CW 2GeV Linac Error Simulations at 10 mA

80 parameters scanned / "New TRACK"

Jean-Paul Carneiro

March 23, 2010

ALIGN Parameter TRACKv39

n ALIGN name δ_{xy} δ_z ϕ_z $\delta\phi_{dyn.}$ $\delta F_{dyn.}$ $\delta\phi_{static}$ δF_{static}

- From RFQ exit to end of the CW 2 GeV linac ($\sim$400 meters)
- 80 errors simulated with TRACKv39
- Each error simulated with 100 runs with 3D SC (10 mA)
- 80$\times$100=8000 runs with TRACKv39 on FermiGrid

Parameters 01-20

- 01/ Solenoids $\delta_{xy} = 150\ \mu m$
- 02/ Solenoids $\delta_{xy} = 300\ \mu m$
- 03/ Solenoids $\delta_{xy} = 500\ \mu m$
- 04/ Solenoids $\delta_{xy} = 750\ \mu m$
- 05/ Solenoids $\delta_{xy} = 1000\ \mu m$

- 06/ Solenoids $\delta_z = 150\ \mu m$
- 07/ Solenoids $\delta_z = 300\ \mu m$
- 08/ Solenoids $\delta_z = 500\ \mu m$
- 09/ Solenoids $\delta_z = 750\ \mu m$
- 10/ Solenoids $\delta_z = 1000\ \mu m$

- 11/ Sol. Field $\delta F_{dynamic} = 0.5\ \%$
- 12/ Sol. Field $\delta F_{dynamic} = 1.0\ \%$
- 13/ Sol. Field $\delta F_{dynamic} = 1.5\ \%$
- 14/ Sol. Field $\delta F_{dynamic} = 2.0\ \%$
- 15/ Sol. Field $\delta F_{dynamic} = 2.5\ \%$

- 16/ Sol. Field $\delta F_{static} = 0.5\ \%$
- 17/ Sol. Field $\delta F_{static} = 1.0\ \%$
- 18/ Sol. Field $\delta F_{static} = 1.5\ \%$
- 19/ Sol. Field $\delta F_{static} = 2.0\ \%$
- 20/ Sol. Field $\delta F_{static} = 2.5\ \%$

Parameters 21-40

- 21/ Quads $\delta_{xy} = 150\ \mu m$
- 22/ Quads $\delta_{xy} = 300\ \mu m$
- 23/ Quads $\delta_{xy} = 500\ \mu m$
- 24/ Quads $\delta_{xy} = 750\ \mu m$
- 25/ Quads $\delta_{xy} = 1000\ \mu m$

- 26/ Quads $\delta_z = 150\ \mu m$
- 27/ Quads $\delta_z = 300\ \mu m$
- 28/ Quads $\delta_z = 500\ \mu m$
- 29/ Quads $\delta_z = 750\ \mu m$
- 30/ Quads $\delta_z = 1000\ \mu m$

- 31/ Quads $\phi_z = 1$ mrad
- 32/ Quads $\phi_z = 2$ mrad
- 33/ Quads $\phi_z = 5$ mrad
- 34/ Quads $\phi_z = 7$ mrad
- 35/ Quads $\phi_z = 10$ mrad

- 36/ Quads Field $\delta F_{dynamic} = 0.5\ \%$
- 37/ Quads Field $\delta F_{dynamic} = 1.0\ \%$
- 38/ Quads Field $\delta F_{dynamic} = 1.5\ \%$
- 39/ Quads Field $\delta F_{dynamic} = 2.0\ \%$
- 40/ Quads Field $\delta F_{dynamic} = 2.5\ \%$

Parameters 41-60

- 41/ Quads Field $\delta F_{static} = 0.5$ %
- 42/ Quads Field $\delta F_{static} = 1.0$ %
- 43/ Quads Field $\delta F_{static} = 1.5$ %
- 44/ Quads Field $\delta F_{static} = 2.0$ %
- 45/ Quads Field $\delta F_{static} = 2.5$ %

- 46/ Cav. $\delta_{xy} = 150$ μm
- 47/ Cav. $\delta_{xy} = 300$ μm
- 48/ Cav. $\delta_{xy} = 500$ μm
- 49/ Cav. $\delta_{xy} = 750$ μm
- 50/ Cav. $\delta_{xy} = 1000$ μm

- 51/ Cav. $\delta_z = 150$ μm
- 52/ Cav. $\delta_z = 300$ μm
- 53/ Cav. $\delta_z = 500$ μm
- 54/ Cav. $\delta_z = 750$ μm
- 55/ Cav. $\delta_z = 1000$ μm

- 56/ Cav. $\phi_z = 1$ mrad
- 57/ Cav. $\phi_z = 2$ mrad
- 58/ Cav. $\phi_z = 5$ mrad
- 59/ Cav. $\phi_z = 7$ mrad
- 60/ Cav. $\phi_z = 10$ mrad

Parameters 61-80

- 61/ Cav. Phase $\delta\phi_{dynamic} = 0.5°$
- 62/ Cav. Phase $\delta\phi_{dynamic} = 1.0°$
- 63/ Cav. Phase $\delta\phi_{dynamic} = 1.5°$
- 64/ Cav. Phase $\delta\phi_{dynamic} = 2.0°$
- 65/ Cav. Phase $\delta\phi_{dynamic} = 2.5°$

- 66/ Cav. Field $\delta F_{dynamic} = 0.5$ %
- 67/ Cav. Field $\delta F_{dynamic} = 1.0$ %
- 68/ Cav. Field $\delta F_{dynamic} = 1.5$ %
- 69/ Cav. Field $\delta F_{dynamic} = 2.0$ %
- 70/ Cav. Field $\delta F_{dynamic} = 2.5$ %

- 71/ Cav. Phase $\delta\phi_{static} = 0.5°$
- 72/ Cav. Phase $\delta\phi_{static} = 1.0°$
- 73/ Cav. Phase $\delta\phi_{static} = 1.5°$
- 74/ Cav. Phase $\delta\phi_{static} = 2.0°$
- 75/ Cav. Phase $\delta\phi_{static} = 2.5°$

- 76/ Cav. Field $\delta F_{static} = 0.5$ %
- 77/ Cav. Field $\delta F_{static} = 1.0$ %
- 78/ Cav. Field $\delta F_{static} = 1.5$ %
- 79/ Cav. Field $\delta F_{static} = 2.0$ %
- 80/ Cav. Field $\delta F_{static} = 2.5$ %

(181) Solenoids $\delta_{xy} = 150\ \mu$m

Figure: RMS Emittance X

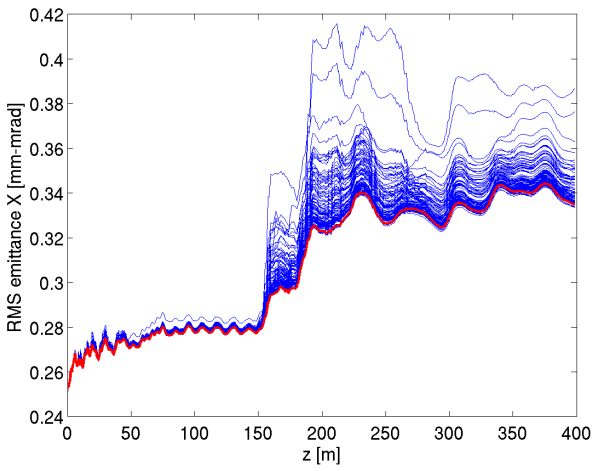


Figure: RMS Emittance Y

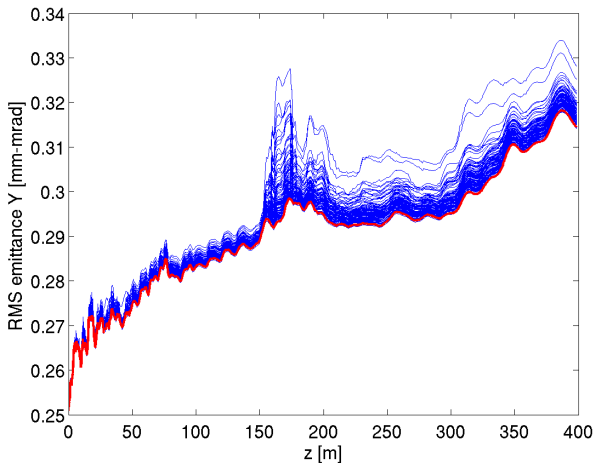


Figure: RMS Emittance Z

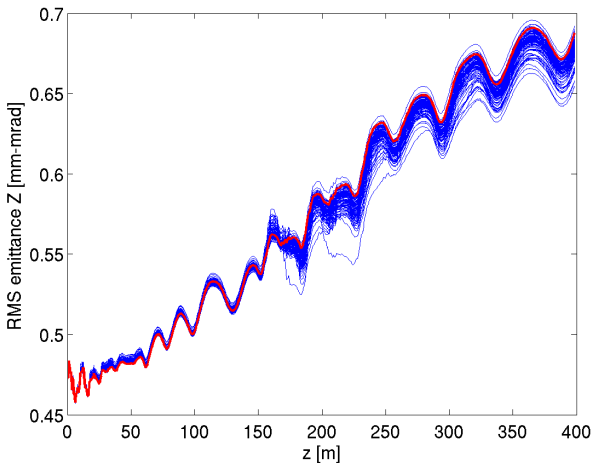
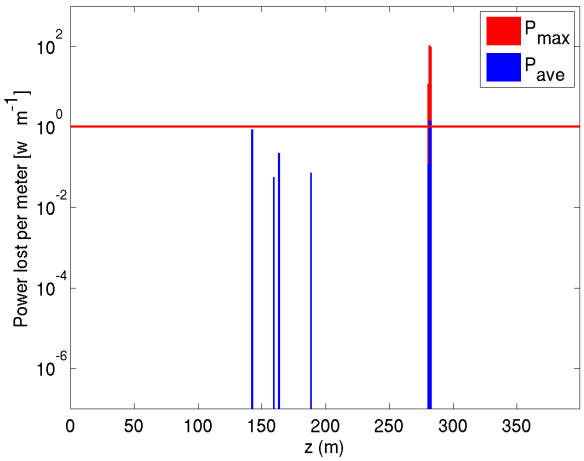


Figure: Losses [W·m^{-1}]



(182) Solenoids $\delta_{xy} = 300\ \mu$m

Figure: RMS Emittance X

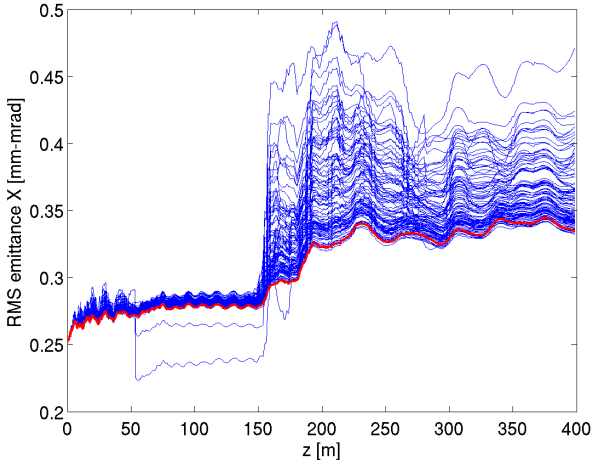


Figure: RMS Emittance Y

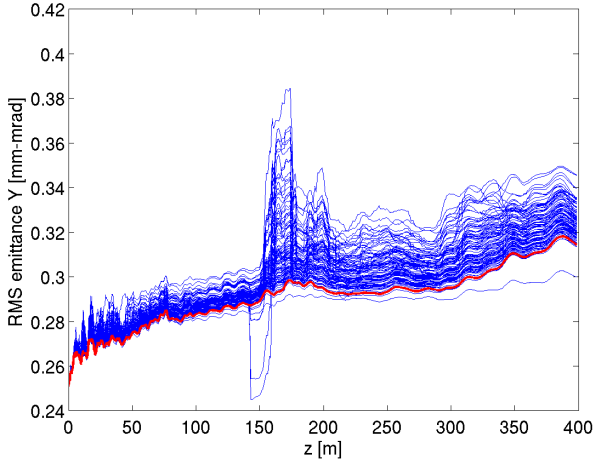


Figure: RMS Emittance Z

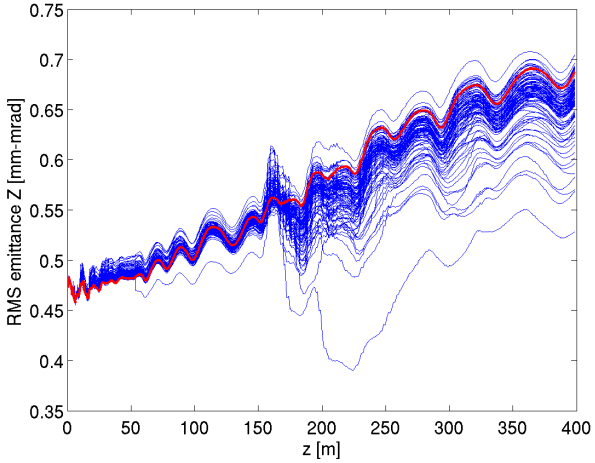
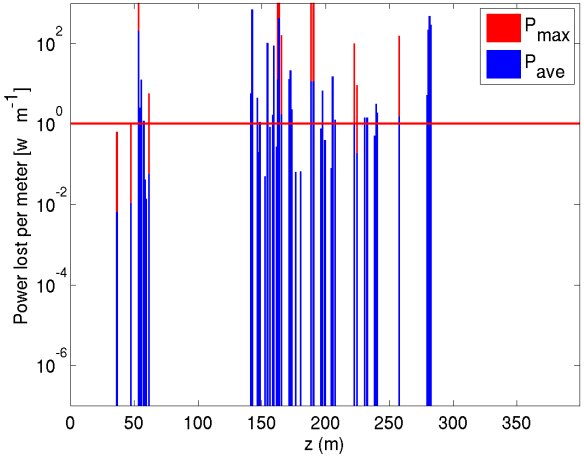


Figure: Losses [W·m^{-1}]



(183) Solenoids $\delta_{xy} = 500\ \mu$m

Figure: RMS Emittance X

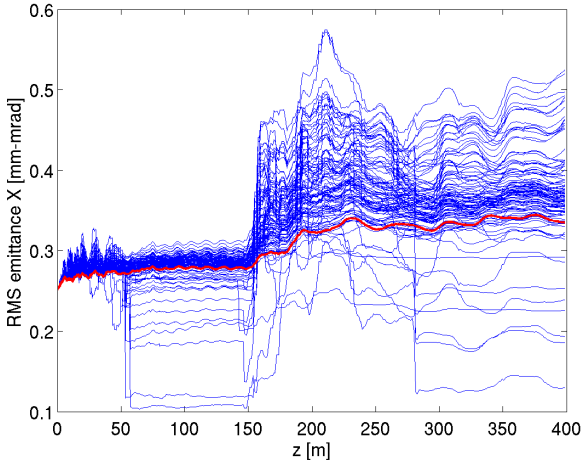


Figure: RMS Emittance Y

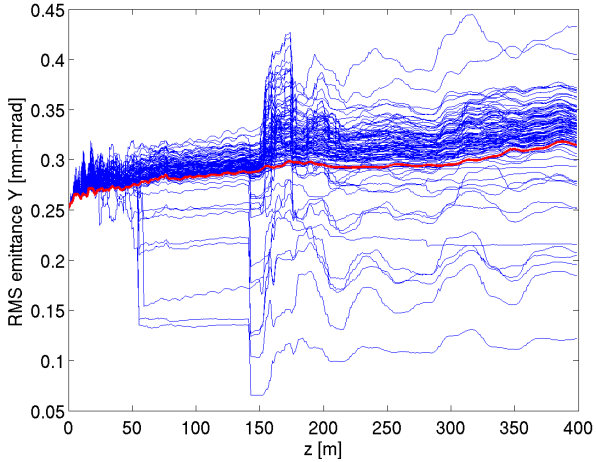


Figure: RMS Emittance Z

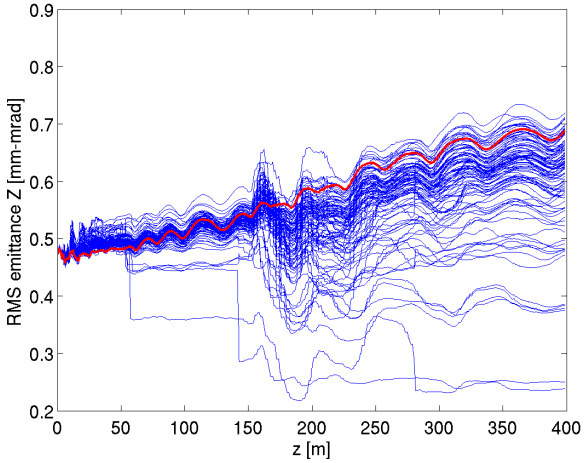
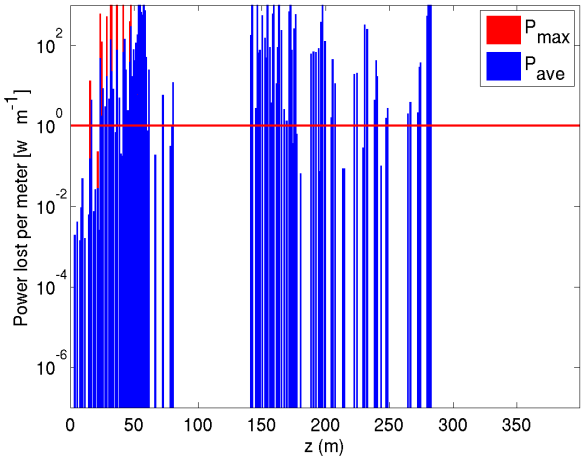


Figure: Losses [W·m^{-1}]



(184) Solenoids $\delta_{xy} = 750\ \mu$m

Figure: RMS Emittance X

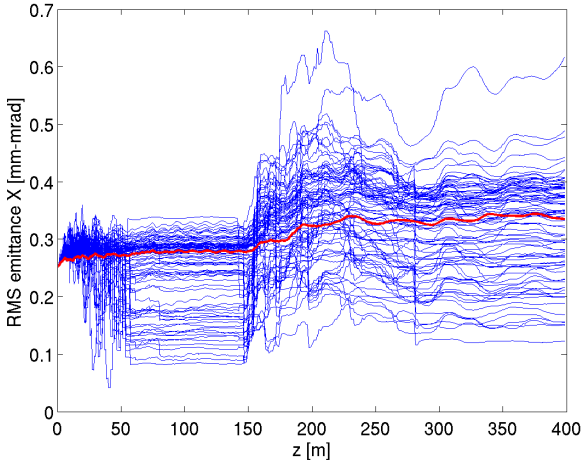


Figure: RMS Emittance Y

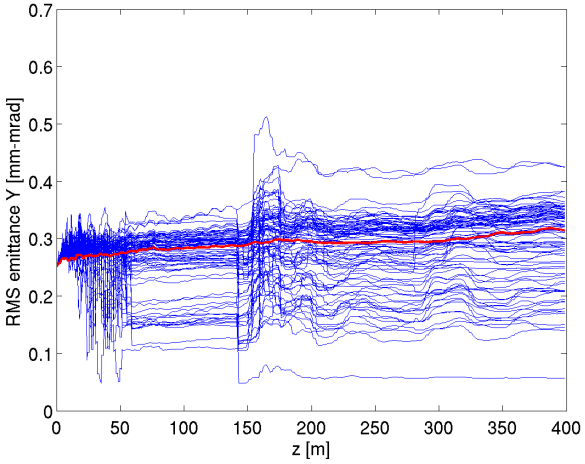


Figure: RMS Emittance Z

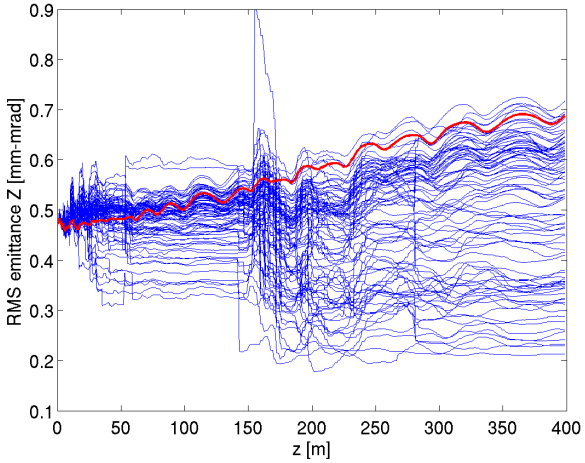
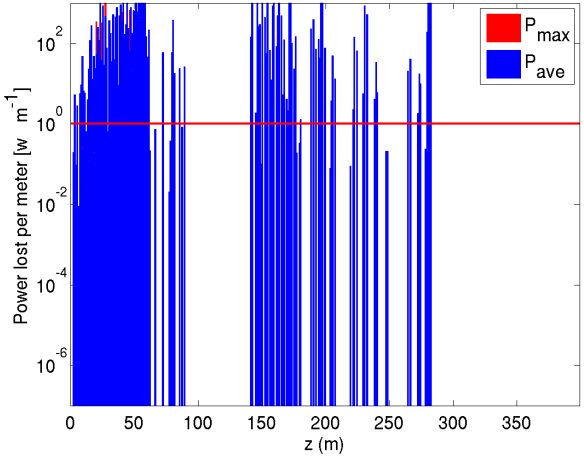


Figure: Losses [W·m^{-1}]



(185) Solenoids $\delta_{xy} = 1000\ \mu$m

Figure: RMS Emittance X

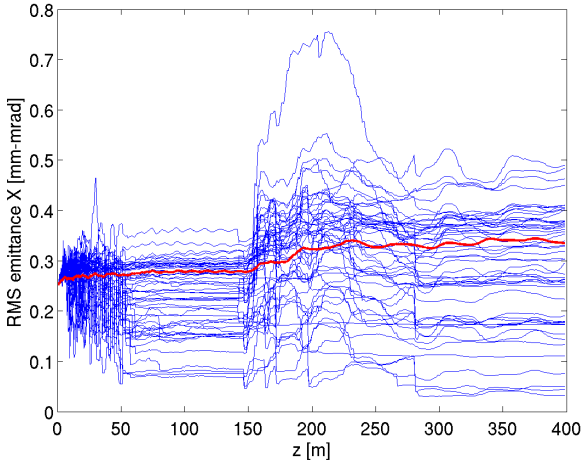


Figure: RMS Emittance Y

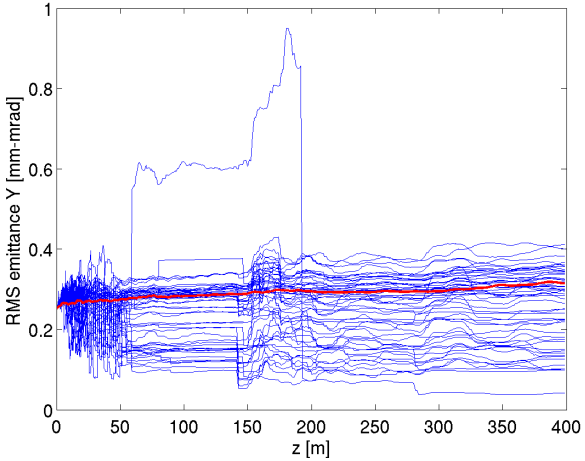


Figure: RMS Emittance Z

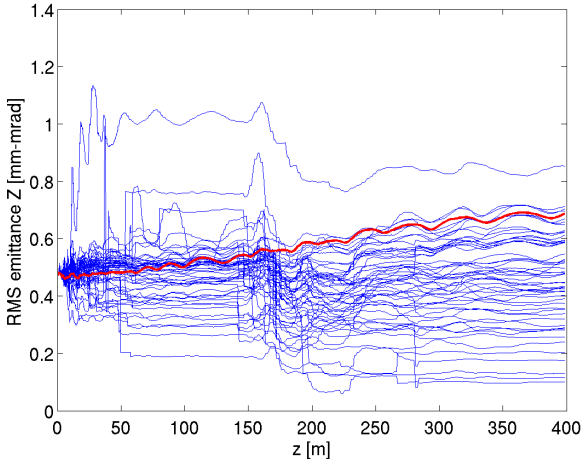
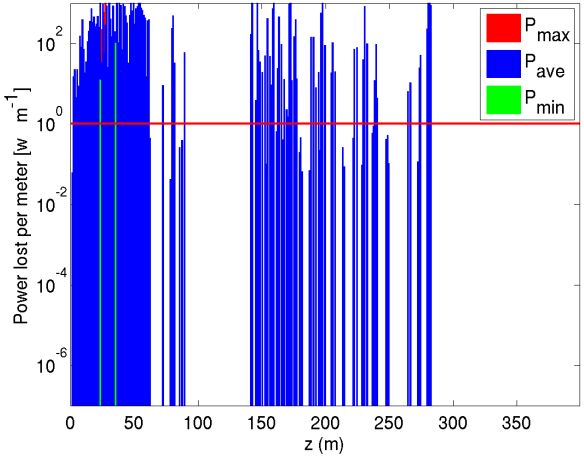


Figure: Losses [W·m^{-1}]



(186) Solenoids $\delta_z = 150\ \mu$m

Figure: RMS Emittance X

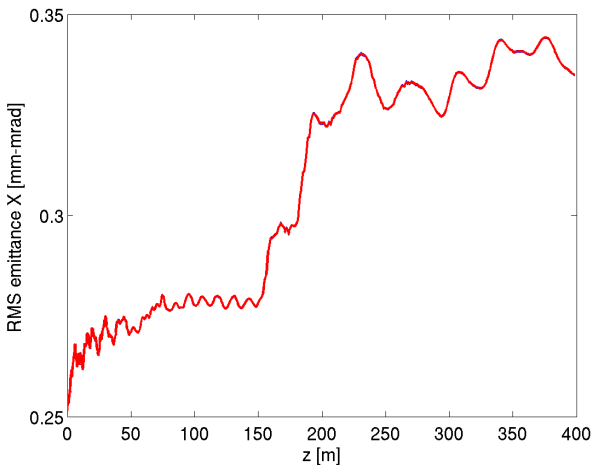


Figure: RMS Emittance Y

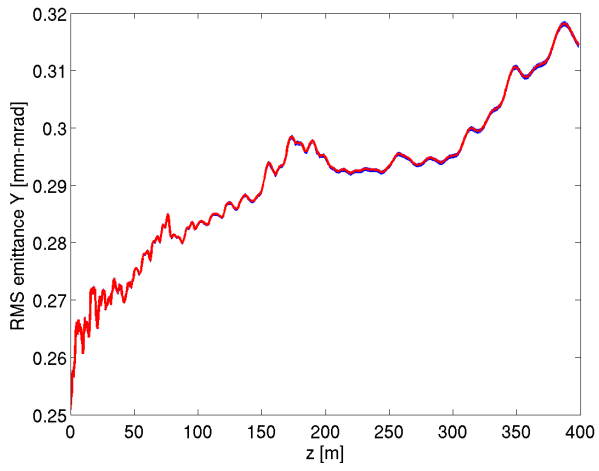


Figure: RMS Emittance Z

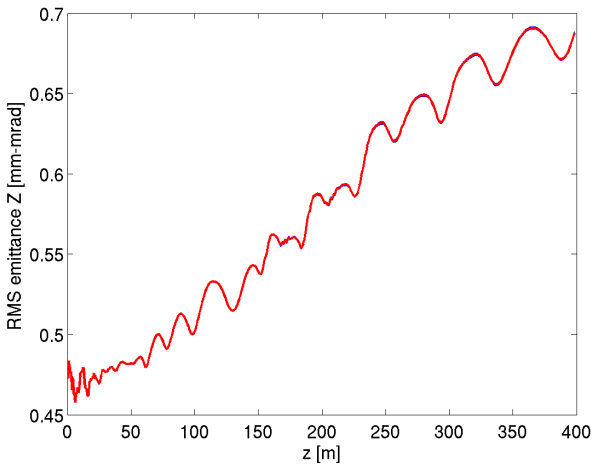
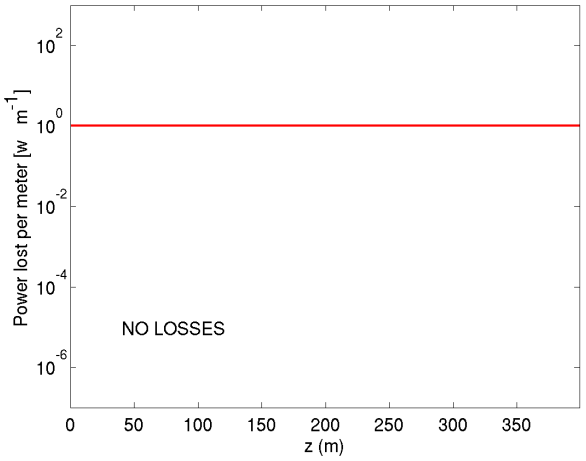


Figure: Losses [W·m^{-1}]



(187) Solenoids $\delta_z = 300\ \mu$m

Figure: RMS Emittance X

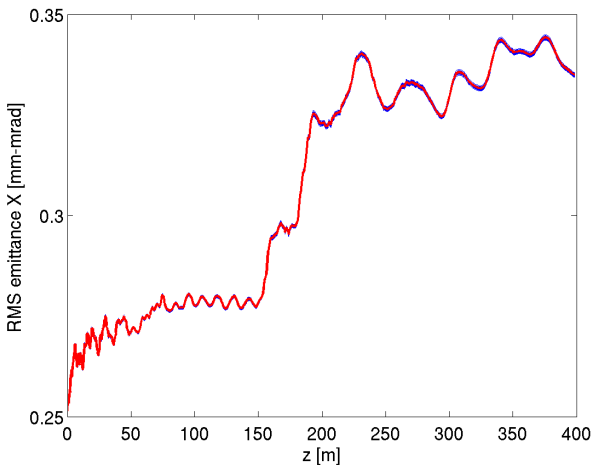


Figure: RMS Emittance Y

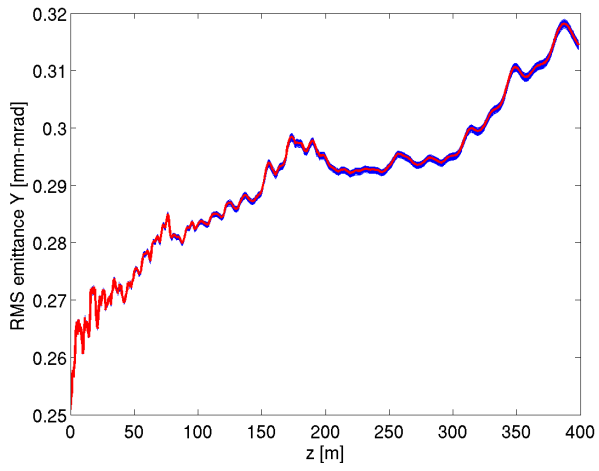


Figure: RMS Emittance z

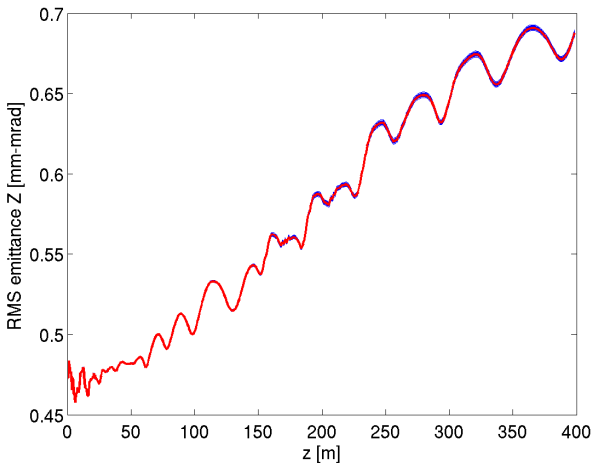
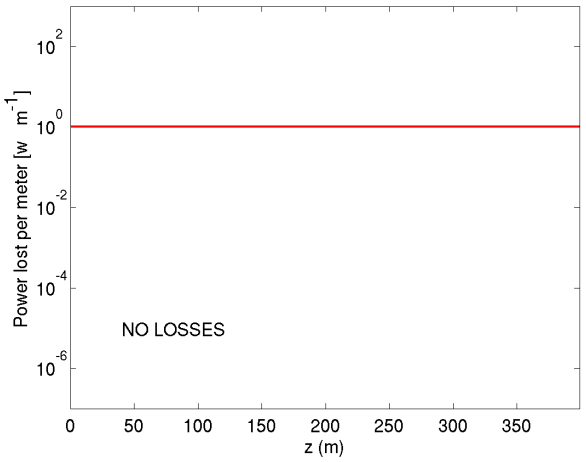


Figure: Losses [W·m^{-1}]



(188) Solenoids $\delta_z = 500\ \mu$m

Figure: RMS Emittance X

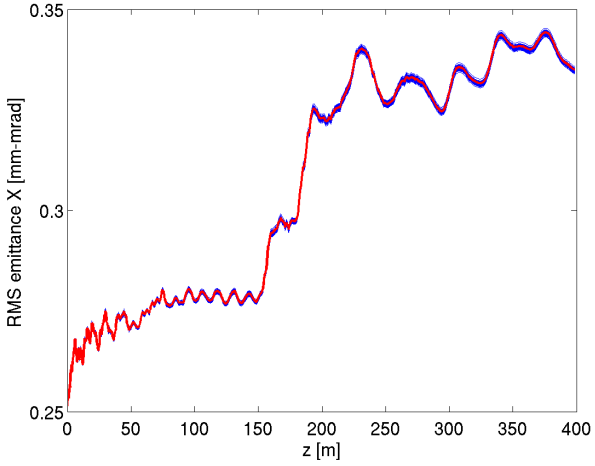


Figure: RMS Emittance Y

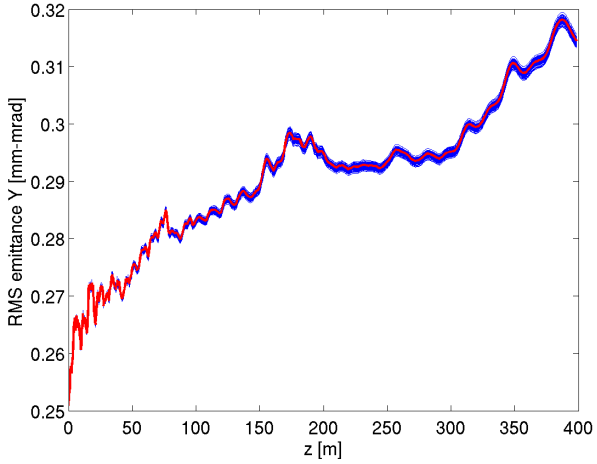


Figure: RMS Emittance Z

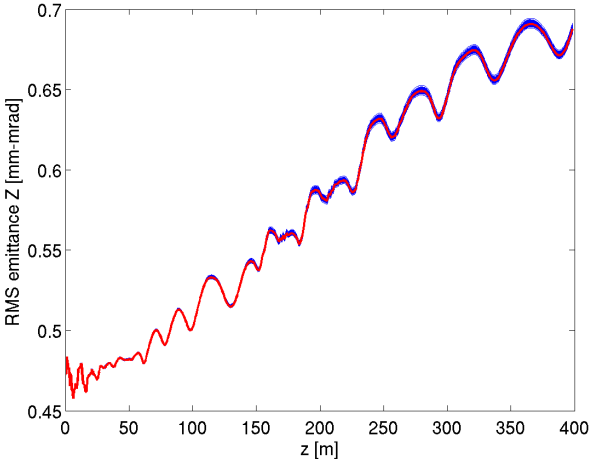
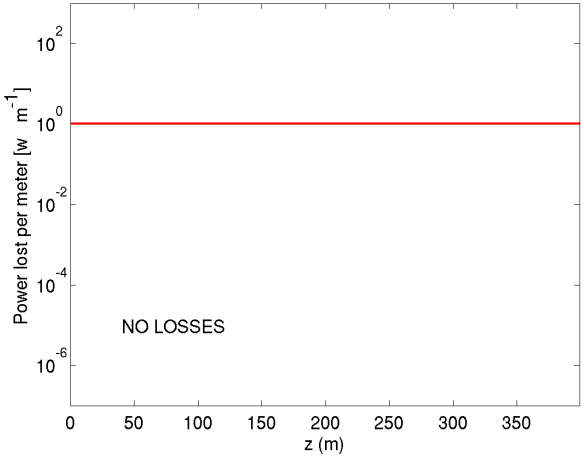


Figure: Losses [W·m^{-1}]



(189) Solenoids $\delta_z = 750\ \mu$m

Figure: RMS Emittance X

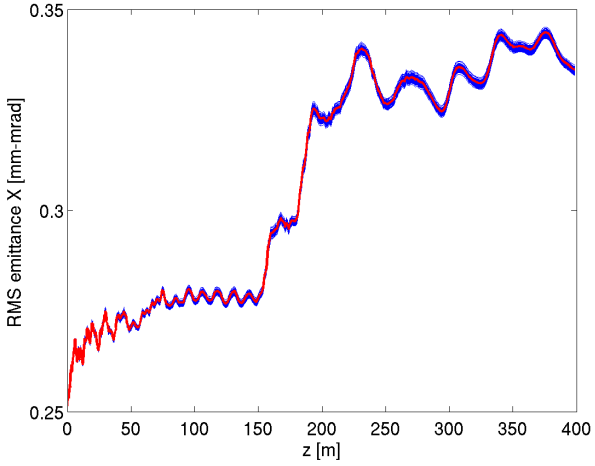


Figure: RMS Emittance Y

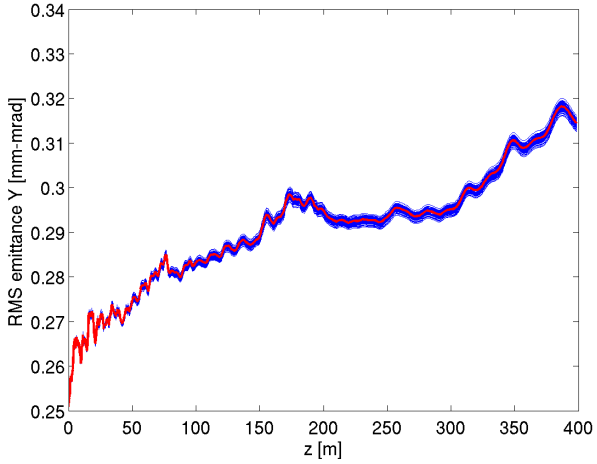


Figure: RMS Emittance Z

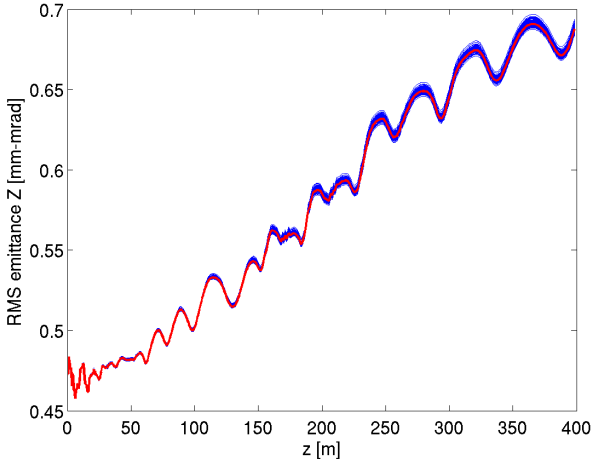
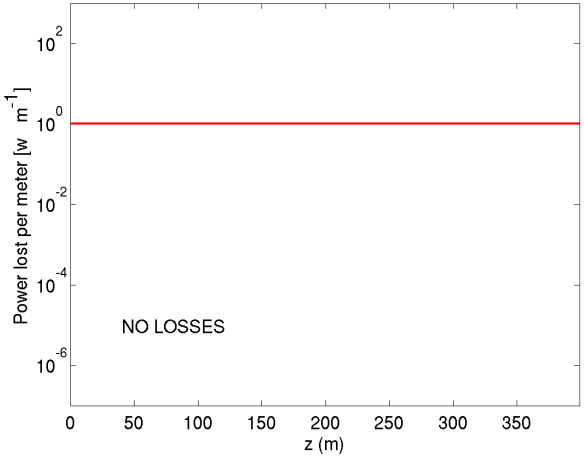


