End-to-End Simulations

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End-to-End
Beam Dynamics Simulations

- The "Parmila" code calculates particle dynamics in the linac.
  MEBT-DTL-CCL-SRF-HEBT

- A 10k 4D Waterbag beam distribution is started from the RFQ entry.

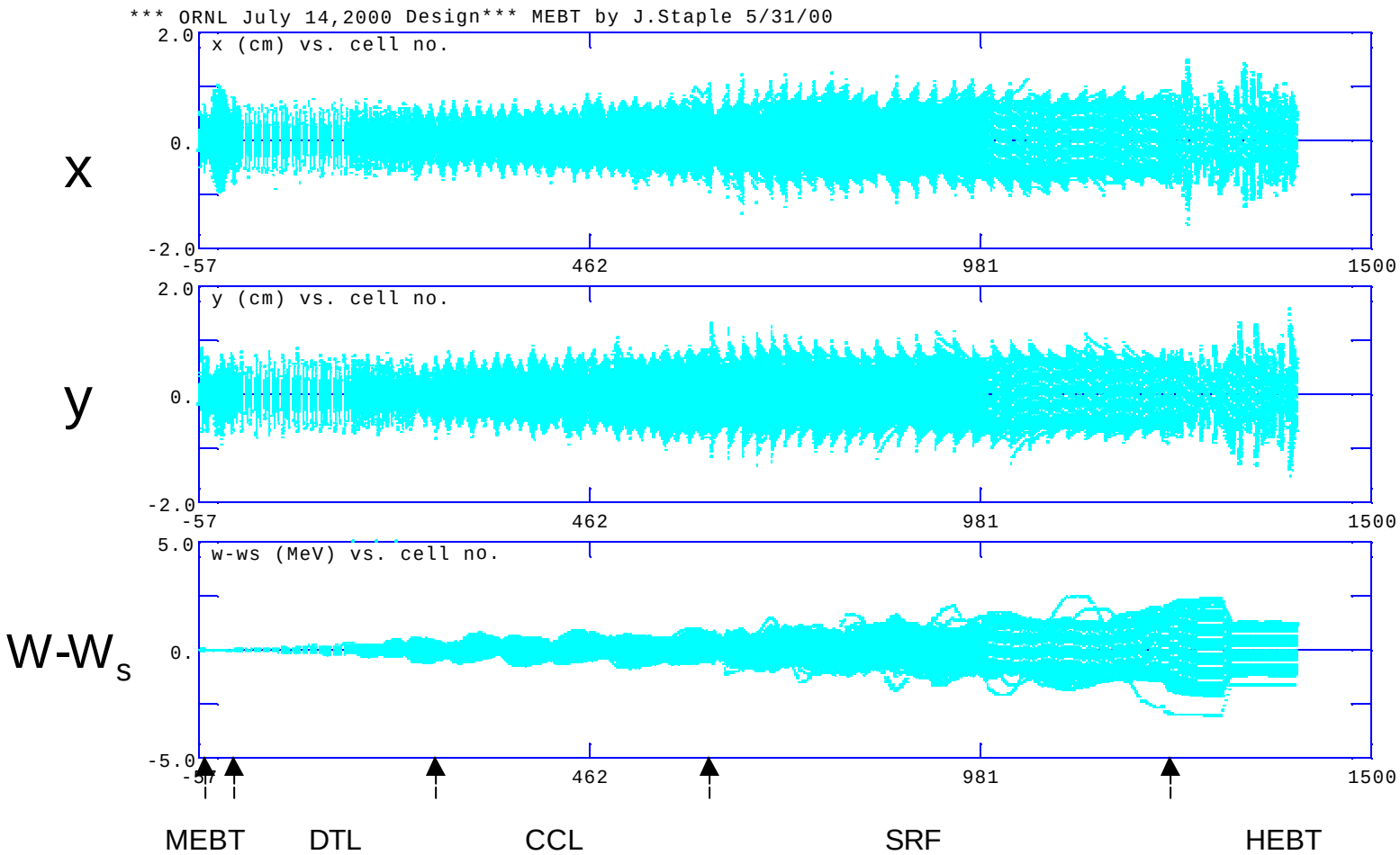
- The "Parmila" simulation starts with the particle distribution at the exit of the RFQ.

Error Budgets

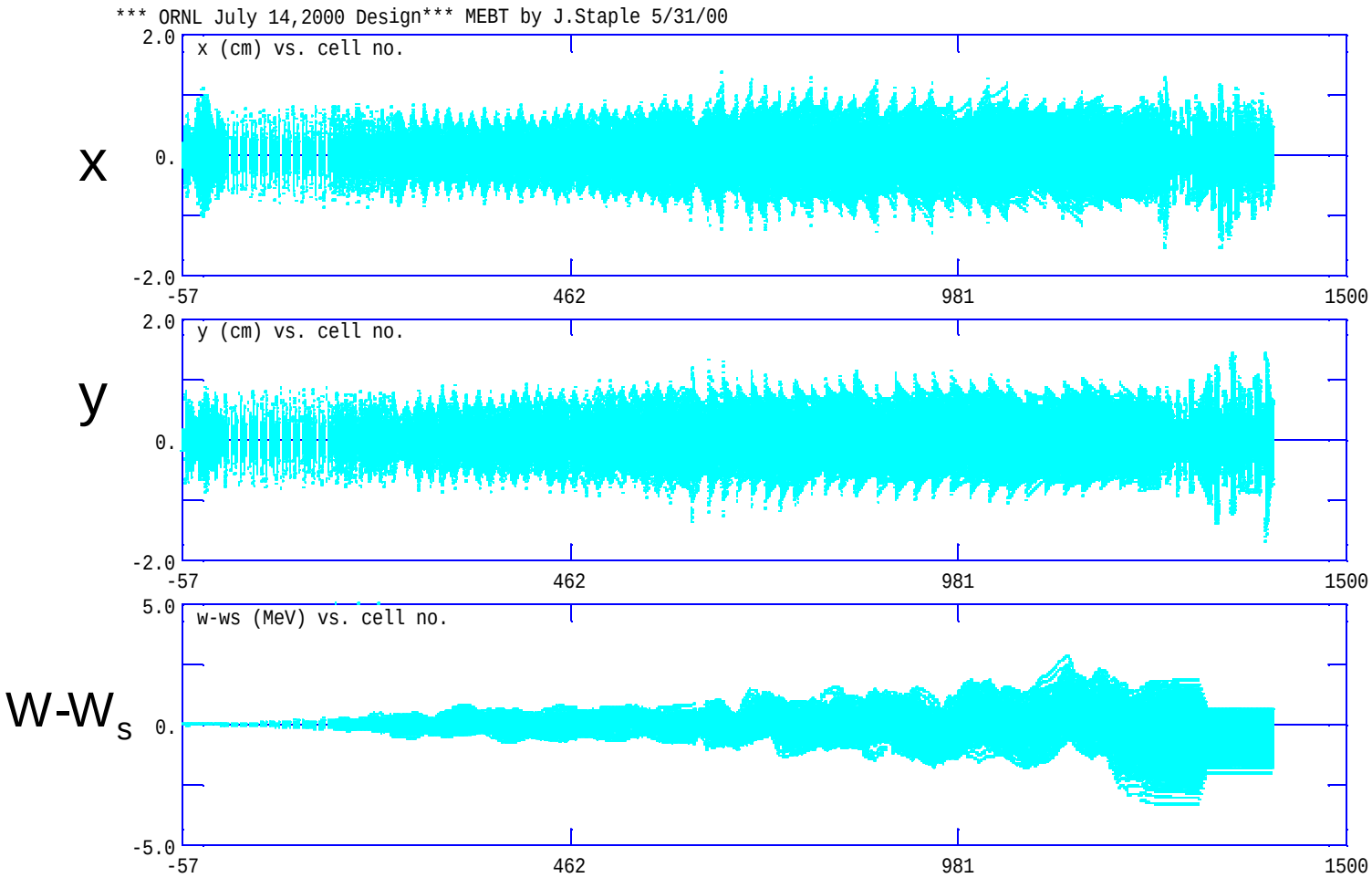
	Units	MEBT	DTL	CCL	SRF
Quad Errors:					
displacement __	cm	--	--	--	--
Pitch & yaw	deg	0.57	0.57	0.57	0.57
Roll	deg	0.25	0.29	0.29	0.29
Gradient	%	1.73	0*	0.5	0.5
Cavity Errors, Static:		--	--	--	--
Cavity Errors, Dynamic:					
Phase	deg	--	0.5	0.5	0.5
Amplitude	%	--	0.5	0.5	0.5
Tilt	%	--	0.1	0.	0.

