HHC Research and ICABU poster progress

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Outline

1. New approach to the synchronous phase

2. Bunch length simulation (with 3HC)

3. ICABU poster progress

- Synchronous phase

$$eV \sin \phi_s = U_0 \quad \rightarrow \quad \phi_s = \sin^{-1}\left(\frac{U_0}{eV}\right) \quad \text{or} \quad \pi - \sin^{-1}\left(\frac{U_0}{eV}\right)$$

- Synchronous oscillation

$$\omega_s^2 = -\frac{heV\omega_0^2 \eta \cos \phi_s}{2\pi\beta^2 E_0} > 0$$

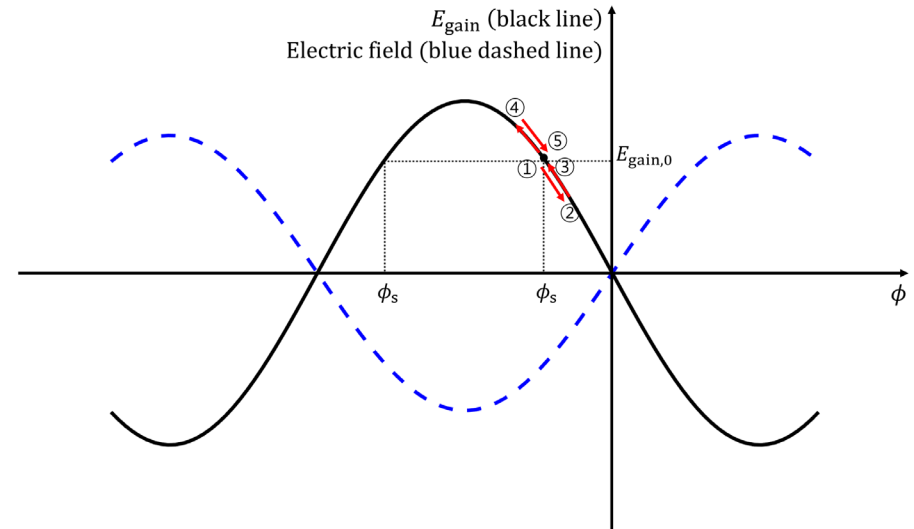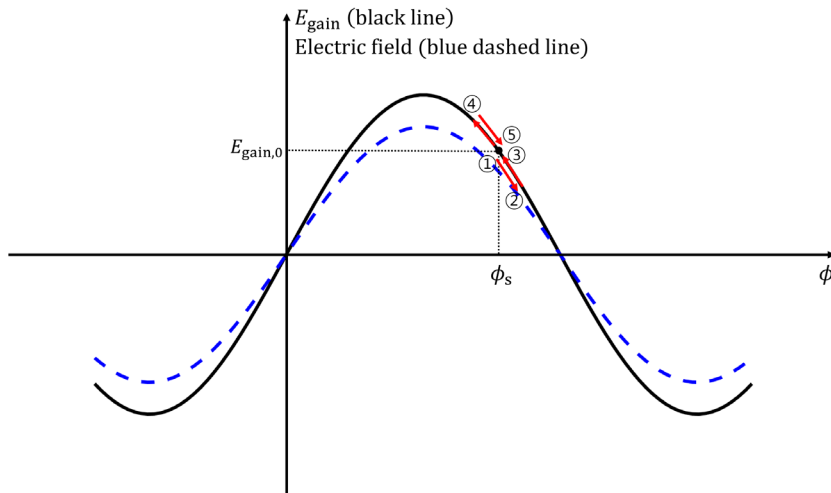- Assume $eV > 0 \quad \rightarrow \quad \eta \cos \phi_s < 0$

$$\begin{cases} \dfrac{\pi}{2} < \phi_s < \dfrac{3\pi}{2} & \text{if} \quad \gamma > \gamma_T \quad (\textit{above} \text{ transition}) \\ -\dfrac{\pi}{2} < \phi_s < \dfrac{\pi}{2} & \text{if} \quad \gamma < \gamma_T \quad (\textit{below} \text{ transition}) \end{cases}$$

