# EMS Survey instruments

## The How, What and When

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**Devico survey tools @ geomem:**
http://www.geomem.com/catalogue/categories/82/devico.html

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# Electronic
# Multi-shot
# Systems

Specifically refer to systems using Magnetic and Gravity sensors.

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# The Sensors:

**3 Accelerometers** (Earths gravity field)

Accelerometers / gravity = INCLINATION

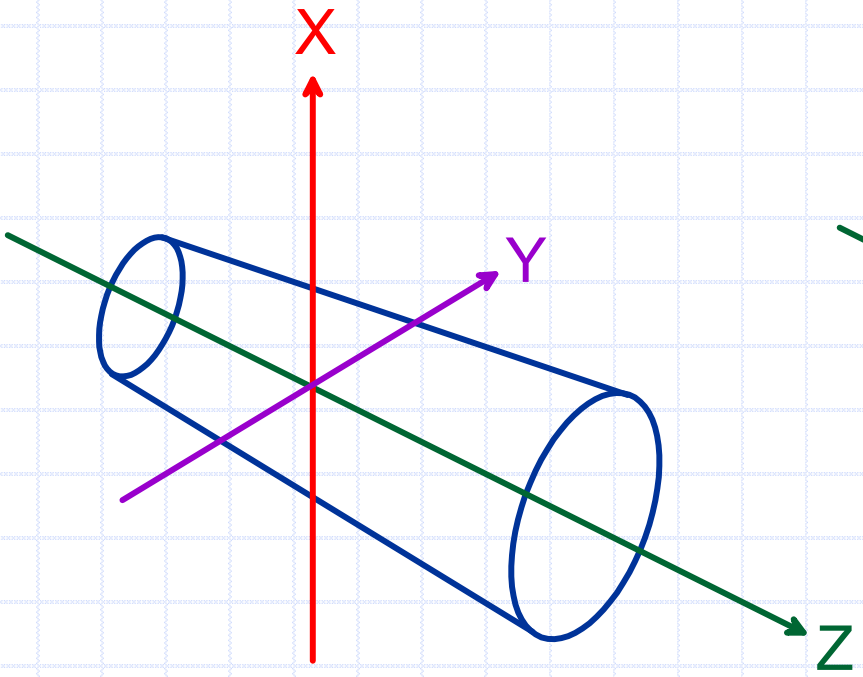
**3 Magnetometers** (Earths magnetic field)

Magnetometers = DIRECTION

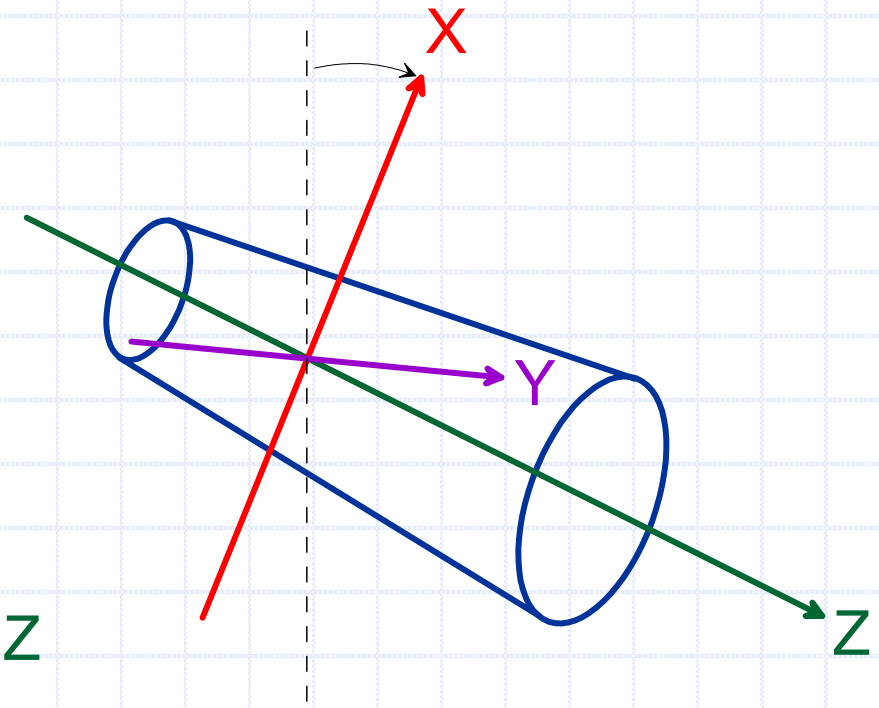
Set at right angles (orthogonal) to each other (Tools internal axes) to define required vector …

