On-board processing requirements of future space missions are constantly increasing, calling for new hardware than the traditional ones used in space. Embedded GPUs are an attractive candidate offering both high performance capabilities and low power consumption, but there are no complex case studies from the space domain demonstrating these advantages. In our University booth we show a demonstration of a GPU parallelisation of an on-board algorithm, which has been implemented as a Master thesis project, within the framework of the GPU4S (GPU for Space) project funded by ESA.

The algorithm in question is oriented in processing Near Infrared (NIR) images. This images are very useful to undercover the secrets of the universe. In the pictures below we can see that with the visible spectrum we can see the beauty of the pillars of creation, and with the near infrared images we can see the stars that form this universe structure and the starts behind.

In our solution we ported the original sequential version of Euclid NIR from ESA to CUDA. In order to optimise our implementation, we took advantage of parallelism in several levels: at frame level, application stage level and intra-kernel. Each of the application stages are implemented as separate kernels, although in some cases we have merged three stages in a single kernel in order to increase the number of cache hits due to data reuse. The overview of the GPU parallelisation can be seen in the top of the next column.

We optimised our code on the NVIDIA’s Xavier platform. If we compare the sequential version over the parallel one in the same platform, for various input sizes, the GPU implementation is 3.5X faster that CPU on the smallest size, and up to 15X for the larger sizes similar to the requirements of future missions.

As a conclusion the demonstration of this algorithm running in GPU, opens the future for more space-base algorithm to take advantage of the embedded GPU for increase the on-board capabilities of the future missions.

If you want to know more, pass by our booth to see it in action or attend our presentation on Thursday 12/3 in the Session 12.6 at 17:00 in Room Lesdiguières