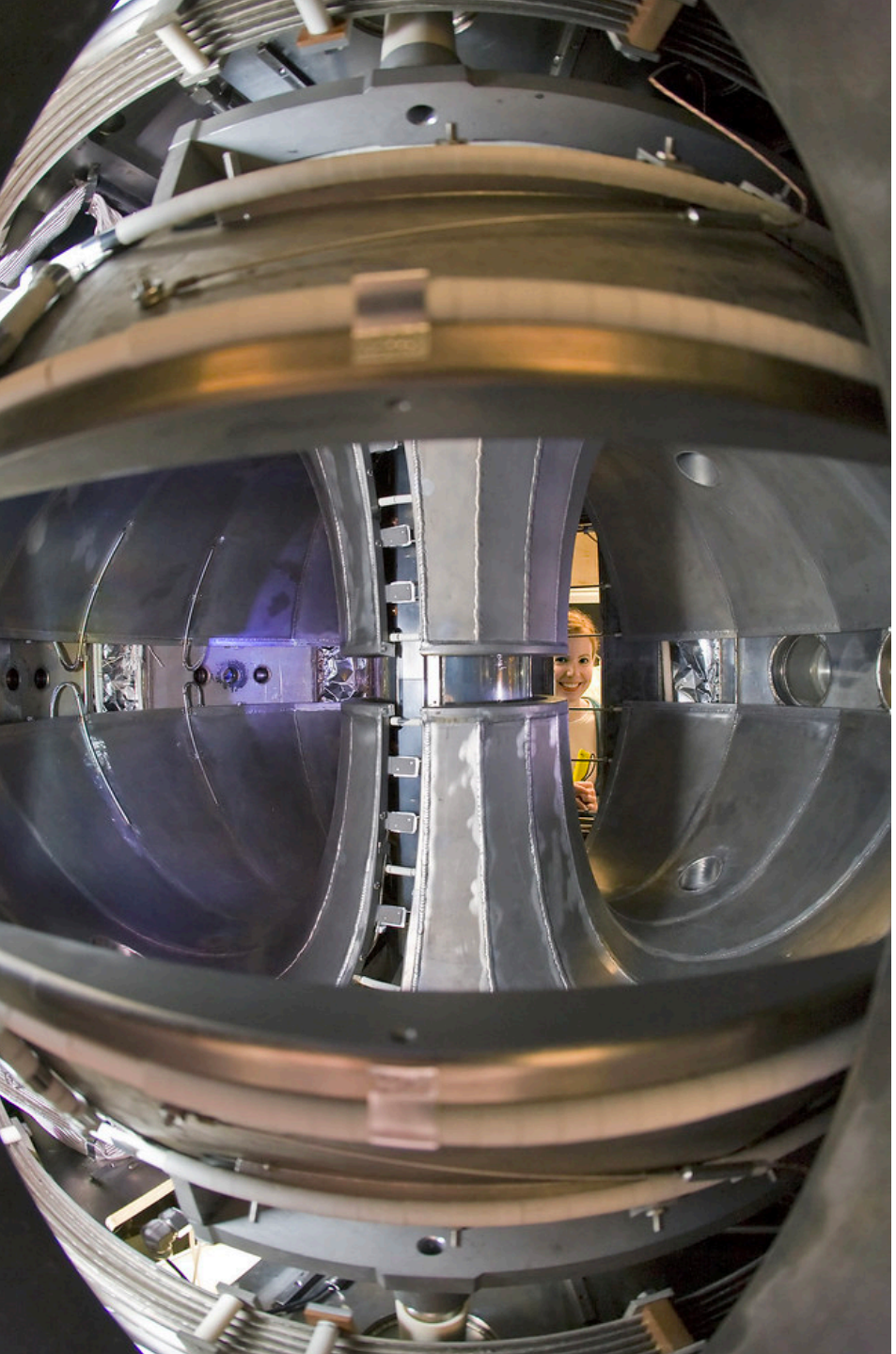

Temperature Programmed Desorption Upgrade for the Sample Exposure Probe for LTX-β Surface Analysis

