What is the Ewald sphere and how to use it ?

The Ewald sphere is a very useful tool to determine the direction of the diffracted beam relative to the incident beam for a specific reciprocal lattice vector **h**. In other words, the direction of the diffracted beam with intensity I(*hkl*) can be determined).

The Ewald sphere is based on the Laue condition for diffraction which is

$$\mathbf{s}-\mathbf{s}_0=\mathbf{h}$$

Here $\mathbf{s}_0$ and **s** is the direction of the incident and diffracted beam respectively, and $\mathbf{h} = h\mathbf{a}^* + k\mathbf{b}^* + l\mathbf{c}^*$ is a reciprocal lattice vector. Moreover, $|\mathbf{s}_0|$ and $|\mathbf{s}|$ are equal to $1/\lambda$, the wavelength of the incident and diffracted beams.

The Ewald sphere is represented below in form of a two-dimensional drawing. Its radius is $1/\lambda$. The Laue condition $\mathbf{s}-\mathbf{s}_0=\mathbf{h}$ imposes that the three vectors form an isosceles triangle with two constant lengths, $|\mathbf{s}_0|$ and $|\mathbf{s}|$ and variable $|\mathbf{h}|$**.** To bring one reciprocal lattice vector in diffraction position, it is necessary to rotate the crystal around O' so that the end of the **h** vector intersects the surface of the sphere (here on the circle). All vectors **h** such that $|\mathbf{h}| \leq 2/\lambda$ can be brought into the diffraction position by a rotation.