
HOWARD UNIVERSITY WASHINGTON D.C.
VERITAS
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1867

HU RADIO TELESCOPE

EECE-401
SENIOR DESIGN I

INTRODUCTION

BISON ENTERPRISES – TEAM MEMBERS

Advisor/Sponsor
- Dr. Marcus Alfred

Manager
- Richard Farrell

Team Leads
- Marlon Smith
- Jarrett Goddard

Team Members
- Erik Cooper
- James Peters
- Shaleen Shah

OUR PURPOSE

Our objective is to build a **portable radio telescope** based on the MIT Haystack SRT project. This instrument will allow the measurement of the galactic rotation curve, which will aid in the research of Dark Matter.

DESIGN CONSTRAINTS

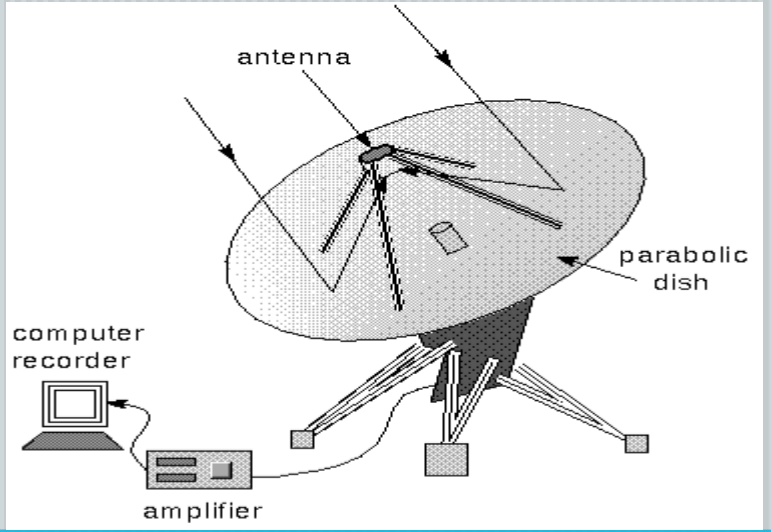
- **Dish-**(Parabolic, Mesh, 2.3M or less)
- **Dish Mount**- (Motorized, horizon to zenith)
- **Receiver-**(Tuned to frequency of Hydrogen Line)
- **Low-Noise Amplifier (LNA)**
- **Feed-**(Copper,helical)

