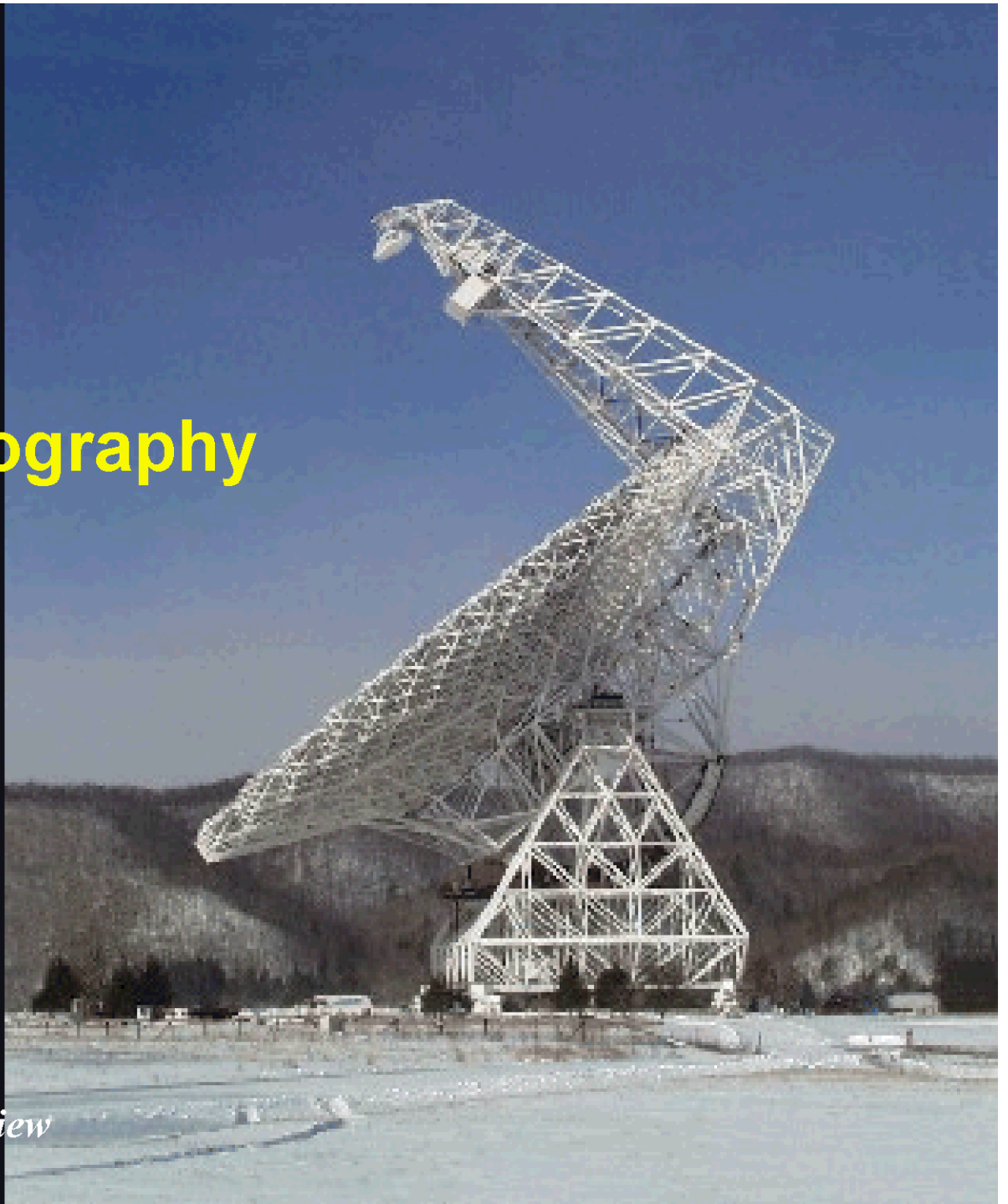


# “Traditional” Holography

Ronald J. Maddalena

*GBT PTCS Conceptual Design Review  
April 8/9, 2003 Green Bank*

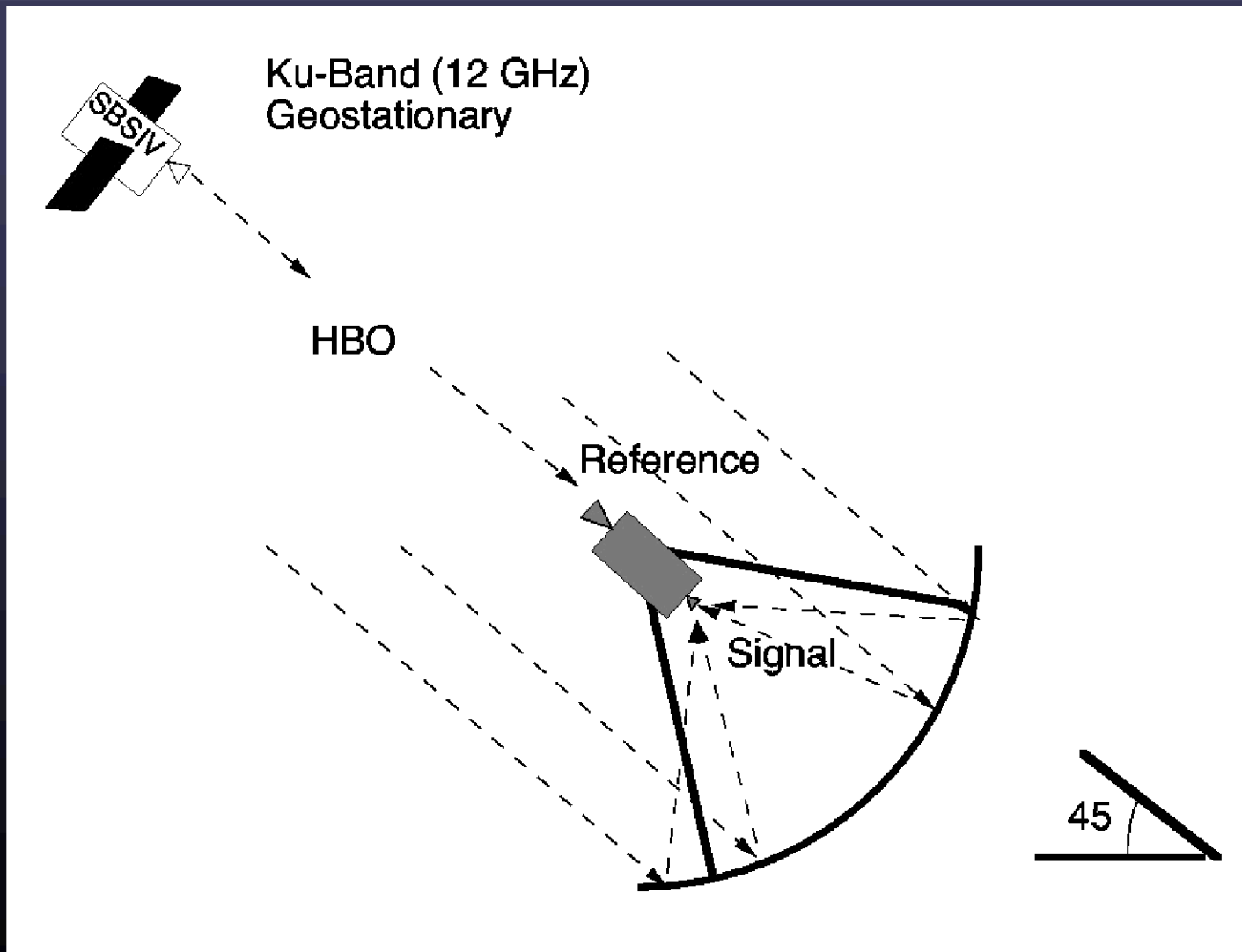




- Gregorian “Signal” receiver
  - Prime focus mount not suitable for holography
  - Combines the errors from primary and secondary
  - Special purpose 12 GHz receiver
- “Reference” receiver mounted at the tip of the feed horn
  - Except for gain, a clone of signal receiver
  - Special cables to keep relative phases stable
  - 30-cm diameter feed horn provides sufficient collecting area
- Special-purpose correlator
  - Used in 1992 for measuring the OVLBI antenna



