

PBA Array Warpage Analysis Report

Analysis Folder: Analysis Data

Number of Files: 10

Date: 2025-08-25 15:28:43

PBA Warpage analysis

Main Analysis Contents:

- Individual PBA array heatmap analysis
 - Statistical comparison analysis across arrays
 - 3D surface visualization of warpage patterns
 - Advanced statistical analysis
-

Generated by Warpage Analysis Tool v2.0
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Samsung Electronics Co., Ltd.

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Total Pages: 22 pages

Legend & Terminology

STATISTICAL METRICS

Basic Statistics:

- Mean: Average warpage value across all measurement points on PBA array
- Standard Deviation (Std): Measure of data spread around the mean
- Range: Difference between maximum and minimum warpage values (Max - Min)
- Min/Max: Minimum and maximum warpage values in the PBA array dataset

Advanced Analysis:

- Hotspots: Areas on PBA array where warpage exceeds 95th percentile threshold
- Local Variability: Spatial variation in warpage across the PBA surface
- Gradient Magnitude: Rate of change in warpage values across the array
- Contour Plots: Lines connecting points of equal warpage values
- CDF Plot: Cumulative distribution of (Max-Min) ranges across PBA arrays
- Correlation Matrix: Shows relationships between different PBA arrays

Distribution Analysis:

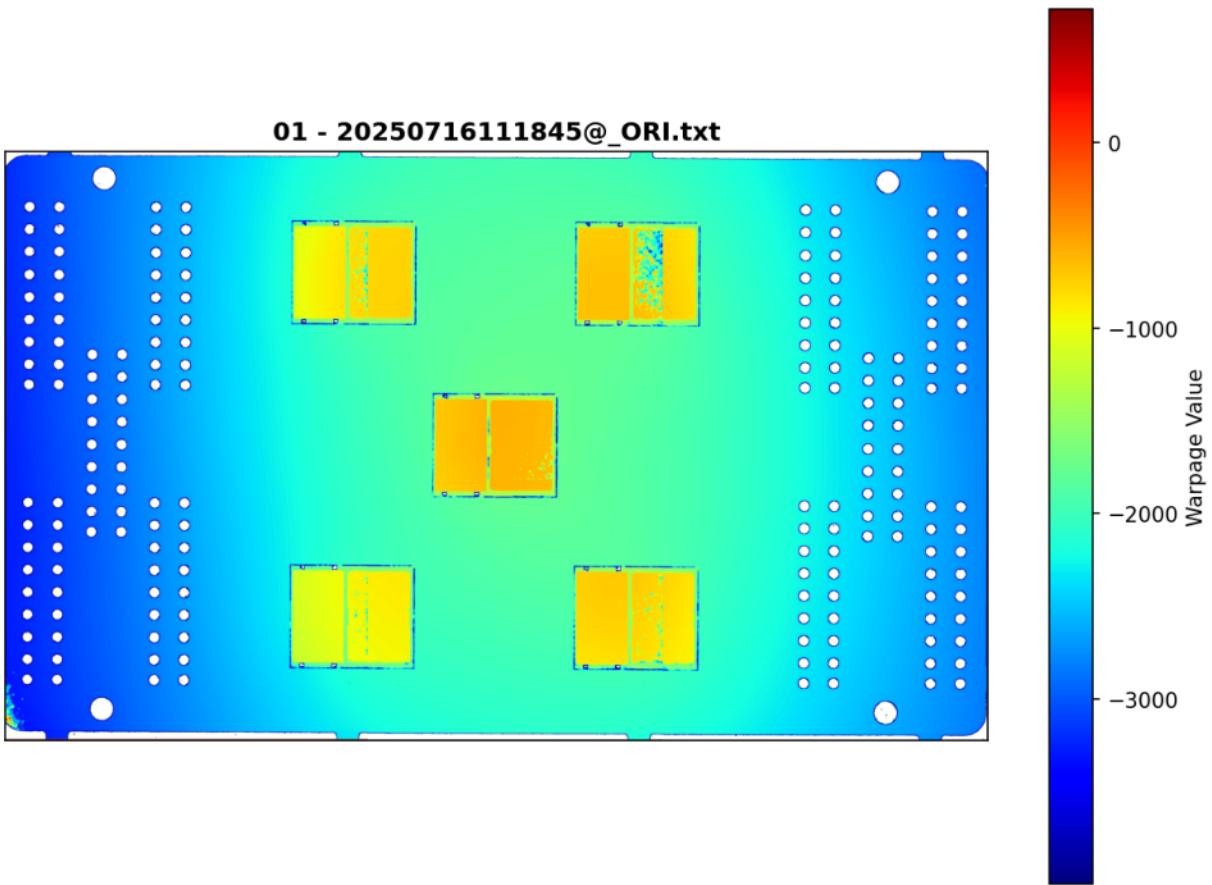
- Violin Plots: Extension of box plots showing probability density of data distribution
- Percentile Analysis: Analysis of percentile distribution in data

Generated by Warpage Analysis Tool v2.0

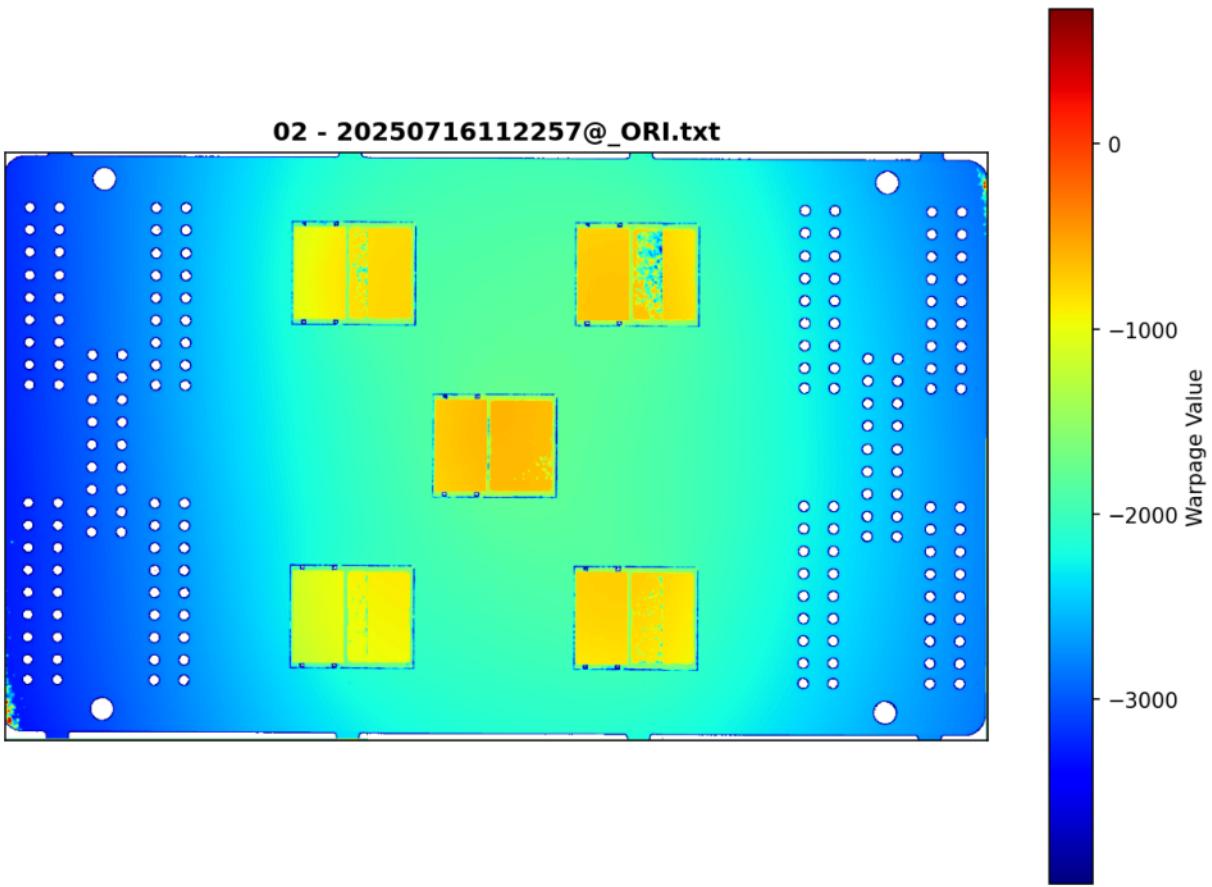
CAE Group, SiHun Lee

Samsung Electronics Co., Ltd.

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Std: 628.034713

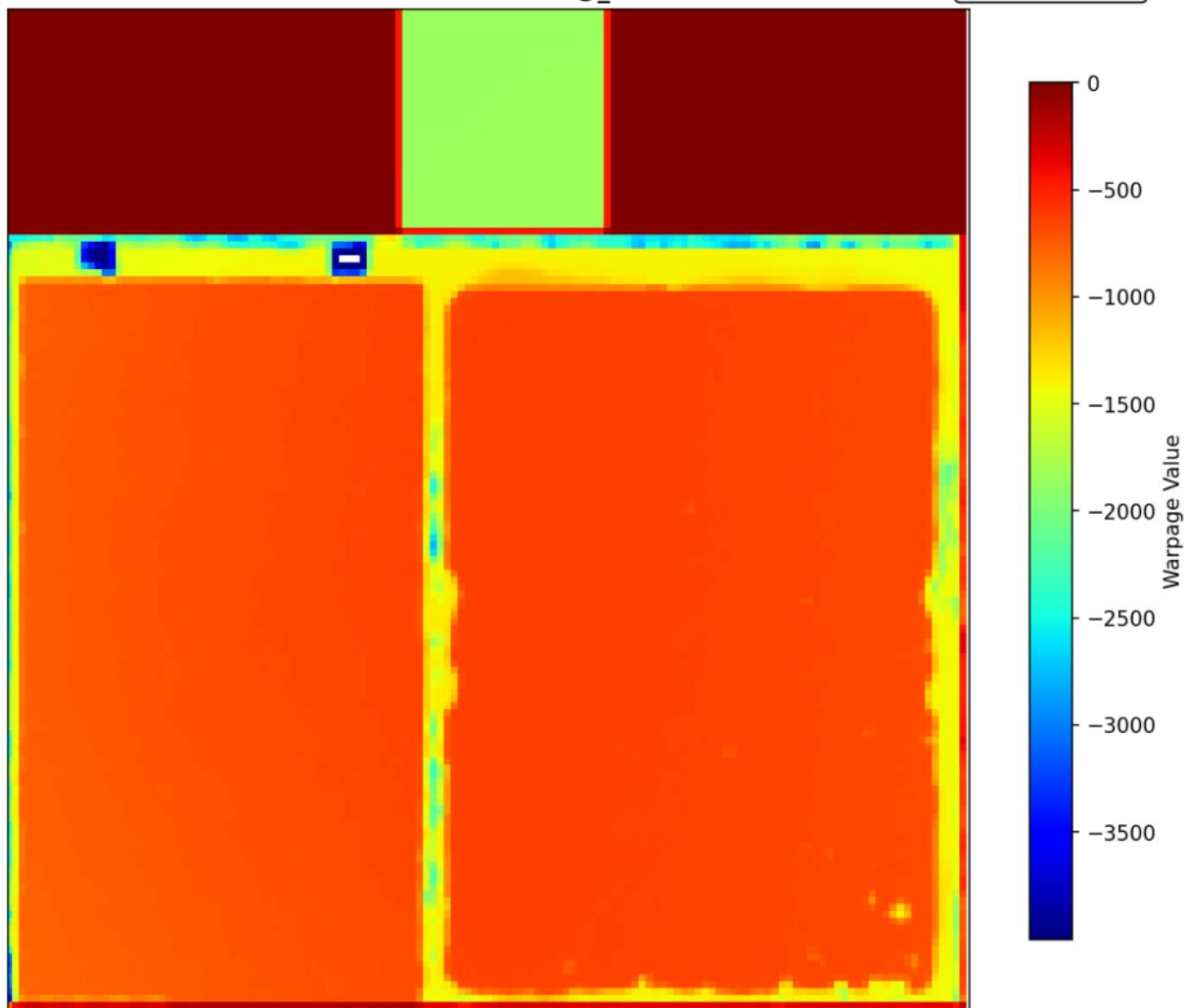


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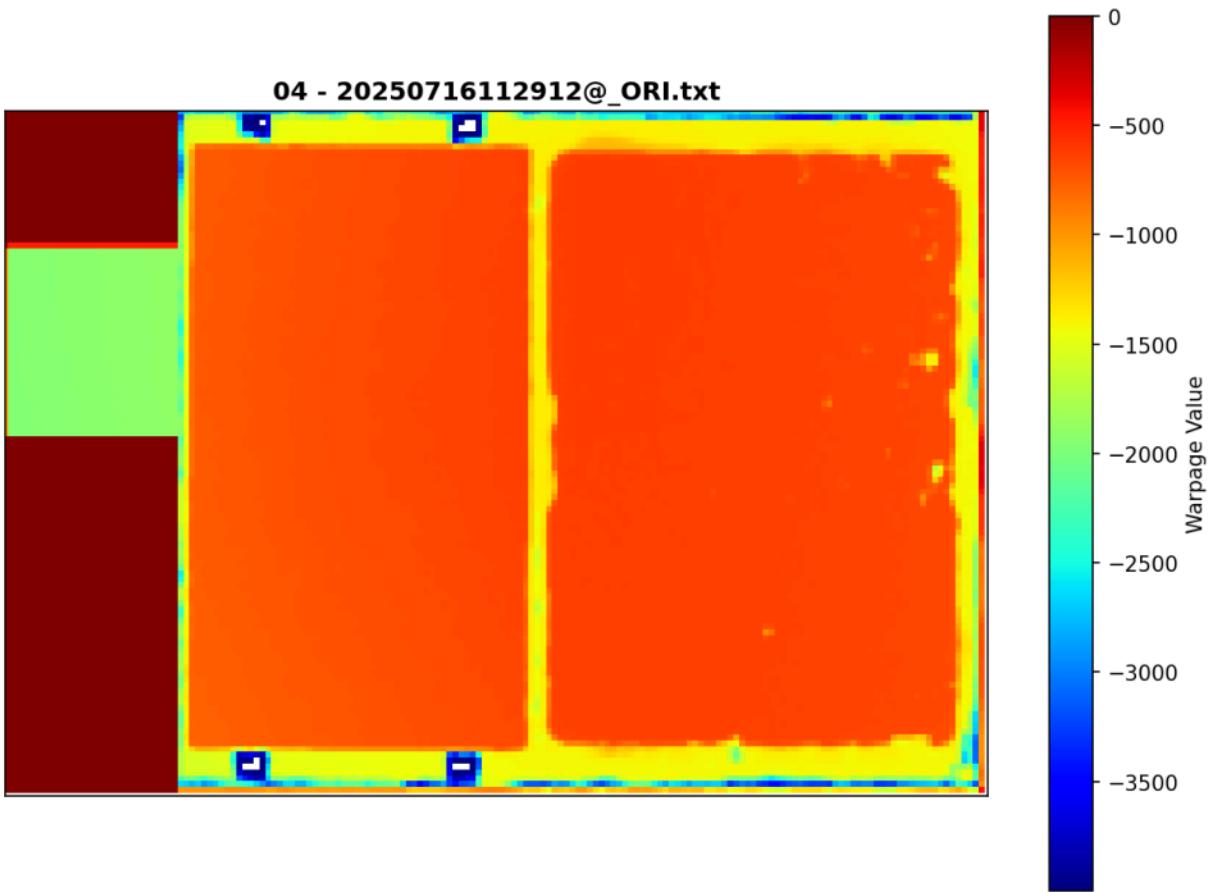


