# DistoX calibration with TopoDroid

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# What is a “calibration”?

- Analogy: a scale


Mechanical calibration

# Why “calibration”?

- The DistoX contains tri-axial Magnetic and accelerometric sensors
- The sensors axes are not perfectly orthogonal
- the X sensor axes are not perfectly aligned with the laser direction
- sensors have different bias and gain

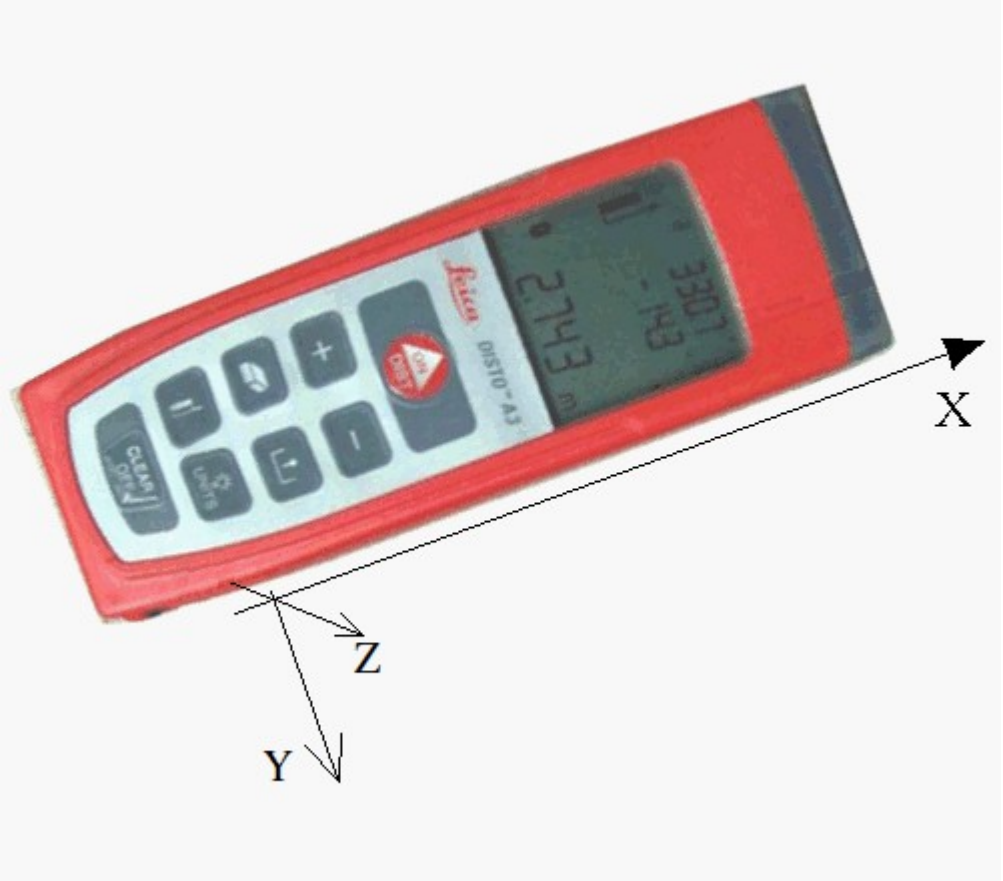
# Calibration transformation

- the DistoX calibration is a geometrical transformation that “rotate” the sensors measurements into the frame of reference of the DistoX
- 24 (or 27) numbers
- uploaded and stored in the

