

Long Symmetric Cumulant paper : 5th IRC review

Dear IRC members

We would like to thank all IRC members for useful comments. The summary of the changes made in the updated version of the manuscript are provided below briefly.

New version:

https://twiki.cern.ch/twiki/pub/ALICE/PtDependentStandardCandles/longSC_IRC_R5_v7.1.pdf

Difference between new and reviewed version:

https://twiki.cern.ch/twiki/pub/ALICE/PtDependentStandardCandles/diff_IRC_R5_R4.pdf

The reply to the comments :

https://twiki.cern.ch/twiki/pub/ALICE/PtDependentStandardCandles/IRC_R5_Reply.pdf

Reviewed version :

https://twiki.cern.ch/twiki/pub/ALICE/PtDependentStandardCandles/longSC_IRC_R4_v7.0.pdf

Regards,

DongJo on behalf of PC

A. Sudhir Raniwala

Hello DongJo,

Some of the following should have been mentioned earlier, some may be repeated, and some reflect my need for better (deeper) understanding.

L15-17: 'The comparisons.....'.

This is demonstrated by stand alone model results, and do NOT require any comparisons with data.

R : We think the current version is ok, we can see if we can get a concrete suggestion from CR.

L30: For completeness, should the initial spatial anisotropy be mentioned here as the cause of unequal pressure gradients?

R : We think the current version is ok

L45: I think I had mentioned this earlier. Magnitude of ψ_n does NOT quantify anisotropic flow. Since the intent seems emphasise that symmetry plane angles are used, may be one could change to '.....quantified with nth-order flow harmonics v_n obtained using corresponding symmetry plane angles ψ_n'.

R : anisotropic flow is a general term used in many papers including the short SC paper we wrote. This is quantified both with v_n and corresponding symmetry planes.

L87: '.....a new multiparticle observable(s).....'

R : changed a -> the

L88: I do not like ‘so-called’.....this conveys a certain arbitrariness denoting ‘not quite an apt or correct name/description’.

R : Let’s see if we can get better suggestions from CR.

L187: May be put inverted commas around standalone TPC tracks -> ‘standalone TPC tracks’

R : We think the current version is ok

Section 5 Results:

General:

The results shown in data are described in words in most part of the text....essentially saying this is greater, this is smaller but an overall message is missing here. At the cost of repetition, will it help to write a sentence in the beginning of this sections that conveys that detailed dependence on centrality and pt on the symmetric cumulants may provide means to discern the relative contribution of initial state and eta/S while comparing with models. The dependence of SC(n,m) on centrality and pT for different n,m will provide further insight in discerning the relative contribution of initial state and eta/S.

Specific:

L225-226: ‘.....increase non-linearly....’.

So? A linear relation may be a big deal, but non-linear is not such a big deal, particularly if it is plotted as a function of ‘centrality percentile’. I do not know what is conveyed from this.

R : We describe a general trend of the data and don't have any intention to convey any message.

L239: $\langle v_n \rangle \rightarrow \langle v_n^2 \rangle$

R : it is $\sqrt{\langle v_n^2 \rangle}$, we think we are fine with it.

LL249-251: ‘....in the left panels...’ and ‘...on the panel...’. Generally ‘in’ is used. Also, we could remove ‘as an new addition in this article’.

R : fixed, removed.

Fig.3: More for my understanding: Including this figure immediately promotes the question: “why not compare these results with various models, and those comparisons may provide enough information to constrain the initial conditions and/or eta/S of the models. Further, how do these constraints compare with the constraints obtained by comparing with SC(m,n)?” While I think that may be making an important statement, it could well be outside the scope of the present work. Further, these are not used in calculation of NSC, as stated in line 247. The analysis uses $\langle v_n^2 \rangle$ and NOT v_n for NSC. So I am a little confused and will like to be educated on the motivation of including this figure in the manuscript .

R : The comparison is in the appendix. It was shown in the short SC paper and explained why (in L59-66) that individual v_n have some difficulties to constraint IC and/or eta/s.

It is $\sqrt{\langle v_n^2 \rangle}$, it was agreed that we don't show $\langle v_n^2 \rangle$ but do show $\sqrt{\langle v_n^2 \rangle} = v_n$.

L335-338: ‘Among theranges’ -> You may consider breaking this into two sentences, or rephrase this.

R : We think the current version is ok

L340-342: This is an observation. Do we understand this observation.... ? Just curious whether we understand these results to the next levels. But this is more for my benefit.

R : Maybe it is an accident since there are still the qualitative differences of v_2 and v_3 between models and Data for VISH2+1 hydrodynamics.

L350-353: Is this a trivial conclusion....because $\langle v_n^2 \rangle$ can not be described well by the models?

R : Even if it is true, in our SC observable , the separation is more clearly shown.

L381: Do we see any pattern in this hierarchy ($m-n \leq 2$ are greater than others).

R : NSC(3,2) ~ NSC(4,3) for anti correlations.

