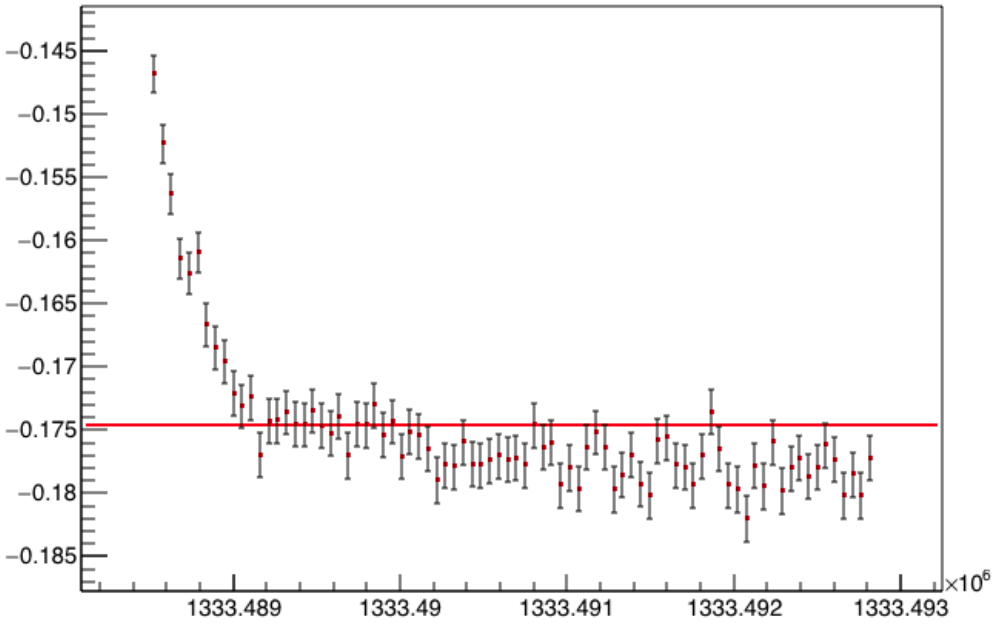
Polarization Uncertainties (revisited)

1/12/16

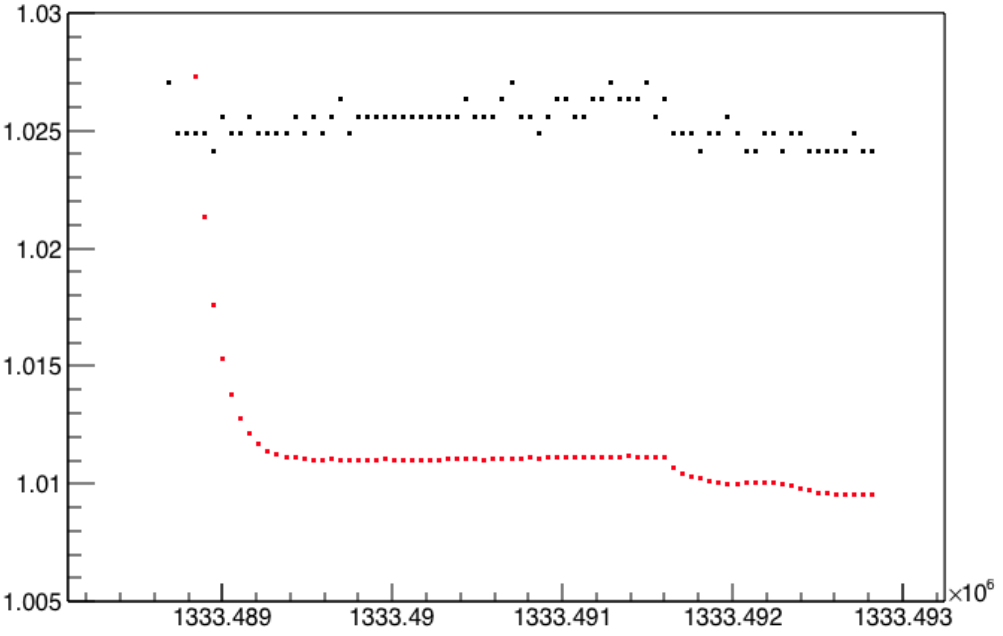
Example TE analysis process

- Start by finding the TE in the raw data file (using start/end time from logbook)
- Plot He3 and He4 manometer temperatures.
  - ➔ *Temperature uncertainty is the variance between the he3 and he4 data.*
- Plot integrated area and fit.
  - ➔ *1% systematic uncertainty in area due to reimann sum process*
- Restrict TE length to a stable region in temperature.
- Iteratively reduce TE length until reduced chi-squared from fit is minimized.

