

Center for Aircraft Structural Life Extension

Providing Structural Integrity Technology to the Aerospace Community



AFGROW COM programming for EIFS calculations



U.S. AIR FORCE

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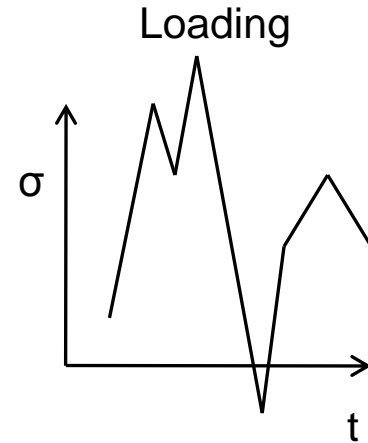
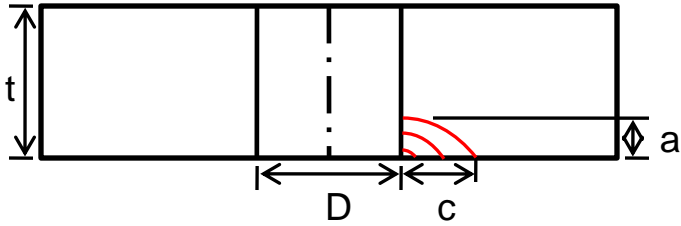
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- **EIFS Assumptions and Background**
 - **EIFS Calculation Process and Input Data**
 - **Crack Size Probability Distributions**
 - **EIFS Calculations and Updated Guess Logic**
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- **Equivalent Initial Flaw Size**
 - **Assumes Linear Elastic Fracture Mechanics valid**
 - **Material crack growth properties**
 - **Assumed loading in actual structure**
 - **“Real-world” crack geometry and life**
-

