Levelling

What is Levelling?

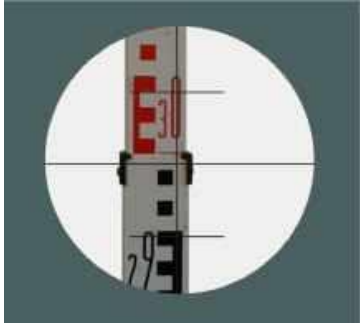
- **Levelling is the process by which differences in height between two or more points can be determined.**

- **Measuring the height**
- **Measuring and calculating the height of a point relative to another point**

- **Height differences for 2+ points above datum (geoid).**

Determination of elevations with a surveying instrument

Levelling Staff



Levelling

Height of the Plane of Collimation (HPC)

R1

R2

RL A (known)

Measured and Calculated

Level of A

Reduced (unknown)

Level of B

RL B

A

B

DATUM

HPC = RL A + R1

RL B = HPC - R2

Basic Definitions

- Vertical Line is a line parallel to the direction of gravity
- Level Surface is a surface of constant elevation, that is perpendicular to the plumb bob line (vertical line) at every point
- Level line is a curved line in a level surface all points are of equal elevation
- Horizontal line is a straight line tangent to a level line at one point
- Horizontal plane is surface tangent to level surface at one point
- Geoid is the datum for all the vertical measurements and it is an equipotential surface perpendicular to vertical direction at each point on it. It can be realized approximately in nature by determining the mean sea level.
- Mean sea level, is defined as the position the sea or ocean would take if all tides and currents were eliminated and determined by averaging the hourly elevations of the sea over a long period of time, usually 19 years .

