V. Plotnikov

1) Line 101: Replace reference 27 with published article in JINST (BM@N spectrometer);

2) Fig.7, p.13: The caption to the figure talks about system errors, which are depicted by rectangles. But the said rectangles are not visible in the figure;

3) Reference [38] does not point to a file with tables of results for p, d, t, but for pi+ and K+;

4) Fig.8, p.15: The caption talks about vertical bars corresponding to statistical errors, but the vertical bars are not visible in the figures;

5) Fig.9,10, p.16,17: In Fig. a) and b) the markers are of different sizes;

6) Line 572: Shouldn't clusters with A=1 also include n, and clusters with A=3 also include He3?
Reply: We only use in this analysis the measured by BM@N species. The values for the yields of neutrons and He3 can in principle be obtained from models, but, in this case the results will be model-dependent.

7) Reference [39] has a published version. Wouldn't it be better to cite it?
Journal reference: PhysRevC.110.054911(2024)
Related DOI: https://doi.org/10.1103/PhysRevC.110.054911
Reply: Done

8) Reference [24]: Is it correct that the arxiv reference ends in "v" without specifying a version number?
Reply: Corrected

S.Nemnyugin

Lines 340, 344 and 424: "feed-down" and "feeddown" must be written the same.
Reply: Unified writing to ‘feed-down’

Line 446: The word "model" is repeated twice.
Reply: Corrected.

Enumerations often lack spaces between list items. Examples: Figure 14 caption, Figure 15 caption, lines 464, 467, 546, etc.
Reply: Corrected.

Line 495: the speed interval is best specified as [0, yb]
Reply: Done.

Line 529: The term "evolution" usually denotes development over time. According to Wikipedia, this is "a process of gradual irreversible change, one of the types of development." Perhaps this term should be replaced by another.
Reply: “evolution” changed to “pT-dependence”.

Line 536: the correct spelling of the surname is Boltzmann.
Reply: Corrected.

Figure 21 caption: Are the expressions "baryon rapidity density" and "midrapidity baryon density" in line 578 consistent?
Reply: L.578 “midrapidity baryon density” → “midrapidity baryon rapidity density”.

Figure 22 caption: “freezout” and “freez-out” must be written the same.
Reply: Corrected.

List of references and sources: when mentioning Internet resources, indicate the date of access. At the end of each point should be a dot.

A.Solomin

line 15 - from proton up to gold ions --->
from protons up to gold ions
Reply: Done.

line 15 - in the range from 1 to --->
in the range of 1 to

line 18 - created in the collisions of a heavy-ion beam with fixed targets --->
created in heavy-ion beam collisions with fixed targets
the last looks more correct in English (and without "the" since it is a general case
Reply: Done.

line 19 - 3-4 times ---> here hypen should be replaced with "en" dash for proper scientific formatting
Reply: Done.

line 19 - thus allowing studying heavy-ion interactions --->
thus allowing to study heavy-ion interactions
two participles in a row -- not very commonly used figure of speech
Reply: Done.

line 20 - in the regime of high-density baryonic matter --->
in the high-density baryonic matter regime
it is more common to put a definition before a noun.
Reply: Done.

line 21 - In the commissioning phase, in a configuration with limited phase-space coverage, BM@N collected first data with beams of --->
During the commissioning phase, BM@N, in a configuration with limited phase-space coverage, collected its first data with beams of
two times "in" in a row was used
Reply: Done.

line 23 - In the first physics paper --->
In the first physics publication
looks better
Reply: Done.

line 23 - BM@N reported on studies of π+ and K+ production --->
BM@N reported studies of π+ and K +production
Reply: Done.

line 32 - essential constrains ---> essential constraints
Reply: Done

lines 32-33 The BM@N experimental arrangement makes it possible to measure the distribution of protons and light nuclei (d, t) --->
The BM@N experimental setup allows for the measurement of the distribution of protons and light nuclei (d, t)
Reply: Done.

