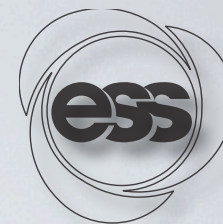


POST 2011 ESS LINAC(S)

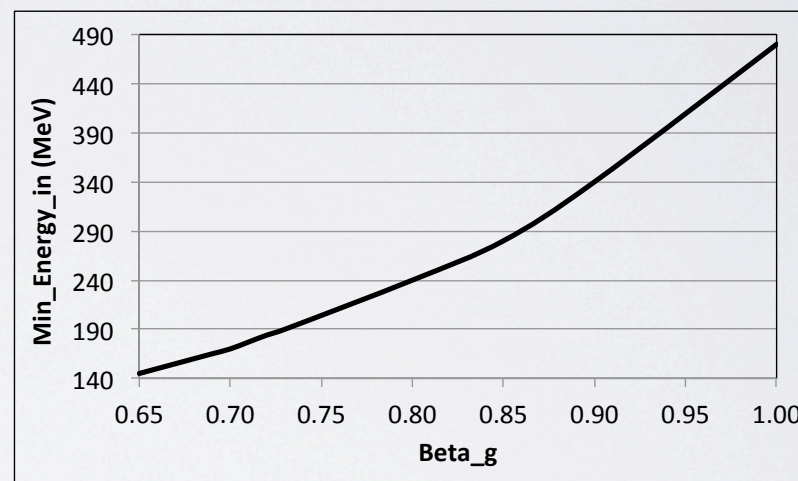
M. Eshraqi

SLHiPP, Catania, 3–4 May 2012

CHANGES SINCE 2011



- Higher DTL energy
- Modified phase law
- Warm quadrupoles
(Segmented linac)

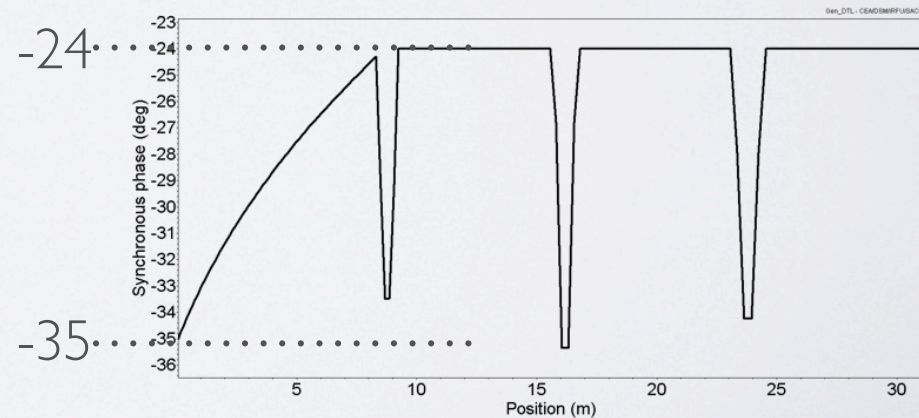
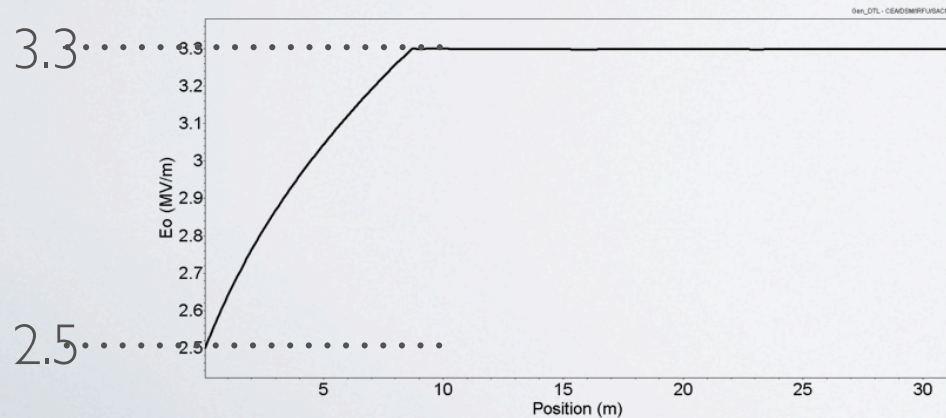


- Increasing the input energy to of medium β cavities and reducing the β_g in this region.

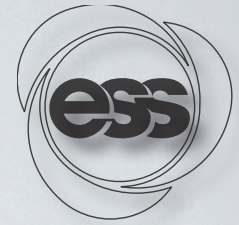
DTL



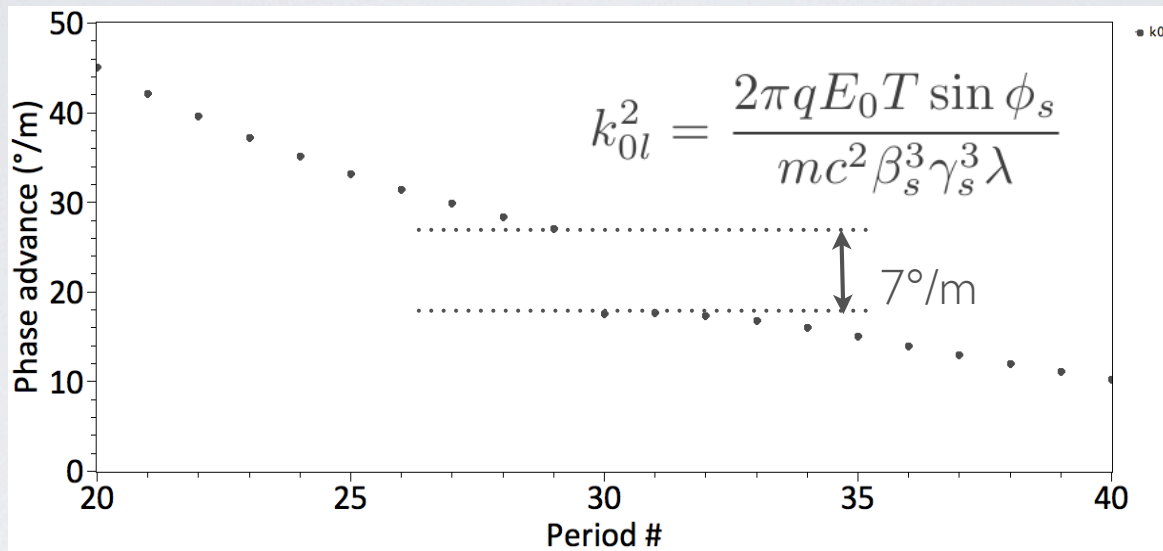
	L (m)	N_cell	Energy(MeV)	Power (MW)
Tank 1	8.7	71	23.0	2.13
Tank 2	7.4	34	42.5	2.12
Tank 3	7.6	28	61.6	2.14
Tank 4	7.5	24	79.3	2.08



