Effect of Beam-Loading on the Breakdown Rate of High Gradient Accelerating Structures

J.L. Navarro, for the CTF3/CLIC Collaboration
The **Compact Lineal Collider** (CLIC) aims to collide e- e+ at 3TeV using a new **Two beam Acceleration Concept**.
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- Energy for the main beam is provided by deceleration of a high current “drive beam”
**Where...?**

- The **Compact Lineal Collider** (CLIC) aims to collide e- e+ at 3TeV using a new **Two beam Acceleration Concept**

- Energy for the main beam is provided by deceleration of a high current “drive beam”

- **Traveling waves** cavities
  - Nominal gradient ~ 100 MV/m
  - Nominal RF pulse length ~ 240 ns
  - Peak Power ~ 61 MW
  - Max. Surf. Field ~ 230MV/m
CLIC works with **strong accelerating fields** (~100 MV/m)

**Problem of Break Downs (BD):** Very fast (10 ns – 100 ns) and localized dissipation of stored energy in the structure with undesired effects:
- Loss of acceleration
- Damage in the structure
- Kick in the beam
- Luminosity Reduction **Max DB rate allow** for CLIC ($3 \times 10^{-7}$ BD pulse$^{-1}$ m$^{-1}$)
Breakdowns

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Nominal BD rate already achieved without beam loading
Beam Loading modifies the gradient distribution along the structure

I = 0 A
P ~ 43 MW
Beam Loading modifies the gradient distribution along the structure.

- Beam loading effect
- Gradient, MV/m
- Length, m
- \( I = 0.35 \, \text{A} \)
- \( P \approx 43 \, \text{MW} \)
Beam Loading modifies the gradient distribution along the structure

\[ I = 0.6 \text{ A} \]
\[ P \sim 43 \text{ MW} \]
Beam Loading modifies the gradient distribution along the structure.

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**Graph Details**

- **Gradient, MV/m**
- **Length, m**

**Plot Information**

- **Current (I):** 0.95 A
- **Power (P):** ~ 43 MW
Beam Loading modifies the gradient distribution along the structure.
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- Beam loading effect
- $I = 1.2 \, \text{A}$
- $P \sim 53 \, \text{MW}$
Beam Loading modifies the gradient distribution along the structure.

Unpredicted effect on Breakdown rate.

I = 1.2 A
P ~ 63 MW
Beam loading effect

Beam Loading modifies the gradient distribution along the structure

Unpredicted effect on Breakdown rate

Experiment located in the Dogleg Line of the CLIC Test Facility (CTF3)

We test the effect of beam loading on the Breakdown Rate

Visit TUPP028 to learn for CTF3 activities
Where to find more information:

Visit this poster TUPP033 in stand 33 for more information

If you want to learn about...

✓ Experiment Layout
✓ First results

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