

# TOTEM – T0 Test Evaluation Module

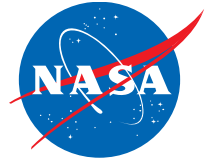
ASTM Committee Week 11/5/2018

ASTM E08.07.06 – E1921

Levi Shelton

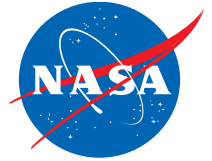
Cameron Bosley

# Topics



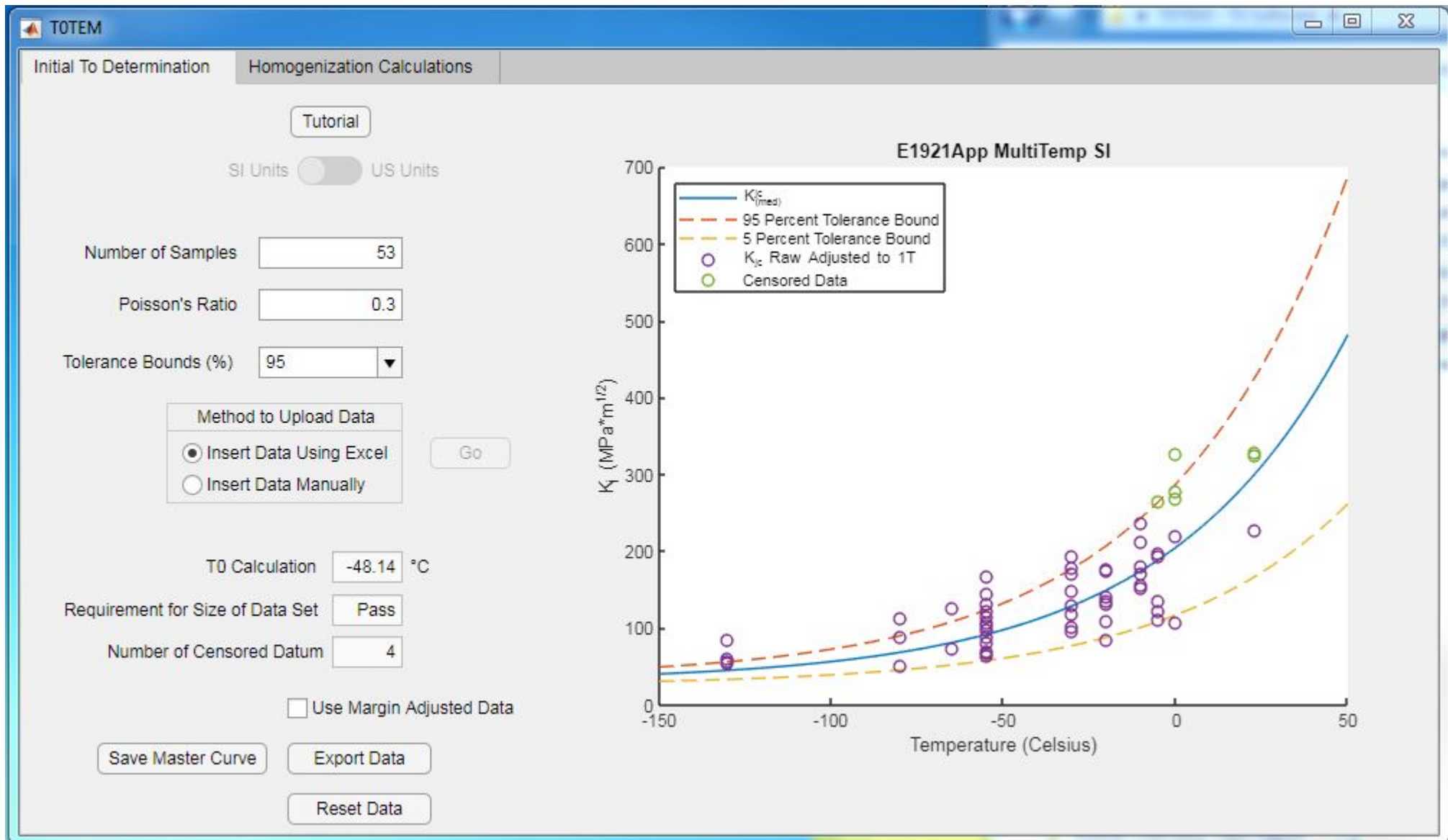
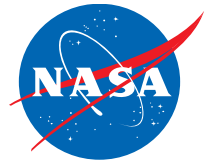
- Status
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# Status

