System’s Features

• Large fields 30 mm or more.
• Arcuate scan line in the fast scan direction - linear translation of the system for the slow scan.
• All reflective system for minimal dispersion
• High NA, the example is 0.5NA but higher NA is possible
• High resolution, diffraction limited
• Optional low noise collection into small detectors
• Telecentric scanning
• Large working distance
• Used with a flat cranial window
An all-reflective design another view

Laser input beam

Even aspheric on the axis of symmetry

Scan mirror: Shown at three scan angles about the axis of symmetry

Arcuate scan about the axis of symmetry

Free form mirror

Flat cranial cover and nominal .3 mm thick tissue

Note: the different colors are for different locations of the scanning spot
Combined scanner and an Offner-like collector

Axis of symmetry

Collector primary mirror

Collector secondary mirror

Even spherical on the axis of symmetry coated with a dichroic coating

Arcuate detector

Scan mirror shown at three angles

Beam out of the compensator (not shown)

Arcuate scan at the Image plane

In TPM the scanning beam is usually in the IR, like 900 nm (shown in red) and the collected light is at half the wavelength at 450 nm (shown in blue). The aspheric mirror is coated to reflect the long wavelength in the TPM case and transmit the short wavelength.
Multiple beam scanning

The Offner-like collector is capable of imaging multiple arcuate scan lines onto a corresponding set of multiple arcuate slit detectors as shown below for 3 color coded scan lines which could be of the same wavelength and polarization or at different wavelengths or polarizations.

The detector slits are of small area and thus the low noise.
Scanner and a monolithic “glass-Offner” collector

Toroidal mirror about the axis of symmetry *coated with a dichroic coating*

Axis of symmetry

Offner Collector primary mirror

弧形探测器

弧形扫描位置

弧形探测器

弧形扫描在图像平面
Depth scanning and Adaptive Optics (AO)

The design was examined with changes of plus minus 100 microns in the water/tissue domain (shown not to scale below). An AO device on the input beam (not shown) is used to maintain the resolution at the tissue.