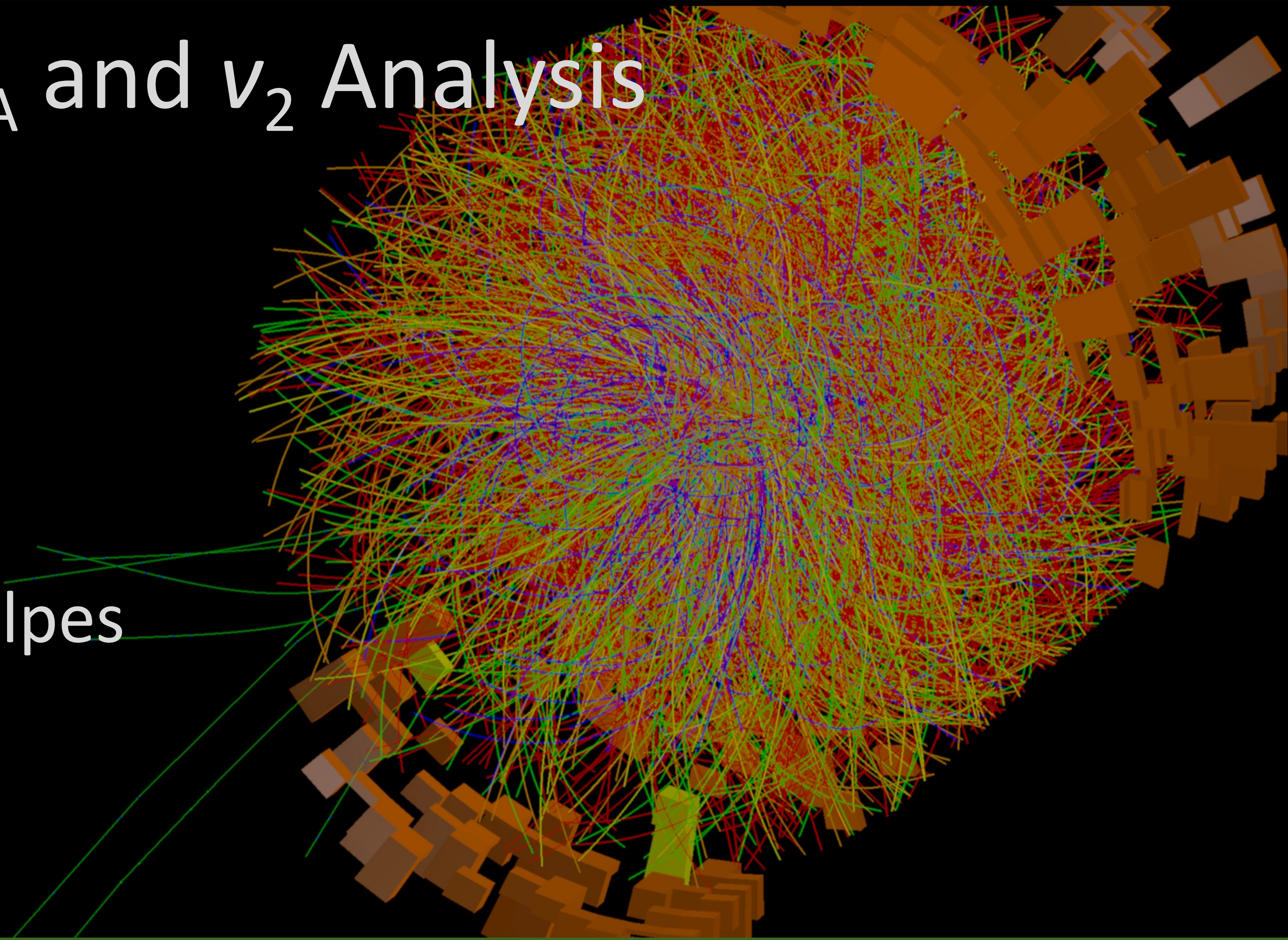
Inclusive Jet R_{AA} and v_2 Analysis



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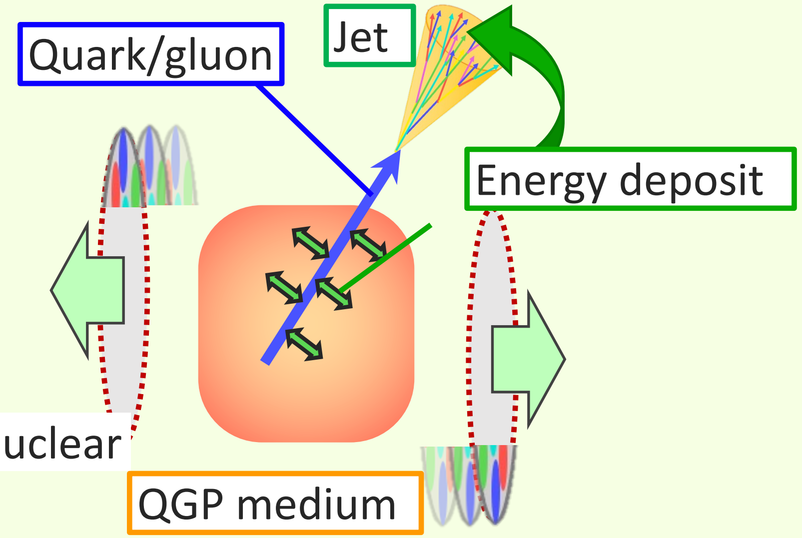
Physics target: Parton Energy loss

Partons deposit energy in the QGP medium.
→ Jet tomography of the QGP



Energy loss

$$\Delta E \propto \hat{q} L^n$$

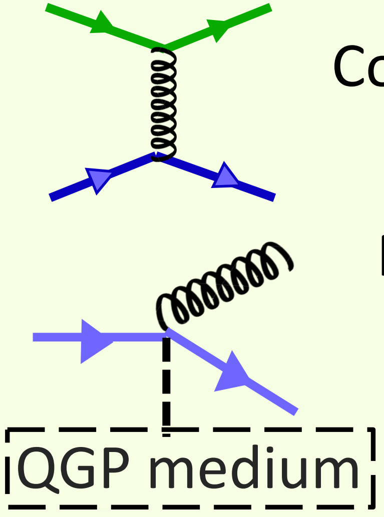
$\hat{q}$: transport coefficient

$$\hat{q} = mD \times \rho \times \sigma$$

m_D: medium mass
ρ: medium density
σ: cross section

L: path length in QGP

Jet suppression mechanism



Collisional $\Delta E \propto L$

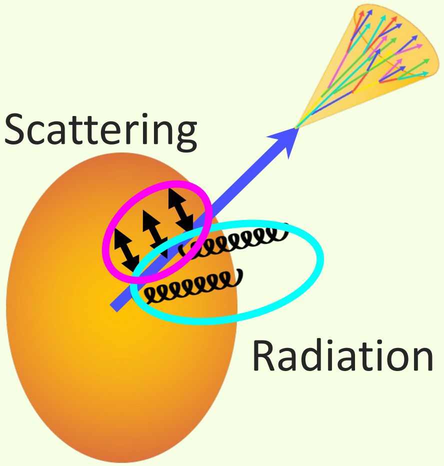
Radiative $\Delta E \propto L^2$

Jet measurements help to:

- **quantify $\hat{q}$**
- **understand suppression mechanism**

Study Goal: Jet v_2 and R_{AA} measurement

Jet v2 measurement enable to measure the jet suppression effect according into QGP matter shape



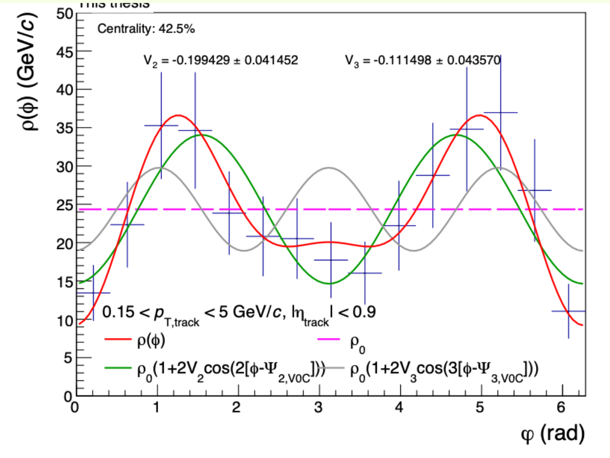
$$v_2^{\text{jet}} = \frac{1}{\text{Res}\left\{\psi_2^{meas}\right\}} \frac{\pi}{4} \frac{N_{in} - N_{out}}{N_{in} + N_{out}}$$

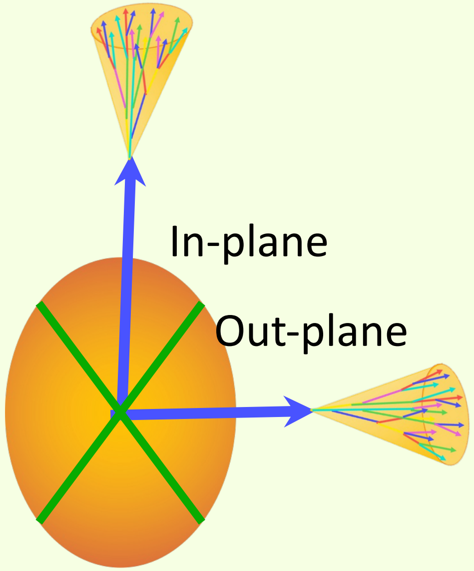
$N_{in},\ N_{out}$: Jet yield at in-plane and at out-of-plane

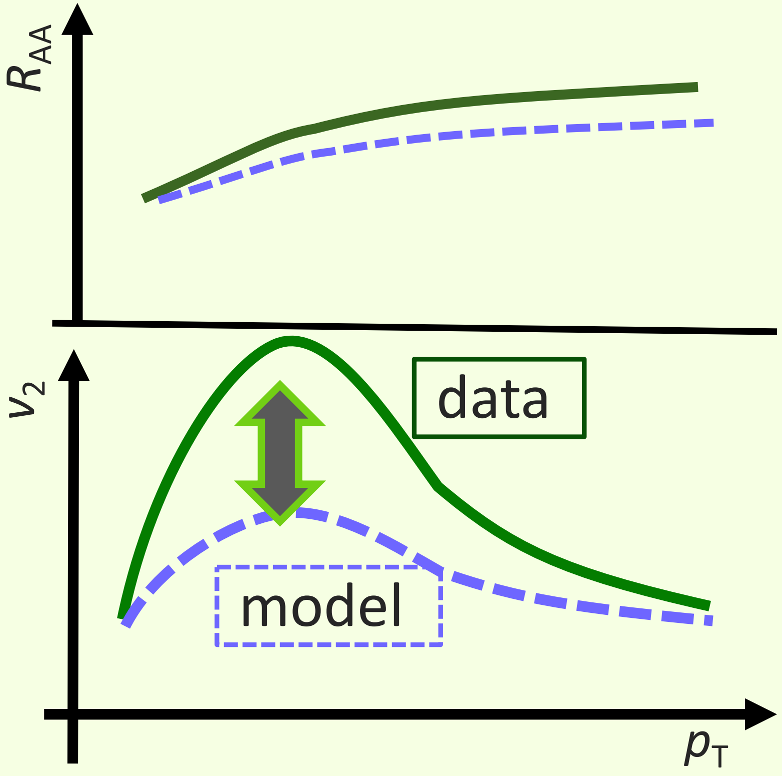
$\text{Res}\left\{\psi_2^{meas}\right\}$: Event plane resolution

Radiation / Scattering dominant?

→ L^2 or L

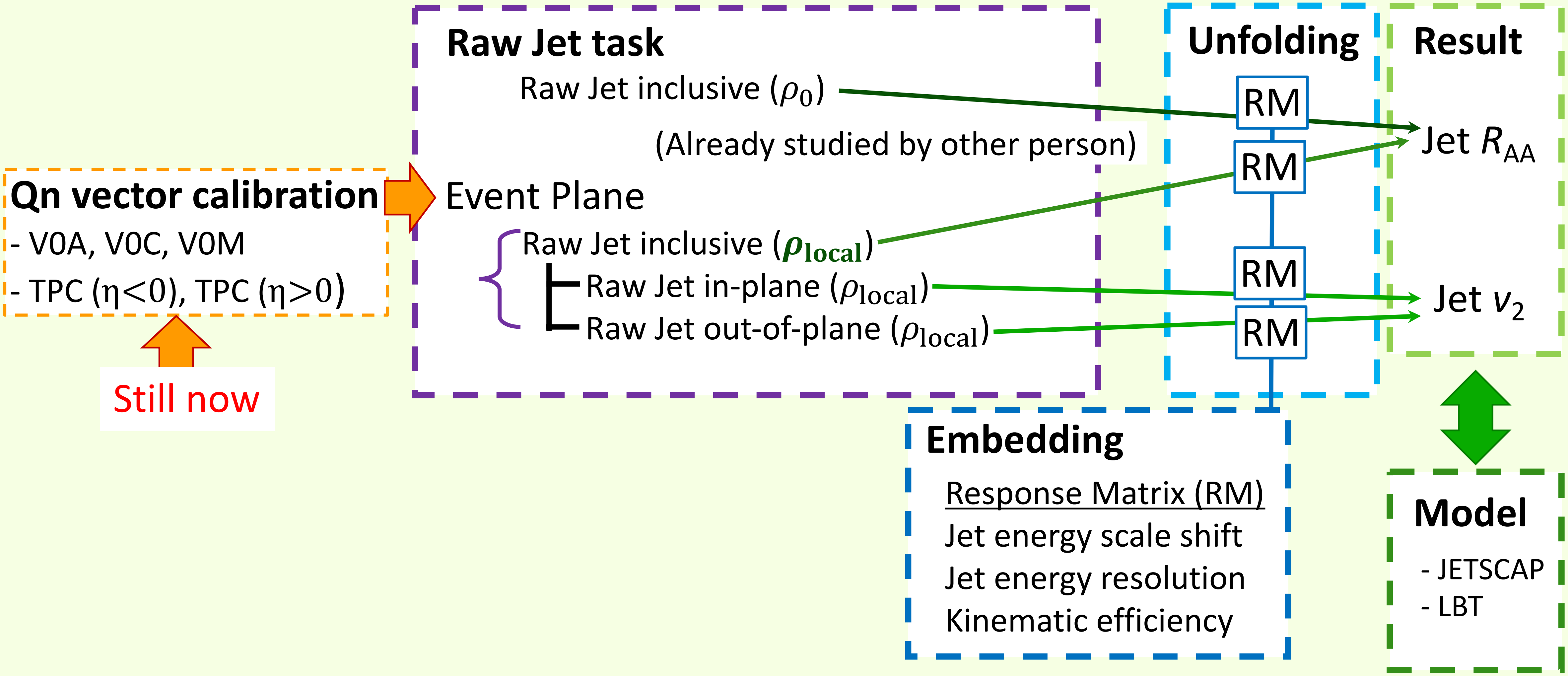






It enables to two kinds of approach for measuring pass length dependency of jet suppression