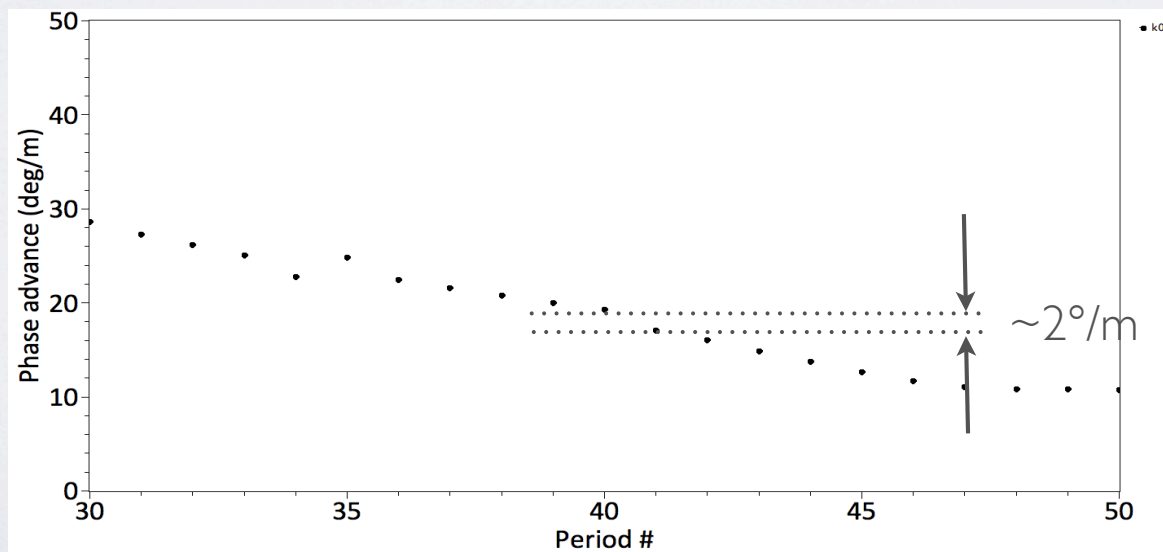
HIGHER DTL ENERGY I



Before



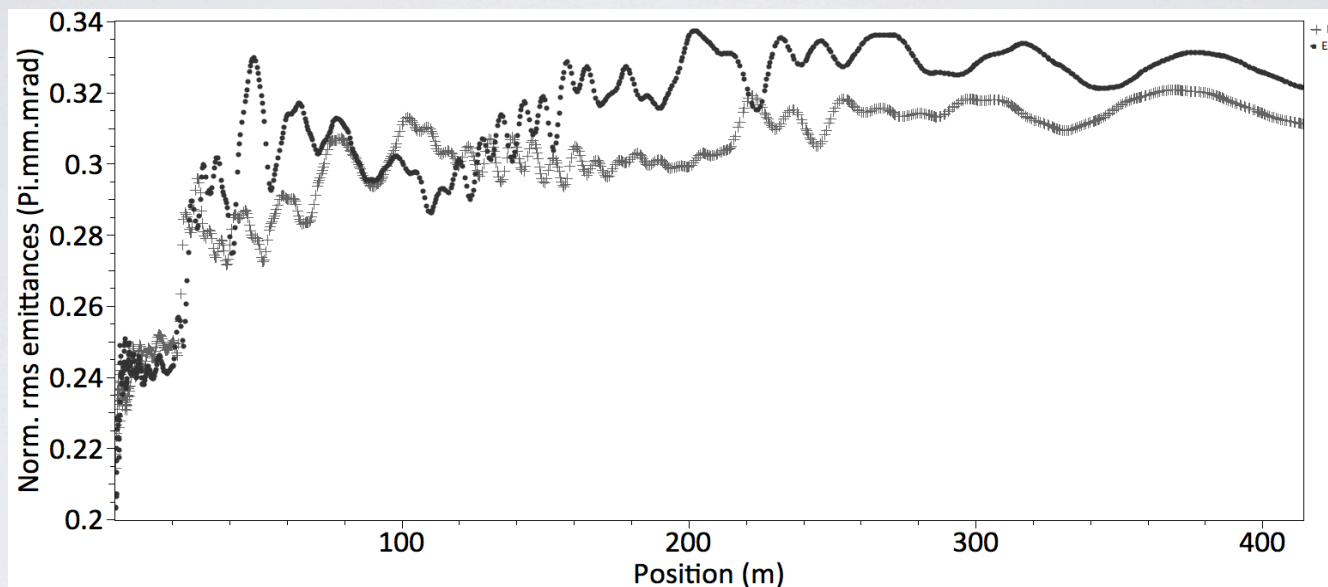
After



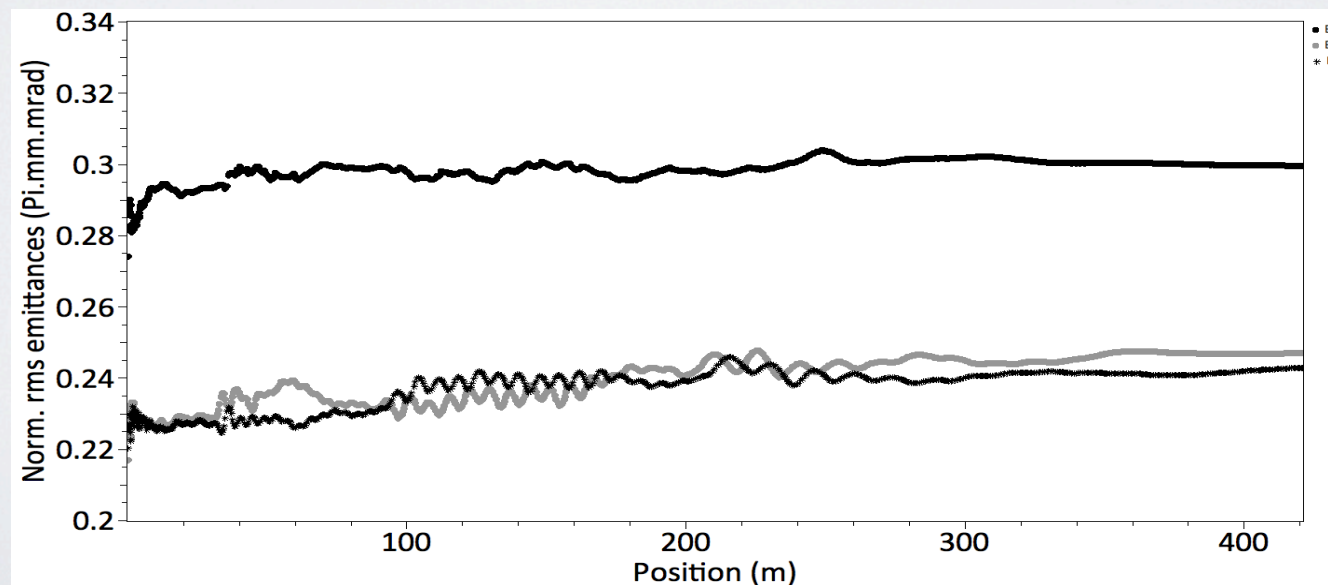
HIGHER DTL ENERGY II



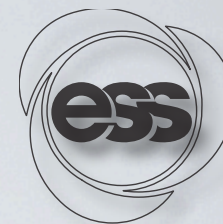
Before



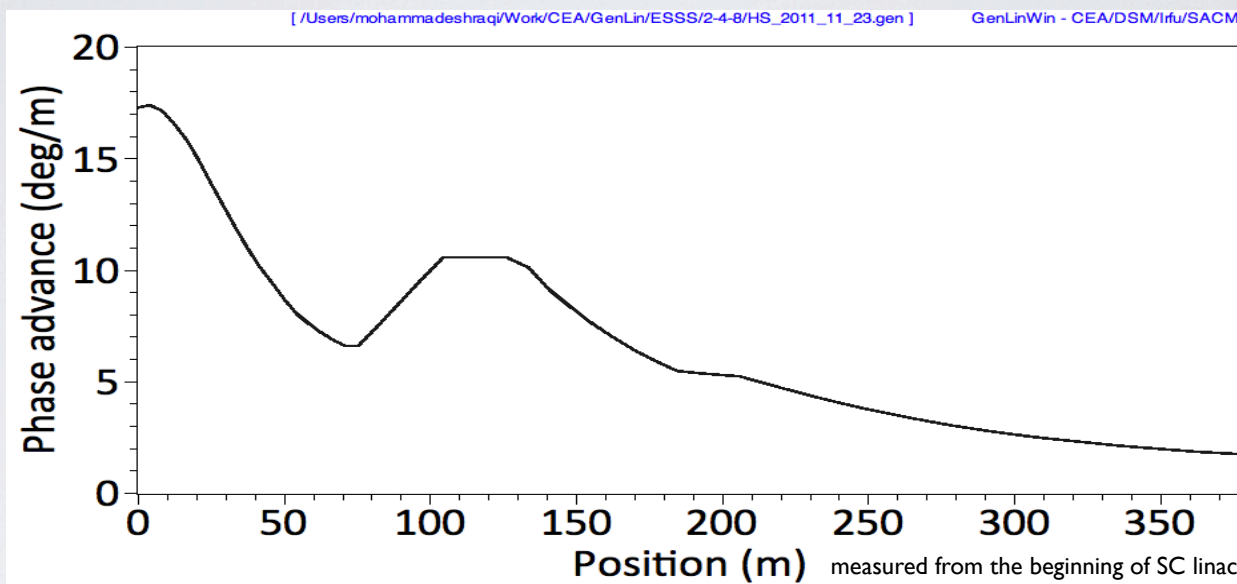
After



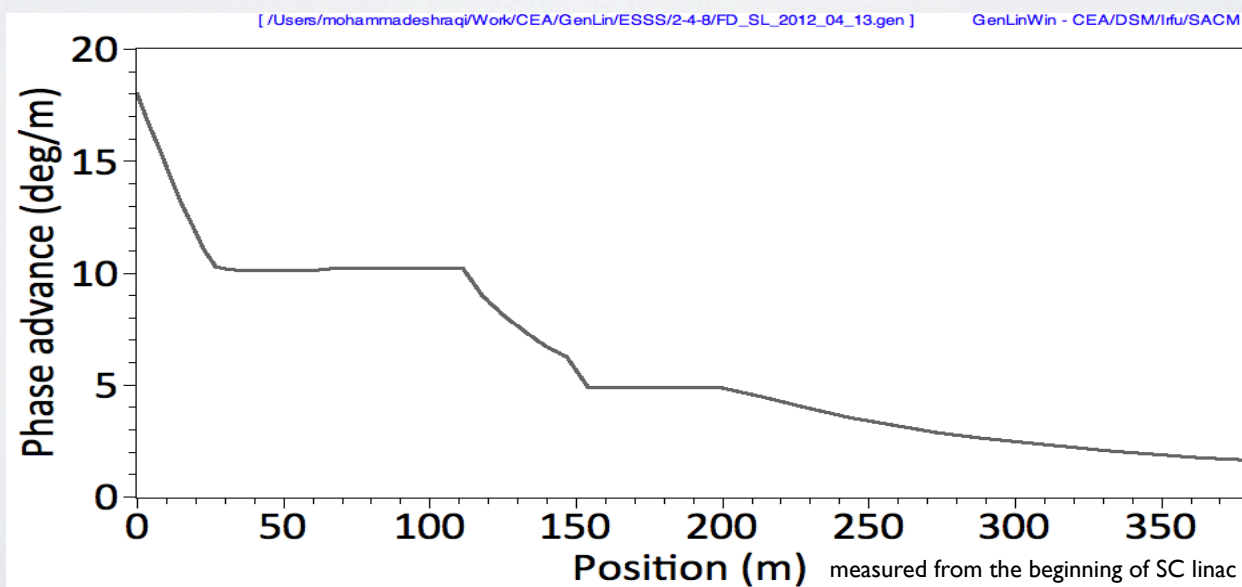
MODIFIED PHASE LAW I



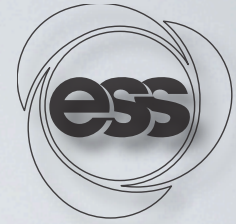
Before



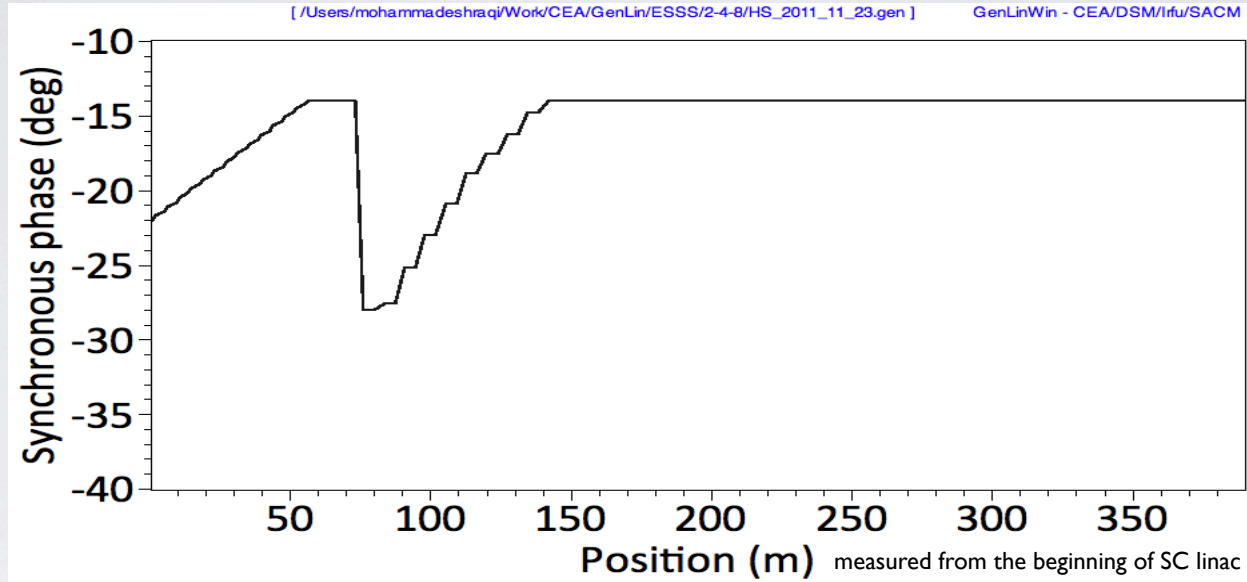
After



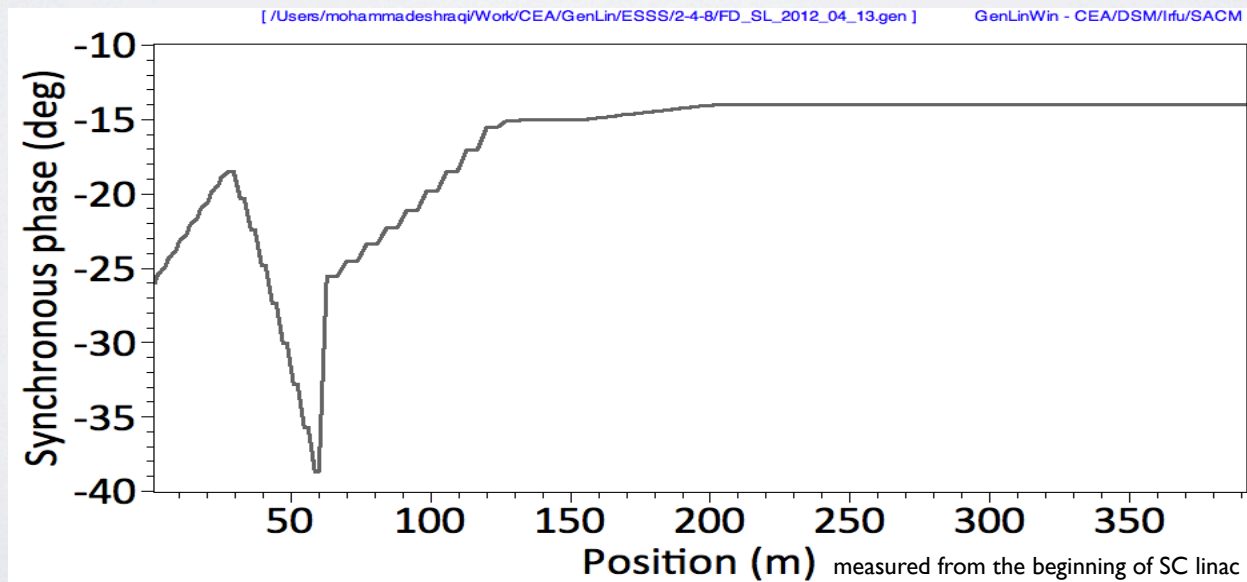
MODIFIED PHASE LAW II



Before



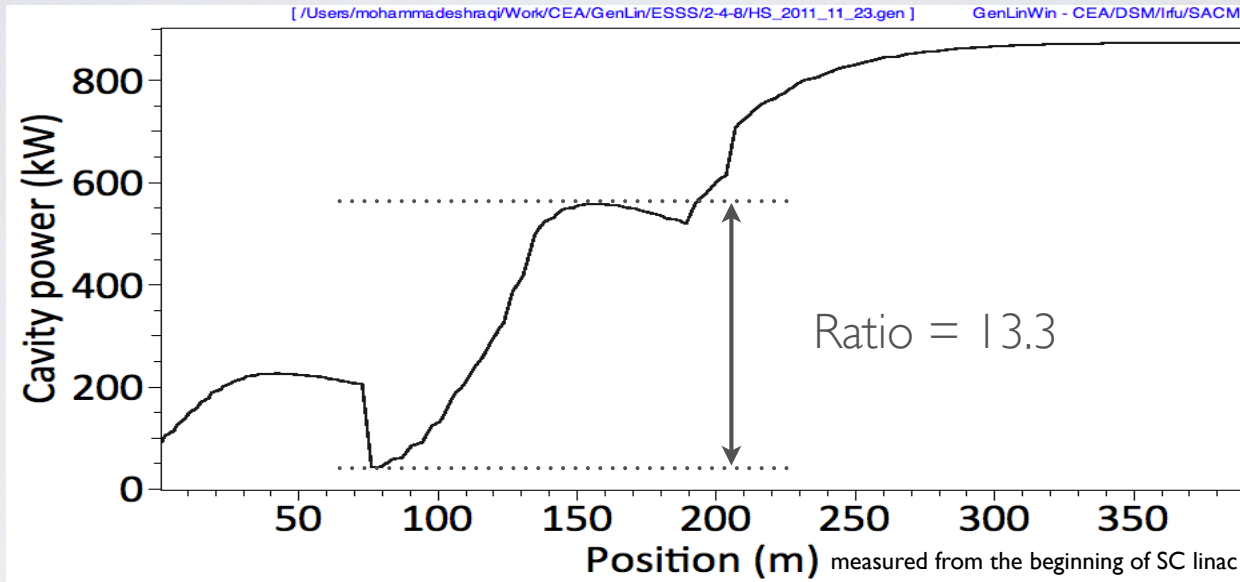
After



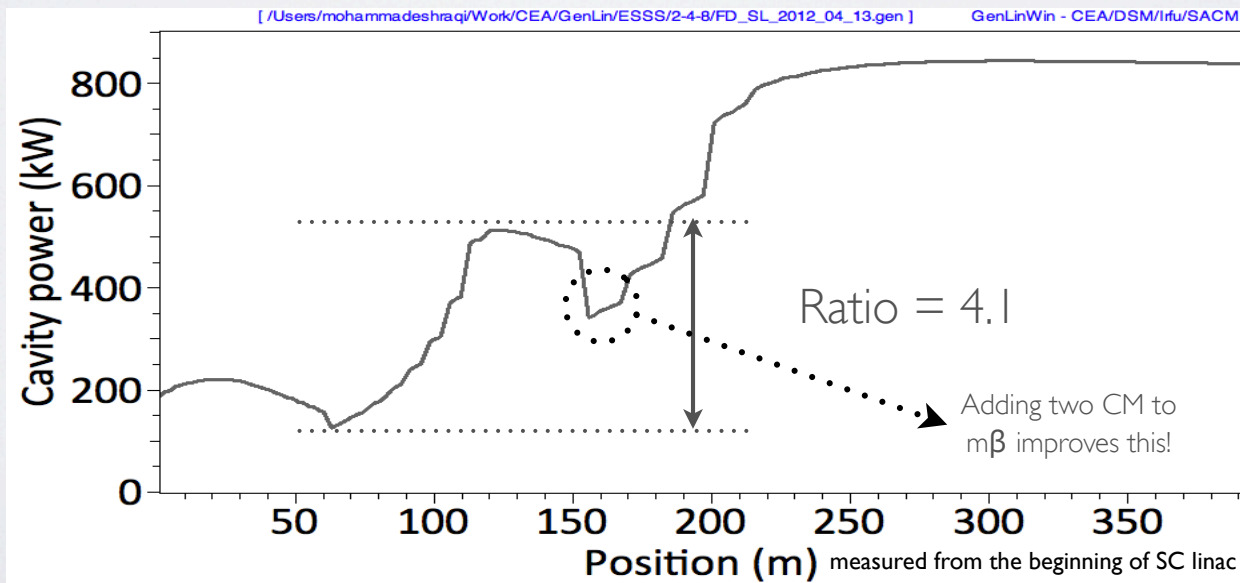
MODIFIED PHASE LAW III



Before



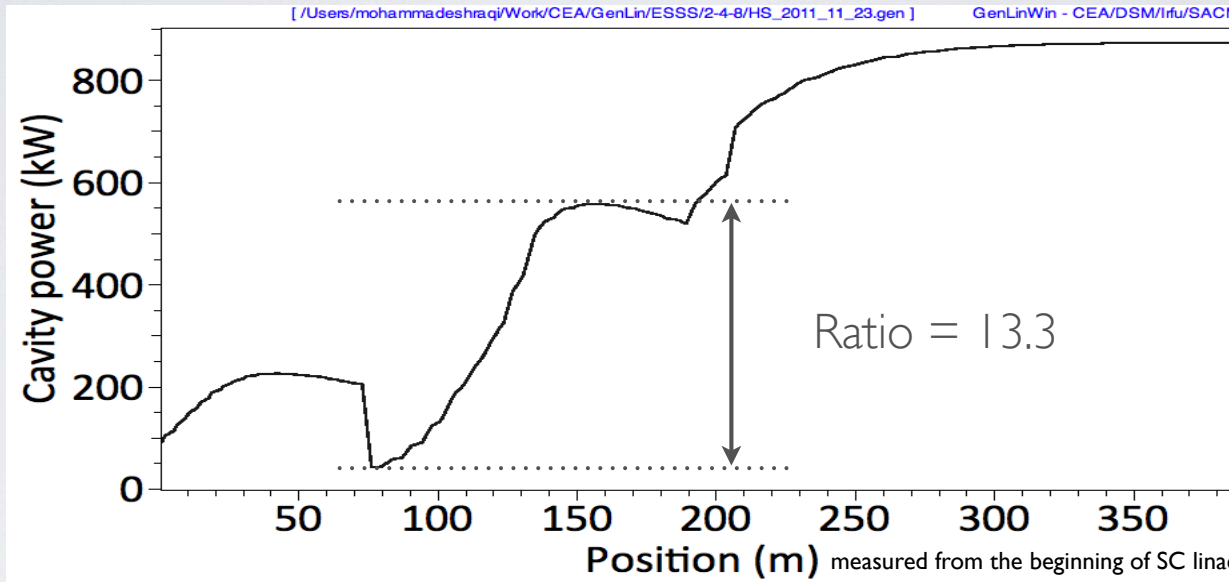
