Survey Definition Tool

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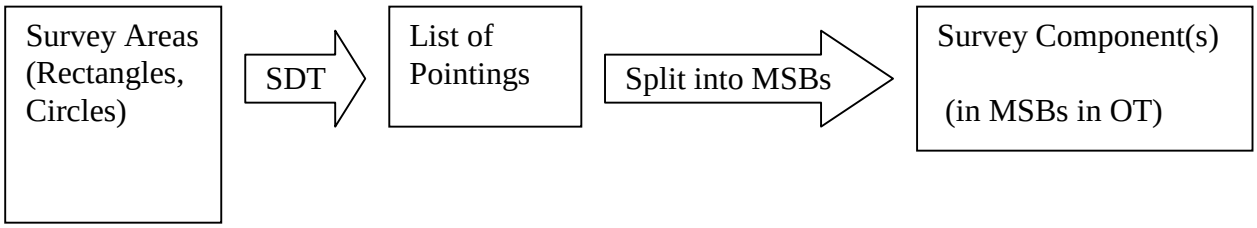
This document can be thought of as a "Pre-Demo" of the Survey Definition Tool (SDT). The intention is to give a short overview and trigger questions and comments.

In this document all coordinates are given as decimal degrees (including RA).
(I have not had the time to change these to HMS, DMS in the images concerned.)

Overview



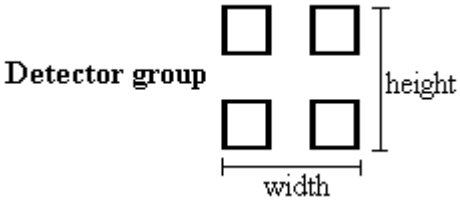
1. Define a "*primitive pattern*" [1] of pointings (e.g. filled square/tile etc.) which is then used to cover survey areas. A primitive pattern allows the definition of a contiguous rectangle that can be used to cover a survey area when the detector group footprint is dis-contiguous such as in the case of WFCAM.
2. Define *survey areas* as rectangles or circles in given coordinate systems. (FK5, FK4, Galactic, SLOAN coordinates)
3. The SDT converts the boundaries of these survey areas to FK5 (RA/Dec) and creates a *list of pointings* that make up the primitive patterns that fill each survey area along rows of constant declination.
4. The SDT will then try to find suitable guide stars in a catalogue (USNO 2.0A) for each of the pointings. If a guide star cannot be found then the pointing is shifted back (in negative RA direction) until a guide star comes in reach. The following pointings in that row are shifted accordingly and an extra pointing is added at the end of the row if necessary.
5. Small areas that should not be observed can be specified as rectangles or circles in a given coordinate system. The pointings that fall into these areas are taken off the list of pointings of the respective survey area.
6. Finally the list of pointings created by the SDT are split into MSBs and stored in Survey Components in the Observation Preparation Tool (OT). As an entry in a Survey Component each pointing can then be accessed and edited in the same way as the Target Information component in the current OT. This allows loading a sky background image and superimposing the WFCAM detector group footprint for individual pointings etc.

Steps 1, 2, 3 are described in more detail below.

[1] If anyone comes up with a more suitable expression, don't hesitate to let me know.

Defining a "Primitive Pattern"

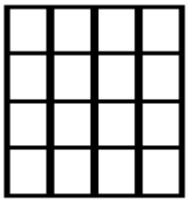
A primitive pattern is defined in terms of a number of pointing offsets in RA direction (geodesic distance, not |ra0 – ra1|) and Dec direction: see OFFSTES_X, OFFSETS_Y below.



Given a *detector group* these primitive patterns can be used to define contiguous rectangular areas that are later used to cover an entire survey area (see next section).

Offsets to the next primitive pattern are also supplied: NEXT_PATTERN_X, and NEXT_PATTERN_Y. To calculate the overall area covered by the pattern it is also necessary to specify the width and height of the detector group (DETECTOR_GROUP_WIDTH, DETECTOR_GROUP_HEIGHT).

