100% Fill Factor
White Paper

January 2008

Why Choose BNS?

BNS has been continuously developing liquid crystal spatial light modulators for over 15 years. Through this development process, there has been an advancement of SLM performance not matched by other SLM manufacturers. Such performance enhancement includes:

1) **Sub-millisecond frame loading to prevent phase droop and addressing latency;**
2) **100% fill factor to reduce higher-order diffraction;**
3) **Intra-pixel-pair modulo-2π transitions to maximize space bandwidth product;**
4) **Unique LC modulators**.

100% Fill Factor

The pixel structure associated with LCoS SLM backplane acts as a grating that diffracts considerable light into higher orders. BNS has developed a process for eliminating grating effects due to the pixel structure. Optically, the active area of the backplane is converted into a flat dielectric mirror by depositing and planarizing dielectric layers to eliminate the amplitude and phase variations associated with the underlying pixels. The dielectric stack is kept thin, allowing most of the field to drop across the LC layer. As shown in Figure 1, the field (represented by the density of the line pattern) is created by the voltage differential (ΔV_y) between the pixel pads and the coverglass electrode.

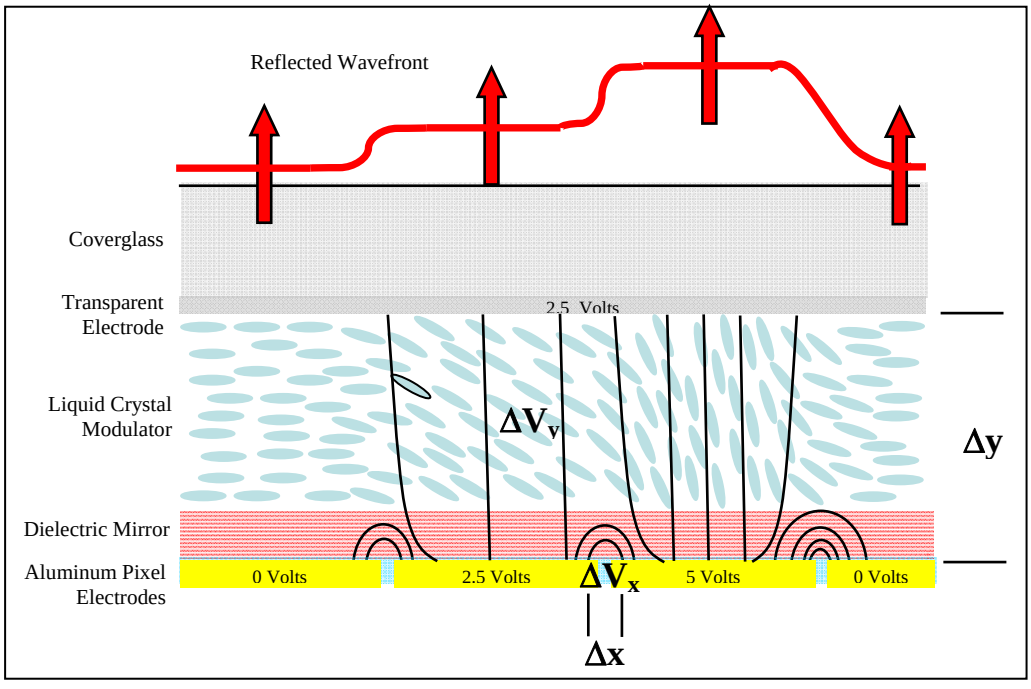

Figure 2 ~ Planarized dielectric mirror and smoothing of the electric field eliminate most of the grating effects associated with pixellated spatial light modulators.

If the combination of this voltage differential with the pixel-to-coverglass distance (Δy) is significantly greater than the voltage difference between adjacent pixels (ΔV_x) and the electrode gap (i.e. $\Delta V_y \Delta y >> \Delta V_x \Delta x$), then the optical path difference produced by the LC modulator will smoothly transition from one pixel to the next. In other words, there are no abrupt changes in phase modulation (such as dead zones) between pixels due to the smoothing (low pass spatial filtering) which results from separating the LC modulator from the driving electrodes.

Company Profile

Boulder Nonlinear Systems, Inc. (BNS) is an innovative technology company specializing in dynamic liquid crystal polarization control solutions for both laser-based and imaging systems. Company strengths in scientific research and development are leveraged into OEM and standard product offerings targeted for astronomy, biomedical, defense, microscopy, optical computing, optical storage, and telecommunications applications.

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