A_1^n Polarized ^{3}He cell production and characterization

Peoplepower

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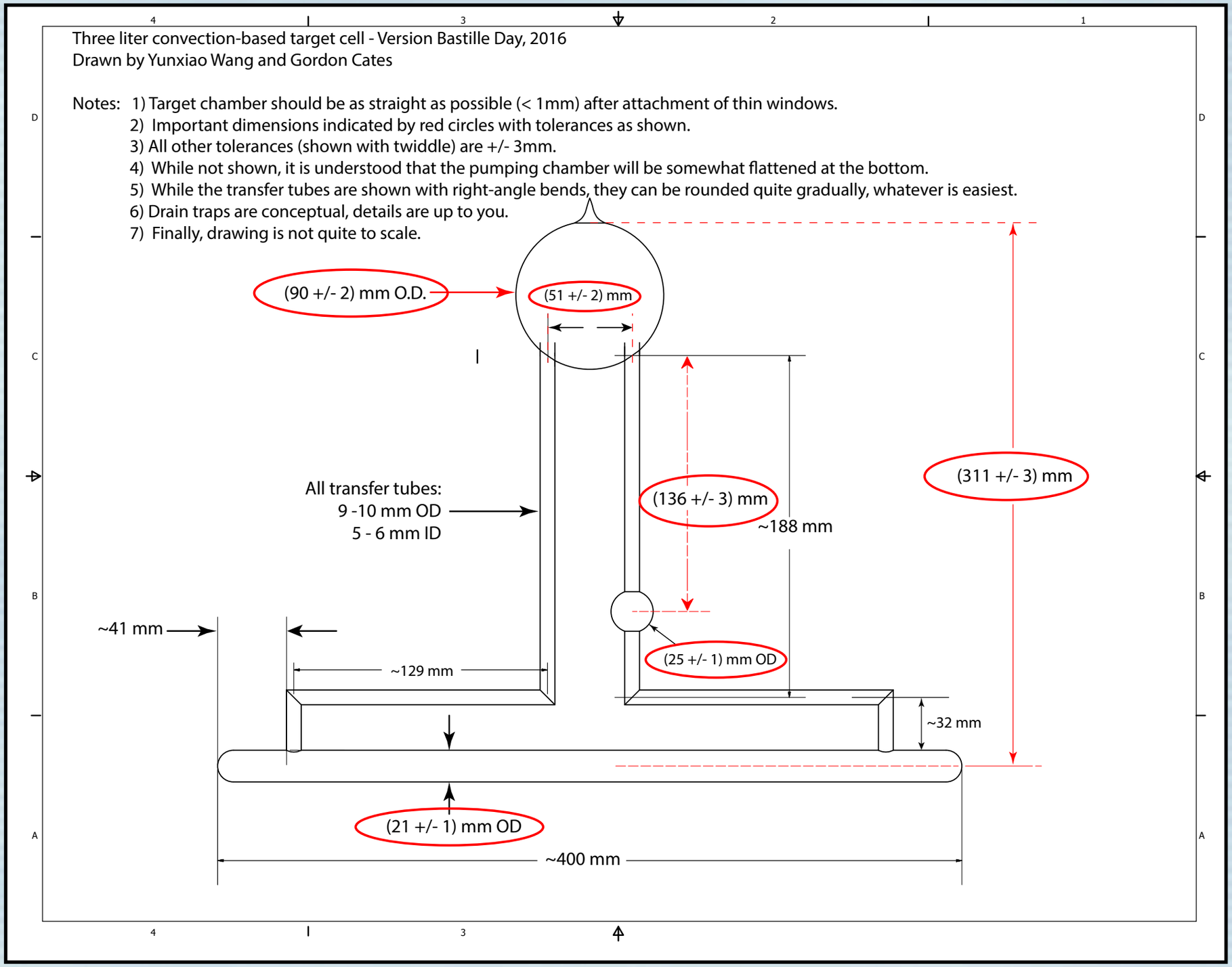
Gordon D. Cates

