Q1.

What's the difference between our launch (robot_pose_ekf.launch) file and original launch file? And please explain why we add these modifications.

A1.

There are three difference between our launch file and original launch file.
First, the value of "output_frame" change from "odom" to "odom_combined", it just changes the name of publish topic.
Second, the "odom_used" is close, because we don't need to use.
Third, add <remap from="vo" to="/zed/odom" />, because our subscribe topic name is "/zed/odom", so we need to remap from "vo"(our input in .cpp file) to "/zed/odom".

Q2.

Which parts in IMU data and ZED odometry are used? And please explain why it choose this way.(odom_estimation_node.cpp)

A2.

In IMU data, the header, orientation and orientation_covariance data are used.
In ZED odometry data, header and pose.pose(position) data are used.
When we do ekf, we need just the time(header) and position data. In <sensor_msgs/IMU> orientation data is easier to convert into position data than angular velocity and linear acceleration, so we choose it. In <nav_msgs/Odometry>, the position data is in ->.pose.pose.position(x,y,z), so we choose it.

Q3.

Please try to adjust covariance setting in odom_estimation_node.cpp (in imuCallback() & voCallback()), and observe how it affect the resulting path.Also, give your opinion which setting is better, and why?
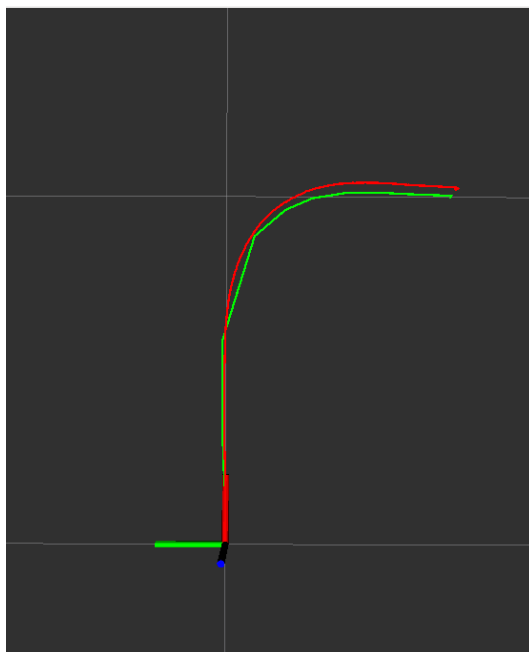
A3.

I tried three ways to find the relationship. Imu covariance equal to vo covariance, imu covariance smaller than vo covariance, and imu covariance larger than vo covariance. The result is below. When the imu covariance enhance, the result(green line) is not

similar with the only visual odometry data(red line), it means imu data and visual odometry have some deviation. In the real case, we thought the deviation in visual odometry is smaller than the deviation in imu data. So, we thought vo covariance higher than imu covariance is better.
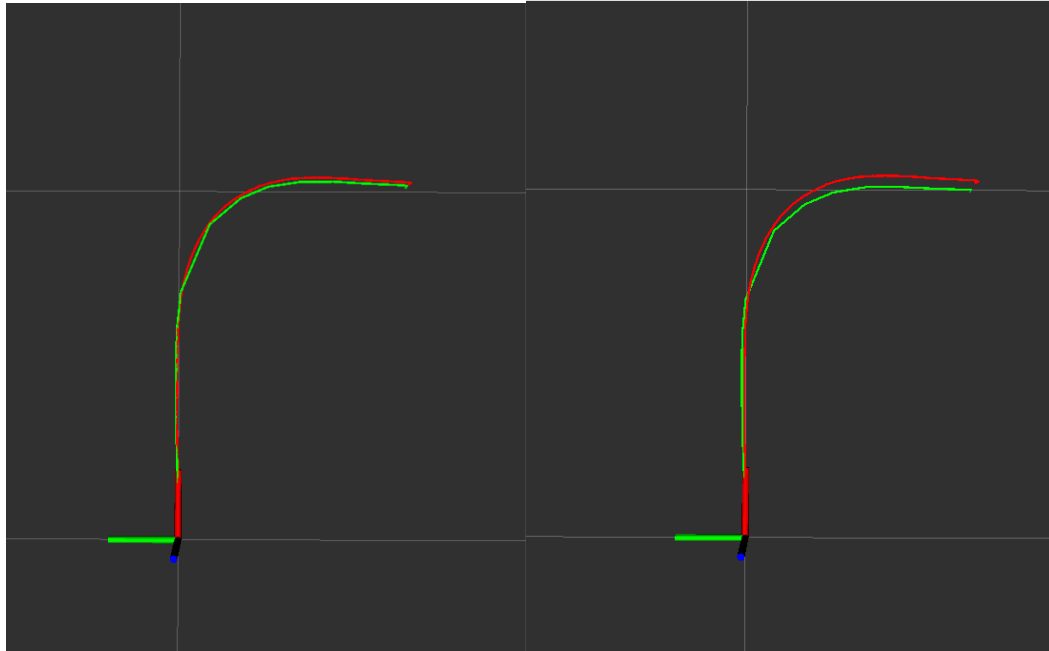
Imu(3) vo(6) (original)

imu(6) vo(6)

Imu(9) vo(6)