# What Do We Observe

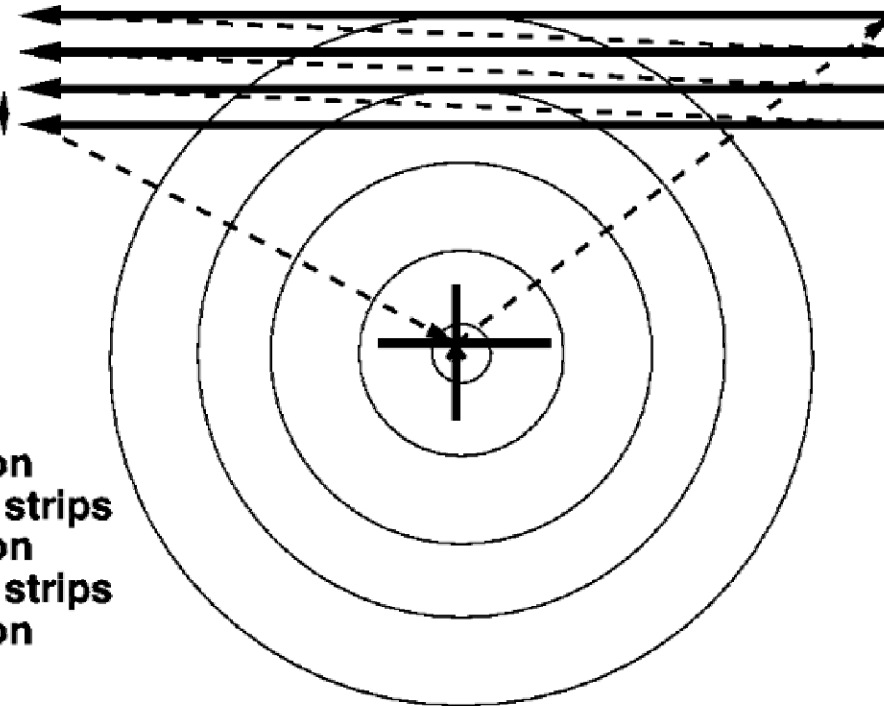


# How Do We Observe?

Wavelength / D  
 □ or  
 Beamwidth / 2

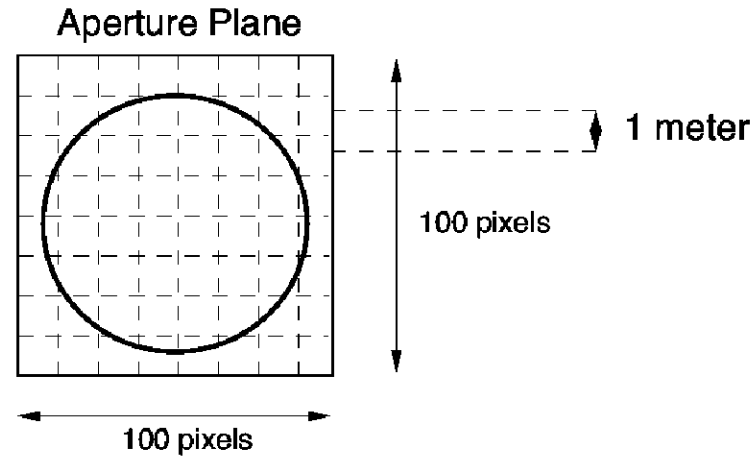
- (1) Point
- (2) Focus
- (3) Calibration
- (4) Do some strips
- (5) Calibration
- (6) Do some strips
- (7) Calibration
- (8) etc.

Repeat Point and Focus whenever needed.

