

COLD simulations

S. M. Liuzzo



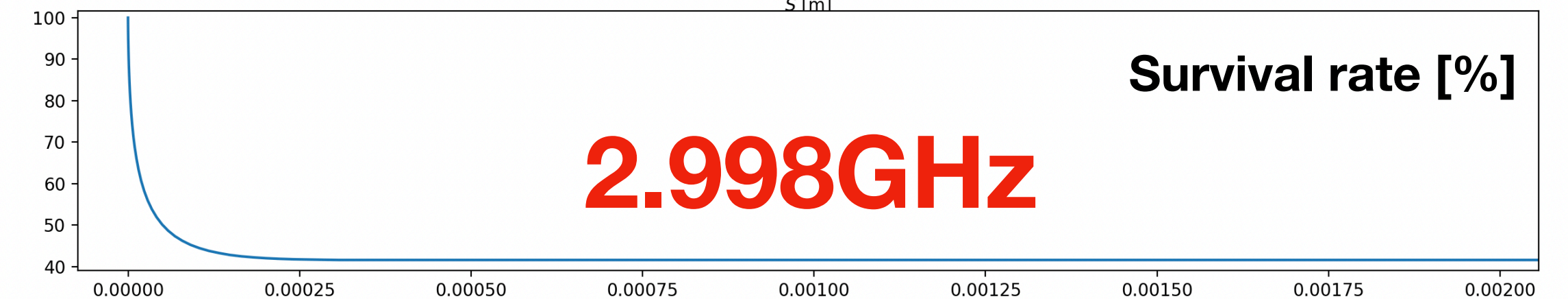
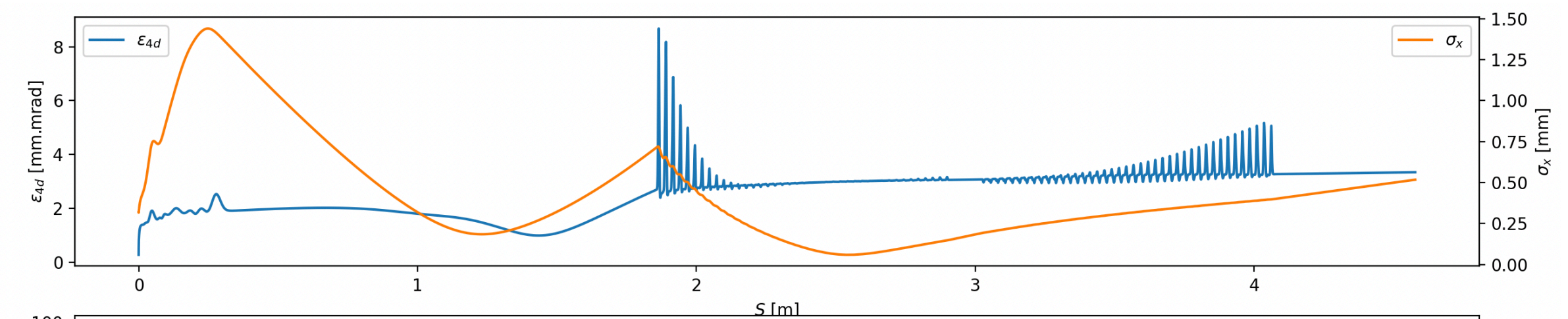
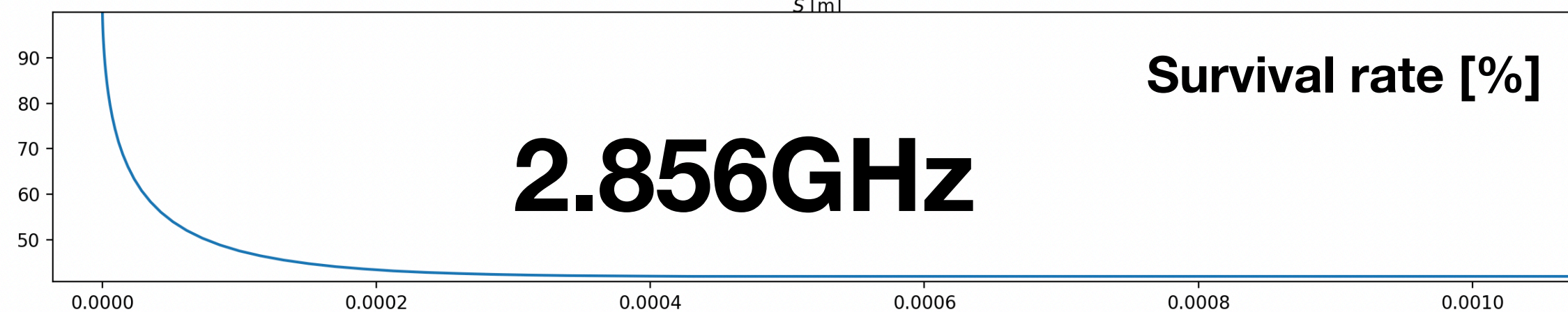
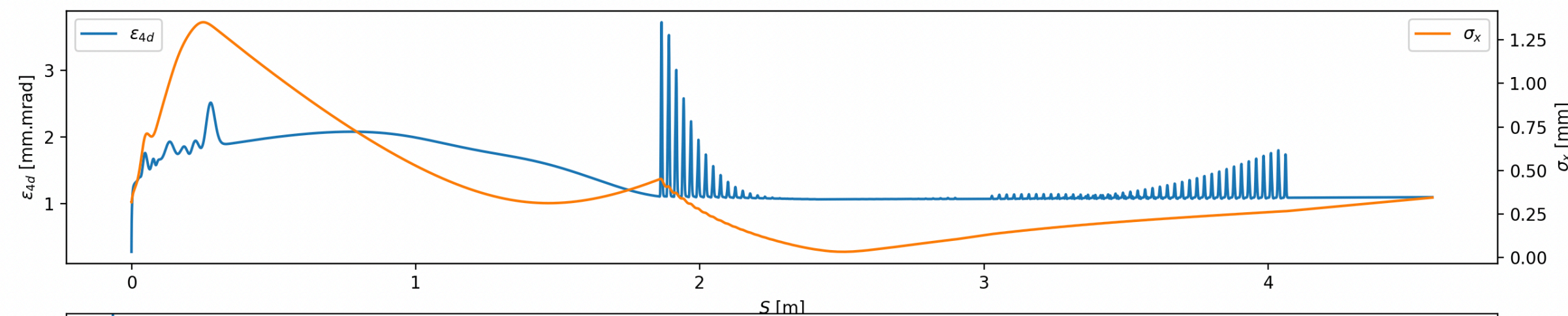
Observations

M5 vs intel **processor**: M5 = few seconds, intel+RF-Track 2.5.4= several minutes.

