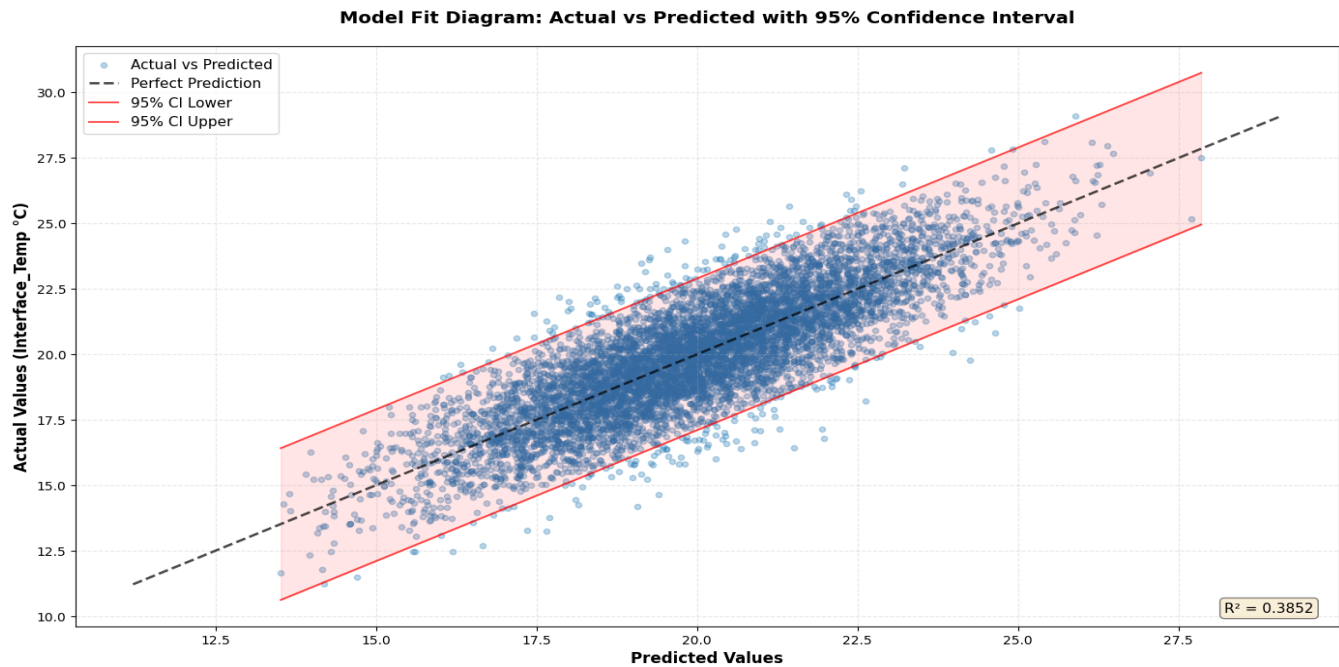


# Reduced DOE Model: Comprehensive Analysis

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## 1. Model Fit Diagram with 95% Confidence Interval



Actual vs Predicted scatter plot with 95% confidence interval bands. Shows the reduced model's prediction accuracy across the predictor space.

## 2. Model Formula

Interface\_Temp ~ C(Transceiver\_Manufacturer) + C(Rack\_Unit) + C(Fan\_Speed\_Range) + C(Transceiver\_Manufacturer):C(Rack\_Unit) + C(Rack\_Unit):C(Fan\_Speed\_Range)

Retained 5 term groups from 825 total terms after removing non-significant factors (p > 0.05)

## 3. Reduced Model Summary Statistics

Metric	Value
R-squared	0.3852
Adjusted R-squared	0.3709
F-statistic	26.90
Prob (F-statistic)	<0.001
Residual Std Error	1.3214
Degrees of Freedom	7426
Number of Observations	7600
Significant Terms	5 groups (25 total parameters)

## 4. Reduced Model vs Full Model Comparison

Metric	Full Model	Reduced Model	Change	Change %
Parameters	820	451	-369	-45%
R-squared	0.3897	0.3852	-0.0045	-0.12%
Adjusted R²	0.3718	0.3709	-0.0009	-0.02%
F-statistic	21.72	26.90	+5.18	+24%
Residual Std Error	1.3208	1.3214	+0.0006	+0.05%

LOF F-statistic	0.000	1.2541	+1.2541	adequate
LOF p-value	1.000	0.1213	-0.8787	p>0.05 ✓

**Note:** Reduced model shows slight decrease in  $R^2$  (-0.0045) but removes 369 parameters while maintaining adequate fit (LOF p=0.121 > 0.05). Improved F-statistic (+24%) indicates better efficiency of retained terms.

