

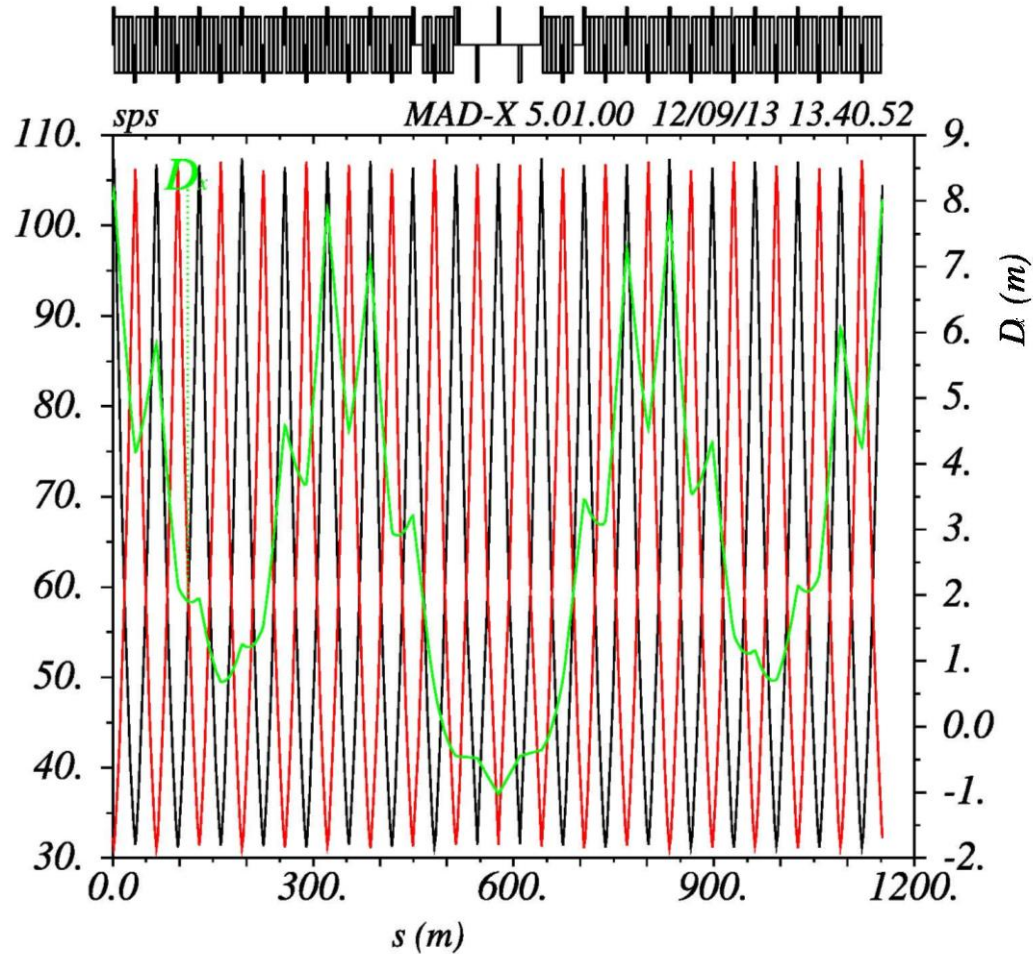
Intrabeam Scattering Computations for the SPS Lead Ion Beams

CH. CARLI, M. MARTINI

Contents

- **SPS optics (1st sextant)**
- **SPS beam parameters at injection (lead ion Pb^{82}_{208})**
- **SPS IBS growth times and growth rates**
- **SPS IBS emittance increase**

SPS optics (1st sextant)