EIFS Process

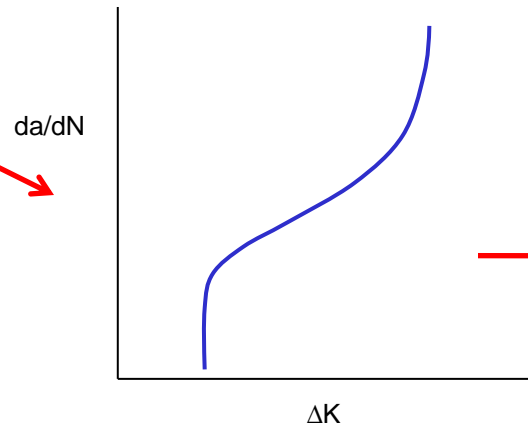
Real Crack



LEFM
Solutions

$$\Delta K = \beta \Delta \sigma \sqrt{\pi a}$$

Material Data

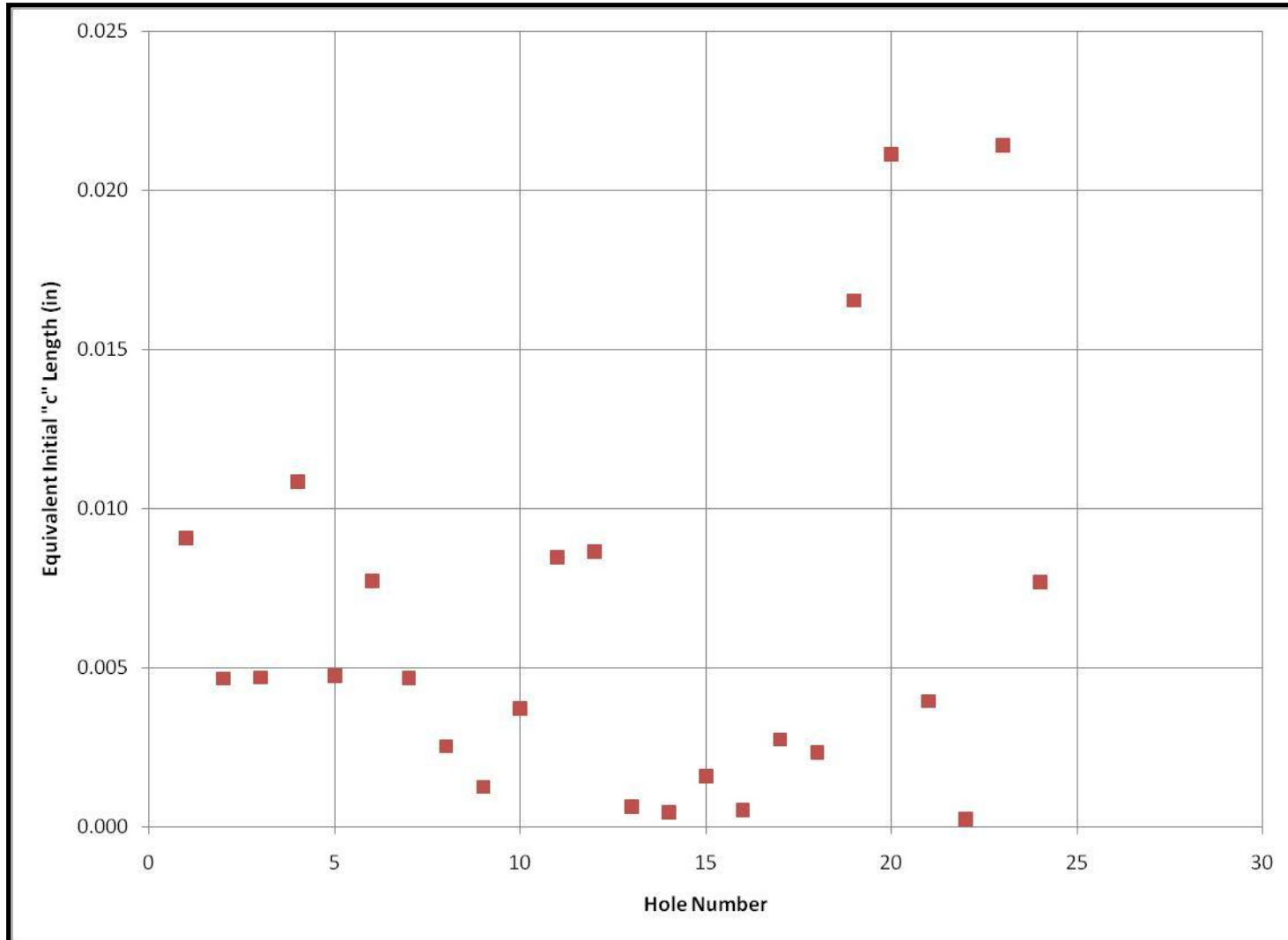


EIFS

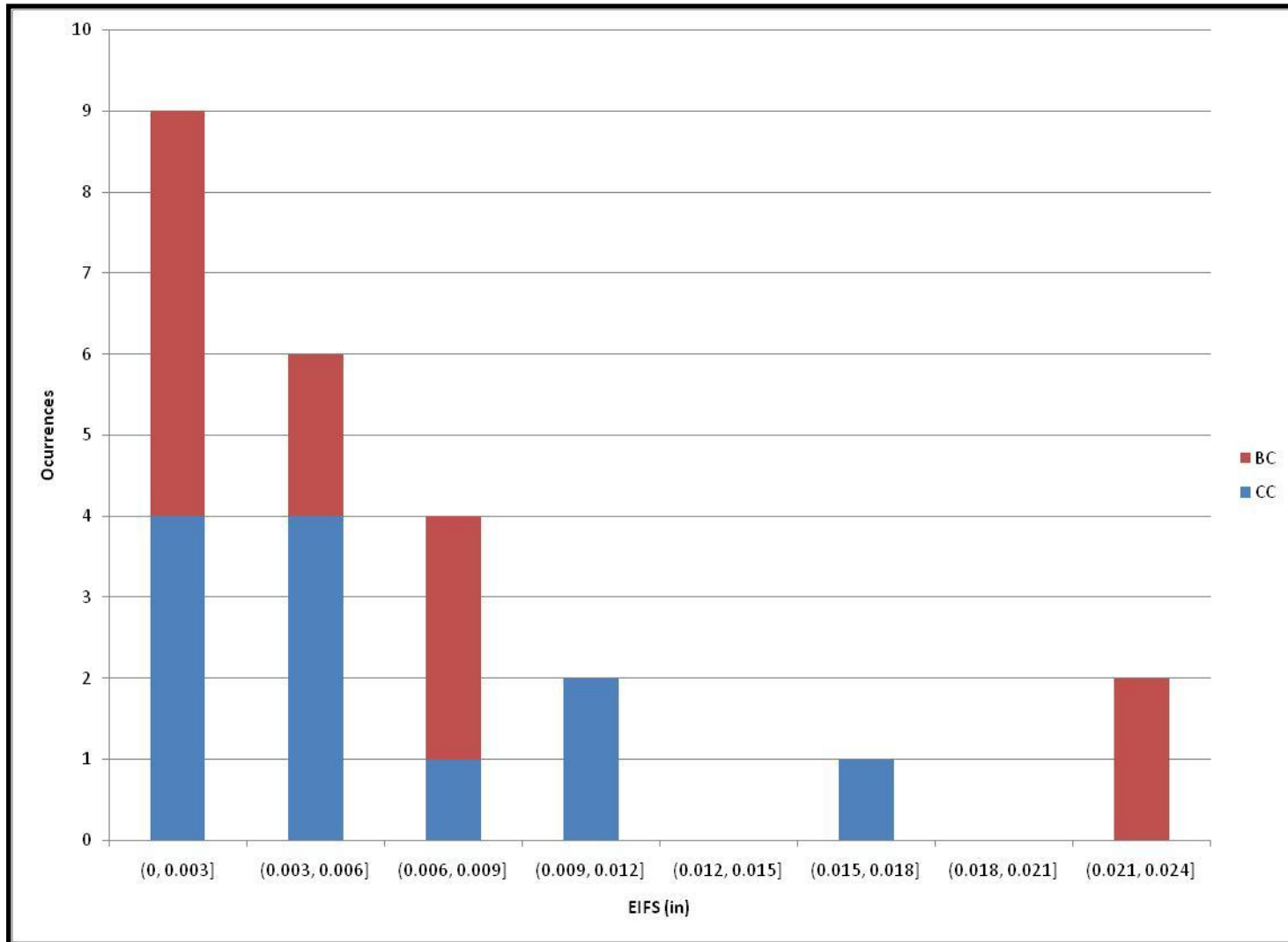
Example User Input

| Model | Hole Diameter | Thickness | Width | "a/c" ratio | SMF | SOLR | Material | Final "c" Length | Number of Cycles | Tolerance |
|-------|---------------|-----------|-------|-------------|------|------|-----------|------------------|------------------|-----------|
| 1030 | 0.259 | 0.165 | 10 | 0.60 | 25.4 | 2.7 | M7HG11AB1 | 0.025 | 530,318 | 53 |
| 2020 | 0.198 | 0.163 | 10 | 1.78 | 25.4 | 2.7 | M7HG11AB1 | 0.045 | 569,312 | 57 |
| 1050 | 0.196 | 0.251 | 10 | 1.29 | 25.4 | 2.7 | M7HG11AB1 | 0.017 | 569,312 | 57 |
| 1040 | 0.234 | 0.248 | 10 | 1.33 | 25.4 | 3.3 | M7TF11AB1 | 0.045 | 584,910 | 58 |
| 1060 | 0.187 | 0.277 | 10 | 1.22 | 25.4 | 3.3 | M7TF11AB1 | 0.056 | 577,111 | 58 |
| 2030 | 0.198 | 0.266 | 10 | 1.14 | 25.4 | 2.7 | M7HG11AB1 | 0.055 | 577,111 | 58 |
| 1030 | 0.236 | 0.259 | 10 | 0.78 | 25.4 | 3.3 | M7TF11AB1 | 0.023 | 522,520 | 52 |

