SAND2015-6077C

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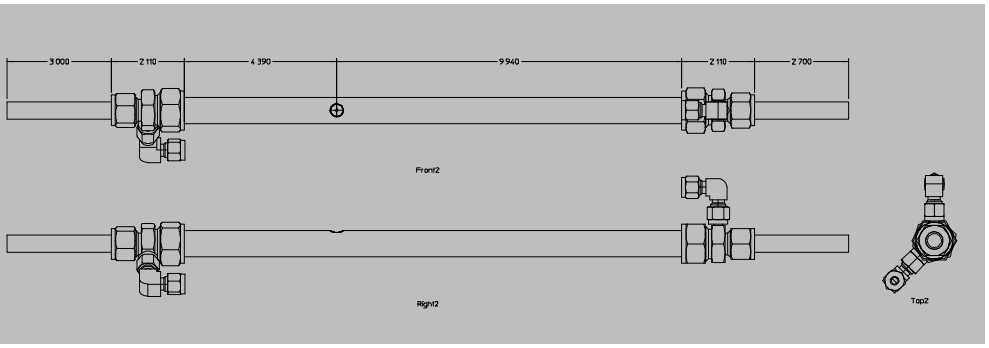

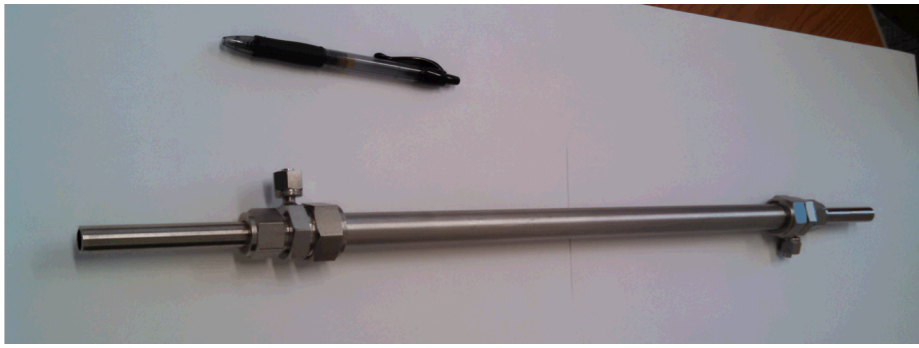

Development of a Low-Temperature Flow Tube for Use in MPIMS

Leah G. Dodson, Howard Johnsen,
Mitchio Okumura, David L. Osborn

U.S. DEPARTMENT OF ENERGY
National Nuclear Security Administration

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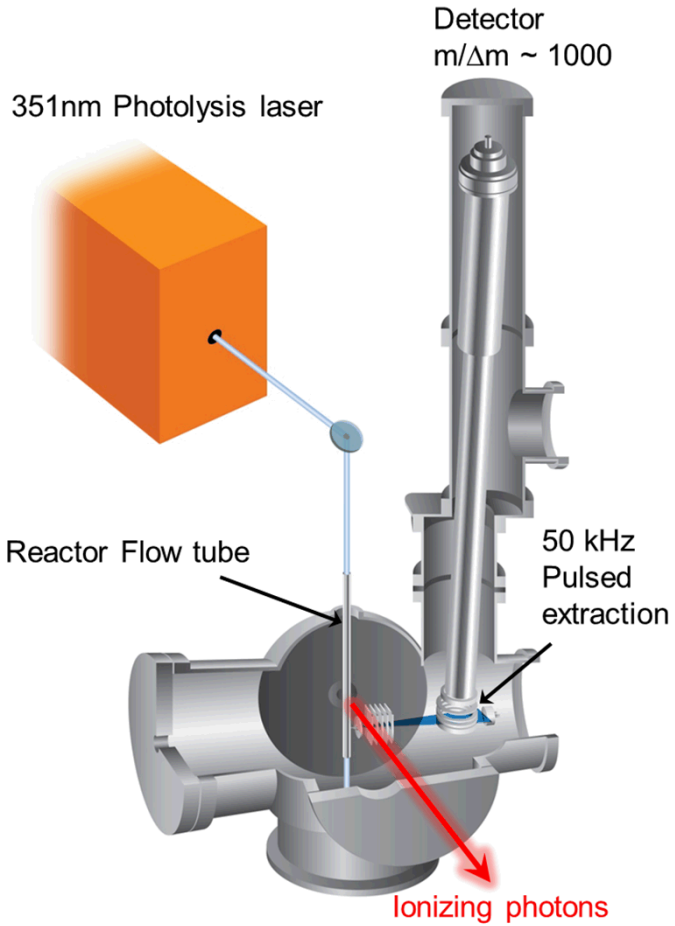
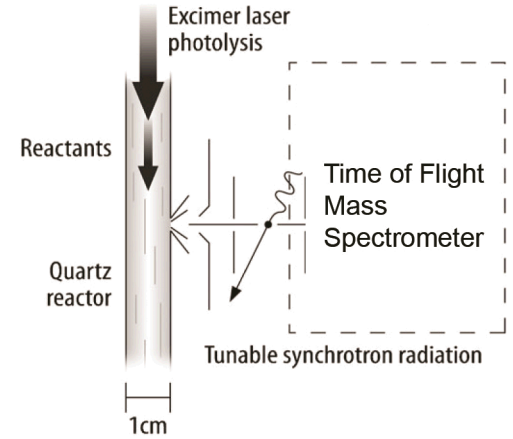
Sandia Multiplexed Chemical Kinetics Reactor

