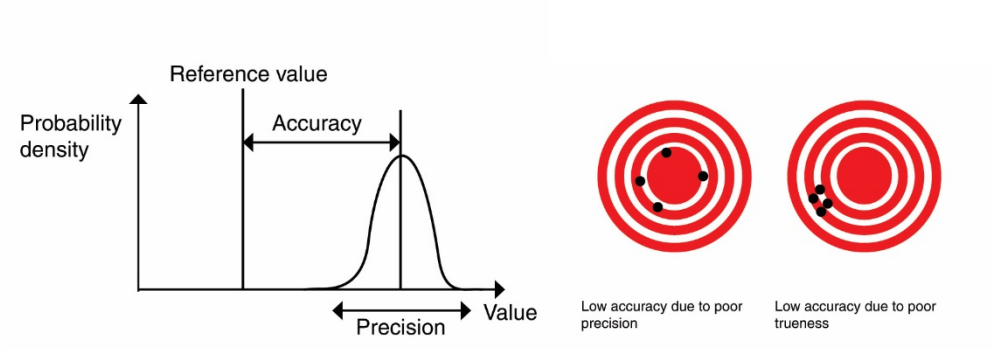
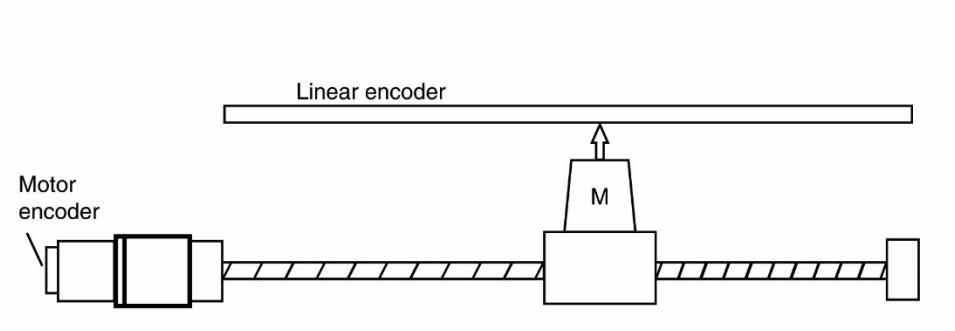
Accuracy and precision:

Accuracy refers to closeness of the measurements to a specific value,
while **precision** refers to the closeness of the measurements to each other. Also called repeatability.



Let's consider this example:



a servo motor is connected to a lead screw through a planetary gear. The load is connected to a secondary linear encoder.

Motor encoder resolution : 10,000 PPR
Linear encoder resolution : 1um (one micron)
Gear ratio: 1:10
Gear backlash: 10 arc min
Lead screw pitch: 10mm
Lead screw backlash: 1um

Let's calculate the **accuracy** of the system:
If we assume a rigid system (no backlash) then the minimal possible step will be:
[10mm (pitch)] / [10,000 revolution (moto encoder)] / [10 (gear)] = 0.0000001m = 0.1um.
Since our linear encoder is 1um, our position loop will give us a 1um resolution .

* assuming ideal encoder

The motor encoder is recommended to have at list a X10 better resolution than the reflected load encoder!

Now for the **precision**:
[1um(leadscrew)] + [10mm(screw pitch) / (21,600arc minutes in gear cycle) * 10arc min(gear)]=

1um + 4.6um = 5.6um is the maximal mechanical error.
In this example the linear encoder will allow us to correct the errors and bring precision to 1um.

*assuming ideal encoder