Material Modeling 2D Examples Inconel-718 V1 Adiabatic Shear Band (ASB)

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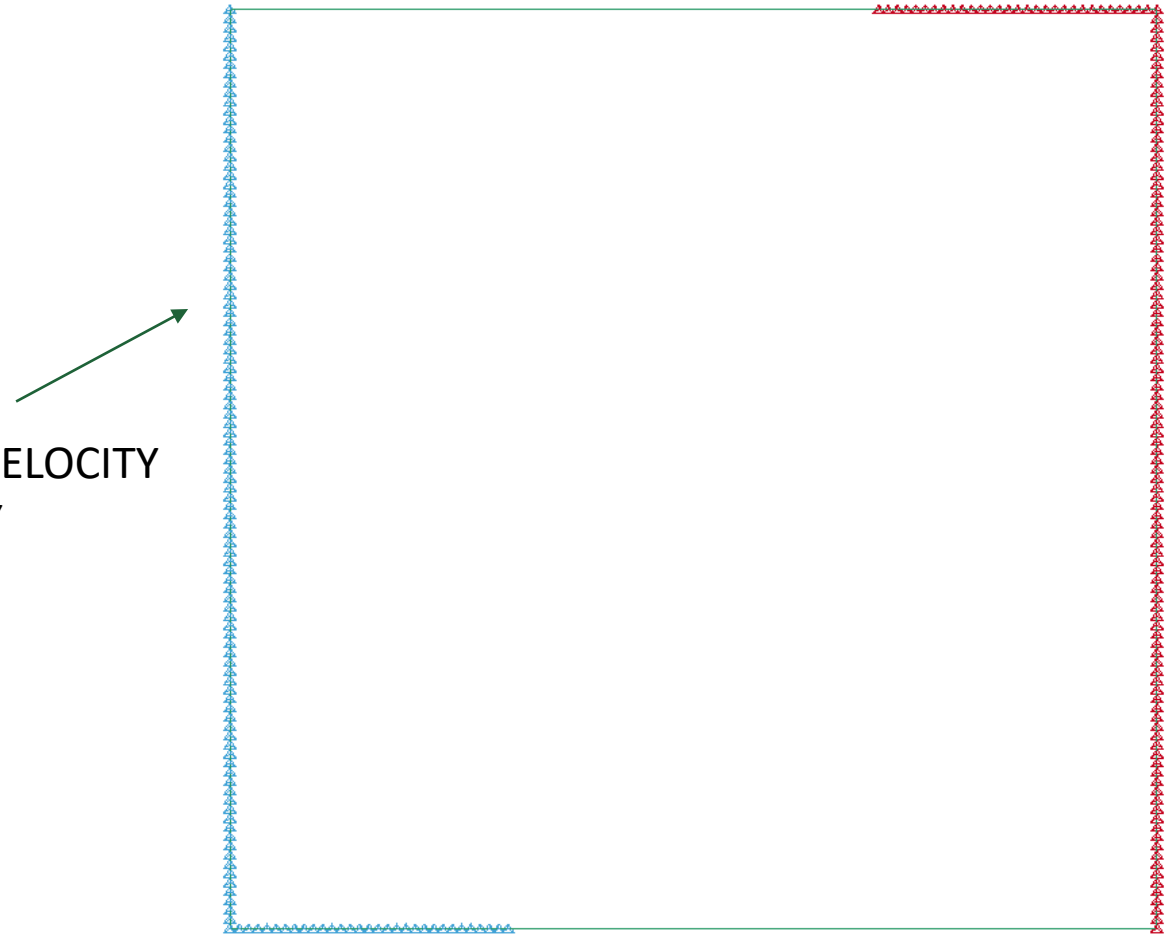
SUMMARY

- Intro
- Boundary Conditions
- Input Decks
- 0.0005 mm NO ASB feature activated
- 0.2 mm NO ASB feature activated
- 0.2 mm ASB feature activated
- Remarks

Introduction

- WARNING: THE ASB FEATURE WORKS ONLY WITH DEV-86797 or later development versions
- 3 Cases presented:
  - 0.5µm elements mesh without ASB feature activated
    - Baseline adiabatic shear band analysis demonstrated
    - ASB feature not required because of small element size
  - 200µm elements mesh without ASB software activated
  - 200µm elements mesh with ASB feature activated

