Adiabaticity experiment - update

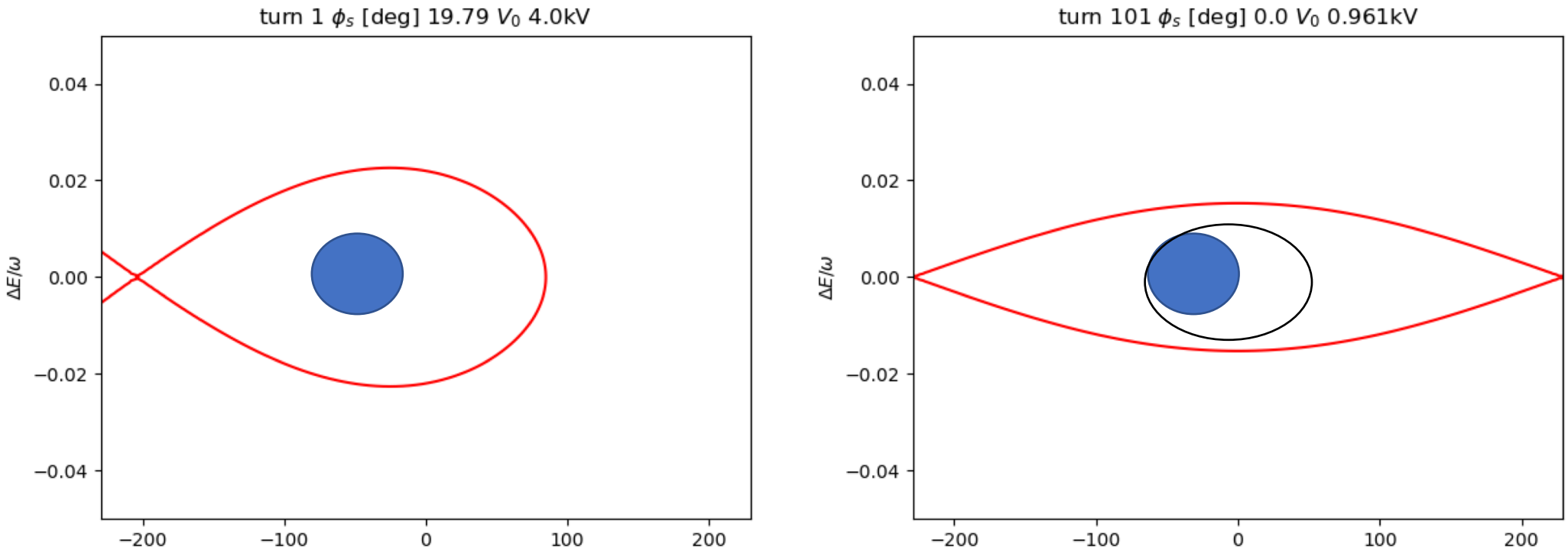
David Kelliher, RAL, 4/3/2021

Revisiting the synchronous phase ramp

- Up to now, considered only the adiabaticity ε when considering emittance growth caused by varying ϕ_s.
- It was pointed out during the FFA workshop that there is also a ”geometric” affect analogous to moving the pivot of a pendulum.
- It may be possible to measure the contribution to emittance growth arising from these two mechanisms.