Figure: Losses [W·m^{-1}]



(190) Solenoids $\delta_z = 1000\ \mu$m

Figure: RMS Emittance X

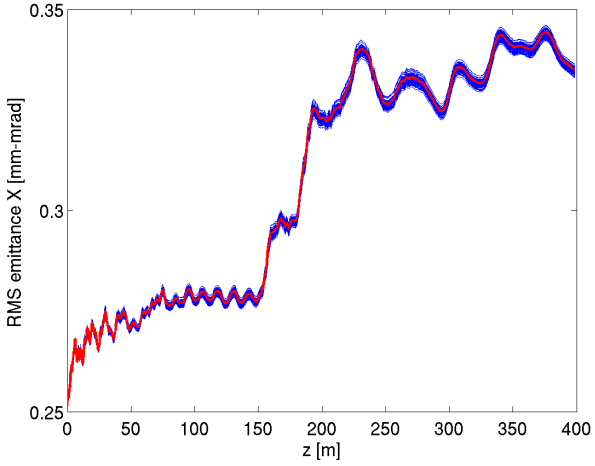


Figure: RMS Emittance Y

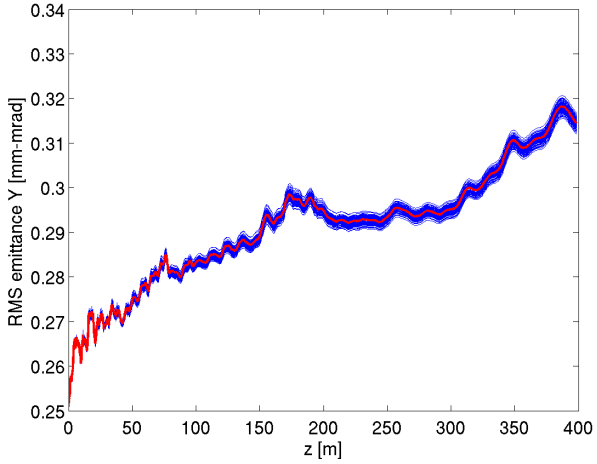


Figure: RMS Emittance Z

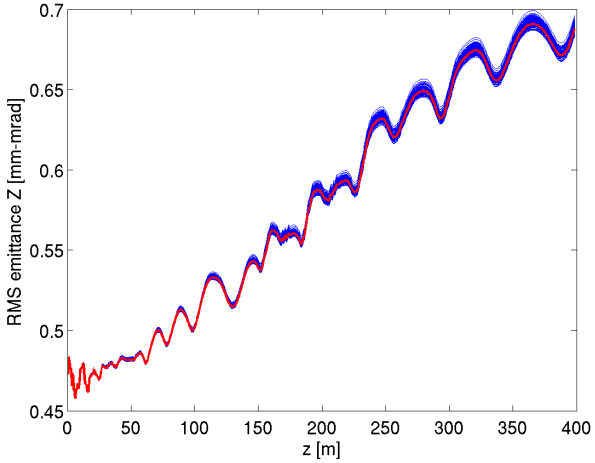
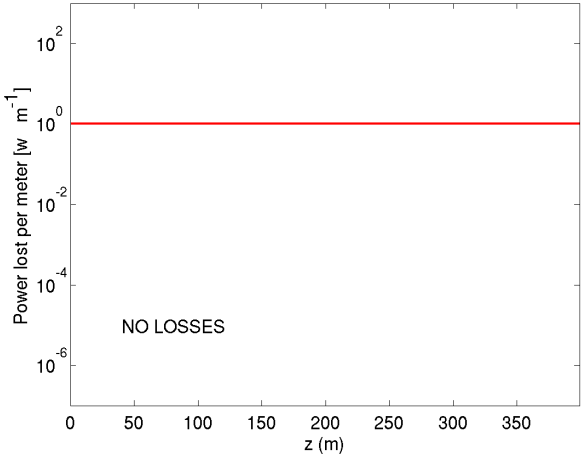


Figure: Losses [W·m^{-1}]



(191) Sol. Field $\delta F_{dynamic} = 0.5$ %

Figure: RMS Emittance X

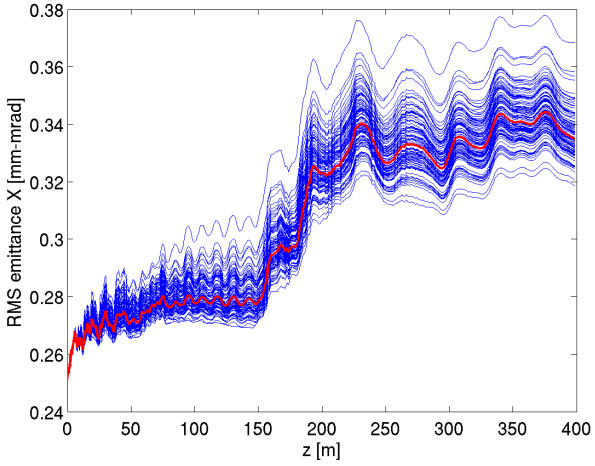


Figure: RMS Emittance Y

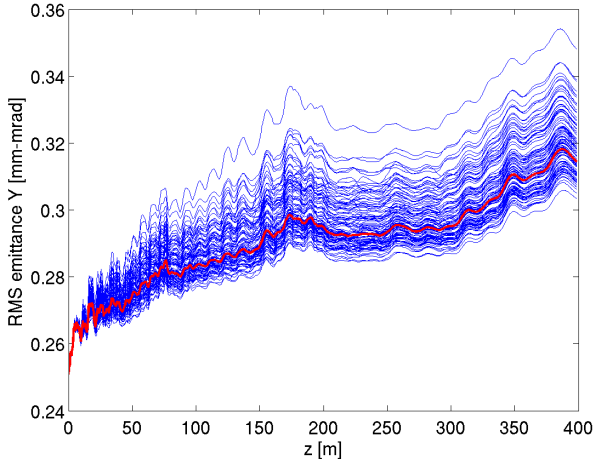


Figure: RMS Emittance Z

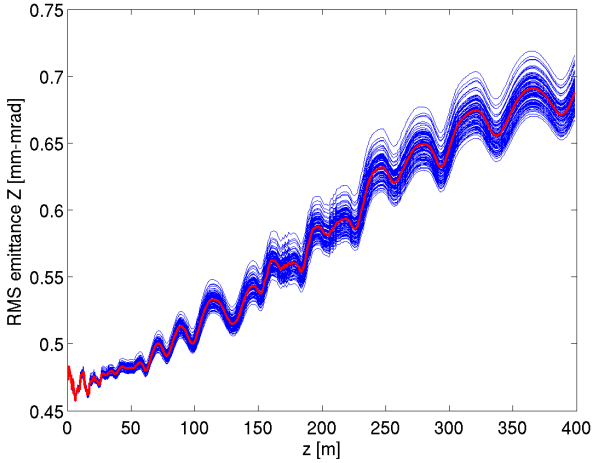
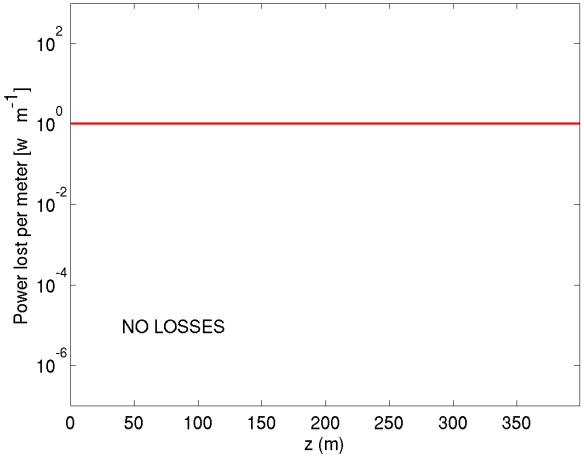


Figure: Losses [W·m^{-1}]



(192) Sol. Field $\delta F_{dynamic} = 1.0$ %

Figure: RMS Emittance X

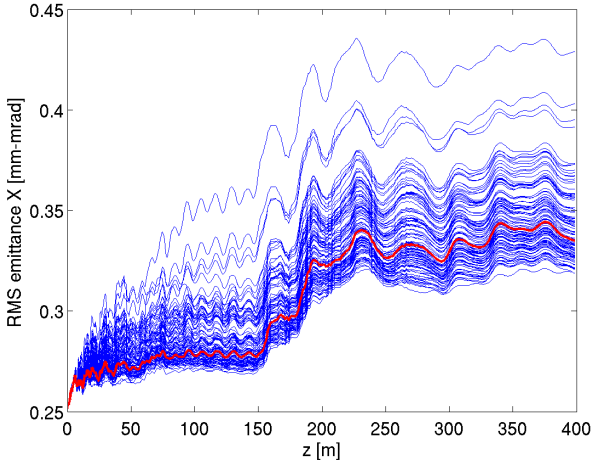


Figure: RMS Emittance Y

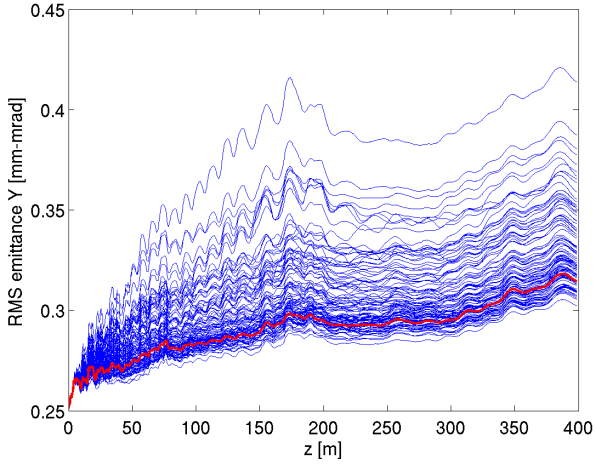


Figure: RMS Emittance Z

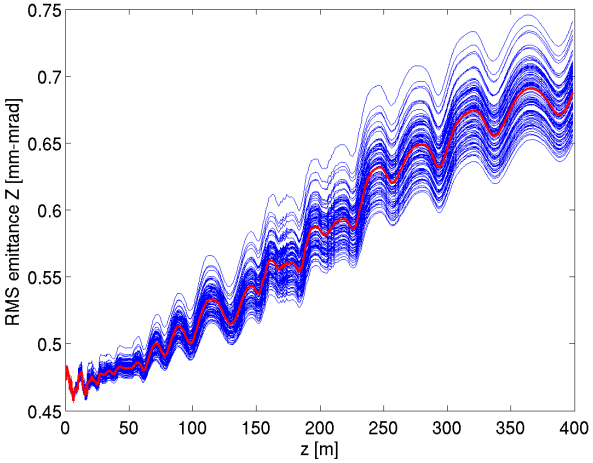
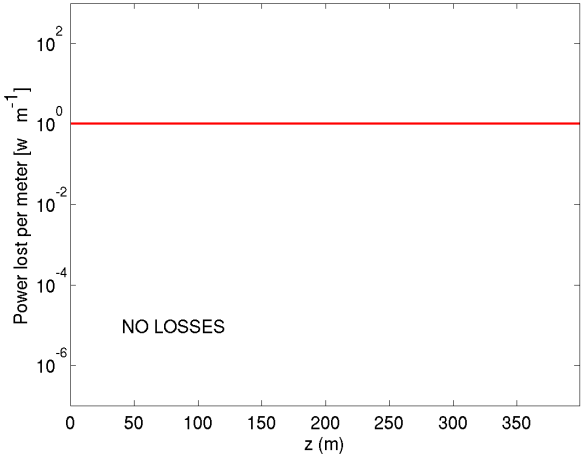


Figure: Losses [W·m^{-1}]



(193) Sol. Field $\delta F_{dynamic} = 1.5\ \%$

Figure: RMS Emittance X

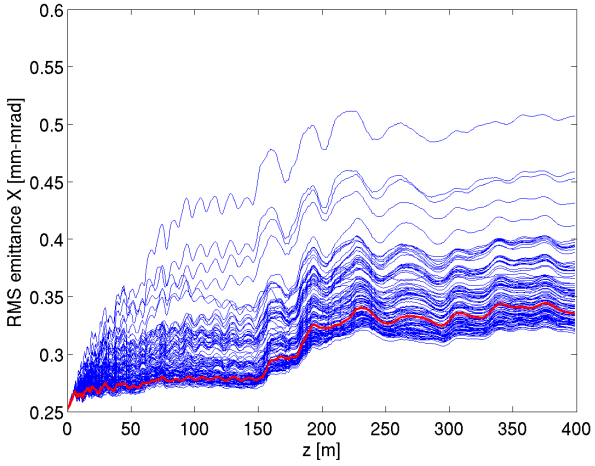


Figure: RMS Emittance Y

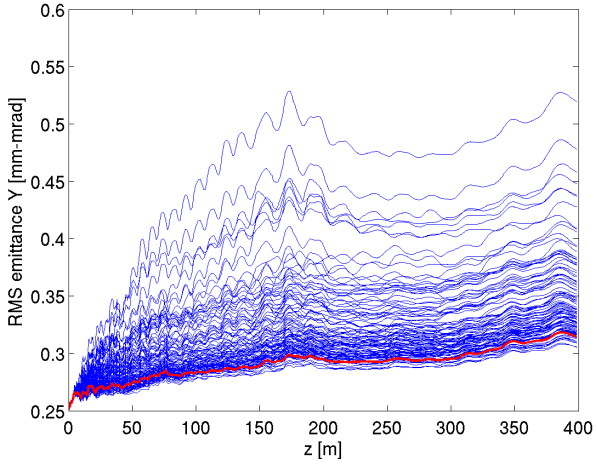


Figure: RMS Emittance Z

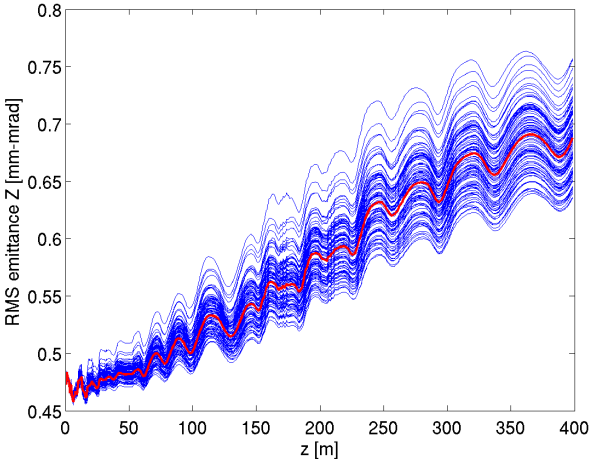
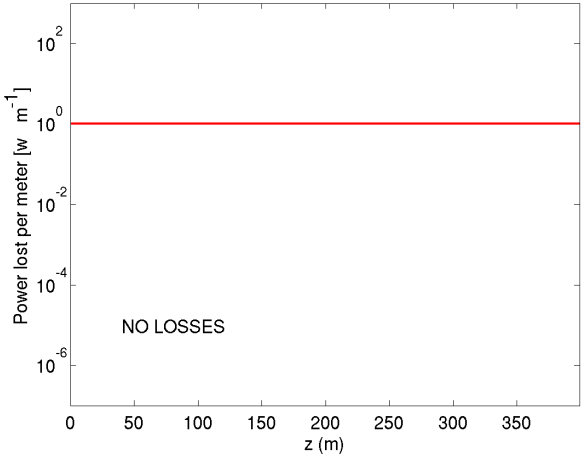


Figure: Losses [W·m^{-1}]



(194) Sol. Field $\delta F_{dynamic} = 2.0$ %

Figure: RMS Emittance X

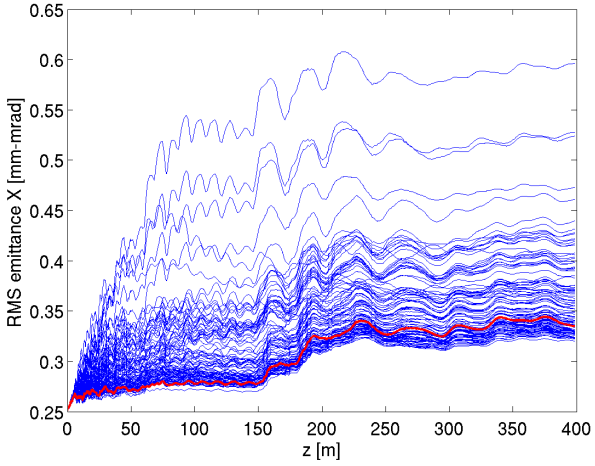


Figure: RMS Emittance Y

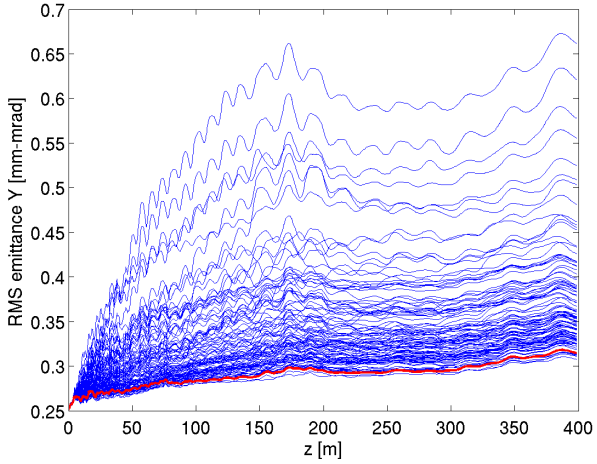


Figure: RMS Emittance Z

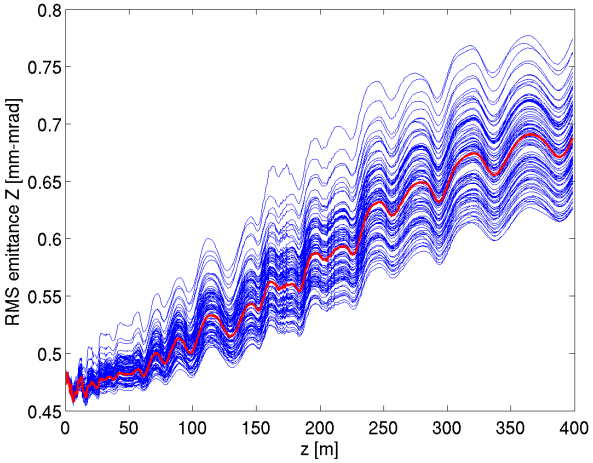
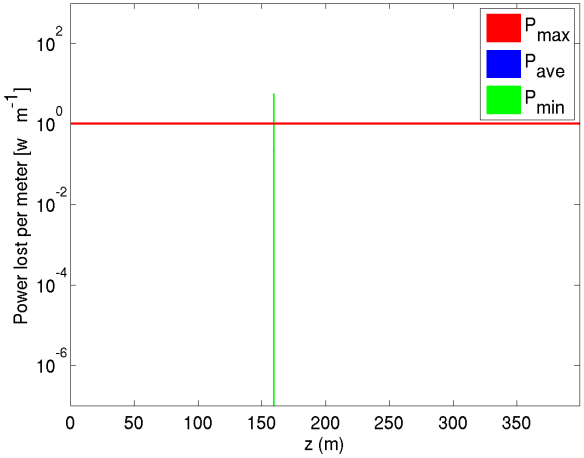


Figure: Losses [W·m^{-1}]



(195) Sol. Field $\delta F_{dynamic} = 2.5\ \%$

Figure: RMS Emittance X

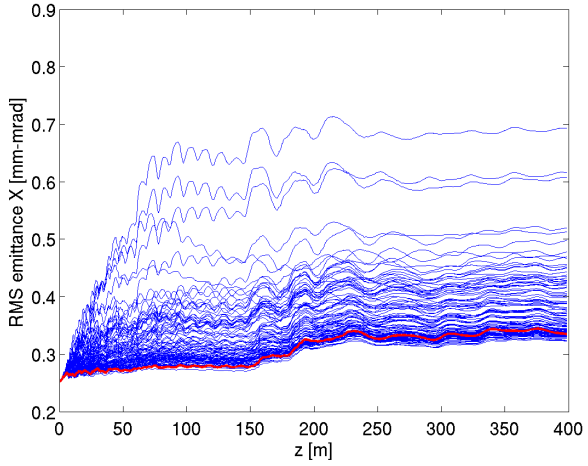


Figure: RMS Emittance Y

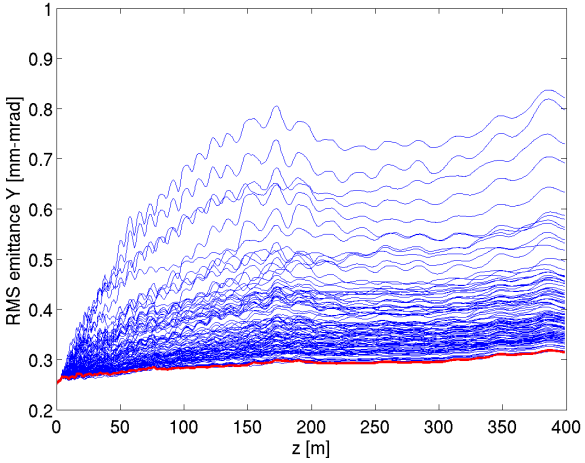


Figure: RMS Emittance Z

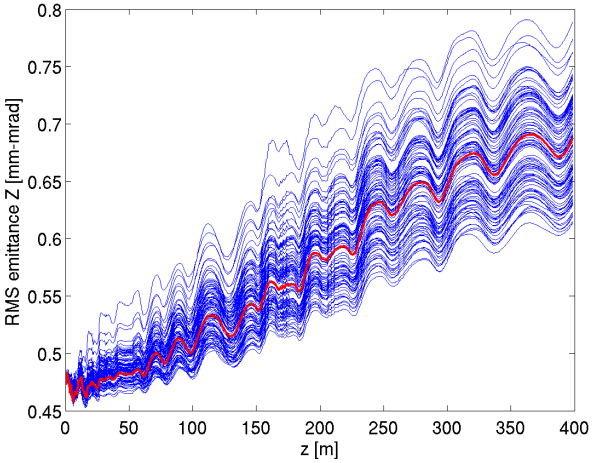
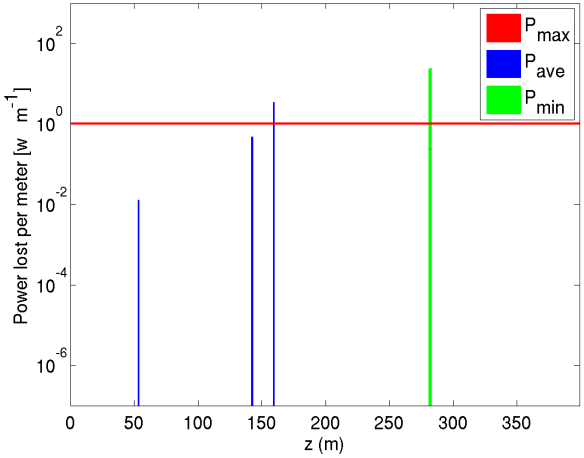


Figure: Losses [W·m^{-1}]



(196) Sol. Field $\delta F_{static} = 0.5$ %

Figure: RMS Emittance X

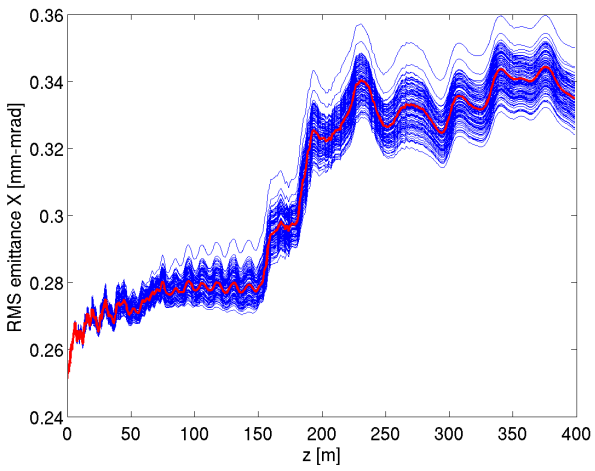


Figure: RMS Emittance Y

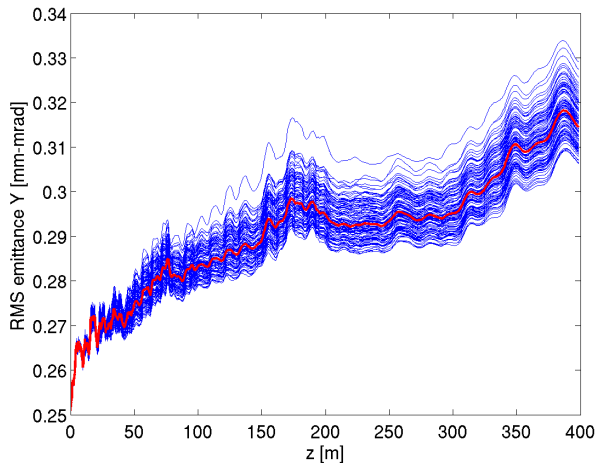


Figure: RMS Emittance Z

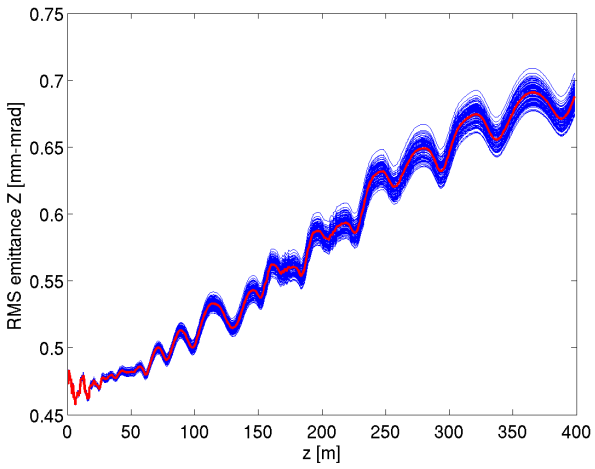
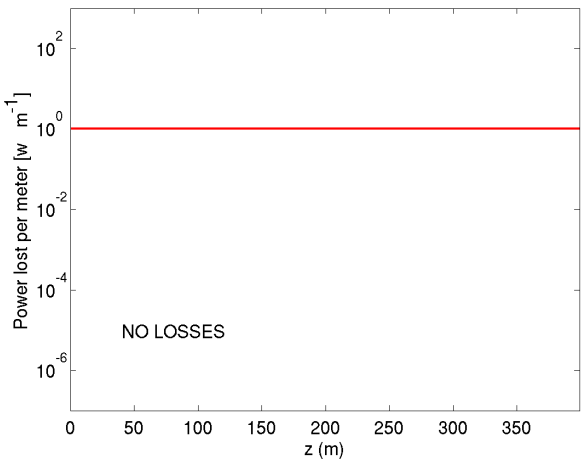


Figure: Losses [W·m^{-1}]



(197) Sol. Field $\delta F_{static} = 1.0$ %

Figure: RMS Emittance X

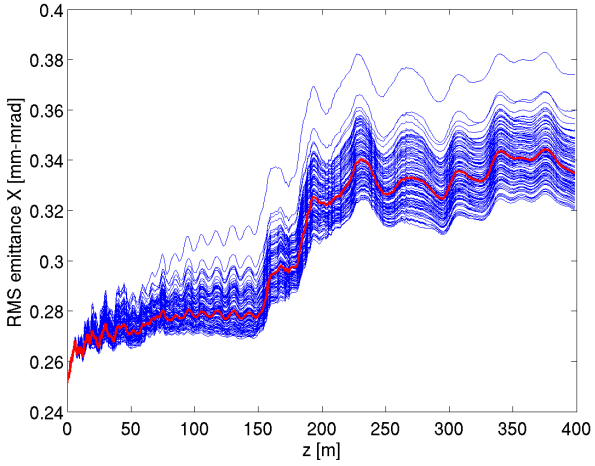


Figure: RMS Emittance Y

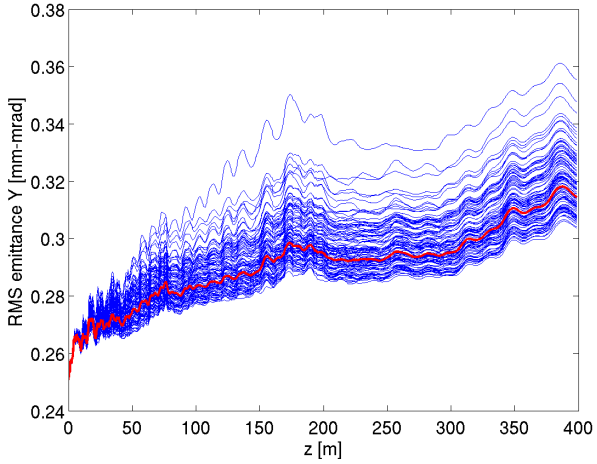


Figure: RMS Emittance Z

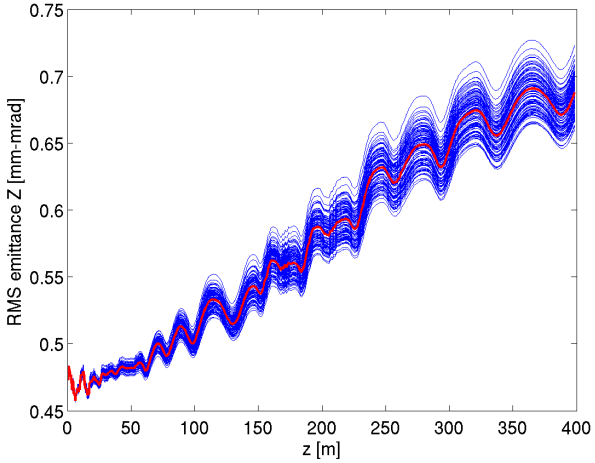
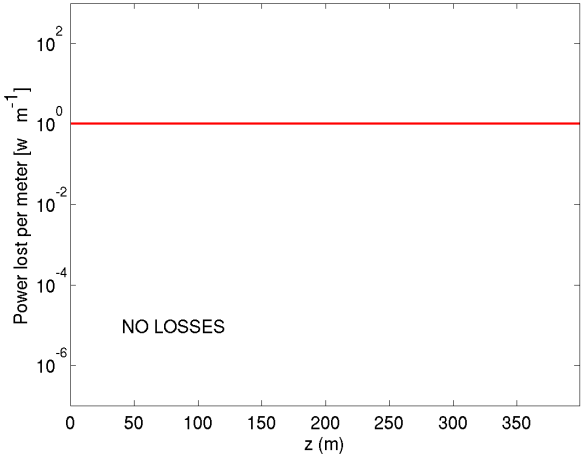


Figure: Losses [W·m^{-1}]



(198) Sol. Field $\delta F_{static} = 1.5$ %

Figure: RMS Emittance X

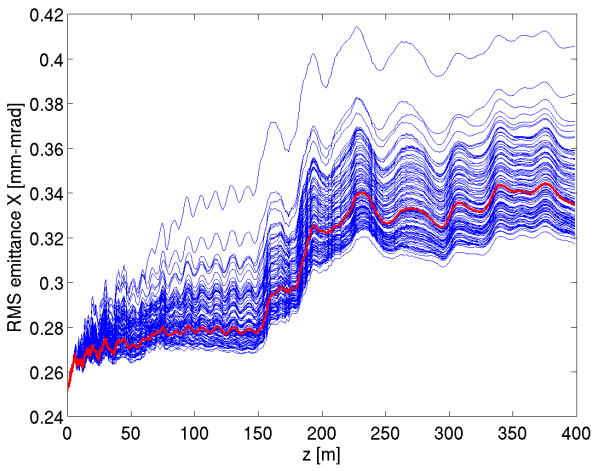


Figure: RMS Emittance Y

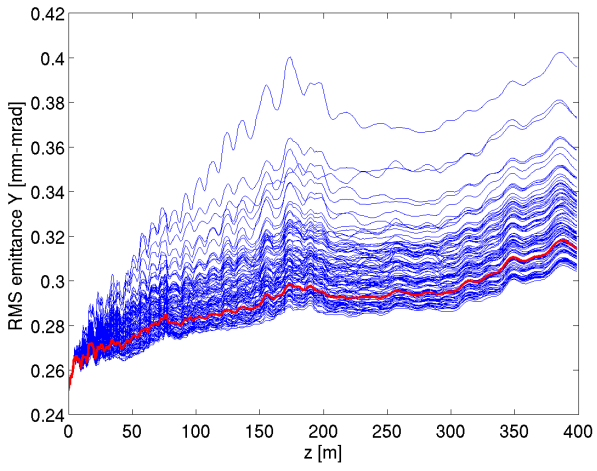


Figure: RMS Emittance Z

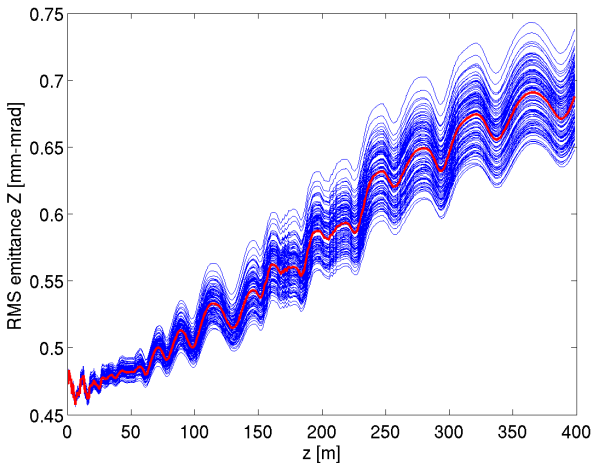
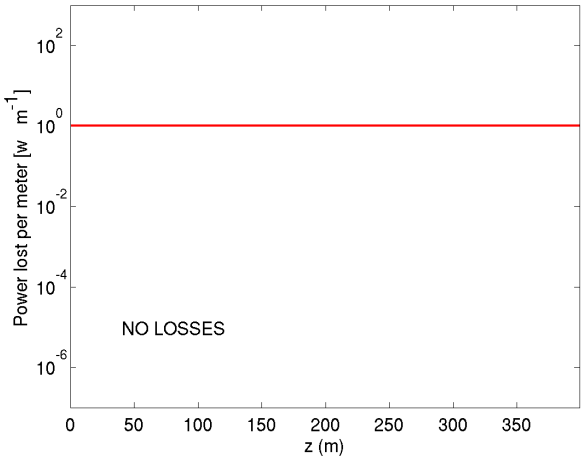


Figure: Losses [W·m^{-1}]



(199) Sol. Field $\delta F_{static} = 2.0$ %

Figure: RMS Emittance X

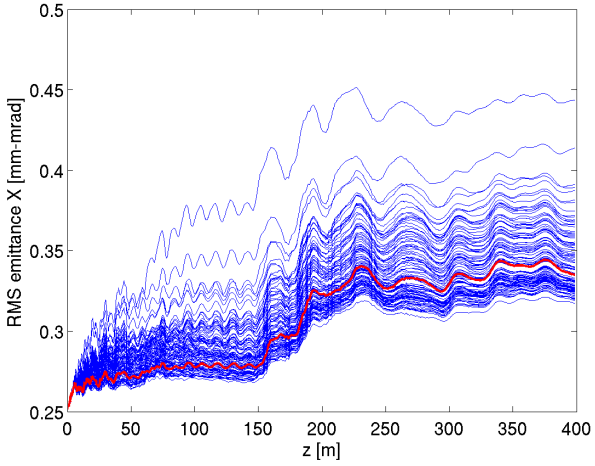


Figure: RMS Emittance Y

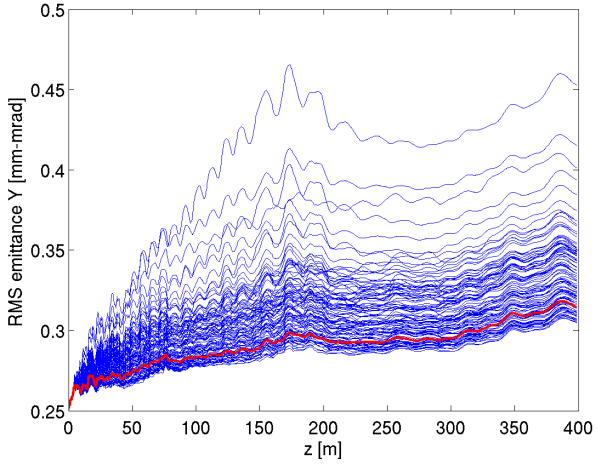


Figure: RMS Emittance Z

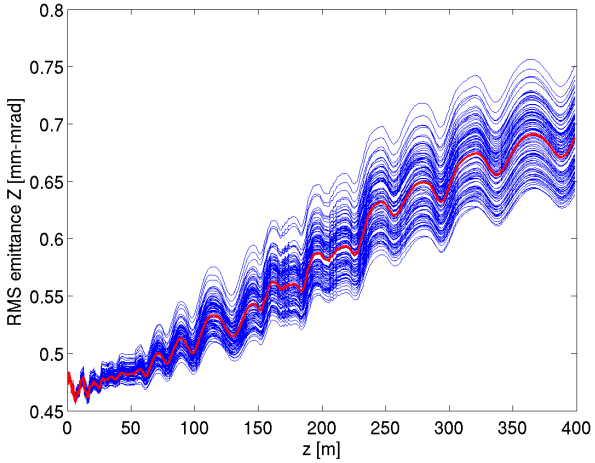
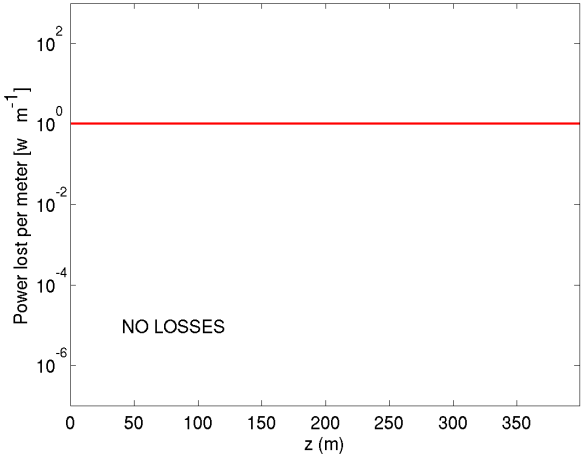


