Web-based scientific simulation tools for E-ELT instruments

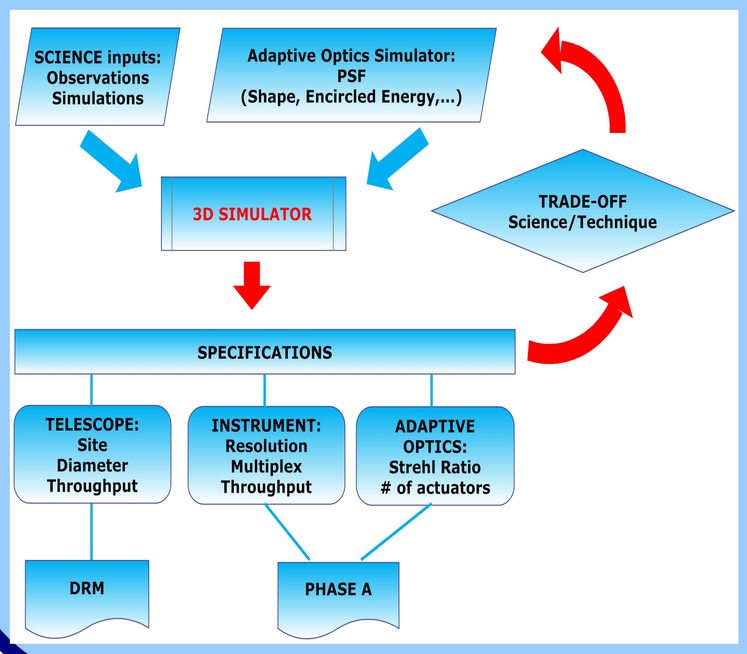
M. Puech, Y.B. Yang, H. Flores (GEPI)

Galaxies Étoiles Physique et Instrumentation

MOSAIC

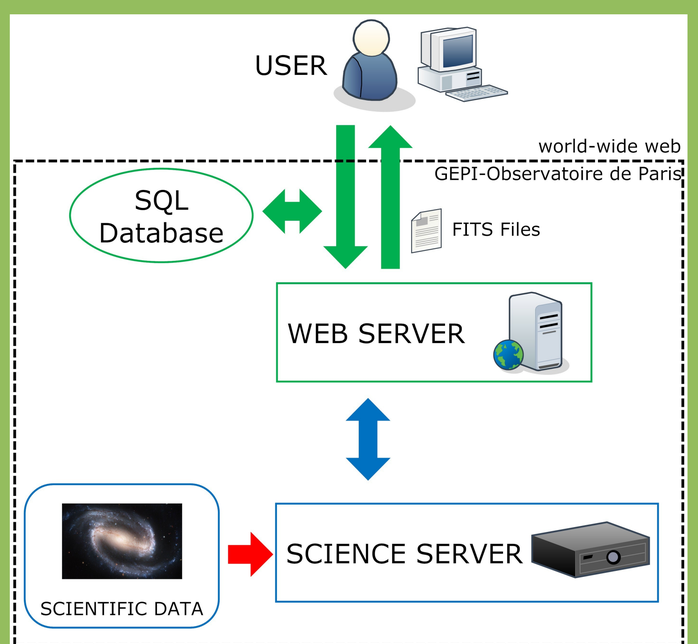
In the frame of the ESO/E-ELT Design Reference Mission, and EAGLE & OPTIMOS-EVE phase A studies, we have developed a scientific simulator which has been used to constrain the instrument high level specifications. This simulator was coupled to a web interface to allow an easier access by the science teams, and run specific simulations covering the respective scientific objectives. We also developed other telescope/instrument simulators, including a general image/datacube simulator which is accessible at *https://websim.obspm.fr*.

METHODOLOGY



The end-to-end simulator produces datacubes in FITS format, mimicking the result of real observations. An AO system can be modeled through its PSF, which is simulated using a dedicated pipeline (e.g., Neichel+08, JOSAA, 26, 219)

WEBSIM



The user interface (see web forms on the top-right) is hosted on a secured served called *WEBSIM*.

The simulations are run on a science server. When completed, an email alert is sent and the products (FITS files) can be downloaded.

DEVELOPMENTS

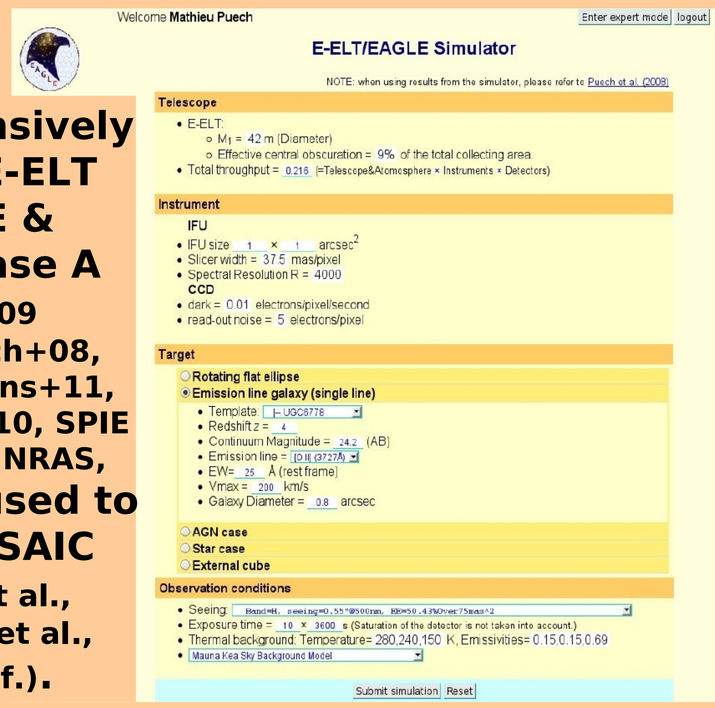
Over the next two years, *WEBSIM* will be improved on several aspects:

