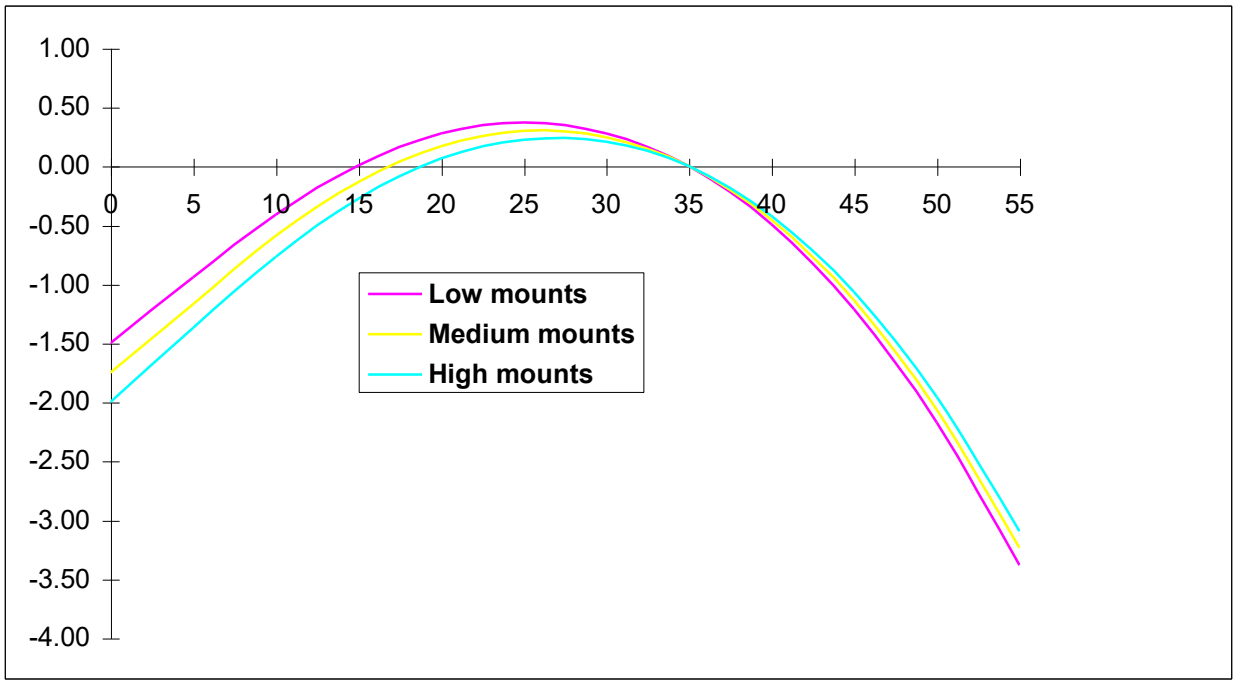

MKARC
Range finding & Trajectory

What's Next?

So you've zeroed your rifle; what do you do now?

To hit your target, you need to know how far away it is and where the pellet will land relative to the aiming mark – to do this you will need to estimate the range and know the trajectory of the pellet in your rifle.

The relationship between the sight line (X axis, 0 – 55 yards) and the pellet path (coloured lines, trajectory in inches) for 0.177 Air Arms Field at a muzzle velocity of 790 ft/sec. (8.4g) is shown below, for a selection of scope mount heights.



RANGE FINDING

There are three techniques which may be used when hunting, but which are prohibited in all forms of FT competition:

1) Laser range finders.
2) Coincidence optical range finders.
3) Gun mounted lasers.

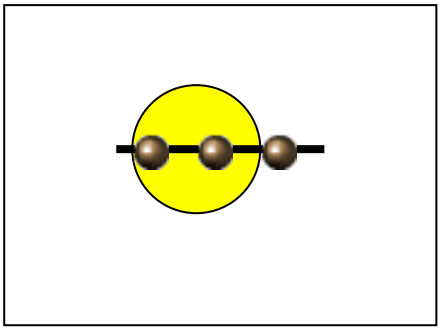
In competition, we are limited to:

1) Optical estimates (how far away it looks).
2) Bracketing (using the reticule to assist range estimating)
3) Parallax (using the forward or side focusing ring to estimate range)*

* Not permitted in HFT competition.

