Comparing IBS calculation with measurements

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(John Jowett)

IBS Calculation

- Varying
  - RF voltage
  - Transverse Emittance
  - Longitudinal Emittance
- Interpolating functions for the growth times

Measured Data

- 3 Fills (1366,1375,1400)
- Bunch by bunch data (intensity , luminosity and bunch length)
- Smoothing the data by moving average
- Interpolating functions for the data (as a function of time)
  - Bunch length -> longitudinal emittance + growth time
  - Intensity and luminosity -> transverse emittance + growth time

Fill 1366: Bunch length
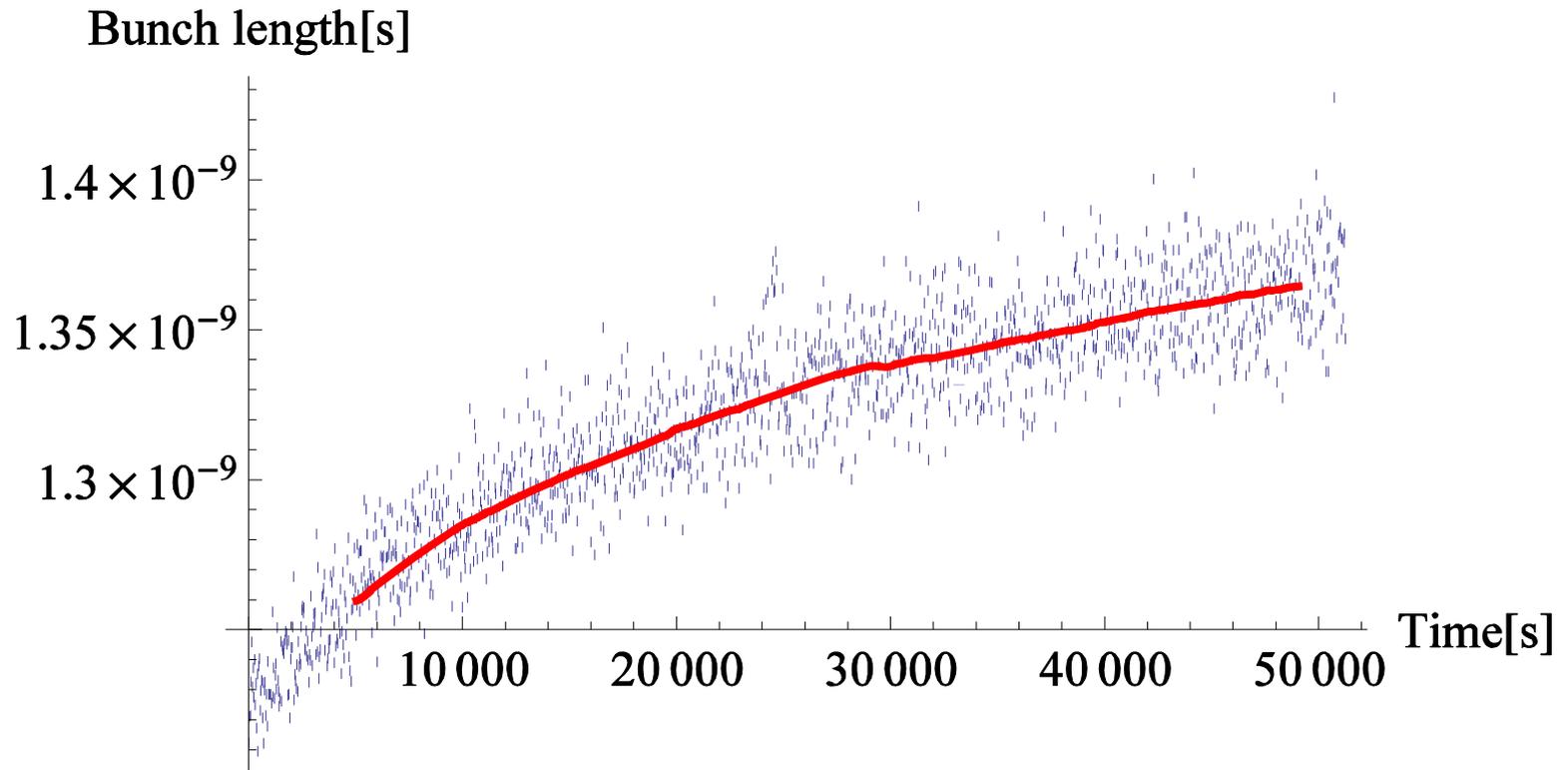
Fill 1366: Longitudinal

Fill 1366 Bunch 1

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1366 Bunch 15

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1366 Bunch 17

τ[Hours]

Measured[bunch length]

Time[s]

Average over all bunches

τ[Hours]

