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Comparison FLAT TOP vs Gaussian LASER Profile Pulse

Summary for the S2E Meeting
18.06.2013

Parameters at the 1st Quadrupole

Charge	**1nC**			**500pC**		
N Particles	200.000					
Nrad x Nlong	40 x 100					
Laser form	Flat Top	Gauss	Gauss	Flat Top	Gauss	Gauss
Laser rms, [ps]	20/2	6.25	5.25	20/2	6.25	5.25
MaxB1, [T]	0.2225	0.2219	0.2221	0.2223	0.2219	0.2219
XYrms, [mm]	0.445	0.384	0.404	0.287	0.263	0.278
τ rms, [mm]	2.031	2.300	2.098	1.931	2.118	1.915
$\varepsilon_{s=14.44m}$, [mrad]	0.704	1.055	1.128	0.4382	0.6268	0.6455
$\beta_{s=14.44m}$, [m]	9.18	14.37	13.22	19.48	21.29	20.62
$\alpha_{s=14.44m}$	0.100	-1.178	-0.994	-0.5957	-1.373	-1.447
ΔE,rms [keV]						
Last update	27.05.13	30.05.13	30.05.13	31.05.13	31.05.13	03.06.13

14ps FWHM corresponds to 5.945ps rms for Gauss

Parameters at the 1st Quadrupole

Charge	**1nC**			**500pC**		
N Particles	200.000					
Nrad x Nlong	40 x 100					
Laser form	Flat Top	Gauss	Gauss	Flat Top	Gauss	Gauss
Laser rms, [ps]	20/2	6.25	5.25	20/2	6.25	5.25
MaxB1, [T]	0.2225	0.2221	0.2220	0.2223	0.2219	0.2219
XYrms, [mm]	0.445	0.385	0.405	0.287	0.263	0.278
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.704	1.053	1.107	0.4382	0.6268	0.6455
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.63	0.65-0.75	0.70-0.80	0.40	0.32-0.42	0.40-0.50
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.439	0.401	0.449	0.274	0.256	0.277
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.704	0.874	0.983	0.425	0.526	0.584
$\delta E^{sl,av}$,rms [keV]	1.1	1.9	2.0	0.7	1.0	1.1
Ip, [A]	45.8	42.7	46.8	23.9	23.3	25.7
τ rms, [mm]	2.031	2.294	2.103	1.931	2.118	1.915
Last update	03.06.13	03.06.13	03.06.13	03.06.13	03.06.13	03.06.13

