# CLIC Power Extraction and Transfer structure (PETS)

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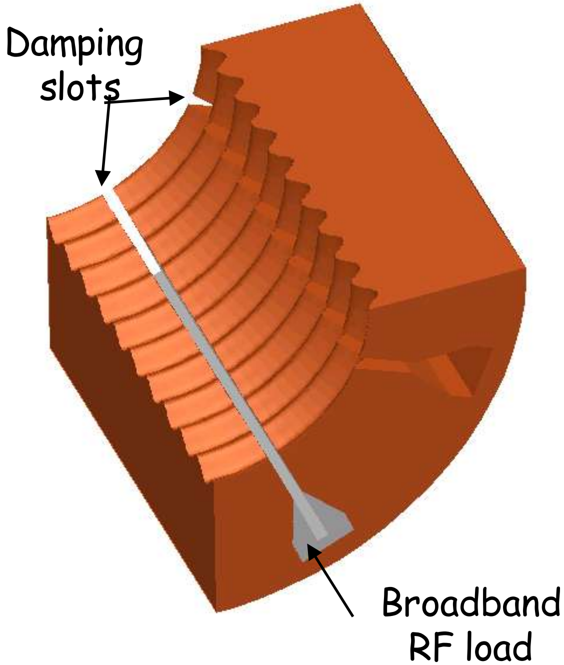
## Intro

CLIC Power Extraction and Transfer structure (PETS) should generate 30 GHz RF power in interaction with the drive beam and deliver it to the accelerating structure. The structure should provide stable transportation of the high current beam (about 140A) and the highest possible extraction efficiency (>95%).

To satisfy these demands PETS should have low longitudinal impedance (few hundred Ohms) together with a strong damping ($Q_d$< 50) of the transverse modes.

The actual status of the CLIC PETS is presented.

# Circularly symmetric 30 GHz RF Power Extraction and Transfer Structure for CLIC




A quarter geometry of the C-PETS with 8 damping slots and SiC load

The 25 mm beam aperture structure with sinus-type corrugation and 8 damping slots, each of 1 mm width is considered now as the CLIC PETS candidate.

## Parameters of the C-PETS

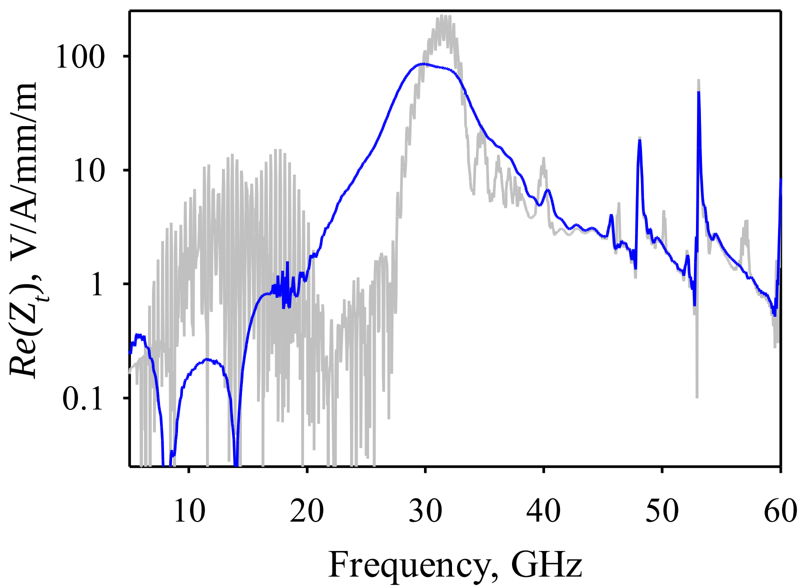
| | |
|---|---|
| Beam chamber diameter, mm | 25 |
| Synch. mode frequency, GHz | 29.9855 |
| Synch. mode $\beta_g$ | 0.85 *c* |
| Synch. mode R'/Q, Ω/m | 244 |
| Synch. mode Q-factor | 12000 |
| Number of damping slot (1.0 mm width) | 8 |
| Transverse mode $\beta_g$ | 0.8 *c* |
| Peak transverse wakefield V/pC/m/mm | 0.83 |
| Transverse mode Q-factor (damped) | < 50 |
| Structure length, m | 0.8 |
| Nominal output RF power at 30 GHz, MW | 560 |