DistoX

- automatically applied to

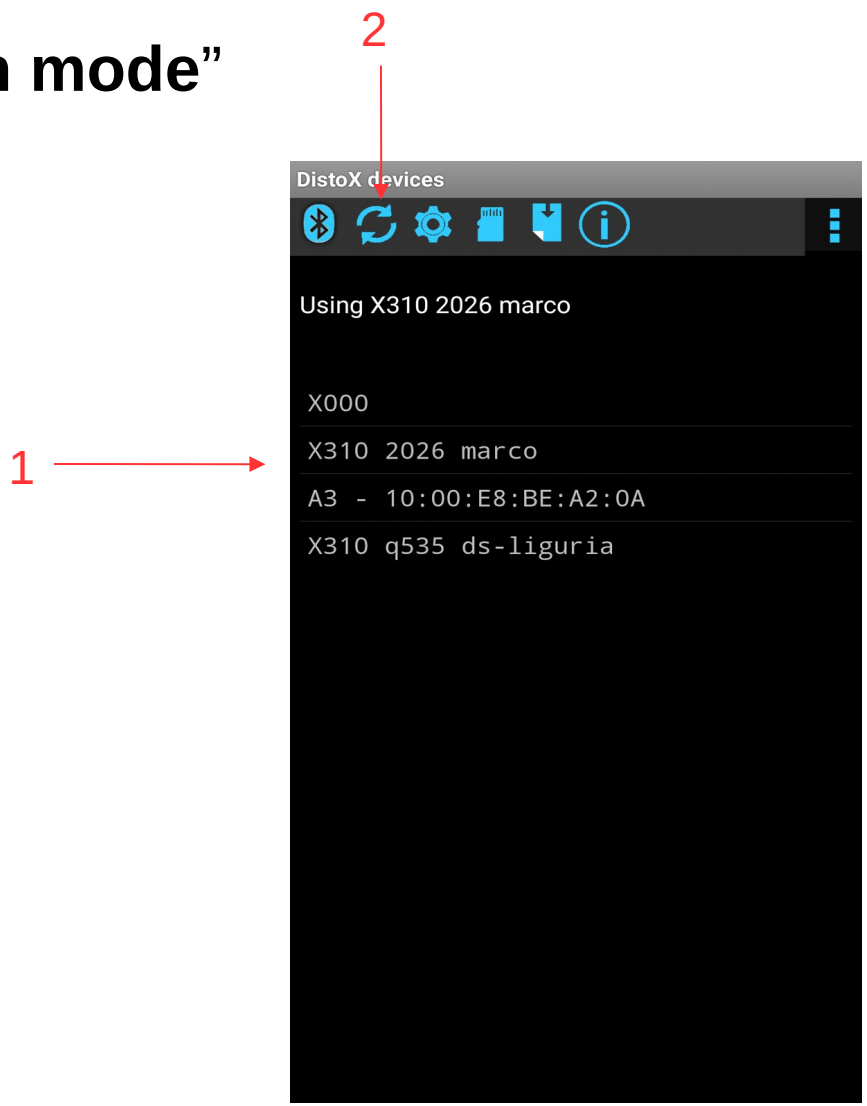
every measurement



# How to “calibrate” a DistoX? [1]

1 Select the DistoX to calibrate as work device

2 Toggle the DistoX into “**calibration mode**”

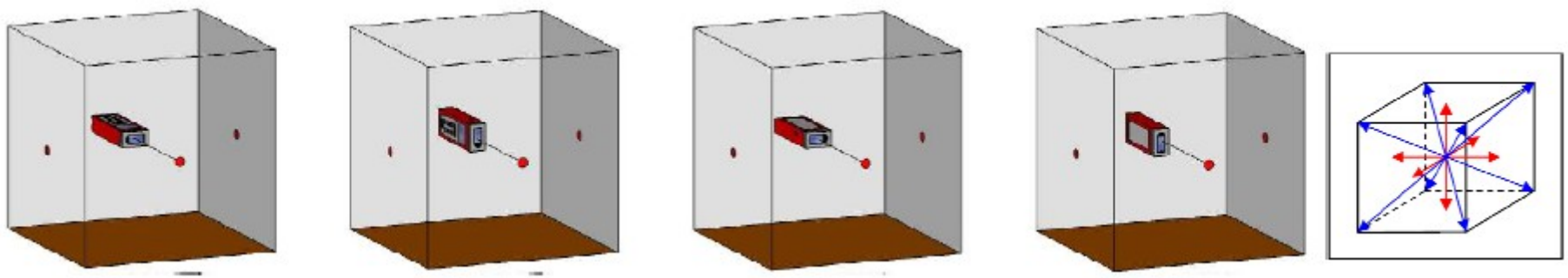


# How to “calibrate” a DistoX? [2]

- Take several measurements in directions that **covers all the azimuth and inclinations**
- For each direction **four** measurements rotating the DistoX around the laser axis by 90° at a time
- At a minimum (face centers and corners of a “cube”):
  - four directions in the horizontal plane, roughly at 90° of azimuth with one another