June 2018 Collaboration Meeting

Steps in cell production

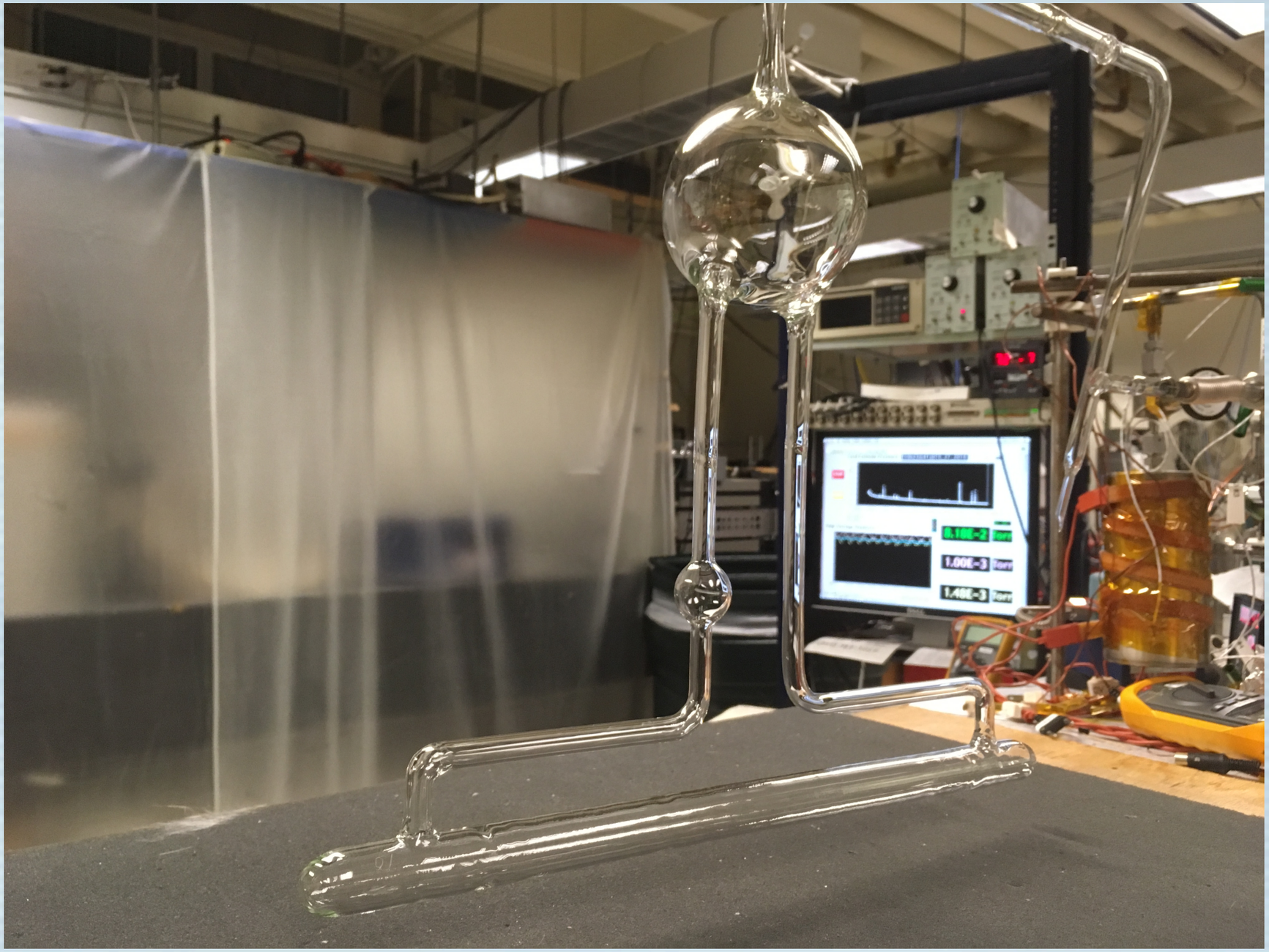
- Fabrication of the cell itself - for us, this is mostly pressure-testing the thin glass end-windows.
- Filling the cells - a big production I won't say much about.
- Cell Characterization
  - Intrinsic lifetime
  - Maximum polarization
  - Pressure
  - Wall thicknesses
  - K/Rb ratio (D value)
- Timing - historically, we have produced target cells as quickly as one per two weeks, since one cell can be on the vacuum system while one is being tested. With a year before the run, producing 9 or 10 additional cells is quite realistic.