Figure: Losses [W·m^{-1}]



(200) Sol. Field $\delta F_{static} = 2.5$ %

Figure: RMS Emittance X

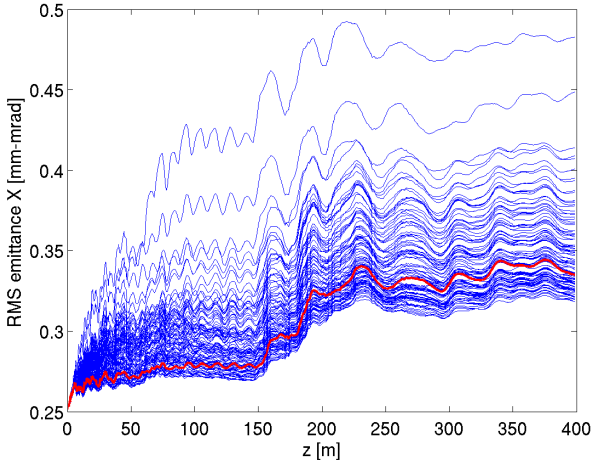


Figure: RMS Emittance Y

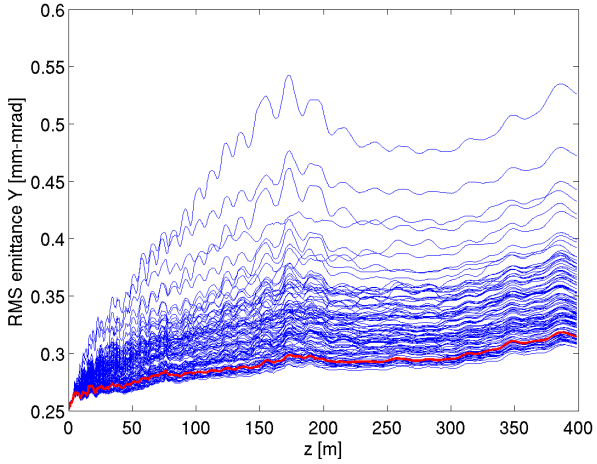


Figure: RMS Emittance Z

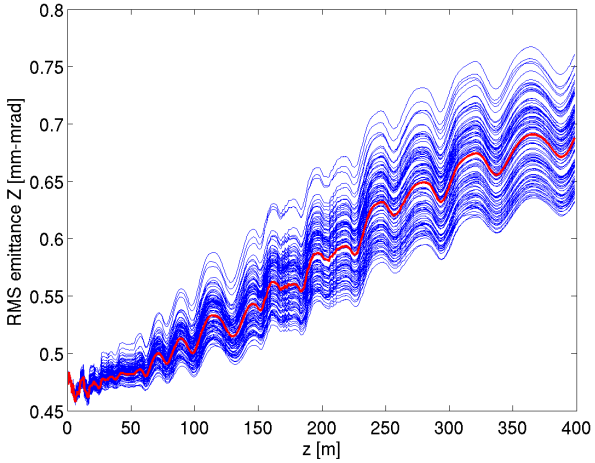
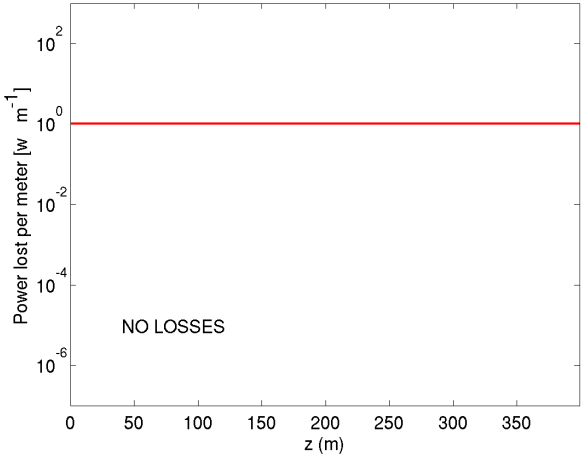


Figure: Losses [W·m^{-1}]



(201) Quads $\delta_{xy} = 150\ \mu$m

Figure: RMS Emittance X

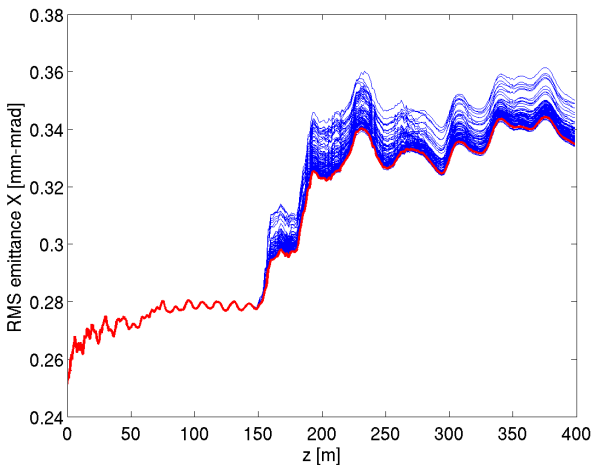


Figure: RMS Emittance Y

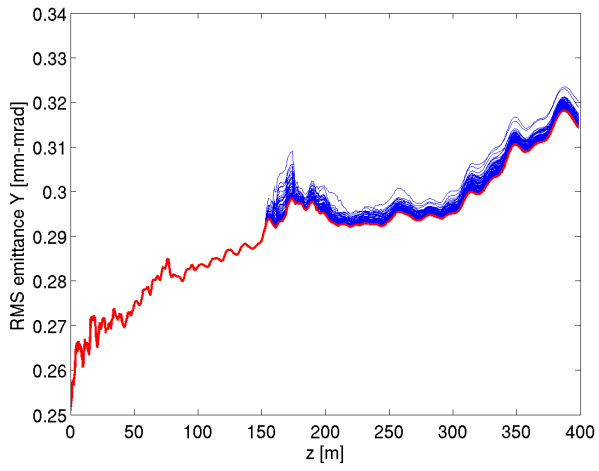


Figure: RMS Emittance Z

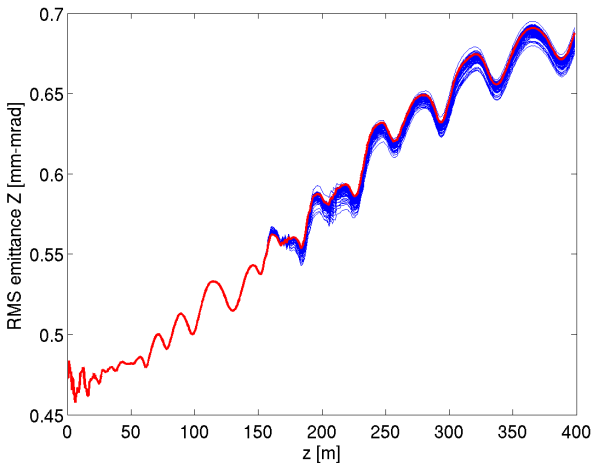
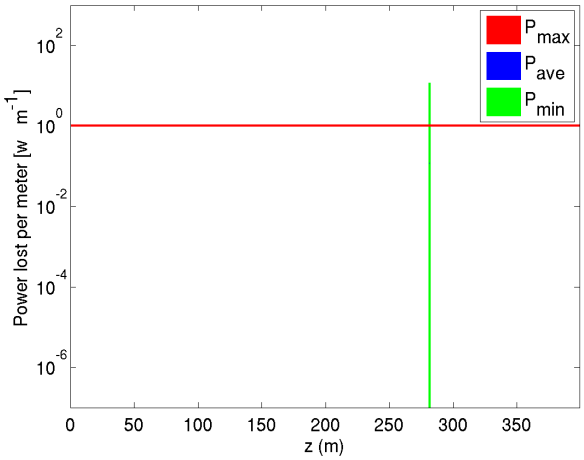


Figure: Losses [W·m^{-1}]



(202) Quads $\delta_{xy} = 300\ \mu$m

Figure: RMS Emittance X

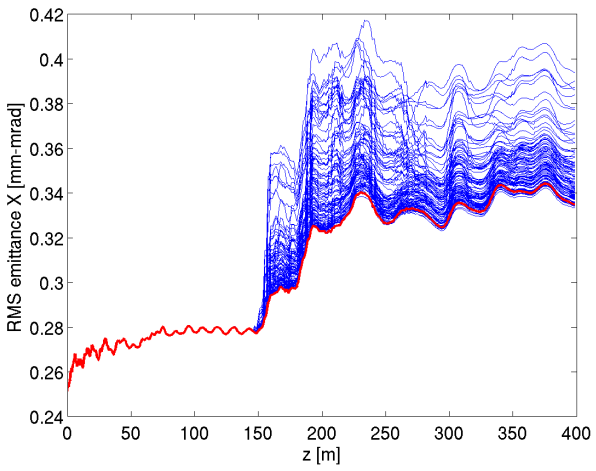


Figure: RMS Emittance Y

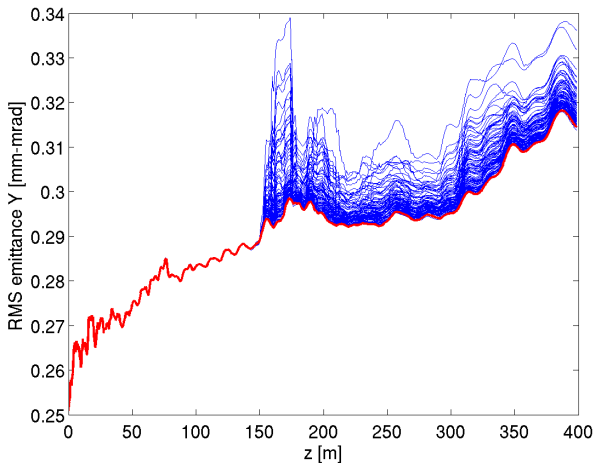


Figure: RMS Emittance Z

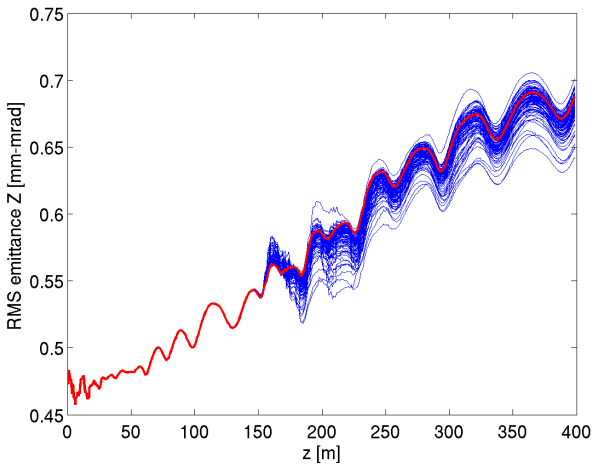
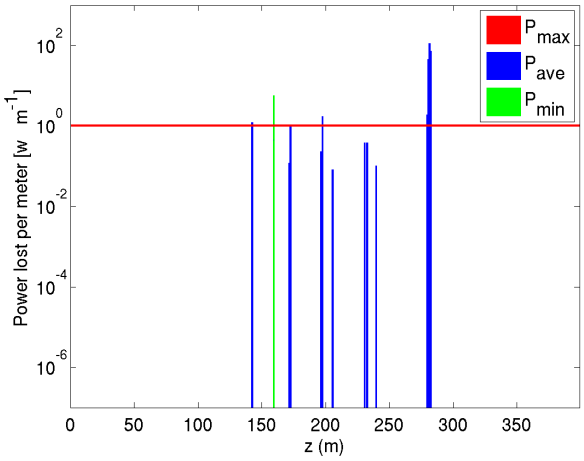


Figure: Losses [W·m^{-1}]



(203) Quads $\delta_{xy} = 500\ \mu$m

Figure: RMS Emittance X

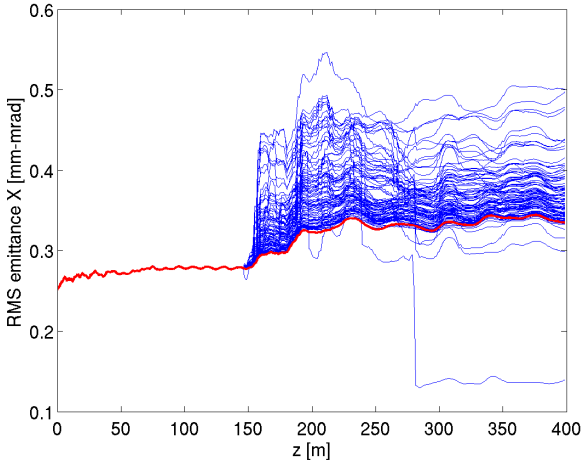


Figure: RMS Emittance Y

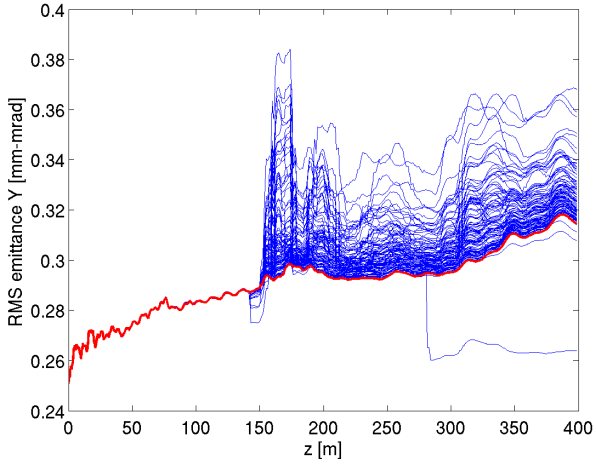


Figure: RMS Emittance Z

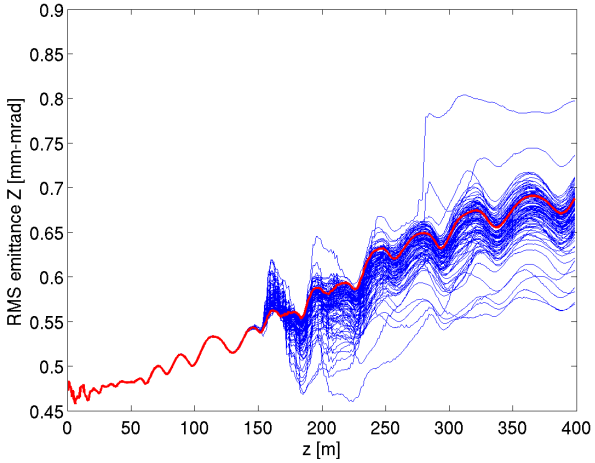
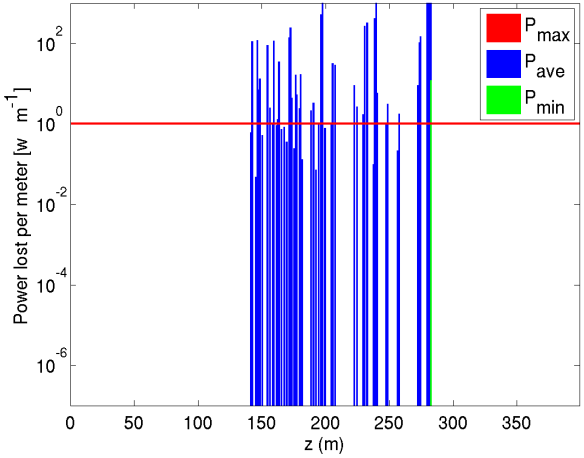


Figure: Losses [W·m^{-1}]



(204) Quads $\delta_{xy} = 750\ \mu$m

Figure: RMS Emittance X

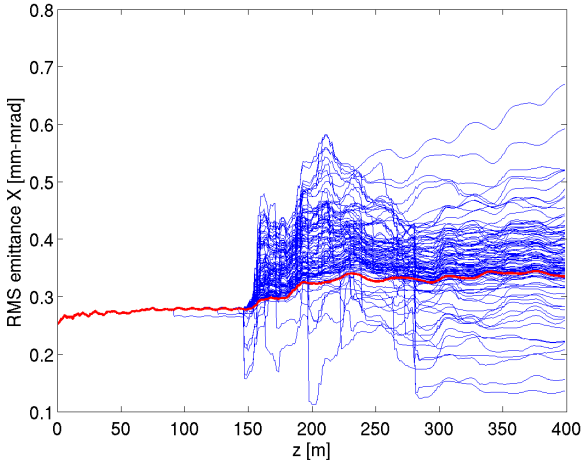


Figure: RMS Emittance Y

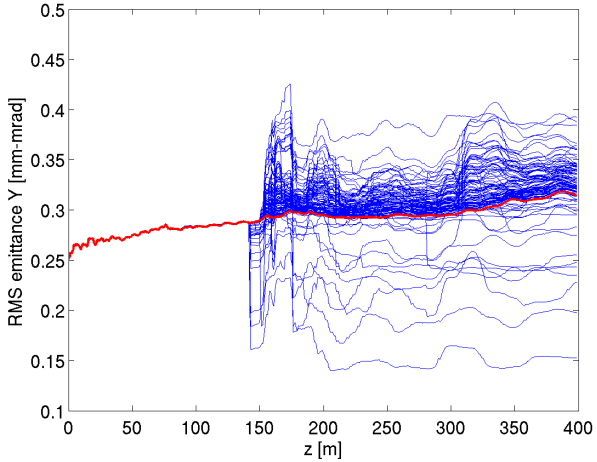


Figure: RMS Emittance Z

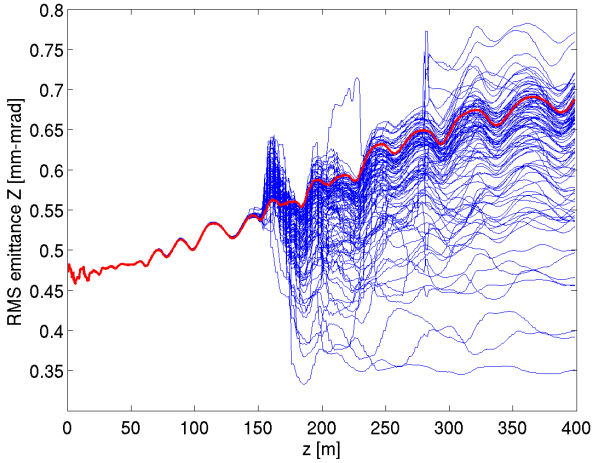
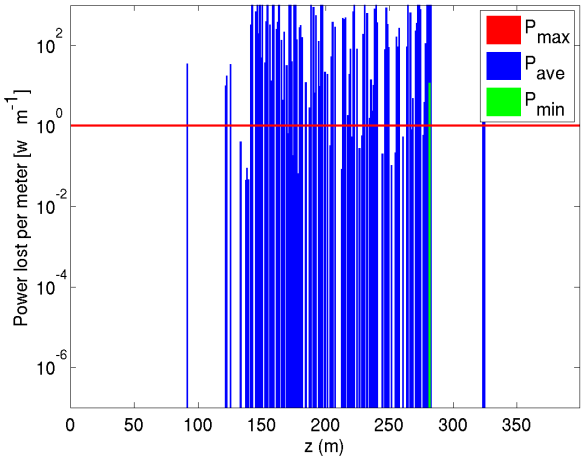


Figure: Losses [W·m^{-1}]



(205) Quads $\delta_{xy} = 1000\ \mu$m

Figure: RMS Emittance X

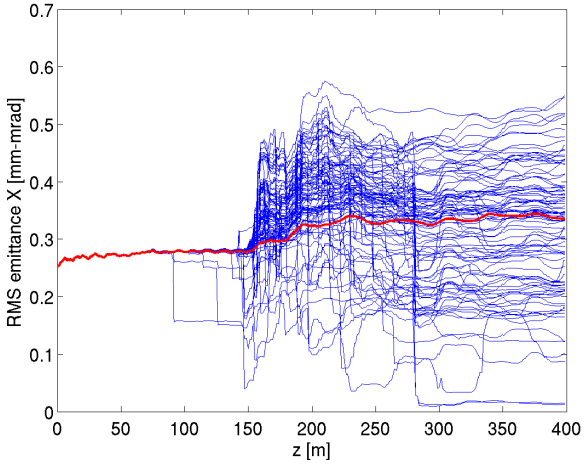


Figure: RMS Emittance Y

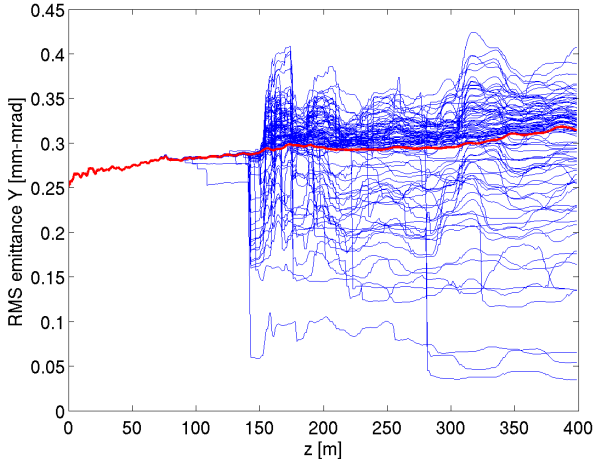


Figure: RMS Emittance Z

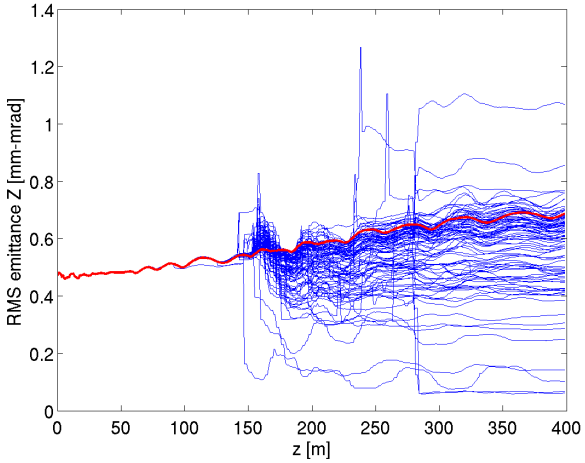
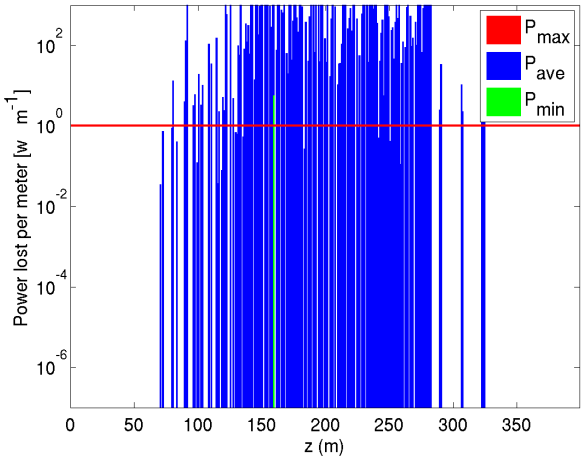


Figure: Losses [W·m^{-1}]



(206) Quads $\delta_z = 150\ \mu$m

Figure: RMS Emittance X

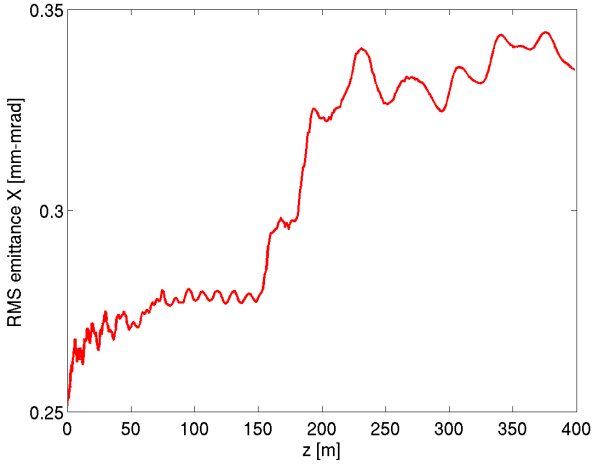


Figure: RMS Emittance Y

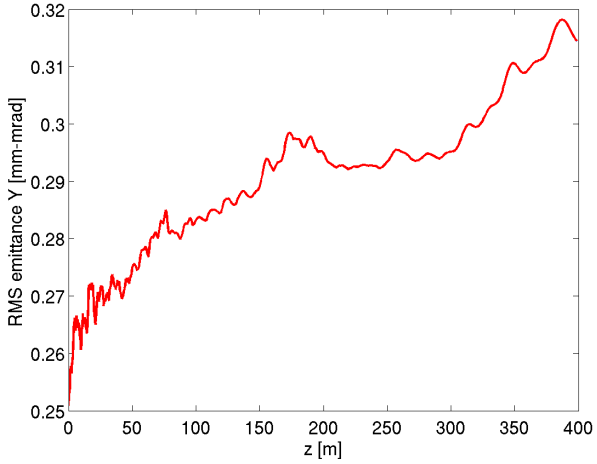


Figure: RMS Emittance Z

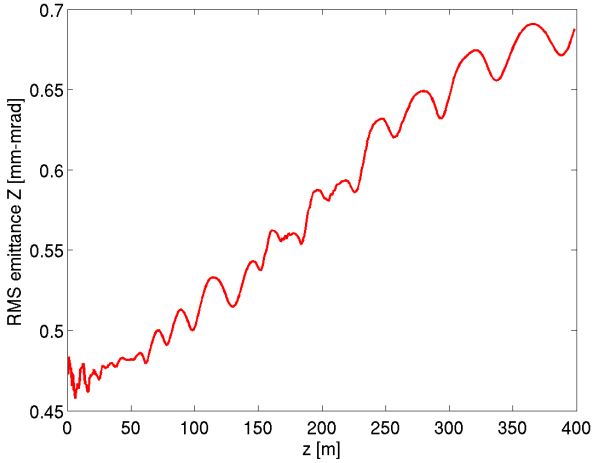
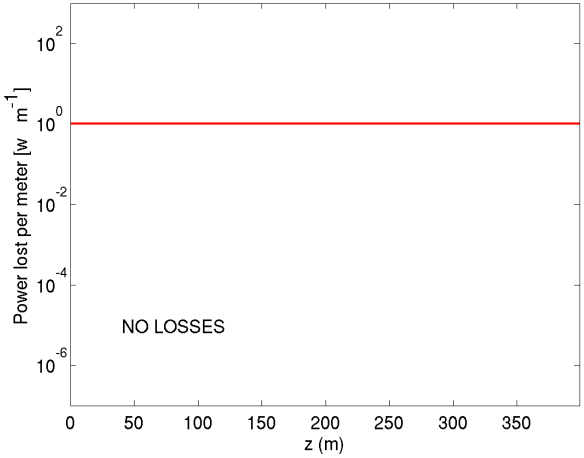


Figure: Losses [W·m^{-1}]



(207) Quads $\delta_z = 300\ \mu$m

Figure: RMS Emittance X

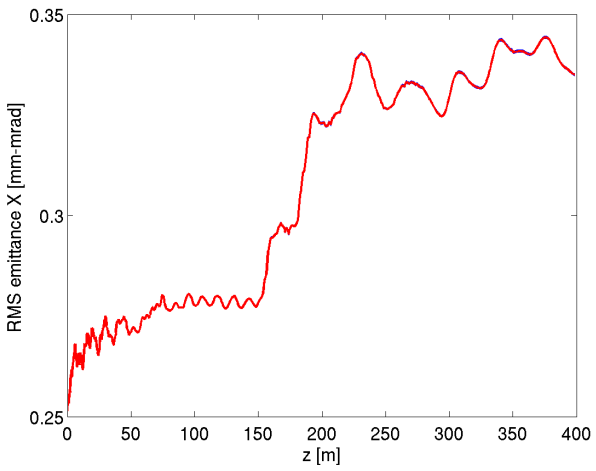


Figure: RMS Emittance Y

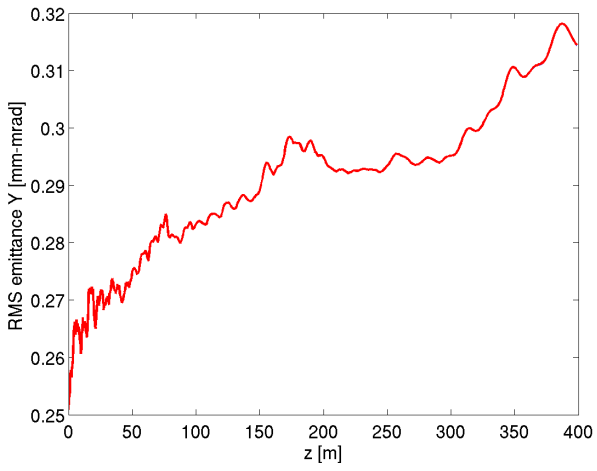


Figure: RMS Emittance z

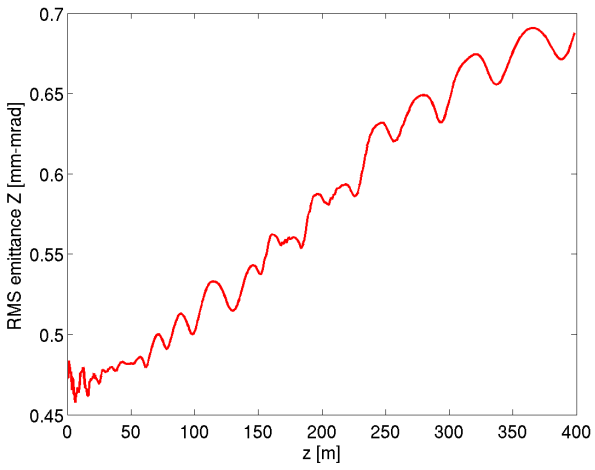
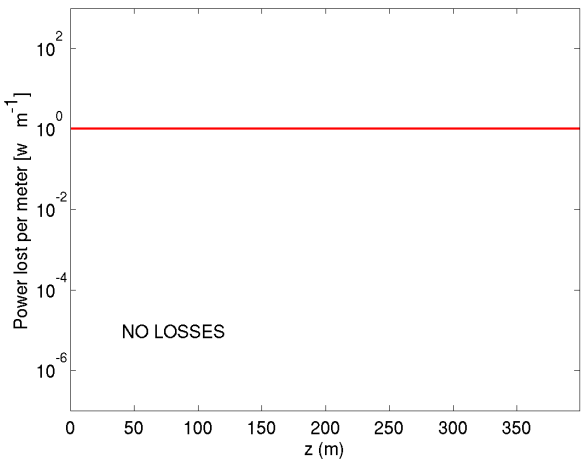


Figure: Losses [W·m^{-1}]



(208) Quads $\delta_z = 500\ \mu$m

Figure: RMS Emittance X

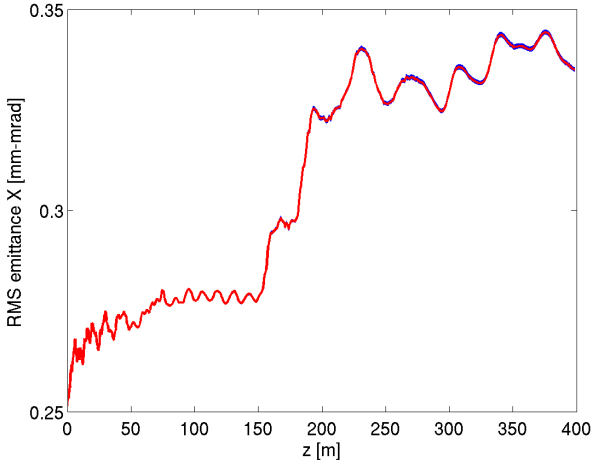


Figure: RMS Emittance Y

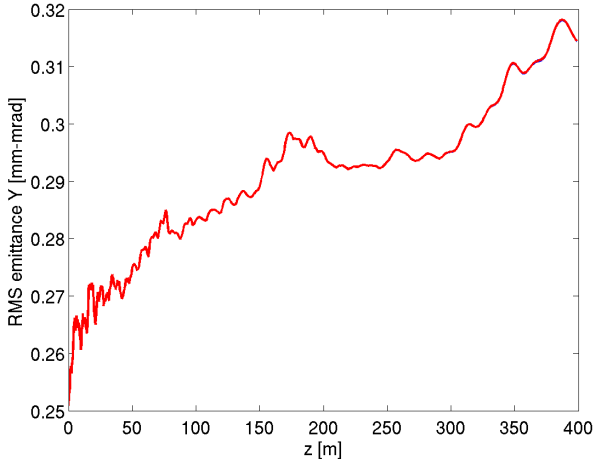


Figure: RMS Emittance Z

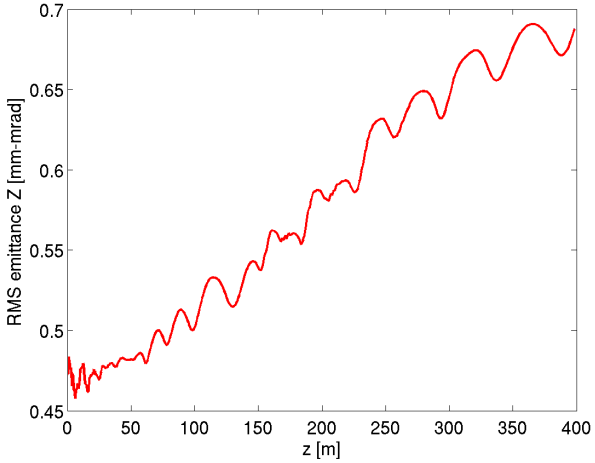
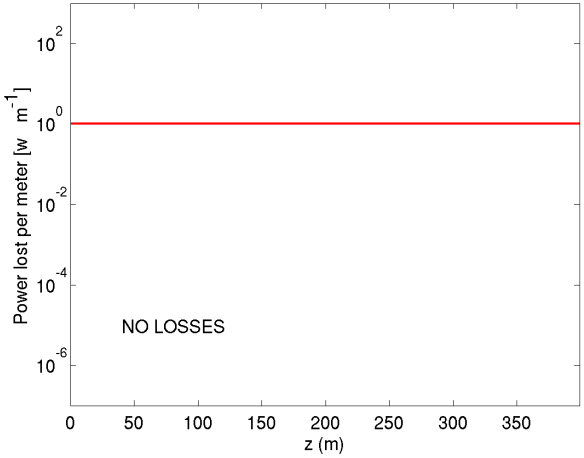


Figure: Losses [W·m^{-1}]



(209) Quads $\delta_z = 750\ \mu$m

Figure: RMS Emittance X

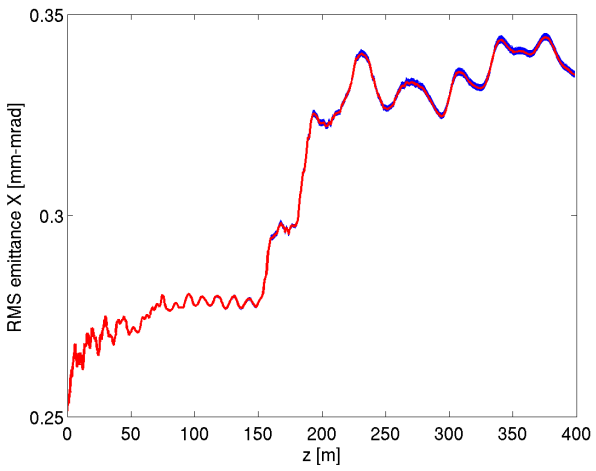


Figure: RMS Emittance Y

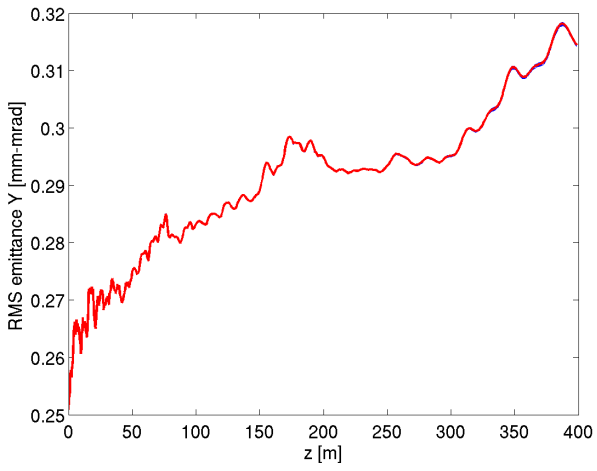


Figure: RMS Emittance Z

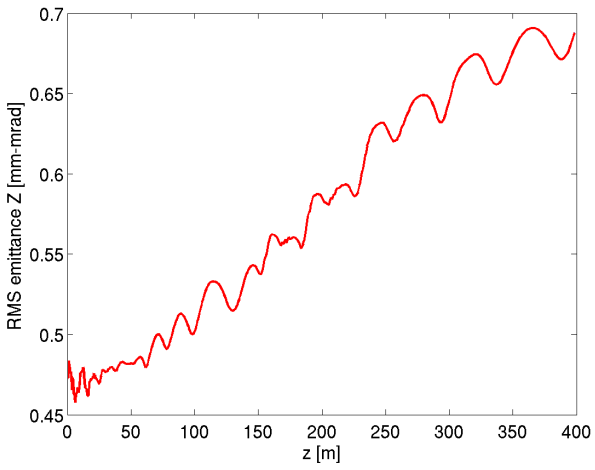
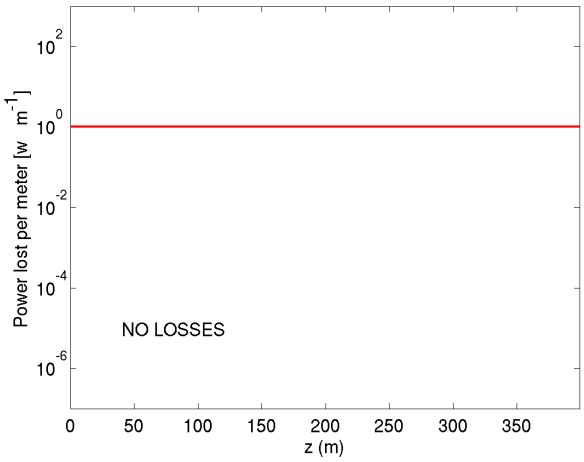