* Equivalent 2% sorted.

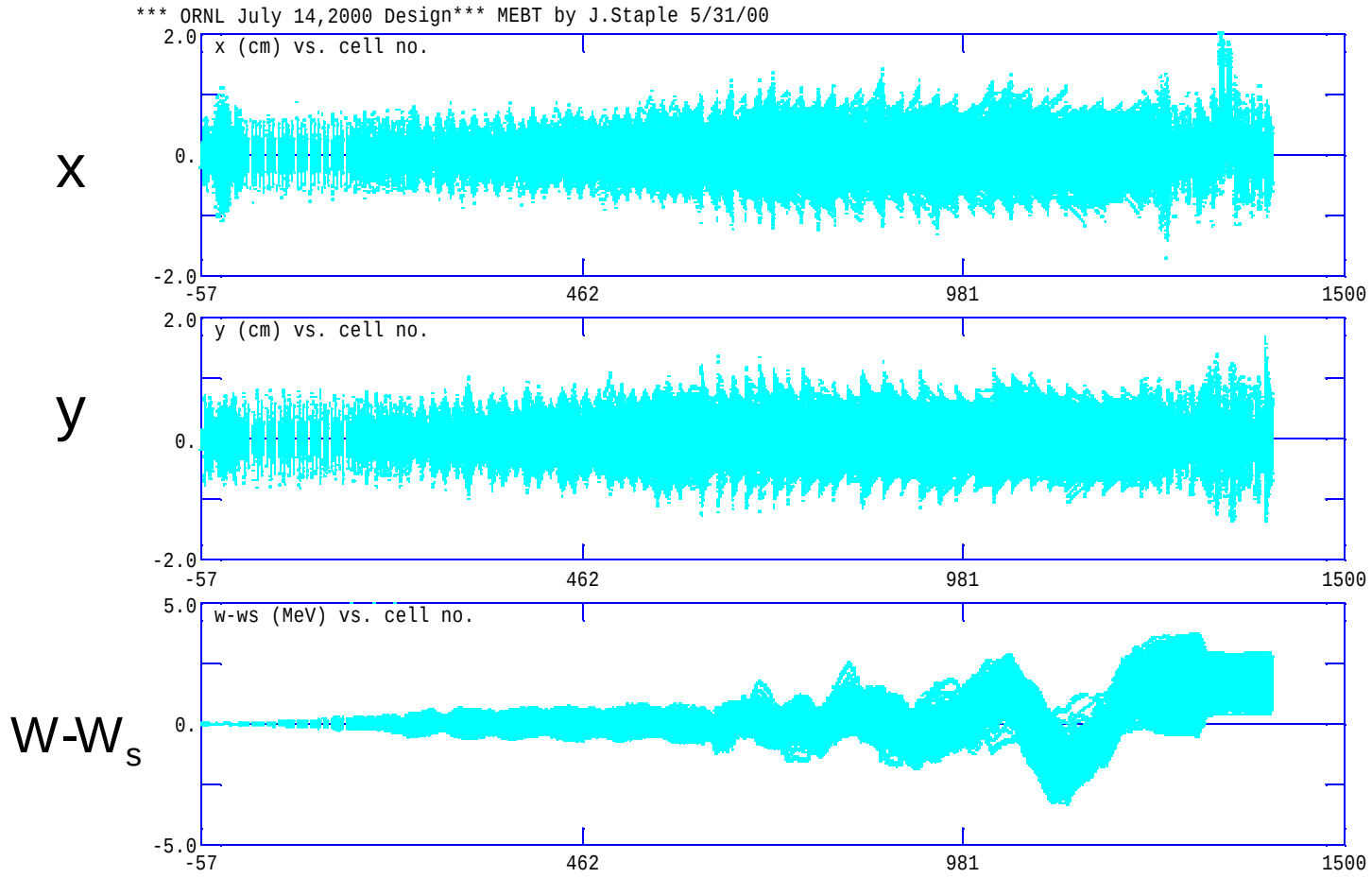
X, Y and Energy(W) Profiles Without Errors



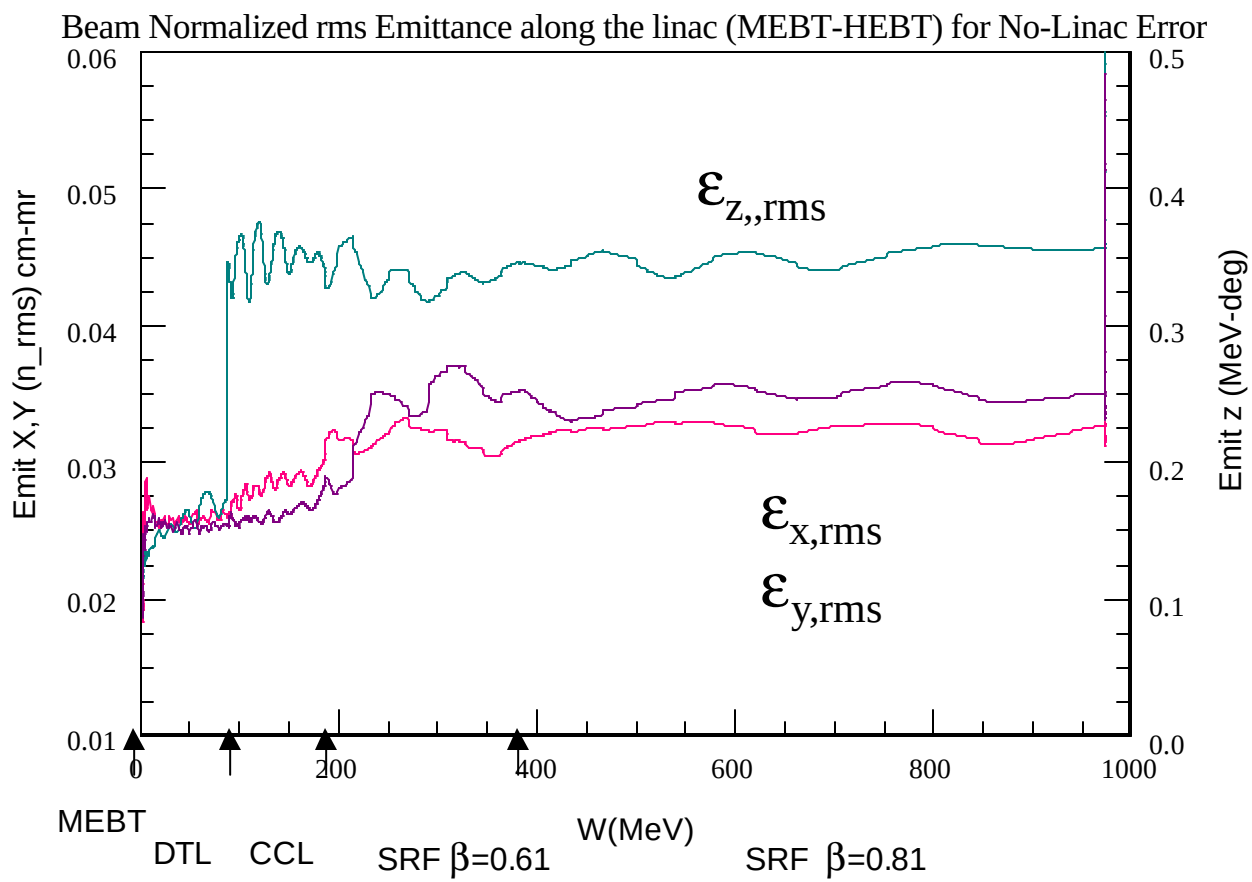
X,Y and Energy(W) Profile With Errors (1)