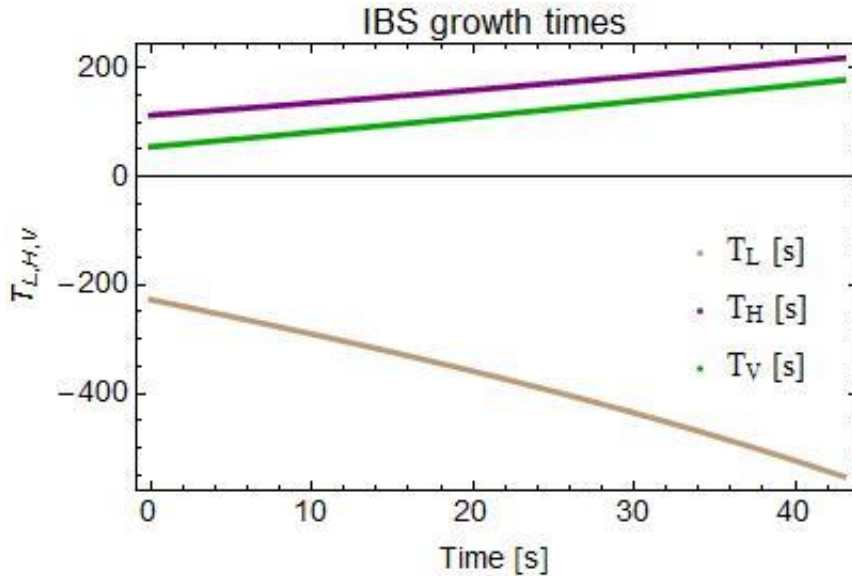
Q20 lattice : $Q_h=20.13$, $Q_v=20.18$

SPS beam parameters at injection (lead ion Pb^{82}_{208})

Relativistic factor γ	7.31
Momentum, pc , (GeV/c)/u	6.75
Proton equivalent momentum, pc_{PEM} , (GeV/c)/charge	17.11
Bunch intensity, ions/bunch	3.6×10^8
Circumference, m	6911.5
RF voltage, MV	2.4
Bunch length (4 rms) τ_B , ns (s_B , m) ($\sigma_{\tau_B} = \tau_B/4$, $\sigma_{s_B} = s_B/4$)	4.0 (1.2)
Relative momentum spread (2 rms) $\delta_p = \Delta p/p$ ($\sigma_{\delta_p} = \delta_p/2$)	1.13×10^{-3}
Longitudinal emittance (2 rms) $\varepsilon^{2\sigma}_L = 4\pi \square pc \square \sigma_{\delta_p} \sigma_{\tau_B}$, eVs/u	4.79×10^{-2}
Longitudinal emittance $\varepsilon^{2\sigma}_L = 4\pi E_{ion} \sigma_{\delta_E} \sigma_{\tau_B} = 4\pi \beta \gamma A E_u \sigma_{\delta_p} \sigma_{s_B} / c$, eVs	9.97
Horizontal normalized emittance (rms) $\varepsilon^{1\sigma}_H$, μm	0.9
Vertical normalized emittance (rms) $\varepsilon^{1\sigma}_V$, μm	0.7

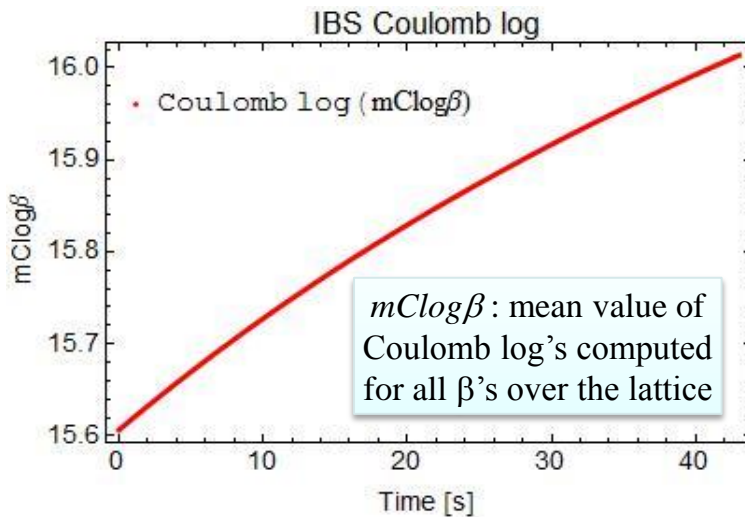
SPS IBS growth times and growth rates						
	τ_L s	τ_H s	τ_V s	τ_L^{-1} s	τ_H^{-1} s	τ_V^{-1} s
Bjorken & Mtingwa (M.M.)	-227.1	113.2	55.0	-4.4×10^{-3}	8.8×10^{-3}	1.8×10^{-2}
Piwinski (Ch.C)	-223.7	112.9	56.8	-4.5×10^{-3}	8.9×10^{-3}	1.8×10^{-2}

