



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 and a second mode which is orthogonal to the first mode oscillating at a frequency of 3.0735 GHz (difference 75 MHz). Both modes have 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 ϵ 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. Due to the second mode the beam is deflected in both directions perpendicular to the propagation axis resulting in a Lissajous-like streak pattern. 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

Features

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

General

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

Cooling

Water Connection	:	Legris (6×1 mm) push in fitting
Water cooling	:	DrX chiller recommended - temperature stability < 1 mk

Temperature Sensor

Type	:	PT100 for seamless integration with DrX chiller
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RF

Mode of operation	:	TM ₁₁₀
Frequency 1	:	2.9985 GHz
Frequency 2	:	3.0735 GHz (Frequency 1 + 75 MHz)
Loaded Q	:	> 6000
Power connector	:	SMA-Type female
P _{max}	:	15 W - Continuous - Total

Vacuum

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

Dimensions

Size	:	$112.5 \times 112.5 \times 341$ mm
Weight	:	Unknown