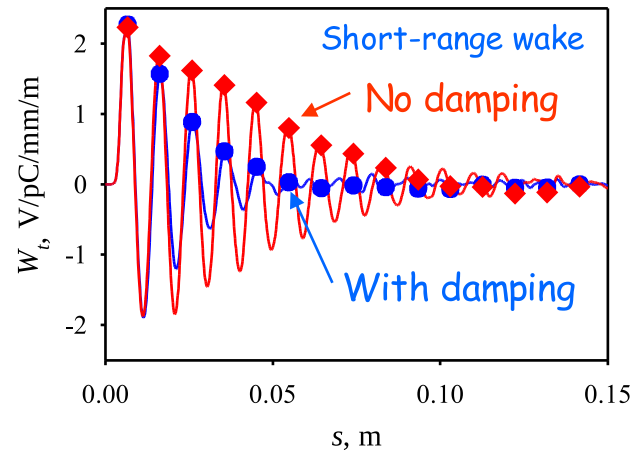
*Max. Surface electric field (slot edge included) ~130 MV/m

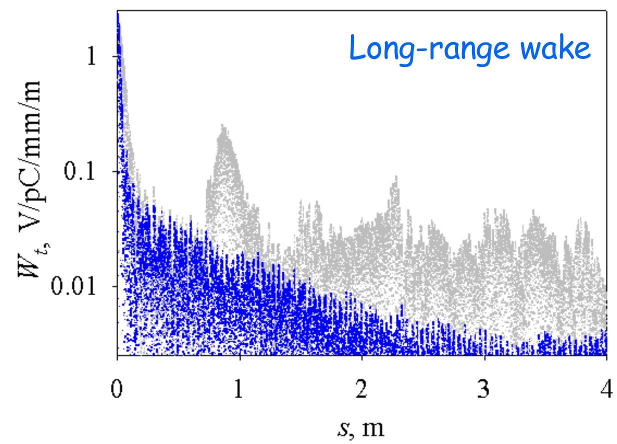
# The mechanism of the transverse modes Damping in the C-PETS

The concept of distributed damping is developed. Every period of the slot-loaded structure acts like a single source in an array antenna, radiating through the slots to the outside. The radial component of the radiation (damping) is a function of the phase advances between the two cells. The smaller the phase advance, the stronger the damping. Broadband RF loads terminate the slots.

20 mm aperture C-PETS,
GdfidL results (100 cell)

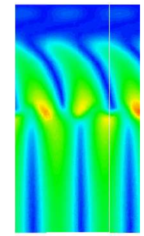


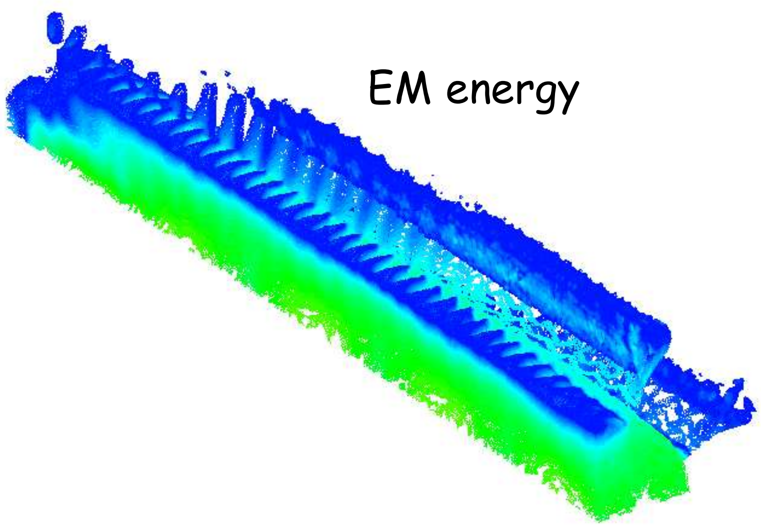



# Qualitative study using the steady state beam simulation with HFSS.

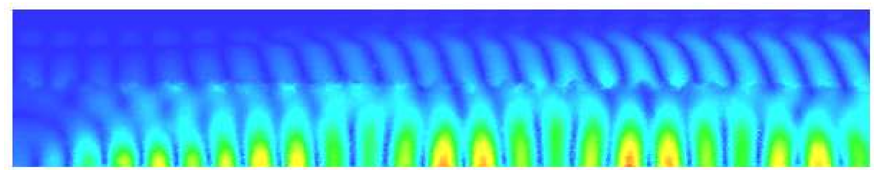
The beam current is represented by the discreet current sources oscillating with a fixed frequency. To be analogous with the drive beam, the RF phase difference between the two neighbors sources is chosen to be: $\Delta\phi=\omega L/c$. Where L is the distance between the two. In a given example 26 sources spaced by $\lambda/6$ where used.