SPS IBS growth times and growth rates

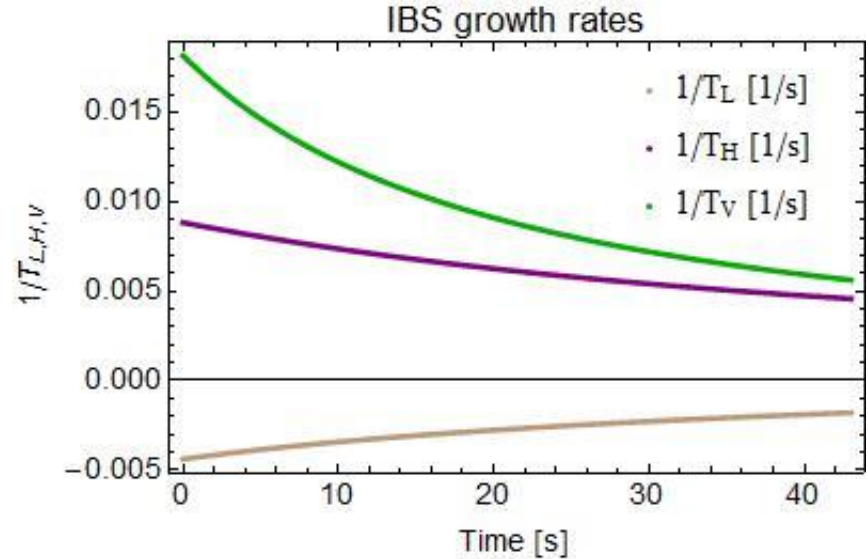


$$\begin{aligned} \tau_L(0) &= -227.1 \text{ s} \\ \tau_H(0) &= 113.2 \text{ s} \\ \tau_V(0) &= 55.0 \text{ s} \end{aligned}$$

$$\begin{aligned} \tau_L^{-1}(0) &= -4.40 \times 10^{-3} \text{ s}^{-1} \\ \tau_H^{-1}(0) &= 8.83 \times 10^{-3} \text{ s}^{-1} \\ \tau_V^{-1}(0) &= 1.82 \times 10^{-2} \text{ s}^{-1} \end{aligned}$$

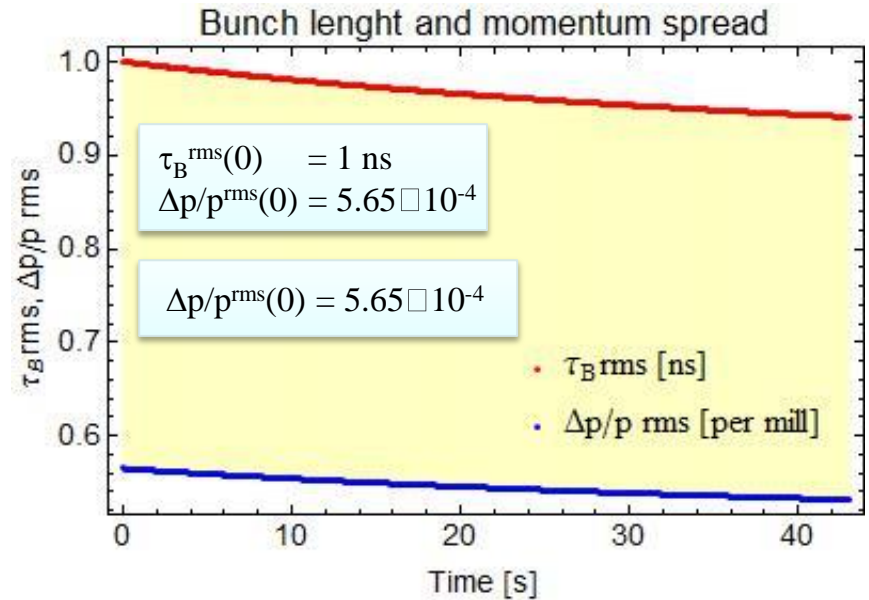
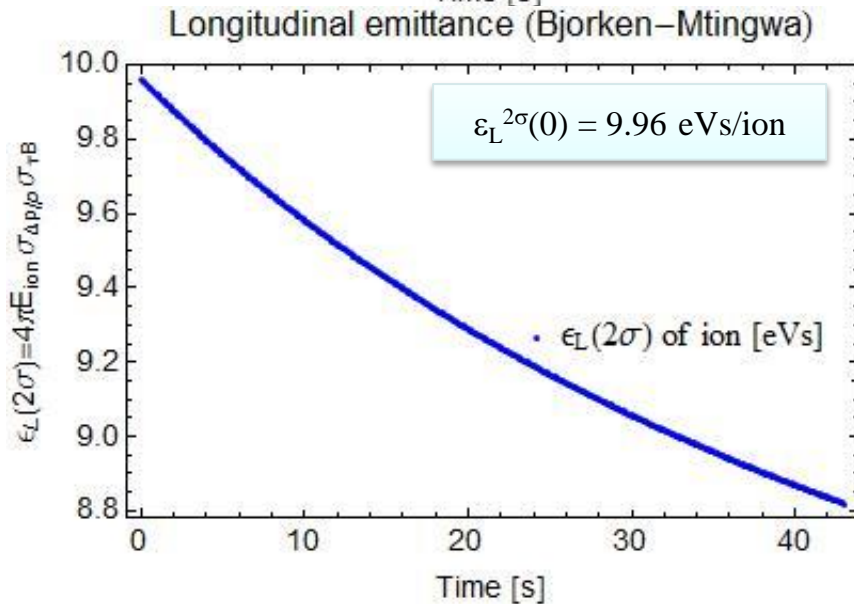
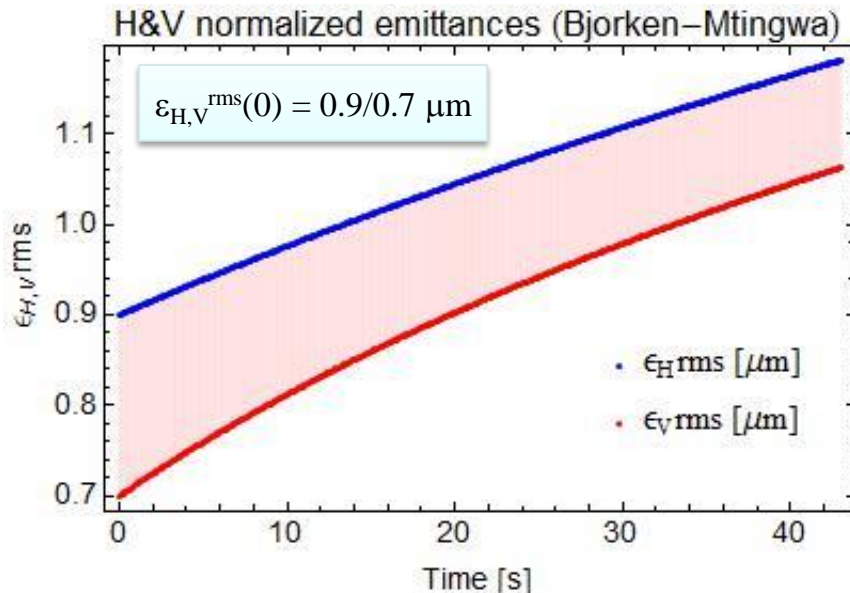


