

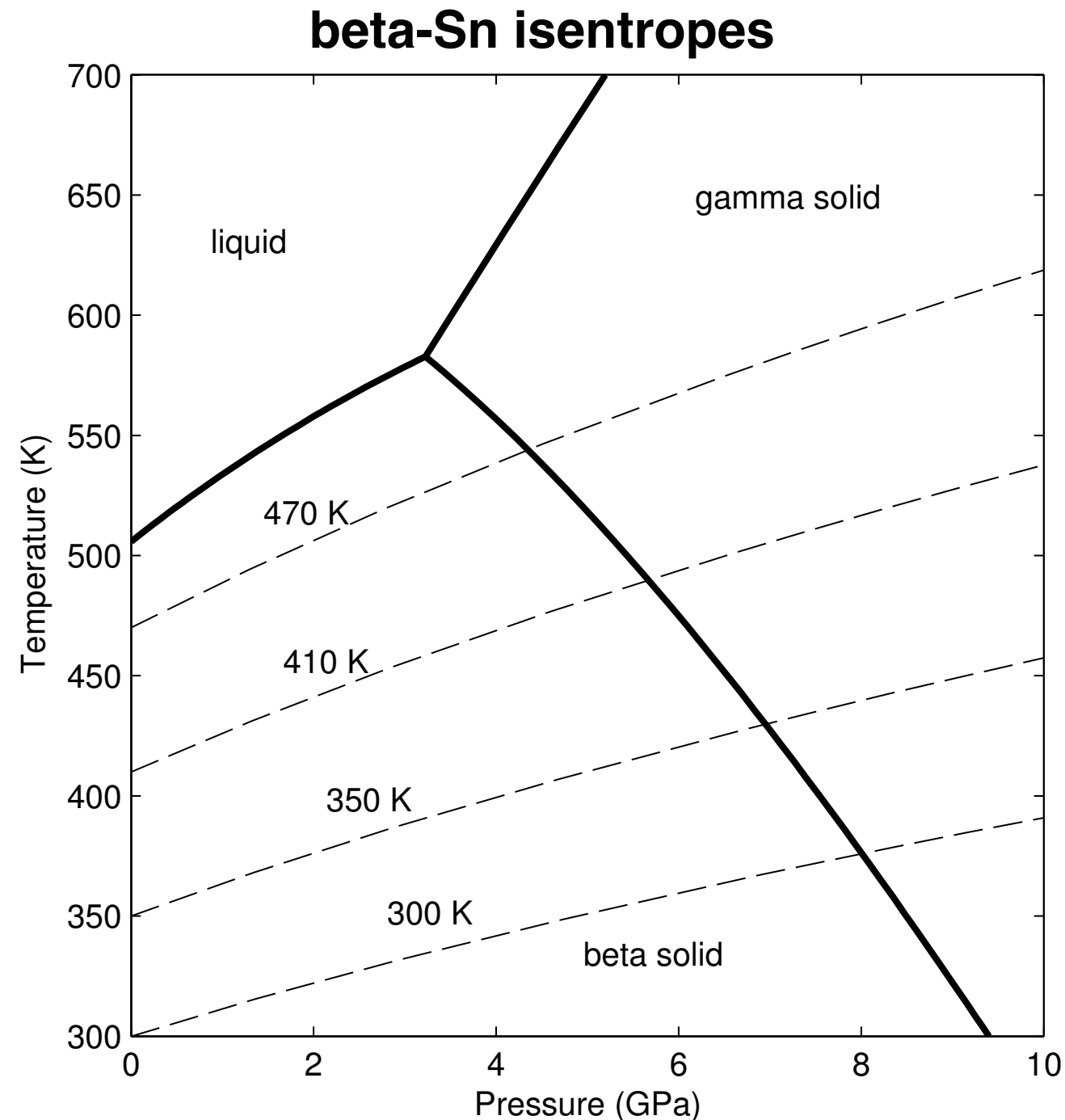
Determination of the beta-gamma phase boundary for tin from ramp- wave compression experiments

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D.H. Dolan, J.L. Wise, J.-P. Davis, C.A. Hall,
and D.B. Hayes
Sandia National Laboratories

