



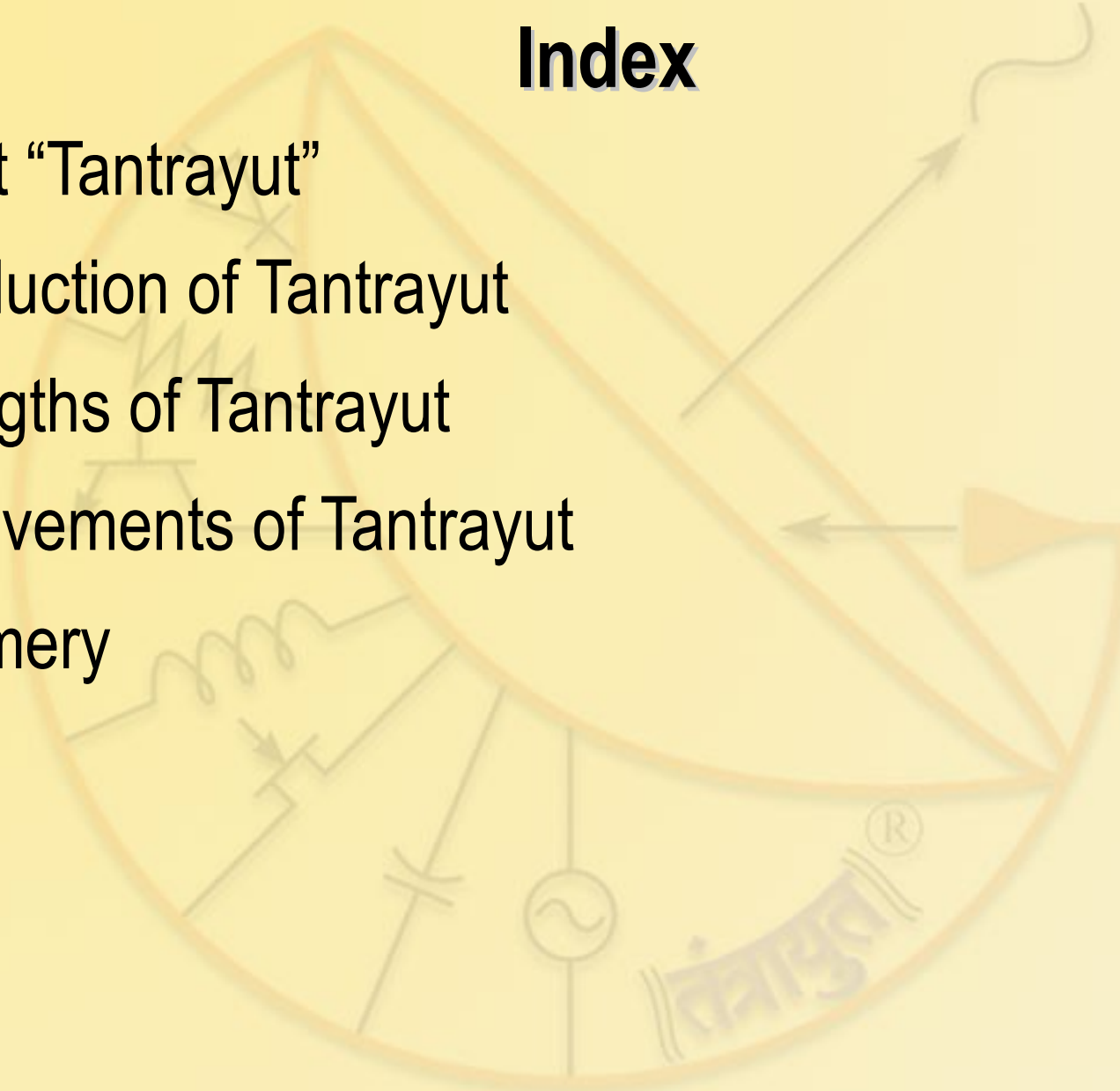
**Tantrayut's Perspective
on
Indian Contribution to Building of
SKA Antennas and Electronics.**

at
Australia-India Research and Development in
Radio Astronomy.
(ARDRA)



Index

- About “Tantrayut”
- Introduction of Tantrayut
- Strengths of Tantrayut
- Achievements of Tantrayut
- Summery





Introducing Tantrayut



Dr. Yogesh Karandikar

- Antenna/RF, Microwave Expert
- 10+ years of Experience
- PhD Chalmers Univ, Sweden

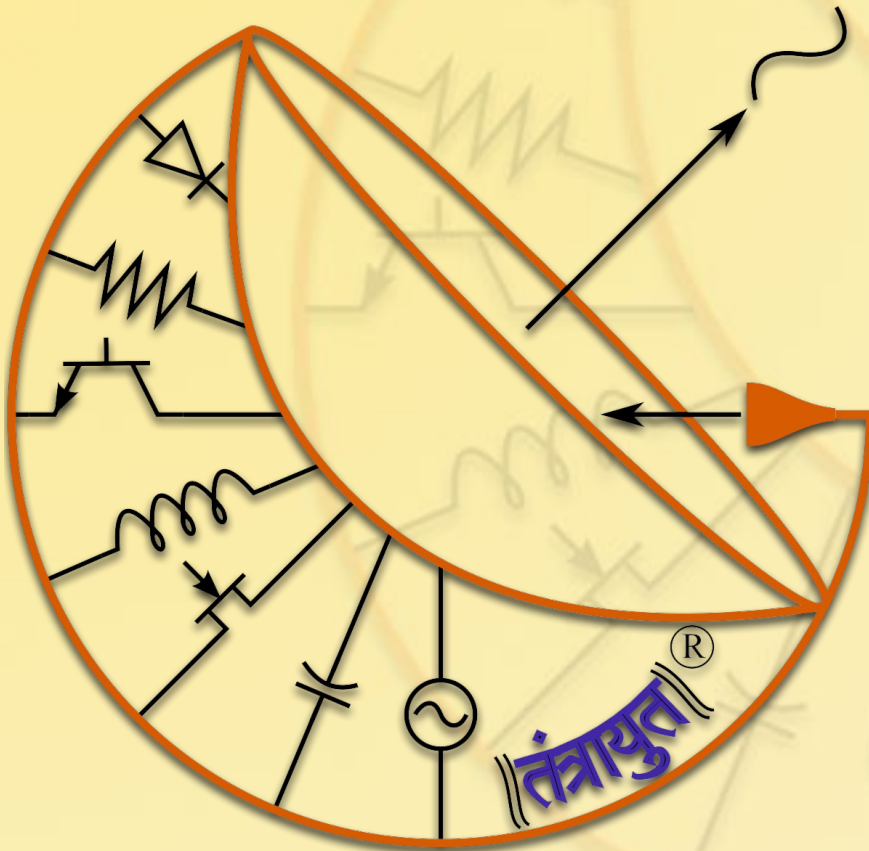


Mr. Sandip Khopkar

- Embedded, Automation Expert
- 20+ years of Experience
- IoT based Industrial Automation