Design of the Hall C convection target



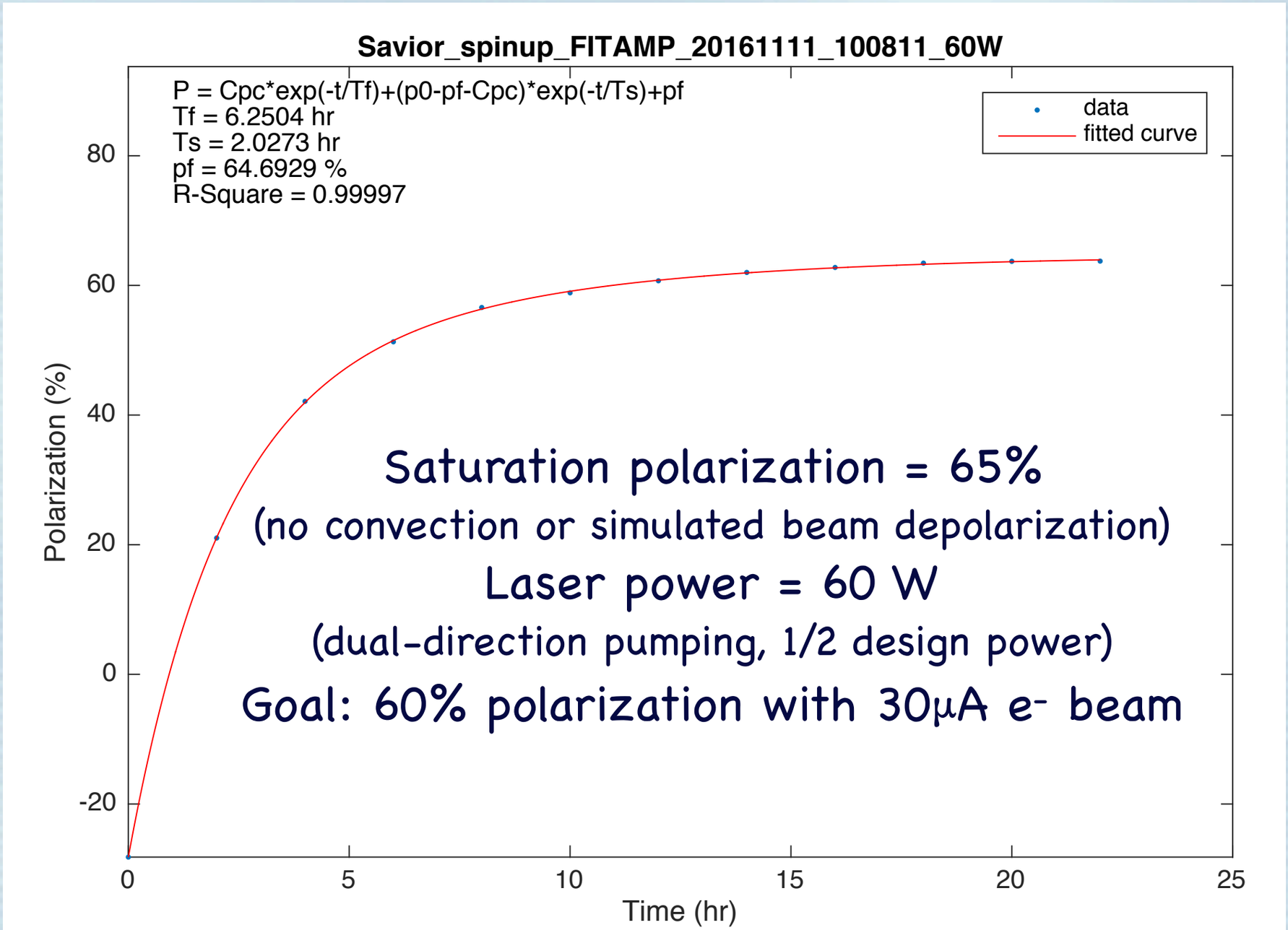
Note that the pumping chamber extends from roughly 22.1cm to 31.1 cm above the center of the target chamber.

First beam-ready production target: Savior



On the gas system prior to being filled.