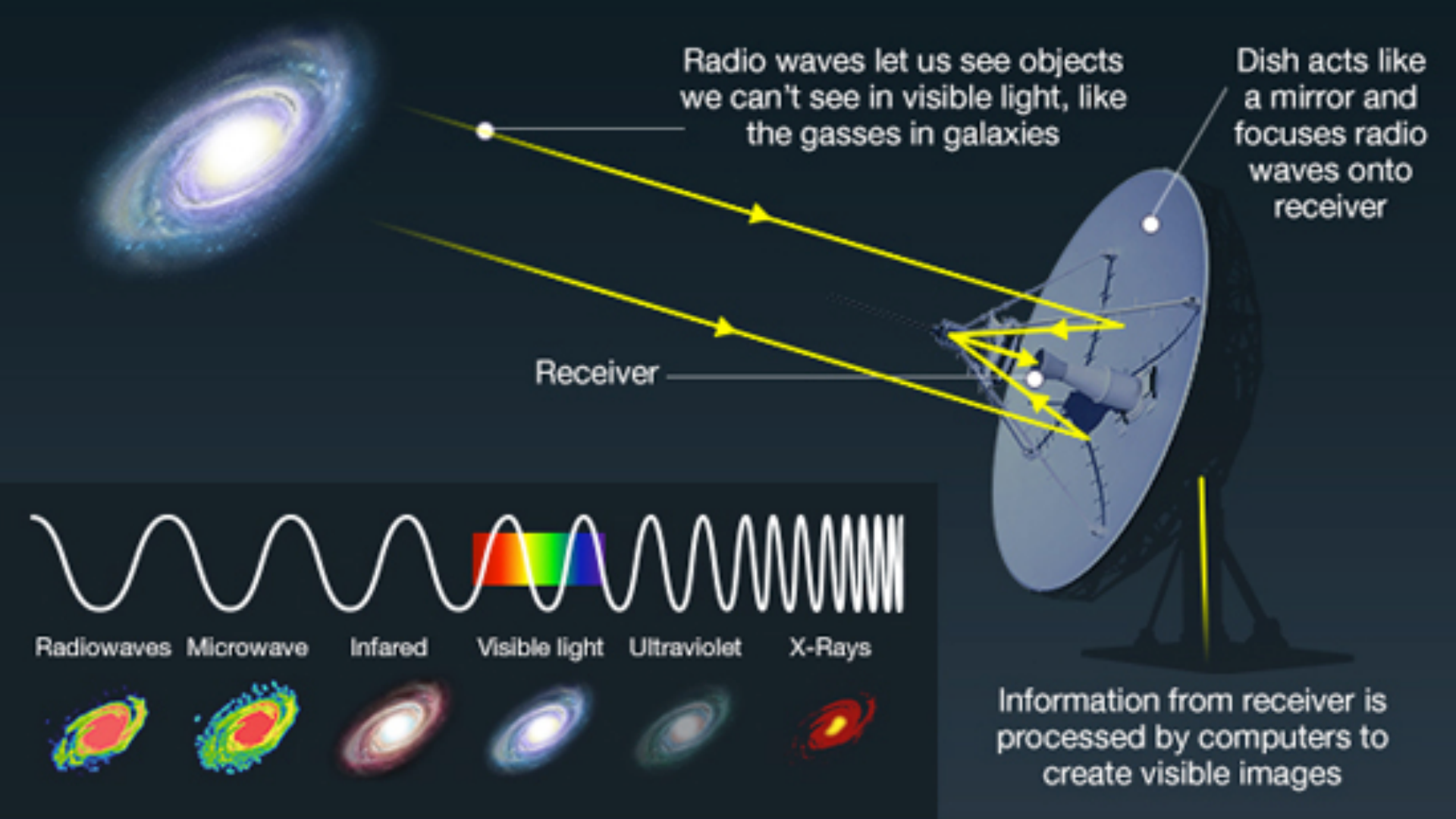
PROJECT OVERVIEW

WHAT IS A RADIO TELESCOPE?

1. Parabolic Dish
2. Antenna/Feed
3. Amplifier/Receiver
4. Computer/Recorder
5. Dish Mount

Note: A mount for a radio telescope is ideal but not crucial. A radio telescope in general is comprised of the first four major components listed above.




Radio waves let us see objects we can't see in visible light, like the gasses in galaxies
Dish acts like a mirror and focuses radio waves onto receiver
Receiver
Radiowaves
Microwave
Infared
Visible light
Ultraviolet
X-Rays
Information from receiver is processed by computers to create visible images

MARKET OVERVIEW

Institutions and Individuals Using the SRT

Boston University
Dartmouth College
Haverford College

Northeast Louisiana University
NRAO, Green Bank

Princeton University
University of Massachusetts, Lowell
University of New Hampshire

Wellesley College
Bucknell University
Guilford College
Marlboro College
Mayo High School, MN
NRAO, Charlottesville
Union College
University of Michigan
Valdosta State University

Williams College
Alfred A. Aburto, Jr.
Arizona State University
California State Univ--Sacramento
California Institute of Tech
California State Univ--Los Angeles
with Los Angeles City College
Carleton College

University of Cincinnati
Guilford College
Hampden-Sydney College
Hofstra University
Loras College
Louisiana State University
Lycoming College
McGill University
Southeast Missouri State Univ.

