Reply to comments of Anonymous Referee #2

reference: gi-2017-1

We thank the Referee for his careful reading, and the valuable comments and suggestions he/she made to improve the quality of the manuscript. We considered each of the comments and provided an adequate answer. The comments of Referee #2 are written in bold and the answers in plain text. *Sentences indicating a modification to the manuscript are written in italic.*

The latex diff of the revised manuscript, accounting for comments of referees #1 and #2 is provided as attached file.

1 suggested improvements and clarifications

1. The quality of Fig 1 makes it is very difficult to visualize especially the IDEE instrument. The figure ought to be improved. Define also the meaning of a Si cell and a CdTe cell.

The a. and b. parts of Figure 1 have been changed. The IDEE instrument is not easy to see in the 3D view (part **a.**), so we think it is better to show a schematic view (part **b.**) of the instruments to clearly show their position on the TARANIS spacecraft.

2. The XGRE sensors are tilted by 20 ∘ to the base plate; but it is not clear how they are placed. Discuss also the expected angular resolution on the TGF direction determination using this arrangement.

We believe the new version of Figure 1 makes it clearer about how the three XGRE sensors are placed.

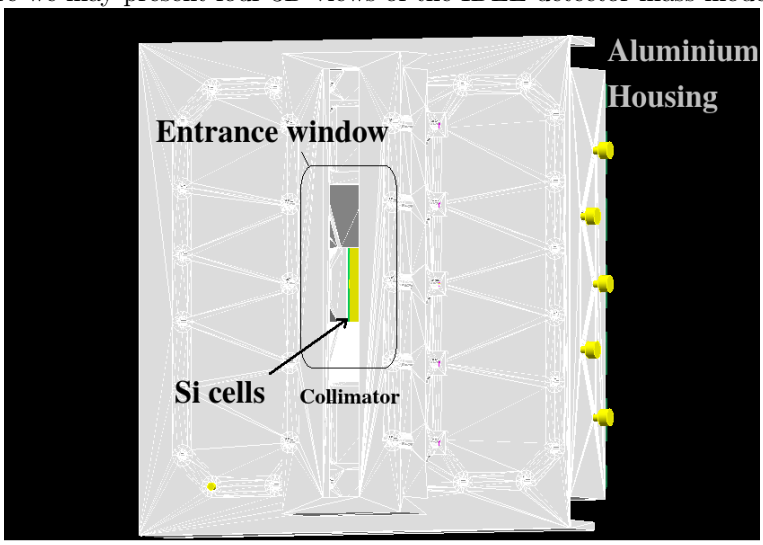
Simulations show that the angular resolution will be about 38^o for a TGF that produces 100 counts, 27^o for 200 counts and 18^o for 400 counts. However this has to be checked using the measurements of the satellite calibration campaign that will be held in 2018. *The manuscript was updated to provide these information (see page 3, lines 13-17).*

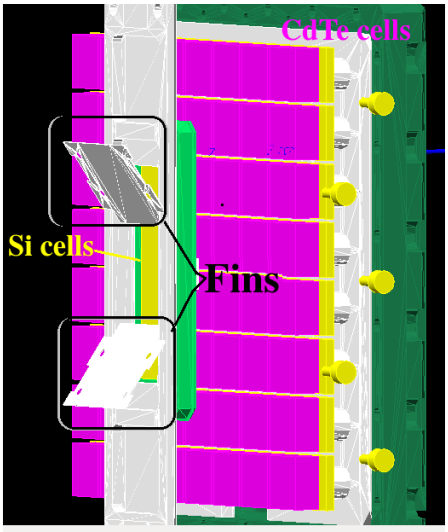
3. The XGRE is planned for photons up to 10 MeV, however, the discussion and plots operates with energies up to 20 MeV, for IDEE the discrepancy is even greater since the max energy is 5 MeV. I suggest that at least the plots indicate the energy range of the instruments, e.g. using dashed/dotted lines outside energy range.

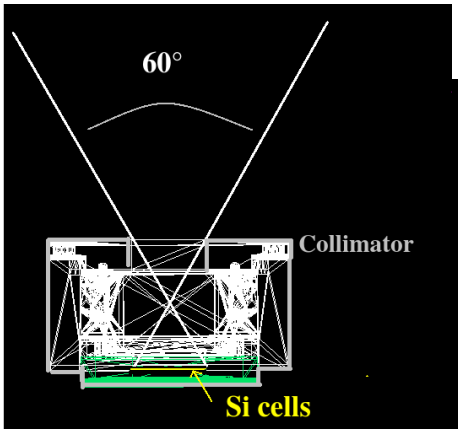
As suggested, the Figure 2 has been updated to present the range where spectroscopy is possible for all the instruments. A full line indicates the spectroscopy is possible and a dot line indicates the spectroscopy is not possible. For electron detection, only IDEE and XGRE present full lines since the other instruments are not designed to detect electrons. For positrons, all curves show dot lines since none of them is designed to specifically detect positrons.

