170g Poisson's Effect in Electrical Field Flow Fractionation

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Recent and earlier models of Electrical Field Flow Fractionation (EFFF) have assumed that the electric field within the fluid domain is governed by Laplace's Equation. This assumption results in a linear potential and a spatially constant field across the channel and is generally true for very dilute systems and relatively high effective potentials. Experimental studies show, however, that the effective potential within the channel may be as little as 1% of the applied potential, this due apparently to double layer formation and charge buildup at the poles. In such cases, local analyte concentrations can be orders of magnitude higher than the bulk mean and the local potential gradient small, both of which can lead to a non-linear spatial distribution of the field strength. In such cases Poisson's Equation must be used in place of Laplace's Equation. Both stead-state and dynamic EFFF simulations were performed using a Poisson's equation based model. The domain in which Laplace's Equation is valid was identified and the effects of concentration and effective field strength on device performance were explored.