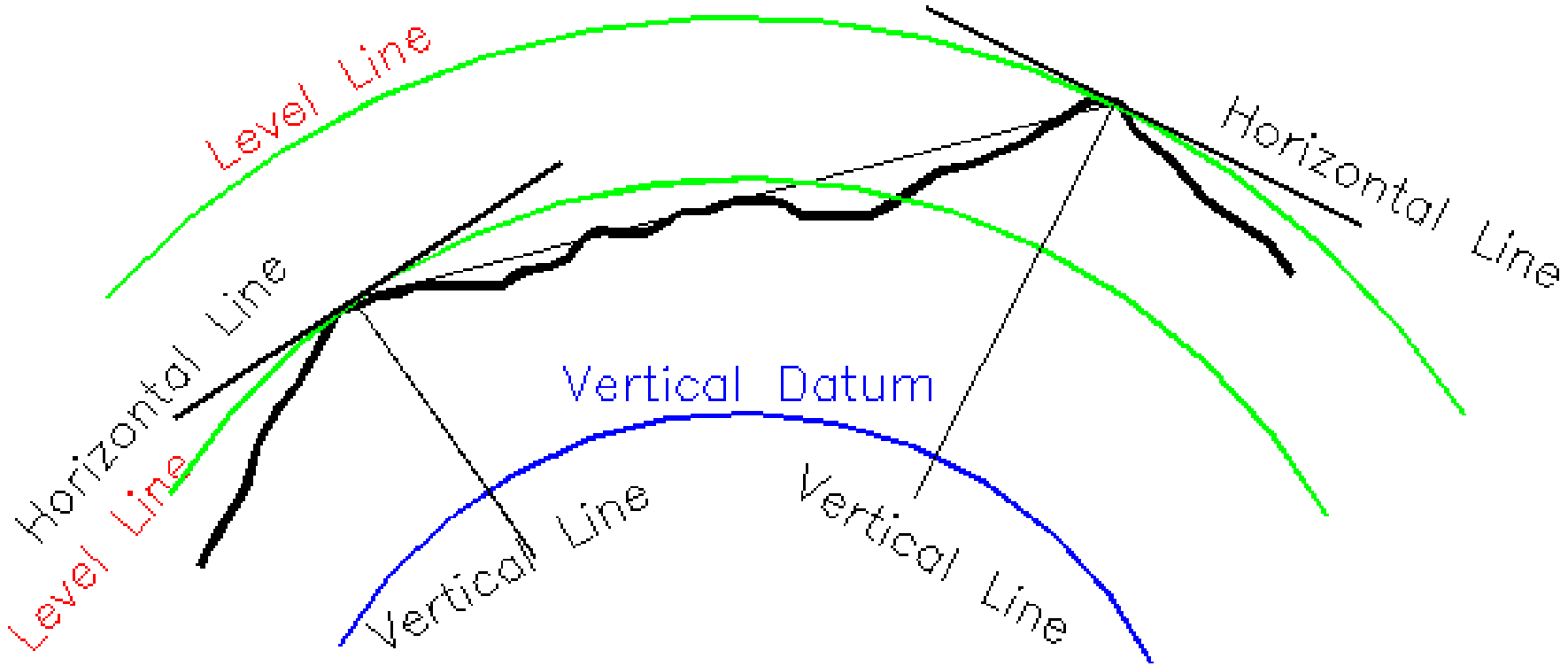
Basic Definitions

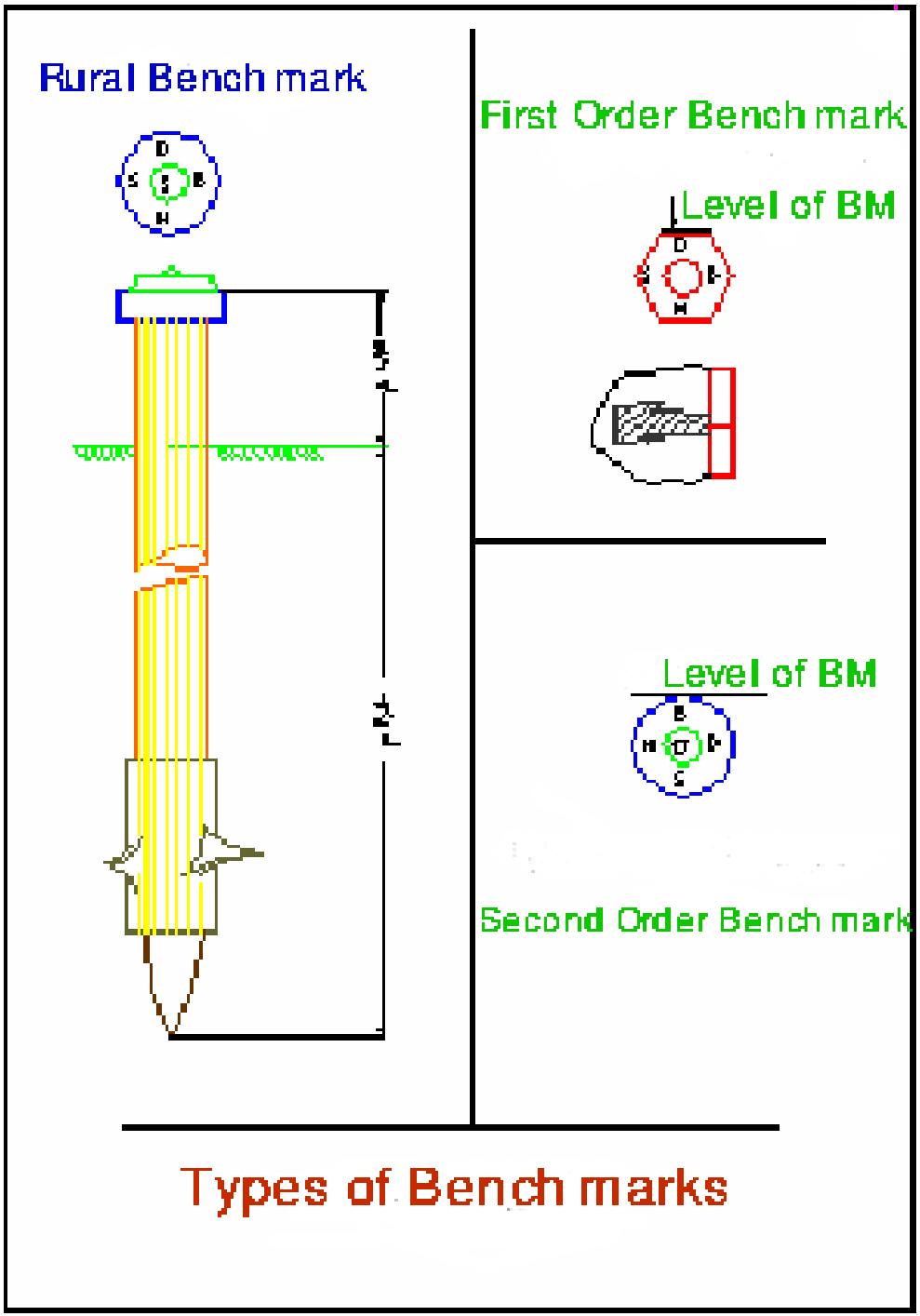
Vertical datum is basis of all elevations in levelling work and mostly defined by mean sea level.