Figure: Losses [W·m^{-1}]



(210) Quads $\delta_z = 1000\ \mu$m

Figure: RMS Emittance X

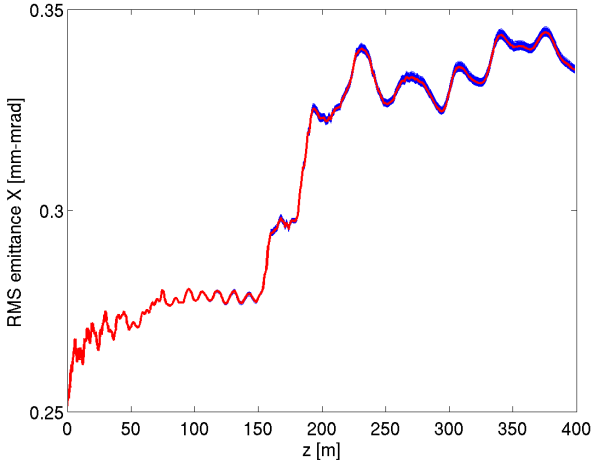


Figure: RMS Emittance Y

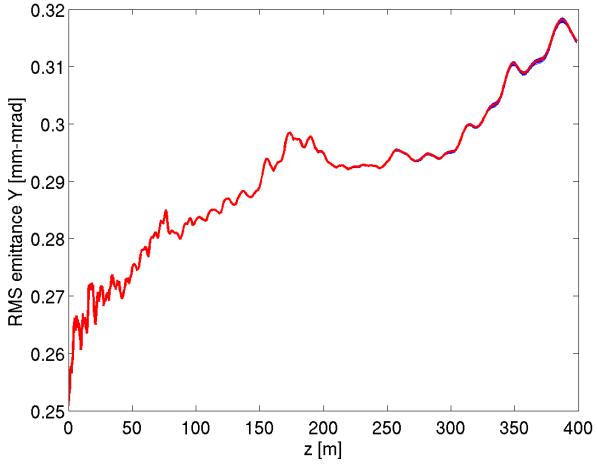


Figure: RMS Emittance Z

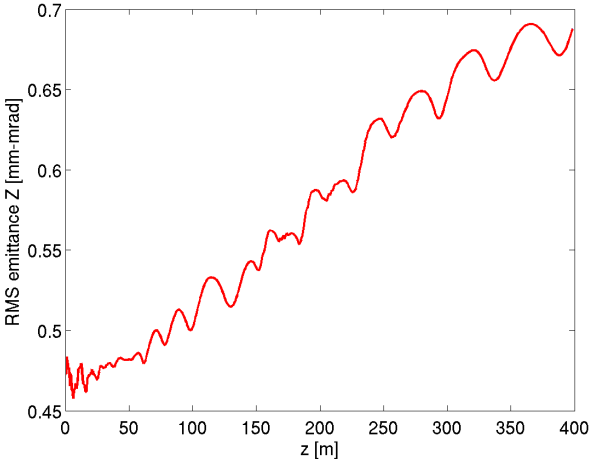
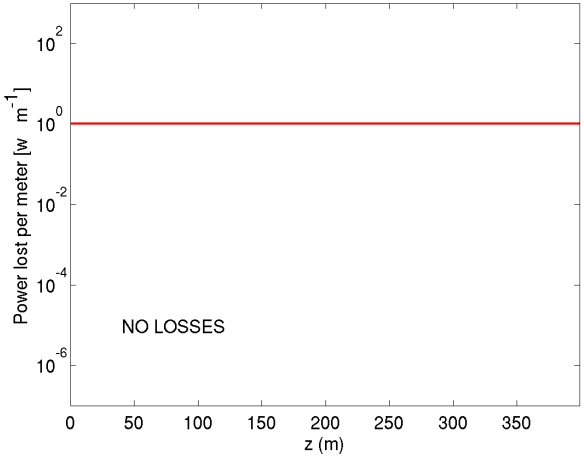


Figure: Losses [W·m^{-1}]



(211) Quads $\phi_z = 1$ mrad

Figure: RMS Emittance X

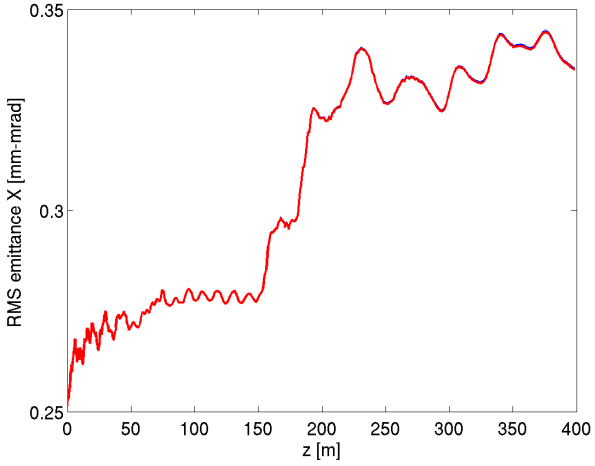


Figure: RMS Emittance Y

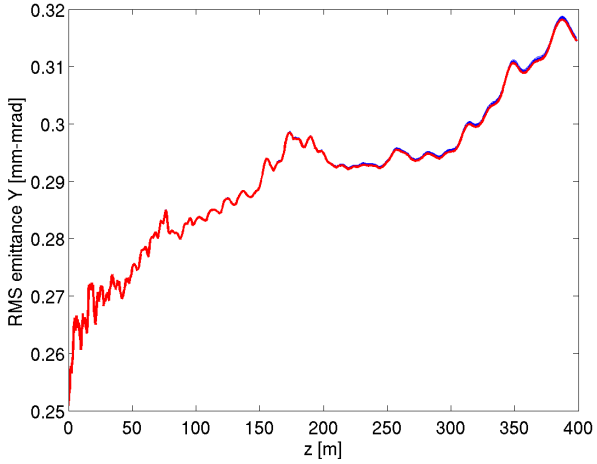


Figure: RMS Emittance Z

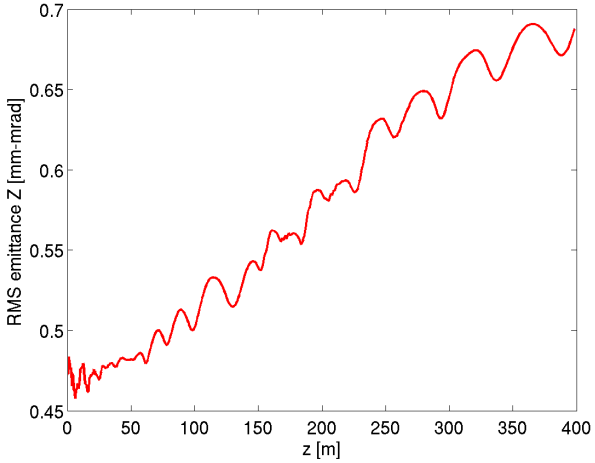
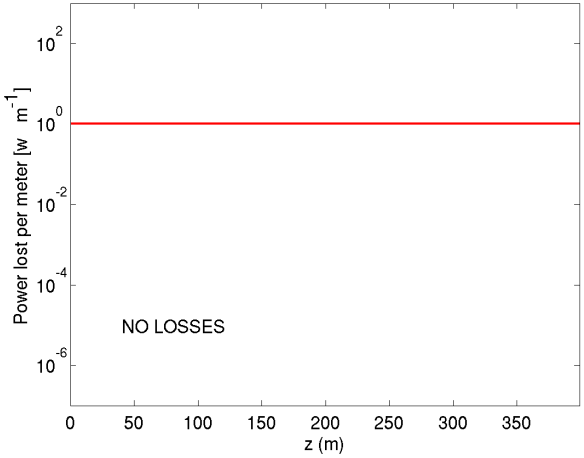


Figure: Losses [W·m^{-1}]



(212) Quads $\phi_z = 2$ mrad

Figure: RMS Emittance X

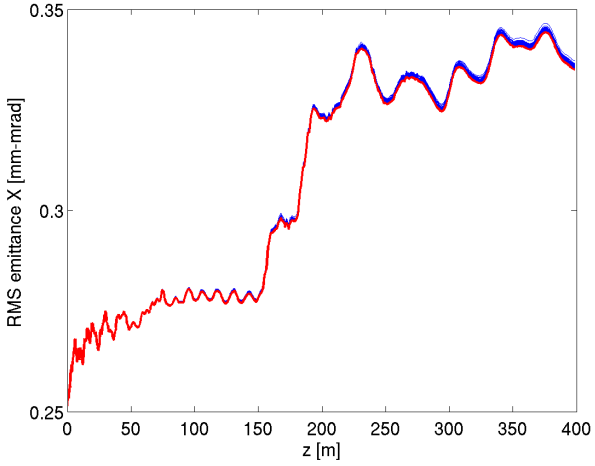


Figure: RMS Emittance Y

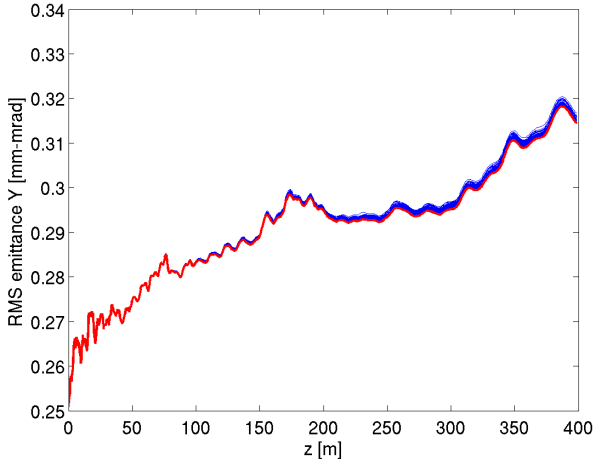


Figure: RMS Emittance Z

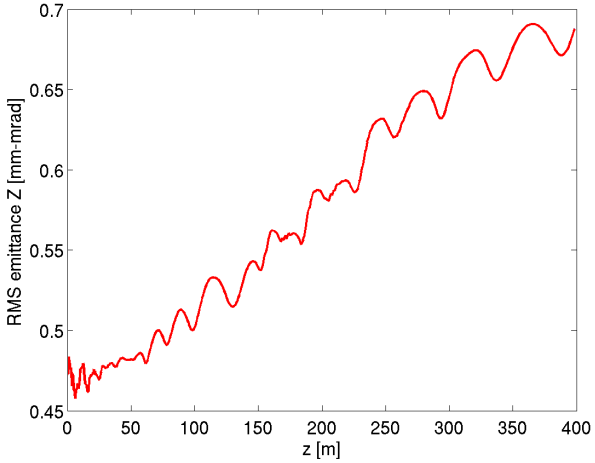
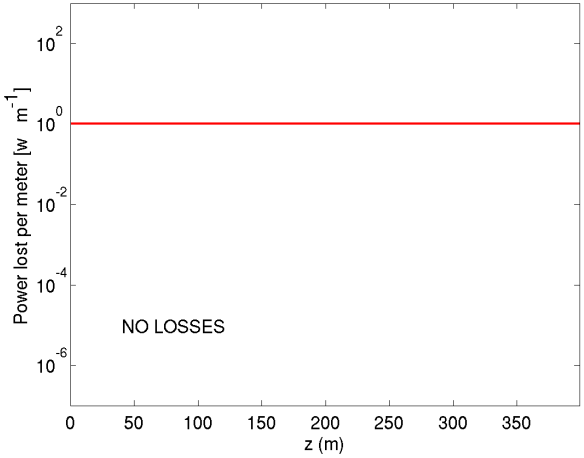


Figure: Losses [W·m^{-1}]



(213) Quads $\phi_z = 5$ mrad

Figure: RMS Emittance X

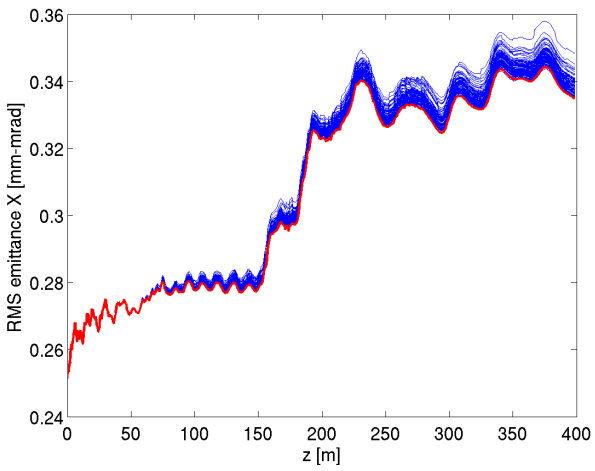


Figure: RMS Emittance Y

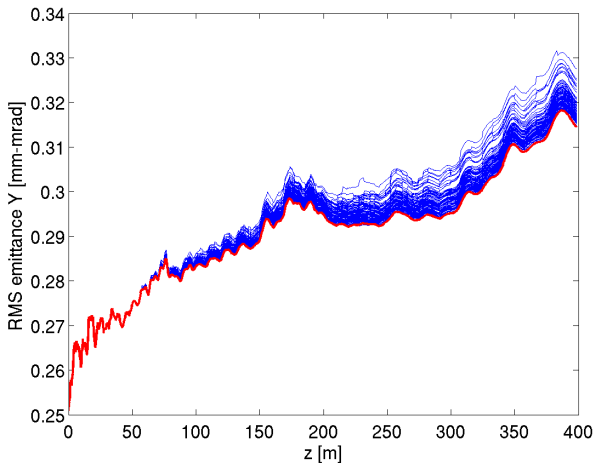


Figure: RMS Emittance Z

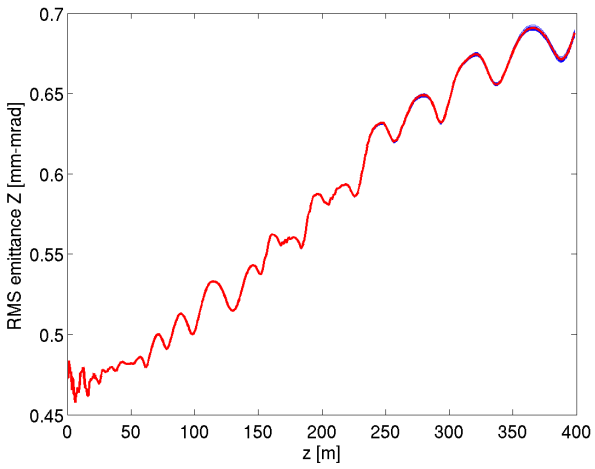
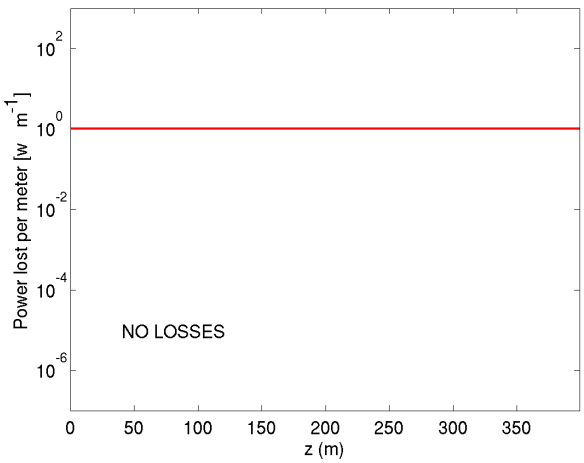


Figure: Losses [W·m^{-1}]



(214) Quads $\phi_z = 7$ mrad

Figure: RMS Emittance X

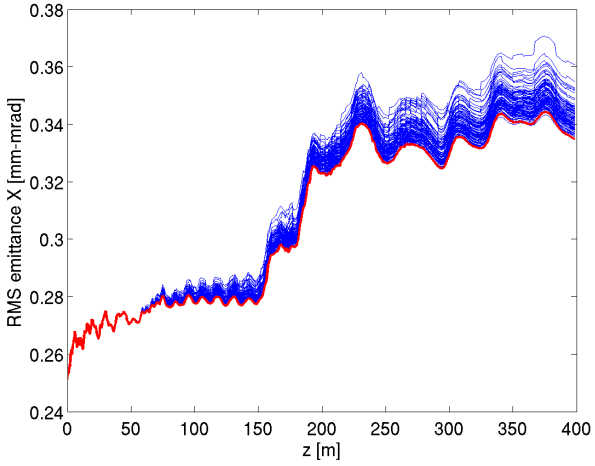


Figure: RMS Emittance Y

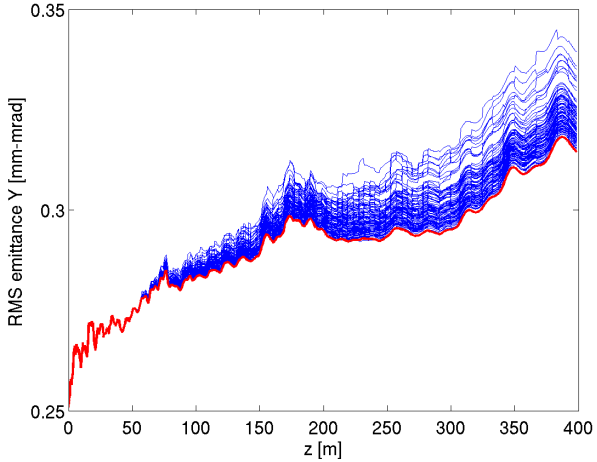


Figure: RMS Emittance Z

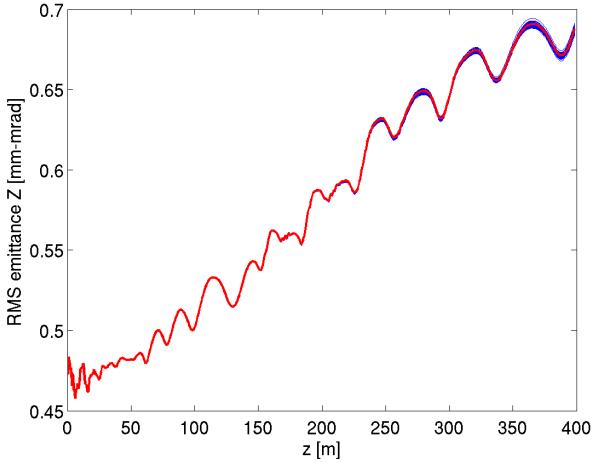
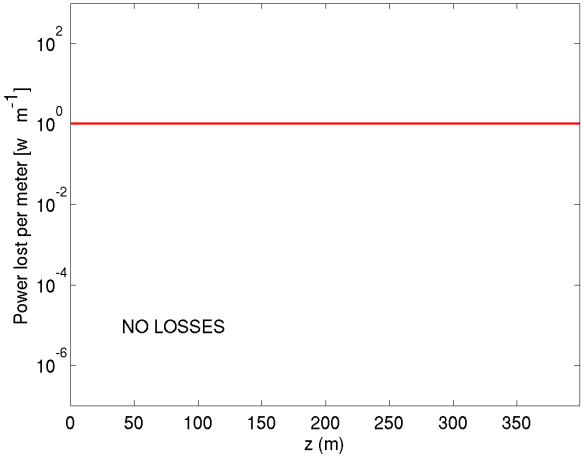


Figure: Losses [W·m^{-1}]



(215) Quads $\phi_z = 10$ mrad

Figure: RMS Emittance X

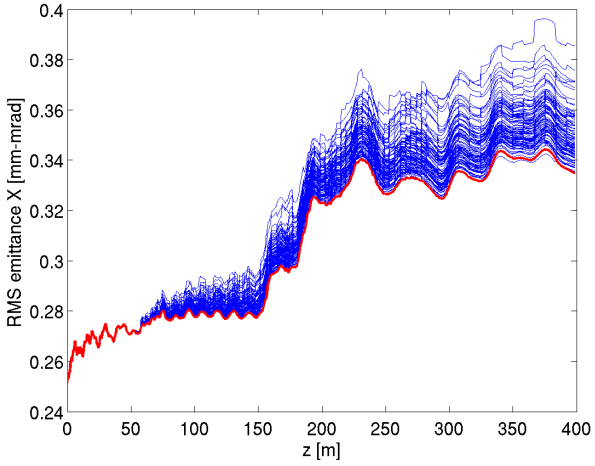


Figure: RMS Emittance Y

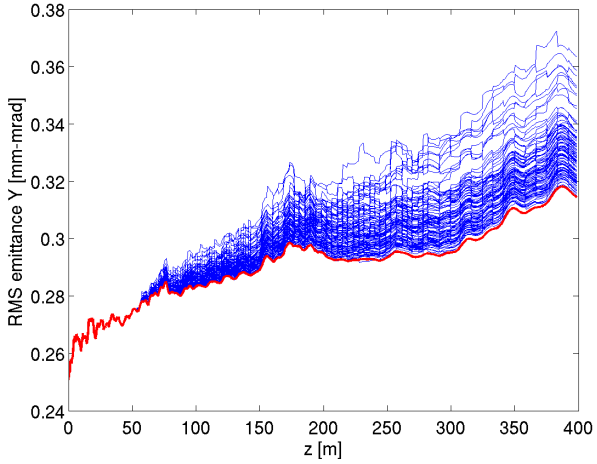


Figure: RMS Emittance Z

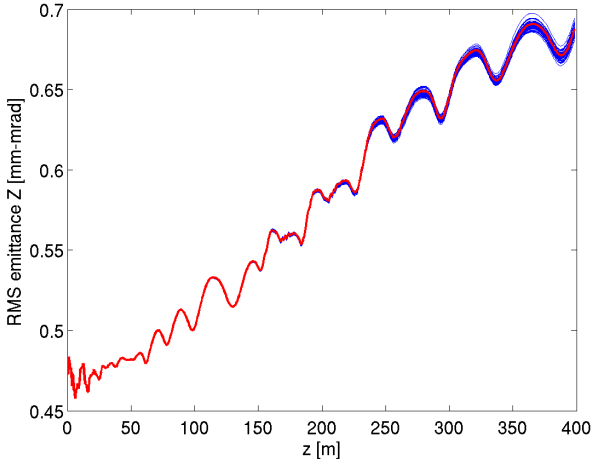
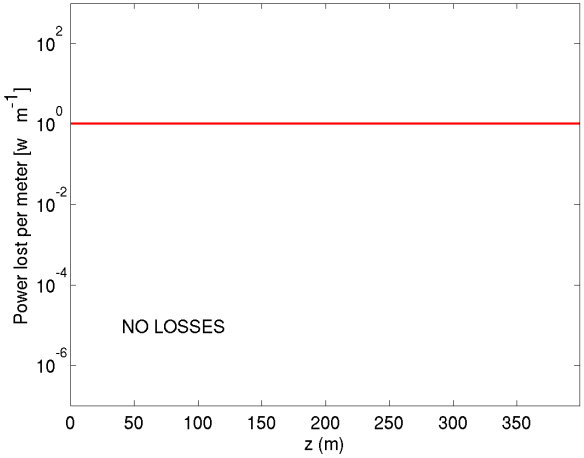


Figure: Losses [W·m^{-1}]



(216) Quads Field $\delta F_{dynamic} = 0.5$ %

Figure: RMS Emittance X

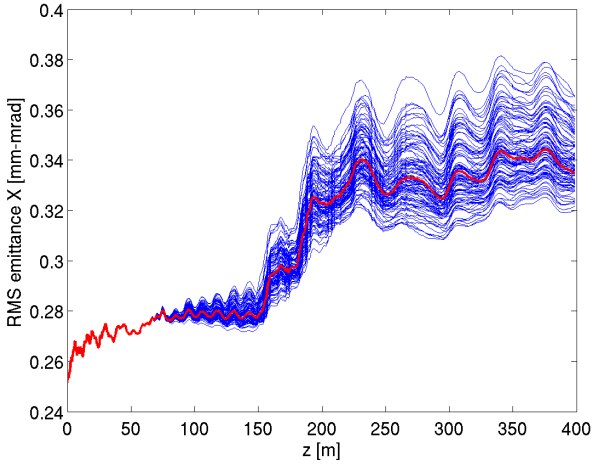


Figure: RMS Emittance Y

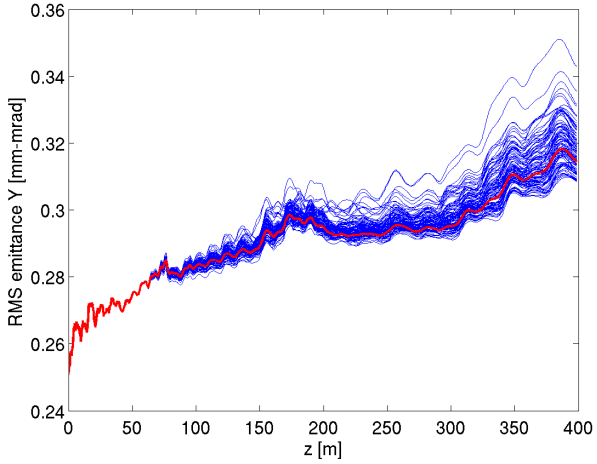


Figure: RMS Emittance Z

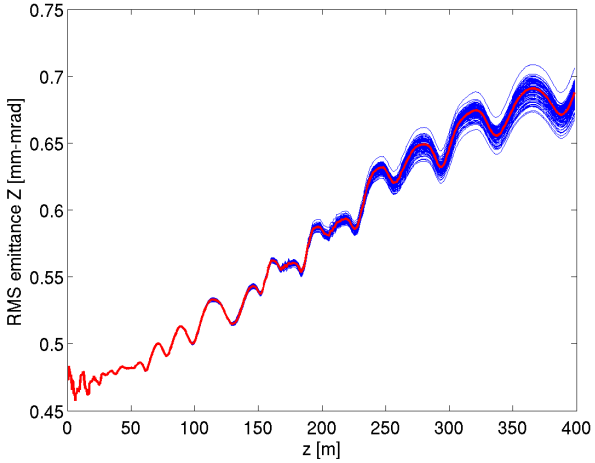
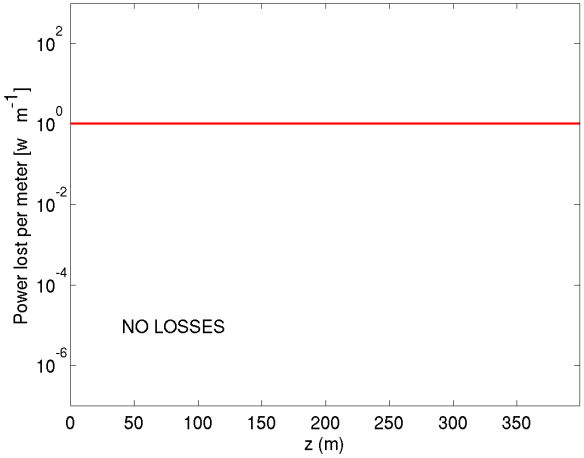


Figure: Losses [W·m^{-1}]



(217) Quads Field $\delta F_{dynamic} = 1.0$ %

Figure: RMS Emittance X

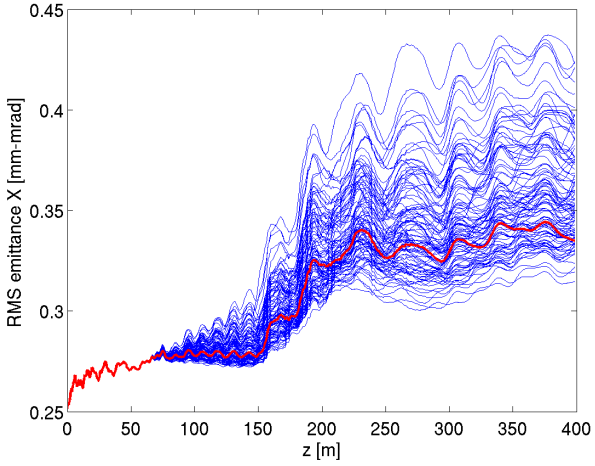


Figure: RMS Emittance Y

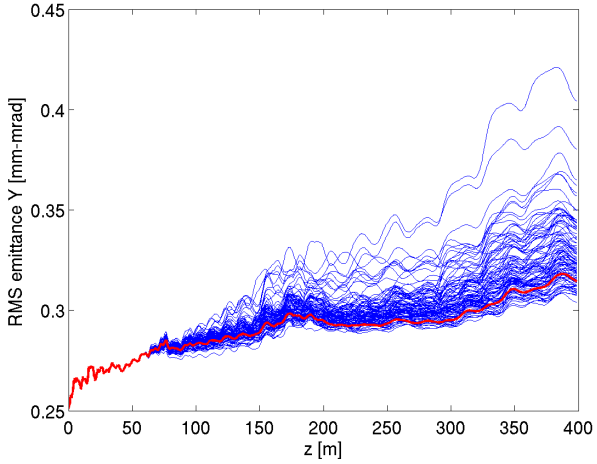


Figure: RMS Emittance Z

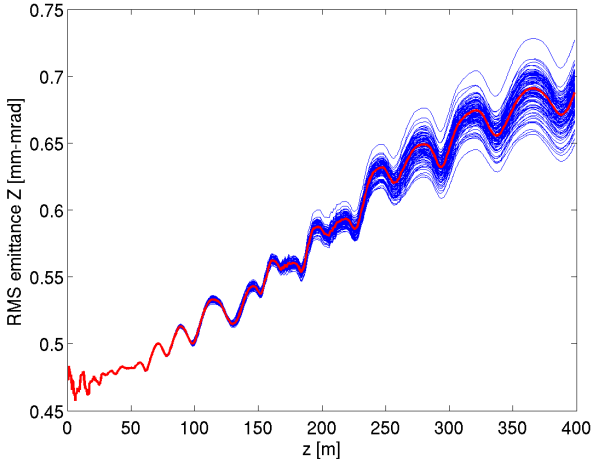
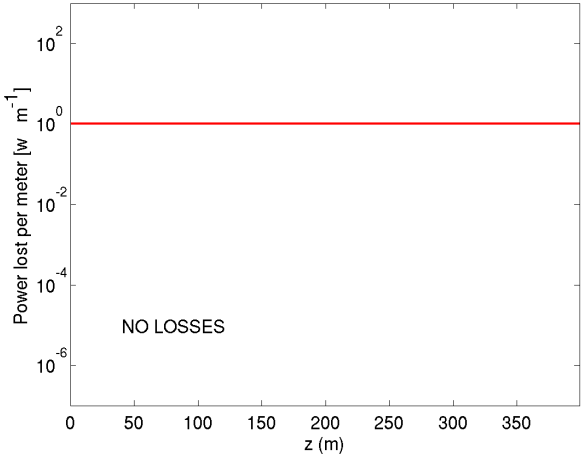


Figure: Losses [W·m^{-1}]



(218) Quads Field $\delta F_{dynamic} = 1.5\ \%$

Figure: RMS Emittance X

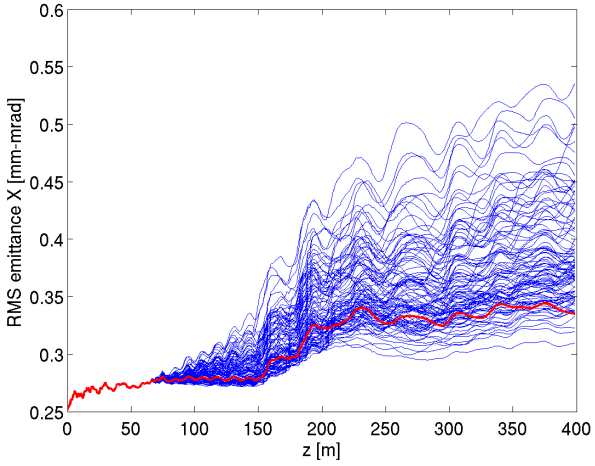


Figure: RMS Emittance Y

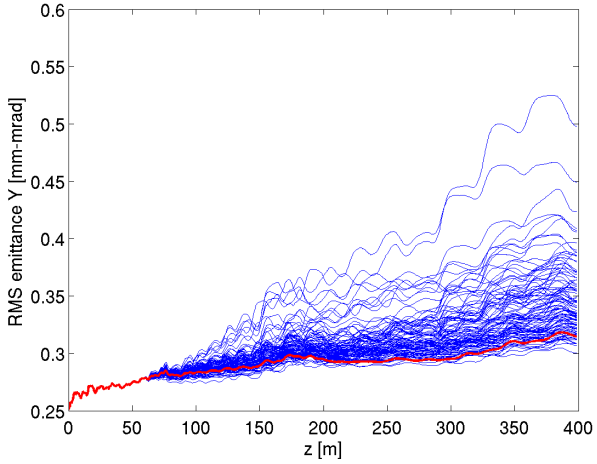


Figure: RMS Emittance Z

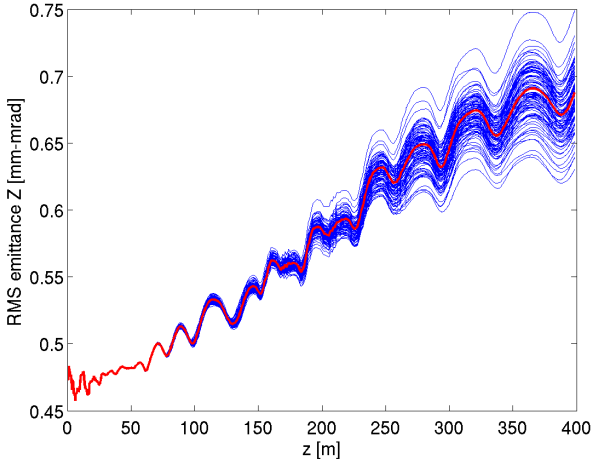
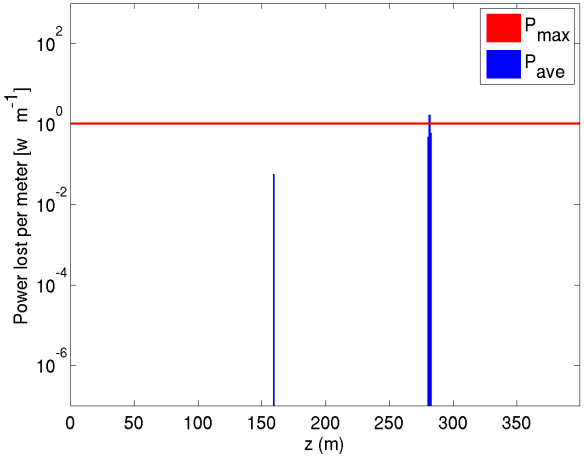


Figure: Losses [W·m^{-1}]



(219) Quads Field $\delta F_{dynamic} = 2.0$ %

Figure: RMS Emittance X

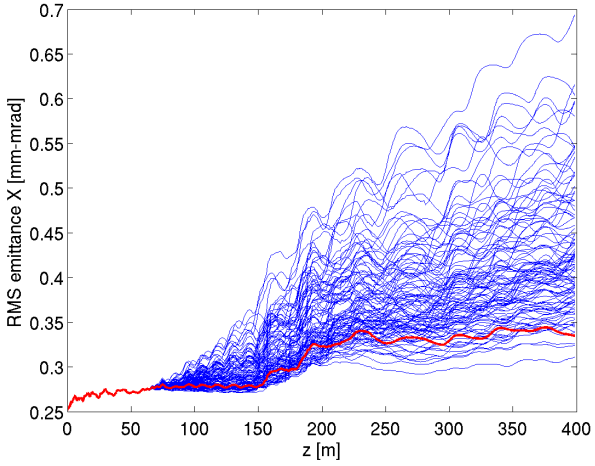


Figure: RMS Emittance Y

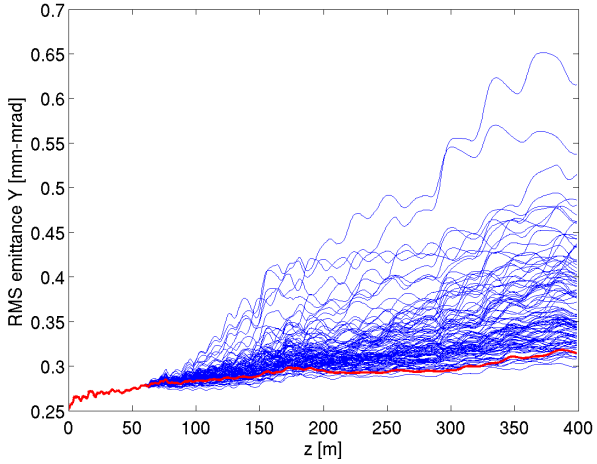


Figure: RMS Emittance Z

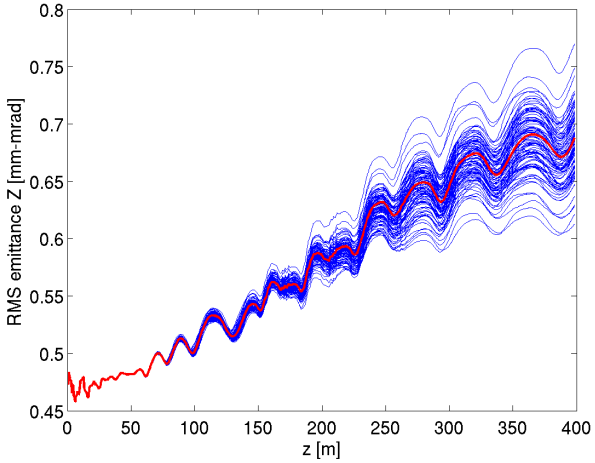
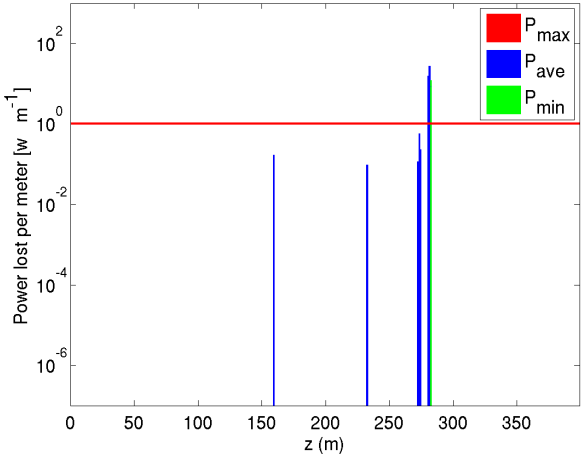


Figure: Losses [W·m^{-1}]