1. New approach to the synchronous phase

- Now, consider $e < 0$ and $V > 0$ for electron → $\eta \cos \phi_s > 0$ for stable oscillation
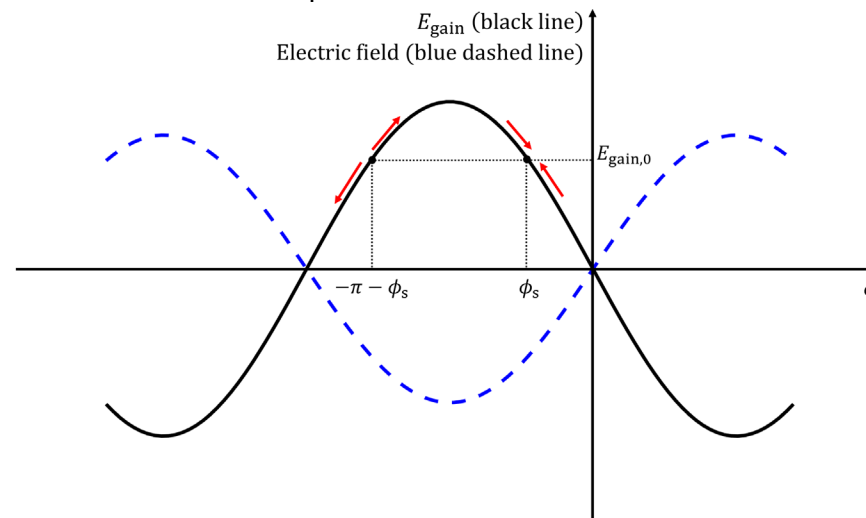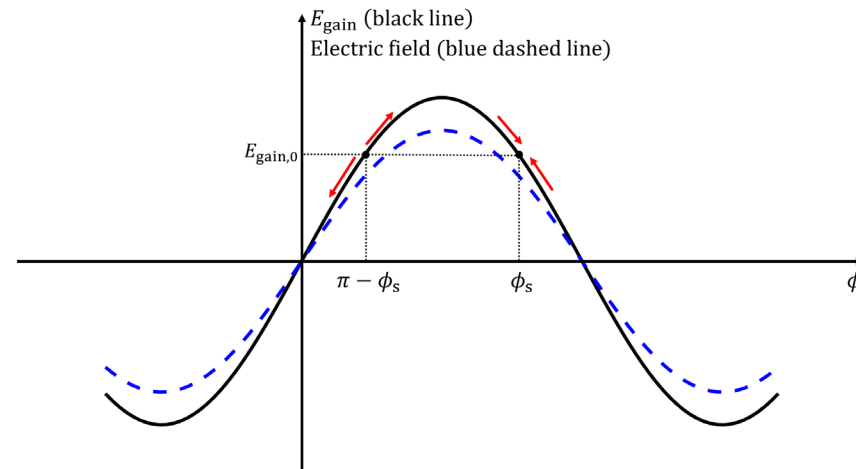
$$
\begin{cases}
-\dfrac{\pi}{2} < \phi_s < \dfrac{\pi}{2} & \text{if} \quad \gamma > \gamma_T \quad (\textit{above} \text{ transition}) \\[2ex]
\dfrac{\pi}{2} < \phi_s < \dfrac{3\pi}{2} & \text{if} \quad \gamma < \gamma_T \quad (\textit{below} \text{ transition})
\end{cases}
$$

