VIDEO RATE PROJECTION AND IMAGING DEMONSTRATOR KIT (DEMO-04)

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TECHNOLOGIES, INC.

For DEMO-04 Kits
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Mirrorcle Technologies, Inc.

Overview

□ DEMO-04 kit combines the following items to provide users with the capability of flexible and programmable video-rate laser projection or laser-based imaging/sensing

- MEMS Pair Module (MPM) with video-rate scanning MEMS mirrors

- Laser module with small beam diameter and divergence and video-rate modulation capability

- FPGA-based USB MEMS Controller

- Breadboarding for easy experimentation

- Matlab based GUI application for scan parameter exploration

- Documentation

- Software Support Hours

DEMO-04 - Contents

- 2x MPM – Two **MEMS Pair Modules**

  - MEMS1 – 0.9mm mirror

  - MEMS2 – 3.2mm x 1.3mm elongated mirror

- Cable for laser and MEMS mirror

- LM – Laser Module (Monochrome, Single Color)

  - Green ~520nm, ~20-40mW

  - Modulation capability >100MHz

  - Mounted with beam reducer to <0.9mm diameter, also low divergence for sharp projection

- Controller – FPGA-based controller with USB interface

  - Embedded MEMS driver

- Software

  - Matlab-based GUI application for scan parameter exploration

 - Windows-based console demo application

MPM prototype
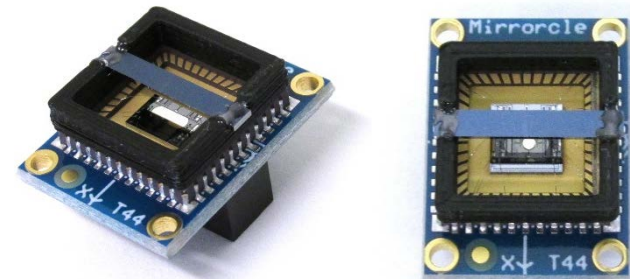
FPGA-based USB MEMS and Laser Controller

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MPM Specifications

☐ **MEMS Pair Module – single die (chip) with two single-axis mirrors** that combine their actuation for video rate raster scanning.

☐ **MPM P/N: F1V9.2**

    ☐ **MEMS 1**: F1R9.1-900D Integrated, resonant MEMS mirror

        ■ 0.96mmx0.90mm elliptical mirror, ~23-25kHz resonance, ±6° mech. angle

        ■ 5.2mm x 5.2mm die size, 0.491mm thick

    ☐ **MEMS 2**: F1Q32.1-3200X1300AL- integrated, quasi-static MEMS mirror

        ■ 3.2mm x 1.3mm elongated mirror, ~1kHz bandwidth, ±5° mech. angle

        ■ 5.2mm x 5.2mm die size, 0.491mm thick (**same die with MEMS1**)

        ■ Fully programmable quasi-static position control, e.g.:

            ■ Offset to a given line and hold

            ■ Run sub-segments of a raster or offset rasters

            ■ 60Hz, 90Hz, 120Hz sawtooth scan (90% duty cycle) capability
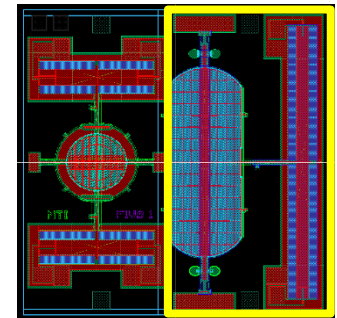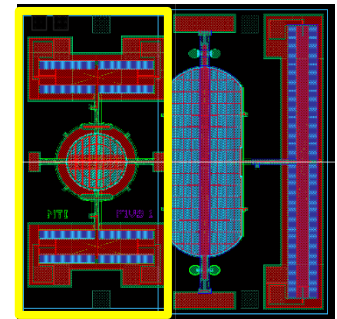
Example Scan Specifications

☐ Scan parameters such as MEMS1 angle, MEMS2 angle, number of lines, number of retrace lines, MEMS1 frequency and others are modifiable from the Matlab GUI – within limits of the devices' capabilities. Examples of scans that could be set are:

☐ 24°x18° max field of regard or lower (programmable)

☐ Based on the ~24kHz rate of MEMS1, horizontal axis scans 48000 lines per second with programmable vertical settings. Example configurations:

- ☐ 240p to 400p @ 90Hz
- ☐ 640p @ 60Hz
- ☐ 720p to 800p @ 50Hz

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Example Scans

Higher Resolution Scan
(600p, 50Hz)

Lower Resolution Scan (240p, 90Hz)

Programmable aspect ratio

GUI-based Application for Scan Parameter Exploration

Original Image

Displayed Image (Adjusted for Rotation)

X-Axis Amplitude and Y-Axis Angle

Load device profile and settings. Import Y LUT based on device selection.