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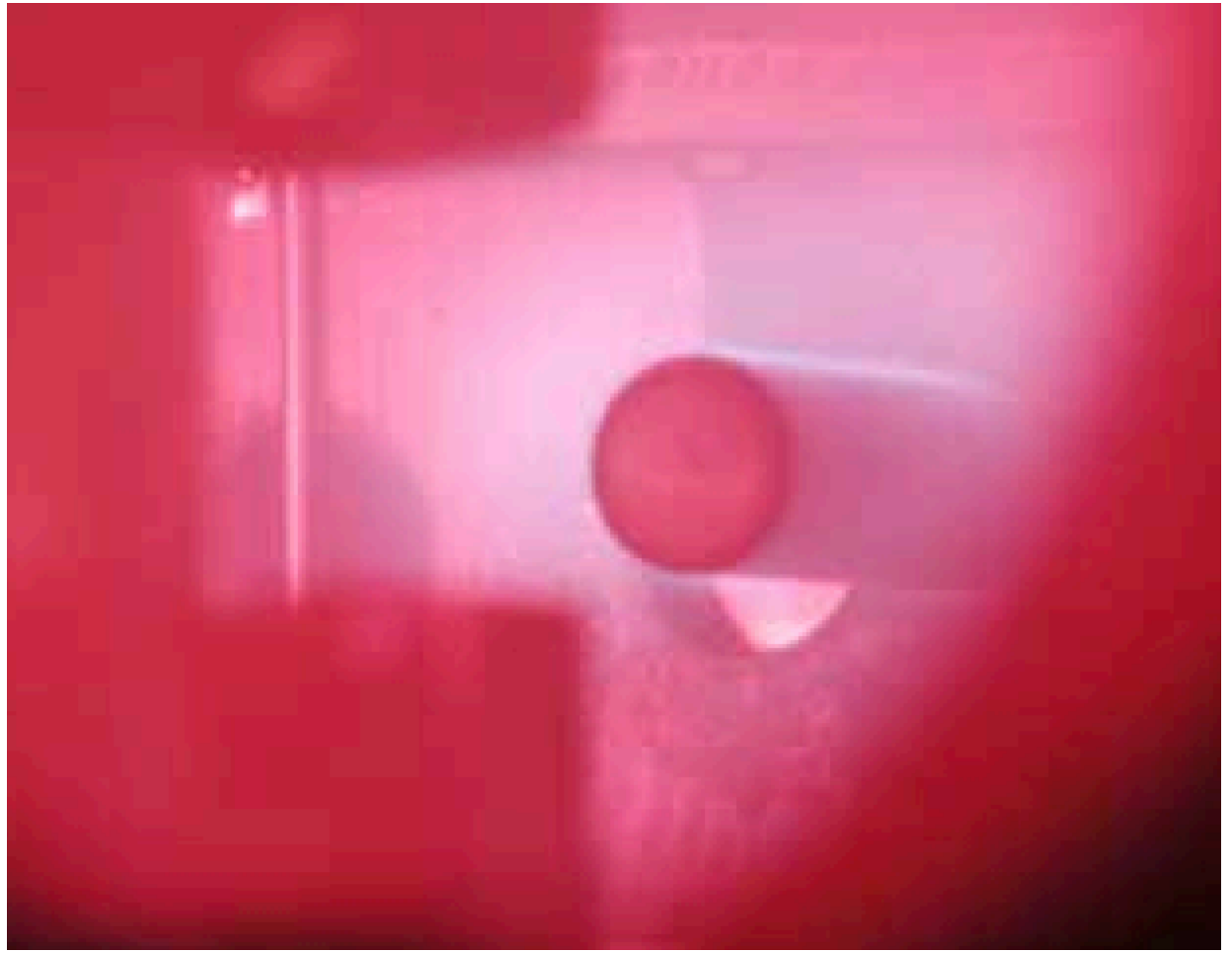
Massachusetts Institute of Technology

Importance of TPD for Fusion Reactor Surface Analysis

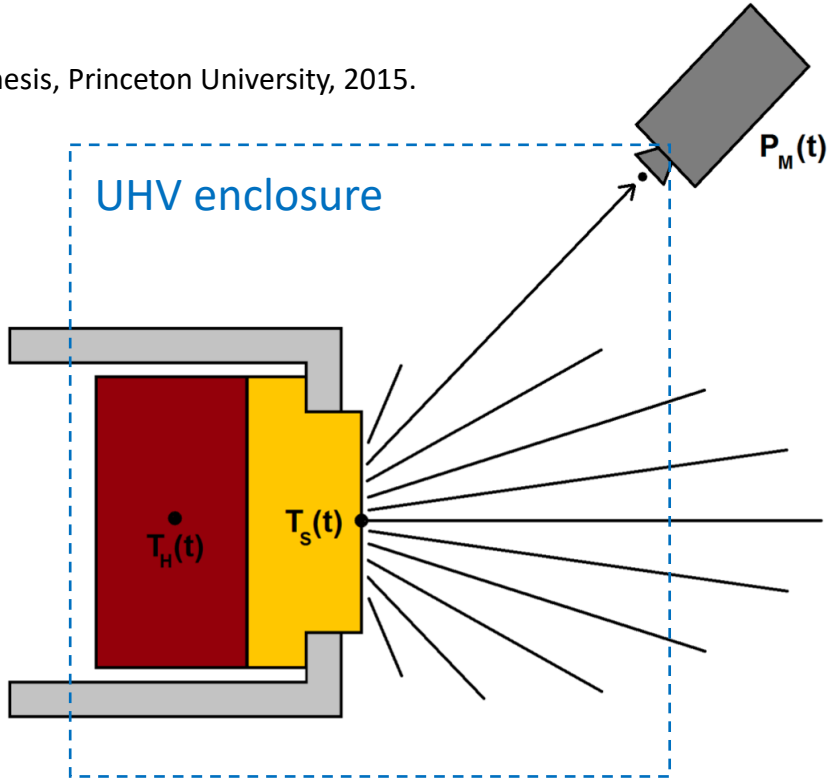
- Hydrogen retention in PFCs
- Impurities (plasma performance)
- Liquid PFCs chemical and physical stability



Interior of LTX – β during plasma glow procedure. PPPL.

