

CLIC positron injector linac studies

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CLIC MB Injector Meeting

02/12/2024

$2\pi/3$ Phase advance structure scans
(for 1 nC bunch charge)

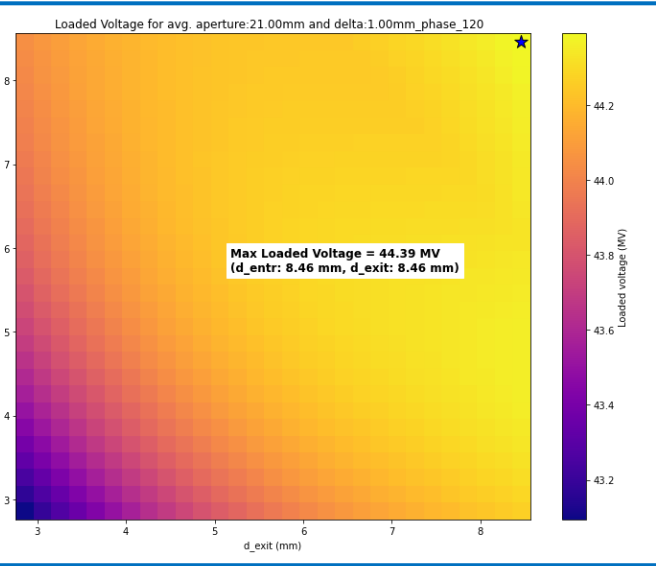
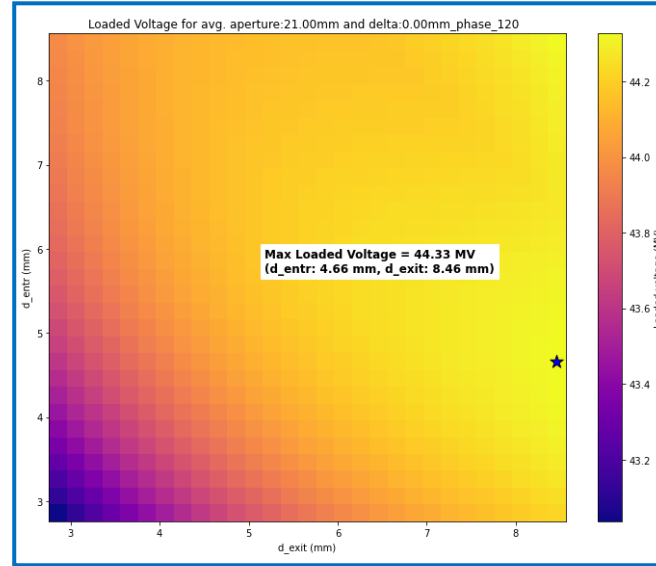
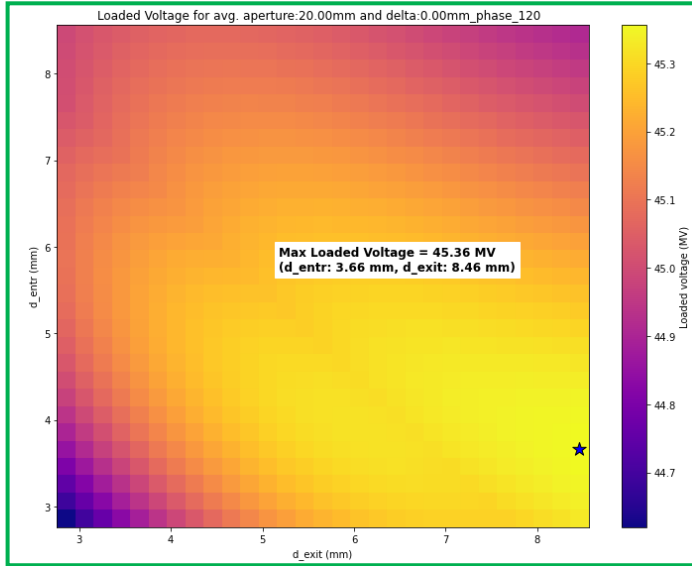
CLIC Injector Linac Loaded Voltages

Scanned from avg. aperture 20 mm to 22 mm.
No wake conditon considered.

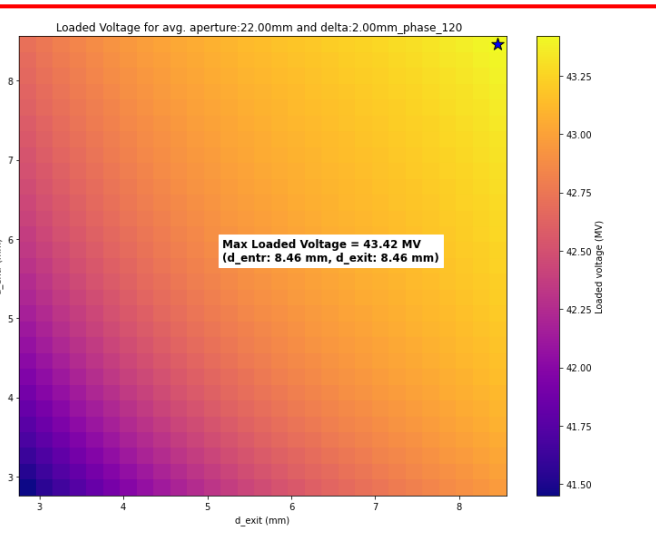
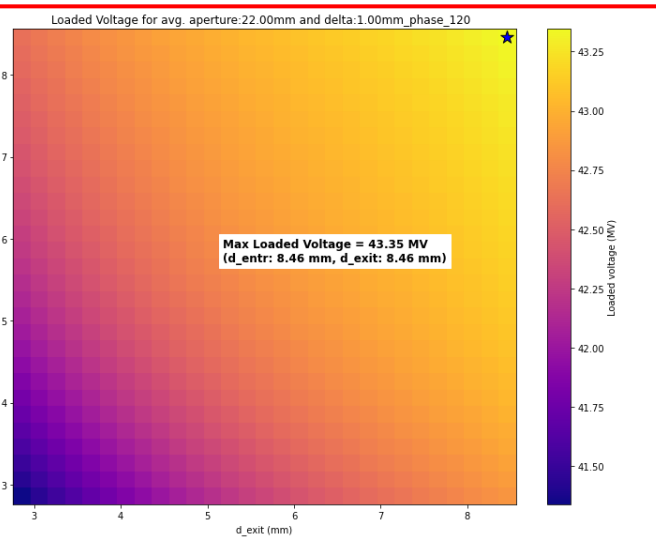
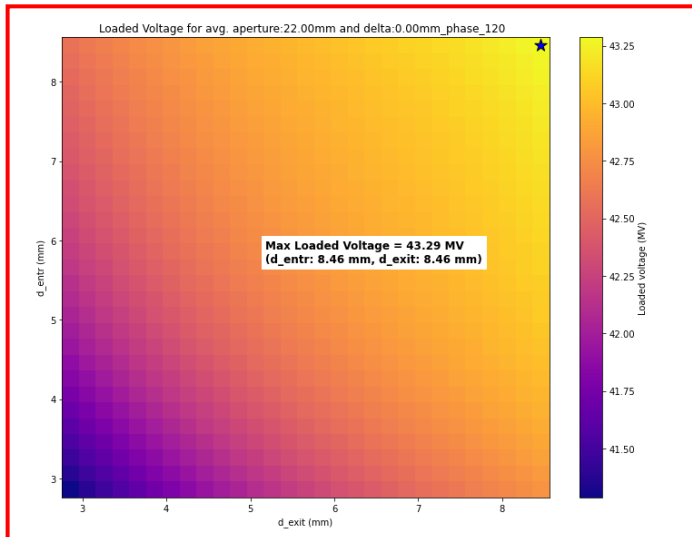
- Parameters for the structure:
- $f = 2$ GHz, Length = 3m, Phase advance = $2\pi/3$, $Q_{0,SLED} = 2e5$, $T_{klystron} = 5$ us, $P_{klystron} = 31$ MW (2 acc. Struc. Per klystr.)