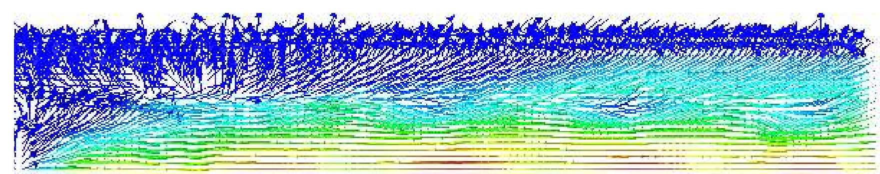
HFSS with periodic boundaries



EM energy

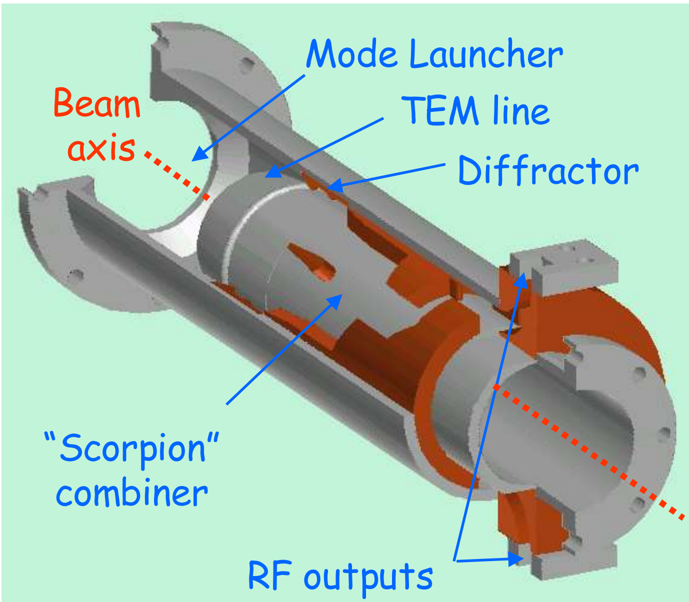


Electric field plot



Poynting vector

# RF Power Extractor for the CLIC C-PETS.

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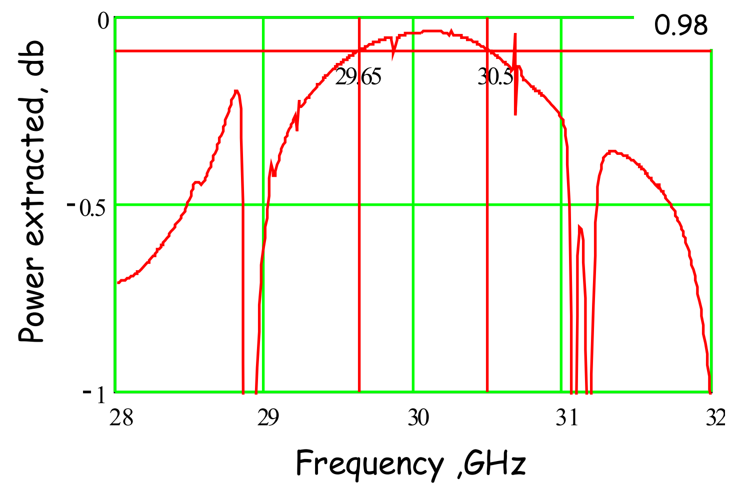
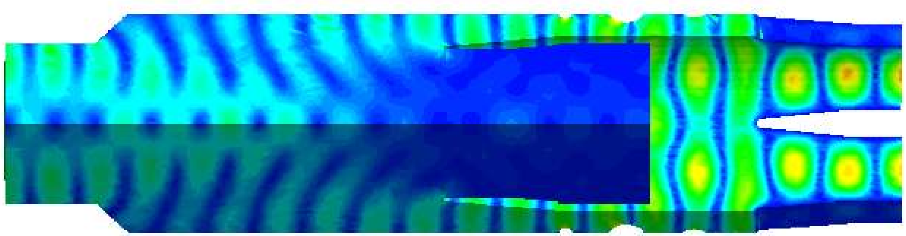
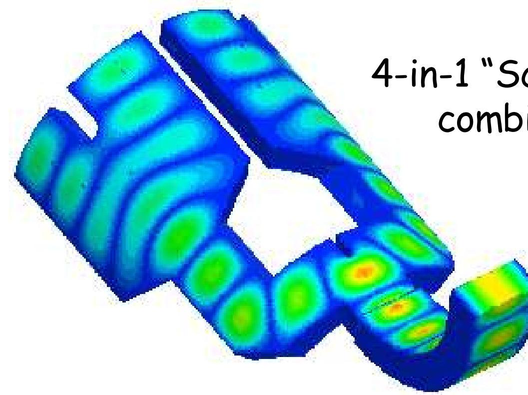
Power extraction efficiency