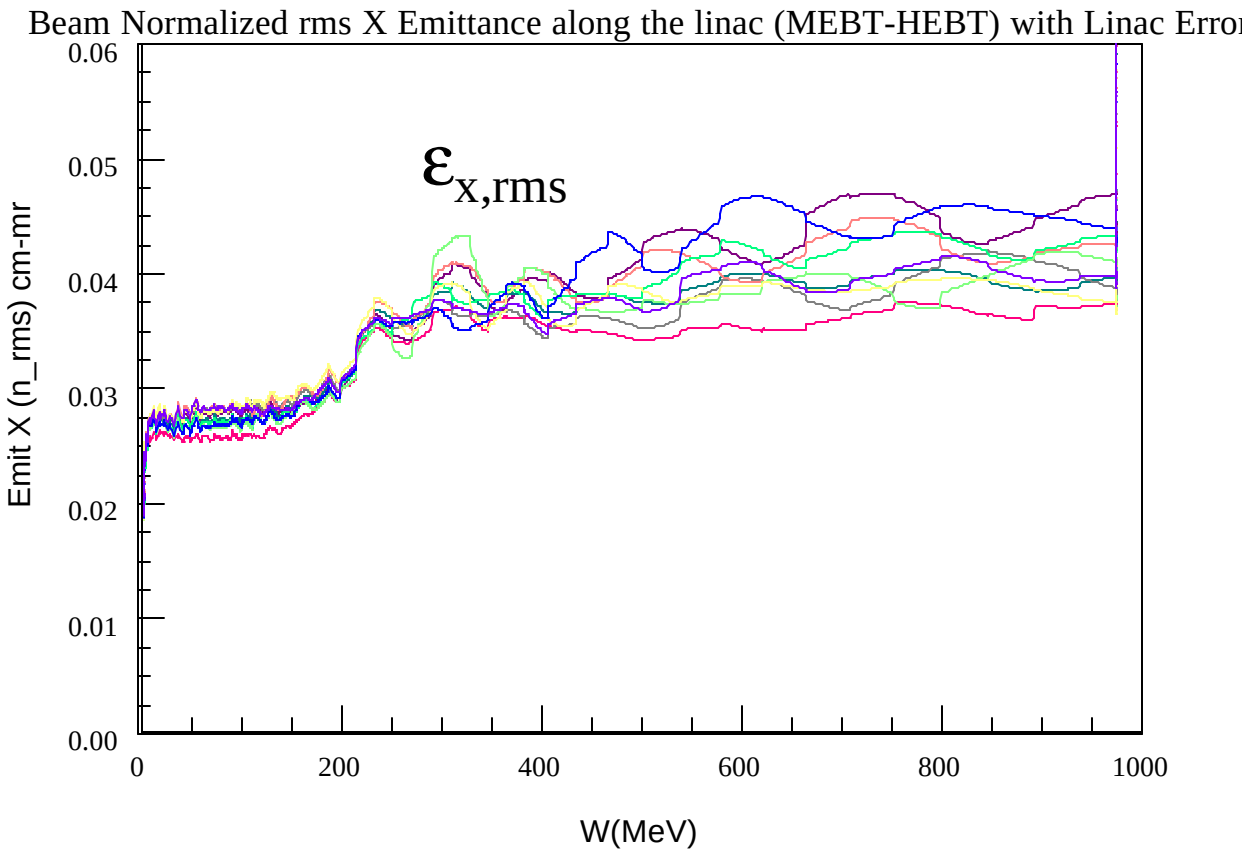
X,Y and Energy(W) Profile With Errors (2)