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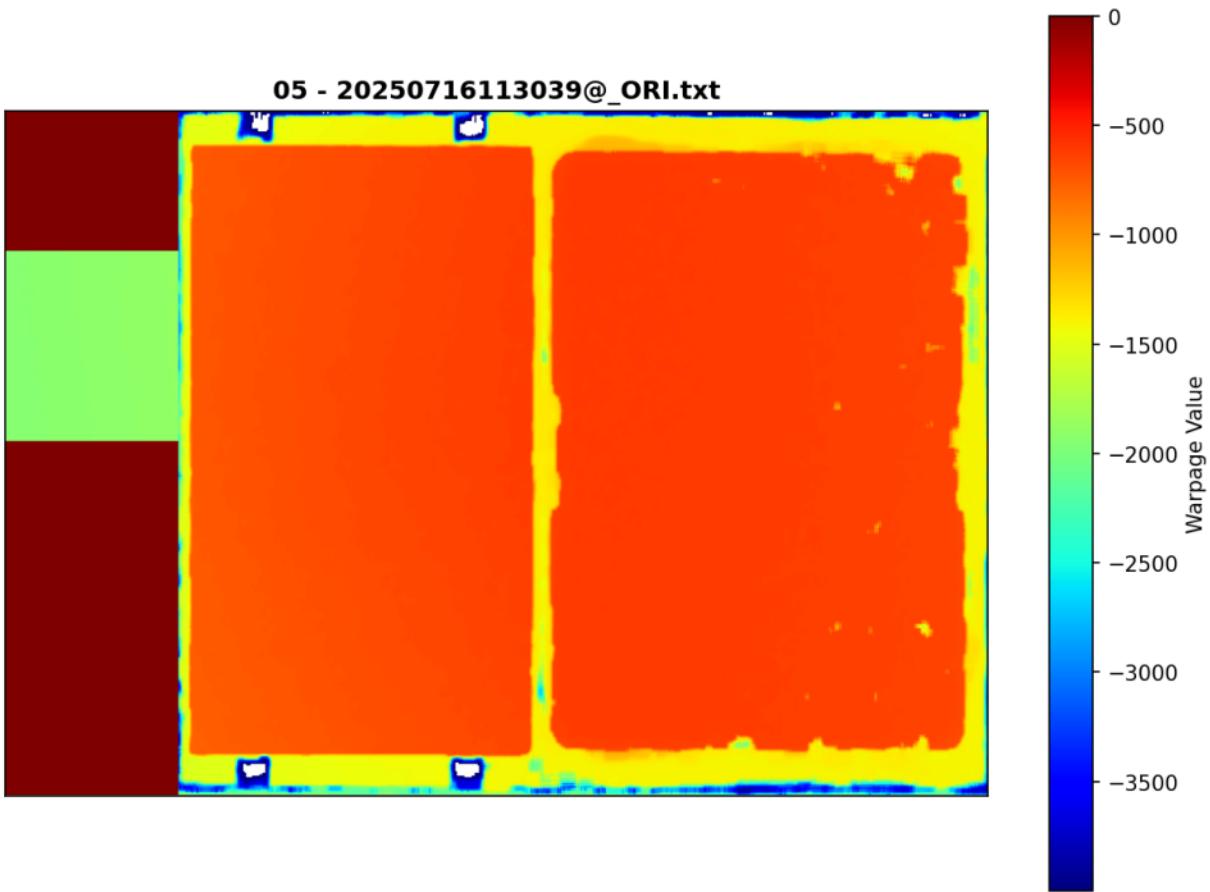
03 - 20250716112716@_ORI.txt



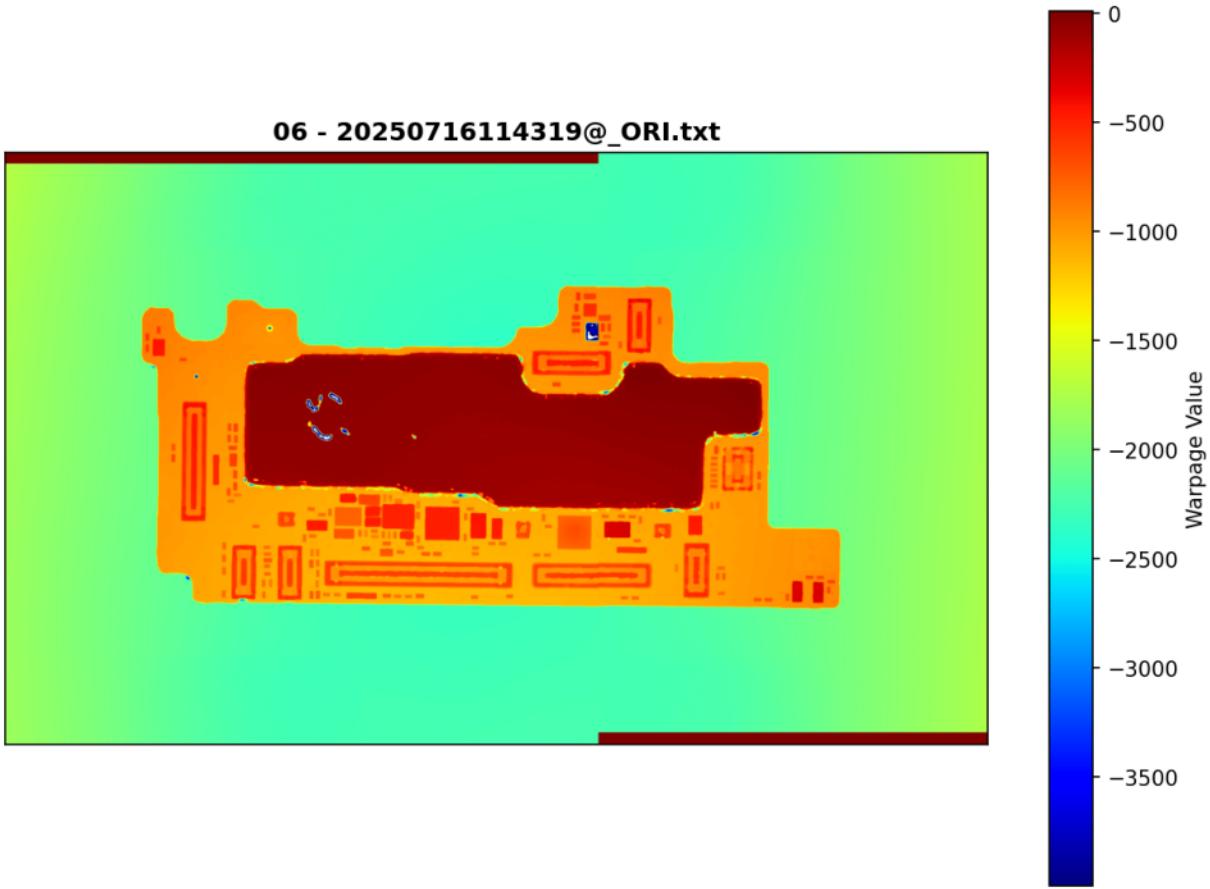
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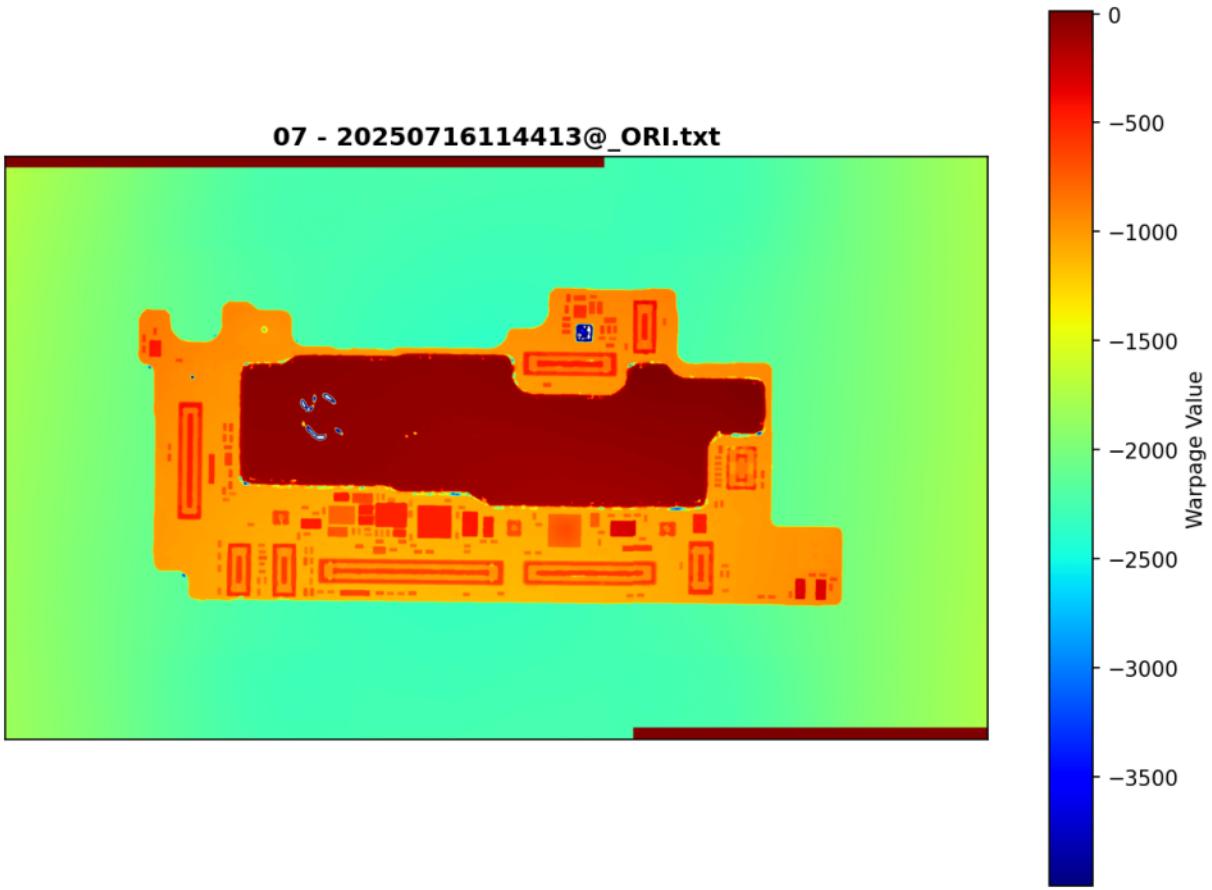
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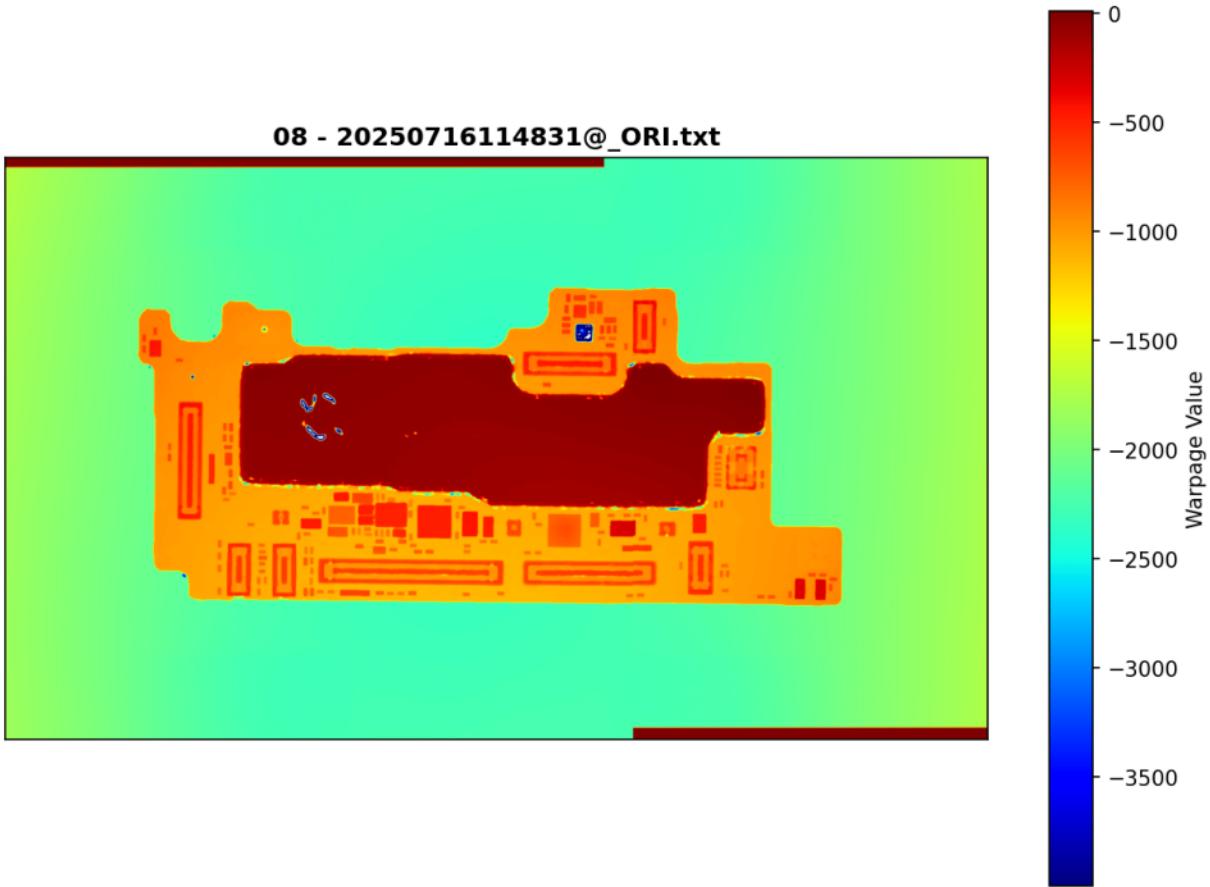
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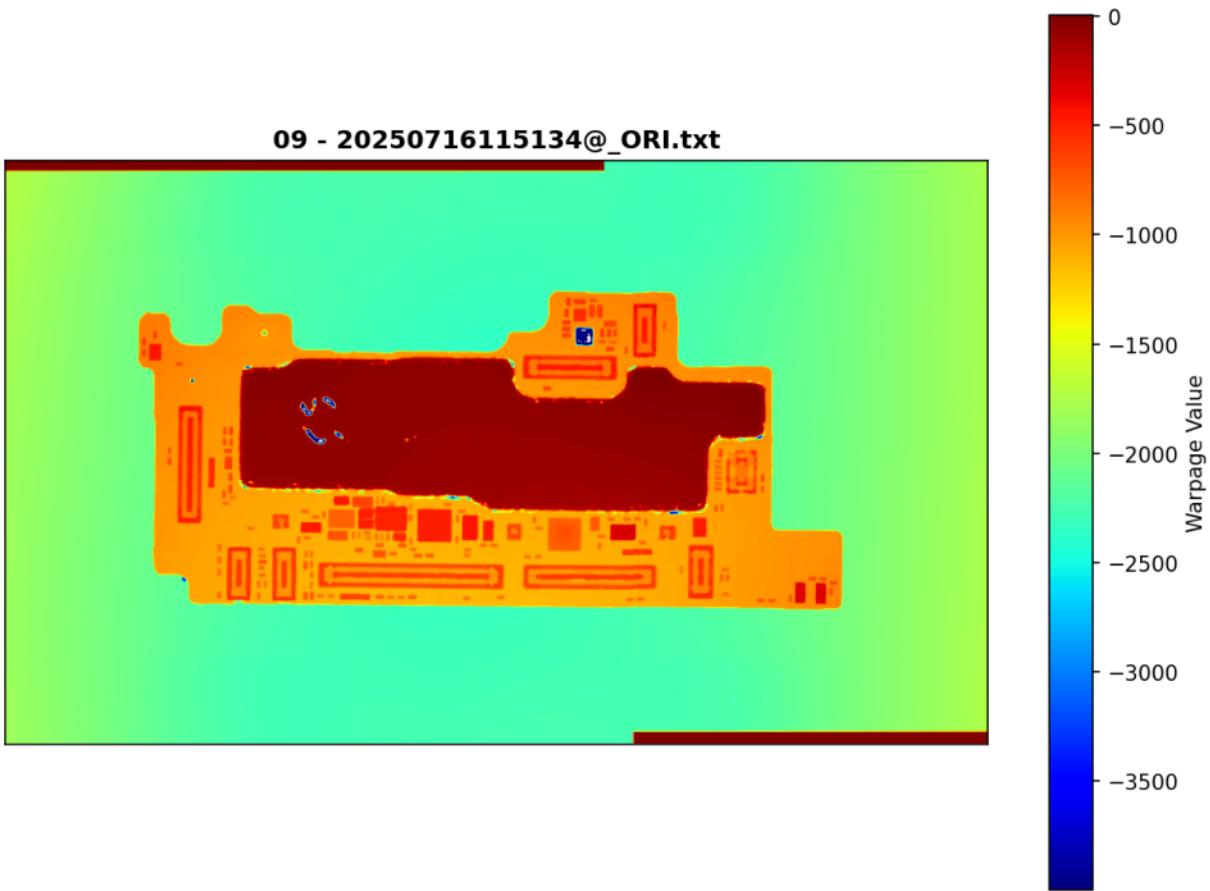
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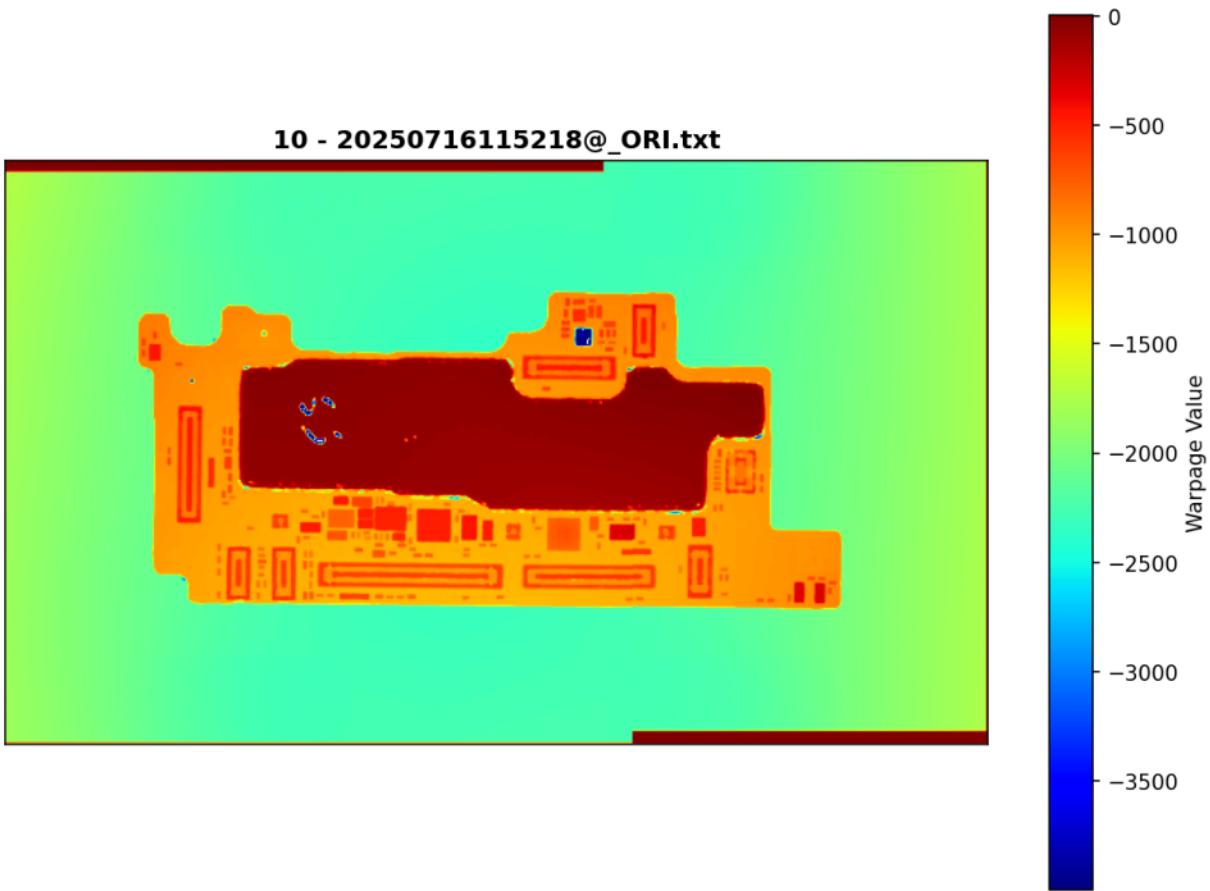
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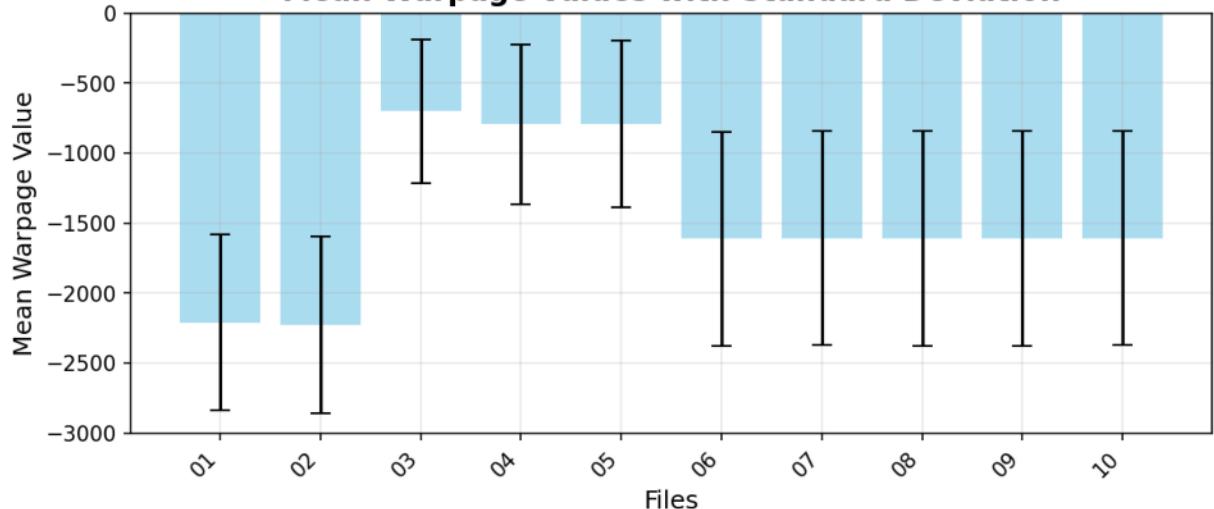