MEMS Pair ID

Input and Output Beams

MPM on Kinematic Mount with a 20°
angle of incidence (AOI)

40°
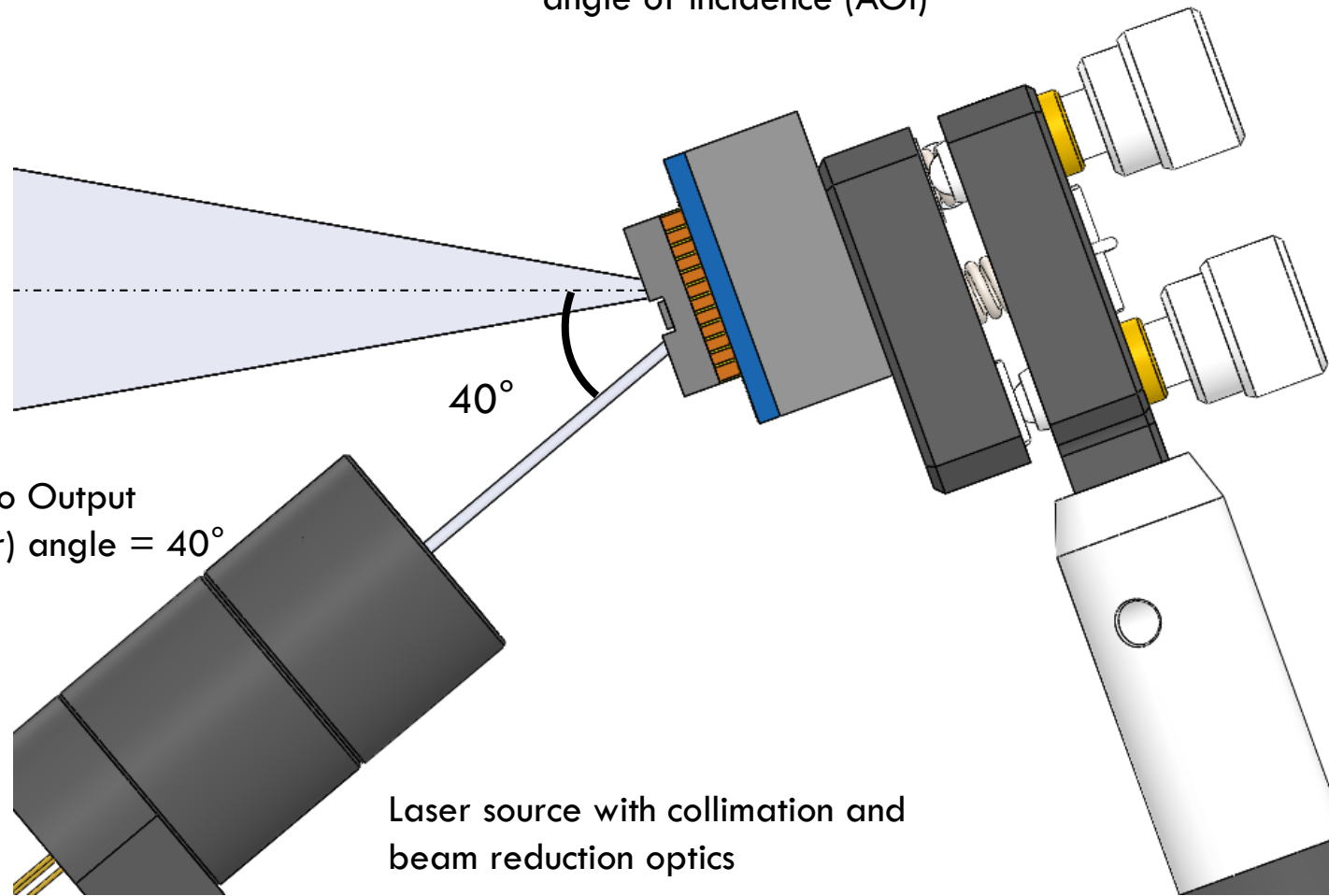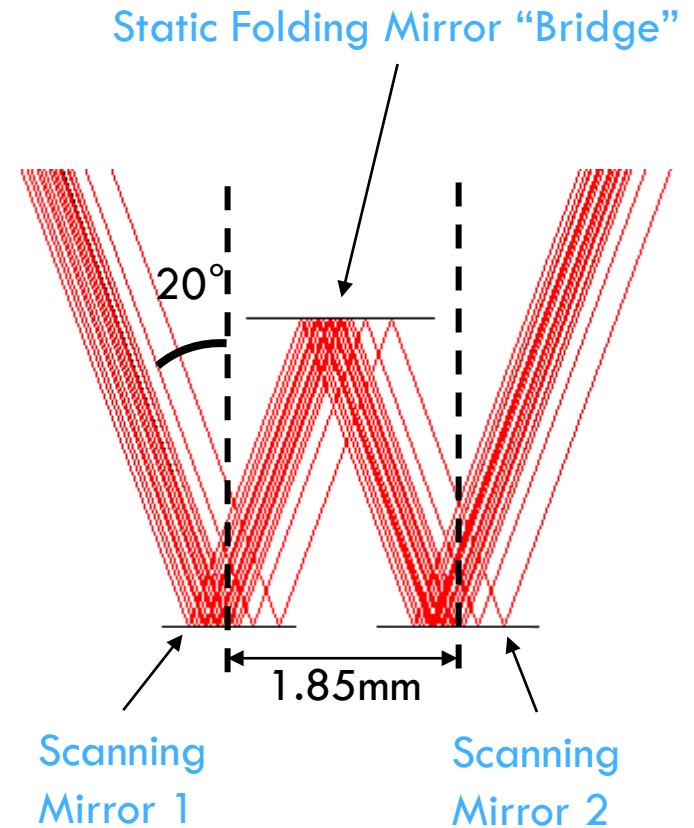
AOI = 20°