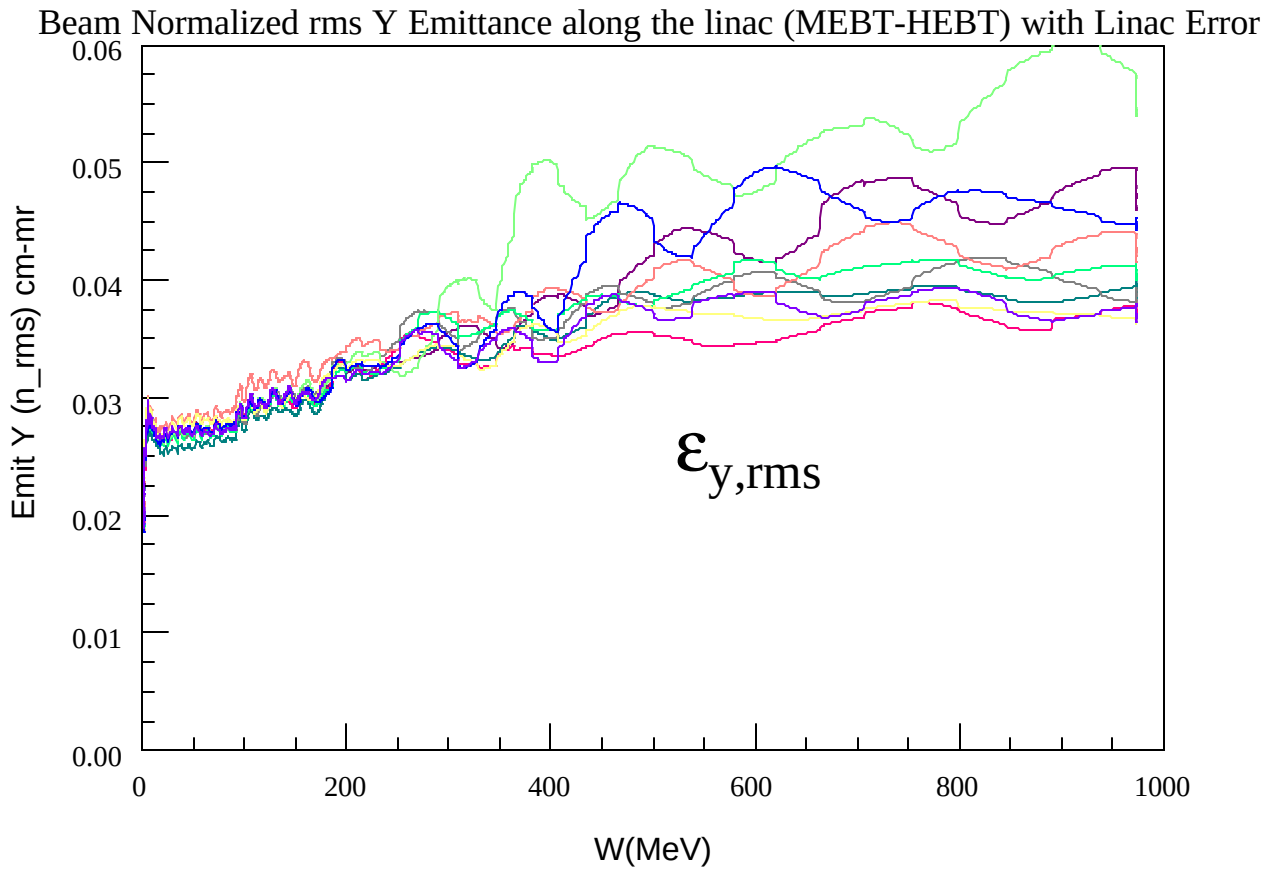
rms Emittance Profiles Without Errors



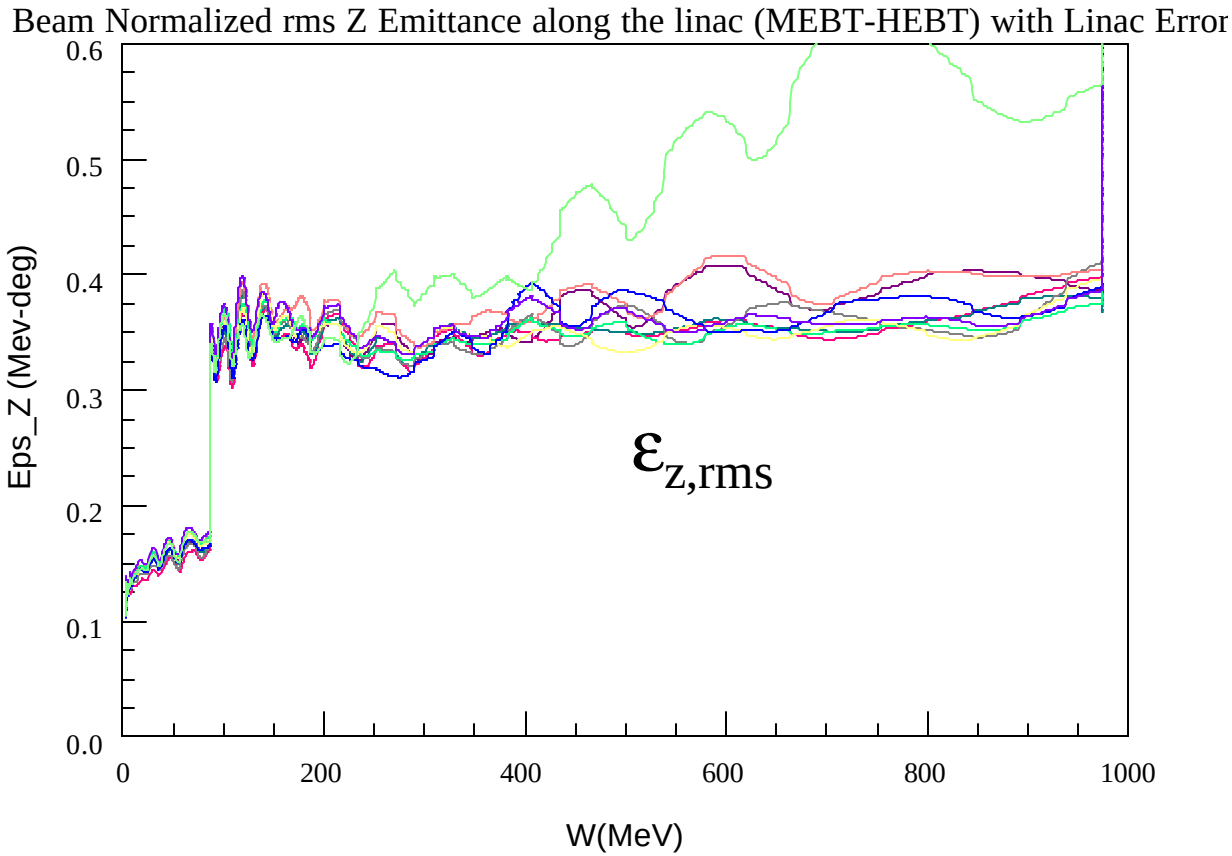
$e_{x,rms}$ Profile With Errors



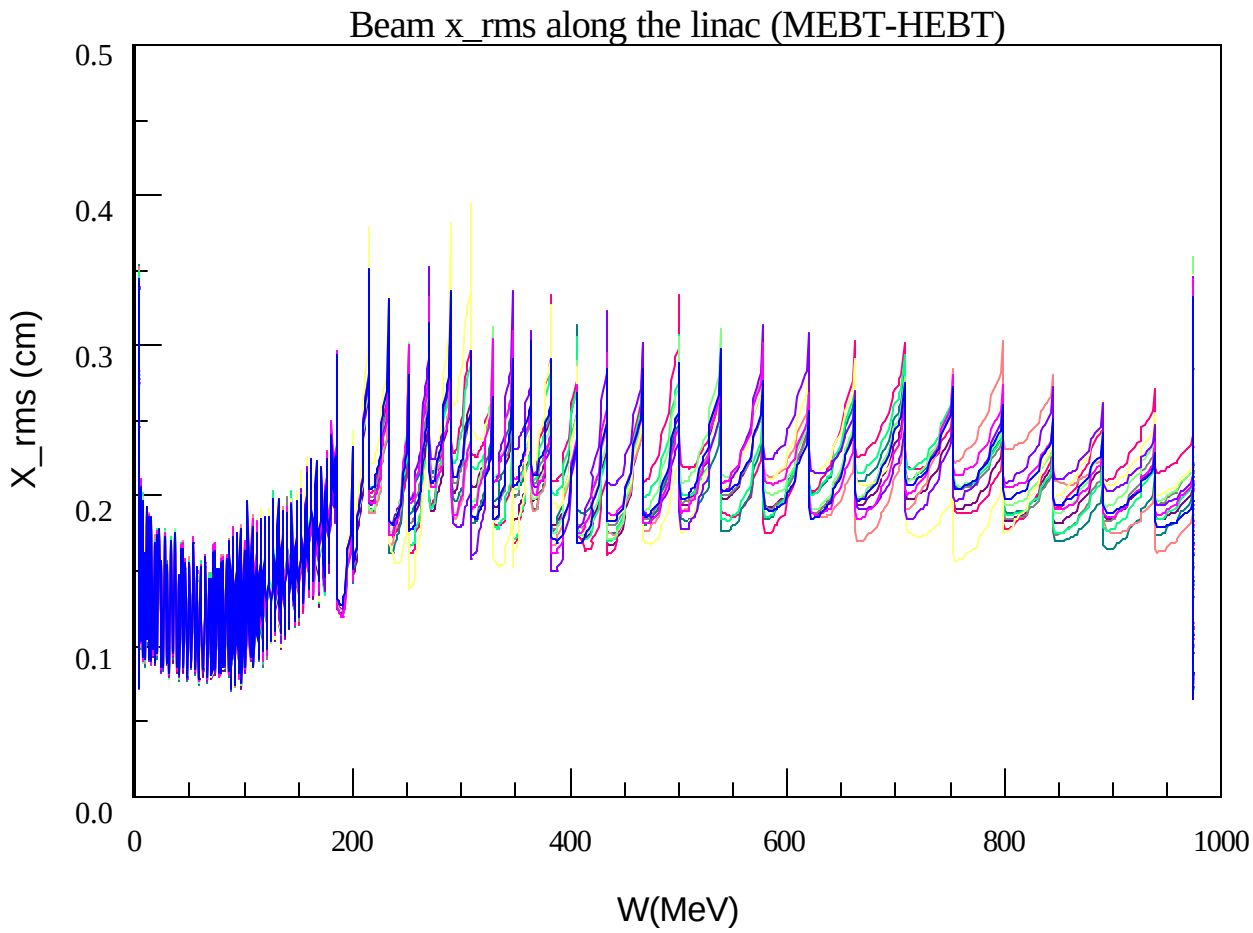
$e_{y,rms}$ Profile With Errors



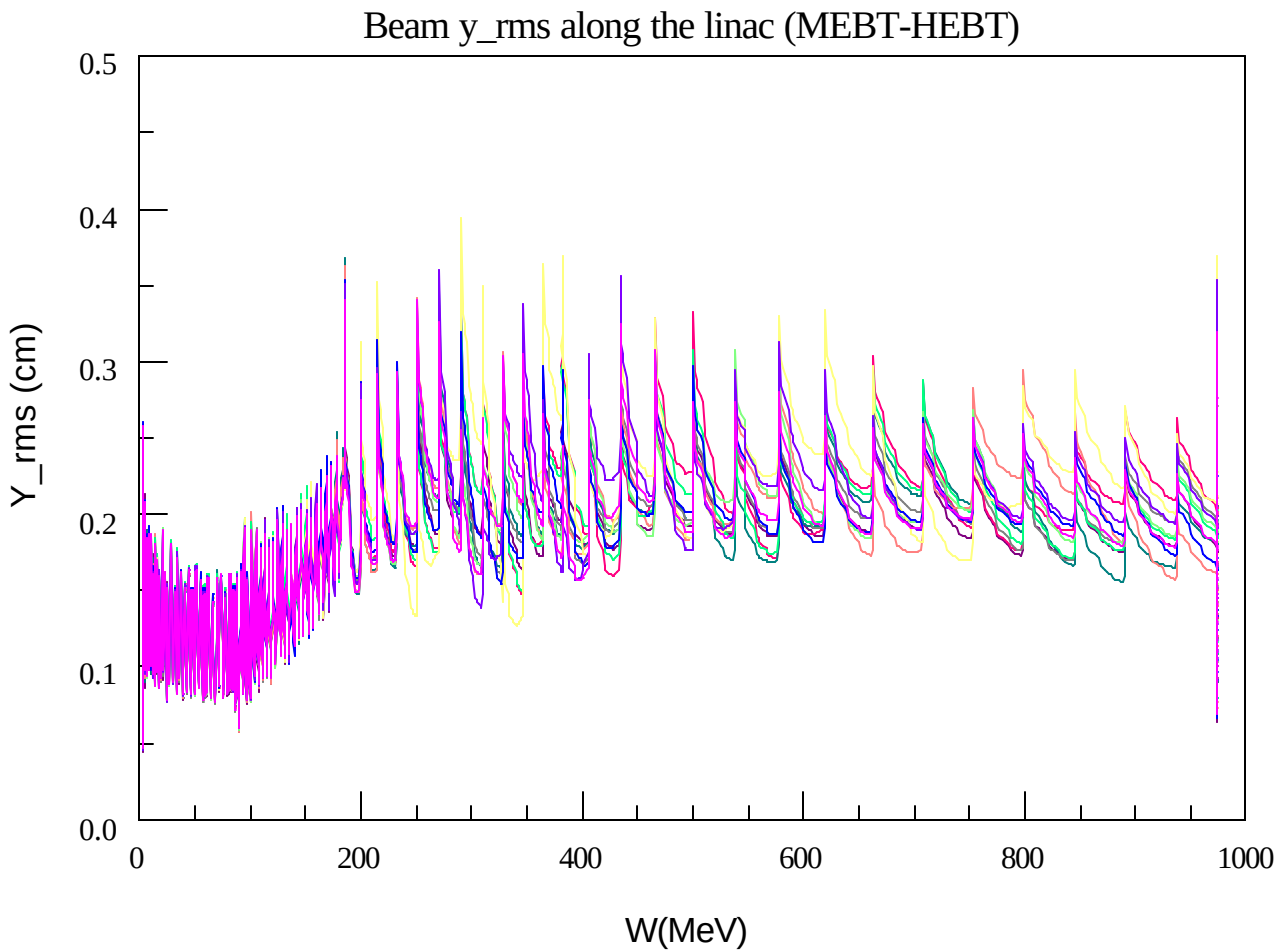
$e_{z,rms}$ Profile With Errors



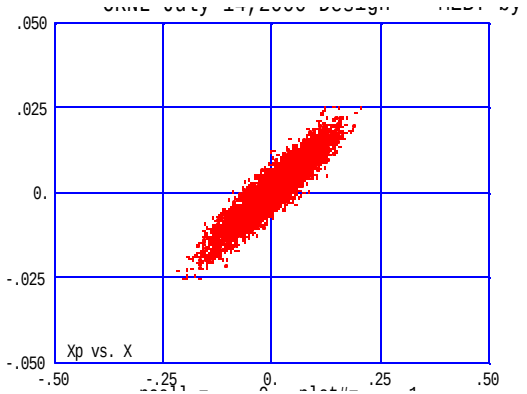
X_{rms} Profiles for 10 runs With Errors



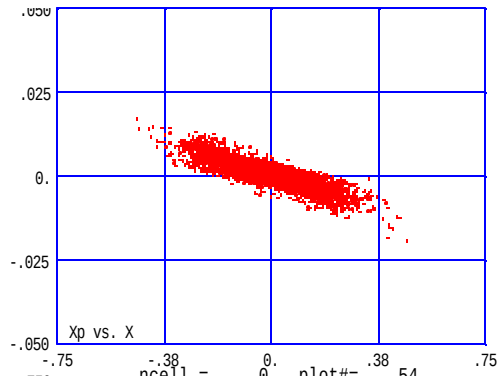
Y_{rms} Profiles for 10 runs With Errors



