General

The paper has improved and I really appreciate that you incorporated our comments in a nice way. I also liked the fact that you added a new subsection where you focus on the similarities and the differences between the NL and the total vn. However, I feel that it is misplaced and can profit from a further expansion of the discussion (some suggestions and further ideas about this are listed below).
Finally, the text needs some still a bit of tweaks here and there so I give some additional suggestions below.

Physics+analysis related

- maybe state at the end of the abstract how better/worse the models do wrt the total flow instead of the generic statement of lines 18-19?
- L80: I feel you are mixing the name of the χs which you call here “non-linear flow mode coefficients” with how you call the vnmk (non-linear mode coefficients”
- L83-84: “The approximation…flow coefficients” this needs a reference. How valid is this assumption?
- L196: ru sure the cut in the z-coordinate of the dca is that loose?
- L296: “iv) not rejecting all events with tracks caused by pileup.” I commented on this before! I hope you mean that you make the "pile up cut" stricter not that u make it looser; if so the sentence should be modified accordingly
- L314: you need to describe here what online is! don't use jargon: nobody outside ALICE knows what offline and online V0 fimder is! You have to say sth like "combining pairs of track candidates while the track reconstruction is performed..." ==> find the proper description of this mode
- L316: why do you loosen the cut for the pointing angle? you increase the background like this! for all other cuts we always tighten the requirement
- L350-351: “It is shown in MC studies that both e2 and e3 increase for peripheral collisions [8]. Although, this increase is less pronounced for e3.” ==> isn't it mainly that e2 is the one rising with centrality? e3 rises as well but the relative rise is smaller than the one of e2? See Z. Qiu, U. W. Heinz, Phys.Rev. C84, (2011) 024911 as an example; i see you write it later in the end of the paragraph; but I feel that it's better if stated in one go? think about it
- L354-356: make sure you spell out why it is "as expected" for 6,222 and why 6,33 is not changing as much with centrality
- L364-365: “between the non-linear response of the system and radial flow.” ==> I don't understand this about the “interplay of the *nl response with radial flow*; don't you want to say that it arises from the initial coordinate space anisotropy (e2+e3) + radial flow?
- L382: you should indicate here the pT/nq range where the scaling is supposed to be relevant!
- L423-437: in general I like this attempt; however it needs to become clear that:

i. for the total vn you look at v2, v3 (which have indeed larger magnitude than the ones you report in your analysis but this is irrelevant) and at v4 which is the only relevant harmonic where this direct comparison can be made
ii. ii. you report v532 and two modes of v6, which indeed have small magnitudes but the total v5 and v6 is not reported (not your fault, I'm just stating it)

So in total, I propose the following:
- you first put Table 4 and make it Table 3 i.e. the comparison of the total vn to the models comes first and you discuss the ranges, finishing with the total v4
- you then add the table for vnmk, and you start with v422 and make the comparison not only with the models but also how better/worse they describe v422 wrt to total v4
- you then discuss how the models do for v532 and the two v6 you report

- L438: I would move this new subsection just before the model comparison; the argument is that we first discuss in detail all the data points and then we go to the comparison with models
- In the current subsection 6.3 I think I'm missing a couple of plots here that would support the discussion. I would try to do the following:

- split the discussion in two paragraphs, the first about the mass ordering the other about the grouping
- I would add a couple of indicative plots e.g. relative mass ordering, relative grouping
- for each paragraph I would attach the indicative plot and I would discuss in detail the observation
- can we make a story about the expectation of the mass ordering and the grouping for v422 and v4 from v2^2? similarly for v532 from v2 and v3?

Cosmetics for plots

I like what you did with the plots; if there is anything more we can do to make them even nicer we will do it better

Editorial

L10: “…identified hadrons with reference particles from…” ==> “…identified hadrons with reference charged particles from…”
L11: “..contribution from second and…” ==> “…contribution from the second and…”
L12: “…anisotropy coefficients in higher flow harmonics.” ==> “…anisotropy coefficients to higher flow harmonics.”
L13: remove "(e.g. v2 and v3)”
L14: remove “measurement of the”
L15: “…the centrality percentile…” ==> “…centrality percentile…”