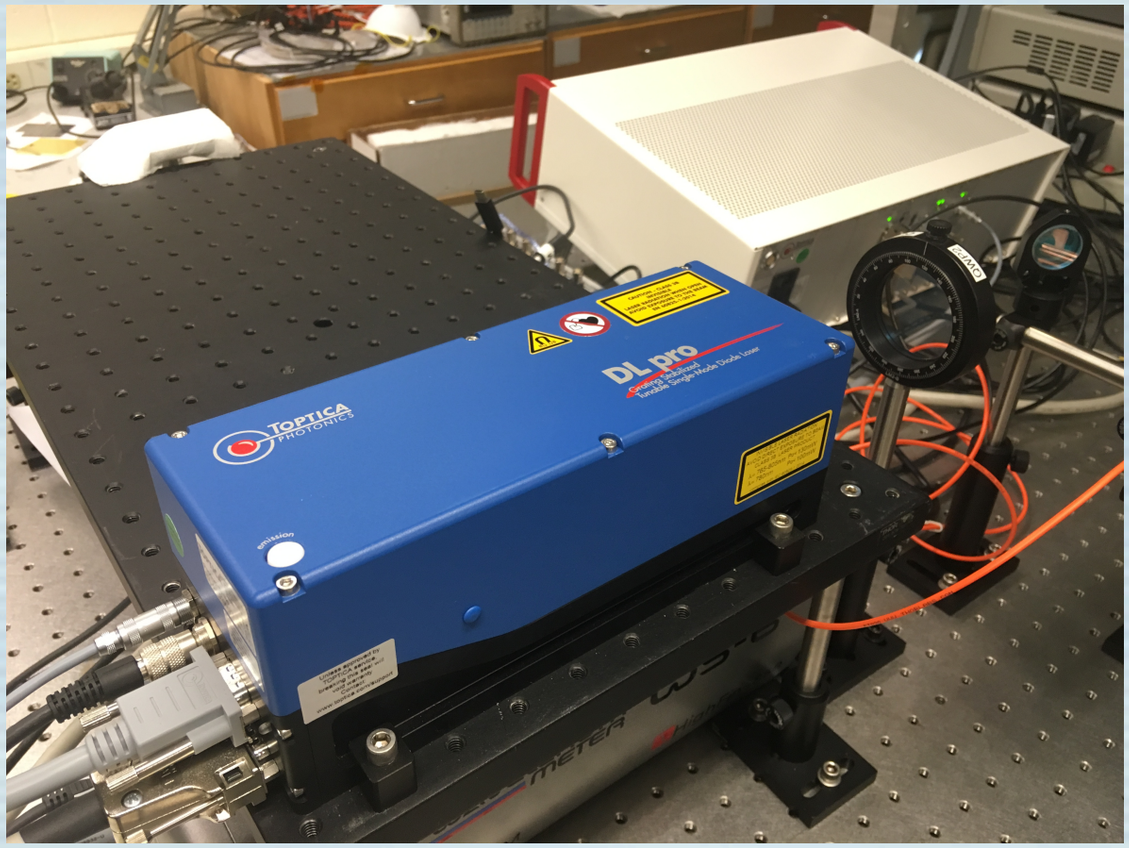
Polarization test of Savior

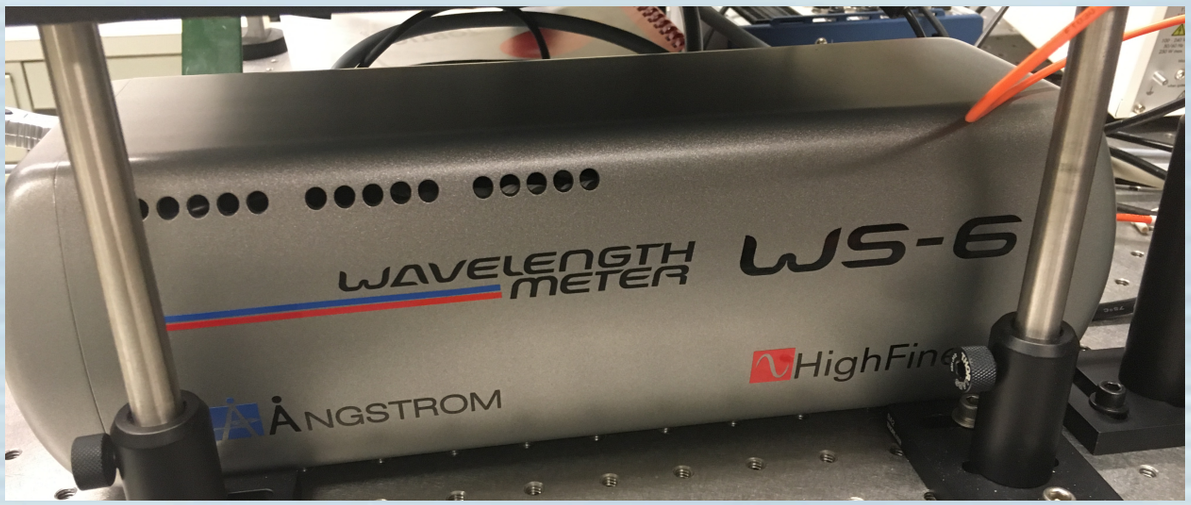


While not a full simulated beam test, this was nonetheless extremely encouraging.

