Data Analysis and Polarization Measurements with GEMS

Here is my abstract:

The Gravity and Extreme Magnetism SMEX (GEMS) mission was selected by NASA for flight in 2014. GEMS will make the first sensitive survey of X-ray polarization across a wide range of source classes including black hole and neutron star binaries, AGN of different types, rotation and accretion-powered pulsars, magnetars, shell supernova remnants and pulsar wind nebulae. GEMS employs grazing-incidence foil mirrors and novel time-projection chamber (TPC) polarimeters leveraging the photoelectric effect. The GEMS detectors image the charge tracks of photoelectrons produced by 2 - 10 keV X-rays. The initial direction of the photoelectron is determined by the linear polarization of the photon. We present an overview of the data analysis challenges and methods for GEMS, including procedures for producing optimally filtered images of the charge tracks and estimating their initial directions. We illustrate our methods using laboratory measurements of polarized and unpolarized X-rays with flight-like detectors as well as from simulated tracks. We also present detailed simulations exploring the statistics of polarization measurements appropriate for GEMS, and make comparisons with previous work.