Input Beam to Output
Beam (center) angle = 40°
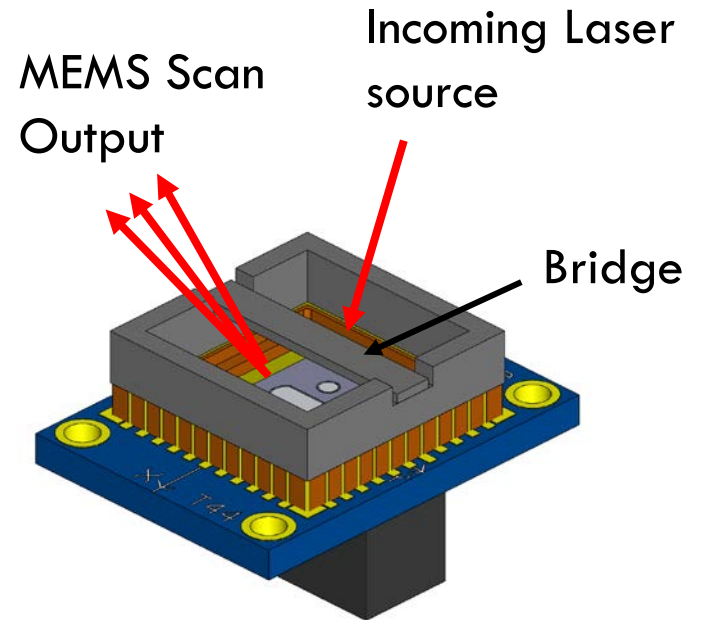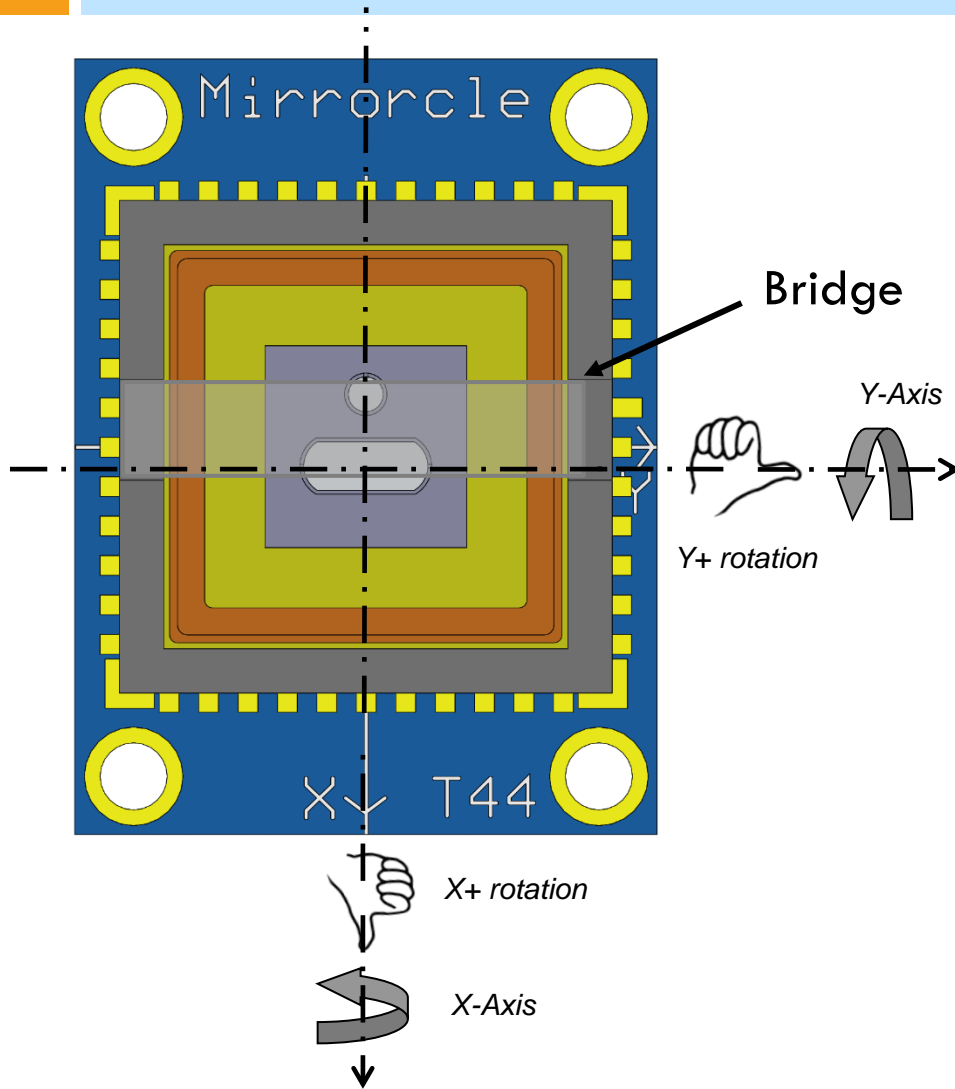
Laser source with collimation and
beam reduction optics