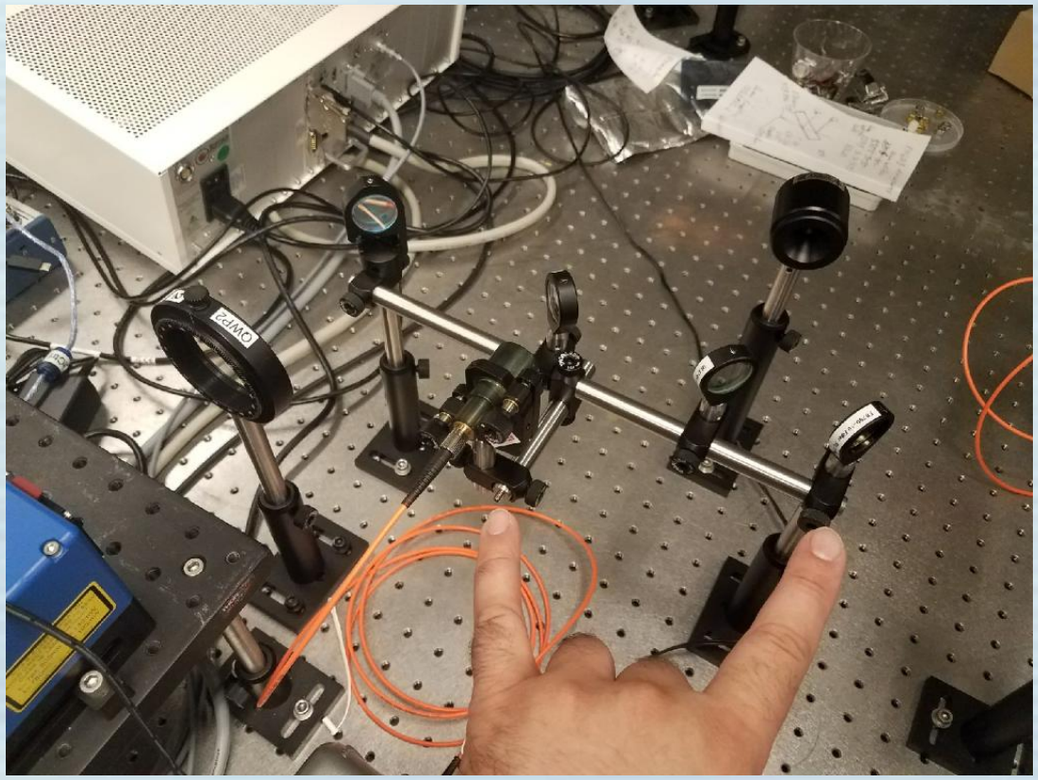
Cell Characterization

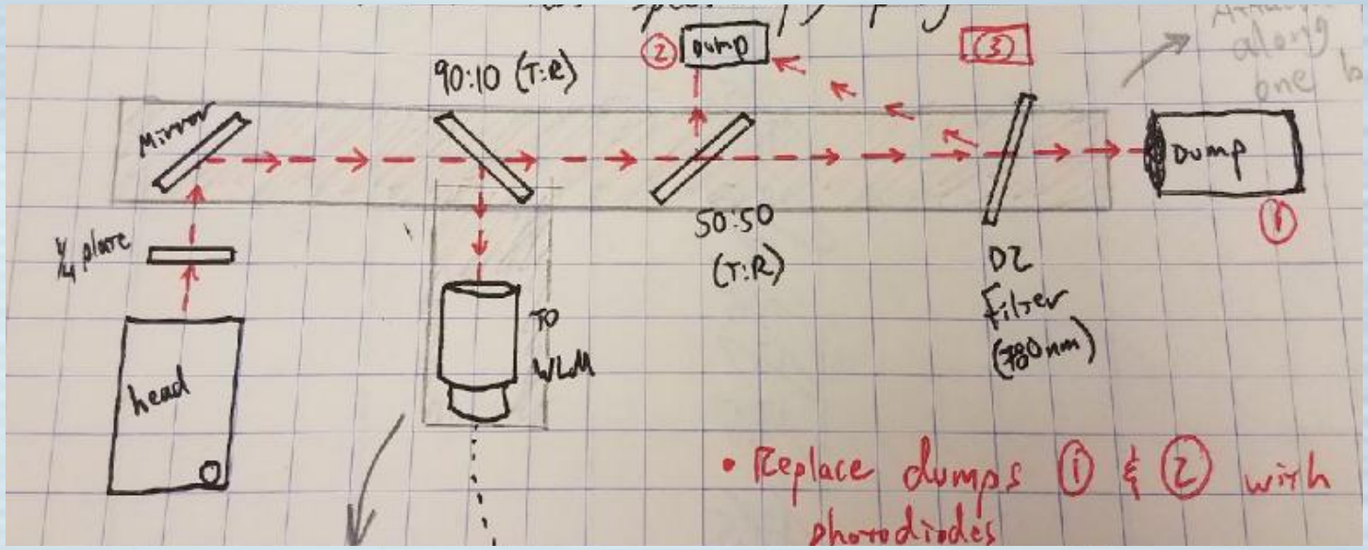
- Requires a scannable single frequency laser.
- Our Coherent 899-29 is just too old!
- We have obtained a new Toptica DL Pro, scannable from roughly 700 - 800 nm. Roughly 100 mW over our frequency range of interest.



