Wideband Single Pixel Feeds

DVA-1 Project

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TDP Broadband Feed Development Goals

• Research and prototype feeds with bandwidths up to 10:1 with high performance when mounted in reflector antennas.

• Develop matching wide band LNA’s closely integrated with the corresponding feed.

• Develop supporting cryogenic cooling methods and designs.

• Other research groups pursuing similar goals.
Baseline Frequency Coverage Plan

• Cover .3 to 1.5 GHz with an uncooled feed with cooled LNA
  1. Low frequency feed is too large to cryocool
  2. Thermal transition on transmission line challenging

• Cover 1.5 to 10 GHz with a completely cooled feed / LNA
  1. All cryocooled practical at higher frequencies

• PAF mounted at prime focus with interchange mechanism
Figure 1: Receiver for 0.5 to 3 GHz in lab at Caltech prior to installation for tests on a 34m radio telescope at Goldstone during summer 2005. The key components of the receiver shown at right are the wideband quad-ridge feed and a long-life cooler to cool the low noise amplifiers to 50K.
Cal Tech Feed / LNA Update

• Three “Lindgren” style feeds built & measured, feed patterns measured both open and in a dewar can, two installed on the GAVRT antenna.
• Data posted to feed pattern data base.
• Continued development of differential LNA’s matched to feed characteristics.
• Improved versions are under construction, both in LNA interface and in radiation pattern.
ATA Log-periodic Feed
ATA Log-periodic Feed
ATA Log Periodic Update

• Original design modeled in CST and calculated patterns included in TDP feed pattern data base.

• Two versions of an improved feed are almost finished. One will be tested at Cal Tech and one at ATA facilities.

• The new ATA version will be housed in a glass dewar and cryocooled. It also has a redesigned feed to LNA connection.

• The new Cal Tech version will be housed in a metal dewar and cryocooled. Also has improved feed to LNA connection.
The Ultra Wide Band QSC Feed
300 MHz to 3 GHz Prototype

Truncated Ground plane to 500 MHz for Initial testing:
low frequency extension straightforward
QSC Feed Update

- Original model measured at Satimo and pattern data posted to the data base.
- Second version designed and model patterns calculated both with and without a simulated dewar can.
- Pattern data posted to data base.
- Design work under way on a higher gain version and for other frequency bands.
Broadband Feed Trade Off & Risk Mitigation

- DVA-1 will provide a test bed to evaluate wide band feeds.
- One (or more) corrugated horns will be mounted and tested in DVA-1.
- Combined with pricing for receiver packages these results will inform tradeoffs between performance, frequency coverage and cost.
- Input from calibration and processing will be critical in evaluating feed options.