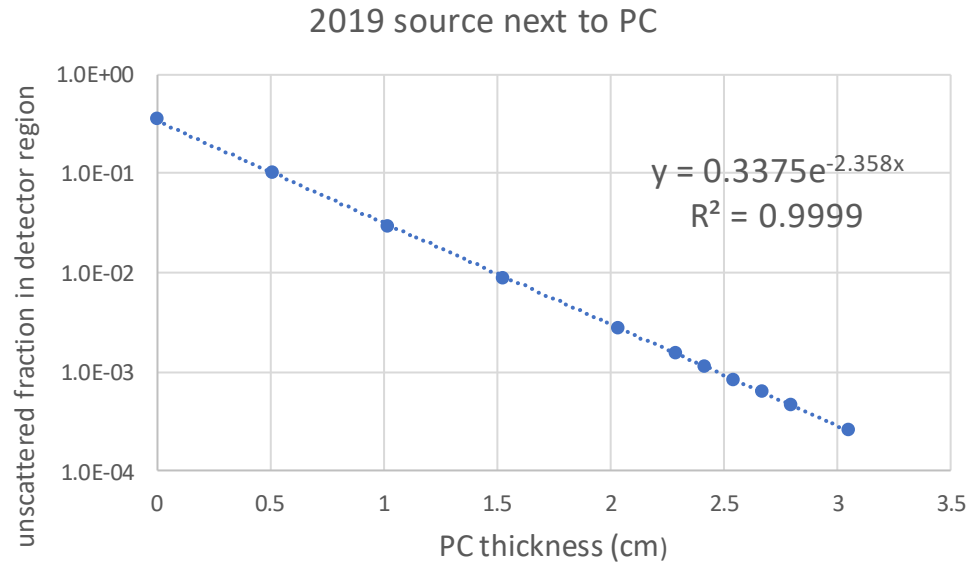


Lawrence Heilbronn June 13, 2023

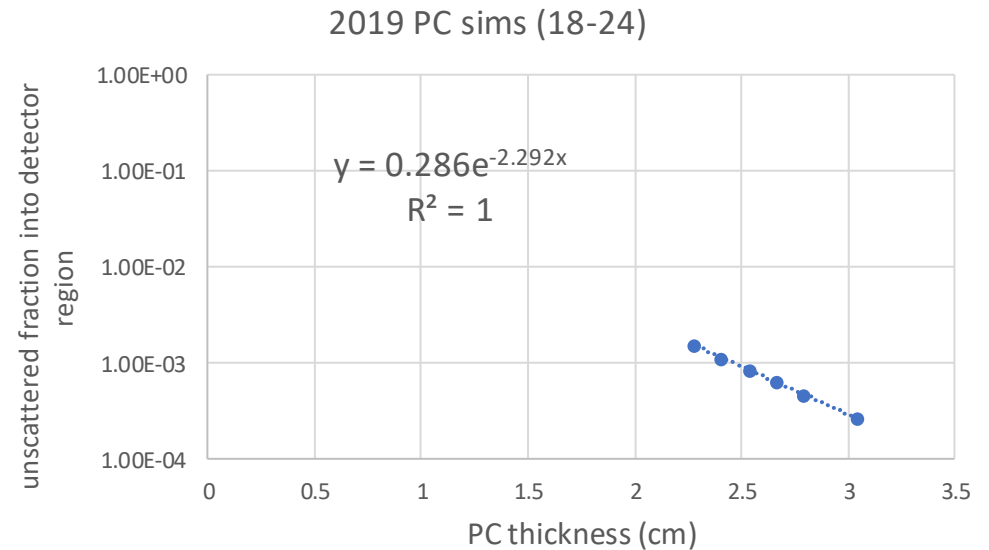
July 13 2023 update on PHITS simulations of SNS pinhole spectra attenuation

- Have completed full set of simulations for the 2019 pinhole spectrum at 0, 4, 8, 12, 16, 18, 19, 20, 21, 22, and 24 layers of 0.127-cm thick slabs of PC
- Have completed the simulations for 2020 pinhole spectrum at 0, 18, 19, 20, 21, 22 and 24 PC slabs.
 - Cary is also running 2020 simulations with the newest version of PHITS