After



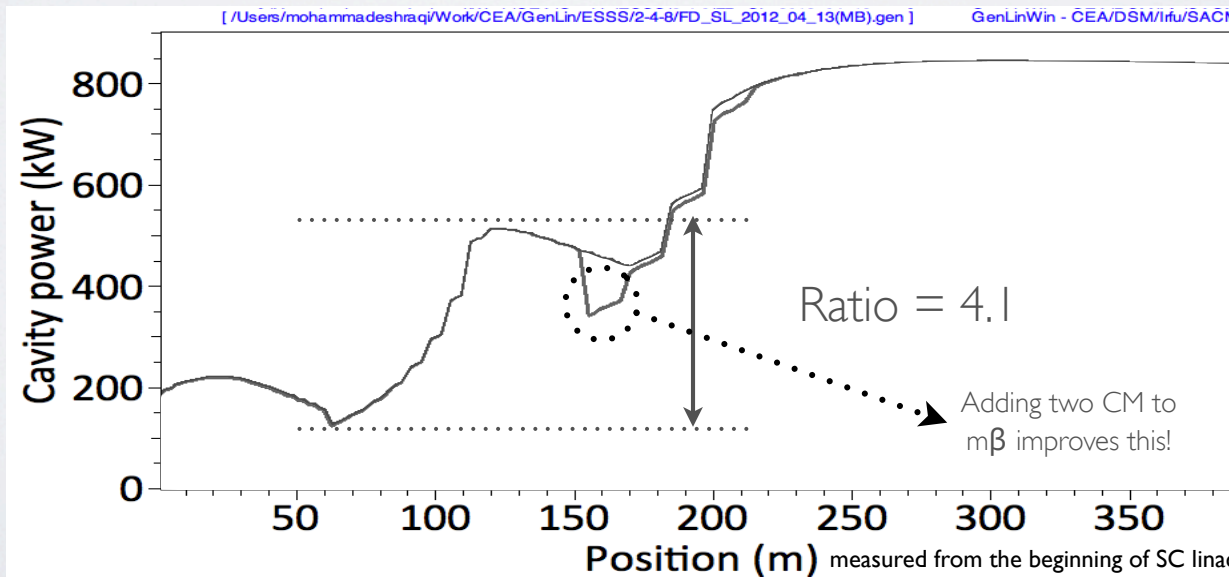
MODIFIED PHASE LAW III



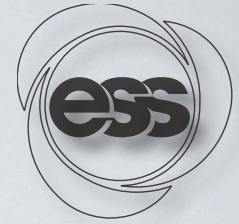
Before



After



SSCL



ASSEMBLY LENGTH



8 CAVITIES WITH COLD AND WARM VALVES



CONE = 100MM



DN100 VALVE = 85MM



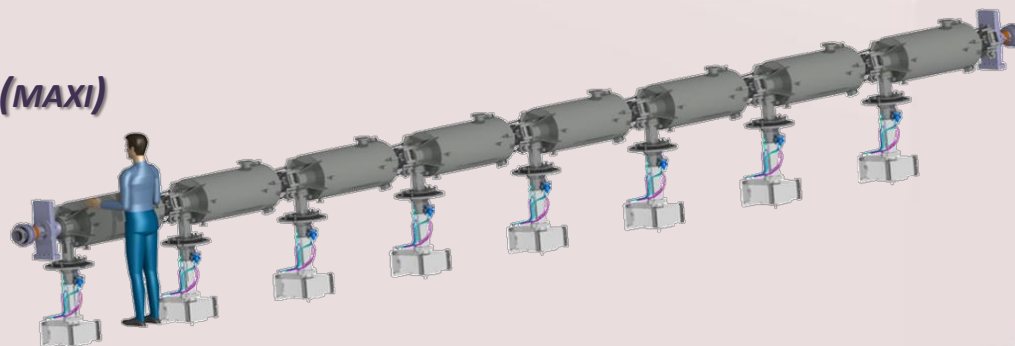
C/W TRANSITION = 300MM (MAXI)



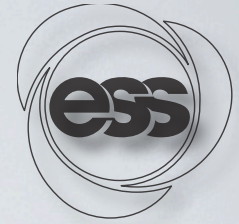
BELLOWS = 150MM



CAVITY = 1356MM (MAXI)



FDSL



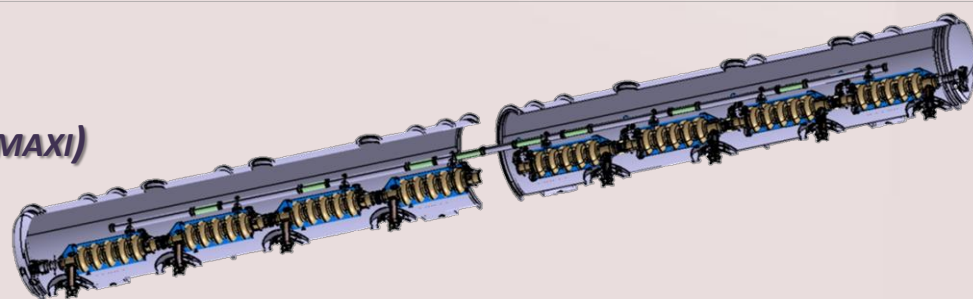
ASSEMBLY LENGTH



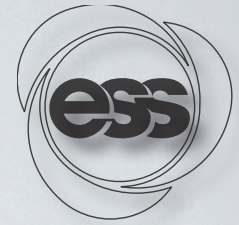
4+4 CAVITIES WITH COLD AND WARM VALVES



-  **CONE = 100MM**
-  **TRANSITION + PUMPING = 150MM**
-  **DN100 VALVE = 85MM**
-  **C/W TRANSITION = 300MM (MAXI)**