Elevation of a point is the vertical distance above or below a reference level surface

***Reduced level* (*RL*): Height of a point above the particular datum used**

Bench mark (BM) is Point with previously determined RL with respect to national vertical datum, and it is often constructed as permanent markers. Temporary bench mark (TBM) is a point referenced to arbitrary datum


Level Line
Horizontal Line
Horizontal Line
Level Line
Vertical Datum
Vertical Line
Vertical Line


Rural Bench mark
First Order Bench mark
Level of BM
Level of BM
Second Order Bench mark
Types of Bench marks

Optical Levels

Automatic Level

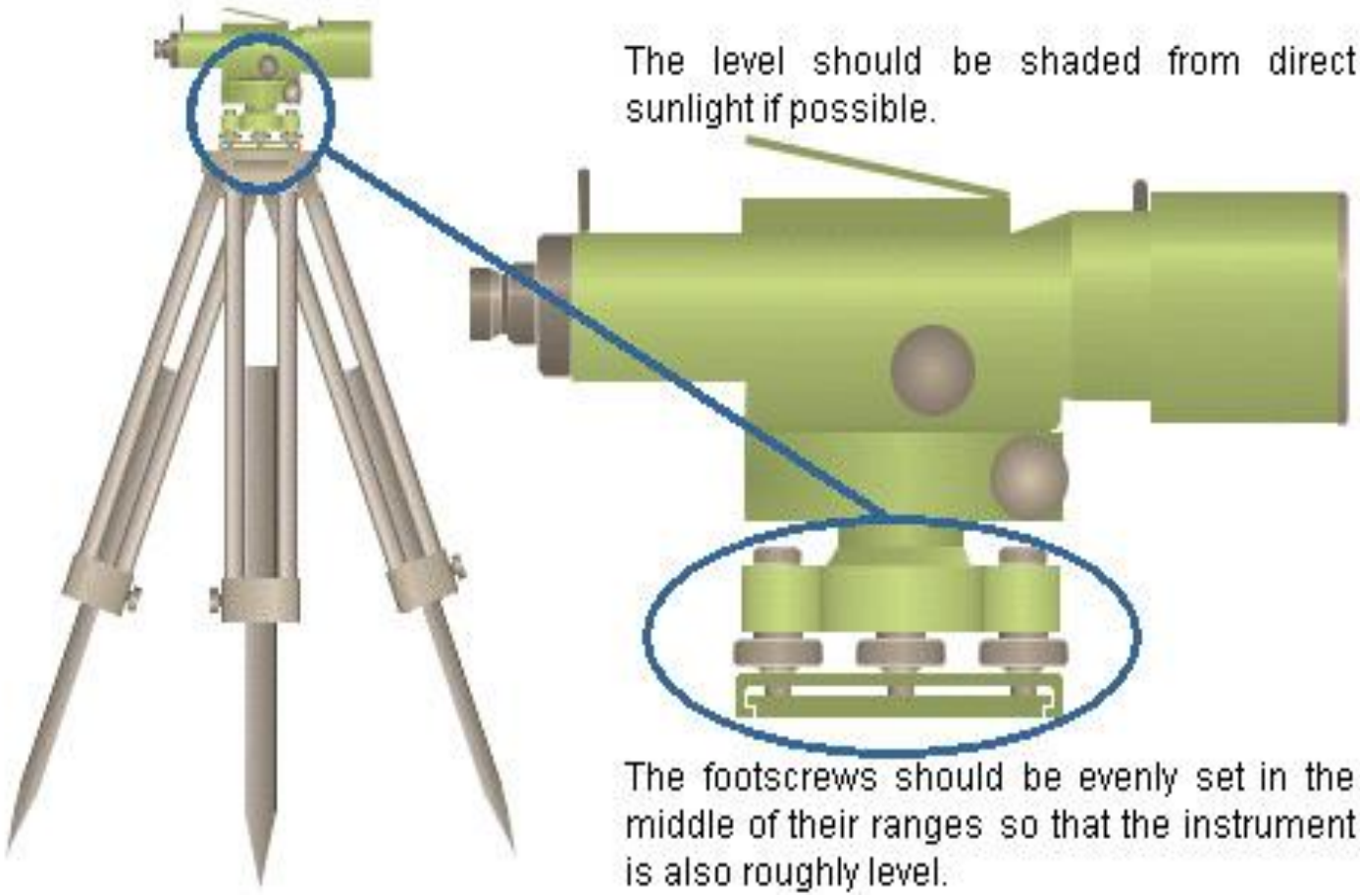
Tilt Level

Tilt Level

Setting up the Tripod

- Position the tripod legs roughly over the place with the head of the tripod of the tripod roughly level.
- On soft ground, push the legs in firmly to stabilize the tripod.

Attaching the Level



Screw the level and tribrach on.