Boundary Conditions



Input Deck

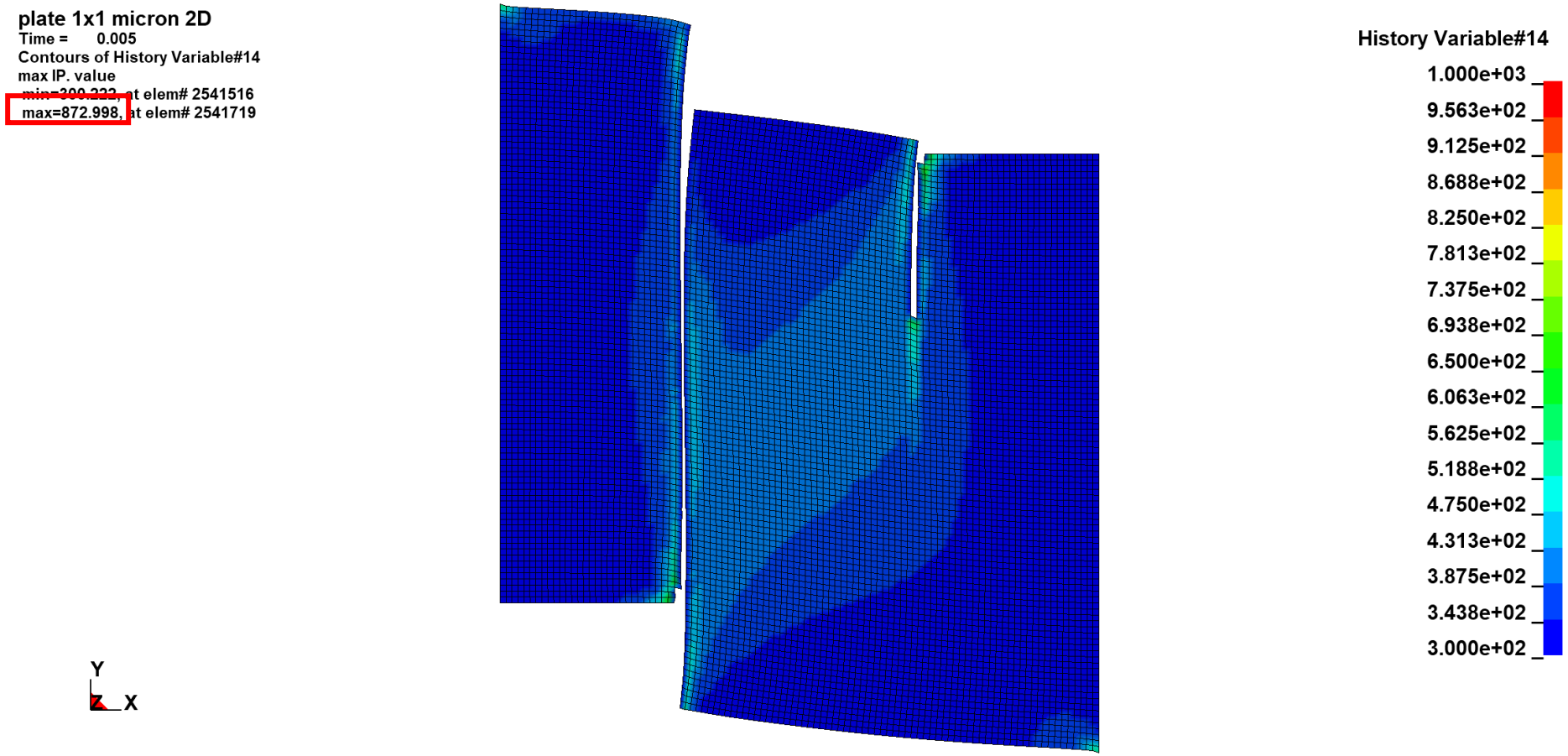
ASB

```
*MAT_TABULATED_JOHNSON_COOK_TITLE
MAT_224_Inco718_ASB
$      mid        ro         e        pr        cp        tr      beta     numint
       100  8.190E-6     210.0      0.29     435.0     300.0     -6701       1.0
$     lck1      lckt       lcf       lcg       lch       lci      bflg
         1         2       500       600       700       900         1
*CONTROL_SOLUTION
$#    soln       nlq     isnan     lcint     lcacc     ncdcf
                                    1000
```