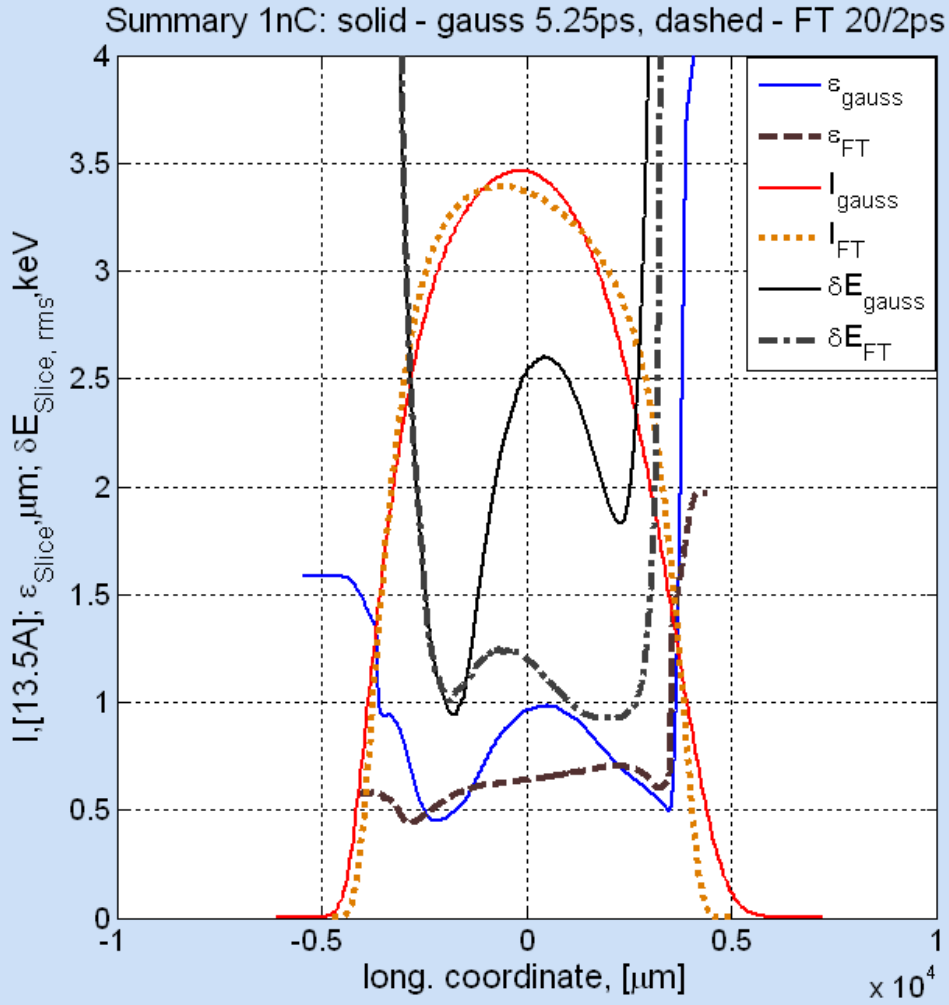
14ps FWHM corresponds to 5.945ps rms for Gauss

Parameters at the 1st Quadrupole vs. Baseline UNDULATOR
for 1nC Bunch Charge

Charge	**1nC**			
Laser form	Flat Top	Gauss	Gauss	Baseline UND
Laser rms, [ps]	20/2	6.25	5.25	
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.704	1.053	1.107	
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.63	0.65-0.75	0.70-0.80	0.92
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.439	0.401	0.449	0.75
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.704	0.874	0.983	1.09
$\delta E^{sl,av}$,rms [keV]	1.1	1.9	2.0	450 (wo LH)
Ip, [A]	45.8	42.7	46.8	5000
τ rms, [mm]	2.031	2.294	2.103	0.0766
Last update	03.06.13	03.06.13	03.06.13	22.12.10

→ Baseline values can be most probably hold

Summary: Comparison for 1nC Bunch at 14.44m
FT vs Gaussian Pulse



Charge	1nC	
Laser form	Flat Top	Gauss
Laser rms, [ps]	20/2	5.25
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.704	1.107
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.63	0.70-0.80
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.439	0.449
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.704	0.983
$\delta E^{sl,av}$,rms [keV]	1.1	2.0
Ip, [A]	45.8	46.8
τ rms, [mm]	2.031	2.103