Analysis flow



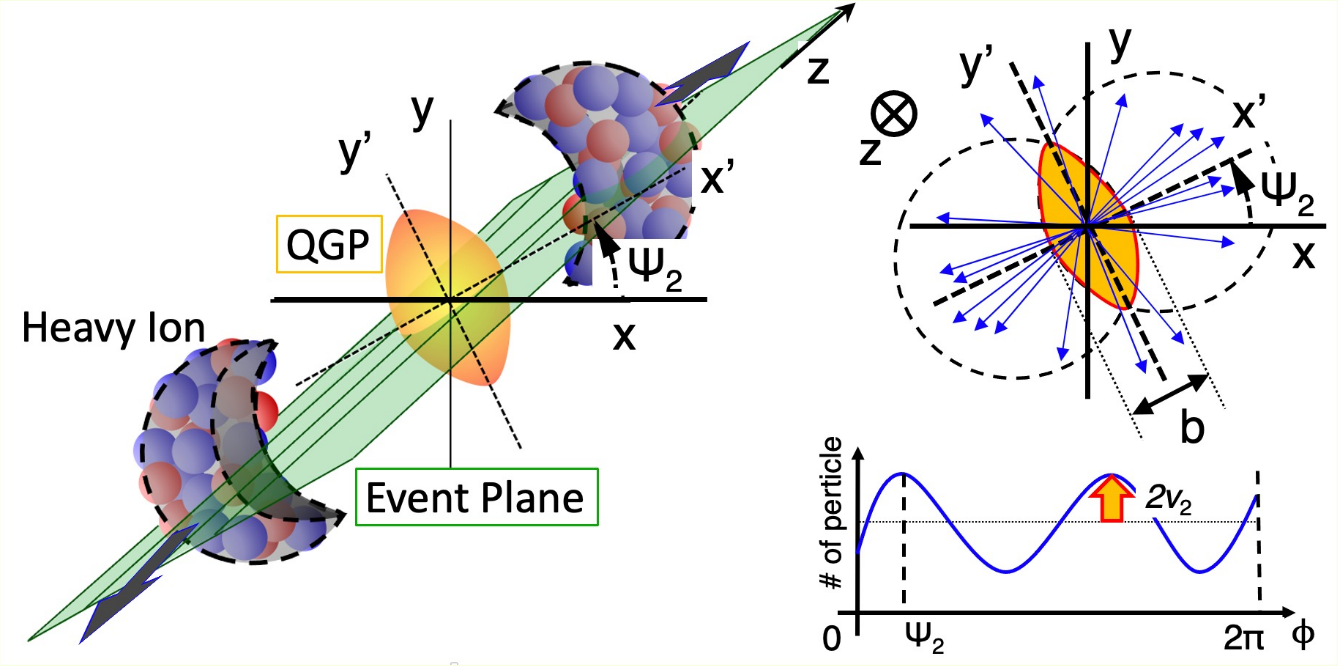
Event Plane calculation

Flow vector from detector measurement

$$Q_{n,x} = \sum_i \omega_i \cos n\phi_i$$

$$Q_{n,y} = \sum_i \omega_i \sin n\phi_i$$

(ϕ_i : Track angle, ω_i :multiplicity weight, n: Fourier order)



Event Plane

$$\Psi_{\mathrm{EP},n} = \frac{1}{n}\arctan\frac{Q_{n,y}}{Q_{n,x}}$$

Event Plane calcuration problem

Event Calibration Codes

1. Run1 framework : Firstly, I implemented it. On the other hand, it does not work in train. And in Run2 analysis, it is not used (Rihan Haque(PWGCF))

Current codes

2. Rhian way: Mostly same of Run1 calculation.
3. Yale group way (M.Oliver , C.Beattie): Use A.Dobrin (PWGCF) calibration parameters.

Main Different points

a. Collision point (z) dependency: the 2nd consider z dependence, but 3rd does not.
b. V0 merge way: The 2nd use following equation and recentering calibration but the 3rd one does not use following weight and does not recentering.

$$\mathbf{Q}_{n,\mathrm{V0}} = \chi^2_{n,\mathrm{V0A}}\mathbf{Q}_{n,\mathrm{V0A}} + \chi^2_{n,\mathrm{V0C}}\mathbf{Q}_{n,\mathrm{V0C}}$$

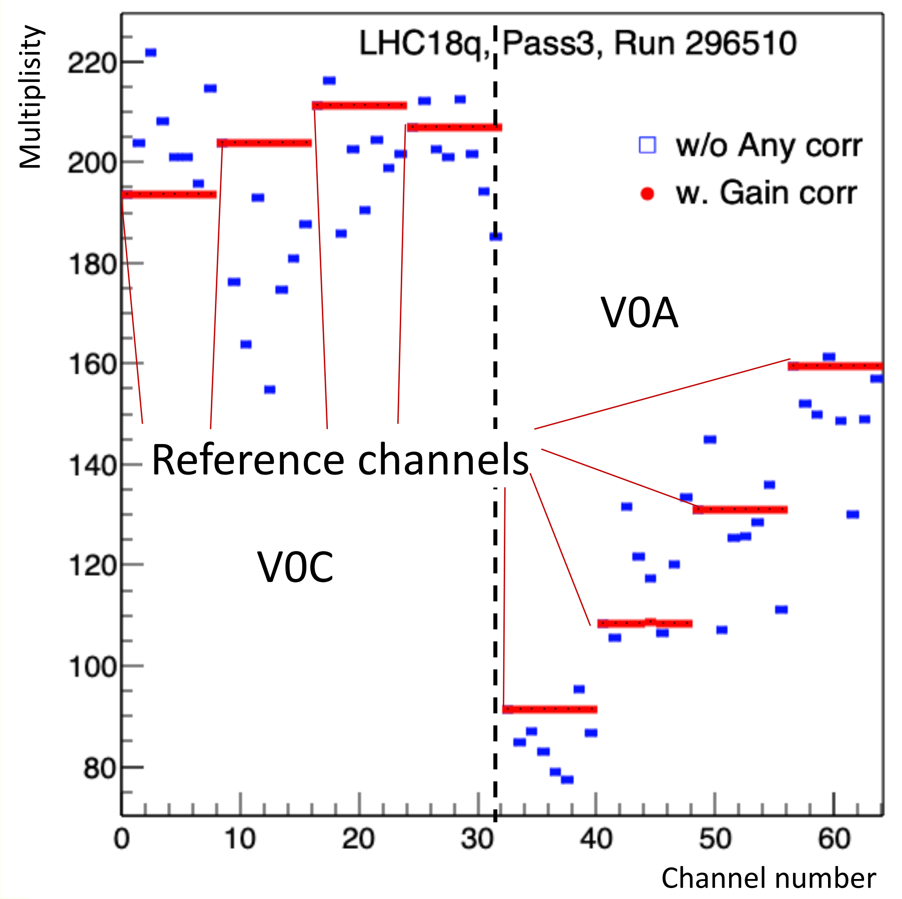
Now, I am trying to use the 3rd way because it already got preliminary.
However, it does not work for Ψ_n, so I implemented modified the 3rd way into my code.

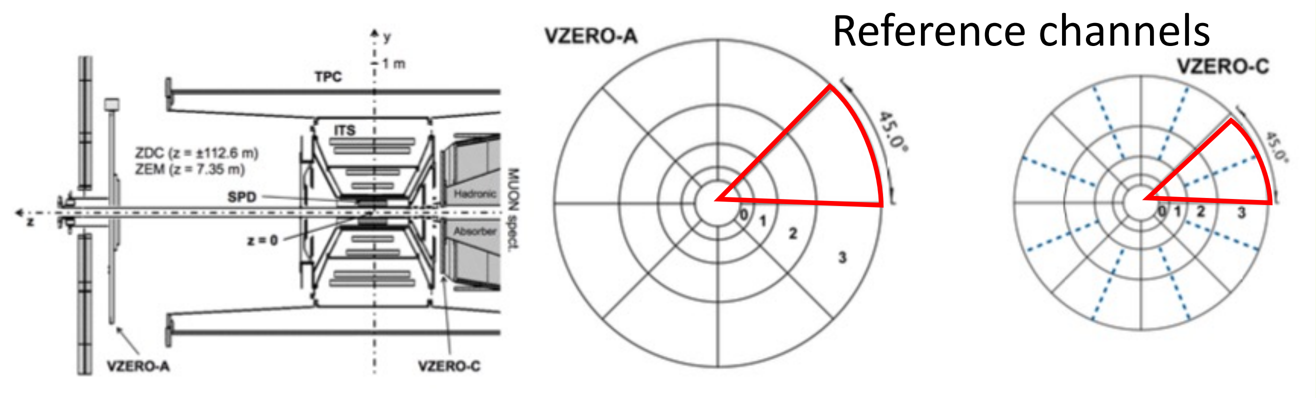
Qn vector **Gain** calibration

Gain equalization

$$\omega_{\mathrm{ch}} = M_{\mathrm{i}} \frac{\langle M_{\mathrm{ref}} \rangle}{\langle M_{\mathrm{i}} \rangle}$$

This part is estimated for run-by-run.
This average means the run average.





Equalizate gain to uniform the each channel value on the same ring.

Rhian way: As the reference value, average value of 8 ch on a ring is used.
A.Dobrin way: As the reference value, the first ch value is uesed

