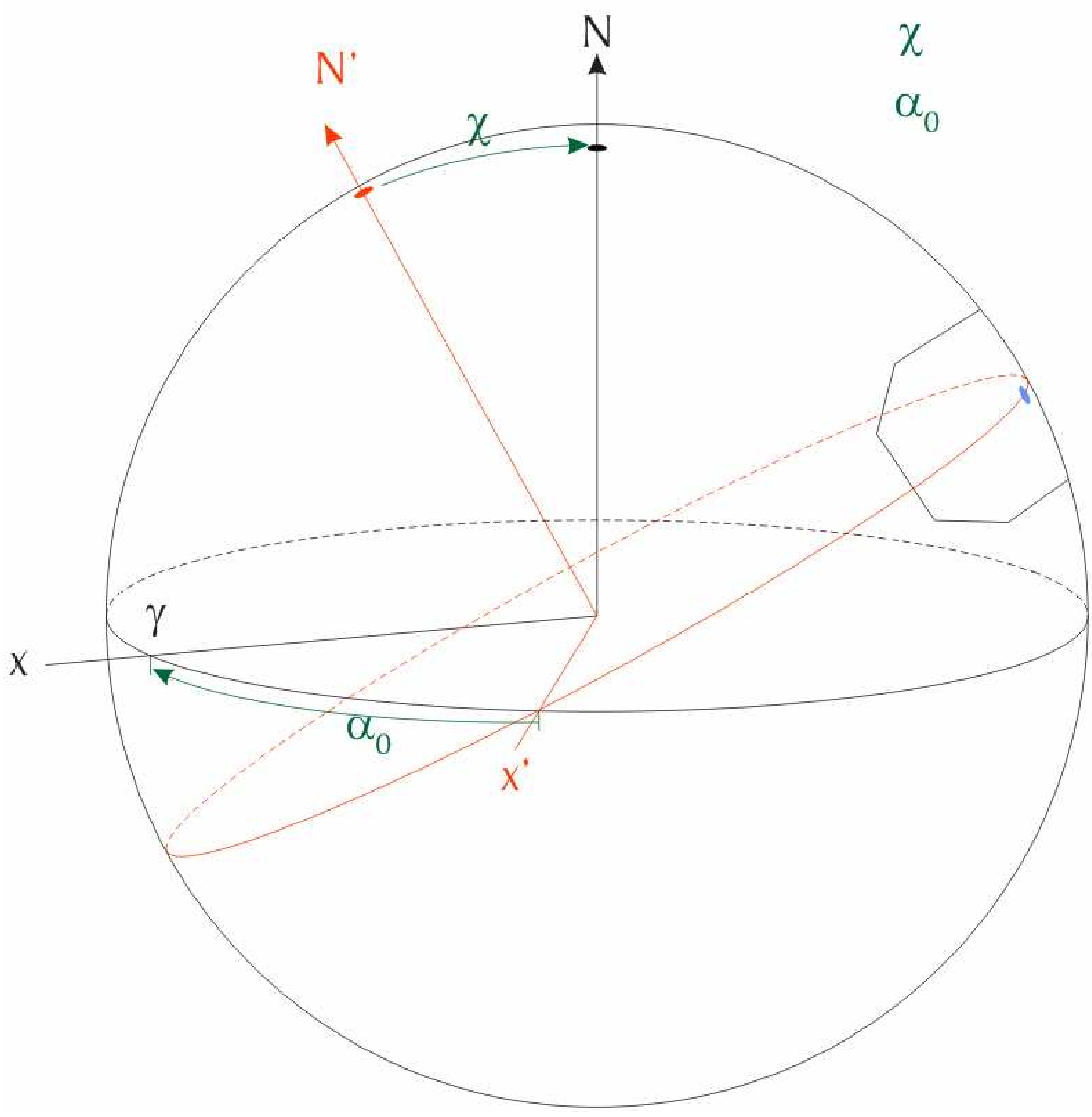
Coordinate system for J-PAS:

The idea is to set for each J-PAS field a coordinate system such that its “equator” (a maximum circle) crosses just through the centre of the field. This way we improve the tiling of the sky, minimizing unwanted overlapping. To pass from this system ’ to the classical equatorial system, you need two rotations (in green):



From this definition in follows that the origin of α' is the point x’ (where both equators cross). But we desire as origin of α' the centre of the field, therefore we are going to consider (α'+90º) instead.

For J-PAS North, we consider as the “centre” of the field of view the sky position RA=13h, δ=+55º. This implies χ = 55, α_0 = 19h = 285º.

For J-PAS South, we consider as the “centre” of the field of view the sky position RA=1h, δ=+25º. This implies χ = 25, α_0 = 7h = 105º.