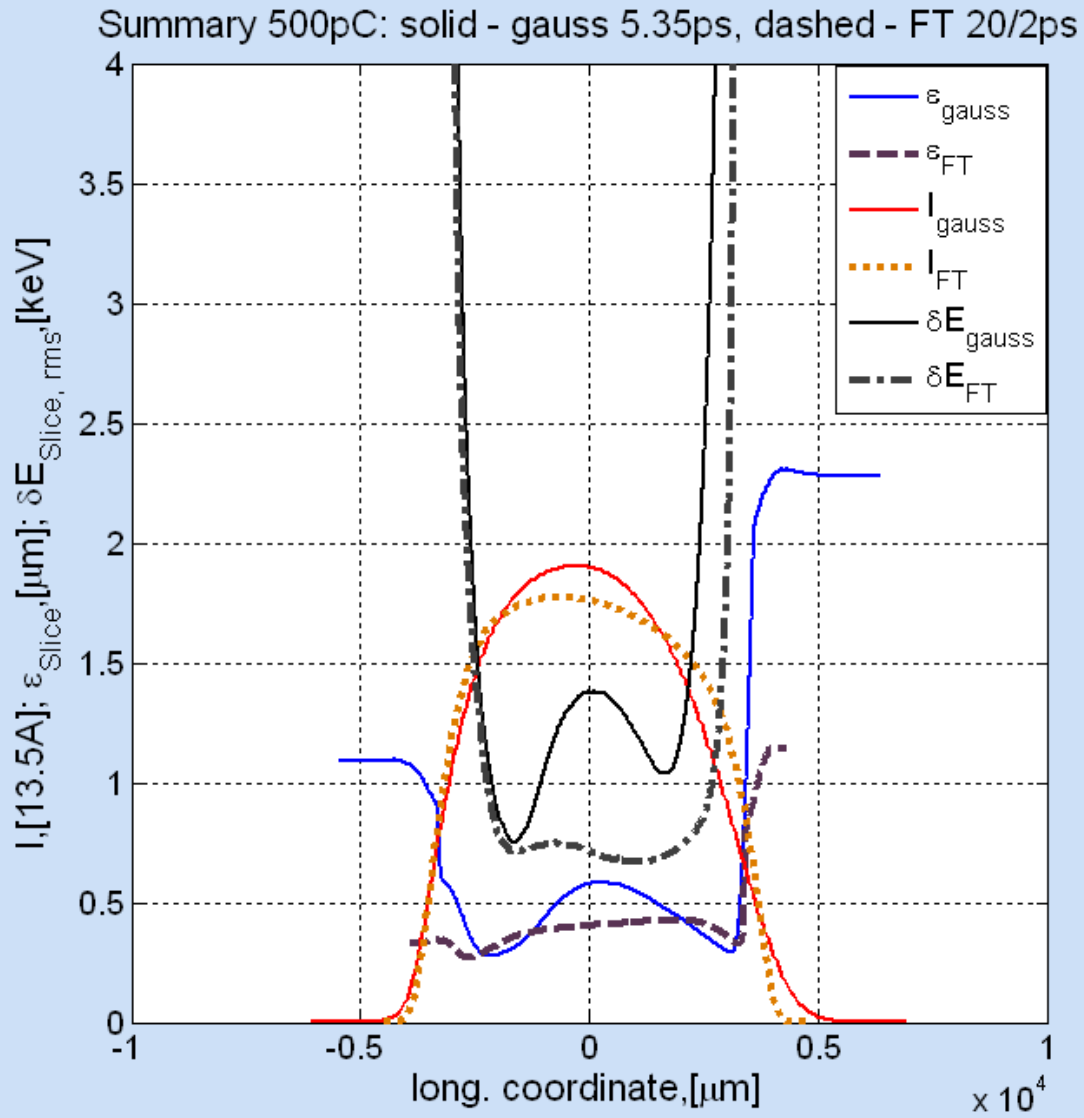
→ Projected emittance and slice energy spread become significantly worse

NB: Emittance calculation for the gaussian case without tails!

Parameters at the 1st Quadrupole vs. Baseline UNDULATOR
for 500pC Bunch Charge

Charge	**500pC**			
Laser form	Flat Top	Gauss	Gauss	Baseline UND
Laser rms, [ps]	20/2	6.25	5.25	
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.4382	0.6268	0.6455	
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.40	0.32-0.42	0.40-0.50	0.64
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.274	0.256	0.277	0.57
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.425	0.526	0.584	0.74
$\delta E^{sl,av}$,rms [keV]	0.7	1.0	1.1	430 (wo LH)
Ip, [A]	23.9	23.3	25.7	5000
τ rms, [mm]	1.931	2.118	1.915	0.03064
Last update	03.06.13	03.06.13	03.06.13	22.12.10

Summary: Comparison for 500pC Bunch at 14.44m
FT vs Gaussian Pulse



Charge	500pC	
Laser form	Flat Top	Gauss
Laser rms, [ps]	20/2	5.25
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.4382	0.6455
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.40	0.40-0.50
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.274	0.277
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.425	0.584
$\delta E^{sl,av}$,rms [keV]	0.7	1.1
Ip, [A]	23.9	25.7
τ rms, [mm]	1.931	1.915

NB: Emittance calculation
for the gaussian case without tails!