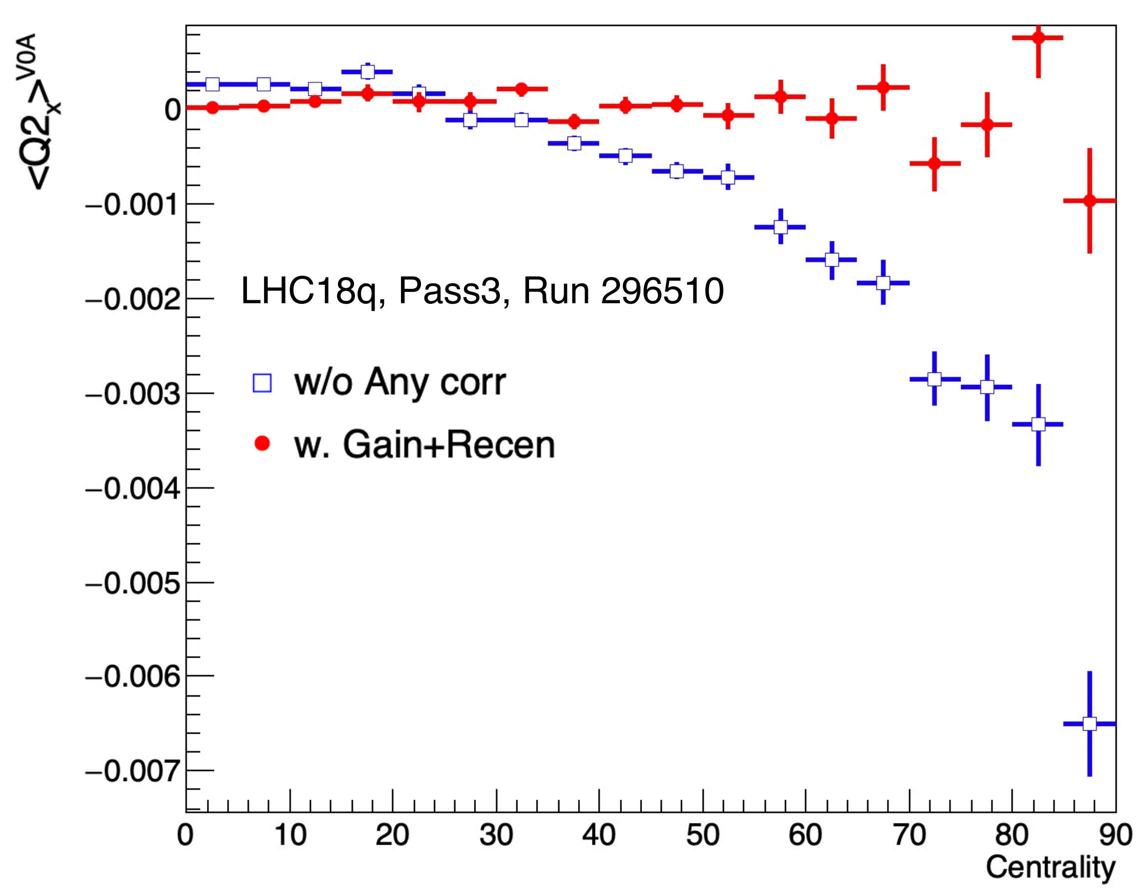
Qn vector **re-centering** calibration

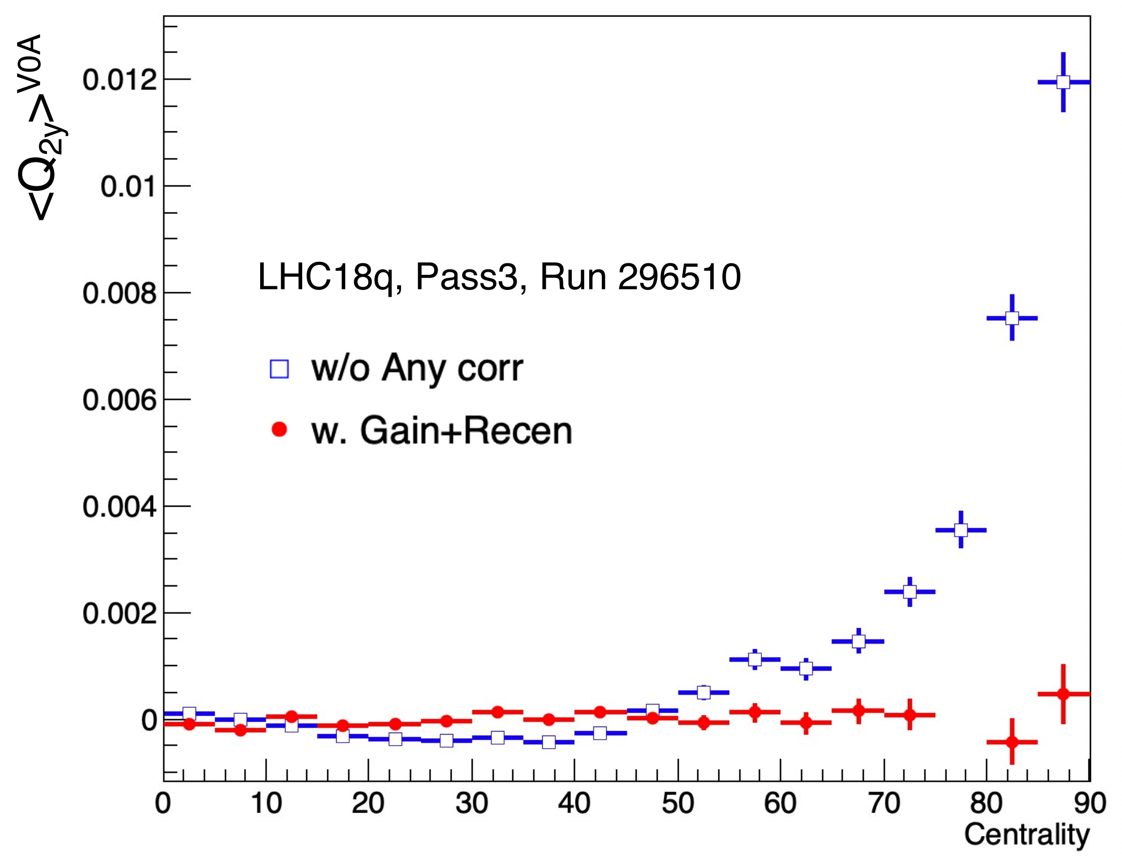
Recentring

$$Q'_n = Q_n - \langle Q_n \rangle$$

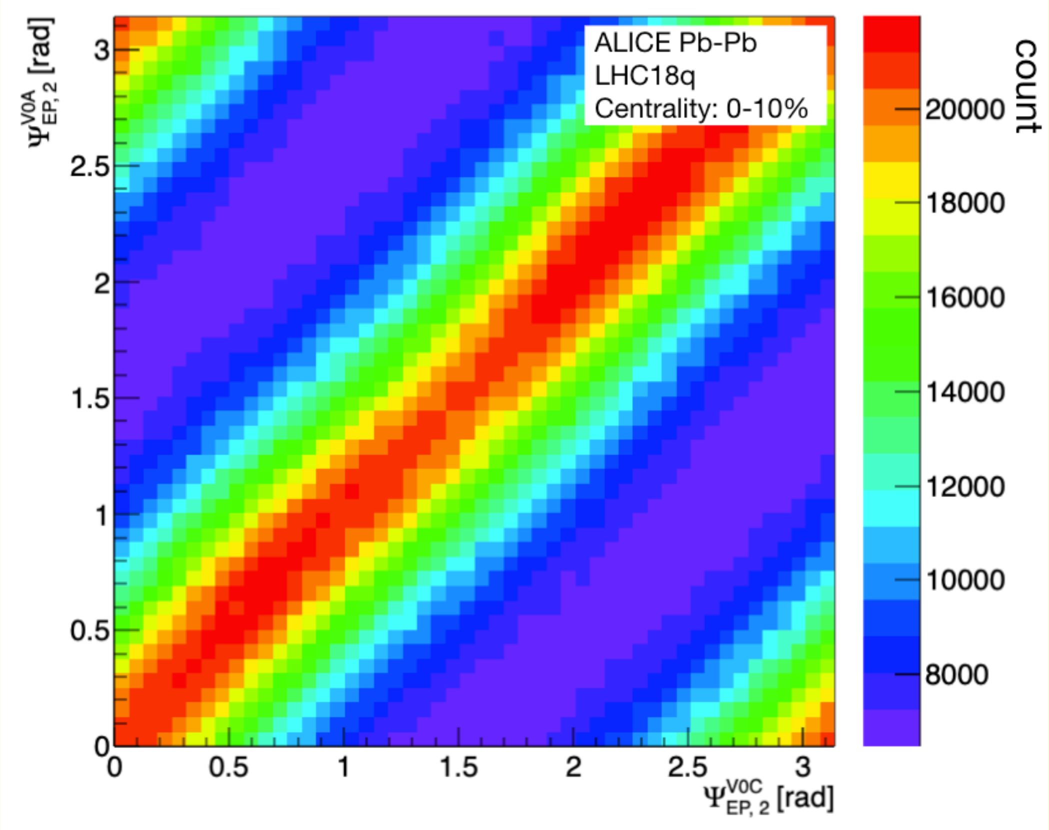
This part is esimated for run-by-run.
This average means the run average.

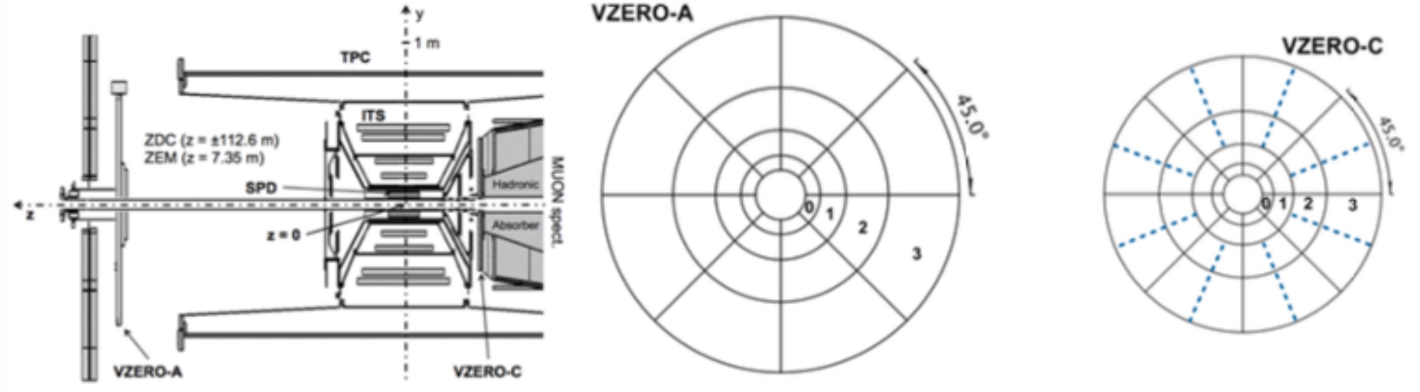
Rhian's way
I still reproduce Alex way results





Calibration of estimated event plane anlgle between V0C and V0A





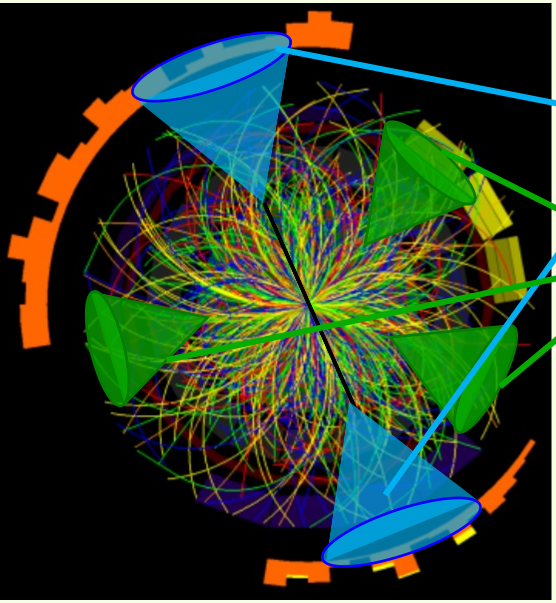
$$Q_{n,x} = \sum_i \omega_i \cos n\phi_i$$

$$Q_{n,y} = \sum_i \omega_i \sin n\phi_i$$

$$\Psi_{\mathrm{EP}\,n} = \frac{1}{n} \arctan \frac{Q_{n,y}}{Q_{n,x}}$$

The correlation seems correct.

Background p_T distribution (ordinary way)



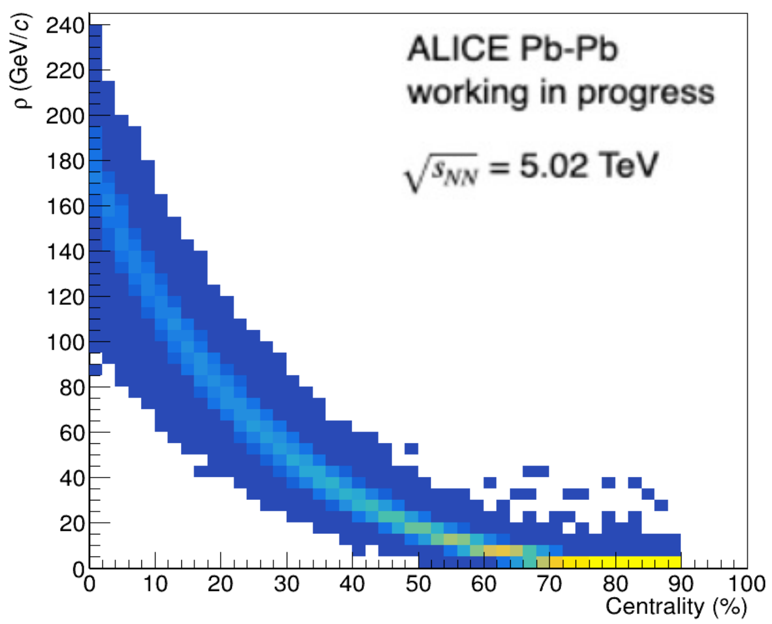
In HIC, a huge number of particles are produced.

→ Signal jets are reconstructed with the background particles.

→Estimate background p_T density (ρ) except for jet area to subtract the background from the signal jets

$$\rho = \mathrm{median}(p_{T,i}/A_i)$$ A : cluster area, i: cluster id

background p_T for centrality



ρ is considered uniform and determined event by event

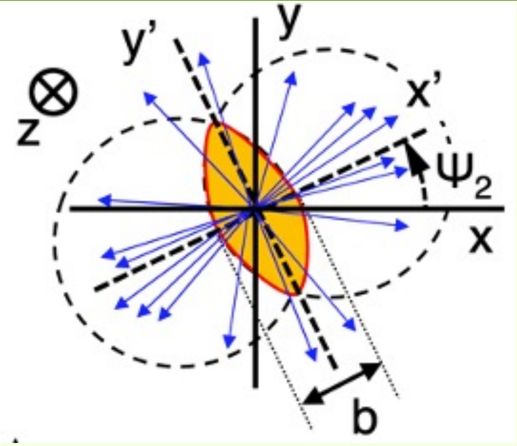
→ subtract the background from each jet

$$p_{T,corr}^{jet} = p_T^{jet} - \rho A$$

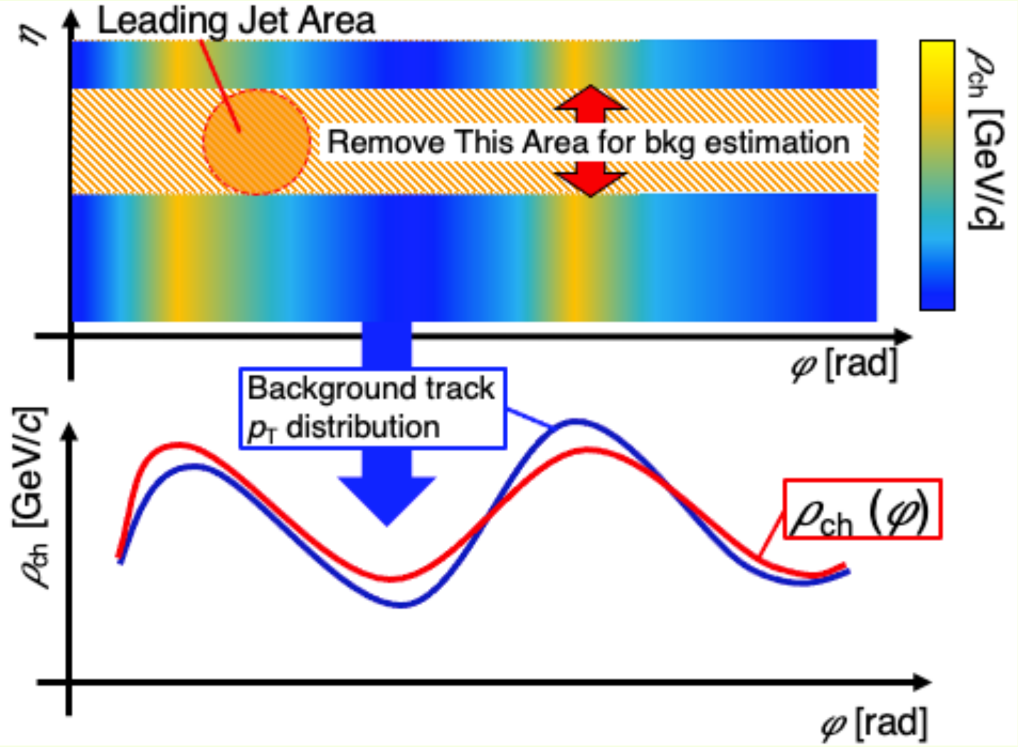
A : jet area

Local background p_T estimation

The soft particle background is **not uniform** for azimuthal angle (φ).
→The background calculation should take the φ dependency into account.



The local rho is estimated using tracks except the leading jet η region. (Because of the statistic problem, it includes the sub-leading jet region.)



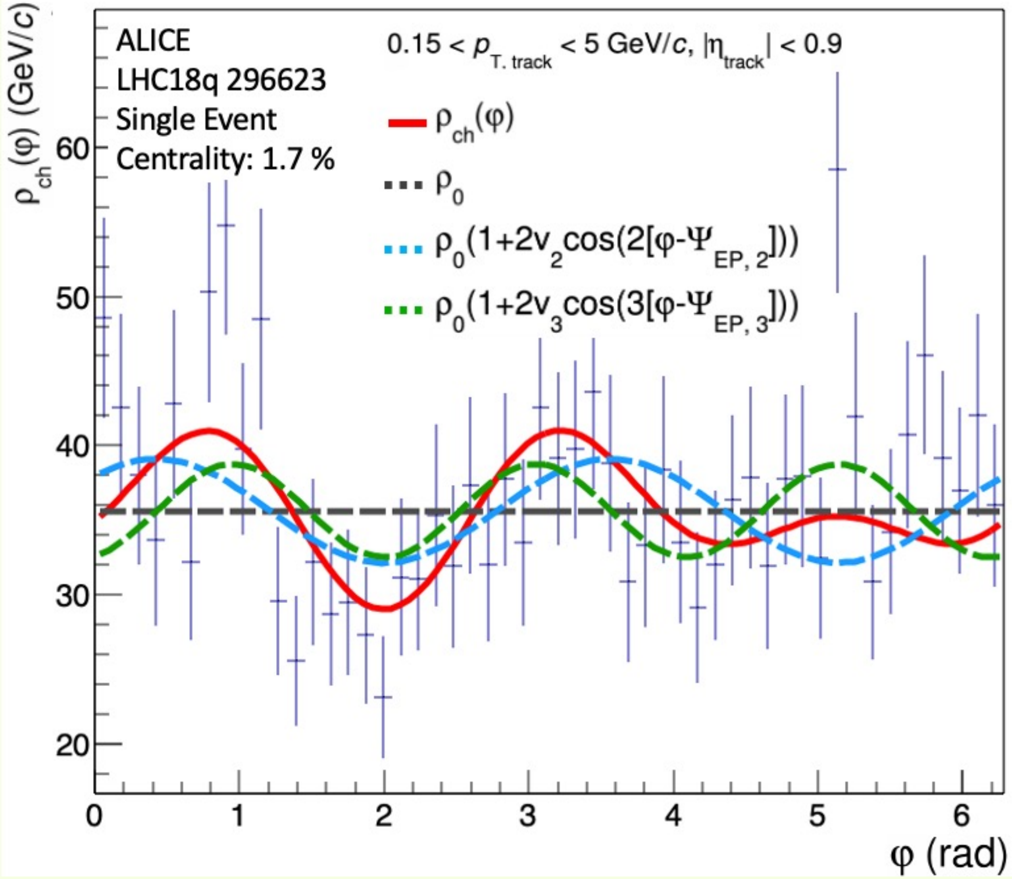
In this analysis, a following equation is used.

