LASER CALIBRATION WITH LUCID

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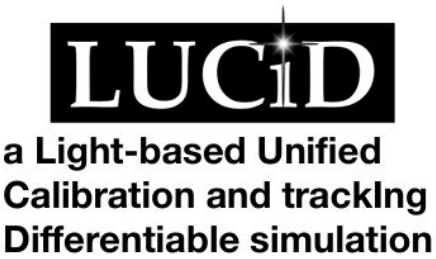
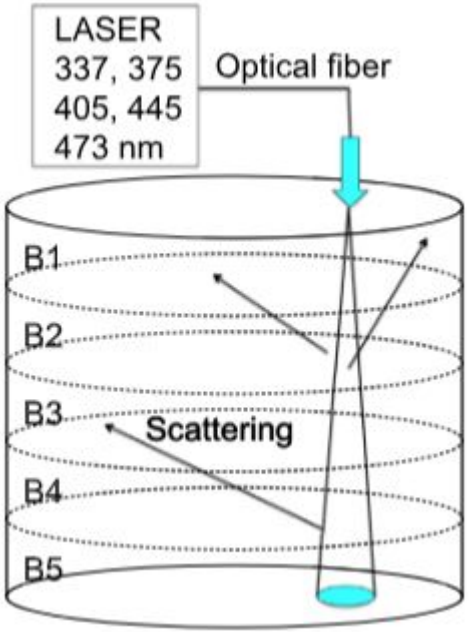
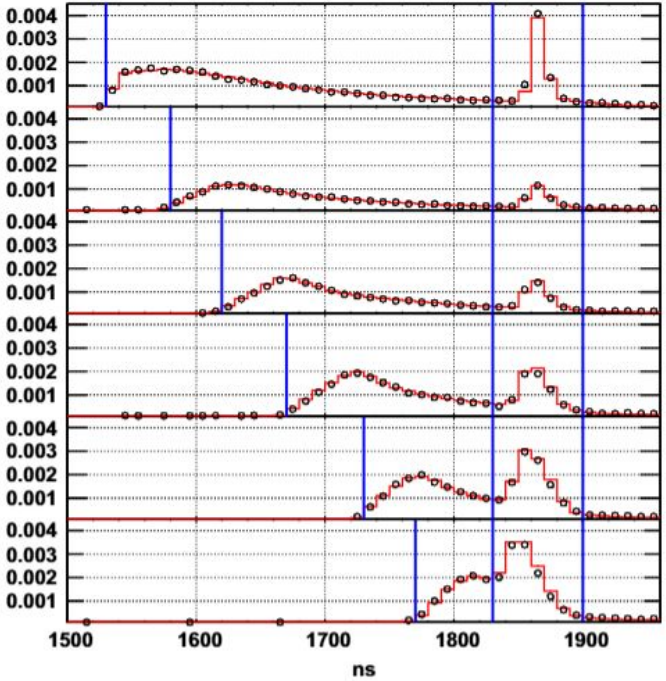


