

IBS simulations at ThomX

M. Biagini, C. Bruni

IBS code by C. Bruni

- Growth rates computed by integration of Bjorken-Mtingwa equations
- Beam parameters are from Linac injection (see Table), round beam
- Bunch length matched to ring ($4 \rightarrow 20$ ps)
- Time span: 20 msec
- Varied parameters: emittances, $\delta E/E$ ($\rightarrow \sigma_L$), beam charge
- Each parameter varied keeping others constant (non physical?)

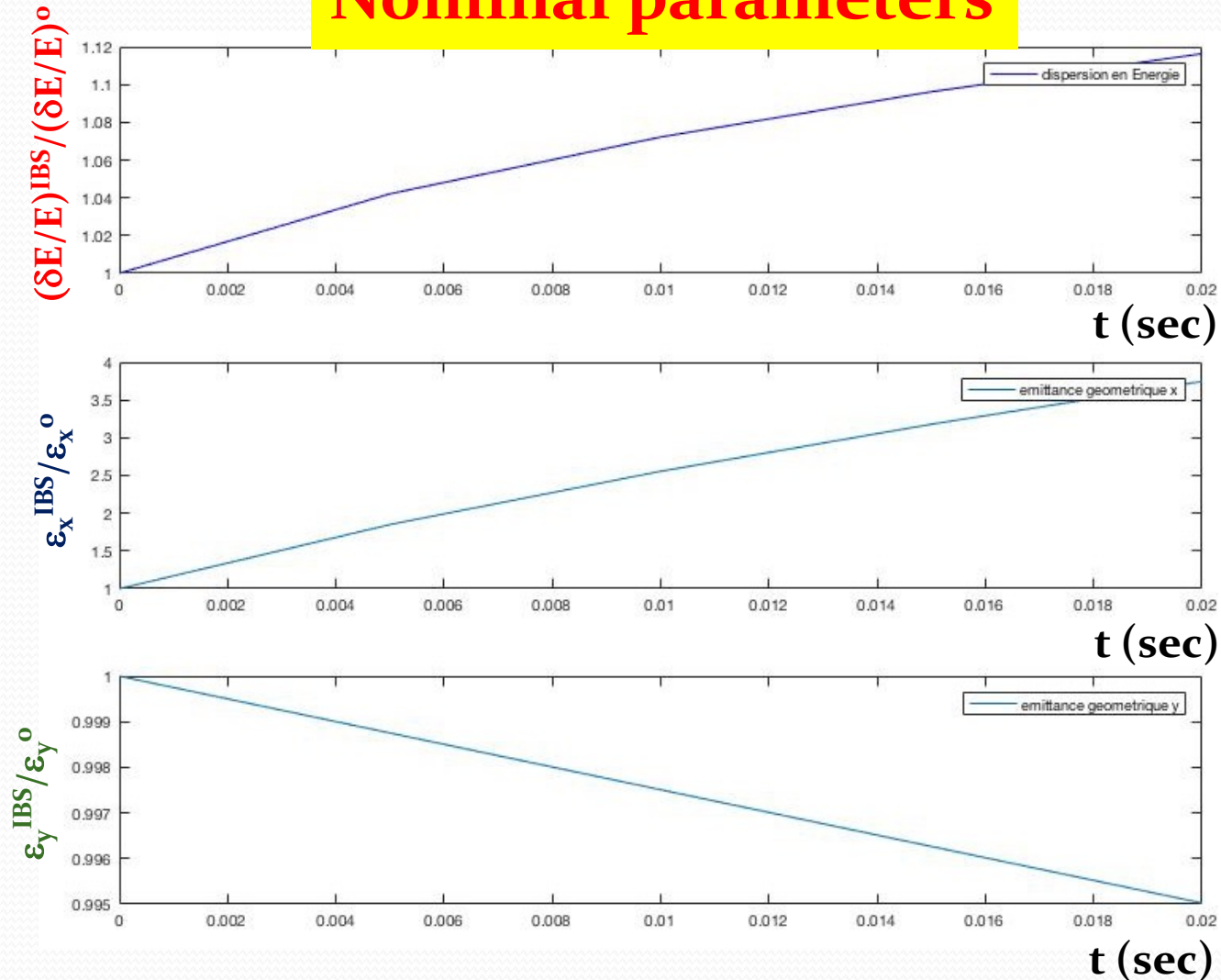
ThomX nominal parameters

Parameter	Unit		Parameter	Unit	
Geometric ε_x (from Linac)	m*rad	4e-8	Equilibrium ε_x	m*rad	2.0e-9
Geometric ε_y (from Linac)	m*rad	4e-8	Equilibrium ε_y	m*rad	2.0e-9
$\delta E/E$ (from Linac)		3e-3	Equilibrium $\delta E/E$		7.0e-5
Charge	nC	1.0	Equilibrium τ_x	sec	4.48
Synchrotron frequency	kHz	313	Equilibrium τ_y	sec	3.81
Bunch length (matched to ring)	ps	20	Equilibrium τ_E	sec	1.78