(220) Quads Field $\delta F_{dynamic} = 2.5$ %

Figure: RMS Emittance X

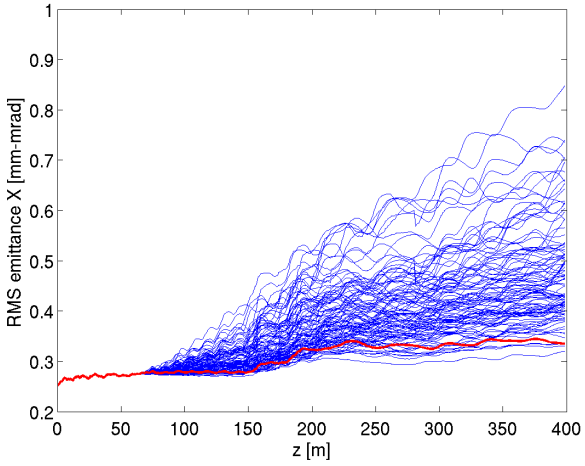


Figure: RMS Emittance Y

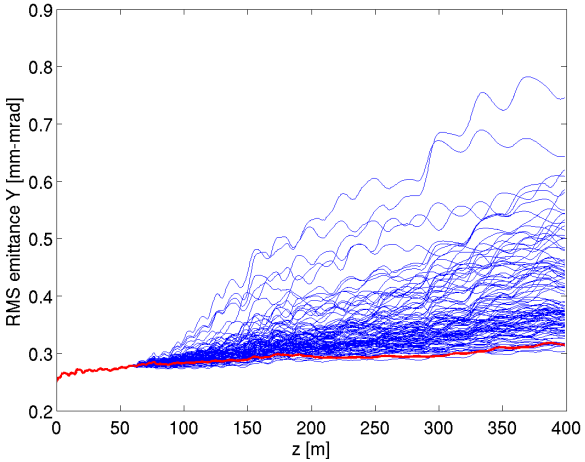


Figure: RMS Emittance Z

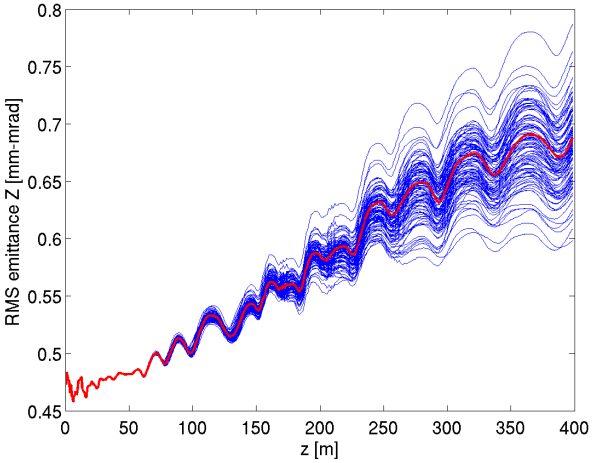
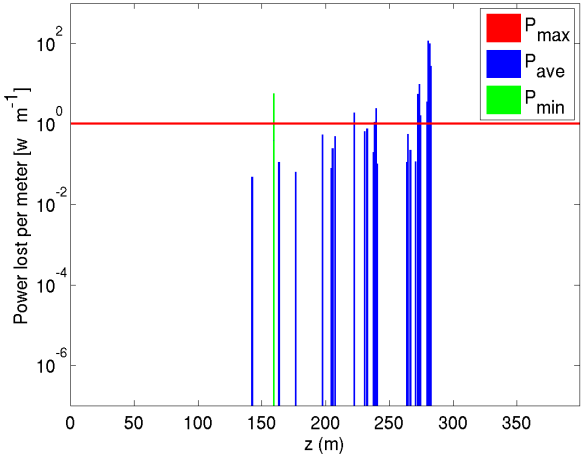


Figure: Losses [W·m^{-1}]



(221) Quads Field $\delta F_{static} = 0.5$ %

Figure: RMS Emittance X

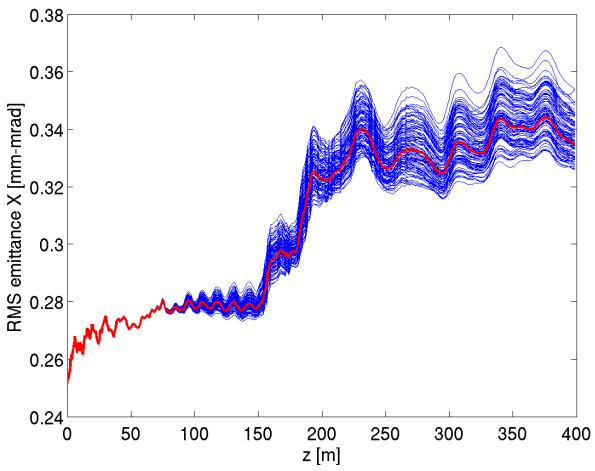


Figure: RMS Emittance Y

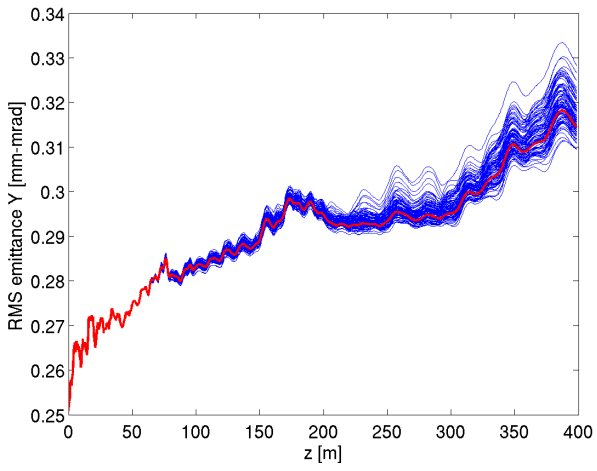


Figure: RMS Emittance Z

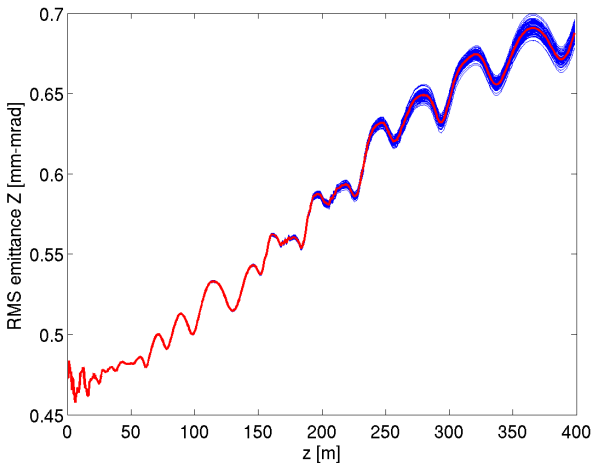
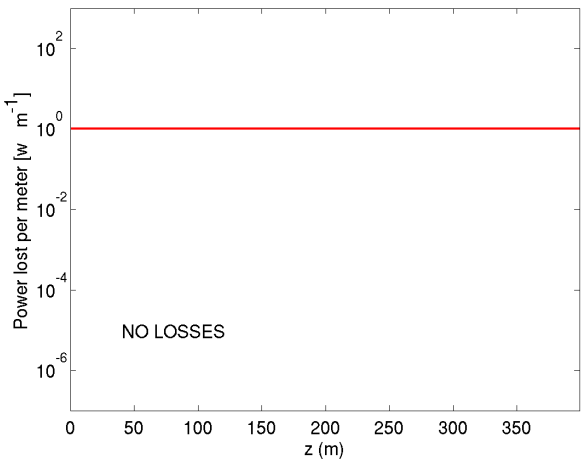


Figure: Losses [W·m^{-1}]



(222) Quads Field $\delta F_{static} = 1.0$ %

Figure: RMS Emittance X

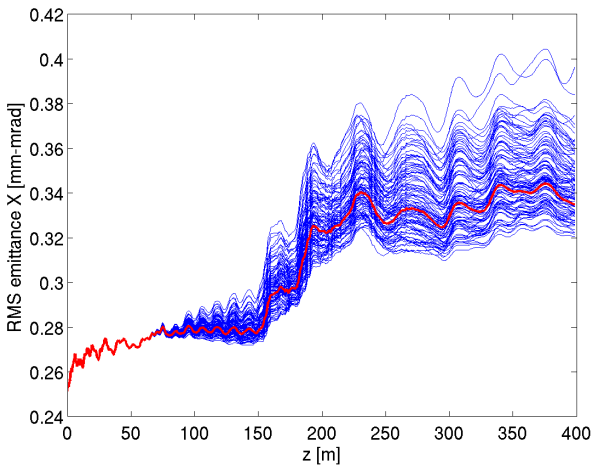


Figure: RMS Emittance Y

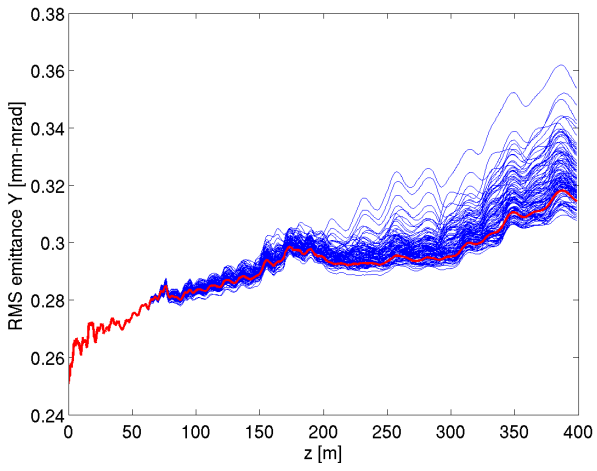


Figure: RMS Emittance Z

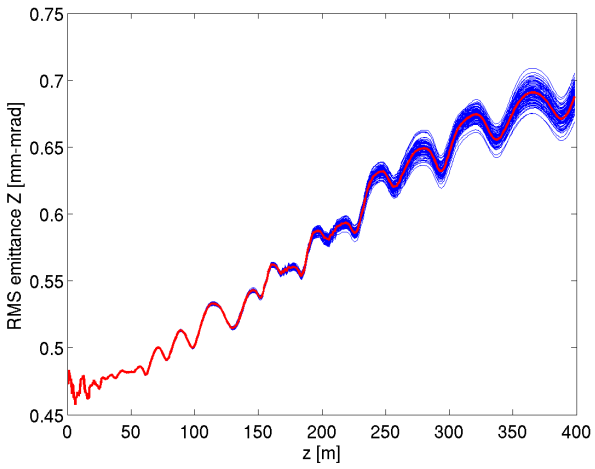
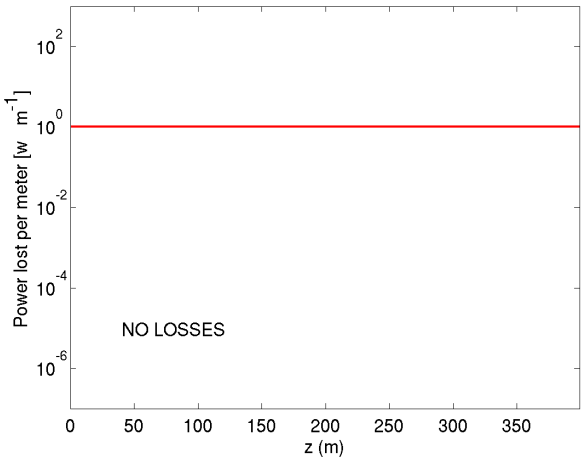


Figure: Losses [W·m^{-1}]



(223) Quads Field $\delta F_{static} = 1.5$ %

Figure: RMS Emittance X

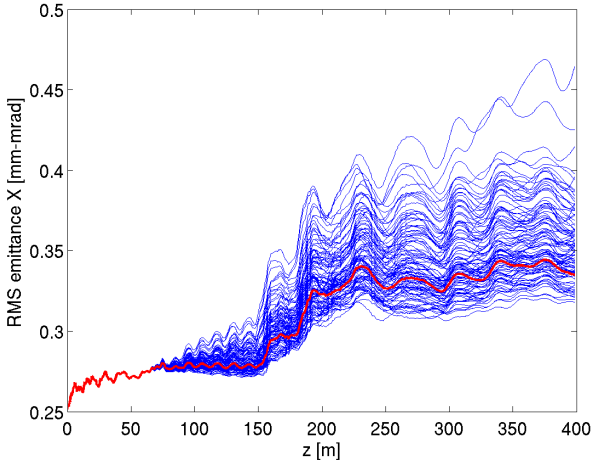


Figure: RMS Emittance Y

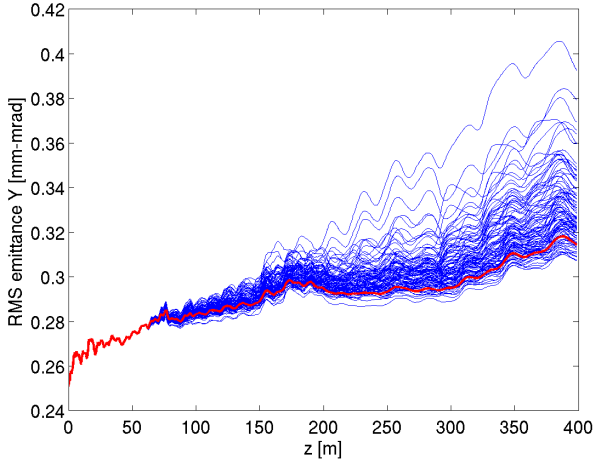


Figure: RMS Emittance Z

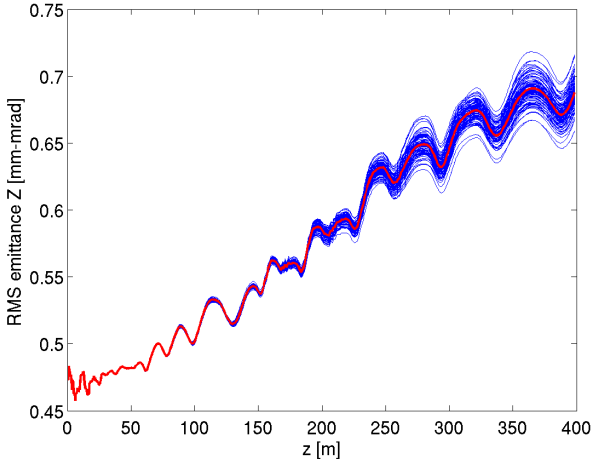
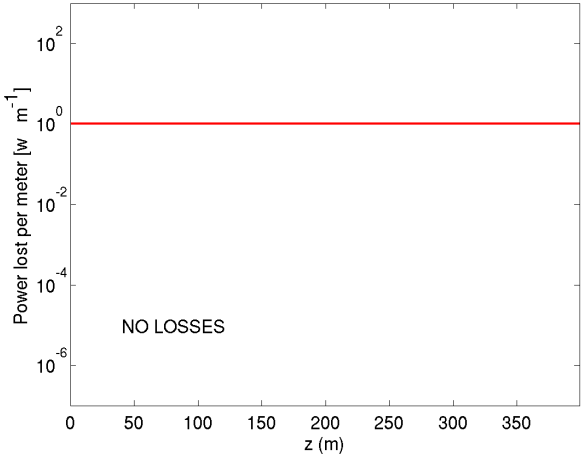


Figure: Losses [W·m^{-1}]



(224) Quads Field $\delta F_{static} = 2.0$ %

Figure: RMS Emittance X

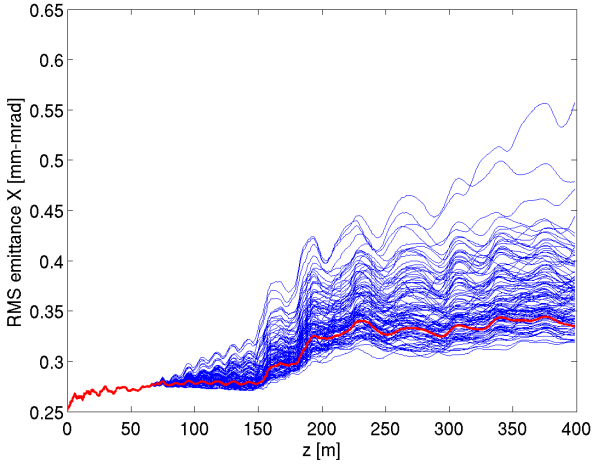


Figure: RMS Emittance Y

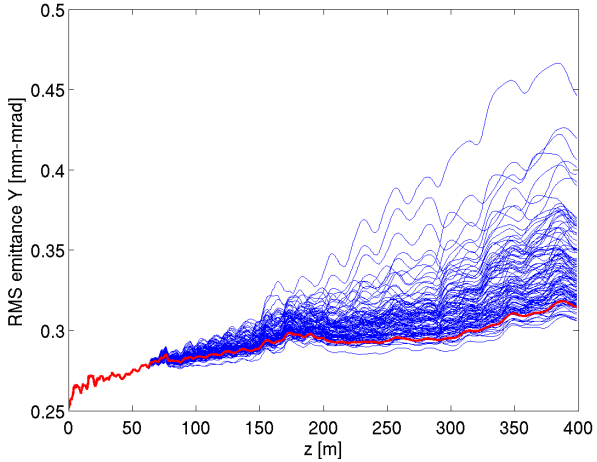


Figure: RMS Emittance Z

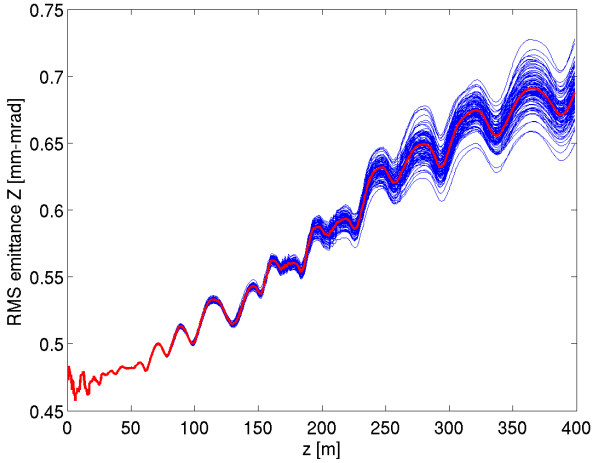
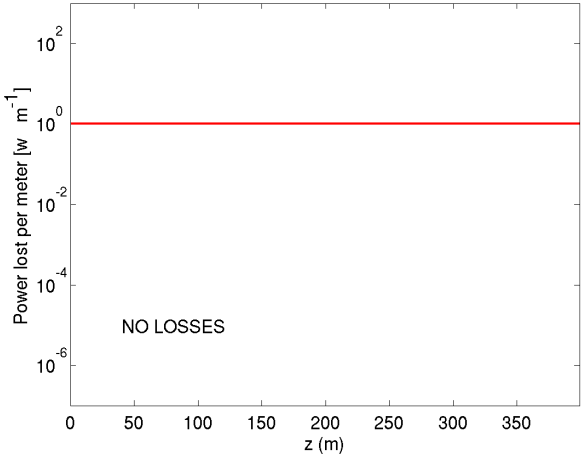


Figure: Losses [W·m^{-1}]



(225) Quads Field $\delta F_{static} = 2.5$ %

Figure: RMS Emittance X

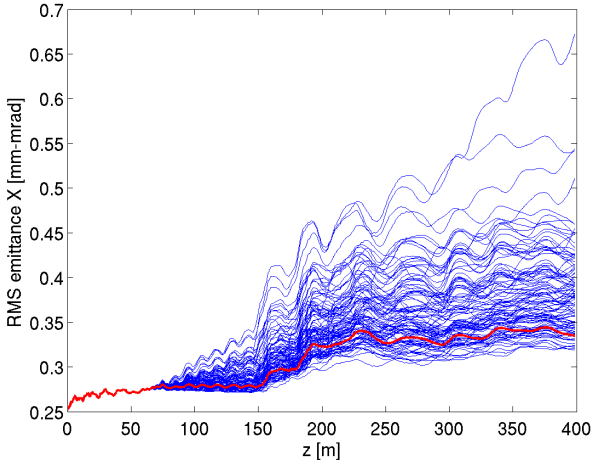


Figure: RMS Emittance Y

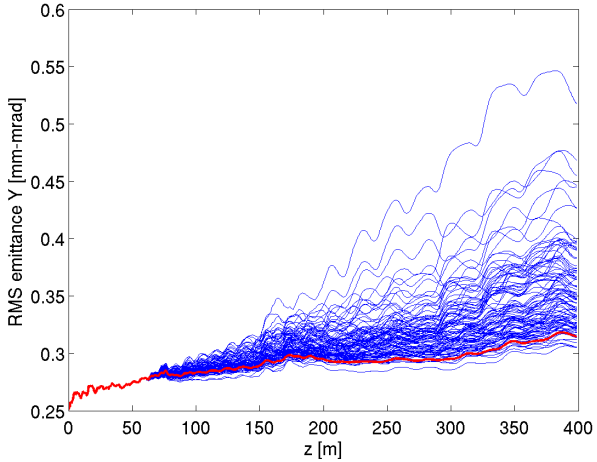


Figure: RMS Emittance Z

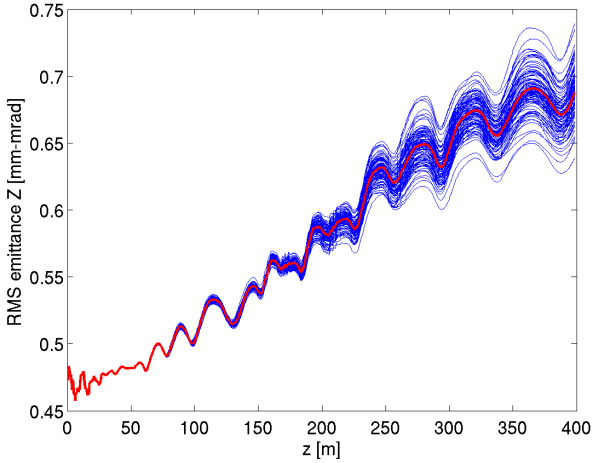
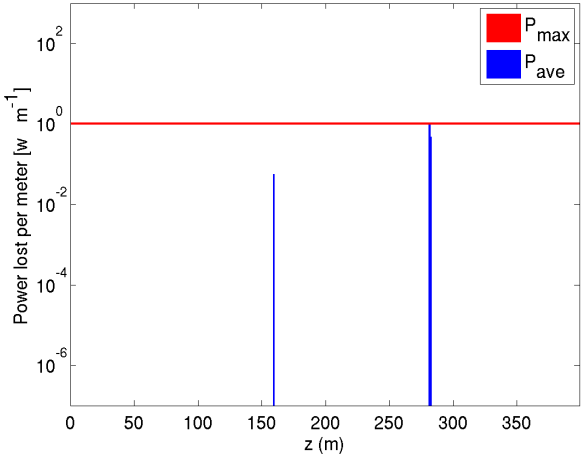


Figure: Losses [W·m^{-1}]



(226) Cav. $\delta_{xy} = 150\ \mu$m

Figure: RMS Emittance X

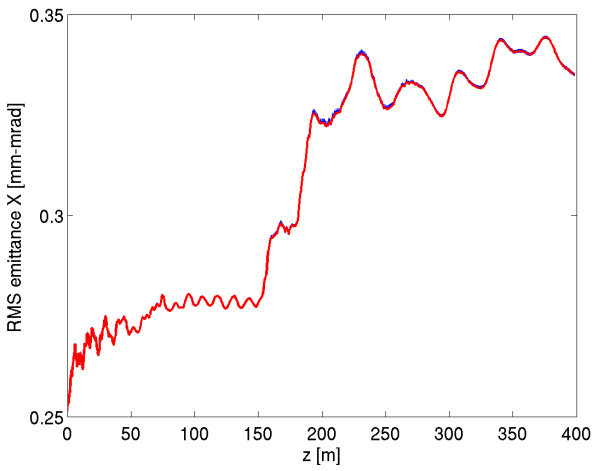


Figure: RMS Emittance Y

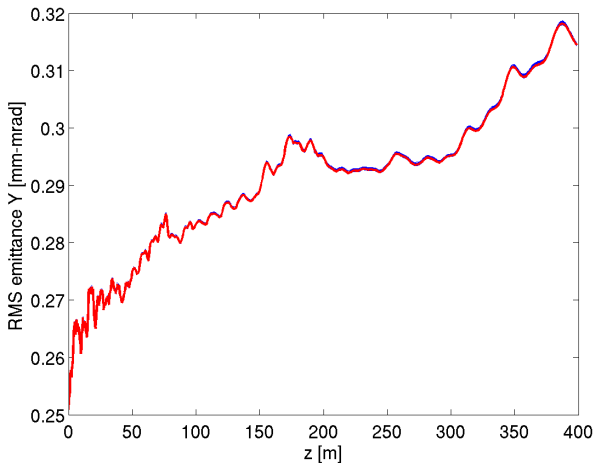


Figure: RMS Emittance Z

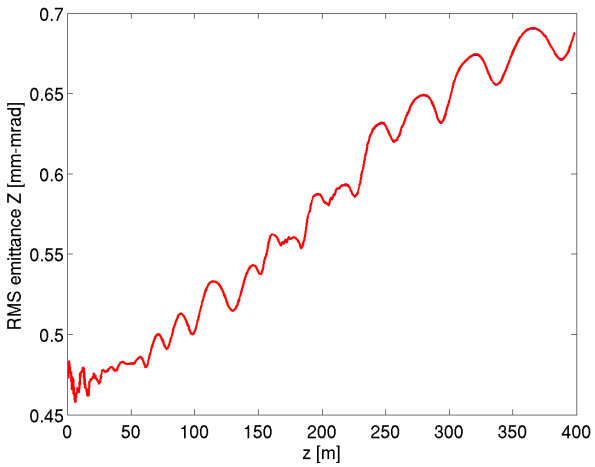
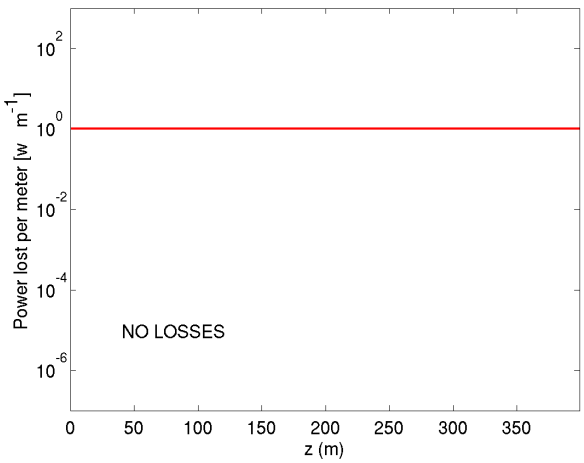


Figure: Losses [W·m^{-1}]



(227) Cav. $\delta_{xy} = 300\ \mu$m

Figure: RMS Emittance X

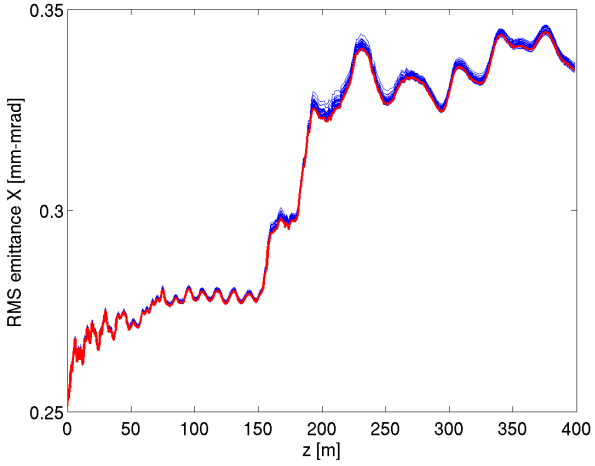


Figure: RMS Emittance Y

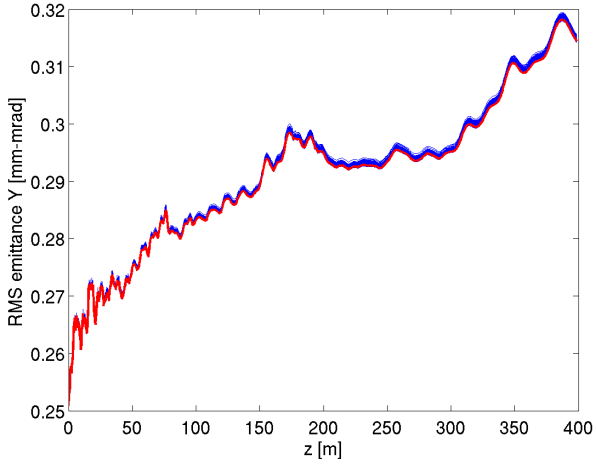


Figure: RMS Emittance z

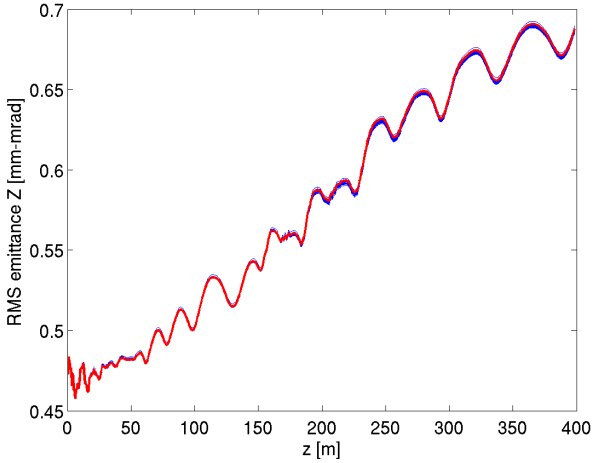
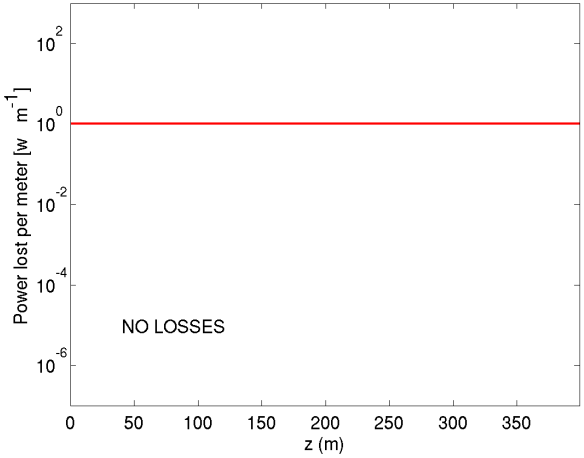


Figure: Losses [W·m^{-1}]



(228) Cav. $\delta_{xy} = 500\ \mu$m

Figure: RMS Emittance X

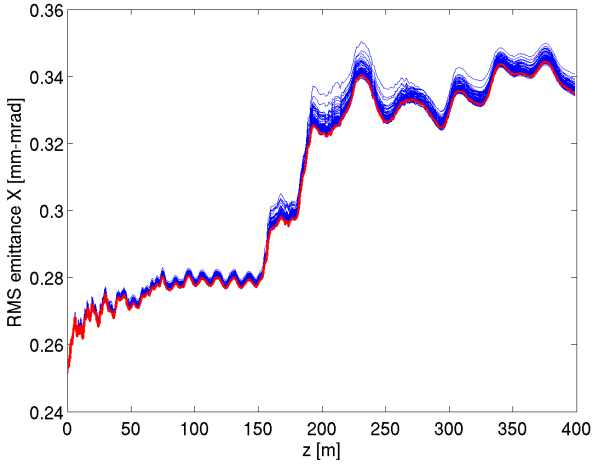


Figure: RMS Emittance Y

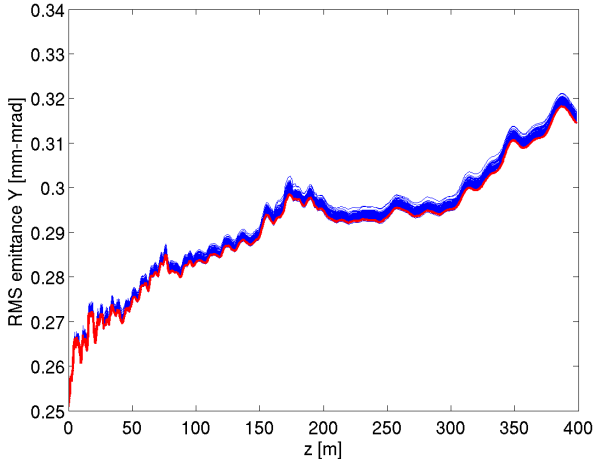


Figure: RMS Emittance Z

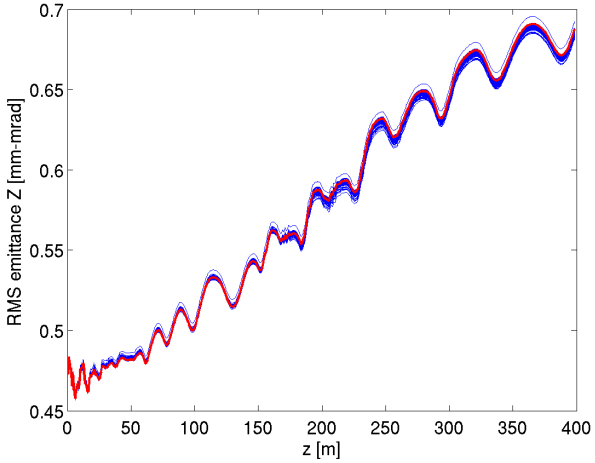
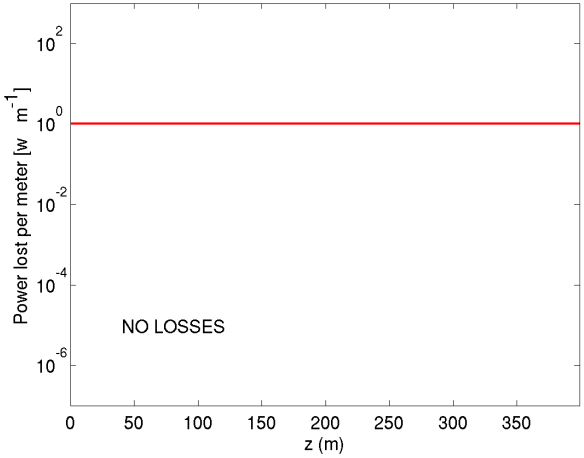


Figure: Losses [W·m^{-1}]



(229) Cav. $\delta_{xy} = 750\ \mu$m

Figure: RMS Emittance X

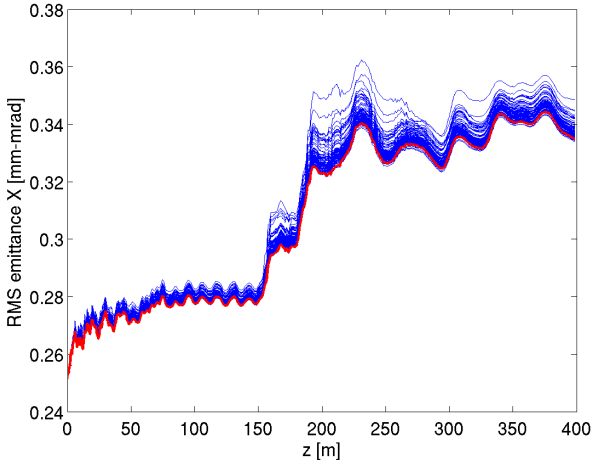


Figure: RMS Emittance Y

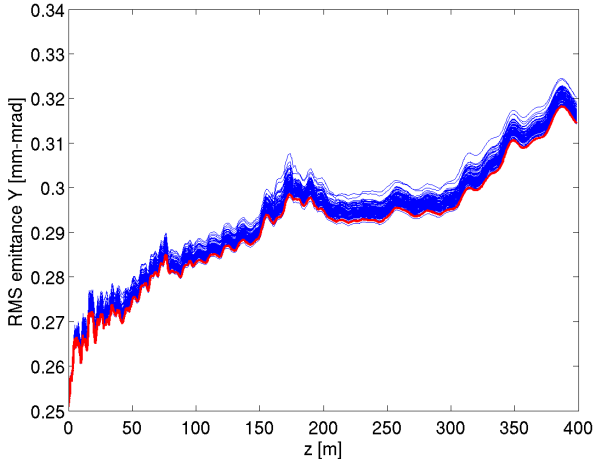


Figure: RMS Emittance Z

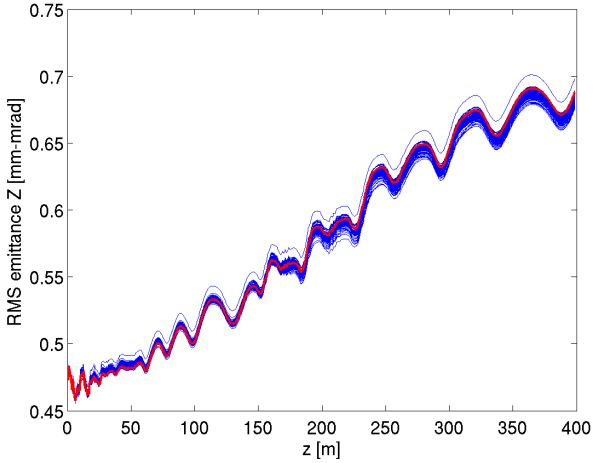
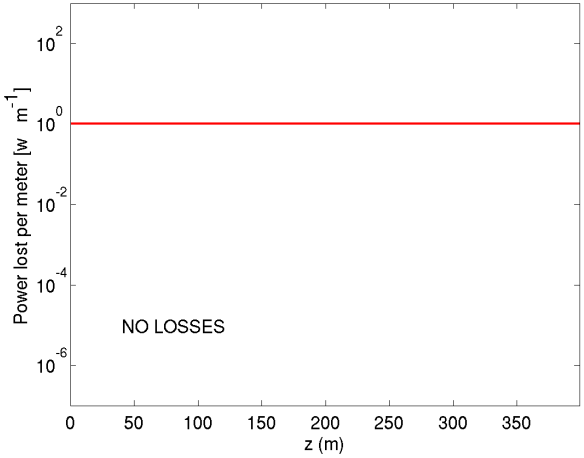


Figure: Losses [W·m^{-1}]