Temperature Programmed Desorption (TPD)

M. Lucia, PhD thesis, Princeton University, 2015.



RGA must be in the line-of-sight of the sample

$$N_d^X \propto \int_{t_1}^{t_2} P_M(t)dt$$

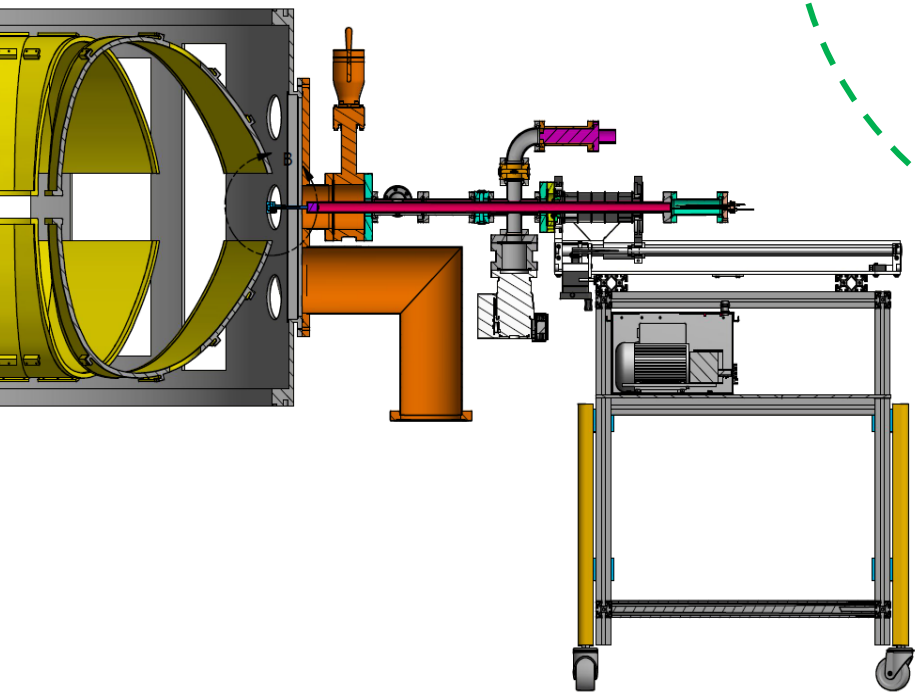
$$\log\left[P_M(t)\right] - n\log\left[f_\Theta(t)\right] = \log\left(\alpha\nu\Theta_0\right) - E_d^X\left(\frac{1}{T_S(t)}\right)$$