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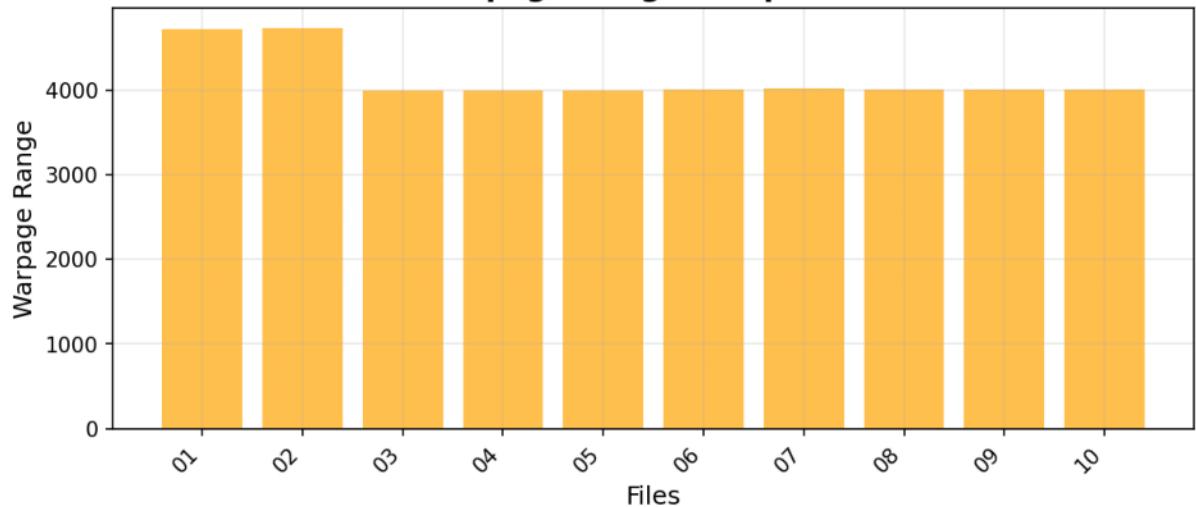


Statistical Analysis - Warpage Comparison

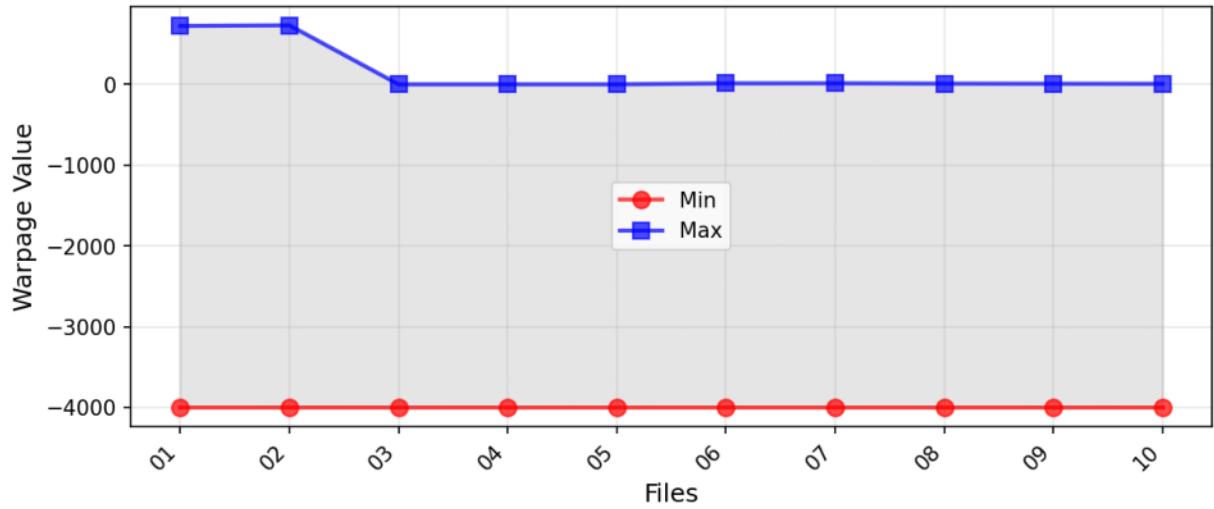
Mean Warpage Values with Standard Deviation