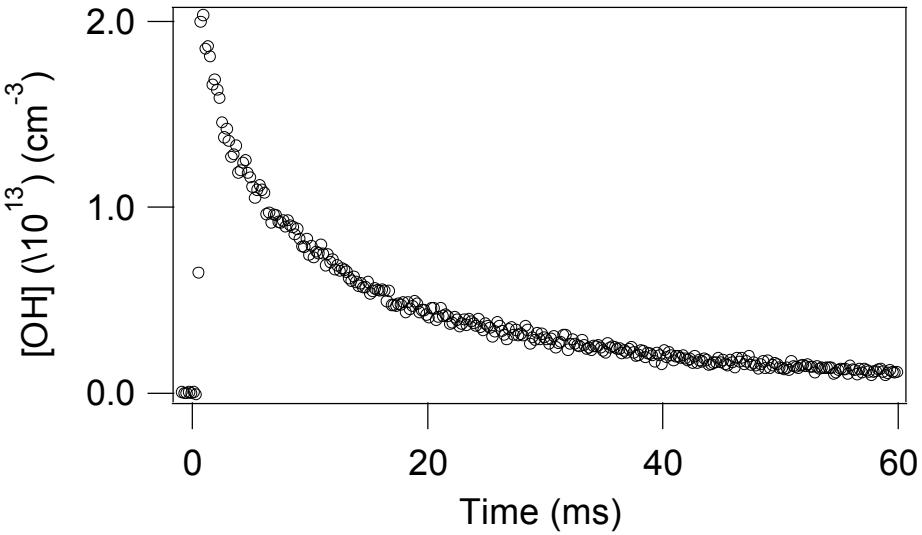


Current capabilities:

300 – 1050 K

At 1023 K, temperature is uniform ± 4 K





Gas Flow:

366 cm/ms

In 60 ms, gas has traveled 22 cm (≈9 in)

Osborn, D.L., et al. *Rev. Sci. Instrum.* **79**, 104103 (2008).