The level should be shaded from direct sunlight if possible.

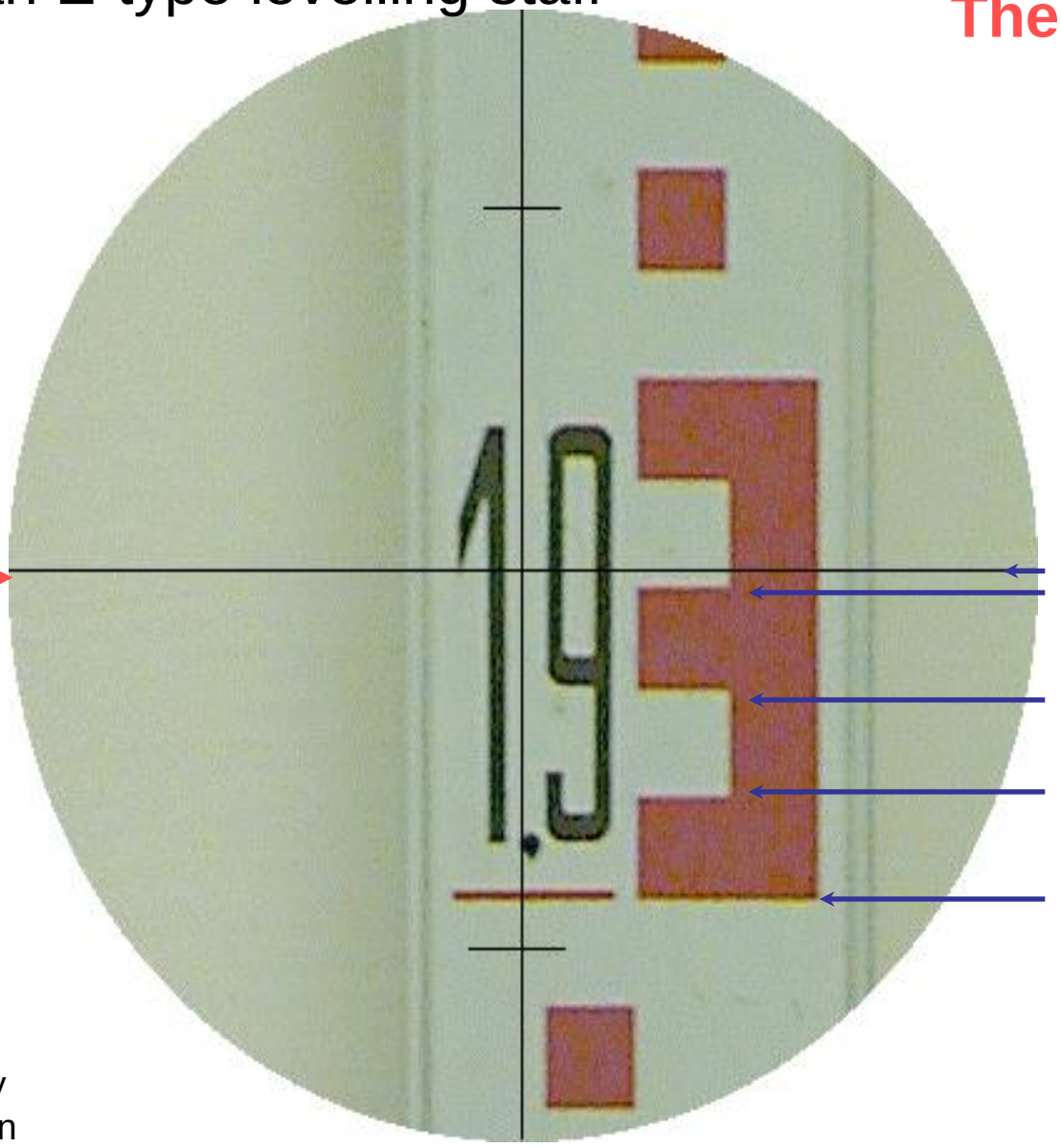
The footscrews should be evenly set in the middle of their ranges so that the instrument is also roughly level.

