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Interactive comment on "Technical note: TRACK*Flow*, a new versatile microscope system for fission track analysis" *by* Gerben Van Ranst et al.

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Reviewer Comments on the "Technical Note: TrackFlow, a new versatile microscope system for fission track analysis" by Gerben Van Ranst, Phillipe Baert, Ana Clara Fernandes and Johan De Grave.

Potential conflict of interest declaration

This paper describes a new Nikon-based microscope system to assist with Fission Track (FT) analysis, which it is claimed, has a number of advantages, although being more limited in scope, than other currently available systems. The paper refers in

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Discussion paper

several places to the existing “TrackWorks suite from Autoscan systems” which is currently the only comprehensive system available for this purpose. To be strictly correct, TrackWorks is the microscope control and image capture package in the Fission Track Studio Suite, which includes the paired FastTracks image analysis and review package for offline data collection. This software suite is marketed by Autoscan Systems based on the Zeiss Axio-Imager microscope platform, but I need to declare at the outset that the software system, and the technical innovations encapsulated within it, have been entirely developed with our Research Group at the University of Melbourne. As the principal creator of this potentially competing system, I have raised this as a possible issue with the editor who subsequently confirmed that he would still like to have my review as I therefore provide as follows.

Comments on the paper:

A general point about this paper is that it has been submitted for publication as a Technical Note, which the Journal indicates should be ‘several pages’ in length. As noted by the other reviewers, however, the paper in its present form is much too long for this format, and indeed is longer than most of full research articles that are already published in Geochronology. By my estimate the paper as it is would come to about 13-16 published pages. It is up to the editors to decide how much latitude they will allow in the interpretation of ‘several pages’ but even the most generous interpretation suggests that this paper needs to be drastically reduced to no more than about 25-30% of its present length.

Another point that has also been raised by other reviewers is that the paper reads rather like an advertising brochure for Nikon, which should be modified to simply document the key features. I note that the original Conflict of Interest statement was deficient but has now been changed to reflect the fact that two Nikon employees are represented in the authorship. It is useful to learn that Nikon produces a fully motorised research microscope with specific features relevant to FT work, but these are then detailed as if they are unique to this system. In reality these features are common to essentially

all high-end motorised research microscopes. The same is true of the stages supplied with these microscopes which may be, and often are, equipped with Märzhäuser stages (page 4), as are most recent TrackWorks based systems. It is not clear why this was mentioned as an apparent point of differentiation. I think the specific features of the microscope used in this system need only the briefest summary, perhaps with reference to their website for additional details. This would greatly assist in reducing the length of the paper. Similarly, I think the background discussion of the basic FT method on pages 1 and 2 is largely unnecessary in a Technical Note and could be substantially reduced.

This brings me to the more substantive point that it is not obvious to me what is actually novel in this paper. At the simplest level the whole paper could be summarised as "We have duplicated some of the capabilities of TrackWorks using a Nikon microscope". At the top of page 3 of the contribution is described as "a novel microscope system developed and optimised for the fission track laboratory". The implication is that the discussion from that point on is describing a series of novel features, but in reality, almost all of these have been detailed in earlier publications and implemented in TrackWorks and FastTracks for years.

I am left with the impression that the only real point of novelty is the fact that the system is built within the Nikon operating environment. I have no problem with this being stated in an appropriately shortened Note, but I think that the authors need to be very clear about what they are claiming to be truly novel. Where they are simply duplicating specific innovations or features that have already been available in other systems, or described in previous publications, appropriate recognition and citation of that earlier work should be made. Much is made, for example, of the System Philosophy on page 3 which aims to obtain maximum efficiency by separating the microscopy from subsequent image-based analysis. This is definitely not new and has been the basis for the FT Studio suite since its inception in the early 2000s. This separation of tasks that frees up microscope time has been widely known since it was first presented publicly at

the European Thermochronology Conference in 2006 and detailed in subsequent publications. There are many other instances of re-inventing what has been done before, without proper attribution, such as the use of circular polarisation to discriminate apatite from epoxy, transforming coordinate systems, setting up a grid of counting points on a large area crystal, preserving images of tracks destroyed by later laser ablation, sending an email to the operator on completion etc. All of these, and more, are features of already existing systems. Even the name 'TrackFlow' is uncomfortably similar to 'TrackWorks'.

Similarly, great versatility is claimed for the new TrackFlow system because it is embedded within a broader generic microscope system. However, no evidence is given to support this assertion of greater versatility, and the Zeiss Axio-Imager system, which is the primary platform controlled by TrackWorks is also a generic high-level research microscope with multiple capabilities and broadly-based software options. Our Zeiss microscopes (under TrackWorks control), for example, are already regularly being used for other non-fission track applications in the earth sciences, so it is hard to justify the claim that this new system will be more versatile. These other applications include thin section analysis, imaging various other geological materials, 3D imaging of particles, pollen analysis, mineral grain characterisation, alpha track studies, and analysis of laser ablation pit dimensions, amongst others.

The very high-resolution camera (16 MPixel) utilised with the TrackFlow system is probably excessive for what is needed for FT work and likely to have significant drawbacks both in speed of operation and needlessly large file sizes. In FT analysis all images are usually captured at the highest magnifications (using a 100x objective), where the diffraction limited resolution of the optics determines that there is not much more than about 1 MPixel of useful information present. Some oversampling is useful to allow digital enlargement of the images, but 16MPixel is much more than is necessary and creates excessive demands on image storage and computational power for image analysis. The frame rate for such high-resolution cameras may also be quite poor which

can slow down image capture. Smaller format CMOS cameras can have full video frame rates at full resolution which greater facilitates imaging and storage, especially for high-throughput laboratories which this system seems to be aimed at, at least in part.

A couple of minor points are that the term ‘focal plain’ is used more than once, whereas the correct term should be ‘focal plane’. Also, the term ‘according’ is used to describe the transformation between equivalent grain and induced track pairs in the External Detector Method. The terms ‘corresponding’ would make more sense.

Conclusion:

In summary, I think this paper could be acceptable for publication as a Technical Note in Geochronology, but only after major revision to drastically shorten it to the brief format anticipated for this kind of contribution. It is currently of the length of a Research article, but the content is not suitable for that format. Also, the tone of the paper needs to get away from the sense of it being an advertisement and focus much more on what is actually novel. Where ‘new’ features are described that already exist in closely similar form in other systems or have been documented in the literature, appropriate recognition and citation should be made.

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