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Comment on egusphere-2022-1258

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Referee comment on "Magnetic fabric analyses of basin inversion: a sandbox modelling approach" by Thorben Schöfisch et al., EGUsphere,
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The manuscript by Schöfisch, Koyi and Almqvist demonstrates an innovative application of magnetic grains to track fabric development during extensional faulting and subsequent inversion under contraction. The ability of AMS to track magnetic fabric development provides new insights into the evolution of strain patterns. I really enjoyed reading this paper and am excited to see more work using this approach as it seems to be a wonderful way to quantify the accumulated pervasive strain fabric in experiments. Very interesting approach!

The study is a great contribution to EGUsphere and, in particular, the special issue on basin inversion. The paper is generally very clearly written and presented. I have a few suggestions that can strengthen the interpretations and clarify the presentations.

- The introduction could benefit from some description of the mechanisms that produce the detected magnetic fabric. Are the magnetic grain not equant? The discussion mentions grain rotation but this not explained in the introduction. Presumably, if the grains are equant they would not have consistent rotation. Does the degree of rotation depend on the aspect ratio of the magnetic grains (e.g., Tickoff and Markley 2002)? How does the sensitivity of magnetic fabric development within dry sand with increasing strain scale to the development of crustal magnetic fabrics with strain? While some of this background may in earlier papers of the authors some overview of the mechanism s that produce magnetic fabric in the sandbox will be very helpful.
- Following from the previous point, the developing of initial fabric from sieving should be

explained in the methods section so that we can better appreciate the results. I thought that the stereonets were showing a deformation fabric so when I read that it was from sieving in the discussion section, I had to go back and reread the results to modify my understanding. I appreciate that the paper carefully distinguished between the presentation of the results in section 3 and interpretation of these results in the discussion. This does require that the reader needs to be guided a bit more in the to connect interpretations to the relevant results without becoming confused within the data presentation. I bring this up for the seiving induced fabrics but other interpretations in the discussion could also benefit from connections with specific observations within the figures.

- What is the uncertainty of the AMS measurements? Can this uncertainty be conveyed on the stereonets and on Figure 3? The degree of anisotropy data (Pf) is quite variable and it would be helpful to see how much of this variation is within or outside of the measurement uncertainty. Furthermore, it may be helpful to present figure 3 as a 'violin' plot rather than as a scatter plot. This can highlight the differences of anisotropy between the experiments. Also, with the violin plots you will be able to quantify the differences among the different types of data.
- The paper is very careful to distinguish between the presentation of the results in section 3 and interpretation of these results in the discussion. This does require that the reader needs to be guided a bit more in the discussion to connect interpretations tot the relevant results.
- The lack of pervasive extensional fabric is likely a consequence of the granular analog material that has very low cohesion. This point should be made in section 4.2.
- The development of faults in granular material involves dilation as grains move past one another. The dilation along the normal faults is likely the reason that these zones are sensitive to compaction and magnetic fabric realignment during later contraction. Mentioning the dilation along faults in section 4.3.3 (around line 341) can help with the interpretation of the results.

Specific suggestions/comments.

- Line 19: "further towards" reads awkwardly. Do you mean 'further away from' or 'closer towards'?
- Line 12: The 'however' is not needed because the previous sentence and this sentence are both valid. The word 'however' implies that one sentence contradicts the other.
- Line 58 "… crustal magnetic fabric .."
- Line 100: This text can be revised to clearly present that both models 2 and 3 were extended 1 cm before inversion. At least that is my understanding from other parts of the paper – it wasn't clear here.
- Line 122: this is a nice framed caveat about the fault fabrics.
- Lines 133 and 135. For clarity equations should have their own lines and numbering
- Line 157-8: I found this sentence confusing. The concepts/observations need more explanation.
- line 195: What specifically should I be comparing from figure 4 and 2 to see that the normal fault fabric is less pronounced? The confidence contours seem pretty similar. Or am I supposed to have seen this difference in figure 3? The range of Pj with x (normal faults) seems similar for the three models. Similarly, I'm not sure that I see the

stronger fabric of the thrust faults in figure 3 (range of Pf seems similar) or in the difference between figures2 and figures 4/5. Being new to looking at this type of data, I could benefit from some more guidance on what particular aspects of the data indicate more pervasive fabric.

- Line 260: Explain that the basal plate moves so that the sandpack in the other hanging wall lies over the stationary base and might not experience as much vibrations.
- Line 278-9: awkward unclear wording
- Line 291-2: The parenthetic of initial to thrusting via penetrative strain induced fabric is awkward. This idea can be more clear if presented in a second paragraph.
- Line 320: Awkward phrasing.
- Line 332: monitored is probably not the word you want. Maybe 'detected' is better.
- Line 337: awkward phrasing
- Line 347-348. Awkward sentence that needs to be revised.

References

Markley, M.J. and Tikoff, B., 2002. Matchsticks on parade: Vertical axis rotation in oblique divergence. Journal of Geophysical Research: Solid Earth, 107(B12), pp.ETG-9.

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