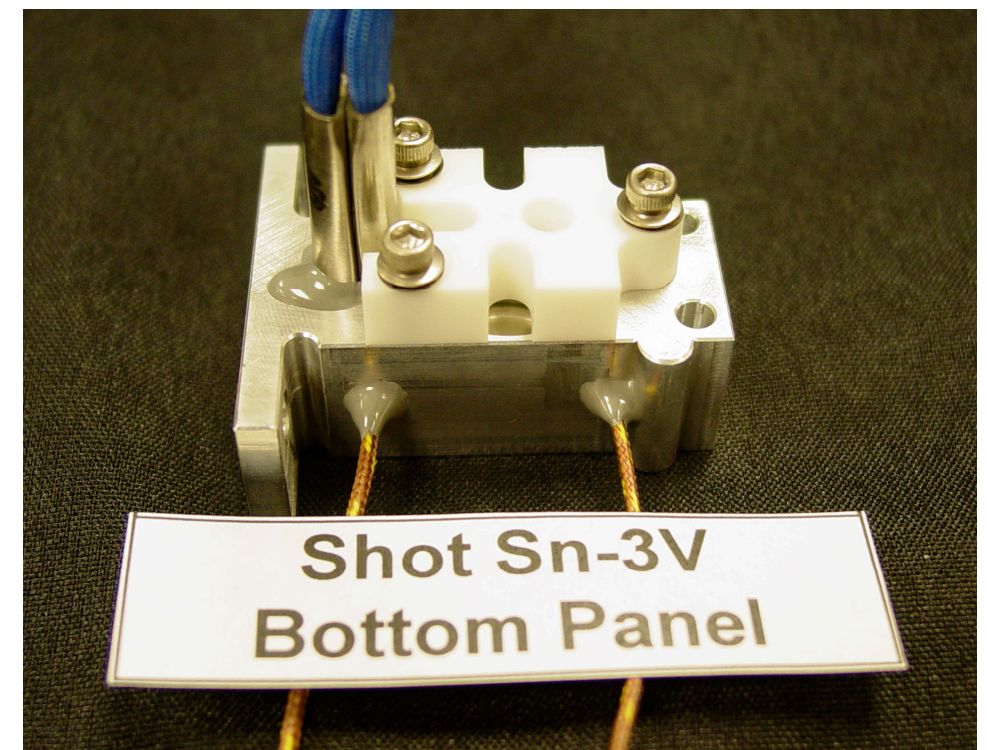