Low Temperature Studies of Radical-Radical Reactions

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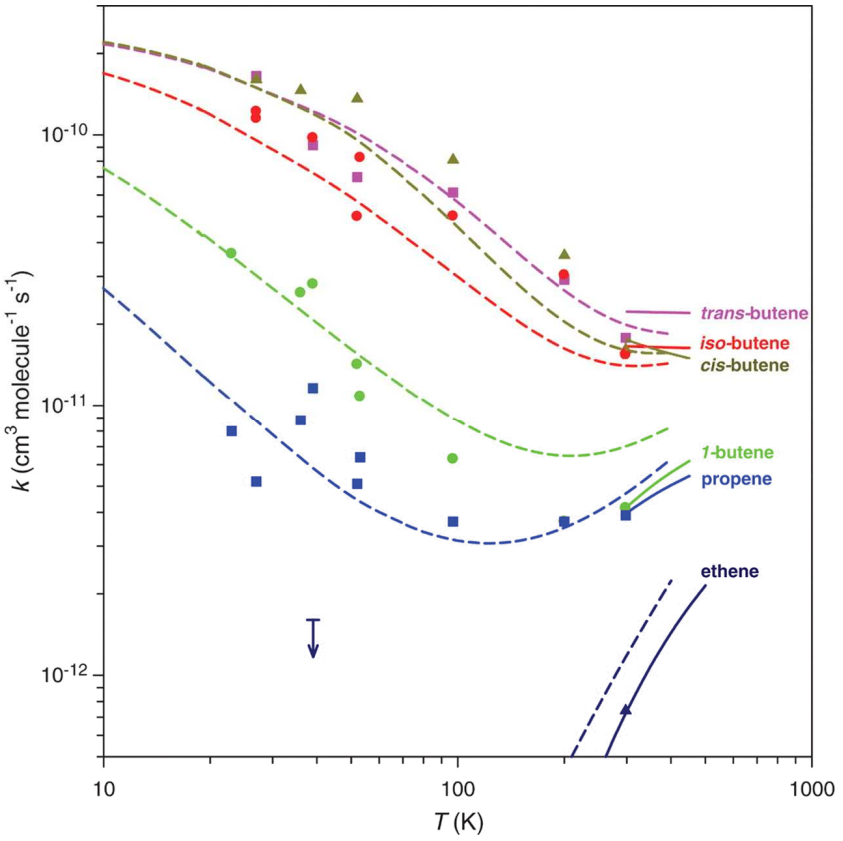
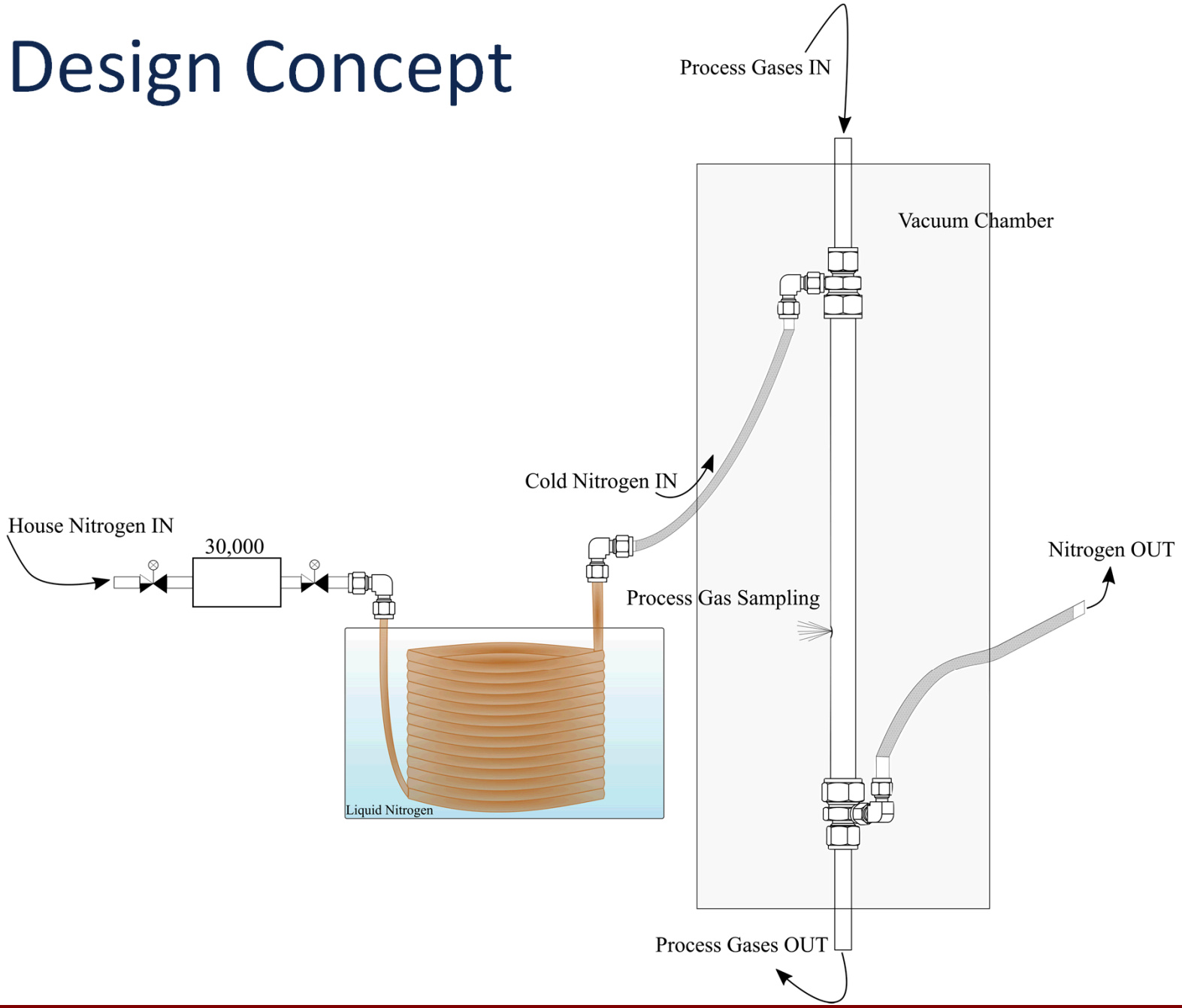
- Chemical reactions that have potential energy surfaces with multiple wells present a challenge
- The ability to measure reaction rates below room temperature complements high temperature experiments
- Example: $O(^3P)$ + alkene – the outer transition state probed at low T, inner transition state at high T