-  **BELLOWS = 150MM**
-  **CAVITY = 1356MM (MAXI)**



FODOSL



ASSEMBLY LENGTH



4 CAVITIES WITH COLD AND WARM VALVES



CONE = 100MM



DN100 VALVE = 85MM



C/W TRANSITION = 300MM (MAXI)

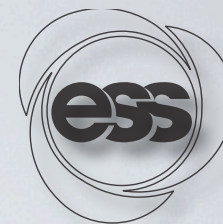


BELLOWS = 150MM



CAVITY = 1356MM (MAXI)

NEW LAYOUTS



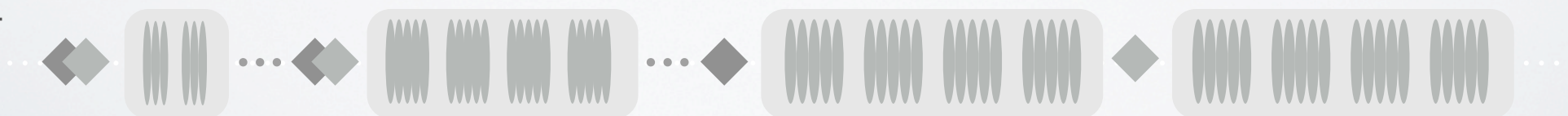
SSCL



SSCL - FD

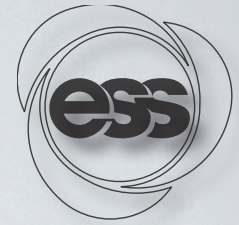


SSCL - FoDo

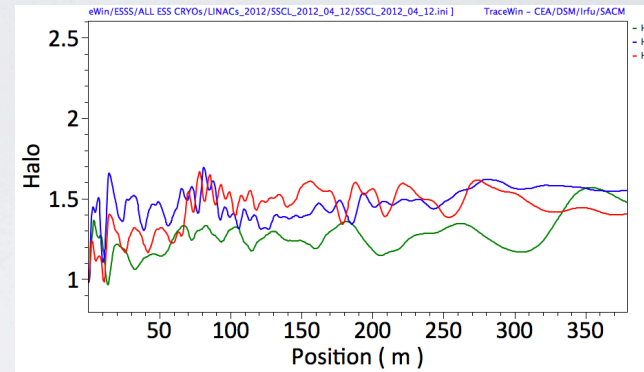
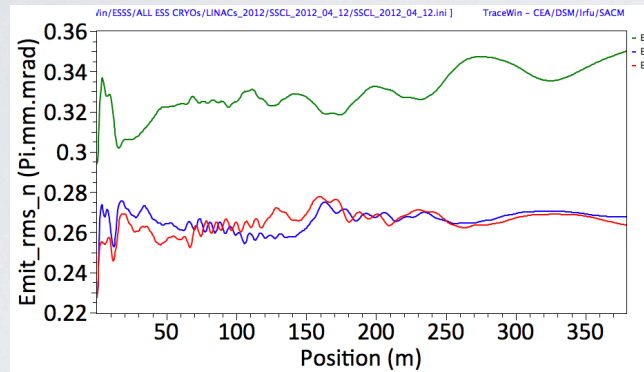


Proposed

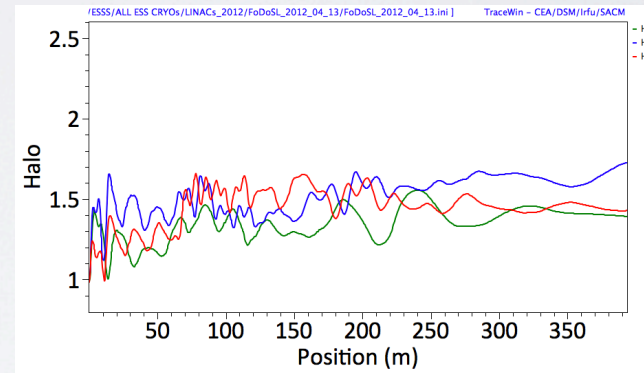
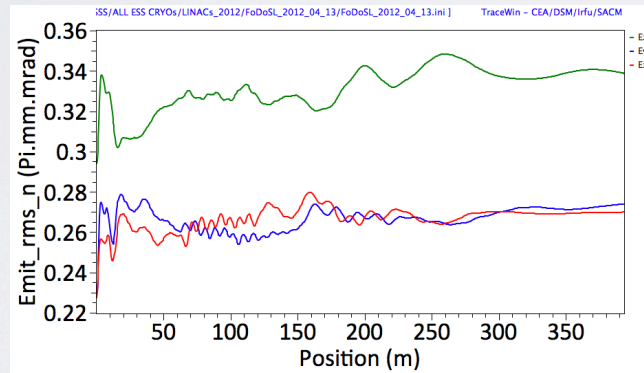
EMITTANCE & HALO



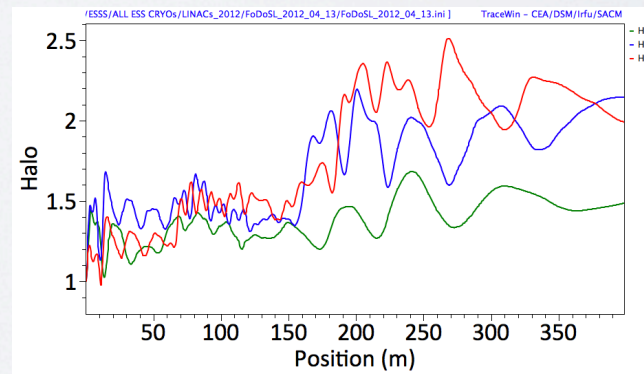
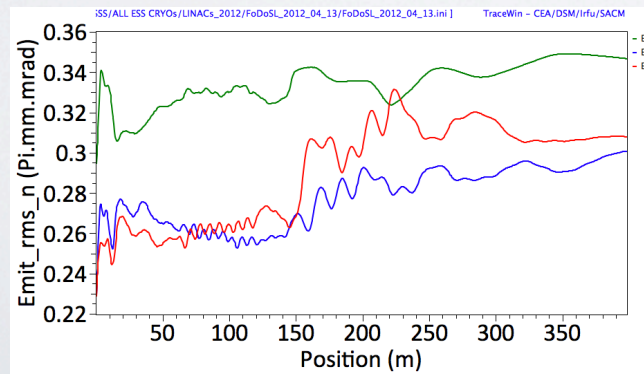
SSCL