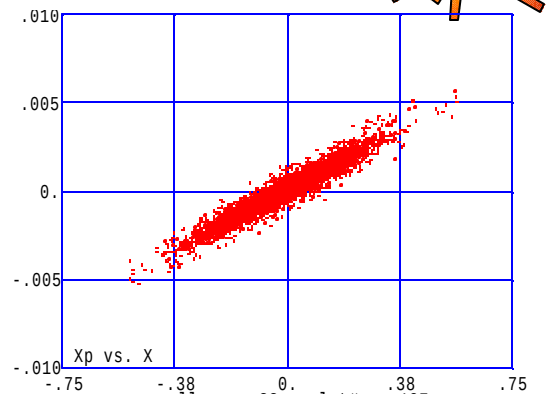
X-X' Projections Without Errors (Auto scaled)



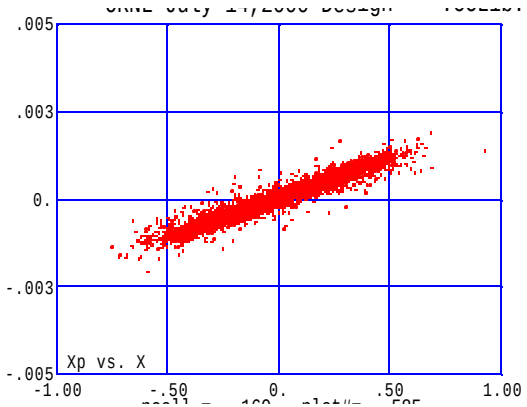
MEBT Entry



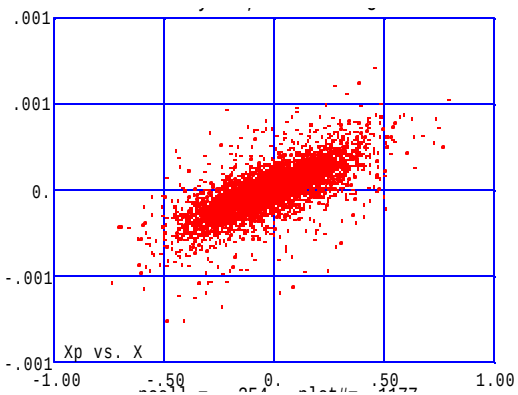
DTL Entry



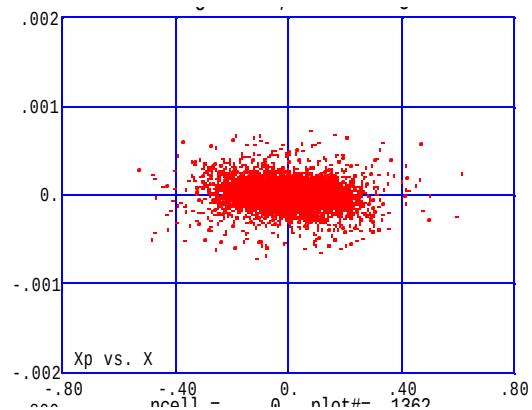
CCL Entry



SRF Entry 185.6 MeV

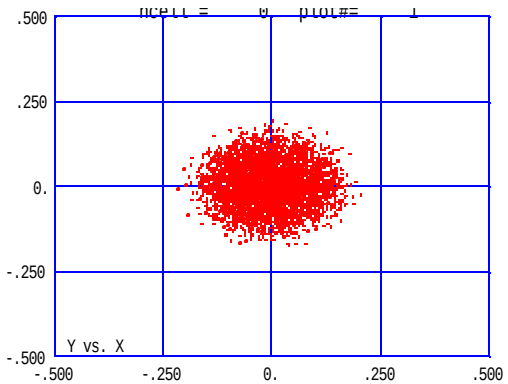


SRF Exit 973 MeV

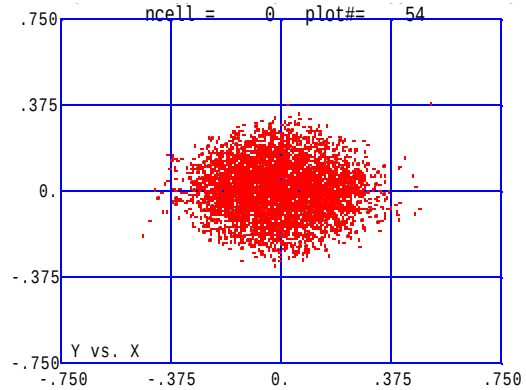


HEBT 973 MeV

X-Y Projections Without Errors (Auto scaled)