To pass from (α',δ') to the classical equatorial coordinates (α,δ) (in degrees), just do:

$$\begin{aligned} \alpha &= \left[180 + \alpha_0 + \mathrm{ATAN2}\left(\cos\delta'\cos(\alpha'+90)\ ;\ \cos\delta'\sin(\alpha'+90)\cos\chi - \sin\delta'\sin\chi\right)\right] \bmod 360 \\ \delta &= \arcsin\left(\cos\delta'\sin(\alpha'+90)\sin\chi + \sin\delta'\cos\chi\right) \end{aligned} \tag{1}$$

Here we use ATAN2 instead of ATAN in order to avoid ambiguities in the sign.

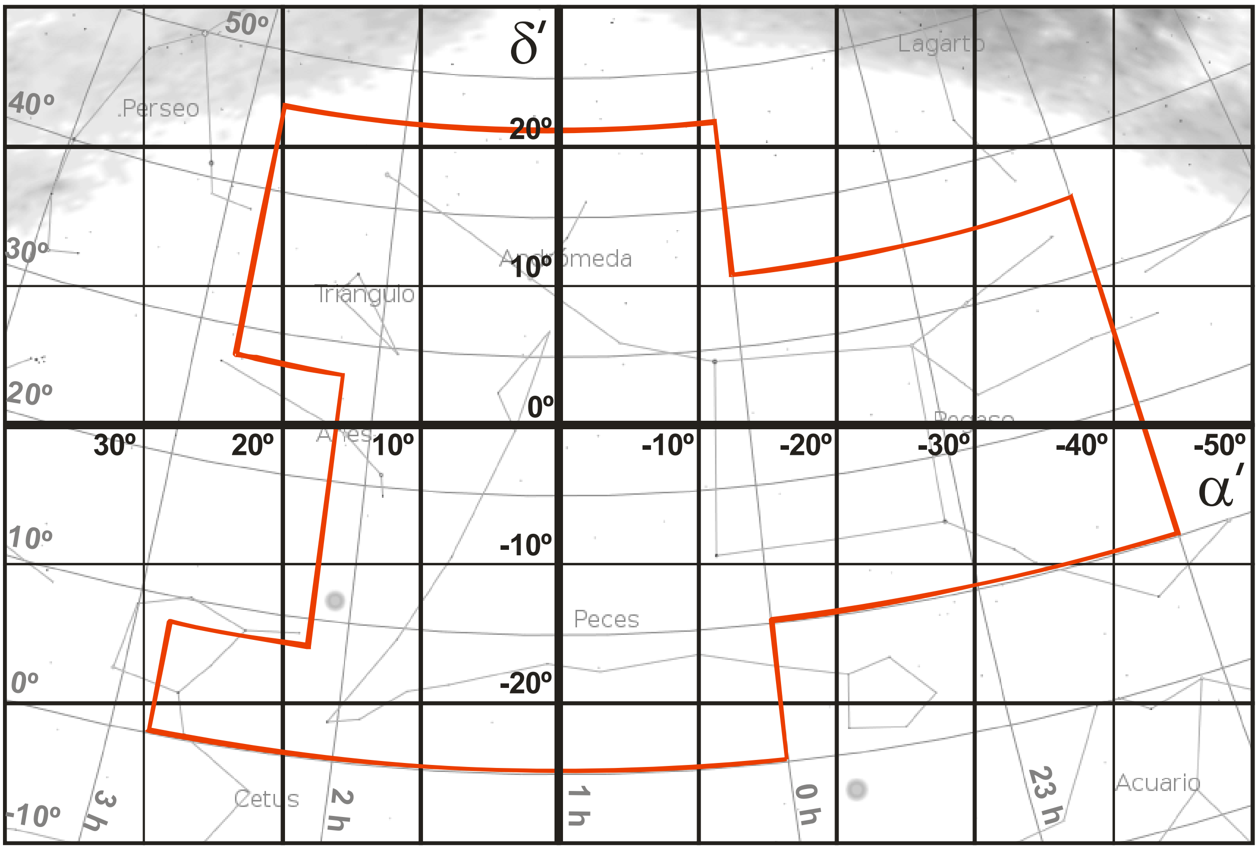
But for a good tiling is not enough to follow a regular pointing grid in the (α',δ') systems. We need also to rotate the derotator a certain angle ω to put the camera parallel to the meridians of the (α',δ') systems. This angle is different for each pointing (α,δ), and is given by:

$$\omega = \mathrm{ATAN}\left[\frac{2\cos(\delta_N)}{\tan\left(\frac{\alpha_N - \alpha}{2}\right)\sin(\delta_N + \delta) + \cot\left(\frac{\alpha_N - \alpha}{2}\right)\sin(\delta_N - \delta)}\right] \tag{2}$$