(230) Cav. $\delta_{xy} = 1000\ \mu$m

Figure: RMS Emittance X

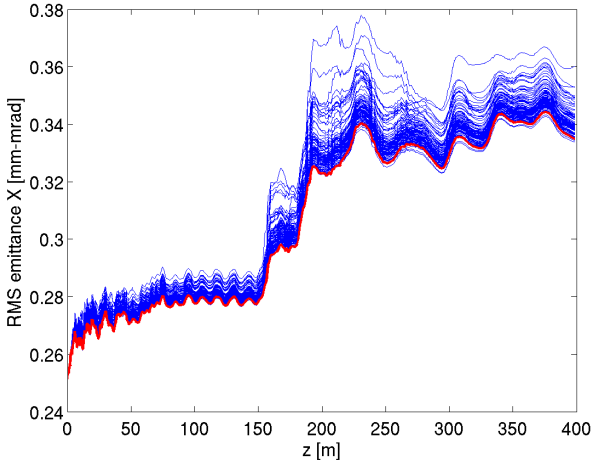


Figure: RMS Emittance Y

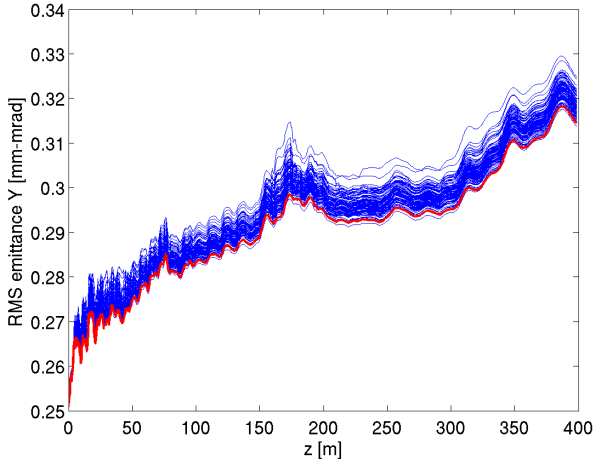


Figure: RMS Emittance Z

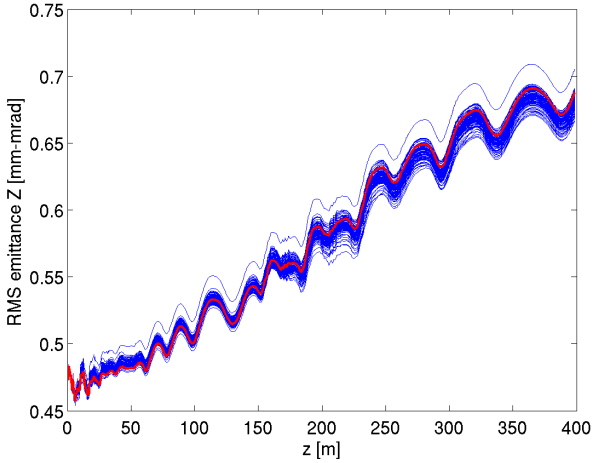
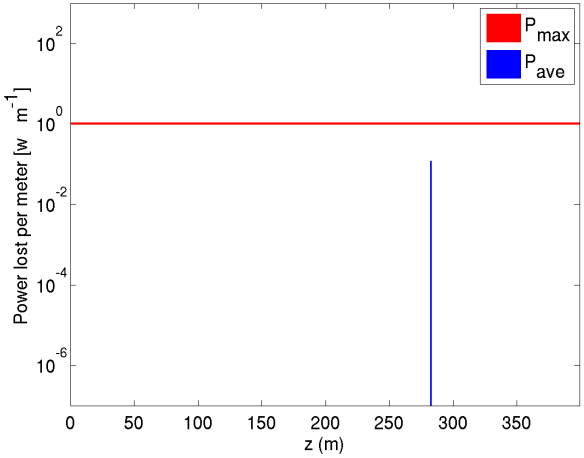


Figure: Losses [W·m^{-1}]



(231) Cav. $\delta_z = 150\ \mu$m

Figure: RMS Emittance X

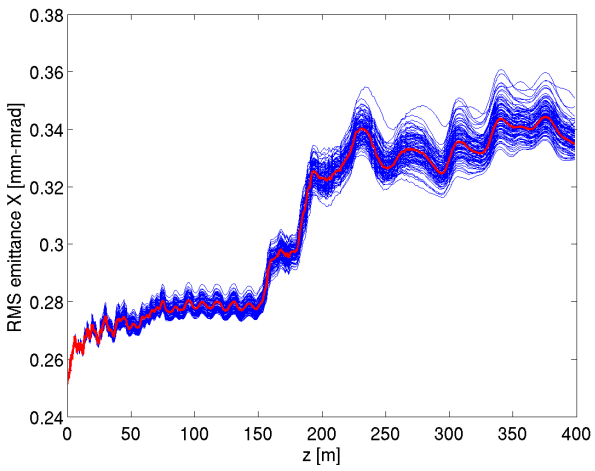


Figure: RMS Emittance Y

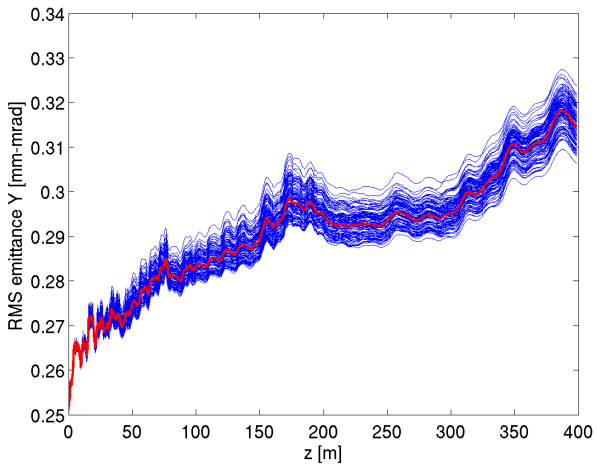


Figure: RMS Emittance Z

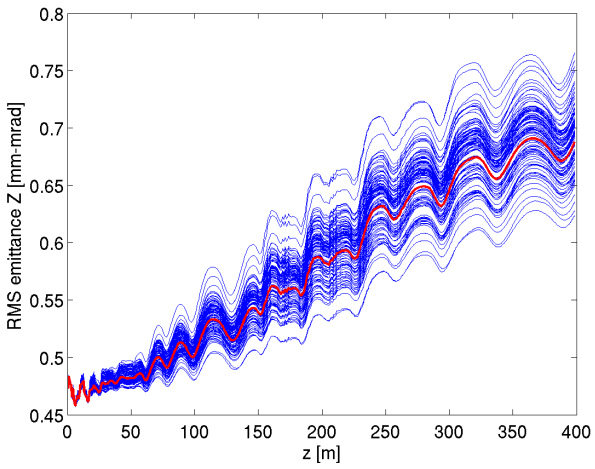
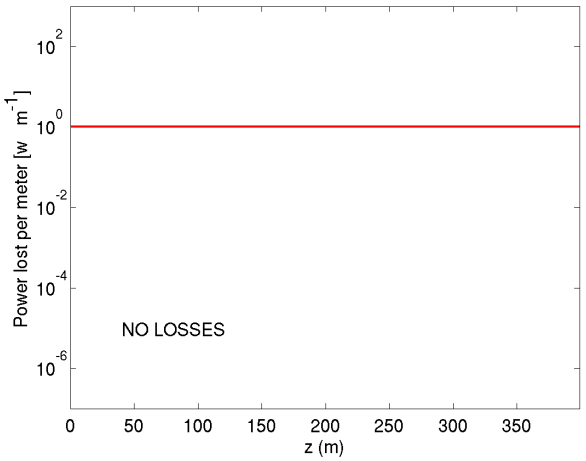


Figure: Losses [W·m^{-1}]



(232) Cav. $\delta_z = 300\ \mu$m

Figure: RMS Emittance X

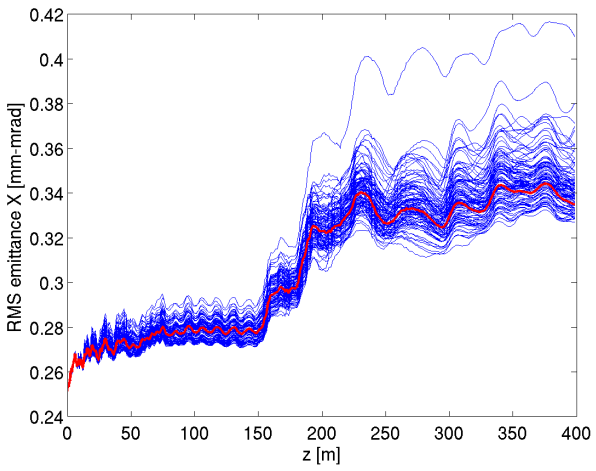


Figure: RMS Emittance Y

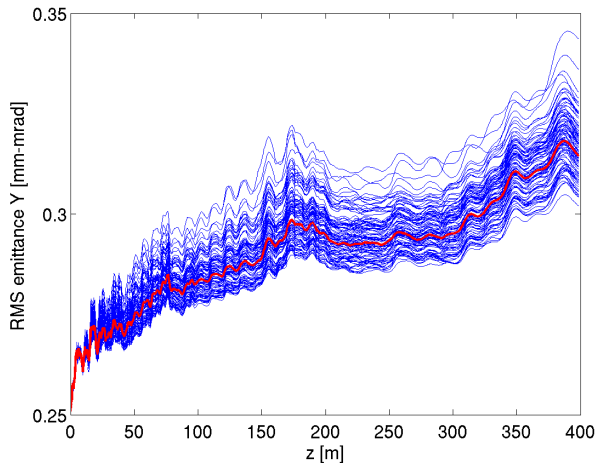


Figure: RMS Emittance Z

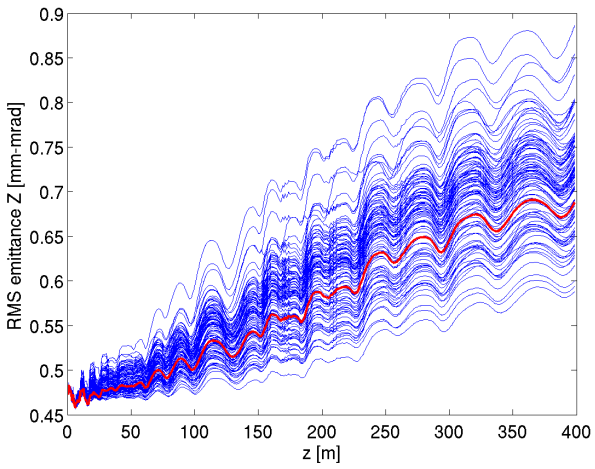
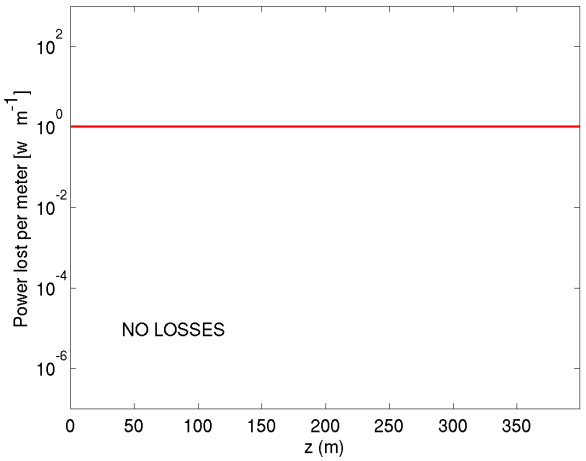


Figure: Losses [W·m^{-1}]



(233) Cav. $\delta_z = 500\ \mu$m

Figure: RMS Emittance X

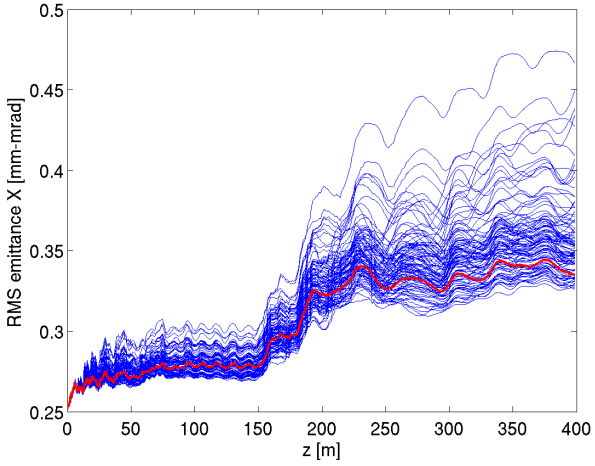


Figure: RMS Emittance Y

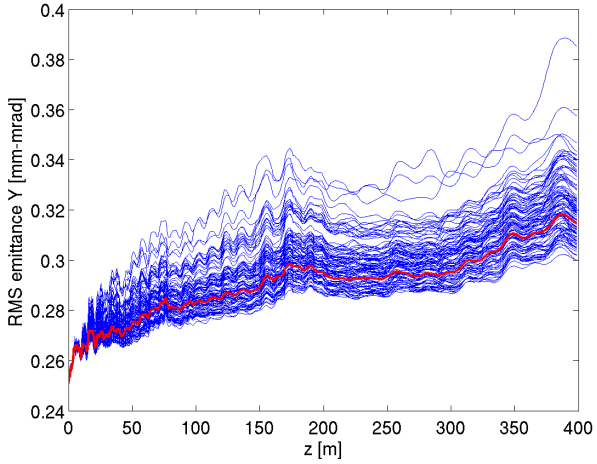


Figure: RMS Emittance Z

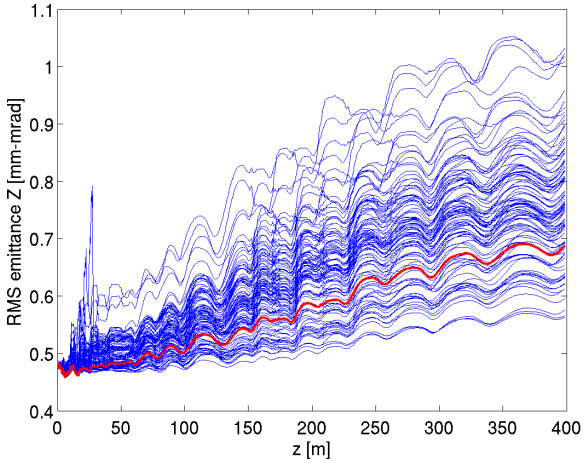
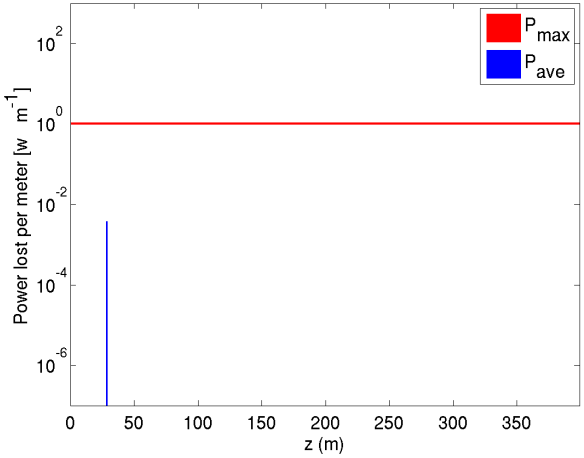


Figure: Losses [W·m^{-1}]



(234) Cav. $\delta_z = 750\ \mu$m

Figure: RMS Emittance X

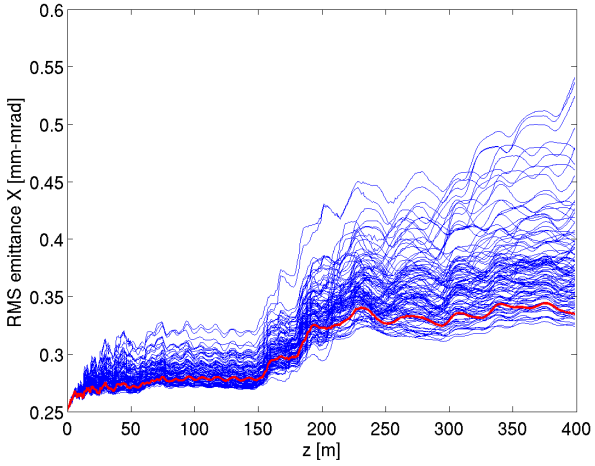


Figure: RMS Emittance Y

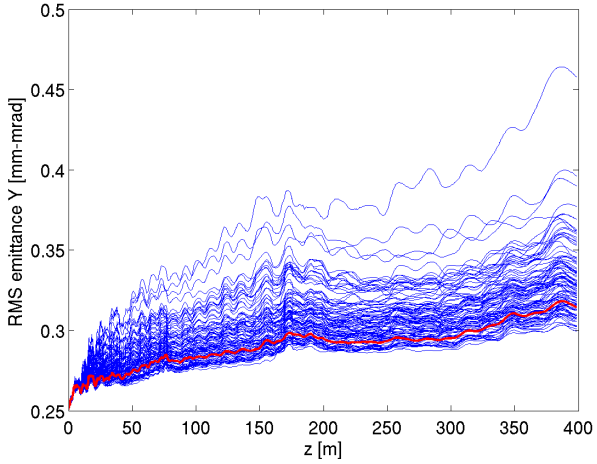


Figure: RMS Emittance Z

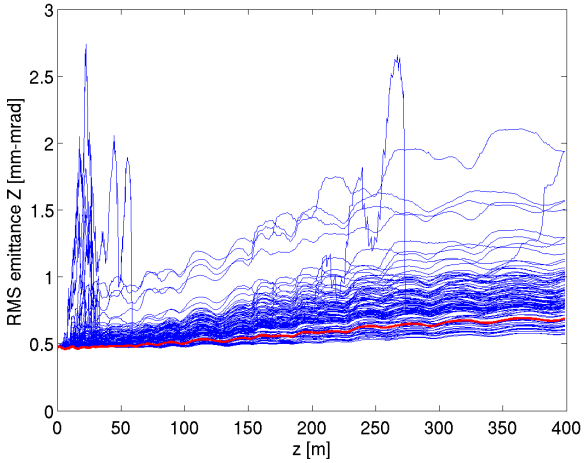
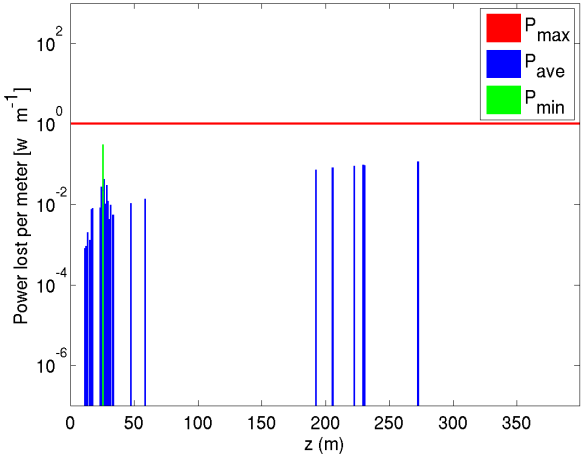


Figure: Losses [W·m^{-1}]



(235) Cav. $\delta_z = 1000\ \mu$m

Figure: RMS Emittance X

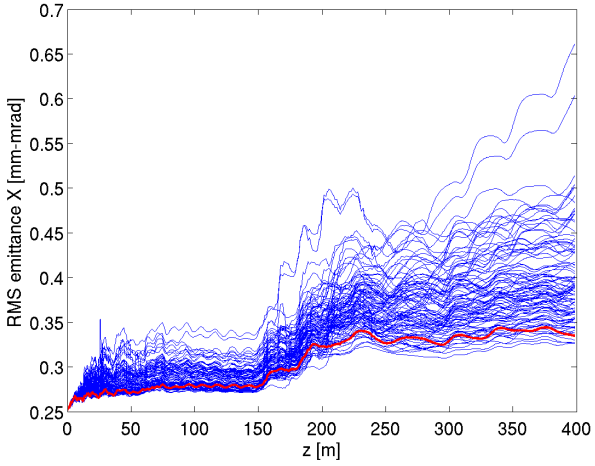


Figure: RMS Emittance Y

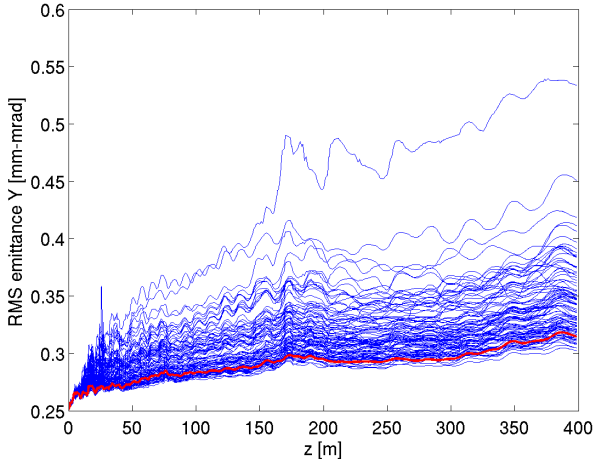


Figure: RMS Emittance Z

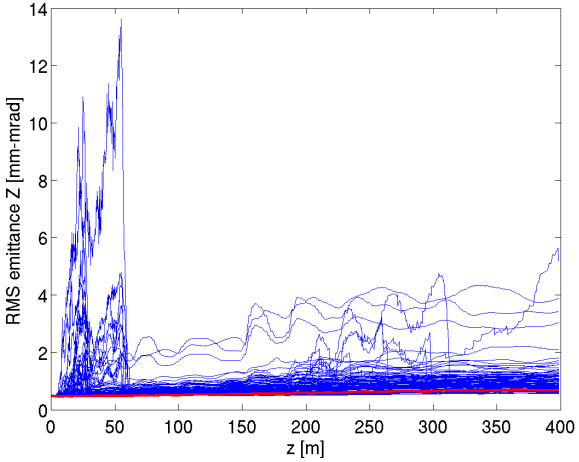
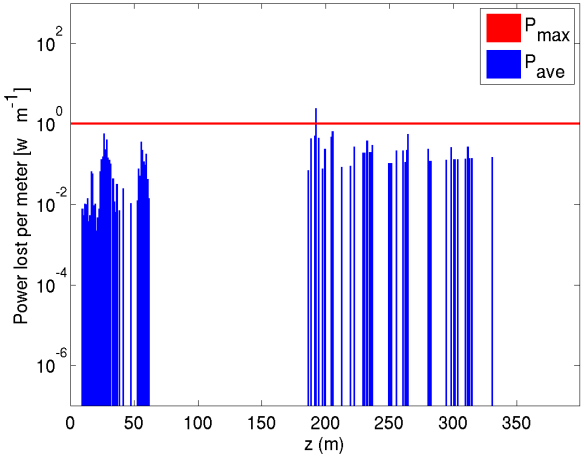


Figure: Losses [W·m^{-1}]



(236) Cavities $\phi_z = 1$ mrad

Figure: RMS Emittance X

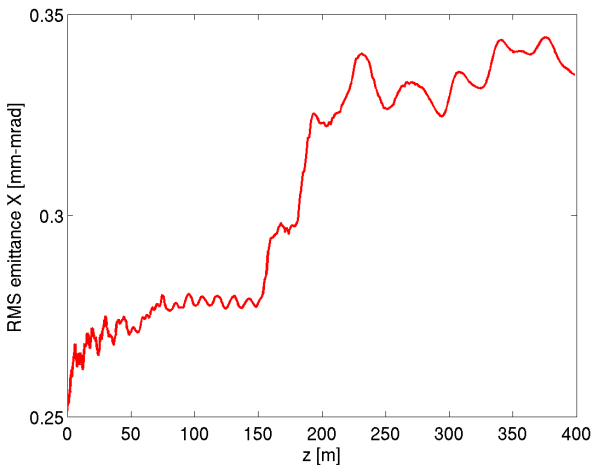


Figure: RMS Emittance Y

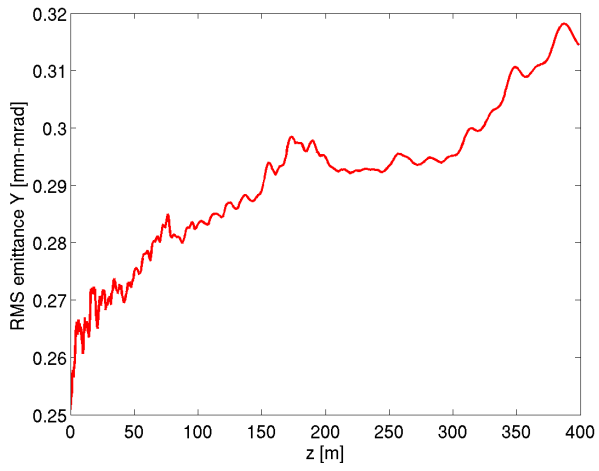


Figure: RMS Emittance Z

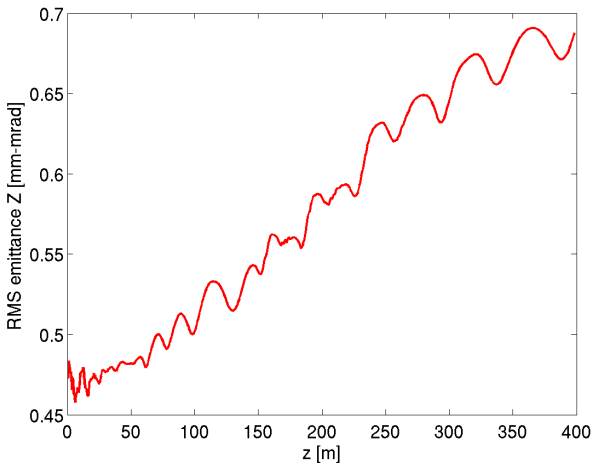
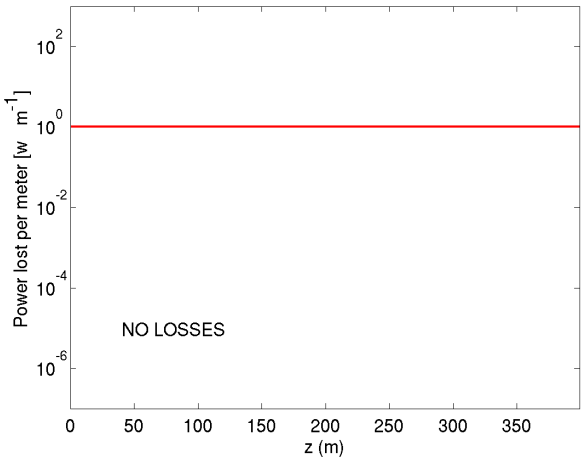


Figure: Losses [W·m^{-1}]



(237) Cavities $\phi_z = 2$ mrad

Figure: RMS Emittance X

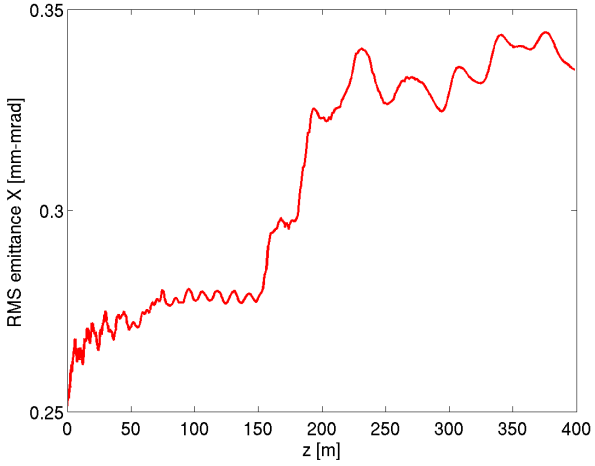


Figure: RMS Emittance Y

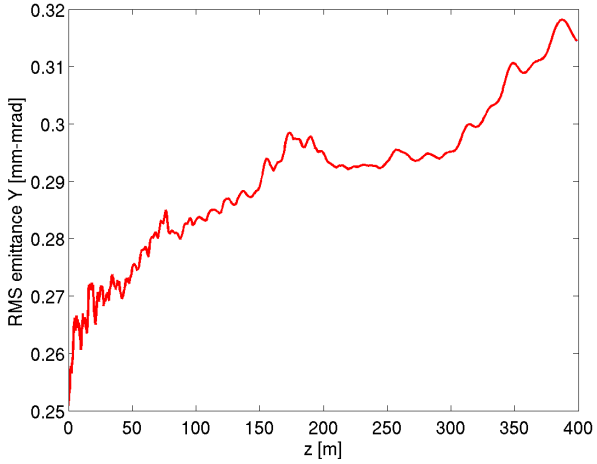


Figure: RMS Emittance Z

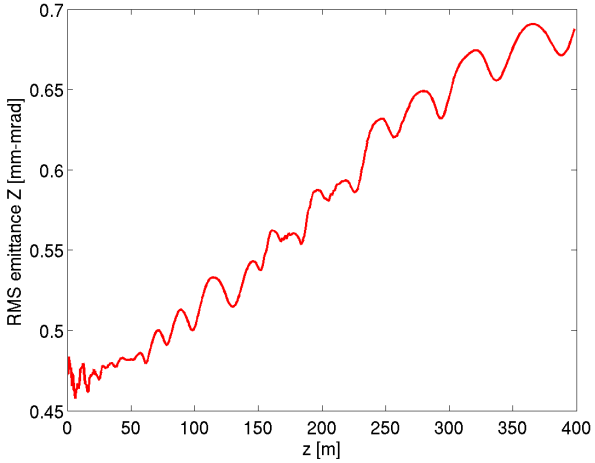
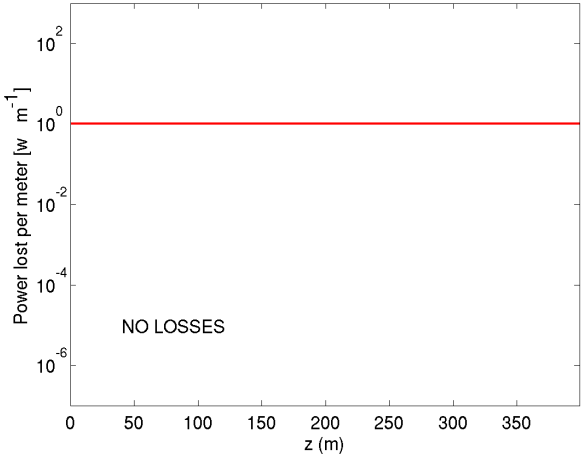


Figure: Losses [W·m^{-1}]



(238) Cavities $\phi_z = 5$ mrad

Figure: RMS Emittance X

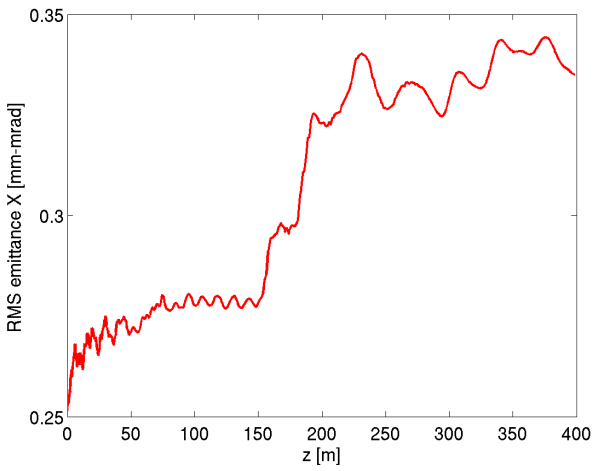


Figure: RMS Emittance Y

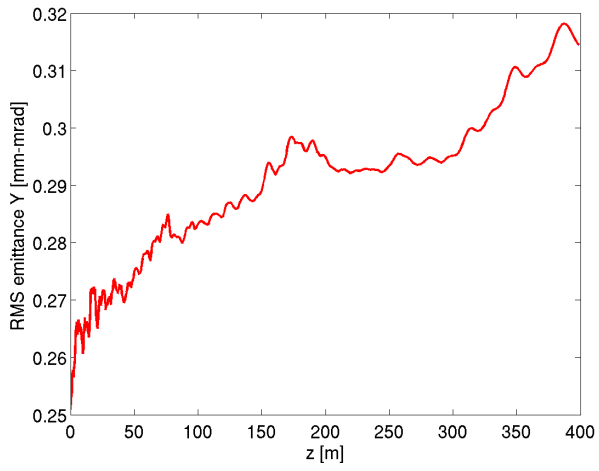


Figure: RMS Emittance Z

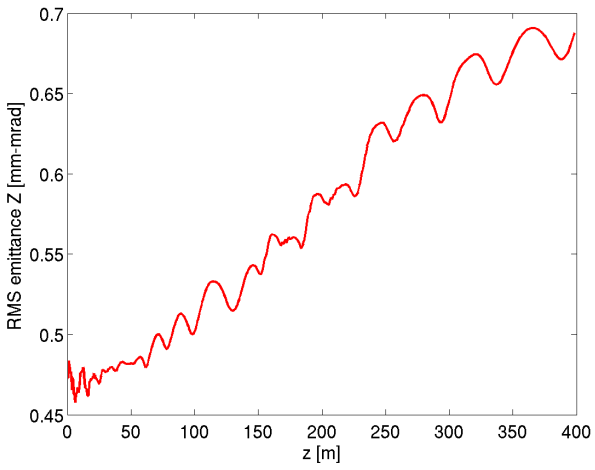
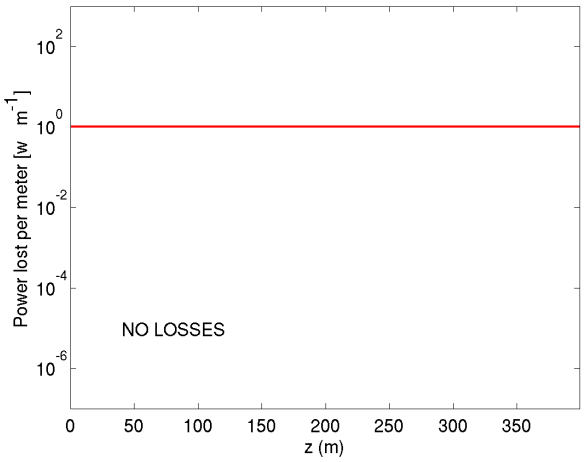


Figure: Losses [W·m^{-1}]



(239) Cavities $\phi_z = 7$ mrad

Figure: RMS Emittance X

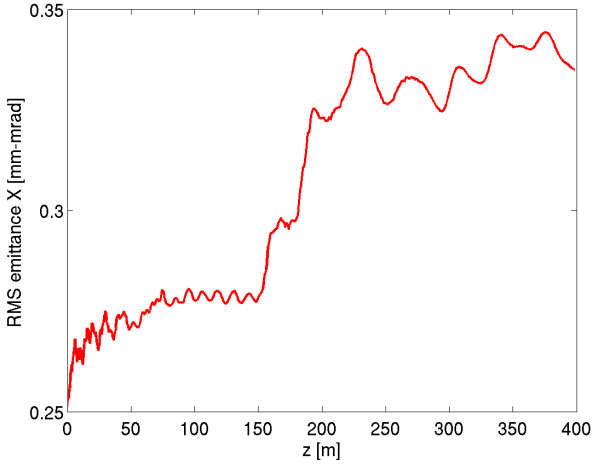


Figure: RMS Emittance Y

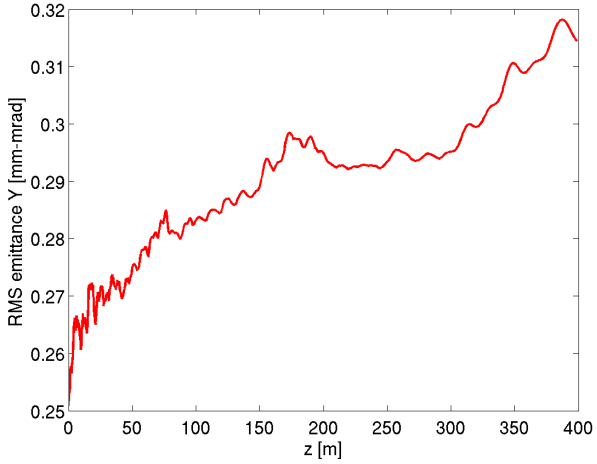


Figure: RMS Emittance Z

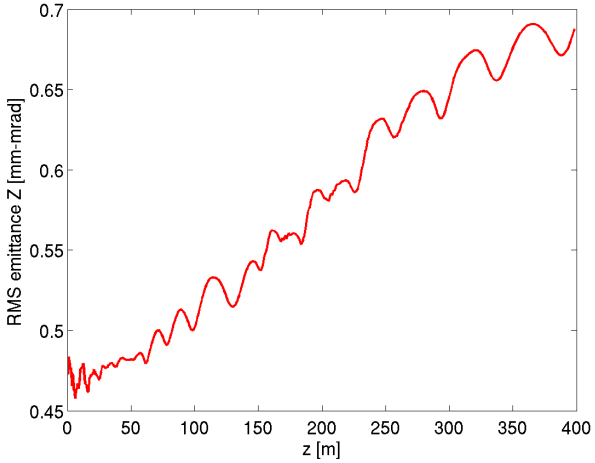
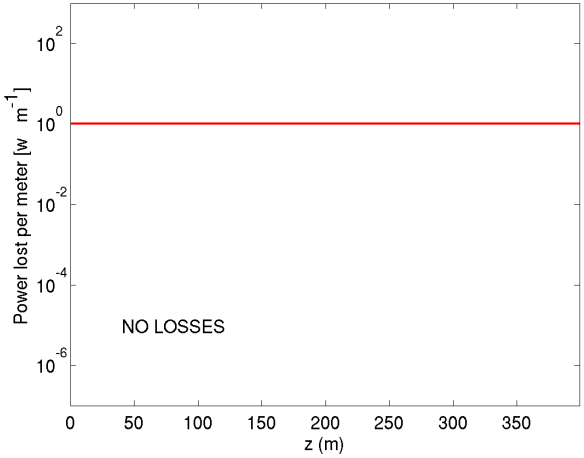


Figure: Losses [W·m^{-1}]