Reminder of SK Calibration Paper

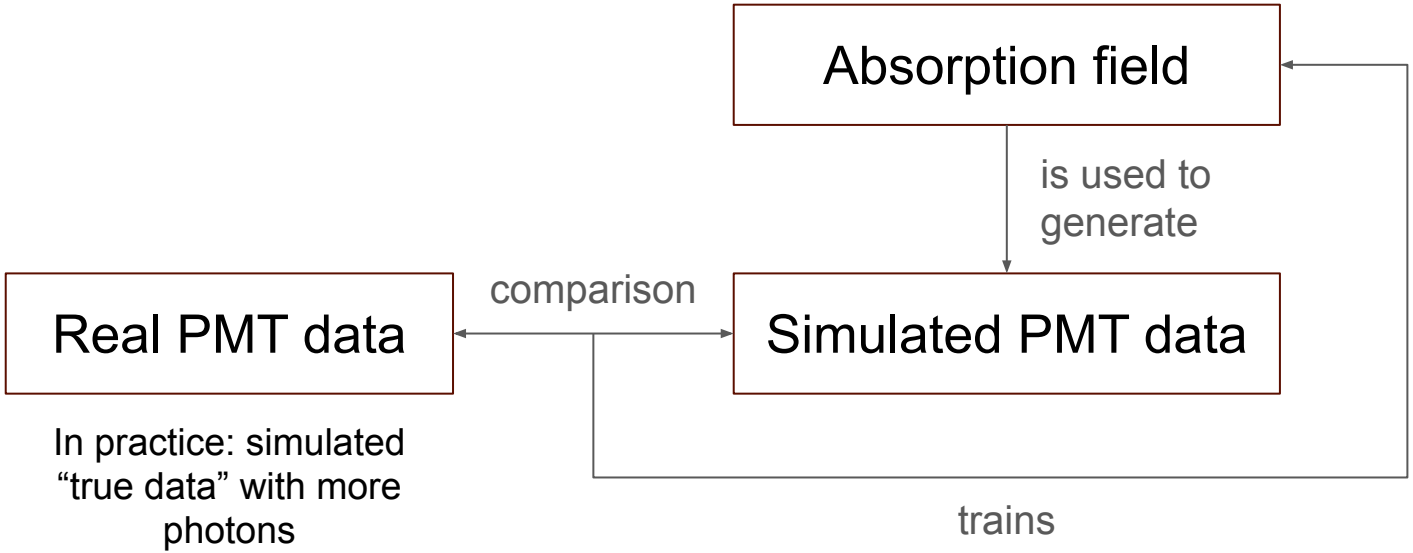


used to measure the absorption&scattering

used to measure the reflection

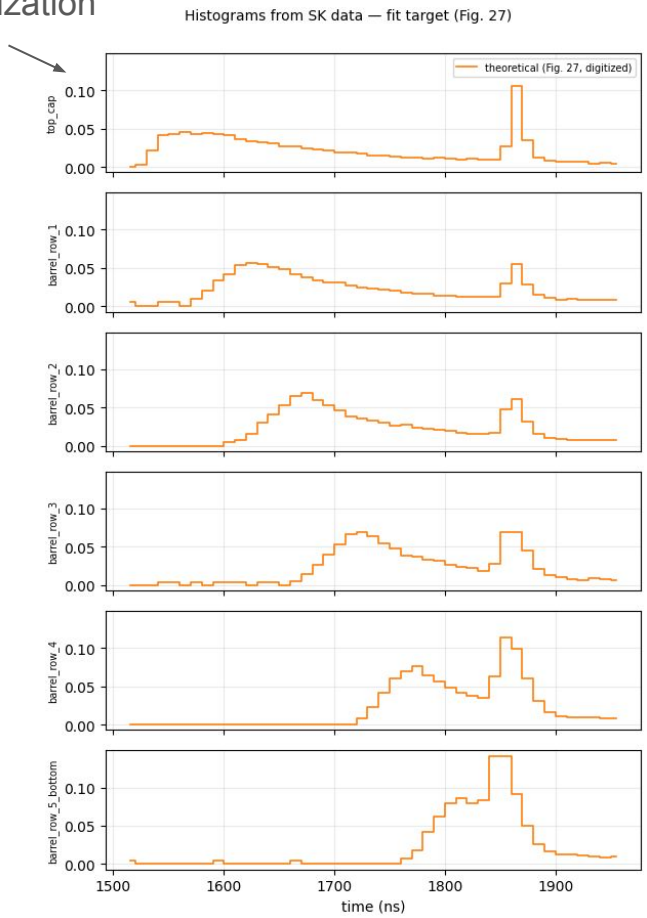


How can we learn the variations of water absorption?