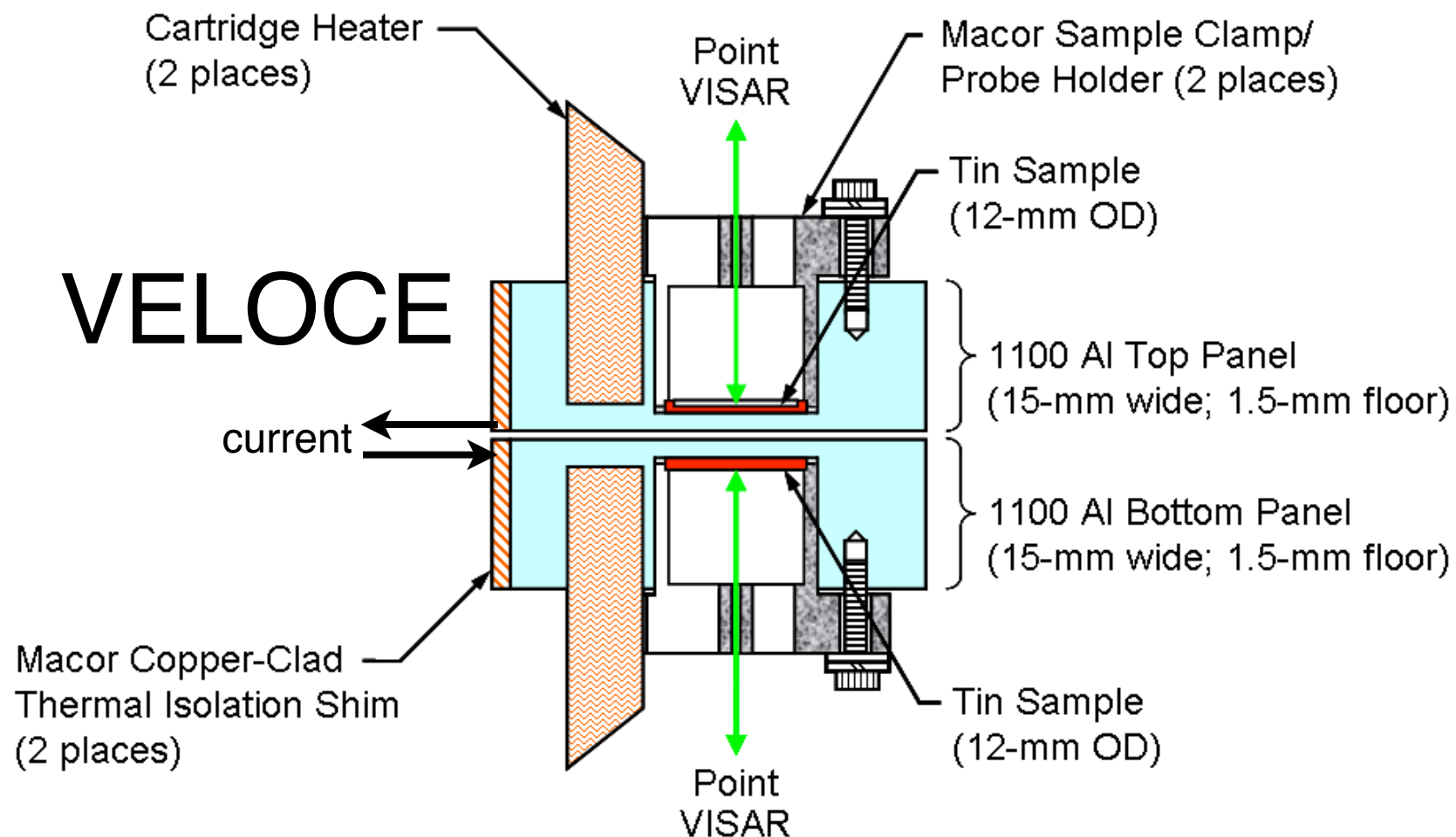
Overview