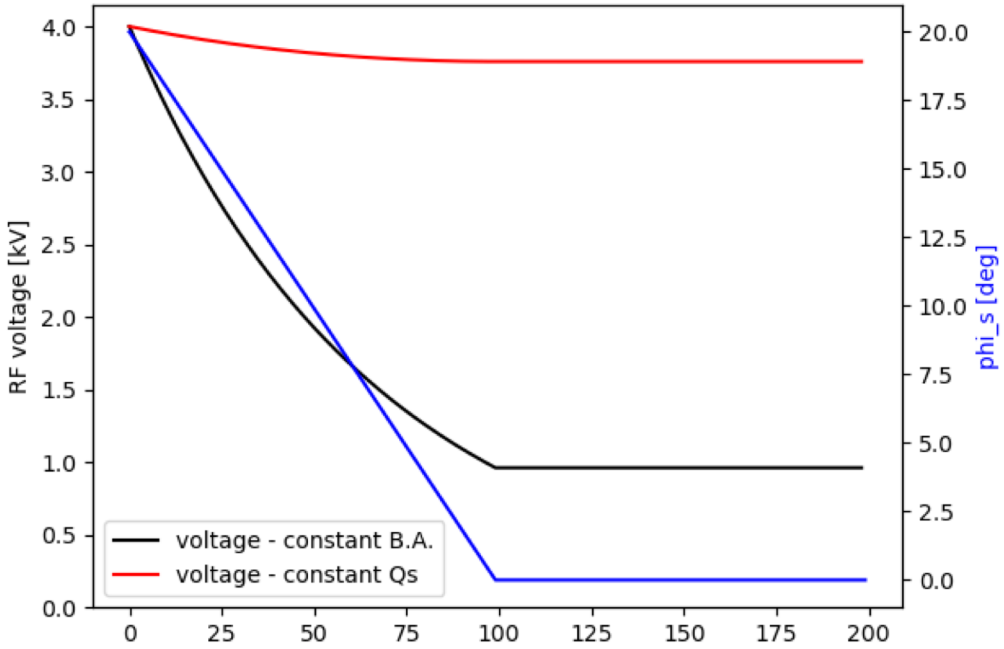
$$\epsilon = \frac{1}{\omega_s^2}\left|\frac{d\omega_s}{dt}\right|$$