$mClog\beta$: mean value of Coulomb log's computed for all β 's over the lattice



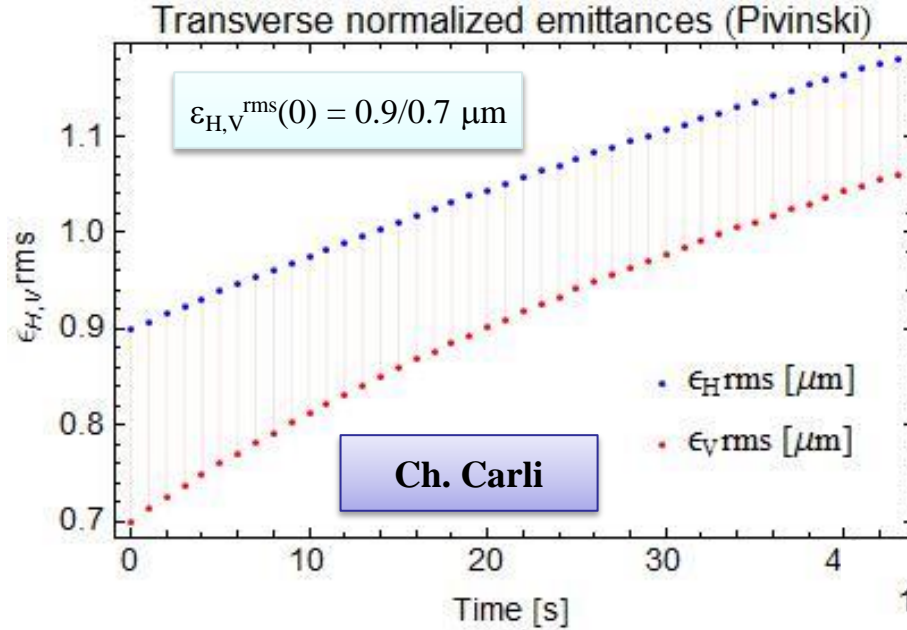
Evolution on the 43 s SPS injection plateau (Bjorken-Mtingwa IBS model)

SPS IBS emittance increase



Evolution along the 43 s
SPS injection plateau
(Bjorken-Mtingwa IBS model)

SPS IBS emittance increase



Evolution along the 43 s
SPS injection plateau
(Pivinski IBS model)