- Ramp-wave compression provides continuous phase information
 - Transitions are never overdriven
- Heated isentropes intersect phase boundaries at different locations
- Phase boundaries can be mapped with a few experiments



Experiment configuration

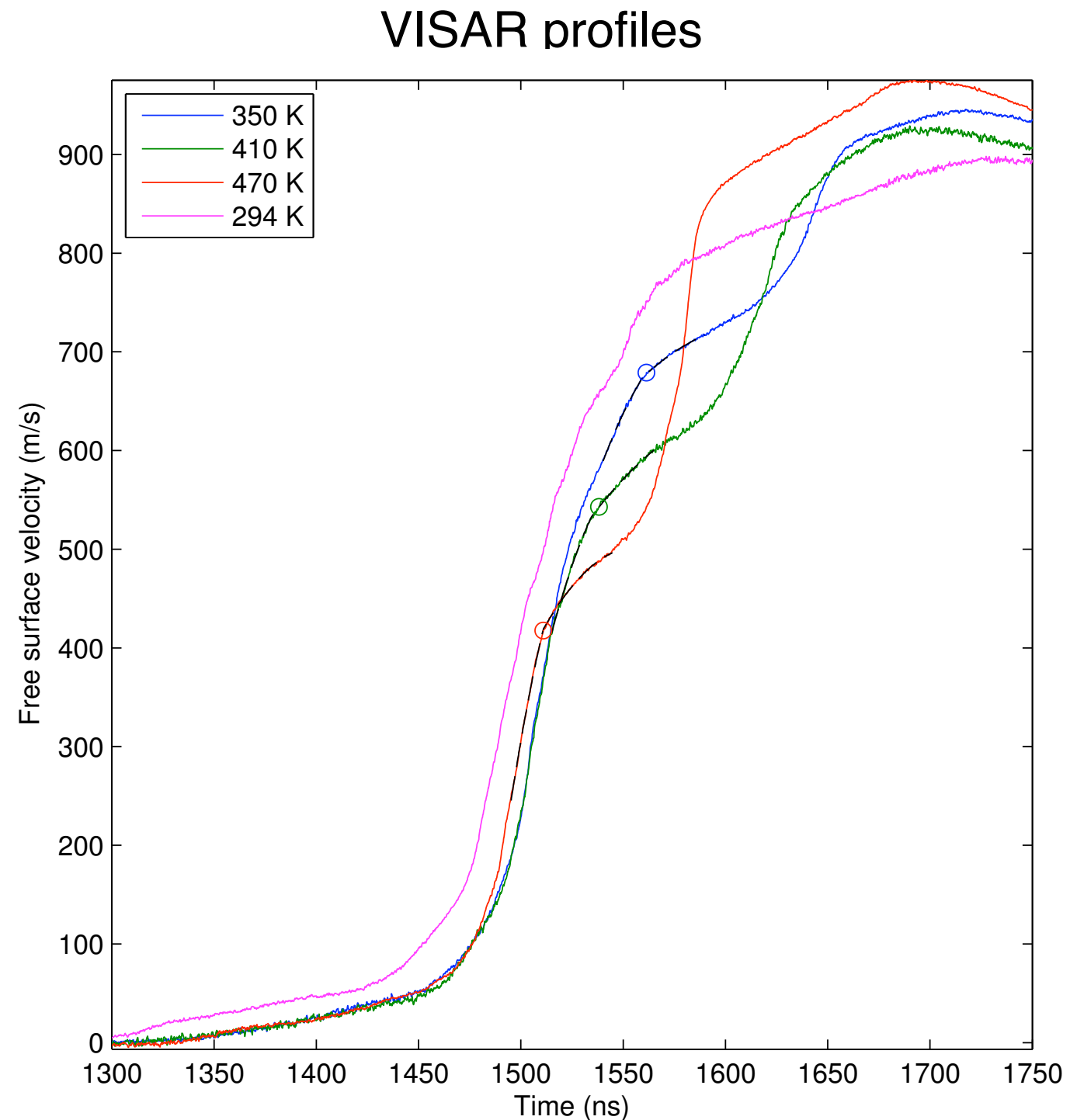
- VELOCE machine (70 kV, 2.2 MA, 440 ns rise time)
- Resistive preheating
- Liquid coupling layer allows thermal expansion
- Free surface VISAR measurements
- Polycrystalline Sn samples provided by G.T. Gray (LANL)