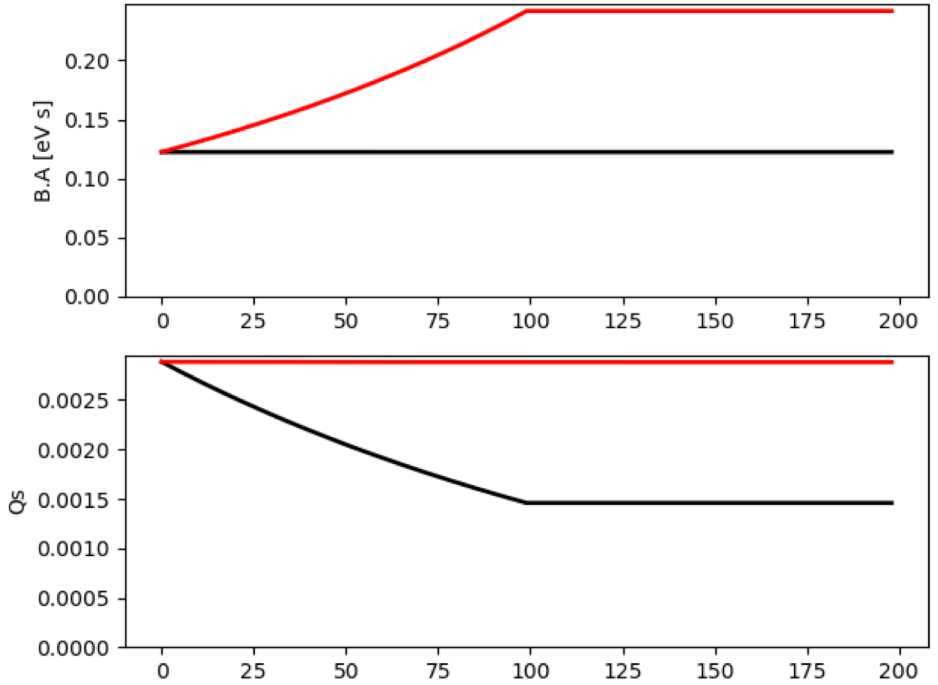
Geometric affect



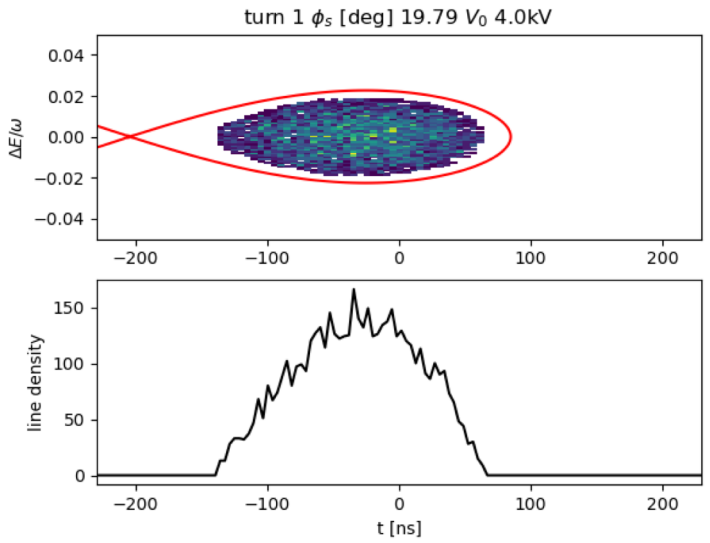
Consider the case where the synchronous phase reduces from 20 deg to zero in a single turn