2021 simulations

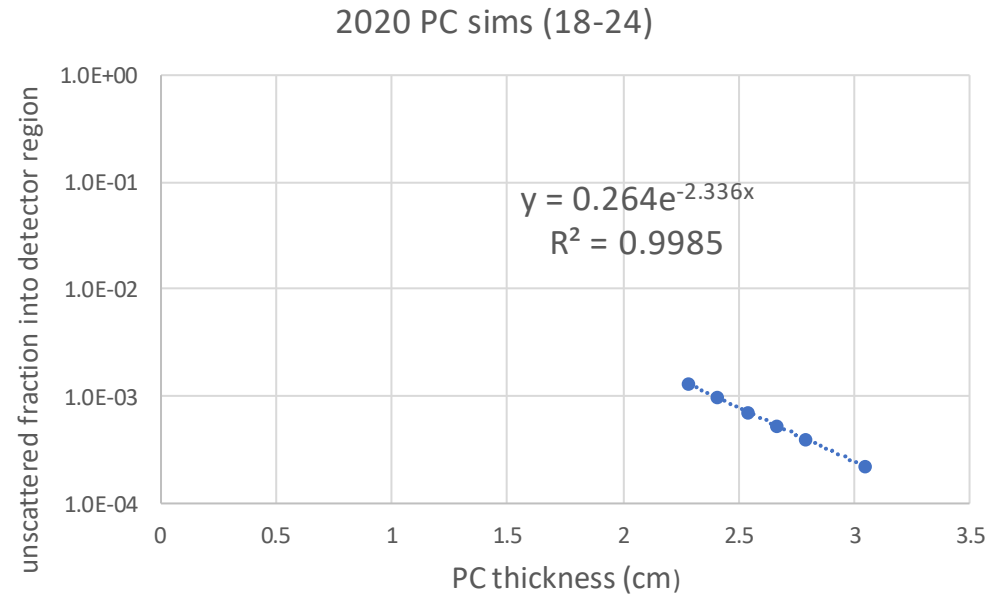


Fit using all points. Actual value at 0 PC is 0.356, fit is at 0.3375 (x-axis is thickness of PC in cm, y-axis is the fraction of neutrons that made it to the detector region without scattering)



Fit using points at PC = 18 – 24. Note that the fit now says the fraction at PC = 0 is 0.286, whereas actual value is 0.356

2020 pinhole spectrum calculations

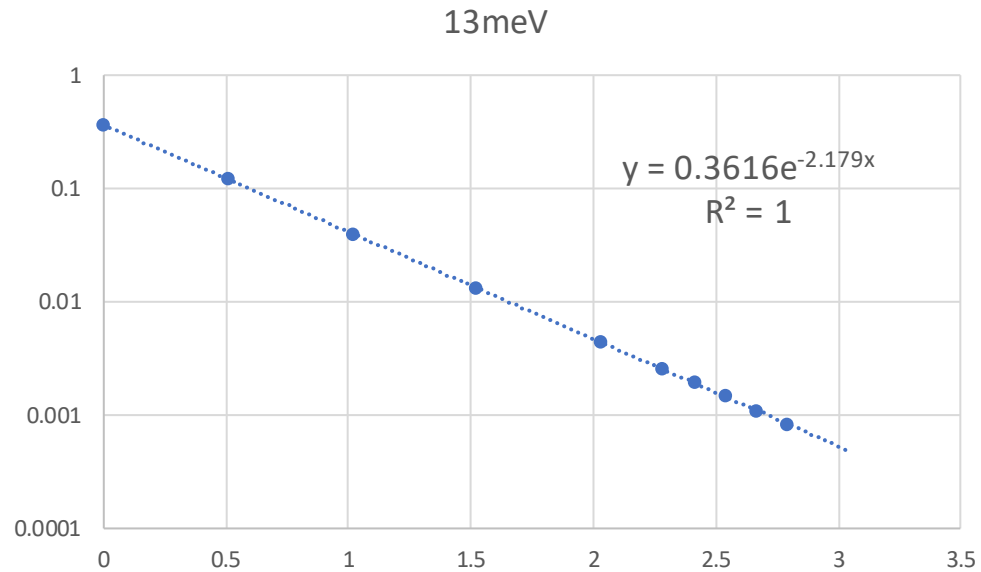


Fit to data between 18 and 24 PC has the unscattered fraction = 0.264. The simulation at 0 cm has the fraction = 0.354.