Average Measured[bunch length]
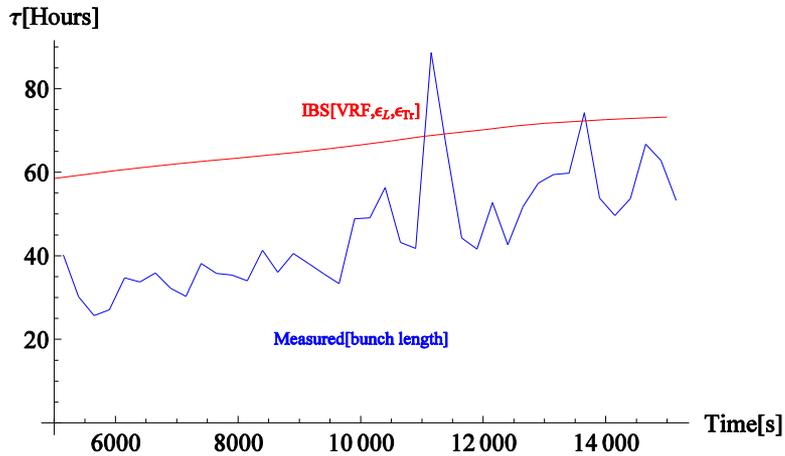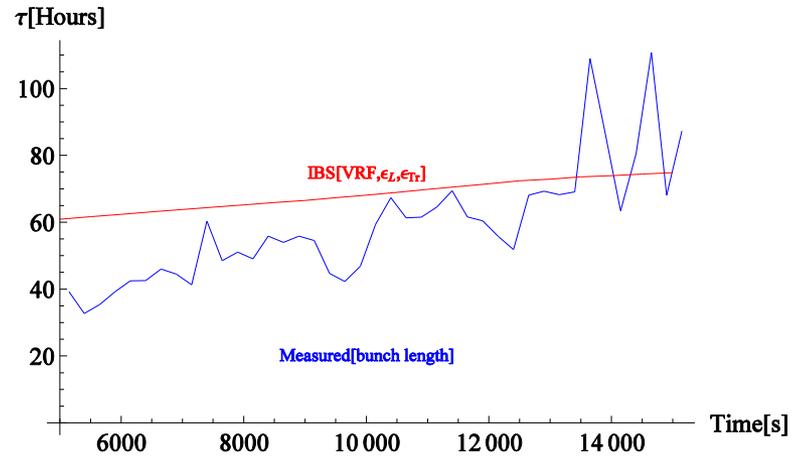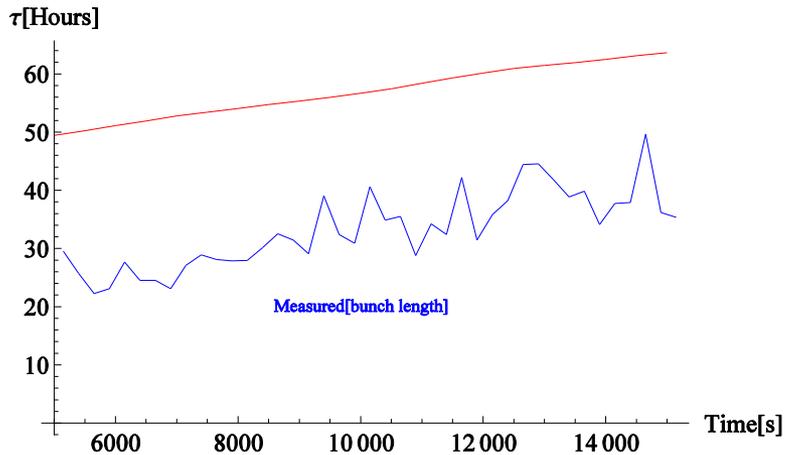
Time[s]
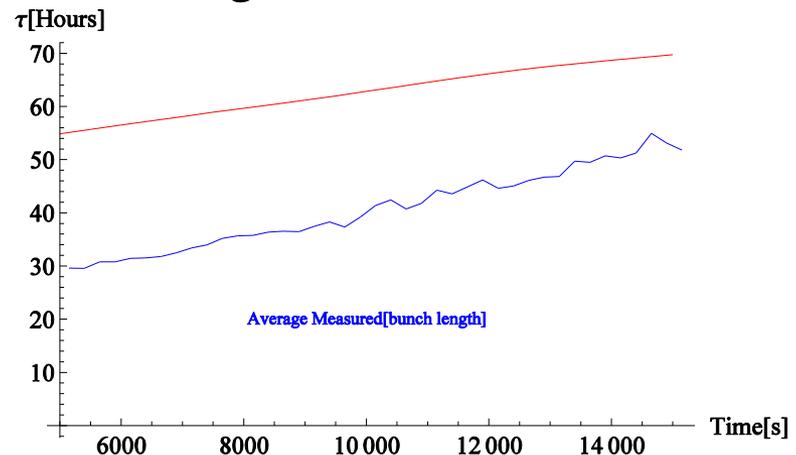
Fill 1366 : Intensity
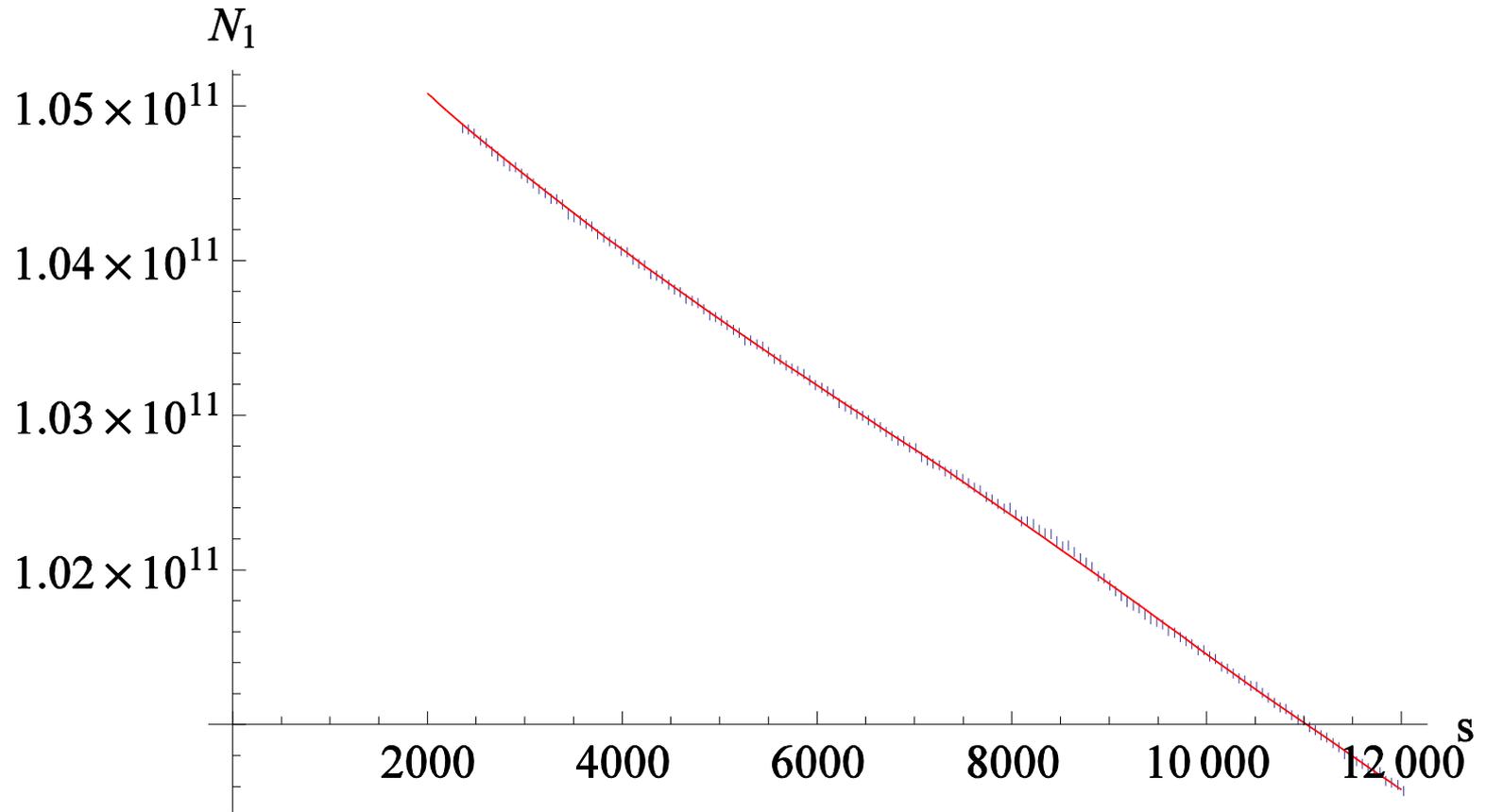
Fill 1366: luminosity
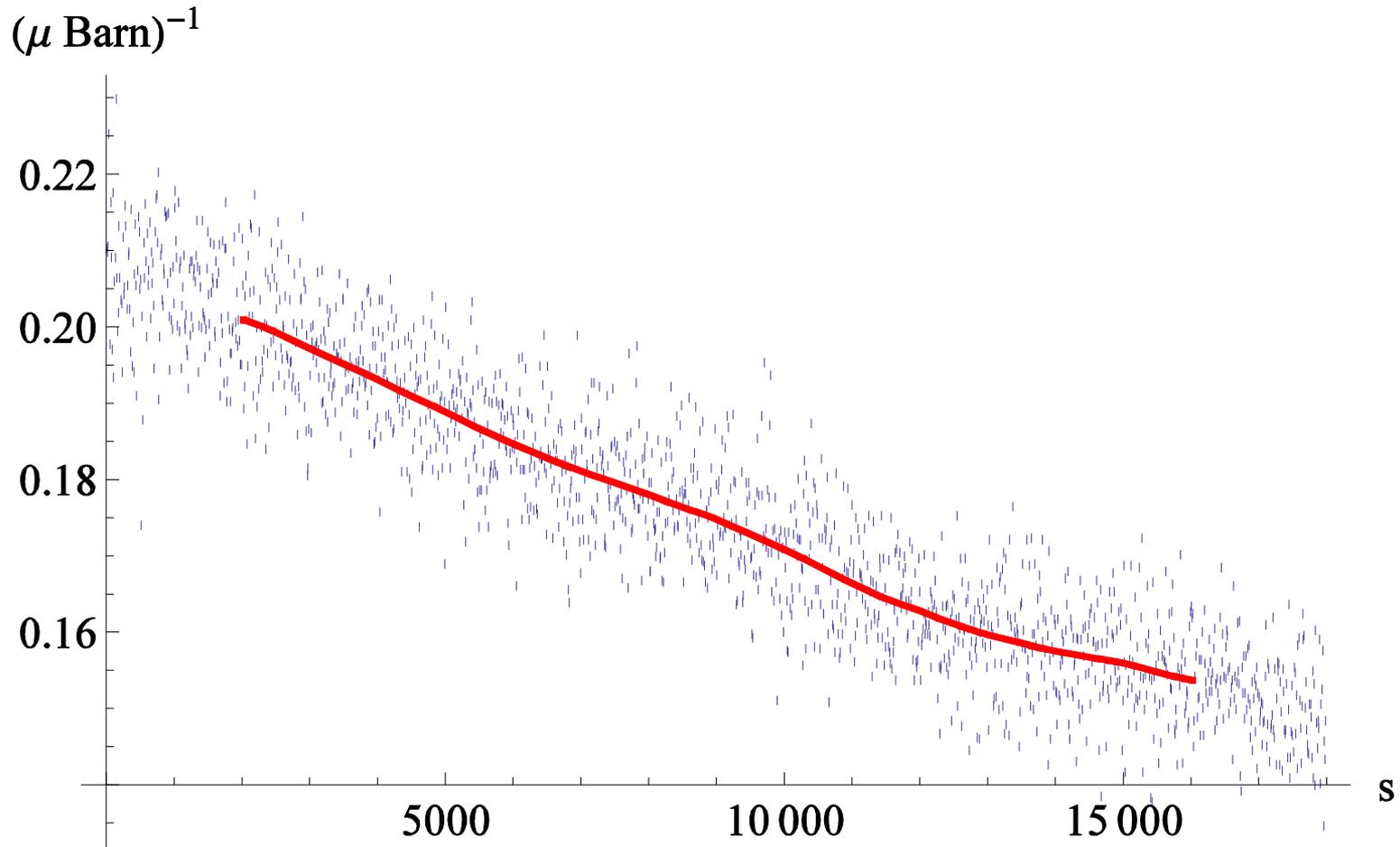
Fill 1366: Transverse

Fill 1366 Bunch 1
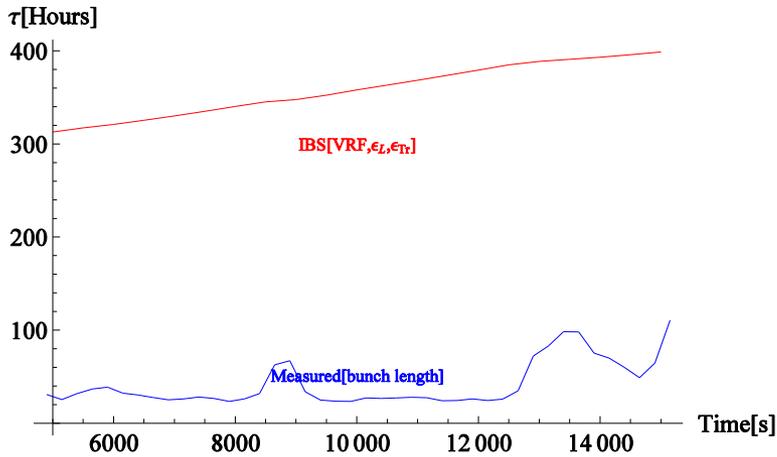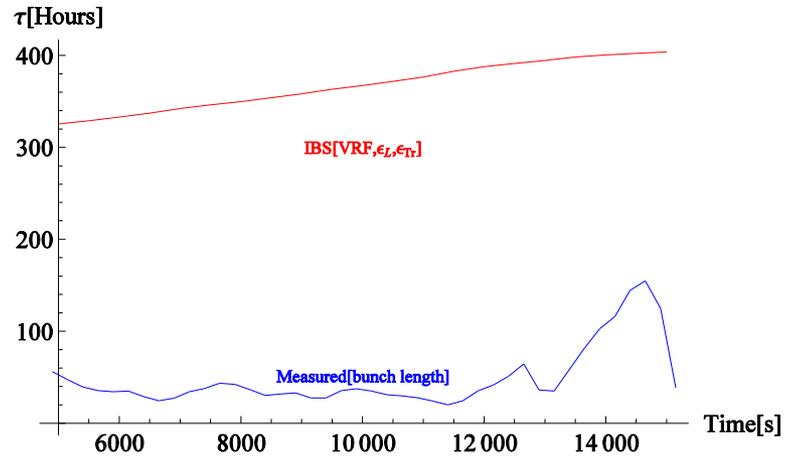
τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1366 Bunch 5

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1366 Bunch 15

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Average over all bunches

τ[Hours]

Average IBS[VRF,ϵ_L,ϵ_{Tr}]

Average Measured[bunch length]