# Internal axes (raw data):

The internal axes (X, Y, Z) of the survey tool.




X and Y axes rotate about Z as the tool rotates during survey.



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# Accelerometers:

- Record Gravitational field (vertical, 1.0 G)
- Inclination – 3 components relative to vertical
- Always “accurate” unless moving!
- Quality check of 1.0 G +/- 2%

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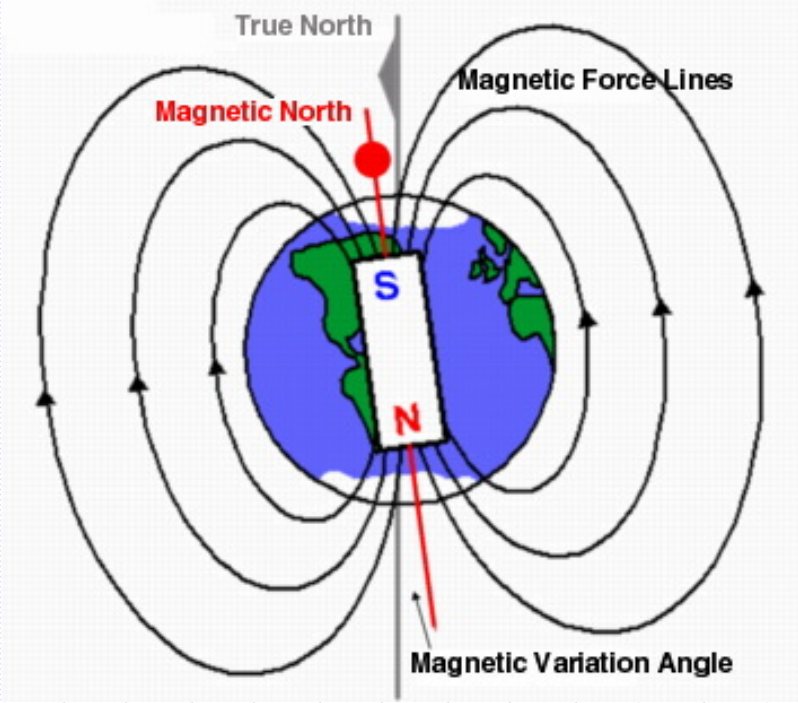
# Magnetometers:

- Record local magnetic field
- Obtain magnetic field strength & dip
- Hence direction (magnetic North)
- Local magnetic variation or declination
- Affected by local magnetic influences (=compass)

(Instrument assumes N-S mag line).

Important to recognise and remove effects of magnetic influences / anomalies.

# Earths magnetism:




At any given point place on the earth's surface, these values are known.

**Variation** - angular difference between True North and Magnetic North

**Magnetic Field Strength** * - the force of the earth's magnetic field

**Magnetic Dip Angle** * - angle the field force lines make with the horizontal

* = used to detect anomalies

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# Recognising anomalies:

- Magnetic field strength > or < expected
- Magnetic field dip > or < expected
- Compare with expected values for locality (**Quality Check**)
- Expected values from USGS site (http://geomag.usgs.gov/models/models/) or by using tool in "clean" area
- Filter anomalous values

