Supplementary Information

Another data presentation method is called Time Surface (TS). [1, 2]The TS method generates a 2-dimentional plot where each pixel stores a time value, which is the timestamp of the latest event at that pixel. The TS plot is a grayscale image containing both spatial and temporal information of the recorded process, with brighter pixels correspond to more recent events. The gradience of the grayscale shows the motion of the edges. The essence of TS method is that it further compresses the events data into a single 2d plot.

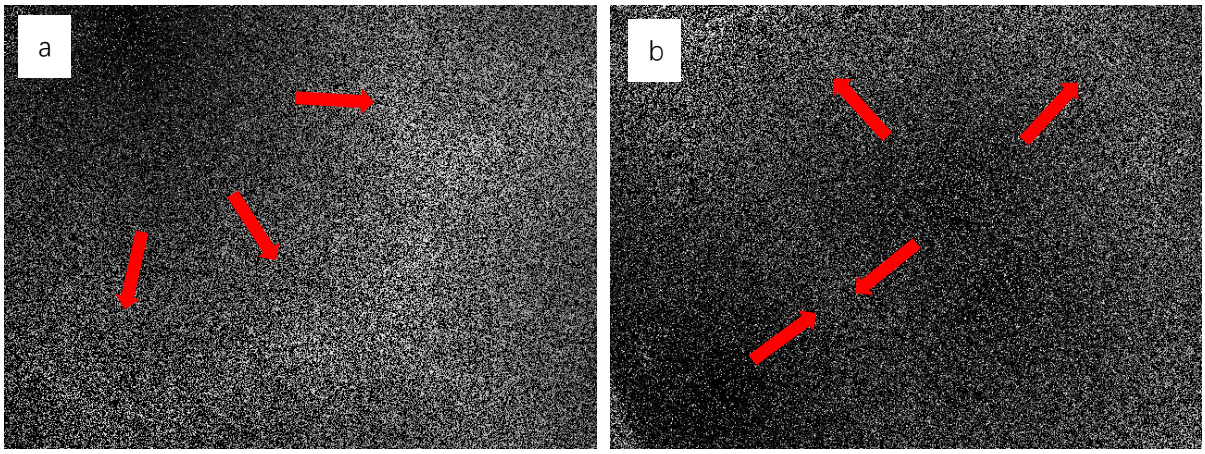

Figure S1. The time surface plots of magnetic domain expansion process. (a) the first expansion process. (b) the second expansion process with opposite magnetization.

In our application, we focus on the process of magnetization one-time flipping without any textured scenes, which is suitable for this method. Figure S1 shows the TS plot corresponding to the magnetic domain expansion process mentioned above. The gradient of the grayscale shows the motion of domain wall.

Consecutive TS plots can be used to generate videos similar to videos captured by standard cameras on MOKE microscope. We generated videos using TS plots of our data in main text Figure 2 as shown in supplementary materials.

1. Delbruck, T. *Frame-free dynamic digital vision*. in *Proceedings of Intl. Symposium on Secure-Life Electronics*. 2008.
2. Lagorce, X., et al., *HOTS: A Hierarchy of Event-Based Time-Surfaces for Pattern Recognition.* IEEE Transactions on Pattern Analysis and Machine Intelligence, 2017. **39**(7): p. 1346-1359.