Frequency of the gun: gun frequency: 2.856GHz $\varepsilon = 1.08$ mmrad

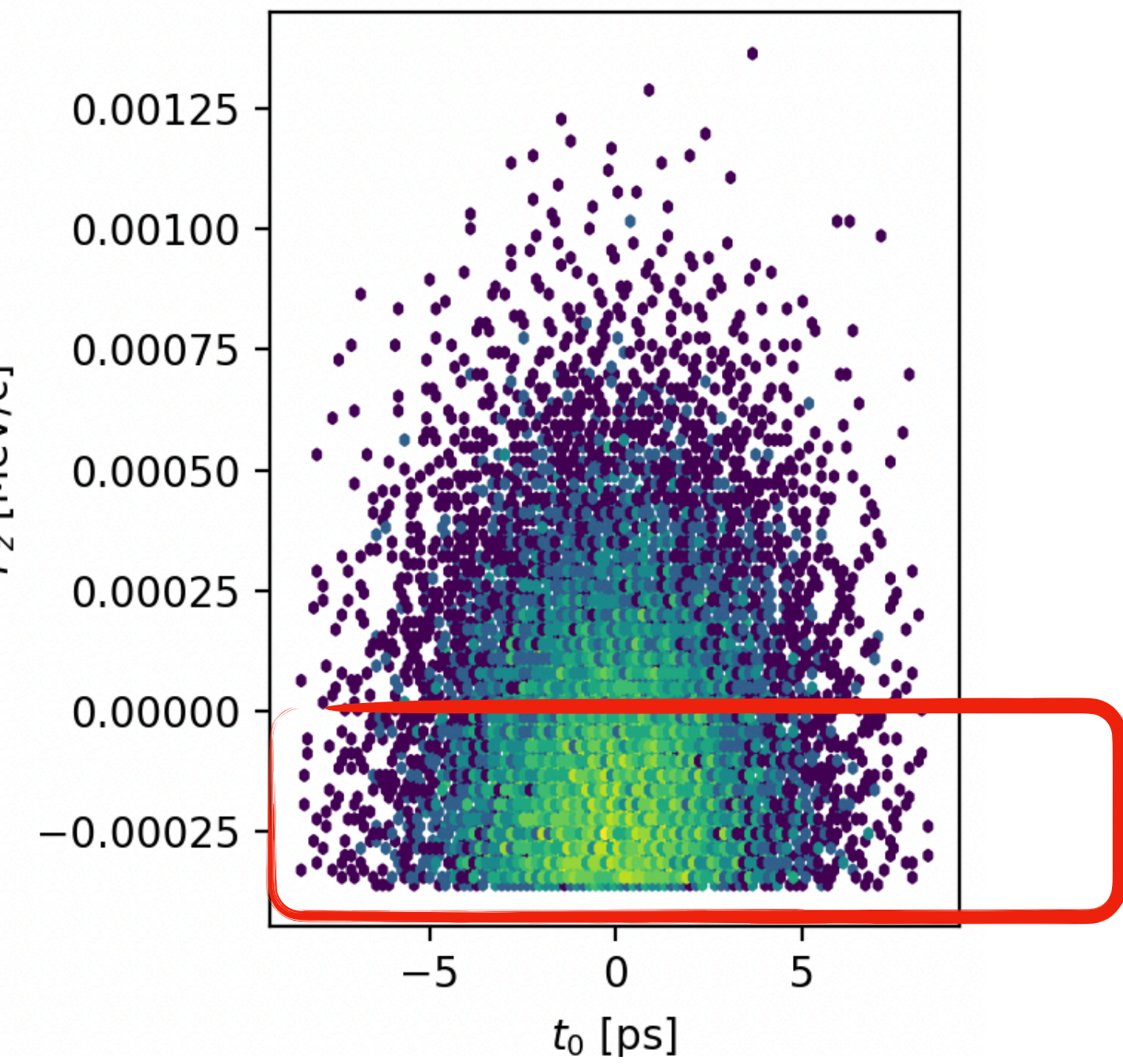
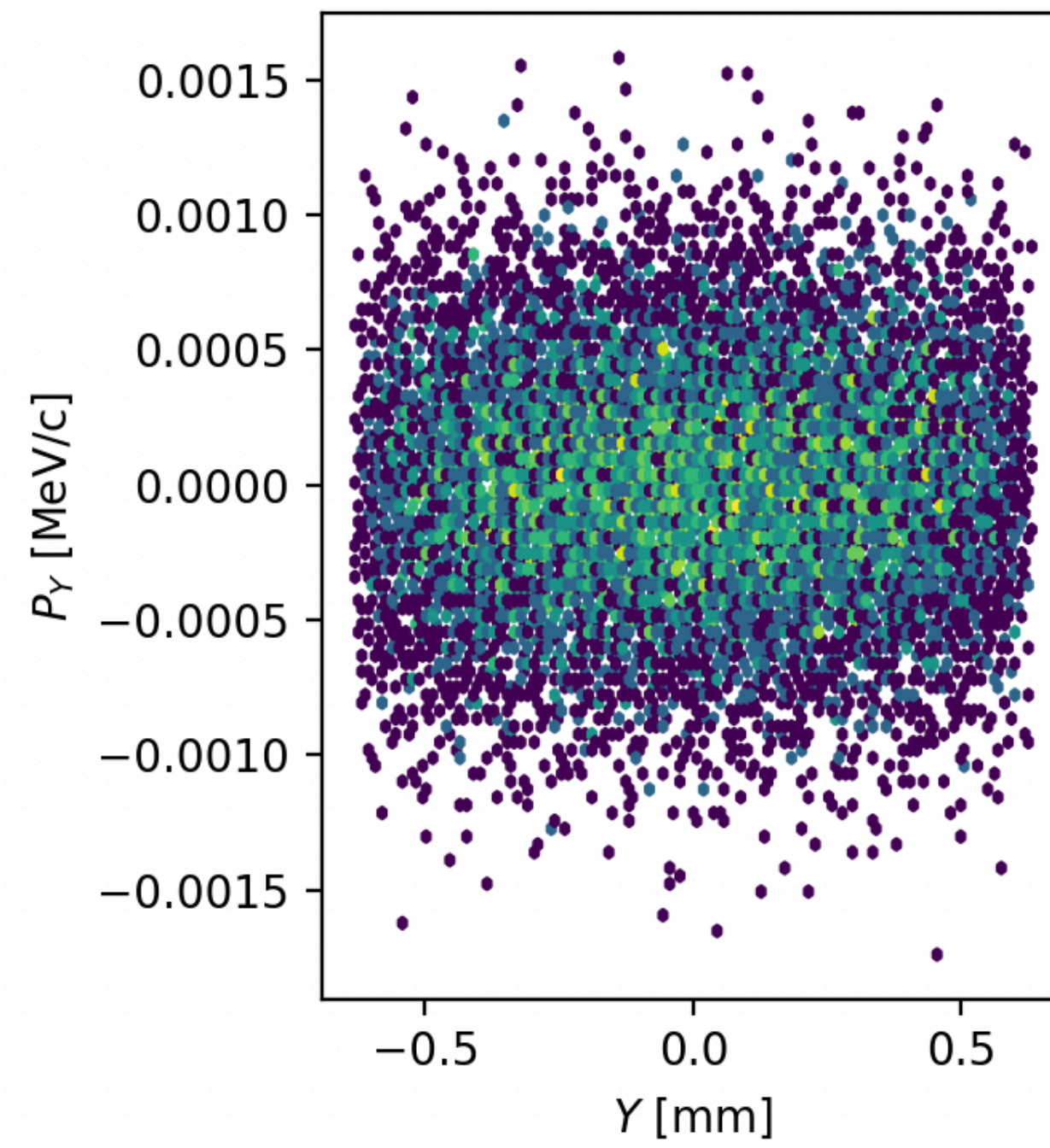
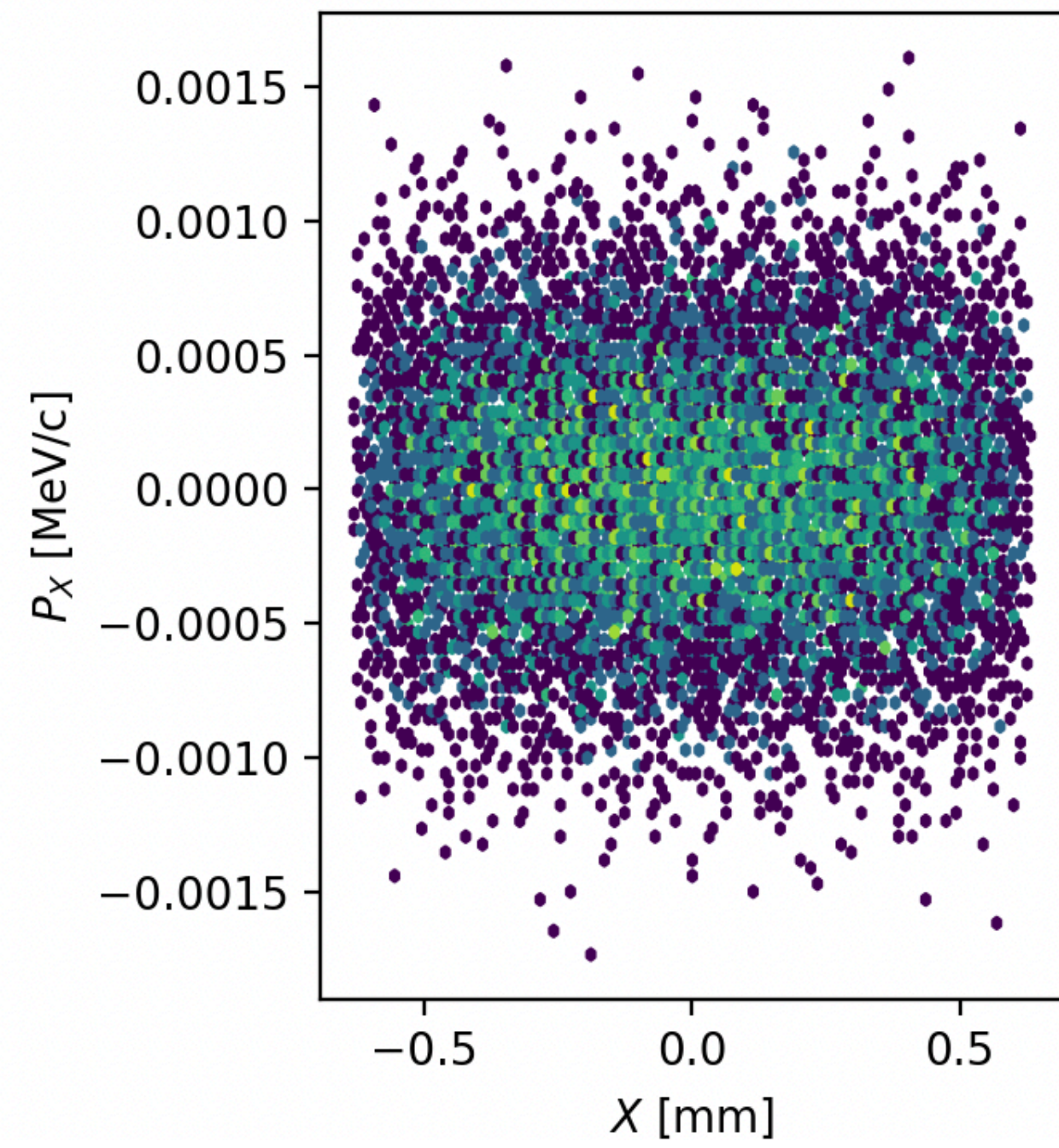
gun frequency: 2.998GHz $\varepsilon = 3.09$ mmrad

40% survival in both cases, particles are lost in the first 250 μ m



Particles lost

ASTRA particles



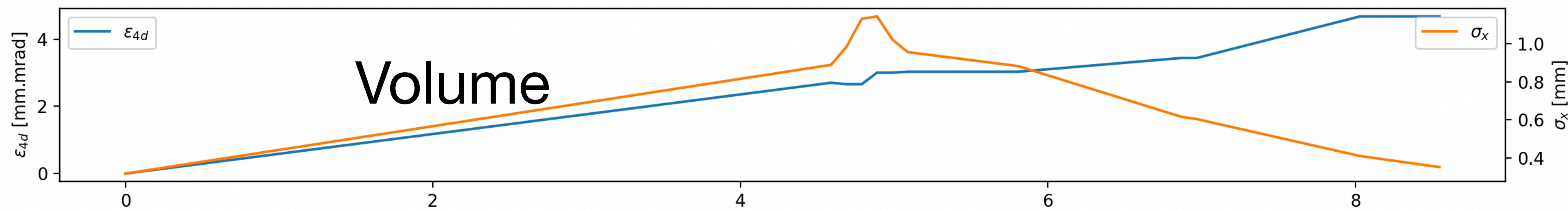
Backward traveling particles?

Add short range wakefields and apertures

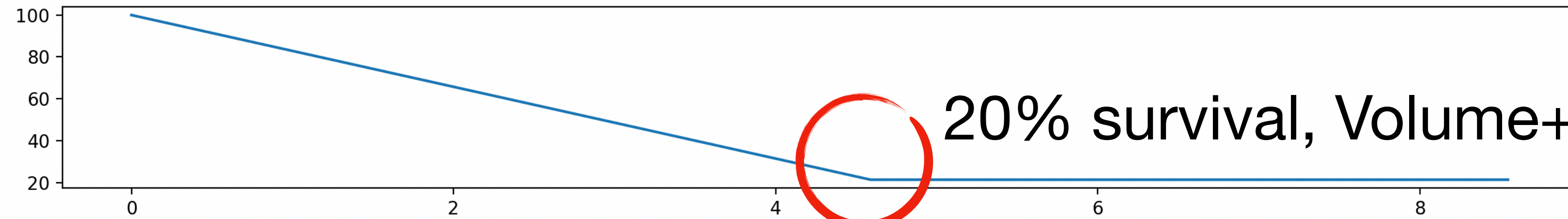
For every structure (4 structures for COLD Phase 2)

```
linac_rft = rft.RF_FieldMap_1d (linac_gradient * (linac), dzlinac, linac_length, 5.712e9, 1)
linac_rft.set_phid(setup.PHIDC1)
linac_rft.set_nsteps(100)
linac_rft.set_aperture(3.55 *1e-3, 3.55 *1e-3, 'circular')
linac_rft.add_collective_effect(SRWF)
linac_rft.set_cfx_nsteps(10)
```

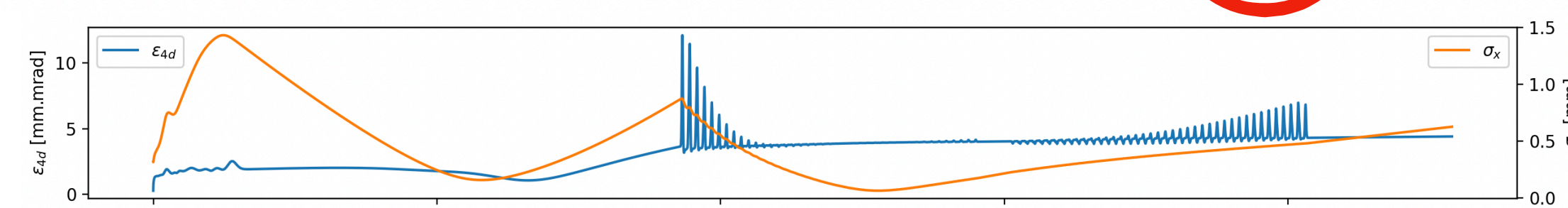
```
# SRWF
SRWF = init_SRWF(freq = 5.712e9, # Hz
                 average_iris_aperture = 3.55 *1e-3, # m
                 average_iris_thickness = 1.5 *1e-3, # m
                 )
```