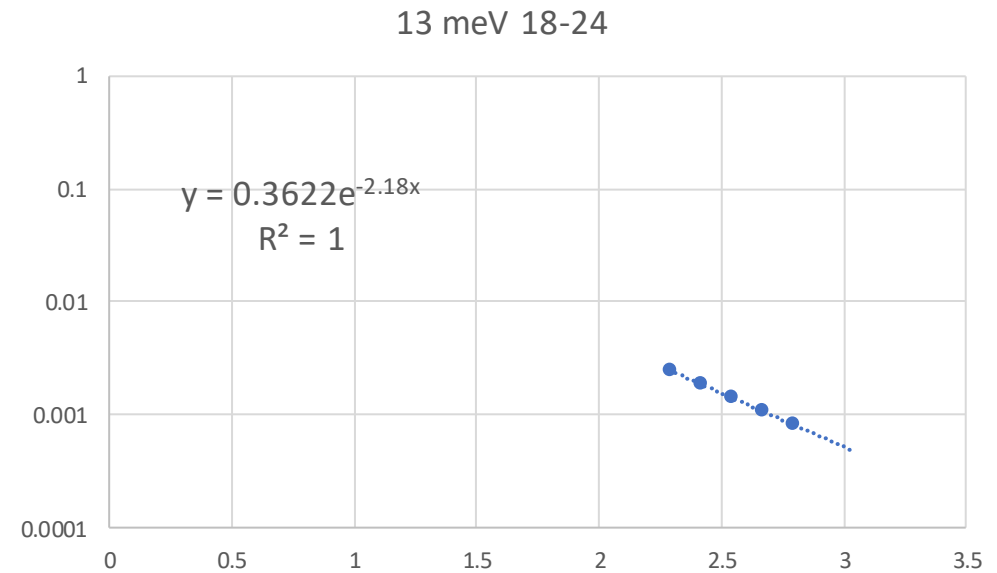
Comparison of 2019 and 2020 simulation results

| | 2019 simulations | 2020 simulations |
|---------------------------|------------------|------------------|
| Frac from fit at 18-24 PC | 0.286 | 0.264 |
| Frac from sim at 0 PC | 0.356 | 0.354 |

Monoenergetic simulations



Simulated fraction at 0 cm = 0.3616



SNS Pinhole Contribution

UT – ORNL n → n' Group Meeting

07/13/2023

Cary Rock

PHITS Contribution

- Installed PHITS v3.3.2
 - Will be used for STEREO investigation as well
 - Dr. Heilbronn has been using v2.8.8
- Ran 2020's pinhole spectrum @ room temp
 - Comparing with Dr. Heilbronn's results – differ
- ~3 hours for:
 - 1e9 neutrons and 24 PC plates (similar times for 18 – 22 PC)
 - 0 PC is ~20 minutes

Update of PHITS simulations analysis

Lawrence H., Cary R., Yuri K.