Time[s]
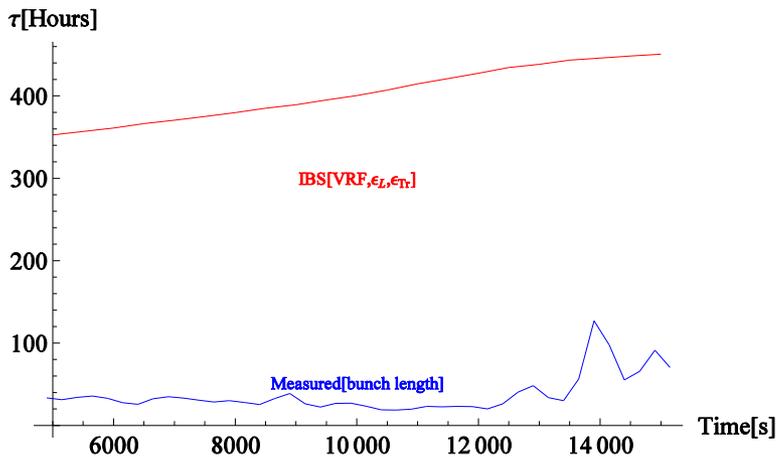
# Fill 1366 : longitudinal emittance
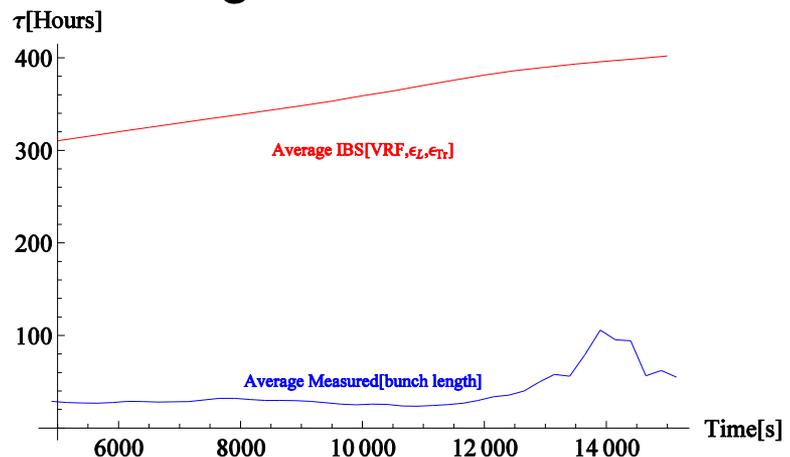
Longitudinal emittances[Time]
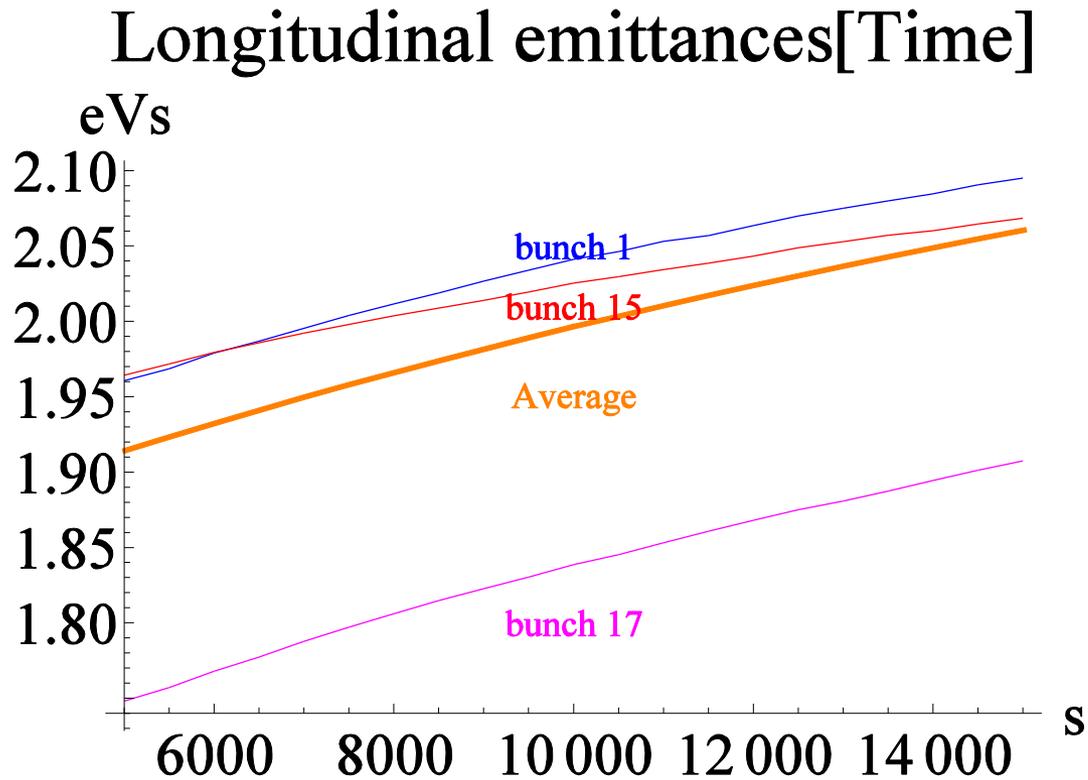
# Fill 1366: transverse emittance

Transverse emittances[Time]
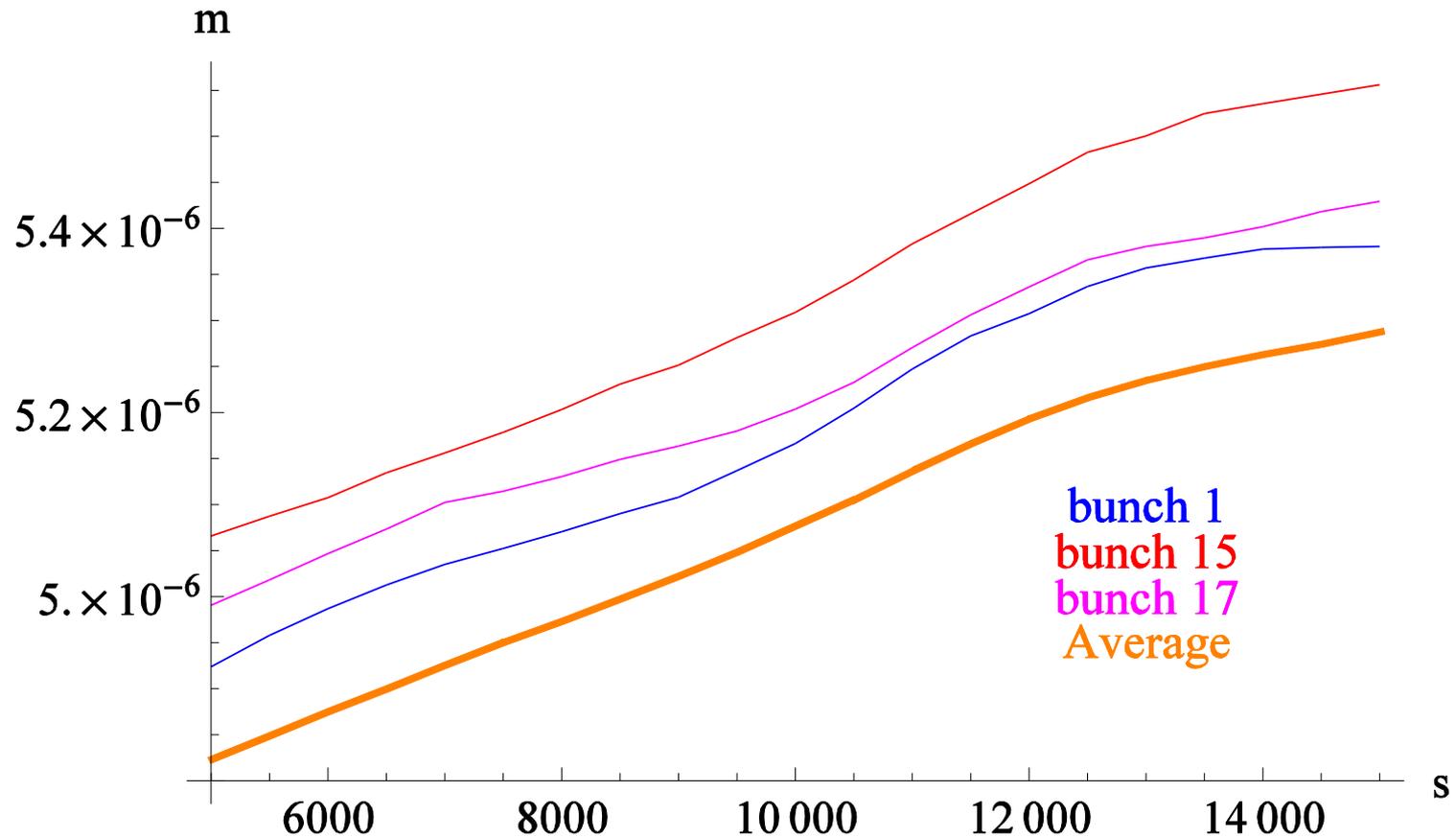
Fill 1375: Bunch length
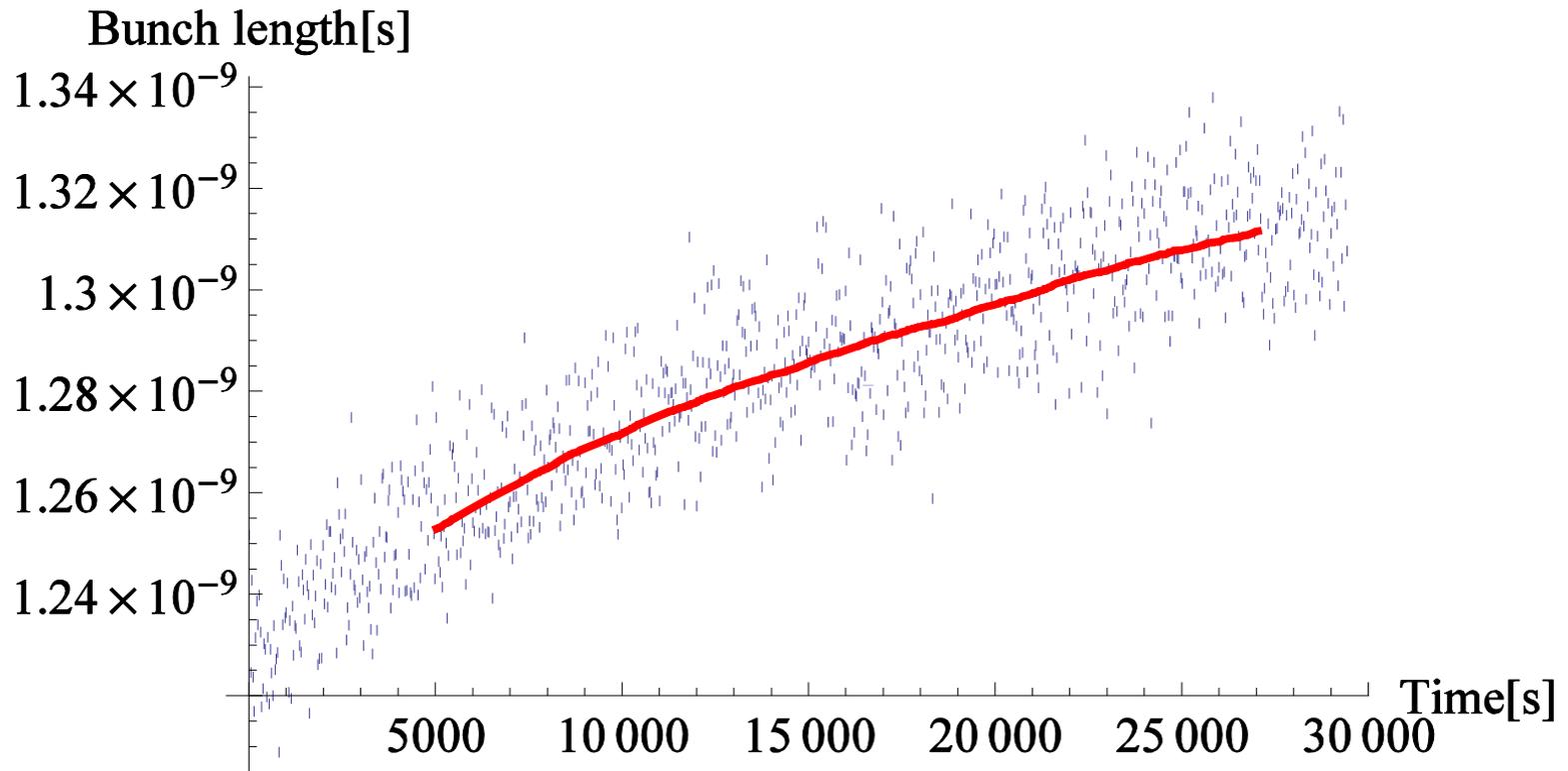
Fill 1375: Longitudinal