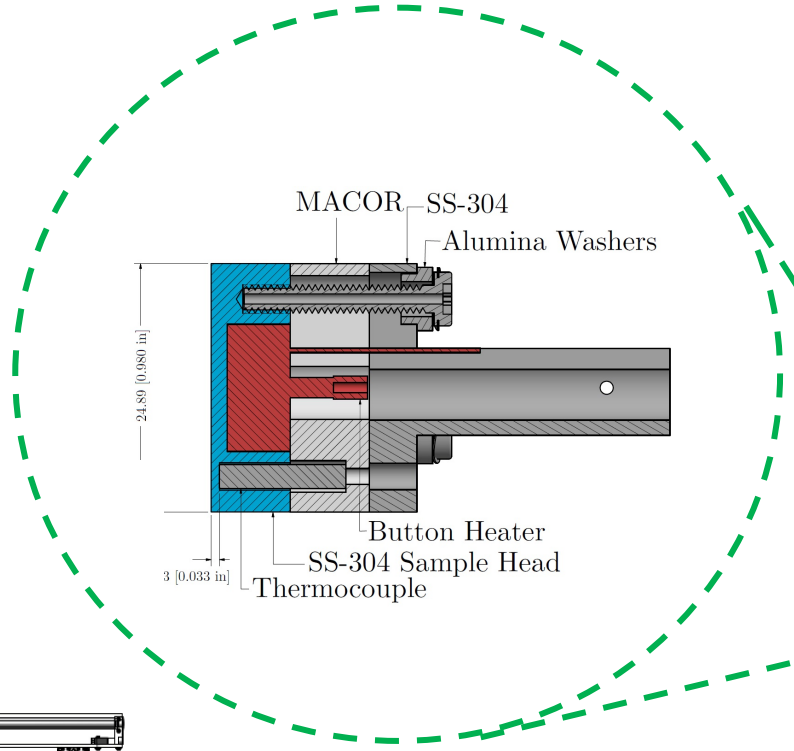
y = b - mx

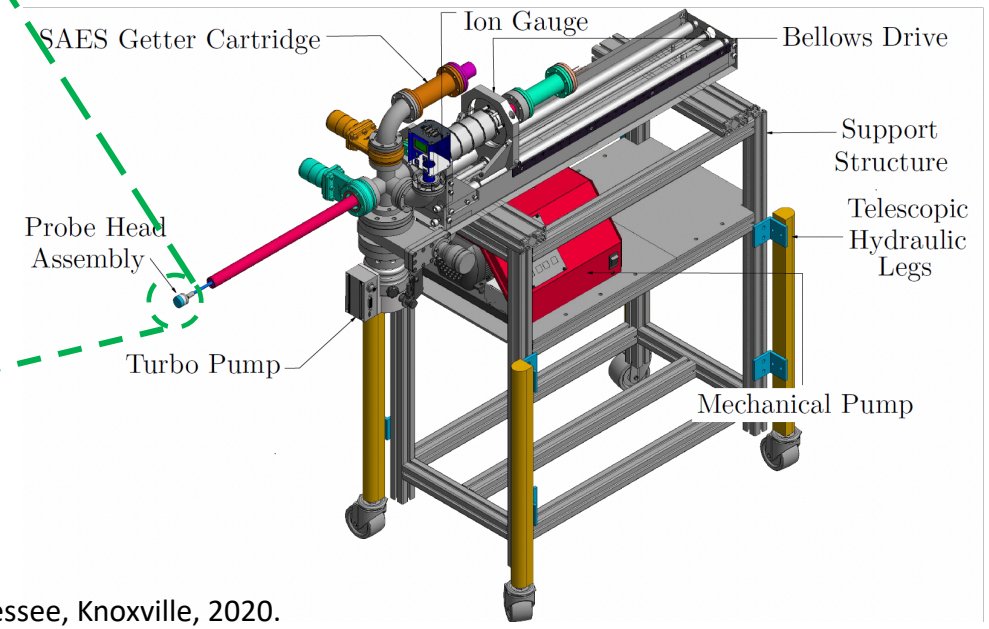
T_H – heater temperature
T_S – sample surface temperature
P_M – partial pressure of mass/charge ratio M

N_d – number of particles desorbed
E_d – desorption energy
f_θ – fraction of surface covered

Sample Exposure Probe (SEP)