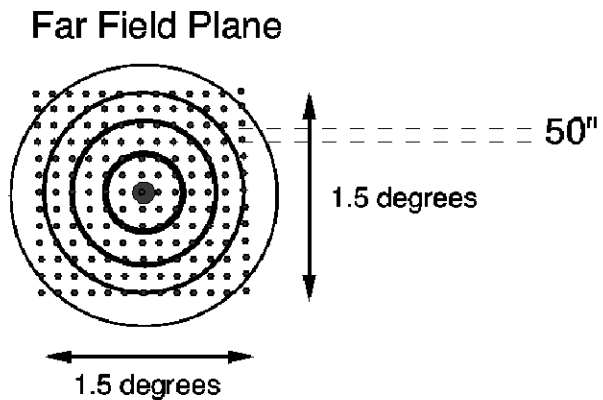


Far Field Plane

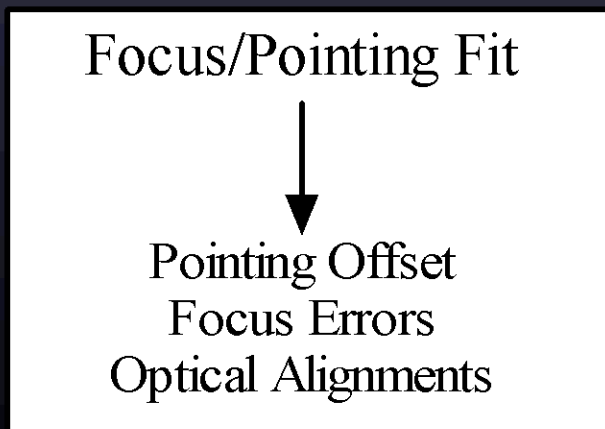
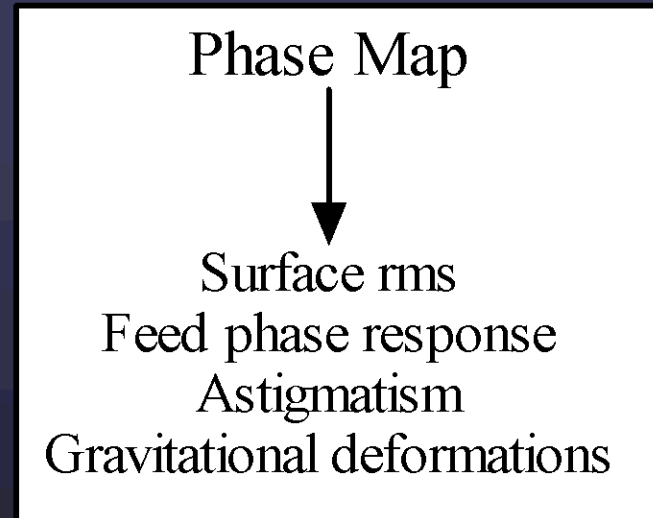
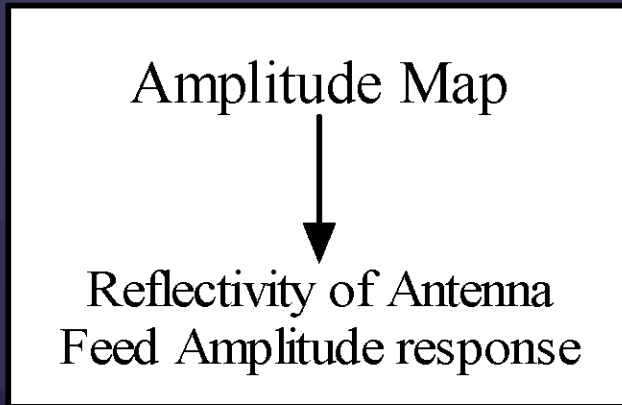
# Map Size



GBT: For 1-m resolution,  
N and M = 100,  
□ beamwidth = 100"  
size = 1.5 degrees



# Products





## Experiment to Determine Panel-to-Panel Errors

- 200  $\mu\text{m}$  rms surface accuracy  $\triangleright$  50  $\mu\text{m}$  rms measurement accuracy.
- Elevation =  $45^\circ$ 
  - Where the best 12 Ghz geostationary satellites are located.
  - Near the rigging angle
- $\frac{1}{2}$  m resolution
  - 200 x 200 pixel,  $3^\circ$  x  $3^\circ$  map
  - About 1 dozen pixels per panel
- Mapping time  $\sim$  4 hours, including overhead
  - 50 msec sampling time (6x oversampling)
  - $3^\circ$  / min slew rates



## Experiment to Determine Large-Scale Errors

- 50  $\mu\text{m}$  rms measurement accuracy.
- Wide range of elevations
  - Methanol masers (  $\sim 1\text{kJy} \times 15\text{ kHz}$  )
  - Same receiver and hardware as for panel setting
- 5m resolution
  - 20 x 20 pixel, 20' x 20' map
  - 7 panels per pixel
- Mapping time  $\sim 30$  min
  - 0.5 sec sampling (6x oversampling)
  - 0.3 deg/min slew rate