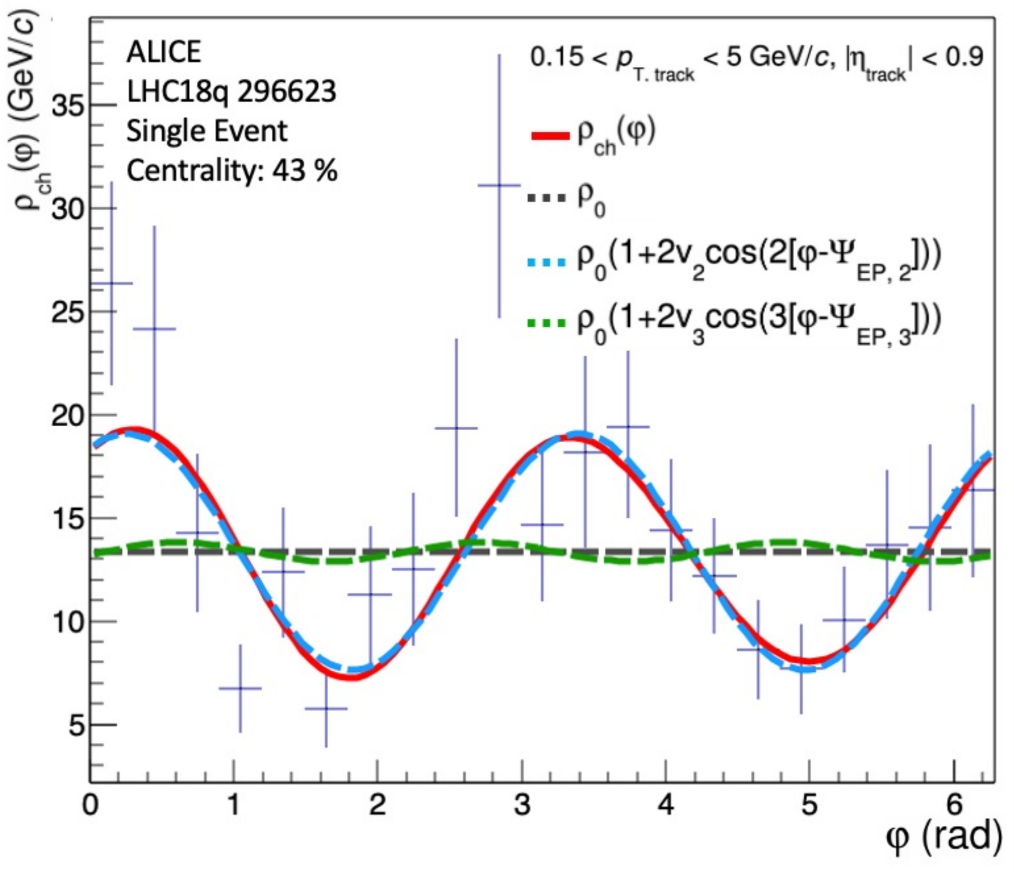
$$\rho_{ch}(\varphi) = \rho_0 \times \left(1 + 2\left\{v_2^{obs}\cos(2[\varphi - \Psi_{EP,2}]) + v_3^{obs}\cos(3[\varphi - \Psi_{EP,3}])\right\}\right)$$

$\Psi_{EP,2}$ and $\Psi_{EP,3}$ are calculated by the Qn vectors.
And ρ_0, v_2^{obs}, and v_3^{obs} are fitting value.

Local background p_T results

$$\rho_{ch}(\varphi) = \rho_0 \times \left(1 + 2\left\{v_2^{obs}\cos(2[\varphi - \Psi_{EP,2}]) + v_3^{obs}\cos(3[\varphi - \Psi_{EP,3}])\right\}\right)$$

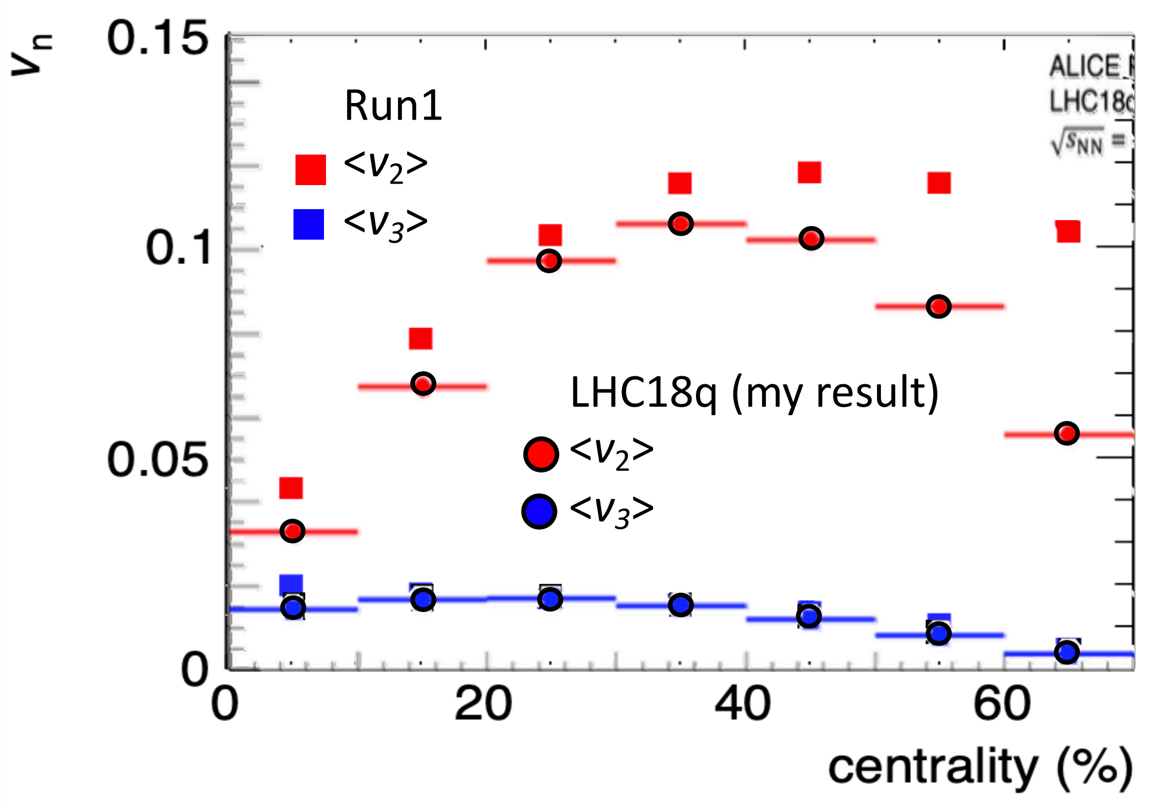




# of bins = $\sqrt{N_{track}}$

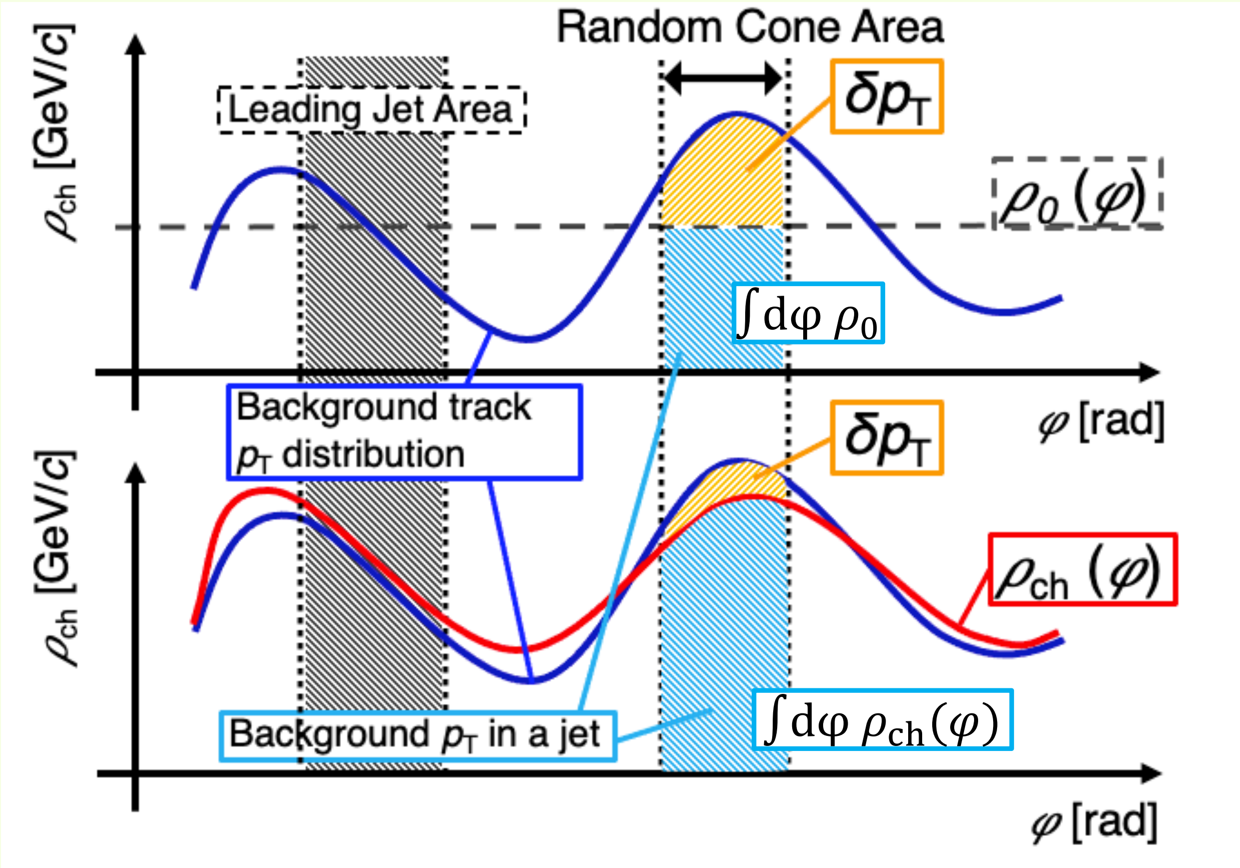
Soft pT particle v2

$$\rho(\varphi) = \rho_0 \times \left(1 + 2\left\{v_2^{\mathrm{obs}} \cos(2[\varphi - \Psi_{\mathrm{EP},2}]) + v_3^{\mathrm{obs}} \cos(3[\varphi - \Psi_{\mathrm{EP},3}])\right\}\right)$$



For <v2>, LHC18q results close to Run1 results untile centrality 40%, but over 50% LHC18q results become smaller.
For <v3>, LHC18q resutls mostly consists with Run1 results.

Evaluation of background fit (δp_T)

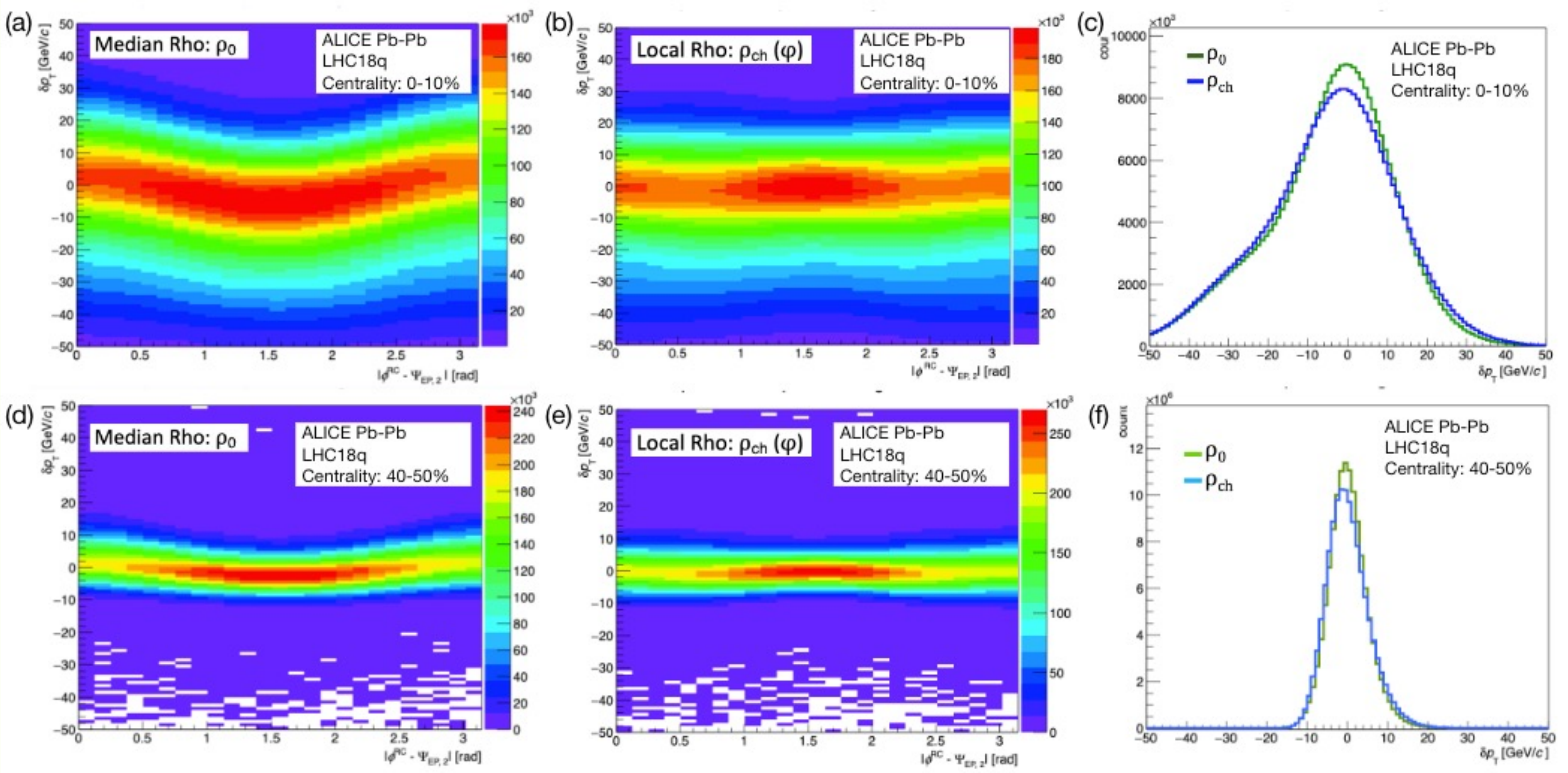


δp_T is a gap between integration of background tracks p_T and integration of background function in a random cone area.

We expect the local rho's δp_T should be smaller than the median one.
And in the local rho case, δp_T phi dependency is expected to make small.