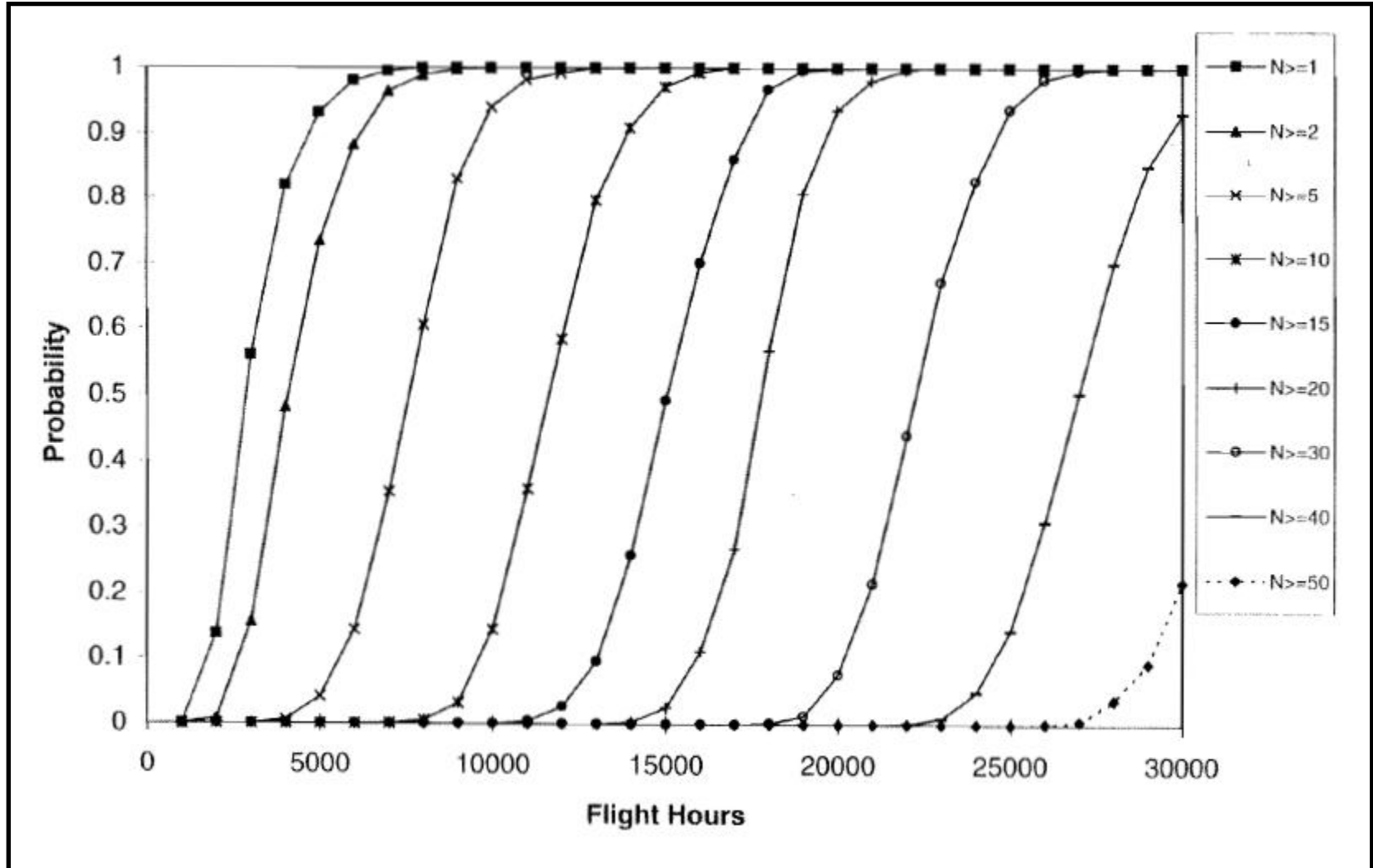
Example Data



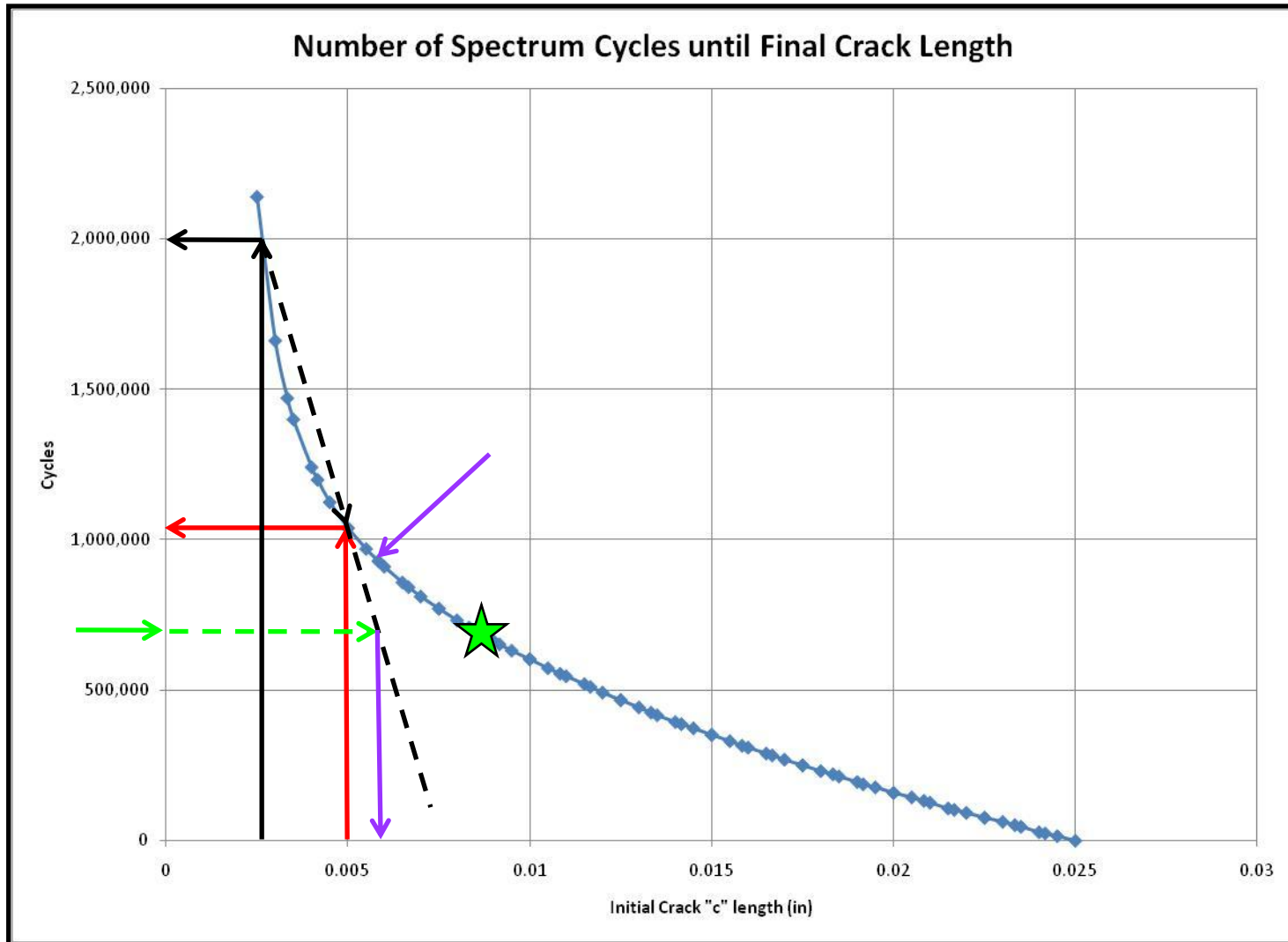
EIFS Histogram



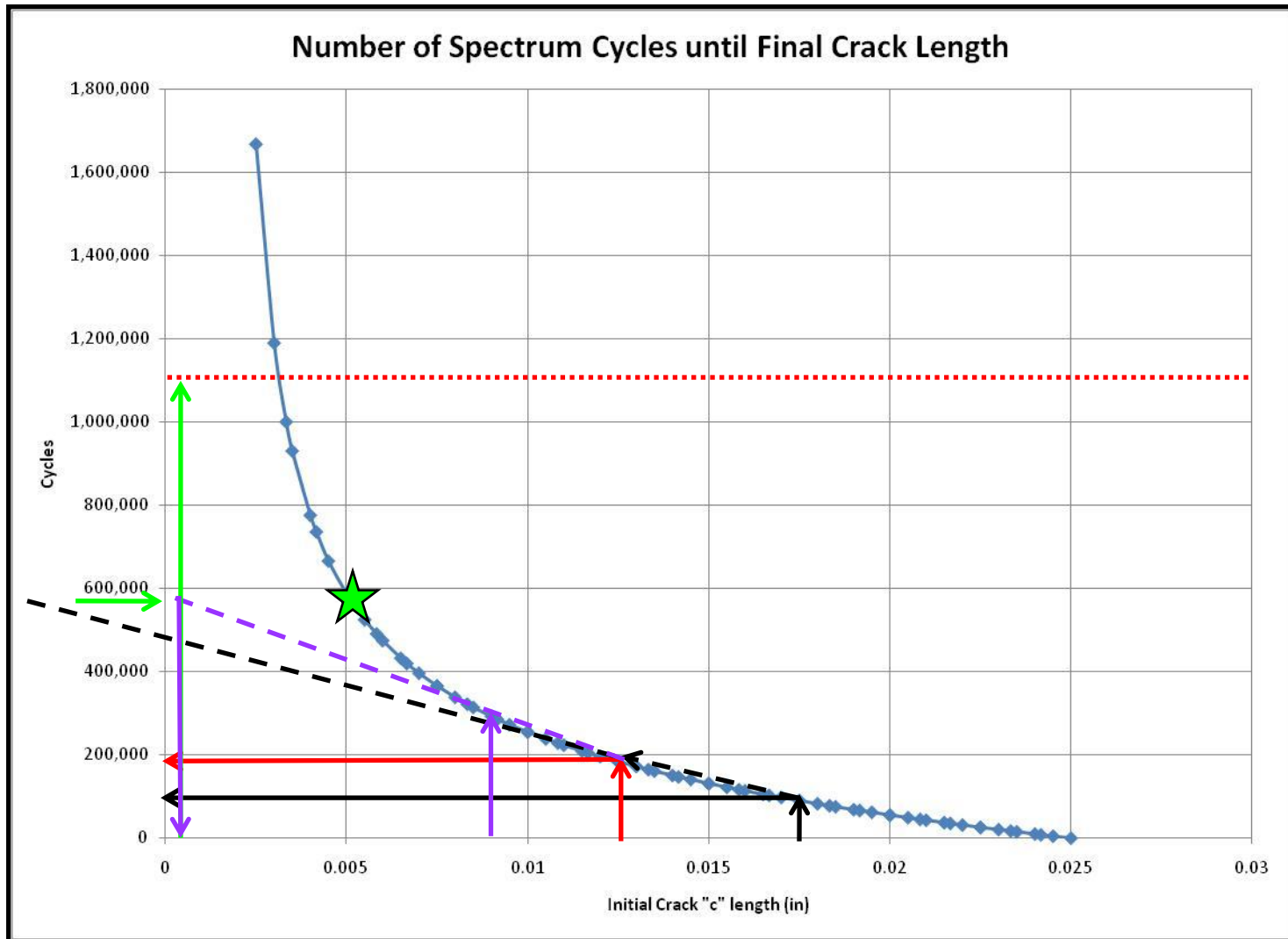