Fill 1375 Bunch 1

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1375 Bunch 15

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1375 Bunch 17

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Average over all bunches

τ[Hours]

Average IBS[VRF,ϵ_L,ϵ_{Tr}]

Average Measured[bunch length]
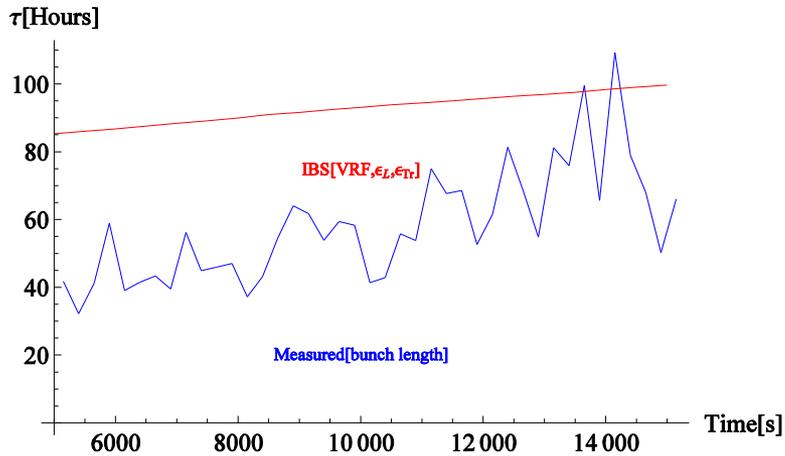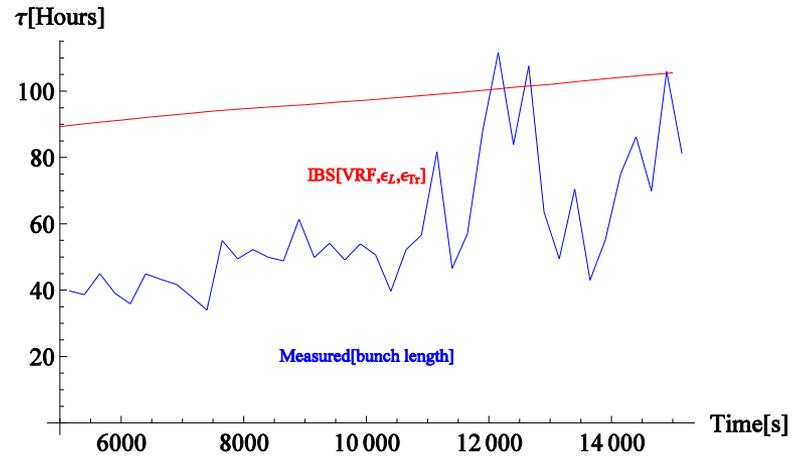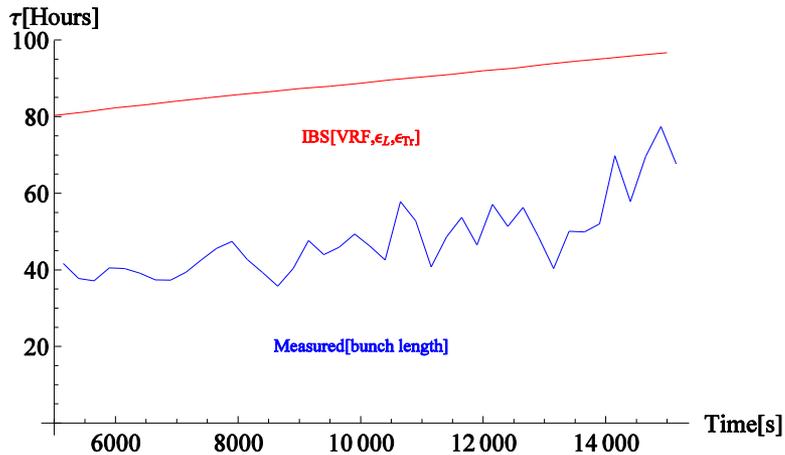
Time[s]
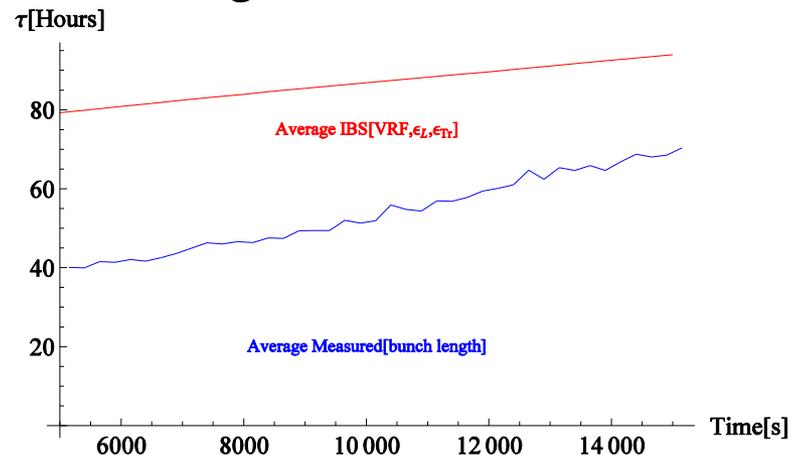
Fill 1375: Intensity
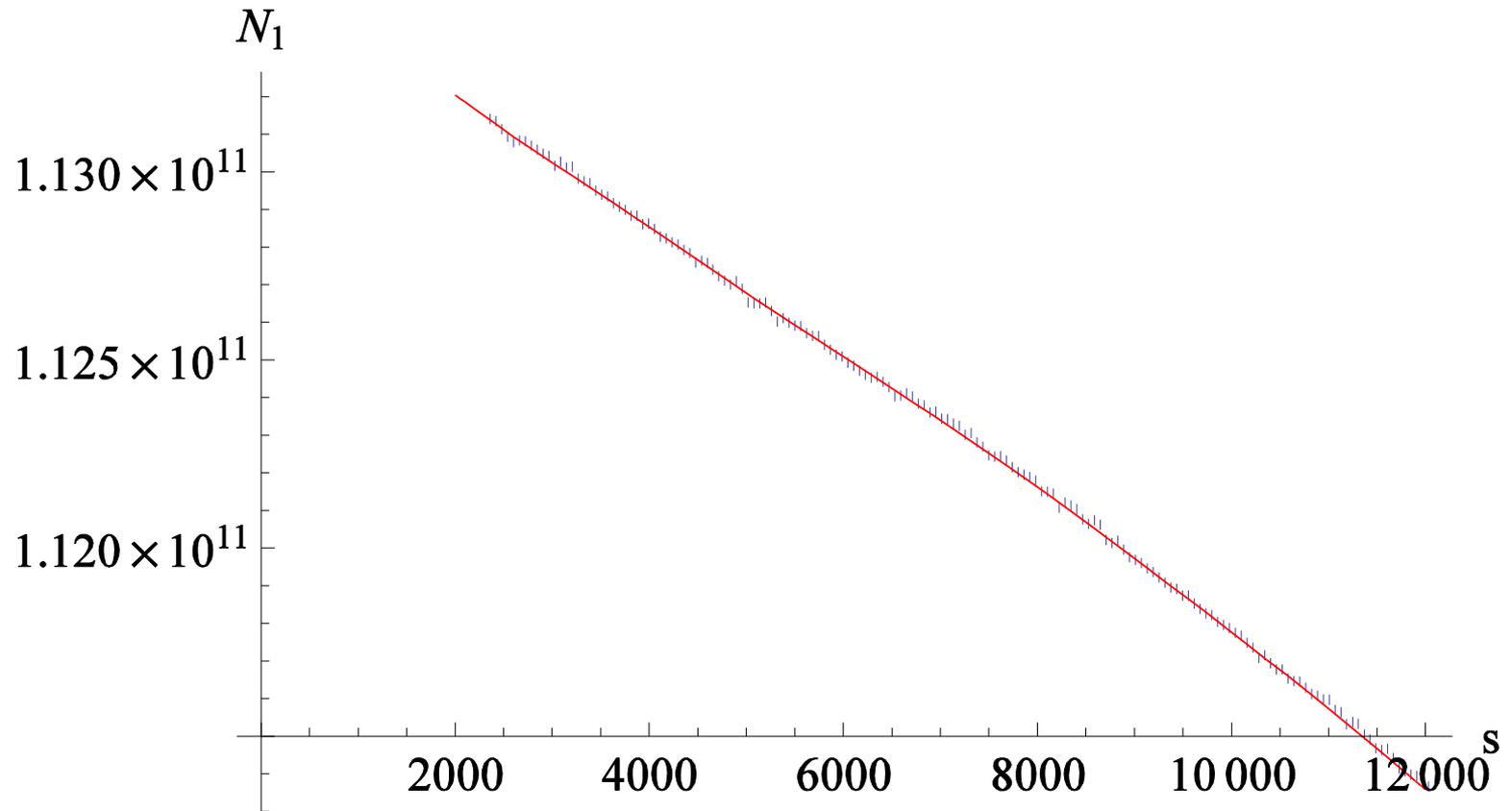
Fill 1375: luminosity
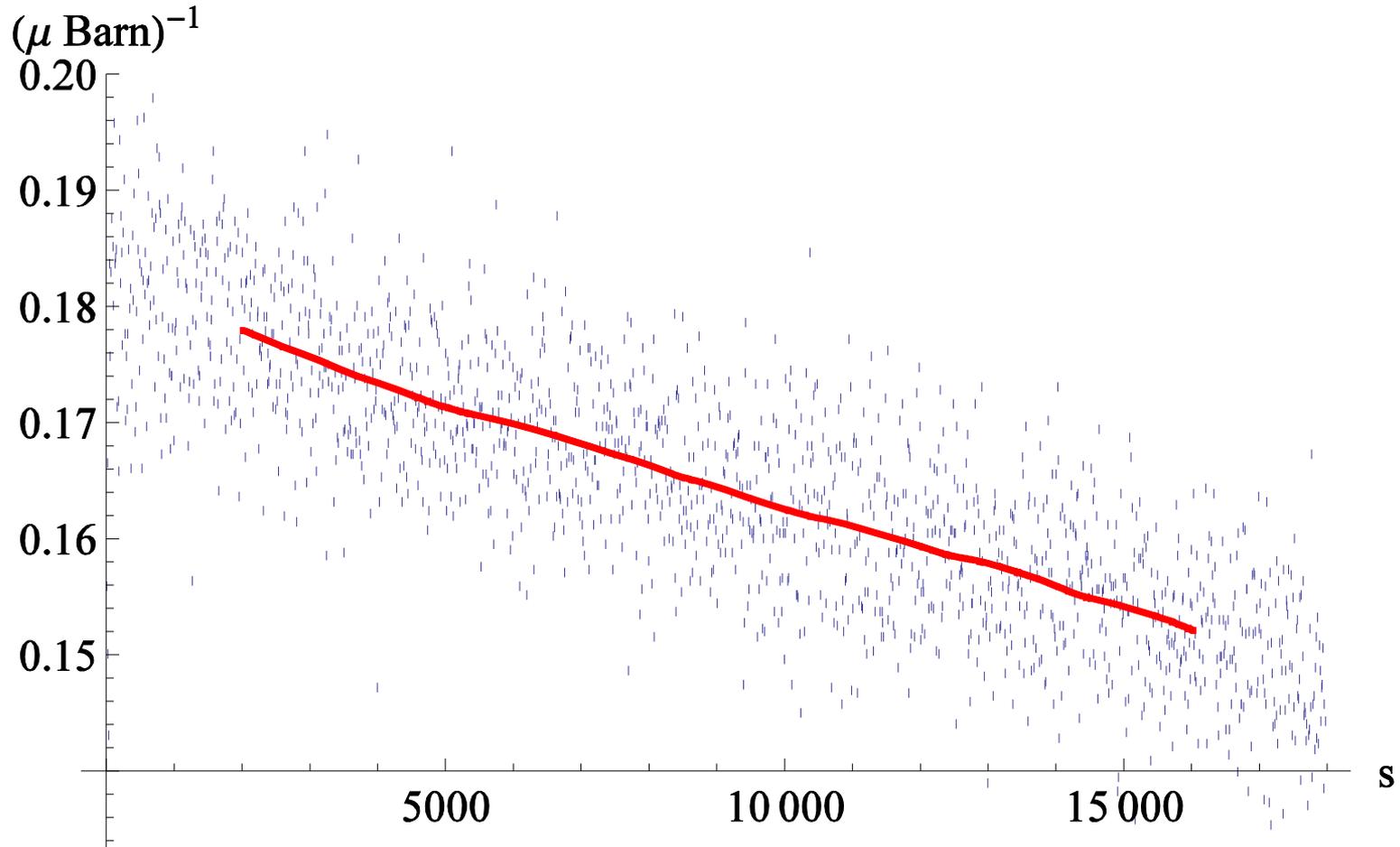
Fill 1375: Transverse