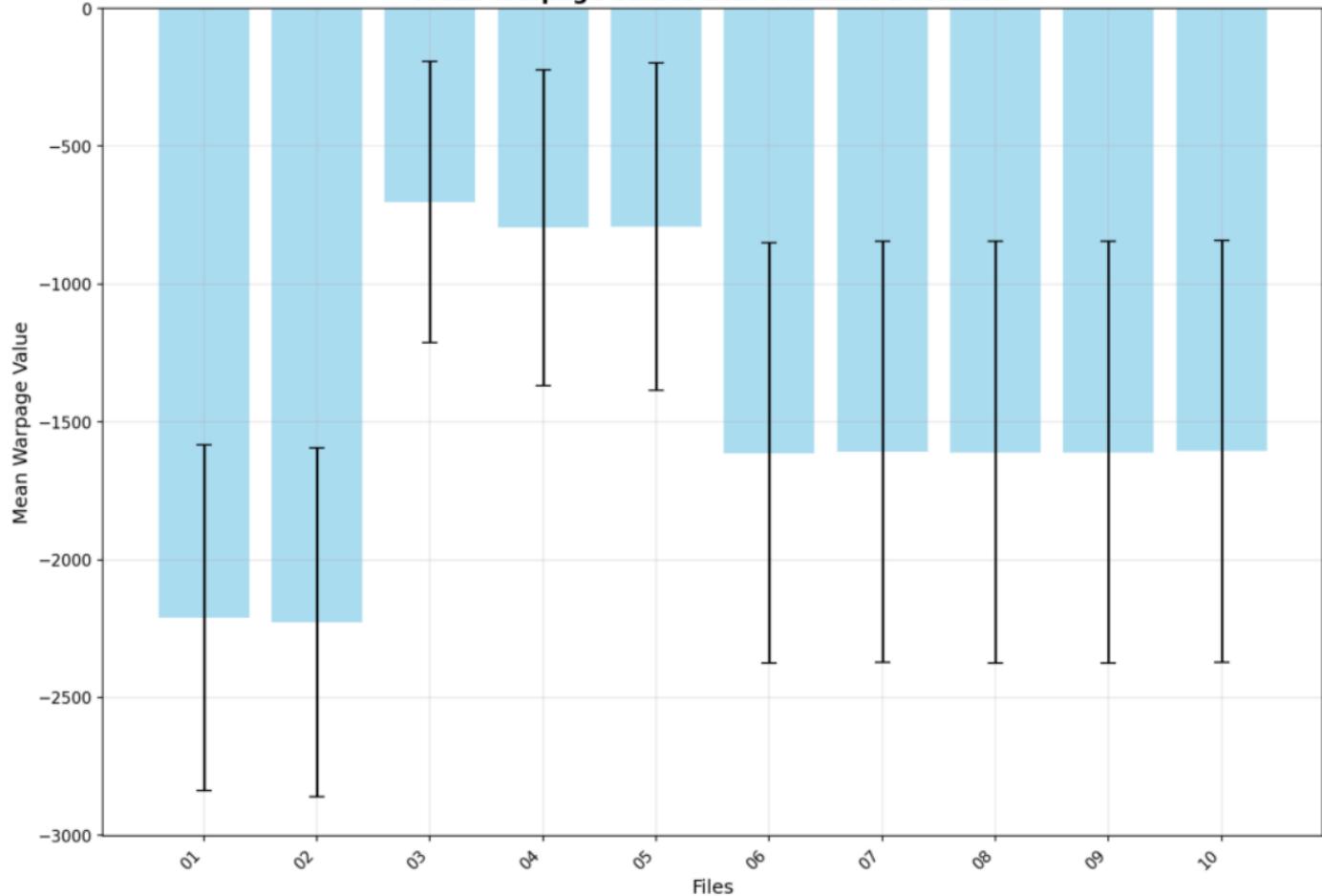
Warpage Range Comparison



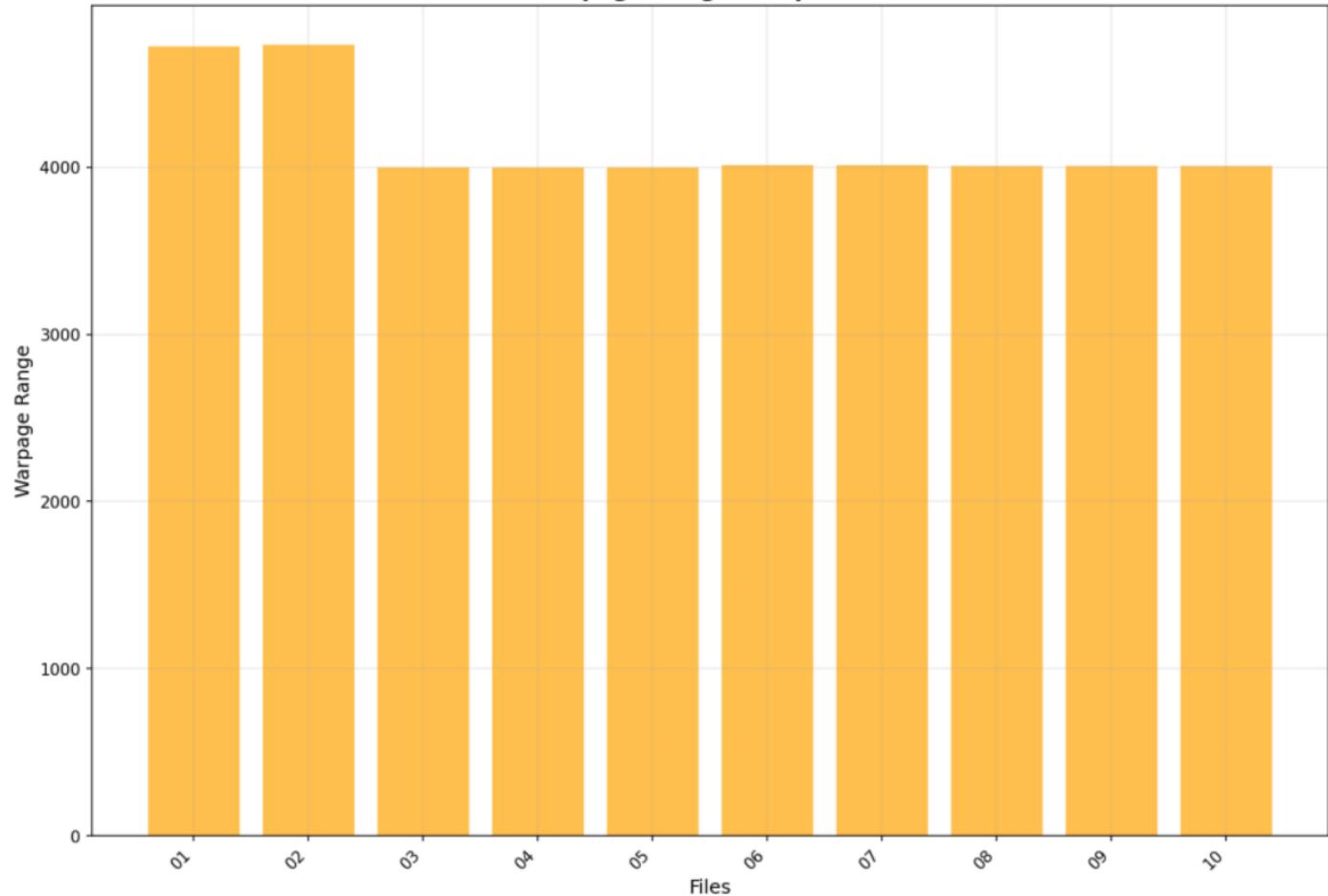
Min-Max Warpage Values



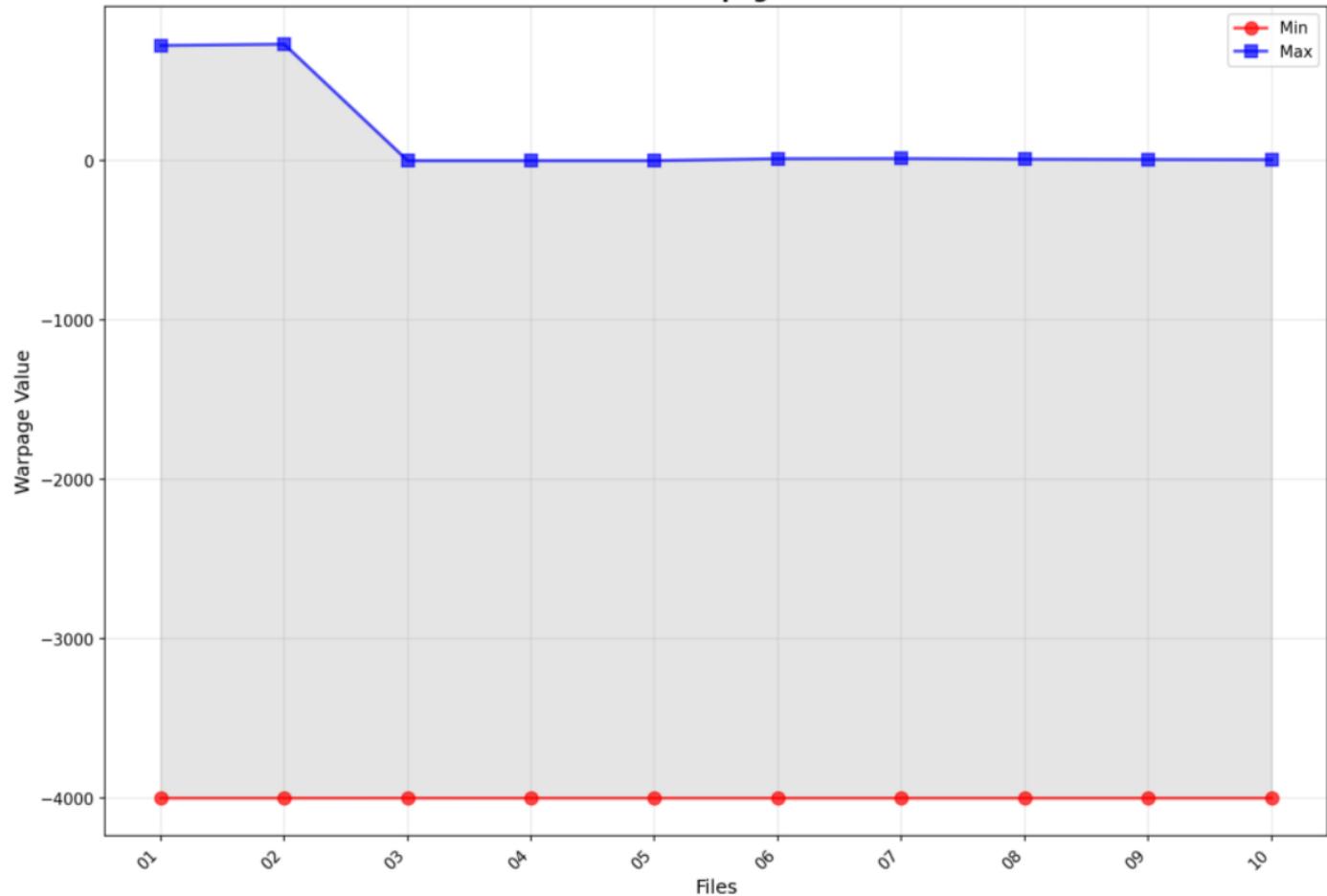
Mean Warpage Values with Standard Deviation