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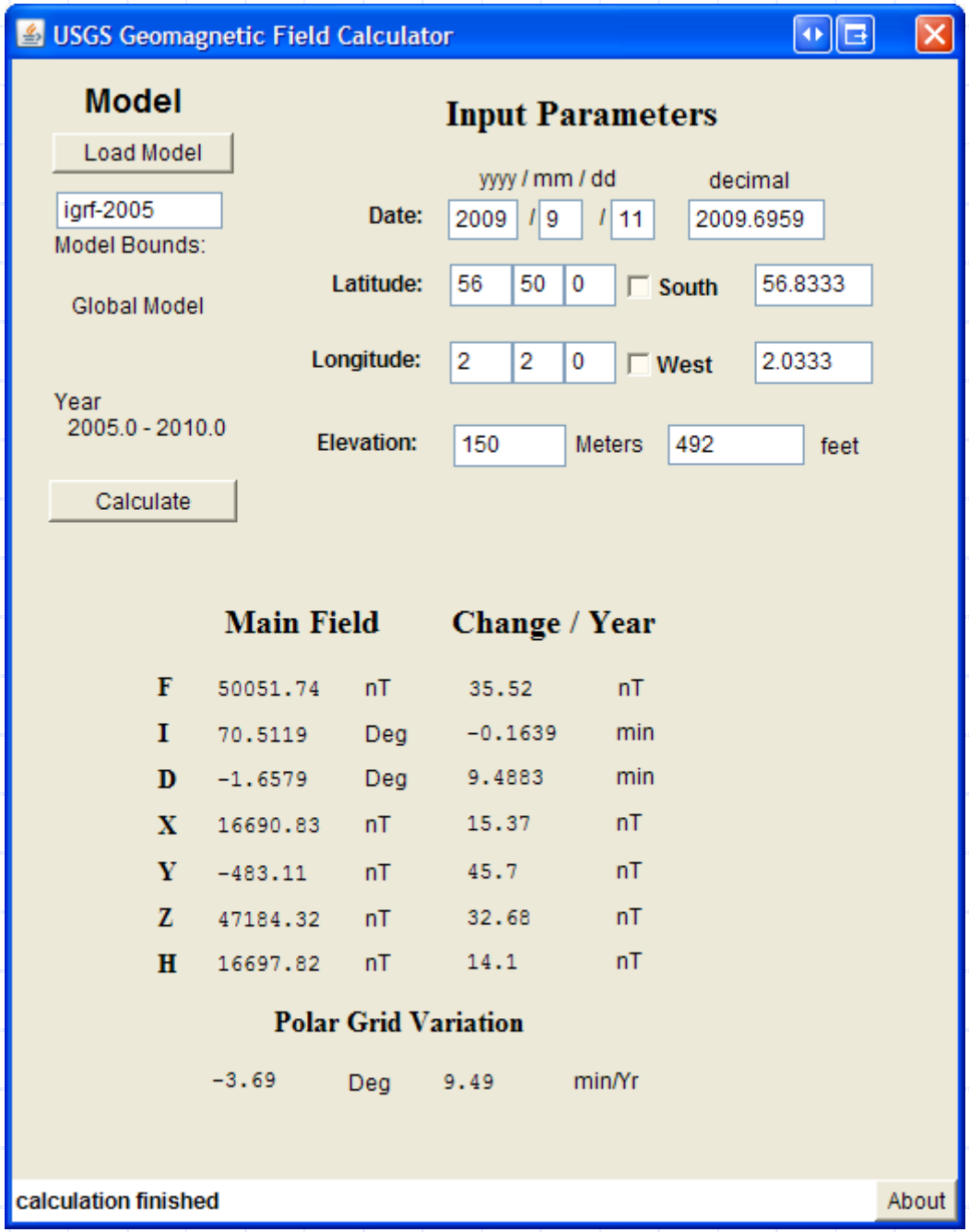
# USGS Mag:



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# Why quality check?

Identifies bad survey points.

Can allow user to “rescue” a survey:

- Bad direction (azimuth) due to magnetic disturbance can be interpolated from nearby points.
- Bad inclination (due to moving tool = wrong gravity) – ignore data point.

Can indicate where improvements in surveying technique are needed.

