Normalized Innovation Squared (NIS)

NIS is used to determine the consistency of designed Filter. For calculating NIS I used below formula:

$$\varepsilon = \left(z_{k+1} - z_{k+1|k}\right)^T \cdot S_{k+1|k}^{-1} \cdot \left(z_{k+1} - z_{k+1|k}\right)$$

Step for calculating NIS:
1. Calculated NIS using the above formula for both Laser as well as Radar.
2. Created and saved the calculated NIS_laser and NIS_radar text files.
3. Changed the noise_ax and noise_ay values which eventually impacts the process noise and finally the NIS values.
4. Calculated NIS with noise_ax and noise_ay set to 9 as well as 5.
5. Plotted the NIS values for Laser, with degree of freedom 2 and compared against chi squared distribution value of 5.991 (5%).
6. Plotted the NIS values for Radar, with degree of freedom 3 and compared against chi squared distribution value of 7.81 (5%).

$\varepsilon \sim \chi^2$

| df | $\chi^2_{.950}$ | $\chi^2_{.900}$ | $\chi^2_{.100}$ | $\chi^2_{.050}$ |
|---|---|---|---|---|
| 1 | 0.004 | 0.016 | 2.706 | 3.841 |
| 2 | 0.103 | 0.211 | 4.605 | 5.991 |
| 3 | 0.352 | 0.584 | 6.251 | 7.815 |
| 4 | 0.711 | 1.064 | 7.779 | 9.488 |
| 5 | 1.145 | 1.610 | 9.236 | 11.070 |

7. To review all the NIS values for both Laser and Radar with different noise_ax and noise_ay check Folder NIS Calculations.