Crack Length Exceedance



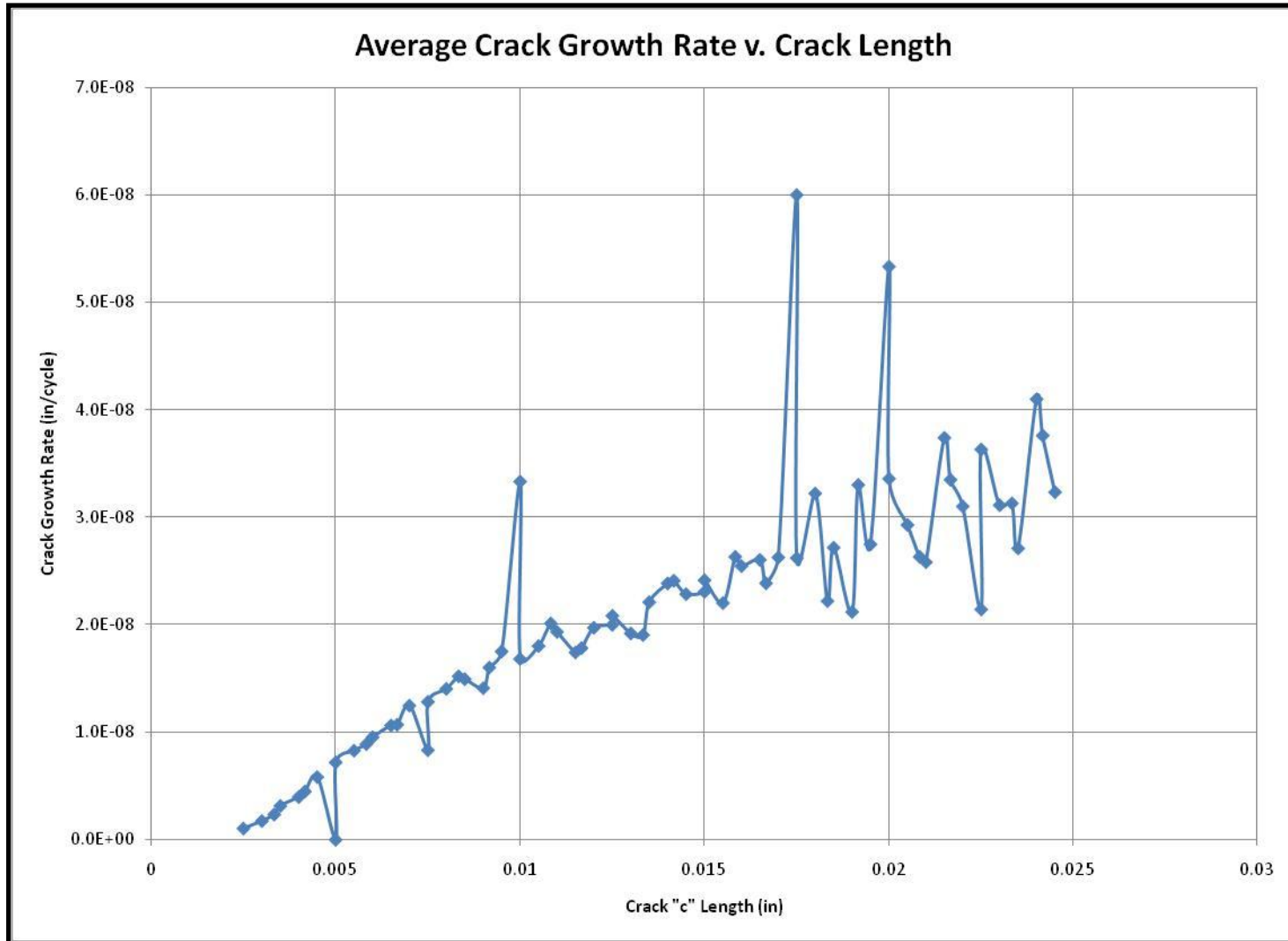
EIFS Updated Guess



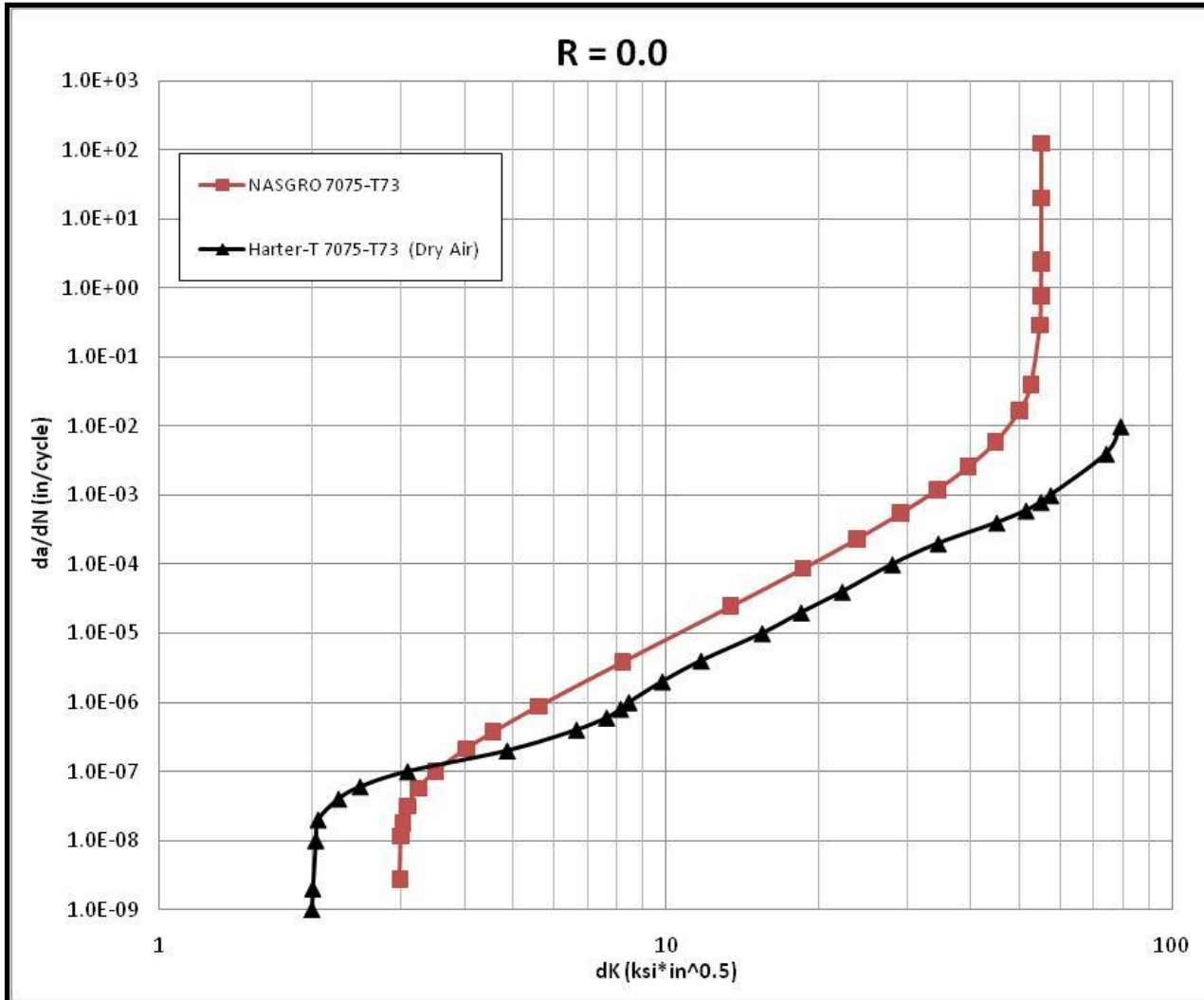