TE Integrated Area



TE Temperature



- Once a stable region is found, calculate CC at each point:

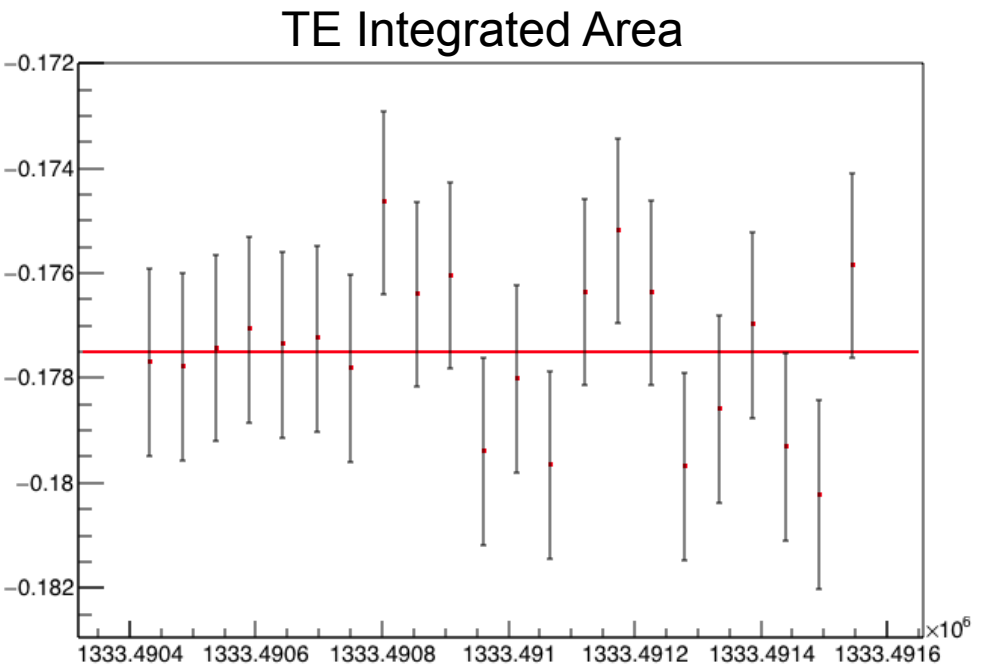
  ➔ $P_{TE} = \tanh\left(\frac{\mu B}{kT}\right)$

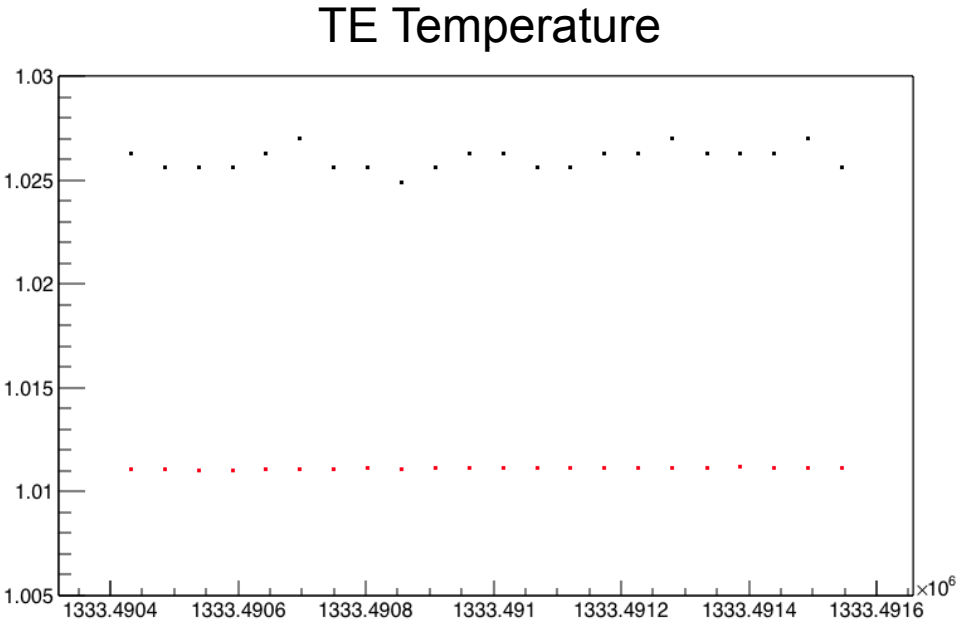
  $CC = \frac{P_{TE}}{A_{TE}}$

- Area uncertainty and polarization uncertainty (from uncertainty in T and B) are propagated to the CC uncertainty in the normal way for each point.
- The weighted average is taken over all of the data points., reducing the uncertainty.

Final CC for TE #12

-1.498 +/- 0.0505 (3.37%)





Material 8

CC ID	CC	CC unc.	Rel. unc.
12	-1.498	0.051	3.4%
14	-1.524	0.049	3.2%
16	-1.542	0.036	2.3%
20	-1.519	0.048	3.2%
22	-1.415	0.027	1.9%
24	-1.401	0.020	1.4%

Final CC:
-1.45 +/- 0.01 (0.91%)

Comparison to GEP (ENTIRE EXPERIMENT!)

Mat ID	CC ID	CC	Rel. unc.
1	1	-1.299	3.1%
2	2	-1.349	3.1%
2	3	-1.477	6.2%
3	4	-1.823	3.0%
4	5	-1.424	2.9%
5	6	-1.799	3.3%
6	7	-1.731	3.2%

MatID 2 is the only material with more than one TE. The final CC for this material is -1.371 (2.79%)

The reason our uncertainties are so small is because we often have a very large amount of TE's done for each material. This significantly reduces the final uncertainty!

Material 13 is an example of a material with only one TE done, final CC is:
-1.51 +/- 0.06 (4.0%)