20 mm

21 mm



22 mm



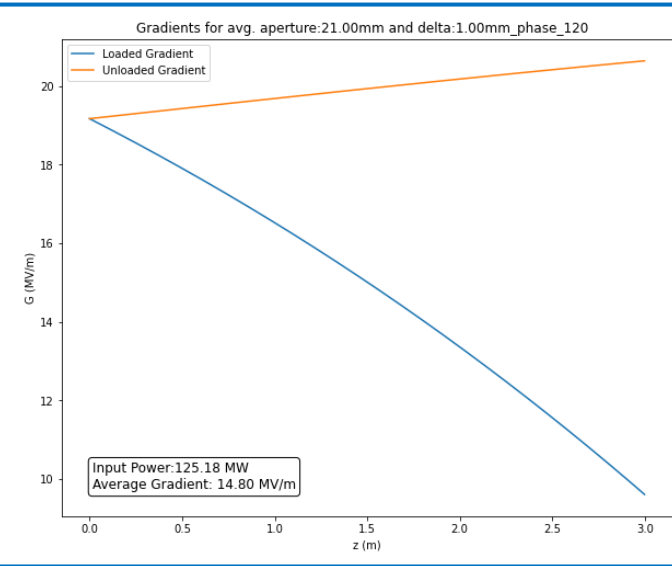
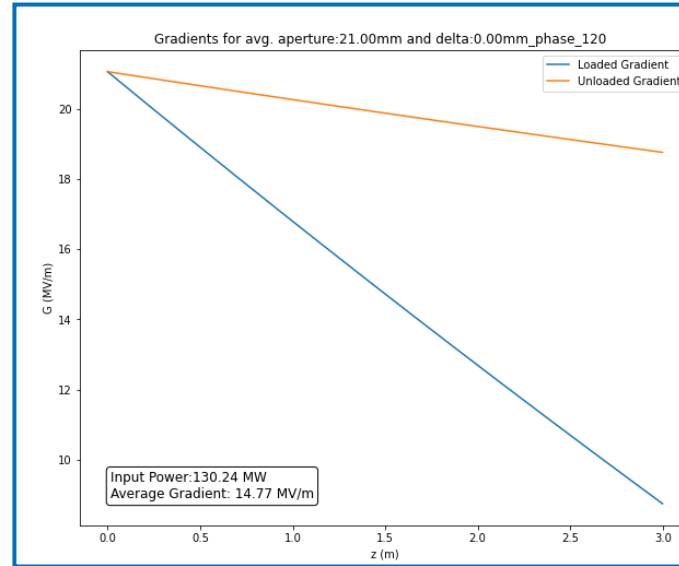
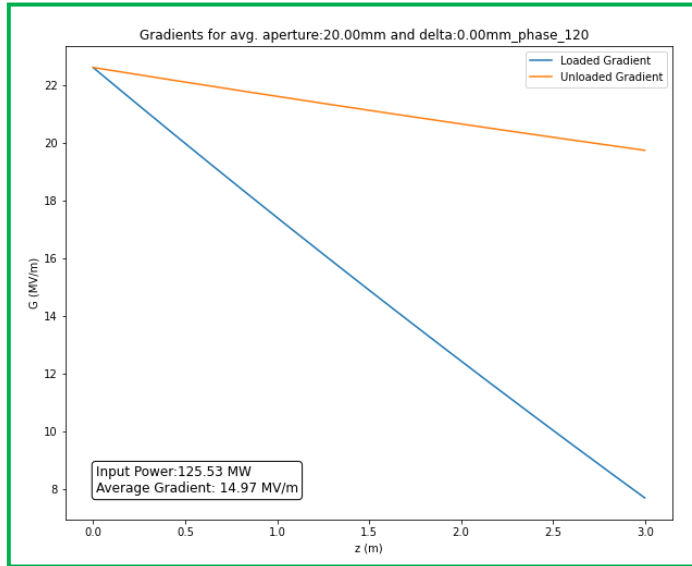
Gradients of the structures

- Parameters for the structure:

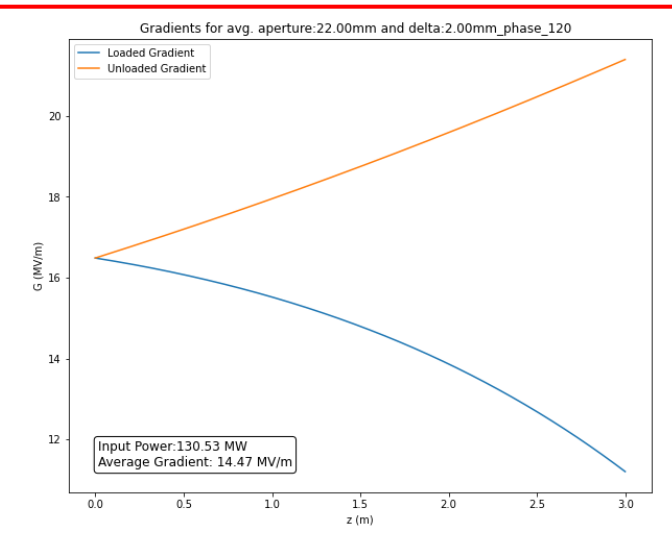
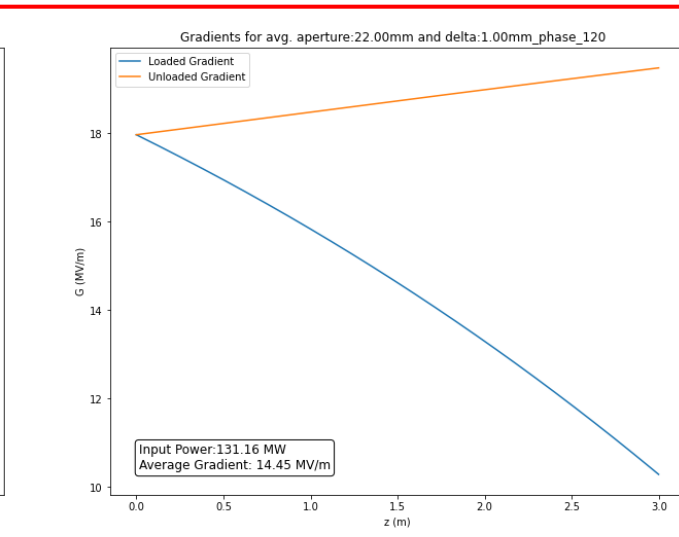
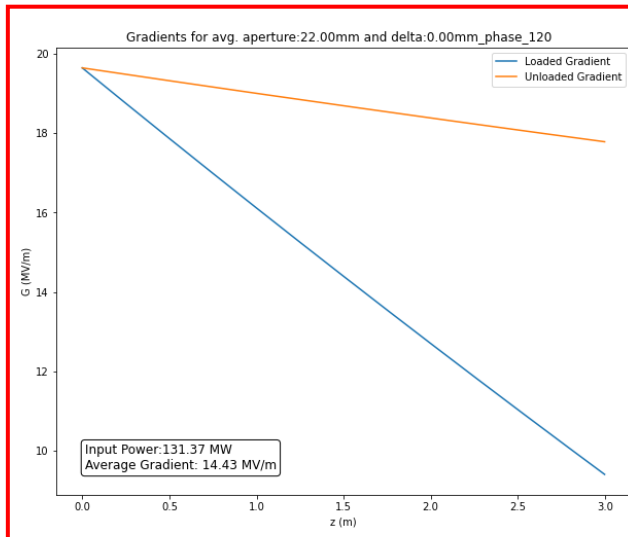
- $f = 2$ GHz, Length = 3m, Phase advance = $2\pi/3$, $Q_{0,SLED} = 2e5$, $T_{klystron} = 5$ us, $P_{klystron} = 31$ MW (2 acc. Struc. Per klystr.)

