Update on RF parameters

Introduction

New SPS/HPPS ratio of 5.5 is assumed.

2 cases have been considered : acceleration of LAGUNA beam and injection into SPS.

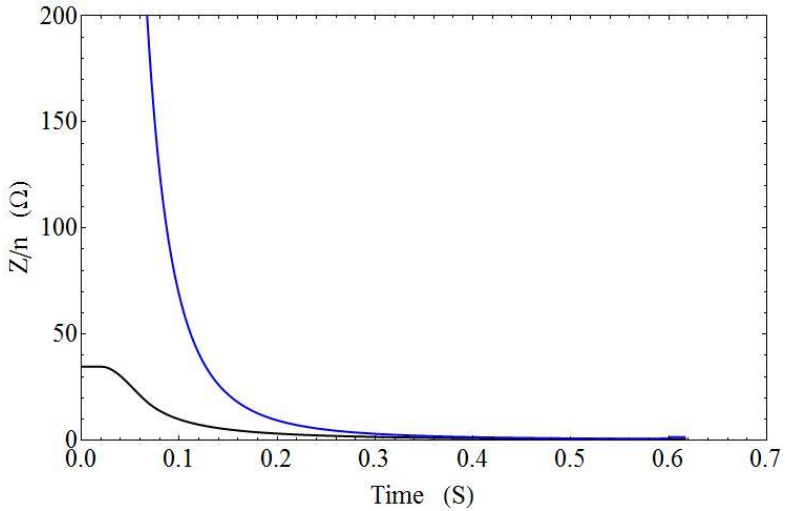
Circumference	1256.63 m
Harmonic number	168
Transition gamma	43.07 i
Intensity (50GeV)	$1.6*10^{12}$ ppb

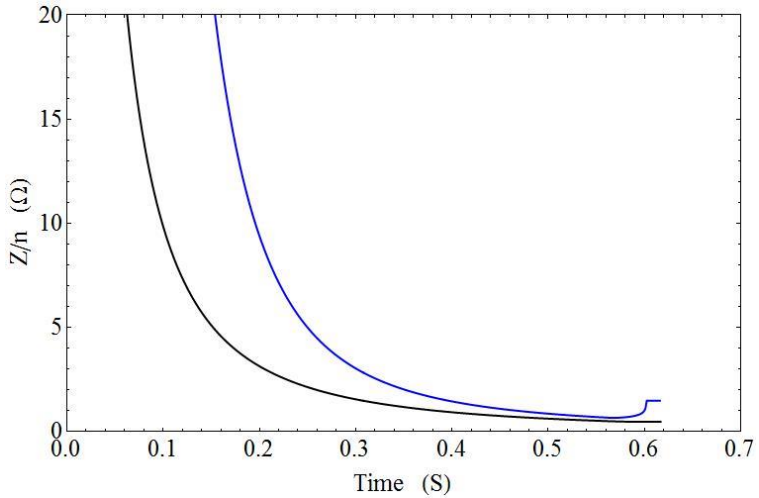
Beam for LAGUNA : stability

The longitudinal emittance of the beam must be large enough in order not to lose the landau damping due to reactive impedance.

Main contribution to reactive impedance is from space charge : $Im\ Z/n = \frac{Z_0 g_0}{\beta\gamma^2}$

Condition to maintain landau damping : $Im\ Z/n \leq \frac{eta\ E}{e\ N_b}\beta^2(\frac{\Delta p}{p})^2\tau\frac{(\pi f_{RF}\tau)^2}{16}$

