

Summer Research 2011

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Over the past eight weeks, I have worked closely with Professor Marr from the Physics and Astronomy department on three java-based programs to be made publically available on the internet: VSRTI Plotter, SRT Plotter and TIFT. Of the three programs, I improved VSRTI Plotter and Cosine TIFT and created SRT Plotter and Complex TIFT. All three programs will be used in Professor Marr's Radio Astronomy laboratory. They will also be very useful for many instructors around the country. A paper informing the astronomy community of these programs will be submitted in the fall.

VSRTI Plotter has four modes that allow students to plot and analyze data taken from the Haystack Very Small Radio Telescope Interferometer (VSRTI). These four modes are Plot Beam, Plot Fringe Pattern, Plot Visibilities, and show Fourier Transform. Each mode will have a lab designed around it.

SRT Plotter is a single program that allows students to plot and analyze data take from the Small Radio Telescope (SRT). In SRT Plotter, students can average and subtract data blocks, Plot the beam width or the average antenna temperature of a data set, delete end channels of a data set, subtract background data and measure the temperature of the moon and sun.

TIFT or a Tool for Interactive Fourier Transform is a teaching aid intended to make the Fourier Transform, a difficult concept that is used in many disciplines, easier to understand and less intimidating to approach. TIFT is a set of two

programs, Cosine TIFT and Complex TIFT. Both programs display interactive graphs of the time domain and the frequency domain where a student can enter an equation or change a point's value and immediately see the signal in the time domain and the frequency domain. Cosine TIFT only displays the Cosine Transform, which is the brother of the Fourier Transform that only handles real numbers. Because it only handles real numbers, Cosine TIFT is a good introduction to the frequency domain, especially for those who are not familiar with complex numbers. Complex TIFT displays the Fast Fourier Transform. Students have the ability to toggle between polar and rectangular representations of the time and frequency domain. That is, the graphs of magnitude and phase or real and imaginary for the time and frequency domain.

Working on this project was really a great experience. It was the first time I was able to use skills I had learned in class on a real project. It also opened my eyes to all the possibilities one has with computer science. Almost every scientific discipline uses graphs to analyze data and unfortunately, most of the time they go to Microsoft Excel to create these graphs and for a lot of people excel can be time consuming and difficult. I can imagine programs such as VSRTI and SRT Plotter that allow users to plot and manipulate scientific data without having to open up one or more data files and copy the data into Microsoft Excel.