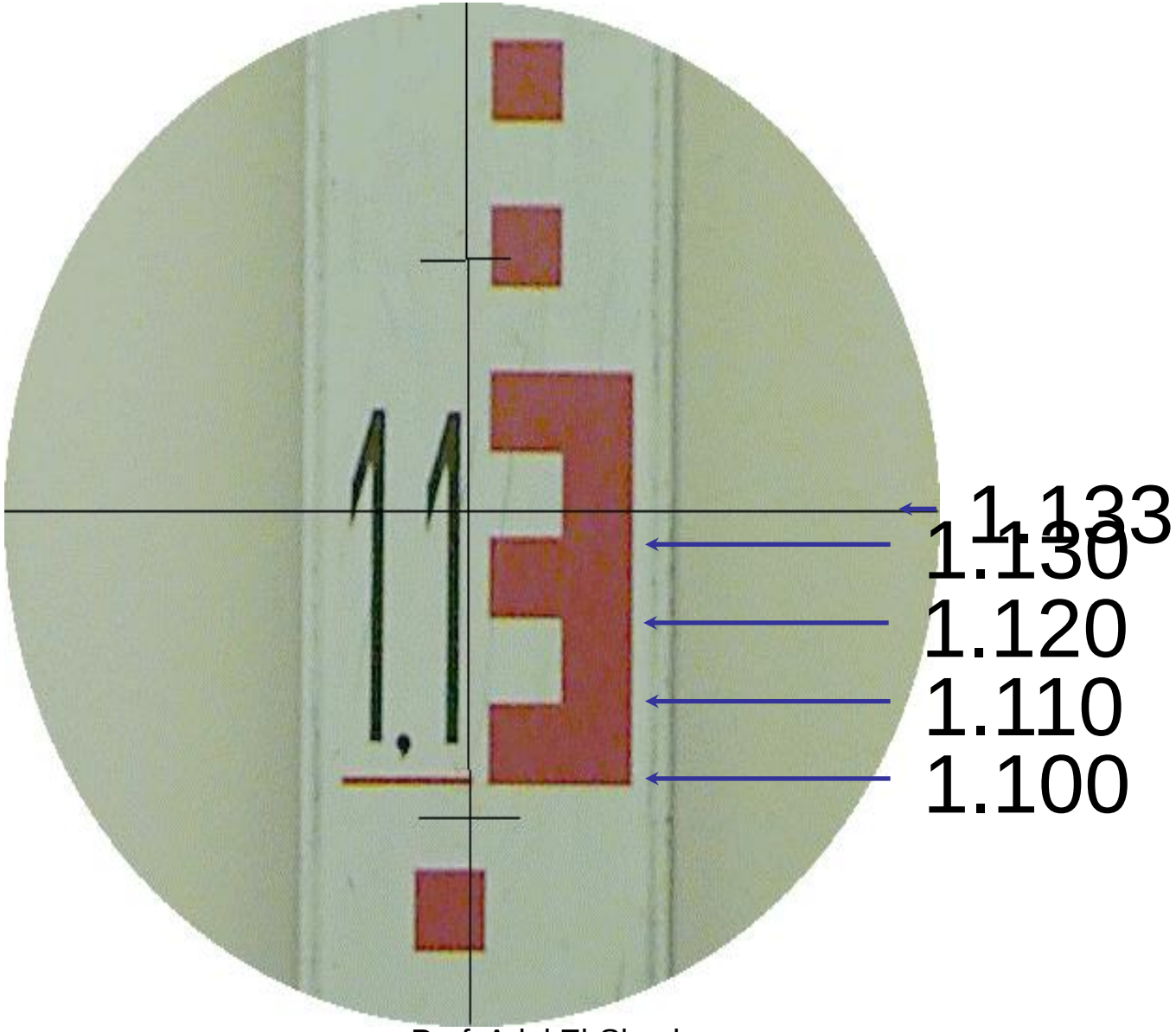
Circular Bubble

Reading an E-type levelling staff

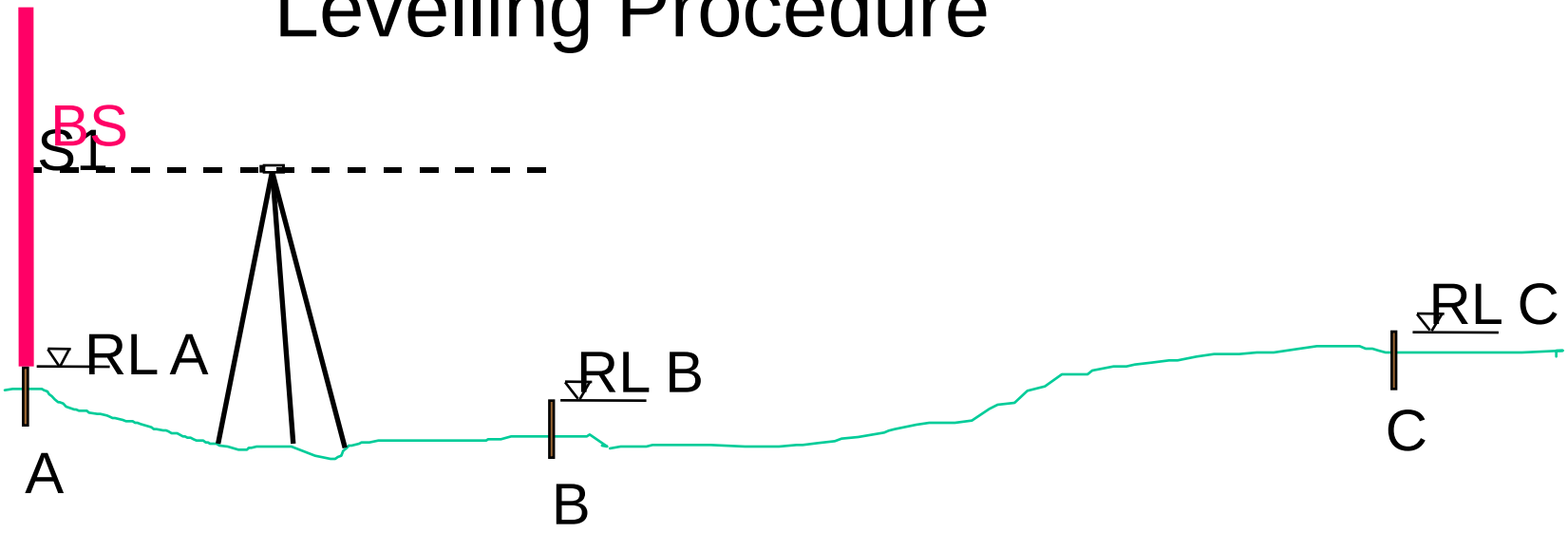
The value is ?