  - four directions at +35°, and four at -35°, roughly at 90 degrees of azimuth with one another, possibly at 45° of azimuth with those in the horizontal plane
  - one direction upward +90°, and one -90°
- But you can take many more !!!

# How to “calibrate” a DistoX? [3]

- Calibration shots must be taken
  - in an environment with **constant magnetic field**: cave, wood. Not good: house, town, etc.
  - between **fixed** points: “stations”
  - enough **far apart** points (the farther the less uncertainty in the angle): 3 m
  - no need to be perfectly aligned to the “directions” of the “cube”



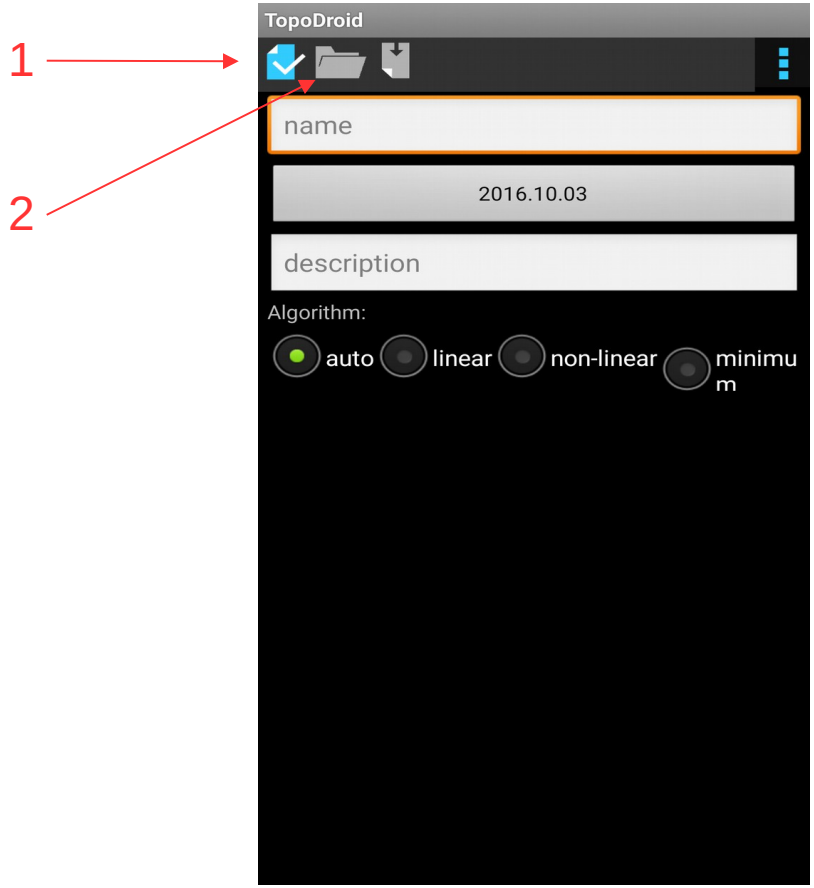
From L. Redovnikovic et al., INGEO 2014, 269-274

