

GBT Holography

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Outline



- What we know
- What we need to improve upon
- Aim of Holography
- Why we need multiple Holography experiments
- Plans for Out-of-Focus holography
 - A preview...
- Plans for Traditional Holography



Telescope Efficiency

- Repeatability (Gravitational) Focus Tracking
 - Subreflector Axial Position
 - Require an accuracy of 1-3 mm in Y_s
 - Currently known to ~ 10 mm
 - Subreflector Lateral Shifts
 - Require an accuracy of 3-6 mm in X_s and Z_s .
 - X_s currently known to ~ 10 mm
 - Z_s has yet to be determined due to limitations in subreflector motion.
 - Subreflector Tilts
 - Require an accuracy of $6'$ in X_t , Z_t
 - Currently known to $10'$

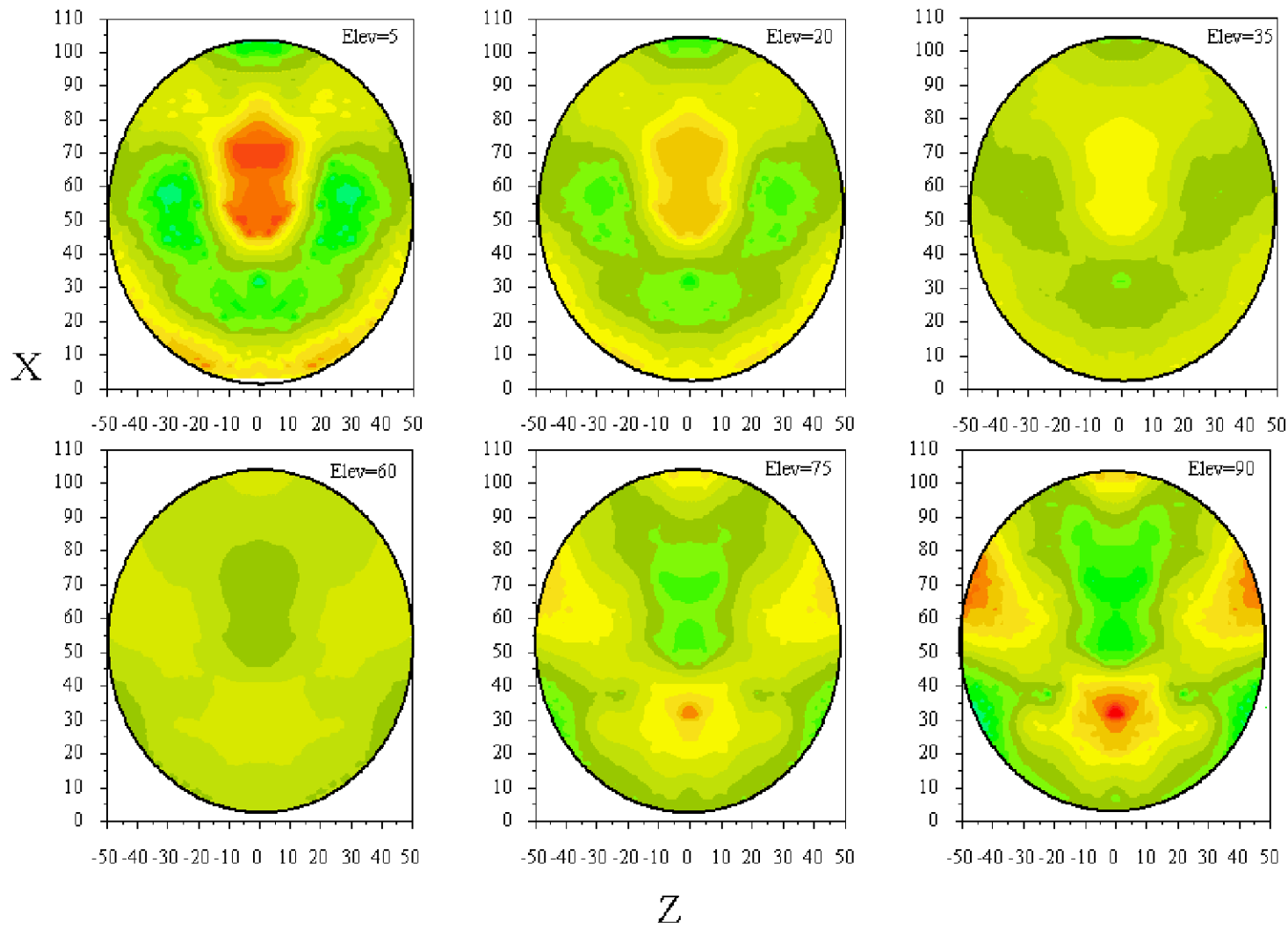


Telescope Efficiency

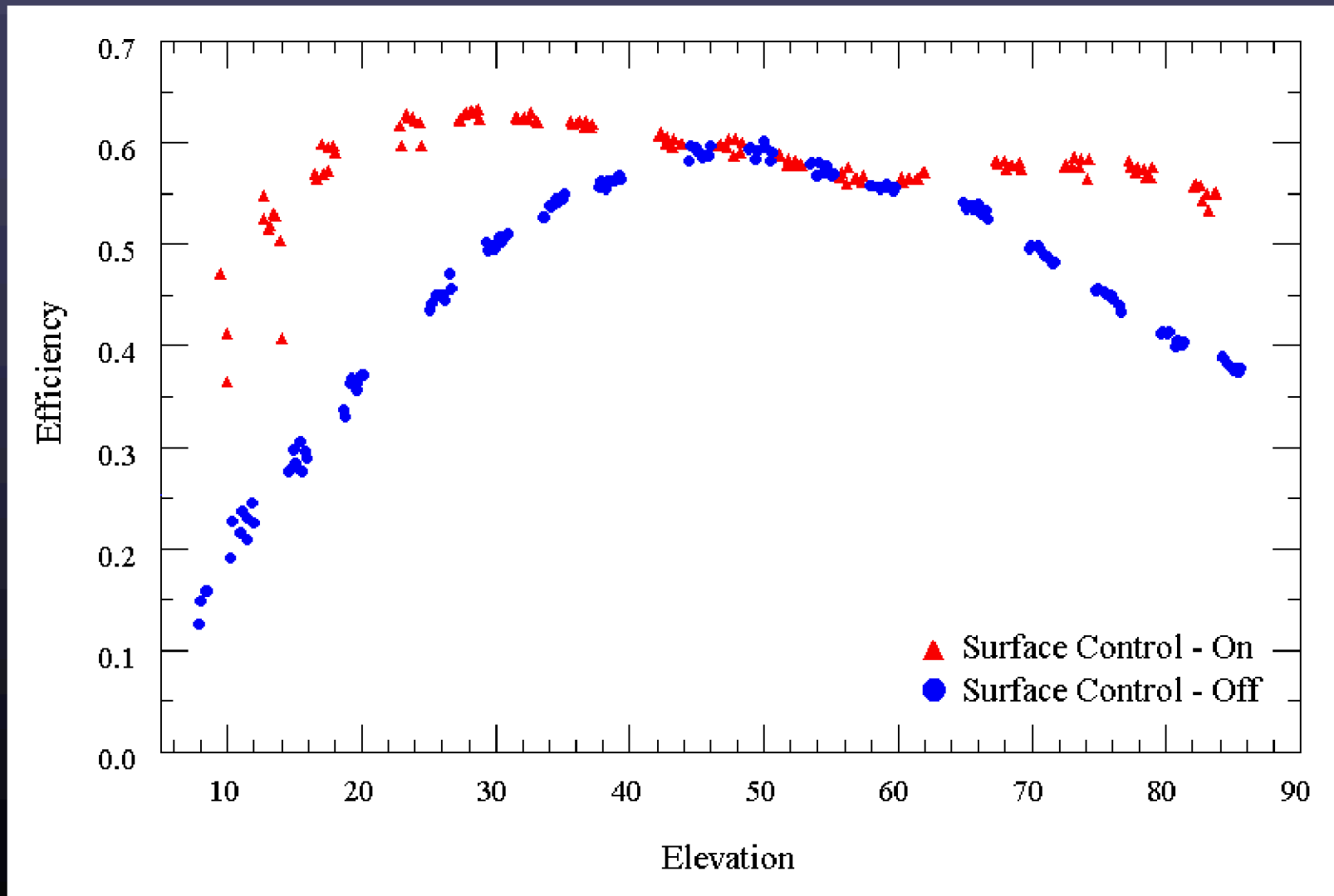
- Repeatability (Gravitational) Large-Scale Surface Errors
 - Require 200 μm
 - 1.2 to 1.5 mm without FEM active surface
 - Probably 450 μm with FEM active
 - 70% at 2 GHz, 60% at 20 GHz, 35% at 42 GHz
 - FEM scale factor is currently assumed.
 - Projection to normal calculation may be wrong
- Small-Scale errors
 - Unknown magnitude
 - Probably the same at all elevations.



Current FEM Model



Efficiencies at 20 GHz





Aim of Holography

- Flatten efficiency curve
 - Improve Focus tracking
 - Determine FEM scale factor, projection to normal
 - Measure and fix large-scale distortions not predicted by FEM
- Raise high-frequency efficiencies
 - Improve Focus tracking
 - Determine FEM scale factor, projection to normal
 - Measure and fix small-scale surface errors



Types of Holography Experiments

- Phase-retrieval Holography
 - Requires very high signal-to-noise
- Out-of-Focus Holography
 - Large-scale errors
 - Focus tracking
 - Multiple elevations
 - No special hardware
- “Traditional” phase-reference holography
 - Large and small scale errors
 - Focus tracking
 - Small-scale errors can probably be measured over a small range of elevations. Maybe large-scale errors at multiple elevations.
 - Requires special hardware