20 mm

21 mm



22 mm



$5\pi/6$ Phase advance structure scans
(for 1 nC bunch charge)

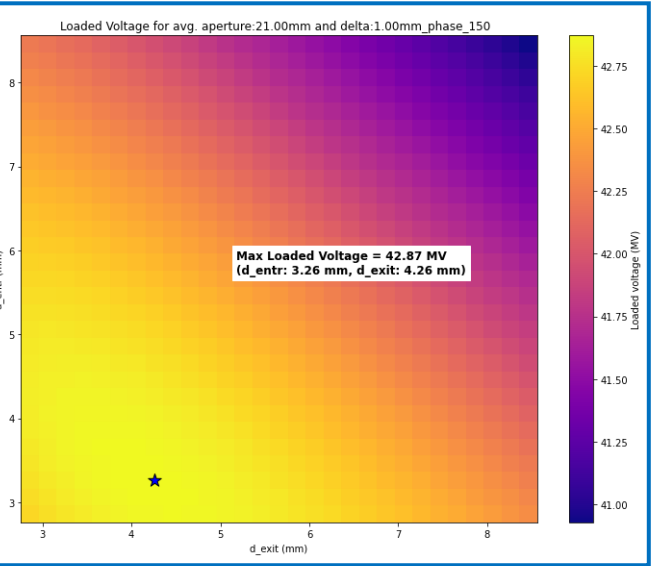
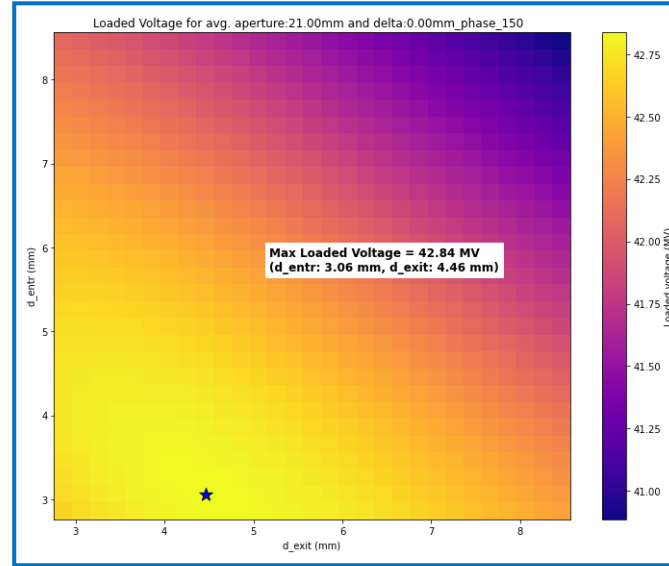
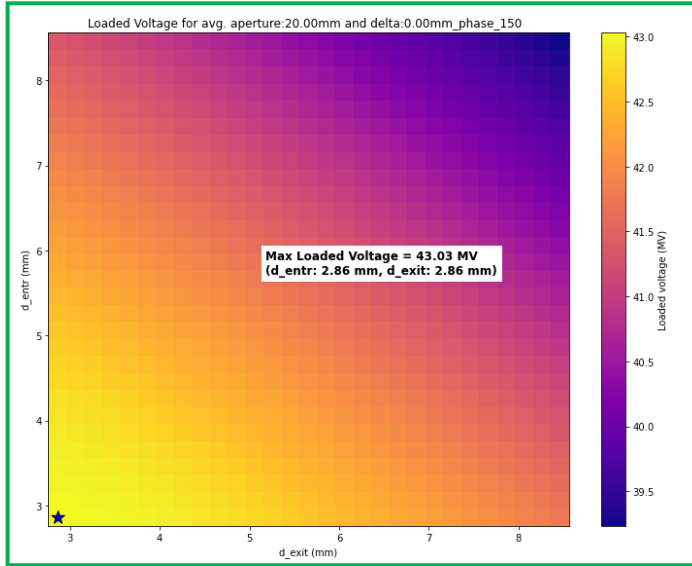
CLIC Injector Linac Loaded Voltages

Scanned from avg. aperture 20 mm to 22 mm.
No wake conditon considered.

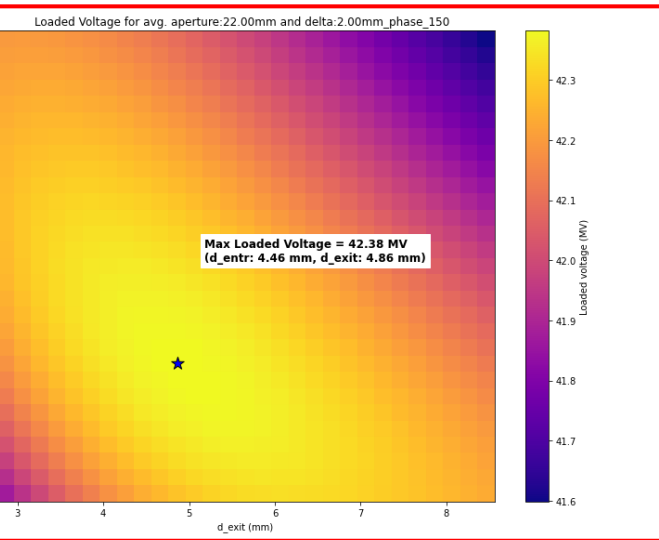
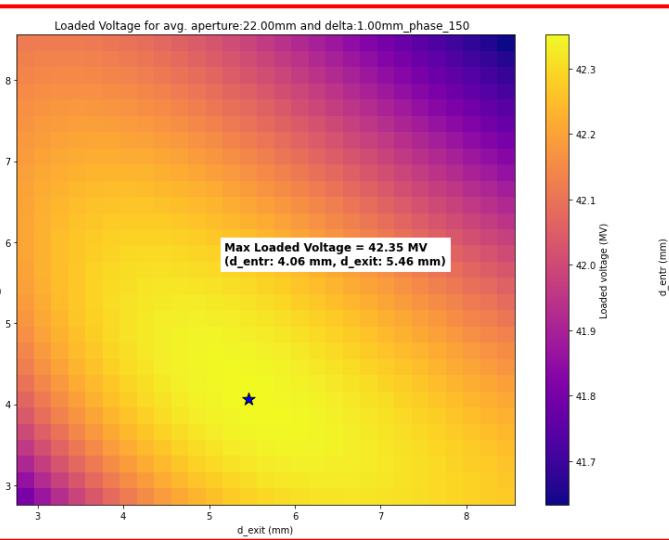
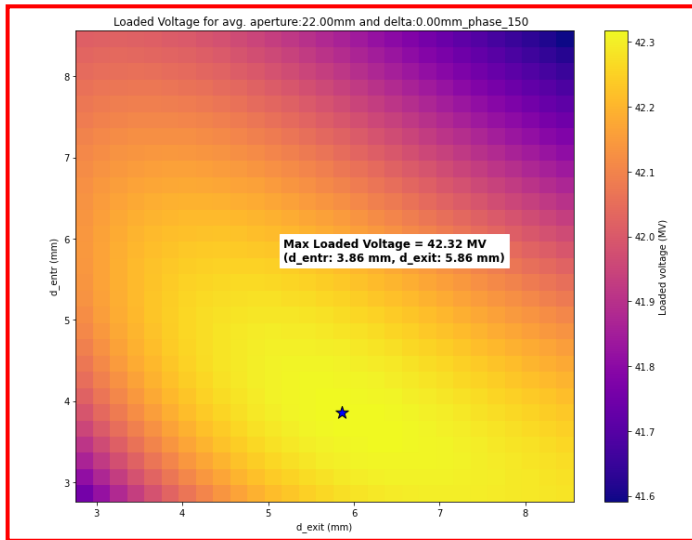
- Parameters for the structure:
- $f = 2$ GHz, Length = 3m, Phase advance = $5\pi/6$, $Q_{0,SLED} = 2e5$, $T_{klystron} = 5$ us, $P_{klystron} = 31$ MW (2 acc. Struc. Per klystr.)