Parameters at the 1st Quadrupole

Charge	**250pC**			**100pC**		
N Particles	200.000			200.000		100.000
Nrad x Nlong	40 x 100			40 x 100		35 x 65
Laser form	Flat Top	Gauss	Gauss	Flat Top	Gauss	Gauss
Laser rms, [ps]	20/2	6.25	5.25	20/2	6.25	5.25
MaxB1, [T]	0.2221	0.2217	0.2217	0.2218	0.2215	0.2215
XYrms, [mm]	0.186	0.176	0.186	0.133	0.123	0.128
τ rms, [mm]	1.845	2.002	1.803	1.640	1.749	1.548
$\varepsilon_{s=14.44m}$, [mrad]	0.2999	0.4221	0.4205	0.1945	0.2787	0.2792
$\beta_{s=14.44m}$, [m]	41.63	35.63	36.17	40.31	37.36	40.5
$\alpha_{s=14.44m}$	-2.044	-2.276	-2.355	-1.999	-2.309	-2.569
ΔE,rms [keV]						
Last update	10.06.13	13.06.13	13.06.13	17.06.13	13.06.13	09.06.13

14ps FWHM corresponds to 5.945ps rms for Gauss

Parameters at the 1st Quadrupole

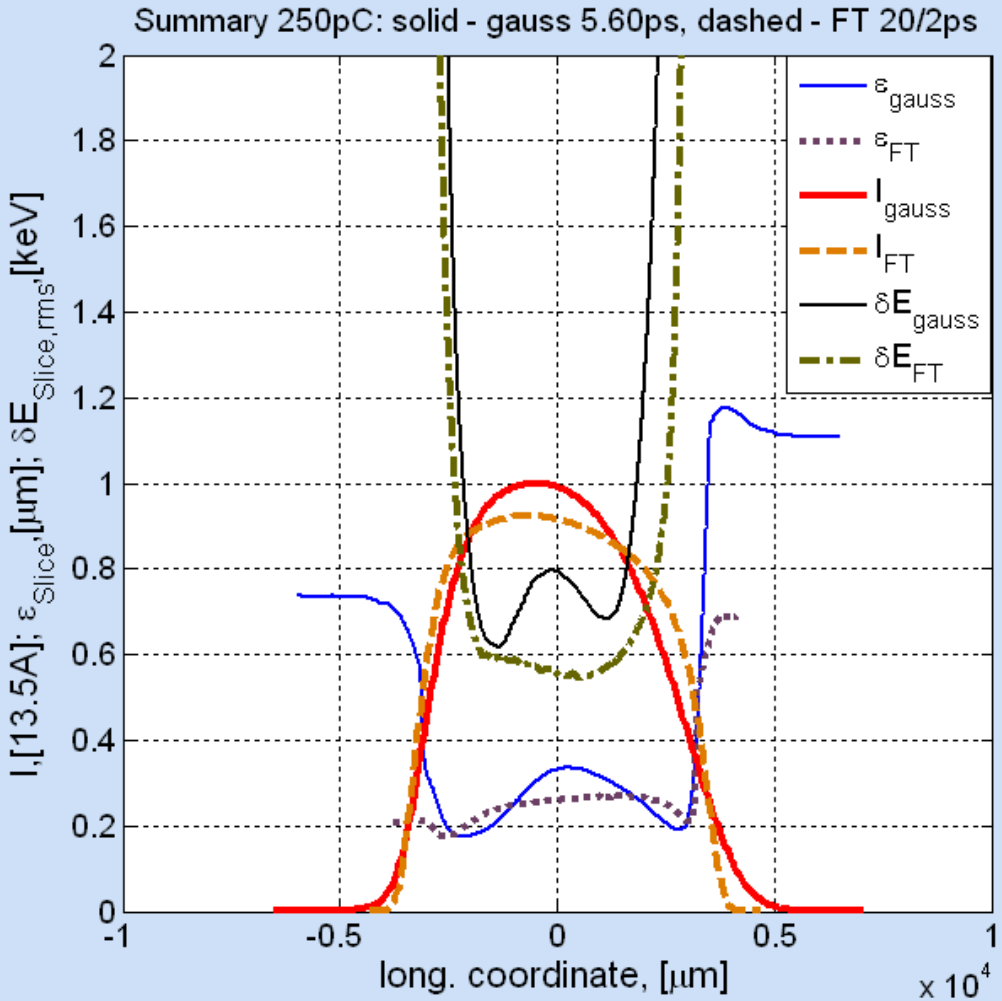
Charge	**250pC**			**100pC**		
N Particles	200.000			200.000		100.000
Nrad x Nlong	40 x 100			40 x 100		35 x 65
Laser form	Flat Top	Gauss	Gauss	Flat Top	Gauss	Gauss
Laser rms, [ps]	20/2	6.25	5.60	20/2	6.25	5.25
MaxB1, [T]	0.2221	0.2215	0.2217	0.2218	0.2215	0.2215
XYrms, [mm]	0.186	0.175	0.186	0.133	0.123	0.128
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.2999	0.4384	0.4205	0.1945	0.2787	0.2792
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.23	0.25	0.25			
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.175	0.169	0.174			
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.268	0.315	0.335			
τ rms, [mm]	1.846	2.015	1.842	1.640	1.749	1.548
$\delta E^{sl,av}$,rms [keV]	0.58	0.70	0.70			
Ip, [A]	12.47	12.43	12.50			
Last update	10.06.13	11.06.13	13.06.13	17.06.13	13.06.13	09.06.13