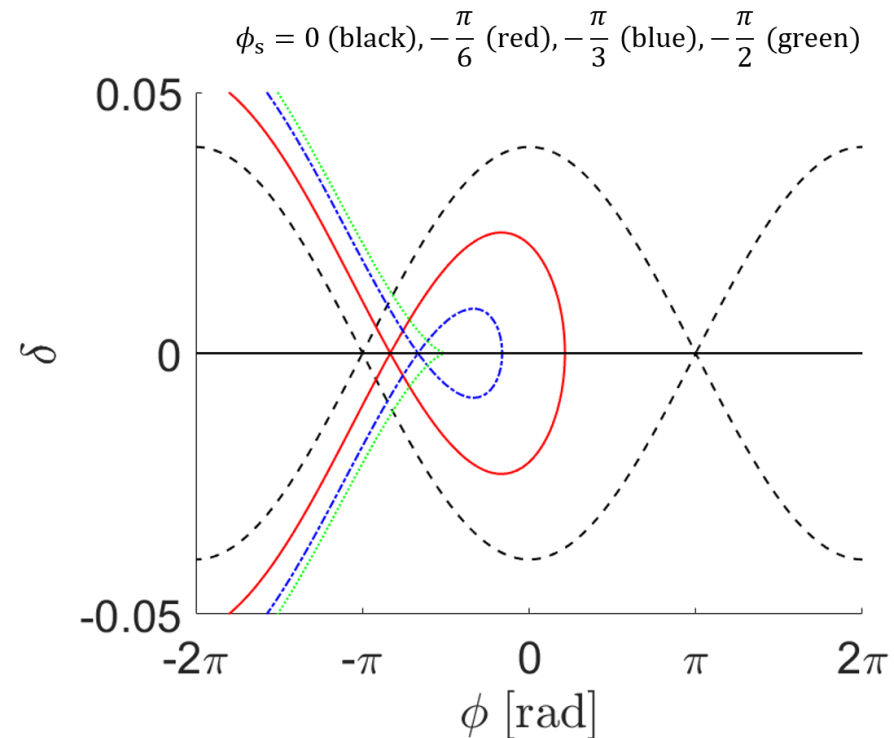- Consider $\sin \phi_s = \dfrac{U_0}{eV} > 0, -\dfrac{\pi}{2} < \phi_s < 0$ for above transition
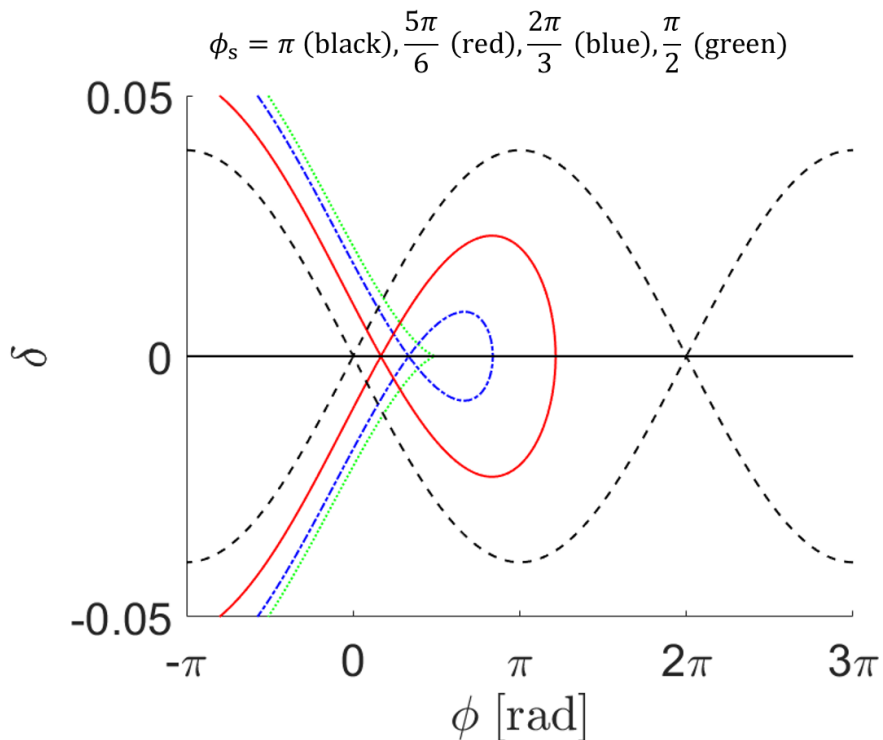
- Stable Fixed Point (SFP) and Unstable Fixed Point (UFP)

1. New approach to the synchronous phase

- Separatrix

$\phi_s = \pi$ (black), $\frac{5\pi}{6}$ (red), $\frac{2\pi}{3}$ (blue), $\frac{\pi}{2}$ (green)

$\phi_s = 0$ (black), $-\frac{\pi}{6}$ (red), $-\frac{\pi}{3}$ (blue), $-\frac{\pi}{2}$ (green)