L443: '....fluctuations of SC(3,2)....'. I know what you mean but fluctuations OF SC(3,2) may be ambiguous and may suggest that SC(3,2) fluctuates.

R : We think the current version is ok.

Also, when $m-n = 1$, then we see anticorrelation (both for SC(4,3) AND (SC(3,2))), while for $m-n \geq 2$, we see a positive correlation, with the magnitudes showing some hierarchy. (Some food for thought?).

R : Good observation. Let's see if it still holds once we include more of $m-n=1$ for 5TeV analysis.

B. Alice Ohlson

Dear DongJo, all,

Sorry that it took me quite some time to get through the latest draft (v.7.0) of the long SC paper. I have only a few small comments, particularly on the parts that were new (Appendix A) and the presentation of the figures.

-- Fig. 2: Systematic uncertainties must be shown, and cannot just be neglected 'for visibility'

R : done

-- I think it looks confusing when figures which have different scales on the vertical axes are made to share an axis, as in Figs. 2-6. I suggest that you keep the ordering of the panels as it is, but separate the left panels from the right panels so that you can have the axis title and labels on the left sides of both plots (i.e. make two columns of plots side-by-side).

R : Since it needs some changes in the macro, we will try to collect more comments from EB or CR. Definitely we will combine the ideas.

-- The axis title size varies significantly within figures and from figure to figure, please unify the sizes of the axis titles, axis labels, and legend texts. In many places the text is very small, it would be good to make it larger so it is legible.

R : We tried to unify as much as we can now. Since the overall figure sizes differ, some of the text or labels looks small but it looks big enough for us. We will try to collect more comments from EB or CR. Definitely we will improve things.

-- in general: n should be italicized when it represents the harmonic number, I noticed it is unitalicized in lines 249, 250, 251, 693, 704, 705, 713, 719, Fig. 3 caption, and Fig. A.1 caption, but there may be more instances so please check.

R : fixed

-- Section 6 is generally about Model Comparisons, while 6.1 is specifically about the centrality dependence and 6.2 is about the p_T dependence. Therefore it seems a bit odd to mention the centrality dependence comparison specifically in lines 255 and 280. I suggest you start Section 6 with something like "Three different models are compared with the experimental results presented in Sec. 5. First, we have compared our observables with event-by-event EKRT..." and then also remove the mention of centrality from line 280.

R : fixed

18: of the specific choice

R : fixed

27: programs

R : conflict with Sudir's comment, change back to programs

75-76: start the sentence with "Higher order ($n \geq 4$) flow harmonics..."

R : done

87: for new multiparticle observables

R : conflict with Sudir's comment, change back to "w/o the"

88: remove "so-called" [this term has a negative connotation in American English, it is better to avoid it entirely in scientific papers]

R : removed

90: independent, complementary information to recent results on symmetry plane correlators

R : done

105: η/s of the QGP

R : done

125-127: I suggest: "Normalized symmetric cumulants reflect only the strength of the correlation between v_m and v_n , while $SC(m,n)$ has contributions from both the correlation between the two different flow harmonics and the magnitudes of the individual harmonics."

R : done

133: for all centralities

R : done

145: (V_0A and V_0C)

R : done

196: is this difference between all charged particles and separated negative and positive charges due to remaining non-flow or statistical fluctuations? is this a fair comparison?

R : We think this is ok and was similarly described in the short SC paper and other flow papers.

Fig. 2 caption: in the left panels... in the right panels

R : done

231: gradually change --> show the results as a function of

R : done

235: "These p_{Tmin} dependent correlations have much stronger centrality dependence" --> "The centrality dependence is stronger with higher p_{Tmin} cuts"

R : done

Fig. 3 caption: in the left panels... in the right panels

R : done

Fig. 3 caption: Note that v_5 is also shown in panel (C).

R : done

250: The v_n values ($n < 5$) are equivalent

R : done

250: fifth order flow harmonic v_5

R : done

251: in panel (C)

R : done

272: In MC-Glauber and MC-KLN

R : done

322: for the "param1" parameterization

R : done

325: for "param1"

R : done

334-335: centrality dependence of the $SC(m,n)$ observables of all orders

R : done

695: capture

R : done

700: could --> can

R : done

704: The overall difference

R : done

705: and 50% for v_4

R : done

706: with an accuracy of

R : done

707-708: missing figure references

R : done

710: "quite a bit" is not very precise

R : removed

717: from event-by-event

R : done

717: hydrodynamics

R : done

719: with an accuracy of

R : done

719: end sentence after 5-20%, start a new sentence with "The centrality dependence..."

R : done

720: in the three models... in the different order

R : done

720-721: description of individual flow harmonics v_n at all orders is necessary

R : done

Thank you for taking into account all our previous comments on the structure and presentation of the results, I think the paper is in very good shape and is as clear as possible given the large amount of data that is presented. From my standpoint, the paper is ready to go to the Editorial Board.

Best wishes,
Alice