14ps FWHM corresponds to 5.945ps rms for Gauss

Parameters at the 1st Quadrupole vs. Baseline UNDULATOR
for 250pC Bunch Charge

Charge	**250pC**			
Laser form	Flat Top	Gauss	Gauss	Baseline UND
Laser rms, [ps]	20/2	6.25	5.60	
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.2999	0.4384	0.4205	
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.23	0.25	0.25	0.50
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.175	0.169	0.174	0.38
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.268	0.315	0.335	0.63
$\delta E^{sl,av}$,rms [keV]	0.58	0.70	0.70	600 (wo LH)
Ip, [A]	12.47	12.43	13.50	5000
τ rms, [mm]	1.846	2.015	1.842	0.01660
Last update	10.06.13	11.06.13	13.06.13	22.12.10

Summary: Comparison for 250pC Bunch at 14.44m
FT vs Gaussian Pulse



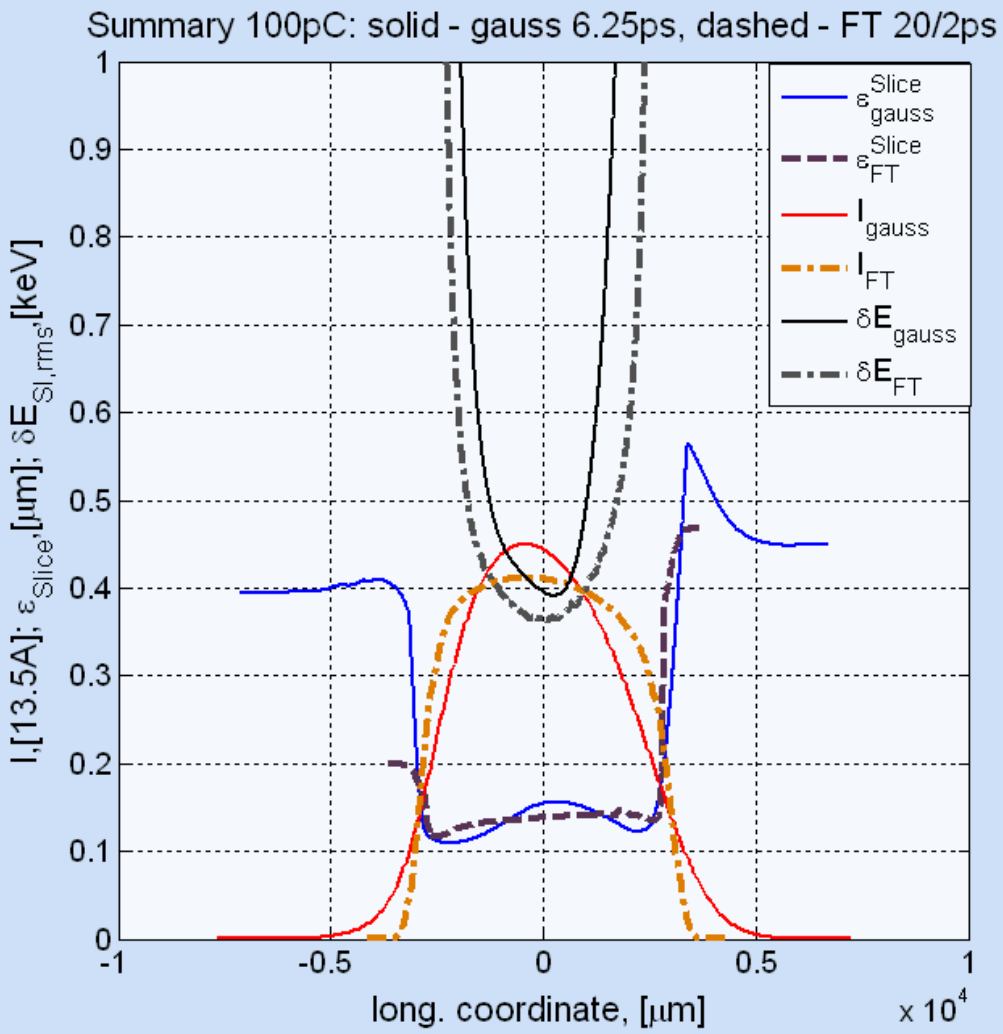
Charge	250pC	
Laser form	Flat Top	Gauss
Laser rms, [ps]	20/2	5.60
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.2999	0.4205
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.23	0.25
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.175	0.174
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.268	0.335
$\delta E^{sl,av}$,rms [keV]	0.58	0.70
Ip, [A]	12.47	13.50