Fill 1375 Bunch 1
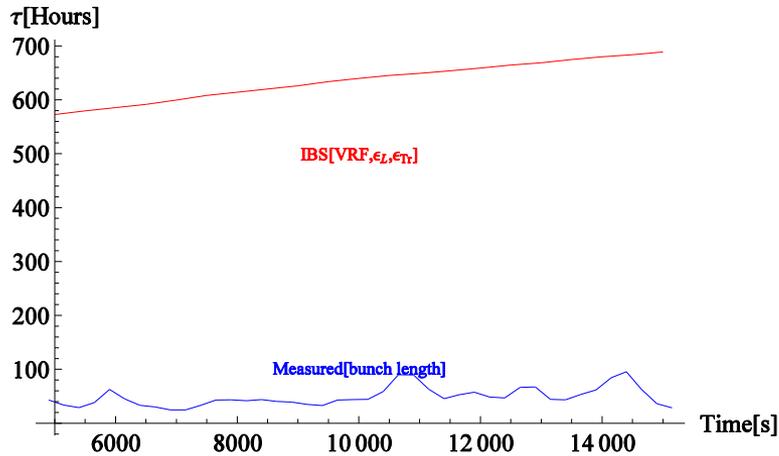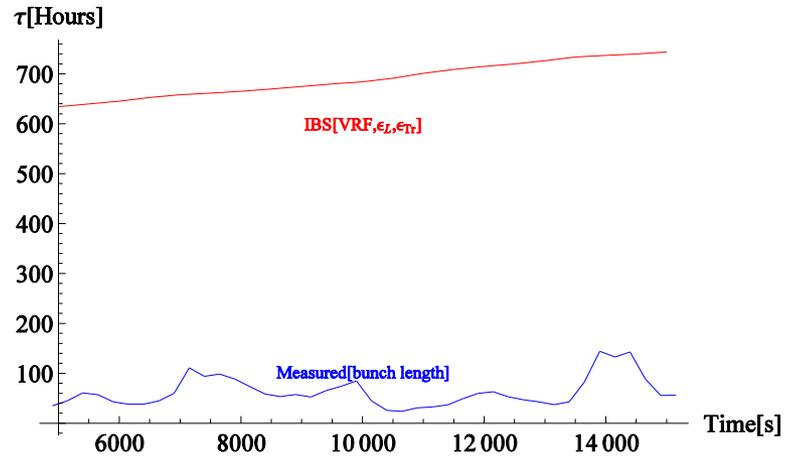
τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

## Fill 1375 Bunch 5

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1375 Bunch 15

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Average over all bunches

τ[Hours]

Average IBS[VRF,ϵ_L,ϵ_{Tr}]

Average Measured[bunch length]

Time[s]
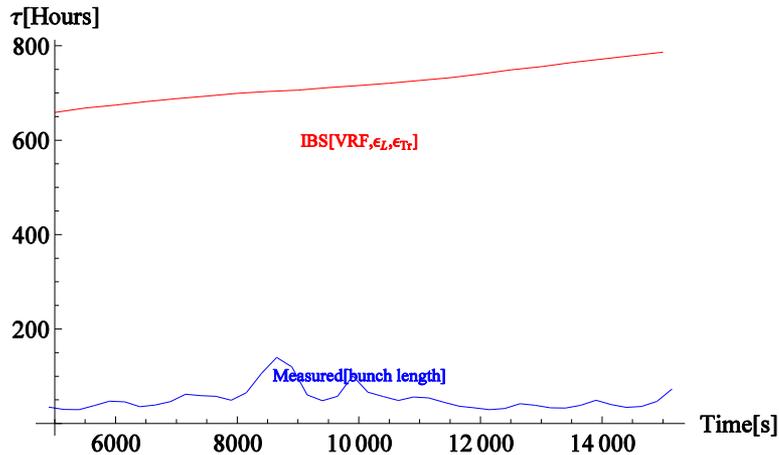
Fill 1375: longitudinal emittance
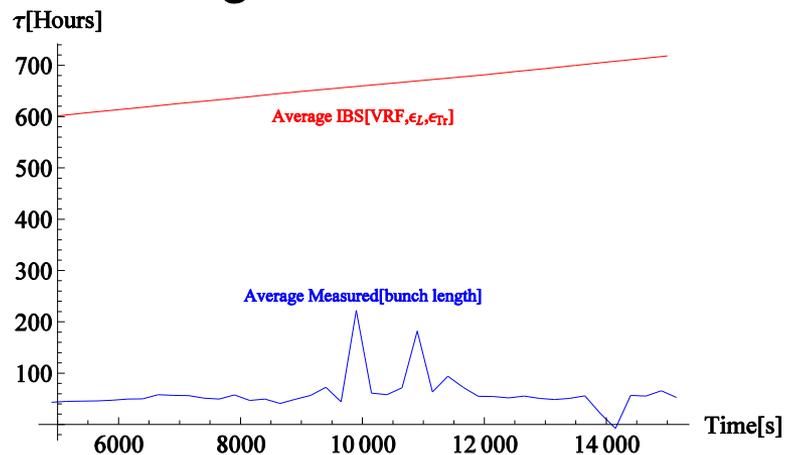

Longitudinal emittances[Time]
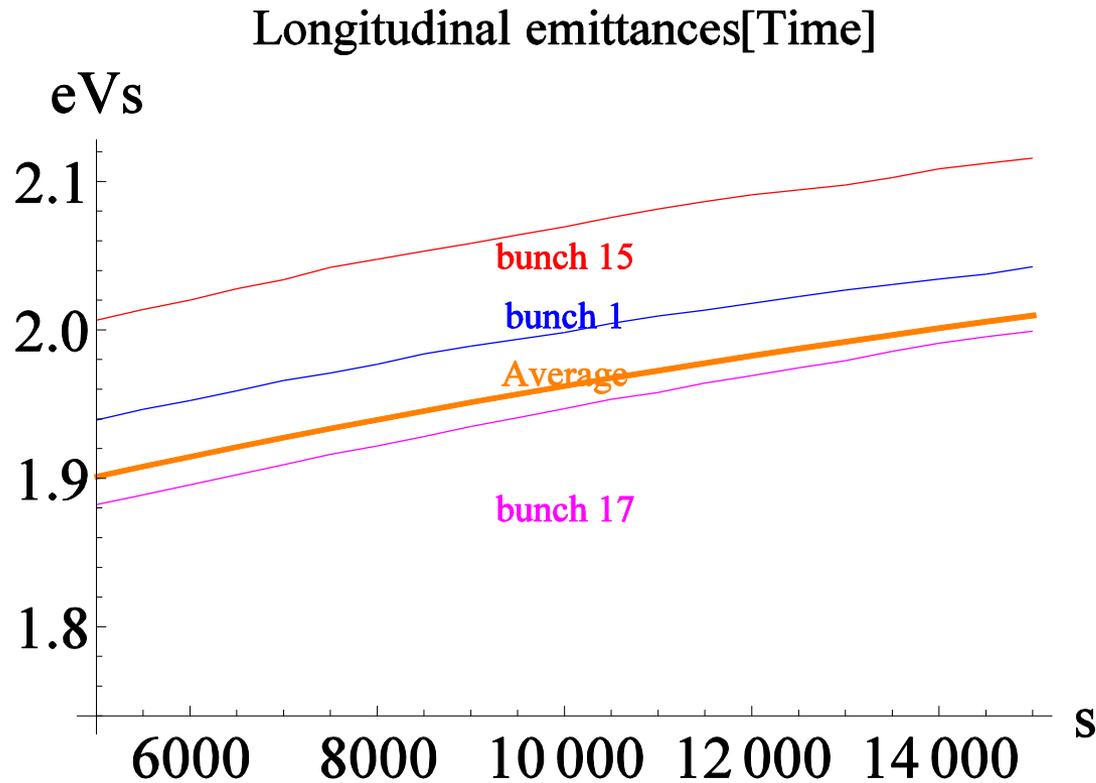
Fill 1375: transverse emittance