## What Has Been Tested?

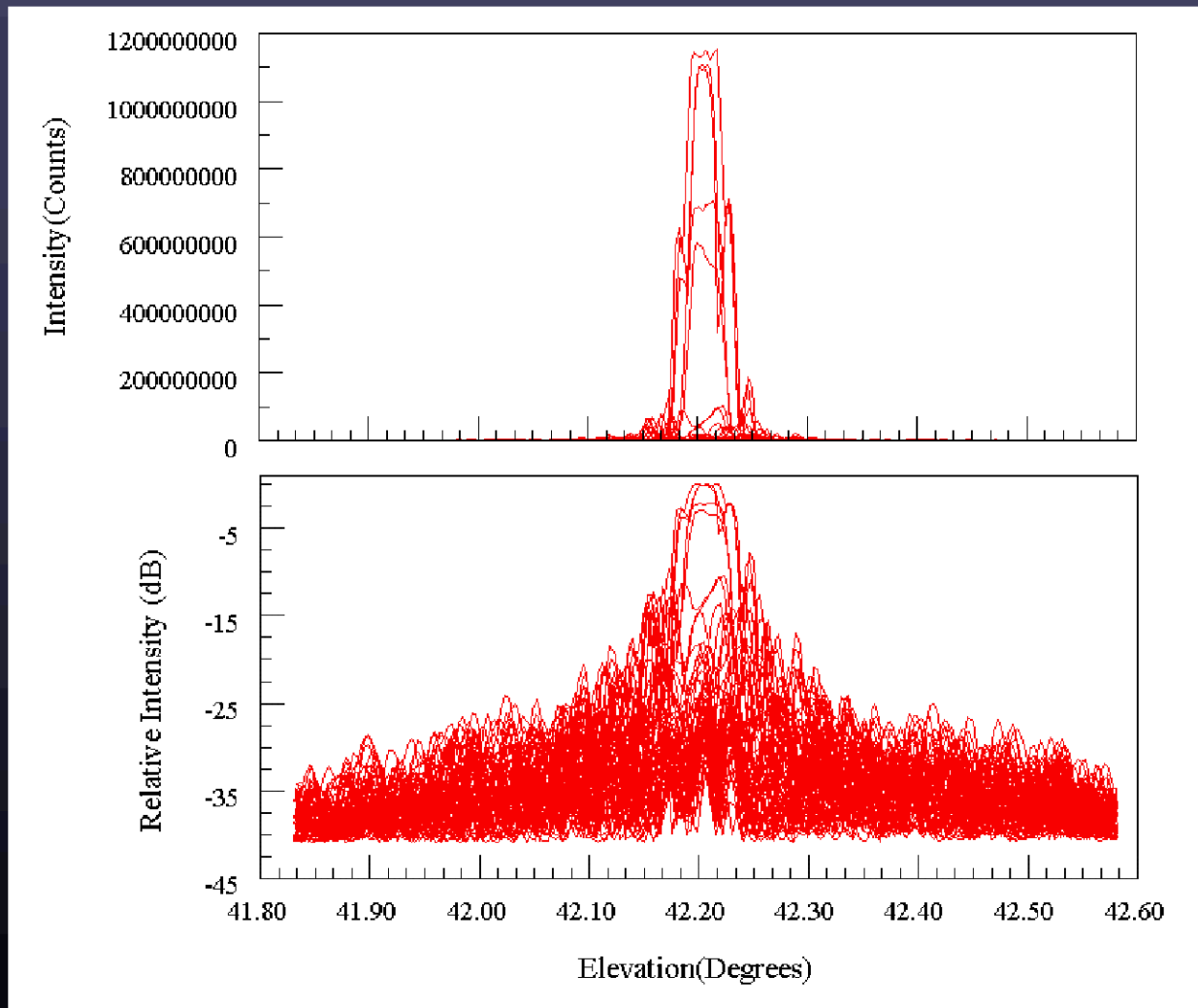
- Correlator – OVLBI Holography experiment in 1992
- M&C Software – 140-ft experiment in 1999
- Analysis Software – Various experiments
- GBT I.F. System – 1998-1999
- GBT Holography receiver – April 2002
  - Miscellaneous problems including I.F. saturation
  - Sufficient signal-to-noise and long-term phase stability