MEBT Entry



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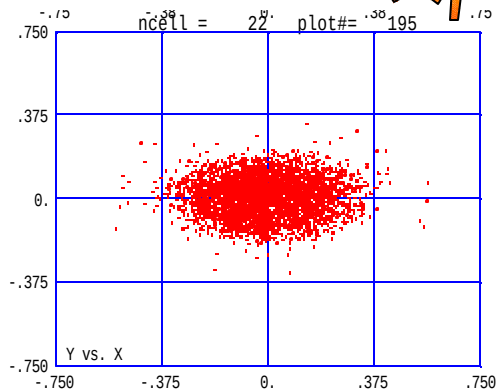
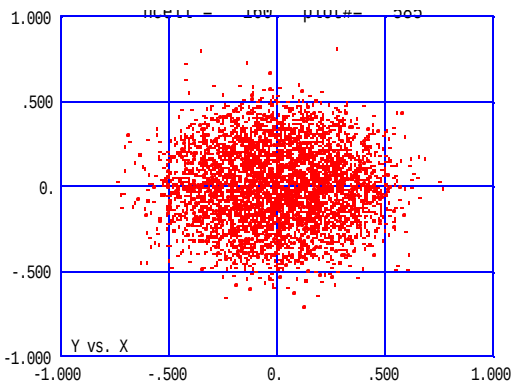
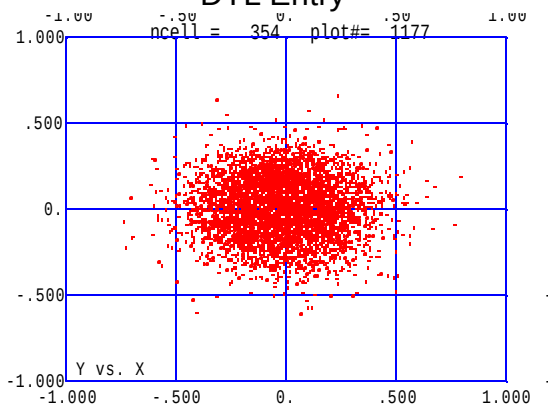


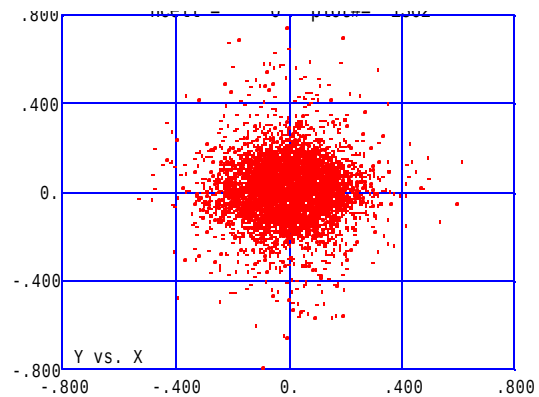
CCL Entry



SRF Entry
185.6 MeV

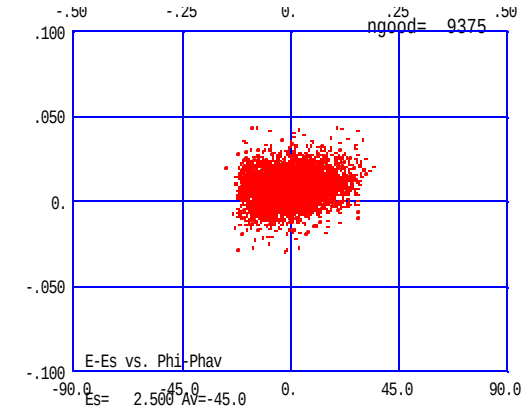


SRF Exit 973 MeV

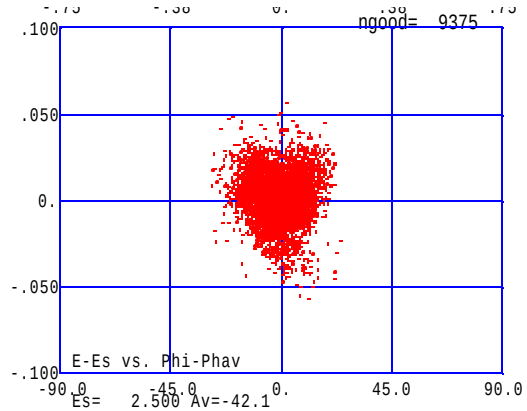


HEBT 973 MeV

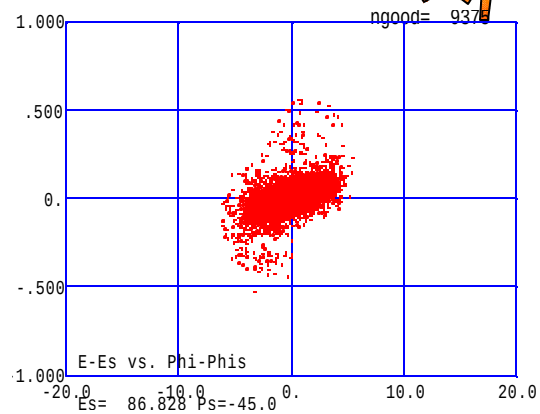
W-f Projections Without Errors (Auto scaled)