2. Bunch length Simulation (with 3HC)

- Natural bunch length ~ 17 mm
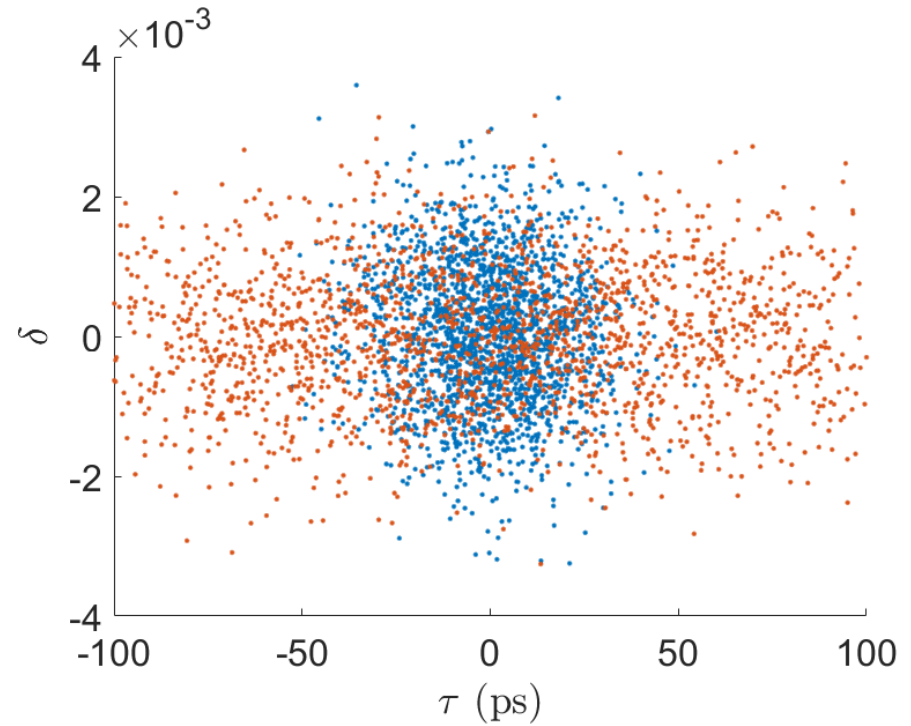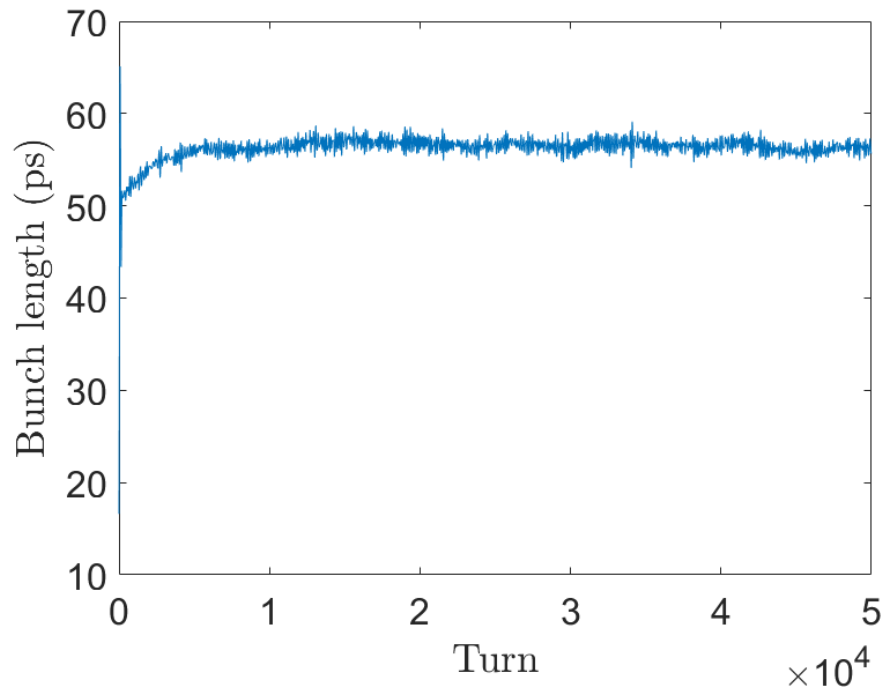
- BLF (Simulation) = 3 ~ 3.2

- BLF (Theory) = 3.08

3. ICABU Poster progress

- Title: Bunch lengthening in the presence of multiple HHCs

- Candidates (with reference)

    - 2HC + 3HC

    - 3HC + 5HC

    - etc.

- Theoretical analysis and simulation can be done within 4 days (not started yet)