Thermal model of the MICE target
- a few simulations -

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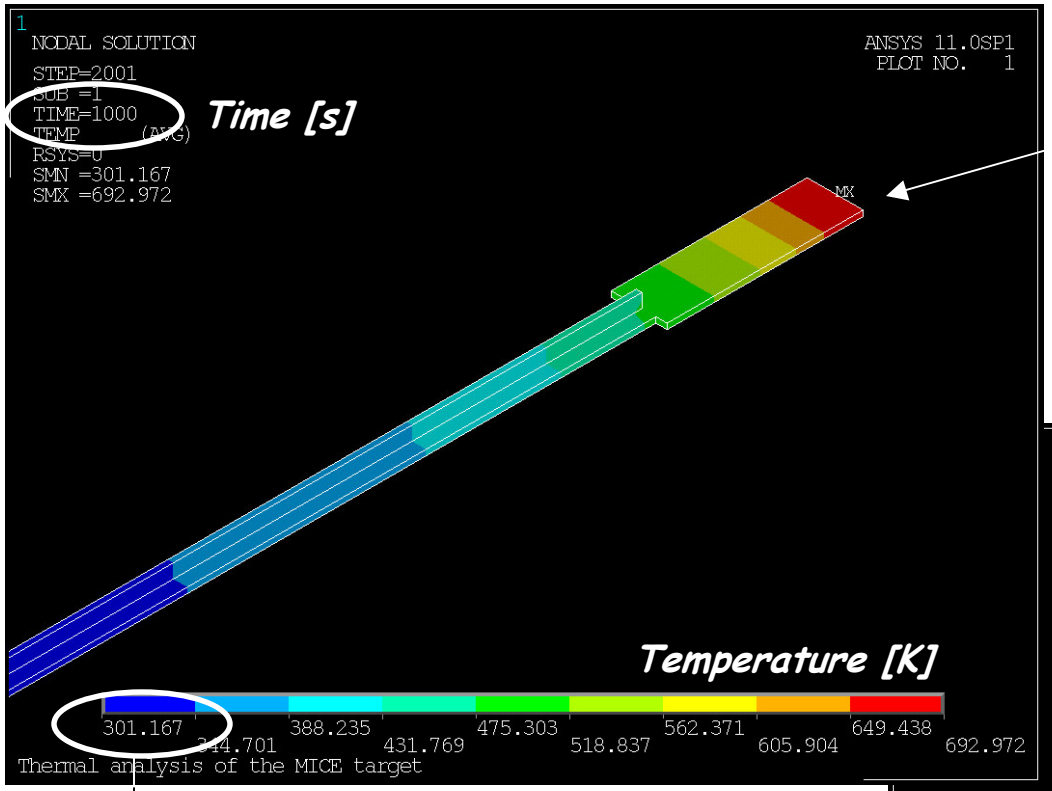
MICE target – normal operation

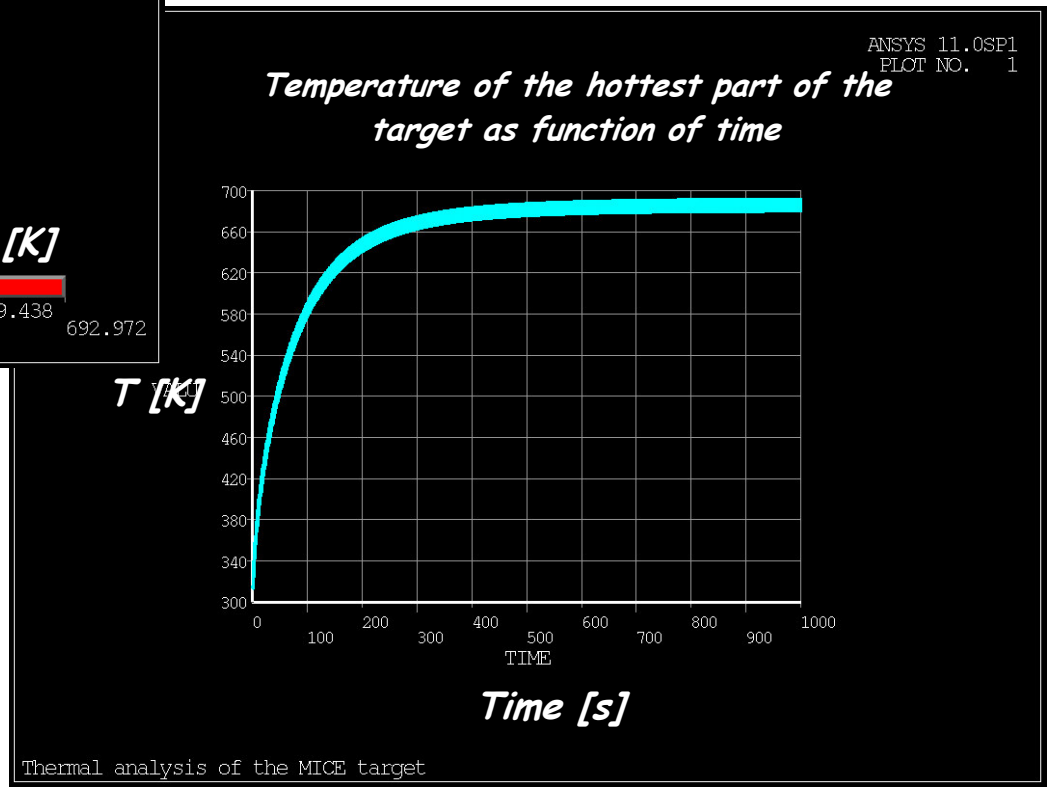


End of the shaft

Energy deposition: 2 J in 2 ms at 1 Hz; energy deposited uniformly over lowest 5 mm of target.

