High power windows for WR650 waveguide couplers


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Based on the robust, pre-stressed planar window concept successfully tested for PEP II and LEDA, a new design for planar ceramic windows to be used with WR650 waveguides has been developed. These windows should operate in pulsed or CW mode and sustain at least 100 kW average power levels. This paper describes an overview of the simulations performed to match the ceramics in WR650 waveguides, design details, as well as the RF measurements and preparation for RF power tests on several high power windows manufactured at JLAB.

Waveguide fundamental power coupler specifications

- Operation frequency: 1300 MHz or 1500 MHz
- Max FWD RF power: 50 kW CW
- Sustain local RF peak power of 200 kW
- Passive and active control of multipacting events in operation
- Baked at 150°C before RF processing
- Water cooled on the border of the ceramic

Conceptual designs for the 1500 MHz WFPC

- Operation frequency: 1500 MHz
- Max FWD RF power: 50 kW CW
- Sustain local RF peak power of 200 kW
- Passive and active control of multipacting events in operation
- Baked at 150°C before RF processing
- Water cooled on the border of the ceramic

Published data for MAPIA simulation of LEDA ceramic window (WR1500 with a=15in=381 mm; b=7.5in=190.5 mm; Iris thickness ±1.5in = ±38 mm, Iris phi ± 7.374in=±187.3 mm; Window thickness 0.452in=11.48 mm)

From HFSS simulation done at JLAB ceramic thickness is 11.7mm at matching frequency 700 MHz with S11 ~-55dB

Wavenumber is 5.05 GHz

HFSS simulations - test chamber

TRL measurements of matched frequencies in WR650 waveguide

- Ceramic thickness (mm)
- Frequency (GHz)
- Power Fit: y = ax^b
  - Coefficient Data:
    - a = 2.9673179
    - b = -0.33800437
- 1 GHz -> 11.4922 mm
- 1.497 GHz -> 7.5702 mm

Vacuum and water leak tests

- Vacuum leak O.K. on test chamber
- Water leak O.K. on test chamber

Conclusions: Simulation, manufacturing and testing methods for compressed RF ceramic windows have been implemented at JLAB. Several 1500 MHz ceramic windows have been brazed and will be RF power tested in the near future.