McMaster University
Mount Union College
Muhlenberg College

NRAO--Socorro
Palm Beach Com. College

Piedmont College
Purdue University
University of South Carolina
South Carolina State University
University of Toronto
Tufts University
U.S. Military Academy
U.S. Naval Academy
University of Utah
Villanova University
Wellesley College

WINTER 2013-2014

SRT-II

HISTORY DRIVES INNOVATION

The past models were lacking in various areas and we seek to improve upon our predecessor's shortcomings

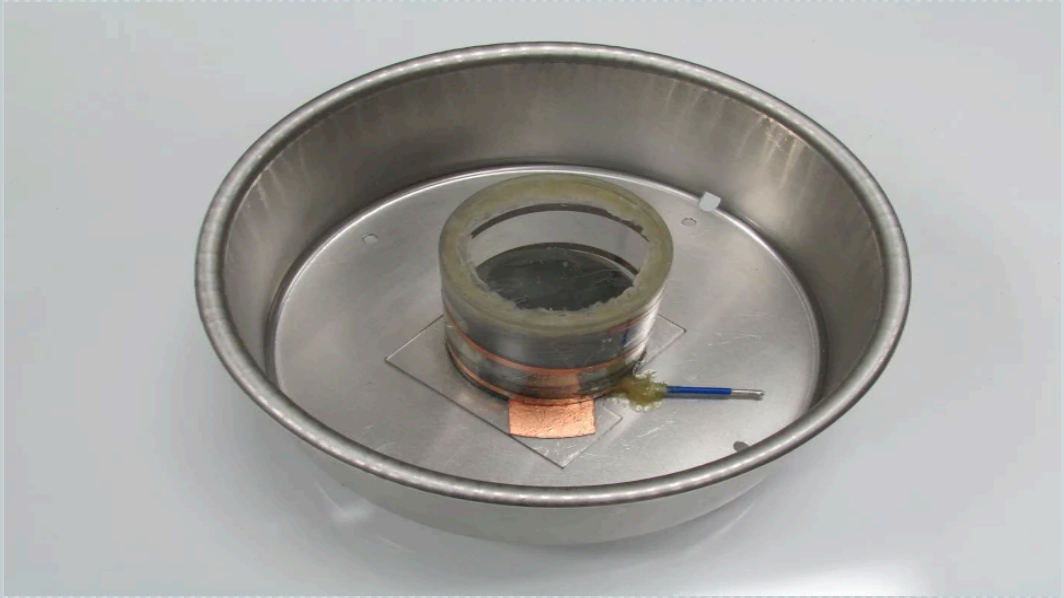
Original was designed to be built with minimal need for specialty installation. We will change the design but try to keep the idea of the original