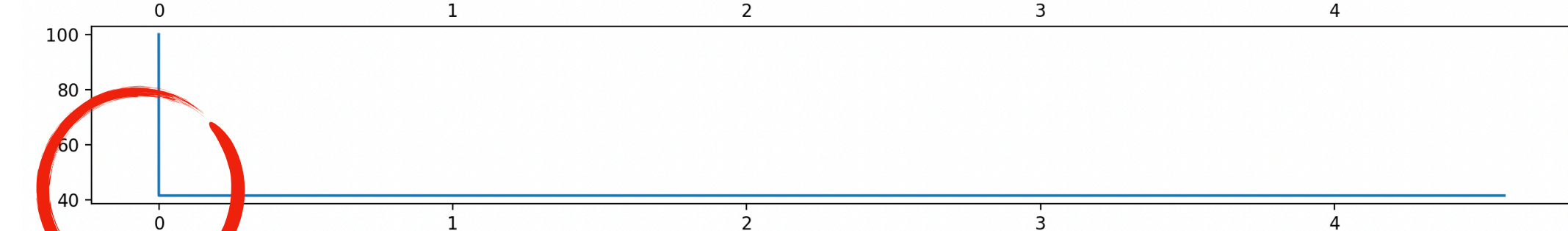
4.7mmrad



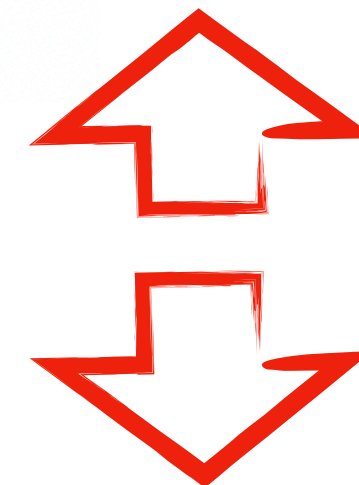
20% survival, Volume+Lattice tracking



4mmrad,



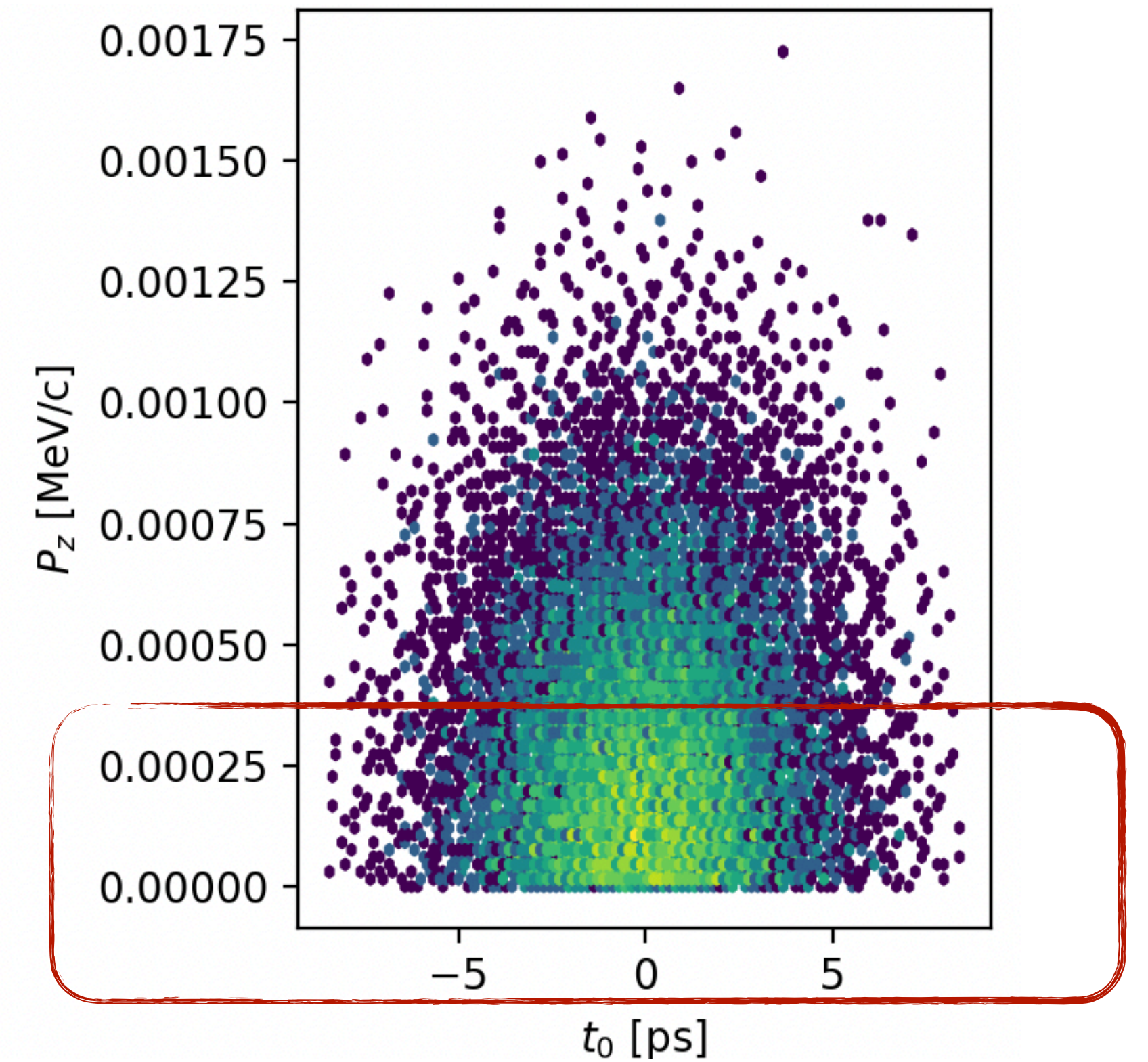
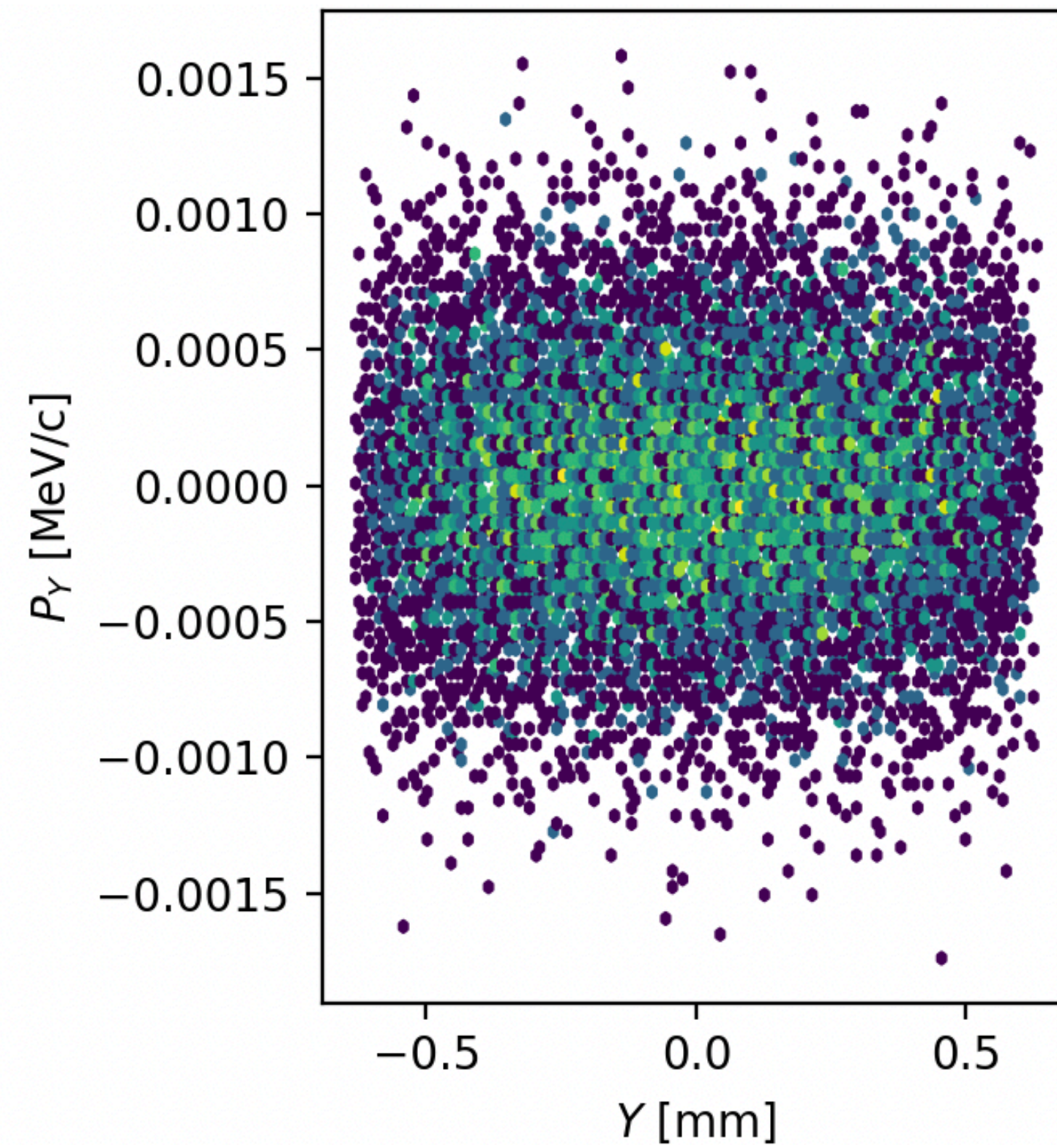
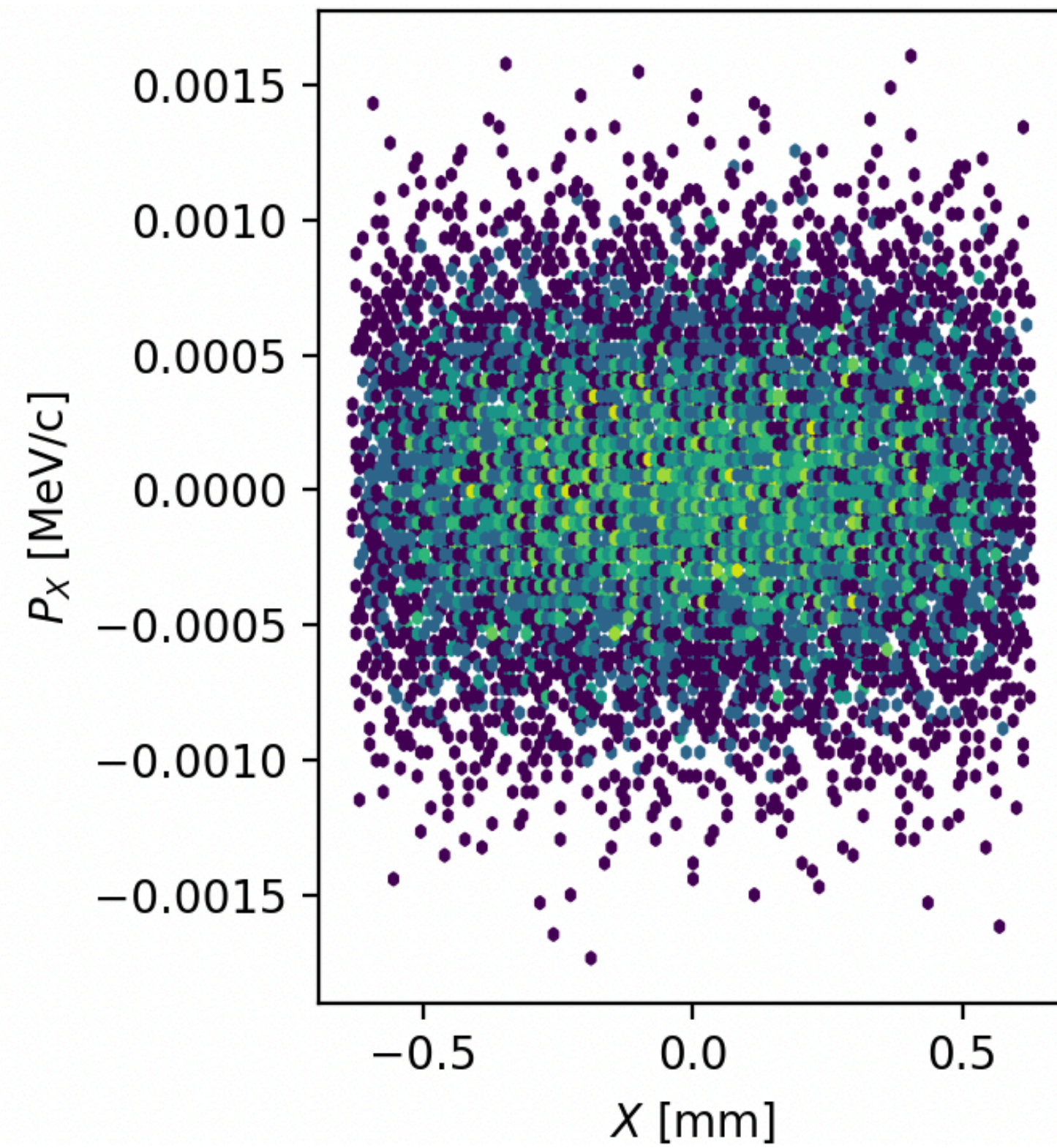
40% survival, Volume only tracking