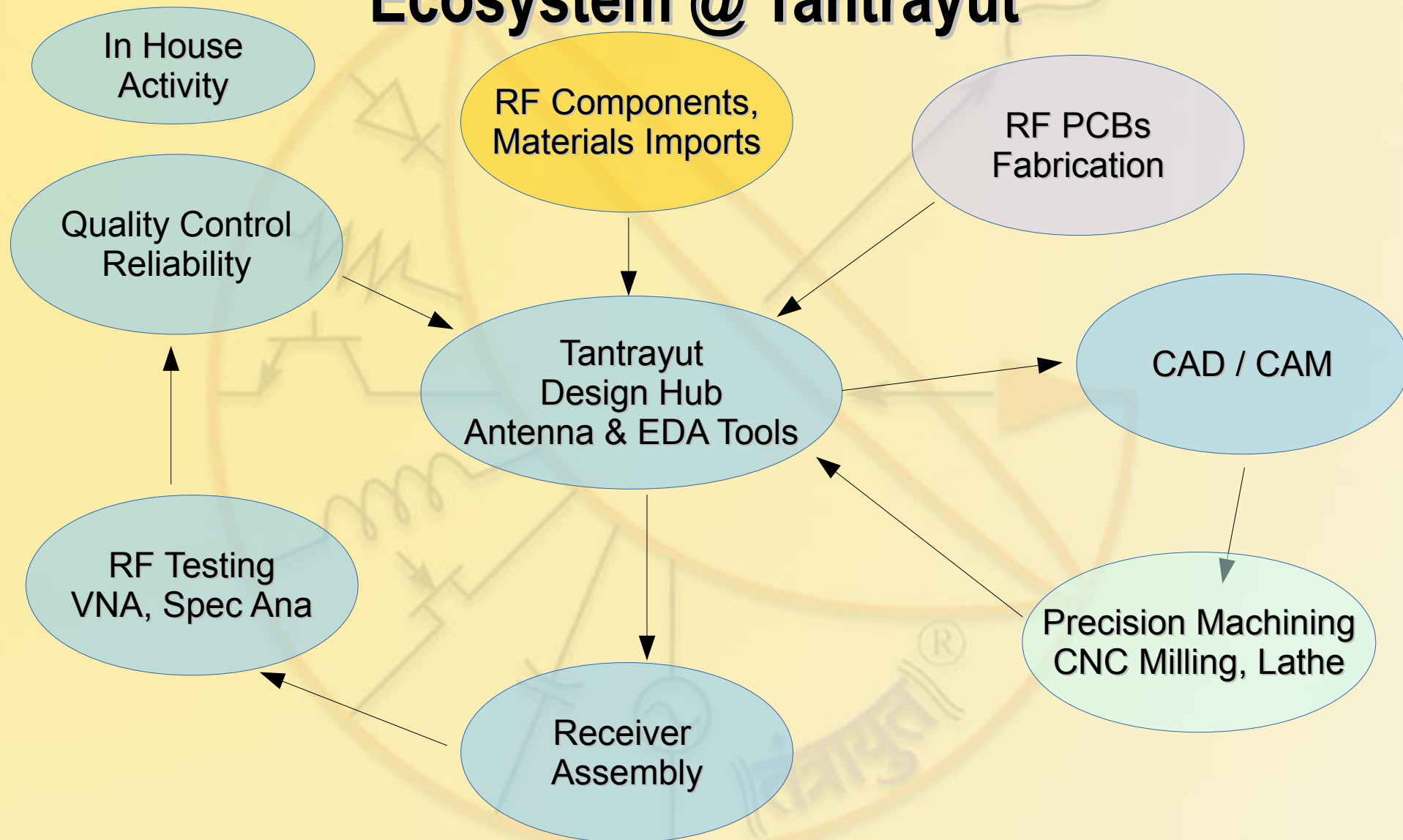
Introducing Tantrayut

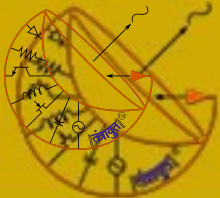


- The word '**Tantrayut**' is derived from ancient language 'Sanskrit'.
- '**Tantra**' symbolizes **Technology**.
- '**Ayut**' signifies **unbounded or limitless** nature.
- These words together interpretes as '**Technology Without Bounds!**'.
- In reality the bounds are always set by Physics.
- The Art of Engineering is to push the technology as close as to the limits set by Fundamental Physics.



Ecosystem @ Tantrayut





Tantrayut offers

<http://www.tantrayut.in/services/>

Design Services

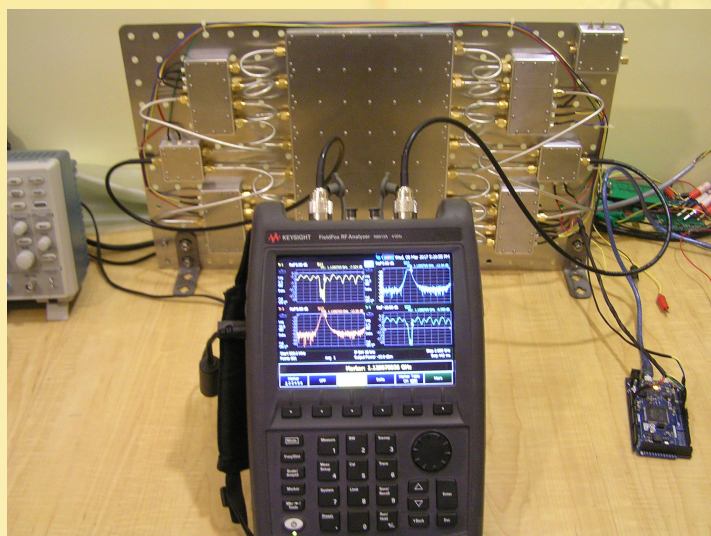
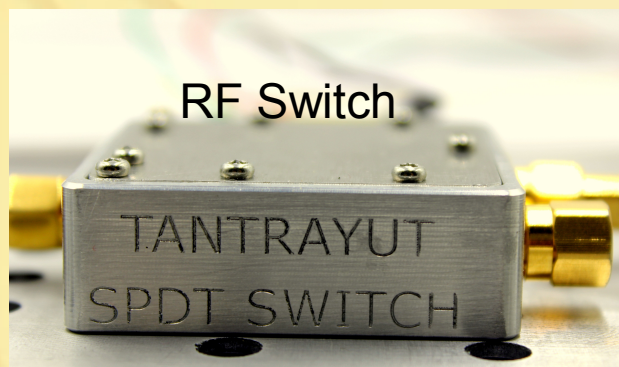
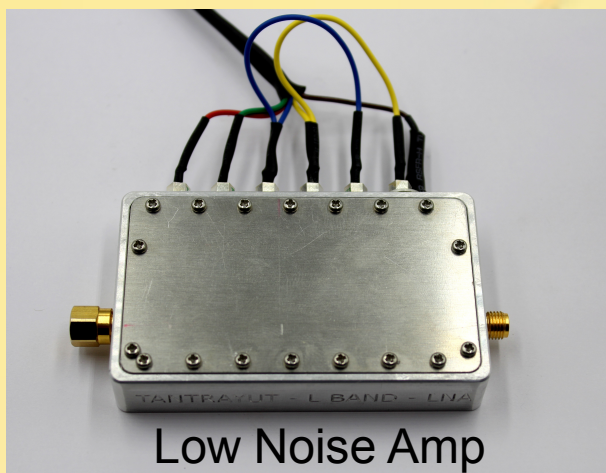
- Custom antenna development of various types planar, horns, lens, reflectors etc.
- Custom microwave passive circuit developments
- Custom microwave Active + Passive circuits using commercial components.
- In house licenses of commercial EDA tools are available.

Prototype Product Development

- Analogue, RF or Mixed Signal circuit + PCB design
- Embedded Systems board development
- Embedded Programming
- Industrial Automation



Front End Components Developed and Produced



Horn Antenna



Scientific Instrumentation

Front End System in L-Band (1050-1600 Mhz) Delivered to NCRA, Pune.