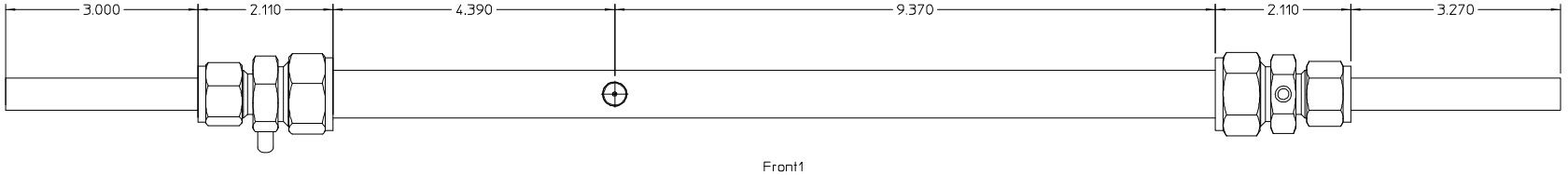


Sabbah, H. et al. *Science.* **317**, 102-105 (2007).

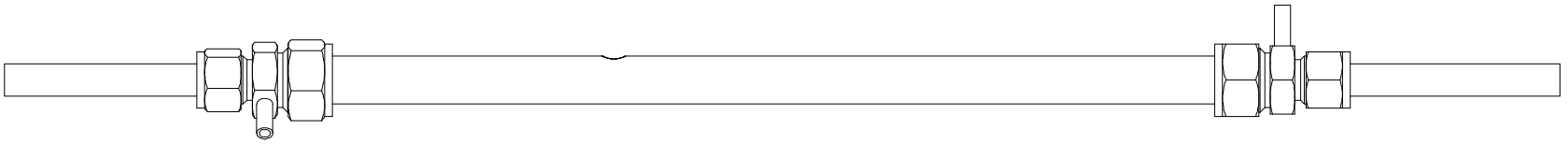
Design Concept



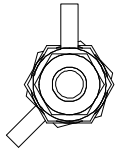
Machine Drawings



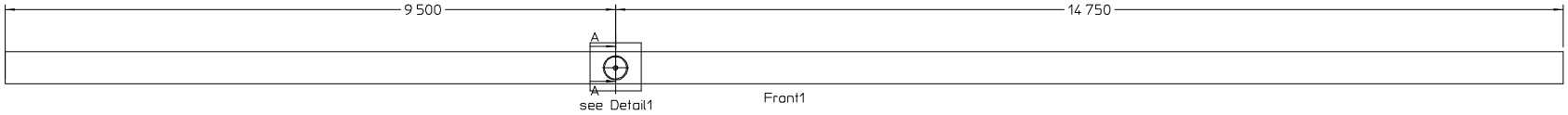
Front1



Right1



Top1

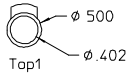


see Detail1

Front1

see Detail2

Right1



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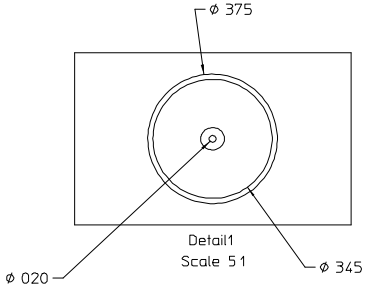
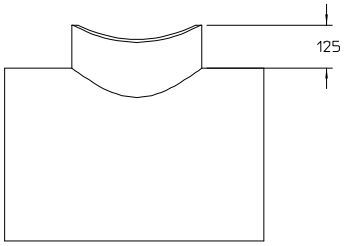
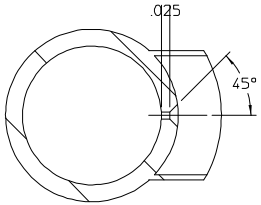