20 mm

21 mm



22 mm



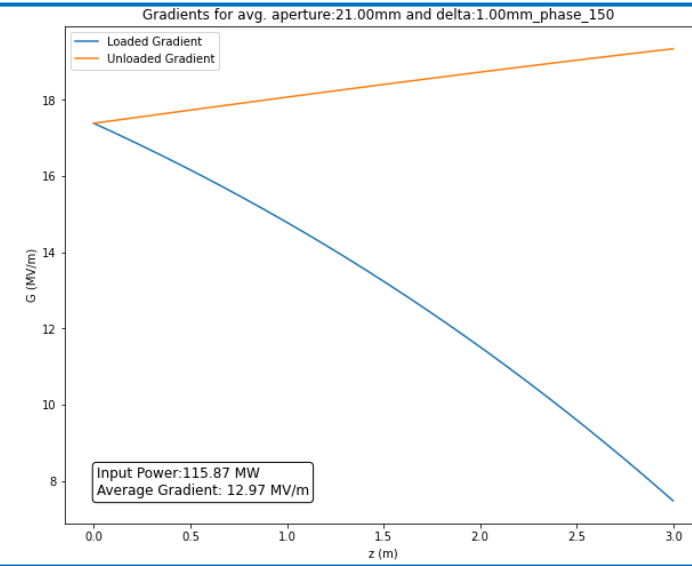
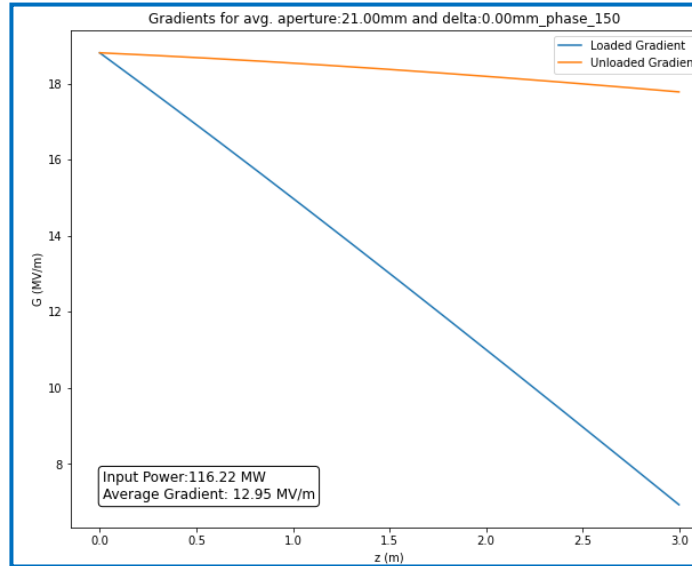
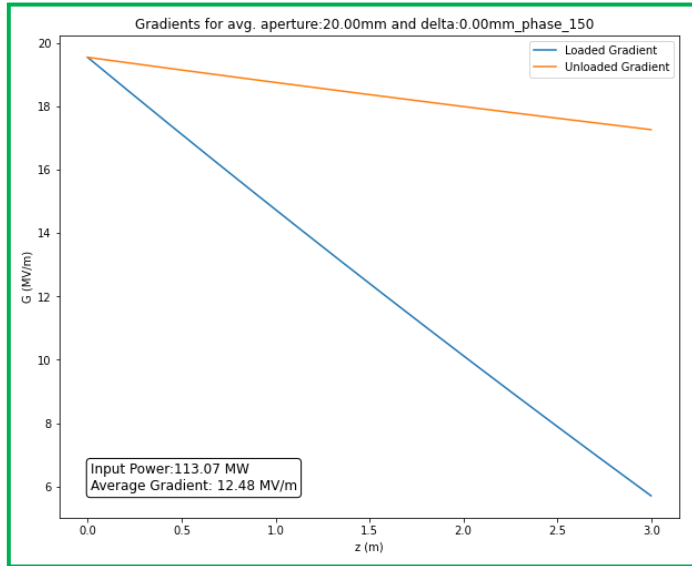
Gradients of the structures

- Parameters for the structure:

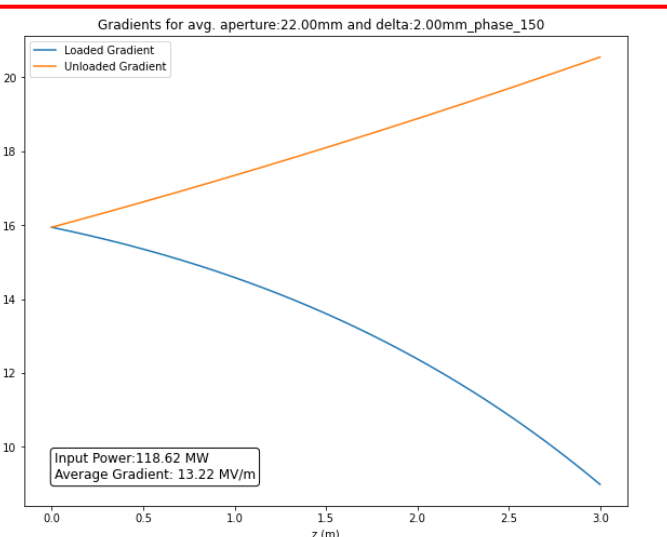
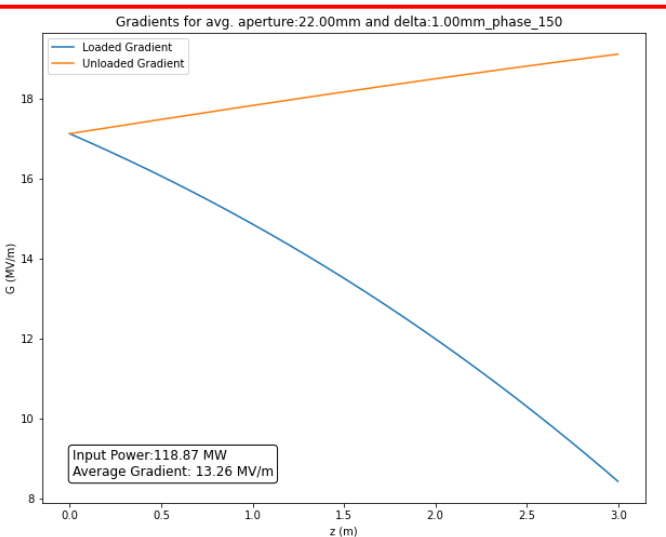
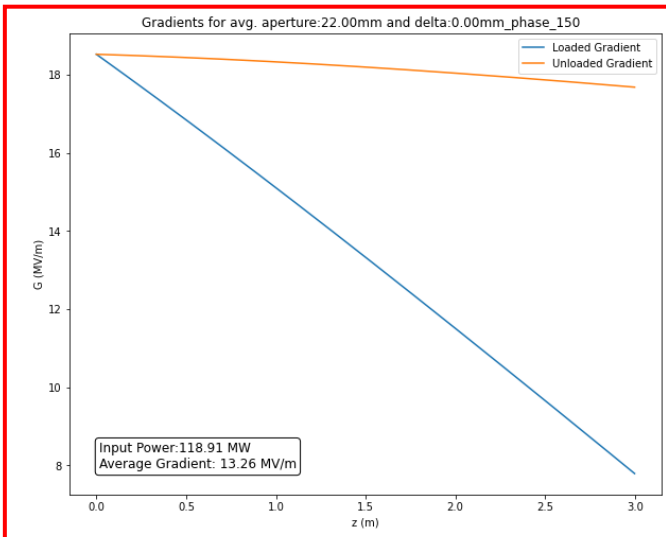
- $f = 2$ GHz, Length = 3m, Phase advance = $5\pi/6$, $Q_{0,SLED} = 2e5$, $T_{klystron} = 5$ us, $P_{klystron} = 31$ MW (2 acc. Struc. Per klystr.)