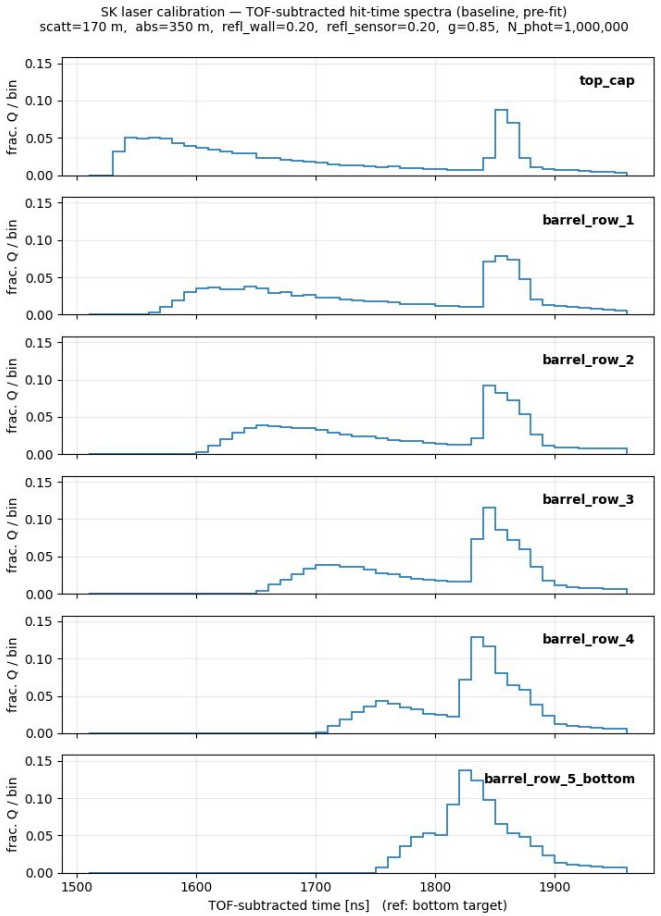
different scale due to normalization

Digitized version

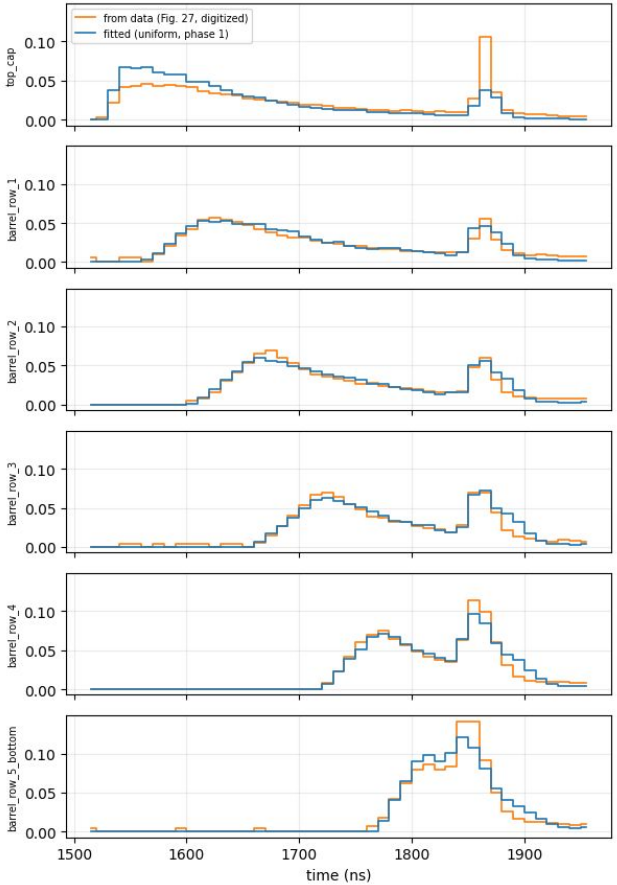


goal: make them fit

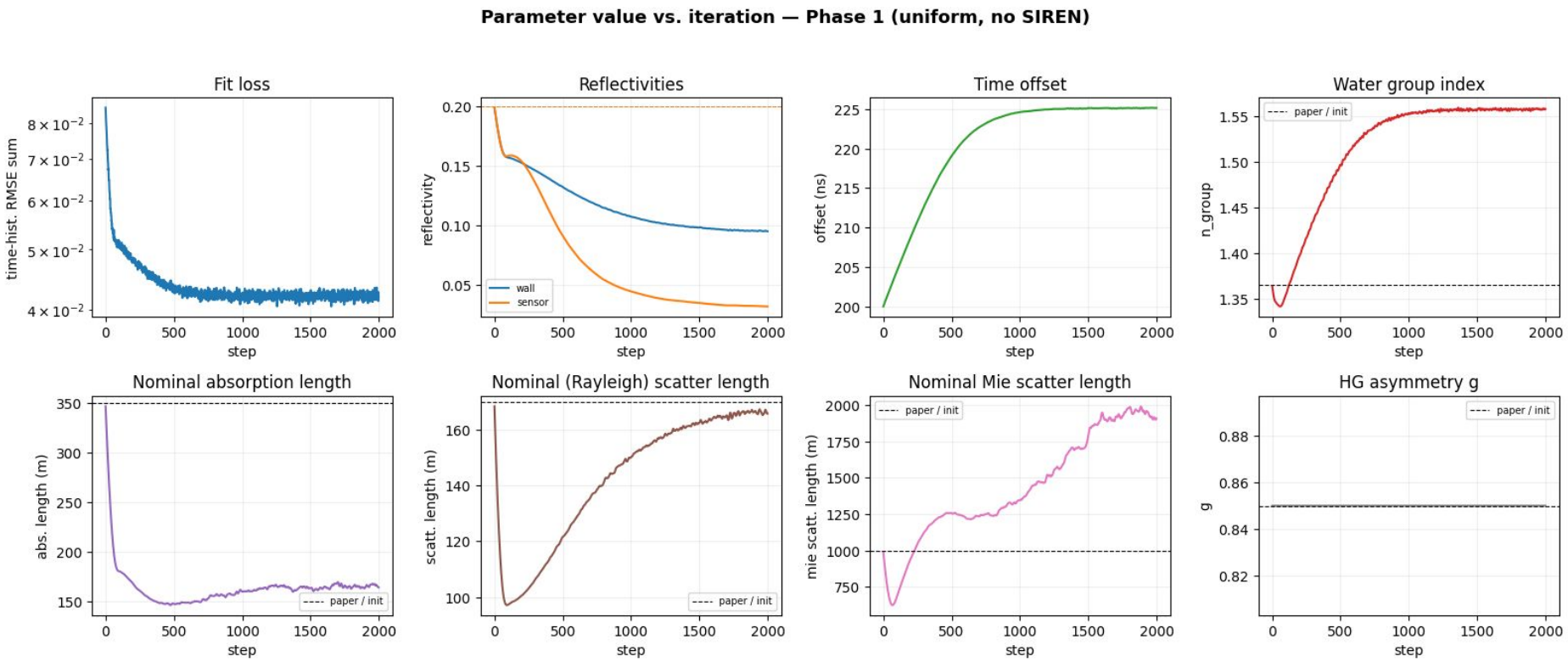
Typical simulated event



Training with a uniform absorption field