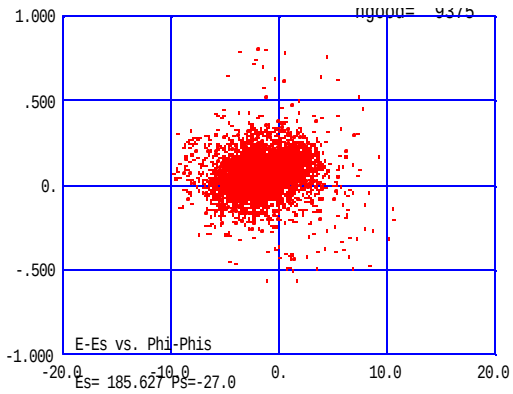
MEBT Entry



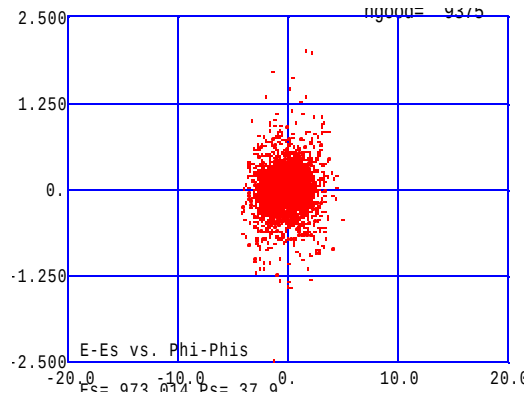
DTL Entry



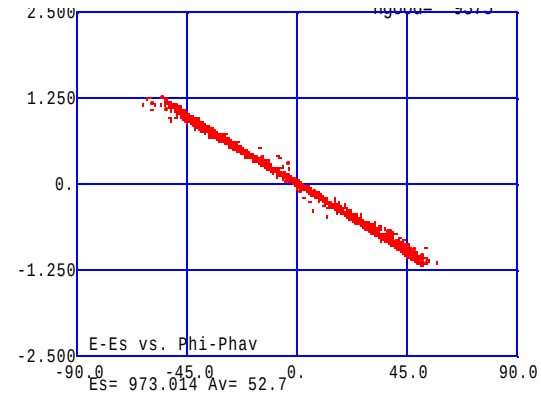
CCL Entry



SRF Entry 185.6 MeV

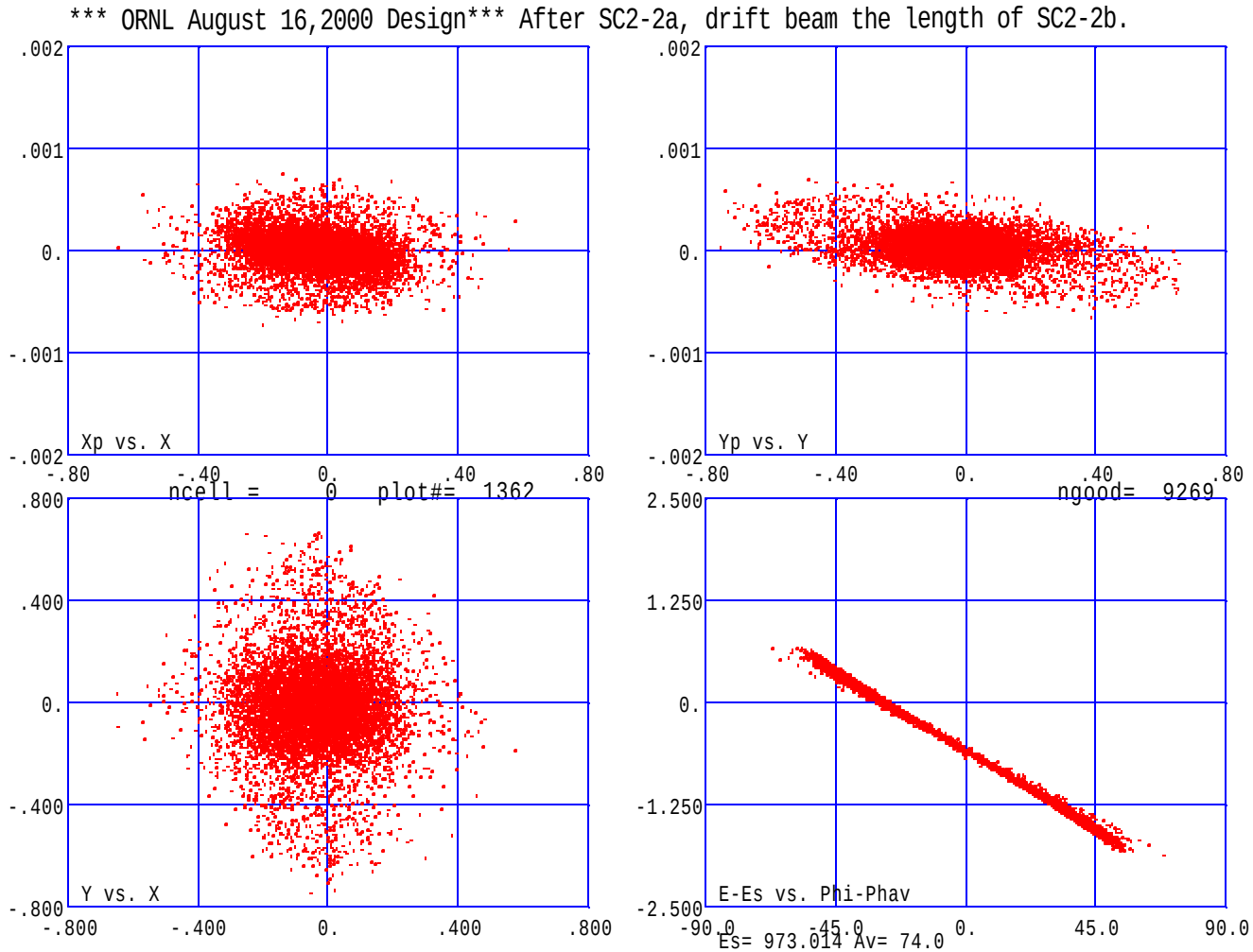


SRF Exit 973 MeV

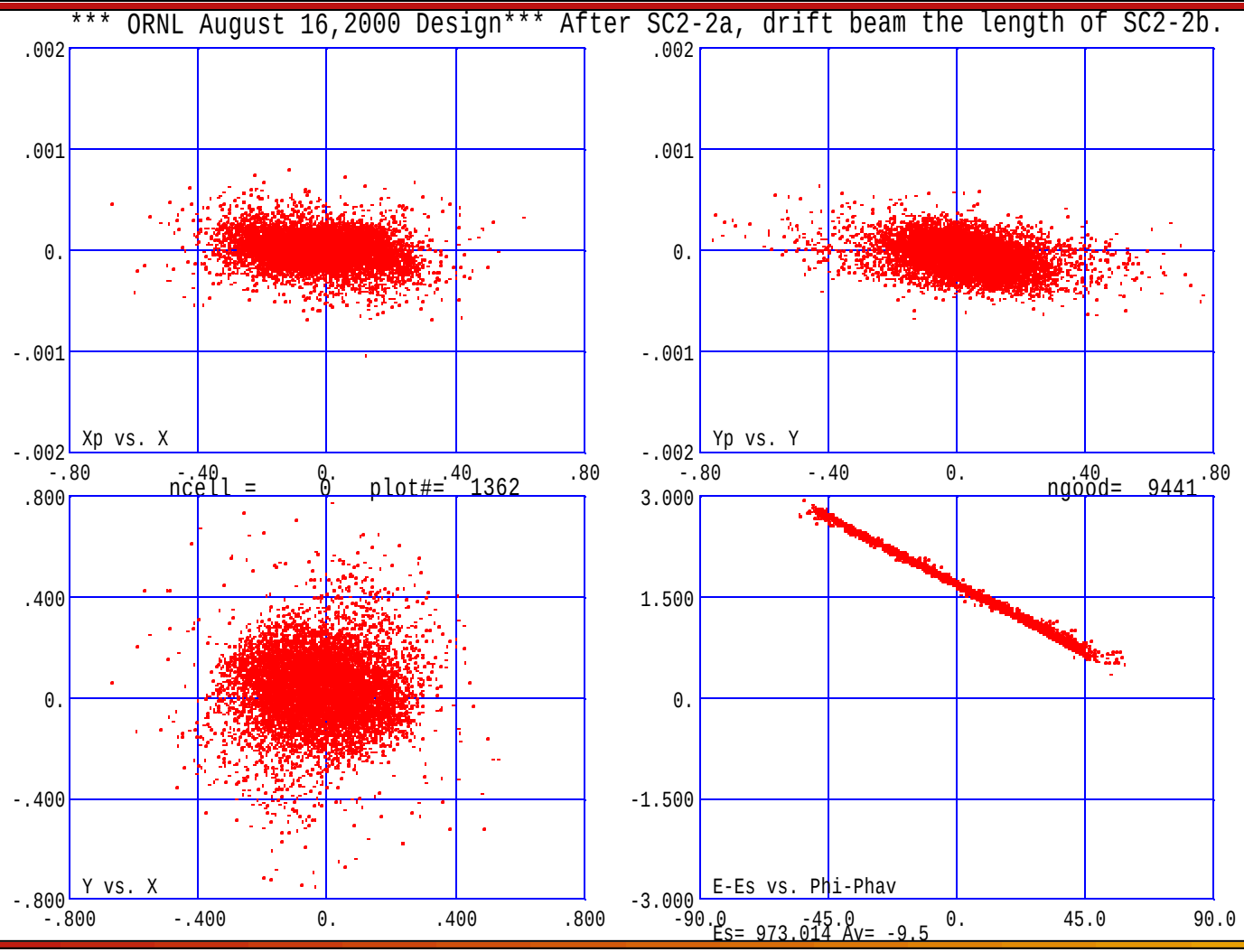


HEBT 973 MeV

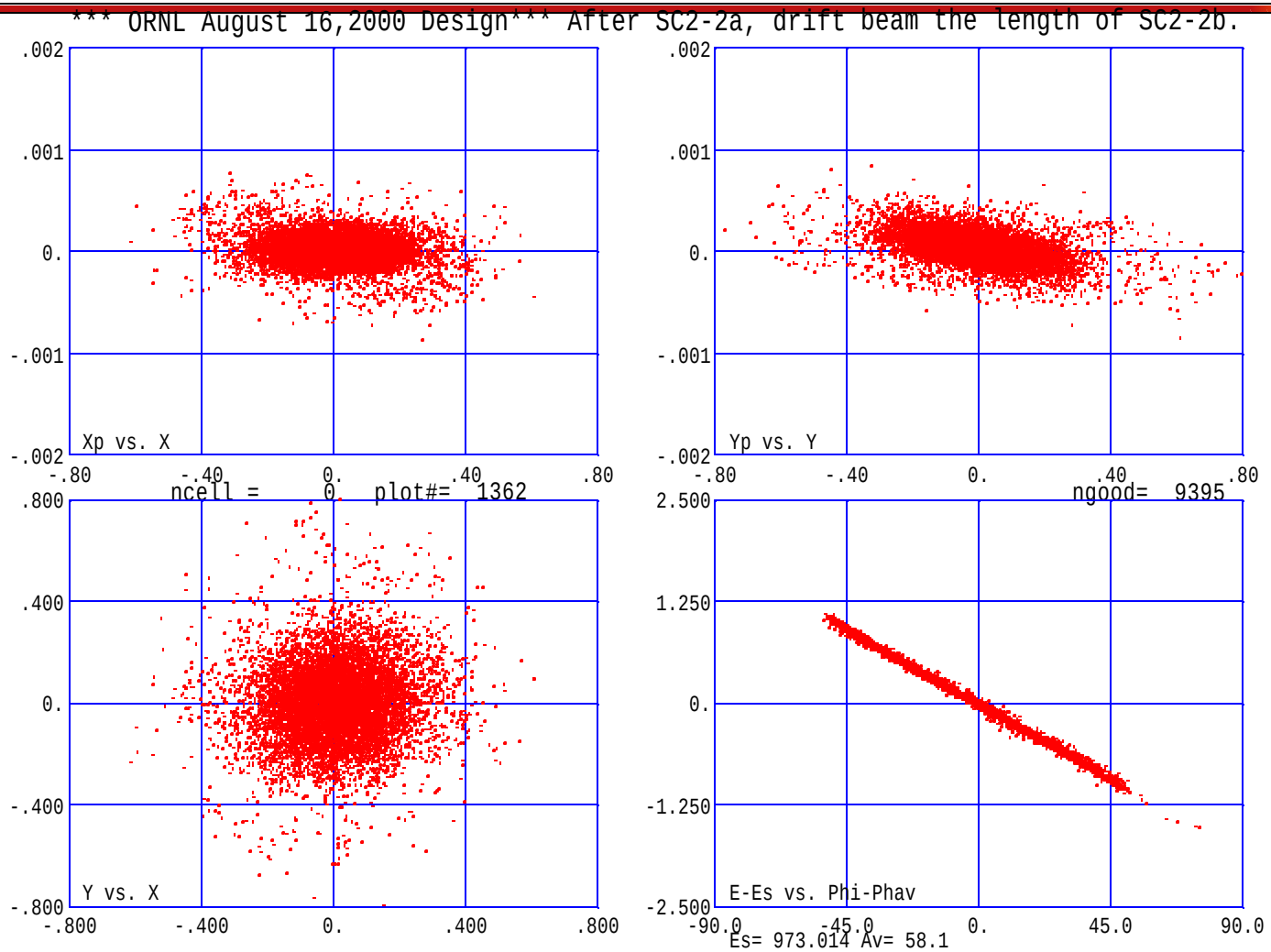
X-X', Y-Y', X-Y and W-f Projections With Errors (1) at HEBT (Auto scaled)



X-X', Y-Y', X-Y and W-f Projections With Errors (2) at HEBT (Auto scaled)



