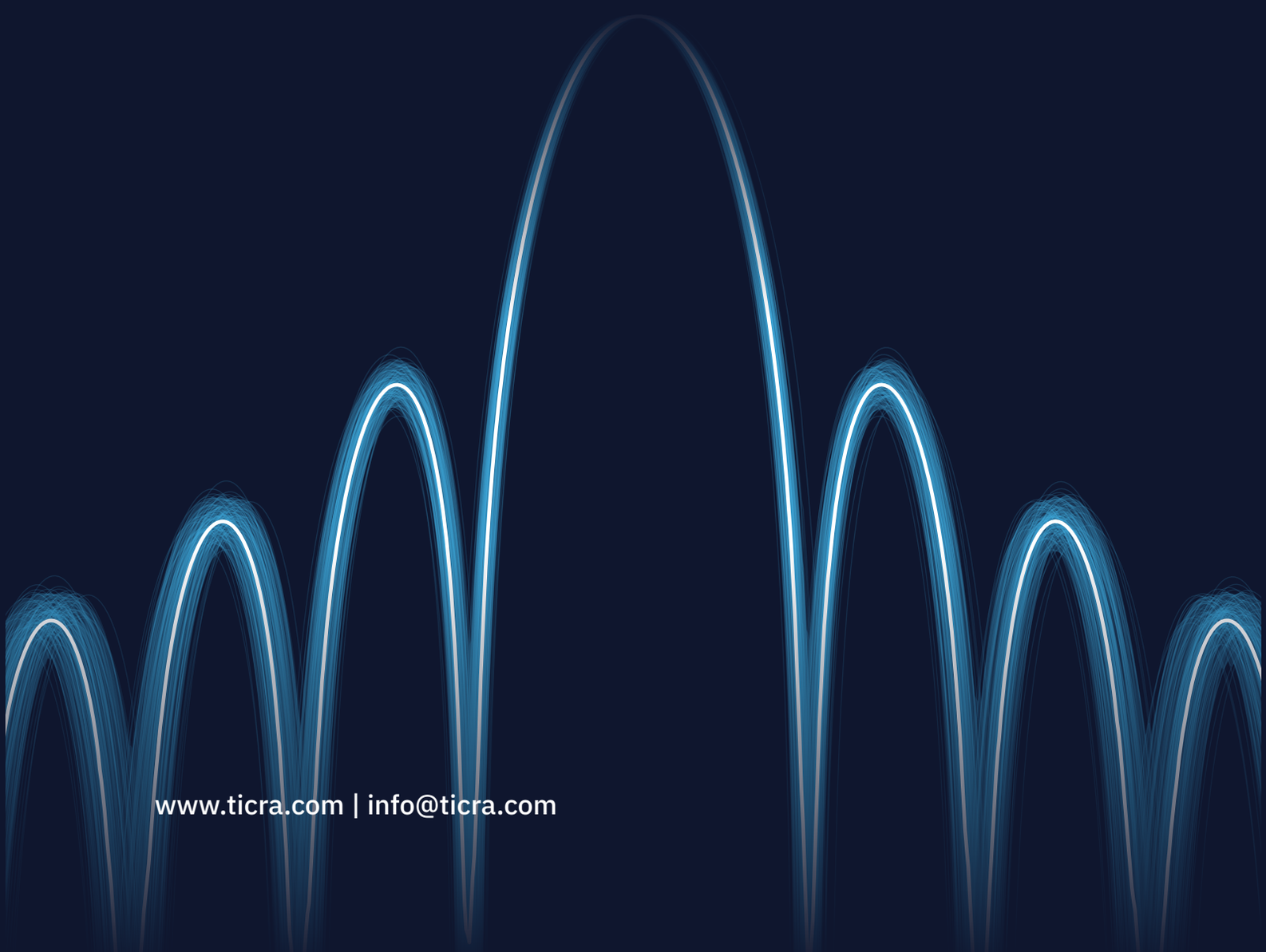
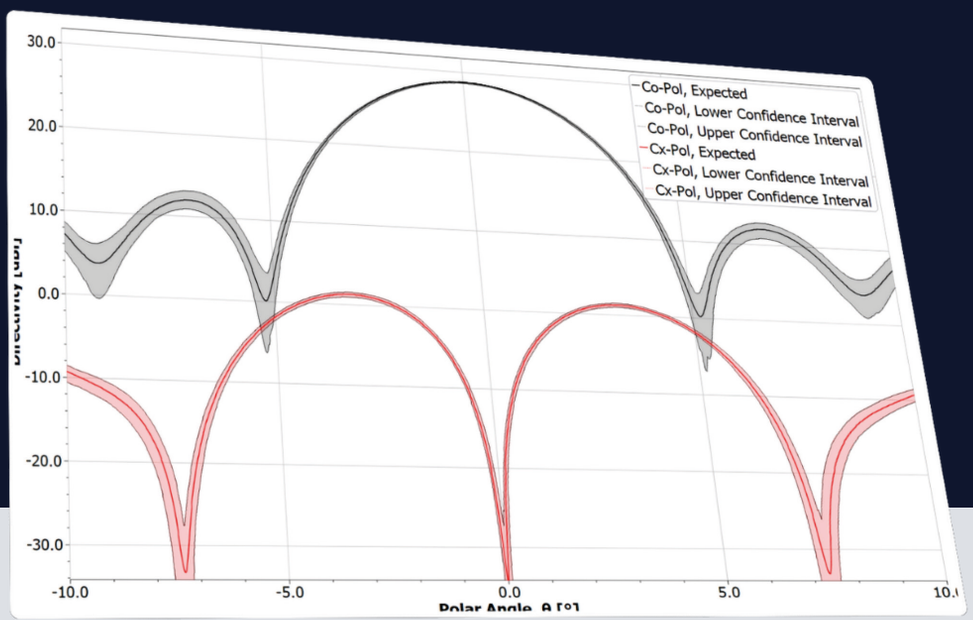
TICRA