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Optical Parameters Overview

- ☐ Laser AOI onto first mirror (nominal): 20°

- ☐ Bridge angle (nominal): 0°

- ☐ Bridge height: 2.5mm

- ☐ Mirror-to-mirror distance: 1.85mm

Static Folding Mirror "Bridge"

20°

1.85mm

Scanning Mirror 1

Scanning Mirror 2

- ☐ Note: Demo is built with the shown arrangement, however production versions could have other angles/arrangements of folding mirror, etc.
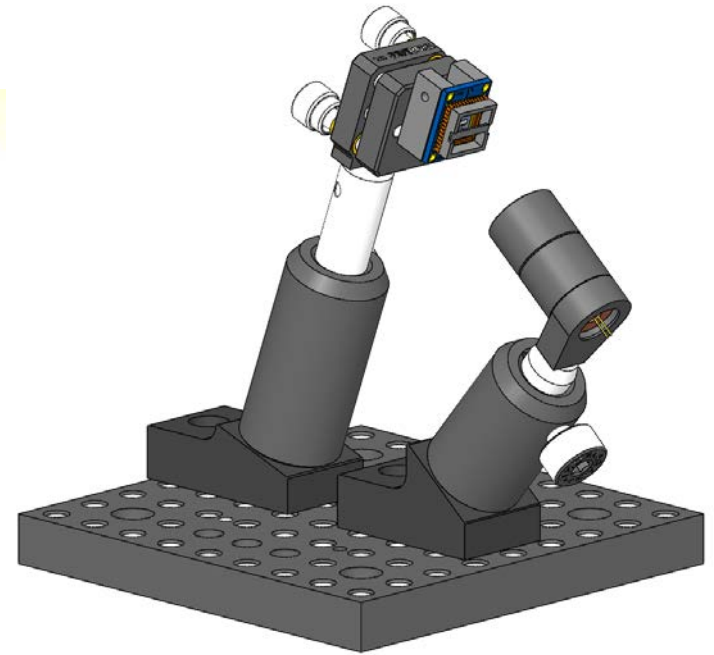
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MPM Orientation and Model

Bridge

Y-Axis

Y+ rotation

MEMS Scan Output

Incoming Laser source

Bridge

X+ rotation

X-Axis

Video Rate Projection and Imaging Demonstrator Kit

FPGA based MEMS Controller
and Software on USB

Optical Breadboarding with
mounting for MPM and laser module

Thank You for Choosing