Transition location

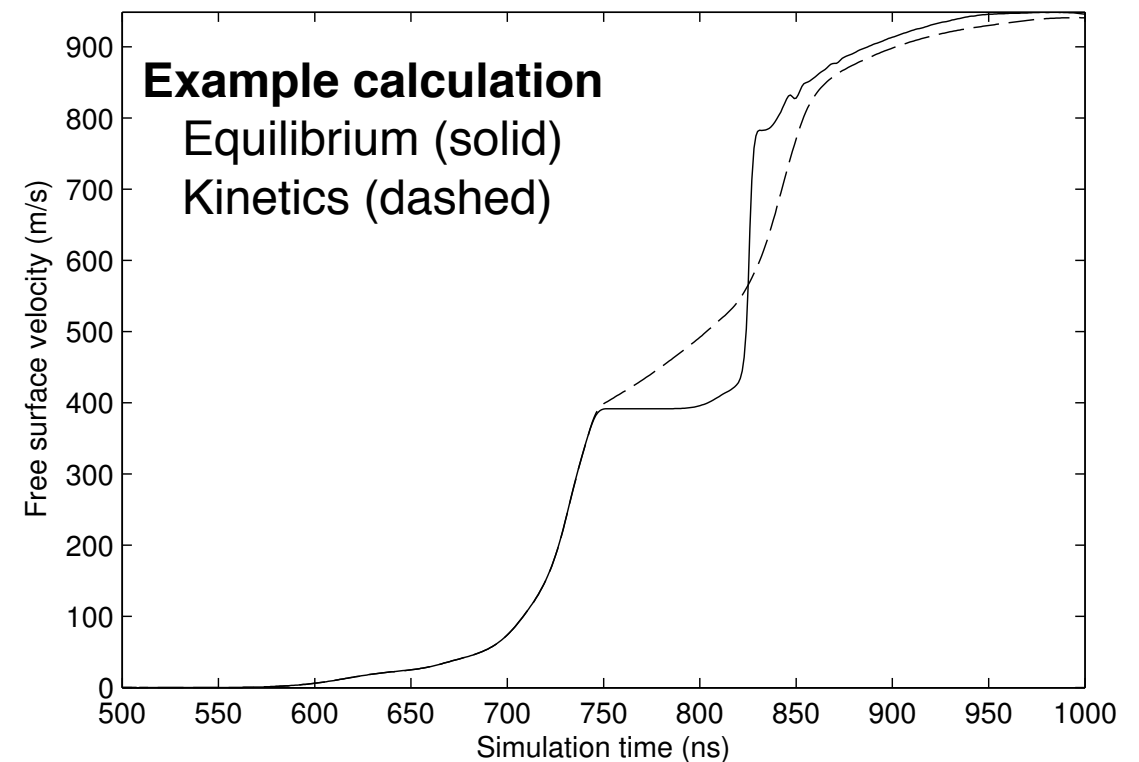
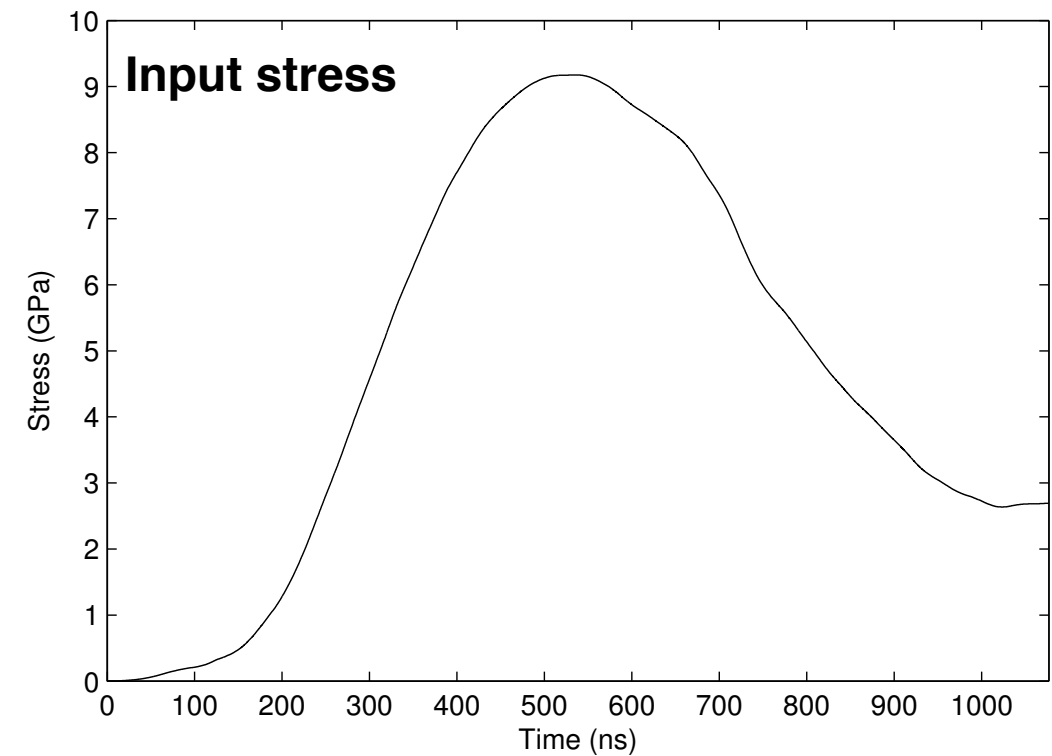
- Transition revealed by a bend in the free surface velocity
 - Location determined by two-piece quadratic fit
- Bend velocity depends on wave propagation effects
 - Free surface release
 - Release-transition interactions