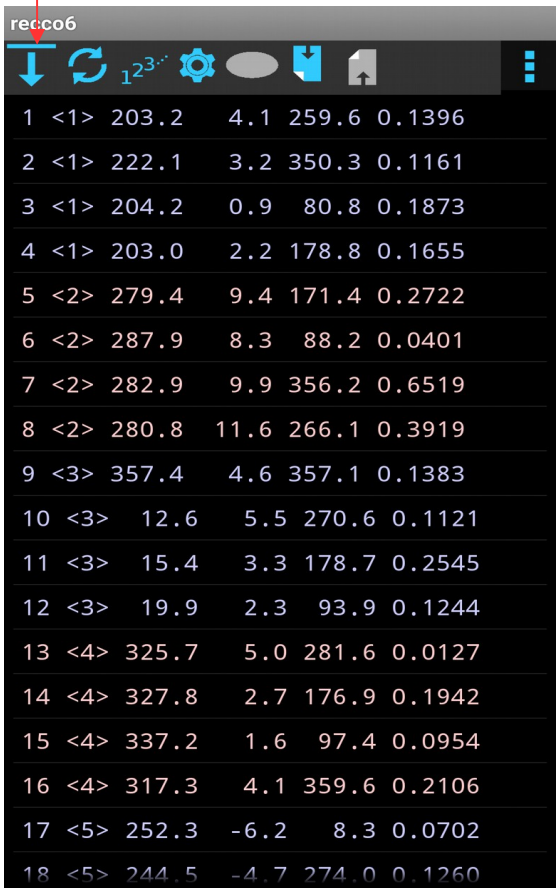
# How to “calibrate” a DistoX? [4]

1 Create a new Calibration in TopoDroid

2 Open it

3 Download the calibration shots



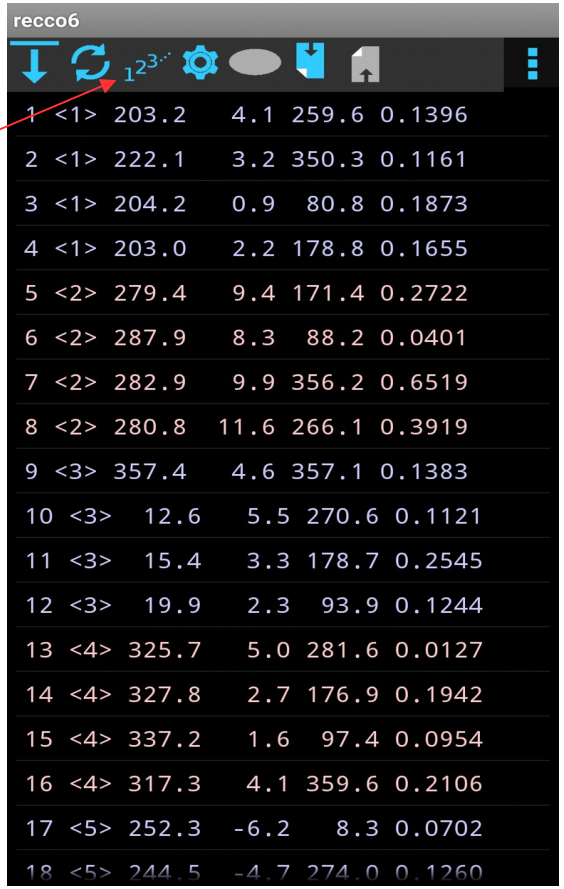
# How to “calibrate” a DistoX? [5]

1 Split the data into **groups** of four

each group corresponds to a set of four shots for a direction

N.B. TopoDroid implements other “grouping” policies, but “four per direction” is the best and the simplest: the DistoX displays the number of calibration shots and it is easy to see if this is a multiple of 4