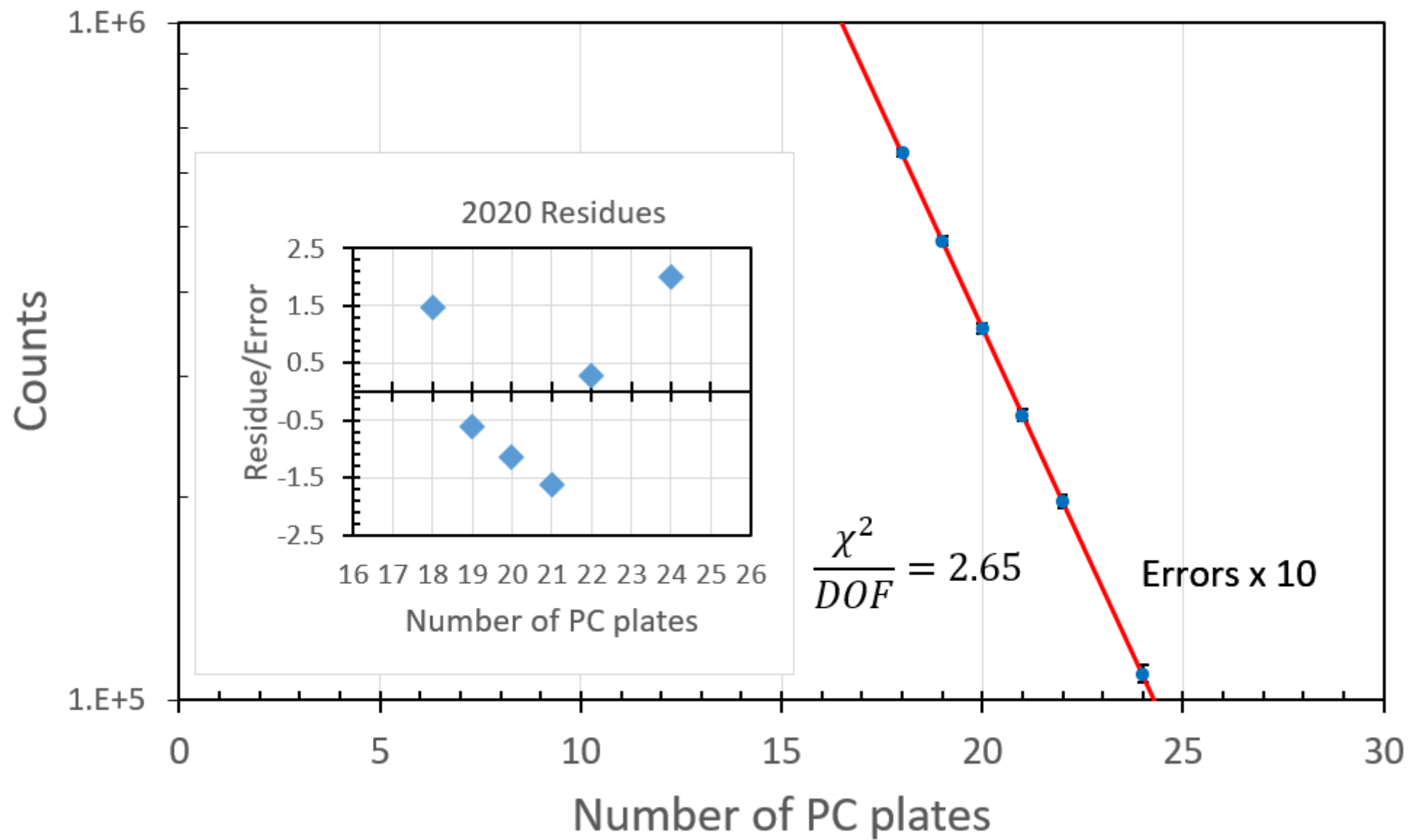
Yuri Kamyshev
kamyshev@utk.edu

Current Status of Simulation Data Sets

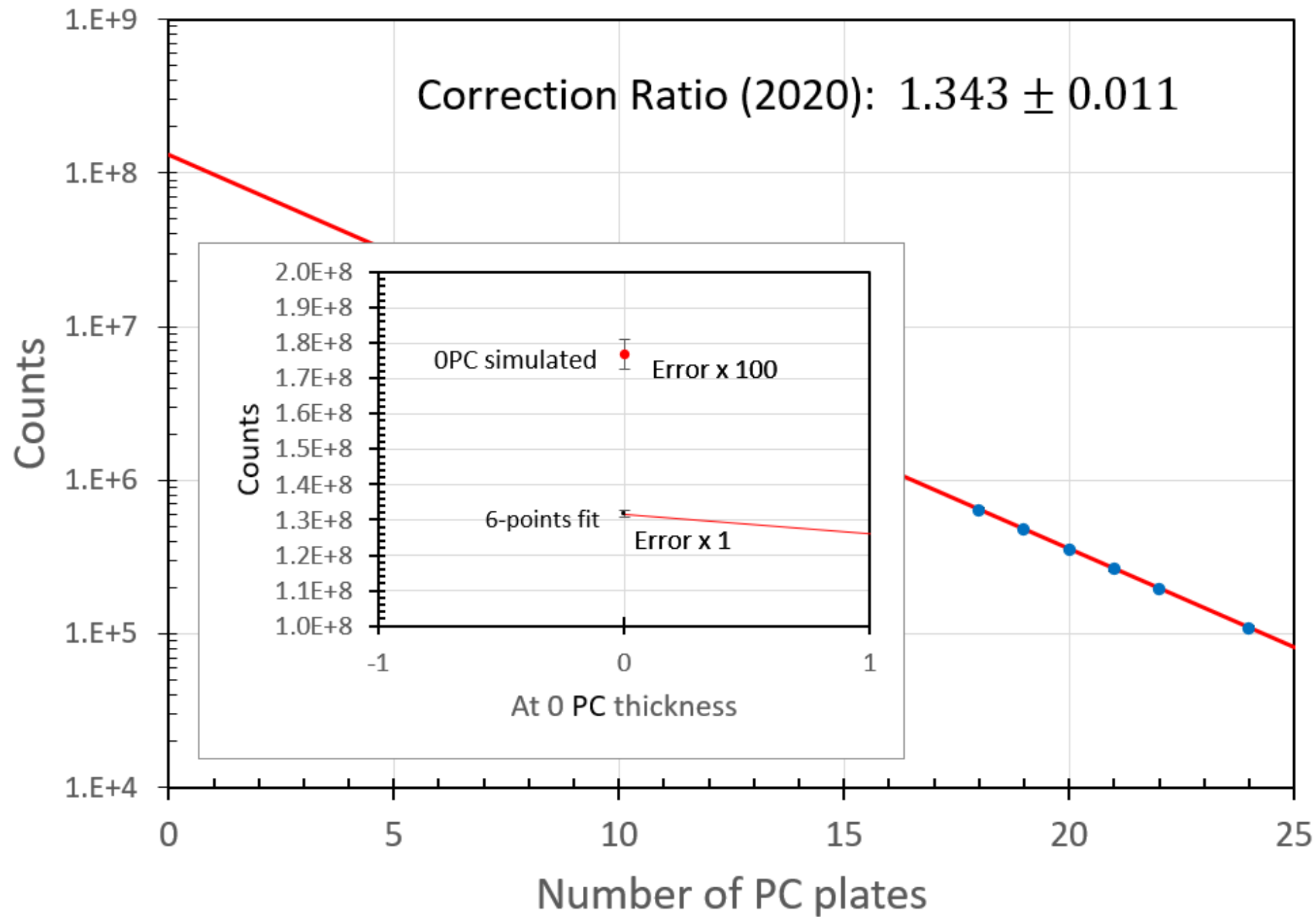
- Pinhole 2019, Room Temperature PC, Lawrence - original PHITS **finished**
- Pinhole 2020, Room Temperature PC, Lawrence - original PHITS **analyzed**
- Pinhole 2020, Room Temperature PC, Cary - new version of PHITS **finished**
- Pinhole 2020 or 2019, Cold Temperature PC, Lawrence - original PHITS **in process**