T0 (K)	Bend (m/s)
350	679 (6)
410	543 (11)
470	418 (2)
297	-



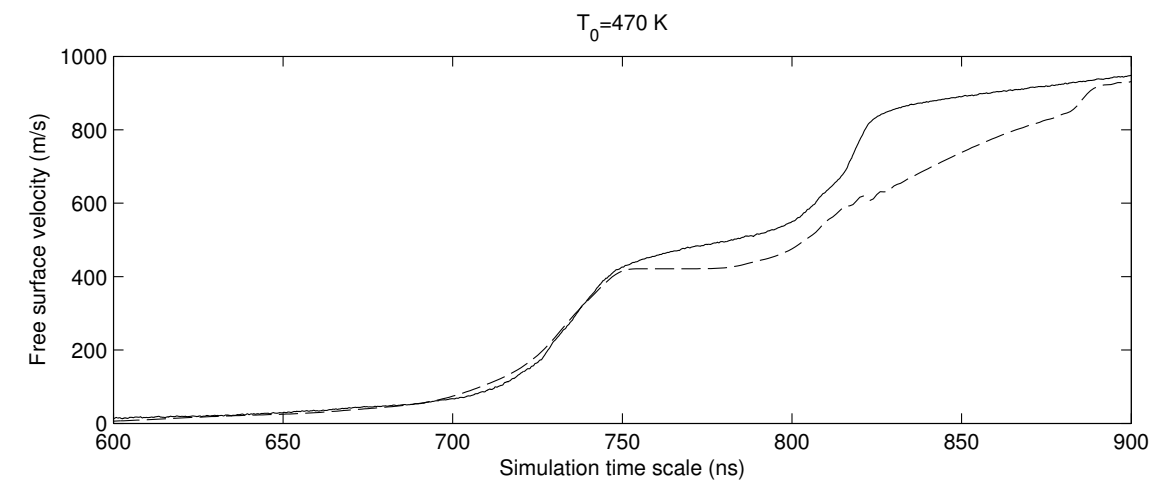
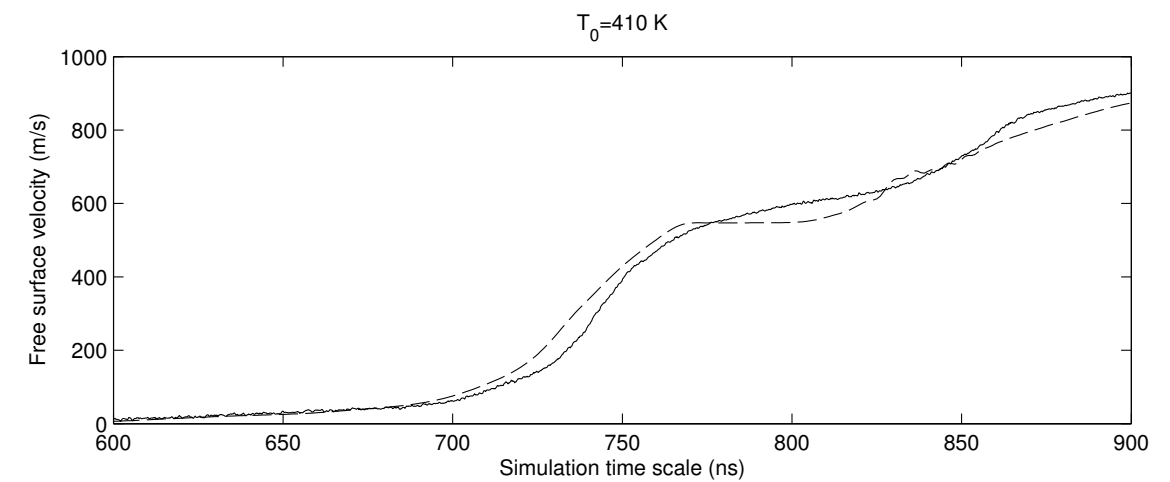