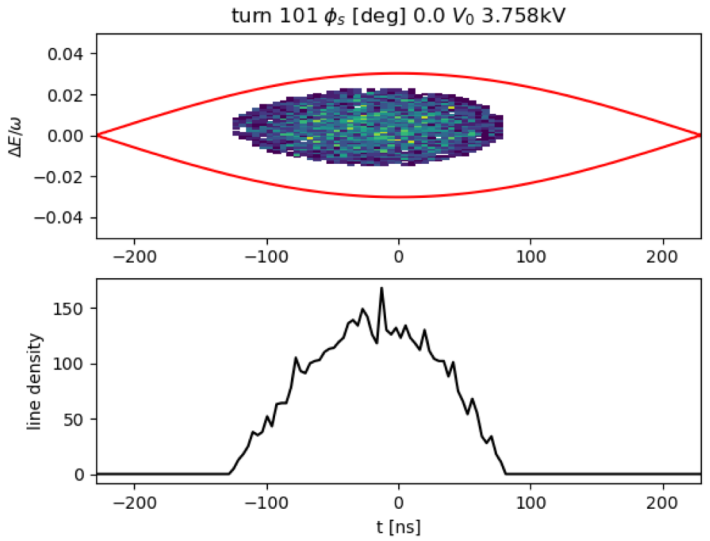
Example RF programs

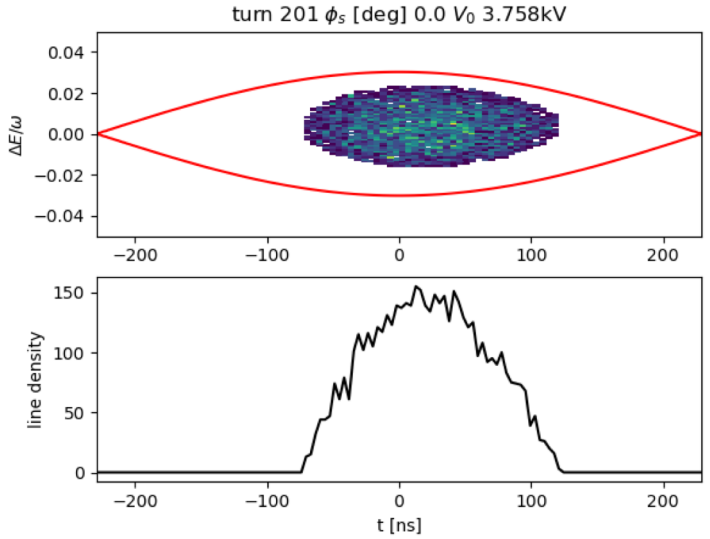


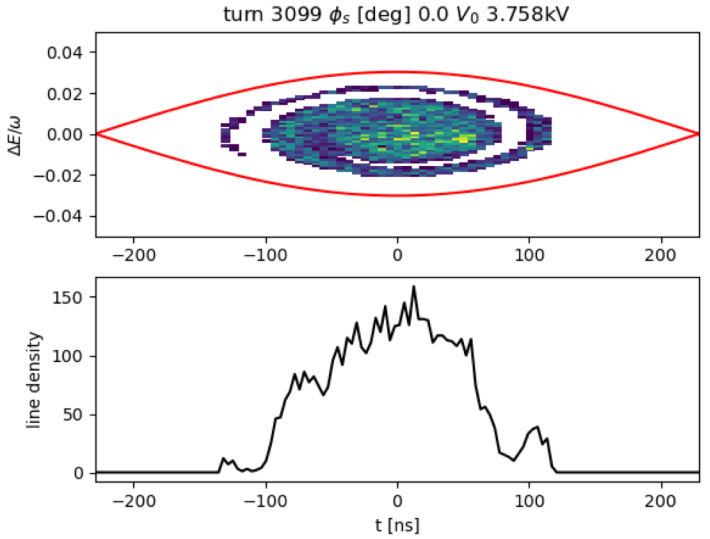


100 ϕ_s turn ramp: constant synch. tune

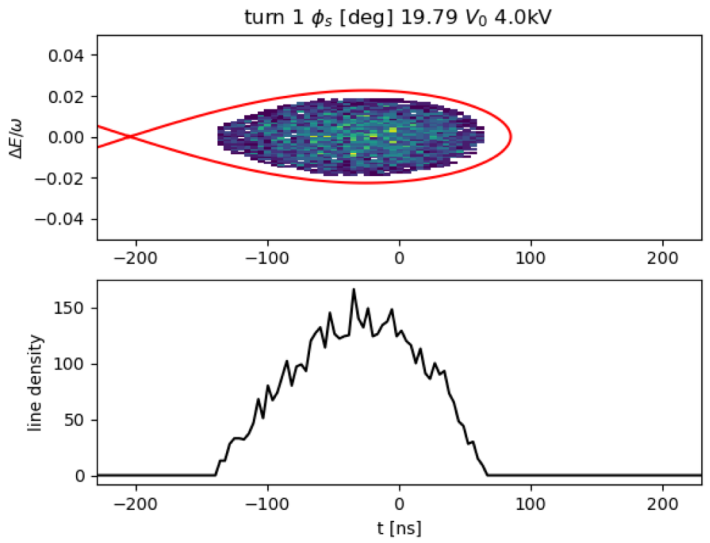