Three Parts

- Dish
- Base
- Antenna

CONCEPTUAL DESIGNS

Conceptual Design of Feed

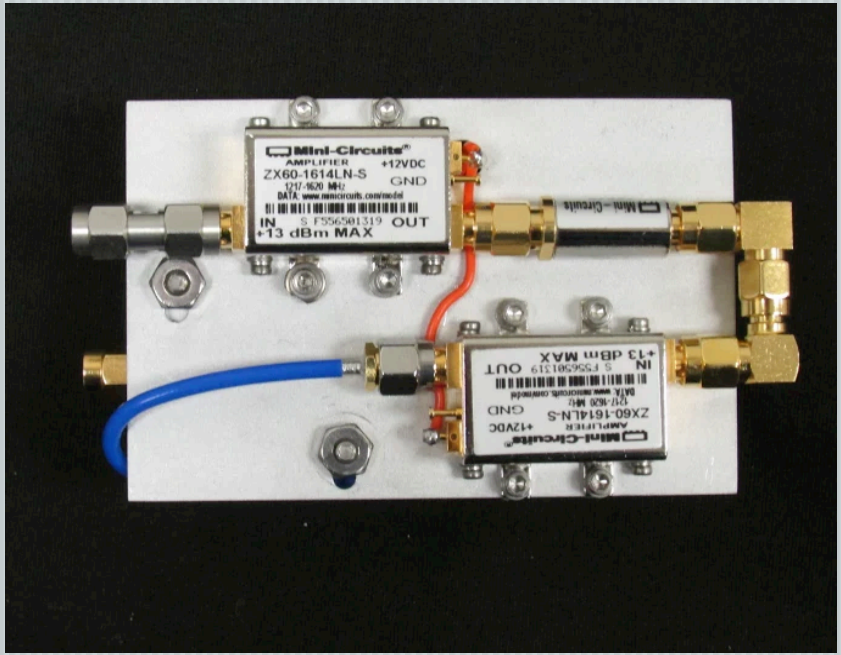


ANTENNA GAIN FORMULA

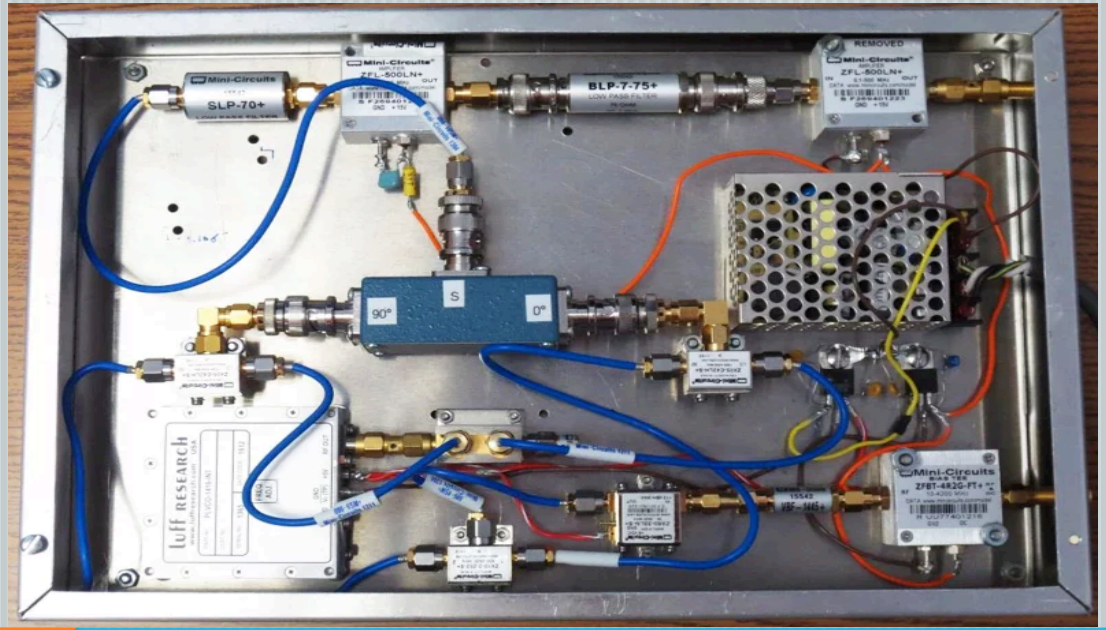
$$Gain\ (dB) = 10 \times \log_{10} k \left(\frac{\pi D}{\lambda}\right)^2$$