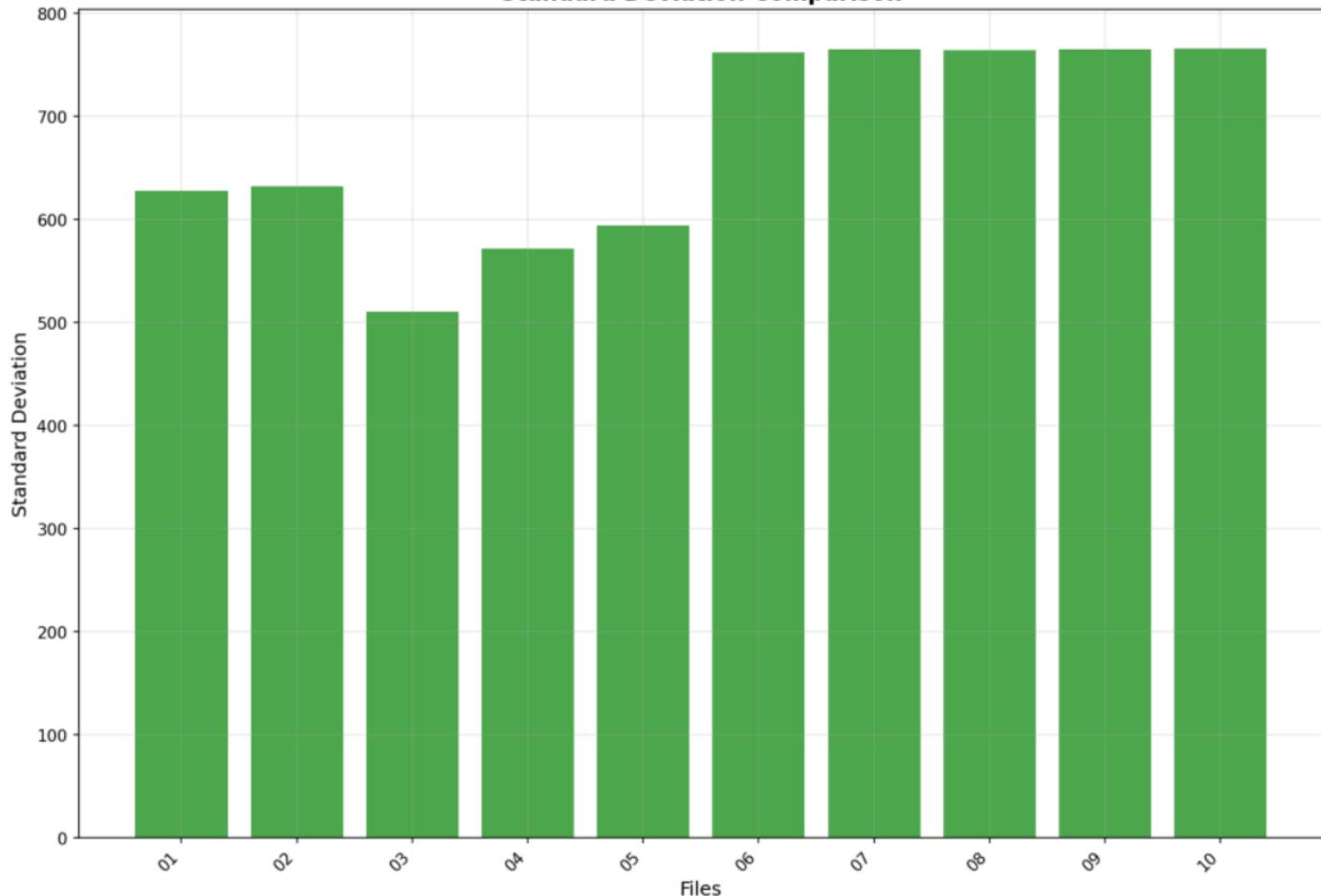
Warpage Range Comparison



Min-Max Warpage Values

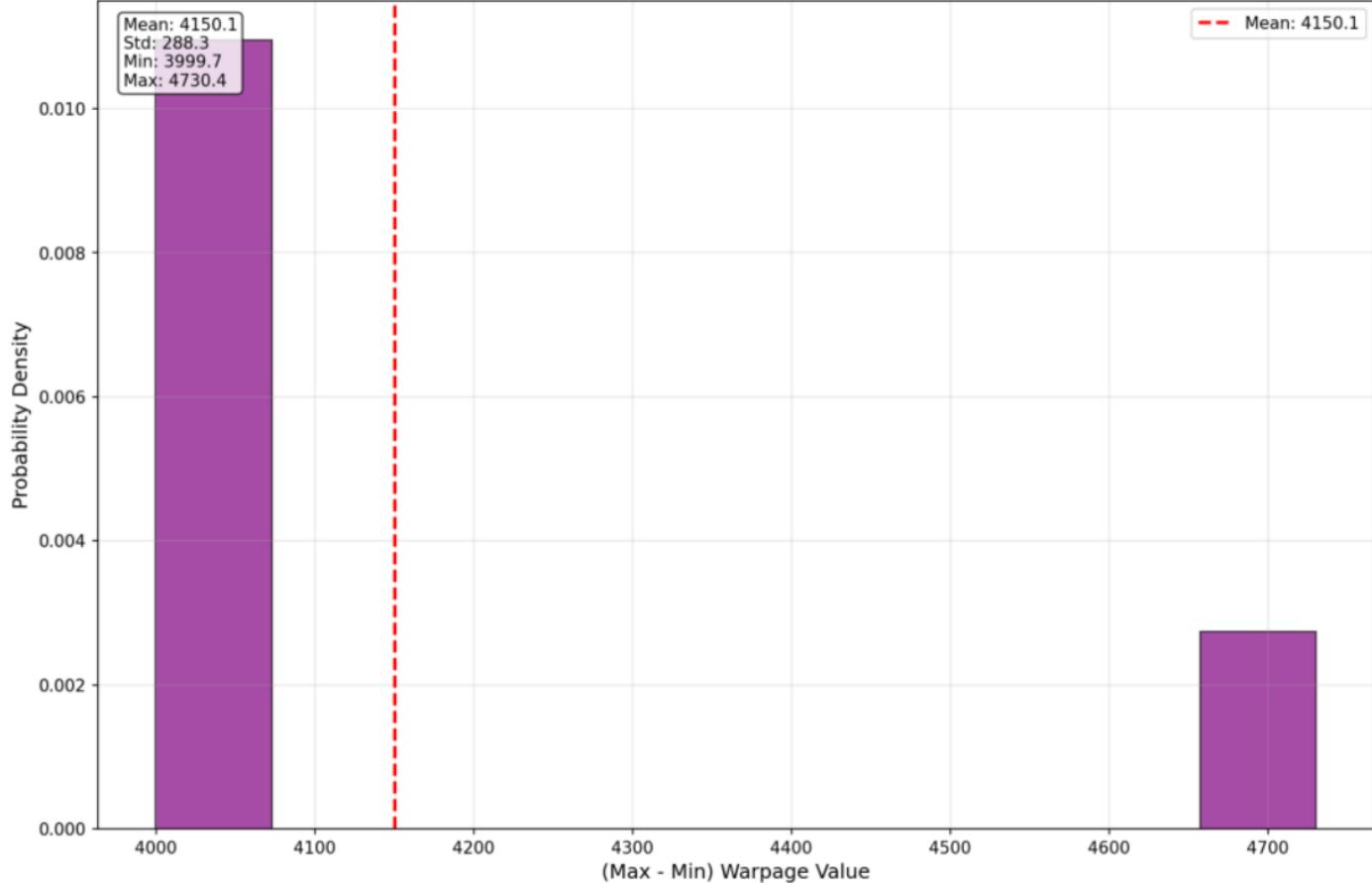


Standard Deviation Comparison

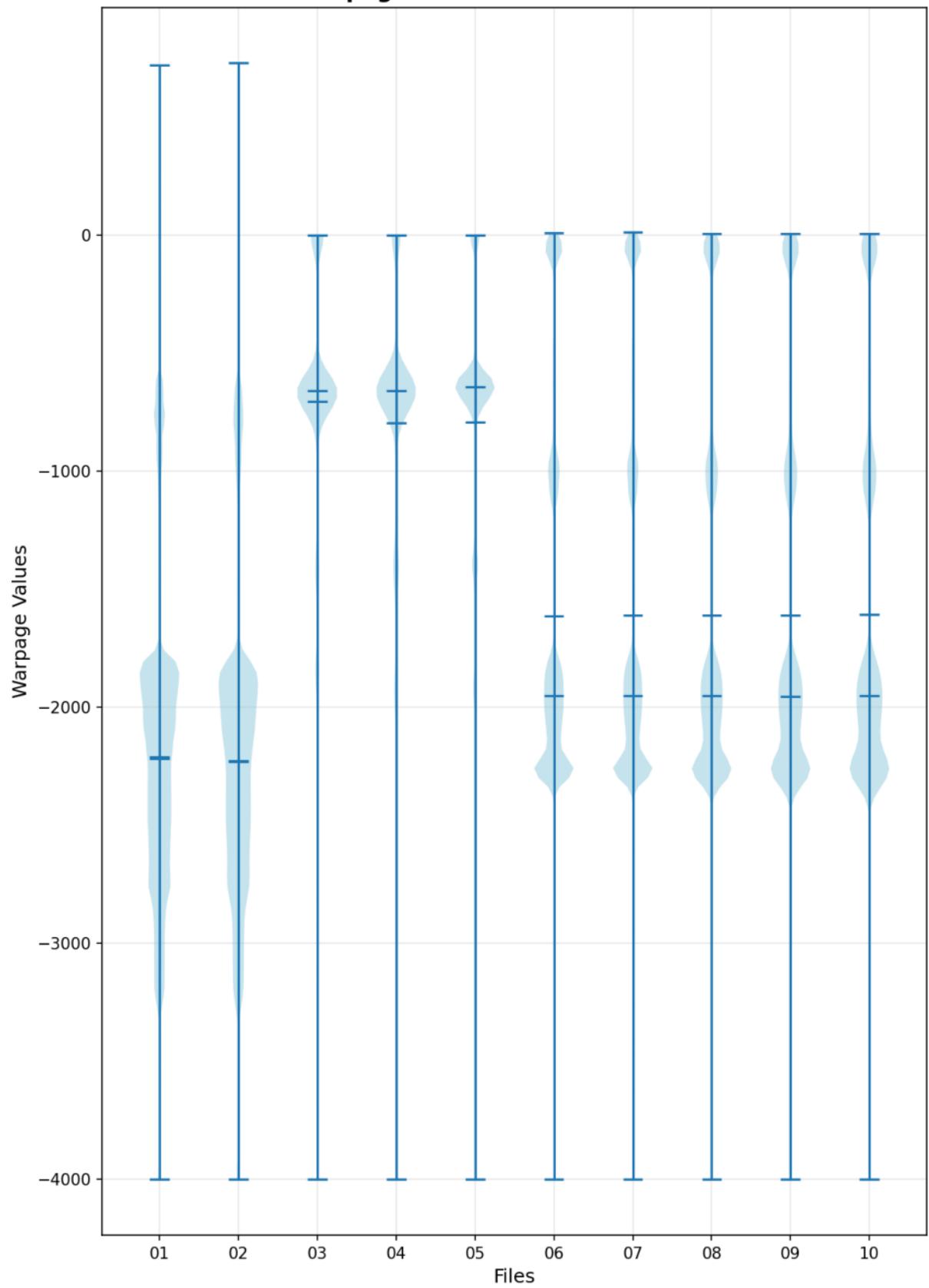


Warpage Range Distribution

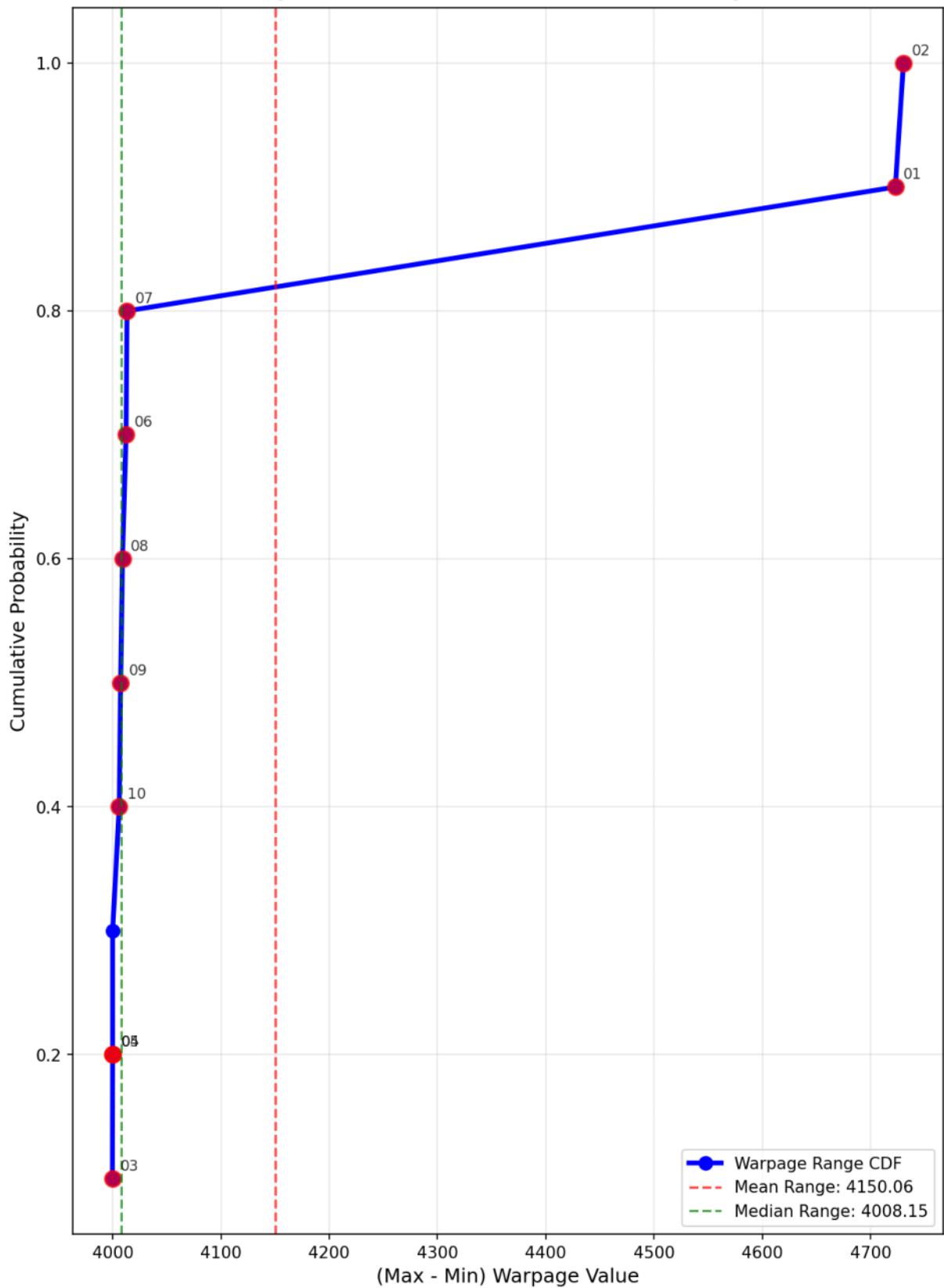
Warpage Range Distribution



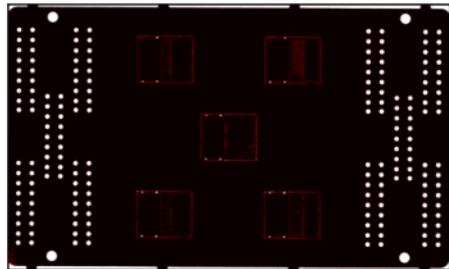
Warpage Distribution - Violin Plots



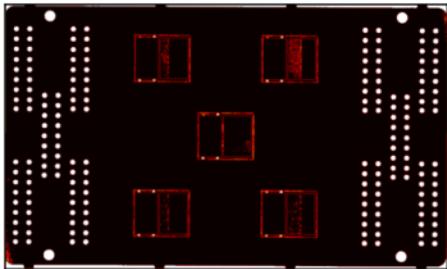
Cumulative Distribution of Warpage Ranges (X-axis: Max-Min values across files)



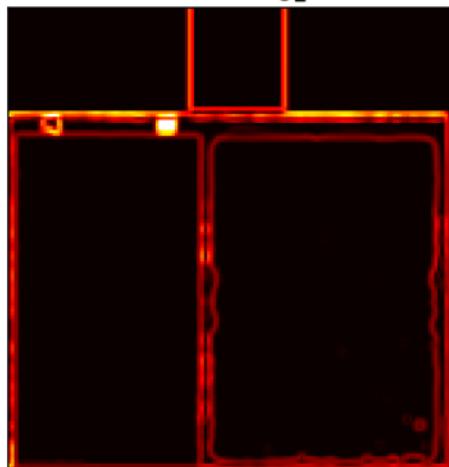
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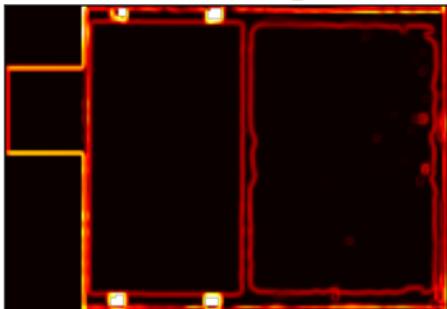
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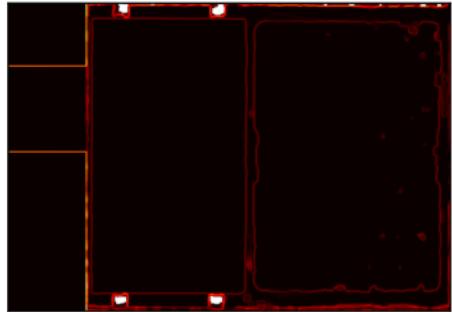
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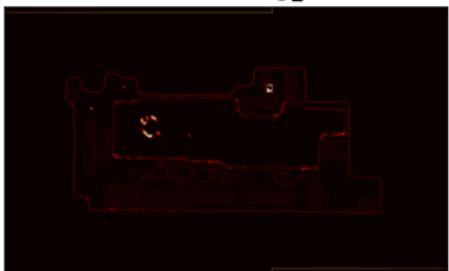
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05 - Gradient Magnitude
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06 - Gradient Magnitude
20250716114319@_ORI.txt