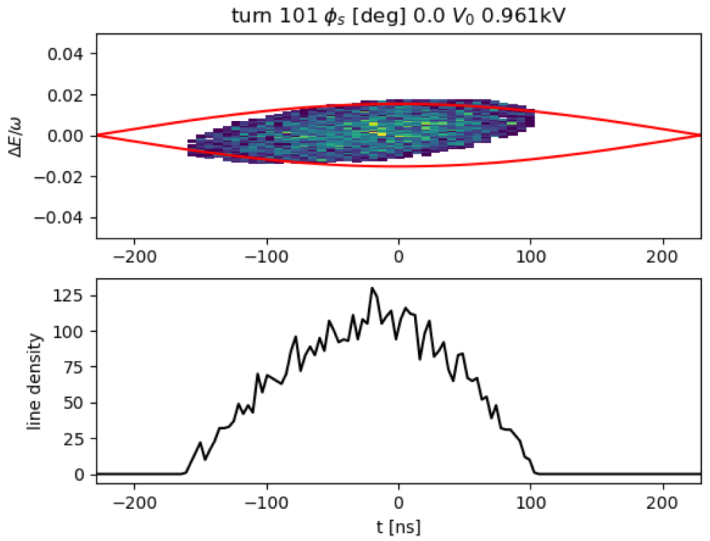


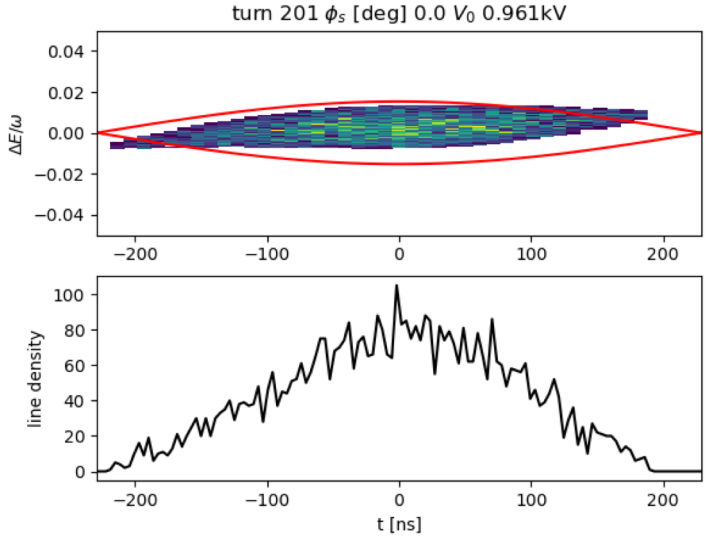


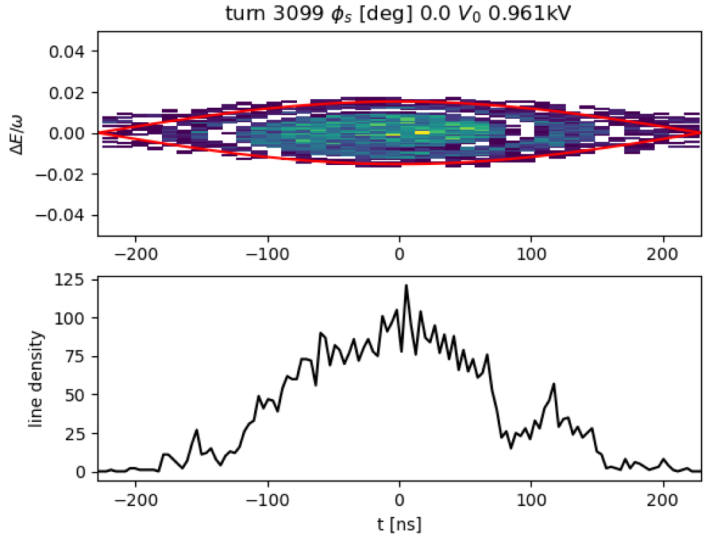


100 ϕ_s turn ramp: constant bucket area



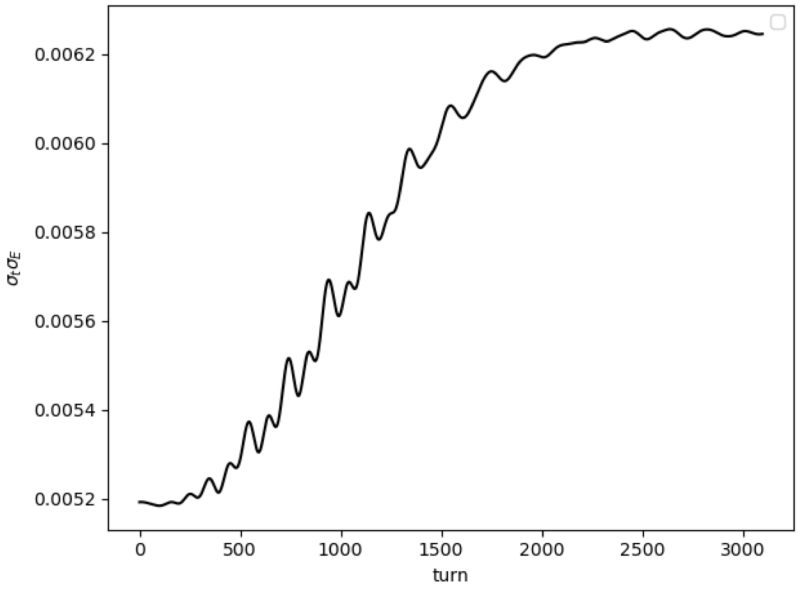