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# On-board computer:

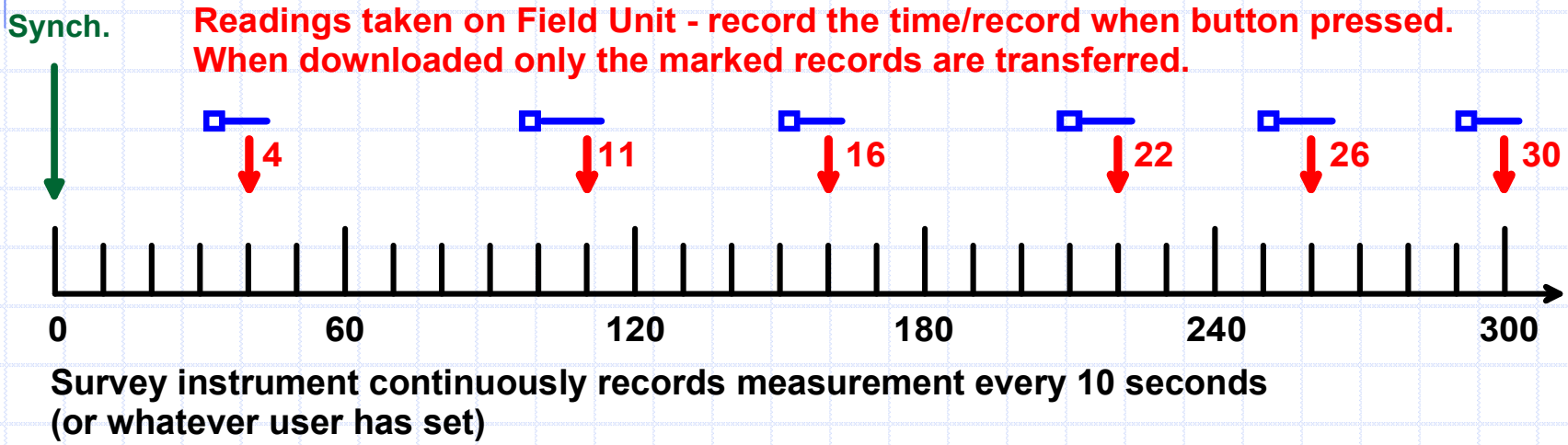
- Communicates with field computer (setup/download)
- Takes readings
- Does some pre-processing
- Stores data in memory to await download
- Transfers data during download

# Measurement process:

Synchronise/Initialise; Disconnect; Measure; Connect; Download !

Button press, followed by wait period.

11 Reading record point and number.




Survey instrument continuously records measurement every 10 seconds (or whatever user has set)

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# Operational requirements:

- Non-magnetic pressure barrel
- Aluminium spacer rods
- Reasonably close spaced stations
- Instrument still during measurement
- Run on Wireline / Rods
- Into and/or out of hole
- Avoid rapid large temperature changes
- Treat with care !

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# Accuracy paper:

Adding Value to Exploration Boreholes by Improving Trajectory Survey Accuracy.

*Sindle, T.G. et al.*

Australian Mining Technolgy Conference, 26-27 Sept 2006.

*http://www.geomole.com/resources/Tim-Sindle---Final-Paper-CRC-Mining-Conference---Trajectory-Surveying.pdf*

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# Maintenance:

**Routine:**

- Change batteries as required
- Return for re-calibration (annually ?)

Repairs as required if instrument damaged or electronics failure.