Example 1: Filled square

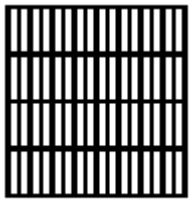


Configuration File:

```
# Primitive Pattern settings for filled square aka 2X2 tile.

# Offsets between pointings in arcsecons
#
# The initial position must be in the list of offsets
# (typically as 0).
#
# All offsets are given as offsets from the origin (0,0)
# (rather than offsets from the previous position)
#
# The offsets MUST be in ascending order for all
# parts of the software to works properly.
OFFSETS_X = 0 792
OFFSETS_Y = 0 792

# Offsets between patterns in arcseconds
# For WFCAM 3170.736 arcsecs leads to an overlap of
# 3 percent of a single detector size between adjacent
# filled squares.
```

```
# That is the same as the overlap between detectors within
# the filled square.
NEXT_PATTERN_X = 3170
NEXT_PATTERN_Y = 3170

# Width and height of detector group in arcsecs
# (smallest rectangle containing all detectors).
DETECTOR_GROUP_WIDTH  = 2402
DETECTOR_GROUP_HEIGHT = 2402
```

Example 2: RA finely sampled



RA finely sampled

```
OFFSETS_X = 0 198 396 594 792
OFFSETS_Y = 0 792

NEXT_PATTERN_X = 3170
NEXT_PATTERN_Y = 3170
```

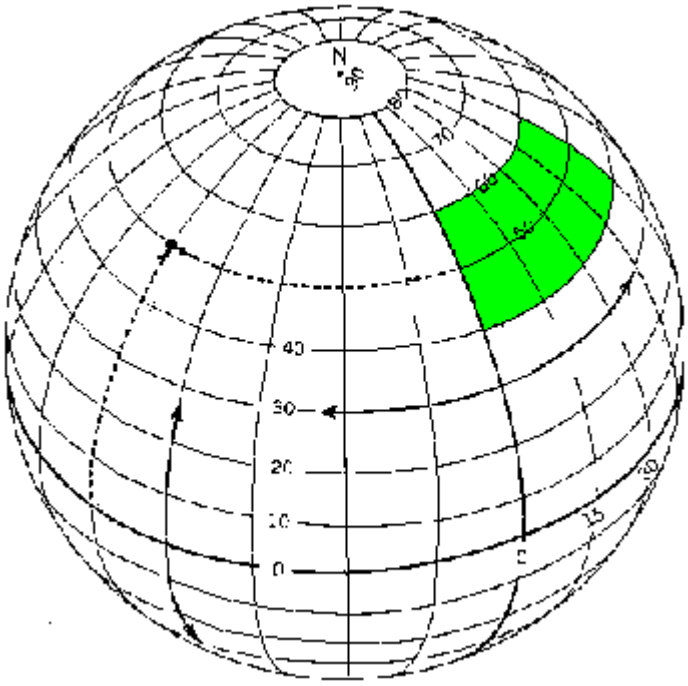
Covering Survey Areas with Primitive Patterns

In the following examples the filled in square is used as the primitive pattern.

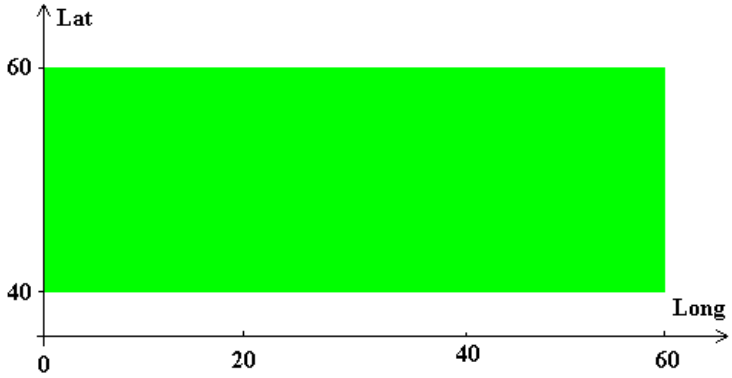
Example 1: Rectangle (0°,40°), (60°, 60°), Galactic

- **The user defines a "rectangle" in a given coordinate System, say *Galactic*.** As seen in the picture below, a rectangle in this context is an area whose boundaries are lines along which one of the coordinates of the given

coordinate system is constant.

