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Dear Donatienne,
many thanks for your review. It is very helpful to rethink about the different aspects of the manuscript. We provide our discussion item-wise below.
With best regards, Charlotte.

**Reply to *Interactive Comment* by D. Leparoux**

About the imagery approach, I just have a general question : if your goal is to image the inner structures of the analog model, why don't you try to perform a tomographic imagery by transmission method (inversion of first arrival times)? Actually you could use sensors all around the model.

- A tomographic image provides us with a velocity structure of a given area, which in some sense is a kind of parameter structure. To rather image a geological structure we have decided for reflection seismic imaging. In addition, the sandbox models scale by the friction coefficient and not the velocities, so that a comparison with the analogue models would be further challenging. However, of course it is a good idea to make an attempt to derive tomographic images in the future.
- Tomography is wave-velocity sensitive, and the wave velocities are very similar (1700 m/s). In fact, we used mono-velcoity NMO and Migration (confirmed by velocity analysis). Tomography has also a lower resolution, unless you have a very wide frequency band, which these piezos cannot produce in equal ampitudes.

Globally, the paper structure is clear but I am not sure that the way you chose - that consists in firstly presenting the experimentation and the experimental data as very clean results and afterwards proposing a separated discussion - is the more convincing: when I read the paper, I wonder that some points were not discussed (but I found them in the discussion part) for example concerning the saturation of the model (How are you sure it is homogeneous saturated..?), the shear zone modeling, but also about the spectral content of the source signal ..etc. You could discuss these key issues when you developed the experimentation and results analysis.

- The key aspect of this paper is to present the technical device, and to prove its feasibility by some first and simple models. Thus, to be scientifically very clear on that, we decided to separate these issues, so that the reader gets first the technical details and facts, then the images and apparent interpretations, and finally the points we could already consider from our work and test experiments to be changed and further tested. Thereby, the discussion works towards the outlook and conclusion, by clarifying points of low and high uncertainty, to enable the reader to get first the entire work flow, and then making an own judgement by considering different aspects of the approach.

About the paper content, my comments are the following ones :
the increment of the receiver and source position is very accurate (0.120 mm). If I well

understand, it concerns a relative position accuracy (incremental position accuracy) but what about the absolute position? I mean, how do you know the position of your measurement device in your model reference and what is the accuracy of this position?

➢ The maximum reference frame is stored in the PC control unit as coordinates and part of the step motor setup. Thereby, all positions are controlled and taken from that for the processing. The end of a survey runs across the edge of the model so that the image is complete.

You present the capacity of your measurement device for providing a 3D measurement configuration but in this case, you should involve multi-offsets acquisition in all the directions in the model surface. Thus, even if the sensor array can be moved laterally, it remains a set of 2D acquisitions. As well, the last model you investigate provide only 2D structures (channel and shear zone), thus it is not really a 3D model. You should precise it.

➢ Yes, the 3-D measurements are part of the mid-term concept and future work. This is clarified in the introduction and the setup.

About the scale factor : the piezoelectric sensors are 5 mm diameter : i.e. 500 m in reality ! It provides a spatial average of recording data (like a spatial filter). Moreover, because of their size, these sensors are very directive and not adapted for great offset measurement. You could adapt a cone (see for example Bretaudeau et al., 2011) to minimize the impact point and to provide a more isotropic source pattern.

➢ This would be technically feasible now and should be considered in the future. At the time we started with the technical setup and experimental modeling, we did not have the hardware possibilities as today. And in fact, we still could require a smaller piezo size than available so far. The directivity and resolution are analysed and discussed in depth by Buddensiek et al. (2009). We refer to their publication in the manuscript here.

Please write Bretaudeau et al. (20011) without "x"

➢ Is done.

you should precise the seismic velocity and the associated wavelength in the media used. Actually a priori knowledges of the media characteristics (including the Quality Factor) are one of the advantage of laboratory seismic measurement : you should em- phasize this key point and maybe discuss the way to evaluate them in an independent manner.

➢ This point is partly raised also in comment 1. So far, we stayed in accordance with the scaling by mechanical properties of rocks and granular materials. To introduce further material properties would be a future task; the suggestion is appreciated and included.

The temporal source used is monofrequency with an apodization. However, the signal imagery resolution depends on the frequency bandwidth. Actually, because your im- agery process are done in the time domain, you should use a very short pulse, i.e. a large bandwidth in the spectral domain. This should attenuate the secondary oscillations (ringing) in the signal.

➢ We included an additional paragraph about the ringing in Chapter 4. We also refer to Buddensiek et al. (2009), where a more complete discussion of these issues was already presented. The monofrequency is attacked by the frequency stack (300-650 kHz, 50 kHz interval). This was done precisely to attenuate ringing in the signal and to broaden the bandwidth.

The model is very small compared to the box but do you record boundary effects in the data?

➢ The model was so small (or the box so big) in order to avoid reflections off the side walls. Also, the water level was rather high so that "seabottom multiples" came much later in time, and were cut from the data. The only effect is coming from the bottom of the plexiglass tray. This is labeled in some of the figures. Other effects do not occur here, which has been tested before and is the reason for the smaller size of the experiment.

For both your experimentation results and particularly the last one, you should present a seismic shot gather in order to expertise the different arrivals.

➢ We included a new figure, now Fig. 8, showing raw shot data. A second panel is introduced for comparison showing how the frequency stacking improves the resolution during processing.

Why do you assert that interferometry measurement does not allow to provide struc- tural information (interfaces) ? The laser interferometer allow to record the particular displacement at the surface of the model as the piezoelectric transducer does. I think you should precise what you mean (or correct this sentence).

➢ Of course interferometry provides structural surfaces, but as you say, at the surface of a model. Here, we also want to look inside a model.

You should present a structural scheme near the raw and migrated data sections for a direct visual comparison.

➢ The general comparison is possible by looking at Figures 7 and 9 (former Fig. 8). Further comparison of stack and migration is not useful or intended. Instead, the sections show that imaging is possible. Further, especially reflection seismic analyses and processing steps are considered beyond the scope here.