Transverse emittances[Time]
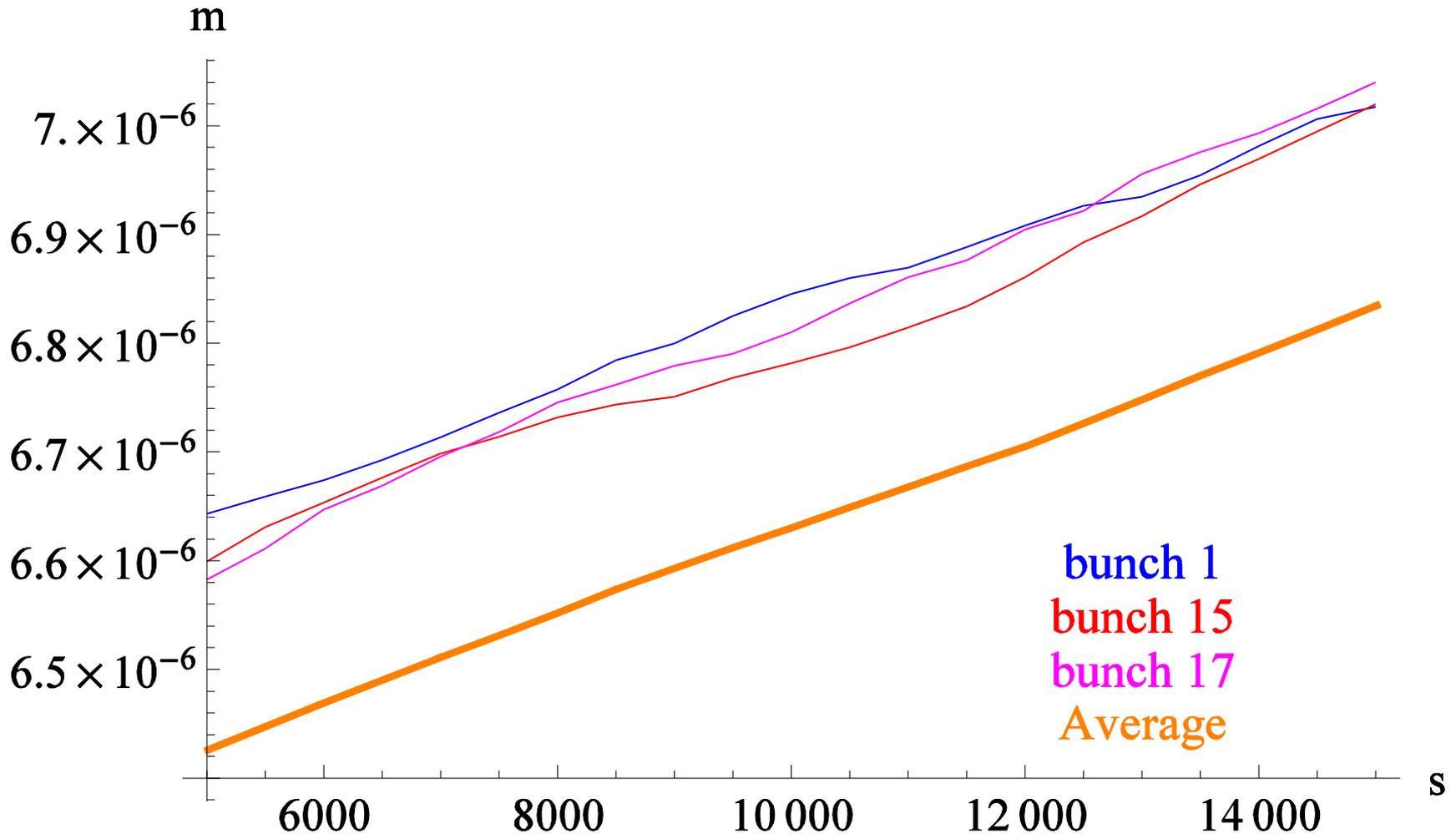
Fill 1400: Bunch length
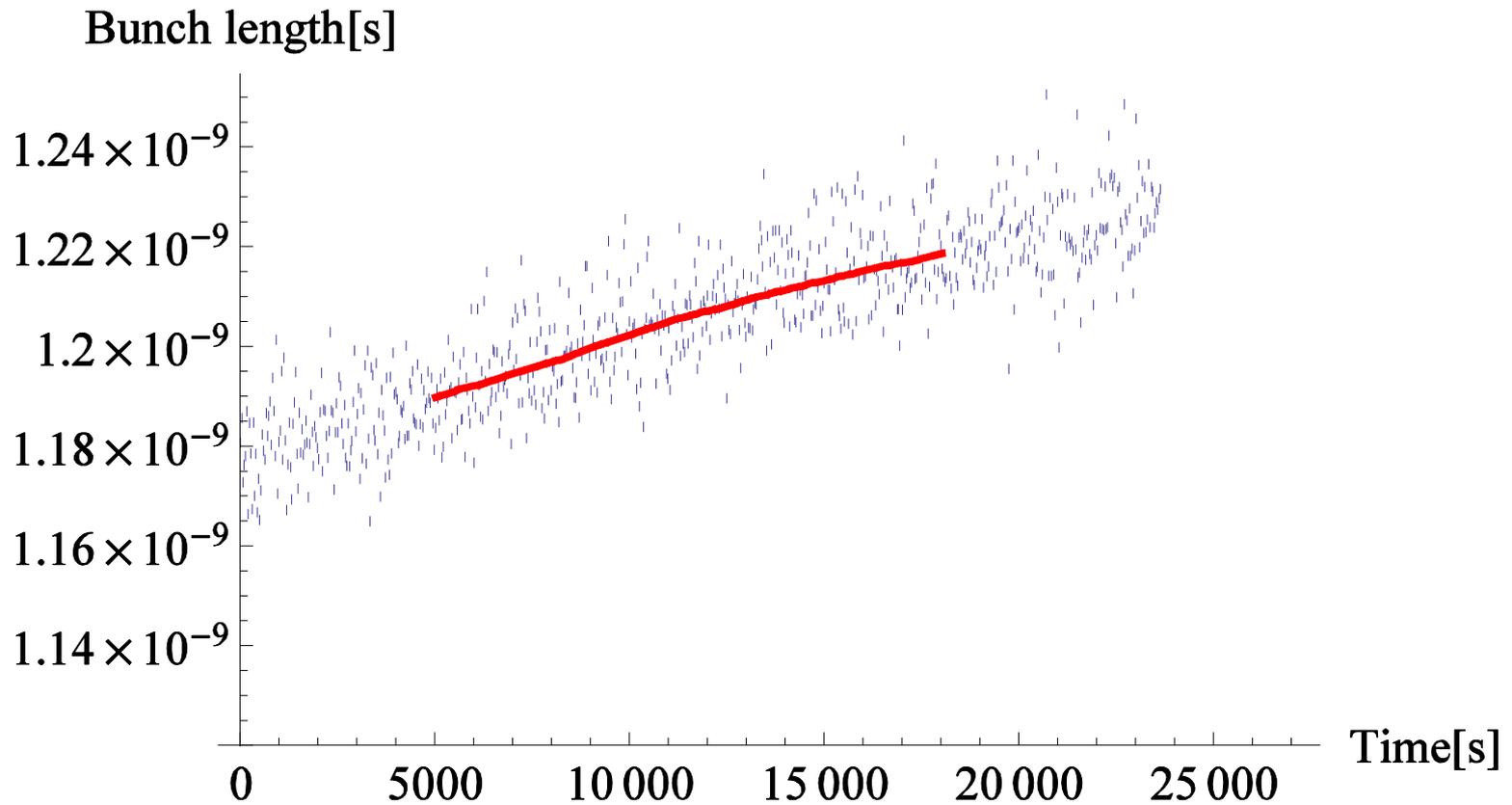
Fill 1400: Longitudinal

Fill 1400 Bunch 1

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Fill 1400 Bunch 14

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Fill 1400 Bunch 17

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Average over all bunches

Average IBS[VRF,ϵ_L,ϵ_{Tr}]

