Summary of Stress Analysis

Facesheet Material	Maximum Normal Stress in Silicon	
	Bottom (psi)	Top (psi)
2.5% RL Converter (Standard)		
318 μm P75/RS-11 (GFRP)	40	651
75 μm P75/RS-11 (GFRP)	-446	272
50 μm Aluminum	-2436	-1640
25% RL Converter (SuperGLAST)		
318 μm P75/RS-11 (GFRP)	-4412	651
75 μm P75/RS-11 (GFRP)	-5491	272
Decoupling Detector from Converter		
Si Ladder & Bias-Circuit	-414	-414
** A negative value indicates compression **		

Conclusions from Analysis

- Standard Tray does not need modifications to the baseline design other than optimization of weight
- SuperGLAST stress levels are of concern
- Published Data suggests a very wide range of strength values
  - 8 ksi up to 1305 ksi
- Experience suggests levels might be as low as 3 ksi
- HYTEC has performed a 3-Pt Bend Test on several silicon detector samples salvaged from the prototype tray and ladder test

Results of 3-Pt Bend Test

MEASURED ULTIMATE STRENGTH OF SILICON DETECTORS
(3-Point Bend Test Results)

- length = 1"
- length = 1.2"
- length = 2"
- length = 3.8"
- Mean
- Mean - 3(St Dev)

Ultimate Strength (psi)
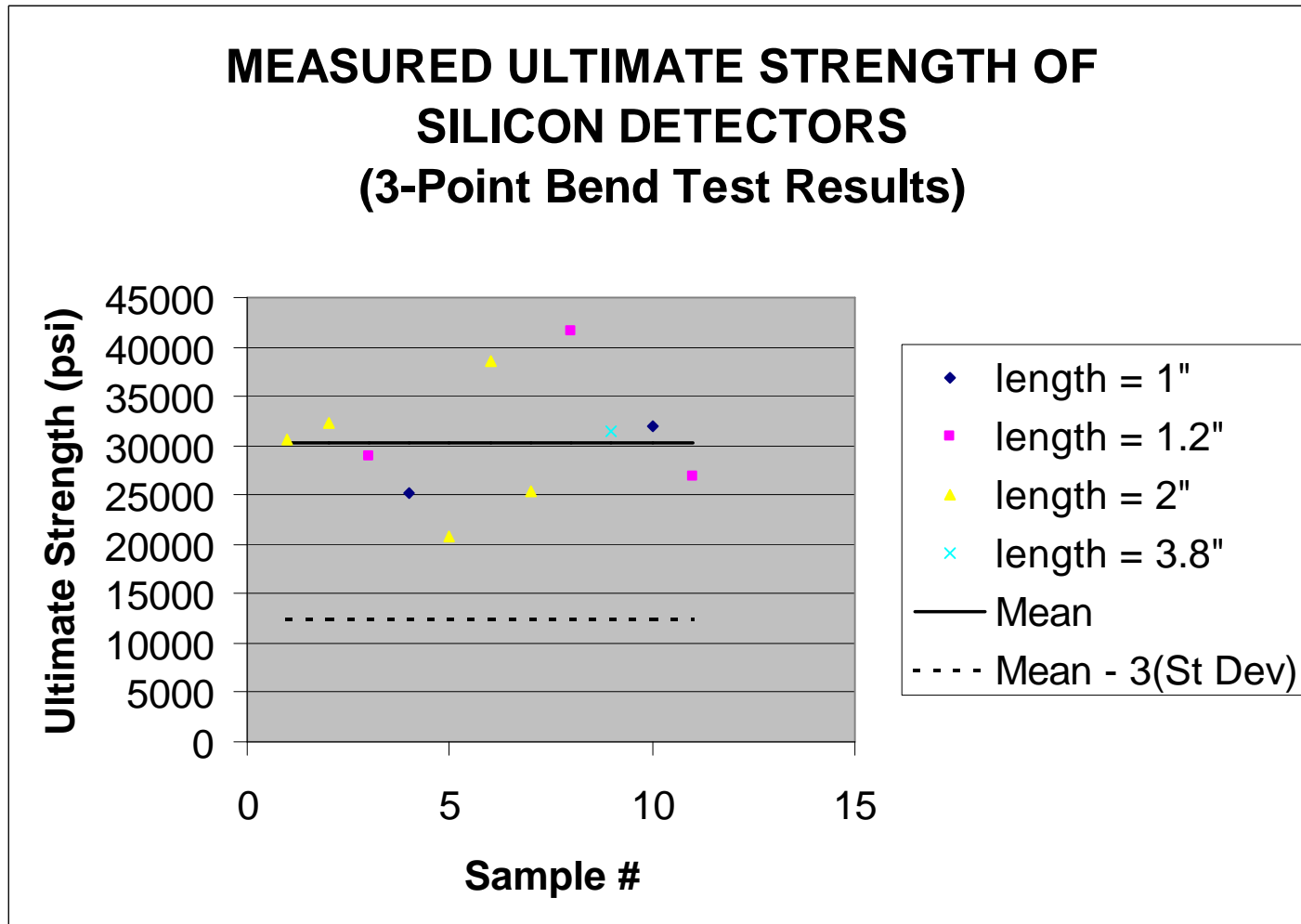
Sample #

Conclusions from 3-Pt Bend Test

- 11 Samples were tested
- Mean Ultimate Strength is 30,300 psi
- Standard Deviation is 6,000 psi
- Minimum Expected Ultimate Strength is 12,380 psi (mean minus 3 standard deviations)
- Design Ultimate Strength is 4,125 psi
  - Factor of Safety taken from NASA-STD-5001

Summary of CTE Mismatch Design Options

- Low Effective CTE Design Options
  - Alternate Materials
  - Lead Matrix Composites
  - Lamination of Lead as a Sandwich Structure
- Options to Decouple Converter and Silicon
  - Compliant Boundary Layers
    - Elastic vs Plastic
    - Location of Compliant Layer
  - Mechanical Isolation of Converter Layer between two face sheets