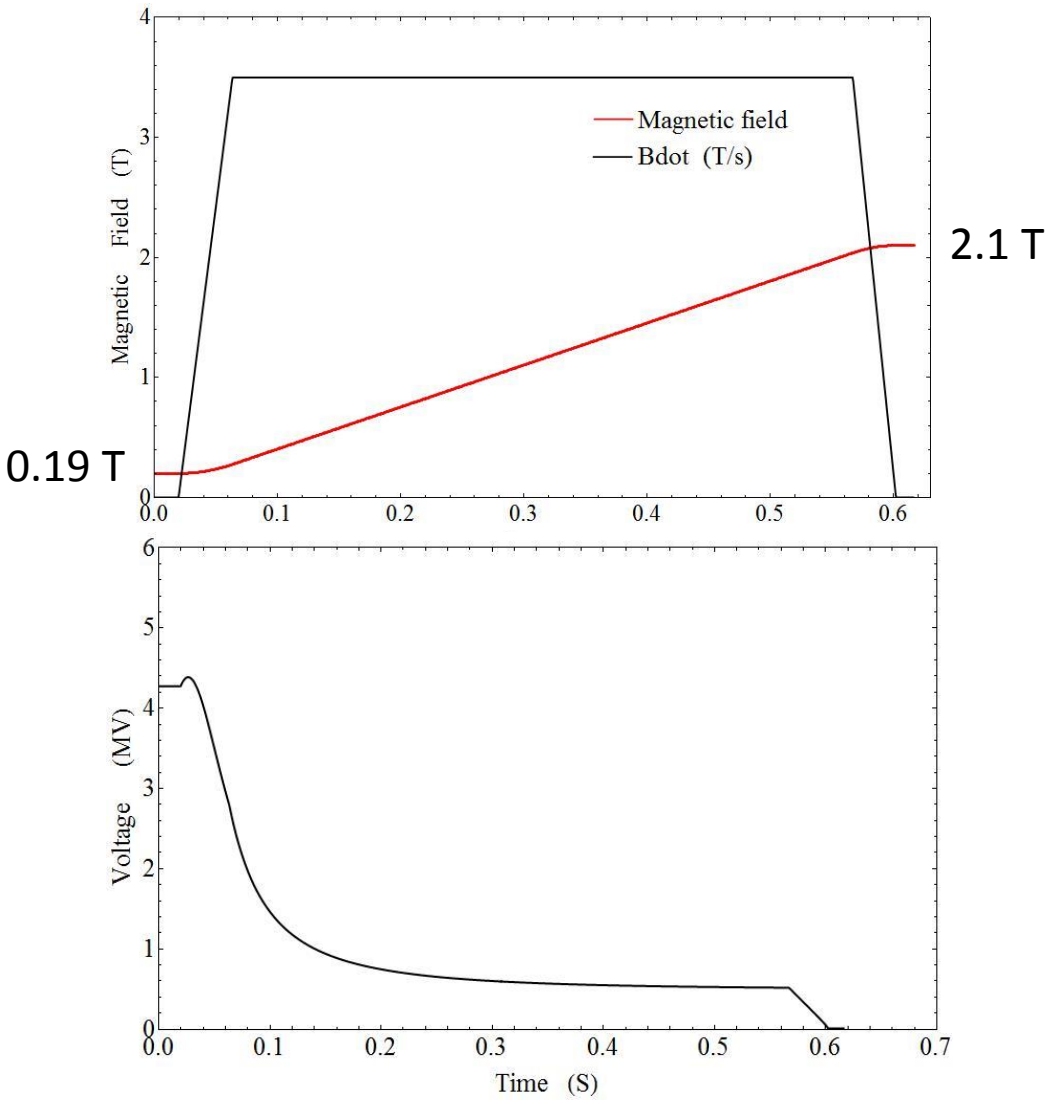




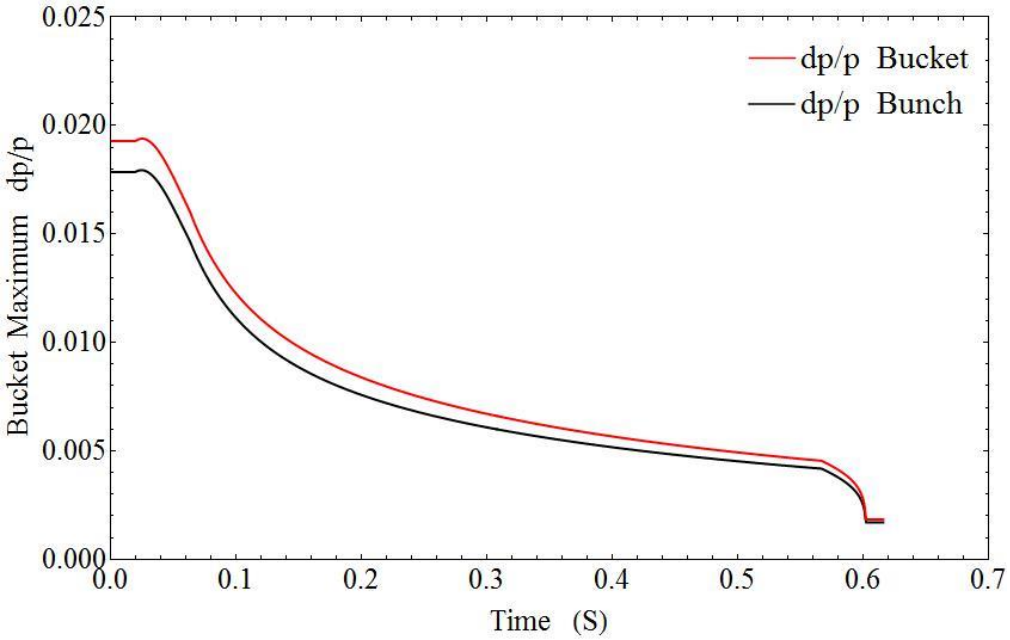
After calculation the longitudinal emittance must be increased up to 1 eV.s in order to maintain Threshold value above space charge impedance.