Optical estimation is a technique, which relies on using both eyes (binocular vision) as a means of assessing range. It cannot really be taught, but it can be learned with a lot of practice.

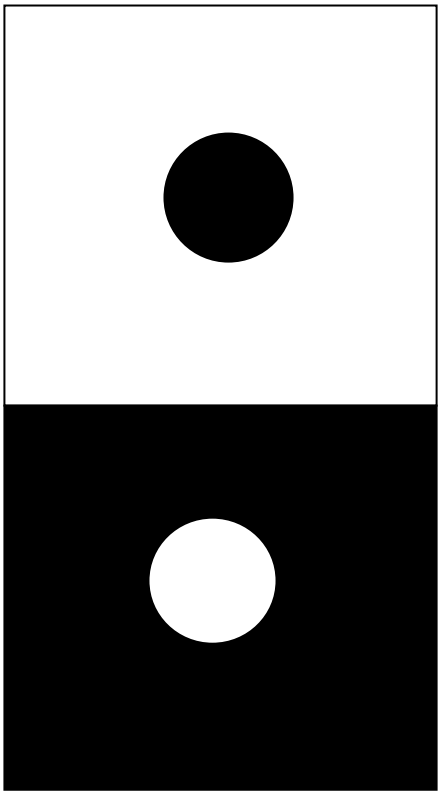
Bracketing uses features in the scope reticule to assist in range estimation. The popular Mil-Dot scope originated as a tool for military snipers to assist range estimation. At 24x magnification, a standard 40 mm FT kill zone will subtend two dots at 55 yards:



Unfortunately, a real sight picture rarely holds so steady!

Parallax is a technique used with parallax adjustable (PX) scopes (adjustable objective rings or side wheels). The adjustment is intended to focus out apparent movement between the reticule and the target image if the scope is looked through at through slightly different angles. In FT, we use high magnification scopes (24x +) with small depths of field (the area seen in focus), using the band of clear focus as a means of establishing the range. Look at the scopes of established club members and you will usually see marks on the rings or wheels indicating the range at which that particular adjustment brings the image into focus.

In order to calibrate the scope PX ring or wheel, adjust the magnification to its highest setting and using either a freshly painted target, or a target similar to the one on the right, place it at 55 yards. Return to the firing point and adjust the PX ring/wheel until the image is at its sharpest focus. Mark the ring or wheel to indicate the range. Move the target back to 50 yards and repeat the process. Continue in 5 yards steps until you reach 10 yards. A final check can be made at 8 yards (FT minimum range) although some scopes may struggle to focus at all at this range unless the magnification is reduced.



Depending on the available magnification, quality of the scope and experience of the user, this technique can permit range finding accurate to about a yard or two at 55 yards.

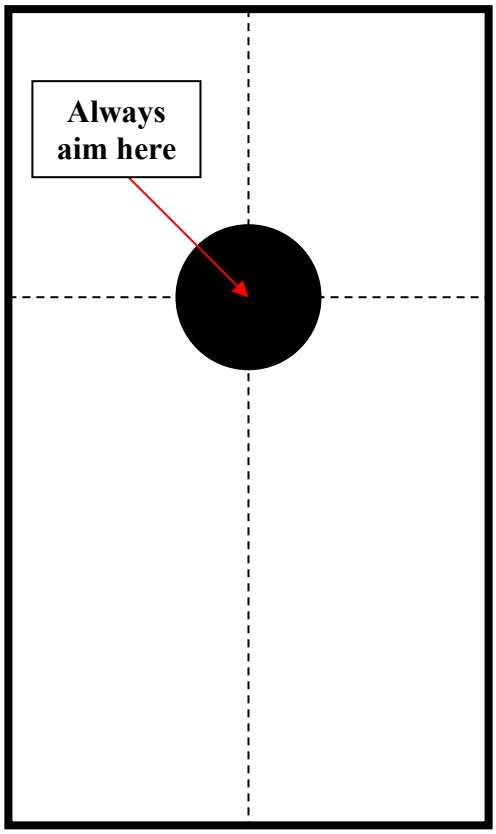
Obviously the metrically minded can work in meters from 50 down to 7.