UQ

Quantify the uncertainty of your antenna performance: predict expected behaviour and confidence intervals from manufacturing tolerances, alignment and excitation errors.



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Design Robust Antennas with Confidence

Every antenna is built with manufacturing tolerances, assembled with alignment errors and operated with excitation errors. Understanding how these uncertainties affect performance is crucial input for ensuring sufficient margins without overdesigning the antenna.

UQ adds uncertainties on any design parameter to the usual design process, and returns the expected performance, confidence intervals and probability distributions for key parameters such as peak directivity.

Sobol indices show how much each parameter contributes to the total uncertainty, so tolerances can be focused where they matter.

From design tolerances to confidence intervals

PRODUCT CAPABILITIES

- Simulate expected performance with confidence intervals for radiation patterns and S-parameters
- Include uncertainty in any parameter, from manufacturing tolerances to alignment and excitation errors
- Quantify uncertainties with Accelerated Monte Carlo, Stochastic Collocation and Polynomial Chaos Expansion
- Identify the most critical parameters with Sobol indices
- Run sensitivity analysis

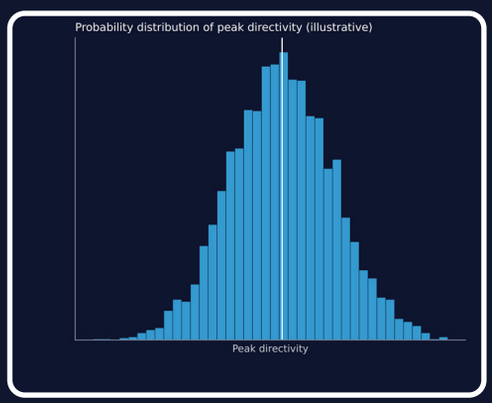
KEY TECHNICAL HIGHLIGHTS

- Accurate uncertainty estimates in a reasonable time
- More general and powerful than sensitivity analysis in competing tools
- Real Variables and Bulk Variables in TICRA Tools supported
- Uncertainty from any one parameter or group of parameters
- Probability distributions for key parameters
- Works with GRASP, ESTEAM, CHAMP 3D, QUPES and POS