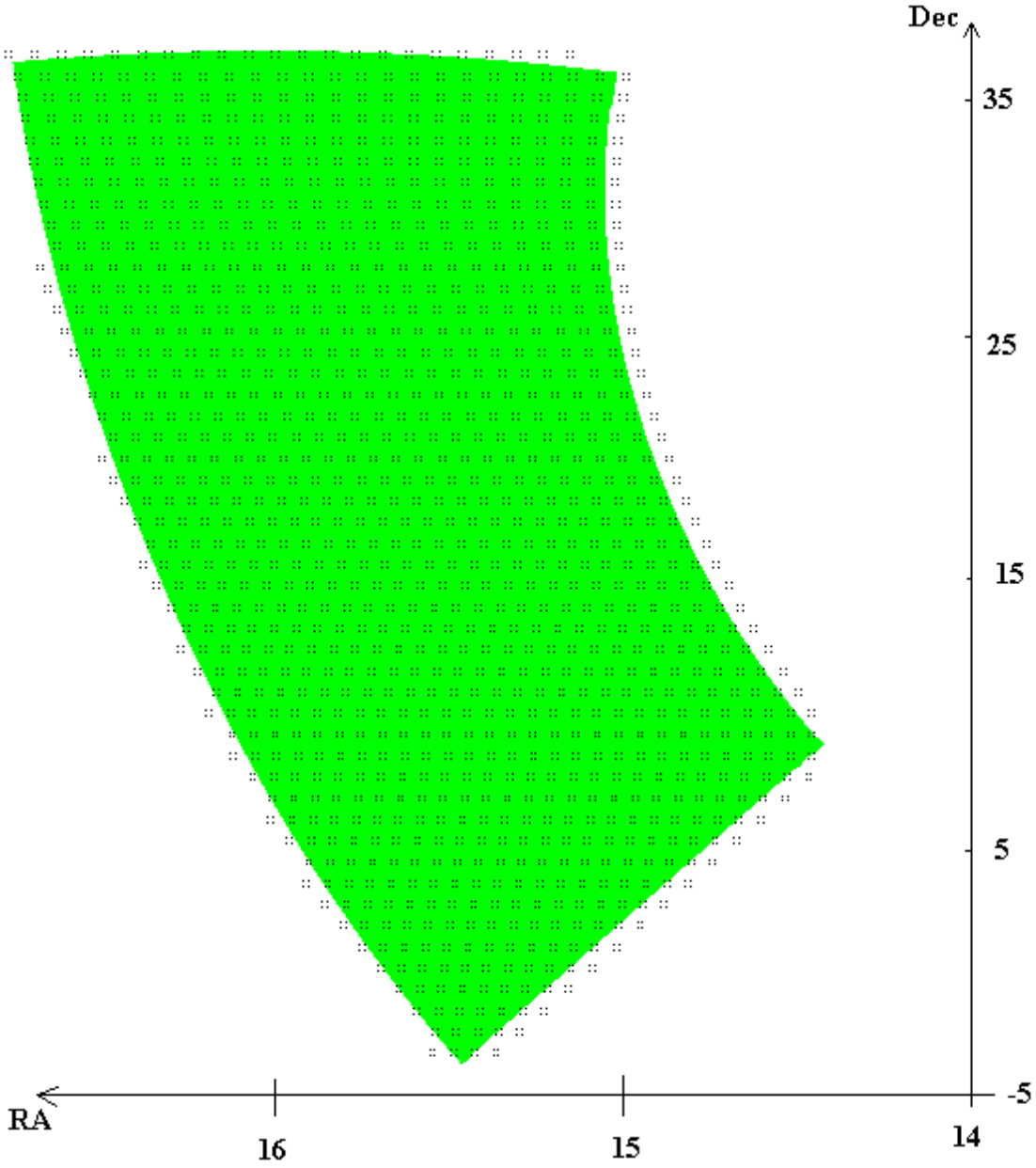


Such a rectangle can be defined in terms to two points in the coordinate system. In this example the two points are (0°, 40°), (60°, 60°) in (Long/Lat). The figure below show the same area plotted in a Cartesian (Long/Lat) coordinate system:



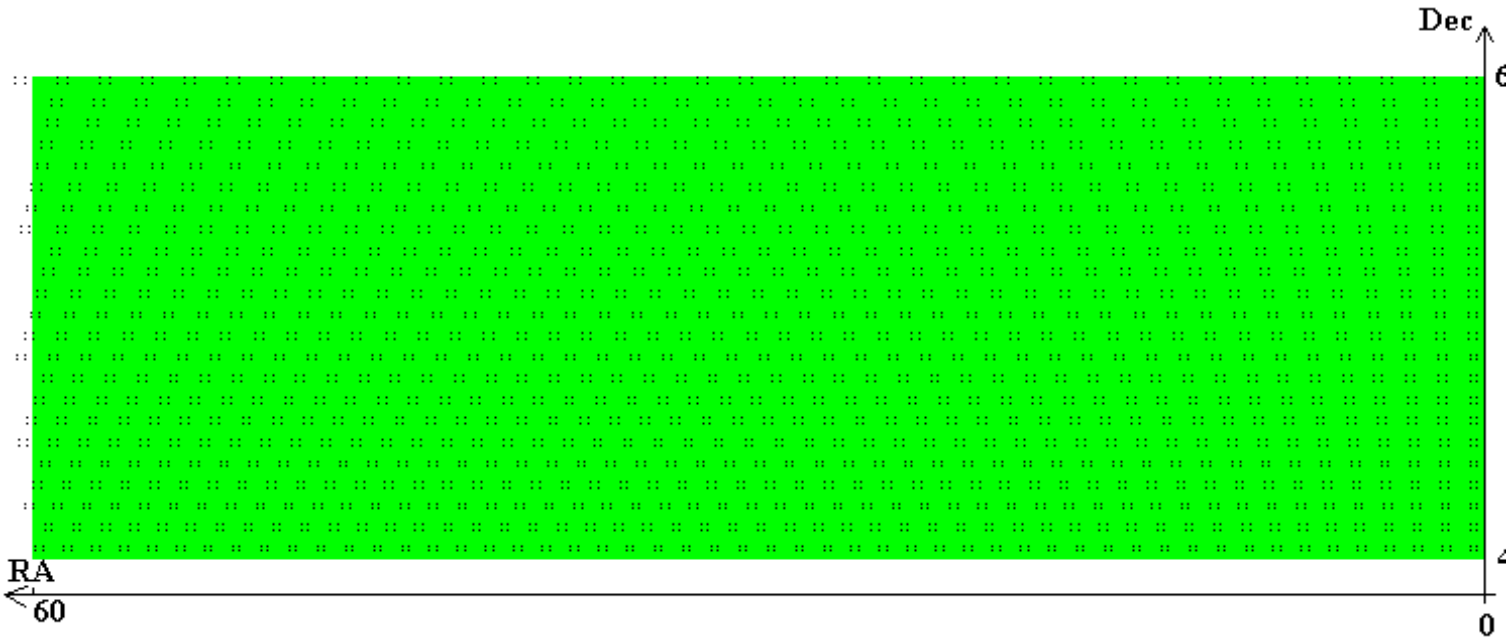
- **The Survey Definition Tool converts the boundary of this area into FK5 (RA/Dec) coordinates** and fills them with *primitive patterns*, along rows of

constant Dec, row by row:



Example 2: Rectangle (0°,40°), (60°, 60°), FK5

The same coordinates are used as in example 1 but this time in FK5 (RA/Dec). So we have the rectangle defined by the two points (0°, 40°), (60°, 60°) in FK5 (RA/Dec). The survey area and the pointings plotted on a Cartesian RA/Dec-grid are:



Example 3: Circle (330°, 55°), FK5, radius = 5°