Check our White Paper
<http://www.tantrayut.in/resource-center/>

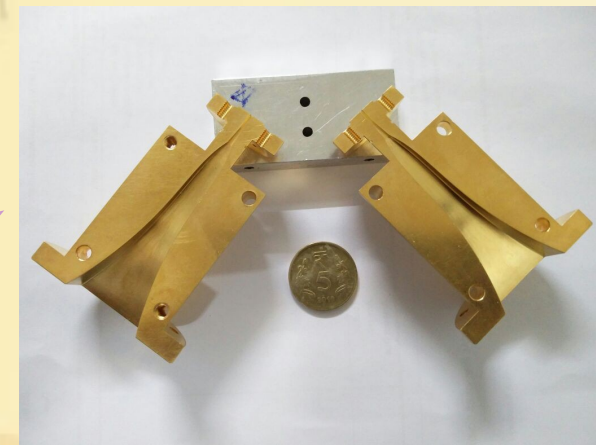




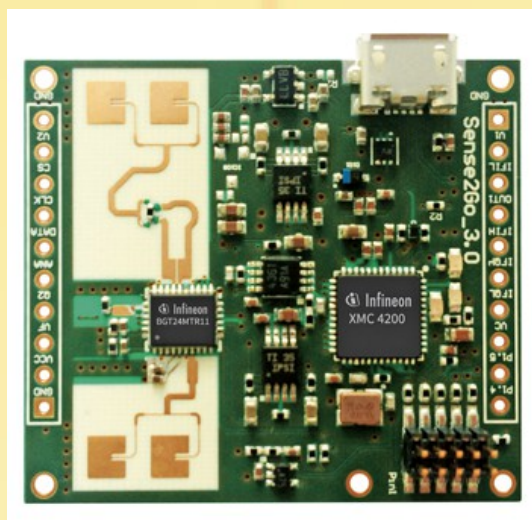
R&D in Four Niche Areas



Square Kilometer Array



Antennas for 5G



24 GHz FMCW Radars

Tantrayut
Design and R&D Hub

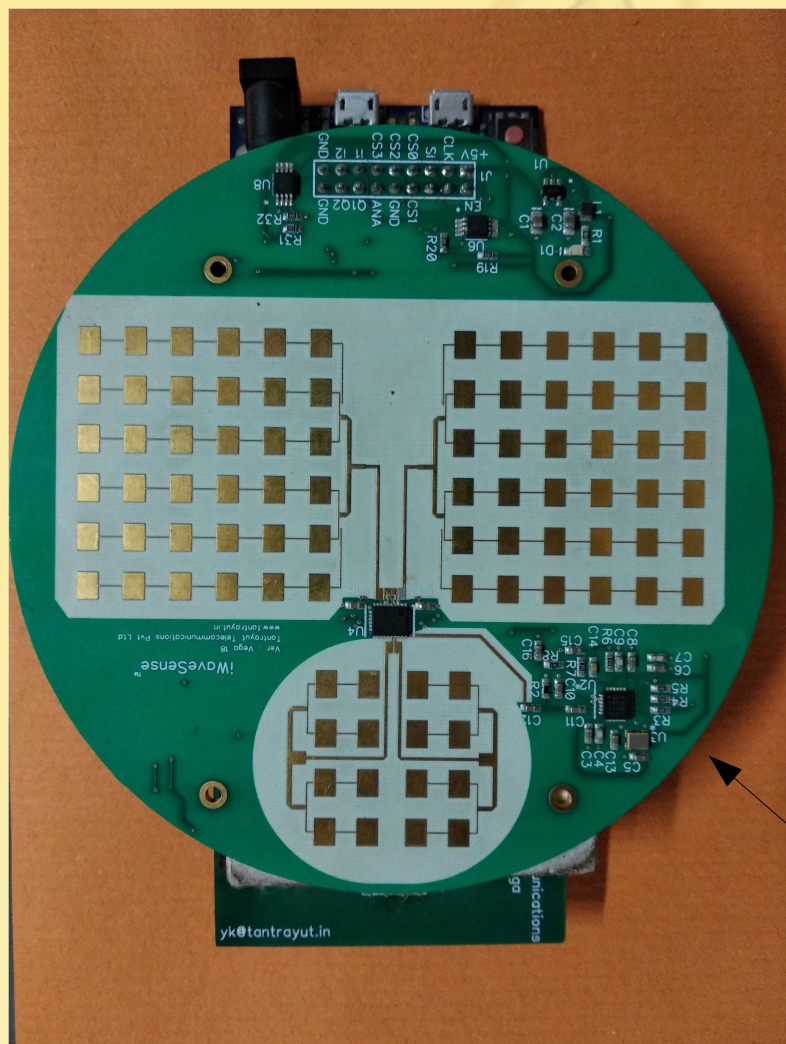


IoT Hardware
Industrial Automation



Our Products

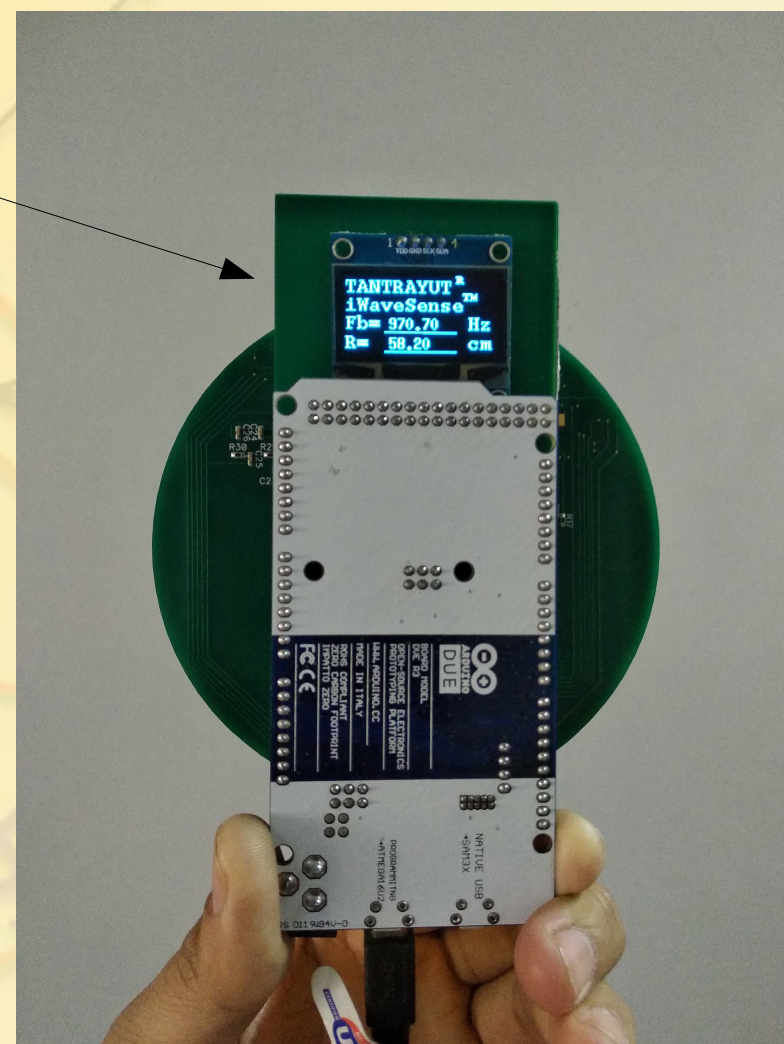
RadarDrishti : 24GHz FMCW Radars



Local Display showing Beat Freq and Corresponding Range.

Tested for ::
Max Range = 20m
Range Error = +/-5cm

2Rx-1Tx FMCW Radar Shield for Arduino DUE





Industrial Testing

RadarDrishti : Ver. Vega

Sensor placed at
an offset distance
from Centre.
This causes
increased clutter.