20 mm

21 mm



22 mm



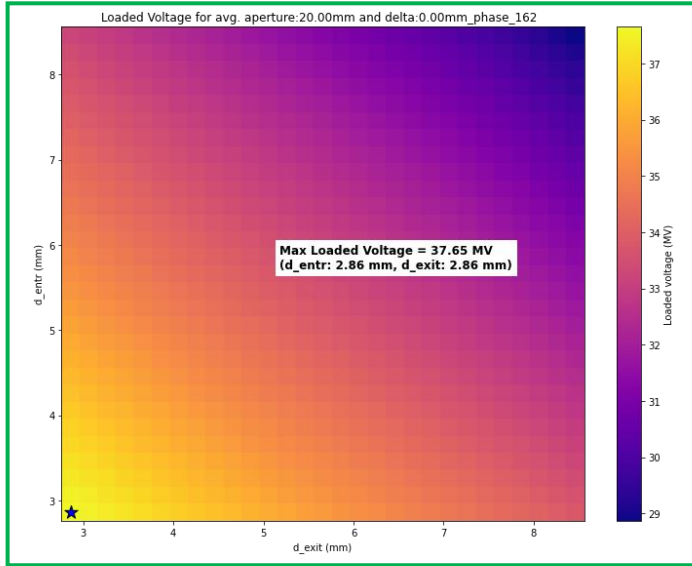
$9\pi/10$ Phase advance structure scans
(for 1 nC bunch charge)

CLIC Injector Linac Loaded Voltages

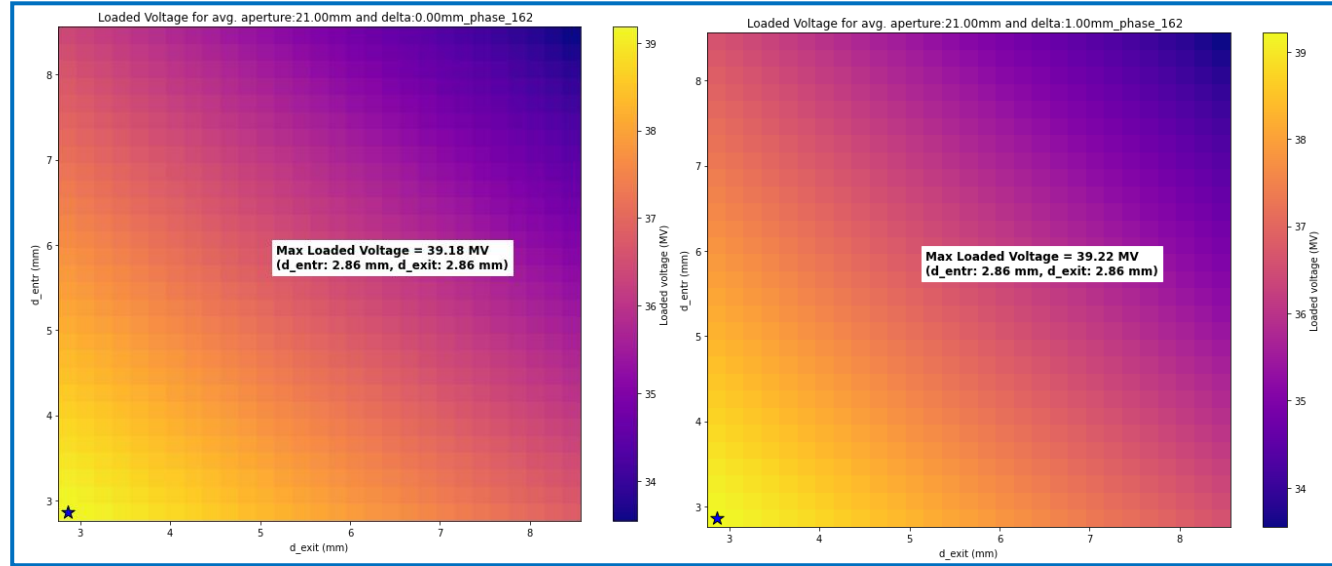
Scanned from avg. aperture 20 mm to 22 mm.
No wake conditon considered.

- Parameters for the structure:
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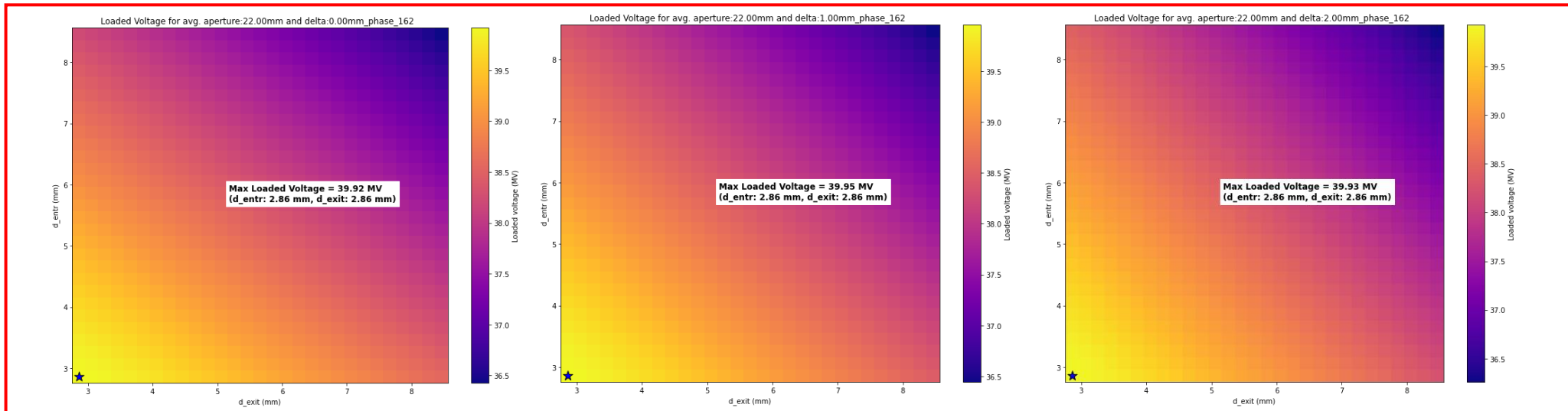
20 mm