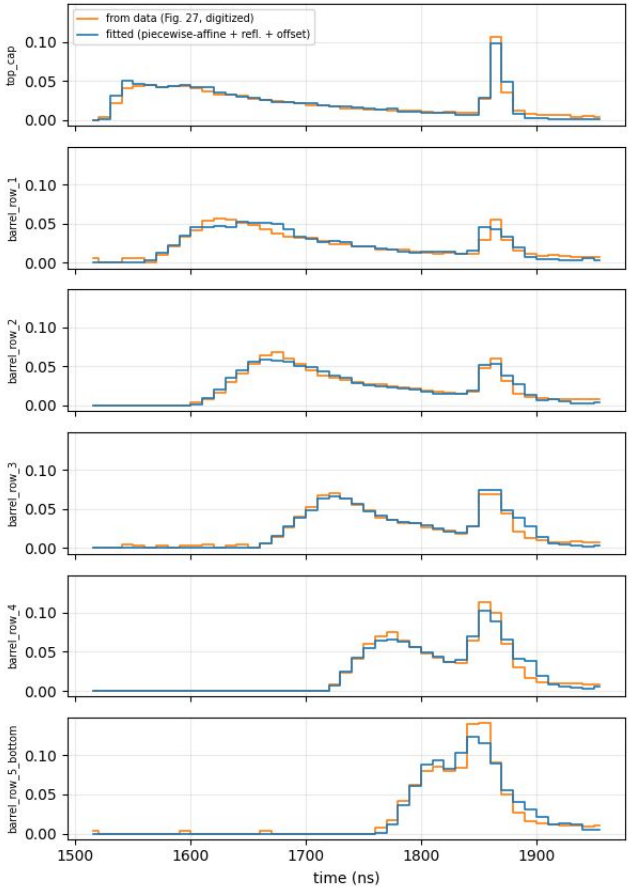


	Paper/initial value	After training
WALL_REFL	0.2	0.095
SENSOR_REFL	0.2	0.032
OFFSET	200 ns	225.15 ns
N_GROUP	1.365	1.5577
ABS_LEN	350 m	164.5 m
SCATT_LEN	170 m	165.7 m
MIE_SCATT_LEN	1000 m	1907.4 m
G	0.85	0.85 (untrained)