Read value at the Horizontal cross hair

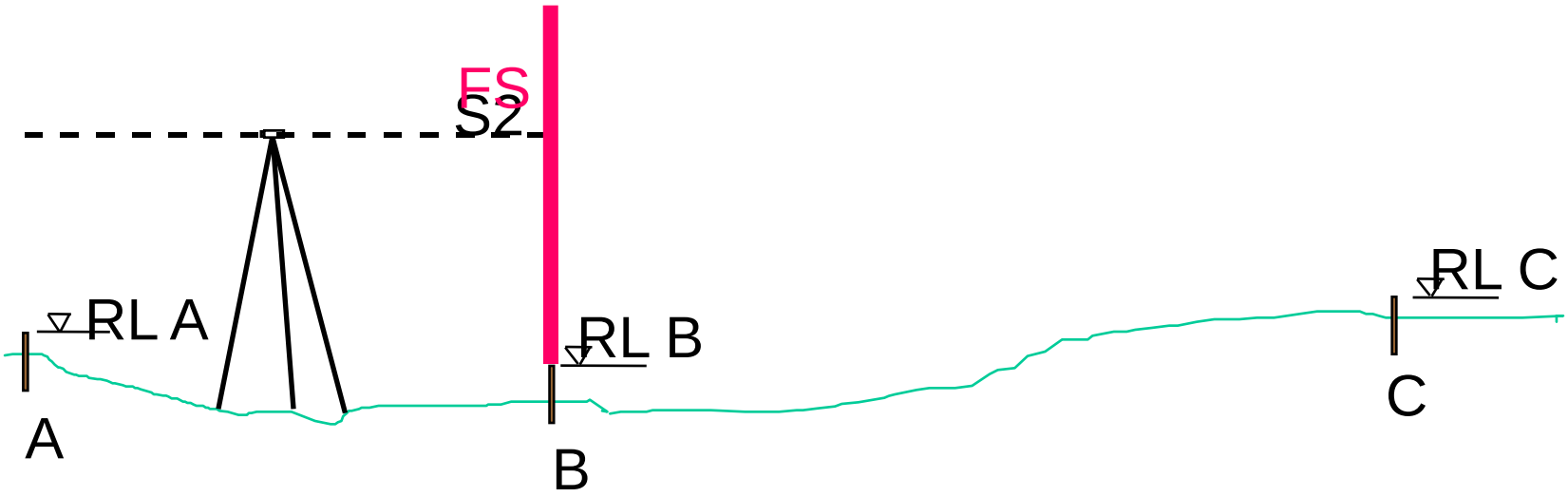



1.133
1.130
1.120
1.110
1.100

Levelling Procedure



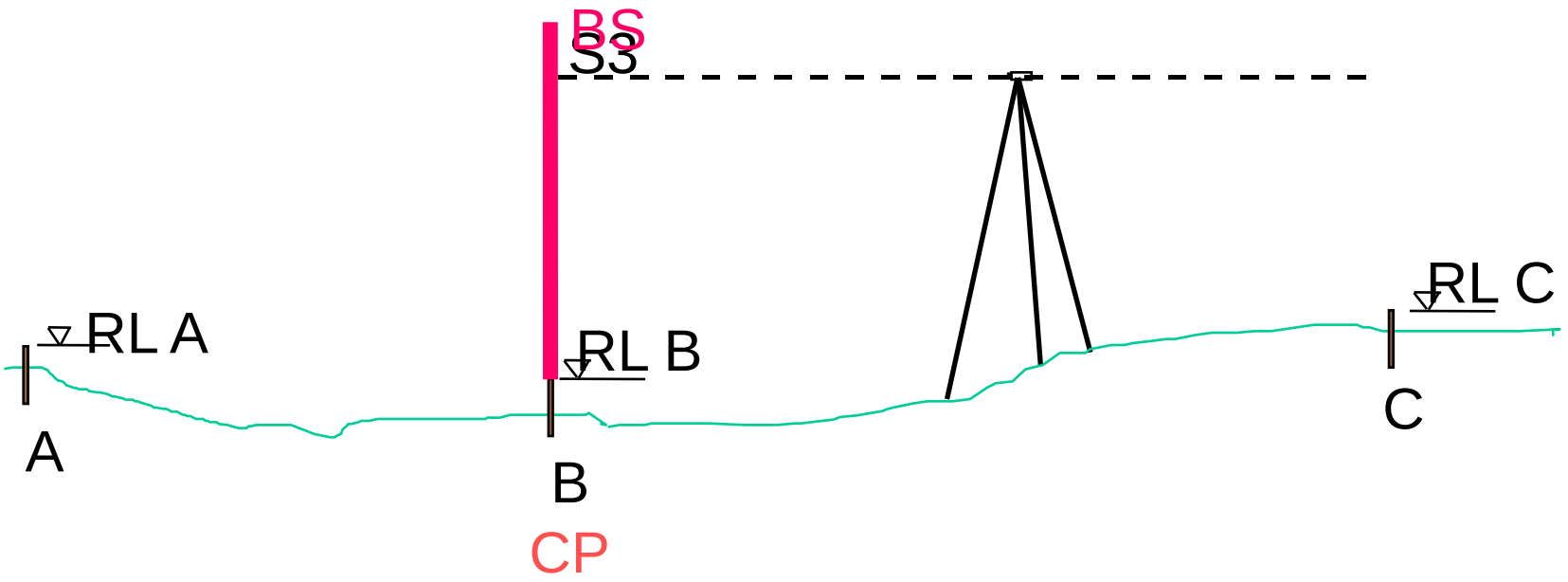
Level staff on A Back Sight (BS) reading is first reading