07 - Gradient Magnitude
20250716114413@_ORI.txt



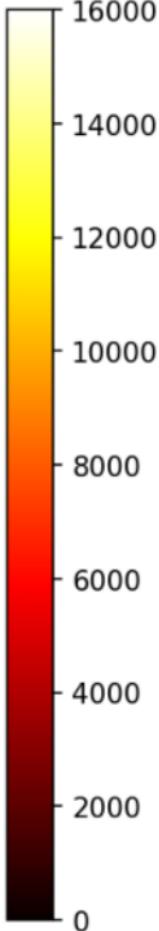
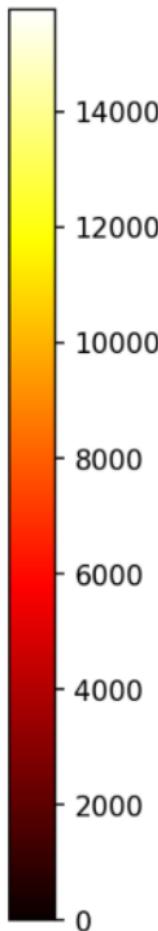
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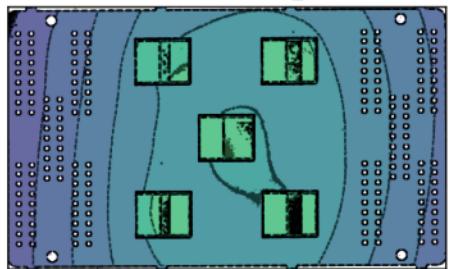
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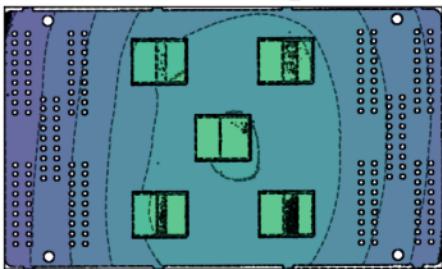
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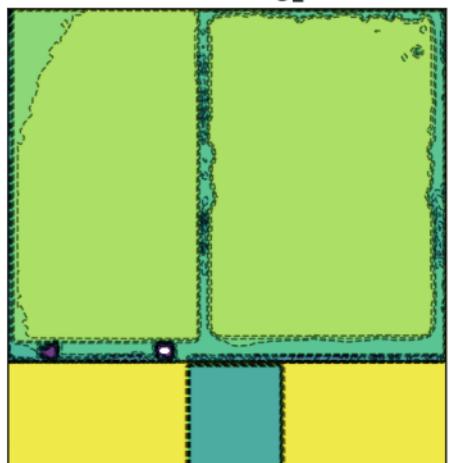
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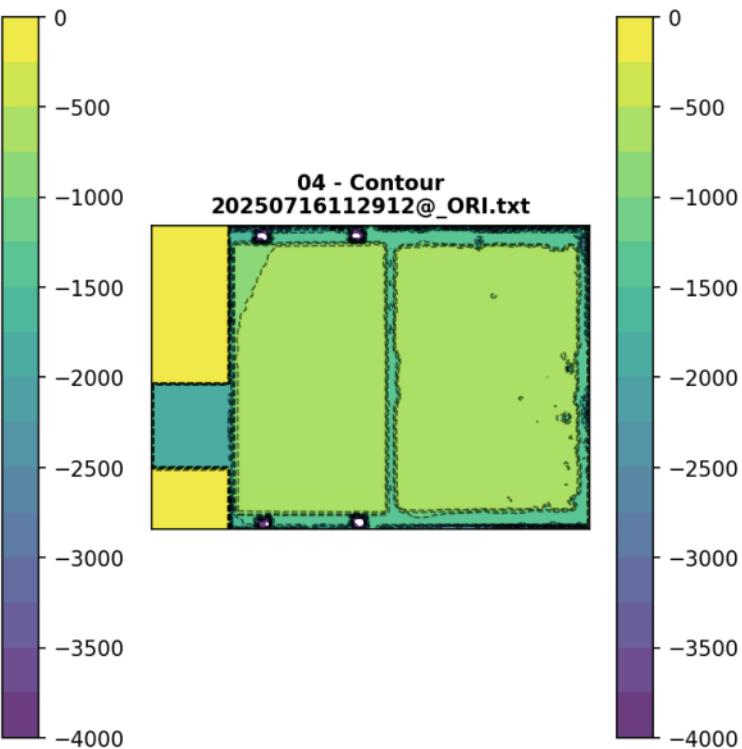
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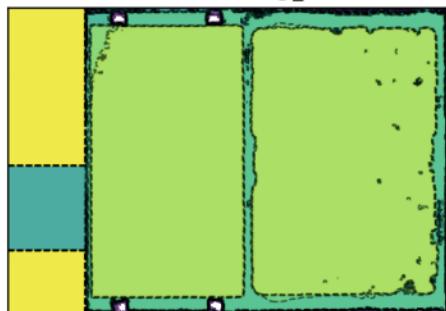
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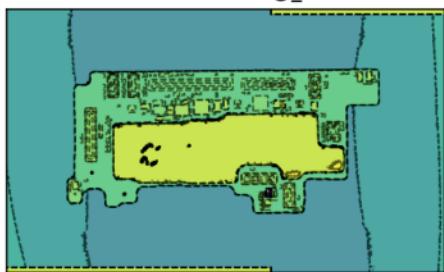
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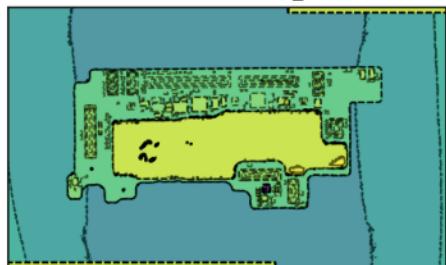
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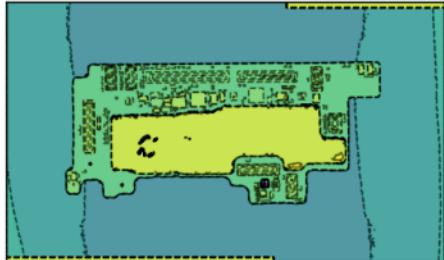
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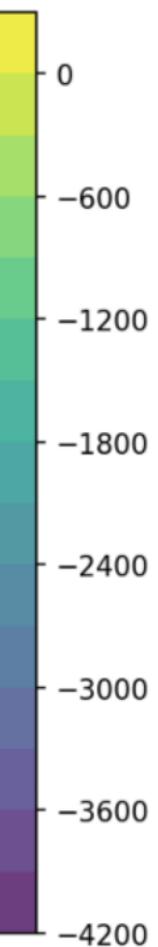
07 - Contour
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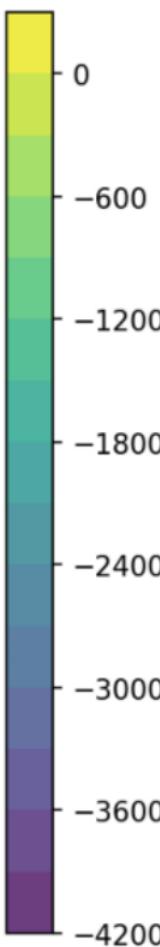
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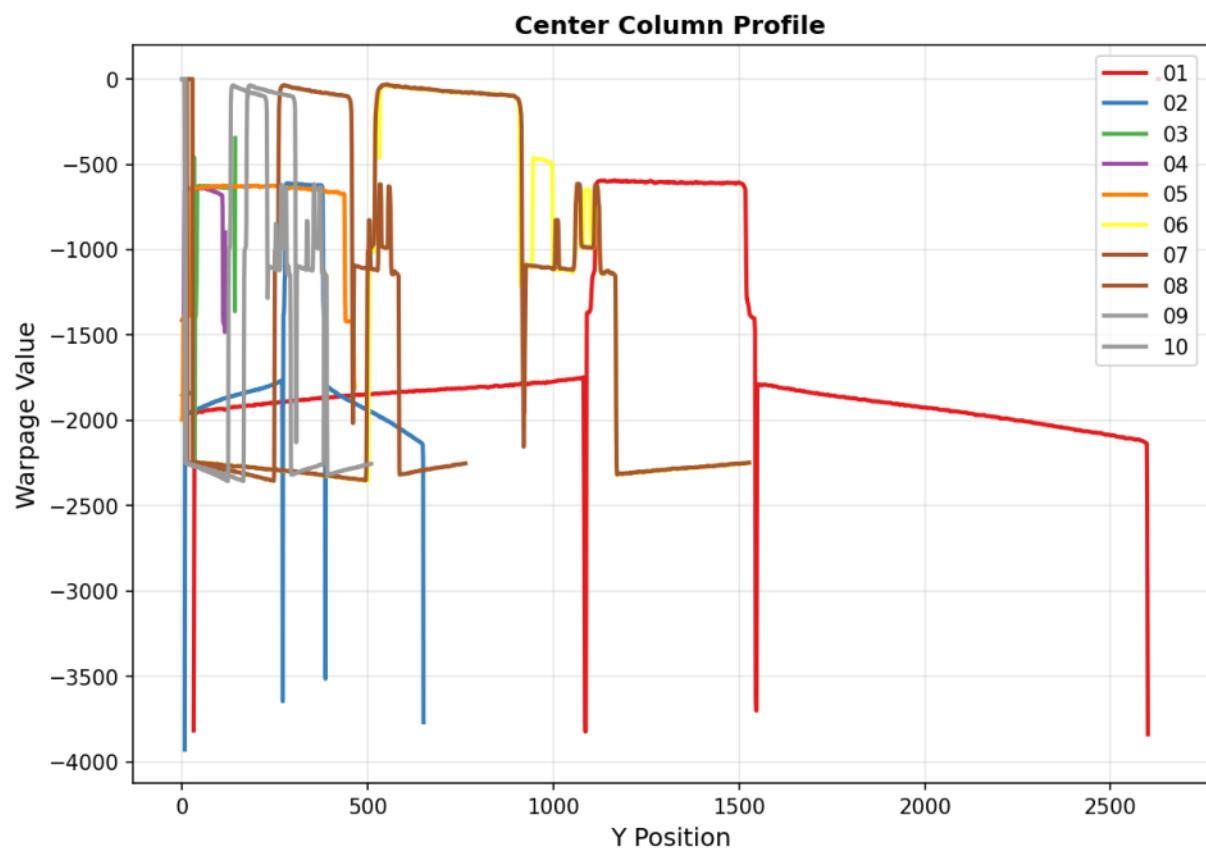
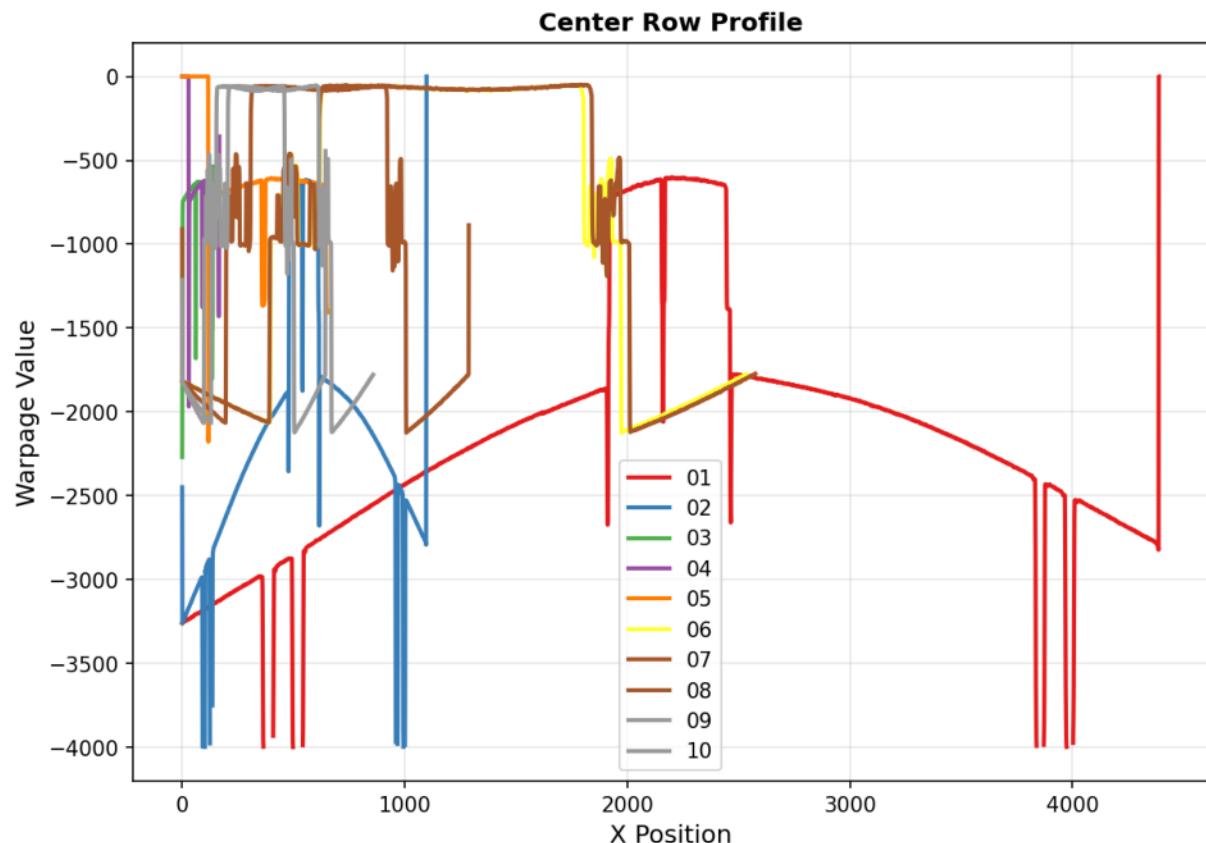


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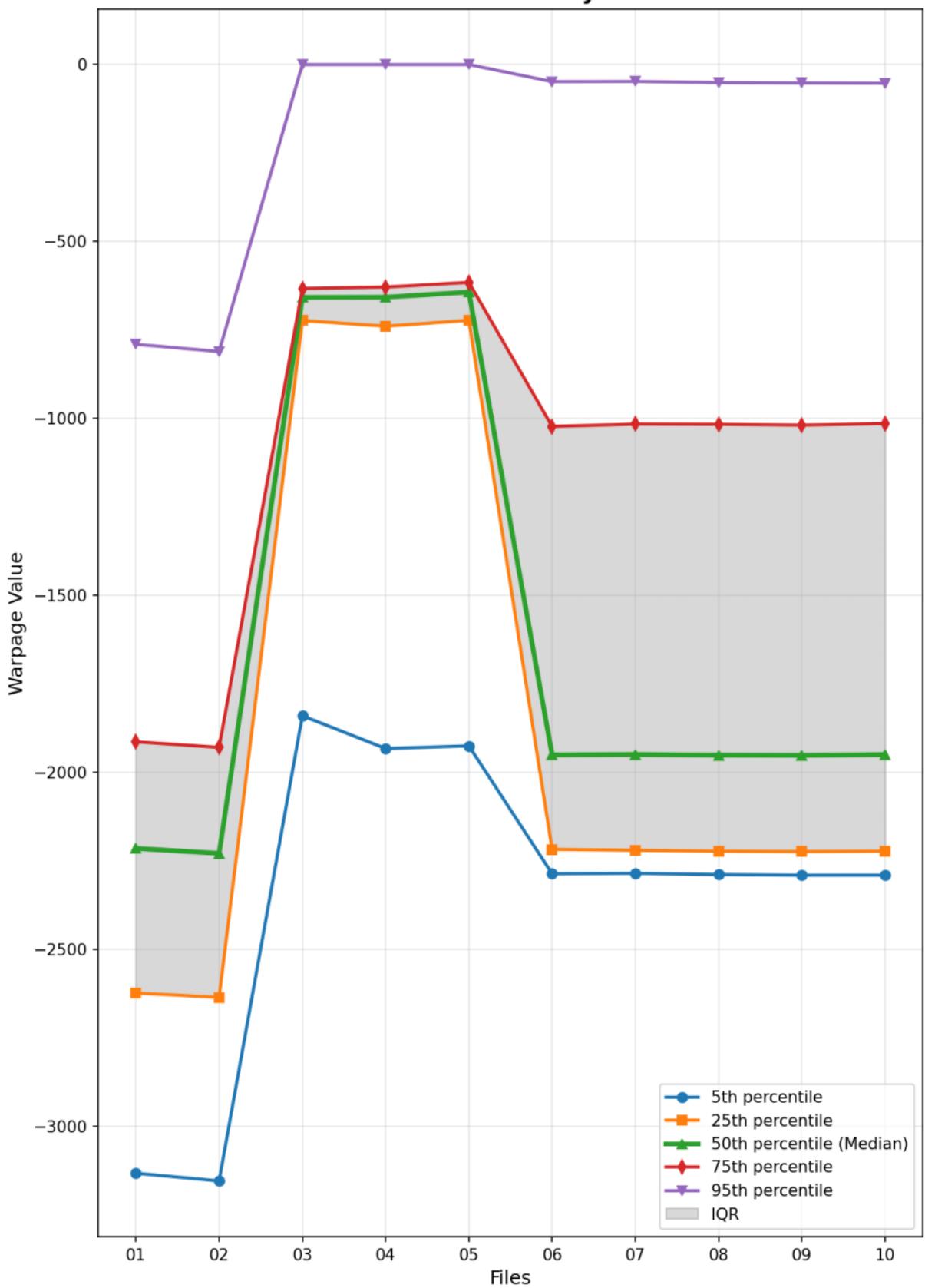


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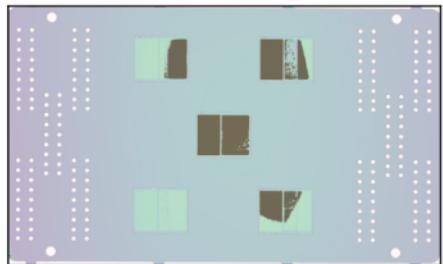




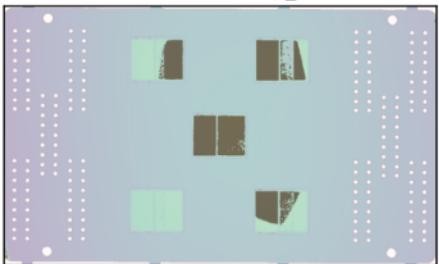
Percentile Analysis



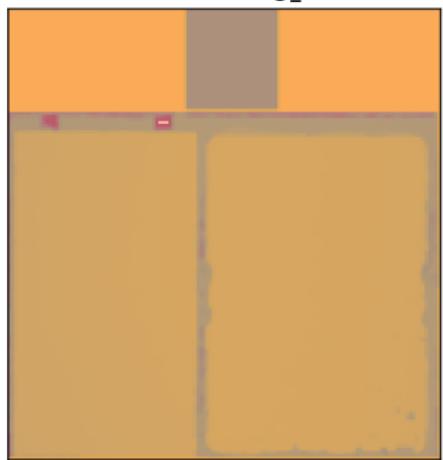
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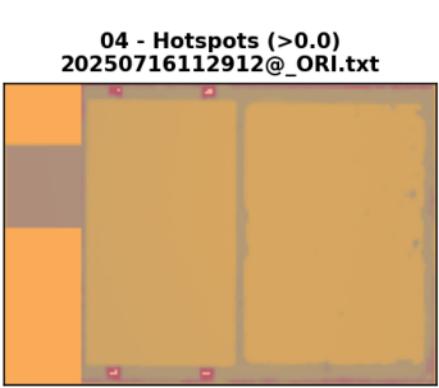
02 - Hotspots (>-811.1)
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03 - Hotspots (>0.0)
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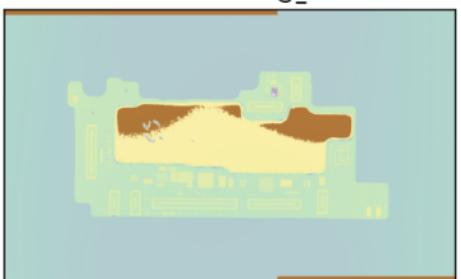
04 - Hotspots (>0.0)
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05 - Hotspots (>0.0)
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06 - Hotspots (>-48.3)
20250716114319@_ORI.txt



