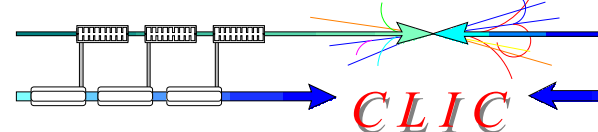


Choice of CLIC main linac accelerating structure at 30 GHz for 150 MV/m loaded accelerating gradient

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Accelerating structure parameters:

fixed: $\langle E_{acc} \rangle = 150 \text{ MV/m}$, $f = 30 \text{ GHz}$,

varied: $\delta\phi = 50^\circ - 130^\circ$,

$a/\lambda = 0.1 - 0.25$,

$d/\lambda = 0.025 - 0.1$,

$N_b, N_{cells}, N_{cycles}$

Optimization criterion

Luminosity per linac input power:

$$\int L dt / \int P dt \sim L_b \times \eta / N$$

Beam dynamics constrains:

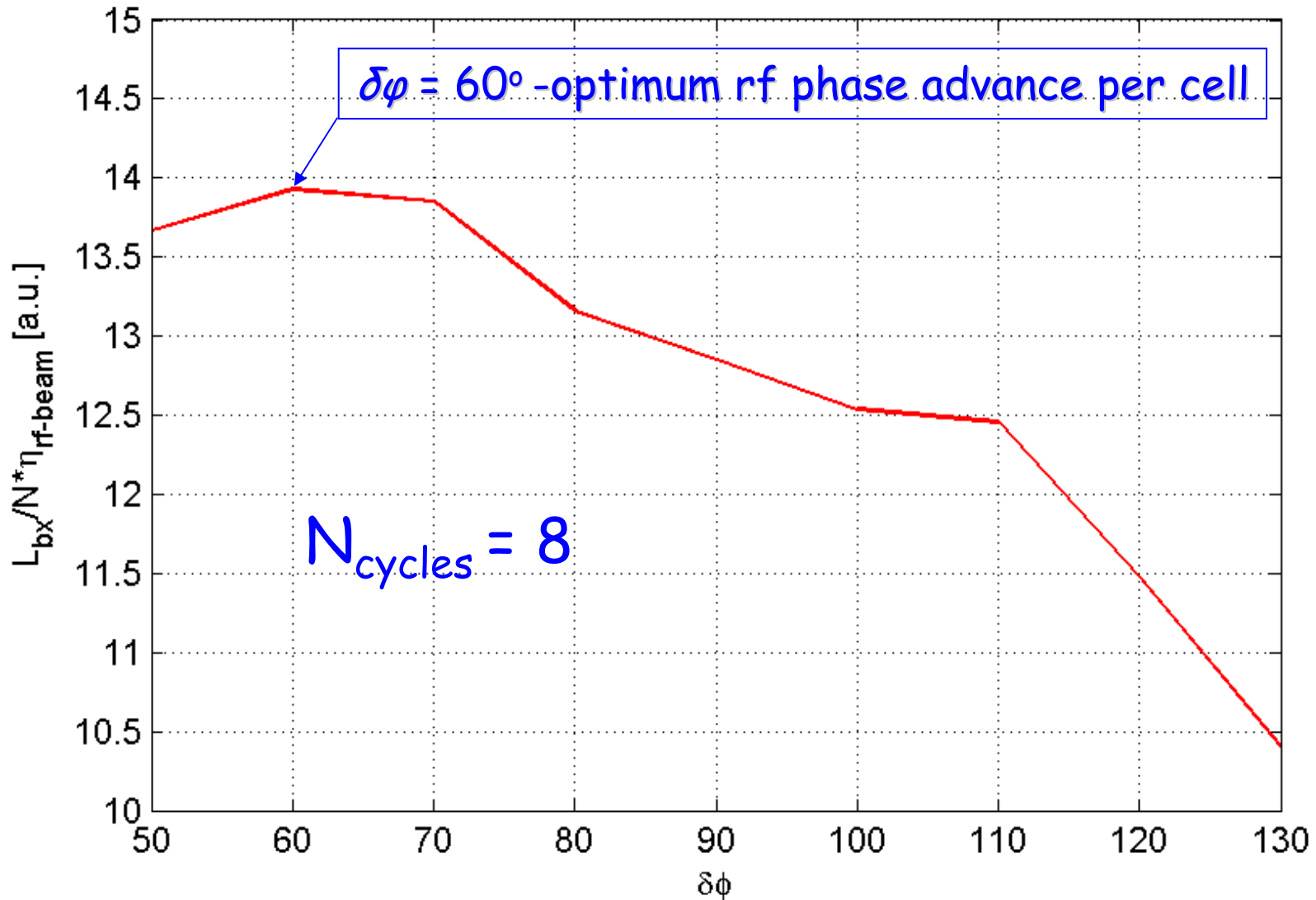
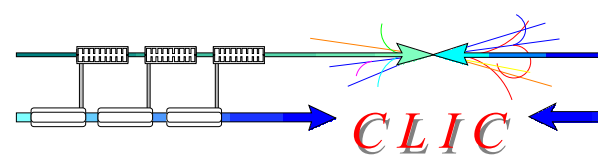
$W_{t,2} = 20 \text{ V/pC/mm/m}$ for $N = 4 \times 10^9$

