RESUME

Today there are several big projects in nuclear physics and main aim of these projects is to learn more about universe and fundamental laws influencing it. Researches in nuclear physics are done with accelerators. LHC (Large Hadron Collider) experiment is one of the better-known experiment among ongoing experiments. Particles are accelerated and collided in LHC and we study new particles born from these collisions. There are several different experiments carried out within LHC. Among them ATLAS Experiment holds a special place. Modeling tasks are very important in ATLAS Experiment. Monte Carlo method is used for modeling. Modeling gives us opportunity to study particles in every way, but in many cases, results of modeling and actual experiment are different and this is the important problem of the research. One of the reasons for this discrepancy might be inaccurate geometric descriptions. Thus, ATLAS detectors components descriptions compare analysis is very impotent task.

<u>I chapter</u> describes ongoing projects in nuclear physics. It is about history of nuclear physics, how was accelerators made and upgraded. This chapter reviews current ongoing projects in nuclear physics such as ITER (International Thermonuclear Experimental Reactor), HERA, FAIR (Facility for Antiproton and Ion Research), LHC (large Hadron Collider), KEK (The High Energy Accelerator Research Organization). Aims and ways to reach those aims are described. Also, structure of ATLAS detector is described. It consists of 4 main structure which are: Magnet System, Inner Detector, Electromagnetic and Hadronic Calorimeters, Muon Spectrometer.

<u>II chapter</u> describes event modeling. ATLAS experiment modeling process is performed in Geant4 modeling package. In simulation of ATLAS Experiment 4 main sub-detectors are used: Muon Spectrometer, Magnet System, Inner Detector, Electromagnetic and Hadronic Calorimeters. Also, CATIA is reviewed, as a platform for modeling. Ways to create geometric primitives and methods to use needed functions on the base of AGDD/xml, Geant4 and GeoModel are described. Problem is fixed, real and modeled experiment results are different. There is an assumption that the reason of this discrepancy is wrongly modeled geometry in modeling package. One of the most problematic area for modeled ATLAS detector experiment is Toroid Magnet area. The aim of the thesis to do compare analysis between real and simulated geometries.

<u>III chapter</u> goes into details of toroid magnet structure and its functional purpose. It weights approximately 240 ton and consists of 11 sub-components. Firstly, SmarTeam engineering database model of Toroid Magnet was analyzed and determined that it was too detailed. Thus, it was reproduced. 902 drawing were used to reproduce Toroid Magnet. This chapter describes every step and method used to reproduce Toroid Magnet. All 11 sub-components of toroid magnet were reproduced. Whole construction consists of 211 Assemblies, 2046 Parts and 16181 Geometric Features.

<u>IV chapter</u> describes compare analysis between toroid magnet model from the simulation package and reproduced model of toroid magnet. 11 structures were analyzed. As a result, there were significant discrepancies between reproduced Toroid Magnet model and Geant4 Geometric descriptions existing in simulation package. 2 structures were found to be 100% different. There were also significant differences between the remaining

structures, which were 58%, 26.5%, 24% and so on. Because of such differences, a change in geometric descriptions of the Toroid Magnet in simulation package was needed.

V chapter describes simplification of reproduced Toroid Magnet. Each reproduced model was simplified by maintaining volumes and masses. 9 structures have been received as a result of simplification. Reproduced and simplified models have a weight difference of maximum 0.02%, which is negligible considering weight of the model. Here is also revived preparation of xml code, the primitives and functions used to create Toroid Magnet code. Totally 22 arbitrary polygon, 21 box, 15 tube and 15 subtract Boolean operation was used. The last part of this chapter discusses conflict analysis of Toroid Magnet described in XML. Two types of analysis were conducted an internal and integration conflicts. As a result, 5 internal and 3 integration conflicts have been observed. To eliminate these both geometry and its position have been modified.