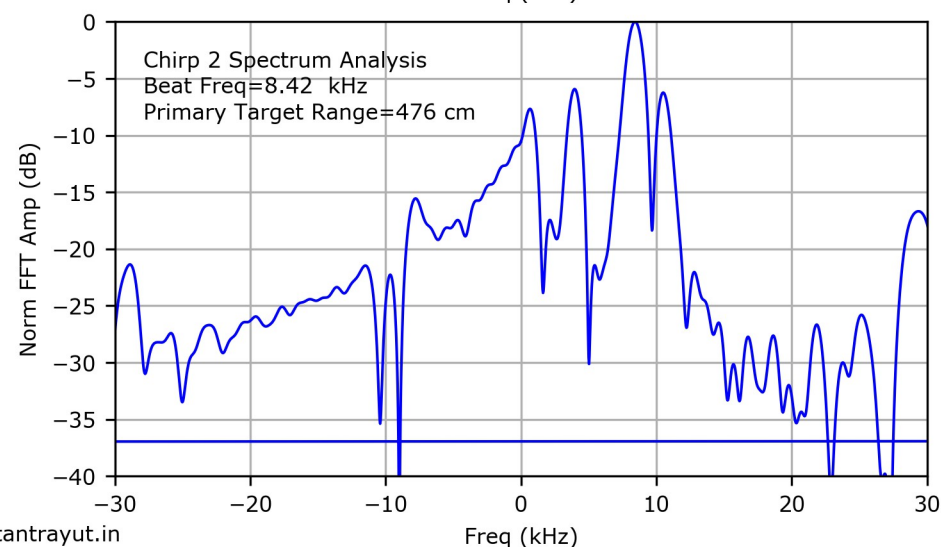
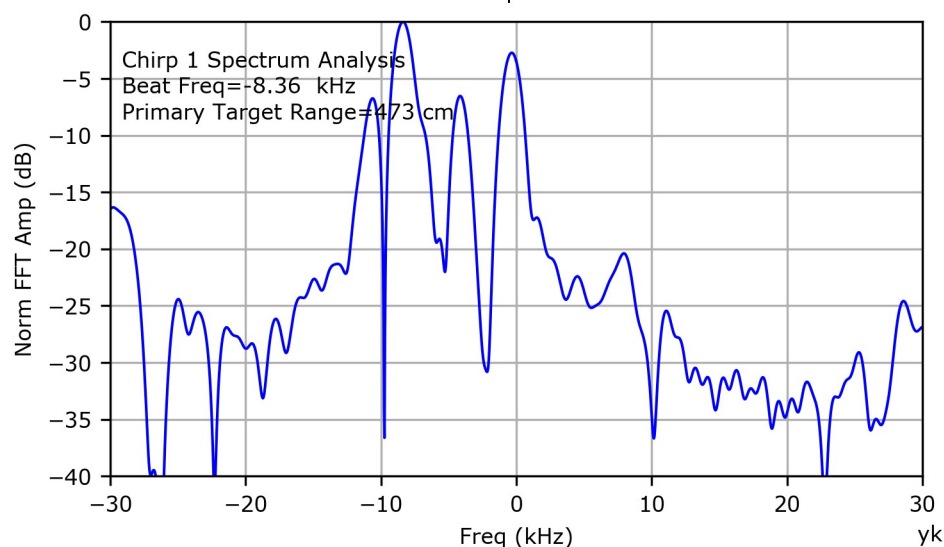
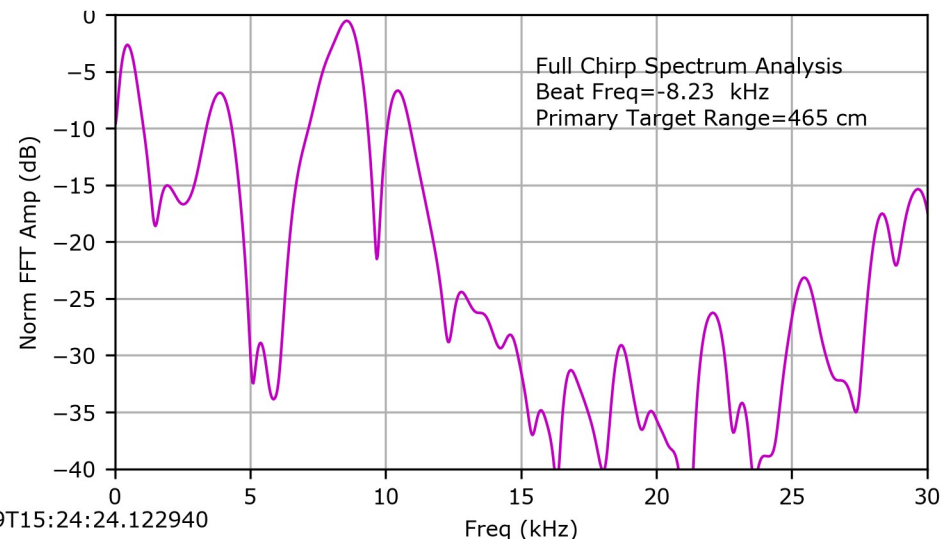
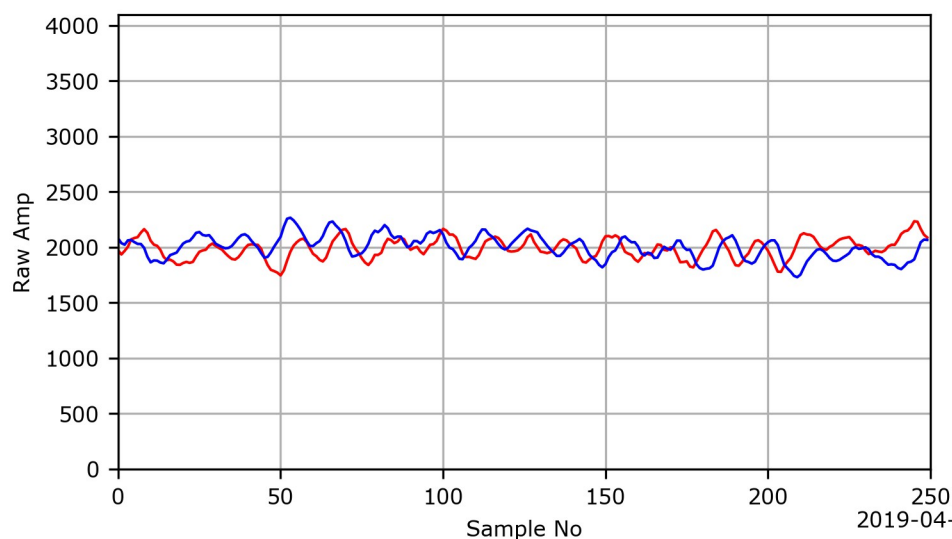
Tested on
Industrial Tank
Contents : Edible Oil

Sensor uplifted to Tank.





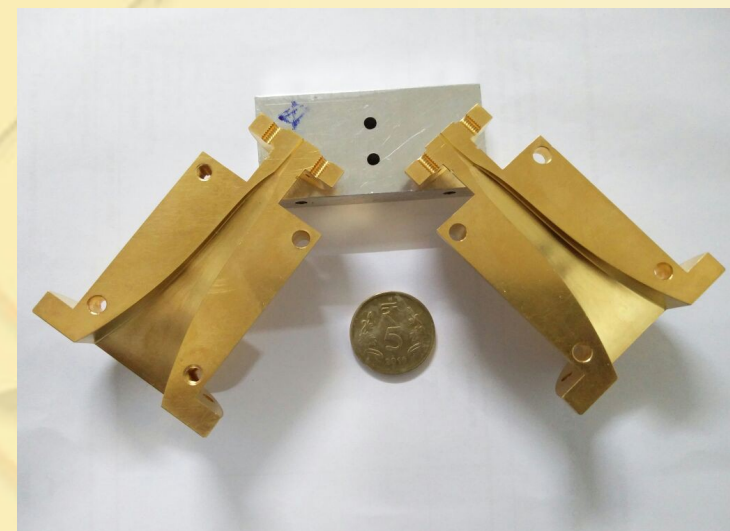
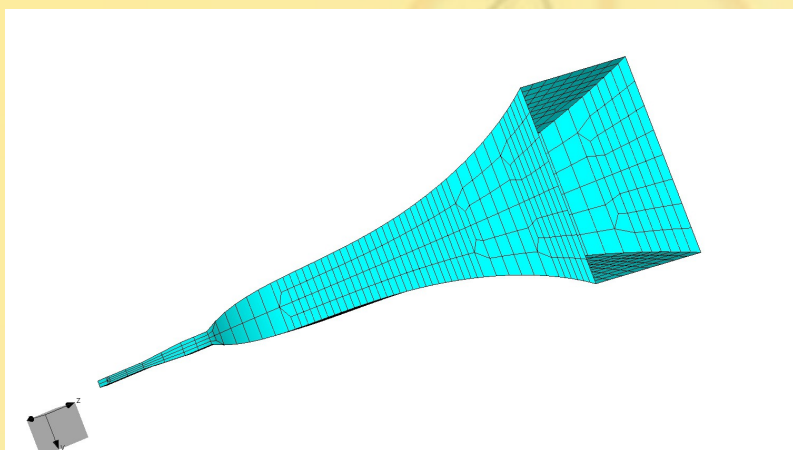
Multi Target Response



