



## Specifications sheet: $TM_{110}$ deflection cavity

### Introduction

The deflection cavity is a compact, single-cell, power-efficient resonant microwave cavity, supporting a  $TM_{110}$  mode at a resonance frequency of 2.9985 GHz with an unloaded quality factor that can be as high as  $Q \approx 5000$ . The deflection cavity is a pillbox cavity partially filled with a dielectric material with a large permittivity  $\epsilon$  and a small  $\tan \delta$ , which allows a substantial reduction in size and power consumption. The  $TM_{110}$  mode has an oscillating magnetic field oriented perpendicular to the symmetry axis, allowing periodic deflection of the electron beam passing through. Presently the ceramic  $ZrTiO_4$  is used, with  $\epsilon \approx 36$  and  $\tan \delta \approx 0.0002$  at 3 GHz, enabling an on-axis magnetic field amplitude of 3 mT at an RF input power of 15 W. Additionally the dielectric can be coated to prevent charging due to the electron beam passing through.

### Applications

- Beam chopper
- Pulse length diagnostics
- ToF electron energy loss spectroscopy
- Streak camera with bandwidth of 13 ns and 100 fs temporal resolution

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| Features |
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- Power efficient
- High vacuum compatible ( $< 10^{-6}$  mbar)
- Tiny footprint

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| General |
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|------------------------|---|--|
| Cavity length          | : | 17.2 mm (optimized for 30 keV electrons)         |
| On-axis magnetic field | : | $\sim 3$ mT for 15 W input                       |
| Pole length            | : | 300 mm standard - variable pole length (special) |

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| Cooling |
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| Water Connection | : | Legris ( $6 \times 1$ mm) push in fitting                |
| Water cooling    | : | DrX chiller recommended - temperature stability $< 1$ mk |

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| Temperature Sensor |
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|------|---|--|
| Type | : | PT100 for integration with DrX chiller |
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| RF |
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|-------------------|---|-------------------|
| Mode of operation | : | TM <sub>110</sub> |
| Frequency         | : | 2.9985 GHz        |
| Loaded Q          | : | $> 6000$          |
| Power connector   | : | SMA-Type female   |
| P <sub>max</sub>  | : | 15 W - Continuous |

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| Vacuum |
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|           |   |                     |
|-----------|---|---------------------|
| Flange    | : | CF63                |
| Steel     | : | 316L                |
| Leak rate | : | $< 10^{-8}$ mbar/ls |

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| Dimensions |
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|--------|---|--|
| Size   | : | $112.5 \times 112.5 \times (41 + \text{pole length})$ mm |
| Weight | : | Unknown  |