FDSL



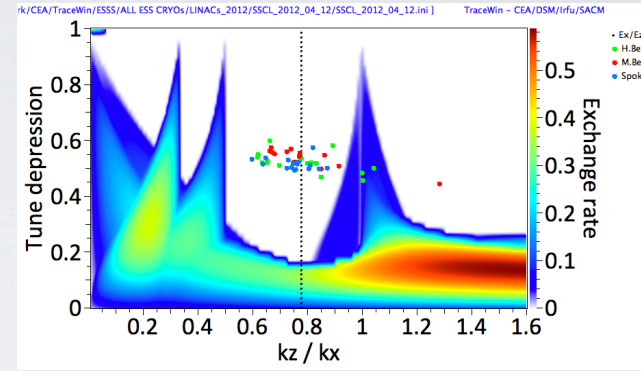
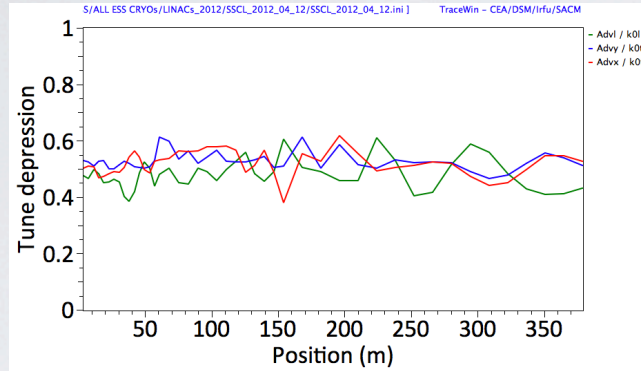
FoDoSL



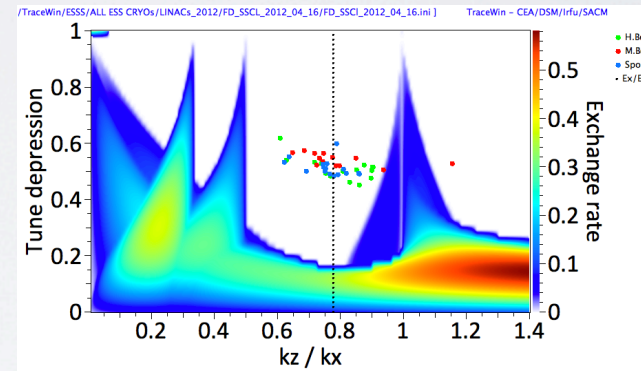
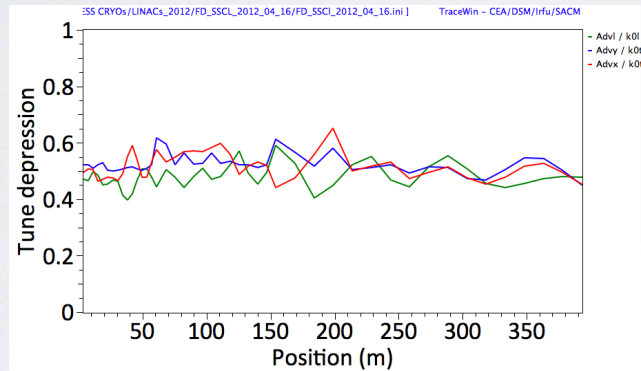
TUNE DEPRESSION



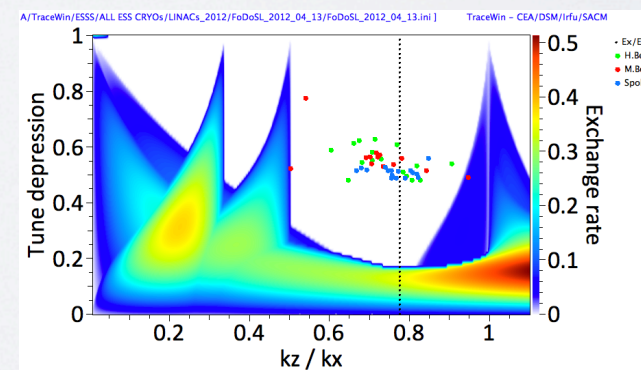
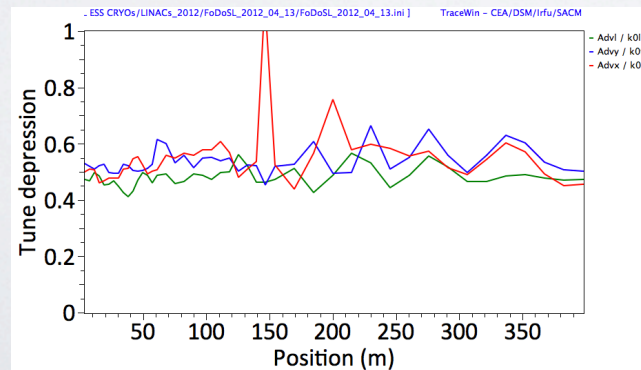
SSCL



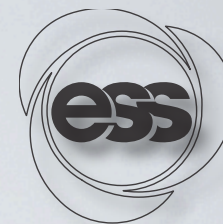
FDSL



FoDoSL



COMPARISON



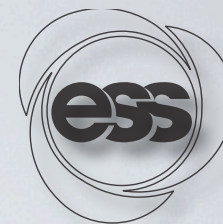
	L^* (m)	N_{cav}	N_{cryo}	N_{quad}
SSCL	386.291	208	44	88
FDSL	394.618	208	59	88
FoDoSL	410.594	208	59	88

* Length of the SC linac excluding the branching sections

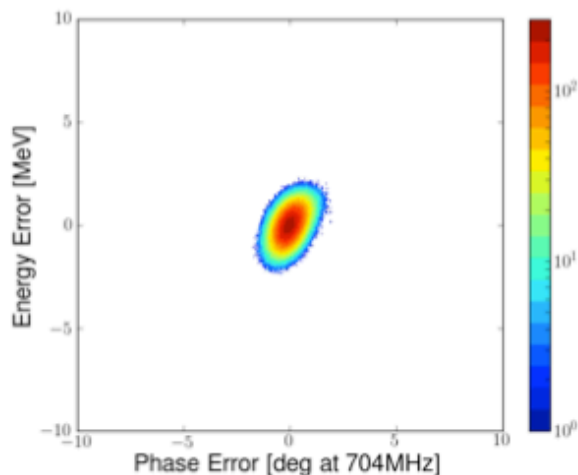
	Spoke $\beta/E(\text{MeV})$	Med. $\beta \beta/E(\text{MeV})$	High $\beta (\beta)$	Cavities
SSCL	0.50 / 203	0.68 / 632	0.90	28 / 60 / 120
FDSL	0.50 / 203	0.68 / 632	0.91	28 / 60 / 120
FoDoSL	0.50 / 203	0.68 / 632	0.92	28 / 60 / 120

$5 \times \sigma$ Gaussian	$\Delta\epsilon_x$ (%)	$\Delta\epsilon_y$ (%)	$\Delta\epsilon_z$ (%)
SSCL	15.86	16.85	19.05
FDSL	18.69	19.53	15.28
FoDoSL	34.47	30.95	17.59

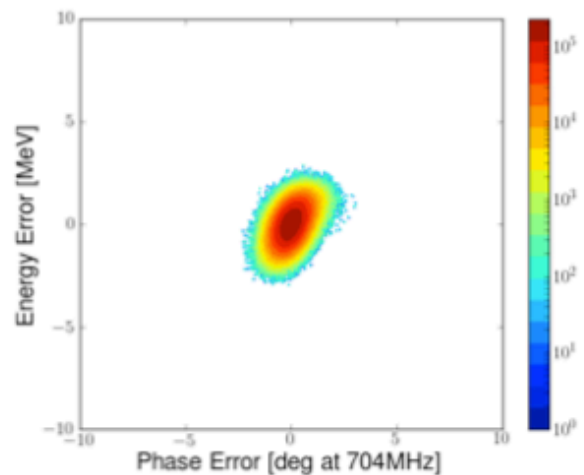
SAME ORDER MODES



Reference

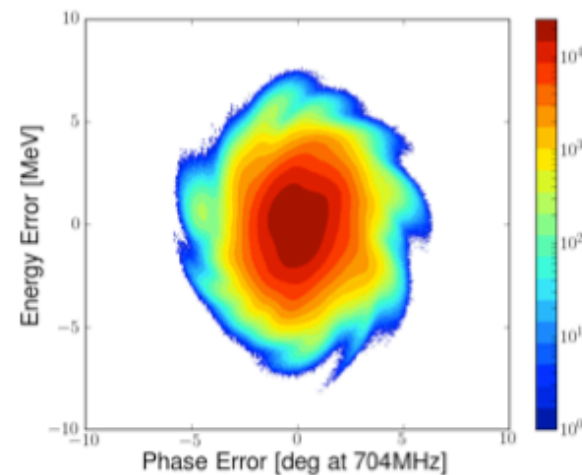


SOMs



Average Growth 1.00102856445
Max Growth 1.00472
Rms Growth 0.000244671549776
90th Percentile Growth 1.0013