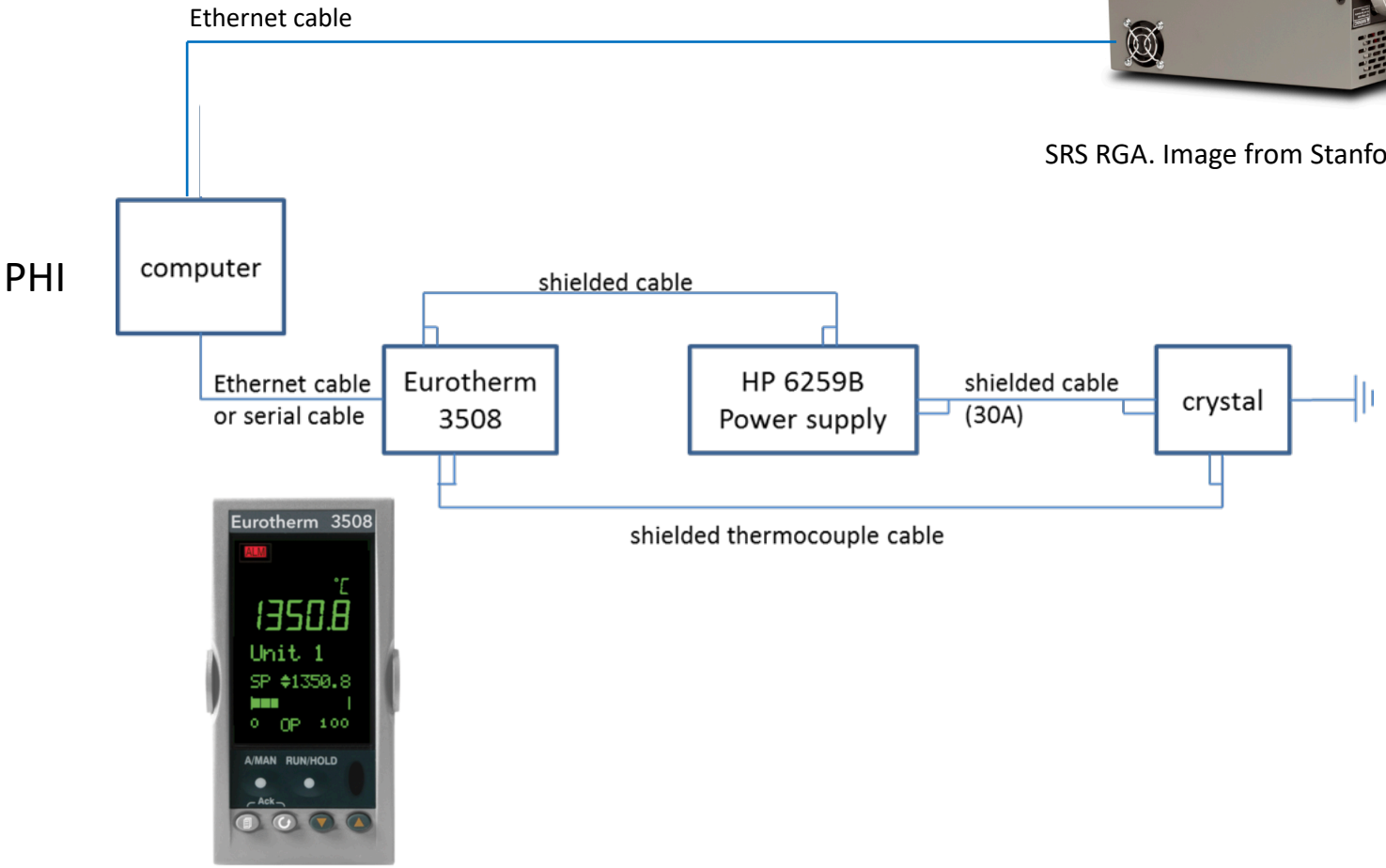




A. Maan, PhD thesis, University of Tennessee, Knoxville, 2020.

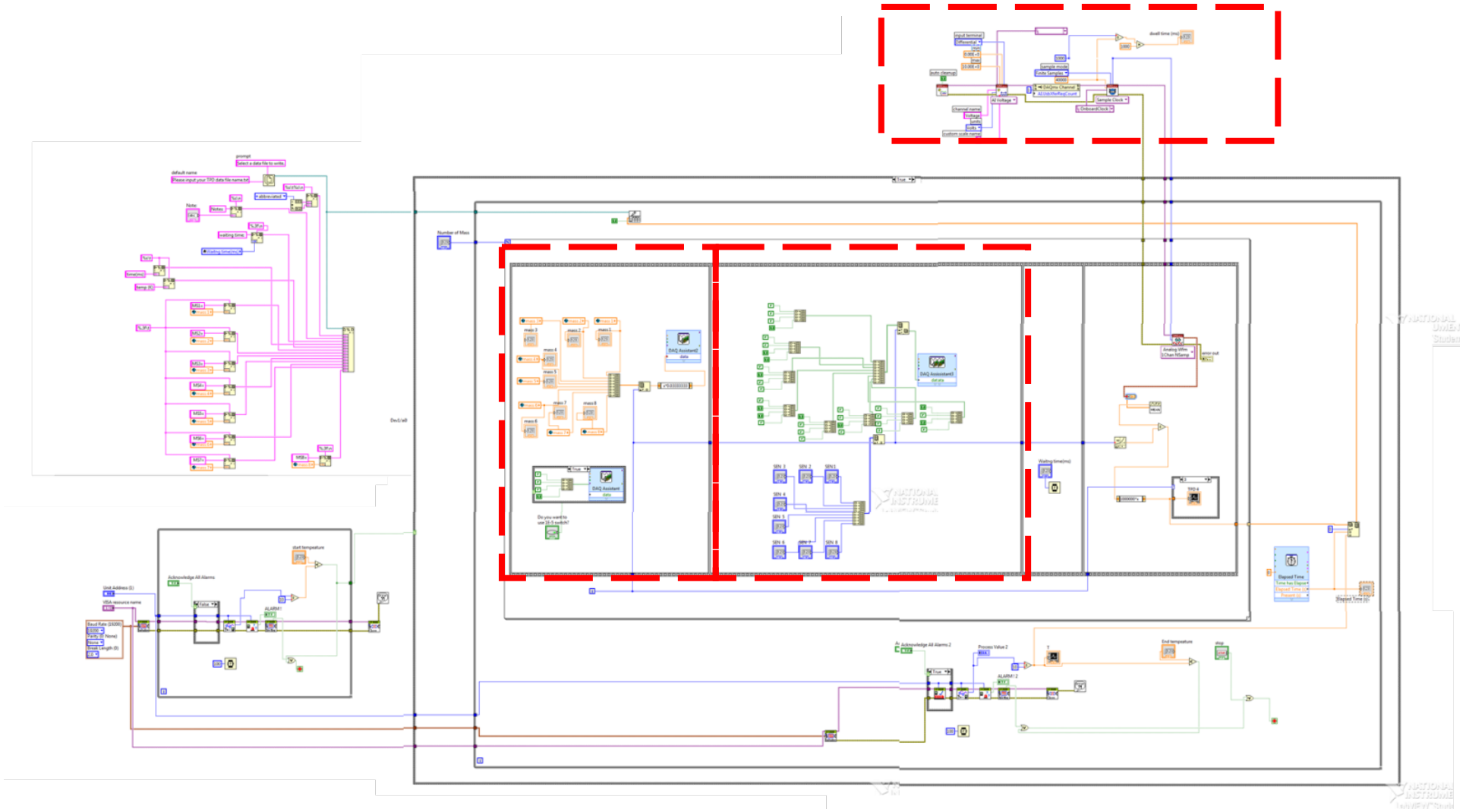
Experimental Setup

SRS RGA. Image from Stanford Research Systems website.

