

# Himel 11: Cavity Shape/Iris Size @ 500GeV

## Cavity Shape/Iris Size @ 1TeV

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Related Groups: GG5 no input (now)  
WG1 input, thanks  
WG2 input, thanks  
WG5 discussion leader

# Himel 11: Cavity Shape/Iris Size @ 500GeV

- Options
  - TESLA shape
  - Low-loss shape
  - Re-entrant shape
  - Possibly, Superstructures with any of the shapes above
- Pros/Cons
  - TESLA shape:
    - Well understood and tested with a large number of samples (>100)
    - Could be short of gradient margins ( $E_{acc} \leq 41\text{MV/m}$ )
  - Other shapes:
    - Reduced surface magnetic field  $\rightarrow$  Potential for higher gradient (47MV/m).
    - 10-20% lower cryo load  $\rightarrow$  Potential cost saving in operation
    - 10-20% higher surface electric field  $\rightarrow$  Field emission
    - Reduced iris radius (TESLA  $\phi 70 \rightarrow \phi 60$ )  $\rightarrow$  HOM and wake more concerned.  
 $\rightarrow$  Tolerance tighter (TESLA  $300\mu\text{m} \rightarrow 220\mu\text{m}$ )
    - Requires - significant R&D to establish performance on, field emission and HOM in multi-cell operation, wake field and so on.
  - Superstructure:
    - Fewer couplers, improved packing factor  $\rightarrow$  Potential of significant cost savings
    - Require – Demonstration with LL/RE shape
      - Couplers with doubled power
      - Superconducting joints highly desirable
      - Otherwise, facilities with doubles sizes

## Cavity Shape (11)

- Since short-range wakefields seem to be the least of our worries, may not be important (to be verified)
- Long-range wakefield effects need to be studied

# Input from WG2

## **Comment on Iris Size from a WG2 perspective**

- Reducing the cavity iris size to 60 mm diameter would probably be OK from a wake-field perspective and  
would reduce cooling requirements by at least 21% and save 67 M\$ in cryoplant costs for a fixed gradient.

It would also reduce the cavity fill-time by 16%, which would reduce the rf system cost by about 11 M\$.

# Himel 11: Cavity Shape/Iris Size @ 500GeV (continued)

- Shape of Choice: TESLA shape
  - Performance and cost best understood
  - Presently, existence proof of 35 MV/m from vertical test, horizontal test, long-term test, one cavity in cryomodule
  - In near future, Cryomodule #8 with 35 MV/m to be completed at TTF (& similar at KEK-STF)

# Himel 11: Cavity Shape/Iris Size @ 1TeV

- Options
  - LL/RE
  - Superstructure with LL/RE
- Pros/Cons
  - LL/RE
    - Reduced surface magnetic field → Potential for gradient margins
    - Reduced cryo-load
    - Higher surface electric field → Field emission
    - Reduced iris radius → Studies on HOM and wake required.
  - Superstructure
    - Fewer number of couplers + Improved packing factor → Cost savings
    - Require:
      - Couplers with higher (doubled) power capabilities
      - Facilities with doubled sizes
      - SC sealing, highly desirable, needs to be developed
- Required R&D
  - LL/RE
    - Multi-cell operation in cryomodules
  - Superstructure
    - Multi-cell demonstration with LL/RE shaped cavities

## Himel 11: Cavity Shape/Iris Size @ 1TeV (continued)

Both (new cavity shapes and Superstructure) will be read by at least 1TeV upgrade construction but,

- Shape of Choice:
  - May the best man win !