Detail1
Scale 5:1



Detail2
Scale 5:1



Section A-A
Scale 5:1

Prototype Testing

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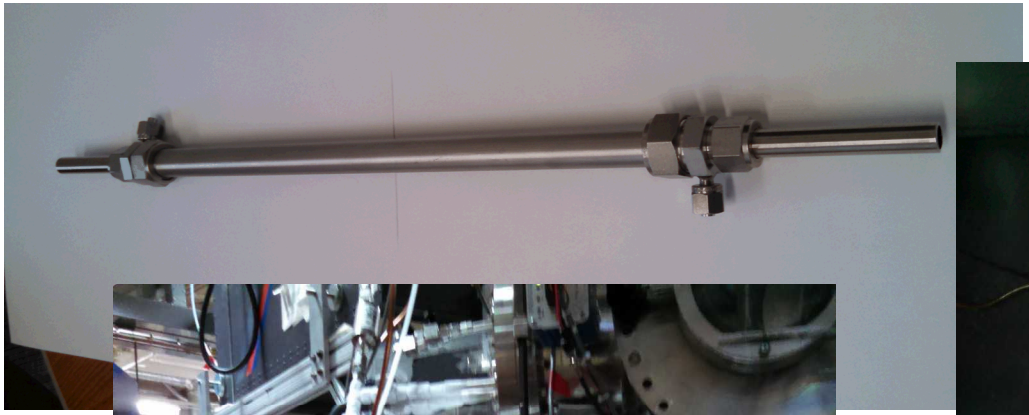
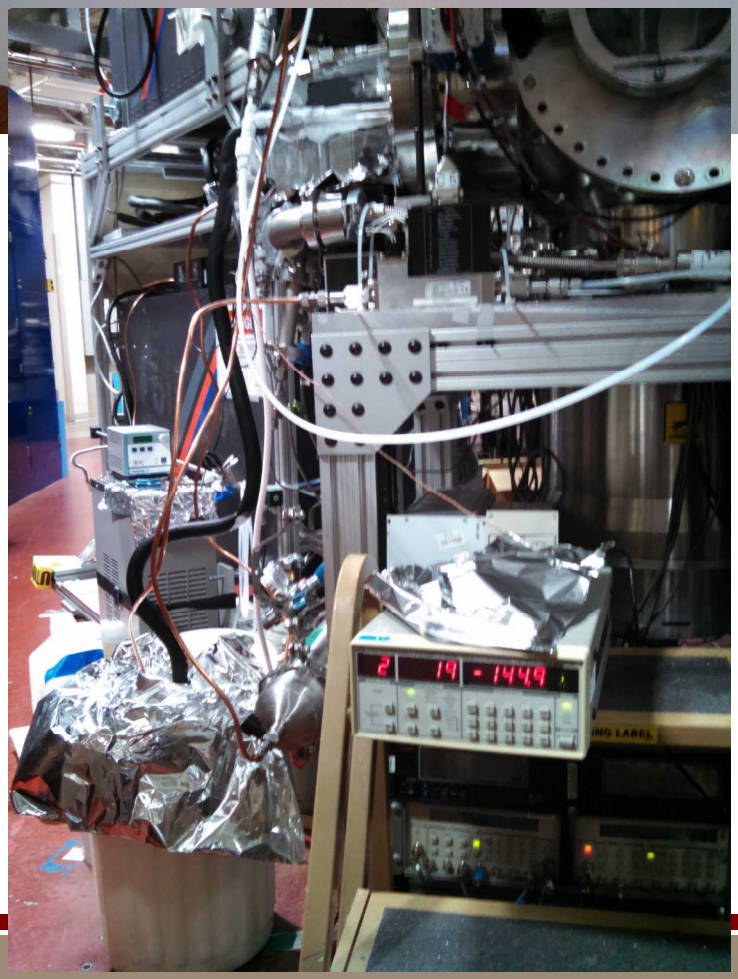
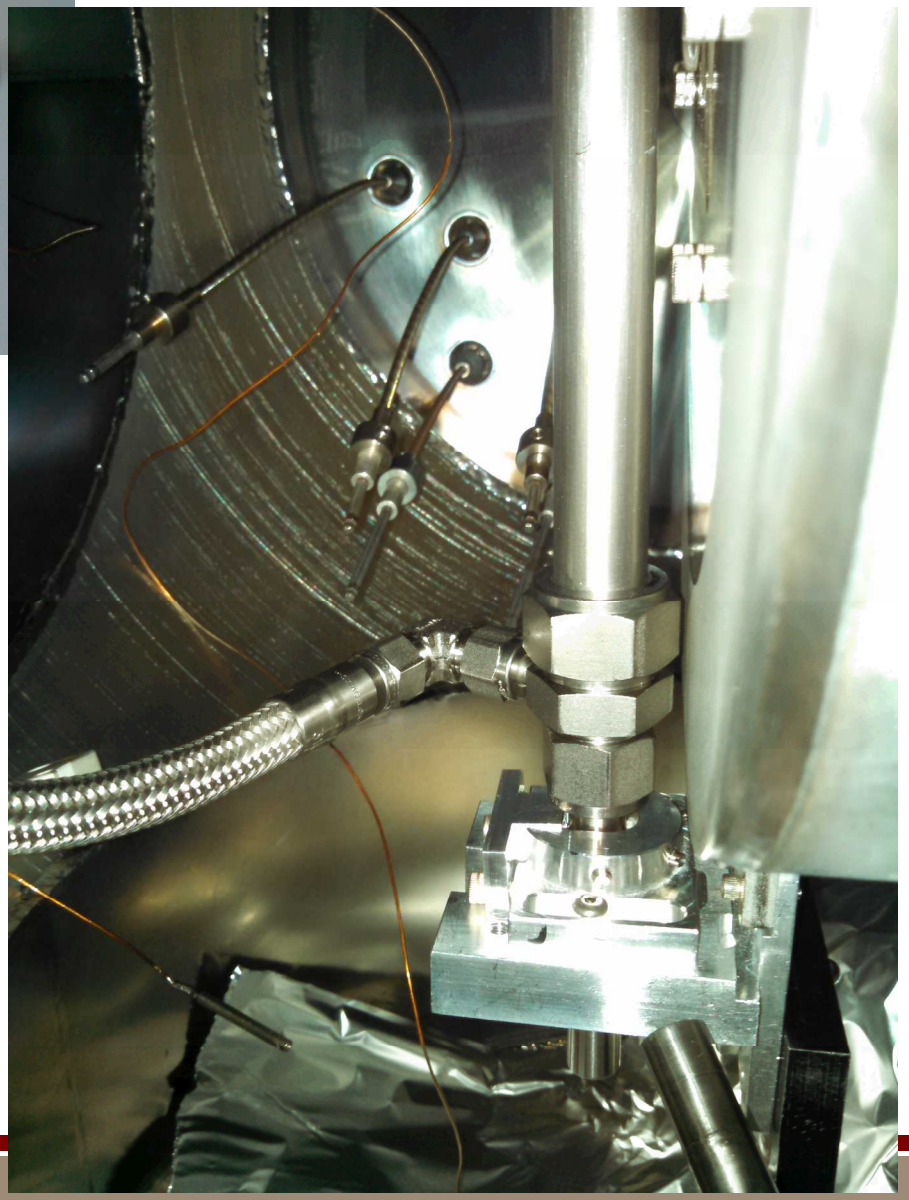
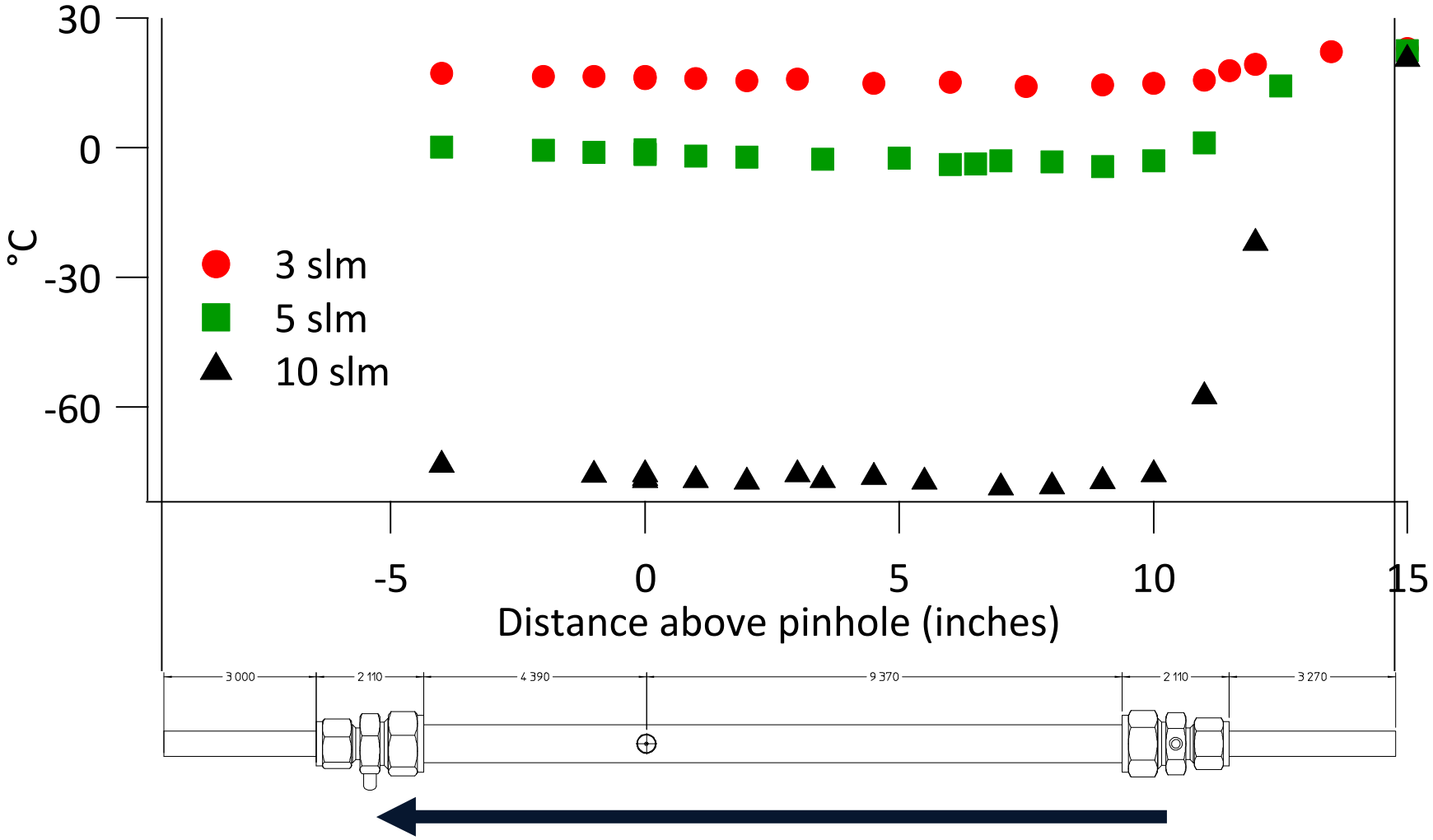