line 35 - "CM" and "beam" subscripts should be upright

line 61 - entropy production can provide information not only about the nucleon phase-space density at the final moments of the reaction (freezeout) ---->
entropy production provides insights not only into the nucleon phase-space density at the final moments of the reaction (freeze-out)
enhanced phrasing for clarity and grammatical flow
Reply: Done.

line 64 - to study the evolution of the entropy --->
to investigate the entropy evolution
Reply: Done.

line 70 - deuterons and tritons observed in the experiment are formed and emitted at the end of freeze-out process, and they mainly carry information about this late stage of the collision --->
deuterons and tritons observed in the experiment form and emit at the end of the freeze-out process, carrying information primarily about this late stage of the collision
this replacement version was proved by a native English-speaking person
Reply: Done.

line 76 - To describe heavy-ion collisions at high energies the simple coalescence model is modified taking into account the nucleon phase space distributions ---> To describe heavy-ion collisions at high energies, the simple coalescence model is modified to account for the nucleon phase space distributions
Reply: Done.

line 83 - The paper is organized as follows. Section 2 describes the experimental set-up and Section 3 is devoted to details of the event reconstruction. Section 4 describes the evaluation of the proton, deuteron and triton reconstruction efficiency. --->

The paper is organized as follows: Section 2 describes the experimental setup, Section 3 details the event reconstruction, and Section 4 discusses the evaluation of proton, deuteron, and triton reconstruction efficiency.
the text is streamlined and condensed for better readability
Reply: Done.

line 89, 92 - results are compared with --->
results are compared to

I.Tserruya

My main comment concerns the figures: in many figures (2, 3, 8-13,16, 18, 19, 21) the fonts in the axes and/or legends are small; in some figures (5-7), they are too small. Some good examples are Figs. 17, 20 and 22.

L 44-5: Modify to read: The nucleon phase space density can be obtained from the ratio of ...
Reply: Done.

L 56: ...of this work is to study the particle phase...
Reply: Done.

L 67: ...compared to the freeze-...
Reply: Done.

L 71: ...of the freeze-out...
Reply: Done.

L 101: give the full reference of 27 in the reference list

L 177: ...in M2 windows...
Reply: Done.

L 181: The expression given for the statistical error is not correct. I suggest removing it and modifying the text to read: "The signals of protons, deuterons and tritons are calculated according to the formula: sig = hist – bg, where hist denotes the histogram integral yield within the selected M2 window and bg is the background. The shape...

L 230: erase it is
Reply: Done.

L 233: ...in the impact parameter interval [b1, b2] of the nucleus-...

L 318: The dN/dy distributions vs y of protons...

L 339-348: This paragraph starts with: "The observed discrepancy ... could be due to feed-down...". However, the subsequent text quantifies the feed-down effects as being at most 60%. This is very far from the factor of 5 discrepancy, contradicting the first sentence of the paragraph. Please reword.
Reply: Changed to “The observed discrepancy ... could be in part explained by feed-down...".

L 379: "to be the same..." do you mean "to be constant"?

L 418: the sentence is not clear ...increased due to finite size...

L 423: ...spin factor of the nuclear...
Reply: Done.

L 429: ...energy range, as the fraction of nucleons...
Reply: Done.

L 431-3: reshuffle to read: The URQMD and PHQMD models predict the n/p ratio to be between 1.09 and 1.18 in the BM@N rapidity range for Ar+C...
Reply: Done.

L 452-4: The sentence "...BM@N measurements follow the general trend ...with raising energy..." is a bit strange since the BM@N measurements were done at a single energy and consequently, they do not provide any trend with collision energy.

Reply: the sentence is changed to “The B_2 and B_3 results for Ar+A interactions with centrality 0--40\% are consistent with the general trend of decreasing B_2 and B_3 values with rising collision energy of central interactions of heavy nuclei.”

Fig. 14 caption: ...result is the weighted average...
Reply: Done.