N, L_{bx} depend on a/λ

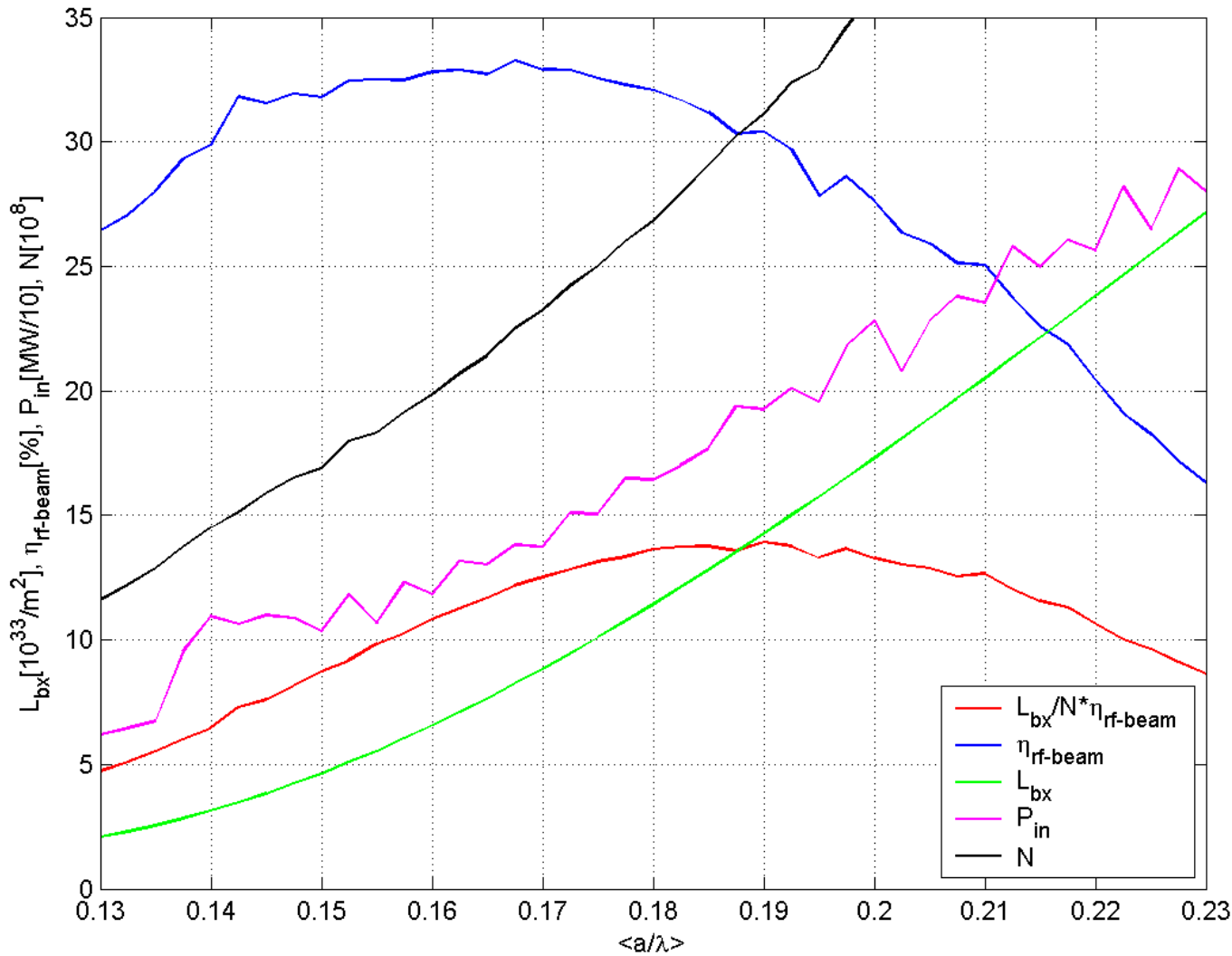
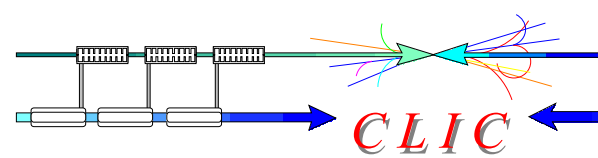
rf breakdown and pulsed surface heating (rf) constrains:

$E_{surf} < 378 \text{ MV/m}$, $\Delta T < 56 \text{ K}$, $P_{in} t_p^{1/2} < 1225 \text{ MWns}^{1/2}$

Luminosity per power versus $\delta\phi$



Parameters versus aperture

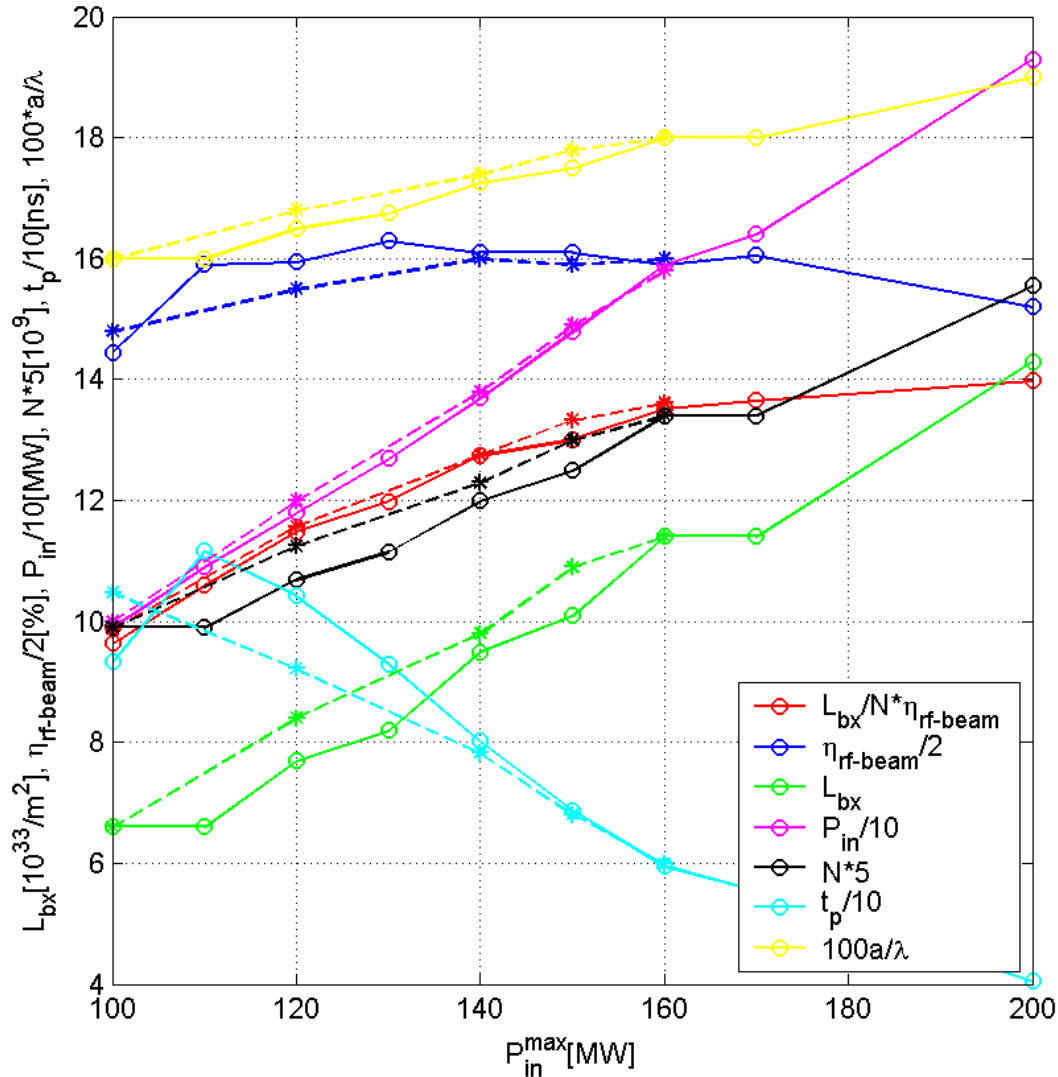


$\Delta\varphi = 60^\circ$
 $N_{cycles} = 8$

Parameters versus maximum P_{in}

CLIC

$N_{cycles}=8$, $N_{struct}=217800$, $f=30\text{GHz}$, $E_a=150\text{MV/m}$, $d\phi=60^\circ$, $tol=0.1$



$\Delta\phi = 60^\circ$
 $N_{cycles} = 8$

Updated parameter list



CLIC

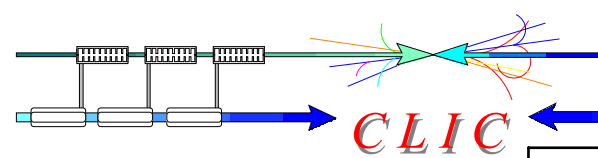
Parameters of the best structures at 30 GHz

(bunch spacing 8 rf cycles and input power limit imposed)

$\Delta\varphi$ [°]	60	60	60
$\langle a/\lambda \rangle$	0.168	0.178	0.19
$L_{bx}\eta/N$ [a.u.]	12.0	13.9	14.6
η, η_{Mo} [%]	31.0, 30.1	31.8, 31.0	30.8, 30.0
$L_{bx}[10^{34}/m^2]$	0.87	1.12	1.47
$N [10^9]$	2.24	2.56	3.1
a_1, a_2 [mm]	1.94, 1.42	2.06, 1.5	2.24, 1.56
d_1, d_2 [mm]	0.25, 0.27	0.25, 0.27	0.25, 0.35
N_{cells}, l [mm]	123, 205	140, 233	158, 263
P_{in} [MW]	120	149	186
t_p [ns]	92.2	68.1	42.2
N_b	311	221	125
$N_{cycles}, \Delta t_b$ [ns]	8, 0.267	8, 0.267	8, 0.267