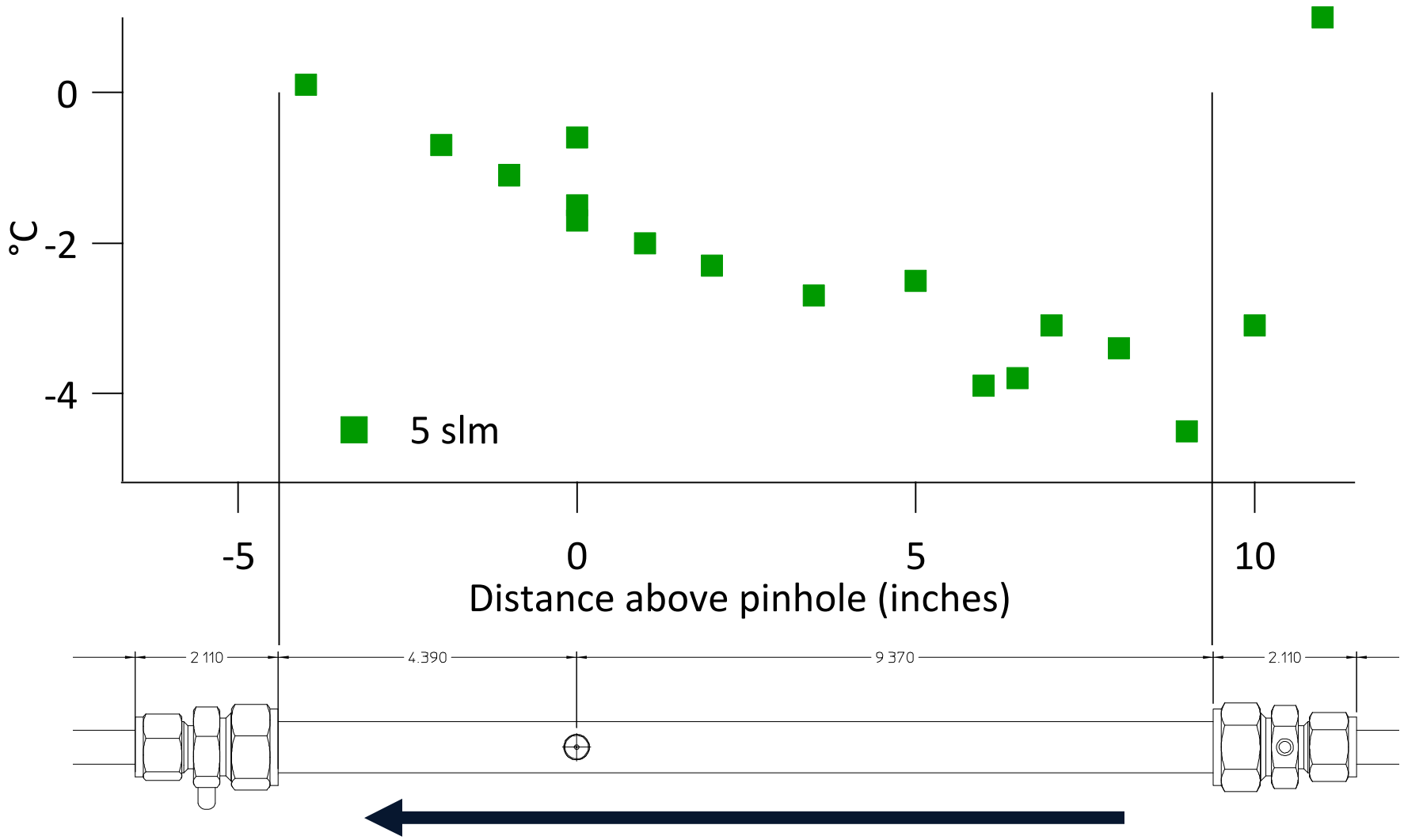




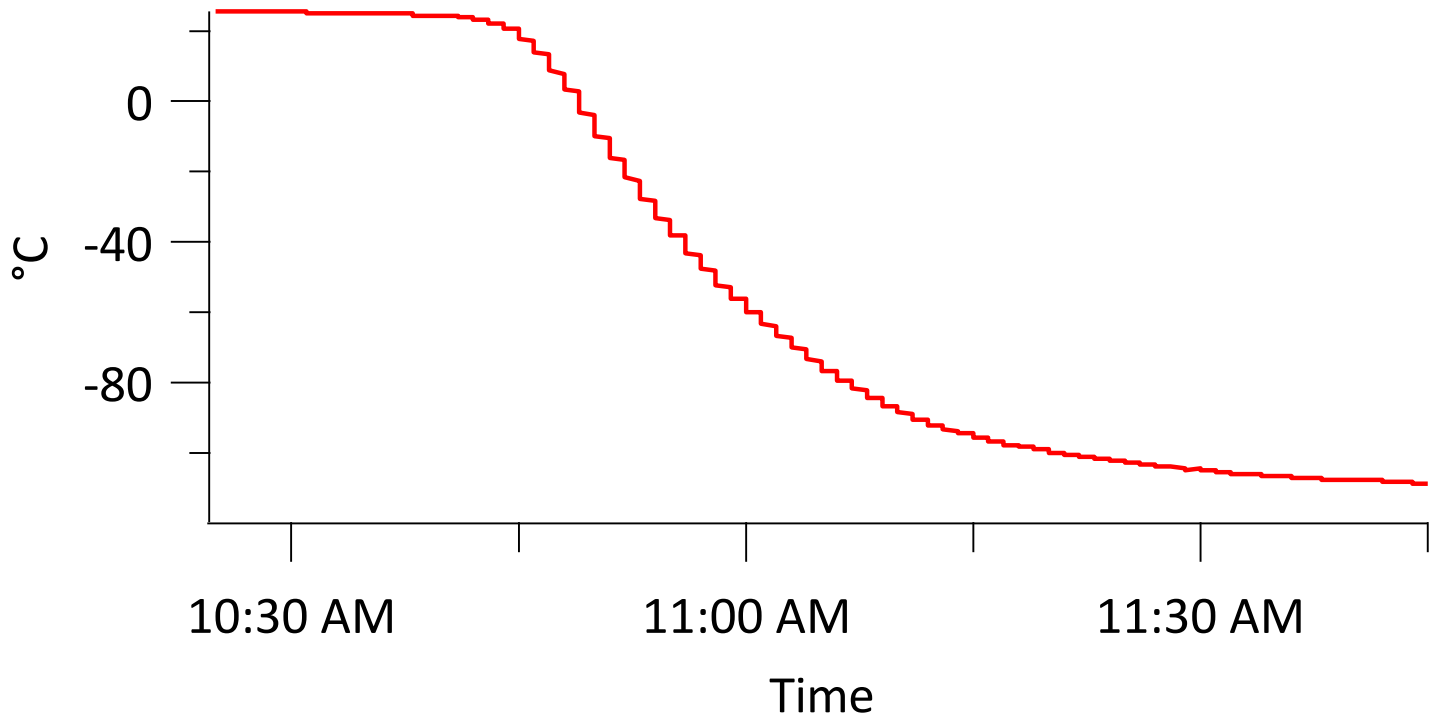
Overall Prototype Performance



Prototype Temperature Profile



Equilibrium



- Temperature equilibrium is achieved after a little over an hour
- Equilibrium temperature varies by less than ± 1 °C

Outlook

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- Tests on prototype were a success
- Final design is being machined

- Testing of final design to begin August 10
- Experiments scheduled August 20 – 23

Acknowledgements

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