DETERMINING THE TRAJECTORY

Although pellet trajectories are sometimes printed in the air gun magazines, the best way of establishing the trajectory of your rifle is to shoot it. This can be done at the same time as calibrating the PX ring, but this will place extra stain on your eyes.

The procedure is similar, with a target being placed at 5 yards increments from 10 yards to 55 yards, shooting a group, aimed at the target without making adjustments to the scope. A simple target is shown below, shot one per range, or a single target, shown later can also be used.

Once the trajectory is known, the method of adjustment can be decided upon.



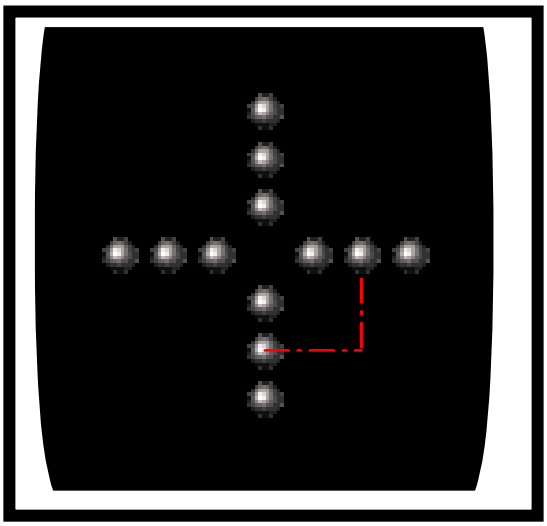
Most FT shooters will "dial in" or adjust the top turret so the impact point coincides with the aim point at the desired range – this is most easily accomplished using a scope with "target" or "sniper" turrets. This method allows the shot to be taken at any magnification the shooter prefers, but there is a risk of forgetting to reset the scope for the next shot or even turning it the wrong way resulting in the sight being a "full turn out"!

Estimated dial in values can be calculated from the centre of the group on the target, which should then be confirmed by re-shooting a group.

In windy conditions you will still be aiming along the horizontal cross hair, which is advantageous.

If your scope has "Mil-Dot", there is usually a magnification where the dots correspond to points of impact at key ranges – the typical 0.177 trajectory gives 1 dot for every 5 yards beyond 35 yards at 24x i.e. 1 dot hold over at 40 yards, 2 dots at 45 yards and so on. This method only works at the magnification matching the trajectory. It is less precise than "dialling in" but quicker to use and doesn't have the risk of shooting the next shot on the wrong setting.

In windy conditions, you may be aiming so many dots high and so many dots off (for wind drift), that you actually have to aim using an imaginary aim point, as illustrated for a 45 yard target in a left to right breeze.