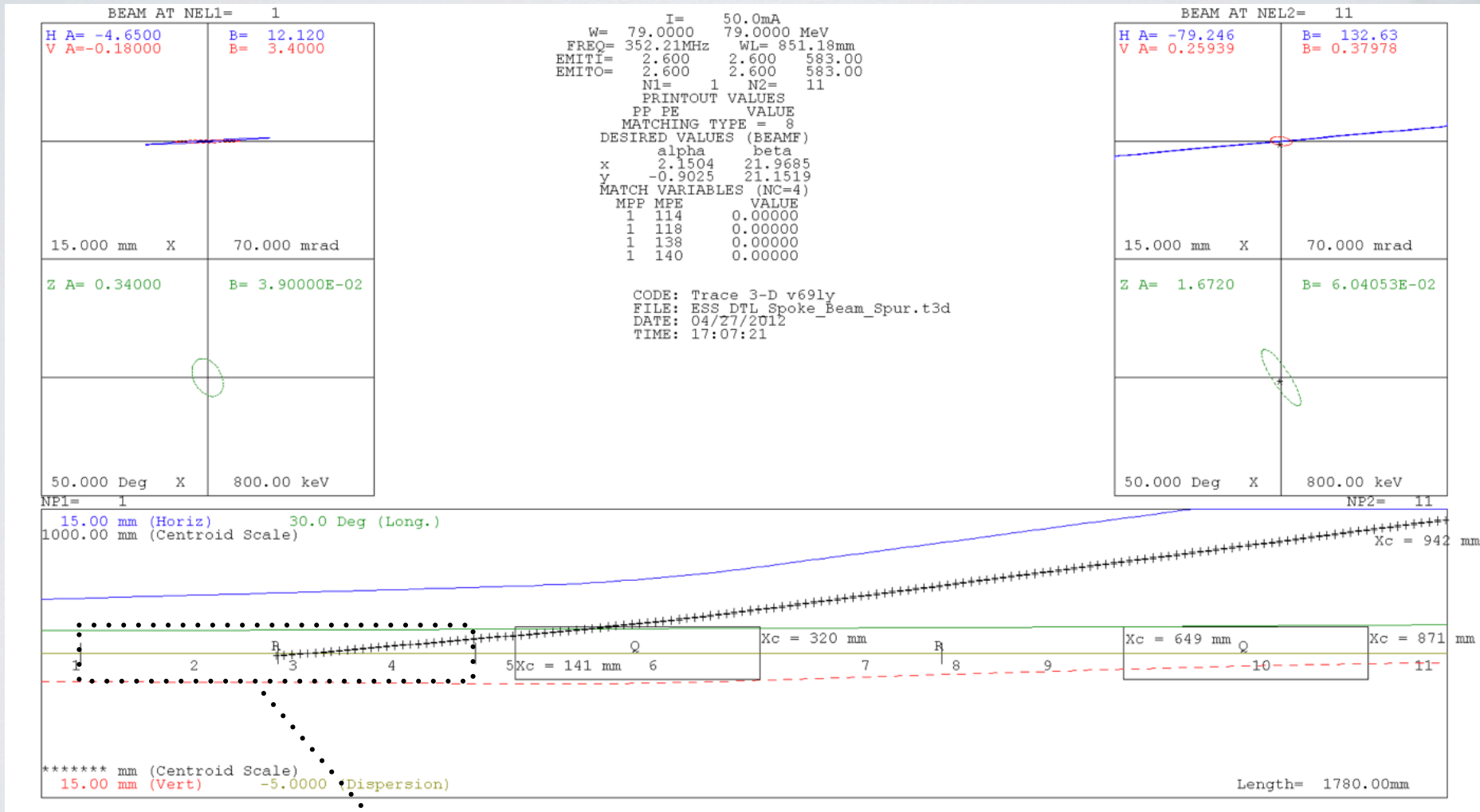
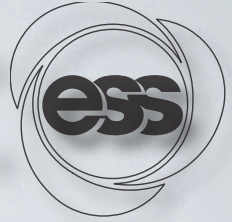
RF Errors



Average Growth 3.87393139648
Max Growth 14.4686
Rms Growth 2.05822449843
90th Percentile Growth 6.61965

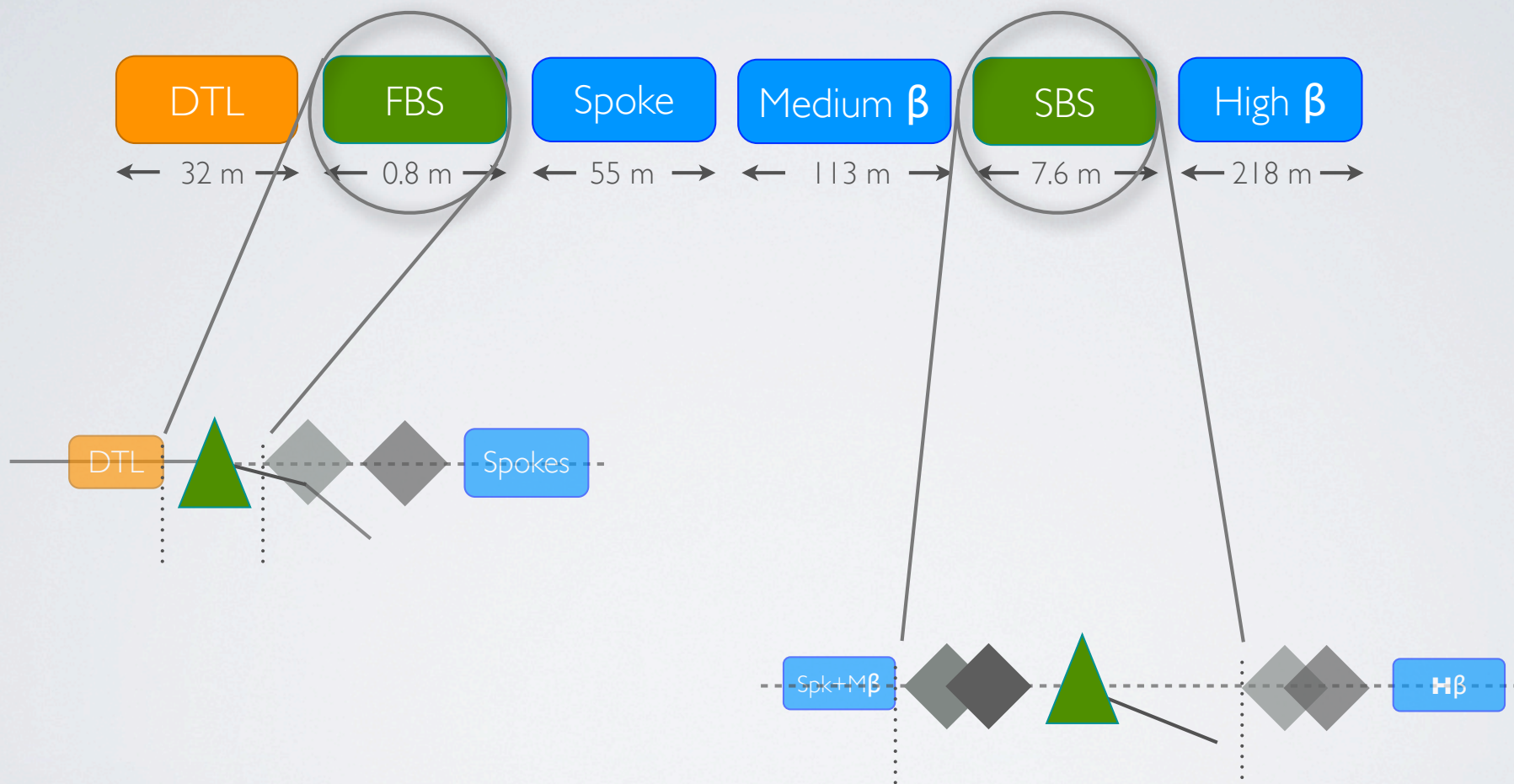
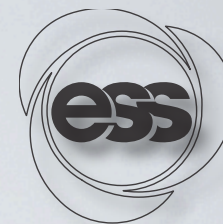
Courtesy of Rob Ainsworth

FIRST BRANCHING SECT.

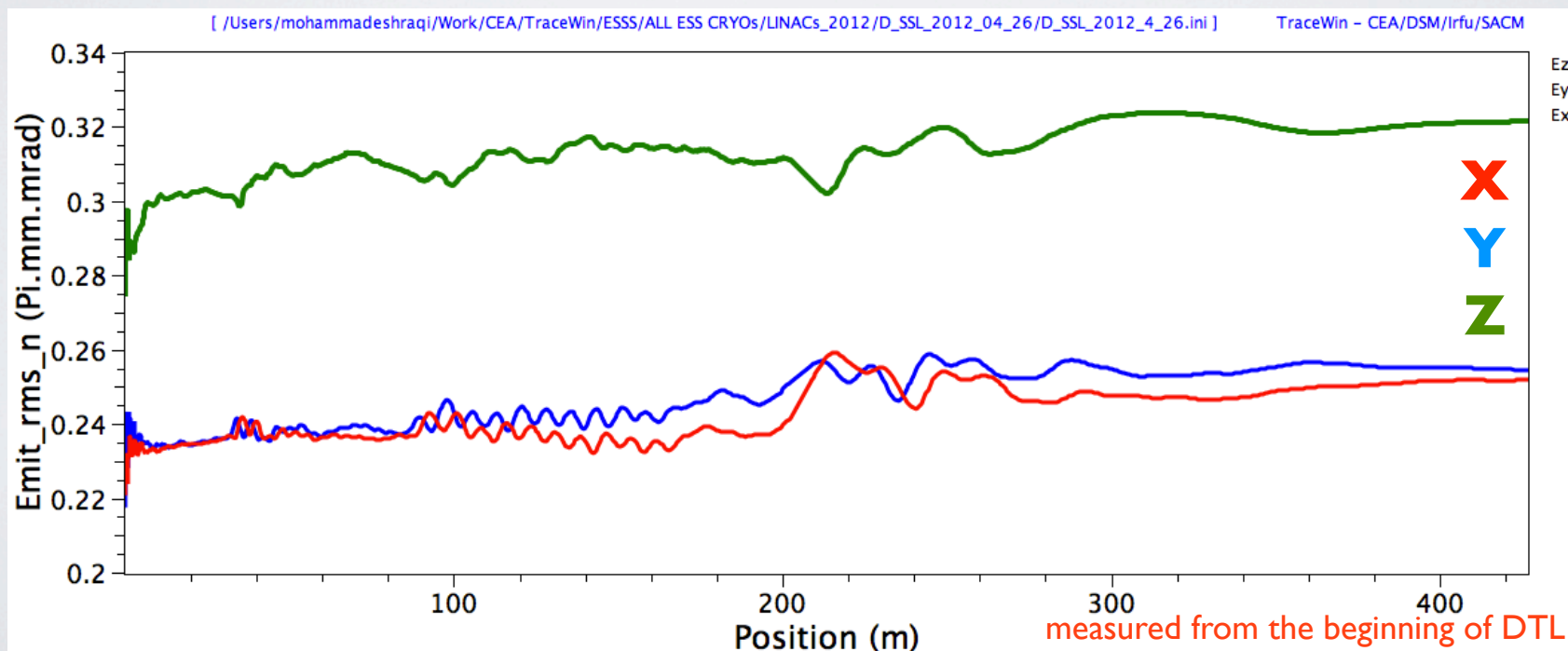
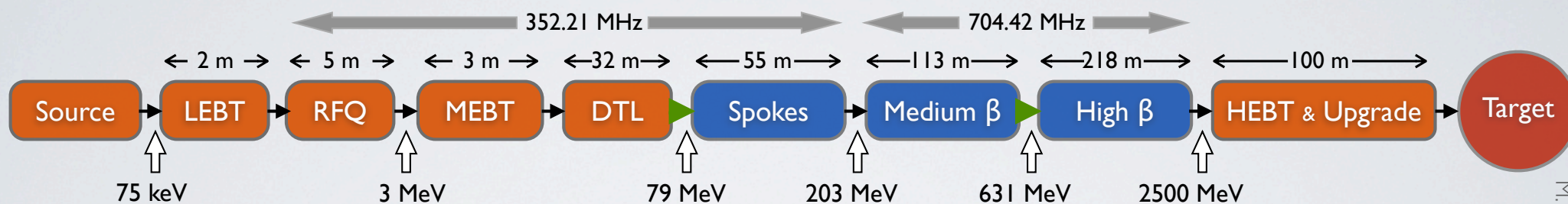
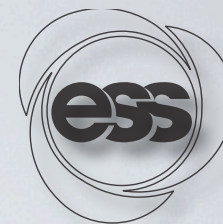