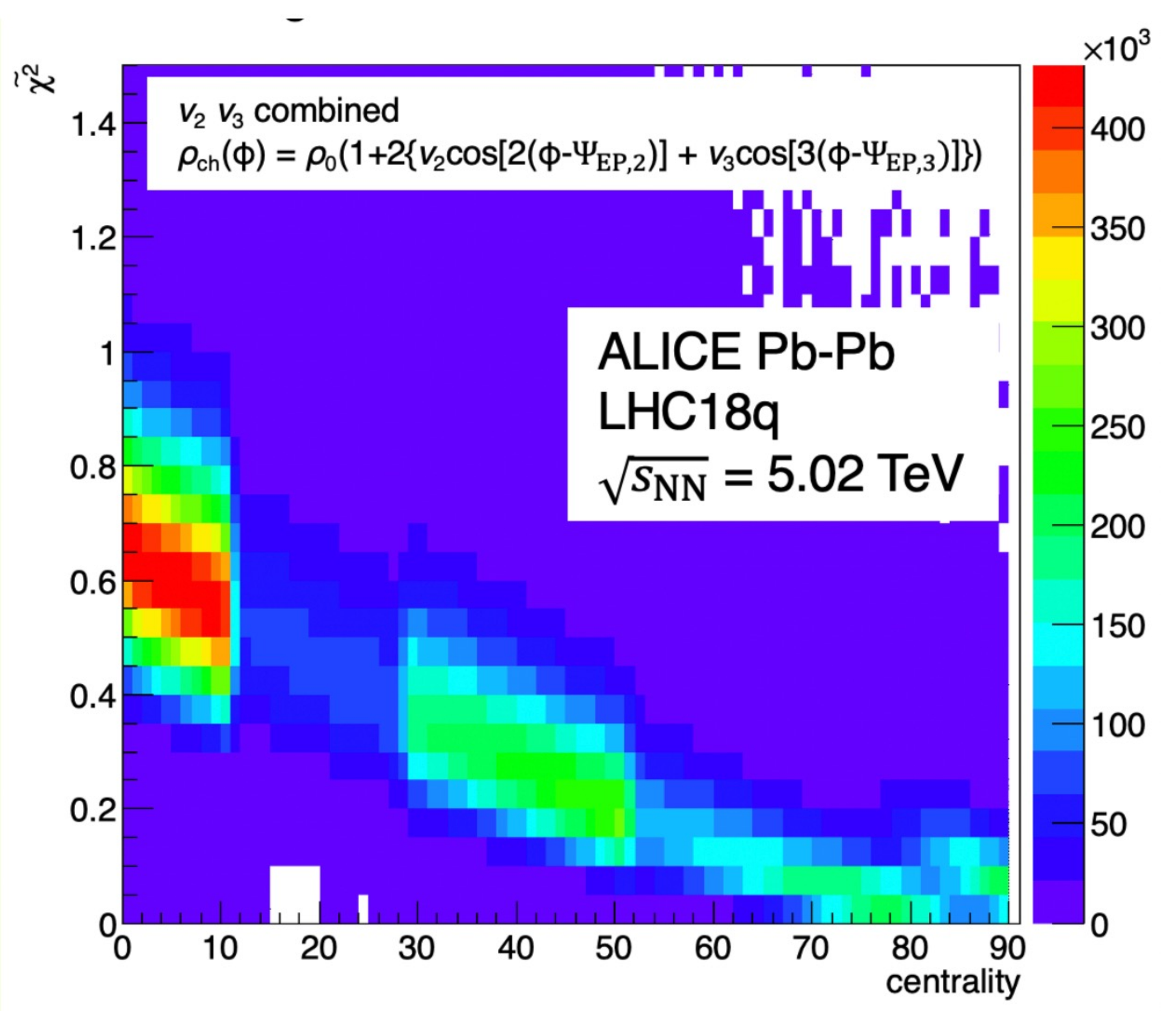
The Random cone is created once per event except the leading jet region.

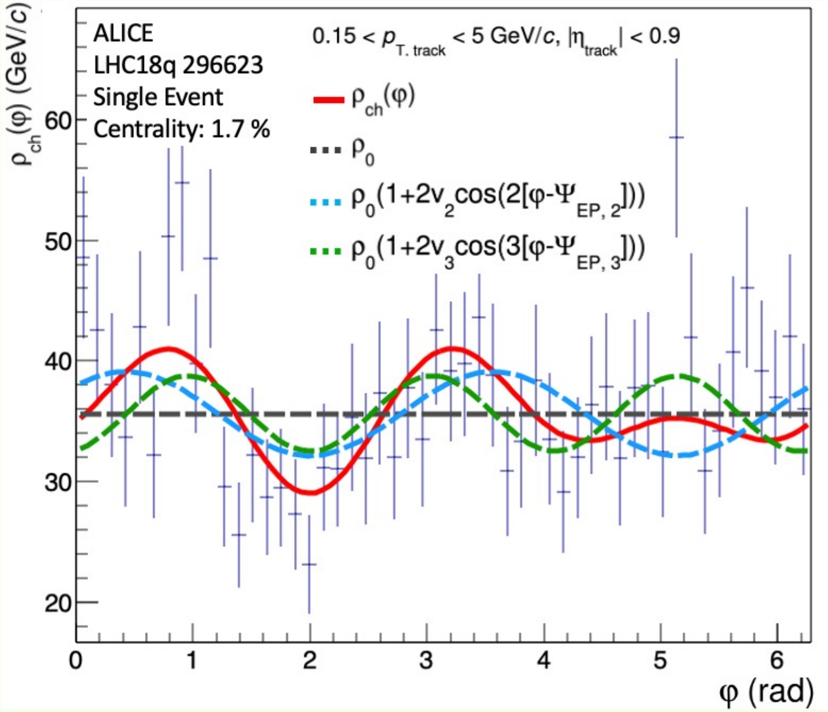
The background δpT distribution



As expected, the median rho has ϕ dependency and the local rho makes smaller the ϕ dependency. Furthermore, the dispersion of local rho background is more narrow than median rho. And these same tendency is seen in the all centrality regions.

Background pT function fit quality





$$\tilde{\chi}^2 = \left(\sum_{n=0}^{i} \frac{\left(p_T^{track} - p_T^{function}\right)^2}{p_T^{track}} \right) \Big/ (\#\text{ of bins } - 3)$$

# of free parameters (ρ_0, v_2, v_3)

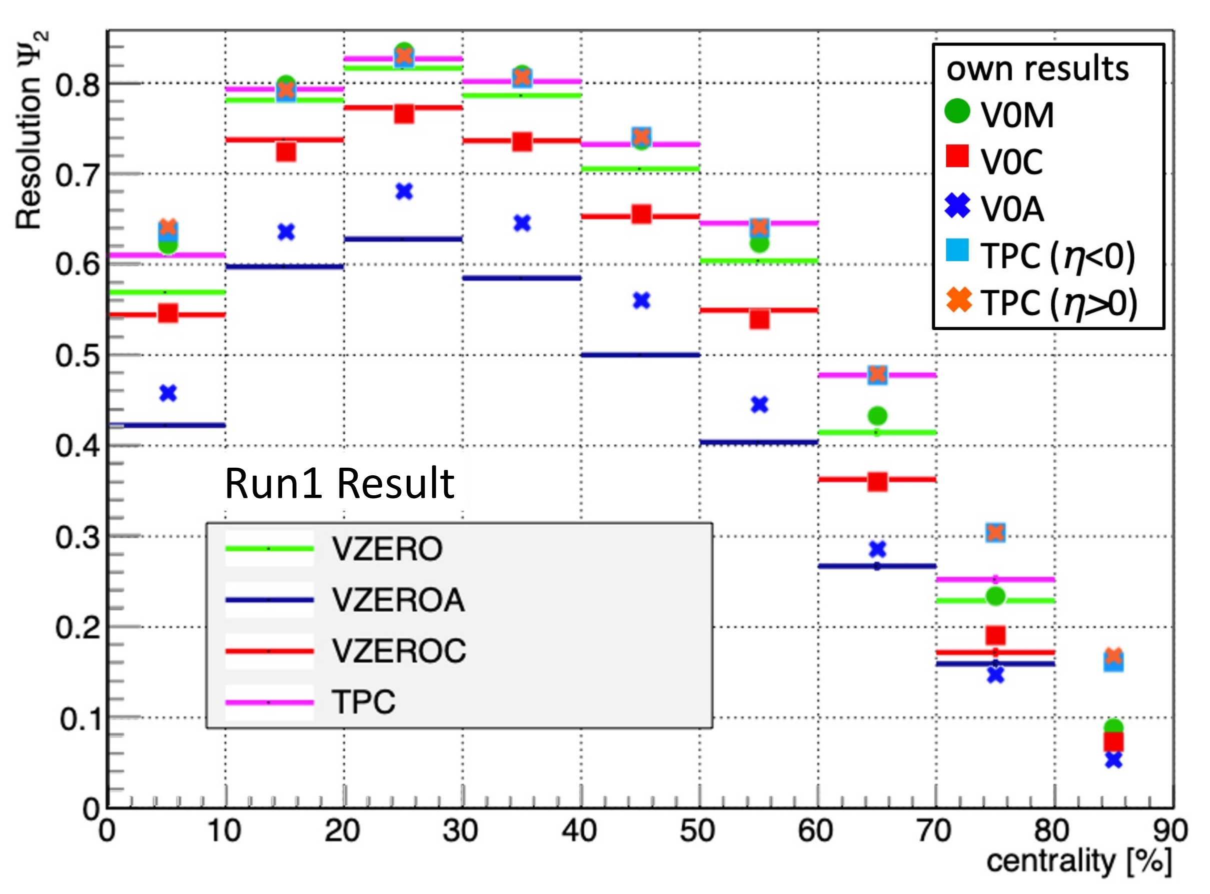
Event plane angle resolution

$$\mathscr{R}_n^a = \langle \cos(n[\Psi^a_{\mathrm{EP},n} - \Psi_n]) \rangle = \sqrt{\frac{\langle \cos(n[\Psi^a_{\mathrm{EP},n} - \Psi^b_{\mathrm{EP},n}]) \rangle \langle \cos(n[\Psi^a_{\mathrm{EP},n} - \Psi^c_{\mathrm{EP},n}]) \rangle}{\langle \cos(n[\Psi^b_{\mathrm{EP},n} - \Psi^c_{\mathrm{EP},n}]) \rangle}}$$

$$v_2^{\mathrm{jet}} = \frac{1}{\mathrm{Res}\{\psi_2^{meas}\}} \frac{\pi}{4} \frac{N_{in} - N_{out}}{N_{in} + N_{out}}$$

Ideally, $\Psi^{\mathrm{a}}_{\mathrm{EP},n} - \Psi^{\mathrm{truth}}_{\mathrm{EP},n}$ close to 0.
In that case, $\mathcal{R}_n^a$ close to 1.

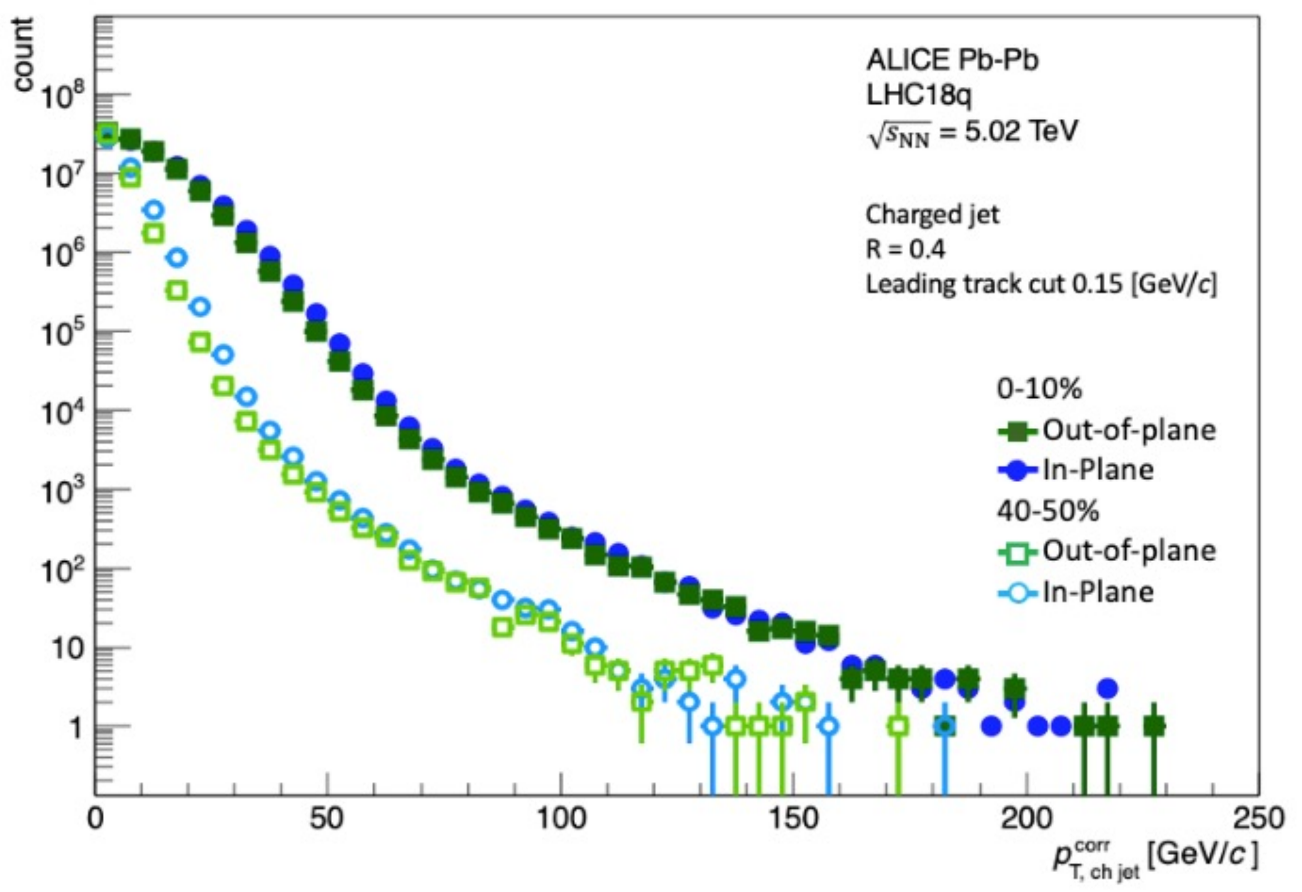
V0 sub-detector
(b: TPC η<0, c: TPC η>0)
TPC sub-detector
(b: V0C, c: V0A)

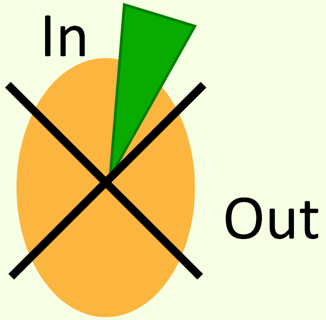


Both side TPC resolutions are matched. → It is reasonable.