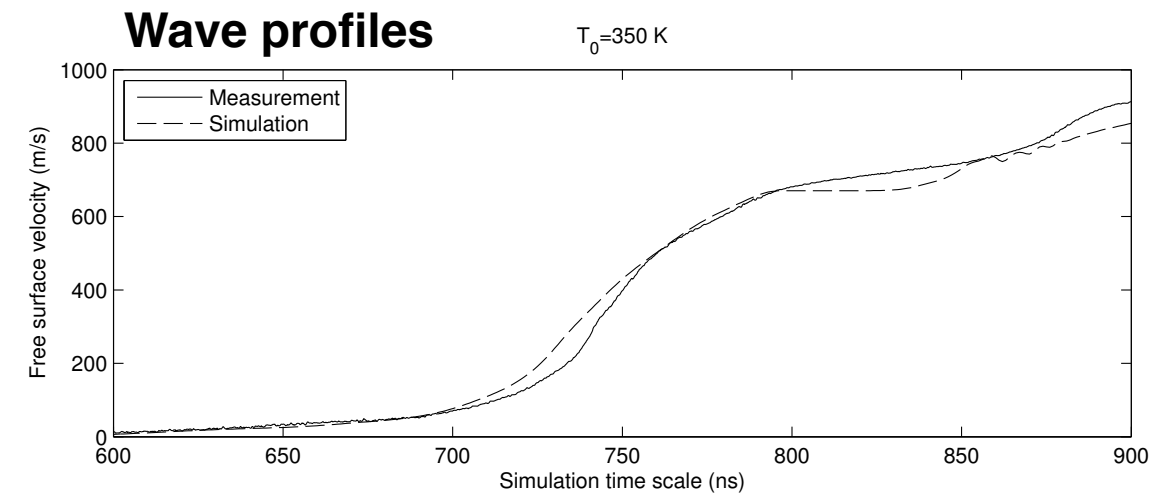
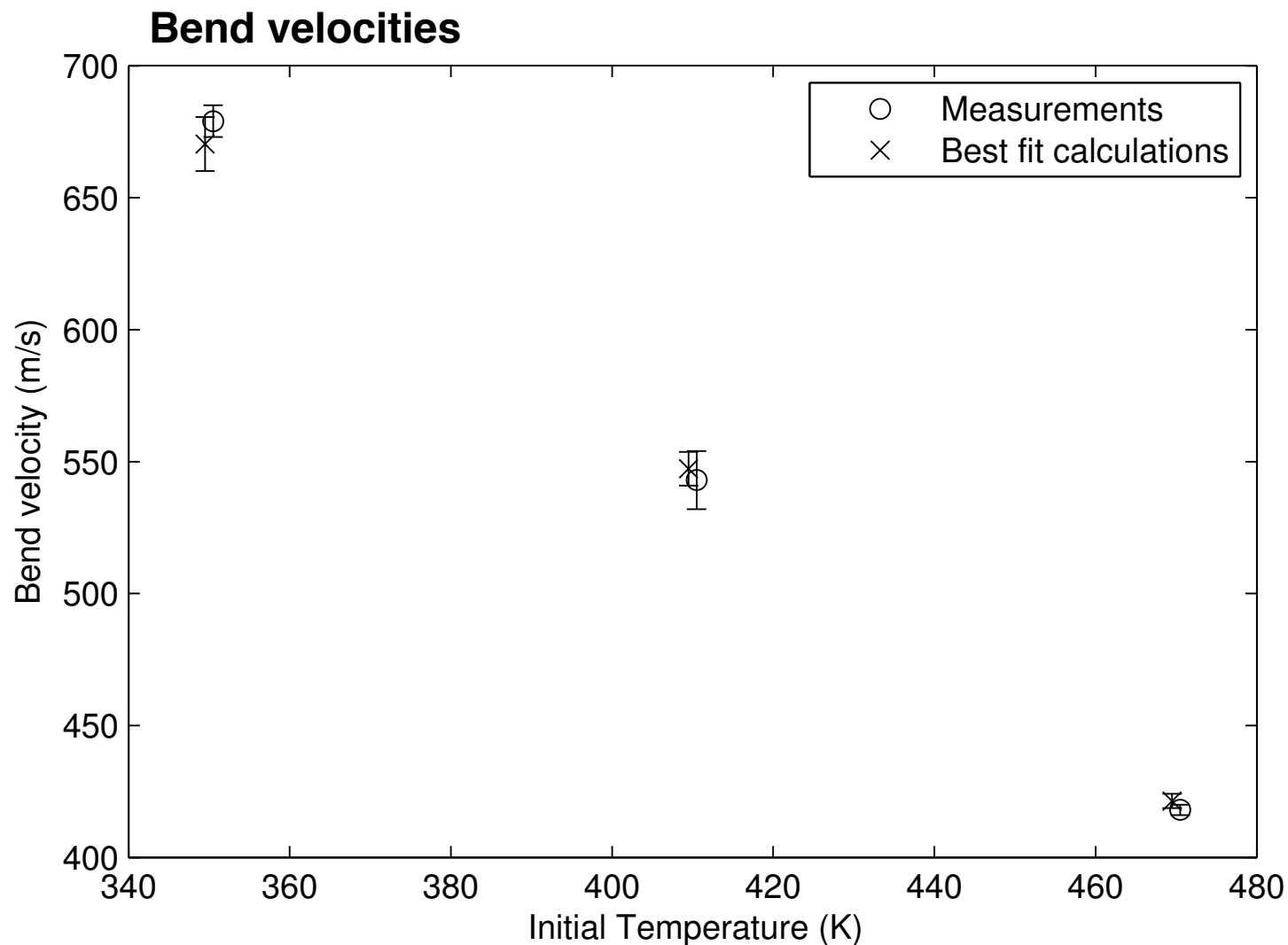
Forward calculations (WONDY)