RED: simulation input parameters

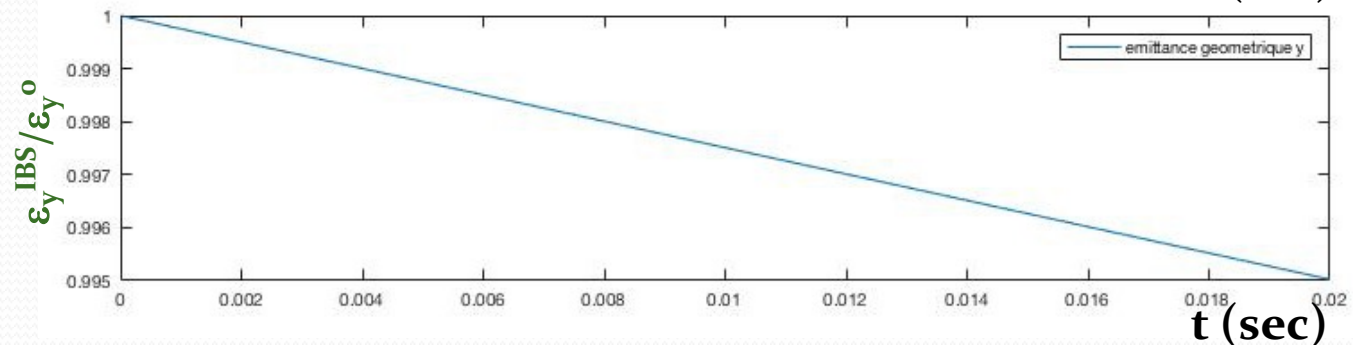
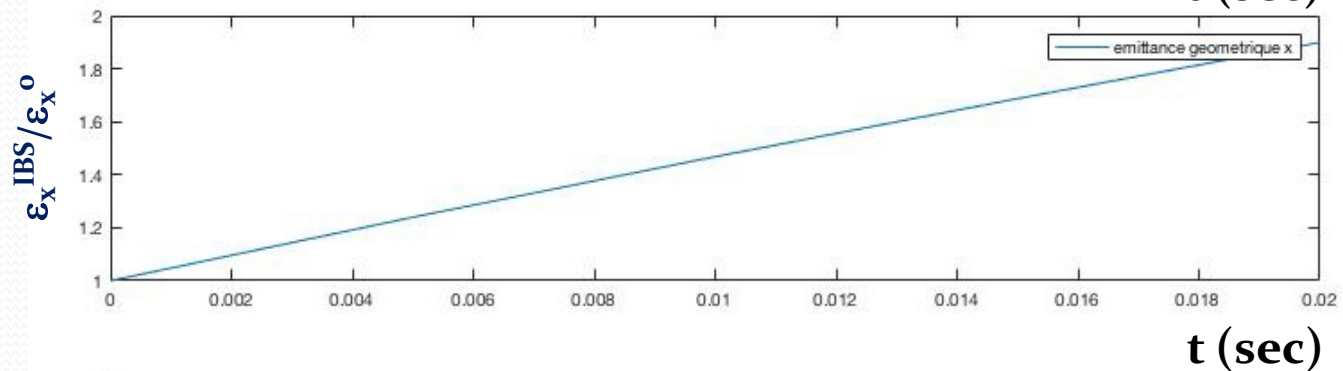
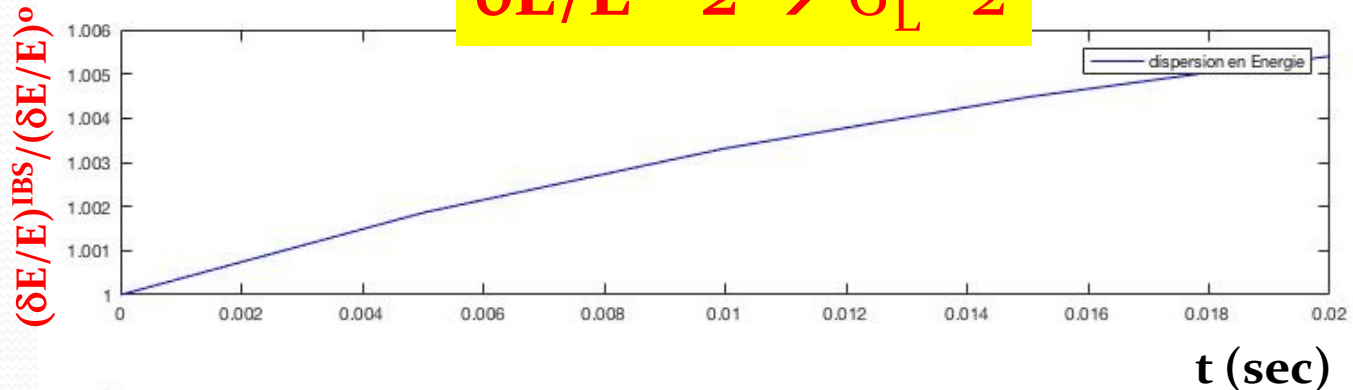
Energy deviation and emittances (x,y) ratios with IBS for 20 msec