(240) Cavities $\phi_z = 10$ mrad

Figure: RMS Emittance X

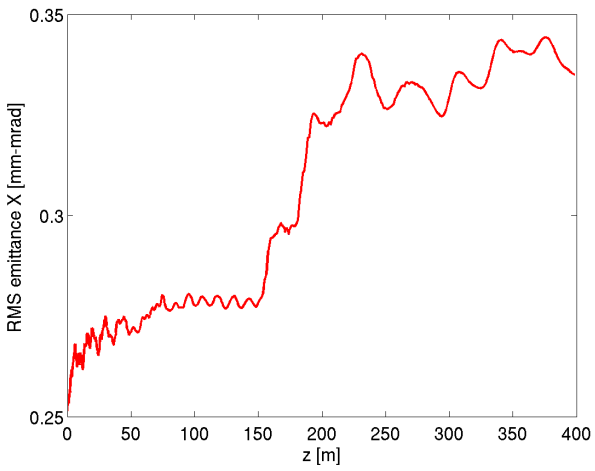


Figure: RMS Emittance Y

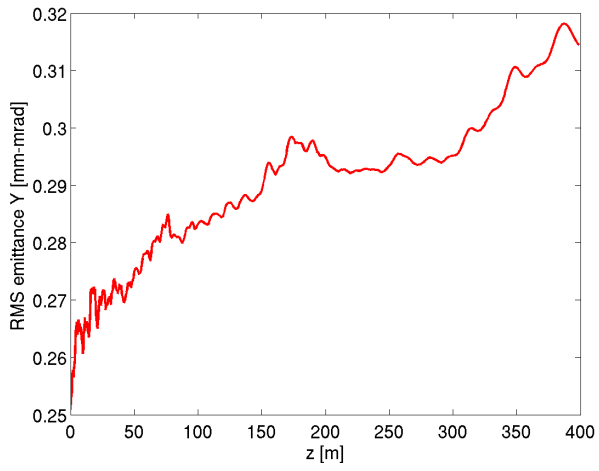


Figure: RMS Emittance Z

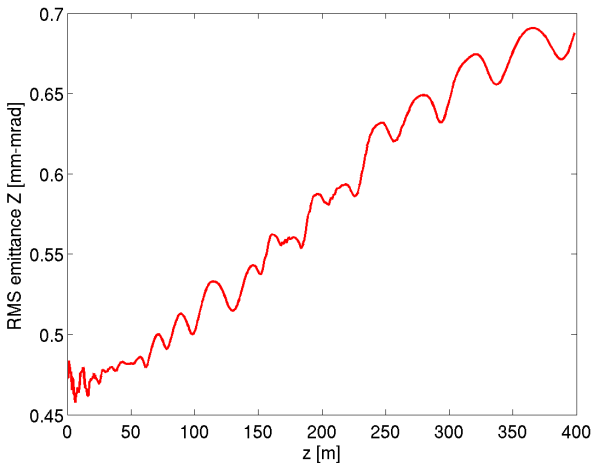
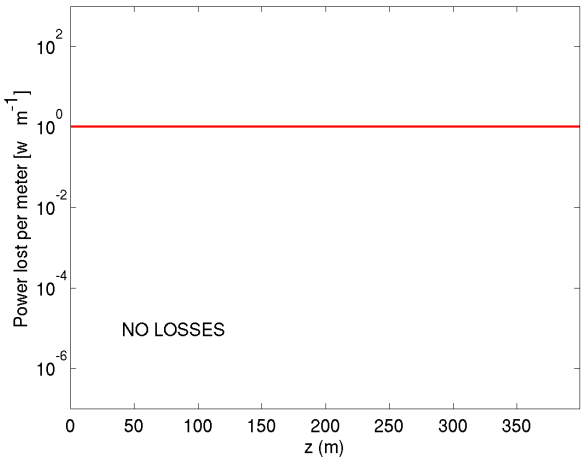


Figure: Losses [W·m^{-1}]



(241) Cav. Phase $\delta\phi_{dynamic} = 0.5^\circ$

Figure: RMS Emittance X

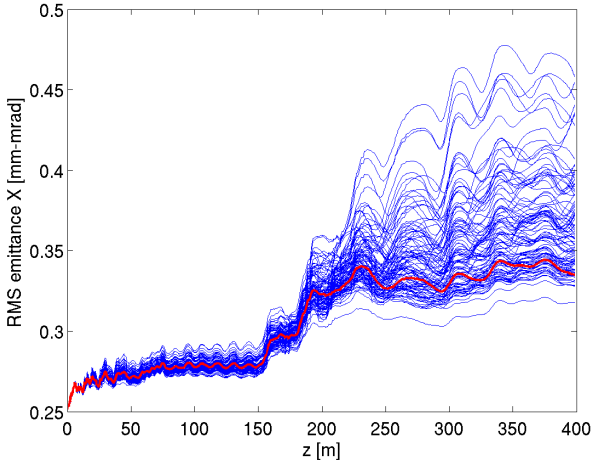


Figure: RMS Emittance Y

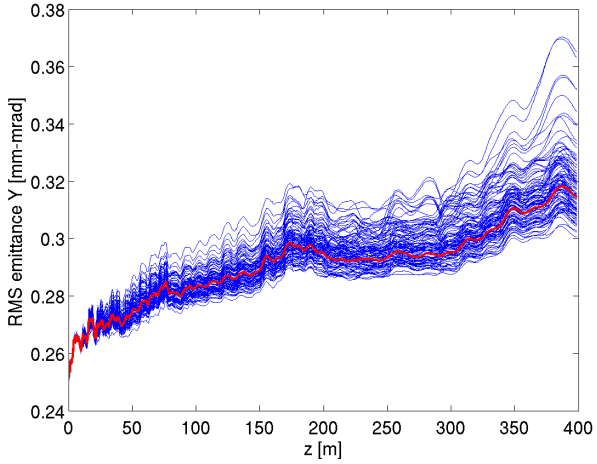


Figure: RMS Emittance Z

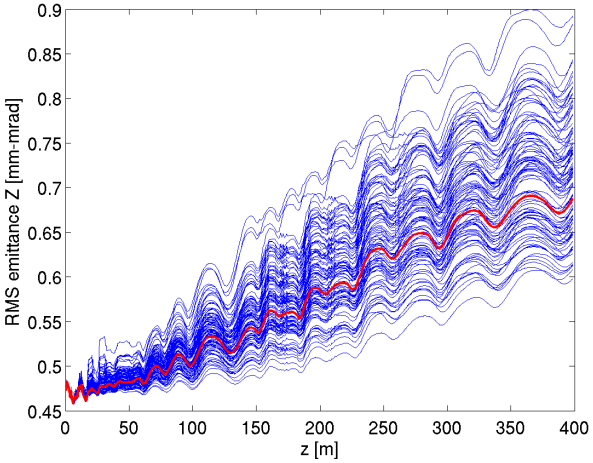
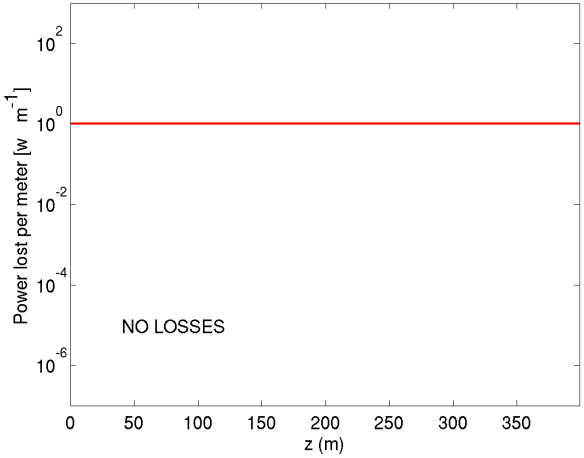


Figure: Losses [W·m^{-1}]



(242) Cav. Phase $\delta\phi_{dynamic} = 1.0^\circ$

Figure: RMS Emittance X

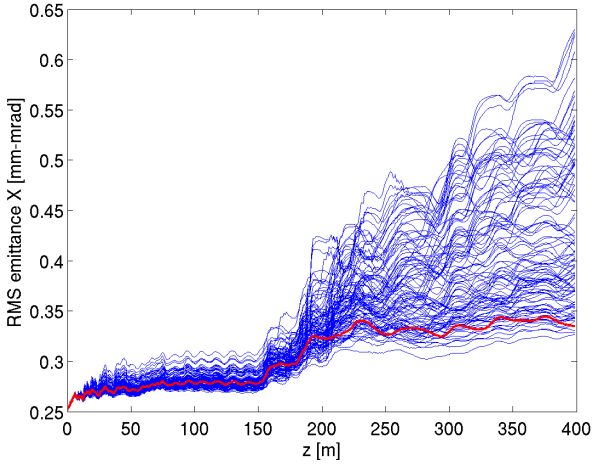


Figure: RMS Emittance Y

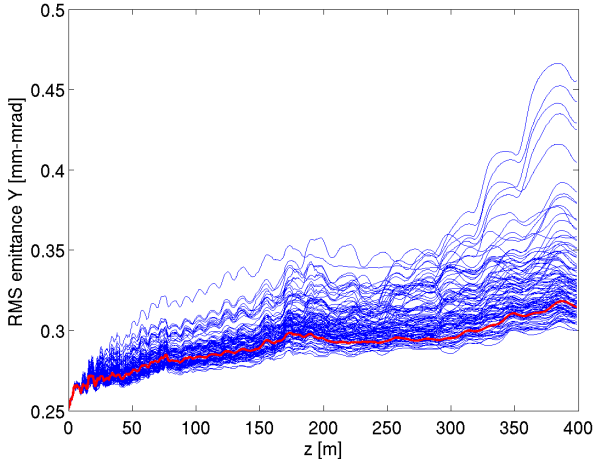


Figure: RMS Emittance Z

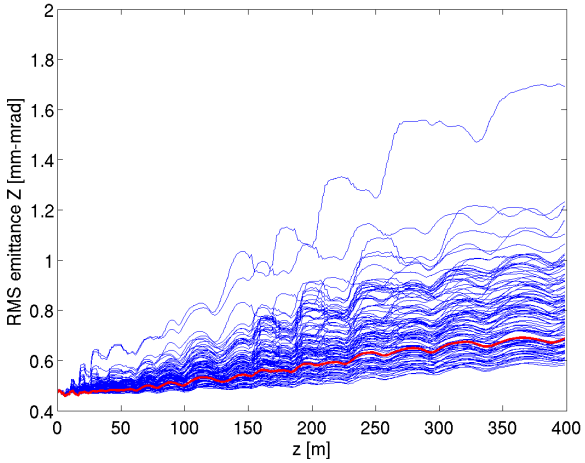
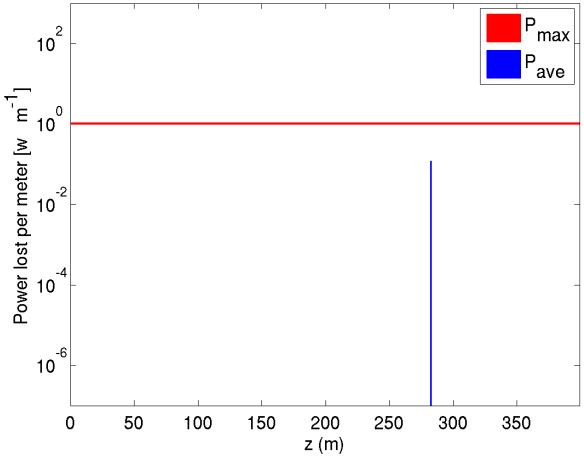


Figure: Losses [W·m^{-1}]



(243)Cav. Phase $\delta\phi_{dynamic} = 1.5^\circ$

Figure: RMS Emittance X

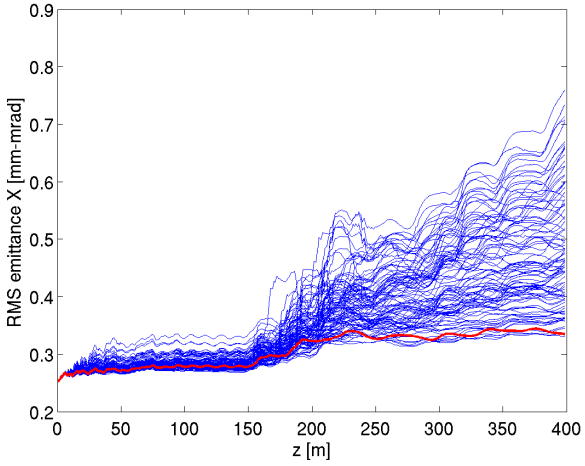


Figure: RMS Emittance Y

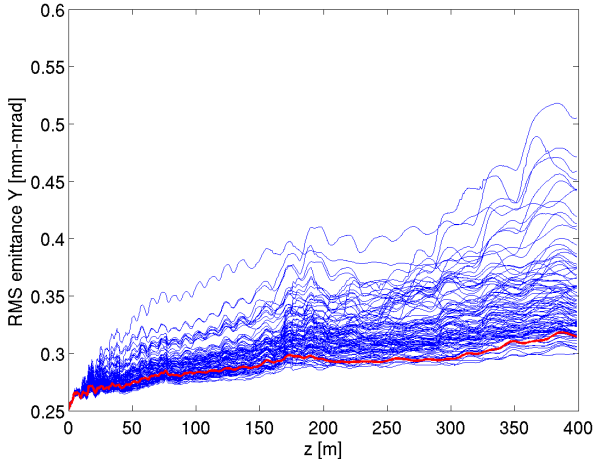


Figure: RMS Emittance Z

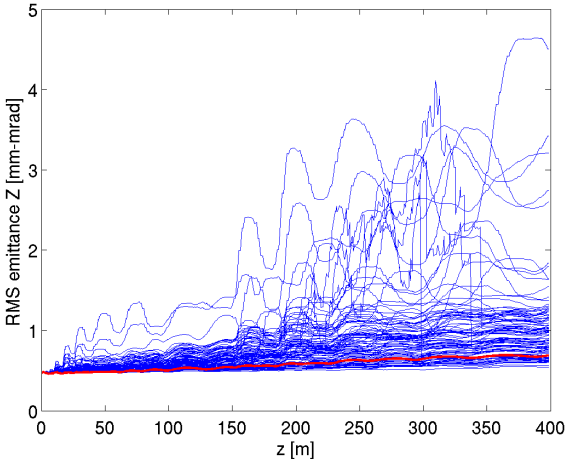
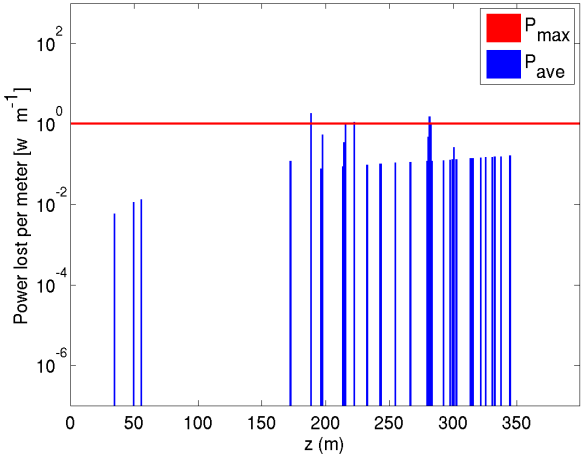


Figure: Losses [W·m^{-1}]



(244) Cav. Phase $\delta\phi_{dynamic} = 2.0^\circ$

Figure: RMS Emittance X

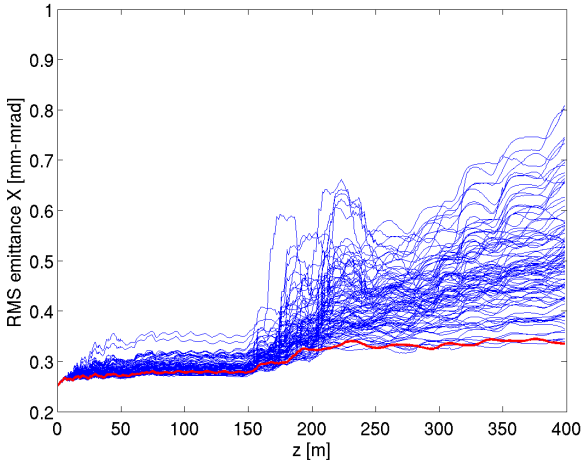


Figure: RMS Emittance Y

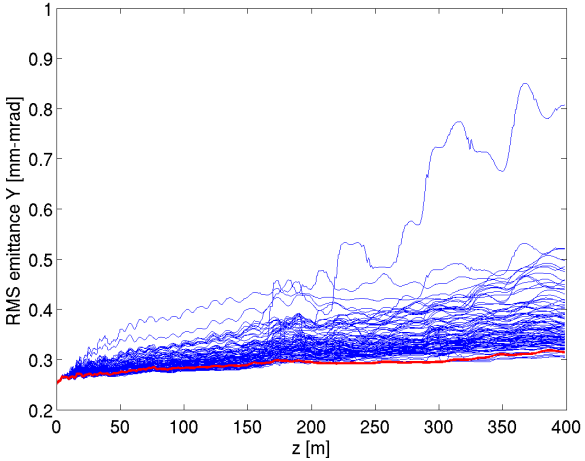


Figure: RMS Emittance Z

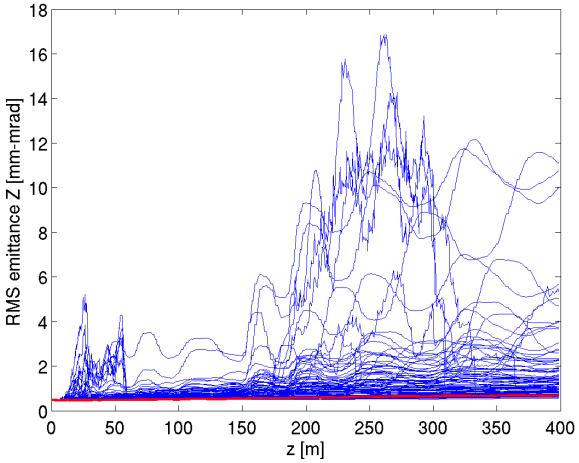
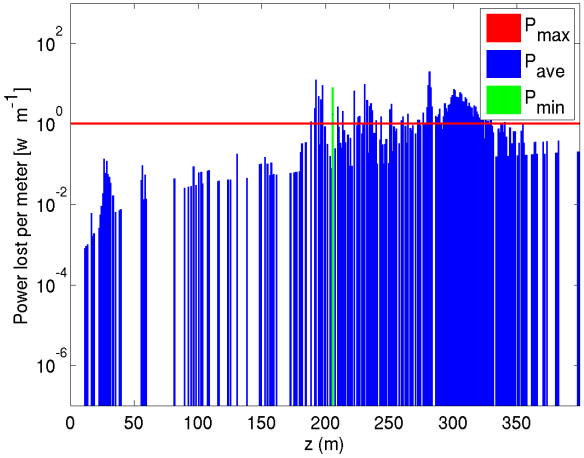


Figure: Losses [W·m^{-1}]



(245) Cav. Phase $\delta\phi_{dynamic} = 2.5°$

Figure: RMS Emittance X

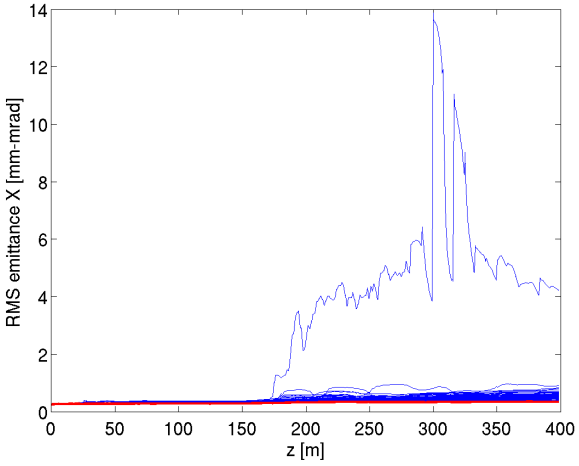


Figure: RMS Emittance Y

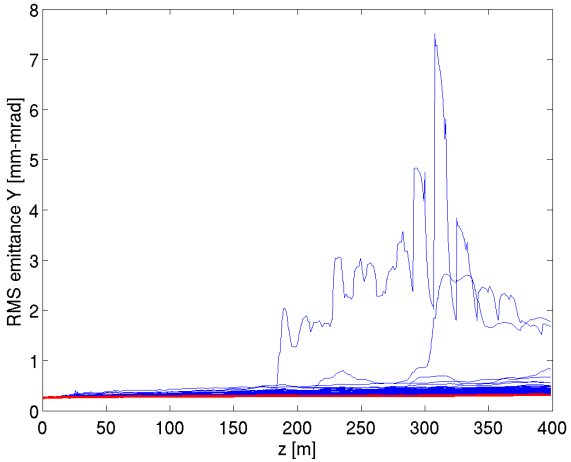


Figure: RMS Emittance Z

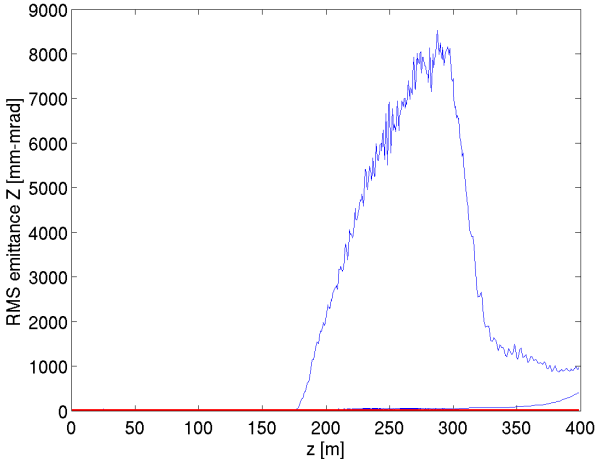
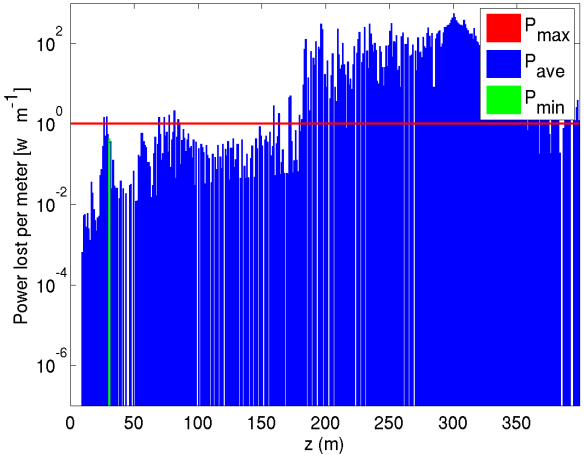


Figure: Losses [W·m^{-1}]



(246) Cav. Field $\delta F_{dynamic} = 0.5$ %

Figure: RMS Emittance X

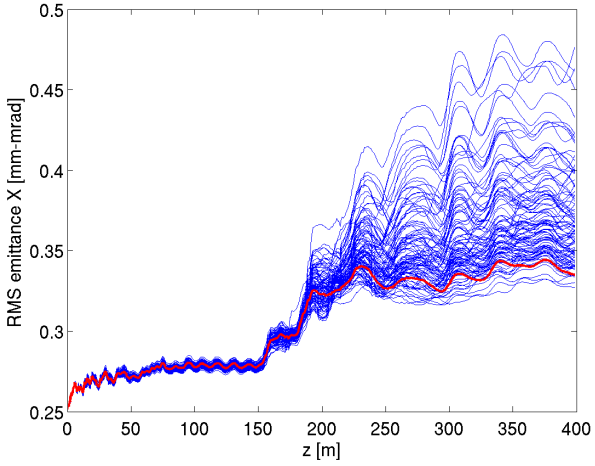


Figure: RMS Emittance Y

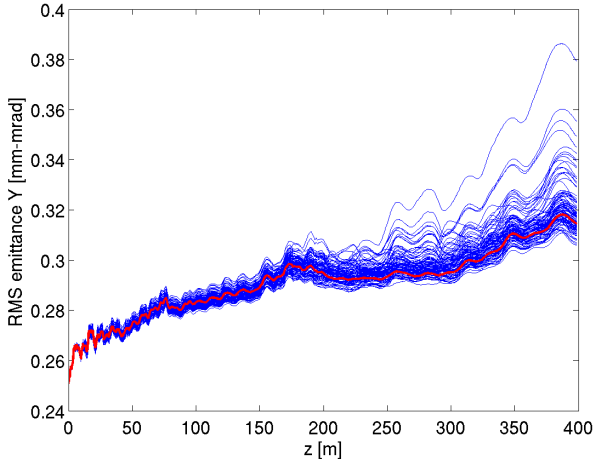


Figure: RMS Emittance Z

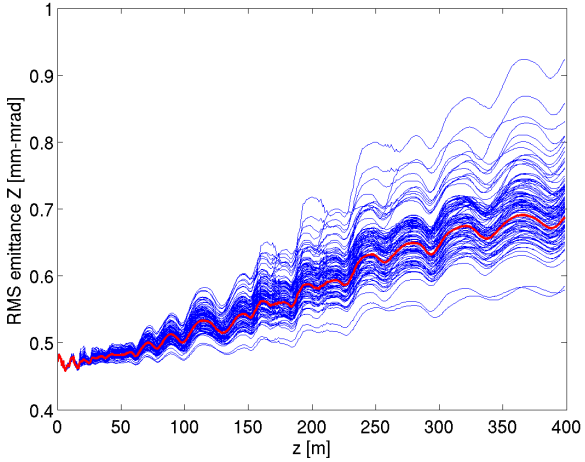
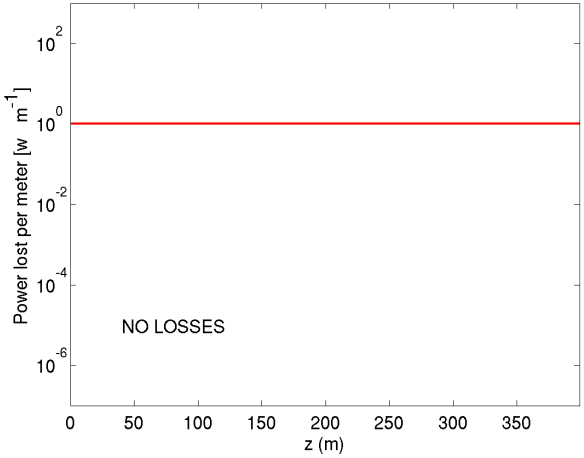


Figure: Losses [W·m^{-1}]



(247) Cav. Field $\delta F_{dynamic} = 1.0$ %

Figure: RMS Emittance X

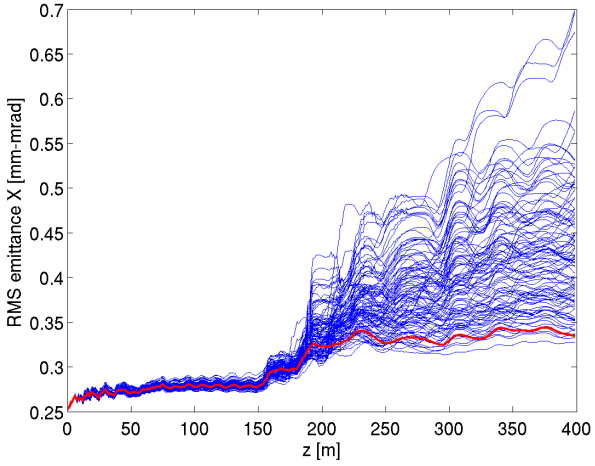


Figure: RMS Emittance Y

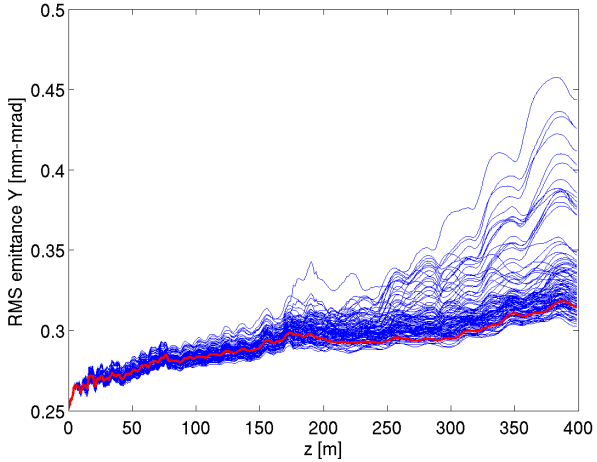


Figure: RMS Emittance z

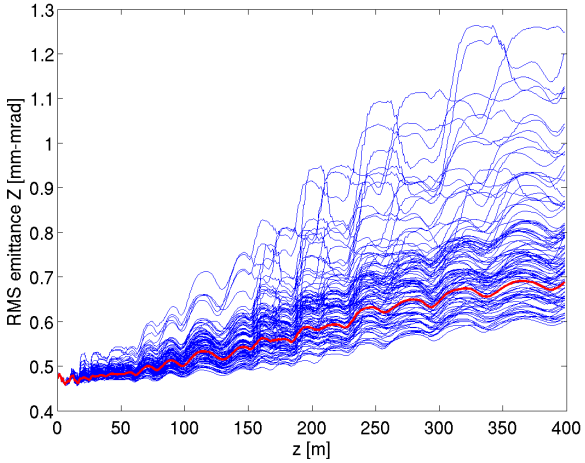
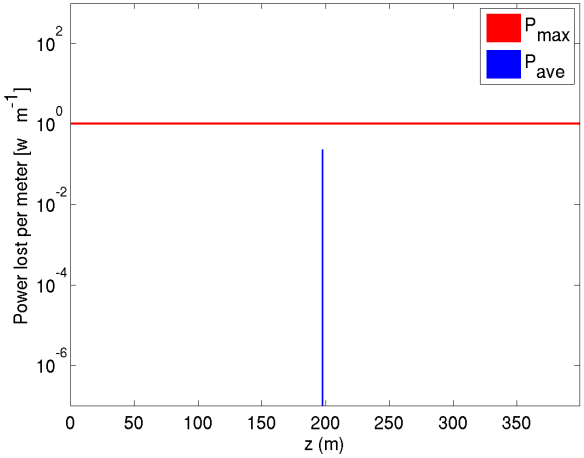


Figure: Losses [W·m^{-1}]



(248) Cav. Field $\delta F_{dynamic} = 1.5$ %

Figure: RMS Emittance X

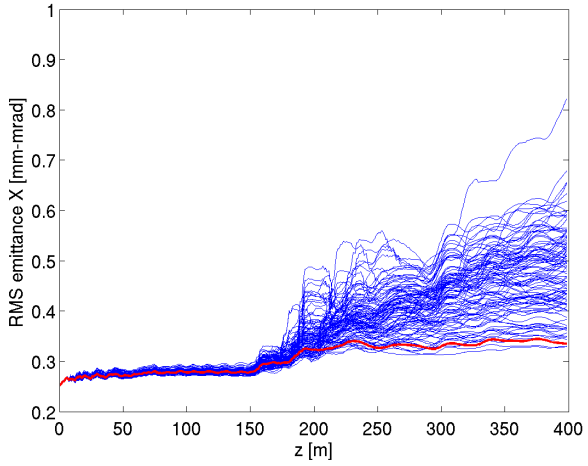


Figure: RMS Emittance Y

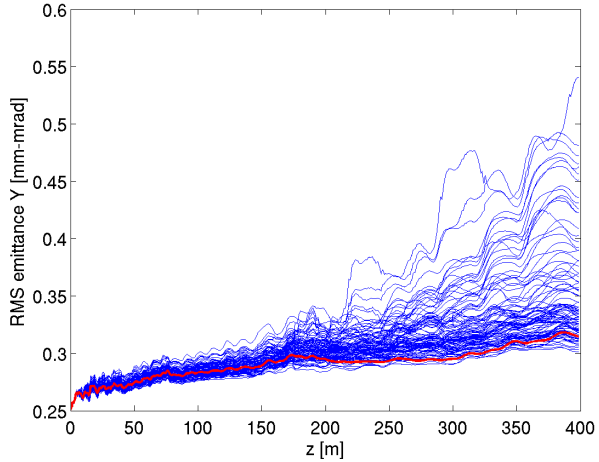


Figure: RMS Emittance Z

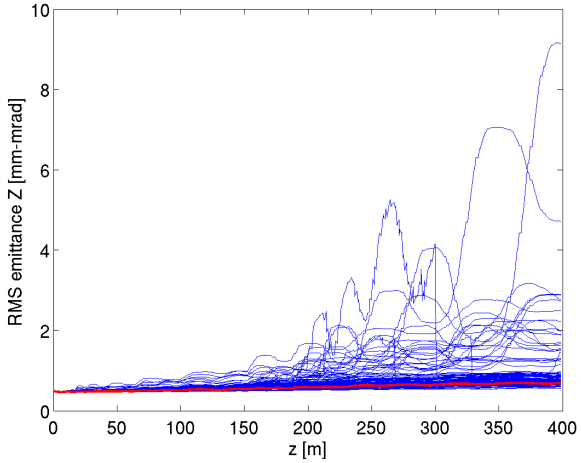
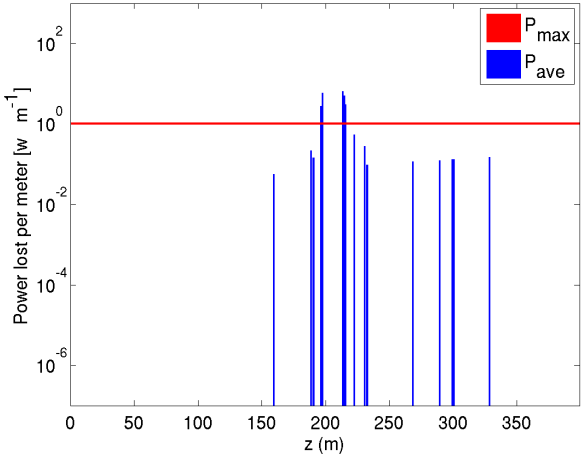


Figure: Losses [W·m^{-1}]



(249) Cav. Field $\delta F_{dynamic} = 2.0$ %

Figure: RMS Emittance X

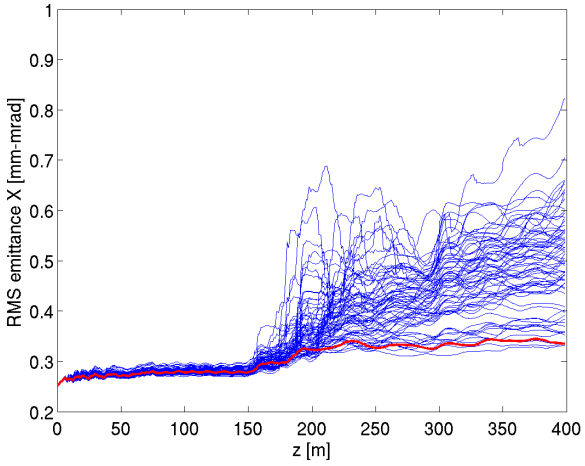


Figure: RMS Emittance Y

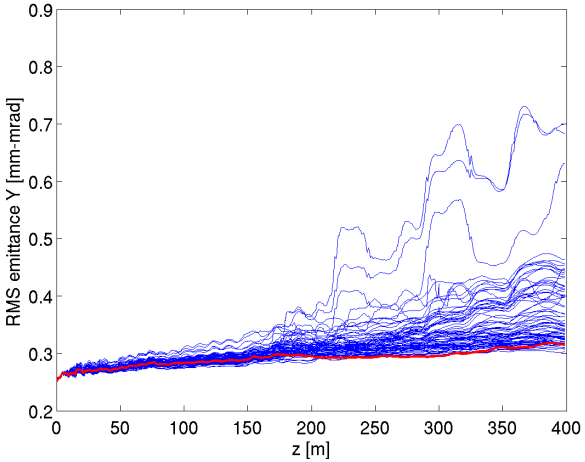


Figure: RMS Emittance Z

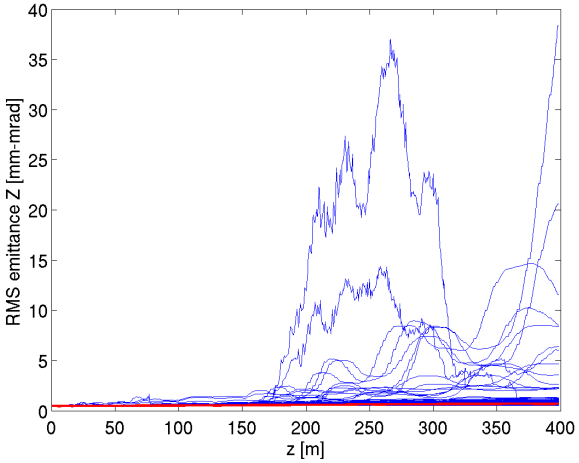
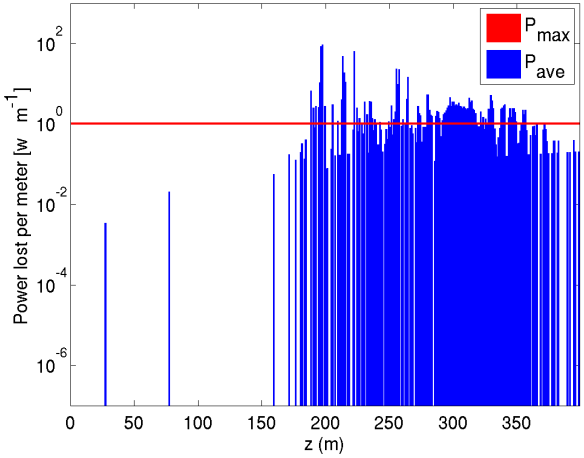


Figure: Losses [W·m^{-1}]



(250) Cav. Field $\delta F_{dynamic} = 2.5$ %

Figure: RMS Emittance X

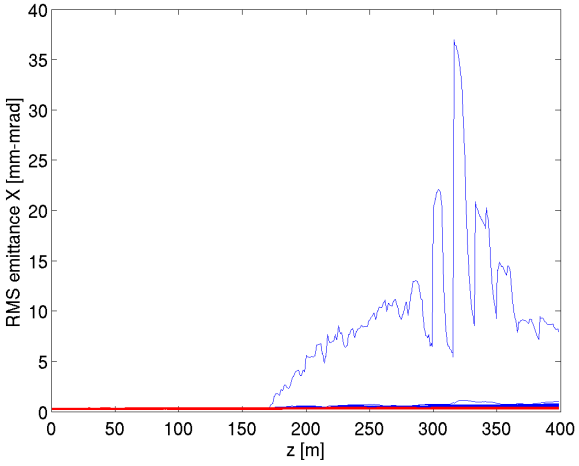


Figure: RMS Emittance Y

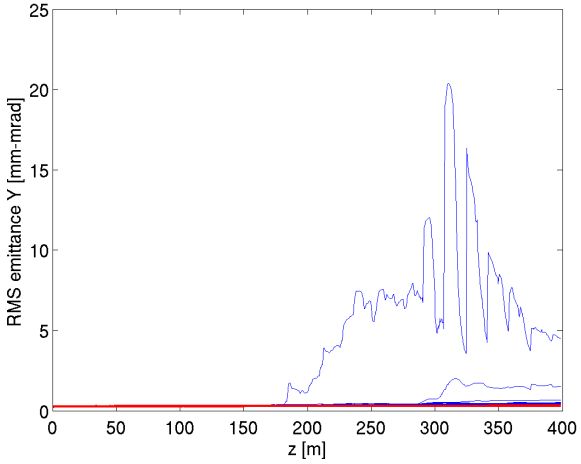


Figure: RMS Emittance Z

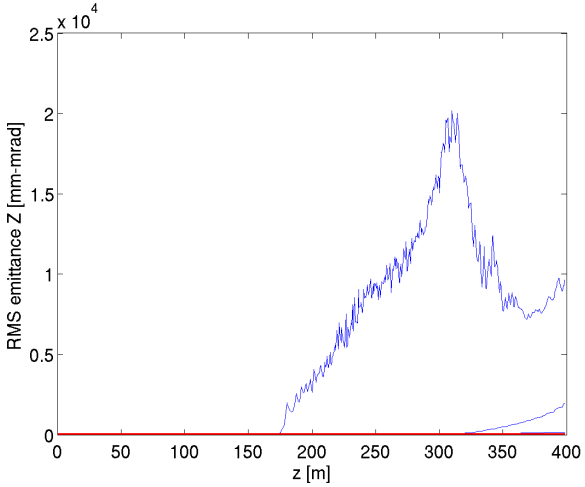
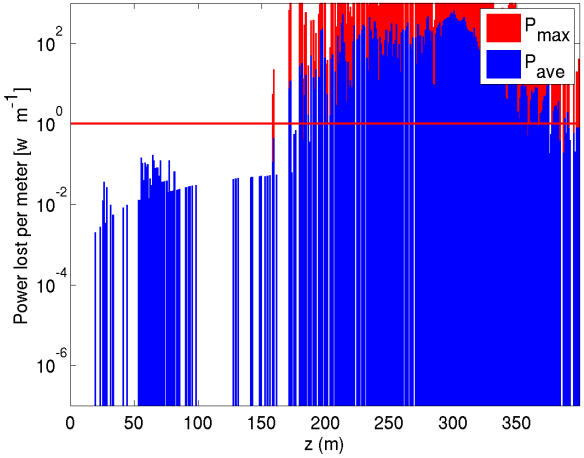