L40: “…of matter is called quark-gluon plasma…” ==> “…of matter is called the quark-gluon plasma”
L43: “…sensitive to the properties of the QGP is the azimuthal…” ==> “…sensitive to these properties is the azimuthal…”
L47: “….in the transverse plane. Through interactions…” ==> “…in the transverse plane which fluctuates from event to event. Through interactions…”
L58: “…(sQGP) but they have also constrained the value…” ==> “…(sQGP) but have also contributed in constraining the value…”
L59: “…(η/s) very close to the lower…” ==> “…(η/s) which is very close to the lower

L60: “…calculations [46] show that higher…” ==> “…calculations [46] showed that higher…”
L65: “…in a collisions according to…” ==> “…in a collision according to…”
L67-68: “Model calculations show that for non peripheral collisions, v2 and to a large extent, v3 are…” ==> “Model calculations show that v2 and to a large extent, v3 are…”
L68: “…linearly proportional to their corresponding…” ==> “…linearly proportional for a wide range of impact parameters to their corresponding…”
L70: “…initial anisotropic coefficient suggests…” ==> “…initial anisotropic coefficients suggests…”
L73-74: “…coefficient [48,49]. This dependence on lower order initial anisotropies gives rise to additional terms in the higher order flow coefficients.” ==> “…coefficient [48,49], where the second term reveals a non-linear dependence of e4 on the lower order e2”
L81: “…modes in higher order…” ==> “…modes for higher order…”
L87: “…showed that pT…” ==> “…showed that the pT…”
L89: “…of state and hadronic rescattering phase [53, 54] as well as particle…” ==> “…of state, the highly dissipative hadronic rescattering phase [53, 54] as well as probing particle…”
L90-91: Reverse “species at the LHC [37, 38, 40, 44] and RHIC [13–16].” i.e. first RHIC and the LHC
L91-92: “…between radial flow and anisotropic flow…” ==> “…between radial and anisotropic flow…”
L92: “…transverse momentum (pT)…” ==> “…transverse momentum…”
L98: “…coefficients exhibit number of…” ==> “…coefficients exhibit what is usually referred to as number of…”
L101: “…centralities challenge hydrodynamic…” ==> “…centralities could pose a challenge to hydrodynamic…”
L107: “…of the mass ordering and particle…” ==> “…of the particle…”
L120: “The reported measurements are therefore…” ==> “The measurements reported in Section 6 are therefore…”

L140: “…for the hadron…” ==> “…for different hadron…”

L176: “…the energy deposition measured in the V0 detectors.” ==> “the signal magnitude measured in the V0 detectors which is related to the number of particles crossing their sensitive areas.”
L198: “…at pT< 0.6 GeV…” ==> “…at pT\approx 0.6 GeV…”
L209: “…purity was required to be 80%.” ==> “…purity was varied to more strict values” (maybe give an indicative number in parenthesis?)
L217: “…topology among reconstructed tracks.” ==> “…topology among pairs of reconstructed tracks.”
L231: “…first layer of the ITS.” ==> “…first layer of the ITS, where the occupancy is the largest.”
L239: “…utilising Bayesian PID…” ==> “…utilising the Bayesian PID…”
L240: “…of 85% using TPC and TOF detectors.” ==> “…of 85% using the TPC and TOF detectors.”
L241: remove “of phi candidates”

L251: “…multi-particle correlators" ==> “…multi-particle correlators given by”
L252: “…sub-event method which was originally…” ==> “…sub-event method originally…”
Eq.12-15 should be moved before Eq. 10-11
L259: “…technique by nature removes majority of non-flow…” ==> “…technique by construction removes a significant part of non-flow…
L259-260: “In order to reduce residual…” ==> “In order to further reduce residual…"
L260-261: “…a larger pseudorapidity gap was applied between the two pseudorapidity regions.” ==> “…a pseudorapidity gap was applied between the two pseudorapidity regions.” mention here in the end the gaps applied
L263: “For inclusive charged hadrons,…” ==> “For charged hadrons,…”
L264-265: “…reconstructed on statistical basis from…” ==> “…reconstructed on a statistical basis from…”
L266: “Therefore, for the aforementioned particle species, the…” ==> “Therefore, the…”
L267: “…and pT per centrality percentile.” ==> “…and pT for each centrality percentile.”