21 mm



22 mm

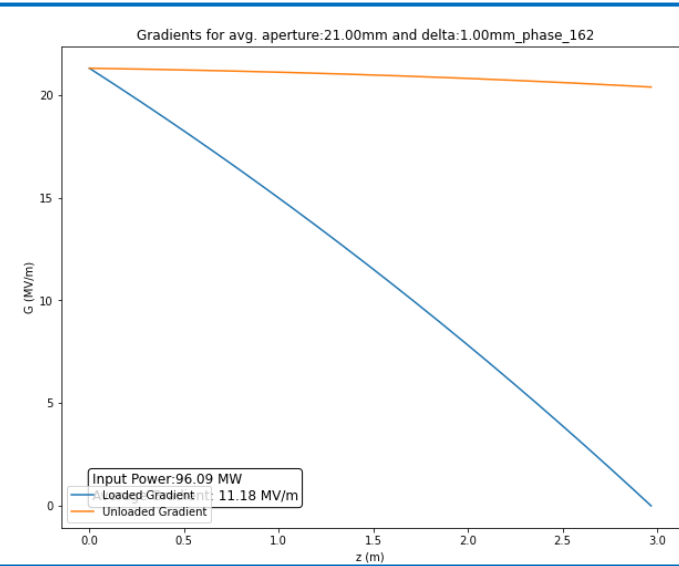
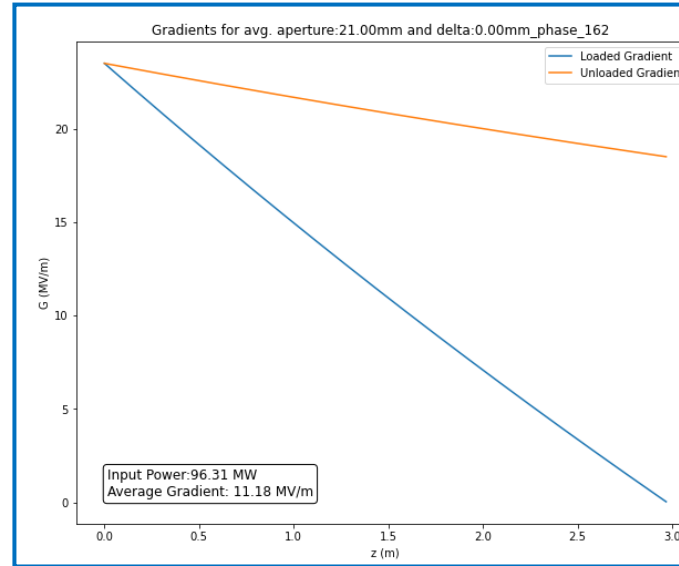
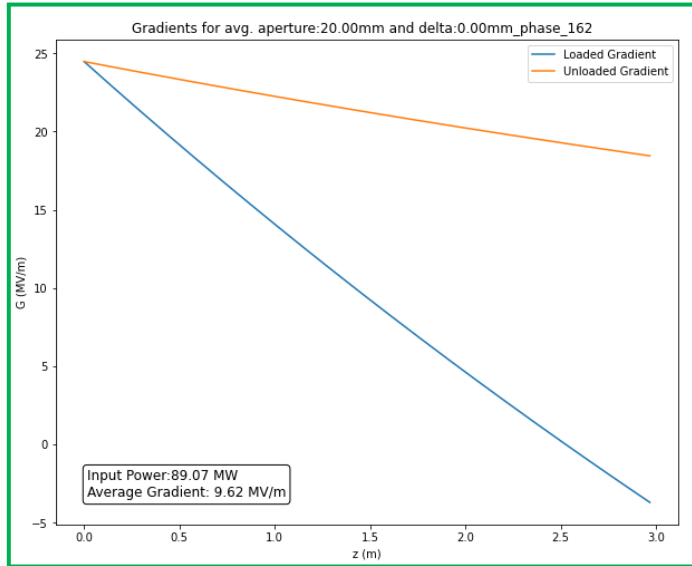


Gradients of the structures

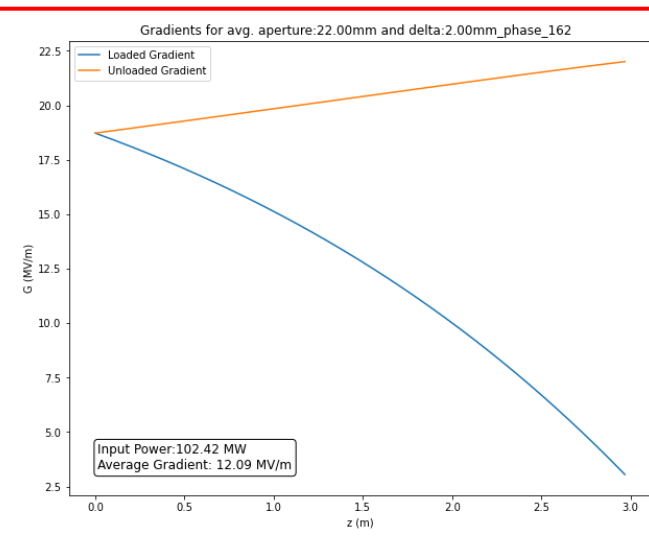
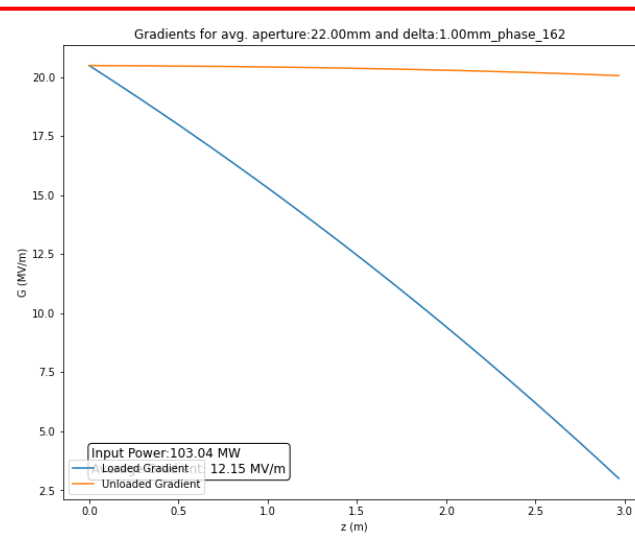
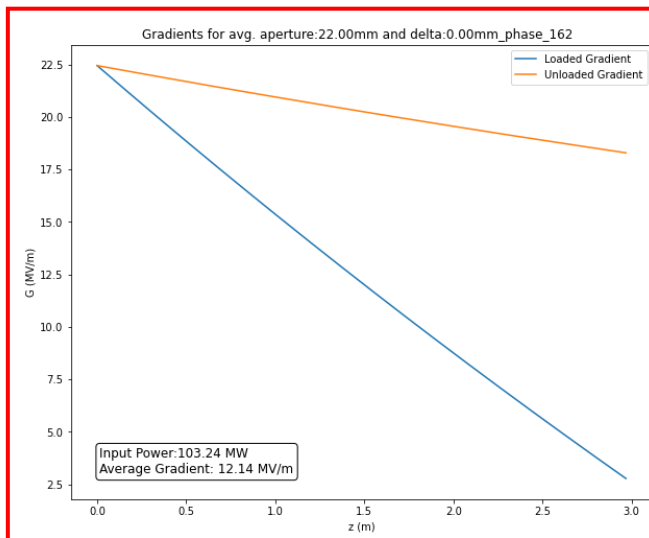
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20 mm