07 - Hotspots (>-47.8)
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08 - Hotspots (>-51.0)
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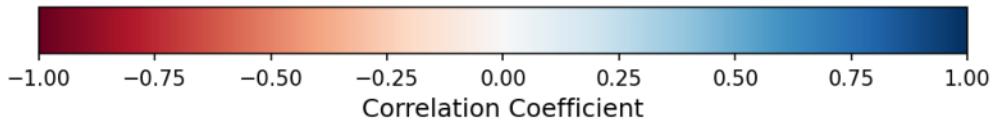


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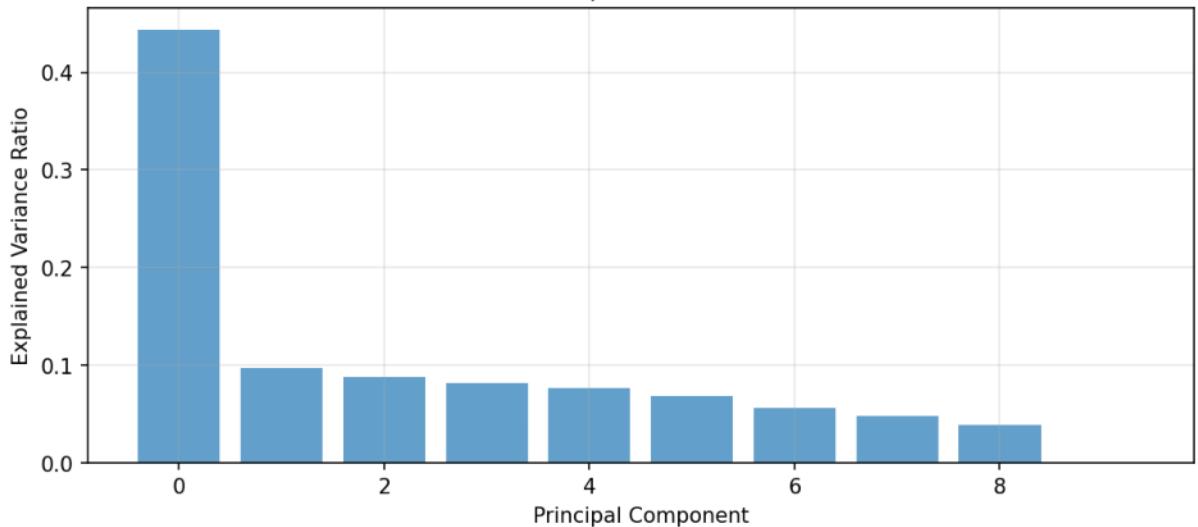


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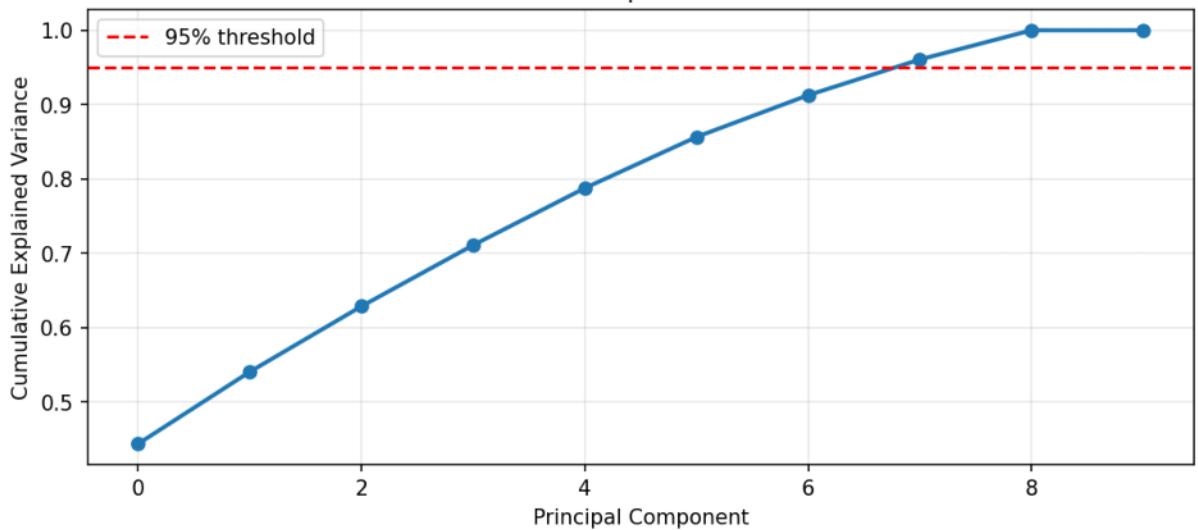


Correlation Matrix Between Files

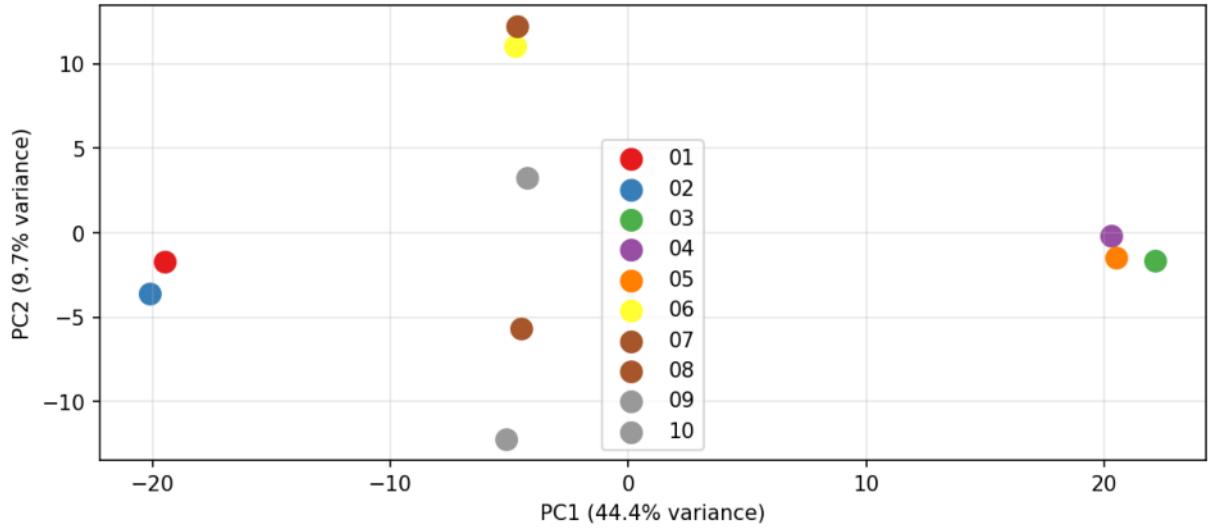
PCA - Explained Variance



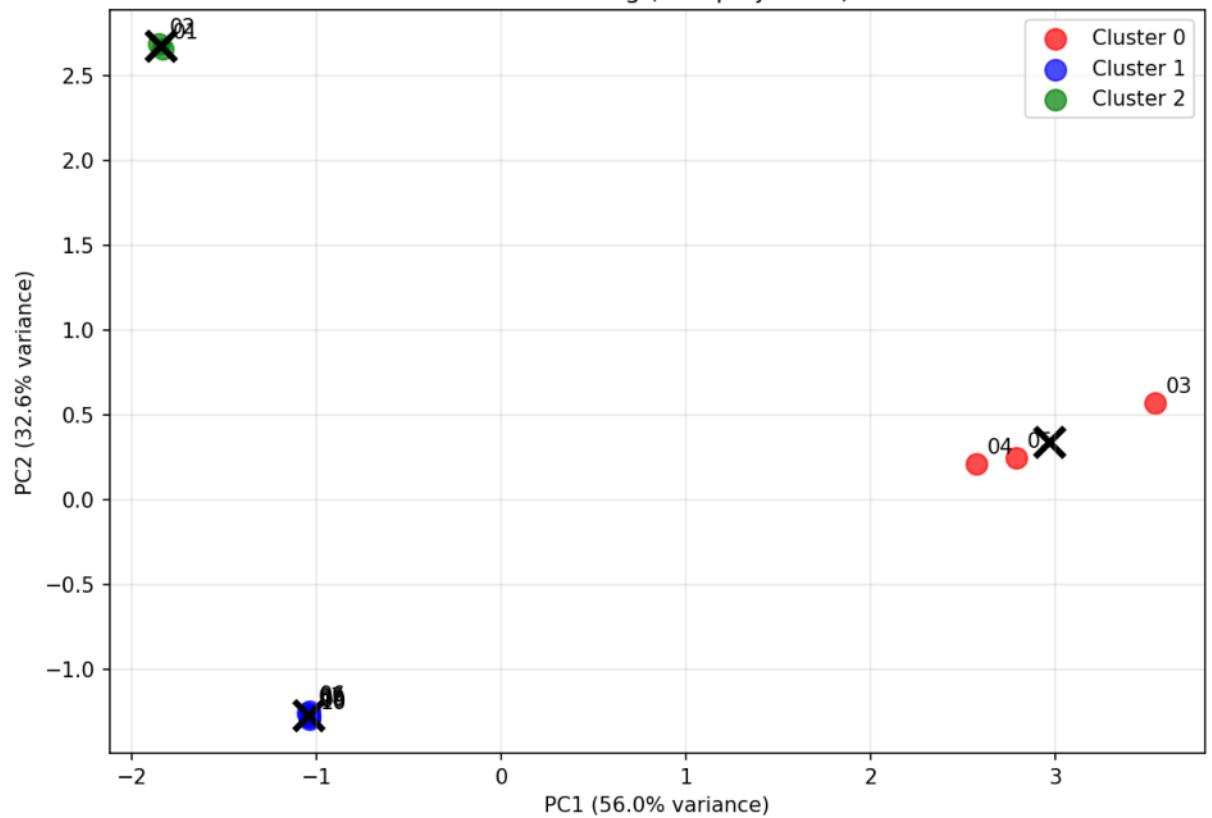
Cumulative Explained Variance



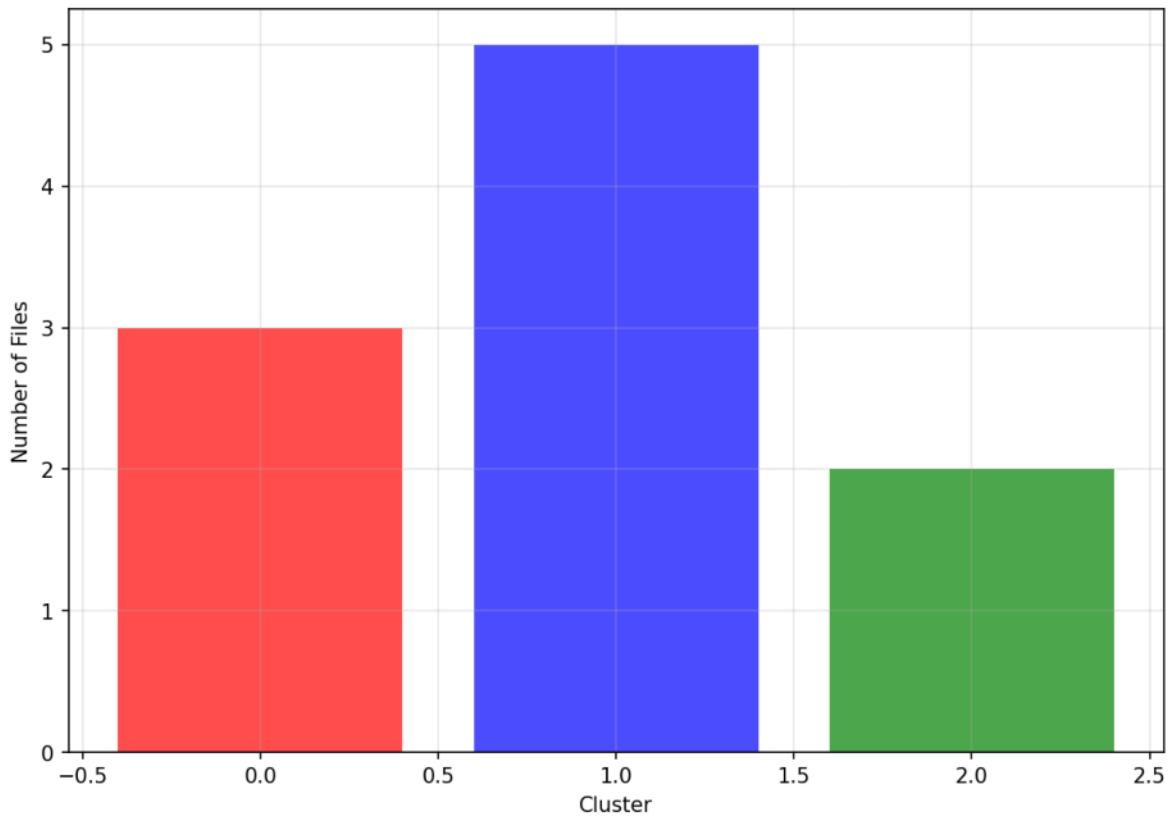
PCA - PC1 vs PC2



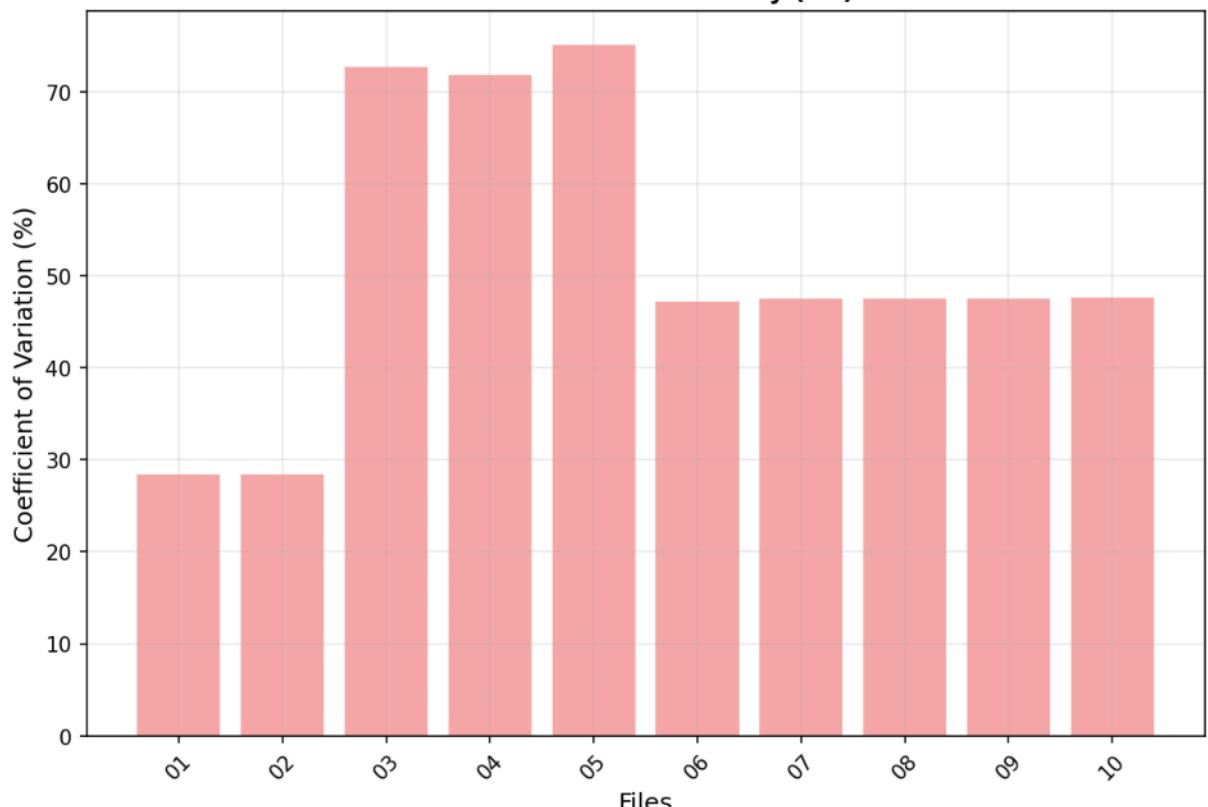
File Clustering (PCA projection)