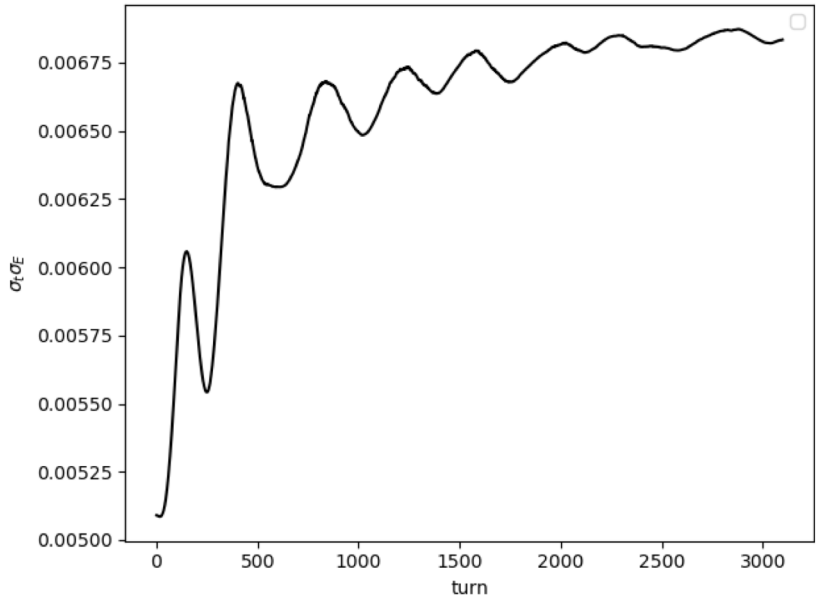


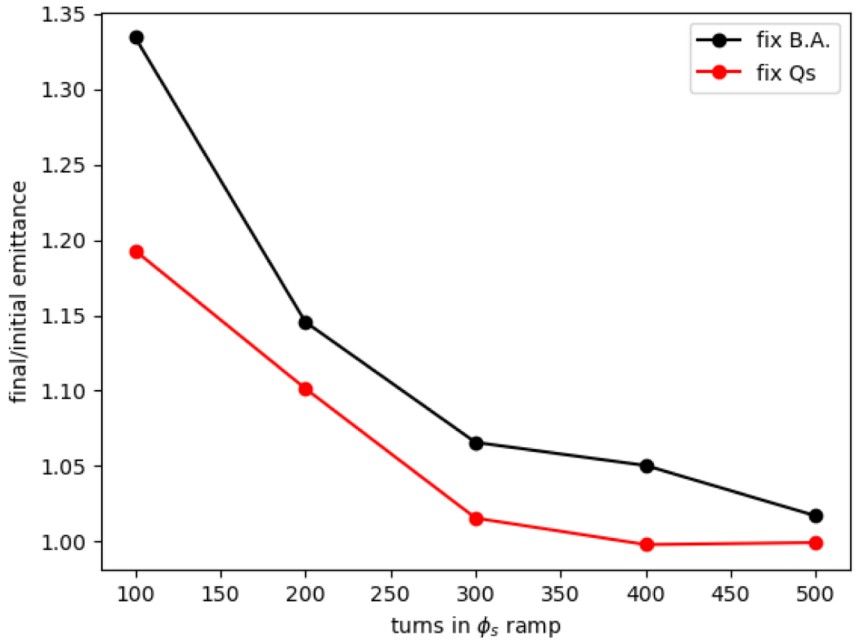


Emittance evolution

100 turn ϕ_s ramp







Synchrotron tune: constant
Bucket area: varies

Synchrotron tune: varies
Bucket area: constant