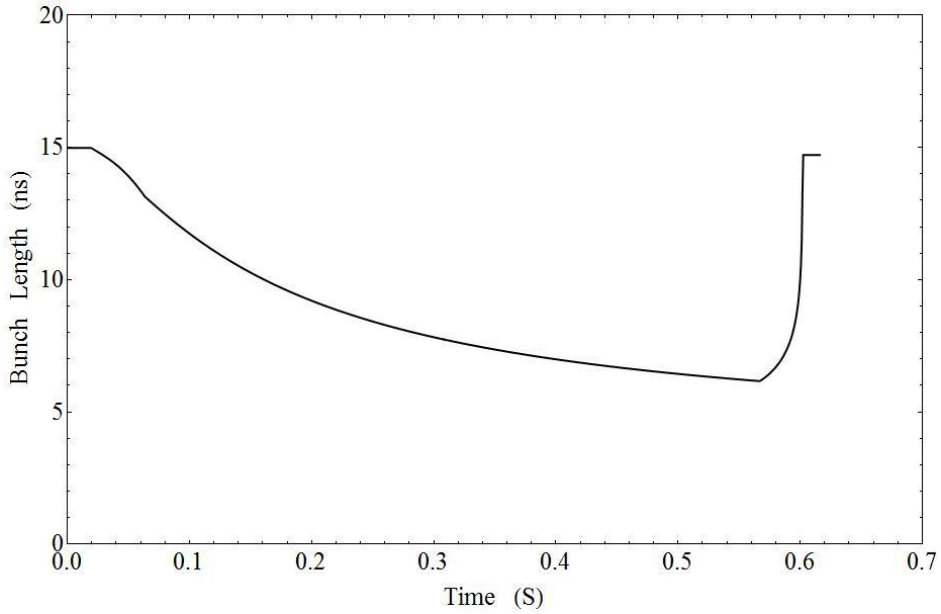
Beam for LAGUNA : Voltage

Voltage has been recalculated using fixed filling factor of 0.9 in momentum and a longitudinal emittance of 1.0 eV.s with new magnetic field.



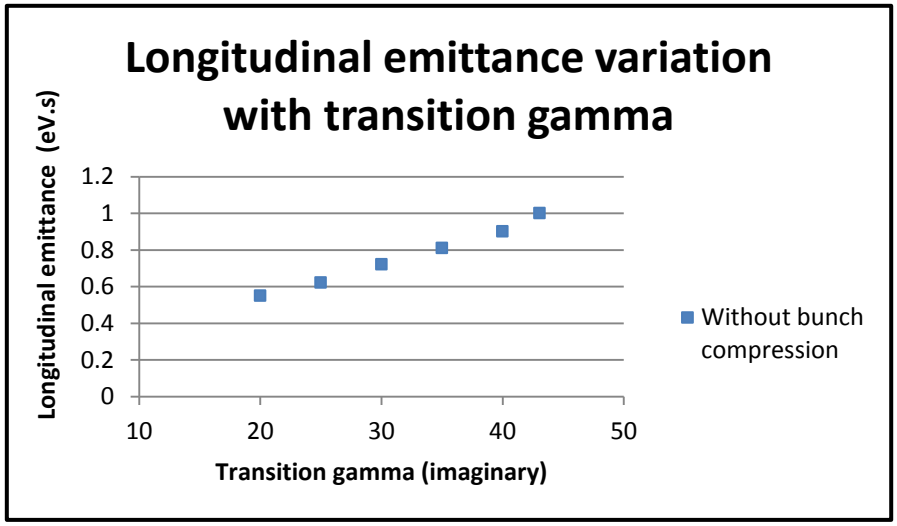
Beam for LAGUNA : Bunch / bucket properties