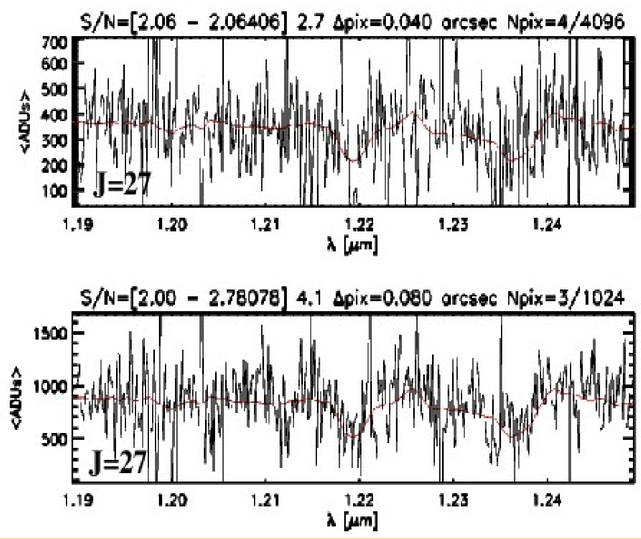
- **Implementation of telluric features;**
- **Implementation of systematic sky temporal and/or spatial variations (see Yang et al., this conf.);**
- **Implementation of a "batch mode" to run several simulations in a row;**
- **A complete AO PSF library will be offered (LTAO, MCAO, MOAO, XAO) as well as morpho-kinematic templates for simulating a large range of astrophysical objects of interest.**

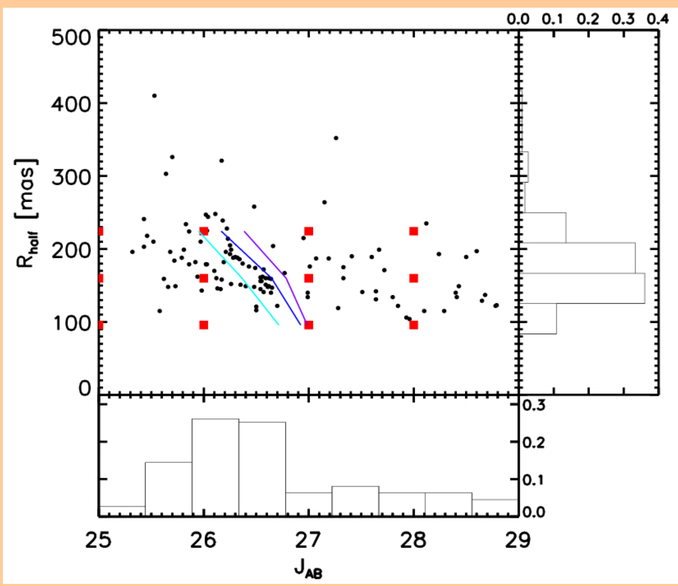
This will be done in the frame of the COMPASS project (PI: D. Gratadour), founded by the French ANR.

SIMULATIONS

***WEBSIM* was extensively used during the E-ELT DRM and EAGLE & OPTIMOS-EVE phase A studies (Puech+09 ArXiv:0909.1747; Puech+08, MNRAS, 390, 1089; Evans+11, A&A, 527, 50, Navarro+10, SPIE 7735, 88; Puech+10, MNRAS, 402, 903). It is now used to constrain the MOSAIC design (Hammer et al., Jagourel et al., Kaper et al., Cuby et al., this conf.).**







***Top-left panels :* Examples of simulations of UV interstellar lines in z~7 galaxies of average size (R_{half}~150 mas). The figure shows two integrated spectra constructed from simulated 40 hr IFU observations with 40 and 80 mas/pix respectively (the original Shapley+03 template is shown in red).**

***Bottom panel :* observed J_{AB} vs. R_{half} distribution of z~7 galaxy candidates (from Grazian+12 A&A,547,51).**

Simulated observations are indicated as red squares. The cyan / blue / violet lines show the limit at which $S/N_{continuum}$=5 is reached on the integrated spectrum for 40, 80, and 120 mas/pixel, respectively. This shows that with 40 hr of integration time and with an MOAO system delivering an Ensquared Energy of 30 % within 80x80 mas², the limiting magnitude for UV interstellar line studies will be J_{AB}~27.

More details in the upcoming E-ELT/MOS White Book (Evans, Puech et al. 2013).