# Session III: Student Talks OI5

## Double-pass technique to compare different visual simulators in an Adaptive Optics environment.

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**Introduction:** Visual simulators based on Adaptive Optics (AO) technologies are increasingly used to test experimentally different multifocal and bifocal corrections prior to fabrication and patient implantation. This is especially relevant in the case of multifocal intraocular lenses (MIOLs) used for Presbyopia correction. In this study we use a polychromatic AO system, which incorporates a Double-Pass (DP) retinal channel to objectively compare through-focus optical quality with real MIOLs, phase plates (PP), and same design simulated with a Spatial Light Modulator (SLM) and temporal multiplexing with optotunable lens. - **Methods:** A custom polychromatic AO system was used, whose main elements are: (1) An illumination-Channel, with light coming from a supercontinuum laser source (450-1100nm); (2) An AO-Channel, consisting of the Hartmann-Shack wavefront sensor (HASO, Imagine eyes, France) and the electromagnetic deformable mirror (DM, MIRAO, Imagine eyes, France), to measure and correct HOAs, respectively; (3) A double-pass (DP) retinal imaging channel, composed by a CCD camera (Retiga 1300, QImaging, Canada) and an objective lens placed at a conjugate retinal plane. The system also incorporates a Badal system and a pupil monitor system. Two visual simulators were used: (1) a reflective LCOS (phase-only) Spatial Light Modulator (SLM) (Pluto-Vis, Holoeye) and (2) a simultaneous vision simulator (SimVis), composed by an optotunable lens (EL-10-30, Optotune) operating by temporal multiplexing. For comparison, similar designs in terms of real MIOLs and phase plates (lathe-manufactured multifocal surfaces) were also tested. The multifocal designs evaluated were: 2-zone angular and 3-zone radial designs (PP), a trifocal diffractive -TriD- and bifocal non-rotationally symmetric refractive -BiR-, were mapped in the SLM (as a spatial phase map), on SimVis (as a temporal profile) and as real M-IOLs. TF DP retinal image series were obtained while moving the Badal system (0 to +3D, in 0.25 D steps) for different pupil sizes. (5mm, 4mm and 3mm) **Results:** We can observe in these through-focuses (TF) images the bifocal pattern, simulated are the SLM, SimVis, and real lens and analyzed in terms of width at half height of each spot profile.

**Conclusions:** Results show a good correspondence between the through-focus DP images obtained when simulating the bifocal and trifocal patterns with SimVis and SLM and the real MIOL lens. Figura 1 shows the results for the bifocal pattern.