

Comparing e-cloud instabilities in the SPS at nominal and at low γ_t -optics - first observations

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Motivation

Motivations for low γ_t

- Low $\gamma_t \rightarrow$ high η
- Instability threshold for headtail-like instabilities scales
 $\sim \sqrt{|\eta|^a}$
- Extrapolation to two-stream instabilities not straightforward
 \rightarrow launch of a HEADTAIL simulation study

^ae.g. strong headtail instability: $I_{\text{th}} = \frac{16\gamma R Q_\beta Q_s}{r_p W_0}$



Parameters

SPS optics parameters

	units	Nominal optics	Low γ_t -optics
γ_{beam}		27.7	27.7
$\gamma_{\text{transition}}$		22.8	18.0
η		-0.00062	-0.00178
ε_x^n	[μm]	2.5	2.5
ε_y^n	[μm]	2.5	2.5
β_x	[m]	42	54.6
β_y	[m]	42	54.6
Q_x		26.13	20.13
Q_y		26.18	20.18



Strategy

Simulation strategies

- Electron cloud interaction confined to straight sections
- Kicks per turn set to 48 for both cases to satisfy numerical convergence and to avoid low order resonances^a
- Electron cloud density set to values from $\rho = 3 \cdot 10^{11} \text{ m}^{-3}$ to $\rho = 1 \cdot 10^{12} \text{ m}^{-3}$
- We scan the beam intensity for different settings of V_{RF} ; scan ranges:

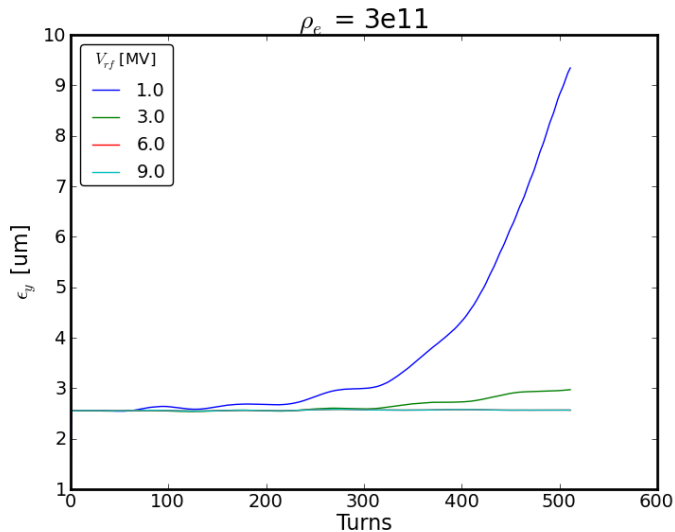
Intensity [1e11]	0.4-2.0
V_{RF} [MV]	0.1-12.0
Q_s	0.00132-0.014 ^b

^awe expect similar electron cloud formation along the machine for both cases

$${}^b Q_s = \sqrt{\frac{qV_{\text{RF}}|\eta|h}{2\pi E_{\text{beam}}\beta_0^2}}, \sigma_z = 0.2 \text{ m}$$



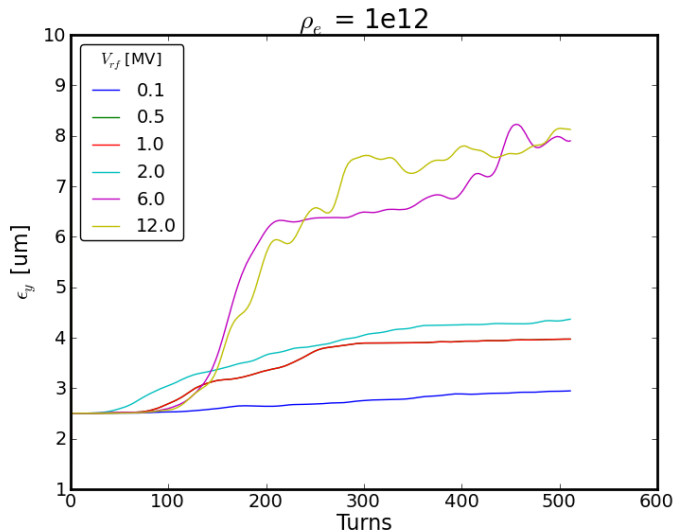
Observations



$$I_{\text{beam}} = 1.5 \cdot 10^{11}$$



Observations



$$^1 I_{\text{beam}} = 1.5 \cdot 10^{11}$$



Conclusions

Preliminary conclusions

- We find 2 regimes with different effects of Q_s
- Below threshold, high Q_s seems to help; the threshold scales as expected
- Above threshold, high Q_s seems to enhance the emittance deterioration



End

Thank you!

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discussion...

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