Average Measured[bunch length]
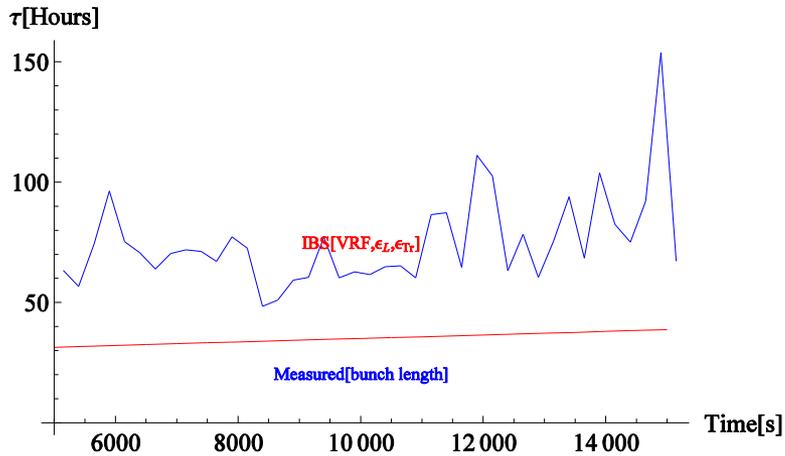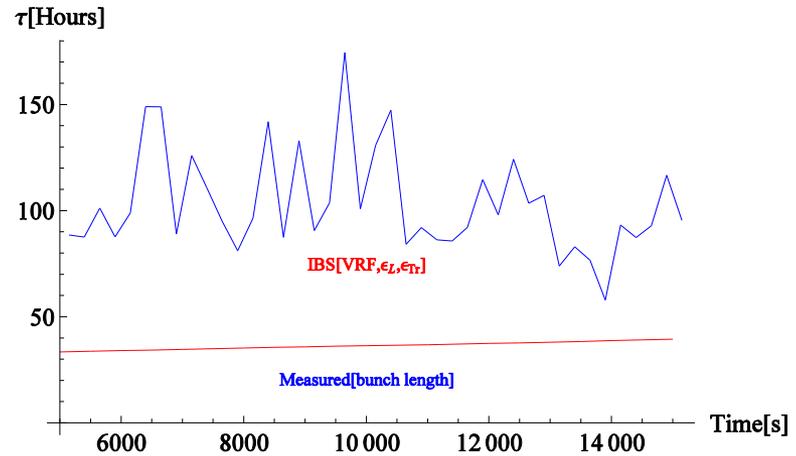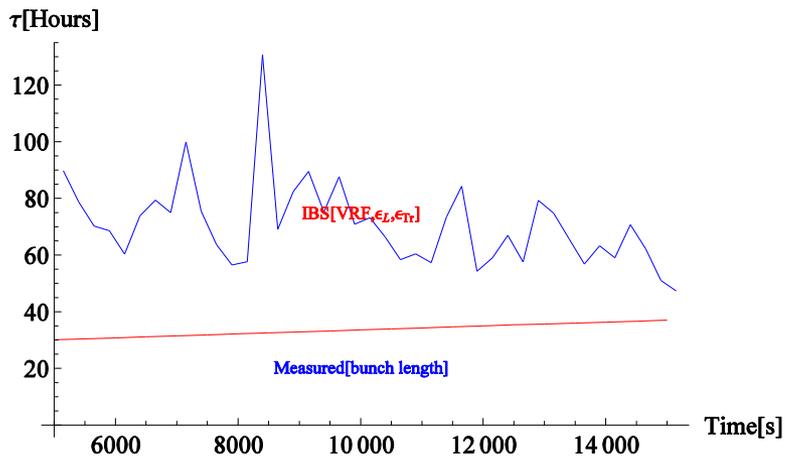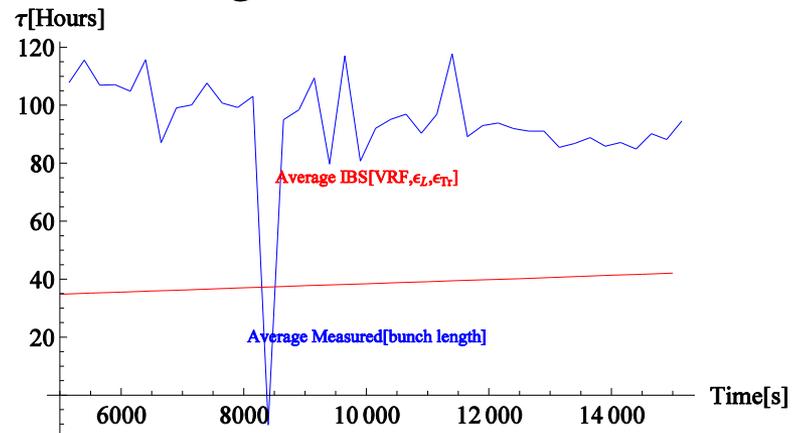
Fill 1400: Intensity
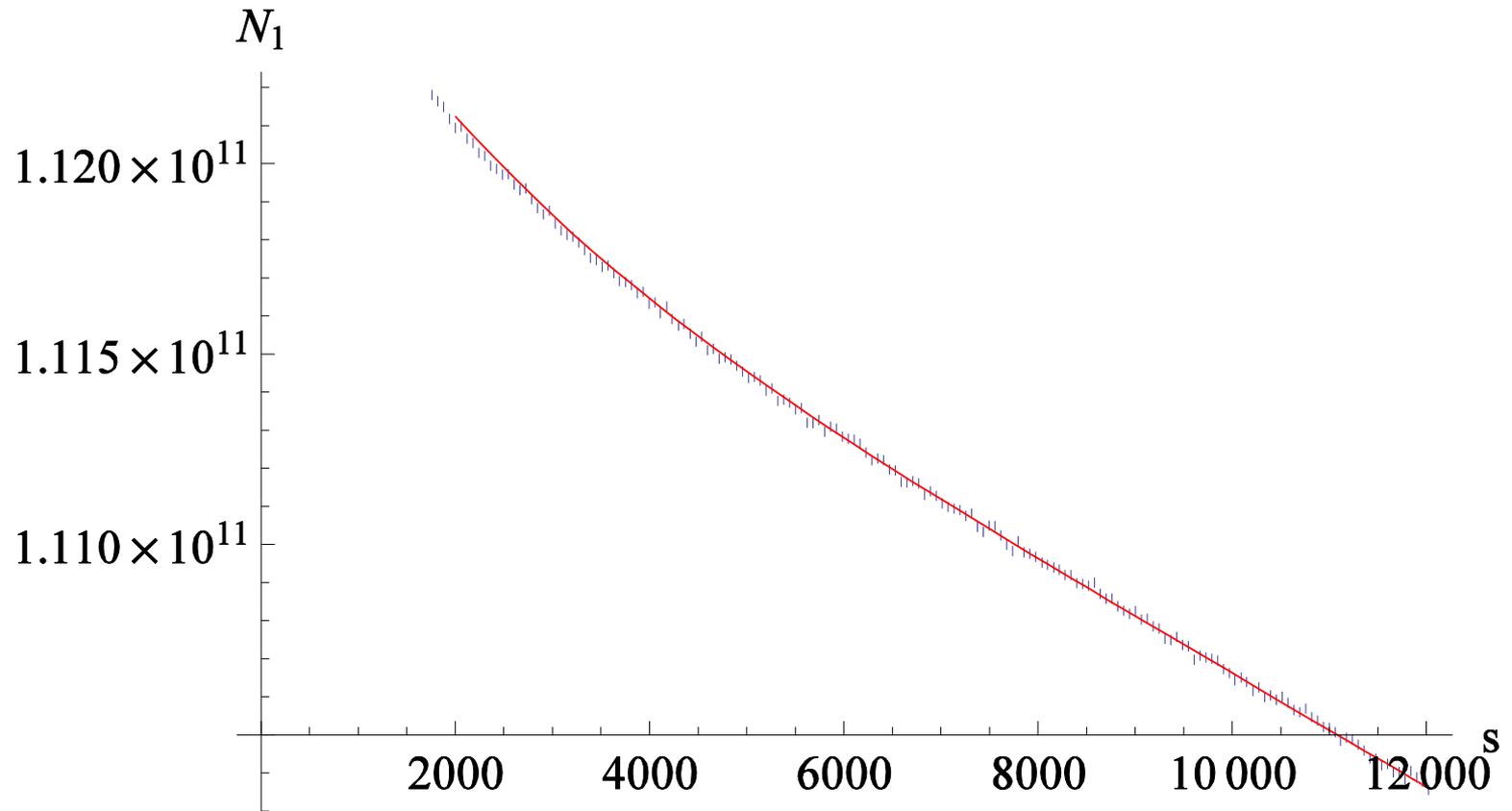
Fill 1400: luminosity
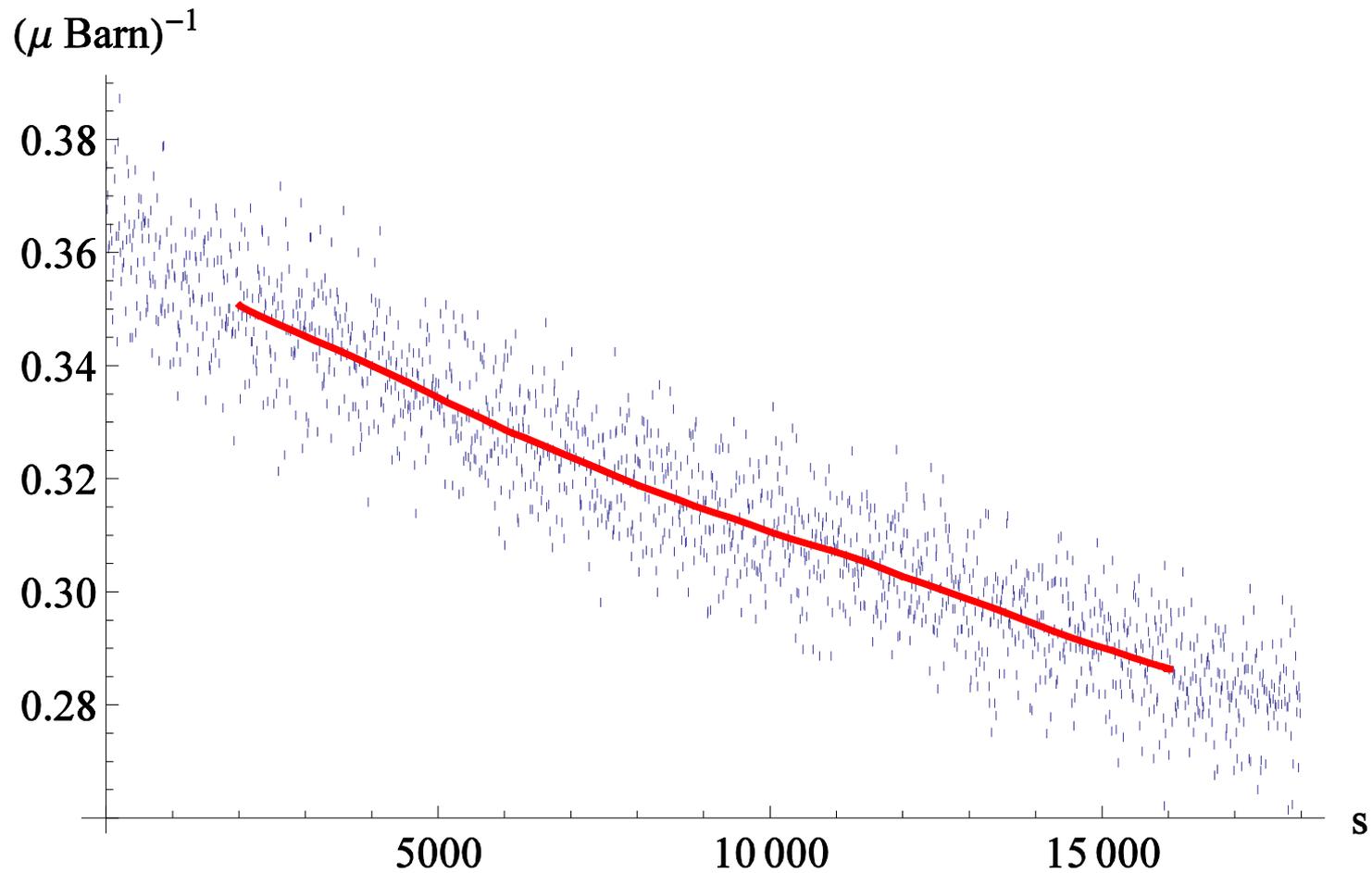
Fill 1400: Transverse

Fill 1400 Bunch 1
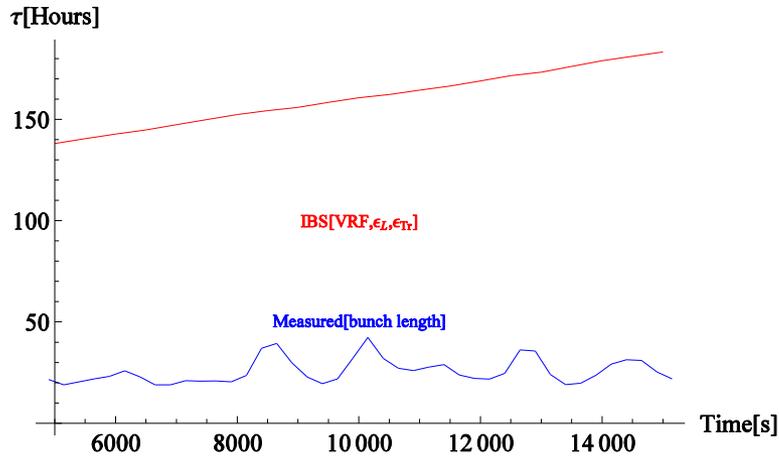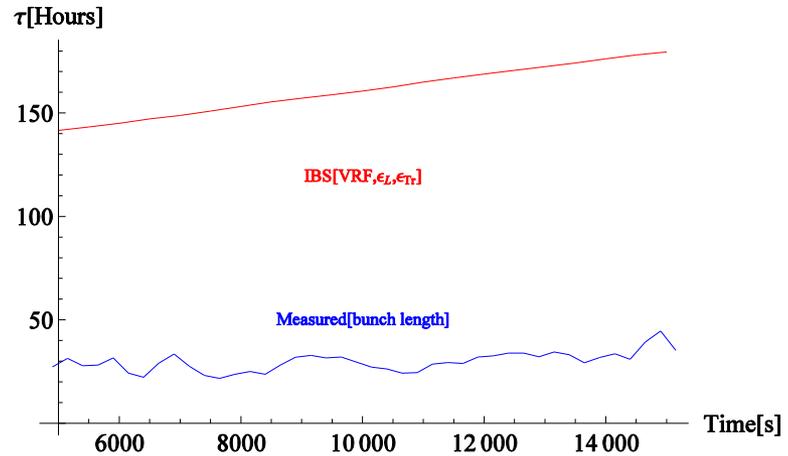
τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1400 Bunch 5