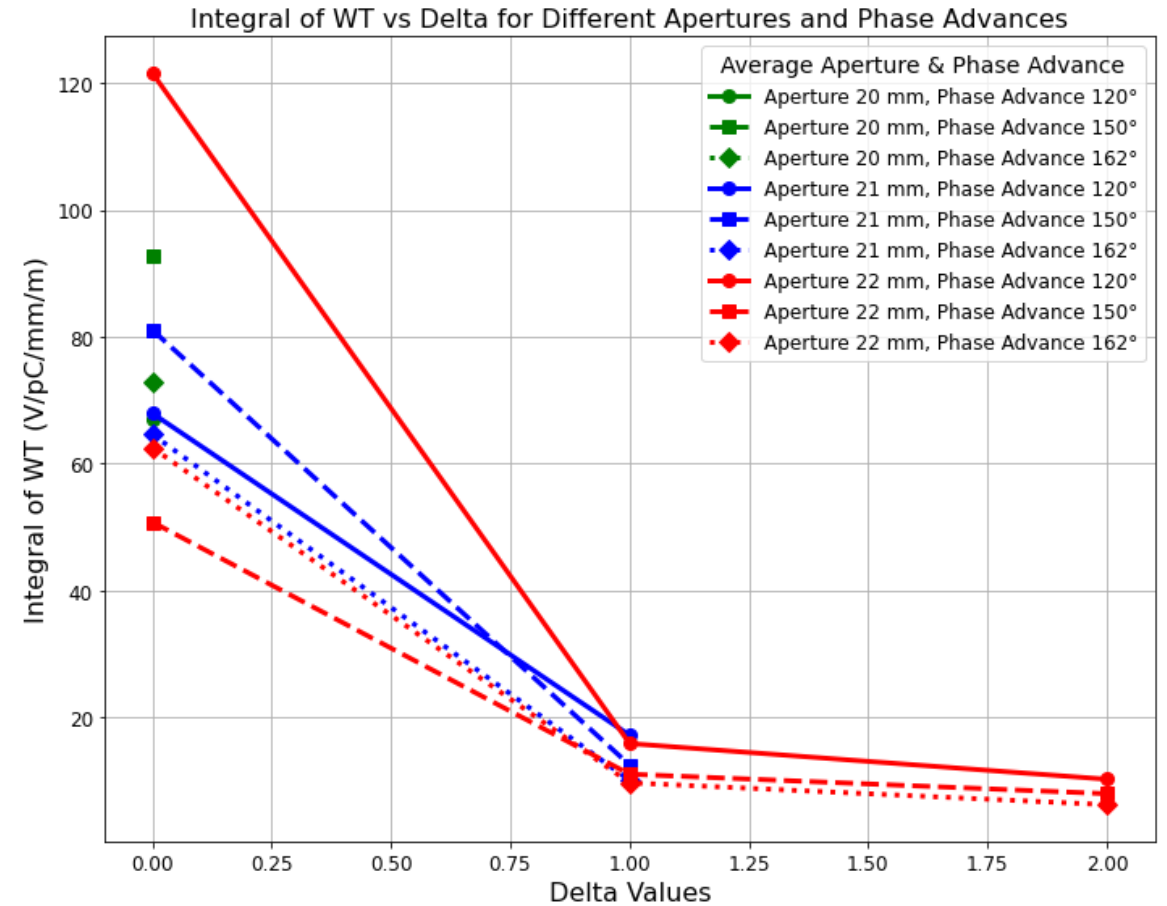
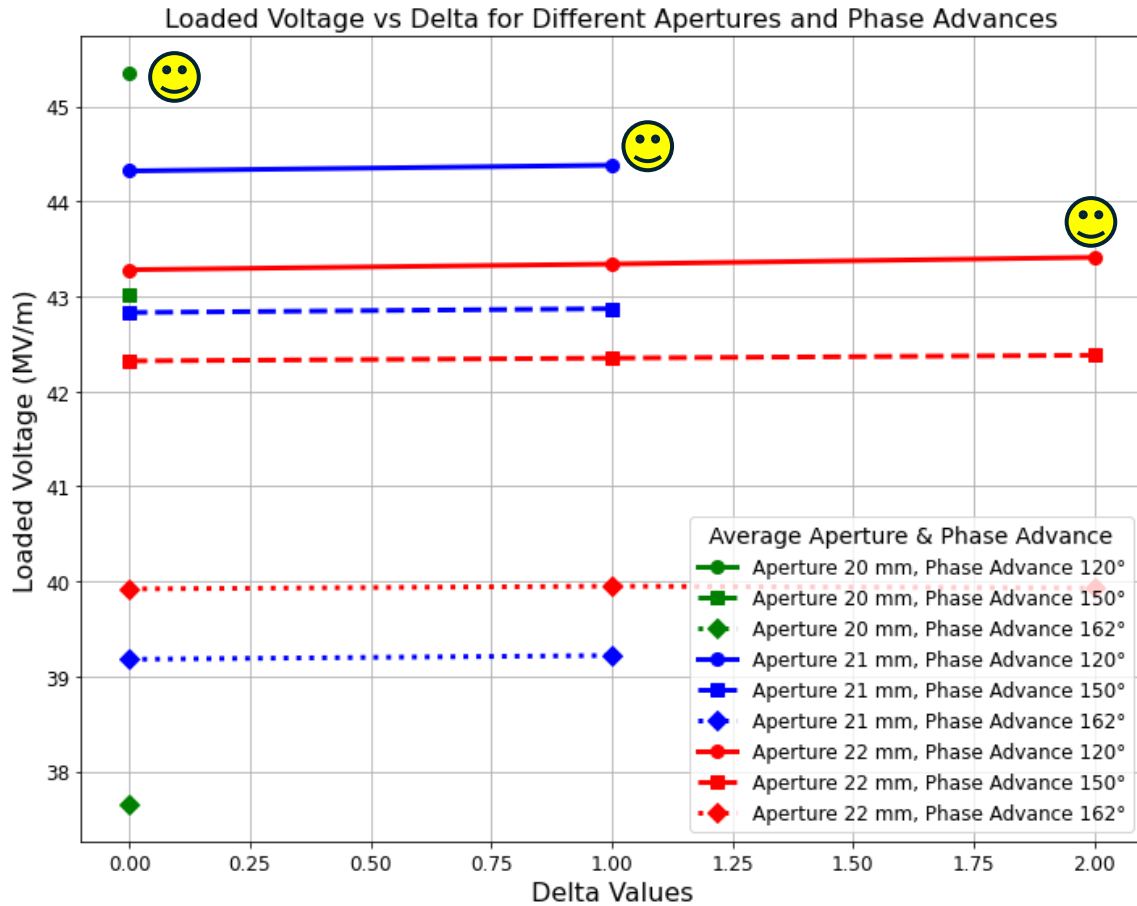
21 mm