Why do you present the weighted average value? This is not mentioned or discussed in the text of the paper.
Reply: Added to the text:
The BM@N values of B2 and $B3 averaged for Ar+Al, Cu, Sn and Pb interactions are compared in figure 15(a),(b) with the measurements of other experiments

L 480-2: Reword to read: "A large difference in the shapes of the dn/dy distributions is observed as more baryons are transported...
Reply: Done.

L 490: erase final

Reply: Done.

L 506: ...does not vary significantly over ...
Reply: Done.

L 522: ...equilibrium and a size substantially larger...
Reply: Done.

L 525: erase the
Reply: Done.

L 527: ... strength of the nuclear...
Reply: Done.

L 537: Two → The
Reply: Done.

L 548: According to an early...
Reply: Done.

L 581: being → are
Reply: Done.

L 596-7: modify to read: It may indicate that there is a weaker pressure gradient in collisions of medium-size nuclei resulting in a ...
Reply: Done.

L 622: erase sqrt_s
Reply: Done.

A.Taranenko

Major comments:
---
1) I understand that you define your 0-40% as BM@N central collisions and 40-80% as peripheral - it is ok. But, this maybe misleading, as usually in the heavy-ion experiments on call <10% as central collisions as you may see it in your Figure 17,
For example in STAR 0-10% central, 10-40% midcentral, 40-80% peripheral.
as seen in the STAR paper ref[30]
many signals for p, d, t from the similar analysis of Au+Au at 3 GeV may change by a factor of 1.5-2 when passing from central 0-10% to 30-40% midcentral collisions.
So if you say that my signal from 0-40% is similar to STAR results from 0-10% - what does it mean?

Reply: We compare the BM@N results with the results of other experiments on B2, B3 and the NpNt/Nd^2 ratio at 3 GeV and higher energies. The purpose of the B2, B3 and NpNt/Nd^2 **plots is to illustrate the general trend in the energy dependence of the values measured in the experiments**. For more accurate comparisons we need to make several corrections to the published data, which we want to avoid. For example, STAR B2, B3 data at 3 GeV are corrected for the n/p ratio and feed-down of protons, the results are given for pT=0.65 GeV/c. The published STAR B2 data at higher energies are not corrected for the n/p ratio and feed-down of protons, results are extrapolated to pT=0 GeV/c. The rapidity ranges of the experiments are not the same.

2) systematic uncertainties - I see no reason not to show all the listed systematic errors in the table Table 2 with the ranges of the systematic uncertainties denotes the minimum and maximum values over the entire range of rapidity and pT.
The Table 2 shows that the total systematic uncertainty can be as big as 44% - do not see it in the data plots.

Reply: Table 2 gives the mean values of systematic uncertainties of the p,d,t yields averaged over the y, pT ranges. Figures 7 and 12 show the p,d,t yields at the y, mT points with the uncertainties which vary from point to point. All the values of the p,d,t yields with the uncertainties are given in tables in ref [38]. The mean values of the uncertainties averaged over the y, pT ranges from ref [38] agree with the values in table 2. The dN/dy, <mT>-m values with the uncertainties in Fig.8-11 are also available in ref [38]. We see no reason to overload Table 2 with the information available in details in ref [38].

3) L317 The dN/dy and T0 values extracted from the fit can be found in ref. [38] - I see no reason not to show it in the paper in form of the compact table, as it was done in the similar STAR paper - ref[30]

Replay: The dN/dy and T0 values with the uncertainties are given in ref. [38]. We do not think that these values should be duplicated in the text of the paper.

4) A Blast-Wave model fits - why aren't you showing the C+Ar results in the Figure 12?: but you claim that one finds a flow velocity consistent with "absolute" zero in central Ar+C collisions - just zero in the Table 3 without any errors. This looks very fishy - you need to show the quality of the fit for C+Ar in Fig 12 or remove it by saying that statistics for C+Ar is too poor to do the Blast-Wave model fit.

Reply: A panel with BW fits of p, d, t spectra for 0-40% central Ar+C collisions is added to Fig.12. The uncertainty of the <beta> value for Ar+C reaction is added to Table 3.

