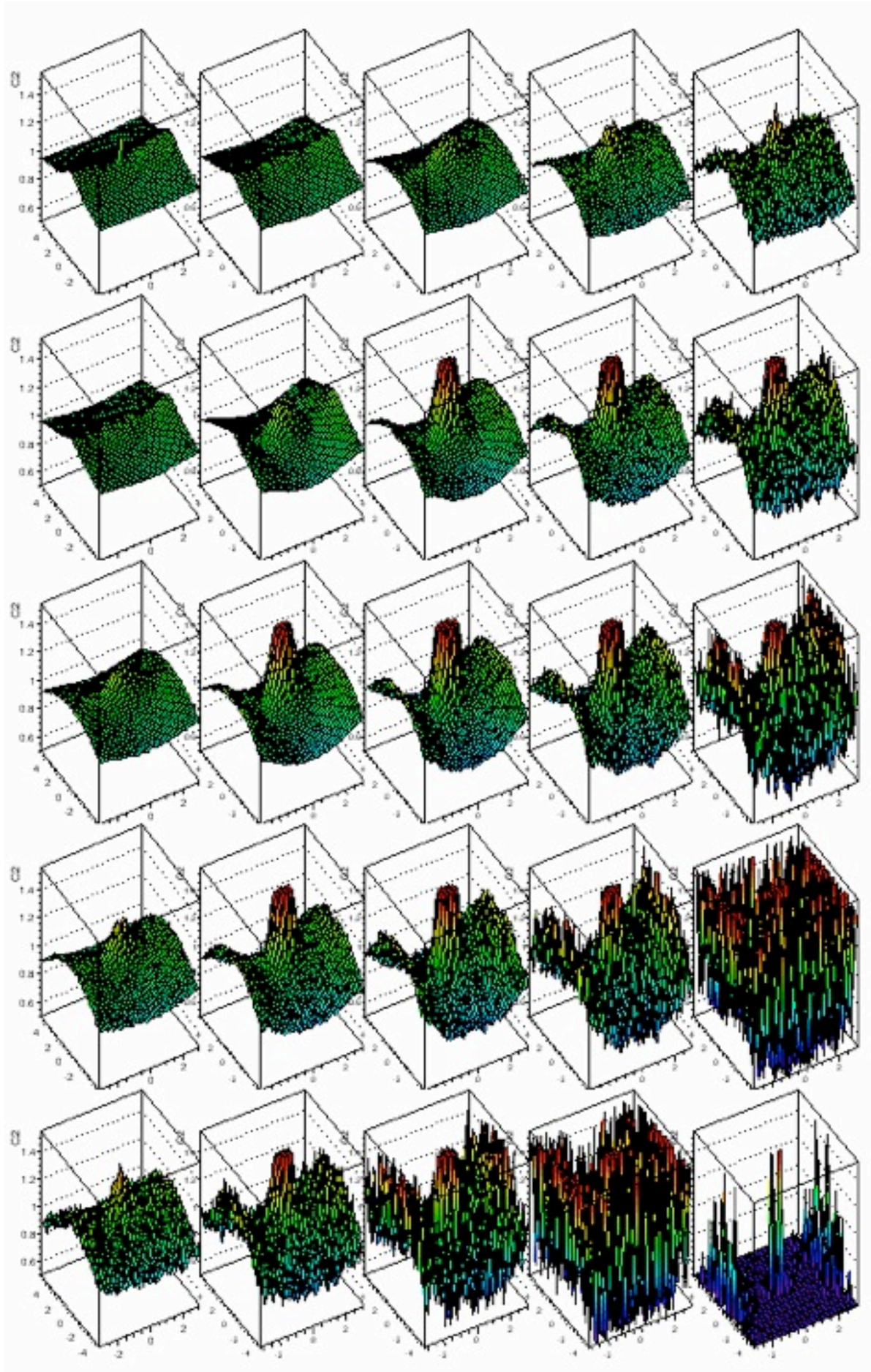
# BACK UP

# C2 distribution

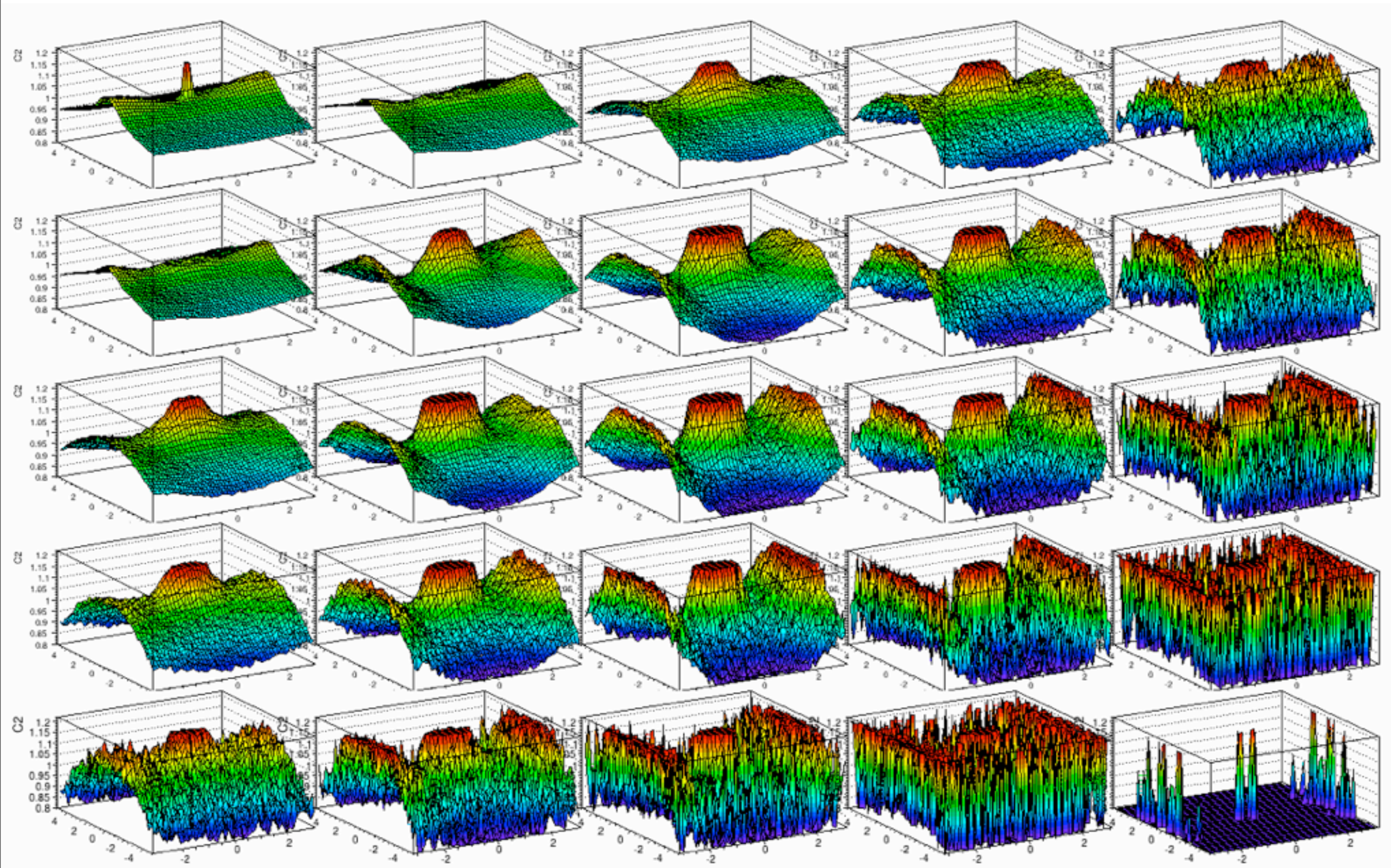
$\Delta\phi$: $-\pi \sim \pi$

$\Delta\eta$: -5~5

C2 : 0.5~1.5



# C2 distribution



# pT + $\eta$ cut

- -3.0~-2.0
- -2.0~-1.0
- -1.0~0.0
- 0.0~1.0
- 1.0~2.0
- 2.0~3.0

✓ Different colors represent the difference of $\eta$ range.