EIFS Updated Guess



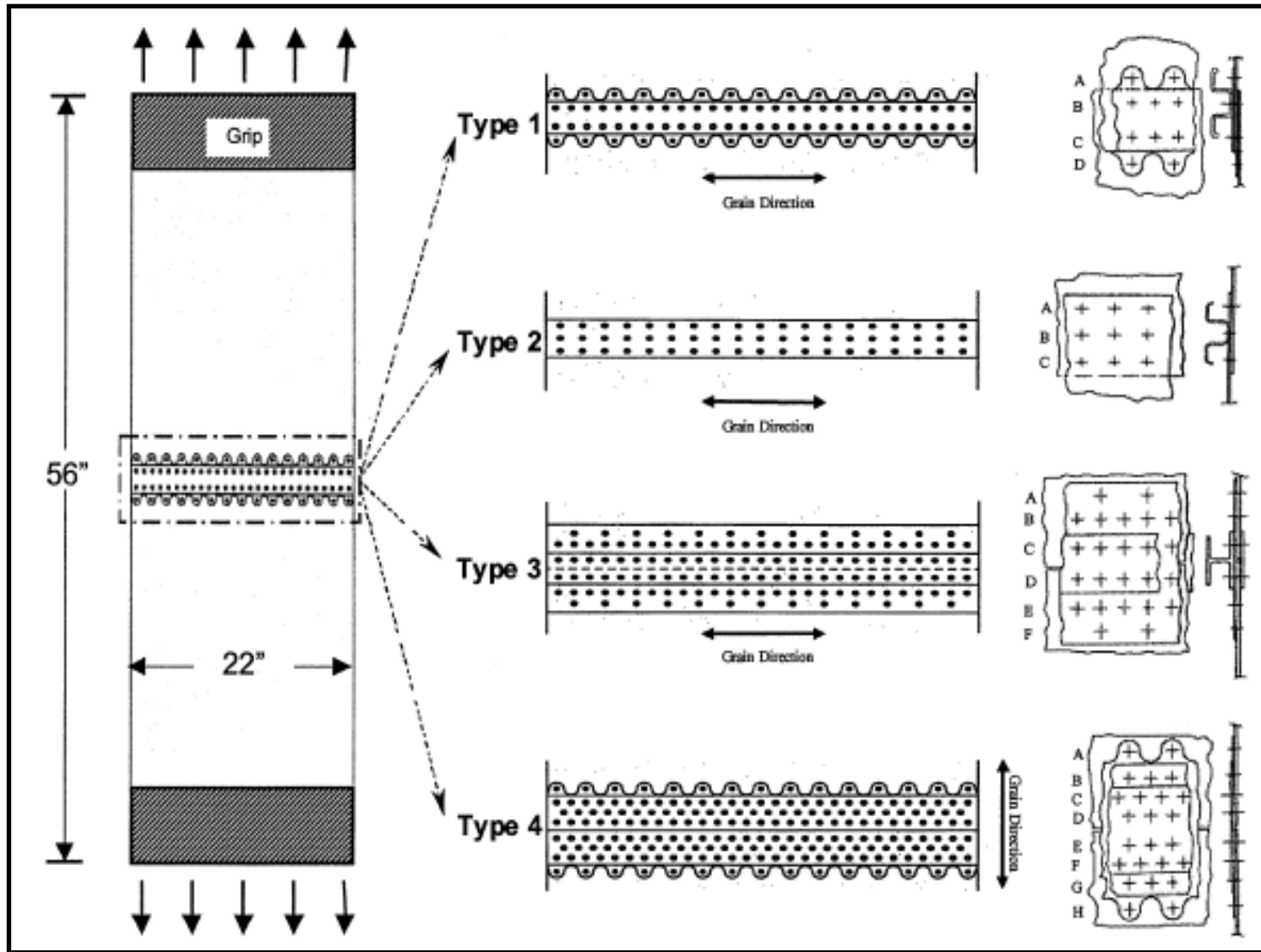
EIFS Updated Guess



Valid Assumptions?



Valid Assumptions?



Conclusions

- **AFGROW lends itself well to iterative LEFM and crack growth analyses via the COM option**

 - **The assumptions made for the analyses can have a significant impact upon the final “answer”**
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Questions?