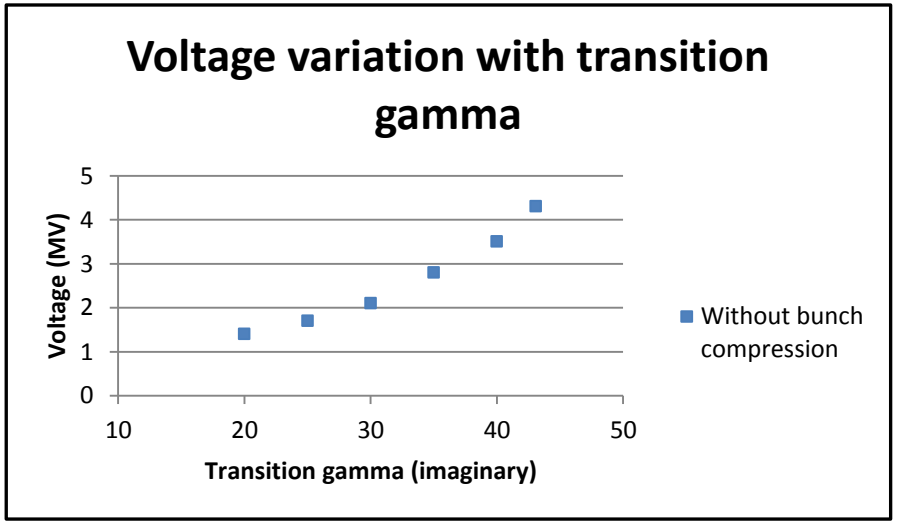




Beam for LAGUNA : transition gamma

All previous calculations have been done taking into account same transition gamma than for present design.
Due to high intensity and high transition gamma, the longitudinal emittance which maintain beam stable is much higher than PS2, leading to high voltage.
One way to decrease this emittance (thus maximum voltage) would be to “play” with transition gamma.

