# CHAPTER V

# CONCLUSIONS

In this work, we presented the calibration neutron monitor results on FLUKA program with Monte Carlo technique to study the interactions of the secondary particles in the calibration neutron monitor and the effects of the environment on its count rate.

We simulated the calibration neutron monitor on cradle, which we set inside and outside the PSNM station with new weight beam of all particles, energies and directions. The initial values of atmospheric secondary particles at Doi Inthanon in Thailand were calculated by John Clem of U. Delaware at the highest point on the Earth with cut-off rigidity of 16.8 GV.

From the simulation results, most of the count rates from calibration monitor and neutron monitor are for neutrons which these monitors detect at about 100 MeV. Other count rates are for proton, positive muon, negative muon, positive pion, negative pion, photon, electron, and positron which are detected as a function of the kinetic energy.

From the experiments and simulations, we conclude that the count rate ratio of the CAL/NM are ~0.00510(4) and ~0.00501(4) for the calibrator height 70 cm and 140 cm respectively. The count rates at the calibrator height of 70 cm are larger than the calibrator height of 140 cm by 1.78% because the probability of reflected neutrons into the lower calibration monitor is high which depends on solid angle between the calibration monitor and the ground. This means that the count rate of the calibration monitor is a function of calibration monitor height. The ratio of CAL/NM from simulation when filled with water in the pool at various water heights is close to constant which is different from experimental results at Doi Inthanon. The count rate ratio of CAL/NM in experiment decreased as a function of the water height. Our simulations are not able to explain absolutely the effect of neutron absorption by water.

The simulation results of CAL/NM when we moved the position of the CALMON inside station to compare count rate inside and outside of the PSNM station are 0.0053(1) and 0.00513(3) respectively. The experimental results of CAL/NM for inside and outside station are 0.005722(3) and 0.005546(2) respectively. Therefore, the difference in value of count rate is in agreement with the measurements. The count rate ratio of CAL/NM inside is larger than outside station. The building environment affects the count rate of calibration monitor, which corresponds to the count rate difference from calibration monitor inside and outside station.

This research, the calibration simulations of a neutron monitoring system, Monte Carlo calculations plays a major role to study and correct various effects. This requires several repetitive simulations. This research work used Monte Carlo simulation to study the response of a calibration neutron monitor. It is therefore recommended to replicate the simulation several times to reduce the error in order to modify the model for more accurate results. It will also be useful to create a data base for the neutron monitor.