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**Radio Astronomy compatibility studies with Pycraf – an application on the SKA**

Federico Di Vruno
Square Kilometre Array Organisation, United Kingdom, e-mail: f.divruno@skatelescope.org

## 1- Extended Abstract

Radio astronomy is considered one of the most sensitive radio applications in the world, using radio telescopes with sensitivities tens of orders of magnitude higher than any other communication service radio astronomers are able to push the limits of our understanding of the universe. For this to be possible, radio astronomy stations require a radio spectrum as free as possible from all man-made radio signals. The presence of radio frequency interference (RFI) can cause partial or total loss of an observation's data and even sometimes it can represent a damaging risk for a radio telescope.

Considering this, in the 1960's the ITU has allocated portions of the radio frequency spectrum to the Radio Astronomy Service (RAS) on a primary or secondary basis and has established the threshold levels for interference in those bands (see Rec. ITU-R RA.769-2). These frequency bands are in constant pressure from other services at the ITU forums (study groups, working parties, etc) and compatibility studies are the tool to justify to possibility (or not) to share a frequency allocation or to impose limitations in one service to prevent interference into other. These compatibility studies are technical documents where, based on the characteristics of the two systems and a propagation model, the possibility of interference to the victim system is assessed.

The work to protect the RAS bands requires to generate and review large amounts of compatibility studies not only at the ITU but other groups as, for example, CEPT in Europe. Pycraf [1] was developed by the Expert Committee on Radio Astronomy Frequencies (CRAF) to assist in this process, it is a Python package that includes many functionalities for compatibility studies. With pycraf, the technical aspect of a compatibility study can be simplified using modules as the antenna pattern of a typical radio astronomy antenna (per Recommendation ITU-R RA.1631) or the propagation model implemented from the Recommendation ITU-R P.452-16 among many others.

In this work, a brief introduction to pycraf is presented along with an example application to the design of the SKA-MID telescope and the control of internally generated RFI.

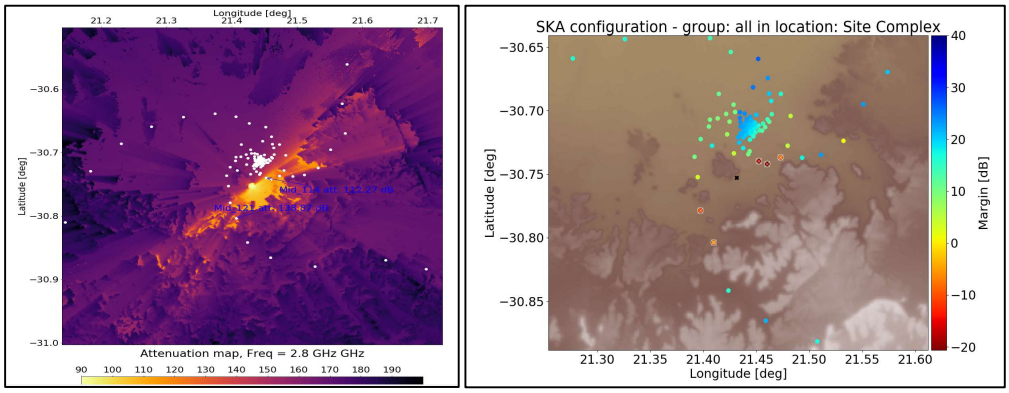


**Figure 1.** Attenuation map at 2.8 GHz generated with Pycraf from the Central Processing building of SKA-MID (left). Resulting minimum margin in decibels for each SKA antenna in all the frequency range of SKA-MID (Right).

## References

[1] B. Winkel and A. Jessner, "Spectrum management and compatibility studies with Python", arXiv:1805.11434