*Sensor failure usually obvious from survey results !*

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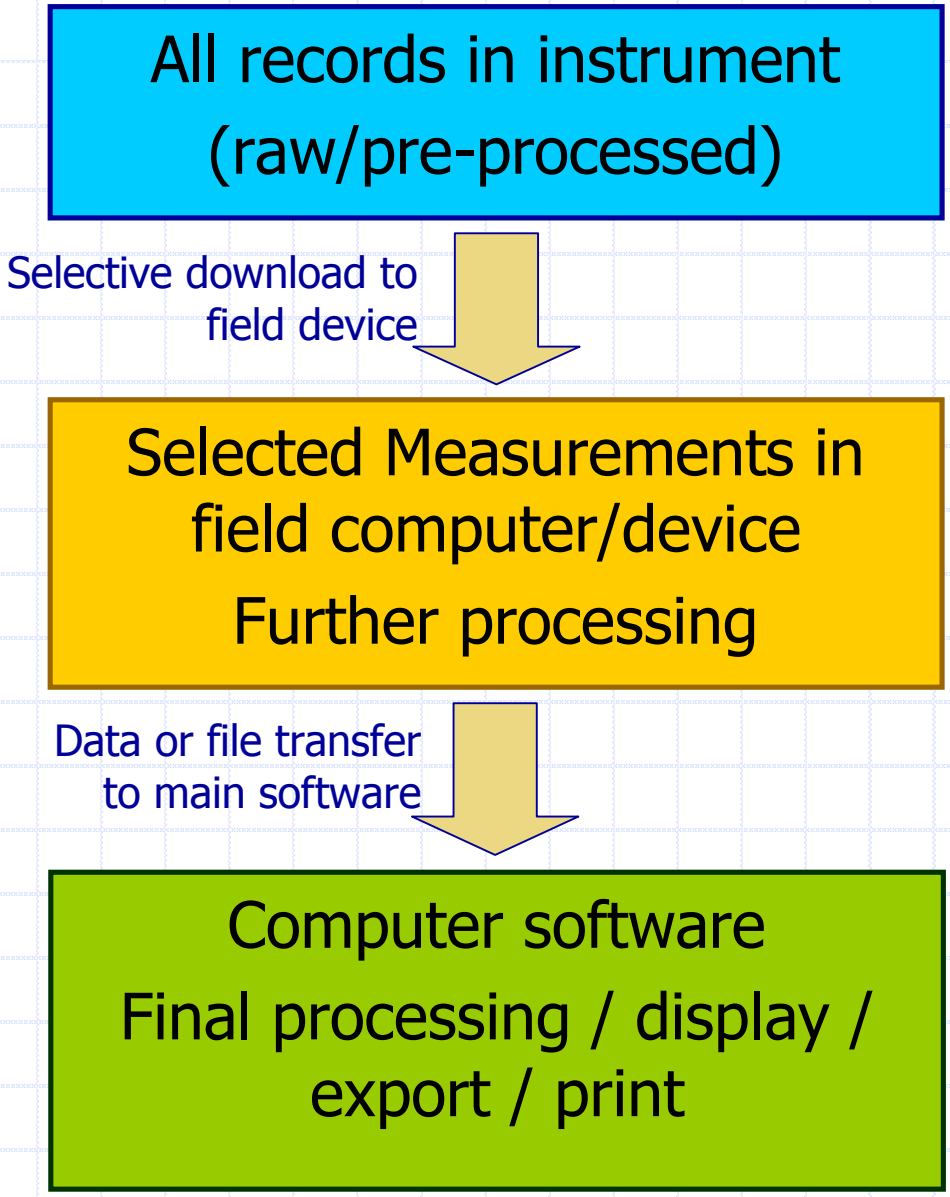
# The data path:




Processing/Calcs:

First: Angles

Then: De-survey to get co-ordinates (East, North, Elevation). *Minimum curvature; straight line*.

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# Survey storage:

Recommendations:

- Avoid Windows “defaults” (My Documents, etc)
- Suggest use own folder structure, e.g.

  D:\SurveyDataFiles\ProjectX

  D:\SurveyDataFiles\ProjectY

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# EMS summary:

- Tri-axial Accelerometers & Magnetometers
- Provide data for Inclination & Direction
- Careful / good operation for most accurate results
- Quality checks to filter poor data
- Maintenance required for lifetime of instrument
- Reference material available on web

# The DEVICO EMS instruments …

- The standard EMS system (links to GeoMEM web site)
- The PEEWEE (slim diameter) (links to GeoMEM web site)

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