1

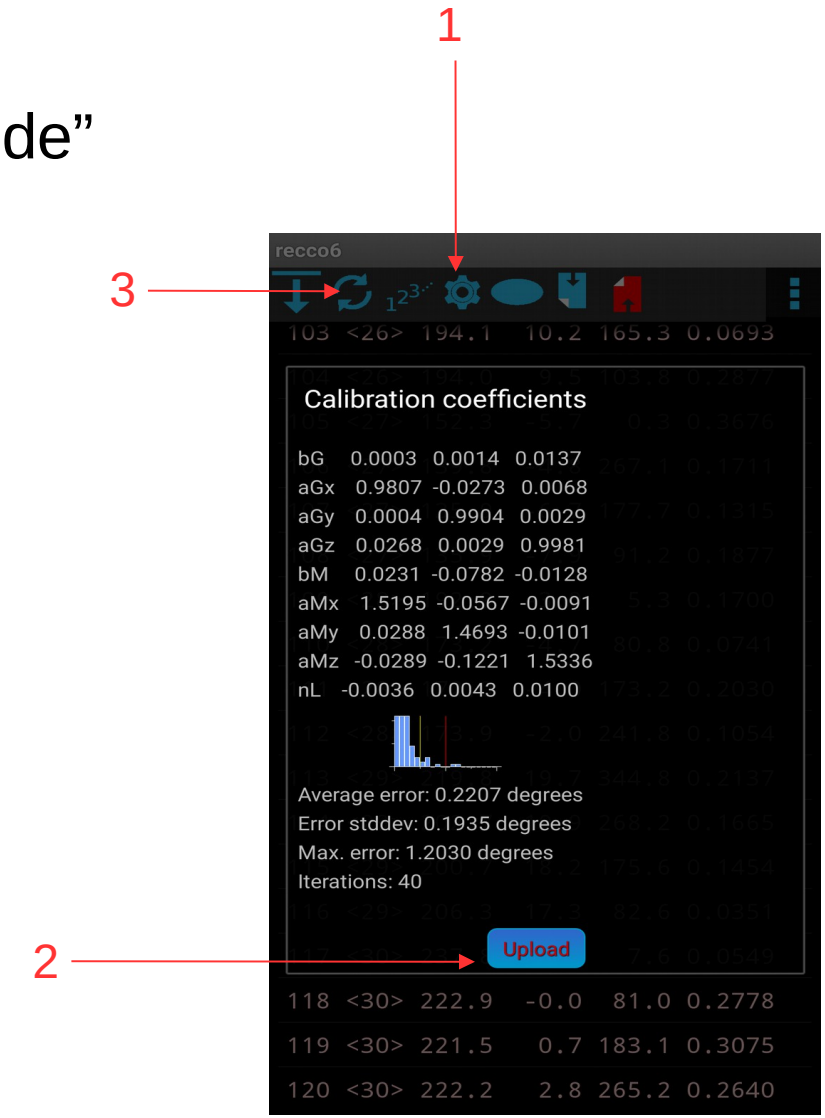


# How to “calibrate” a DistoX? [6]

1 **Compute** the calibration coefficients

2 **upload** them to the DistoX

3 and revert the DistoX to “normal mode”



# Troubleshooting

- How can I tell whether the calibration is **good or not**?
  - The dialog with the calibration result has the histogram of the “error” of the shots: the calibration is “good” if all the bars are to the left of the red line, with most to the left of the yellow one
- How can I **exclude a shot** from the calibration computation?
  - Assign a group of “0” to it
- What if I take a **bad shot** by mistake ?
  - take other shots to complete the group of four and do not use them in the computation of the coefficients
- Can I take other groups of four shots and add them to a calibration?
  - yes

# Calibration settings

- Group policy
  - Group tolerance
- Algorithm
  - Algorithm error
  - Algorithm max. iterations
  - Min-algo params
- Raw data

# Next

- Other TopoDroid calibration functions
- Calibration checks
- Calibration validation
- Calibration algorithms
- B. Heeb's calibration algorithm