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Guide to simulate light curves using SNANA

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1. Introduction

SNANA is software used to simulate light curves using a specific survey. In this document, you are going to learn how to simulate light curves for the LSST.

We highly recommend reading the entire documentation before starting your proyect.

2. Installing SNANA

If you have access to the National Laboratory for High Performance Computing (NLHPC) cluster, you can skip this section, since it is already installed and you just need to load the SNANA module.

Here you can find a introductory course for NLHPC beginners.

You will need the *SNDATA_ROOT* file, that you can downloading it from **here**

2.1. Linux/MacOS

For Linux/MacOS users, you can check the **SNANA installation Guide** from the SNANA github repository.

2.2. Windows

For Windows users, you are doomed to use a virtual machine and follow the same steps for Linux/MacOS. But you can watch this step by step installation tutorial made by myself (creo que podría intentar hacer un tutorial)

3. First Steps

For using SNANA, you're gonna need at minimmun 4 principal files.

3.1. KCOR file

The KCOR file, despite its name, does not have the k-corrections. Instead, it takes filter throughputs, combines them with user-defined filter shifts and zero point offsets, and creates an output FITS file that is used by the SNANA fitting and simulation programs. If it's needed, you can add a referential supernova to calculate the k-corrections.

For the LSST survey, this file is already created in the $SNDATA\_ROOT$ environment.

3.2. SEARCHEFF files

The search-efficiency file or SEARCHEFF file contains the probability of detection as a function of the magnitude. This file is essentially a two-column list for one or multiple filters that gives a magnitude and a probability of detection.

The SEARCHEFF LOGIC file just indicates to the simulation wich combination of detections in each filter must be considered "detections"for the purposes of the survey.

You can find both files for the LSST survey in the $SNDATA\_ROOT$ environment.

3.3. SIMLIB file

The SIMLIB file defines the parameters of the survey observations. At minimum, this requires a list of MJDs, filters, sky noise, and image zeropoints.

This file is one of the most important, because make the simulations realistic defining the cadency and transforming magnitudes in CCD counts.

You can create your own SIMLIB file for the LSST survey with the "$made\_SIMLIB.py$" code.

3.4. INPUT file

The INPUT file is executed with the command "$snlc\_sim.exe < inputfile >$ ". Contains the path to all the other files needed, the model that is going to be used, the filters where the curves are generated, and many values from the models and the simulation.

You can find an INPUT file template made by Isidora Mancilla in the repository. You can use it to create your owns INPUT files.

4. Simulating a light curve

Now that you have all the necessary files, you can run your first simulation.

5. Parallel execution

Now we are going to see how to make multiple simulations using the SLURM tool from the NLHPC, so if you don't have an account, you can aply in the form(formulario de cuentas).

As we said previously, here you don't have to install SNANA, you can simply load the last version module with the command "ml SNANA", that already has the "SNDATA ROOT"file, but you will have to copying it into your user directory, in order to save the simulations there (you cannot modify native NLHPC files).

Next, you will have to modify your environment variables with the new path to the "SNDATA ROOT" file

6. Some considerations and error solutions

here we ...

- If you are using the NLHPC and copy files from your local computer, you may have an error when you execute your tasks. Try giving permission to the directory you copied with the command "chmod -R u+w $< directory\_name >$ ".
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