Initial temperature: 300 K

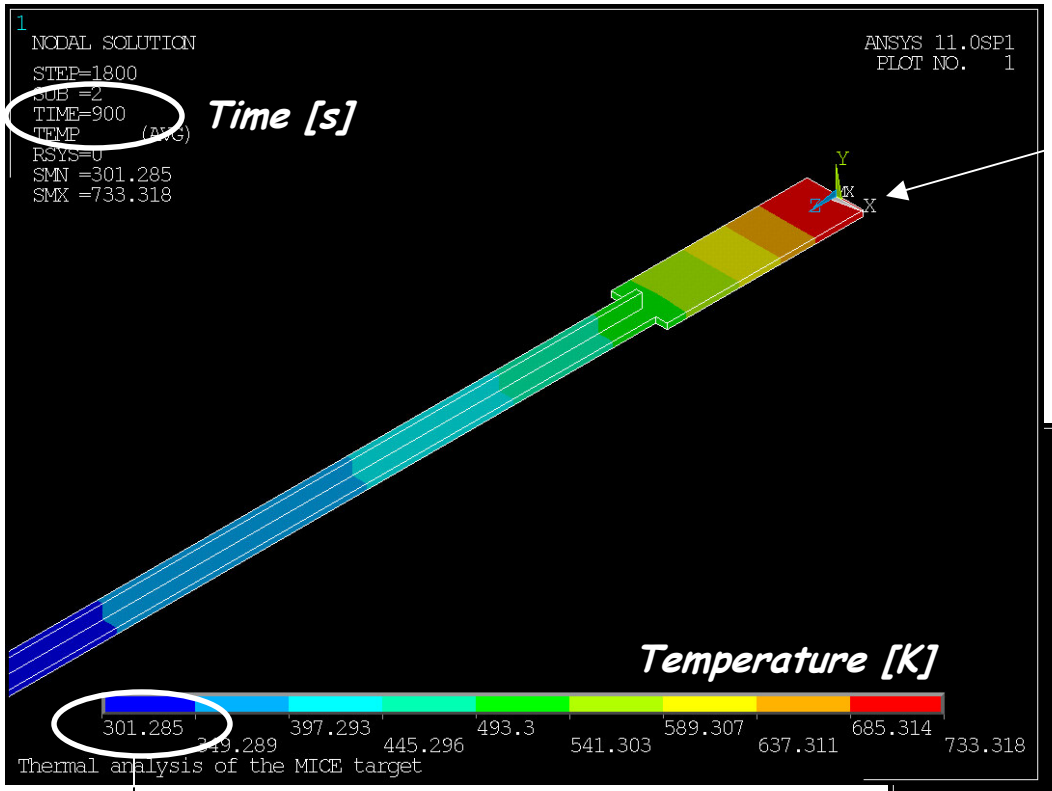
Emissivity: 0.3



Target reaches 'equilibrium' temperature after ~ 15 minutes.

This is for emissivity of 0.3 but it looks that for titanium at room temperature this value is closer to 0.2 (simulations result -> next slide)

MICE target – normal operation



End of the shaft

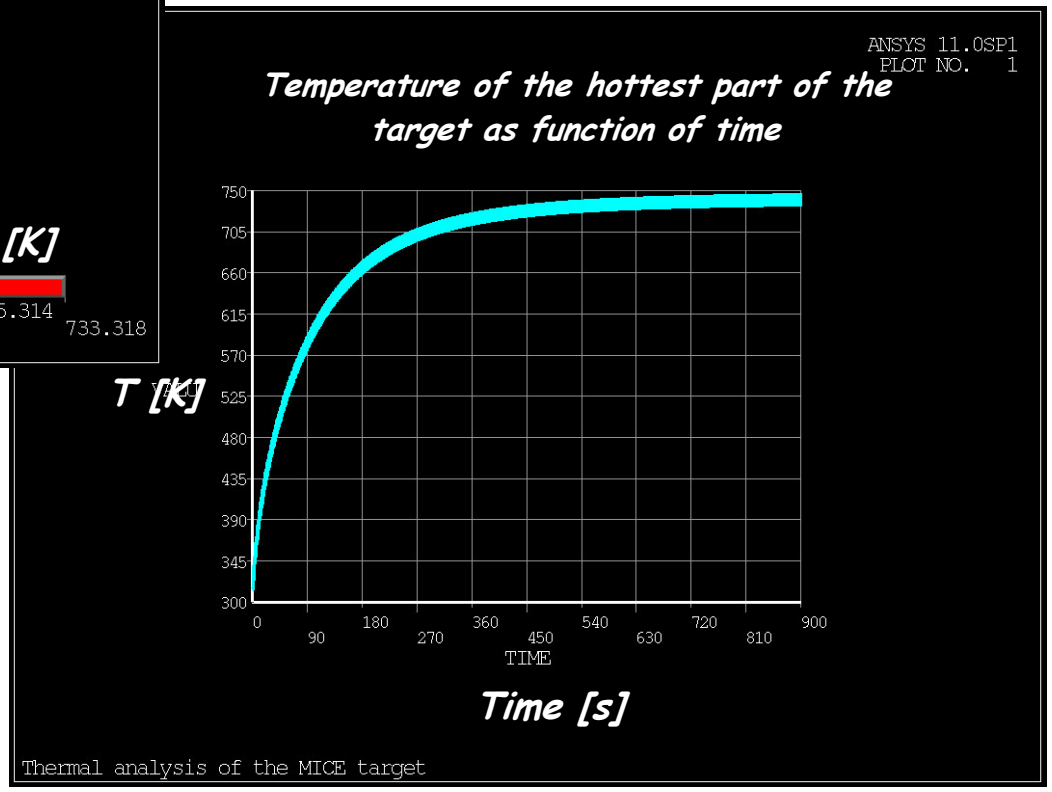
The 'equilibrium' temperature in this case is a bit (~50 K) higher.