Conceptual Design of Dish & Dish Mount

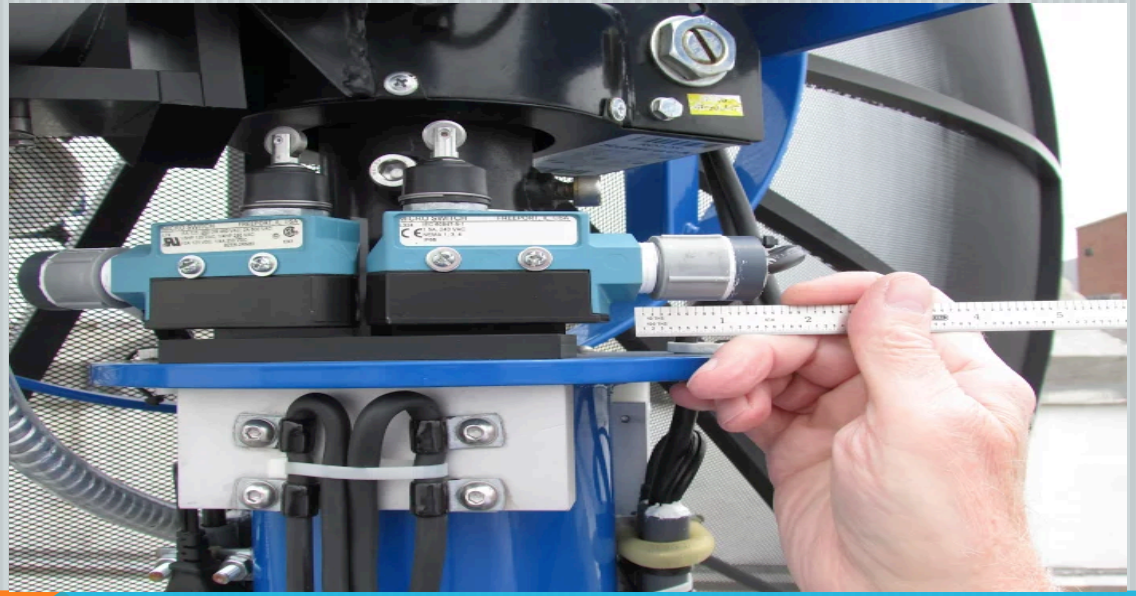
Conceptual Design of Low-Noise Amplifier