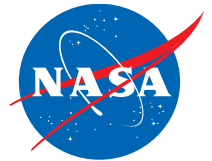


- Basic functionality complete:
  - Standard T0 calculation (multi-temp and single temp methods)
  - Master Curve plotting and selectable confidence bounds
  - Bi-modal and multi-modal calculations and plots
  - US and SI unit selectable
  - Manual entry/file select input
  - Margin adjustment
  
- Work still being done on:
  - Output Files (graphs, CSV)
  - Input File formatting (CSV)

# Software Overview



# Software Overview



TOTEM

Initial To Determination | Homogenization Calculations

Calculate All

Simple Method

ToIN  °C

Bimodal

pa  Homogeneous?

Ta  °C Confidence (%)

Tb  °C

Multimodal

SigmaTm  °C Homogeneous?

Tm  °C Confidence (%)

Export Data

Plot

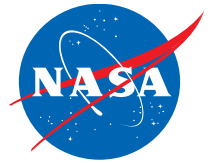
- Raw Data
- Simple
- Bimodal
- Multimodal

### E1921App MultiTemp SI

The graph displays the relationship between the stress intensity factor  $K_I$  (in  $\text{MPa}\cdot\text{m}^{1/2}$ ) and Temperature (in Celsius). The y-axis ranges from 0 to 800, and the x-axis ranges from -150 to 50. Three curves are shown: a yellow dashed line (top), a blue solid line (middle), and a red dashed line (bottom). Data points are plotted as circles, with purple circles clustered between -120 and -20 °C, and green circles clustered between -10 and 20 °C.

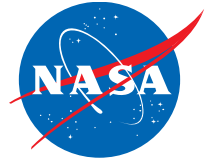
Temperature (Celsius)	$K_I$ (MPa·m <sup>1/2</sup> )
-120	60
-120	85
-80	50
-80	90
-80	115
-60	75
-60	125
-60	155
-60	165
-40	65
-40	100
-40	130
-40	155
-40	175
-20	85
-20	105
-20	125
-20	145
-20	165
-20	185
-20	195
-10	85
-10	105
-10	125
-10	145
-10	165
-10	185
-10	205
-5	105
-5	125
-5	145
-5	165
-5	185
-5	205
-5	225
-5	245
-5	265
-5	285
-5	305
-5	325
0	105
0	125
0	145
0	165
0	185
0	205
0	225
0	245
0	265
0	285
0	305
0	325
20	225
20	325

# Testing Results



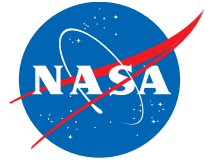
- For E1921 example problem:
  - Time to calculate standard T0 <5s
  - Time to calculate inhomogeneity results ~15s
- Largest data set attempted: 80 specimens
  - Time to calculate standard T0 <10s
  - Time to calculate inhomogeneity results ~30s
- Accuracy compared to original T0 script used to help validate inhomogeneity annex
- Accuracy within 1% to validated values listed in annex

# Planned Additions



- Allow for active adjustment of plot area
- Simple upper shelf plotting ability
- Add list of where specimens fall into validity requirements (to help adjust temperature while testing still being conducted)
- Tutorial auto runs ASTM sample set
- Visual output of  $K_{Ic}$  and  $K_{Ic}$  limit values
- Compressing code into functions for ease of troubleshooting and operation speed

# Working Group Distribution



- Currently going through NASA channels regarding limited distribution to working group test members.
- Need list of people interested in testing out beta version.
- In short term if anyone has non-sensitive data they are willing to share or would like analyzed we can send the input format file and return results for comparison.