What if target is parked in the beam now? (simulations result -> next slide)

Energy deposition: 2 J in 2 ms at 1 Hz; energy deposited uniformly over lowest 5 mm of target.

Initial temperature: 300 K

Emissivity: 0.2



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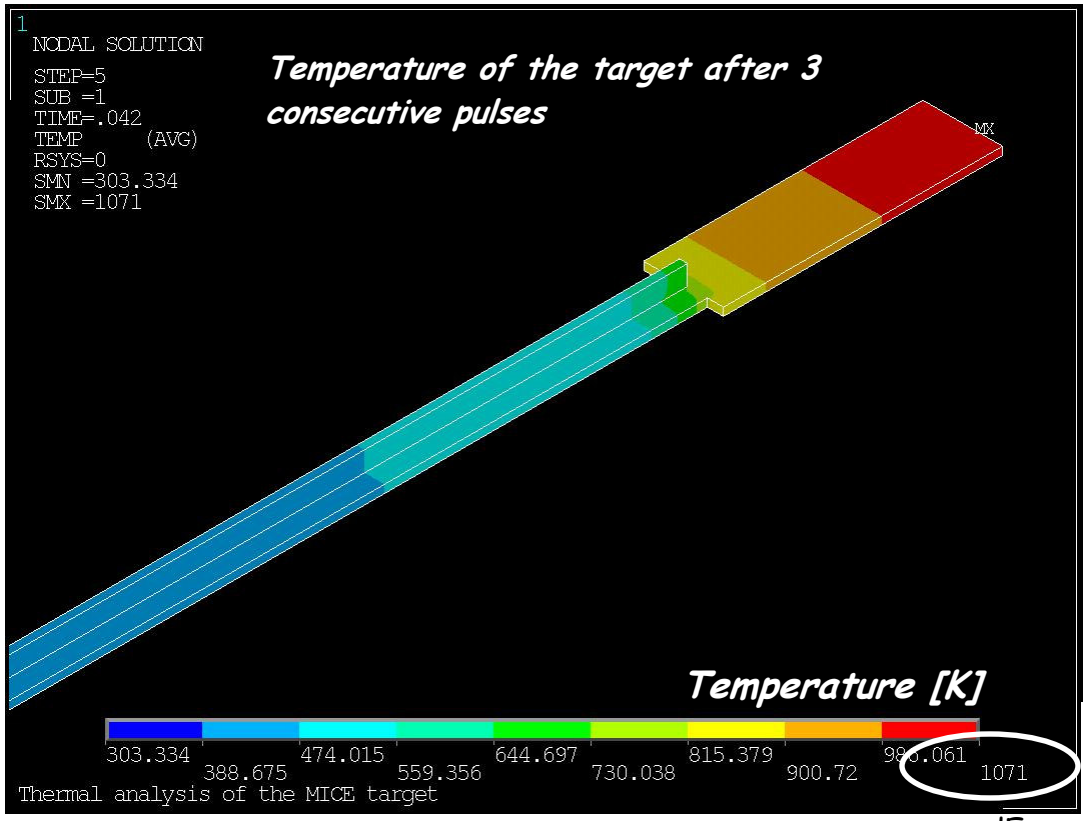
MICE target – fault operation after normal operation



***Fault condition**: 120 J per pulse for 3 consecutive pulses (50 Hz) before ISIS trip, deposited over all 35 mm of target.*

Emissivity: 0.2

3 consecutive pulses -> temperature of the lowest part of the target is 1070 K

12 consecutive pulses -> temperature of the lowest part of the target reaches the melting piont

120 J per pulse = 2.5×10^{13} protons x 30 MeV (estimated dE of 70 MeV protons in 10 mm of titanium)

MARS results on energy deposition in 10 mm titanium target →