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(G*) Improving the Super-Kamiokande systematics uncertainties by characterizing single PMT response at the photosensor test facility

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The Super-Kamiokande (Super-K) is a neutrino detector in Japan that aims to study neutrino sources (atmospheric, solar, supernovae), search for proton decay, measure neutrino oscillation and accelerator neutrinos. It contains ˜11,000 photomultiplier tubes (PMTs) surrounding a massive tank filled with 50 ktons of ultra-pure water.

One of the limiting factors for more measurements of neutrino properties (such as δCP and the neutrino mass hierarchy) and for the sensitivity of higher statistics, larger experiments such as Hyper-Kamiokande are the systematic uncertainties of the detector which is currently around 3% for Super-K. One of the potential sources of systematic uncertainty is our understanding of the PMTs individual responses to external variables such as the magnetic field and the angle of the incident light . Hence, precise measurements and characterization of the PMTs are required to reduce the uncertainty. The photosensor test facility (PTF, at TRIUMF) was recommissioned and improved to measure very precisely the variations of the PMT response in respect to the magnetic field, the polarization, the incident angle, position and the photon energy, all variables that are mixed together in the experiment. These measurements can then be integrated into the Super-K large scale simulation to decrease their contribution to the systematic uncertainty.

During this talk, I will present the work done to rebuild the facility, some of the improvements done on the software and hardware along with preliminary measurements and their application to simulations

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