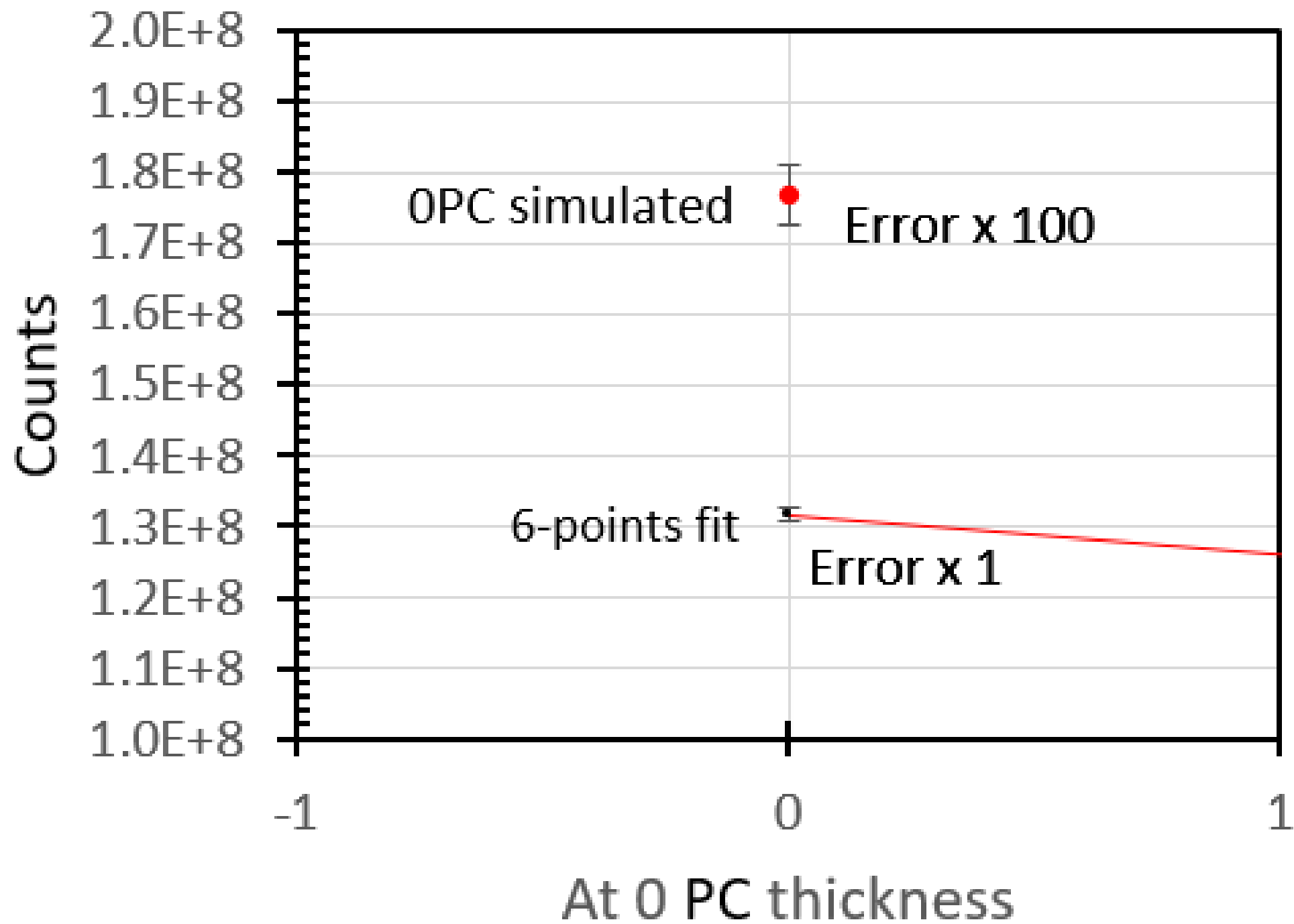
| # PC | Statistics | No interaction in PC | | |
|------|------------|----------------------|------------|------------|
| | | 2019 LH | 2020 LH | 2020 CR |
| 0 | 1.0E+08 | 17,785,552 | 17,686,952 | 17,679,192 |
| 0 | 1.0E+07 | 1,778,200 | | |
| 4 | 5.0E+07 | 2,536,084 | | |
| 8 | 5.0E+07 | 744,799 | | |
| 12 | 1.0E+08 | 447,581 | | |
| 16 | 1.0E+09 | 1,368,298 | | |
| 18 | 1.0E+09 | 759,246 | 643,012 | 617,167 |
| 19 | 1.0E+09 | 566,413 | 477,080 | 457,360 |
| 20 | 1.0E+09 | 422,676 | 354,555 | 339,263 |
| 21 | 1.0E+09 | 315,882 | 263,439 | 251,673 |
| 22 | 1.0E+09 | 236,181 | 196,735 | 187,262 |
| 24 | 1.0E+09 | 132,415 | 109,483 | 103,965 |

Pinhole 2020, room temperature



Pinhole 2020, room temperature





| No interaction in PC | | |
|----------------------|------------|------------|
| 2019 LH | 2020 LH | 2020 CR |
| 17,785,552 | 17,686,952 | 17,679,192 |

At zero PC beam intensity is the same within 0.38% with statistical error 0.02%

Results of the exponential fits are within 6.4%

| | F0 | $\delta F0$ | η | $\delta \eta$ | χ^2/DOF |
|---------|------------|-------------|--------|---------------|---------------------|
| 2019 LH | 1.4411E+08 | 1.10E+06 | 0.7471 | 0.00038 | 1.15 |
| 2020 LH | 1.3171E+08 | 1.10E+06 | 0.7439 | 0.00041 | 2.65 |
| 2020 CR | 1.3060E+08 | 1.12E+06 | 0.7426 | 0.00042 | 2.04 |

We should compare the Correction Factors (not yet done)