Nominal parameters



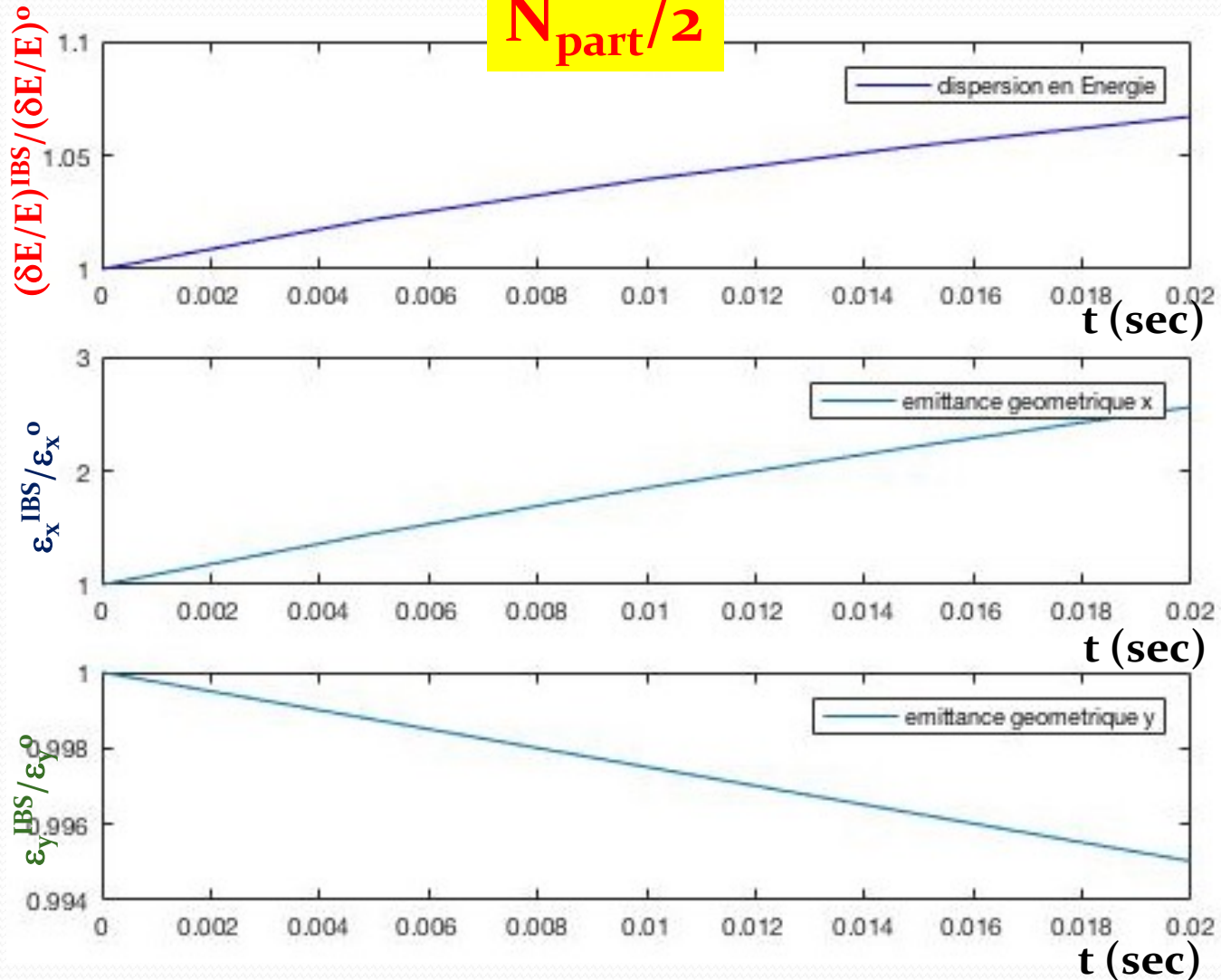
Energy deviation and emittances (x,y) ratios with IBS for 20 msec

