Coordinate measuring systems carry multiple advantageous in the field metrology, such as the universality of their applications, as well as speed, automatization capabilities, and increasingly, their use of use. On the other hand, the most notable disadvantages associated with standard coordinate systems stem from their limited measuring space and lack of portability. In order to alleviate such drawbacks, several laser tracking systems have been developed, including Laser Tracker, and Laser Tracer. Systems of this type are relatively small in size and fully portable. Owing to their considerable benefits, laser tracking systems have been widely used in several industry sectors, such as aviation, shipbuilding, automotive industry, and in measurements of large-scale components. The scientific objective of the project is to develop a mathematical model of laser tracking systems accuracy based on both distance and angular position measurements. The model will incorporate the most important factors affecting measurement results and measurement uncertainty of the considered system. The model should simultaneously account for the impact of distance measurement system errors (resulting, among other factors, from light wave frequency stabilization errors, light wave length compensation errors, and in particular ambient conditions compensation errors, errors induced by vibrations in axes perpendicular to light beam axis, reference point position errors, and errors attributable to manufacturing precision or positioning of optical equipment), as well as angular measurement system errors (resulting from typical errors associated with the use of encoders, e.g. interpolation errors, concentricity errors, and mounting errors within the system, e.g. perpendicularity error, axis intersection error). Based on previous experience acquired by the project coordinator at the Laboratory of Coordinate Metrology during previous projects focusing on the development of accuracy models for coordinate measuring system, it was resolved that in the case of the proposed project it would be advantageous to implement a method of defining the general model on the basis of analysis of a detailed model of the discussed system. Thus, the research plan encompasses the following tasks:

- Impact analysis of errors associated with general operating principles of the distance measuring system, and angular position measurements of the laser tracking system
- Development of a workstation for verification of the system of ambient conditions, including modeling and measurement of parameters influencing distance measurements performed on laser tracking systems
- Impact analysis of errors associated with the operating principle of the environmental conditions system, which includes modeling of parameters influencing distance measurements performed with laser tracking systems
- Definition of mathematical model for determination of simulated point coordinates with regard to the influence of errors of the distance measurement system, angular position system, as well as environmental conditions measurement system
- Definition of a detailed numerical model on an example laser tracking system with regard to the influence of errors of the distance measurement system, angular position system, as well as environmental conditions measurement system
- Experimental verification of the developed model
- Development of a general procedure for implementation of accuracy models for laser tracking systems based on both distance and angular position measurements
- Development of general guidelines for implementation of accuracy assessment models for systems based on measurements of both distance and angular position