# AbstractID: 2894 Title: Exposure Rate Limitations for Light Image Intensifiers with Microchannel Plate Amplifiers used in a Micro-Angiographic Fluoroscope

**Purpose:** The region-of-interest micro-angiographic fluoroscope (MAF) enables both high-resolution rapid-sequence micro-angiography and fluoroscopy. The critical component is the micro-channel plate (MCP)-based light image intensifier (LII). The effect on maximum detector entrance exposure rate caused by LII nominal working-range limitations will be investigated.

**Method and Materials:** The prototype MAF we built consists of a 350 micron thick columnar CsI(Tl) scintillator coupled by a 2:1 fiber-optical taper to an 18mm diameter variable gain LII with two-stage MCP optically viewed by a 12-bit, 1024x1024, 30fps CCD camera. Pixel value versus exposure (0–870μR) was measured with a LII gain of $492(W/m^2)_{out}/(W/m^2)_{in}$ at two different exposure times: 6ms and 30ms. A calculation was made of the maximum entrance MAF exposure rate that results in the maximum LII phosphor screen luminance. The linearity of the MAF was also measured with a higher LII gain of $7{,}728(W/m^2)_{out}/(W/m^2)_{in}$ and a lower lens collection efficiency at an exposure time of 30ms to show the effect of limitations in the LII nominal working range.

**Results:** The MAF with a LII gain of $492(W/m^2)_{out}/(W/m^2)_{in}$ demonstrated linear behavior with 30ms exposure times when the maximum exposure rate was 29μR/ms; however, large fluctuations of mean pixel values occurred for 6ms when the exposure rate exceeded 30μR/ms. The calculation at maximum luminance predicted a maximum entrance detector exposure rate of 32.6μR/ms. The MAF used at a higher LII gain of $7728(W/m^2)_{out}/(W/m^2)_{in}$ demonstrated a non-linear behavior and average pixel value fluctuations in the exposure range 81-870μR.

**Conclusion:** LII working range limits must be considered in the design of the MAF. The measured instability occurred for exposure rates above the value calculated to result in maximum LII luminance. Higher lens collection efficiency can enable the use of a lower LII gain and increased entrance MAF exposure rate.

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