You have a long discussion in lines 392-405 - why not show a comparison with other results in the figure? In the discussion you are trying to use very misleading statements: L394 The FOPI experiment measured ⟨β⟩ L400 The STAR experiment measured that the ⟨β⟩ - we can not measure ⟨β⟩ - or T in the experiment! We can only measure the rapidity distributions or pT-spectrum of particles - and using our sick imagination we can get estimates of ⟨β⟩ - or T using

very primitive models. The same in the introduction L44 A way to measure the nucleon phase-space density is a study of the ratio. One should not use word - "measure" for models.

Reply: This part of the draft (discussion on BW fit results) has modified. A new figure with a collection of kinetic freeze-out parameters (T, <\beta>) from other experiments is prepared and BM@N results are shown there. The text that describes this figure has provided.

5) Coalescence factors

L440 It is found, that B2 and B3 rise with pT - I do not see it in Figs. 13a and 13b
they grow with pt first - then they plateau.
The detailed STAR measurements - see Fig13 (the scaled transverse momentum
(pT/A) dependence of the coalescence parameters for
B2 (d), B3 (t), and B3 (3He)) from ref[30] - show that
$^(A−1)\sqrt{B_A}$ of d, t, and 3He are consistent for all bins in centrality
- do you see the same in the BM@N data?

Replay1: Added to the text "It is found, that B2 and B3 rise with pT at low pT and saturate at higher pT for all the measured targets."

Reply2: We provide the values of B2 and B3 values and the coalescence radii for deuterons and tritons in two rapidity bins in one centrality bin. The coalescence radii are consistent for deuterons and tritons within the uncertainties (see table 4). We believe that the presented results for B2, B3 and coalescence radii are sufficient for interpretations.

Figure 14 - looks very strange for STAR data - one need to explain how STAR data and data for other experiments were extracted and what kind of errors one use in this plot? Lets look at STAR point at 3 GeV - energy close to BM@N - the STAR used 260 M events with much better acceptance in comparison with 16.3M argon-nucleus collisions at 3.2A GeV for all targets. How it can happen - how can it be that the errors for BM@N are 3 times less - than for STAR.
If I look on the similar plot - see Fig.15 from the STAR paper ref[30] - errors for STAR data are very small - comparable to the size of a symbol in the Figure. According to the STAR data the coalescence parameters - strongly depend on centrality - from 0-10% to 20-40% - they change by factor of 1.5-2. Figure 14 - should contain information on centrality for other experiments

Reply: Uncertainties in Fig.15 of the STAR are taken from the STAR HEP Data papers ref [39,57,58]. Only the STAR fixed target uncertainty at 3 GeV is large due to systematics. The STAR B2 uncertainties at higher energy are rather small.
As we have already answered, the comparison of the experimental results in Fig.15a,b is done to illustrate **the general trend in the energy dependence of the values measured in the experiments**. For more accurate comparisons we need to make several corrections to the published data, which we want to avoid. For example, STAR B2, B3 data at 3 GeV are corrected for the n/p ratio and feed-down of protons, the results are given for pT=0.65 GeV/c. The published STAR B2 data at higher energies are not corrected for the n/p ratio and feed-down of protons, results are extrapolated to pT=0 GeV/c. The rapidity ranges of the experiments are not the same.
The centrality ranges are given in the text related to Fig.15ab.

Particle ratios - section
L541 Fig. 19 shows the system size dependence of the slope parameter pT 0 of the pT - dependence for ⟨fp ⟩. Is it data or model results? It is not clear. How did you get Npart from the models for such assymetic collisions? Why one need to make the average of the predictions of the UrQMD and DCM-SMM models?
How one can get Npart for 0-40% centrality? - this need to be explained.
Reply: The presented results are data not models. To avoid further confusion for readers with Npart, we now show the system size dependence for pT_0 (Fig.19 right panel) versus atomic mass number of the target A.

Figure 20: The excitation function of the entropy per baryon S/A from SIS/FOPI AGS/E802 [70], SPS/NA49 [42, 71–73] and NICA/BM@N - is it for central collisions?