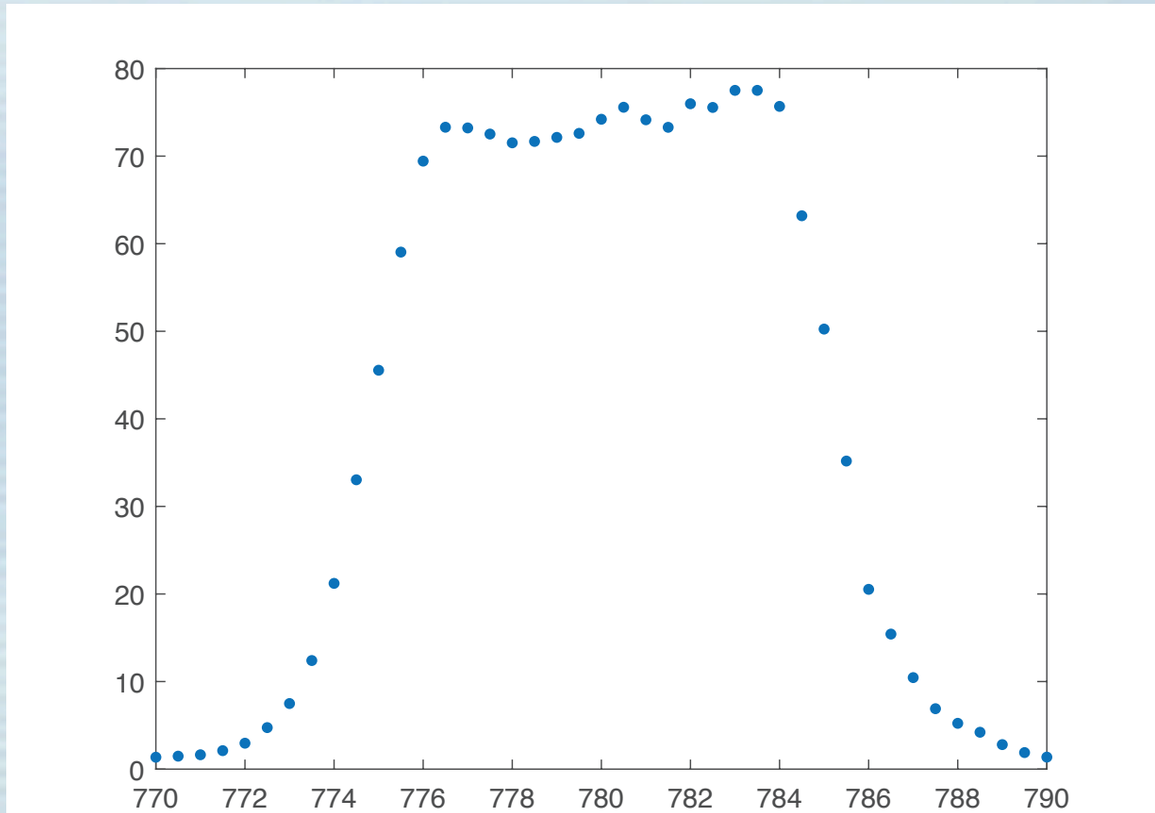


Quick proof of principle of laser's capabilities





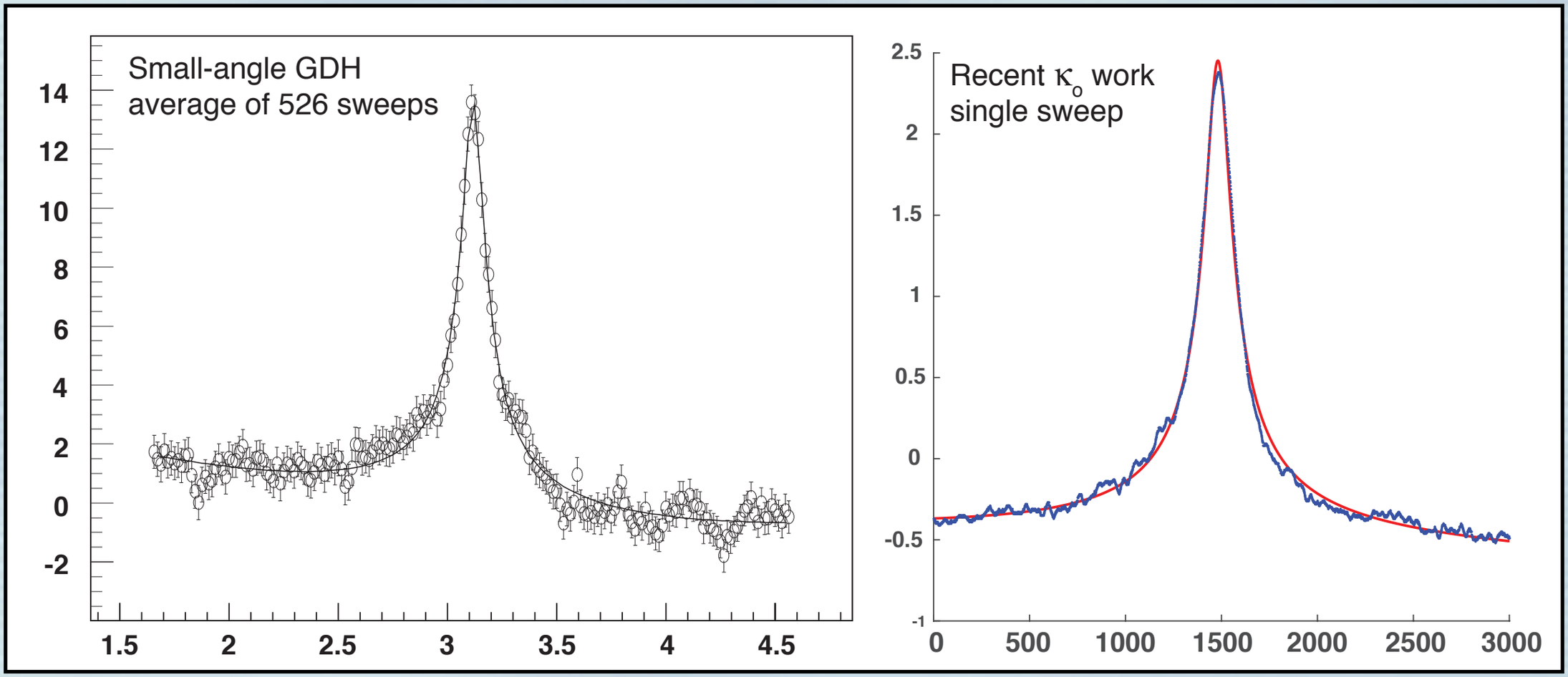
At right, percent transmission of laser light through a D2 filter: meant to be a crude simulation of a pressure broadening curve.