τ rms, [mm]	1.846	1.842

NB: Emittance calculation
for the gaussian case without tails!

Parameters at the 1st Quadrupole vs. Baseline UNDULATOR
for 100pC Bunch Charge

Charge	**100pC**			
Laser form	Flat Top	Gauss	Gauss	Baseline UND
Laser rms, [ps]	20/2	6.25	5.25	
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.1945	0.2787	0.2792	
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.125			0.30
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.116			0.22
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.147			0.41
$\delta E^{sl,av}$,rms [keV]	0.42			580 (wo LH)
Ip, [A]	4.12			5000
τ rms, [mm]	1.640	1.749	1.548	0.00638
Last update	17.06.13	13.06.13	09.06.13	22.12.10

Summary: Comparison for 250pC Bunch at 14.44m
FT vs Gaussian Pulse



Charge	100pC	
Laser form	Flat Top	Gauss
Laser rms, [ps]	20/2	6.25
$\varepsilon^{pr}_{s=14.44m}$, [mrad]	0.1945	0.2787
$\varepsilon^{sl,av}_{s=14.44m}$, [mrad]	0.125	0.133
$\varepsilon^{sl,min}_{s=14.44m}$, [mrad]	0.116	0.109
$\varepsilon^{sl,max}_{s=14.44m}$, [mrad]	0.147	0.156
$\delta E^{sl,av}$,rms [keV]	0.42	0.47
Ip, [A]	4.12	4.50
τ rms, [mm]	1.640	1.749

NB: Emittance calculation
for the gaussian case without tails!