## Next Step...

- When do we start:
  - May 2003
- Map types
  - Panel-to-panel, high resolution maps
  - Some large-scale maps
- Expected Problems
  - Pointing & feed arm sway
  - Temperature changes during a map
- Problem Mitigation
  - Multiple maps to beat down the introduced pointing “noise”
  - Extra overhead to allow time for feed arm to damp out
  - Observe on calm, overcast nights

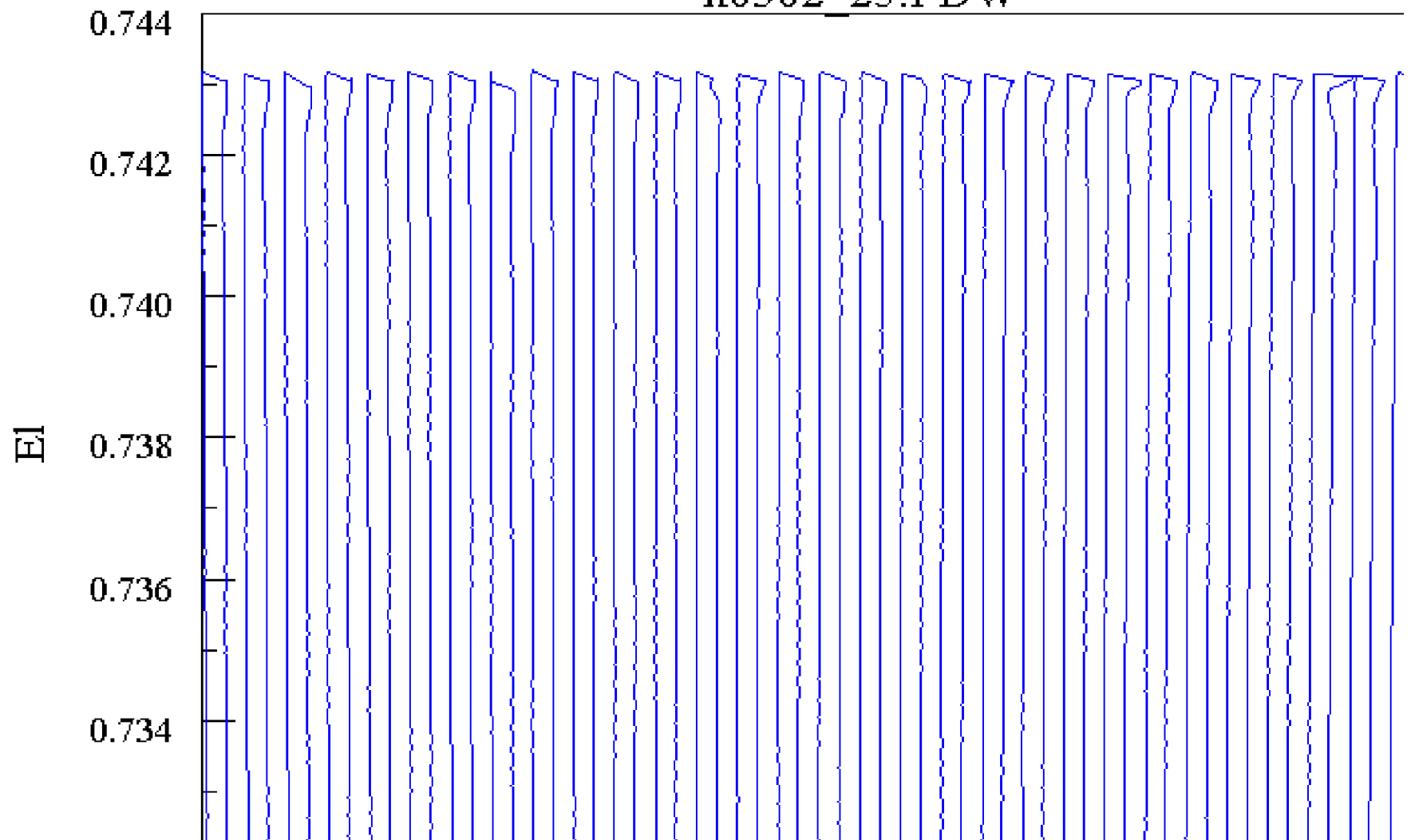
# Saturation



# Pointing



h0302\_25.PDW



# Phase Stability