Electric fields in extractor

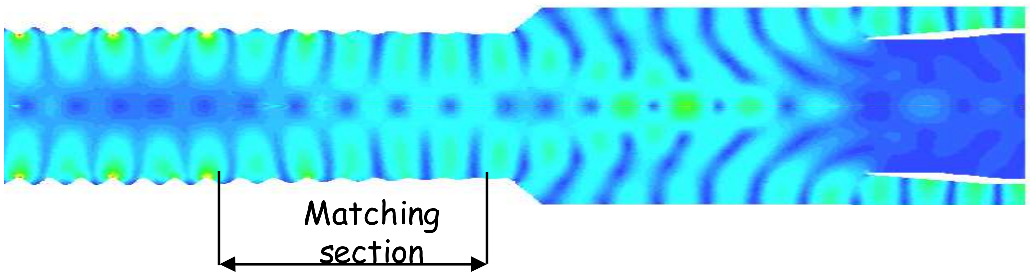




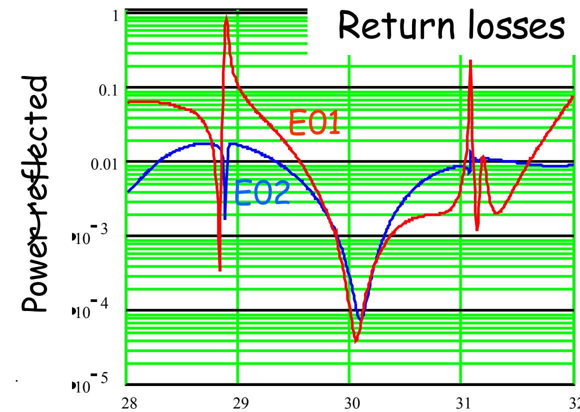
4-in-1 "Scorpion" combiner

# RF Power Extractor for the CLIC C-PETS.

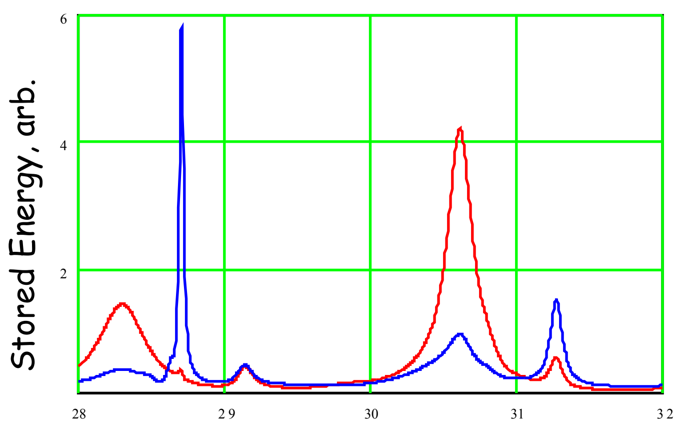
## C-PETS adiabatic matching to the circular WG




## Modal purity




## Deflecting modes in Extractor




The energy spectra of the trapped dipole modes driven by $H_{11}$ (solid line) and by $E_{11}$ (dotted line) waveguide modes