Conceptual Design of Receiver

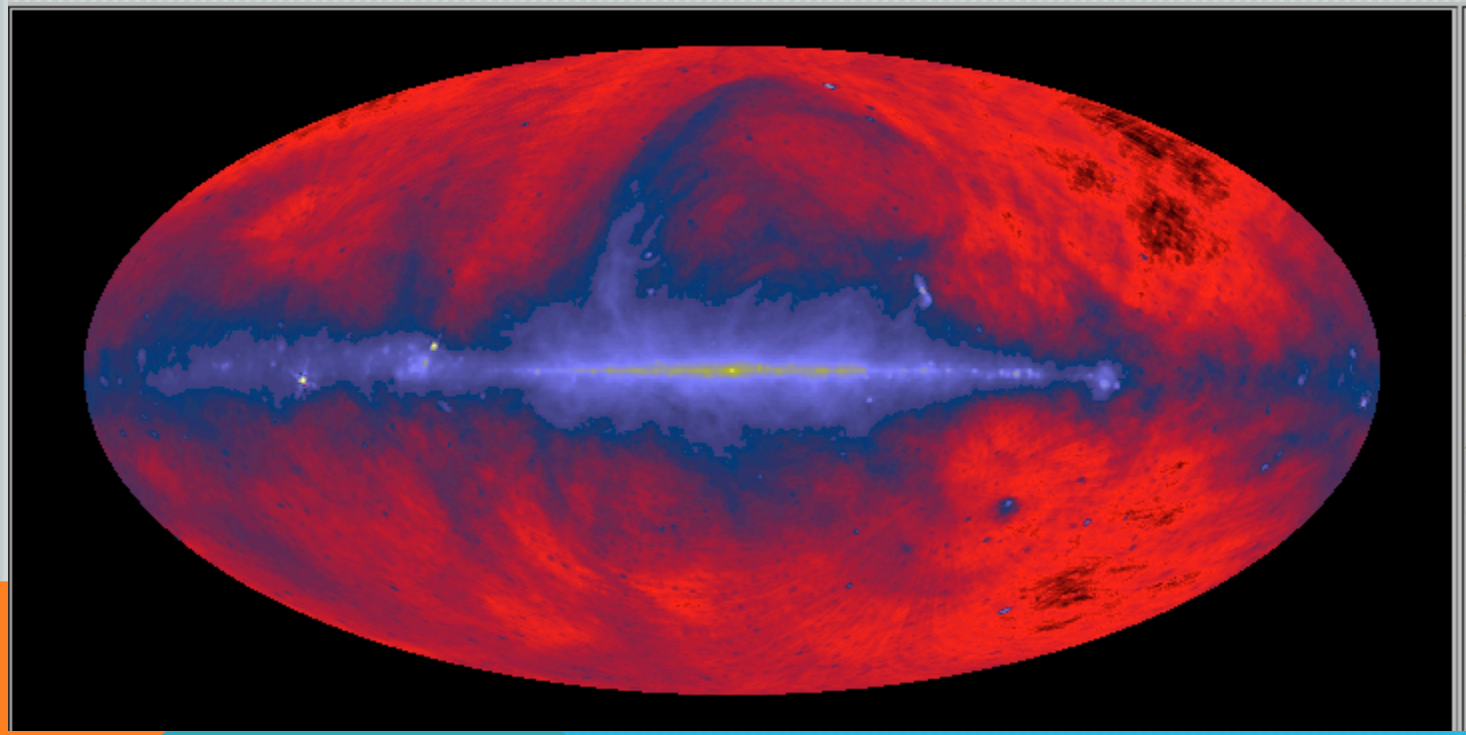


Conceptual Design of Rotor Controller



SOFTWARE OVERVIEW

OUR GALAXY AS SEEN BY A RADIO TELESCOPE

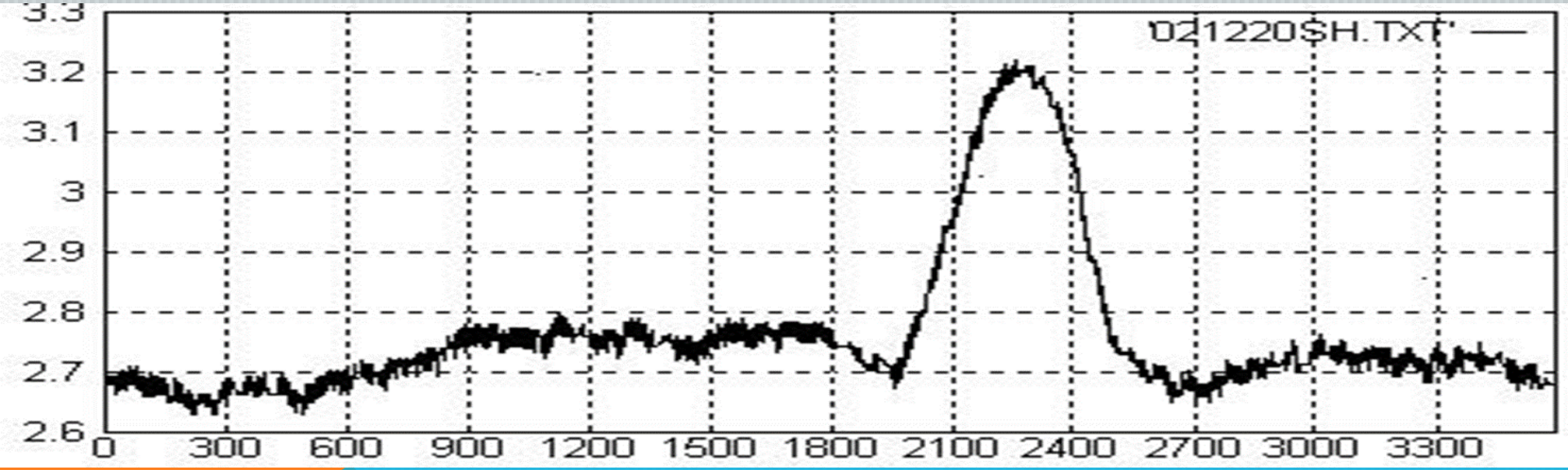


The radio "sees" mostly the regions where cosmic rays circulate in the plane of the galaxy, plus some star forming regions and huge arcs of gas blown into space above and below the plane.