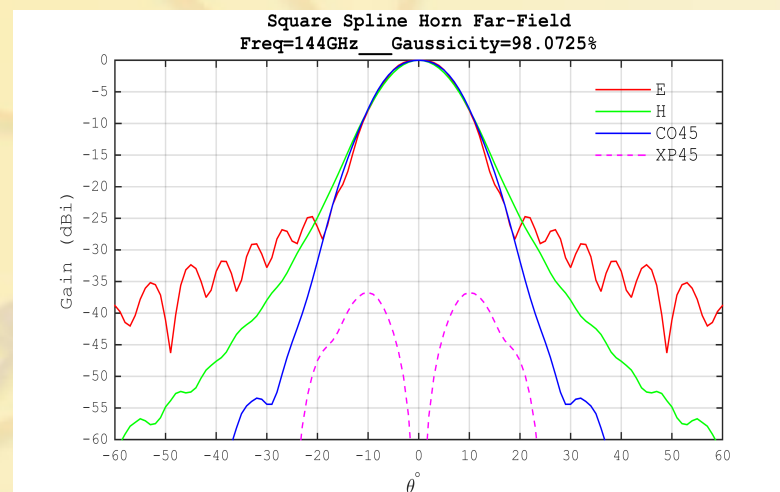


Our Products

Square Spline Horns : Next Gen 5G sub-mm Wave Backhaul



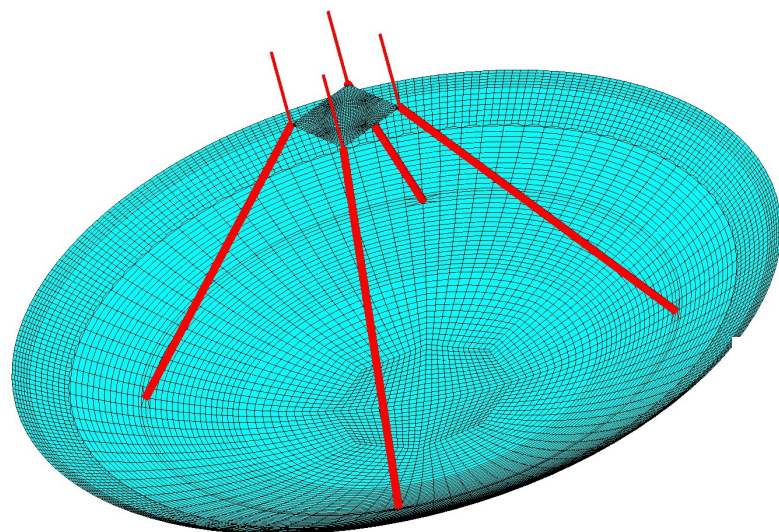
- Performance as competitive as Corrugated Horn but without Corrugations.
- Highly suitable for (> 50 GHz) horn antennas with ease on machining.
- To be published at “2020 International Applied Computational Electromagnetics Society (ACES) Symposium”





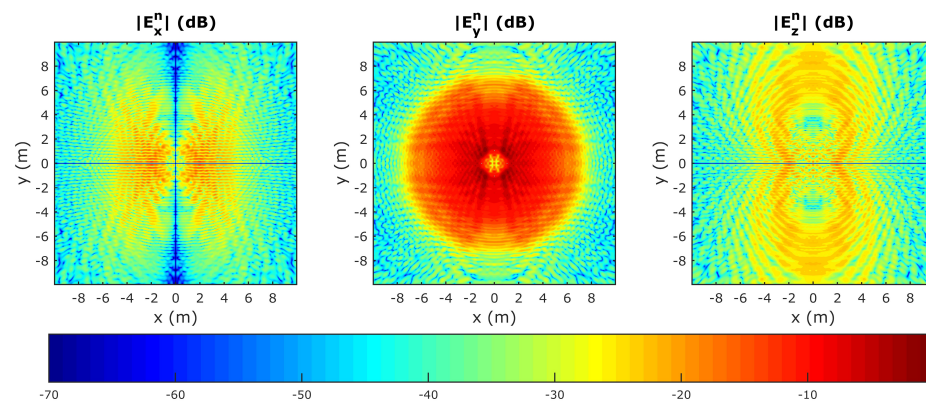
Scientific Instrumentation for Radio Astronomy

A. Competence in Reflector Antennas



NCRA 15m Dish with Blockage

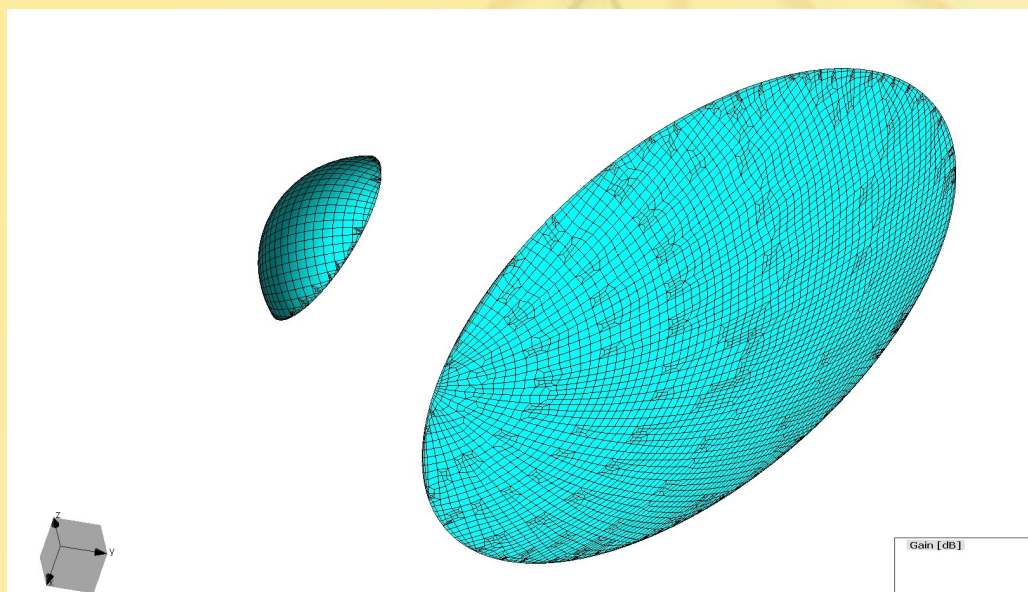
EM Simulated Near Field at Aperture





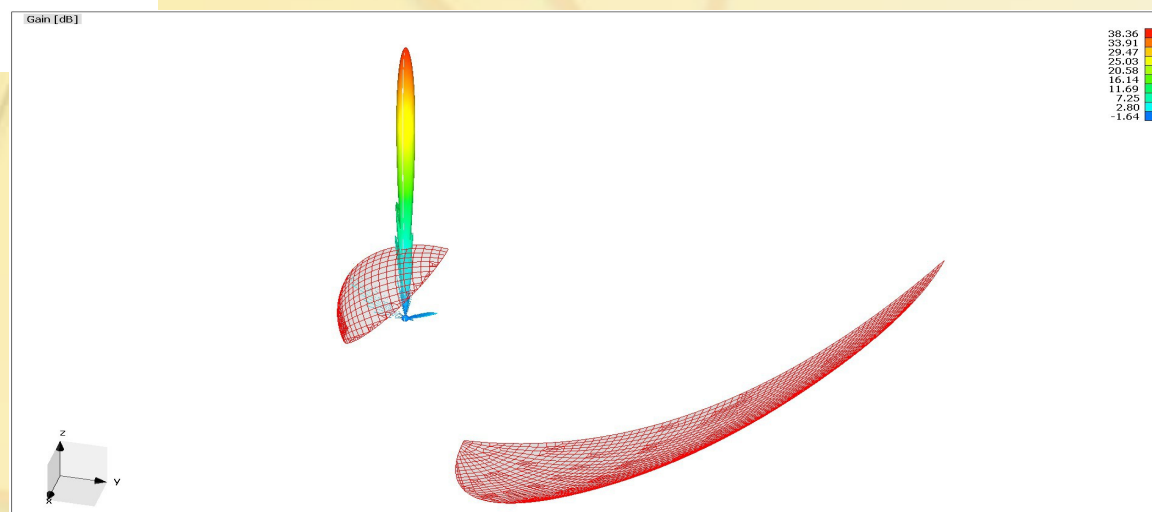
Scientific Instrumentation for Radio Astronomy

