

End-to-end models for ground-based instrumentations

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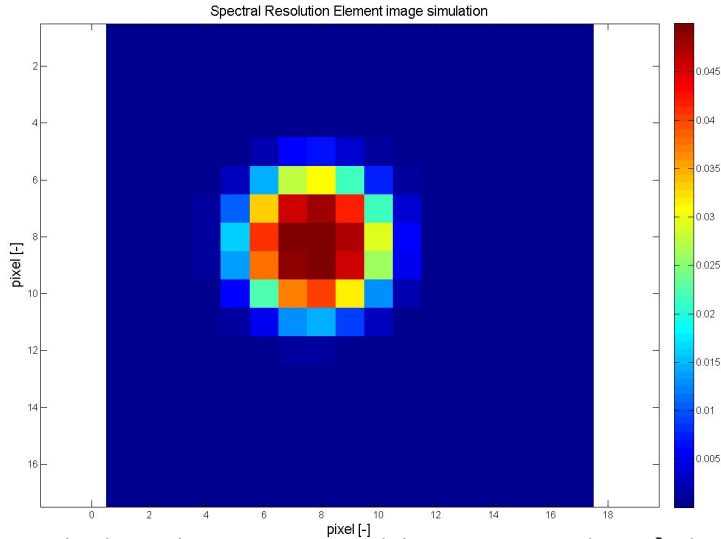


The context

- Projects are becoming more and more complex (e.g. ELT-ANDES, CUBES, etc)
- Thus, the need to have models able to produce the simulated data in advance to guide the design and aid the data reduction is therefore increasing.
- ...especially for high RV spectrographs (10 cm/s or less in precision)

The case of ELT-ANDES

- Modeling and simulation of the photons distribution for each spectral resolution element of each fiber

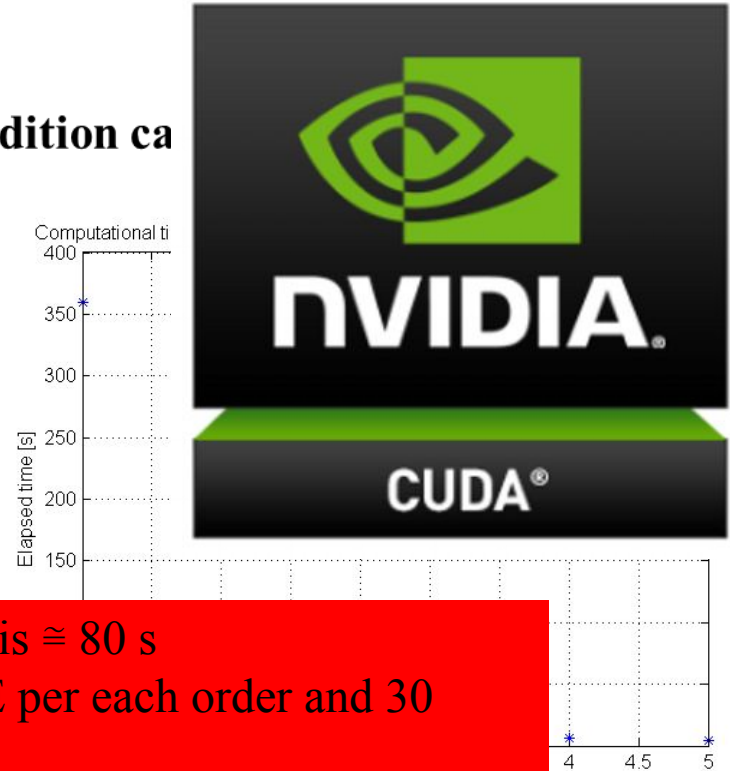


- Required accuracy for spectral resolution element centroid reconstruction \rightarrow induced radial velocity

$$v_{rad,ind} = \frac{c n_{err}}{S_x d_{pix} R} \rightarrow R = 100000, S_x = 3, d_{pix} = 10 \mu\text{m}, c = \text{light speed} \rightarrow v_{rad,ind} \cong 10 \text{ cm/s} \leftrightarrow c n_{err} = 2 \text{ nm}$$

Simulation analysis parameters for **the worst condition case**

- **Original position of x & y centroid at a quarter of pixel (worst condition)**
- $N_{pix} = 15$ (15x15 pixels box)
- $R_{SL} = 15 \mu\text{m}$ (with pix size=10 μm , $S_x=3$)
- **M = 30**



The required computation time for a single fiber SRE is $\cong 80$ s

This means that for 70 fiber per SRE, about 1000 SRE per each order and 30 order in an echellogram the total time

Required to generate a syntetic echellogram would be $= 1.68 \cdot 10^8$ s = 1945 days



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Italian text below

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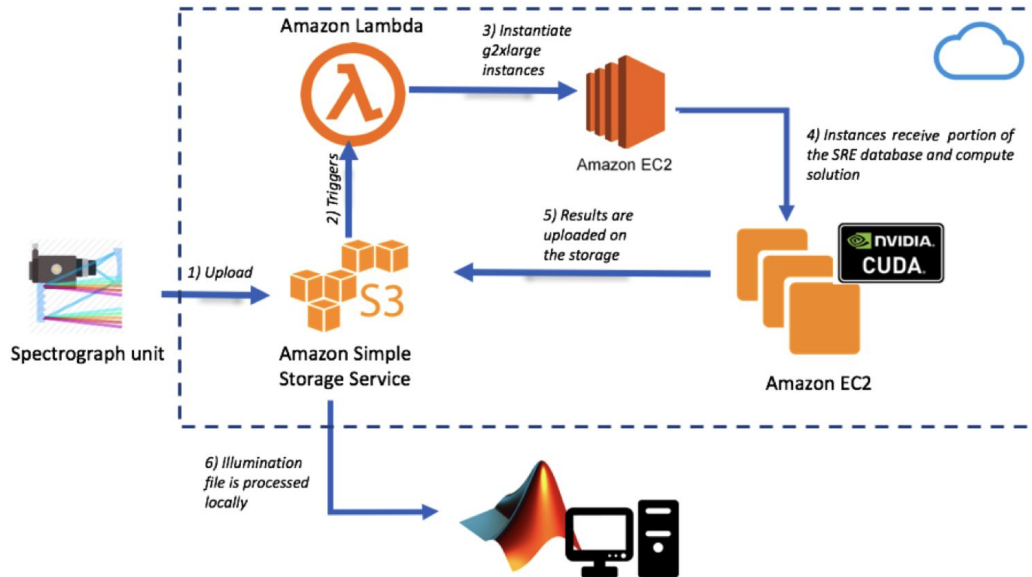
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Architecture and conclusions



- Suitable for ANDES
- General purpose approach for embarrassingly parallel GPU-based computation
- Scaled according to the need of the project.
- Required a couple of kEUR for the whole PhaseA.
- On demand



People involved and expertises

- **Marco Landoni (INAF):** Cloud Computing model, GPU based computing and accelerated computing. Software engineering and science knowledge.
- **Matteo Genoni:** Instrument modeling, designing and system engineering.
- **Andrea Scaudo, Gianluca Licausi:** Detector modeling, Pyxel expertise.
- **Alberto Trombetta (Università Insubria, INAF associate):** Software modeling and computing architecture.