Calibration is done in ~5min for 500 000 simulated photons and 2000 iterations

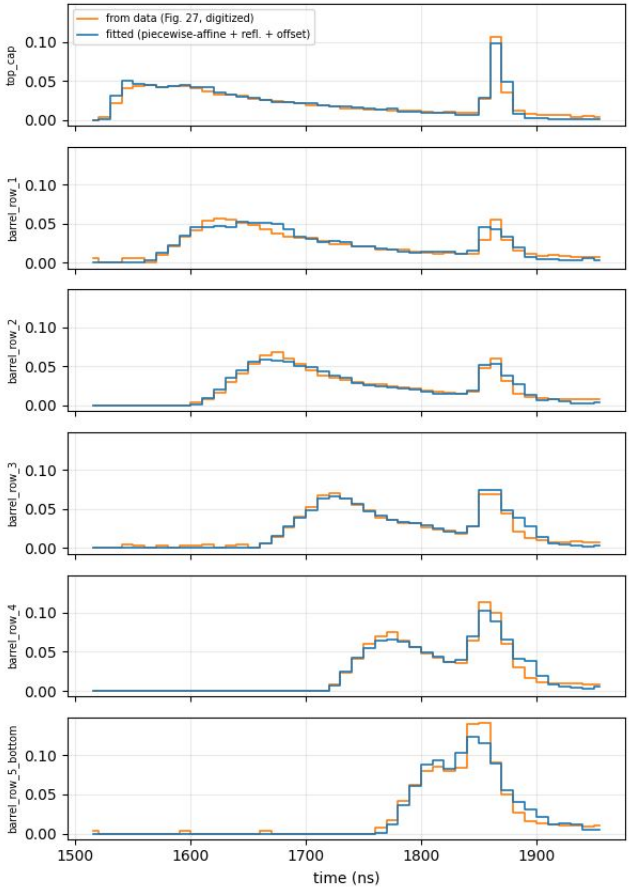
Training with a non-uniform absorption field



using a 12x12x12 (r,z,theta) affine interpolation grid

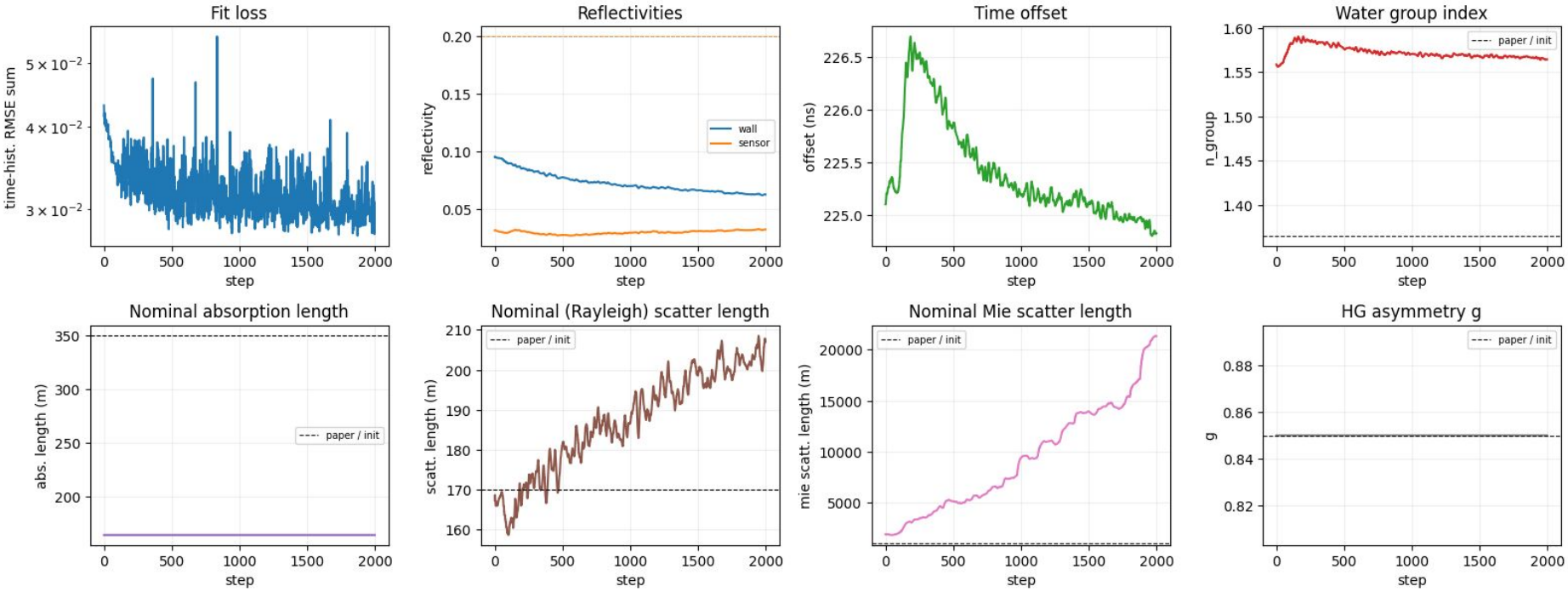
	Previous value	After 2nd training
WALL_REFL	0.095	0.063
SENSOR_REFL	0.032	0.033
OFFSET	225.15 ns	224.82 ns
N_GROUP	1.5577	1.5646
ABS_LEN	164.5 m	164.5 m (untrained)
SCATT_LEN	165.7 m	208 m
MIE_SCATT_LEN	1907.4 m	20000 m
G	0.85 (untrained)	0.85 (untrained)