A. Competence in Reflector Antennas



EM Modelling of Offset Gregorian
Reflector used in SKA

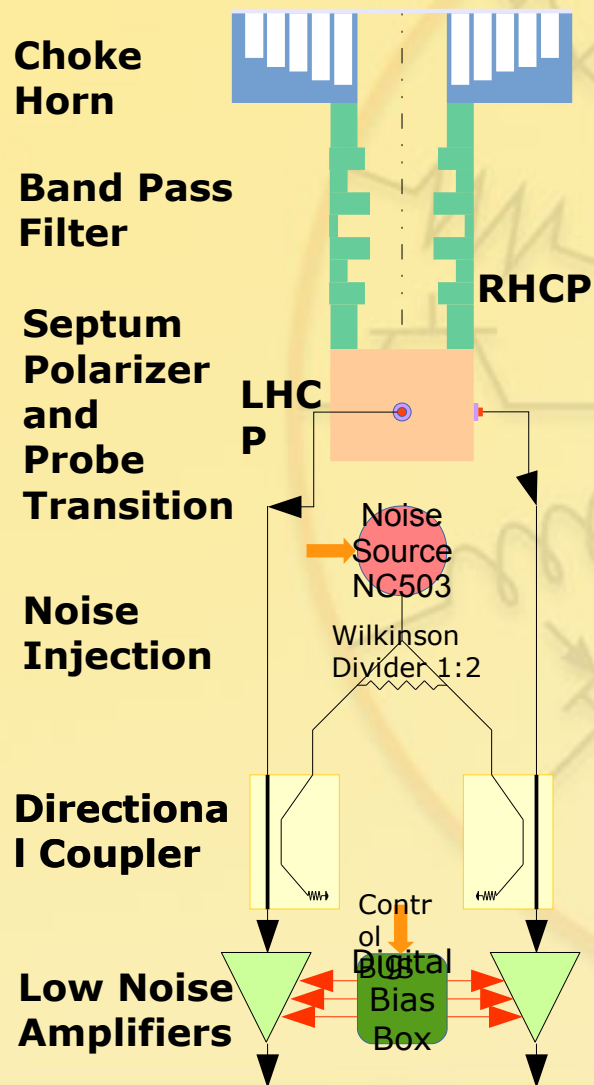
Far-field of SKA dish @ 610 MHz





Scientific Instrumentation for Radio Astronomy

B. Competence in Front End Systems

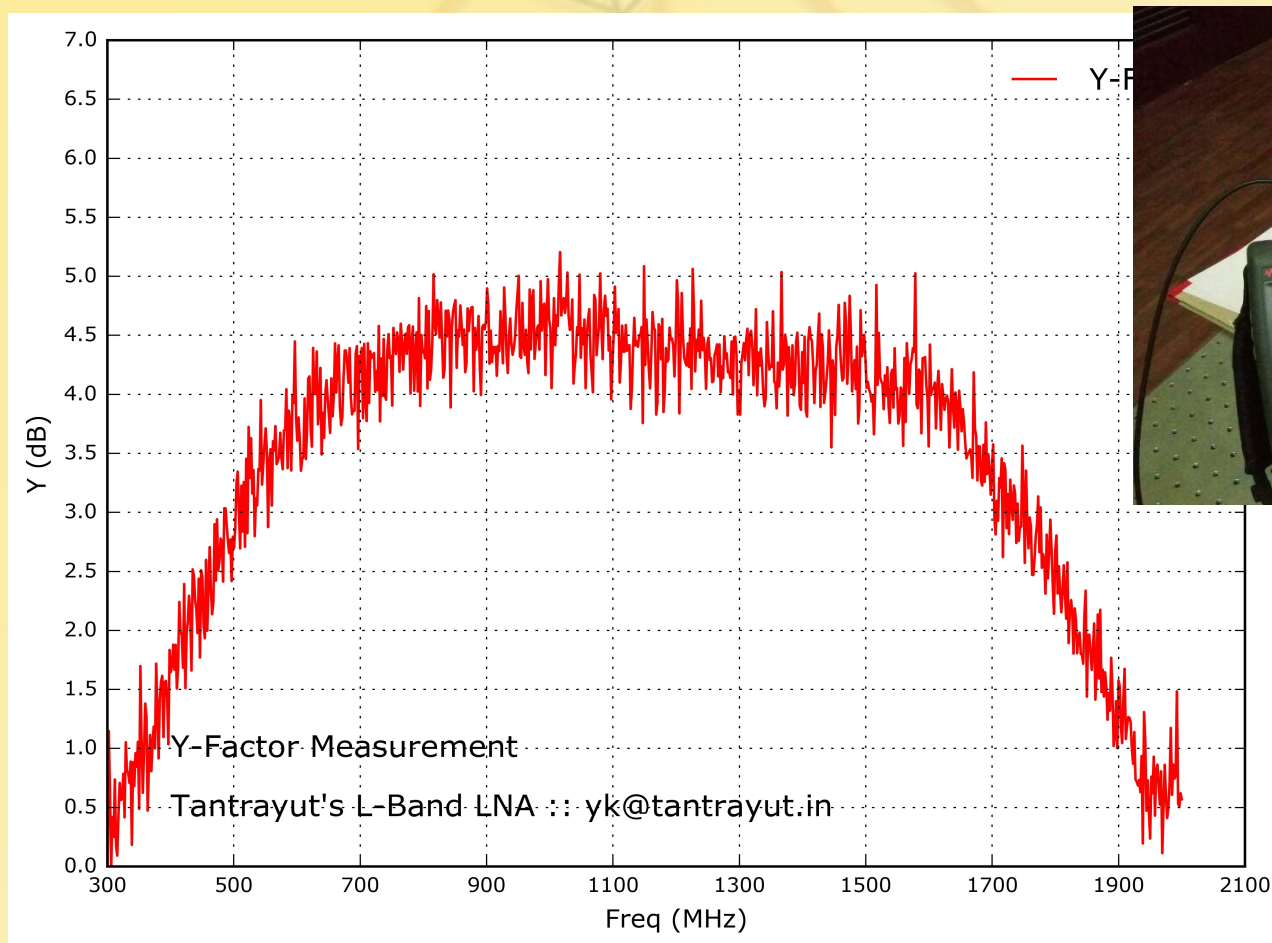


L-band (1050-1600MHz) Front End System delivered to NCRA



Scientific Instrumentation for Radio Astronomy

C. Competence System Modelling and Analysis



- In house development of Room Temp LNAs.
- Digitally Programmable LNA Bias.
- LN2 based Noise Temp estimations.