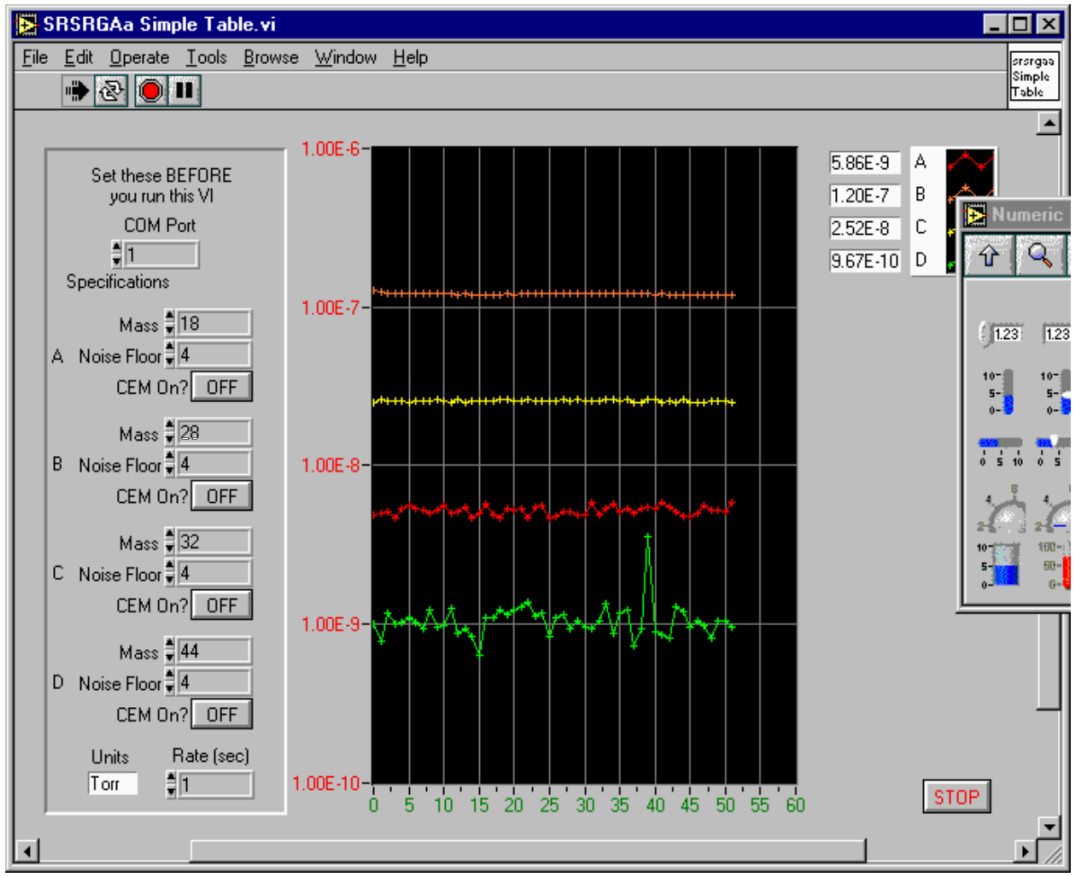


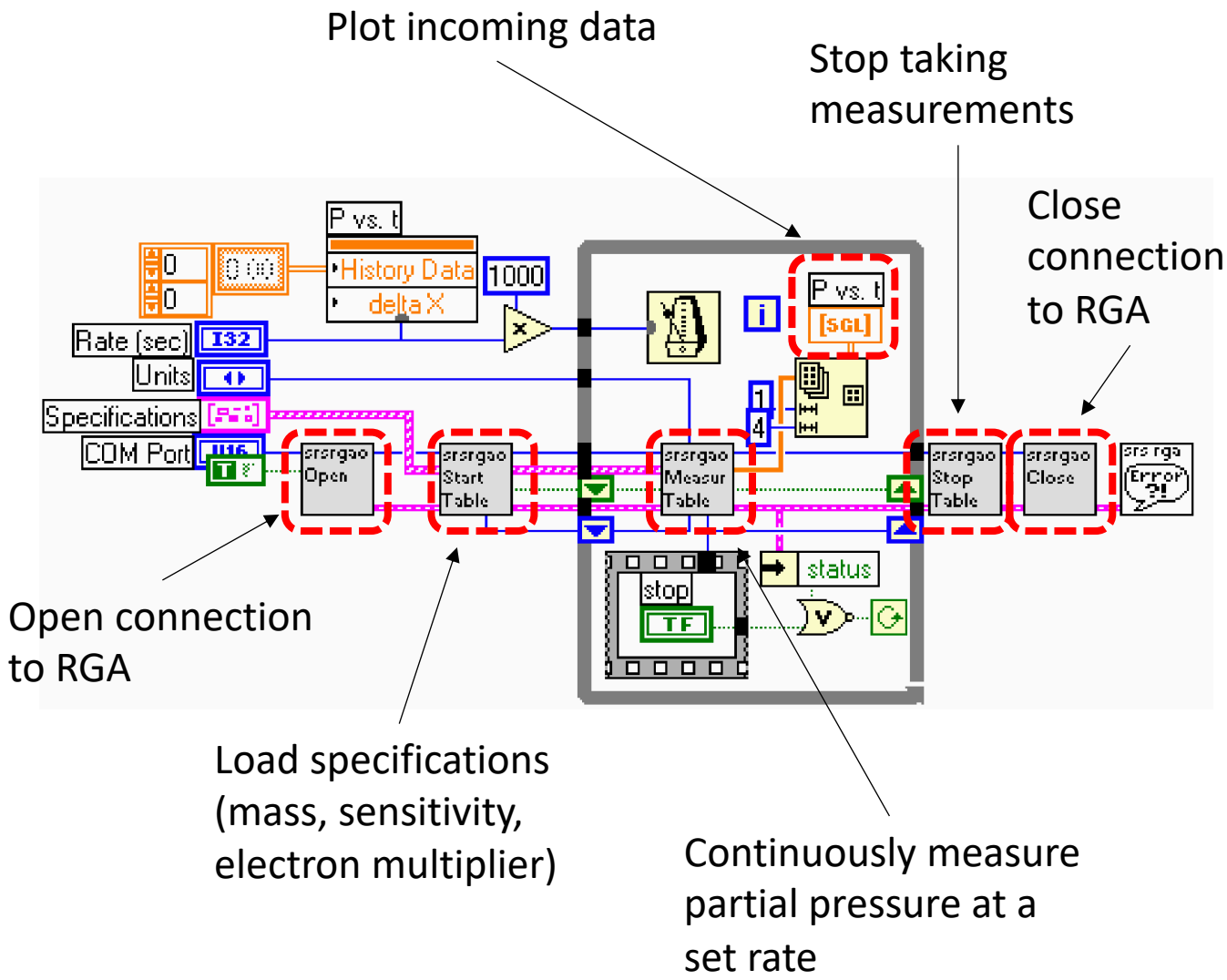
Eurotherm 3508. Image from Eurotherm website.