RECORDING DEVICE

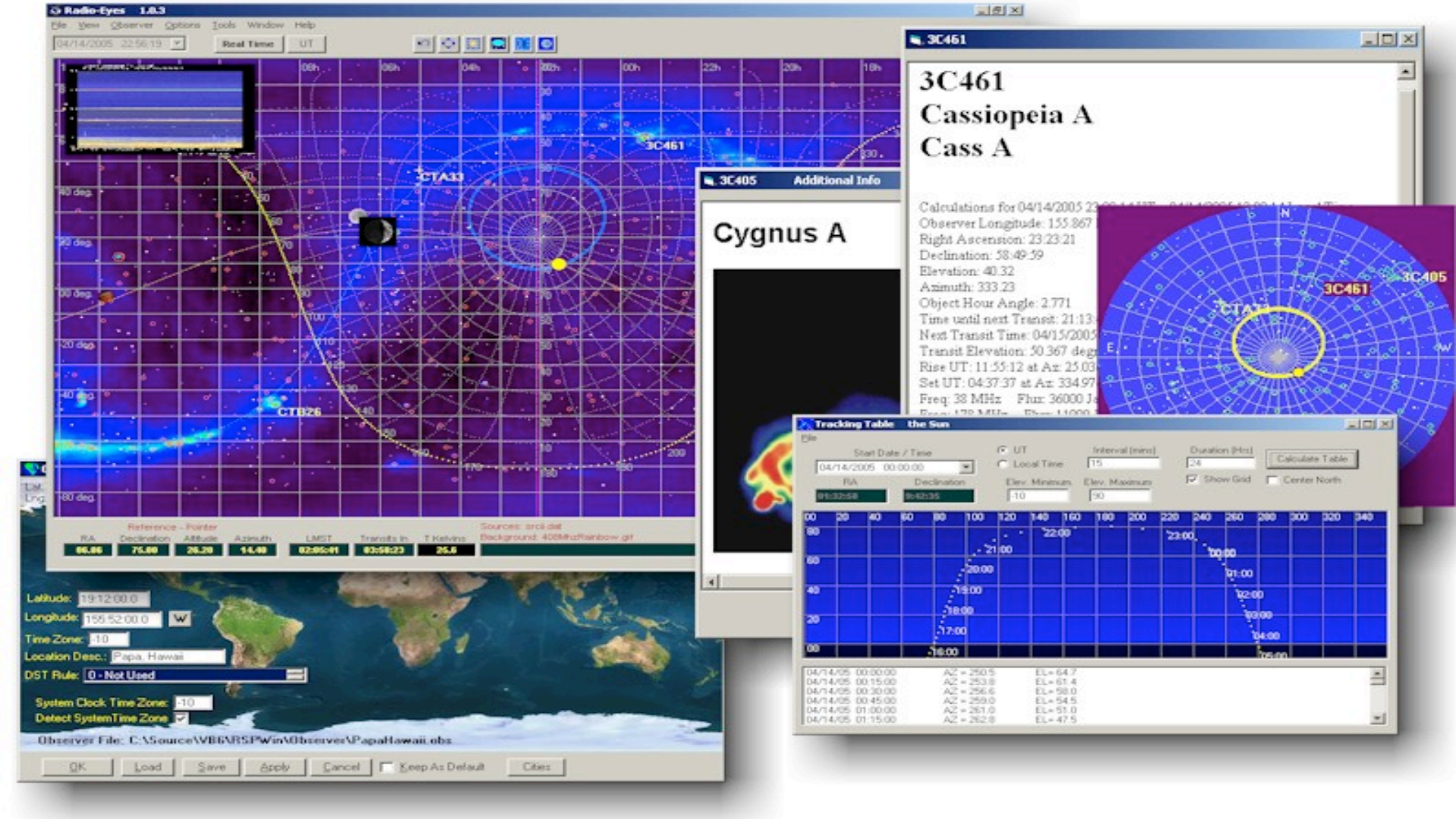
- **The output of a radio telescope must be recorded.**
- **Radio telescope receivers detect the strengths of radio light waves coming from electrons accelerating around in space as well as the signals of molecules spinning in clouds of gas and dust.**
- **For the simple radio telescope, what we want is a record of how strong the signal is over time. If we are using drift scan observations, we can relate the time a particular value of signal strength was recorded to where in the sky our antenna was pointed.**
- **The result is often called a strip chart.**