L285: “…as topological reconstruction…” ==> “…as the topological reconstruction…”
L301: “…are used to hybrid mode…” ==> “…are used to what is referred to as hybrid mode…”
L312-313: remove “The default V0 finding method is described in Sec. 3.3.”
L315: “…to the primary…” ==> “…from the primary…”
L325: Add a last paragraph that connects the previous text with the tables and explain also in the text what these tables contain!

L327: “…the results for the pT-dependent…” ==> “…the results of the pT-dependent…”
L331: “…are compared with vn measurements in Sec.…” ==> “…are compared with the total vn measurements for the same particle species in Sec.…
L331-333: “Note that the same…highlight the physics implications of the measurements in each section.” ==> “Note that in some of the following sections the same…highlight the various physics implications of the measurements in each section.”
L337: “For φ-meson,…” ==> “For the φ-meson,…”
L339: “…expected as v4;22 measures…” ==> “…expected as v4;22 reflects…”
L340: “…which increases for peripheral collisions…” ==> “…which increases from central to peripheral collisions…”
L342: “…observed also in vn measurements…” ==> “…observed also in the total vn measurements…”
L359: “…at all collision centralities.” ==> “…for all collision centralities.”
L360: “…between the anisotropic flow and radial flow. Radial flow…” ==> “…between radial flow and the coordinate space anisotropy, created from both the geometry and the fluctuating initial energy density profile. In particular, radial flow…
L361: “…which leads to lower v4;22 for heavier…” ==> “…which becomes larger in- than out-of plane due to the velocity profile. This naturally leads to lower v4;22 at a given value of pT for heavier…”

L367-370: "In particular, vn;mk of mesons (p, K, K0S and f) and baryons (p+$\bar{p}$ and L+$\bar{L}$) group based on their type, with vn;mk of baryons having a larger magnitude. This particle type grouping was previously observed in the anisotropic flow measurements of various particle species [13–16, 37, 38, 40]. This suggests that flow…" ==> "In particular, the data points form two groups, one for mesons and one for baryons with the values of vnmk of the latter being larger. This particle type grouping was previously observed in the total vn measurements of various particle species [13–16, 37, 38, 40]. This could suggest that flow…"
L372: "As a next step it was suggested…" add reference
L374: "This scaling, worked…" ==> "This worked…"
L380-381: "…scaled by the inverse of number of constituent quarks…" ==> "…scaled by the number of constituent quarks…"
L384: "Similarly, for non-linear flow modes this scaling…" ==> "It is seen that for the non-linear flow modes this scaling…"
L386: "The comparisons of the anisotropic…" ==> "The comparison of various anisotropic…"
L387-388: "measurements at ALICE [40]…" ==> "measurements reported by ALICE [40]…"
L395: "TRENTo [81] initial conditions…" ==> "The version of the model that uses TRENTo [81] initial conditions…"
L396: "…between vn measurements…" ==> "…between the total vn measurements…"
L399: "…than TRENTo model…" ==> "…than the TRENTo model…"
L400-401: remove "Recently, it was shown that the pT-integrated non-linear flow modes are good observables to constrain the initial conditions and transport properties of the system [52]."
L404: "…with two hydrodynamical calculations from [76]." ==> "…with the same two hydrodynamical calculations reported in [76]."
L410: "…ordering feature in pT…" ==> "…ordering feature at pT…"
L413: "…reproduce the measurements for 40-50% and 50-60%. AMPT overestimates…" ==> "…reproduce the measurements for the remaining two more peripheral centrality intervals. On the other hand, AMPT overestimates…"
L415: "…underestimates the pi measurements." ==> "…underestimates the results for pi"
L417: "…data better; it slightly…" ==> "…data better, it slightly…"
L421: "…comparisons…" ==> "…comparison…"
L424: "…In order to compare the performance of these two models in vn and vn;m…" ==> "…In order to compare their performance in describing the total vn and vn;m…
L426: "The ranges in these tables present the minimum and maximum value of a constant fit to the relative ratios obtained from most-central to mid-peripheral collisions." ==> "The values represent the ranges across all centralities that each model is able to describe the measurements of each particle species and vnmk (Table 3) or total vn (Table 4)"
L434: "wrt" :P