Raw Jet Spectrum

Corrected Raw jet pT distribution (w/o unfolding): $p_{\mathrm{T}}^{raw} - \rho(\phi)A$

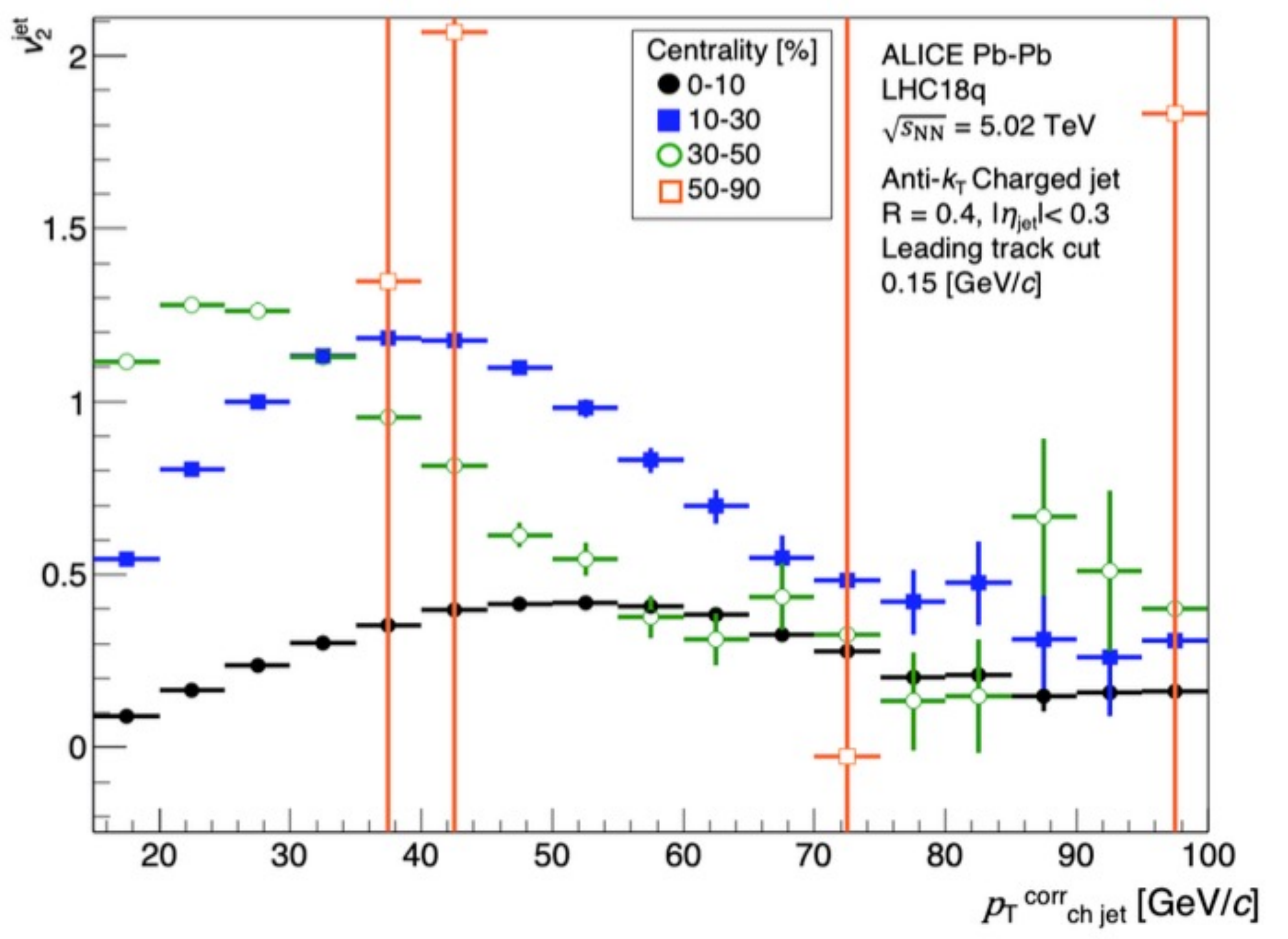




Out-Plane jets are more suppressed than In-plane ones for each centrality.

Raw jet v2 (R=0.4)

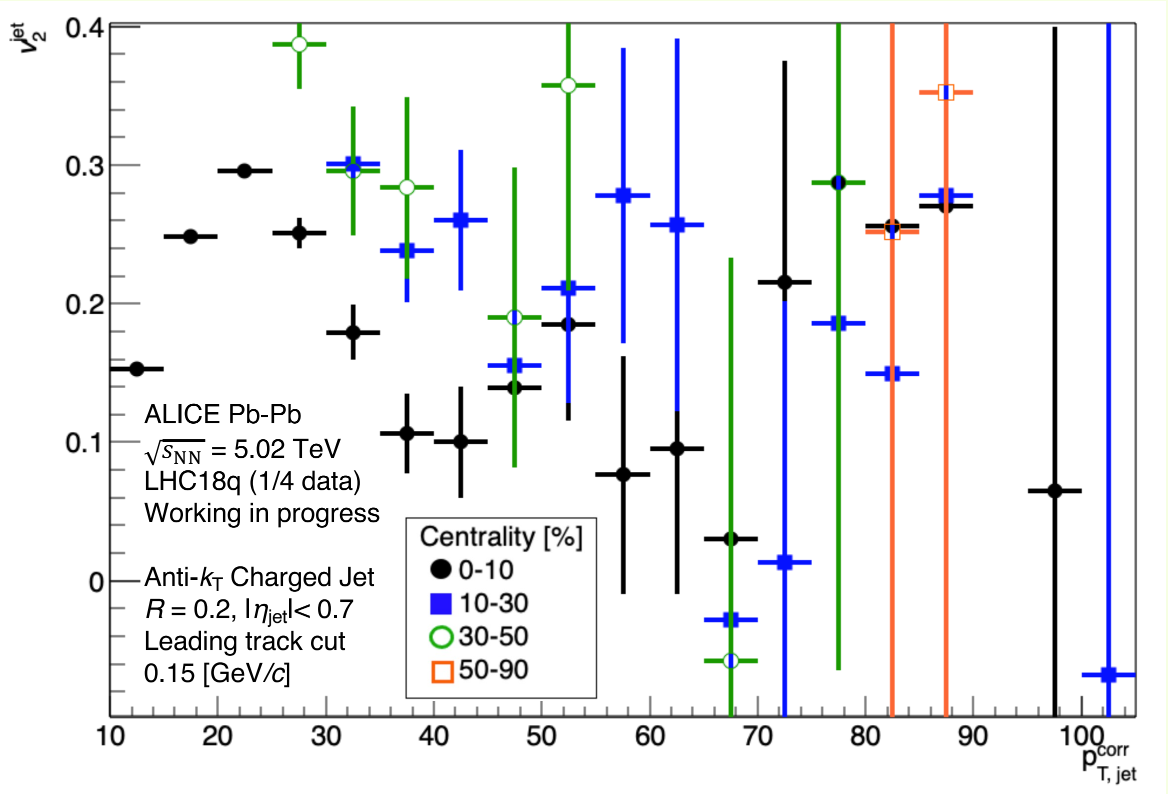
$$v_2^{\text{jet}} = \frac{1}{\text{Res}\left\{\psi_2^{meas}\right\}} \frac{\pi}{4} \frac{N_{in} - N_{out}}{N_{in} + N_{out}}$$



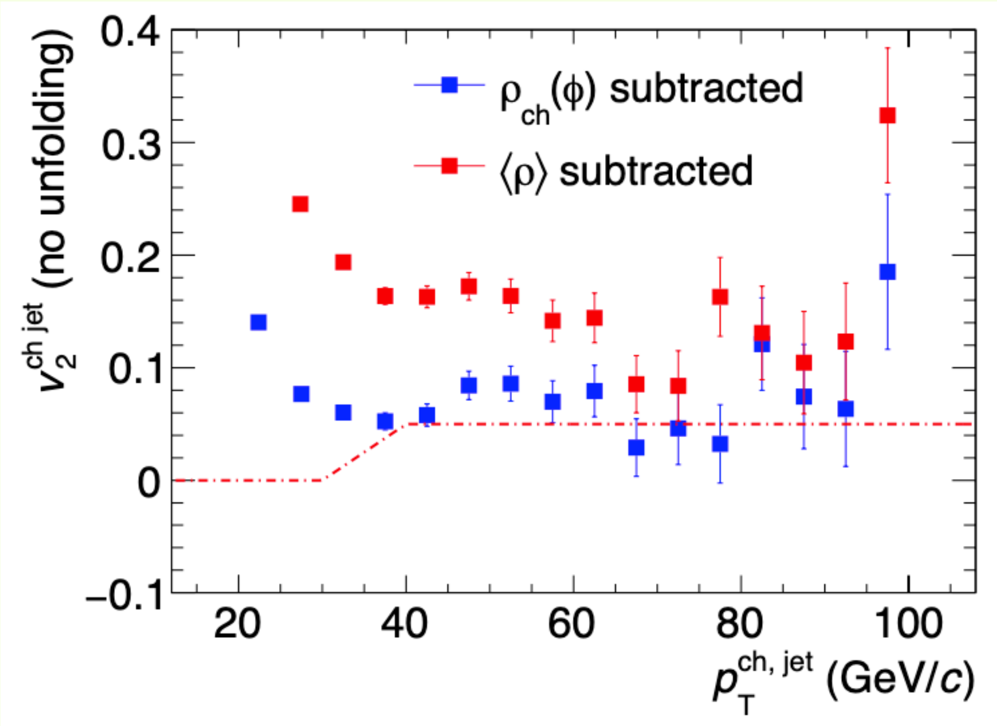
- Jet v2 distribution peak point become smaller as centrality becomes larger.
- The peck amplitude become larger as centrality becomes larger.

Raw jet v2 (R=0.2)

$$v_2^{\text{jet}} = \frac{1}{\text{Res}\left\{\psi_2^{meas}\right\}} \frac{\pi}{4} \frac{N_{in} - N_{out}}{N_{in} + N_{out}}$$



Run1 Result (centrality ?)



Value of jet v2 is close to Run1 results. And the shape around 20 – 40 GeV/c is also similar with Run1 results.
-> Need to increase statistic. (remain LHC18q 3/4, LHC18r, Semi-Central, Central)

Train problem

Train Problem (3 / 4 jobs fail)
(stdout, stderr) https://pcalimonitor.cern.ch/jobs/output.jsp?pid=2808316982&id=2808317260
(trace) https://pcalimonitor.cern.ch/jobs/trace.jsp?pid=2808317260

Check
test train status (CPU Memory, time consumption) → No problem
Make main functions deactivate → there is no difference (3 / 4 jobs fail)
Make make histograms deactivate → there is no difference (3 / 4 jobs fail)
→ not related output file size
Run local train → No problem
Run same task with latest AliPhysics on my mac and lxplus → No problem
Run same task on grid with more strict condition than train → success full statistic
(train: TTL 7000, max number of files per work 20) → (grid: TTL 5000, max file 100)

Next Plan

Qn vector calibration
- V0A, V0C, V0M
- TPC ($\eta<0$), TPC ($\eta>0$)

Still now

Raw Jet task

Raw Jet inclusive (ρ_0)

(Already studied by other person)

Event Plane

- Raw Jet inclusive ($\boldsymbol{\rho}_{\mathbf{local}}$)
  - Raw Jet in-plane (ρ_{local})
  - Raw Jet out-of-plane (ρ_{local})

Unfolding

RM

RM

RM

RM

Result

Jet R_{AA}

Jet v_2

Embedding

Response Matrix (RM)

Jet energy scale shift

Jet energy resolution

Kinematic efficiency

Model
- JETSCAP
- LBT

1. I still have somethigs to confirm for Event Plane.
2. I still have a wired train problem. To run full statistic and for embedding, I need solve this problem.

Backup Slides

Train Problem

About 80% jobs stop with crash (does not specify a bad line)

Processing	processing progress 4346 total, 1061 done, 3285 error, 0 active, 0 waiting

Trace: https://pcalimonitor.cern.ch/jobs/trace.jsp?pid=2808317260
Stderr: https://pcalimonitor.cern.ch/users/download.jsp?view=true&path=%2Falice%2Fcern.ch%2Fuser%2Fa%2Falitrain%2Frecycle%2Falien-job-2808317260%2Fstderr

Wagon	Status		Memory				Output size	Timing				Merging
			Virtual	Virt. Δ	Resident	RSS Δ		Wall	Wall Δ	CPU	CPU Δ	
Base line stdout | stderr stats | output	OK	Max Avg Slope	857.5 MB 813 MB +65.82 KB/evt		463.4 MB 487 MB +66.86 KB/evt		log: 10.87 KB .root: 0 B lego_train.root 9.205 KB	41s 32.81ms/evt	41s 32.81ms/evt	34s 27.19ms/evt 82.87%	34s 27.19ms/evt	No output
CDBConnectTask @ stdout | stderr stats | output	OK	Max Avg Slope	1.079 GB 1.032 GB +64.22 KB/evt	246.9 MB 243.9 MB -1.601 KB/evt	618.6 MB 578.7 MB +65.28 KB/evt	155.2 MB 91.65 MB -1.578 KB/evt	log: 10.83 KB .root: 0 B lego_train.root 5.89 KB	43s 34.65ms/evt	2s 1.84ms/evt	35s 28.39ms/evt 81.93%	1s 1.20ms/evt	No output
MultSelectionTask @ stdout | stderr stats | output	OK	Max Avg Slope	1.091 GB 1.044 GB +68.76 KB/evt	12.93 MB 12.05 MB +4.543 KB/evt	626.1 MB 726.9 MB -0.229 MB/evt	7.5 MB 148.2 MB -0.293 MB/evt	log: 14.45 KB .root: 6.809 KB lego_train.root 30.44 KB	44s 35.15ms/evt	1s 0.50ms/evt	36s 28.69ms/evt 81.61%	0s 0.30ms/evt	OK merge dir
JetFinder_charged_AKT_04 @ stdout | stderr stats | output	OK	Max Avg Slope	1.212 GB 1.161 GB +70.1 KB/evt	123.5 MB 119.5 MB +1.333 KB/evt	700.3 MB 796.8 MB -54.64 KB/evt	74.2 MB 69.88 MB **+0.176 MB/evt**	log: 17.33 KB .root: 0 B lego_train.root 39.93 KB	54s 43.63ms/evt	11s 8.48ms/evt	46s 36.79ms/evt 84.32%	10s 8.10ms/evt	OK merge dir
JetFinder_charged_KT_04 @ stdout | stderr stats | output	OK	Max Avg Slope	1.208 GB 1.16 GB +69.34 KB/evt	119.5 MB 118.6 MB +0.575 KB/evt	695.9 MB 659.3 MB +70.5 KB/evt	69.83 MB -67.58 MB **+0.298 MB/evt**	log: 17.32 KB .root: 0 B lego_train.root 39.94 KB	55s 44.15ms/evt	11s 9ms/evt	46s 37.19ms/evt 84.25%	11s 8.50ms/evt	OK merge dir
RhoNewTask2018 @ stdout | stderr stats | output	OK	Max Avg Slope	1.226 GB 1.173 GB +70.28 KB/evt	18.46 MB 13.88 MB +0.94 KB/evt	1002 MB 941.6 MB +71.02 KB/evt	307 MB 282.3 MB +0.52 KB/evt	log: 18 KB .root: 6.809 KB lego_train.root 42.57 KB	54s 43.77ms/evt	- -0.37ms/evt	46s 37.03ms/evt 84.59%	- -0.16ms/evt	OK merge dir
RawJetSpectraWithEventPlane2021_R04PtCut5 @ stdout | stderr stats | output	OK	Max Avg Slope	1.399 GB 1.344 GB +69.98 KB/evt	54.08 MB 55.7 MB -1.632 KB/evt	896.8 MB 954.9 MB -0.117 MB/evt	-180.3 MB -56.56 MB -0.363 MB/evt	log: 161.2 KB .root: 338.4 KB lego_train.root 48.81 MB	1m 13s 59.18ms/evt	9s 6.93ms/evt	1m 4s 51.80ms/evt 87.53%	8s 6.67ms/evt	OK merge dir
Full train stdout | stderr stats | output	OK	Max Avg Slope	1.399 GB 1.345 GB +66.15 KB/evt	575.4 MB 564.7 MB +0.332 KB/evt	895.8 MB 905.4 MB +66.76 KB/evt	432.4 MB 418.4 MB -98.57 B/evt	log: 161.2 KB .root: 338.4 KB lego_train.root 48.81 MB	1m 14s 59.78ms/evt	33s 26.98ms/evt	1m 3s 50.67ms/evt 84.76%	29s 23.48ms/evt	OK merge dir
Train file generation generation log | output	OK											

