



# LOW DENSITY SUPERSONIC DECELERATOR (LDSD) SUPERSONIC FLIGHT DYNAMICS TEST (SFDT) PLUME INDUCED ENVIRONMENT MODELLING



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## Objectives:

- Provide plume induced heating (radiation & convection) predictions in support of the LDSD thermal design (pre-flight SFDT-1)
- Predict plume induced aerodynamics in support of flight dynamics, to achieve targeted freestream conditions to test supersonic deceleration technologies (post-flight SFDT-1, pre-flight SFDT-2)

## Approach:

- Star48 and Small Solid Nozzle Flow Fields – *RAMP* engineering code
- Star48 and Small Solid Plume Flow Fields – *Loci/CHEM 3.3* CFD code
- Plume Radiation – *Reverse Monte Carlo (RMC)* radiation code
- Reynolds Averaged Navier-Stokes (RANS) Simulations (varying fidelity, grids)
- Two-phase Flow (Gas + Al<sub>2</sub>O<sub>3</sub> particles)
- Two Gaseous Species (thermally perfect, equivalent air and plume, frozen chemistry)

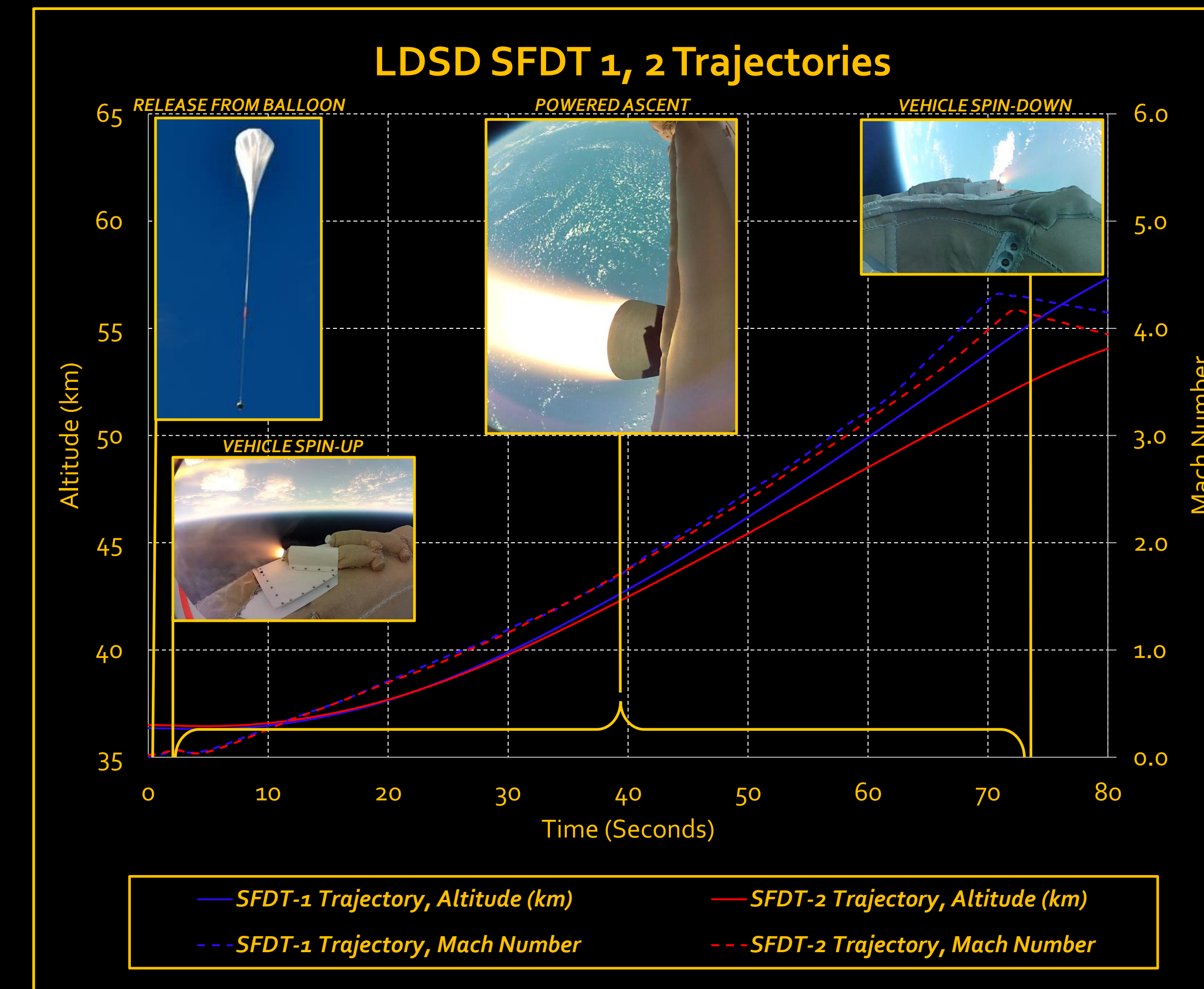
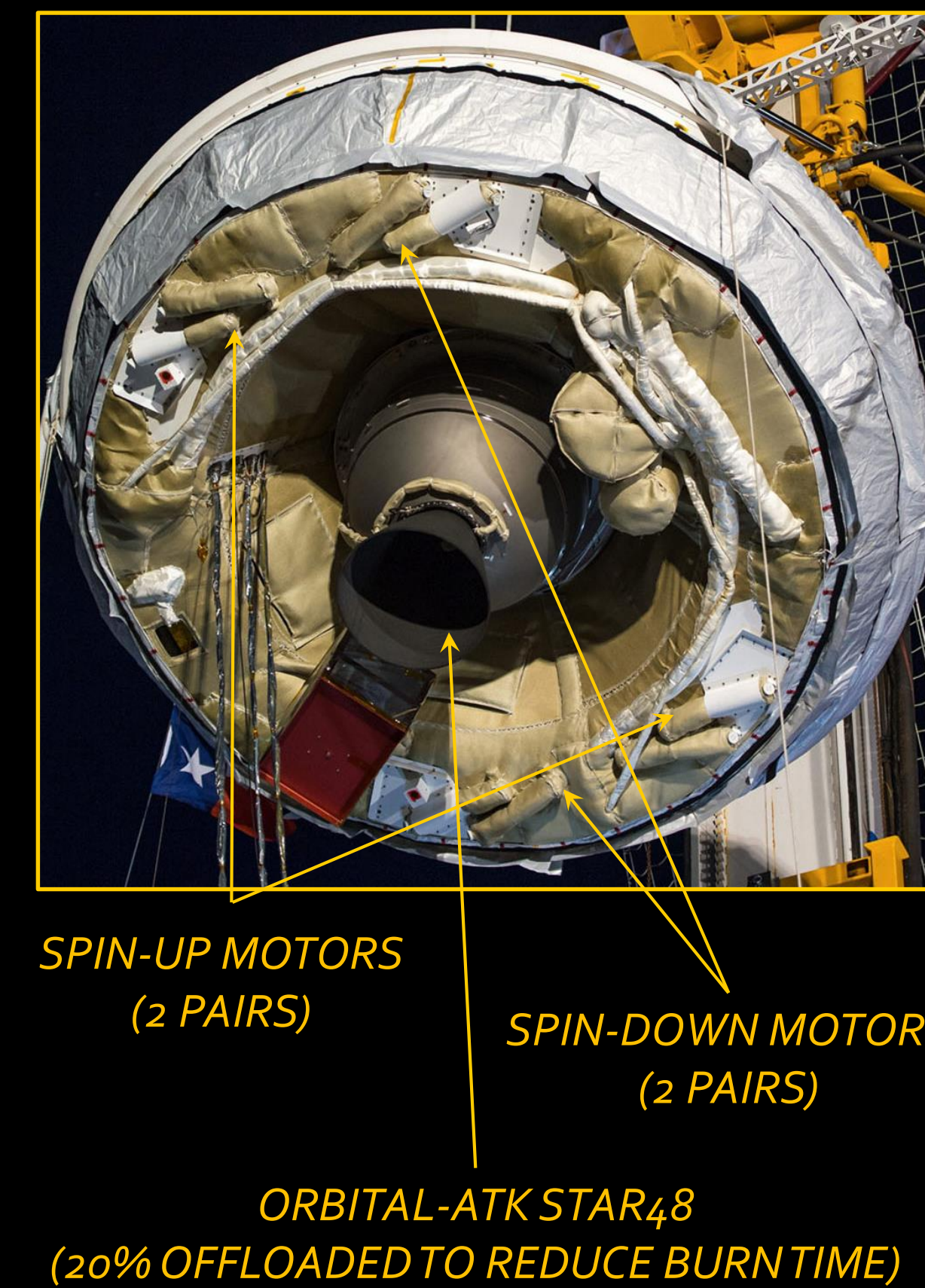
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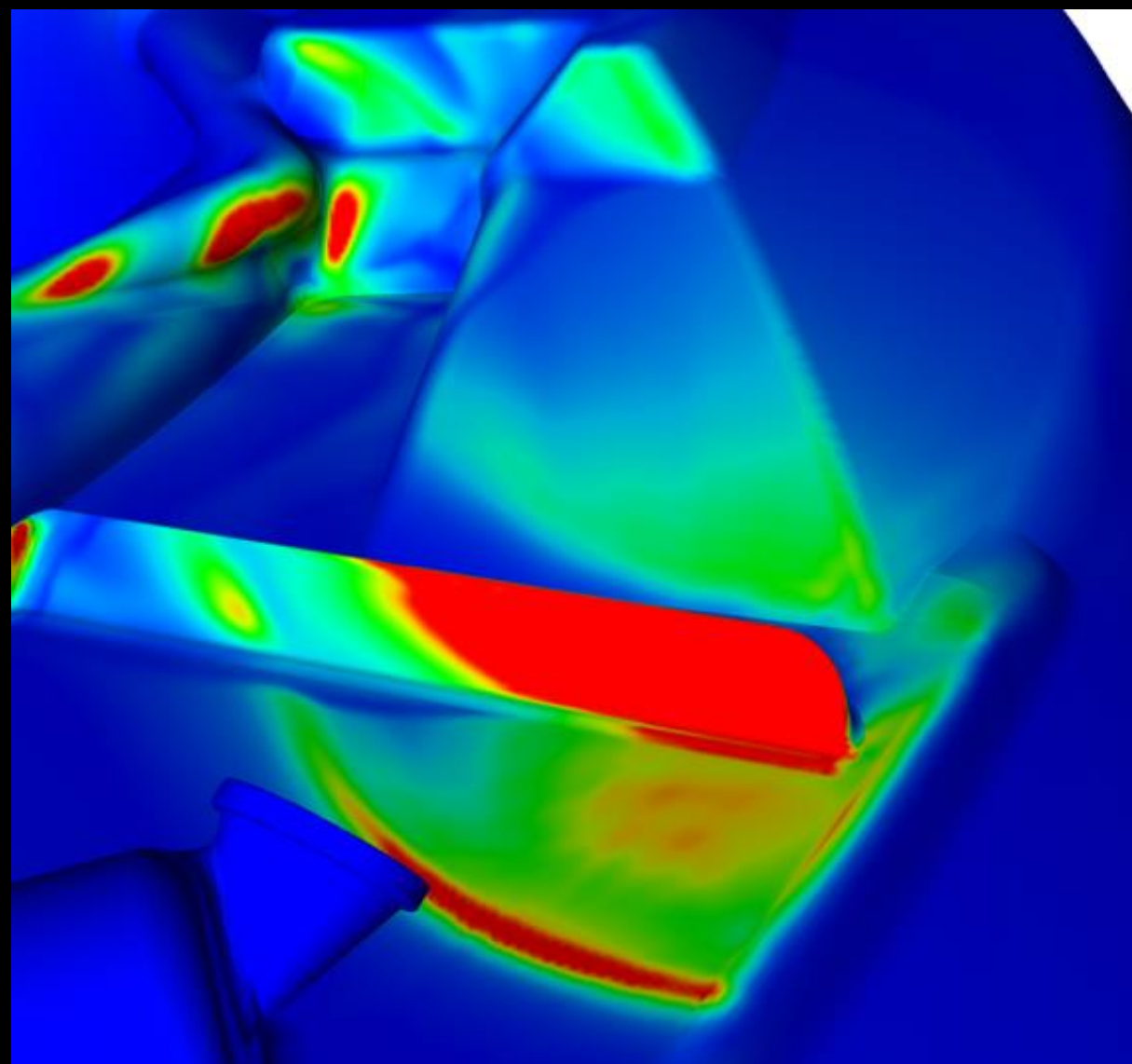
