Practical Sessions 4 & 5: Deep Field and Extended Source Simulations

SIXTE team

End-to-end simulations with SIXTE: An online workshop, March 2022

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ecap ERLANGEN CENTRE FOR ASTROPARTICLE PHYSICS

WFI ATHENA

X IFU ATHENA X-ray Integral Field Unit

Part 4: Deep Field Simulations (with the WFI)

This exercise shows how to create a small SIMPUT catalogue (by adding SIMPUTs with `simputmerge`) and simulating them.

4.1 Create a SIMPUT containing several sources within a few arcmin of each other.

4.3 Observe your field with the full WFI Large Detector Array, using `athenawfisim`.

4.4 Create an image of the whole field.

4.5 Bonus: Extract the spectrum of the brightest source.

*Detailed commands in the Simulator Manual, **Sect. 10.4.1-10.4.2***

Solution at $\sim$/`workspace/Storage/sixte/sixte_volume/sixtedata/` `tutorial/solution_scripts/practical_4/simputmerge`

Part 4: Deep Field Simulations (with the WFI) continued

Now we use an existing, complex SIMPUT file to simulate the Chandra Deep Field South (CDFS) with the WFI.

4.6 Simulate the CDFS with a staring observation at RA=53.13 Dec=-27.8, using `athenawfisim`.
The CDFS SIMPUT files are available on SciServer at `/workspace/Storage/sixte/sixte_volume/sixtedata/tutorial/inputs/CDFS_combined_simput` and for download **here**.

4.7 Create an image of the simulations from 4.6 and inspect it with `ds9` or `fv`.

*Detailed commands in the Simulator Manual, **Sect. 10.4.3***

Solution at $\sim$`/workspace/Storage/sixte/sixte_volume/sixtedata/tutorial/solution_scripts/practical_4/CDFS`

Part 4: Deep Field Simulations (with the WFI) continued

4.8 Create a Lissajous dithering pattern for the CDFS observation, using `attgen_dither`.

4.9 Now simulate the CDFS including dithering with the just created Lissajous-Attitude.

4.10 Create an image of the simulation from 4.9 and inspect it with `ds9` or `fv`.

*Detailed commands in the Simulator Manual, **Sect. 10.4.3-10.4.4***

Solution at ~`/workspace/Storage/sixte/sixte_volume/sixtedata/` `tutorial/solution_scripts/practical_4/CDFS`

Part 5: Extended Source Simulations

> Images of extended sources (e.g., from observations) can be easily added to a SIMPUT file.

The image we are going to use for this exercise is available on SciServer at `/workspace/Storage/sixte/sixte_volume/sixtedata/tutorial/inputs/Cas_A/Cas_A.img` and for download **here**.

5.1 Extract the source position from the image (`CRVAL1` and `CRVAL2` keywords), e.g., using the command `fkeyprint Cas_A.img CRVAL1`

5.2 Create a SIMPUT file using this image and a `phabs*apec` spectral model (suggestion: $N_H = 1 \cdot 10^{22}\,\mathrm{cm}^{-2}$, $kT = 1.25\,\mathrm{keV}$, default for other paramaters) with a flux of $2.9 \times 10^{-9}\,\mathrm{erg/s/cm^2}$ between 0.3 and 10 keV.

5.3 Simulate a 100 s observation with the WFI for one chip.

5.4 Create an image of 5.3 and inspect it with `ds9` or `fv`.

Building a SIMPUT file from an image is shown in the Simulator Manual, **Sect. 10.5.1**

Part 5: Extended Source Simulations

Solution at ∼`/workspace/Storage/sixte/sixte_volume/sixtedata/`
`tutorial/solution_scripts/practical_5`