Figure: Losses [W·m^{-1}]



(251) Cav. Phase $\delta\phi_{static} = 0.5°$

Figure: RMS Emittance X

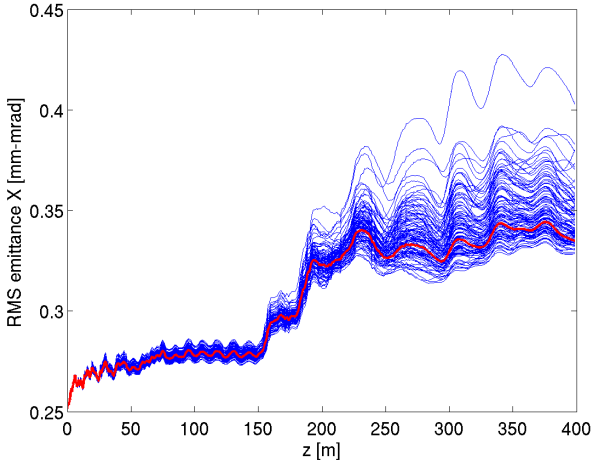


Figure: RMS Emittance Y

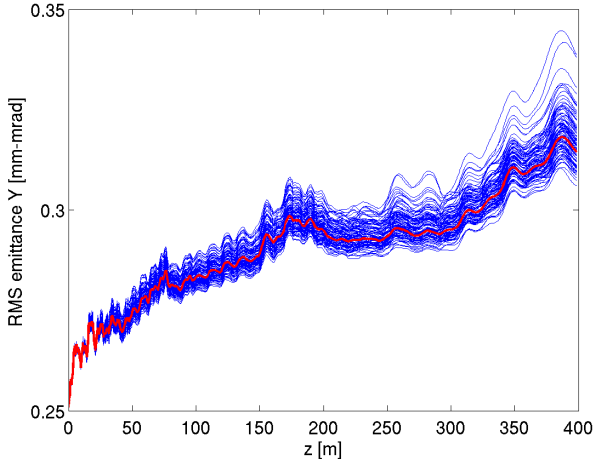


Figure: RMS Emittance Z

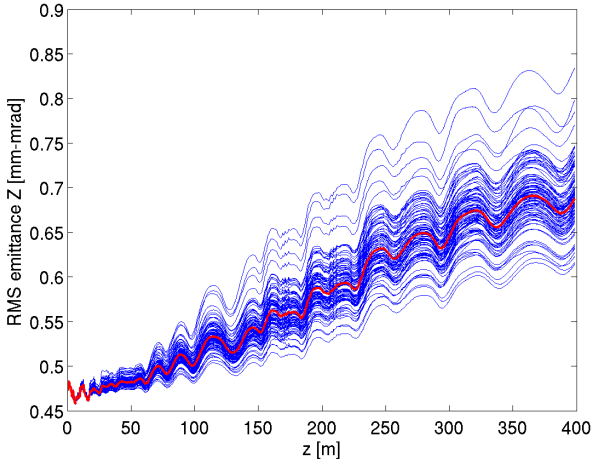
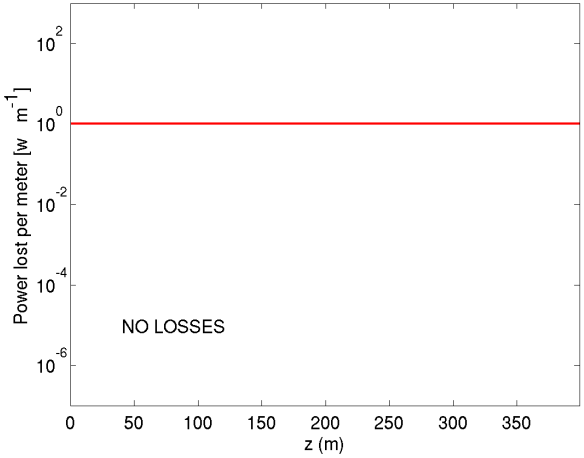


Figure: Losses [W·m^{-1}]



(252) Cav. Phase $\delta\phi_{static} = 1.0^\circ$

Figure: RMS Emittance X

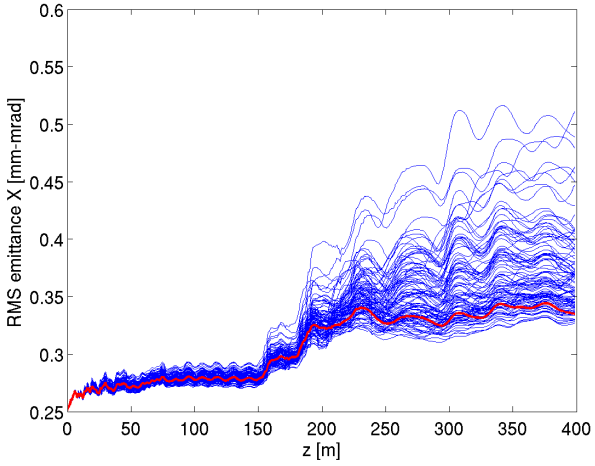


Figure: RMS Emittance Y

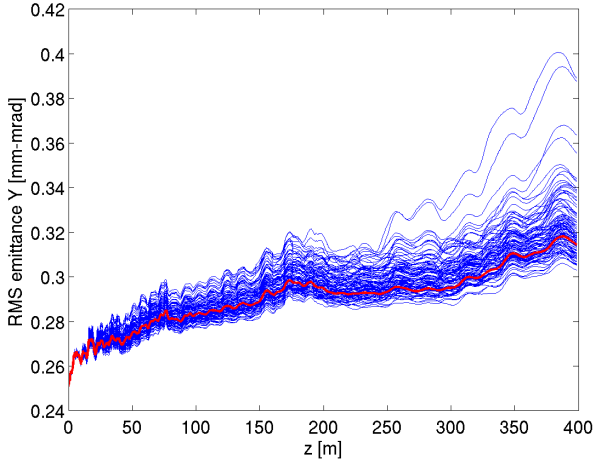


Figure: RMS Emittance Z

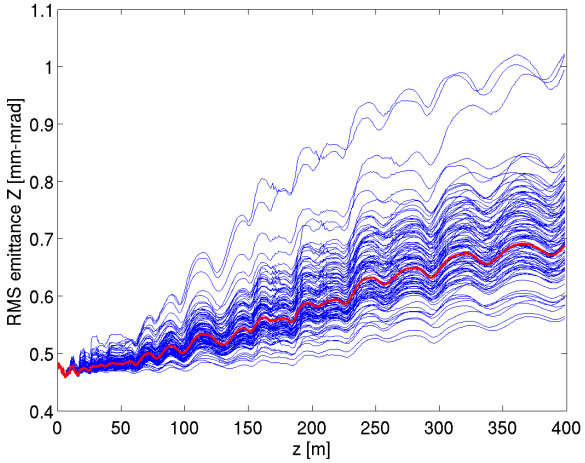
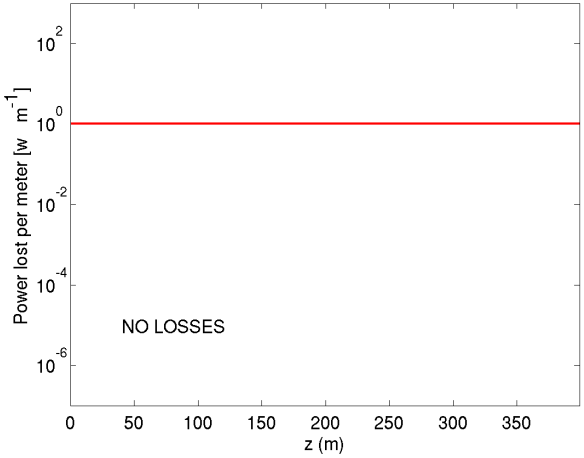


Figure: Losses [W·m^{-1}]



(253) Cav. Phase $\delta\phi_{static} = 1.5°$

Figure: RMS Emittance X

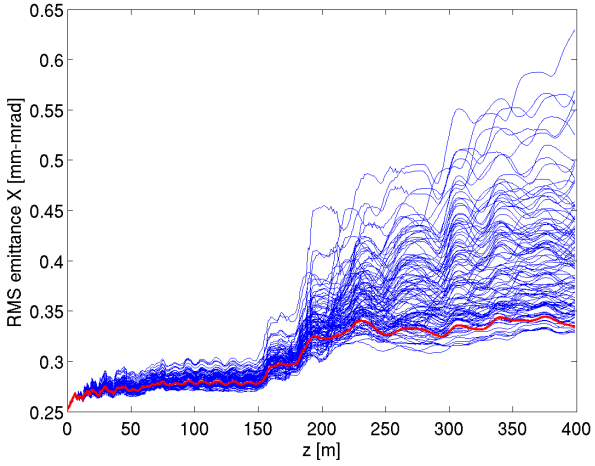


Figure: RMS Emittance Y

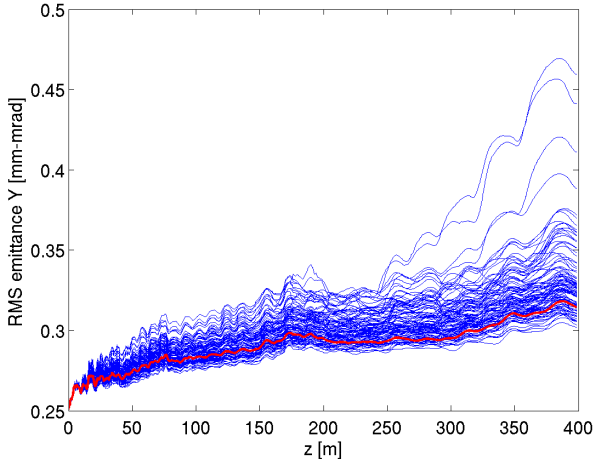


Figure: RMS Emittance Z

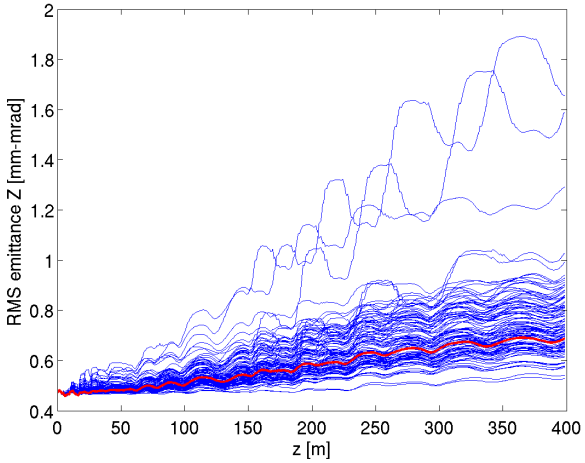
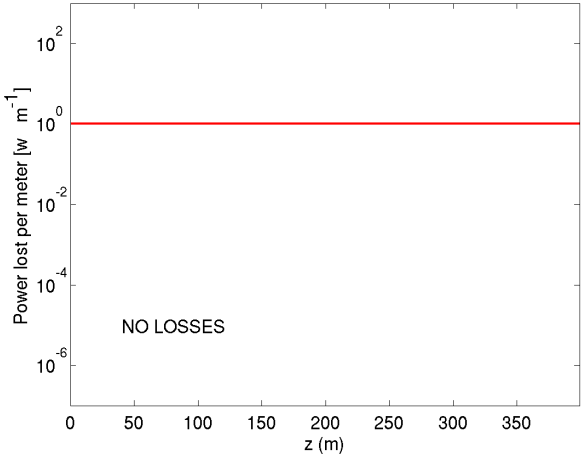


Figure: Losses [W·m^{-1}]



(254) Cav. Phase $\delta\phi_{static} = 2.0^\circ$

Figure: RMS Emittance X

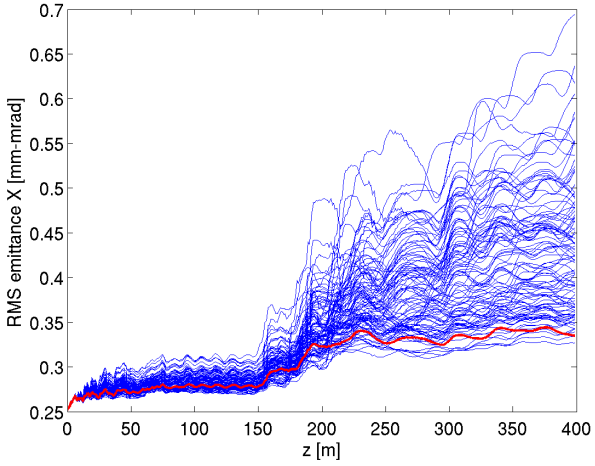


Figure: RMS Emittance Y

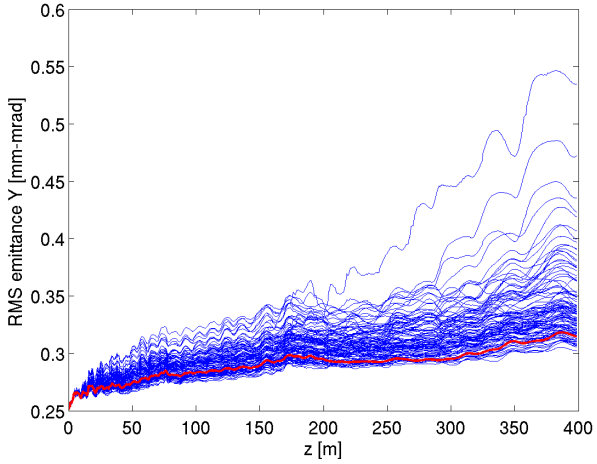


Figure: RMS Emittance Z

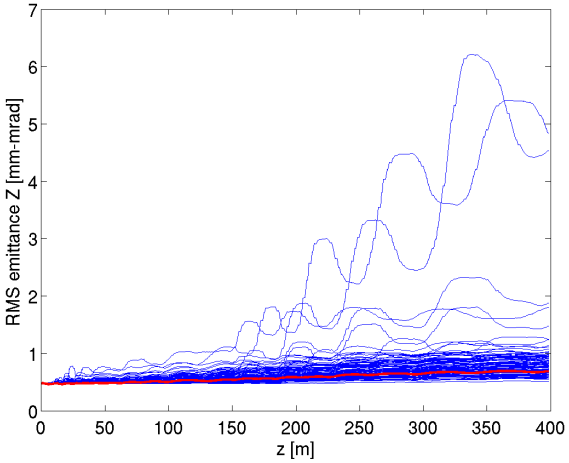
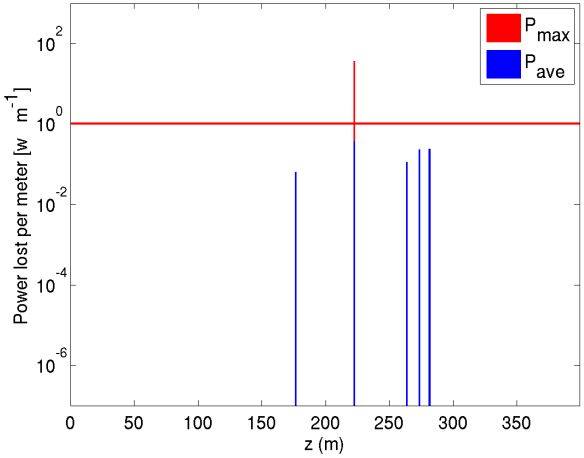


Figure: Losses [W·m^{-1}]



(255) Cav. Phase $\delta\phi_{static} = 2.5°$

Figure: RMS Emittance X

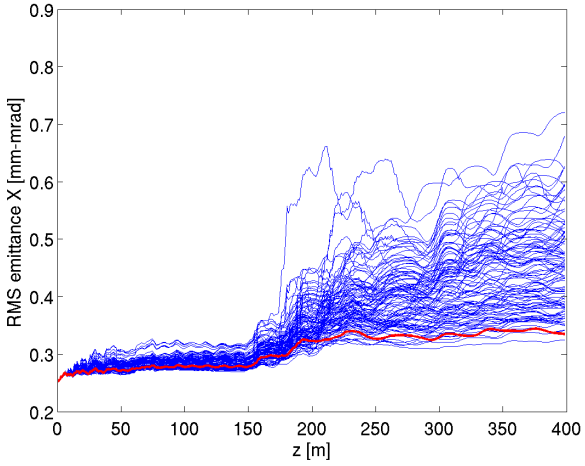


Figure: RMS Emittance Y

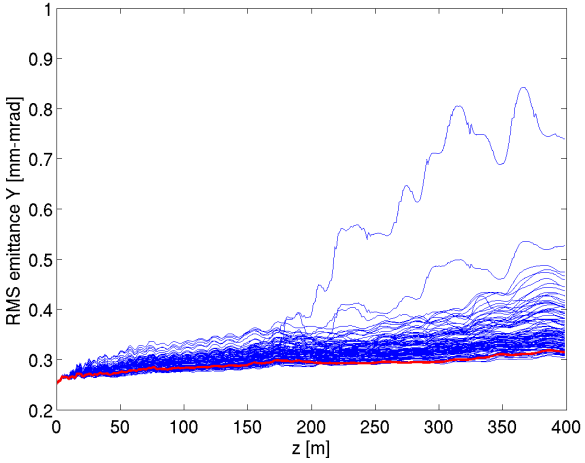


Figure: RMS Emittance Z

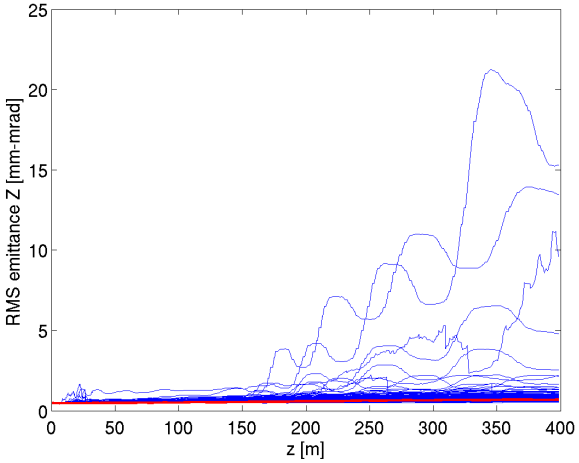
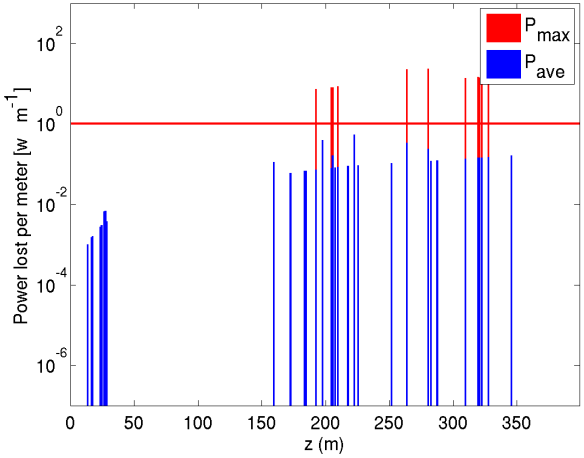


Figure: Losses [W·m^{-1}]



(256) Cav. Field $\delta F_{static} = 0.5$ %

Figure: RMS Emittance X

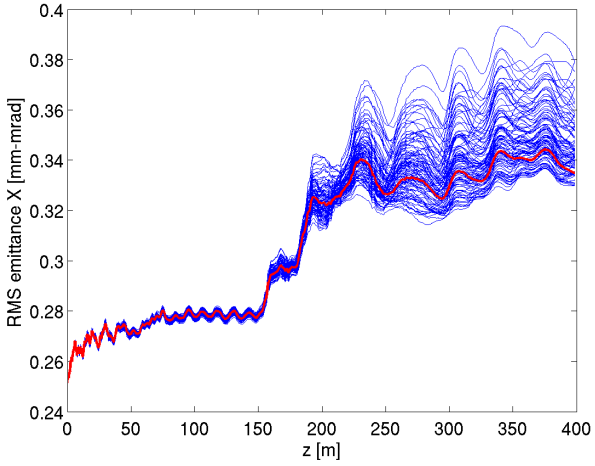


Figure: RMS Emittance Y

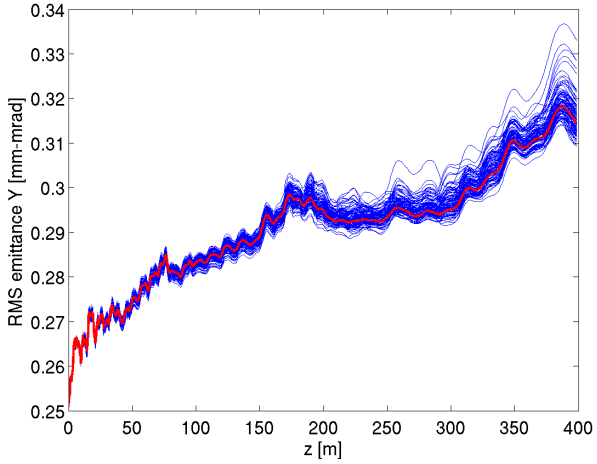


Figure: RMS Emittance Z

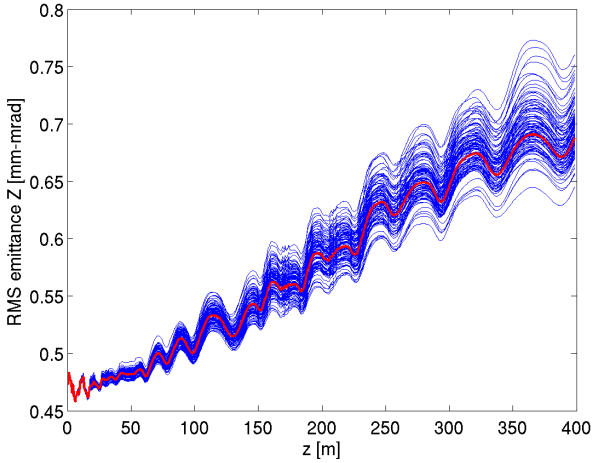
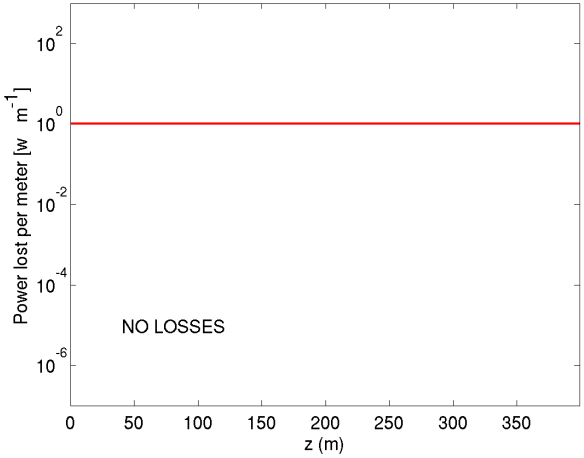


Figure: Losses [W·m^{-1}]



(257) Cav. Field $\delta F_{static} = 1.0$ %

Figure: RMS Emittance X

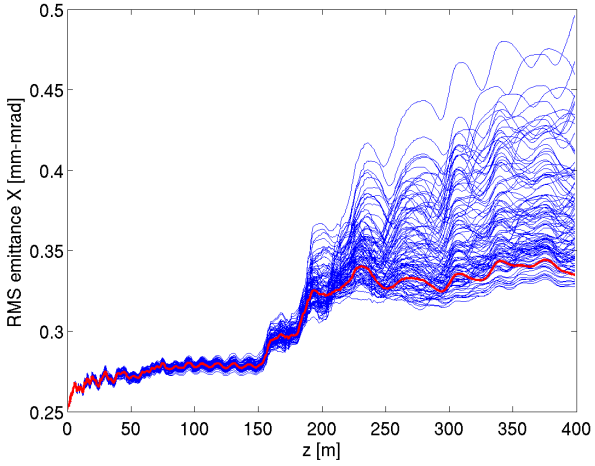


Figure: RMS Emittance Y

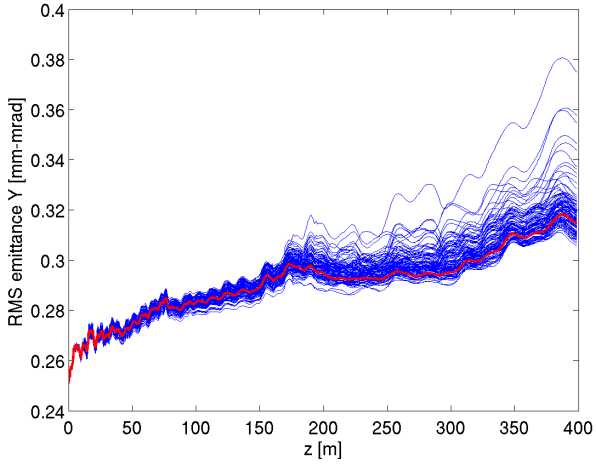


Figure: RMS Emittance Z

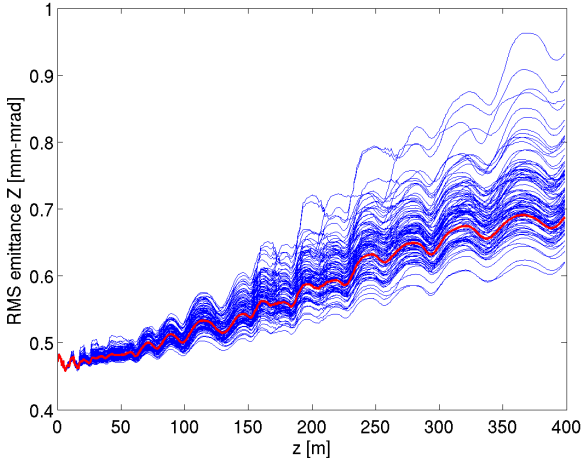
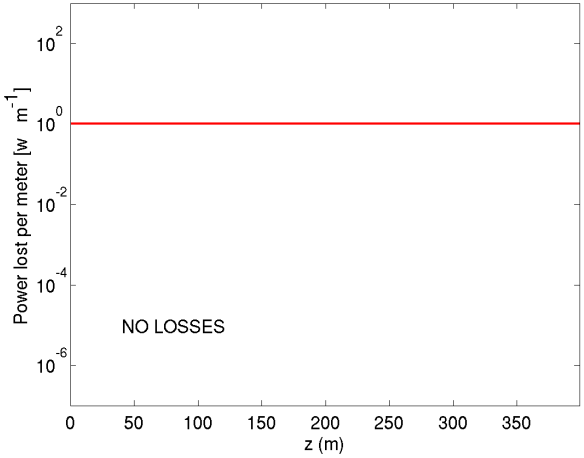


Figure: Losses [W·m^{-1}]



(258) Cav. Field $\delta F_{static} = 1.5$ %

Figure: RMS Emittance X

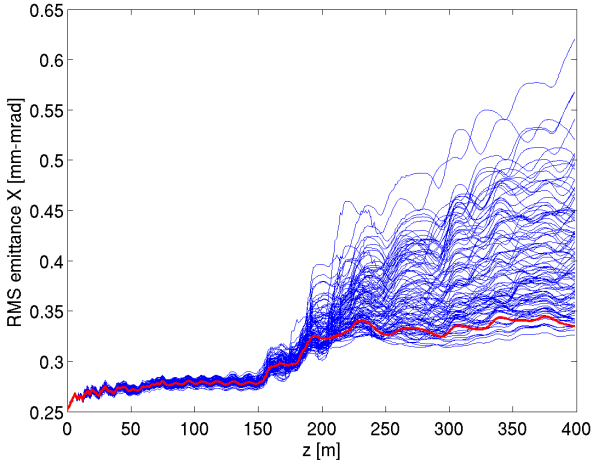


Figure: RMS Emittance Y

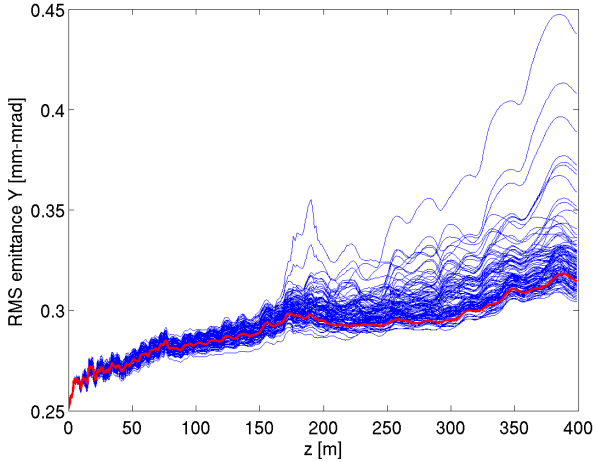


Figure: RMS Emittance Z

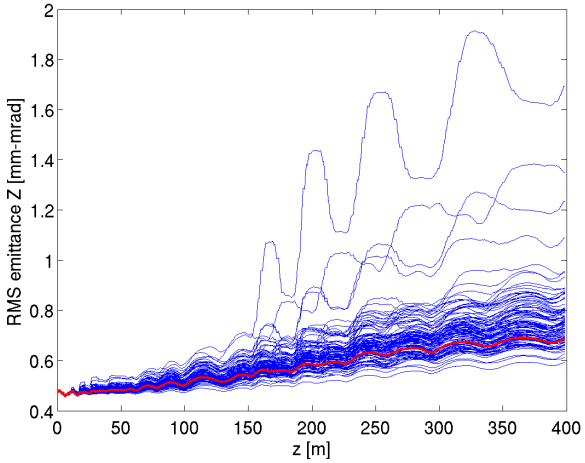
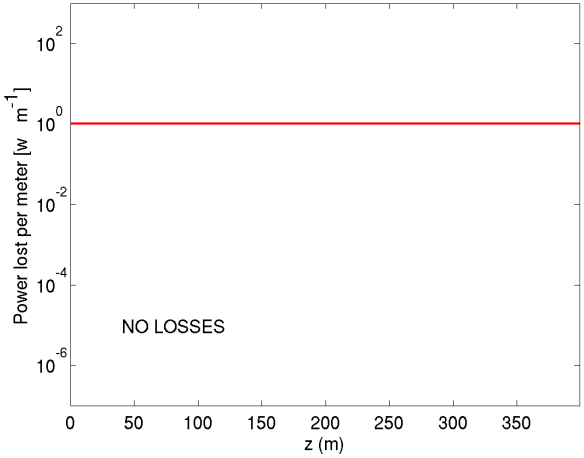


Figure: Losses [W·m^{-1}]



(259) Cav. Field $\delta F_{static} = 2.0$ %

Figure: RMS Emittance X

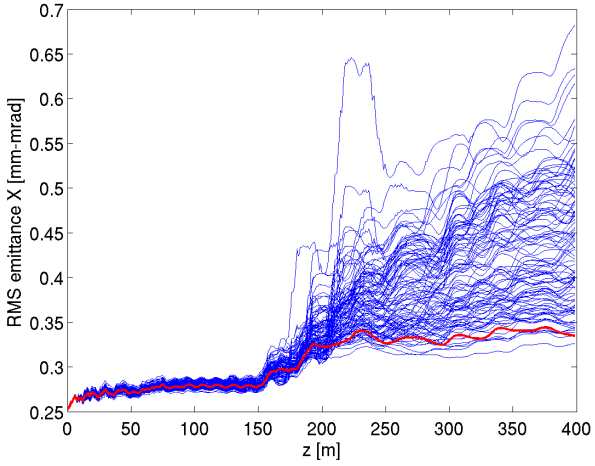


Figure: RMS Emittance Y

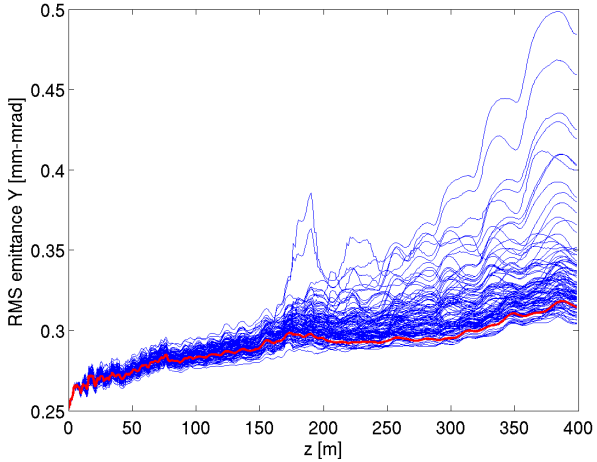


Figure: RMS Emittance Z

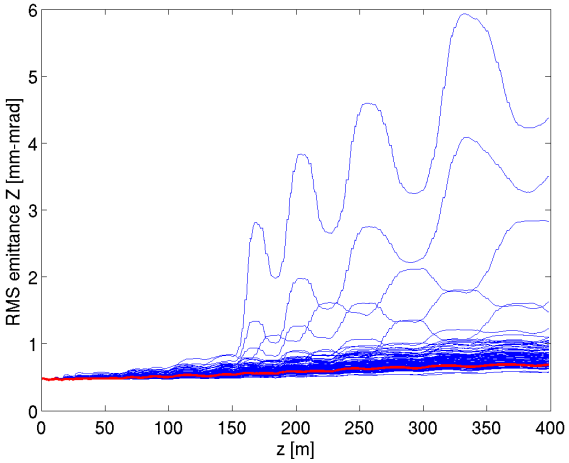
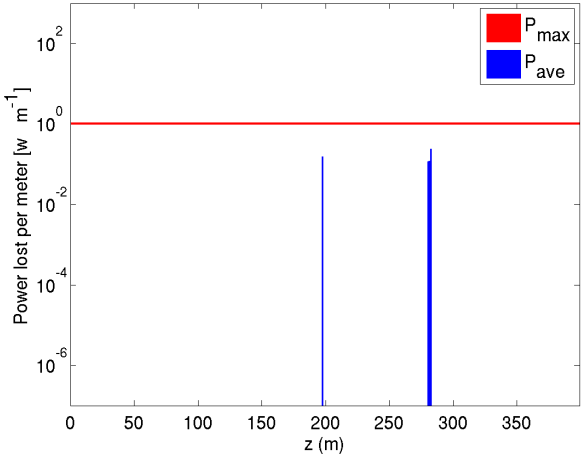


Figure: Losses [W·m^{-1}]



(260) Cav. Field $\delta F_{static} = 2.5$ %

Figure: RMS Emittance X

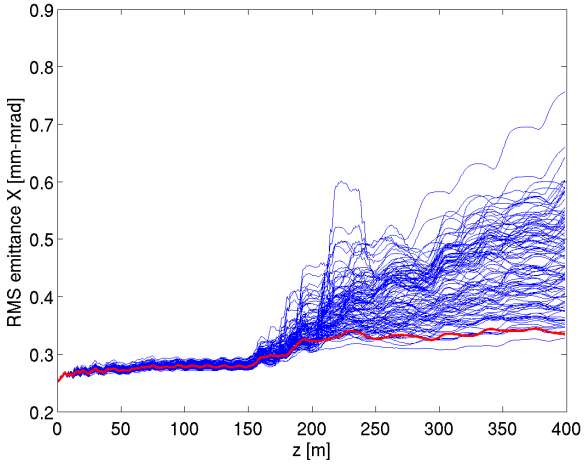


Figure: RMS Emittance Y

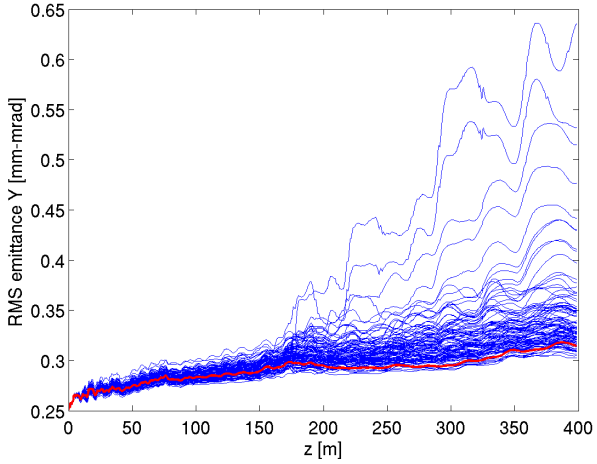


Figure: RMS Emittance Z

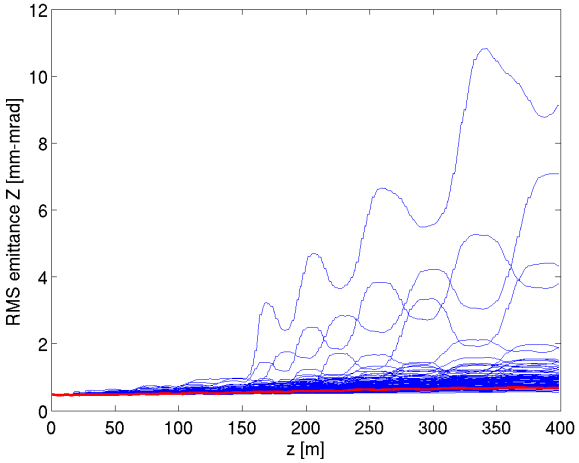
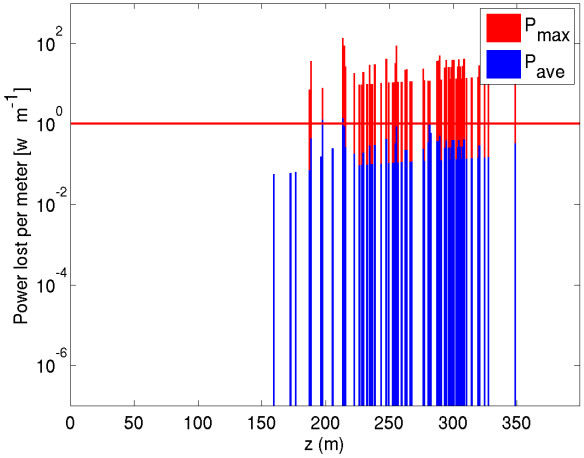



Figure: Losses [W·m^{-1}]