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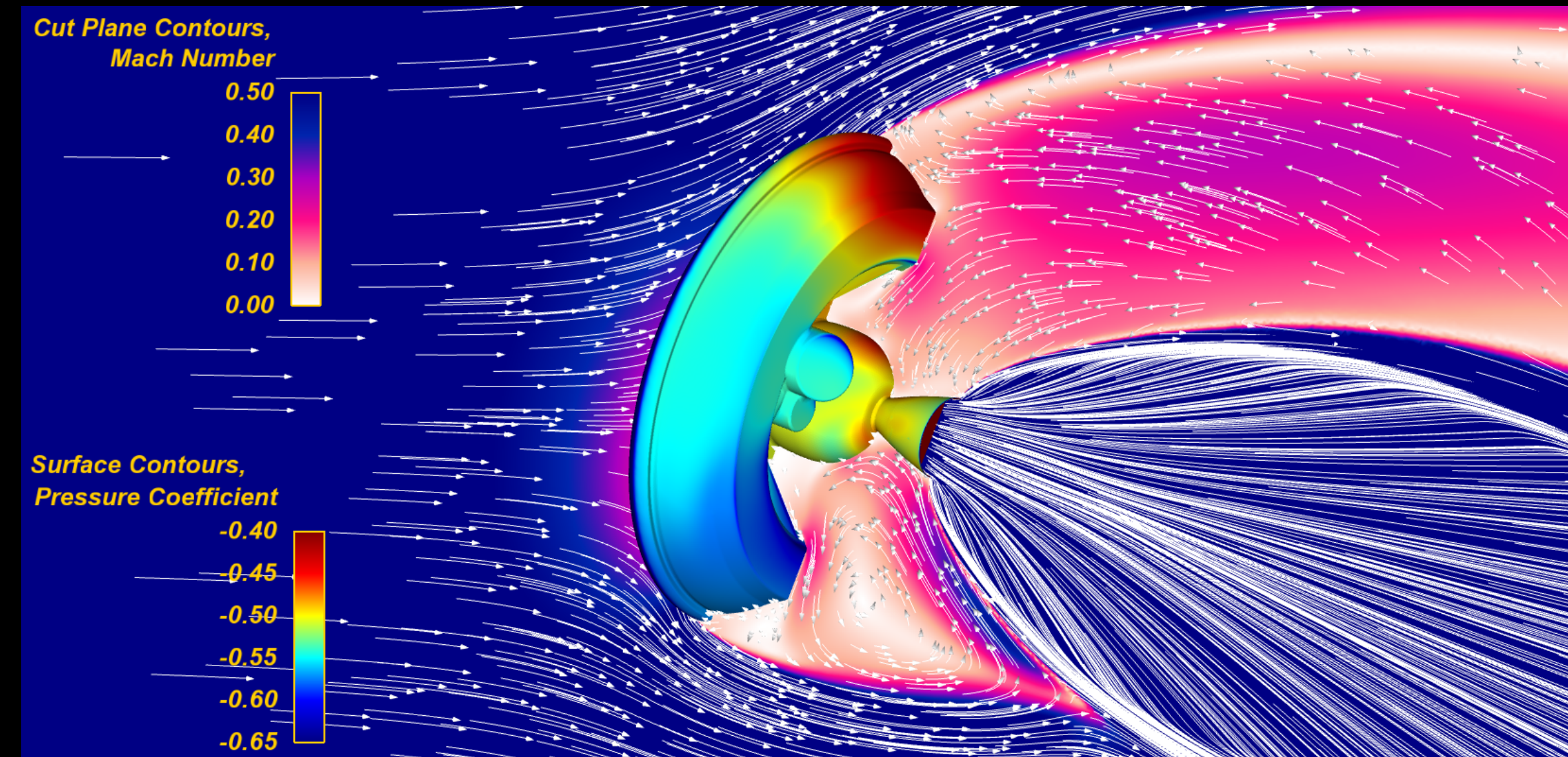
## SFDT-1 SPIN MOTOR PLUME IMPINGEMENT

Pre-flight Heating Contours      Post-flight Charring



## SFDT-2 STAR48 PLUME INDUCED AERODYNAMICS

CFD, Mach = 0.7, Angle-of-Attack = 17.1°



## Loci-CHEM CFD AERODYNAMIC PREDICTIONS VERSUS POST-FLIGHT, BEST EQUIVALENT TRAJECTORY (BET)