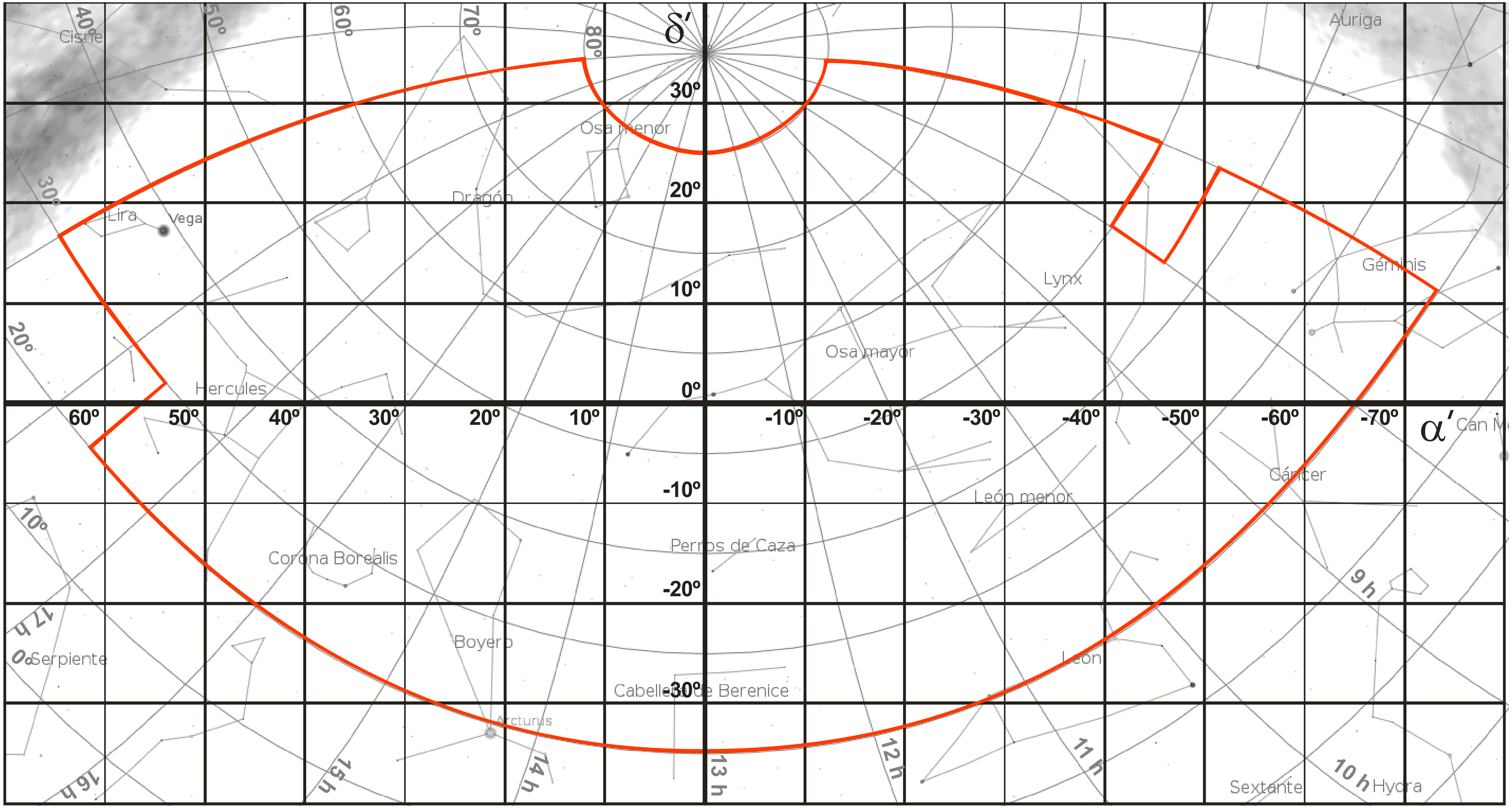
(in this case we need to use ATAN instead ATAN2).
(α_N,δ_N) stands for the location (in equatorial coordinates) of (α',δ') system's north pole, being (α_N,δ_N) = (15º, 35º) for J-PAS North, and = (195º, 65º) for J-PAS South.
(α,δ) are the equatorial coordinates of the current pointing, i.e. the output of equation (1).

ω sign is positive if the derotator rotation (respect to equatorial meridians) is counter-clockwise, and negative if it is clockwise.

Using this coordinate systems, J-PAS South (in cylindrical projection) looks:



and J-PAS North:



With these coordinate systems we can easily define for each field a regular orthogonal grid of pointings (i.e. rows and columns) which simplifies everything. As we increase $|\delta'|$, there will be an overlap in the images of a CCD in contiguous pointings which goes as $1/\cos(\delta)$. This implies an overlap of a 15% at $\delta=\pm30º$, which is not much.