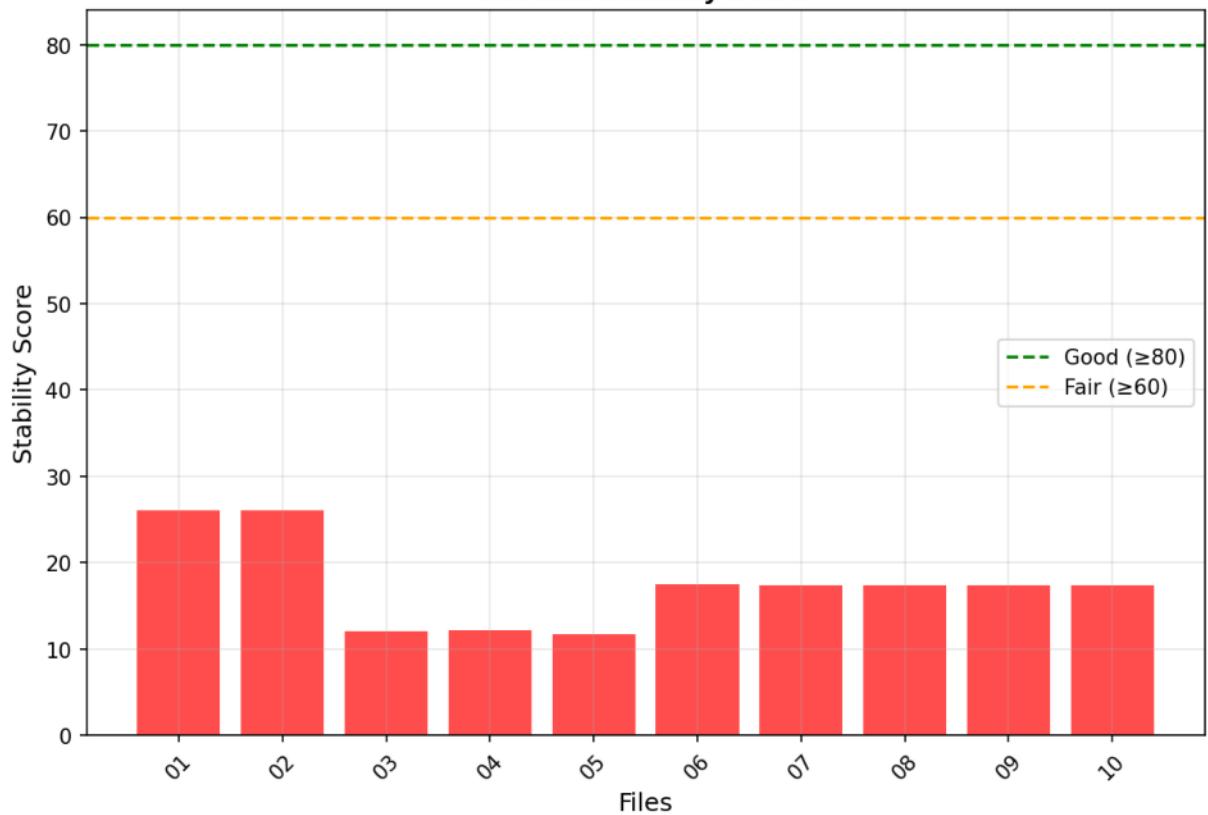
Cluster Distribution



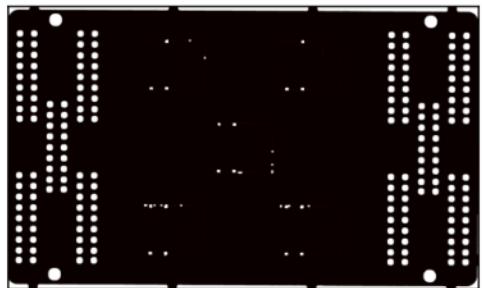
Measurement Variability (CV)



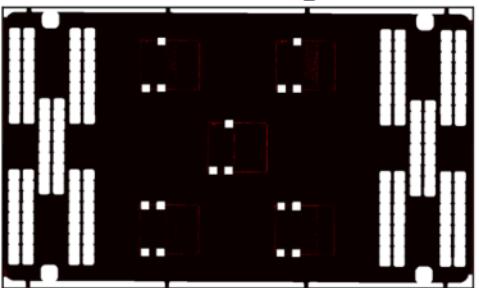
Process Stability Score



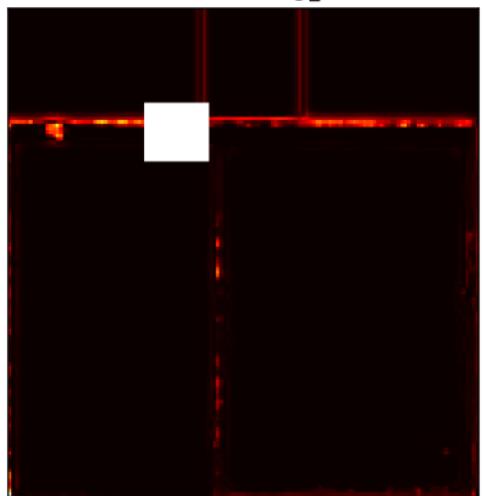
01 - Local Variability
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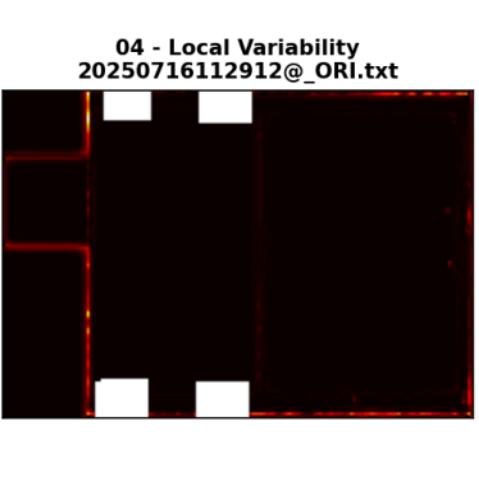
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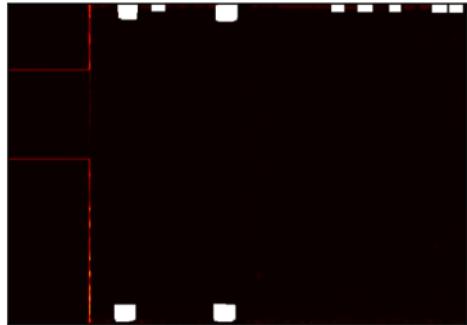
03 - Local Variability
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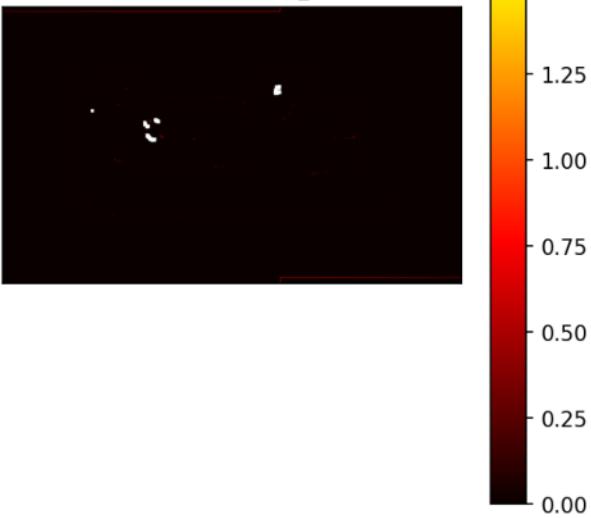
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05 - Local Variability
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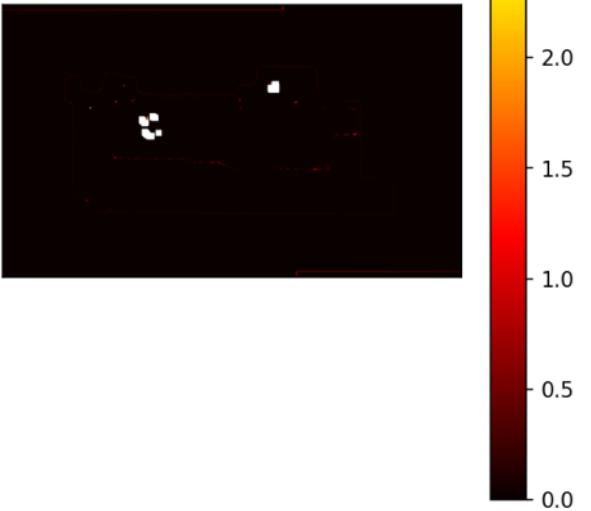
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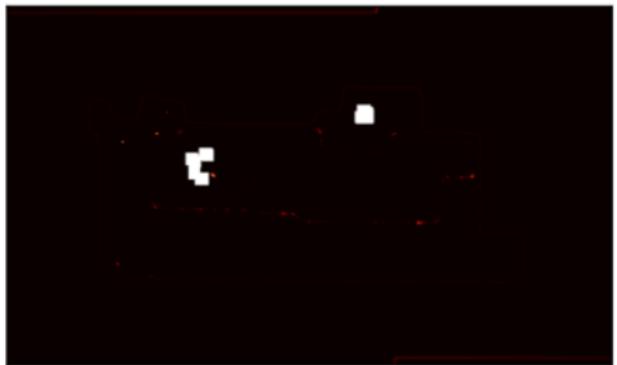
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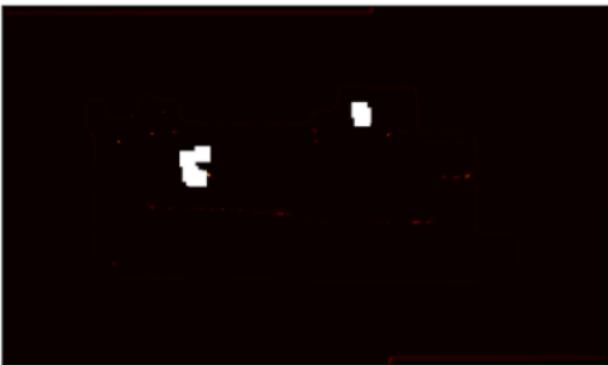
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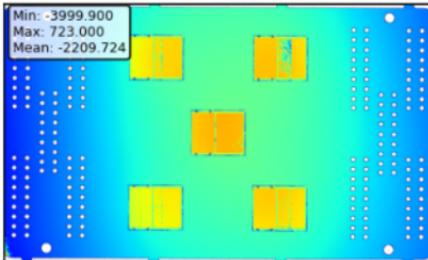
10 - Local Variability
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Warpage Data Comparison

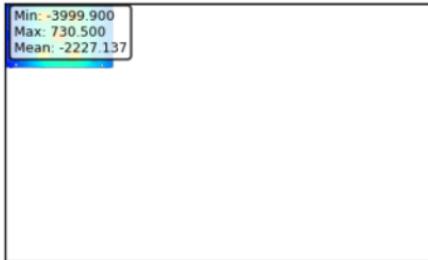
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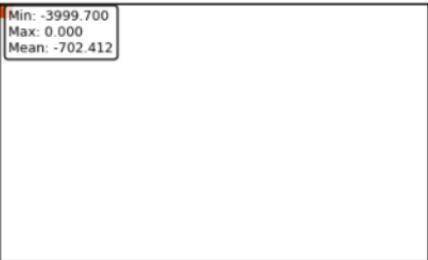
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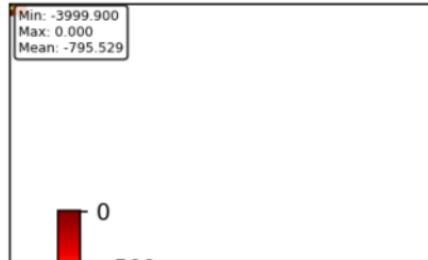
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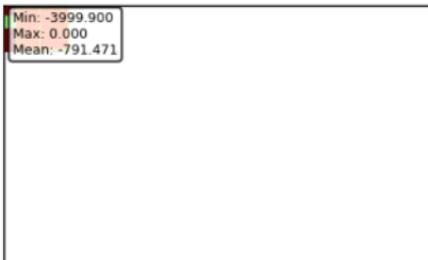
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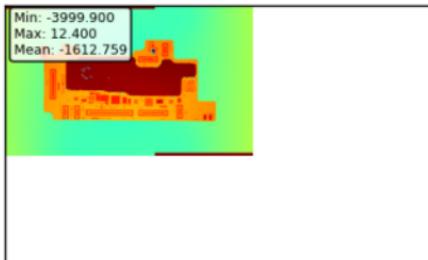
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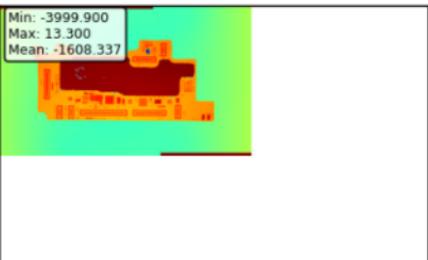
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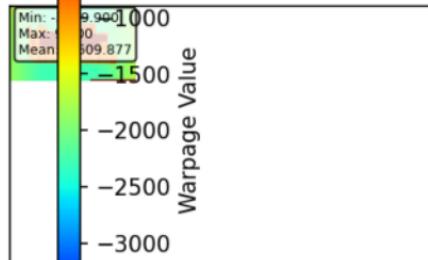
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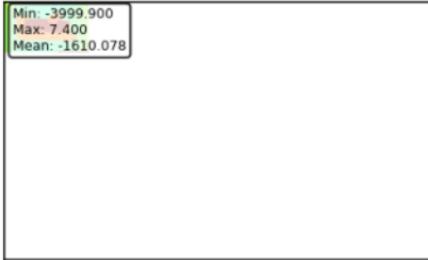
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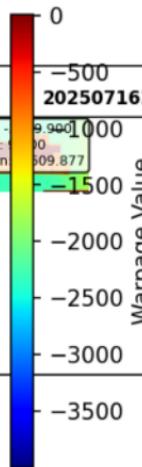
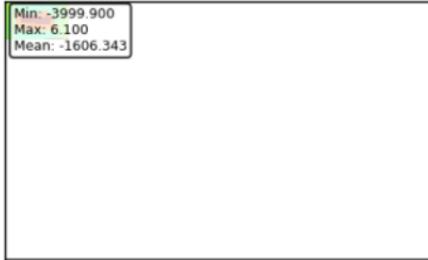
09

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10

20250716115218 @_ORI.txt



3D Surface Plots - Warpage Data