~~2808317586~~	295671	AliPhysics::vAN-20230223_O2-1	/alice/data/2018/LHC18q/000295671/pass3/AOD252/PWGJE/Jets_EMC_PbPb/8638_20230223-1707	17%	23	4	19	10:22	1m 47s	2.042 MB
~~2808317648~~	295668	AliPhysics::vAN-20230223_O2-1	/alice/data/2018/LHC18q/000295668/pass3/AOD252/PWGJE/Jets_EMC_PbPb/8638_20230223-1707	67%	28	19	9	19:05	12m 48s	9.003 MB
~~2808318041~~	295667	AliPhysics::vAN-20230223_O2-1	/alice/data/2018/LHC18q/000295667/pass3/AOD252/PWGJE/Jets_EMC_PbPb/8638_20230223-1707	95%	22	21	1	19:30	10m 11s	9.677 MB
~~2808317602~~	295666	AliPhysics::vAN-20230223_O2-1	/alice/data/2018/LHC18q/000295666/pass3/AOD252/PWGJE/Jets_EMC_PbPb/8638_20230223-1707	65%	20	13	7	11:09	6m 30s	6.042 MB
~~2808317386~~	295665	AliPhysics::vAN-20230223_O2-1	/alice/data/2018/LHC18q/000295665/pass3/AOD252/PWGJE/Jets_EMC_PbPb/8638_20230223-1707	41%	24	10	14	21:45	5m 10s	5.276 MB

Site activity

Site	Job eff.	All files	Local files	Remote files
CERN 7 jobs (38.89%)	36.35%	744 files 5.054 MB/s	744 (100%) 5.054 MB/s	
CATANIA 3 jobs (16.67%)	27.75%	4 files 3.995 MB/s	3 (75%) 8.663 MB/s	1 (25%) 1.478 MB/s
TORINO 2 jobs (11.11%)	41.96%	3 files 4.564 MB/s		3 (100%) 4.564 MB/s
ISS 1 jobs (5.556%)	7.901%	4 files 0.573 MB/s	4 (100%) 0.573 MB/s	
JINR 1 jobs (5.556%)	41.69%	7 files 4.287 MB/s	7 (100%) 4.287 MB/s	
KOSICE 1 jobs (5.556%)	65.49%	2 files 6.157 MB/s	2 (100%) 6.157 MB/s	
NIHAM 1 jobs (5.556%)	39.9%	32 files 8.484 MB/s	32 (100%) 8.484 MB/s	
ORNL 1 jobs (5.556%)	54.39%	11 files 5.747 MB/s	11 (100%) 5.747 MB/s	
RRC_KI_T1 1 jobs (5.556%)	48.64%	7 files 5.762 MB/s	7 (100%) 5.762 MB/s	
TOTAL **18 jobs**	35.73%	**814 files** **4.967 MB/s** **552.6 GB**	**810 (99.51%)** **4.982 MB/s** **550.3 GB**	**4 (0.491%)** **2.914 MB/s** **2.322 GB**

Job status detail

2808317289 : trace | log files | resubmit, 5.984 MB PSS, No Swap PSS (22:53 running, 3s saving, 100.1% CPU @ ALICE::RRC_KI_T1::LCG, max RSS: 911 MB, Virt: 911 MB)
2808317290 : trace | log files | resubmit (19:45 running, 6s saving, 96.66% CPU @ ALICE::CNAF::CNAF-DUE, max RSS: 795 MB, Virt: 795 MB)
2808317291 : trace | log files | resubmit, 871.8 MB PSS, No Swap PSS (21:23 running, 1s saving, 95.07% CPU @ ALICE::ISS::ARC, max RSS: 873 MB, Virt: 873 MB)
2808317293 : trace | log files | resubmit (22:52 running, 2s saving, 100% CPU @ ALICE::NIHAM::PBS, max RSS: 867 MB, Virt: 867 MB)
2808317294 : trace | log files | resubmit, 61.98 MB PSS, No Swap PSS (22:44 running, 3s saving, 99.92% CPU @ ALICE::RRC_KI_T1::LCG, max RSS: 797 MB, Virt: 797 MB)
2808317295 : trace | log files | resubmit, 837 MB PSS, No Swap PSS (20:51 running, 1s saving, 94.16% CPU @ ALICE::ISS::ARC, max RSS: 837 MB, Virt: 836 MB)
2808317296 : trace | log files | resubmit (19:24 running, 6s saving, 96.8% CPU @ ALICE::CNAF::LCG, max RSS: 882 MB, Virt: 882 MB)
2808317297 : trace | log files | resubmit, 822.1 MB PSS, No Swap PSS (23:49 running, 1s saving, 98.19% CPU @ ALICE::NIHAM::PBS, max RSS: 912 MB, Virt: 912 MB)
2808317298 : trace | log files | resubmit, 821.6 MB PSS, No Swap PSS (23:46 running, 2s saving, 99.6% CPU @ ALICE::ORNL::ORNL, max RSS: 834 MB, Virt: 834 MB)
2808317299 : trace | log files | resubmit (20:04 running, 6s saving, 96.42% CPU @ ALICE::CNAF::LCG, max RSS: 732 MB, Virt: 732 MB)
2808317301 : trace | log files | resubmit, 852.3 MB PSS, No Swap PSS (23:43 running, 7s saving, 96.51% CPU, max RSS: 960 MB, Virt: 960 MB)
2808317307 : trace | **log files** | resubmit, 719.1 MB PSS, No Swap PSS (20:05 running, 3s saving, 100.1% CPU @ ALICE::RRC_KI_T1::LCG, max RSS: 719.1 MB, Virt: 719 MB)
2808317312 : trace | log files | resubmit, 830.1 MB PSS, No Swap PSS (20:58 running, 7s saving, 98.2% CPU @ ALICE::CNAF::CNAF-DUE, max RSS: 851 MB, Virt: 851 MB)
2808317314 : trace | log files | resubmit, 831 MB PSS, No Swap PSS (23:13 running, 7s saving, 92.25% CPU @ ALICE::CNAF::CNAF-DUE, max RSS: 886 MB, Virt: 886 MB)
2808317318 : trace | log files | resubmit, 839.8 MB PSS, No Swap PSS (23:49 running, 4s saving, 97.7% CPU @ ALICE::KFKI::LCG, max RSS: 945 MB, Virt: 945 MB)
2808317320 : trace | log files | resubmit, 725 MB PSS, No Swap PSS (23:34 running, 8s saving, 96.48% CPU @ ALICE::KISTI_GSDC::KISTI_GSDC, max RSS: 835 MB, Virt: 835 M

EXPIRED (6 jobs, 6.25%) : resubmit all
2808317243 : trace | resubmit (running for 1d 19:30, 98.64% CPU @ ALICE::UPB::LCG, max RSS: 799 MB, Virt: 799 MB)
2808317246 : trace | resubmit (did not run, 15.21% CPU @ ALICE::RRC_KI_T1::LCG, max RSS: 87 MB, Virt: 87 MB)
2808317270 : trace | resubmit, 852.6 MB PSS, No Swap PSS (running for 1d 15:49, 95.13% CPU @ ALICE::ISS::ARC, max RSS: 869 MB, Virt: 869 MB)
2808317283 : trace | resubmit, 713.8 MB PSS, No Swap PSS (1d 1:59 running, 0s saving, 95.06% CPU @ ALICE::LBL_HPCS::HPCS, max RSS: 812 MB, Virt: 812 MB)
2808317316 : trace | resubmit (running for 1d 15:49, 99.33% CPU @ ALICE::UPB::LCG, max RSS: 760 MB, Virt: 760 MB)
2808317322 : trace | resubmit (running for 1d 13:56, 20.3% CPU @ ALICE::LBL_HPCS::HPCS_Lr, max RSS: 44 MB, Virt: 44 MB)

DONE (18 jobs, 18.75%)
2808317220 : trace | output dir (3:59 running, 8s saving, 22.14% CPU @ ALICE::CERN::CERN-SIRIUS, max RSS: 1.218 GB, Virt: 1.218 GB)
2808317222 : trace | output dir (2:27 running, 10s saving, 24.64% CPU @ ALICE::CERN::CERN-TRITON, max RSS: 1.299 GB, Virt: 1.299 GB)
2808317229 : trace | output dir (8:31 running, 1m 9s saving, 44.76% CPU @ ALICE::CERN::CERN-SIRIUS, max RSS: 1.845 GB, Virt: 1.845 GB)
2808317235 : trace | output dir (8:12 running, 8s saving, 44.87% CPU @ ALICE::CERN::CERN-TRITON, max RSS: 1.896 GB, Virt: 1.896 GB)
2808317237 : trace | output dir (3:59 running, 10s saving, 19.32% CPU @ ALICE::CERN::CERN-TRITON, max RSS: 1.233 GB, Virt: 1.233 GB)
2808317238 : trace | output dir (1:27 running, 58s saving, 47.25% CPU @ ALICE::CERN::CERN-TRITON, max RSS: 1.157 GB, Virt: 1.157 GB)
2808317242 : trace | output dir (33s running, 59s saving, 22.21% CPU @ ALICE::CERN::CERN-SIRIUS, max RSS: 85 MB, Virt: 85 MB)
2808317254 : trace | output dir (4m 16s running, 48s saving, 33.79% CPU @ ALICE::Catania::Catania_VF, max RSS: 75 MB, Virt: 75 MB)
2808317256 : trace | output dir (2m 4s running, 1m 26s saving, 37.43% CPU @ ALICE::Catania::Catania_VF, max RSS: 80 MB, Virt: 80 MB)
2808317258 : trace | output dir (8m 25s running, 1m 39s saving, 9.913% CPU @ ALICE::Catania::Catania_VF, max RSS: 76 MB, Virt: 76 MB)
2808317274 : trace | output dir (1:11 running, 1m 5s saving, 8.32% CPU @ ALICE::ISS::ARC, max RSS: 1.197 GB, Virt: 1.197 GB)
2808317276 : trace | output dir (20m 5s running, 17s saving, 39.83% CPU @ ALICE::JINR::ARC, max RSS: 1.191 GB, Virt: 1.191 GB)
2808317279 : trace | output dir (5m 19s running, 39s saving, 29.61% CPU @ ALICE::Torino::Torino-HTC, max RSS: 74 MB, Virt: 74 MB)
2808317281 : trace | output dir (4m 17s running, 50s saving, 53.5% CPU @ ALICE::Kosice::ARC, max RSS: 87 MB, Virt: 87 MB)
2808317292 : trace | output dir (44m 45s running, 27s saving, 39.56% CPU @ ALICE::NIHAM::PBS, max RSS: 1.127 GB, Virt: 1.127 GB)
2808317300 : trace | output dir (22m 15s running, 13s saving, 52.26% CPU @ ALICE::ORNL::ORNL, max RSS: 1.069 GB, Virt: 1.069 GB)
2808317308 : trace | output dir (11m 53s running, 15s saving, 44.55% CPU @ ALICE::RRC_KI_T1::LCG, max RSS: 1.019 GB, Virt: 1.019 GB)
2808317310 : trace | output dir (2m 1s running, 51s saving, 42.12% CPU @ ALICE::Torino::Torino-HTC, max RSS: 79 MB, Virt: 79 MB)

Test run result

https://twiki.cern.ch/twiki/bin/viewauth/ALICE/AnalysisTrains

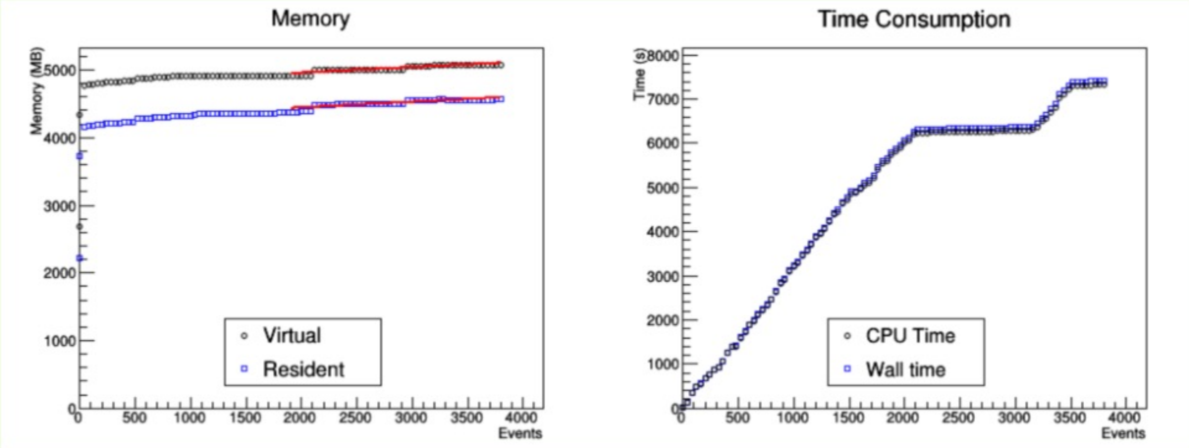
Train guideline

- **Checking the memory of the train before submitting**

Most computing centers allow an upper limit of 8GB of virtual and 2GB of resident memory. The train testing page does not disable the 'Run train' button in case the memory footprint is higher, because there are known leaks in the PIDresponse task that show up in the lego tests but not in grid. Due to this you are the main responsible for enforcing the memory rule. The procedure is quite simple:

Full train stdout I stderr stats I output	OK	Max Avg Slope	**4.96 GB** 4.81 GB +82.88 KB/evt	3.794 GB 3.724 GB **+22.72 KB/evt**	**4.456 GB** 4.277 GB +85.27 KB/evt	3.725 GB 3.645 GB **+18.16 KB/evt**	log: 63.42 KB .root: 10.32 MB **lego_train.root 172.3 MB**	2:03 1,949.72ms/evt	1:59 1,879.71ms/evt	2:02 1,927.61ms/evt 98.87%