In blue - parameters from interpolation, in red - parameters from calculation

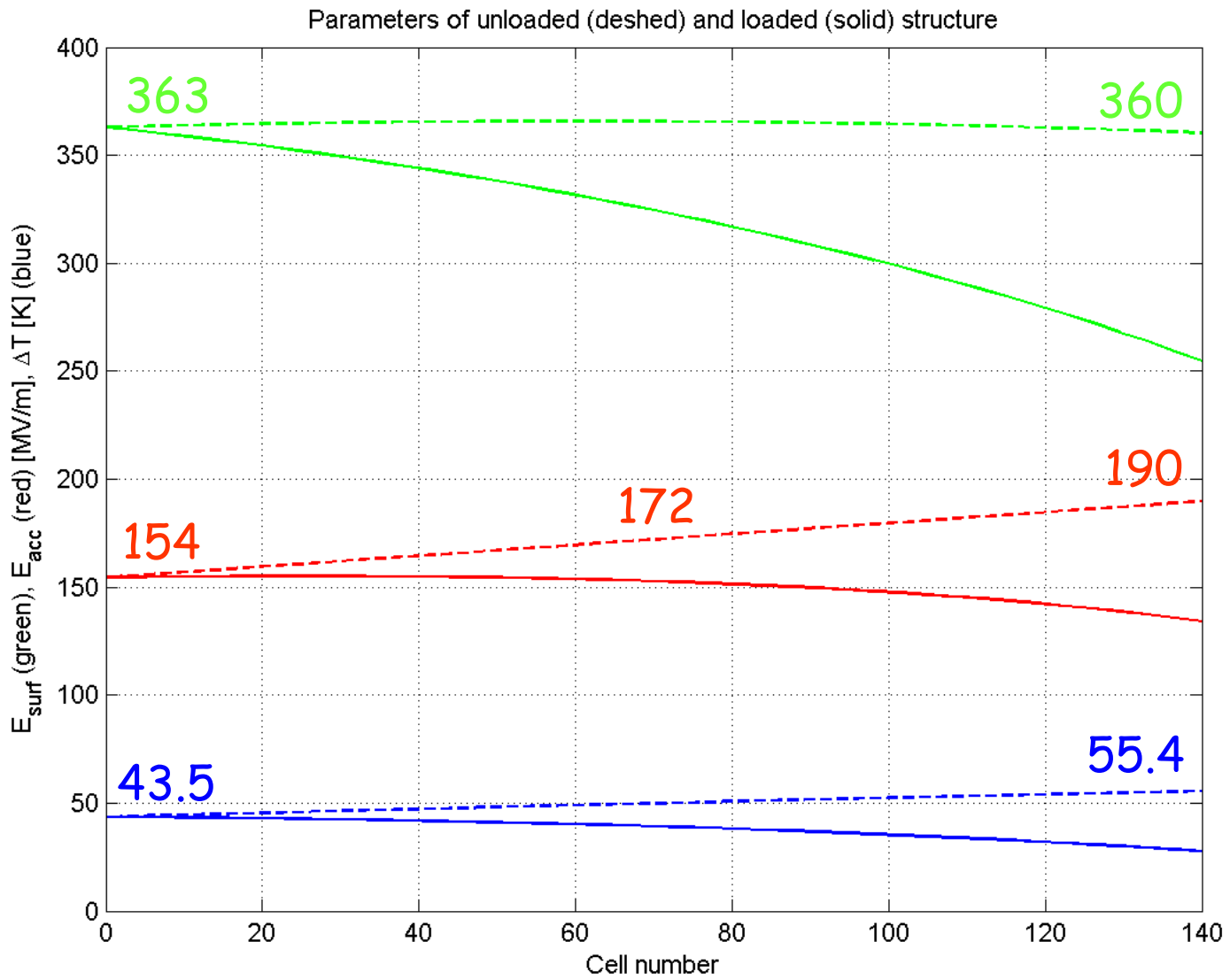
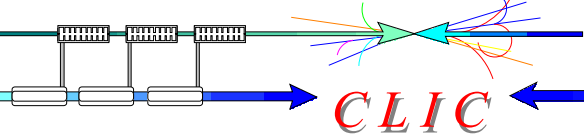
Parameters of HDS140-Mo



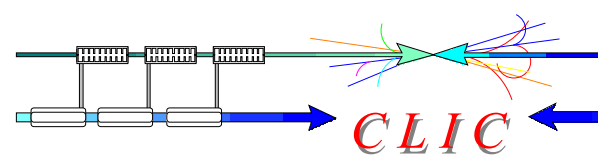
$\langle E_{acc} \rangle$ [MV/m]	150
f [GHz]	29.985
$\Delta\phi$ [°], l_c [mm]	60, 1.66635
$a_{1,2}$ [mm]	2.06, 1.50
$d_{1,2}$ [mm]	0.275, 0.365
$Q_{1,2}$	2590, 2244
$r/Q_{1,2}$ [Linac Ω /m]	30600, 40900
$v_g/c_{1,2}$ [%]	12.2, 5.07
$\langle a \rangle / \lambda$	0.178
N	2.56×10^9
$L_{b \times}$ [m ²]	1.12×10^{34}
N_c, l [mm] (active)	140, 233
N_s	8
N_b	220
τ_p [ns]	68.0
P_{in} [MW]	151
η [%]	30.9

Candidate
structure for
new CLIC
parameter list

Parameters of HDS140-Mo



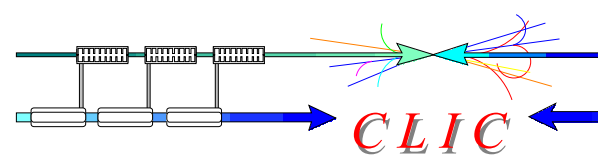
Parameters of dipole modes



Cell position	first	middle	last
a [mm]	2.06	1.78	1.5
d [mm]	0.275	0.25	0.365
First band			
f^{d1} [GHz]	39.76	41.47	42.77
Q^{d1}	11	10	9
A^{d1} [V/pC/mm/m]	1200	1650	2300
Second band			
f^{d2} [GHz]	84.69	83.33	80.99
Q^{d2}	115	117	62
A^{d2} [V/pC/mm/m]	80	160	350

A^{d1} and A^{d2} are given for $\sigma_z = 0.6$ mm

Dipole mode wakes in hds140



Wake Envelope in hds140, $dwi=1.5\text{mm}$, $\sigma=0.0\text{mm}$

