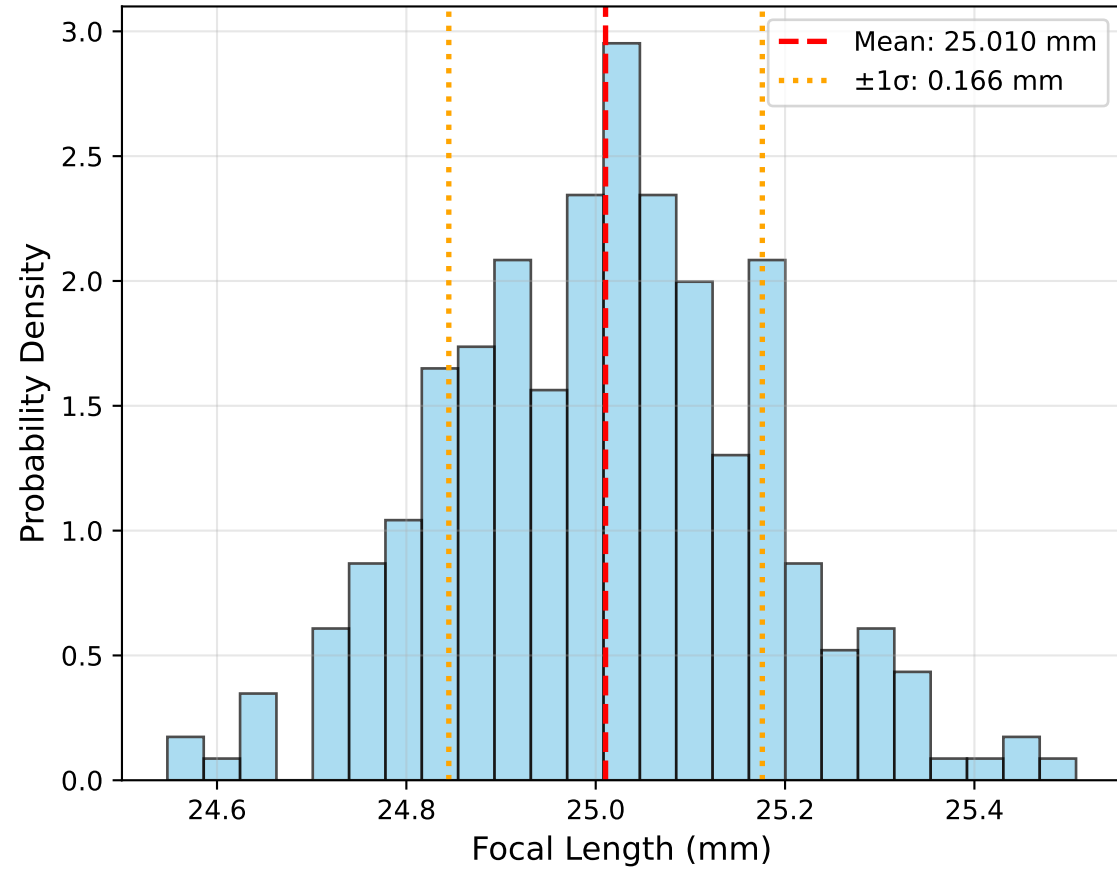


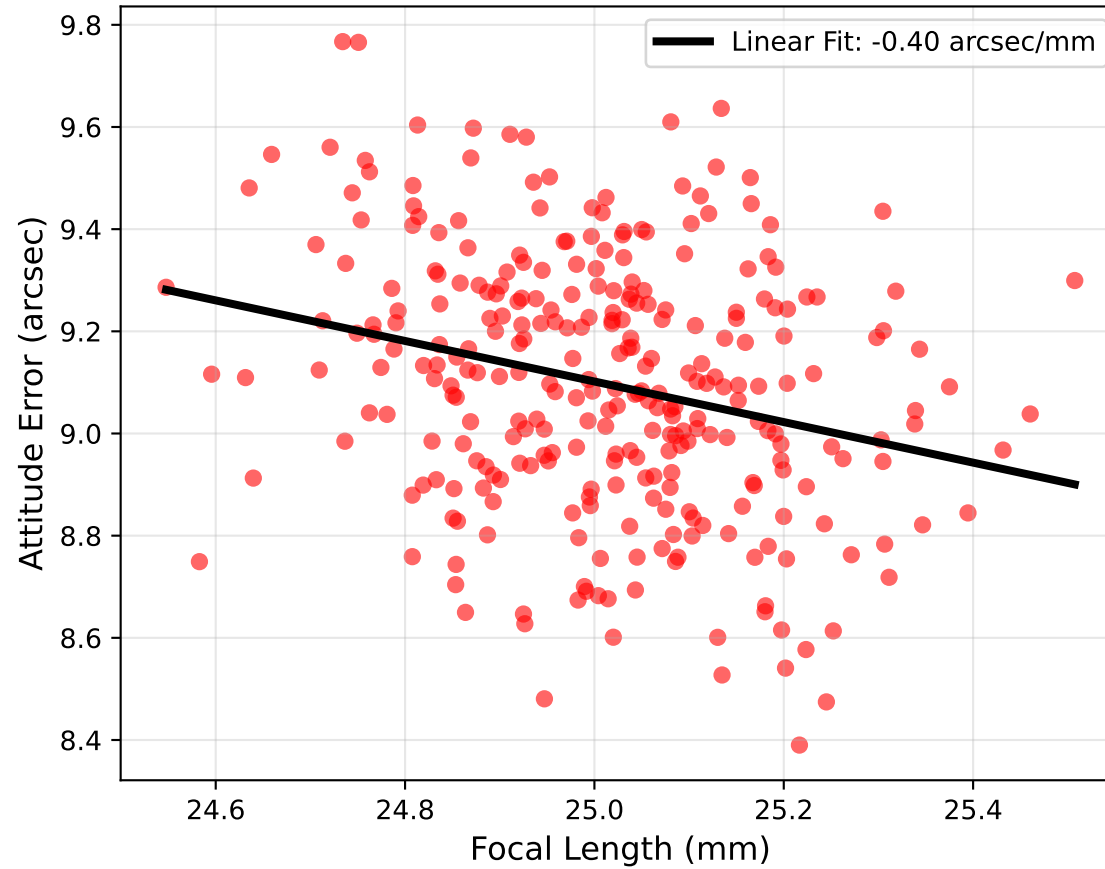
Focal Length Uncertainty Propagation Analysis

