Measuring Bullet Run-Out

Run-out of a bullet refers to the difference in diameter across different points as the bullet is rotated about its central axis. The first problem is how to hold the bullet so that any variation in diameter measured is actually the bullet, and not due to the method of holding and rotating it. That is, how do you secure the bullet so that it is rotated about its true axis, and not at a slight angle, and how do you "null out" the normal tolerances found in any rotating system so that you are not combining bullet and tool tolerances?

Holding the bullet in a precision collet and rotating it in a device with known, measurable run-out, such that a precision ground rod can be substituted for the bullet, and any run-out noted as the spindle is slowly turned can be marked at the high and low points with a marker pin on the front of the collet. This will let you know precisely how much and where the tool itself has consistent, repeatable run-out so you can subtract this from the bullet measurement.

If the tool exhibits random run-out (looseness, changes in the location of high and low points as you repeat the test at different times, or at different temperatures) then this will become a limiting factor as to how precisely you can measure the bullet. For instance, if the tool itself shows a non-repeatable or random 0.0002 inch variation, your measurement will only be accurate to plus or minus 0.0002 inches. If you read a variance of 0.0015 inches when measuring a bullet, you can only say you may have a variance of 0.0011 due to the bullet. It is safer to ignore the order of magnitude (decimals smaller than 0.001) in which you read the tool variance itself.

If you are using a V-block with a dial indicator, then tool variances depend on how securely the indicator support and mechanism itself can hold a given diameter reading, as well as how parallel the V-way might be, especially when trying to measure on a curved or tapered portion of a bullet. For best results, only measure on parallel portions of the bullet shank. This eliminates some of the effect of sliding the bullet or moving it slightly forward and backward during rotation.

When measuring a cylinder (non-tapered, parallel sides) the cylinder must be held in the collet so that the axis of the cylinder and axis of rotation of the collet are the same. If the bullet is held at a slight angle, due to slight imperfections in the collet closure, hole, debris, tool marks, closure of one segment slightly more than the others, etc., then the reading of run-out will not be true. You will be reading a combination of any run-out in the bullet plus the wobble of the bullet as you rotate the collet. This is easy to test by marking the high and low points on the collet with a Magic Marker, then removing the bullet, replacing it, and measuring again. If you get differences in not only where the high and low points are (compared to a mark on the side of the bullet) but how much they are, the setup is not co-axial.

If your measuring tool shows a variation on a precision ground rod that is calibrated to at least 10 times closer tolerance than you need to read (that is. a ground rod that is held to plus or minus 0.0001 and you only need to read 0.001 tolerance) you can note where the high and low points are, mark the rod and the tool, and then ignore this much variation taking place at the same point when you are measuring the bullet. If you mark the high and low point on the bullet circumference, then remove and replace the bullet so the marks are in a different position relative to the collet marks, you can average the readings and get closer to a true run-out spec for the cylinder portion of the bullet OD. On a dual diameter bullet, the pressure of the indicator against the smaller diameter may slightly "tip" the bullet downward when using a V-way instead of a collet system of measurement. This can give an exaggerated reading of run-out that is not correct. Rough areas, serration lines and other non-concentric surface effects can cause the bullet to read artificial run-out, which in fact is not there.