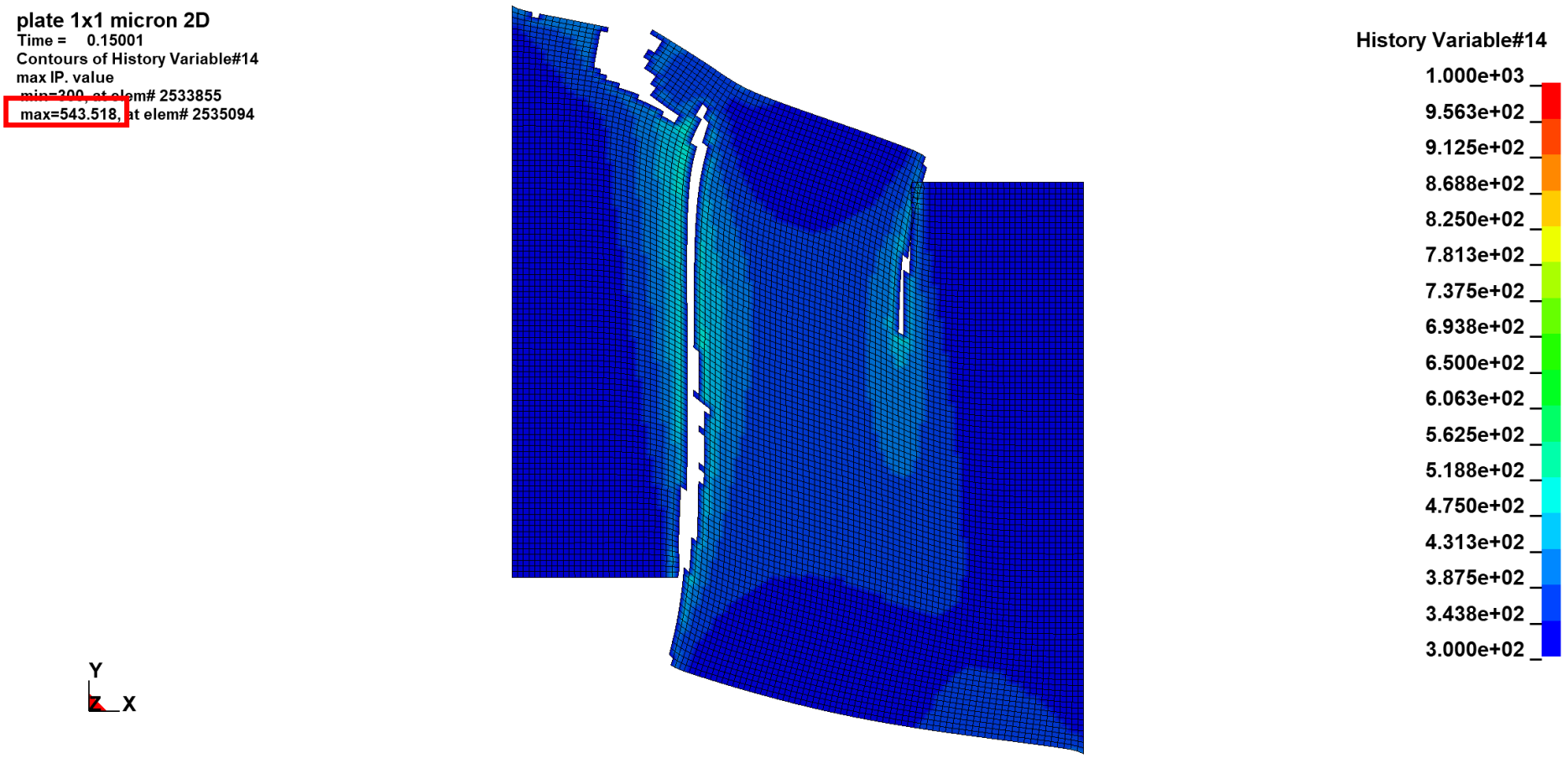
NO ASB

```
*MAT_TABULATED_JOHNSON_COOK_TITLE
MAT_224_Inco718_ASB
$      mid        ro         e        pr        cp        tr      beta     numint
       100  8.190E-6     210.0      0.29     435.0     300.0       0.8       1.0
$     lck1      lckt       lcf       lcg       lch       lci      bflg
         1         2       500       600       700       900
*CONTROL_SOLUTION
$#    soln       nlq     isnan     lcint     lcacc     ncdcf
                                    1000
```

