

Geochronology Discuss., referee comment RC3
<https://doi.org/10.5194/gchron-2020-43-RC3>, 2021
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Comment on gchron-2020-43

Anonymous Referee #3

Referee comment on "Spatially resolved infrared radiofluorescence: single-grain K-feldspar dating using CCD imaging" by Dirk Mittelstraß and Sebastian Kreuzer, Geochronology Discuss., <https://doi.org/10.5194/gchron-2020-43-RC3>, 2021

This paper presents a new approach to date feldspar samples using infrared radiofluorescence (IR-RF) signal by targeting individual grains. Authors named this approach as spatially resolved (SR) IR-RF. This approach exposes all the grains with radiation at a time and captures the luminescence emission from all of them in a single frame. The image (at a certain amount of dose) is then processed to extract luminescence/counts from each grain.

Such a development is not easy and, therefore, authors must be appreciated. They have succeeded in presenting their work quite well. As a first paper discussing single-grain IR-RF measurements, it has enough information and results too. Therefore, I recommend this paper to be published in Gchron. Though I have a few queries and suggestions; I want authors to address them.

The paper is written clearly and well-presented but the authors are suggested to check a few grammar mistakes (such as the use of articles) and typos or misplaced text within a sentence including the type of English (American, British or others). I have pointed out some (find them below) but still, authors need to look at such errors throughout the text. My comments and general queries are as follows (P stands for page number):

- Figure 5: do authors see an initial rise in the signal in these samples? The signals used as the examples in Figure 3 have it. Does this mean it is not there in the samples investigated here (Figure 5)? Have they checked this between the grains? How many initial channels (time) were removed in De determination?
- Authors say they see at least four-dose components. Have they compared their dose response curves (DRCs)? Could they share the data? The authors have not presented any data comparing DRCs within a sample. This is crucial since one would want to know the extent of variation in the DRCs (i.e. if any saturates later or not) in order to evaluate grain-dependent saturation (or dynamic range).

- Do authors think that the grains which were not found bright, in reality, photons were produced but not detected due to the overall noise? In that case, noise can still be suppressed and therefore EMCCD is required since below a threshold detection point EMCCD is still better than sCMOS cameras. Do authors think that it is not important to look for those grains and only the bright grains (and resulting DRCs) will do?

Specific comments are:

P2, line 39-40: I really think this sentence needs a word 'from' before single grains.

P2, line 43: It is 'charged coupled device (CCD)'.

P3, line 67: Seems 'a' is in the wrong place. Further, I do not think it is important to expand SR again since it is already done earlier. One time explanation is enough.

P7, line 148-150: Actually, most of the solar simulator settings differ a bit when compared to Frouin et al. (2015). Therefore, it is good to mention about all of them, not just UV.

P8, line 178: 'a' setting?

P8, line 183: '(2) it reduces the dynamic range and the linearity of the signal acquisition'...! I think this is partially true. There is a limit to which EM gain can still be applied maintaining full well capacity. Under this limit, the EM gain can increase the dynamic range by reducing the read noise.

P10, line 210: 'images are combined to one image by taking the median pixel value for each pixel location....! Does this mean the total no. of images are reduced by the group size during median filtering and the measurement time of each image is summed?

P11, line 222: Authors should provide more information on interpolation methods or provide references, therefore, must expand this paragraph.

P14, line 290, The sigma here represents error?

P15, Figure 5: Good to use unit i.e. px for diameter.

P16, line 329: define sigma_m.

P17, Figure 6: Is it possible to re-number the grains 1-10? As the text says only 10 grains were selected. Further, It would be good to keep the horizontal label within the image's boundaries.

P18, line 356-357: The unit will be in years, not Gy.

P19, line 371: It would be good to cite any work relevant to the potential degradation of the filter under ionising radiation.

P20, line 408: Not sure what effect?

P21, lin3 433: Close the bracket around SR IR-RF.

P23, line 481: the image 'is'.

P25, line 514: d_{pixel} = 16 μm – Is this value from the manufacturer?

P25, line 520: Luminescence signal (phi_grain) per grain is basically the sum of counts from each pixel in an ROI (that has a fixed number of pixels), isn't it? The difference between eq A1 and A6 lies between how phi_grain is chosen: per pixel or in an ROI. am I correct? I think the sum needs to be mentioned.