- Common stress input for all experiment (9 GPa max)
- SESAME 3700 model for Al drive panel (1.50 mm thick)
- Three-phase SN model
 - Based Davis and Hayes [SCCM 2007, p. 159]
 - Equilibrium mixture by forcing ultra-fast transitions
 - Fixed triple point
 - Vary RT transition pressure
 - Match 0.75 mm Sn measurements at different temperatures



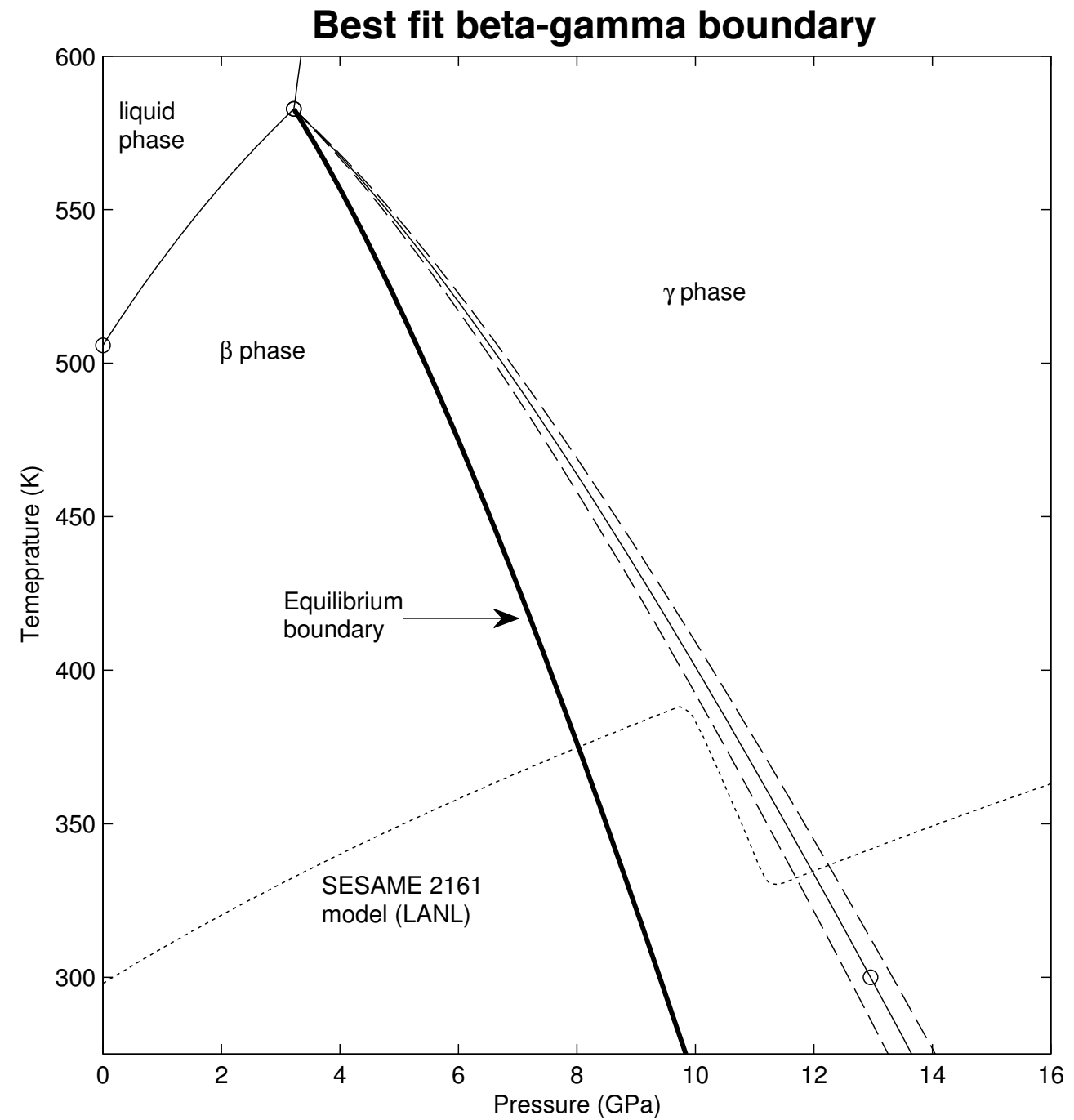
Best fit results

- Reasonable overlap between measurements and model optimization



Dynamic phase boundary

- Optimal RT transition found at 12.96 GPa
 - Uncertainty bands estimated by doubling residual
- Dynamic phase boundary is at higher pressure than the static boundary
 - Indicates metastable domain for the beta phase
- Results consistent with SESAME 2161 model
 - Greef et al [LA-UR-05-9414]





Summary and future work

- Phase boundaries can be mapped using heated ramp-wave compression experiments
 - Wave profiles reduced to a set of bend velocities
 - Mixed phase model adjusted to match bend velocities
 - Boundary survey from a small number of experiments
- Extending the technique
 - Analyze multiple thicknesses
 - Relax triple point constraint
 - Add and refine kinetics, allowing for incubation
 - Refine single phase EOSs
 - Eventual goal is a “universal” continuum model