



# Radar concepts, as understood by radR

The images below describe radR's data and statistical models:

- [radR data model](#)
- [stats model](#)
- [stats model related to the blip parameters window](#)

Note: this is not a summary of standard radar theory, but rather a description of the conceptual model radR uses to process radar data.

A rotating antenna sends out electromagnetic **pulses** and listens for an echo. The **antenna angle** is between the horizontal plane and the structural (not rotational) axis of the antenna. The **antenna aperture** is the geometry of the region from which the antenna can detect an echo from a single pulse. When this region is approximately cone-shaped and centred on the structural axis, the aperture can be defined by a single **aperture angle**.

The strength of the echo over time is digitized into a sequence of **samples**. A **sample value** is represented as an integer with  $d$  **bits per sample**, giving a **sample range** of  $0 \dots 2^d - 1$ . Typically,  $d$  is 8 or 12, giving a sample range of  $0 \dots 255$  or  $0 \dots 4095$ .

A **scan** is the matrix of sample data from one rotation of the antenna. Sometimes this matrix is referred to as **raw data**, to distinguish it from scan converted data (see below).

A **scan row** (of a scan matrix) is the set of  $N$  consecutive samples from the echos of one pulse. **Scan conversion** is the process of building a **pixel matrix**, a two-dimensional spatial representation of the scan matrix. Each **pixel** in the matrix represents one or more samples. A **pixel's class** is the class of the sample at the centre of the pixel. A **pixel's value** is the average value of the sample(s) represented by the pixel. A pixel represents the sample at its centre, as well as up to 2 angular and 2 radial neighbour samples, depending on the zoom level (see below) and the location of the pixel relative to the plot centre (see below).

The **screen colour** of a pixel is selected according to its value from the **palette** for its class.

The **plot window** is the rectangular region of pixels which are actually displayed on the screen. The **plot centre** is the location of the imaginary pixel where samples of index 0 would be displayed. The plot centre need not be within the plot window, which allows for **panning** the window across the scan disk.

The **zoom level** is the width in pixels of those samples which are plotted parallel to the screen's horizontal axis. For example, if the zoom level is 3, then a sample from a pulse that is due east or due west will be drawn 3 pixels wide. The same scale applies to the vertical axis. Fractional zoom levels are allowed.

In radR, because scan conversion is purely for visualization, it is only performed for pixels visible in the plot window. In contrast, computations for finding and filtering blips always use the full raw scan matrix.