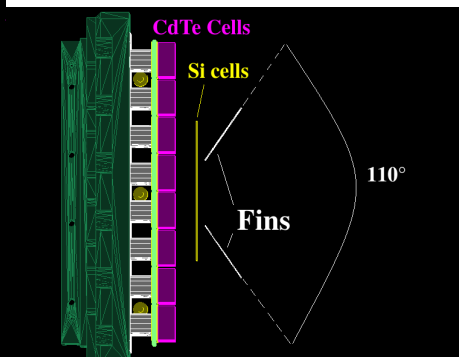
4. It is not clear why the total effective area of the IDEE Si detectors is an order of magnitude smaller than their total geometrical area at 610 keV as explained p.8, l1 and shown in Fig 2b. 600 keV electrons will deposit much more than 80 keV in the Si detectors and therefore they will be detected. Comments and clarification are required.

Here we may present four 3D views of the IDEE detector mass model used :









As seen in these views, the Si cells are mounted behind an aluminium collimator with a narrow slit. The collimator has a thickness of about 4 mm on most of it. Furthermore, two 200 micrometer thick aluminium fins are present, that are used to divide the total Si field of view to three sectors (It is important to keep in mind that the IDEE sensor head design is a compromise for a multitude of science objectives). All this aluminium material will absorb a significant amount on the electrons before they can reach the Si cells, even at for 610 keV particles.

For clarification, a sentence was added to the revised manuscript on page 8, line 7-9; and Figure 1.d. was updated to be give more information (the thickness of some elements are indicated, and the fins are now displayed).

TGF			TEB		
n_T^{min}	R_T^{lim}	$N_T^{TGF,est}$	n_T^{min}	R_T^{lim}	$N_T^{TEB,est}$
10	820 km	202	10	72 km	25
12	775 km	189	12	68 km	22.3
15	724 km	170	15	64 km	19.7
20	663 km	149	20	59 km	17.6
30	582 km	130	30	51 km	13.2

Table 1: Effect of an under-estimated count threshold $\left(n_T^{min}\right)$ on the limit radius $\left(R_T^{lim}\right)$ and the TGF/TEB detection rate estimations $\left(N_T^{XXX,est}\right)$.

5. It is unfortunate that the authors did not try to estimate the in-flight background. For the Taranis quasi-polar orbit it is expected that the background rates will vary significantly also outside the SAA. Therefore the threshold of counts value nmin will vary as well and a single value (e.g. 10 as assumed) might be insufficient. A discussion of the TGF trigger algorithm with respect to a varying background would be useful.

The average background of the XGRE instrument was calculated to be about $B \approx 5000$ counts/second on average along the orbit, but we did not go any further in background estimations. Acording to our current knowledge, most of the of the TGF are expected to be detected in the $\pm 20^o$ latitude range and the background there should be less than B. Furthermore, the models usually have a significant error margin and it is very hard to precisely predict the real background that will be detected, and therefore we should wait for in-flight measurements to be sure about the final value (as it is indicated in page 15, line 20-22 of the revised manuscript). Both XGRE and IDEE have settings depending on the true background level, that will be set during the spacecraft commissioning phase.

For TARANIS, $n_T^{min} = 10$ is a rather optimistic value, and the following tables present how changes in the count threshold (n_T^{min}) can impact our final TGF detection rate estimation (according to the model used for this article and described in section 4.4)

This table was also added to the new appendix B discussing "About uncertainties on the models used, and the impact of wrongly estimated effective areas and count thresholds of XGRE".

6. For clarity I strongly suggest to include outlines of the continents in Fig. 4. The SAA is here drawn in grey color and appear not dark as claimed in the caption. The same is the case for the Taranis orbit which is grey and not black as indicated in the legend.

As suggested, the outline of the continents were added to Fig. 4. The caption of figure 4 was updated to mention grey colors instead of black colors.

All the suggested line-by-line corrections have been done.

1. p. 4, l. 21 we drawn -> we have drawn

2. p.4, l. 27 Emax is about 125 keV -> Emax (∼125 keV)

3. p.7, l.14 have a geometrical area of 8 cm2 (4 per detector) -> have a total geometrical area of 8 cm2 (4 cm2 per detector)

2 Supplementary modifications

- page 3, line 21 : the effective atomic number of plastic scintillators is 12 and not 6. It was changed in the text.

- page 2, line 6-7 : a reference to the very recent discovery of TGF on the BeppoSAX data archive was added.
- During this review phase, we add important comments and corrections of Dr. Lubomir Pech (from Charles University, Prague, Czech Republic) concerning the description of the IDEE instrument and the associated figure. He also greatly helped in making a new version of figure 1 that is submitted with the revised manuscript. For these two important contributions, we added him as a co-author to the article; in agreement with Anna Feist-Polner from the Editorial Support.