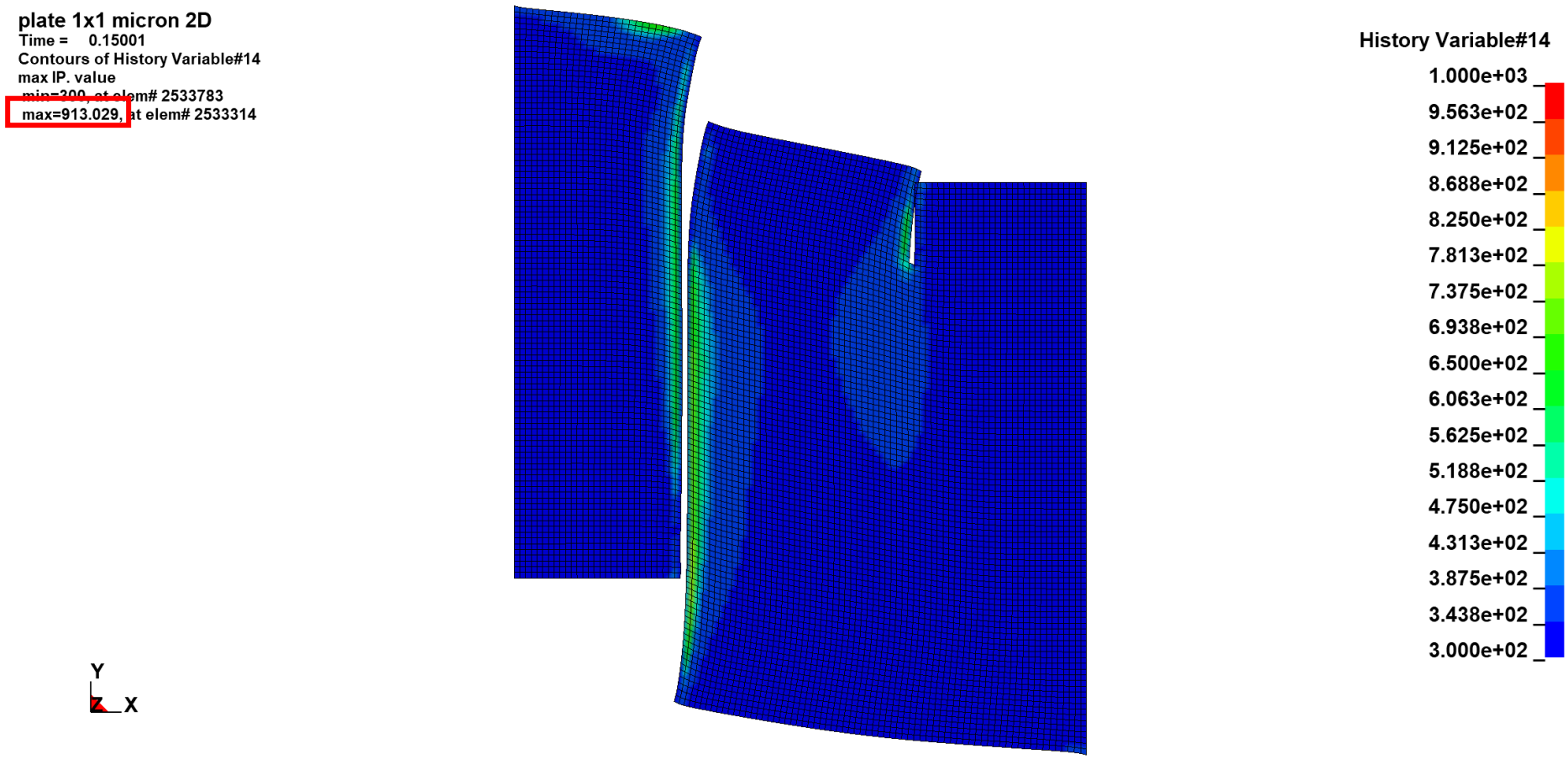
0.0005 mm NO ASB feature – ASB



0.2 mm NO ASB feature – No ASB



0.2 mm ASB feature - ASB



Remarks

- In the 0.5µm case, the mesh is small enough to capture the shear localization and develop an ASB without the ASB feature (max temperature at final analysis timestep= 873 K)
- In the 200µm case, without the ASB feature activated the mesh cannot replicate the ASB (no ASB: max temperature at final analysis timestep= 544 K, ASB: max temperature at final analysis timestep= 913 K)
- This is just an example for description purpose, for more information and real ballistic impact simulation check:

Dolci, S. (2021). The Influence of Strain Rate, Temperature Effects, and Instabilities in Failure Modeling for Metal Alloys (Doctoral dissertation, George Mason University).

https://www.proquest.com/docview/2573003826/fulltextPDF/A2557B05375F44B4PQ/1?accountid=14541