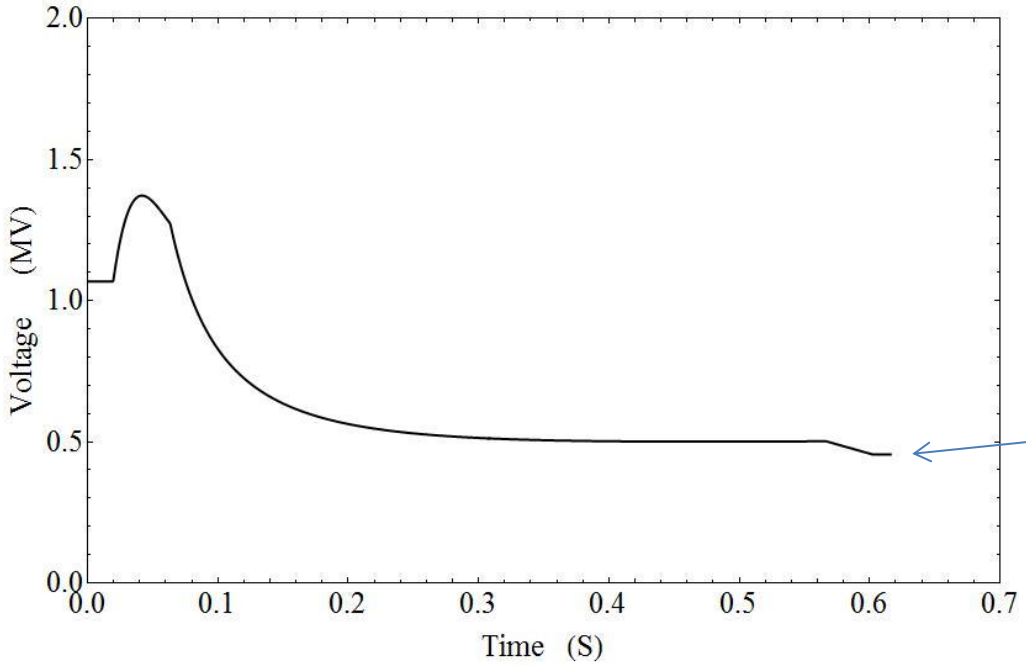




Beam for SPS : constraints

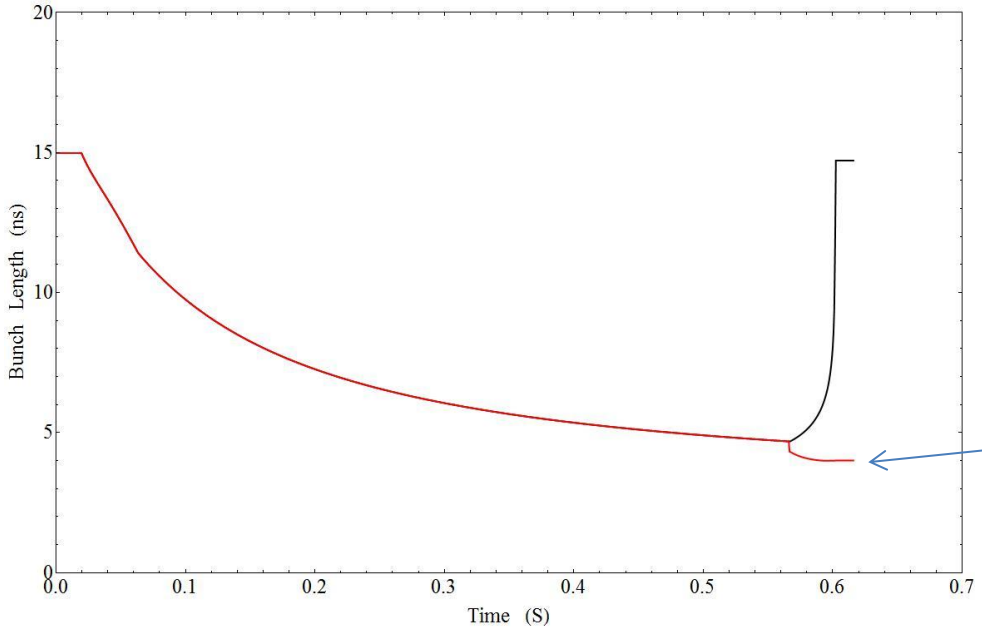
- Longitudinal emittance of 0.5 eV.s
- Maximum bunch length at extraction 4 ns
- Maximum intensity $2.5*10^{11}$ ppp

Beam for SPS : Voltage with bunch compression



0.5 eV.s

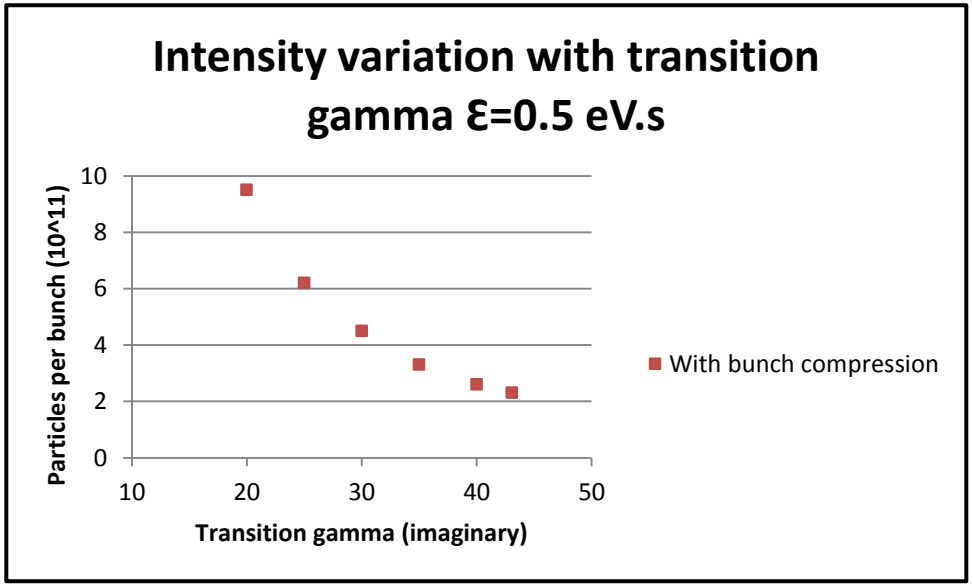
455 kV



4 ns

Beam for SPS : transition gamma

As for LAGUNA beam calculations have been made for 43.07 I transition gamma. It is thus possible to calculate the admissible intensity as a function of transition gamma.



75 GeV option, LAGUNA beam.

Due to the lower intensity for 75 GeV option ($1.1*10^{12}$ ppb) the corresponding broad-band impedance threshold is increased.
This leads to an smaller emittance which can be safely accelerated. (0.85 eV.s) leading to a maximum voltage of 3.3 MV

As for the 50 GeV base line, the longitudinal emittance / maximum voltage can be plotted as a function of transition gamma :