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Fill 1400 Bunch 14

τ[Hours]

IBS[VRF,ϵ_L,ϵ_{Tr}]

Measured[bunch length]

Time[s]

Average over all bunches

τ[Hours]

Average IBS[VRF,ϵ_L,ϵ_{Tr}]

Average Measured[bunch length]

Time[s]
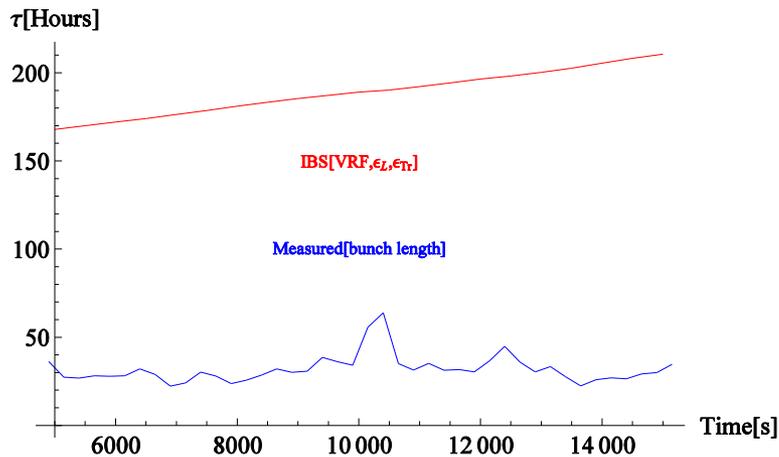
# Fill 1400: longitudinal emittance
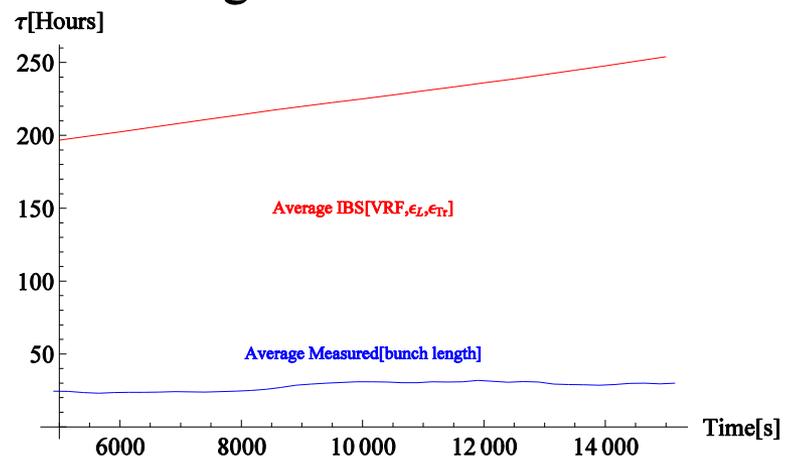
Longitudinal emittances[Time]
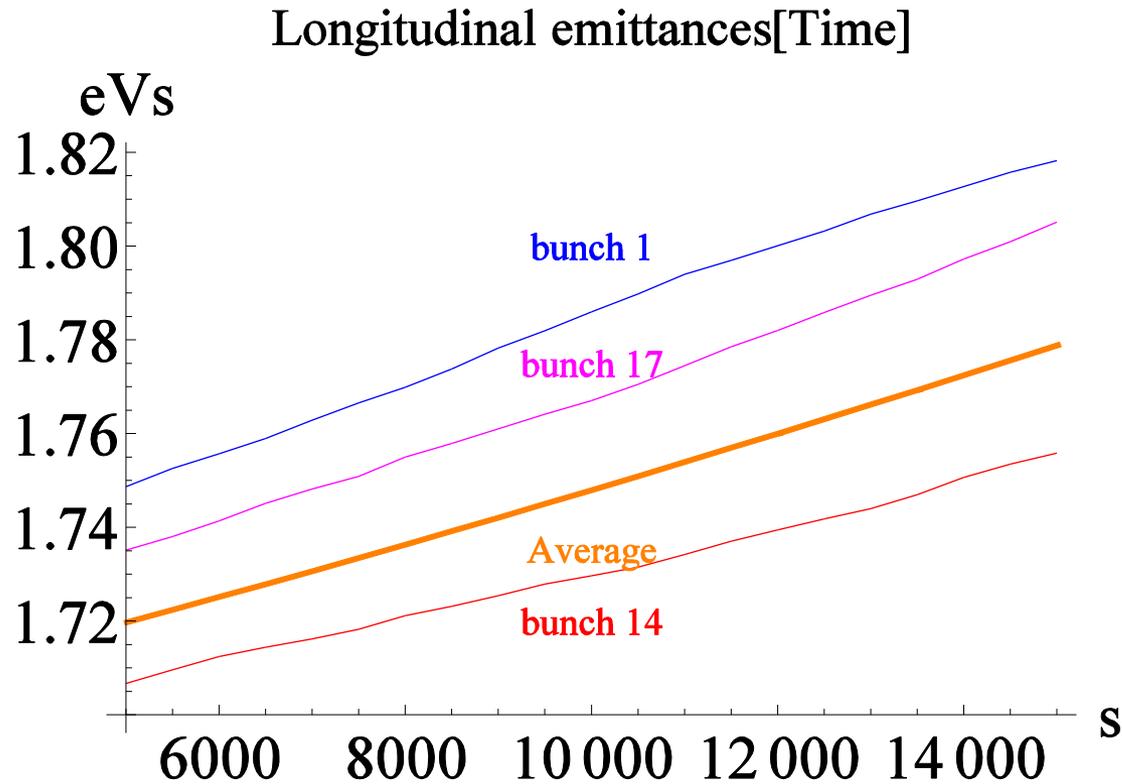
Fill 1400: transverse emittance

Transverse emittances[Time]
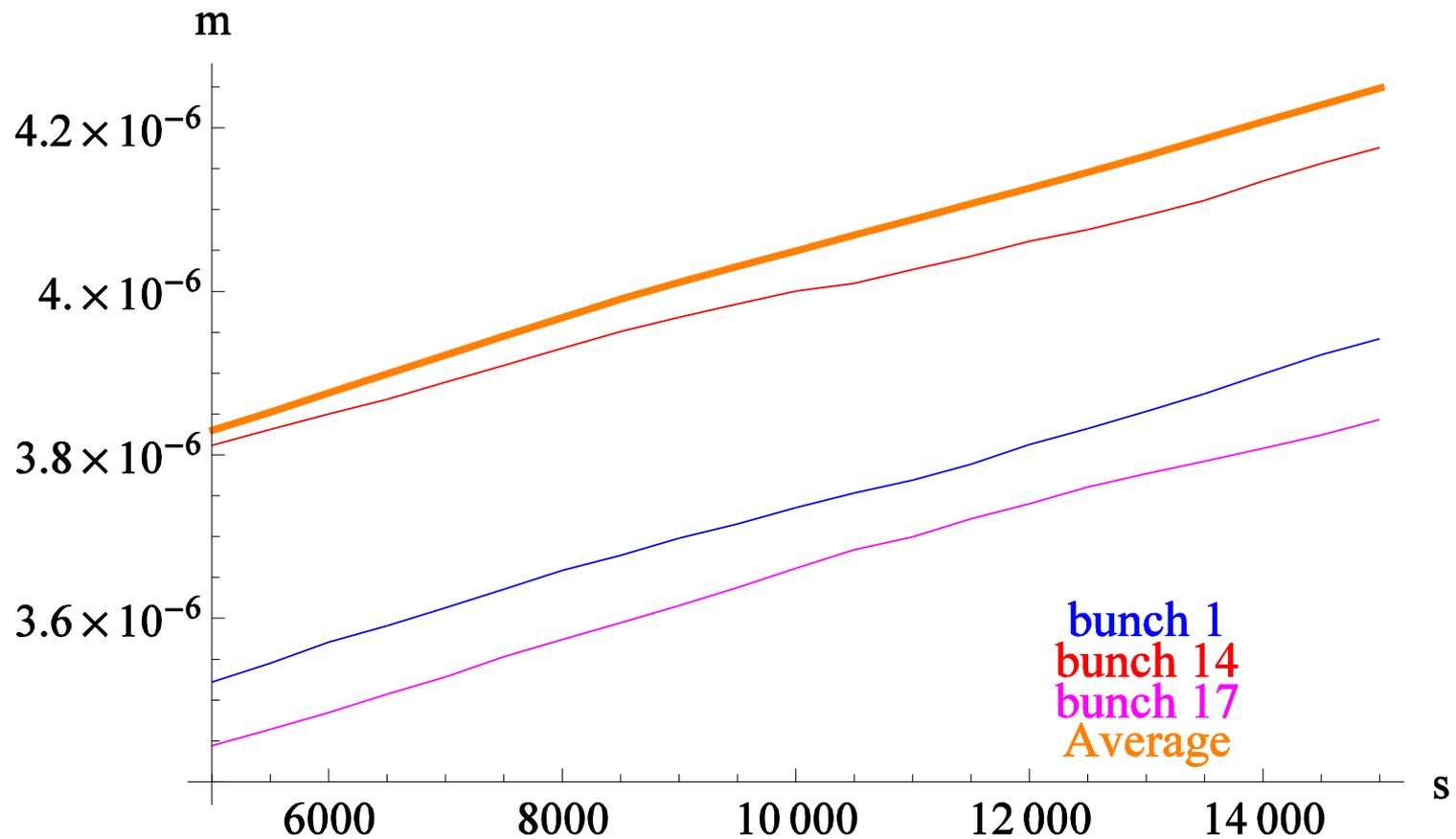
Extra

- Timber Variables
  - LHC.BCTFR.A6R4.B1:BUNCH_INTENSITY
  - LHC.BQM.B1:BUNCH_LENGTHS
  - LHC.BRANA.4L1:BUNCH_LUMINOSITY
  - ACSCA.UX45.L1B1:CAV_FIELD

Optics used in IBS calculation
  - G:\ Projects\ILHC\LHCOpticsSyncCopy\V6.503