??

Fixed ASTRA file load conversion issue

Now no particles with negative longitudinal momenta



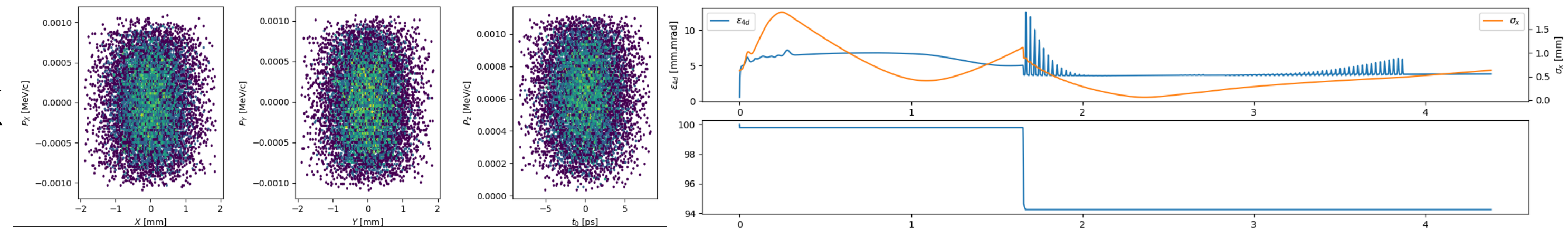
Emittance degradation

	Emittance 4d lat	survival vol.	sure lat
gun frequency to 2.856Ghz.	1mmmrad	40%.	20%
gun frequency to 2.998Ghz.	3mmmrad	40%.	20%
+ Apertures	3mmmrad	40%.	20%
+ SRWF	4.67mmmrad	40%.	20%

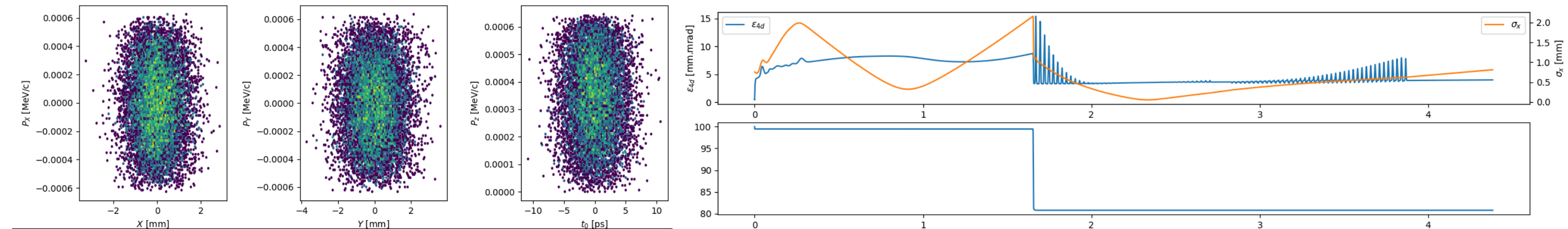
Beam generation at cathode

Obviously I prefer the DISTGEN one, but which one is the correct one?

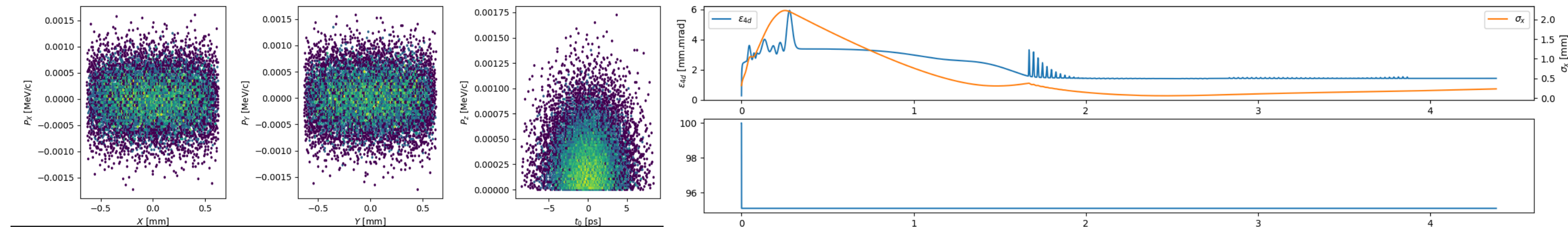
RF-Track



ASTRA

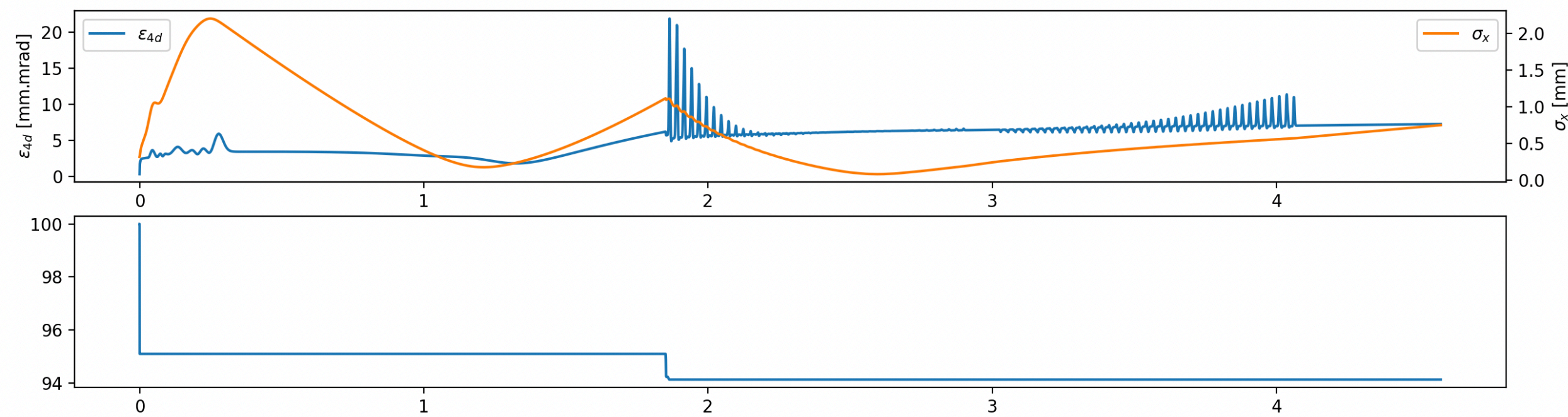
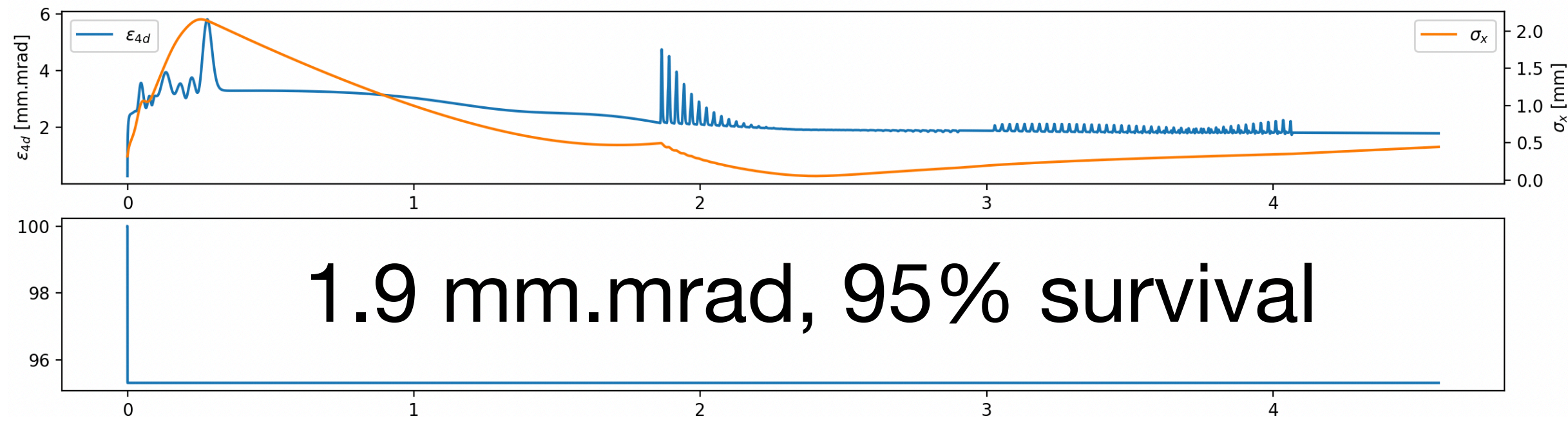