Training with a non-uniform absorption field



It seems that the absorption field has a big influence on the shape of the peaks

However the reconstructed (r,z,theta) grid is not very physical for now (not shown here)


Parameter value vs. iteration — Phase 3 (piecewise-affine field)
Fit loss
time-hist. RMSE sum
step
Reflectivities
reflectivity
wall
sensor
step
Time offset
offset (ns)
step
Water group index
n_group
paper / init
step
Nominal absorption length
abs. length (m)
paper / init
step
Nominal (Rayleigh) scatter length
scatt. length (m)
paper / init
step
Nominal Mie scatter length
mie scatt. length (m)
paper / init
step
HG asymmetry g
g
paper / init
step

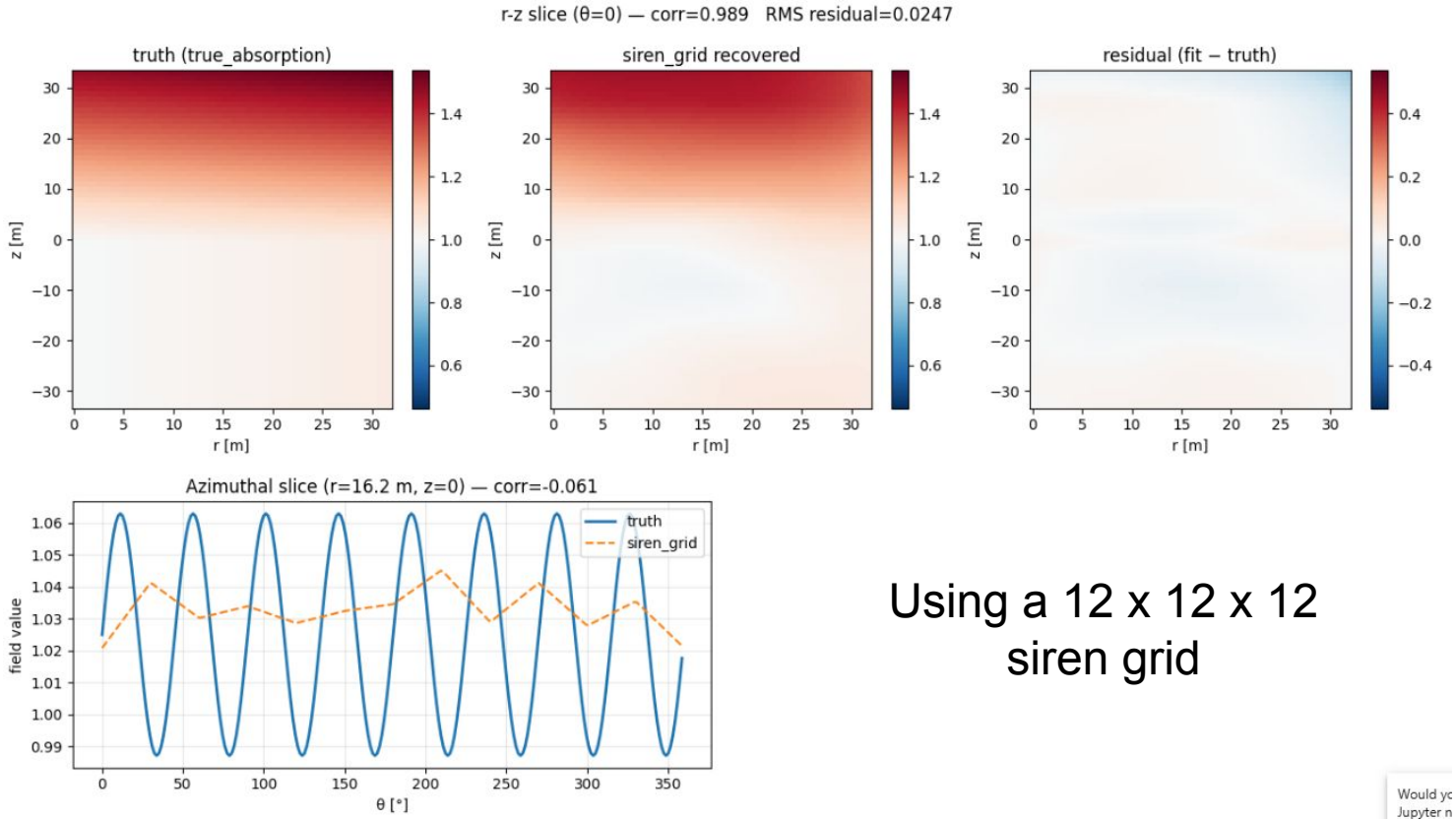
What’s next

We can use other types of field to be more precise => SIREN for example

We want to exhibit the same linear Z behavior as in the SK calibration paper

Maybe the histograms are too general to be precise => use MC simulation data

Some results using a complex true function



Using a 12 x 12 x 12 siren grid

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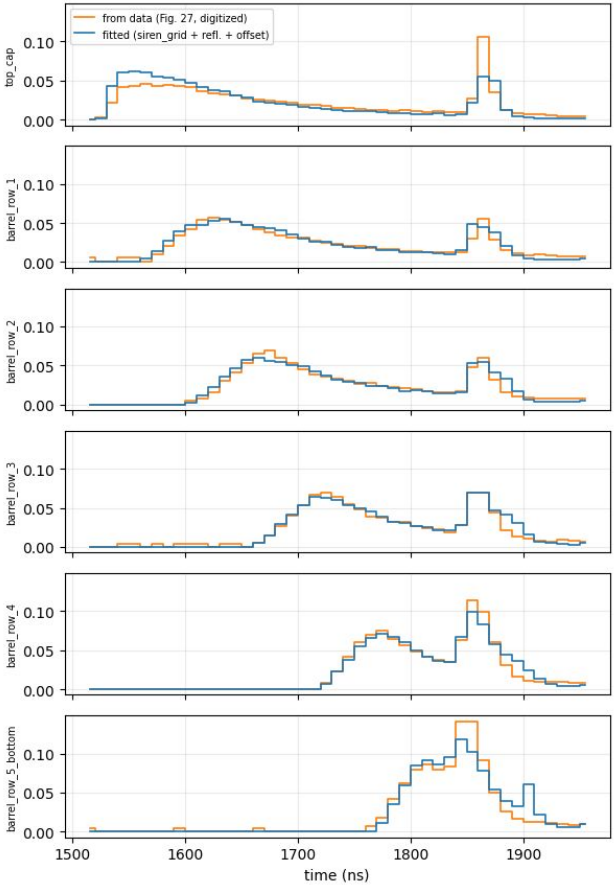
Training with the SIREN



WALL_REFL = 0.104
SENSOR_REFL = 0.032
OFFSET = 226.14 ns
N_GROUP = 1.5788
ABS_LEN = 163.5 m
SCATT_LEN = 166.9 m
MIE_SCATT_LEN = 11355.9 m
G = 0.85 untrained

Parameter value vs. iteration — Phase 1 (uniform, no SIREN)