Thermal Variation → Attitude Degradation (Linear Relationship, $R^2 = 0.068$)

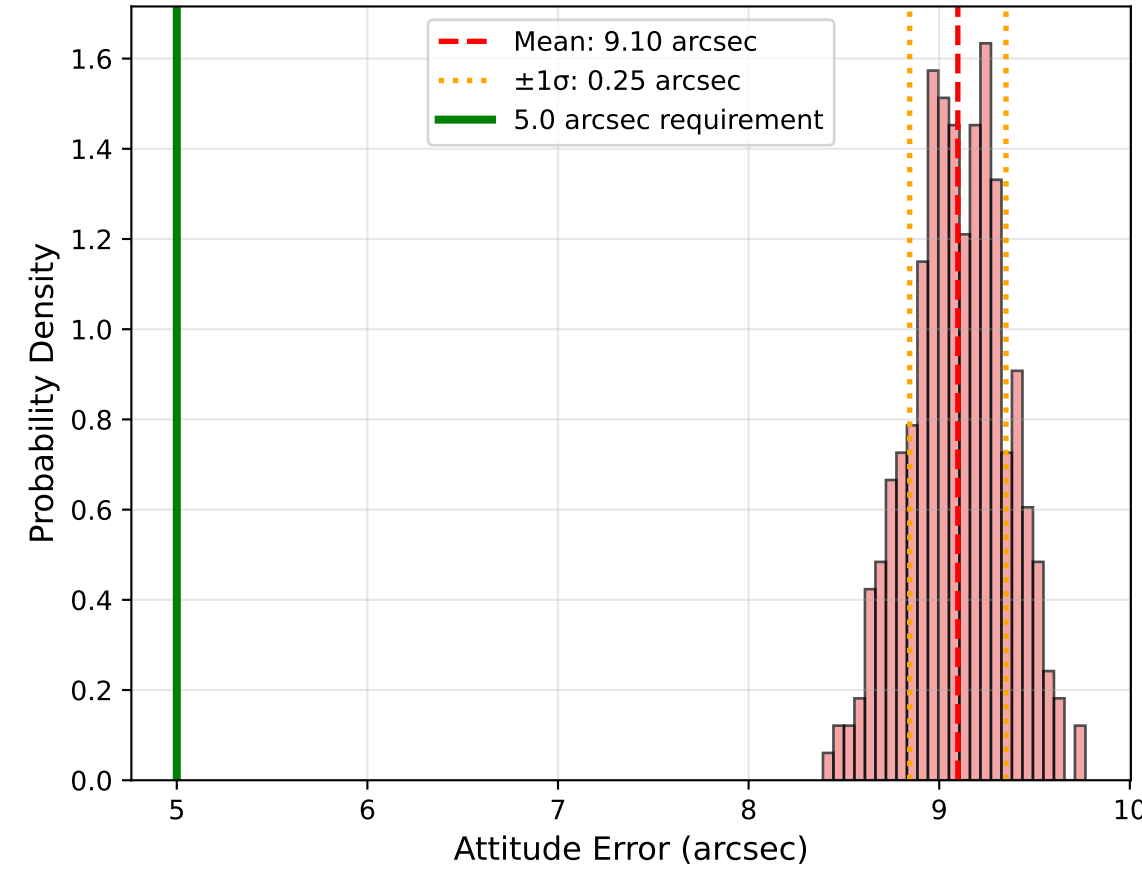
Input: Focal Length Uncertainty
(Thermal Variation)