distgen

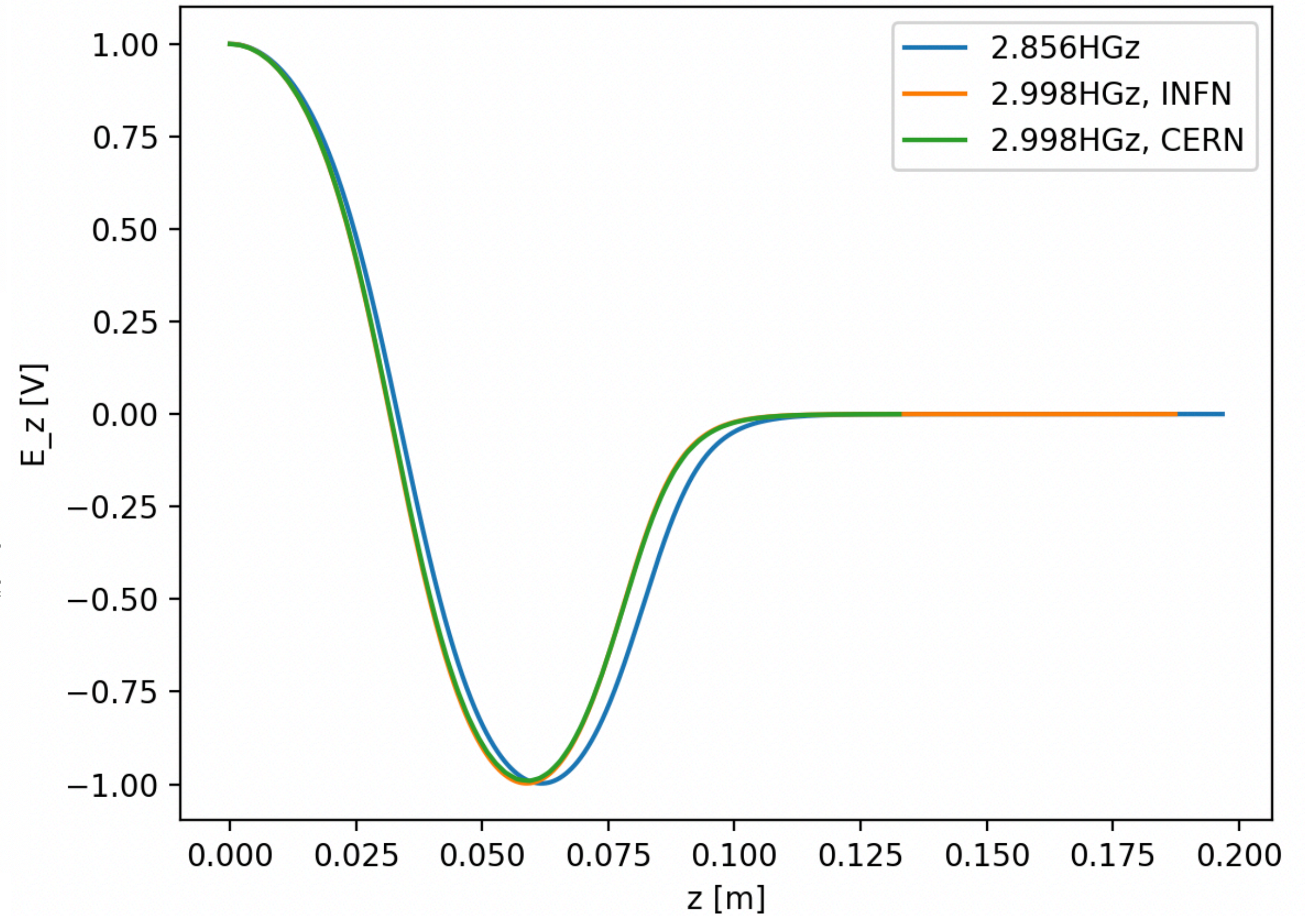


	sigr	sigt	particles	X, Y	LOST	EMIT 4D
DISTGEN	0.63266461	2.79151493	10000	radial_uniform	4.9%	1.45
RF-Track	0.63266461	2.79151493	10000	Gauss	5.75%	3.69
ASTRA	0.63266461	2.79151493	10000	Gauss	19.21%	3.68
RF-Track	0.63266461	2.79151493	10000	plateau	3.17%	3.68