Next cell to be made

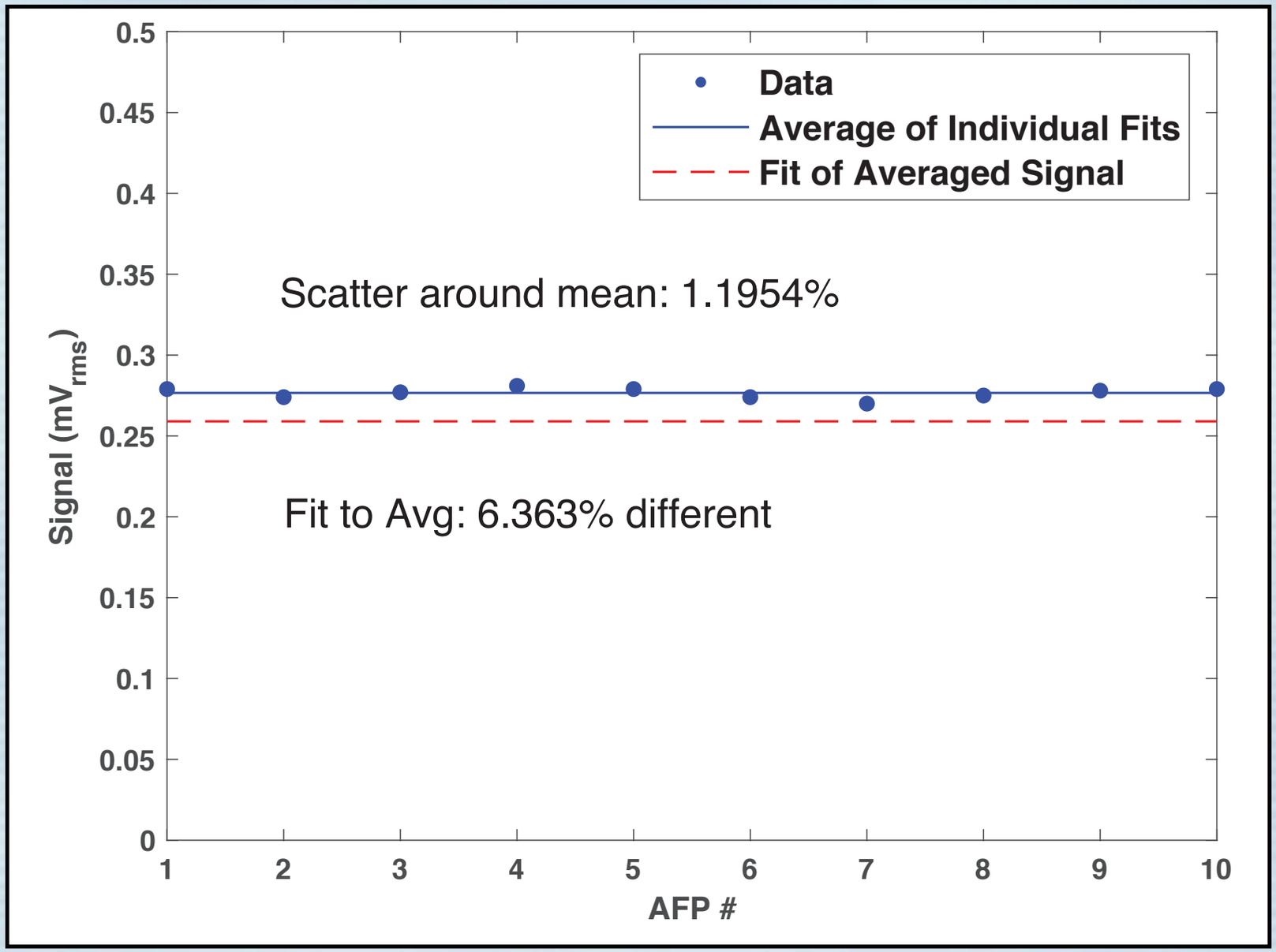
This cell was previously on our gas system, filled with a hybrid alkali mixture, but was then "dumped" to atmosphere. Our expectations are low on its performance, but we plan to fill it as a warmup for the next cell (just received from Mike Souza at Princeton).

One highlight from κ_0 measurement



Comparison of averaged water signal with a single-shot signal.

Water calibrations: the average of fits versus the fit of an average



We consistently see a difference up to several percent. I believe all previous water calibrations suffer from this systematic.

Short-term status and plans

- A new batch of thin end windows have been pressure tested and are ready to be incorporated into target cells.
- The first target cell of "Batch #2", with the recently tested end windows, has been received and is ready for filling.
- We are doing some maintenance on our vacuum system prior to beginning the next set of fills.
- We expect our new laser system to be ready to do characterizations when the next cells are filled.
- We will have roughly 250 Watts of laser light for full-polarization tests, roughly twice what is needed for Stage-I target cells.


STAPLES
Photo
Gummed
Envelopes
50 QTY.
GLASS