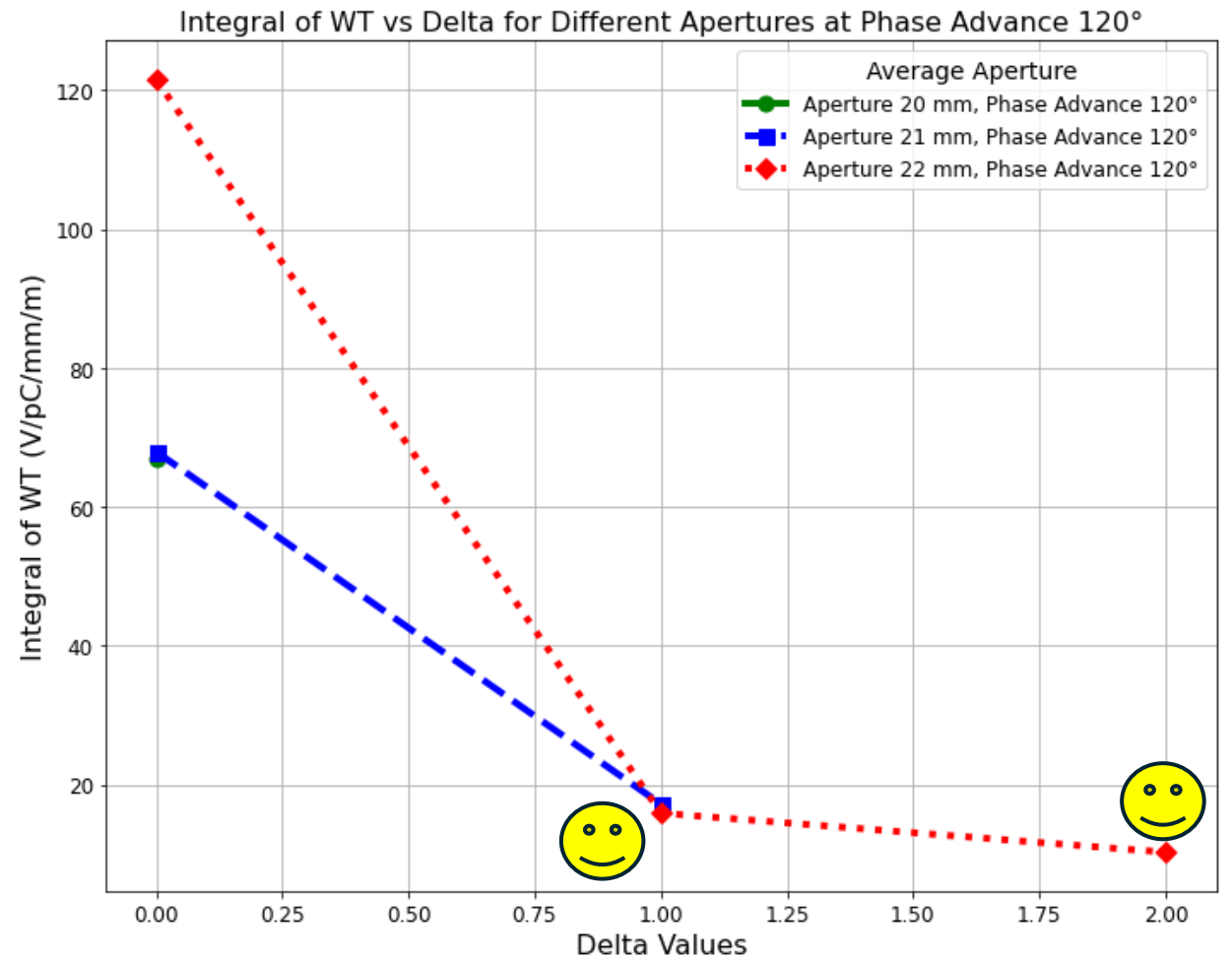
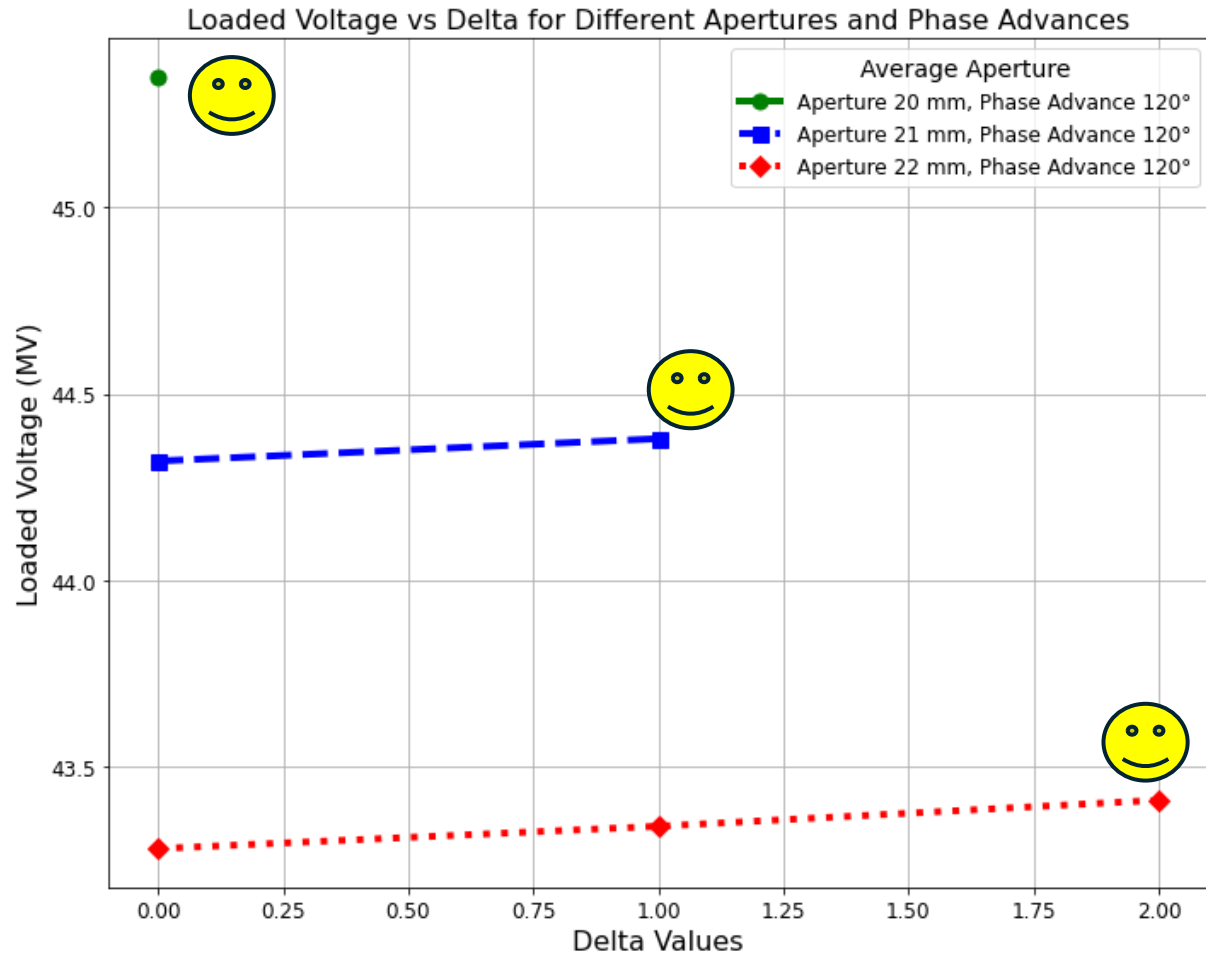
22 mm



- Parameters for the structure:
- $f = 2 \text{ GHz}$, Length = 3m, $Q_{0,SLED} = 2e5$, $T_{\text{klystron}} = 5 \text{ us}$, $P_{\text{klystron}} = 31 \text{ MW}$ (2 acc. Struc. Per klystr.), **1 nc bunch charge (2 A beam current)**.



- Parameters for the structure:
- $f = 2 \text{ GHz}$, Length = 3m, $Q_{0,SLED} = 2e5$, $T_{\text{klystron}} = 5 \text{ us}$, $P_{\text{klystron}} = 31 \text{ MW}$ (2 acc. Struc. Per klystr.), **1 nc bunch charge (2 A beam current)**.



Structure parameters of the candidate TWSs

- $f = 2 \text{ GHz}$, Length = 3m, $Q_{0,\text{SLED}} = 2e5$, $T_{\text{klystron}} = 5 \text{ us}$, **1 nc bunch charge (2 A beam current)**.

	Avg. Aperture: 20 mm	Avg. Aperture: 21 mm	Avg. Aperture: 22 mm
	Delta = 0 mm	Delta = 1 mm	Delta = 2 mm
Phase advance	$2\pi/3$	$2\pi/3$	$2\pi/3$
Entr., exit aperture	20 mm → 20 mm	22 mm → 20 mm	24 mm → 20 mm
Iris thickness	3.66 mm → 8.46 mm	8.46 mm → 8.46 mm	8.46 mm → 8.46 mm
Vg (% c)	3.55 → 2.51	3.40 → 2.50	4.44 → 2.50
r/Q (kOhm/m)	2.68 → 2.57	2.38 → 2.57	2.21 → 2.57
Q	19713 → 18490	18572 → 18490	18619 → 18490
Filling time	340 ns	343 ns	300 ns
SLED coupling	14	14	14
Integral of WT (V/pC/mm/m)	66.91	17.17 (74.33% lower)	10.13 (84.86% lower)
Klystron power per structure	(2 struc. per klyst.) 31 MW	(2 struc. per klyst.) 31 MW	(2 struc. per klyst.) 31 MW
Loaded Voltage	45.36 MV	44.39 MV (2.14% lower)	43.42 MV (4.27% lower)
G_{avg}	14.97 MV/m	14.80 MV/m	14.47 MV/m
E_{max} (instant.)	67 MV/m	64 MV/m	49 MV/m
$S_{c,max}$ (instant.)	193 mW/ μm^2	174 mW/ μm^2	329 mW/ μm^2

Wakefield Comparisons

- $f = 2 \text{ GHz}$, Length = 3m, Phase advance = $2\pi/3$, $Q_{0,\text{SLED}} = 2e5$, $T_{\text{klystron}} = 5 \text{ us}$, $P_{\text{klystron}} = 31 \text{ MW}$ (2 acc. Struc. Per klystr.), **1 nc bunch charge (2 A beam current)**.