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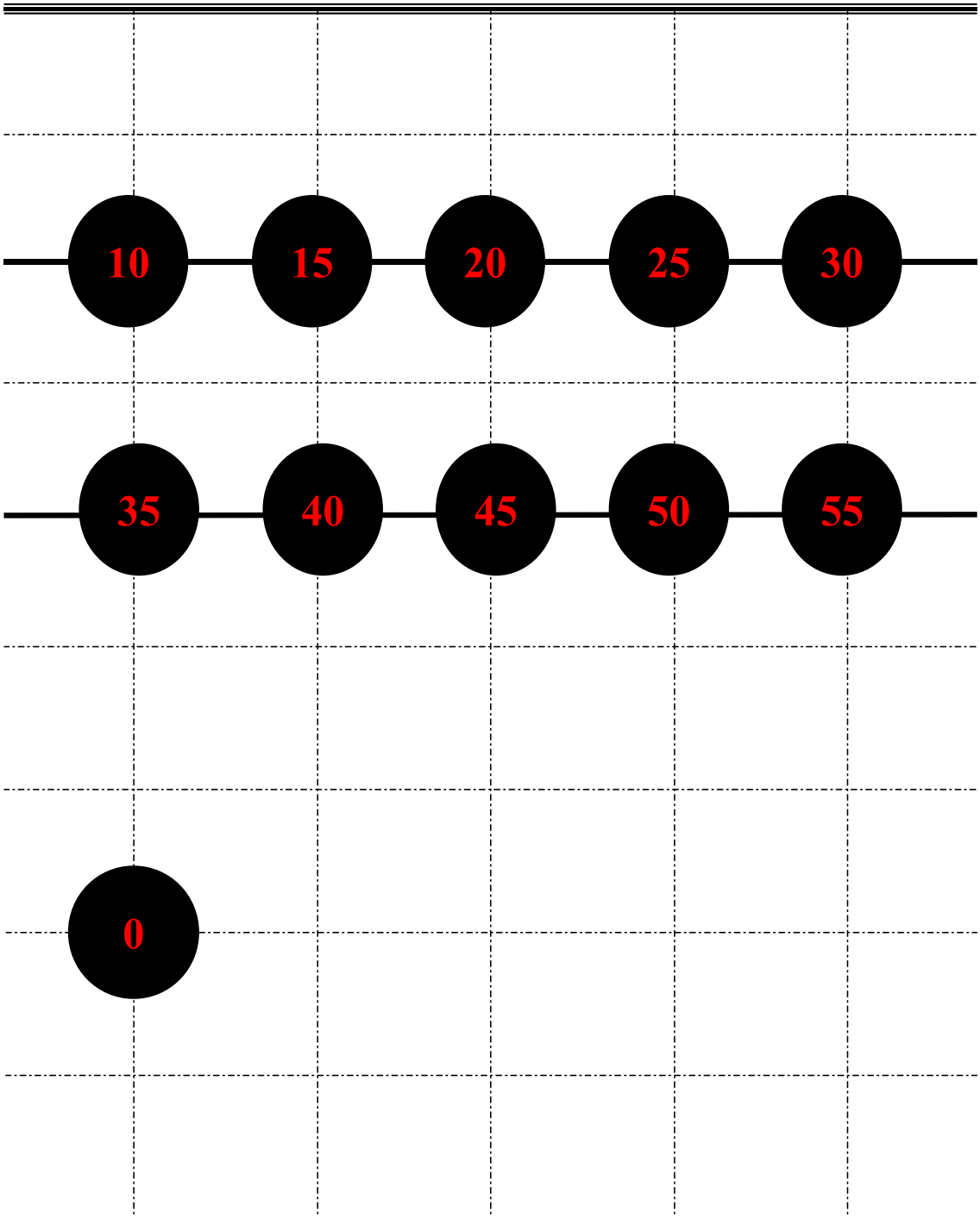
Trajectory Determination Target



How many clicks should I move the turret?

Most air gun scopes will either have 1/4 minute or 1/8 minutes turrets, it is usually indicated on the turrets themselves, but occasionally must be found in the instructions.

1 minute (of angle or M.O.A.) is approximately equal to one inch at 100 yards therefore our scopes would move the point of impact 1/4 and 1/8 of an inch at 100 yards with each click. We don't usually shoot at 100 yards however, so how do we calculate the adjustments required:

The easiest way is to express "clicks per inch"; start by calculating the nominal adjustment as a decimal i.e. 1/4 = 0.25; 1/8 = 0.125. This number is fixed; it is the range, which will alter the actual amount of movement.

The range factor is easy to calculate – just divide the range you are working at by 100, so 35 yards becomes 0.35 and 55 yards becomes 0.55 etc. Remember 8 yards will be 0.08 not 0.8.

Multiply the adjustment (as a decimal) by the range factor and then divide 1 by the answer to get your clicks per inch.

To assist, the "clicks per inch" for common zeroing ranges have been tabled below.

Clicks per inch	0.177 @ 35 yds	0.22 @ 30 yds
1/4 min clicks	11	13
1/8 min clicks	23	27

When you have determined the appropriate adjustments for use at each range, you should either prepare a table listing ranges and adjustments, and then carry it with you, or failing that, find a way of marking them directly onto the elevation (top) turret.