$$\delta E/E * 2 \rightarrow \sigma_L * 2$$

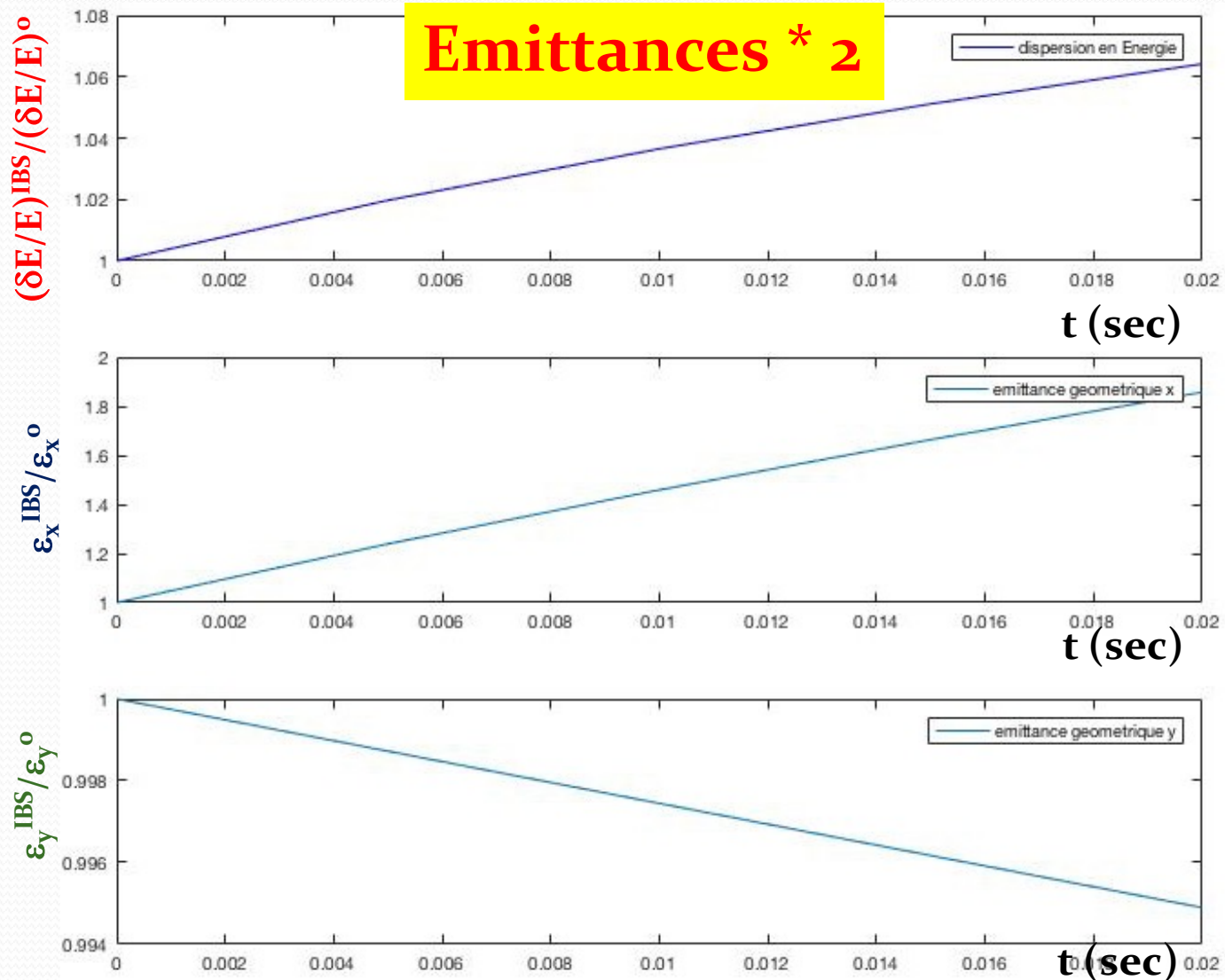


Energy deviation and emittances (x,y) ratios with IBS for 20 msec

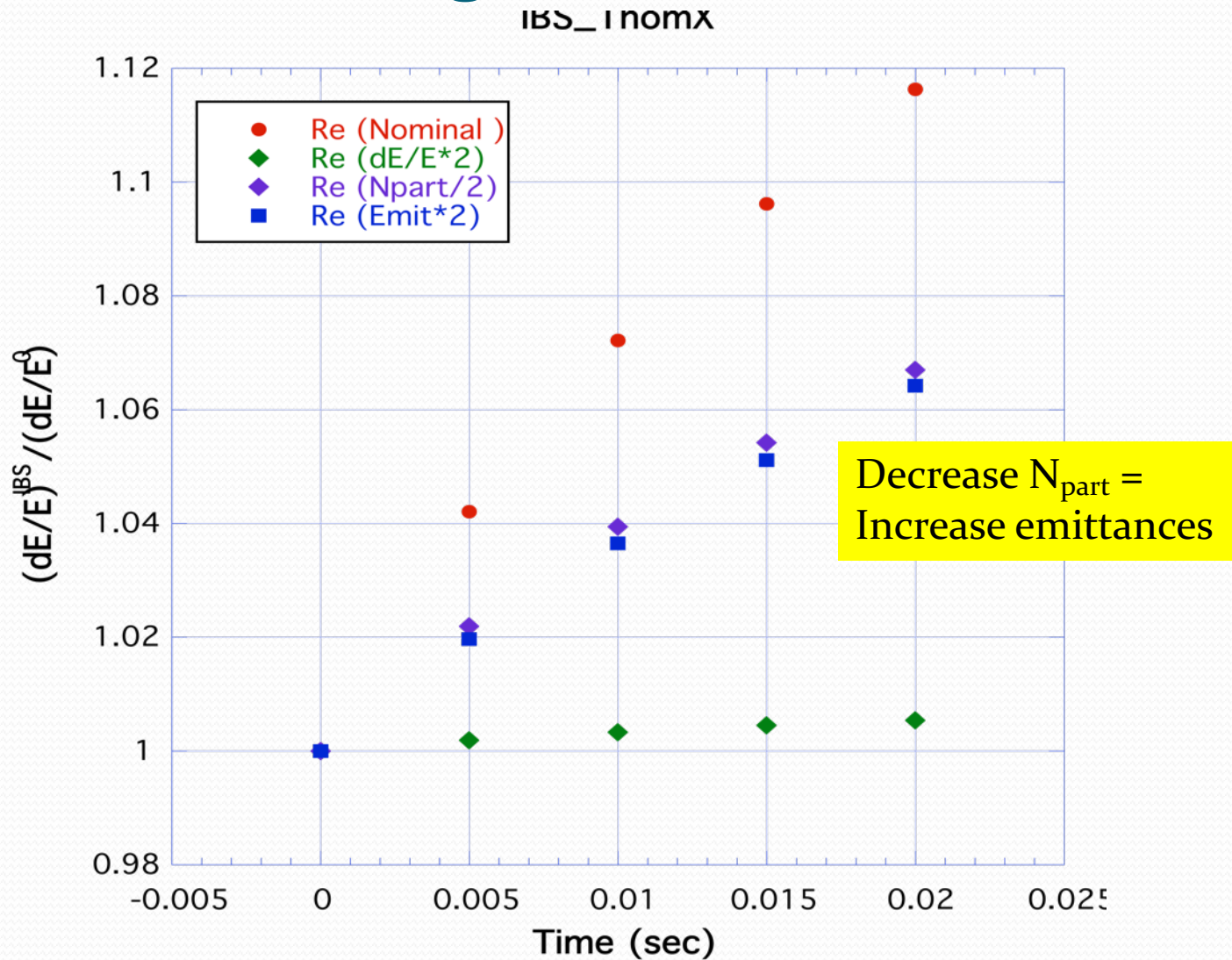
$N_{\text{part}}/2$



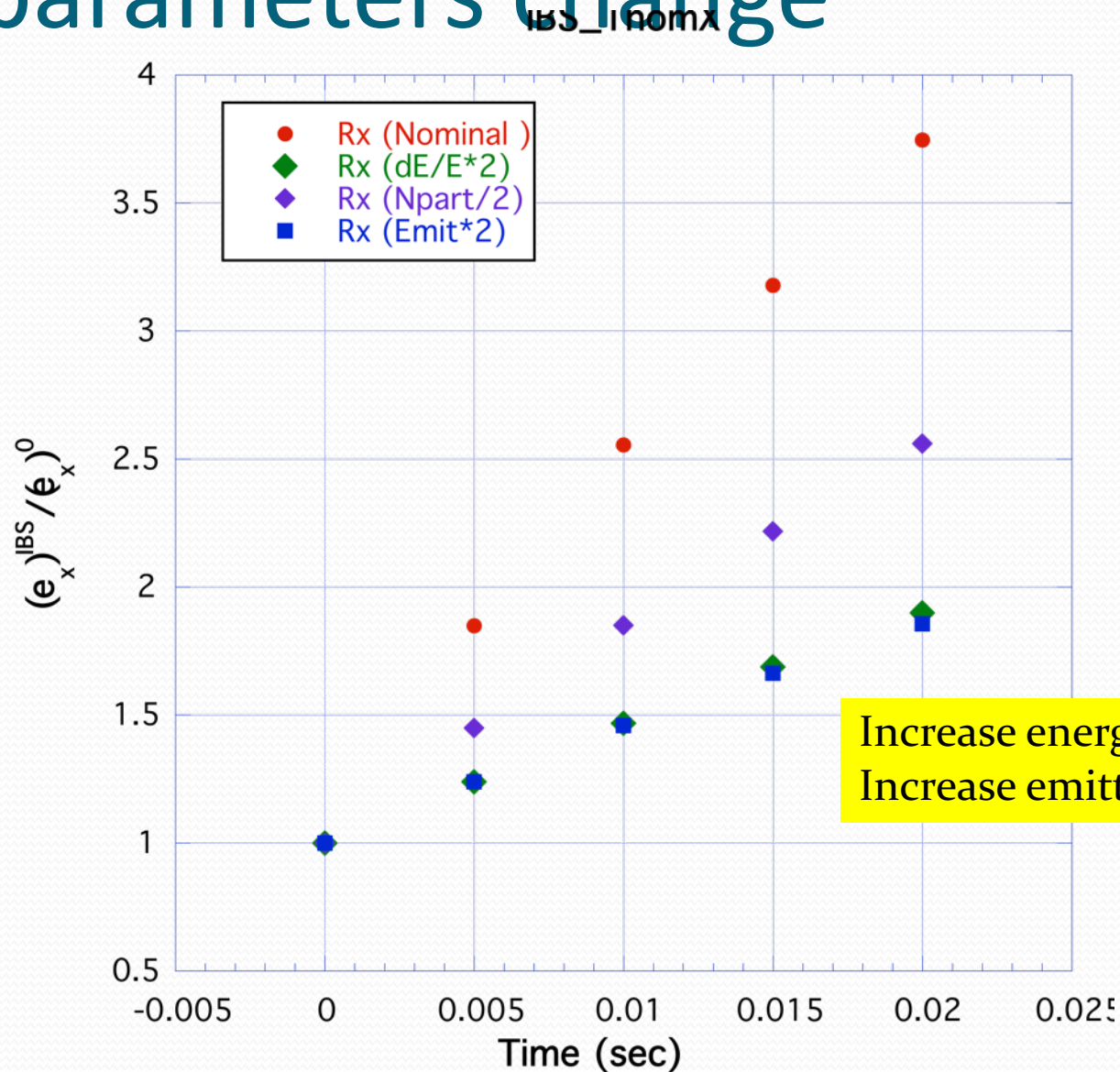
Energy deviation and emittances (x,y) ratios with IBS for 20 msec



Energy deviation growth rates vs parameters change



Horizontal emittance growth rates vs parameters change



Increase energy spread =
Increase emittances

Conclusions

- Work in progress!
- No effect on vertical emittance due to lack of vertical dispersion and coupling
- Beneficial effect of energy spread and bunch length $\rightarrow \delta E$ can “easily” be increased in Linac (simulations to be performed, matching into ring too)
- When N_{part} changes \rightarrow needs to vary ϵ_x too, due to space charge (check with Linac simulations \rightarrow CB). From CB previous simulations it seems we should rather increase the charge!
- CSR effect is less harmful if bunch is longer (to be simulated \rightarrow AL?)
- Compton Back Scattering is also increasing energy spread, can help