Purpose: Two-dimensional ion chamber arrays are widely used in the clinical setting for the verification of MLC dose planes for IMRT treatment plans. However, the sampling resolution of these arrays has been shown to break down during the measurement of small, highly-modulated fluences as seen with IMRS. These fields generally fail due to spatial frequency contributions exceeding the necessary sampling rate as defined by the Nyquist criteria. A study was performed to examine the effects of an extended SSD measurement technique on chamber array resolution.

Methods: HD-MLC line pair patterns with decreasing slit openings from 1.25 to 0.25 cm at isocenter, corresponding to line pairs of increasing frequency (0.4 to 2 cm$^{-1}$), were used to examine an l'mRT MatriXX phantom at various SSDs. A Varian TX accelerator was used to apply 200 MU of 6X photons on the array set at 89, 119, and 208 cm SSD. Additionally, an IMRS patient plan with a poor gamma passing rate (90% of pixels passing 3%, 3mm) at conventional SSD was re-measured with the MatriXX placed at 208 cm SSD.

Results: At 208 cm SSD, this technique increased the number of sampling points per field a factor of 4.8 while improving the spatial resolution by a factor of 2.2 in any direction. Frequency contributions up to 2 cm$^{-1}$ at isocenter were resolved by an effective chamber sampling rate of 3 cm$^{-1}$ at extended SSD. This technique was able to increase the gamma passing rates of all ten IMRS fields to above 95%.

Conclusions: This study demonstrates that an extended SSD measurement can improve the sampling resolution of the MatriXX device with little alteration to existing IMRT QA calculations or procedures. This method allows for the successful measurement of highly modulated fields without using EPID, film or array-shifting QA techniques for improved resolution.