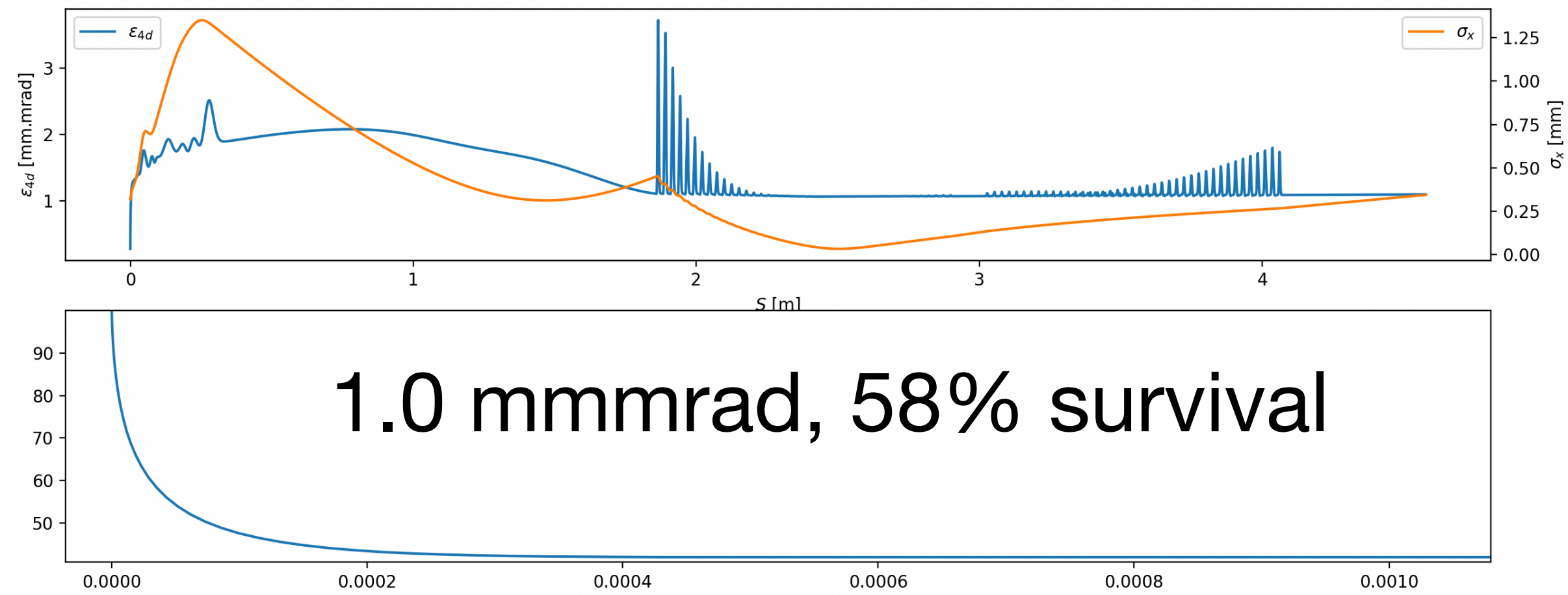
STEP 2: gun frequency 2.856 to 2.99855



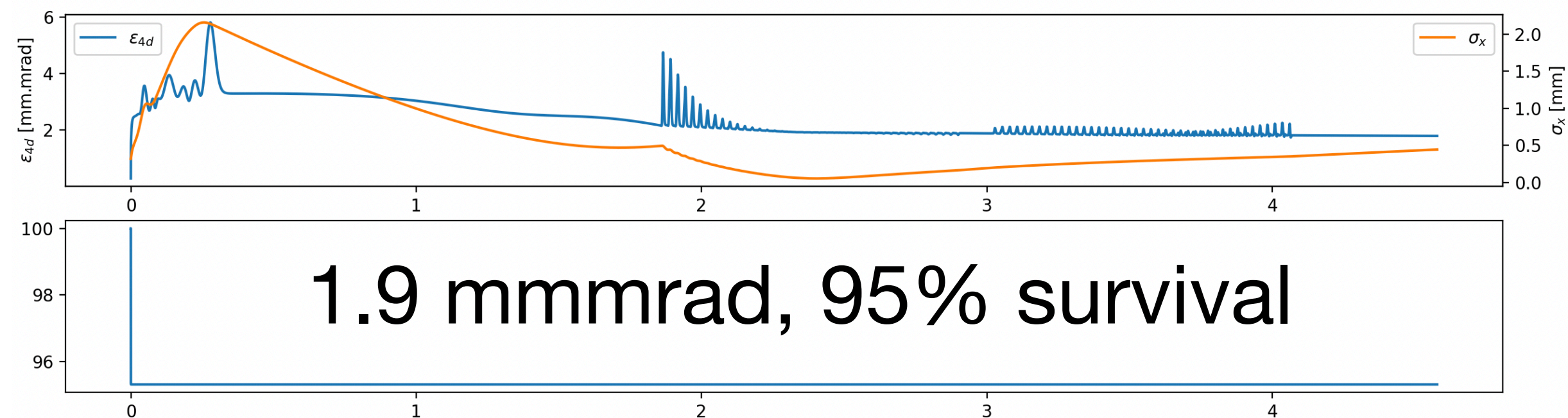
6.5 mm.mrad, 94% survival



STEP 1: fix Load_astra_beam

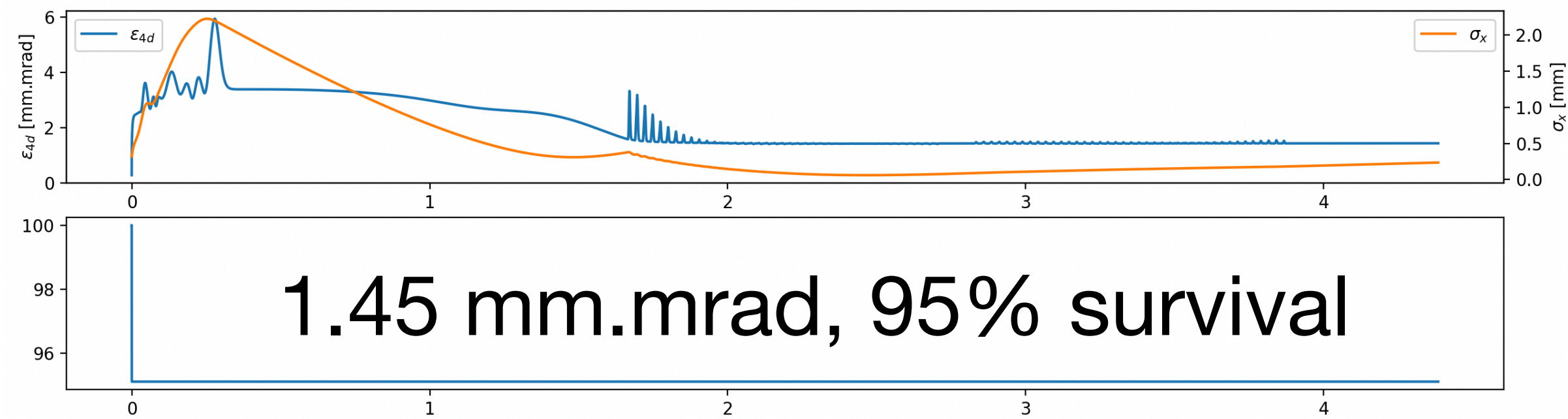


```
# ASTRA MANUAL: Longitudinal particle coordinates, i.e. z, pz and t are given relative to the reference particle.  
T[1:, [2,5,6]] += T[0, [2,5,6]]
```



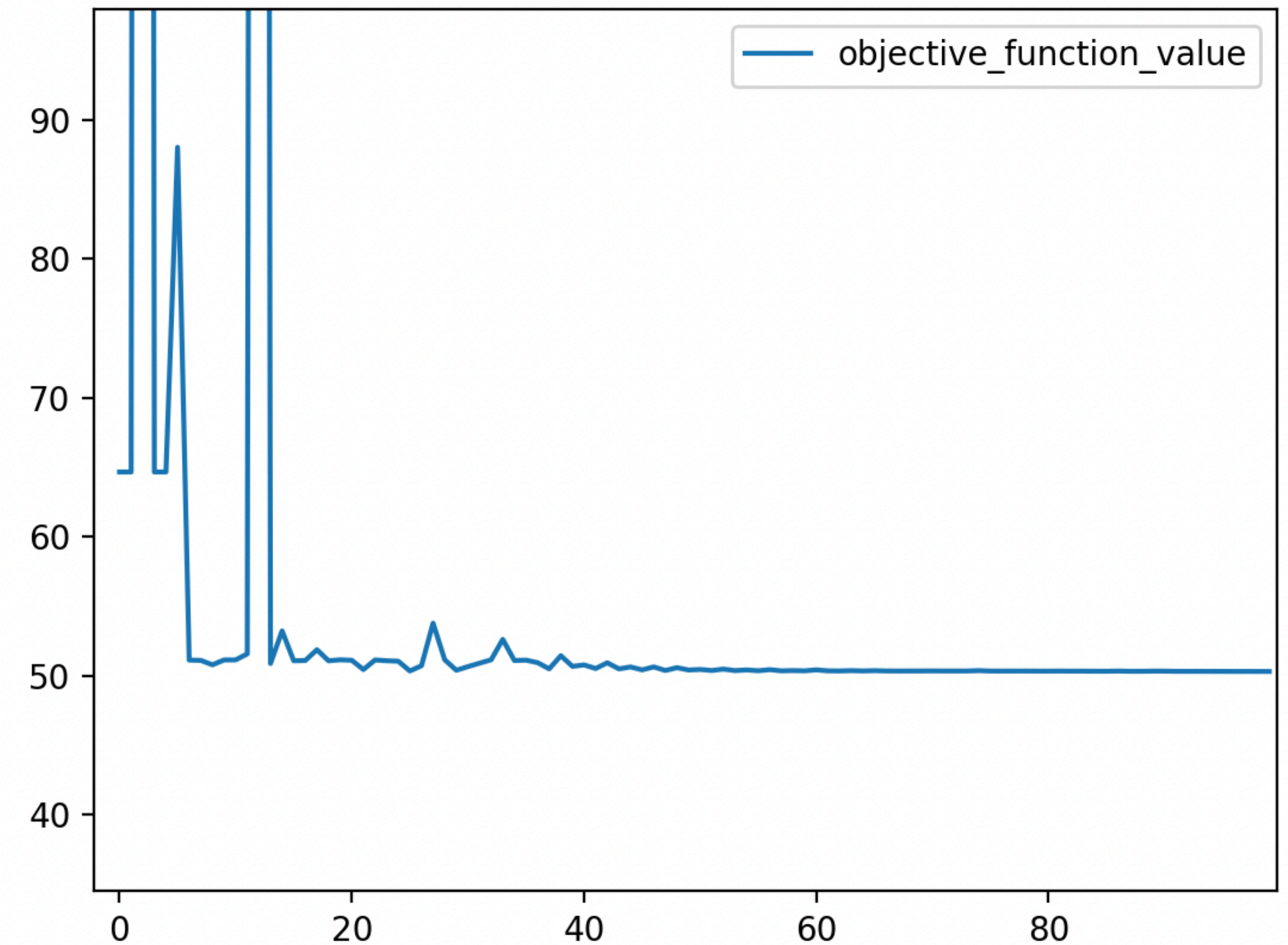
STEP 3: re-optimize

XOpt for phase, distance, Bz.



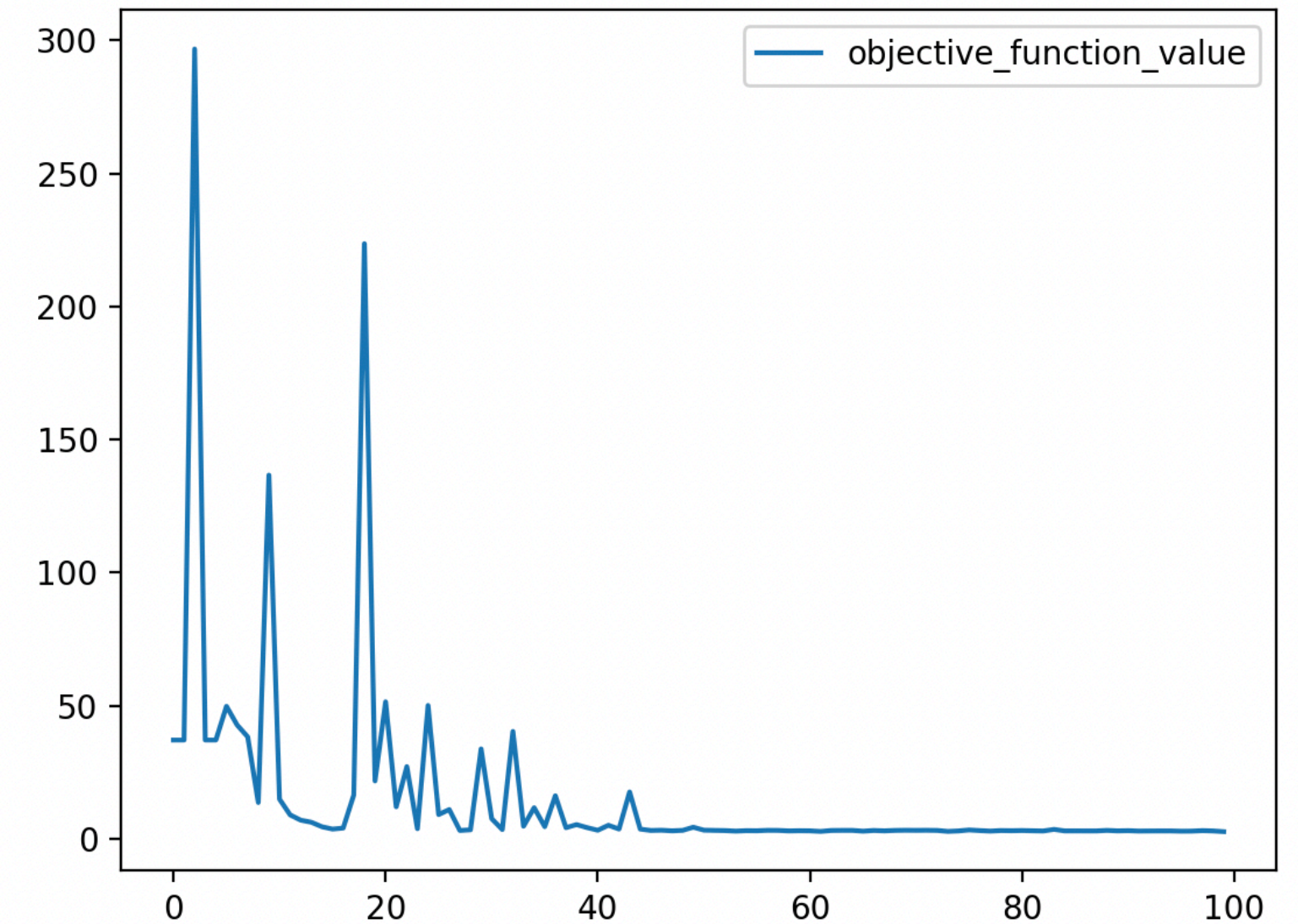
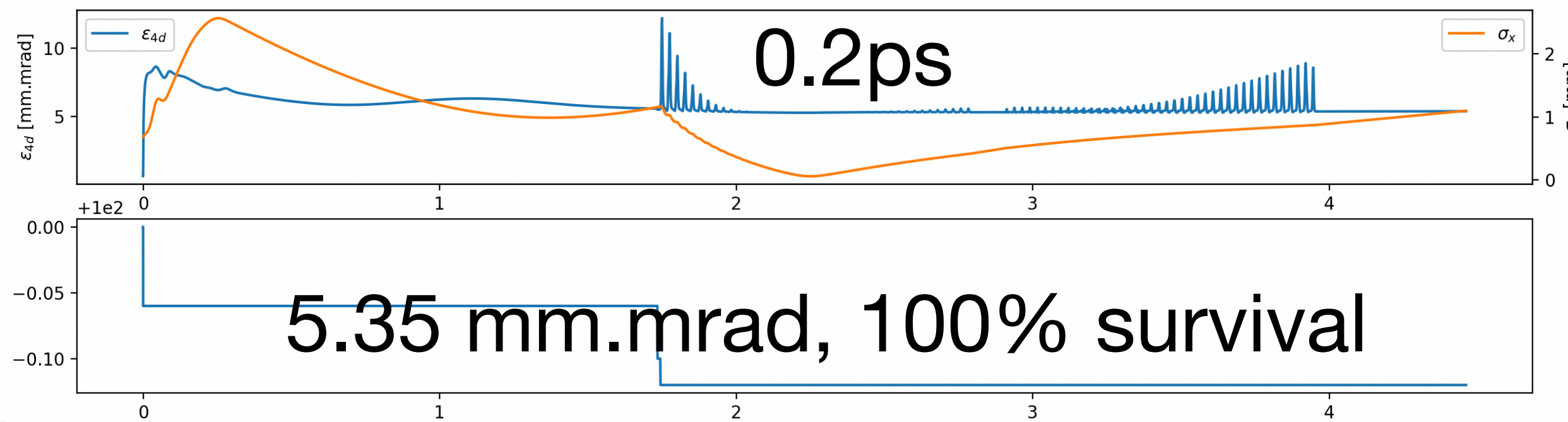
Parameters

	after	Before
Bz'	0.2831352	0.28979
iftGunStru	1.6553	1.8501
PHID'	0.000426	0
PHIDC1'	0.000456	0