Level staff on A Back Sight (BS) reading is first reading

Level staff on B Fore Sight (FS) reading is last reading

Move instrument to new position

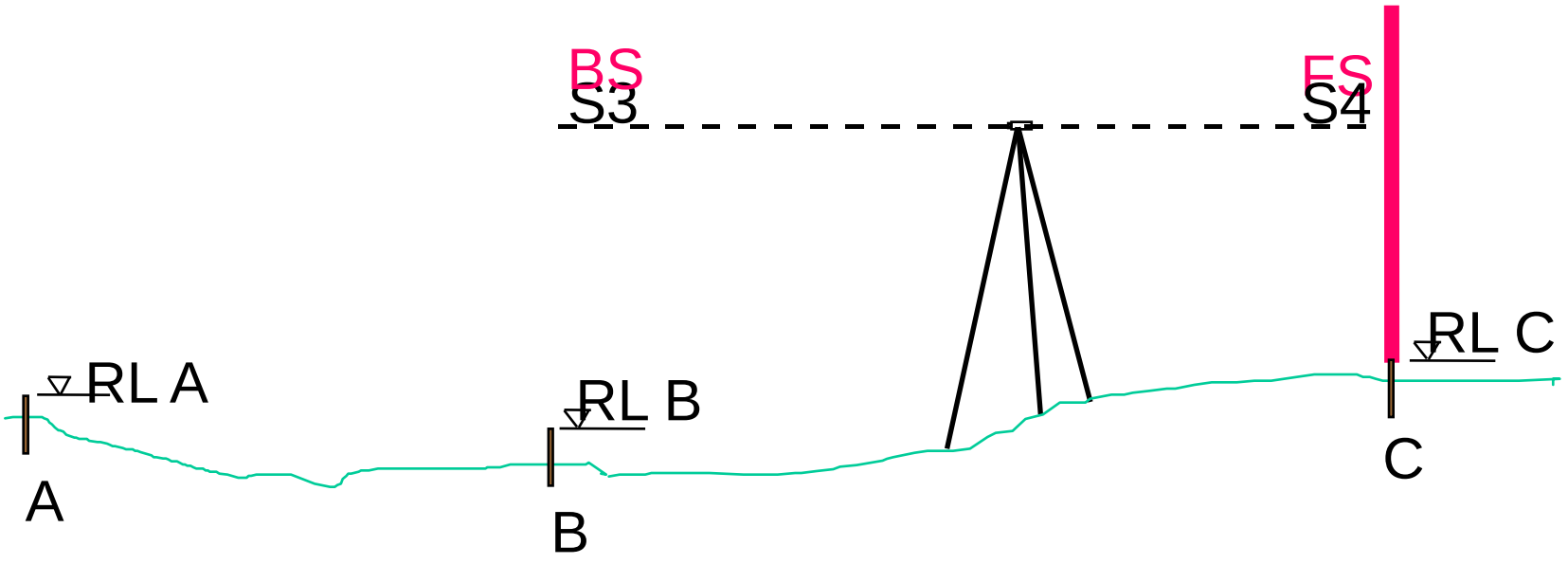


Move instrument to new position Level staff stays on B

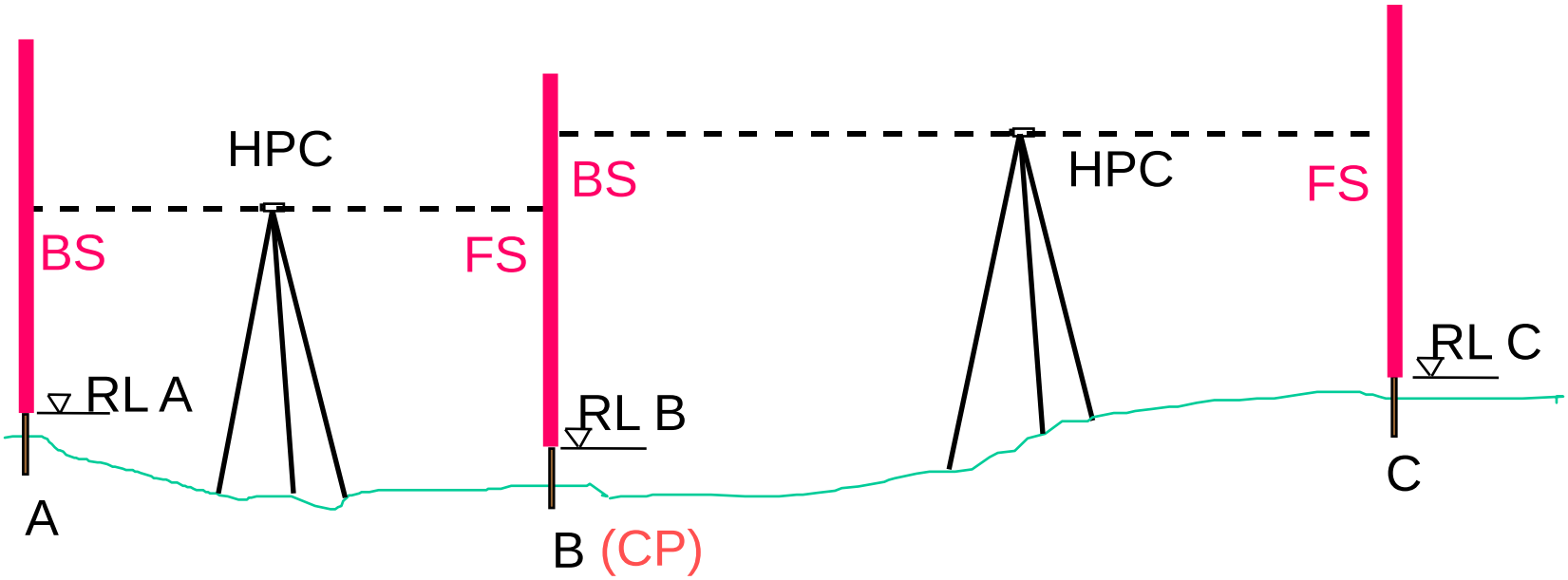
The instrument has changed its position about point B

Point B is known as a Change Point (CP)

2nd instrument position starts with BS to B



and finishes with FS to C



RL A is known

HPC = RL A + BS

RL B = HPC - FS

Now the RL B is known

So we can repeat the process

RL B + BS

RL C = HPC - FS

Generally : **HPC = Known RL + Back Sight**

HPC =

Unknown RL = HPC - Fore Sight