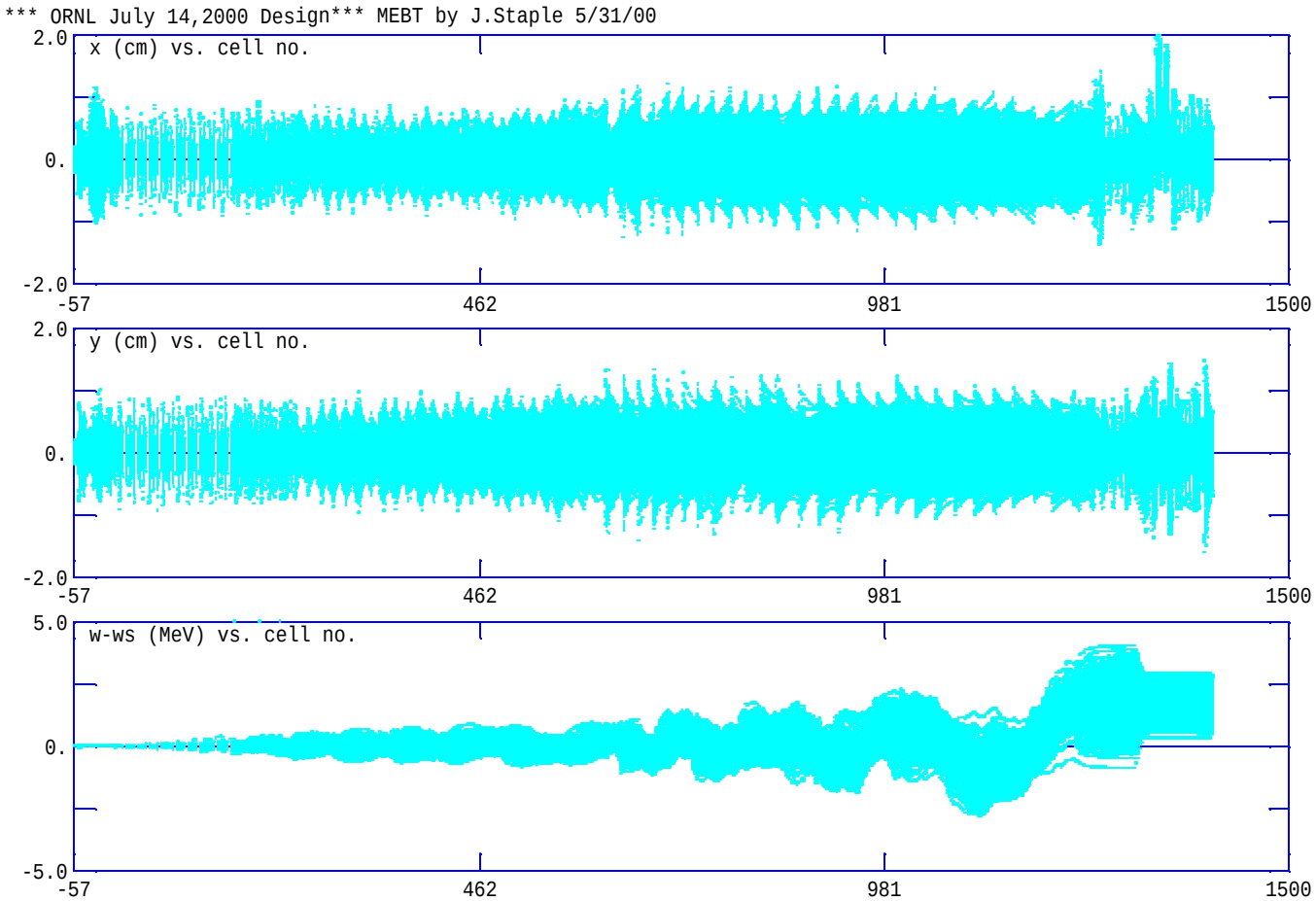
X-X', Y-Y', X-Y and W-f Projections With Errors (4) at HEBT (Auto scaled)



Conclusions

- The parmila code for the End-to-End simulation with the dynamic errors shows that the beam transports through the entire linac without loss of partilcles.

- Ready to study with larger number of simulated particles.

- Preparing to include misalignments, steering and multipoles.

x,y and Energy(W) Profile With Errors (5)