STRIP CHART


'021220$H.TXT'
3.3
3.2
3.1
3
2.9
2.8
2.7
2.6
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
3300

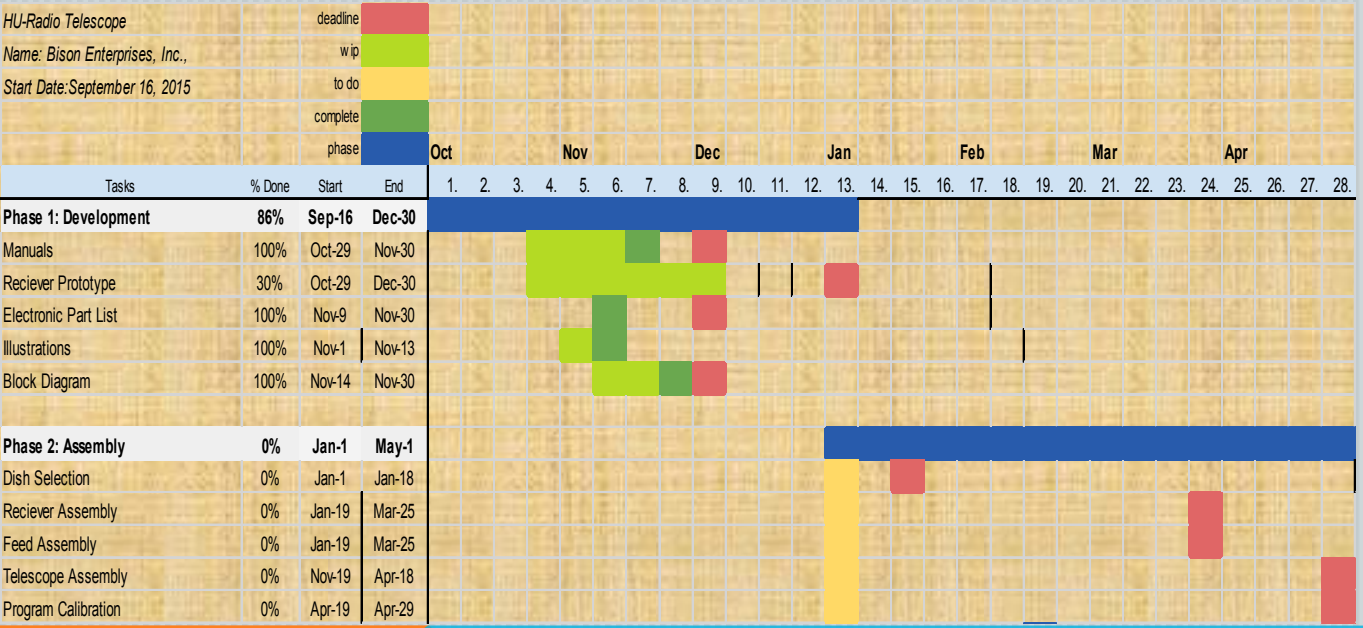
ANALOG TO DIGITAL CONVERTER

The analog voltage strengths which corresponds to the varying strengths in each point of the sky need to be converted to a digital, readable form. One method of doing this is using a software, an analog to digital converter.

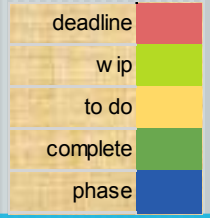

Radio-Eyes 1.0.3
3C461
3C461
Cassiopeia A
Cass A
3C405 Additional Info
Cygnus A
Tracking Table the Sun
Latitude:
Longitude:
Time Zone:
Location Desc.:
DST Rule:
System Clock Time Zone:
Detect SystemTime Zone
OK
Load
Save
Apply
Cancel
Keep As Default
Cities

PROGRESS REPORT

PROJECT MANAGEMENT



- **Phase 1**
- **Phase 2**

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