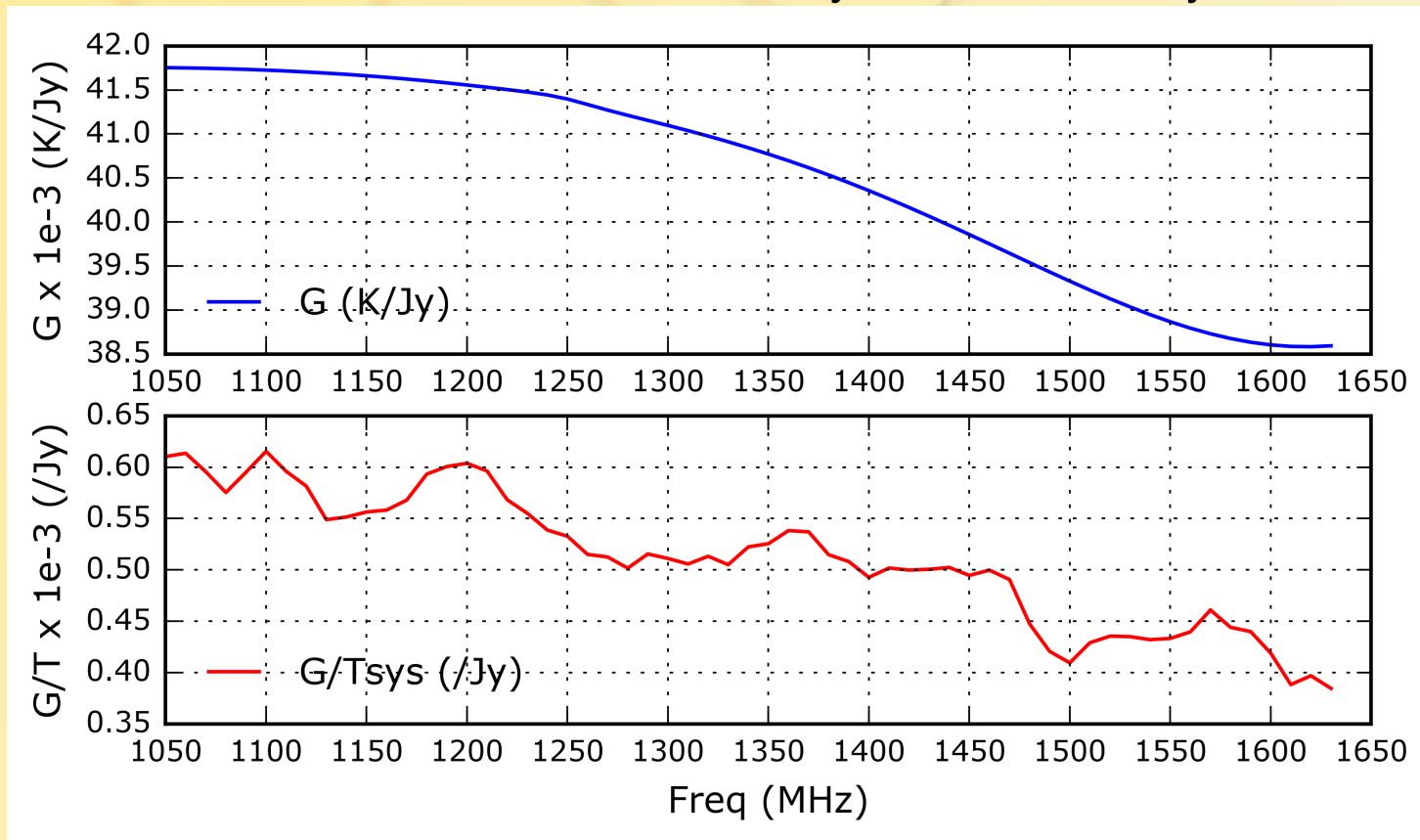


Scientific Instrumentation for Radio Astronomy

C. Competence System Modelling and Analysis

G/Tsys Analysis

NCRA 15m Dish + Tantrayut Front End System

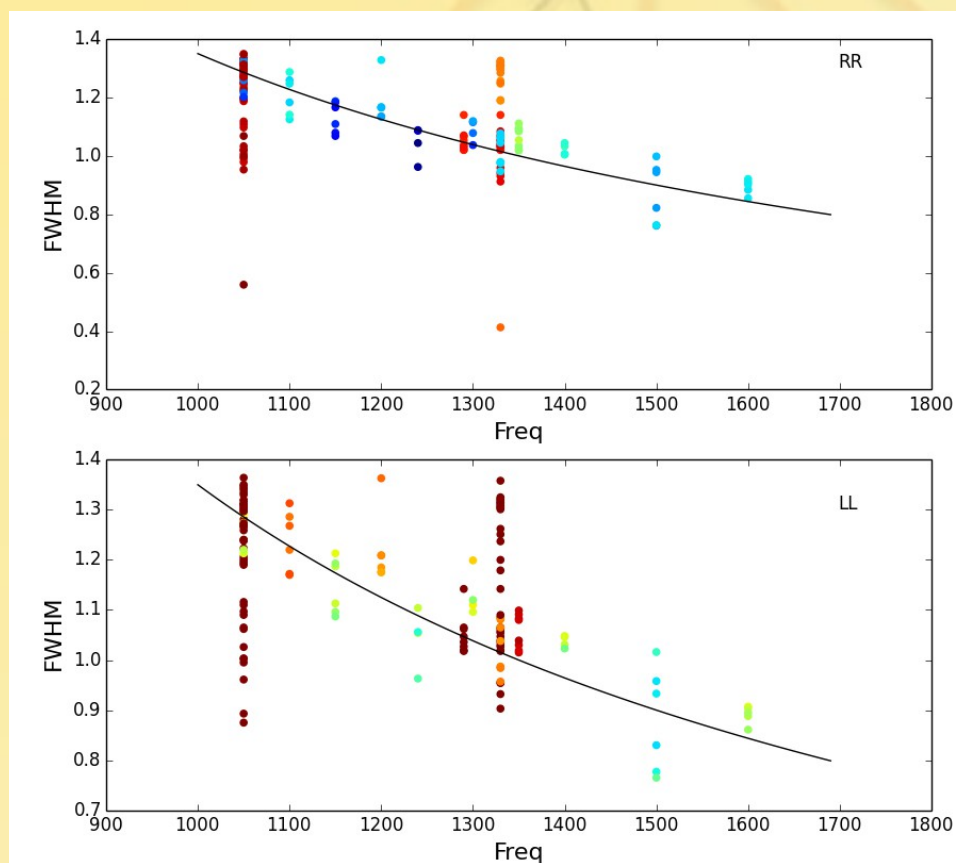


We understand Radio Astronomy Jargon and Engineering Associated with it.