Dipole: $L = 500$ mm, $B = 1.2$ T, $\theta = 27^\circ$

PUTTING IT TOGETHER



SSCL_2012_04_26



M. Eshraqi

SLHIPPP - Catania

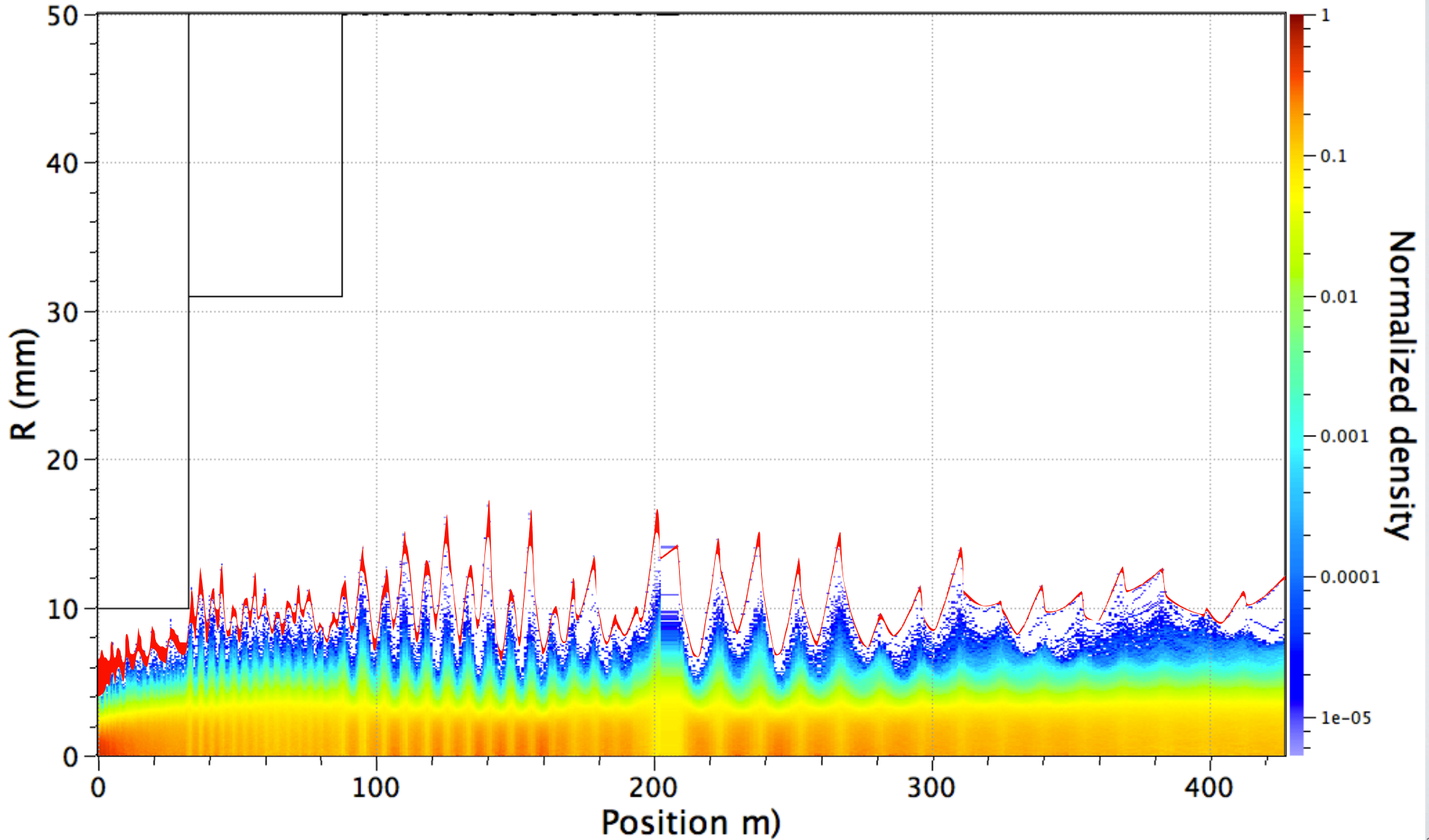
3-4-May-2012

DENSITY

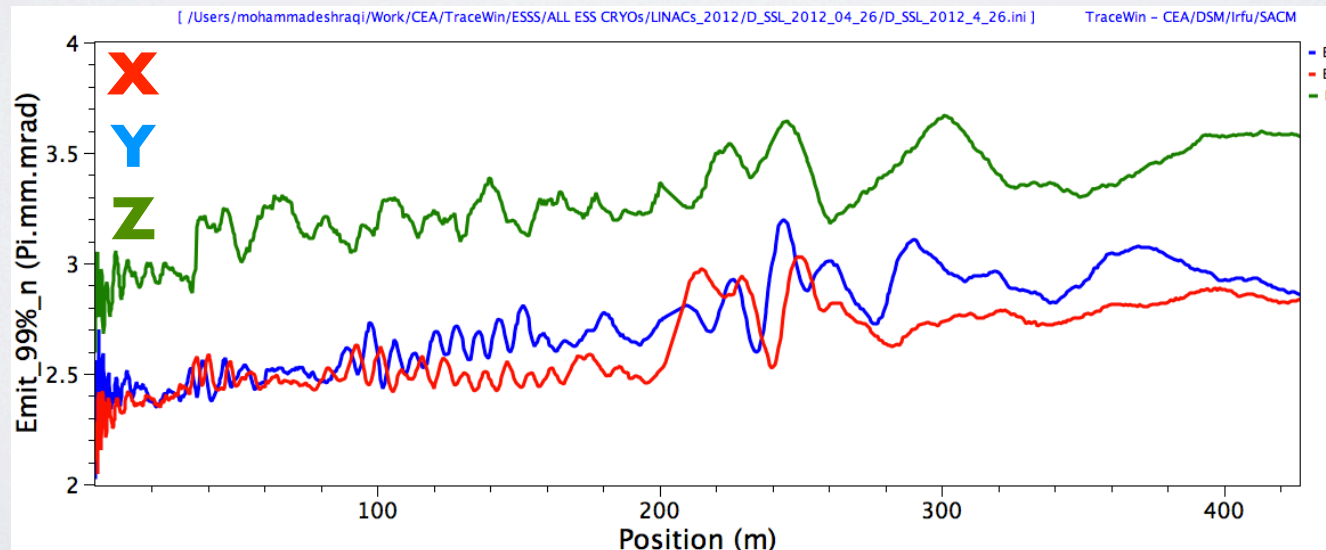
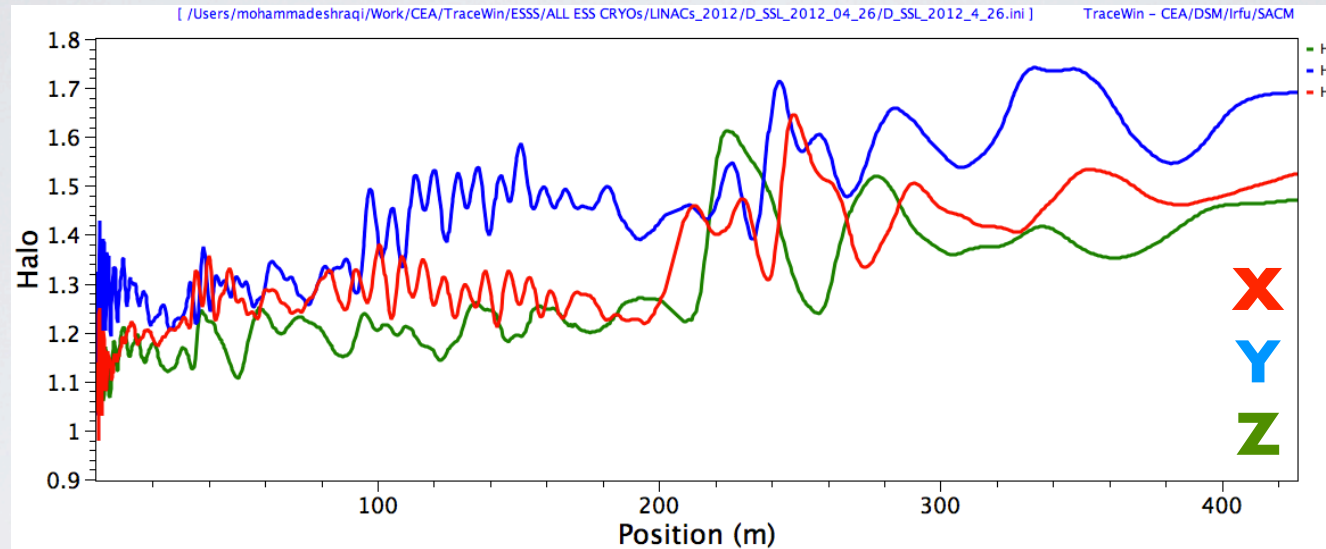
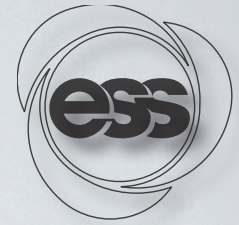


[/Users/mohammadeshraqi/Work/CEA/TraceWin/ESSS/ALL ESS CRYOs/LINACs_2012/D_SSL_2012_04_26/D_SSL_2012_4_26.ini]

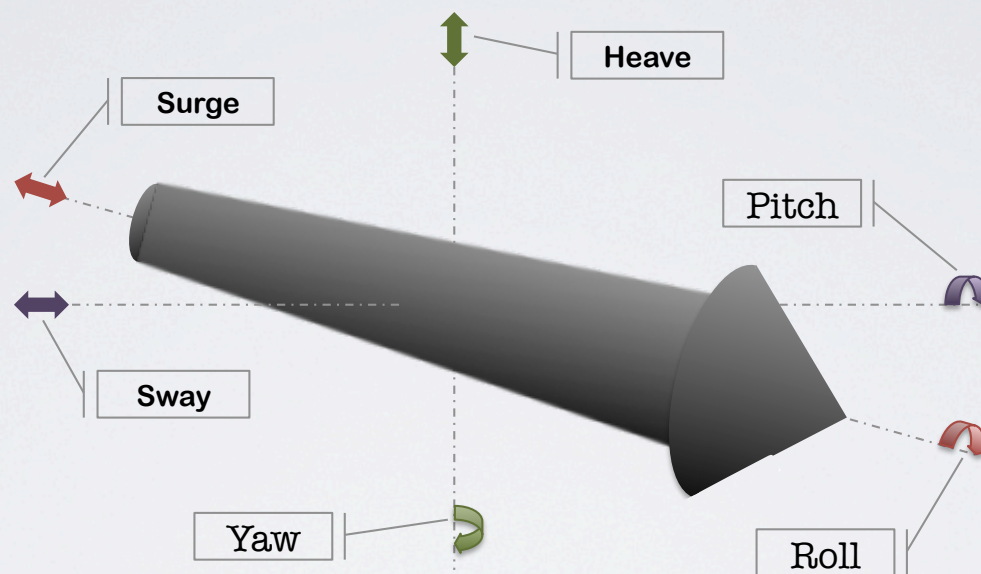
TraceWin - CEA/DSM/Irfu/SACM



HALO / EMIT



ALIGNMENT ERRORS



- For the cavities sway/heave errors of up to 2 mm and yaw/pitch errors of up to 2 mrad are under study.
- For the quadrupoles an error on roll is also being considered.