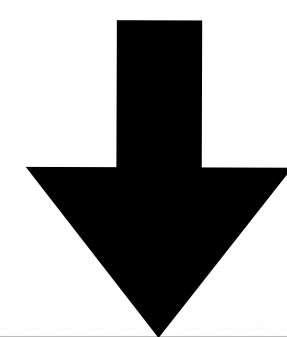


STEP 4: change input beam parameters

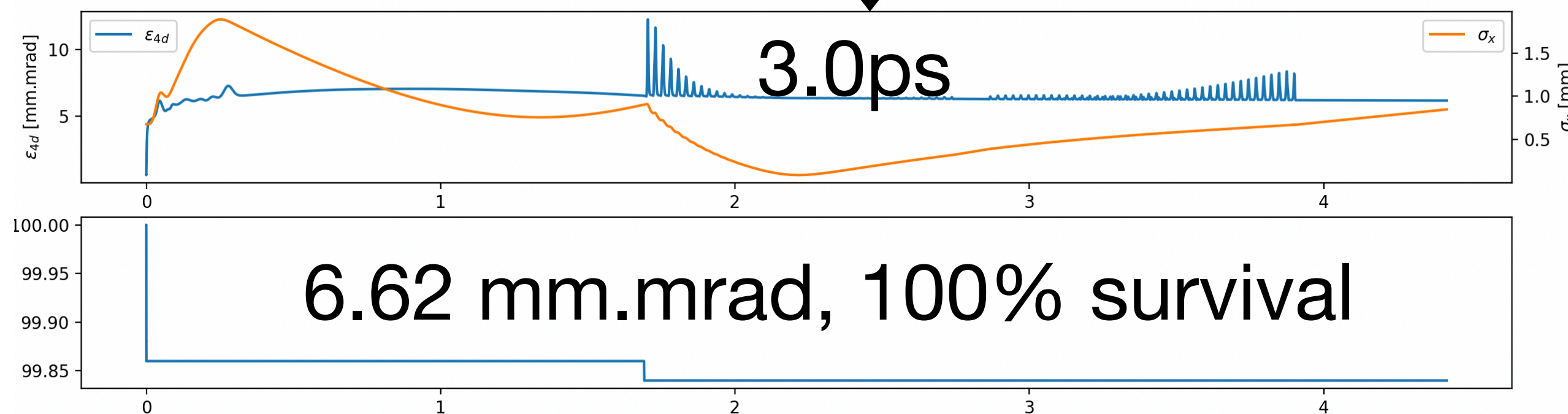
XOpt for phase, distance, Bz, sigr, sigt.



Gained on survived particles, but larger emittance



Long bunch + Xopt



	Before	After	After (long)
Bz'	0.2831352	0.2797	0.2657
ftGunStru	1.6553	1.735	1.7639
PHID'	0.000426	0.00036	0.00037
PHIDC1'	0.000456	0.00039	0.00039
sigr	?	0.6917	0.703
Sigt	?	0.2	3.05
Emit.	1.45	5.35	6.62
Lost	5 %	0 %	0 %

SRWF parameters update

Ankur Dhar, Wei-Hou Tan

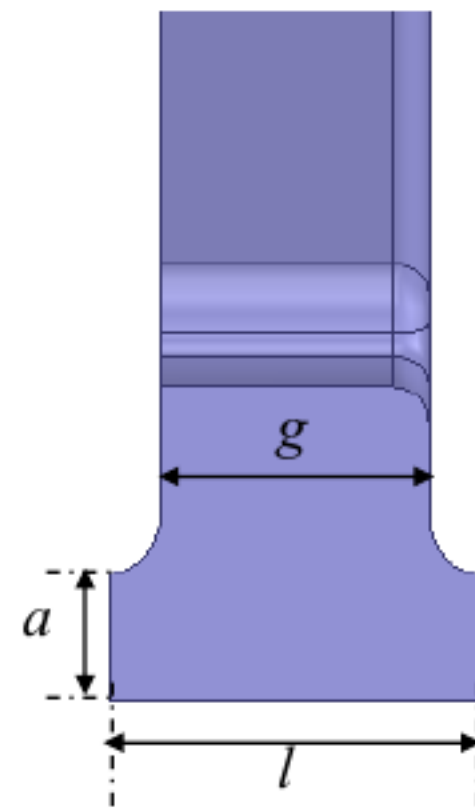
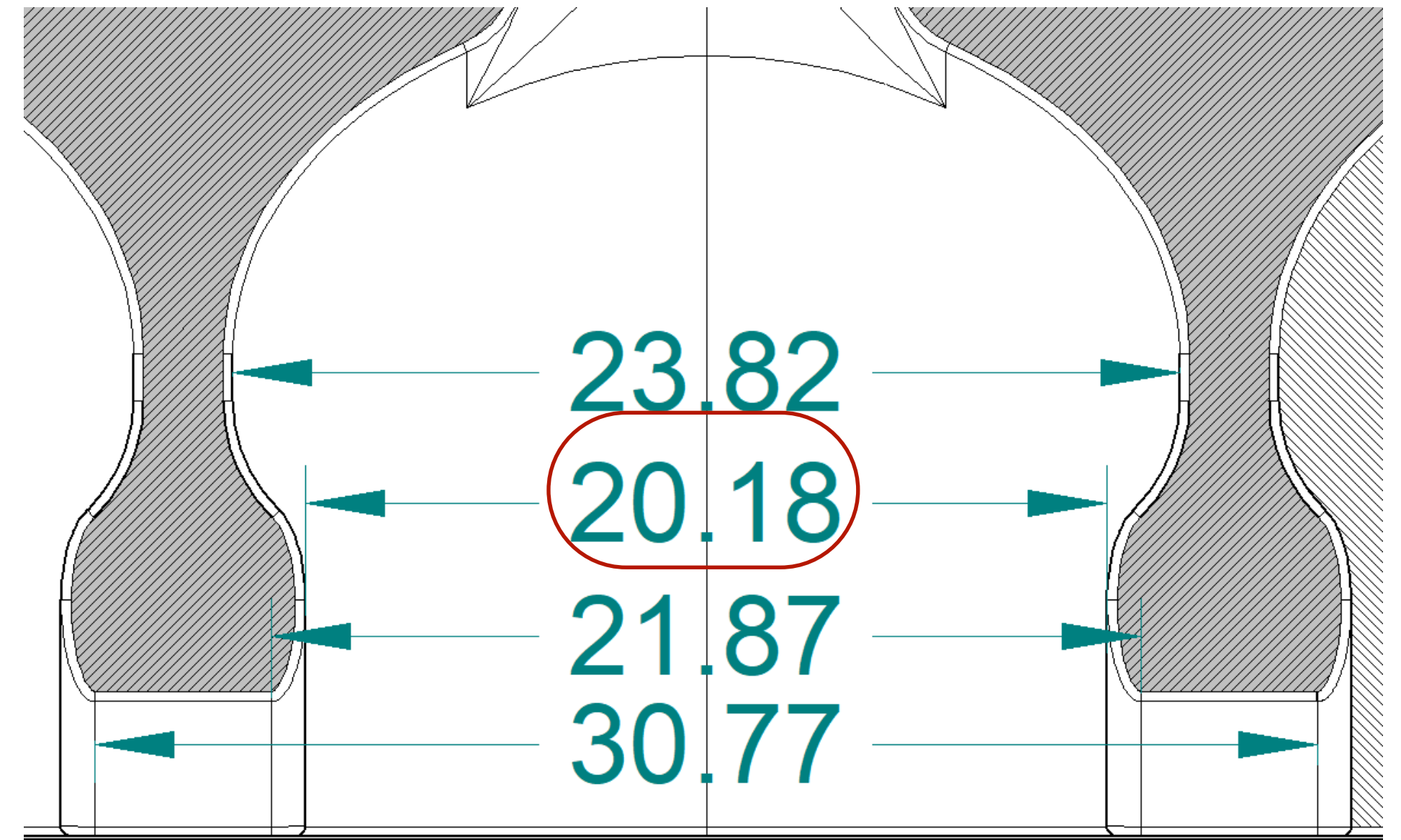


Figure 5.1: The geometric parameters a , g , and l used to describe the short-range wakefield.