Reply: One reads in line 572-3 “In figure 20 we present the energy dependence of S/A in central heavy-ion collisions.”

Figure 22: Freeze-out (T, μB) parameters for A+A collisions. - one need to provide info about other experiments: system - energy - centrality - type of particles - it is not clear - if we're doing an apples-to-apples comparison

Reply: After several rounds of discussions and attempts to improve this part of the draft (text and figure 22), we decided that it is better to omit the results of using penalties for \mu_B estimates. Thus, figure 22 and the corresponding text has removed from the draft.

Fig 23 Compound yield ratio - please indicate the centrality for other experiments

Reply: The centrality ranges of the experiments are given in the text related to Fig.23.

In the sections 8,9,10 - in many cases one use only the statistical errors from BMN - this maybe misleading
Reply: the quadratic sum of the statistical and systematic errors are used. The text is changed.

Minor comments. Typing errors.

L24 This paper presents results on pro-
ton, deuteron and triton production -> This paper presents results on pro-
ton (p), deuteron (d) and triton (t) production in

L26 At the Nuclotron energies
L341 At BM@N collision energies
L346 at NICA/BM@N energies
L348 at BM@N energies - please use the same def.
it is better to use the energy range in GeV - in bad case it will

be mess as you have: EOS energies, FOPI energies,
STAR energies, STAR BES energies, ...
Reply: we keep the text as it is.

L46 -a study, L53 - we study, L64 to study -
replace one of the them by – investigate
Reply: OK

L35 yCM = is not defined
you define it only in L305-306 as
rapidity of the nucleon-nucleon center-
of-mass (CM) system is yCM = 1.08.
Later you define y* as the center-of-mass rapidity in L478???

Reply: corrected to: yCM is the rapidity of the nucleon-nucleon center-of-mass system,
y* is the p/d/t rapidity in the center-of-mass system.

L38 pT-coverage - pT is not defined
Reply: done

L51 baryochemical potential -> baryon chemical potential
L51 here you use μ for baryon chemical potential, but later in the text in L581 and after you use μ_{B} for baryon chemical potential.
Reply: corrected

L90 PHQMD [25] models -> ref [25] is for PHSD model
PHQMD model will be: J. Aichelin et al Phys.Rev.C 101 (2020) 4, 044905
e-Print: 1907.03860 [nucl-th]
DOI:10.1103/PhysRevC.101.044905
Reply: done

L159 - Z0 - need to be defined
Reply: done

L304 Rapidity and mean transverse mass spectra ->
Rapidity and transverse mass spectra
Reply: done

L337 at $\sqrt{s}$ of 3 GeV -> at $\sqrt{s_{NN}}$ of 3 GeV
Reply: done

L376 - y* - you need to define it - you do only in L478
Reply: done

L431 URQMD->UrQMD

L434 Figs. 13a and 13b show - > Figures 13a and 13b show

Comments about freezeout -> freeze-out in too many places - were mentioned already
---
The figures are prepared in completely different styles -
not very good

in many plots you use gridX,Y - it reduces the visibility
and quality of the plots.
Reply: all figures are now without grids

Figure 3 pT (GeV/c)
Figure 4 pT - no units
Figure 5 pT [GeV/c]
Figure 13 pT/A (GeV)
-------- please use the same notation
pT (GeV/c) in all figures
Reply: mostly corrected

Figure 6: 0 < Cent < 40%
Figure 7: Cent < 40%
Figure 8: cent 0-40%
Figure 12: zero - only in the caption 0-40%
Figure 13: cent < 40%
Figure 14: (0-40%)
Figure 16: (0-40% central)
--- please use the same notation
Reply: unified

Figures 8-11
Why do you need to show the definition of lines for DCM-SMM
and PHQMD models in the legend of
each panel if they are exactly the same in each panel?
just to show it in the lagend of one panel - this make plot less busy.
In Fig8 - label y - is to close to 2.5
Reply: keep legends as they are.