CONCLUSION

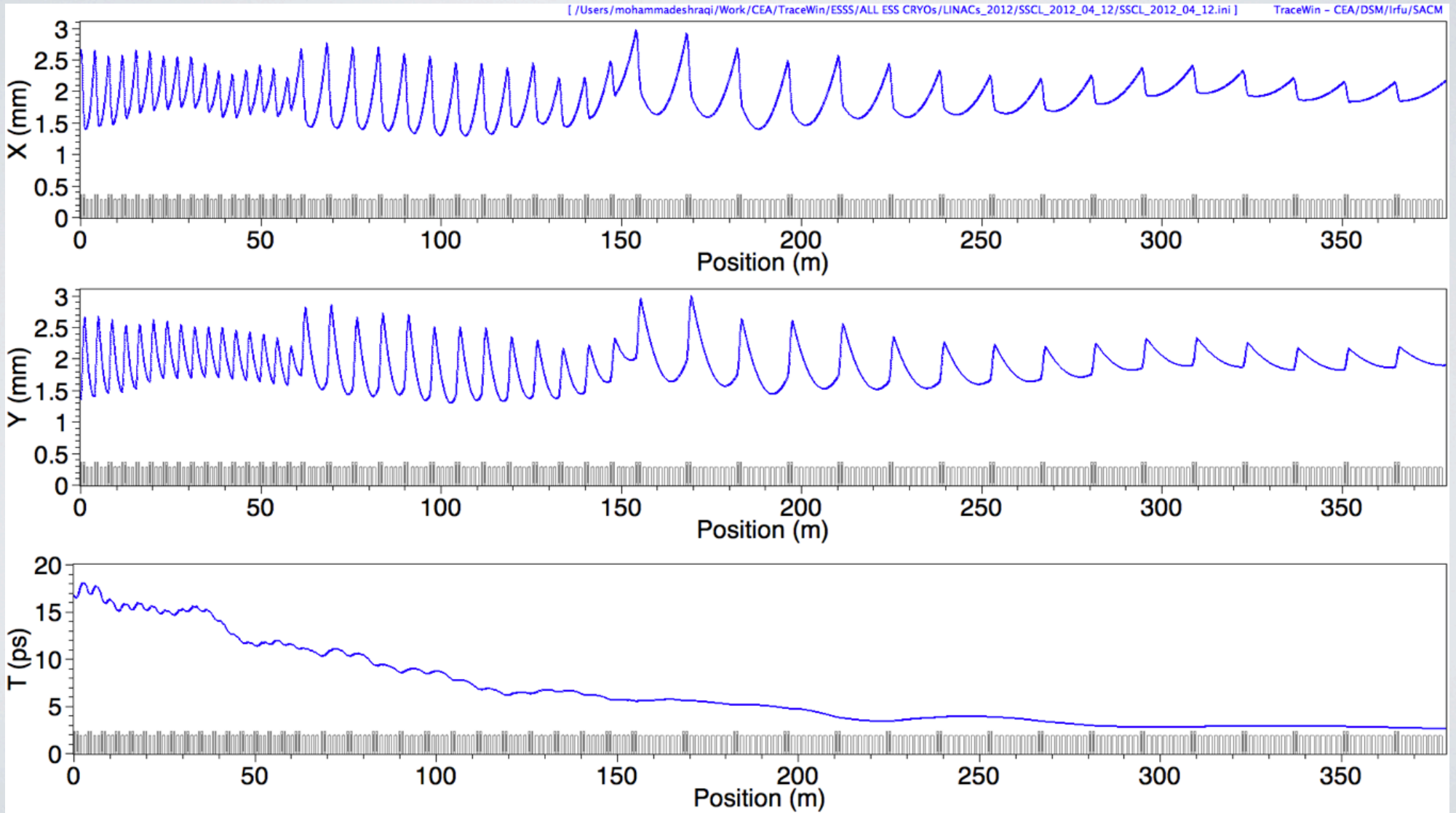


- Increasing the DTL energy improved the beam quality all along the linac.
- The new assembly lengths of cryo modules have increased the linac length.
- Among the 3 studies layouts, SSCL, FDSL, FoDoSL, the SSCL and FDSL result in a better beam quality.
- Two branching sections, one at 80 and another at 630 MeV have been added to the linac.

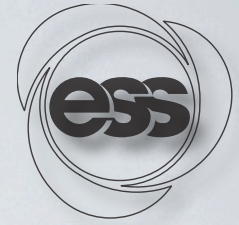


THANK YOU!

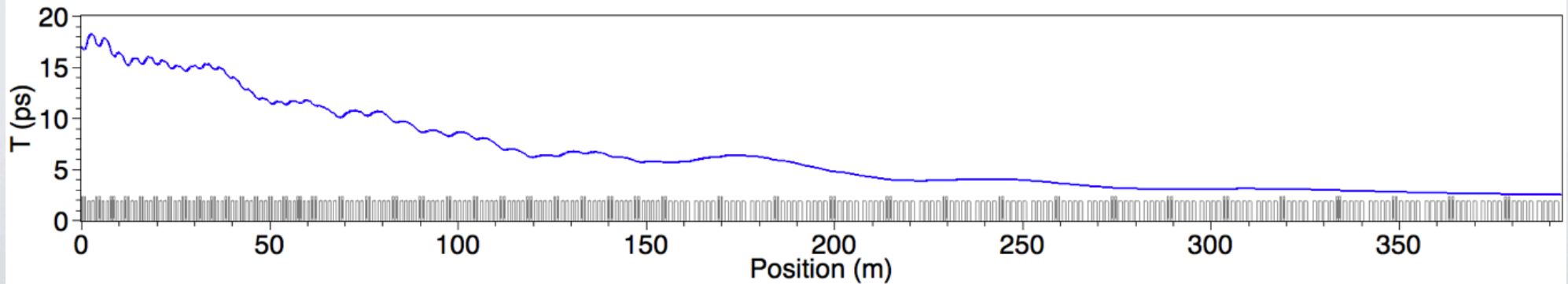
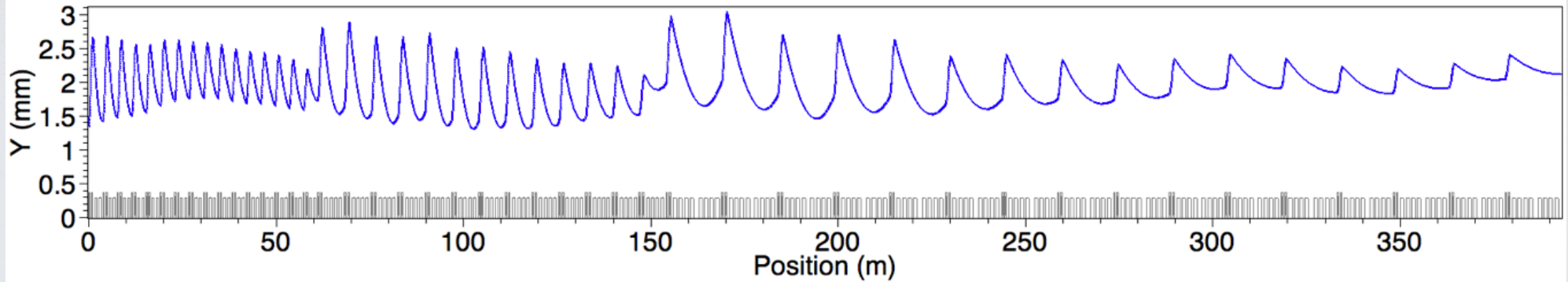
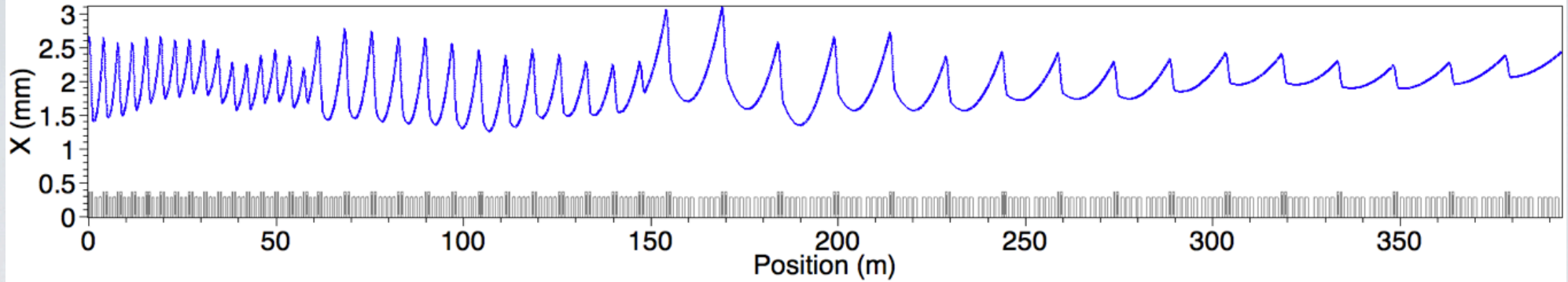
SSCL



FD_SL



[/Users/mohammadeshraqi/Work/CEA/TraceWin/ESSS/ALL ESS CRYOs/LINACs_2012/FD_SSCL_2012_04_16/FD_SSCL_2012_04_16.ini] TraceWin - CEA/DSM/Irfu/SACM



FoDo_SL