TPD LabVIEW Program

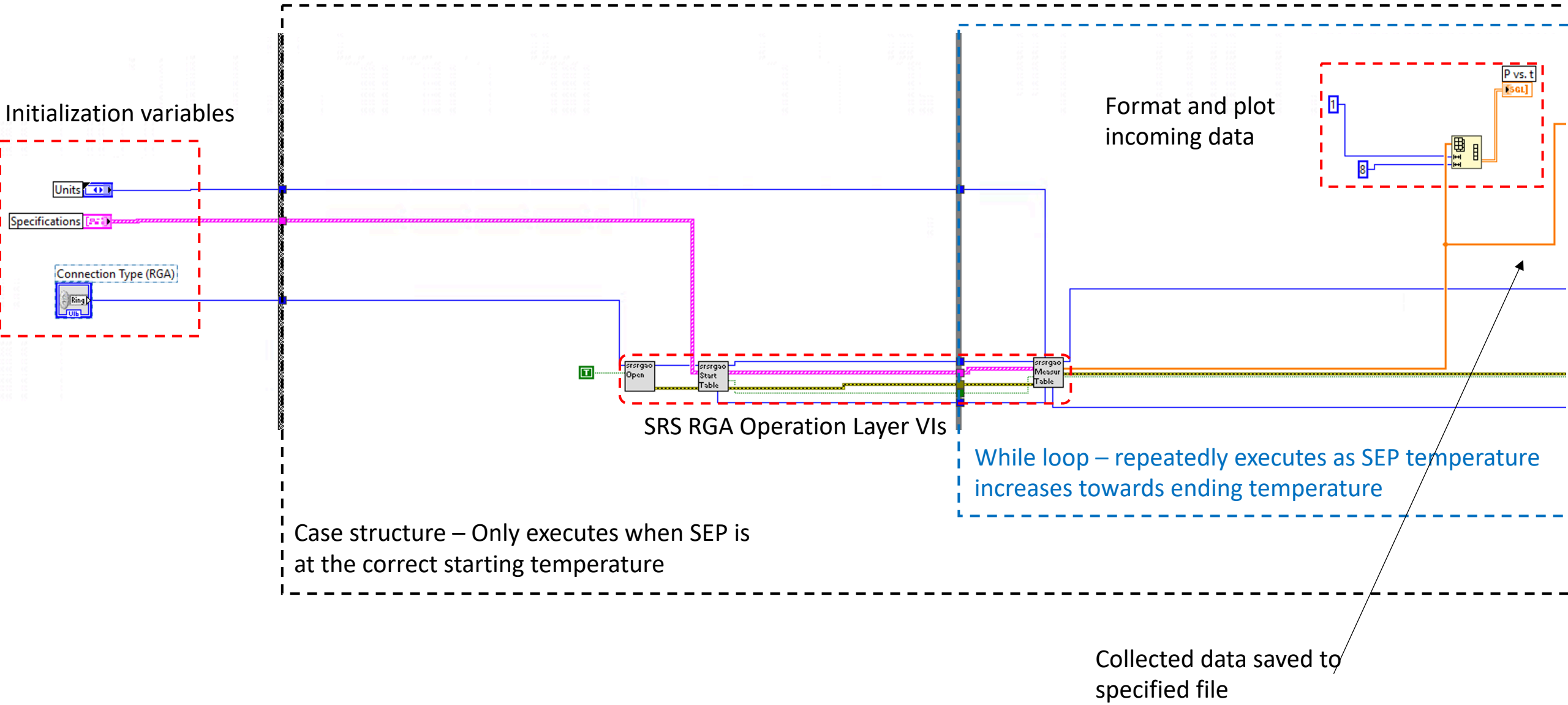


SRS RGA Operation Layer VIs



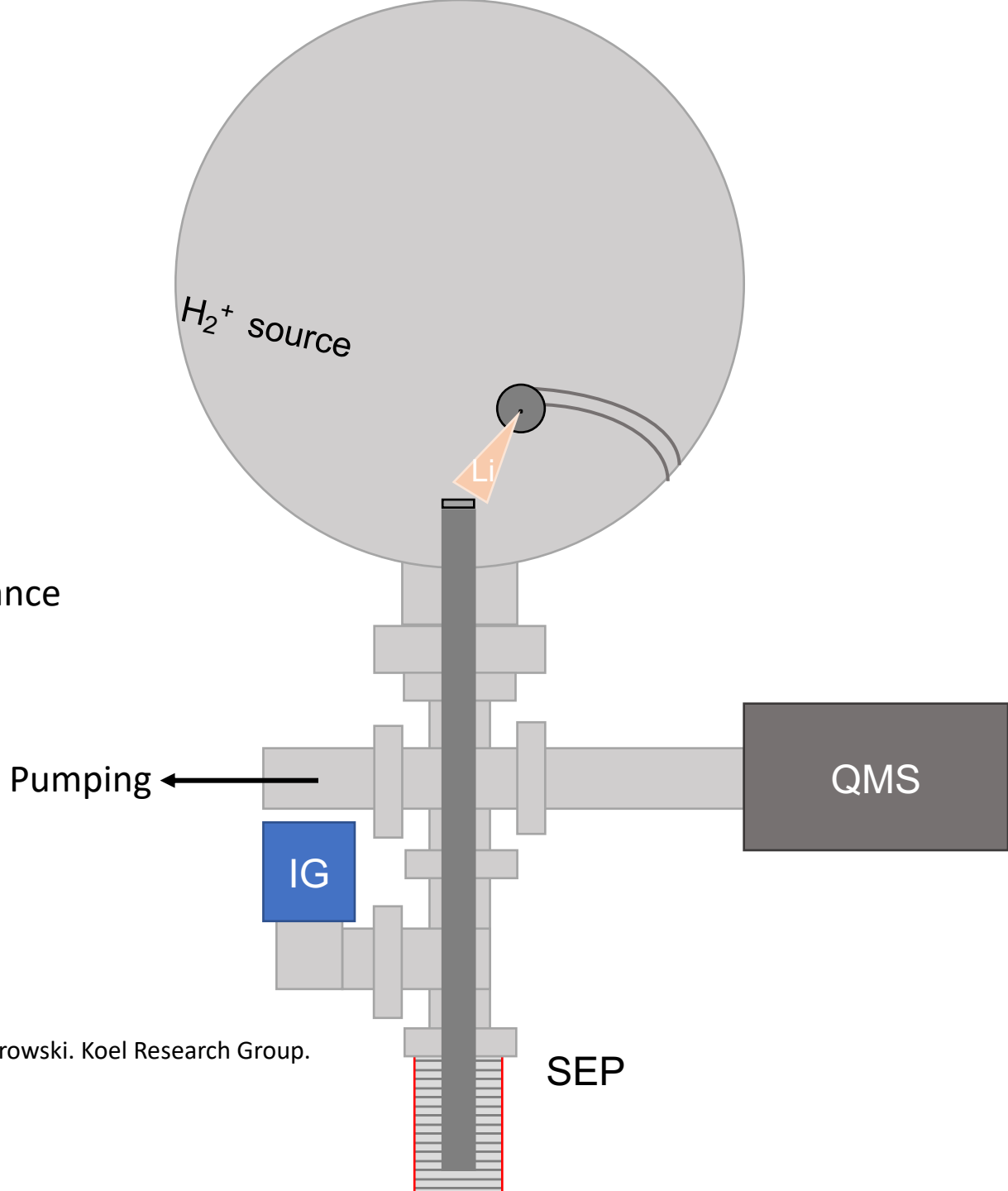


New LabVIEW Program Structure



Next Steps

- Test program using Pt and CO gas
  - CO gas has a known TPD profile on platinum catalysts
- Study hydrogen retention in Li
  - Implications for hydrogen recycling and plasma performance



Drawing made by Evan T. Ostrowski. Koel Research Group.

Thank you!

This work was made possible by funding from the Department of Energy for the Summer Undergraduate Laboratory Internship (SULI) program. This work is supported by the US DOE Contract No. DE-AC02-09CH11466.

This material is based upon work supported by the U.S. Department of Energy, Office of Science/Fusion Energy Sciences under Award Number DE-SC0019308.