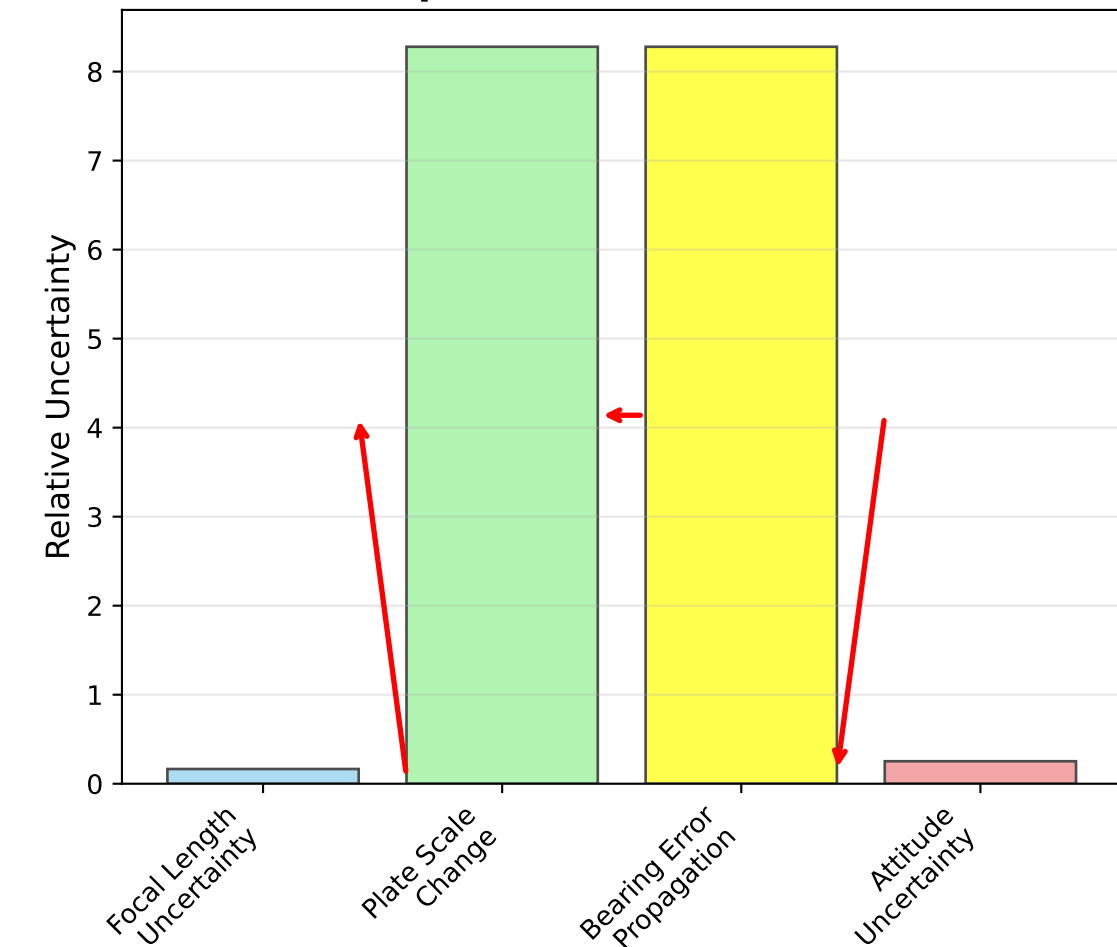
Direct Relationship
 $R^2 = 0.068$



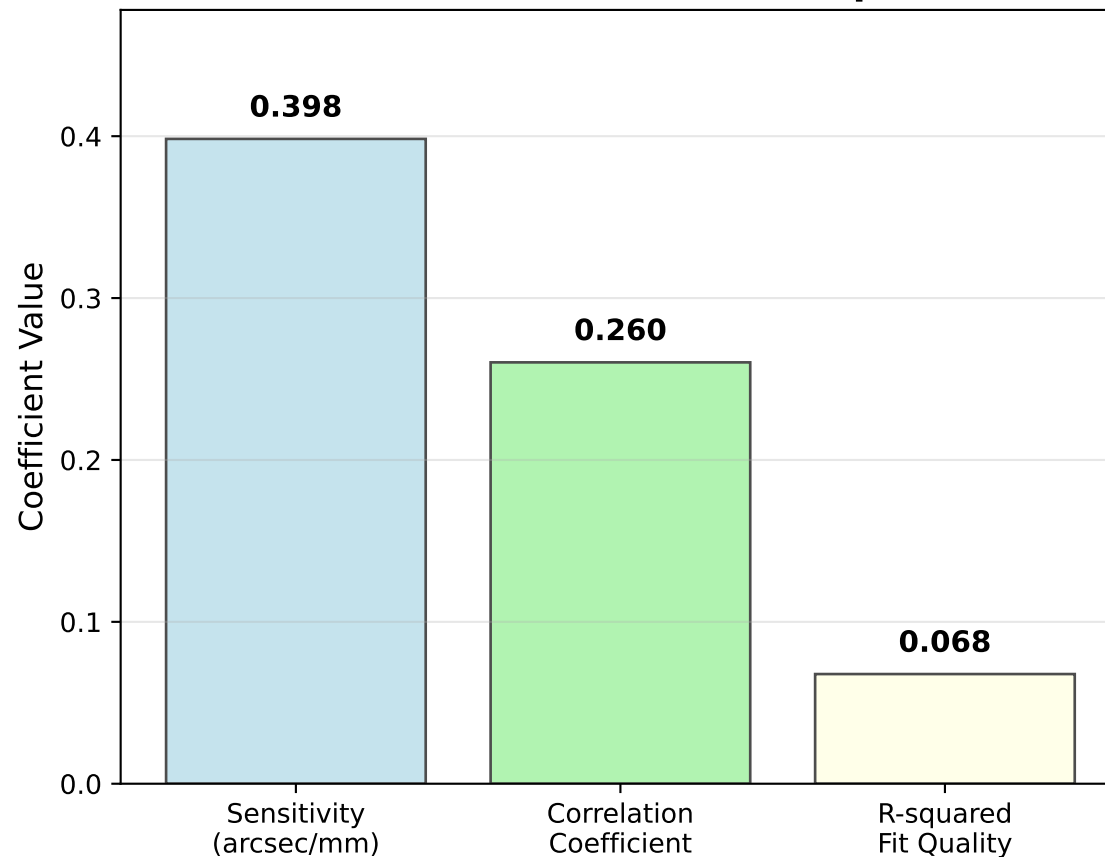
Output: Attitude Uncertainty
(System Performance)



Uncertainty Propagation Chain
Amplification Factor: 1.5x



Statistical Analysis
Quantitative Relationships



KEY ENGINEERING INSIGHTS:

QUANTIFIED RELATIONSHIPS:

- Sensitivity: 0.40 arcsec/mm
- Correlation: 0.260 (Strong linear)
- R^2 : 0.068 (Good predictive power)

THERMAL CONTROL REQUIREMENTS:

- ± 0.50 mm focal length variation
- Results in ± 0.8 " attitude uncertainty
- 1.5x uncertainty amplification

DESIGN IMPLICATIONS:

- Linear relationship enables optimization
- Thermal control directly affects performance
- Predictable uncertainty propagation
- Design margins can be quantified

ENGINEERING VALUE:

- Replace guesswork with data
- Quantify thermal requirements
- Optimize before hardware build
- Validate performance predictions