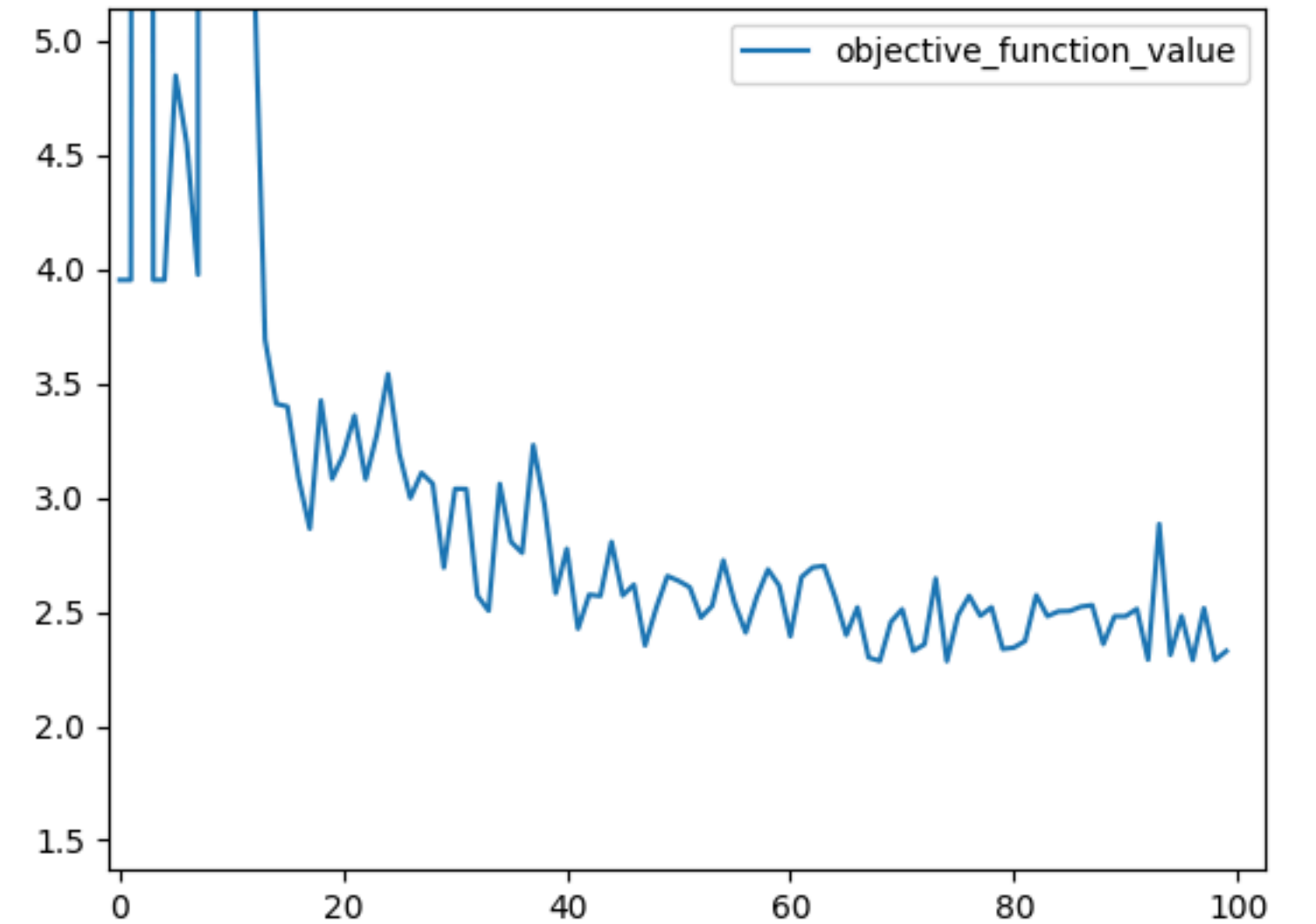
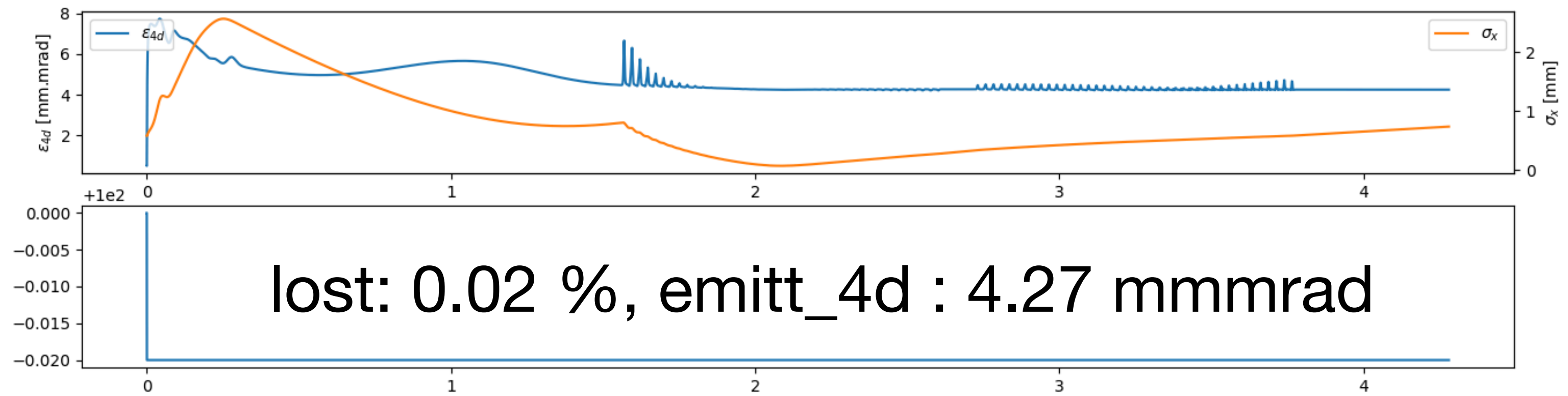


The iris radius is indeed $a = 3.556$ mm.
The cell length should be $l = 26.32$ mm
 $g = 20.18$ mm

OLD value for iris-thickness = 1.5 mm

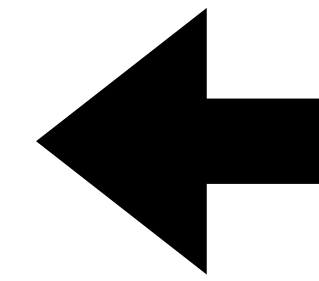
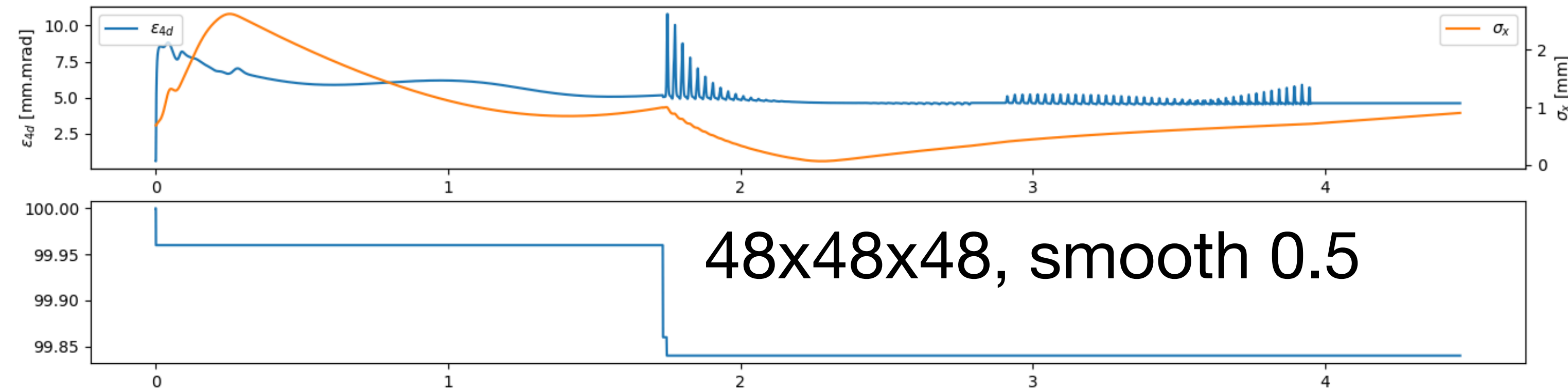
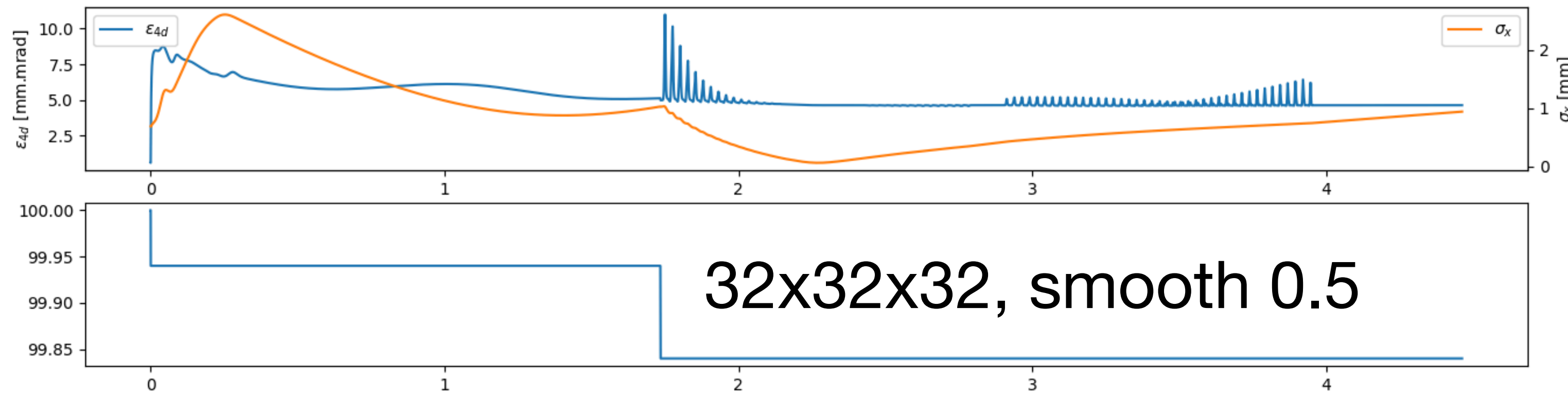
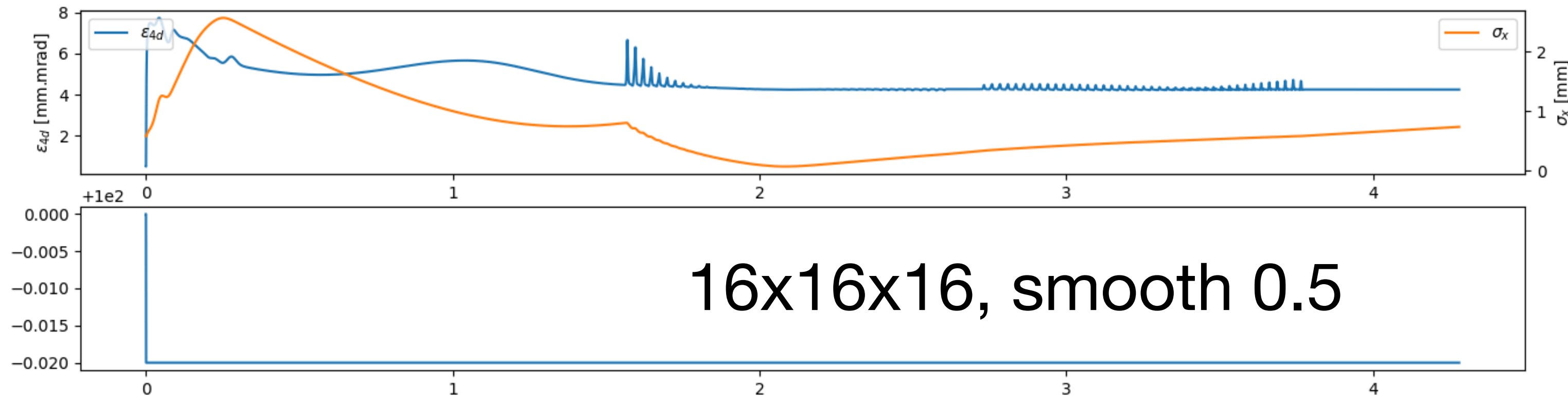
UPDATED = 5.295 mm

Updated SRWF parameters



	Before	After
Bz	0.2797	0.2834
DriftGunStruct	1.735	1.55
PHID	0.00036	0.00039
PHIDC1	0.00039	0.00042
sigr	0.6917	0.58
Sigt	0.2	0.21
Emit.	5.35	4.27
Lost	0 %	0 %

Space charge mesh



Faster, no relevant change in results