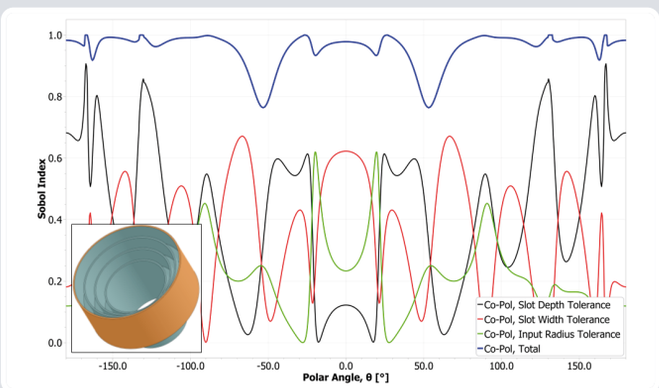
Why UQ and TICRA?

Conventional tolerance studies either assume worst-case values, which is fast but conservative, or run brute-force Monte Carlo simulations, which is slow. UQ uses a higher-order approach that gives accurate estimates in a reasonable time.

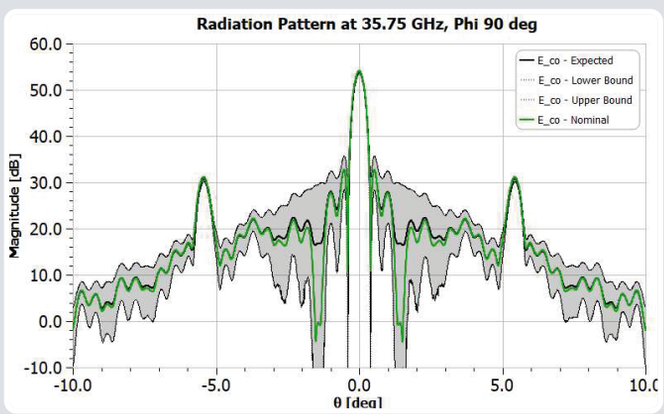
UQ builds on the dedicated EM methods in each TICRA Tools product, so uncertainty analysis is feasible for simple and advanced antenna systems alike.



Deployable reflector for NASA JPL's INCUS mission. 35.75 GHz, fed by seven feed horns. UQ showed that out-of-plane node uncertainties affect performance far more than in-plane ones, mainly in the sidelobes rather than gain and pointing.



Sobol indices for a corrugated horn: contributions of slot depth, slot width and input radius tolerances.



Confidence intervals calculated in rapid time through higher order uncertainty quantification algorithms.

Technical highlights

UNCERTAINTY SOURCES

- Manufacturing tolerances
- Alignment errors
- Excitation errors
- Surface distortions
- Material parameters

ANALYSIS OUTPUTS

- Expected radiation patterns
- Confidence intervals
- Probability distributions
- Sobol indices
- Sensitivity data

DESIGN BENEFITS

- More robust antenna designs
- Fewer design iterations
- Better antenna prototypes
- Tighter margins without overdesign
- Better measurement correlation

Integration with TICRA Tools

UQ works with every antenna product in TICRA Tools: GRASP for reflector systems, ESTEAM for scattering and installed performance, CHAMP 3D for feeds and waveguide components, QUPES for quasi-periodic surfaces, and POS for shaped reflectors and arrays.

Uncertainty analysis uses the dedicated EM methods of each product, giving one consistent environment from nominal design to robust, validated antenna performance.

Get in touch

Advance your antenna tolerance and robustness analysis.

Discover how UQ turns design tolerances into expected performance and confidence intervals.

Request a demo or discuss your application with a TICRA engineer.

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