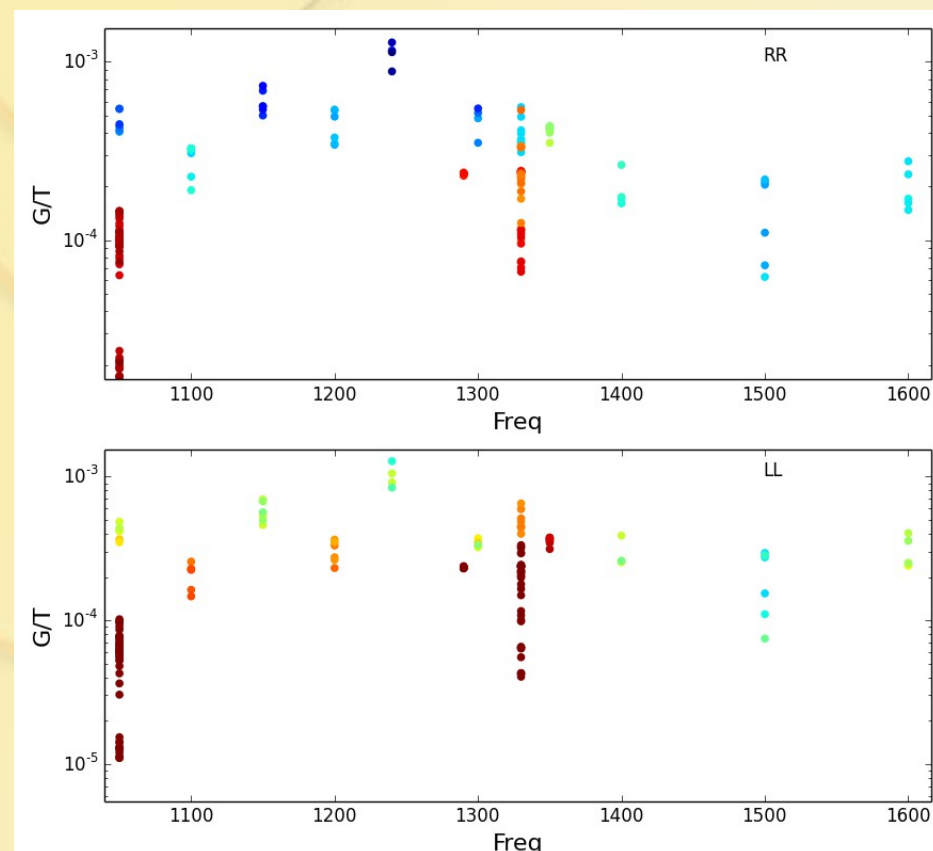


Scientific Instrumentation for Radio Astronomy

C. Competence System Modelling and Analysis



Measured 15m Telescope primary beam vs
Simulated Beam Size



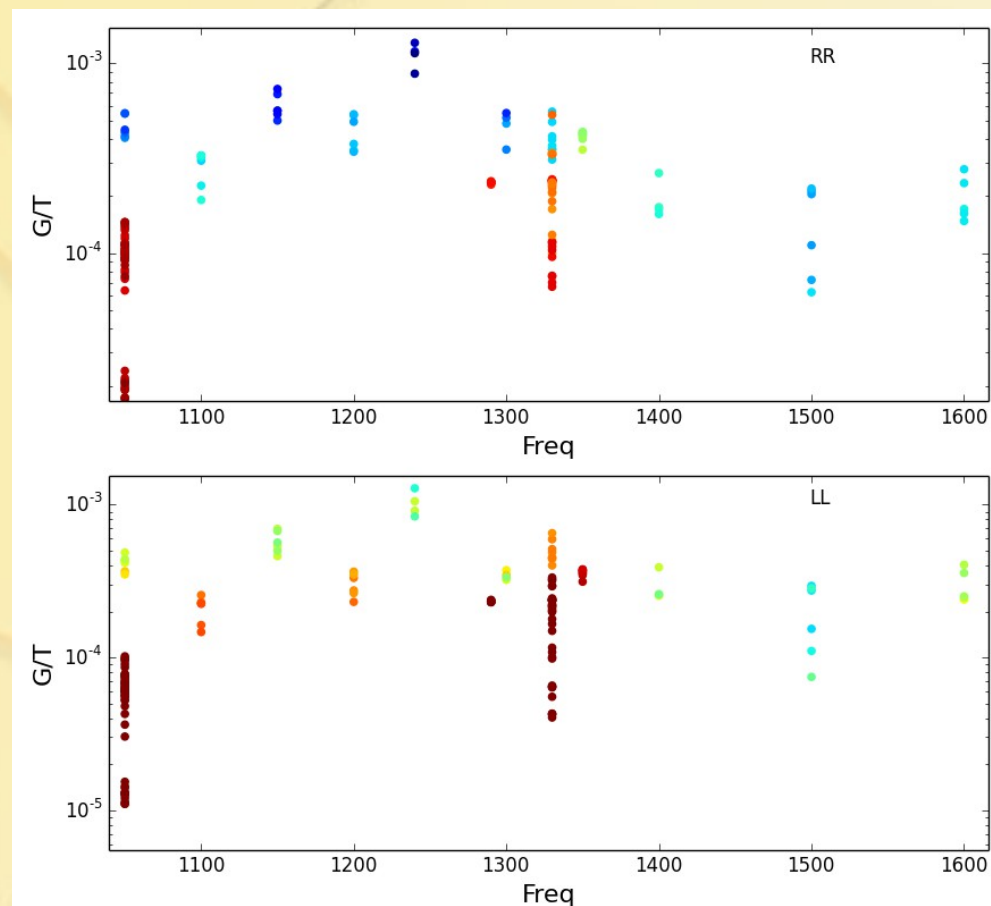
Measured G/Tsys



Scientific Instrumentation for Radio Astronomy

C. Competence System Modelling and Analysis

- Measured values of $G/T_{\text{sys}} \approx 3.4 \times 10^{-4} \text{ Jy}^{-1}$ at 1330 MHz.
- Predicated value of $G/T_{\text{sys}} \approx 5.0 \times 10^{-4} \text{ Jy}^{-1}$
- The deviation in the measured value and predicated is due to the fact that no data is available for mechanical sagging of the dish which causes gain reduction.
- Also the Pointing Error causes further reduction in G/T_{sys} .
- Nonetheless there had been very consistent performance of the system over 2 years with no change in G/T_{sys} .
- Indicating reliable engineering.



Measured G/T_{sys}



Scientific Instrumentation for Radio Astronomy

A proud moment for us


Observations carried out using NCRA 15m Dish with Tantrayut's L-band System resulted in publication.

Monthly Notices
of the
ROYAL ASTRONOMICAL SOCIETY

MNRAS **490**, L12–L16 (2019)

doi:10.1093/mnras/slz140

Super-giant pulses from the Crab pulsar: energy distribution and occurrence rate

Apurba Bera  and Jayaram N. Chengalur
National Centre for Radio Astrophysics, Tata Institute of Fundamental Research, Ganeshkhind, Pune 411007, India

Accepted 2019 August 28. in original form 2019 August 17

ABSTRACT

We present statistical analysis of a fluence-limited sample of over 1100 giant pulses from the Crab pulsar, with fluence > 130 Jy ms at ~ 1330 MHz. These were detected in ~ 260 h of observation with the National Centre for Radio Astrophysics (NCRA) 15 m radio telescope. We find that the pulse-energy distribution follows a power law with index $\alpha \approx -3$ at least up to a fluence of ~ 5 Jy s. The power-law index agrees well with that found for lower-energy pulses in the range 3–30 Jy ms. The fluence distribution of the Crab pulsar hence appears to follow a single power law over ~ 3 orders of magnitude in fluence. We do not see any evidence for the flattening at high fluences reported by earlier studies. We also find that, at these fluence levels, the rate of giant-pulse emission varies by as much as a factor of ~ 5 on time-scales of a few days, although the power-law index of the pulse-energy distribution remains unchanged. The slope of the fluence distribution for Crab giant pulses is similar to that recently determined for the repeating FRB 121102. We also find an anti-correlation between the pulse fluence and the pulse width, so that more energetic pulses are preferentially shorter.

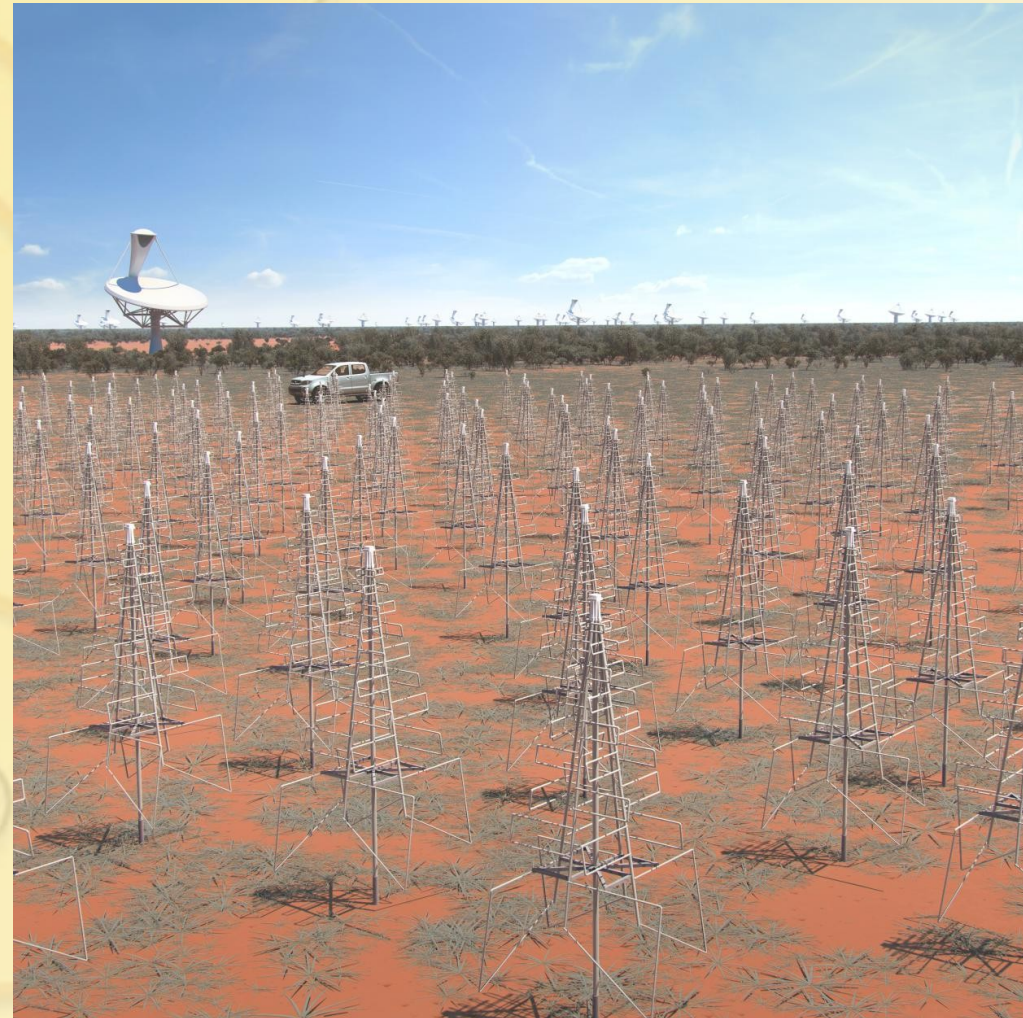
Key words: pulsars: general – pulsars: individual (Crab) – radio continuum: transients.



Expression of Interest for SKA India

Work Package : Low Freq Aperture Arrays

- Given our background, we express interest in LFAA Antenna + LNA Assembly.
- Would like to explore design documents available at CDR stage.





Thank You

