ASTRAL

SNRCalc Tool

Case Study

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The SNRCalc Tool stands for "Signal-to-noise Ratio Calculator", a tool that can be used by astronomers to get an estimate for the expected signal-to-noise ratio with any observation of a single source.

Objectives

The objective of this project is to develop a tool capable of computing an estimated signal-to-noise ratio for any telescope of any single source using the radiometer equation.
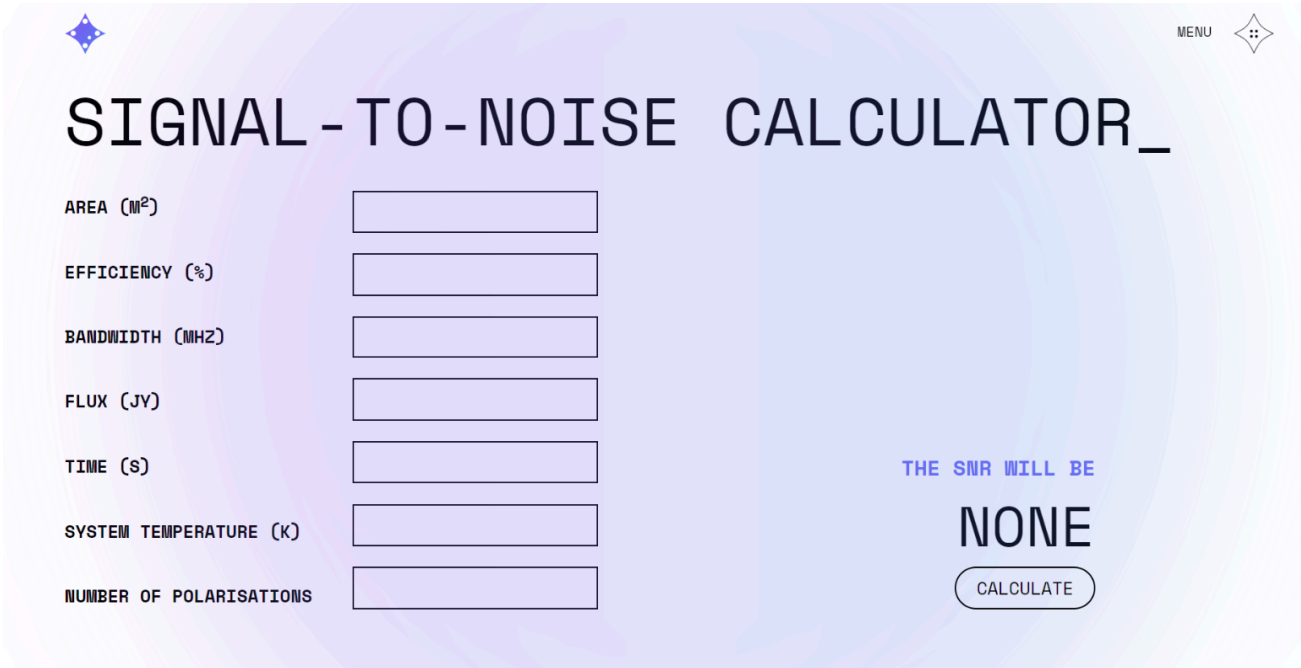
This needed to be packaged in a solution anyone can quickly access, but is also clean, modern and reflects the branding of ASTRAL as well.

Solution

The best way to access a tool such as this one is through the internet, and making this tool as a web application anyone can quickly access was the easiest, simplest option. This required the use of HTML, CSS and Javascript to execute such a tool successfully. This also meant that the web application must be mobile responsive, meaning all the content should be accessible in an easy-to-understand format for those using a phone as well as those using a laptop.

It also needed to be simple to use, and therefore instead of focusing on features that add flair and make the website look cool, care was taken to ensure that anyone can quickly and easily understand how to use the tool As a result, very minimal Javascript was used in the final product, and was mostly used to compute the SNR value.

While the design is a reminder of the ASTRAL's branding, it aims to be much simpler and more conventional compared to the futuristic, feature-driven main website.

SIGNAL-TO-NOISE CALCULATOR_

AREA (M²)

EFFICIENCY (%)

BANDWIDTH (MHZ)

FLUX (JY)

TIME (S)

THE SNR WILL BE

SYSTEM TEMPERATURE (K)

NONE

NUMBER OF POLARISATIONS

CALCULATE

Focus has also been made to ensure the contrast of the text is extremely high and that this website is readable to those with potential vision-related issues.

As far as the calculation is concerned, there is only one formula that is used to compute this, and that is called the radiometer equation -

$$S/N \; = \; \frac{GS}{T_{sys}} \times \sqrt{B \times t \times n_p}$$

Whereby -

$$G = \frac{e \times A}{2k} \times 10^{-26}$$

Where e is the efficiency, A is the area of the telescope in square metres, k is Boltzmann's constant, S is the flux density of the source in Janskys, T_{sys} is the system temperature of the telescope in Kelvin, B is the bandwidth in Hertz, t is the duration of the observation in seconds, and n_p is the number of polarisations available on the telescope.

This website is now useful using the following URL -
https://rudrathegreat.github.io/astral-website/tools/snrcalc/index.html