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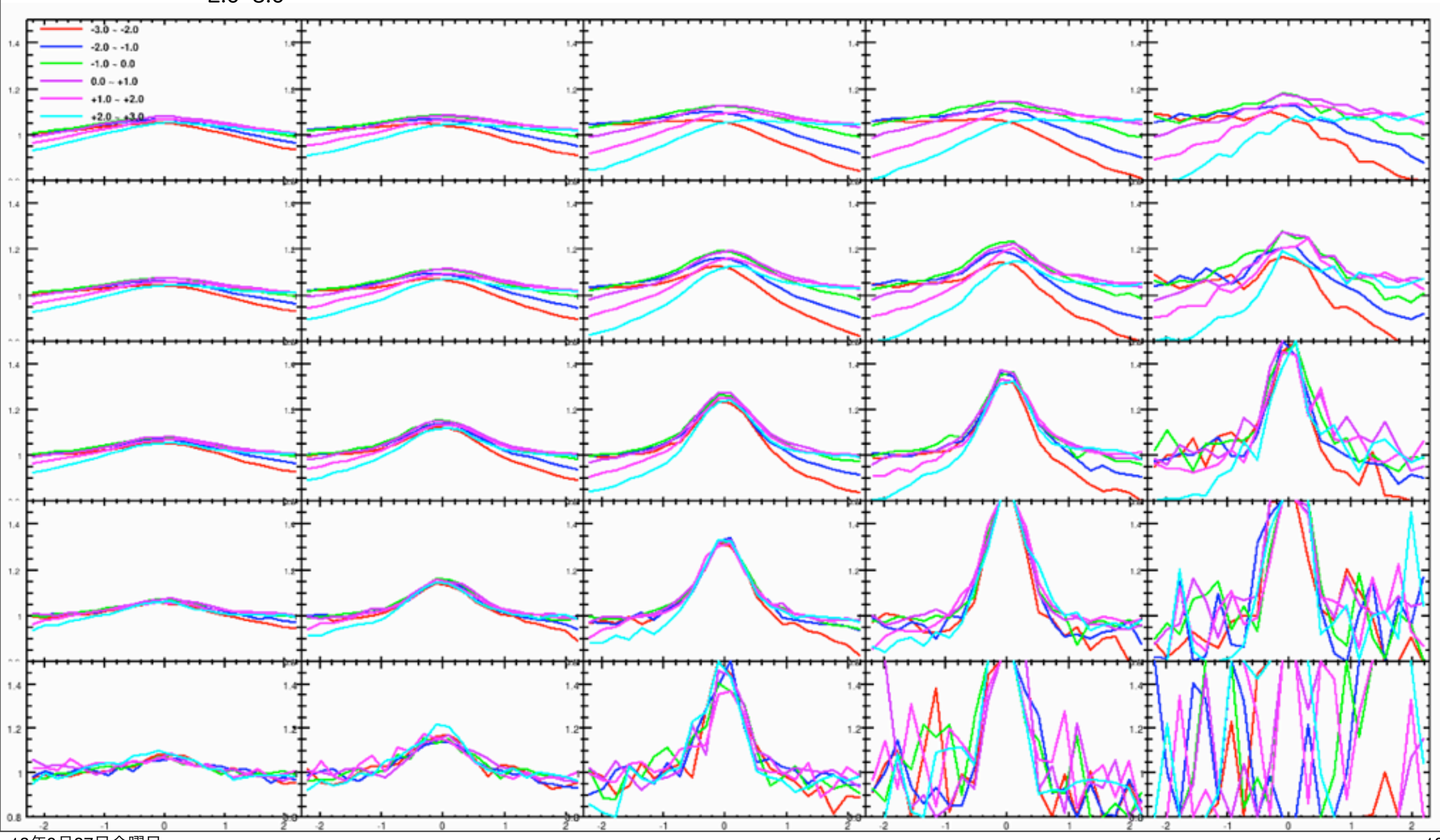

# multiplicity dependence