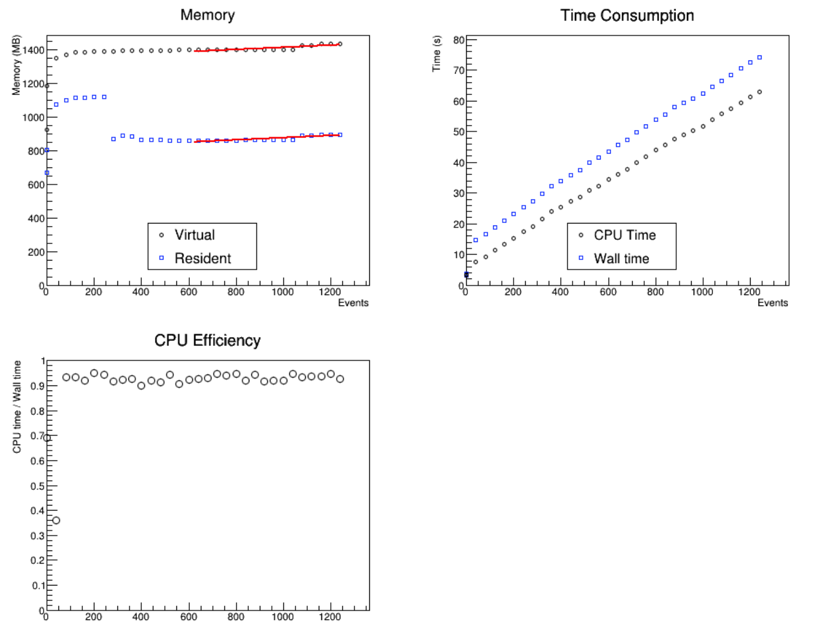
- On the 'Full train' line in the test results, check the values of the resident and virtual memory. If these numbers appear in red as in the snapshot above, you should do a more thorough investigation:
  - Click on the 'stats' link in the 'Full train' table cell, this will open a page showing the memory (top left) and CPU consumption



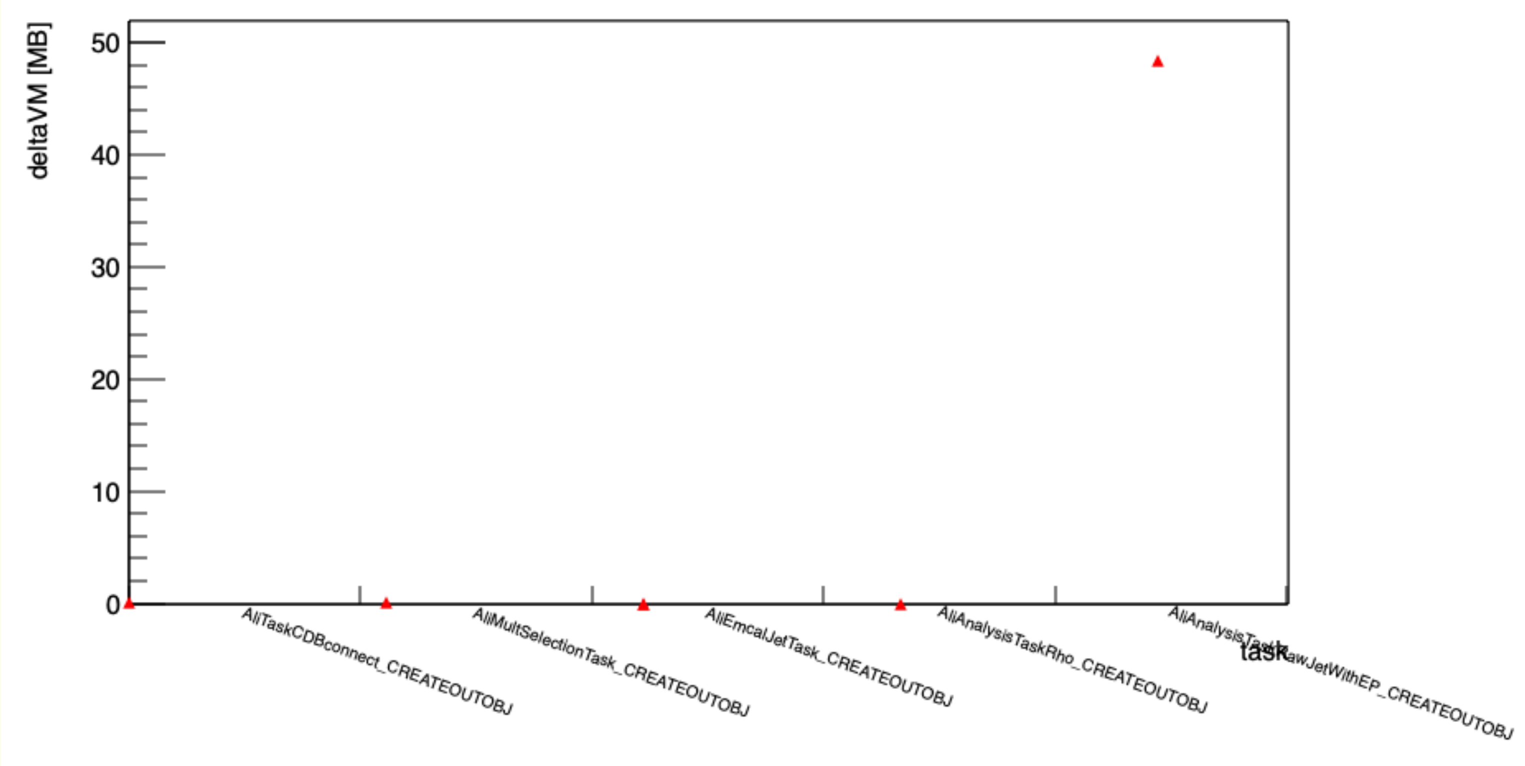
The example above shows a resident memory footprint starting from more than 4GB, with a leak of more than 200MB over 4K events. Such a train should never be submitted. Note that every 100MB beyond the limit of 2GB RSS memory translates to a considerably larger failure rate. For this example most jobs failed (and few nodes were affected).

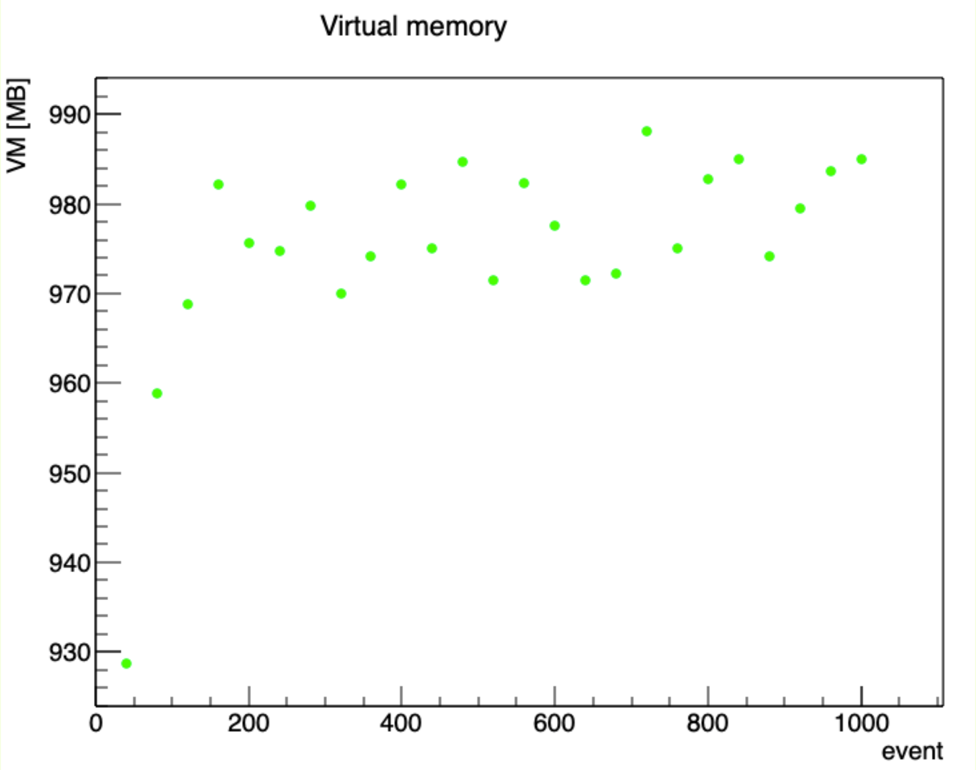
- - Investigate which wagons in the train are responsible, by looking on the same numbers and memory profile on their respective rows in the test report. Typically the 'misbehaved' tasks are the user ones, except the case of using PIDresponse task for meta data sets having many children, due to a known memory leak (affecting much less the grid jobs than the test). The typical memory behavior of such trains (when the user tasks are well behaved) is shown below:

My test train

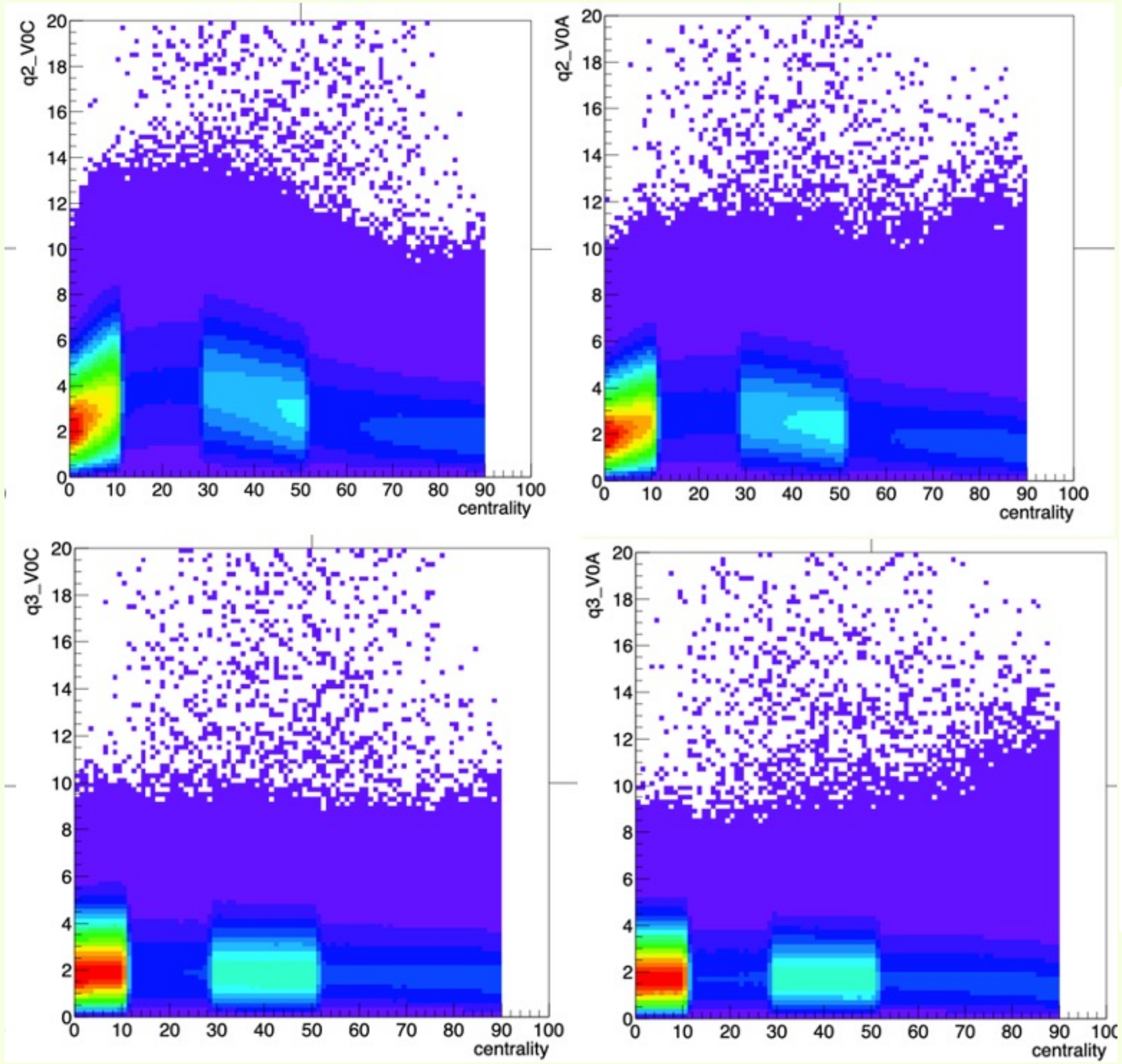


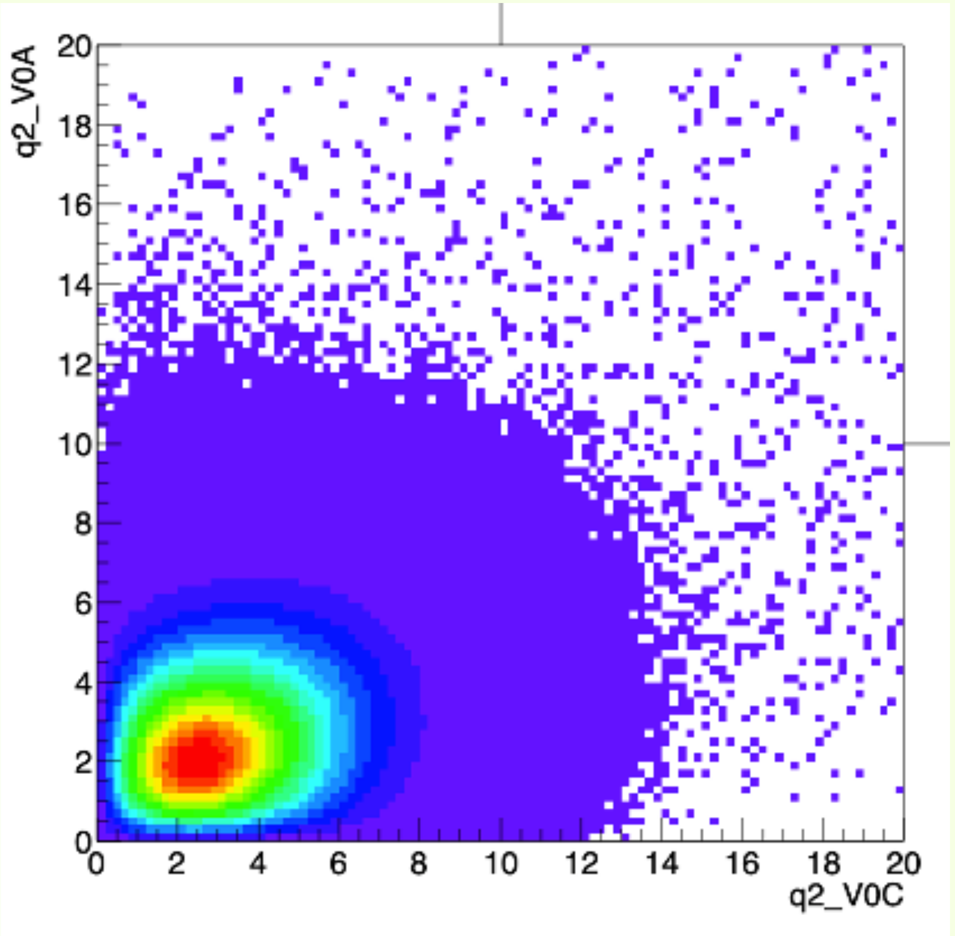
Test local train





q2 value for centrality





Wide pT range of jet v2