Line-by-line response letter to Referee #2: M. Scase, K. Baldwin, R. Hill

*Manuscript Summary:*

After much effort, I understood the concept of the experiment. This difficulty for me indicates the need for a clearer explanation by the authors. I suggest that the authors revise the text by giving the main ideas much more clearly before they get into the details of the protocol.

I suggest that the main text say more clearly that:

1. Initially, the top layer is less dense than the bottom layer so system is Rayleigh Taylor stable.

This has been added [line 48-49].

2. Top layer is paramagnetic, bottom layer is diamagnetic

This was already in the text [line 53-54].

3. When the system descends into strong magnetic field, the paramagnetic top layer is attracted to field so it behaves as if it is heavier than it really is. At the same time, when the system descends, the diamagnetic bottom layer is repelled by the magnetic field so it behaves as if it is lighter than it really is.

This has been added [line 55-56].

 4. If the magnetic effects are sufficiently strong, the top layer becomes heavier than the bottom layer and the system becomes RT unstable.

This has been added [line 56-58].

5. The system is designed so it can be rotating so effect of rotation can be studied.

This has been added [line 44-45].

The amount of body force should be estimated using the magnetic field (gradient?) and the paramagnetism and diamagnetism of the chemical additives. Formulae for calculating the body force should be provided. What is the effective density of each fluid when in the magnetic field?

This information has been added [lines 106-111].

The purpose and geometrical location of the flotation boat is not clear. Figure 1 does not show the flotation boat and it is not evident what the floatation boat has to do with Fig. 1.

The purpose of the flotation boat is to allow the creation of the stable stratification. You are correct that the flotation boat has nothing to do with Fig. 1, it is used only to prepare the liquid layers.

 The reason for a sponge at the bottom of the flotation boat is not clear.

The purpose of the sponge is to allow the lighter fluid to escape from the boat and form the lighter layer in the experimental tank. A line has been added to this effect [line 351 – 353].

There is no discussion of what happens when there is no magnetic field.

Without the magnetic field the relative weights of the fluids cannot be manipulated and so the fluid remains spinning in a stable configuration. There is no growth of perturbations at the interface.

What is meant by a room temperature vertical bore. Why is this bore off center?

The bore is open to the laboratory. The bore is off-centre due to the internal design of the magnet.

In general, this paper gives detailed protocols and qualitative observations, but lacks an easy to understand description of what is really happening and also lacks quantitative analysis of the observations. The paper could give the expected RT growth rate with and without rotation, and compare the observed inhibiting effect of rotation to predictions. Without this, there is the possibility of a large quantitative disagreement between the experiment and theoretical predictions.

We believe that the purpose of the present Journal is primarily to give detailed protocols for reproducing the experiments. Quantitative data is provided in Fig. 6, but is not the primary focus of the manuscript. Further analysis of the results can be found in Reference 16 and is not duplicated herein.

*Major Concerns:*

N/A

No response is required.

*Minor Concerns:*

N/A

No response is required.

*Additional Comments to Authors:*

N/A

No response is required.