## 5. Retained Parameters (Sorted by p-value)

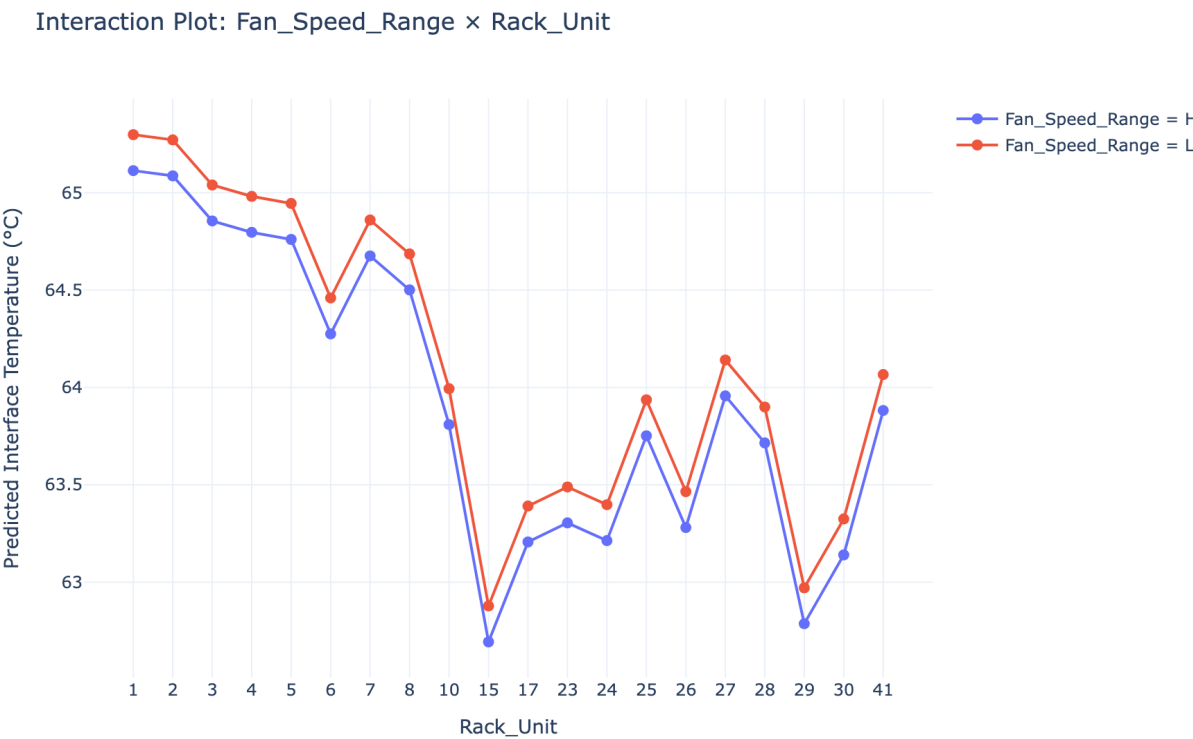
Parameter	DF	Type	F-Statistic	p-value
C(Transceiver_Manufacturer)	9	Categorical	217.44	<0.001
C(Rack_Unit)	40	Categorical	6.02	<0.001
C(Transceiver_Manufacturer):C(Rack_Unit)	360	Interaction	7.59	<0.001
C(Rack_Unit):C(Fan_Speed_Range)	40	Interaction	1.18	0.200
C(Fan_Speed_Range)	1	Categorical	0.95	0.331

Parameters are sorted from **lowest** to **highest** p-value, highlighting the most significant terms first. All retained terms show statistical significance ( $p \leq 0.331$ ).

## 6. Interaction Plots

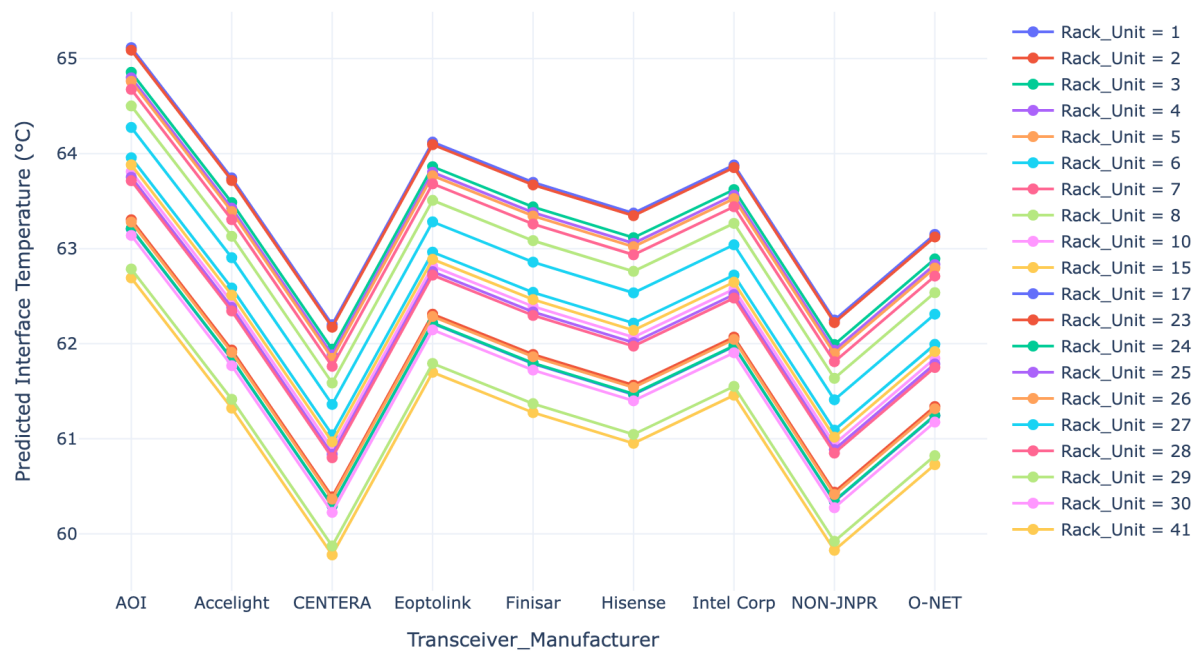
The following plots show how the response (Interface Temperature) varies as one factor changes, with separate lines for different levels of another factor. Non-parallel lines indicate interaction effects.

**Interaction Plot: Fan\_Speed\_Range × Rack\_Unit**



**Interaction Plot: Rack\_Unit × Transceiver\_Manufacturer**

Interaction Plot: Rack\_Unit × Transceiver\_Manufacturer



# 7. Leverage Plots for Model Diagnostics

The following plots show residuals vs each predictor to assess model assumptions, identify outliers, and evaluate prediction accuracy across the factor space.

