ALMA Cycle-3 Capabilities

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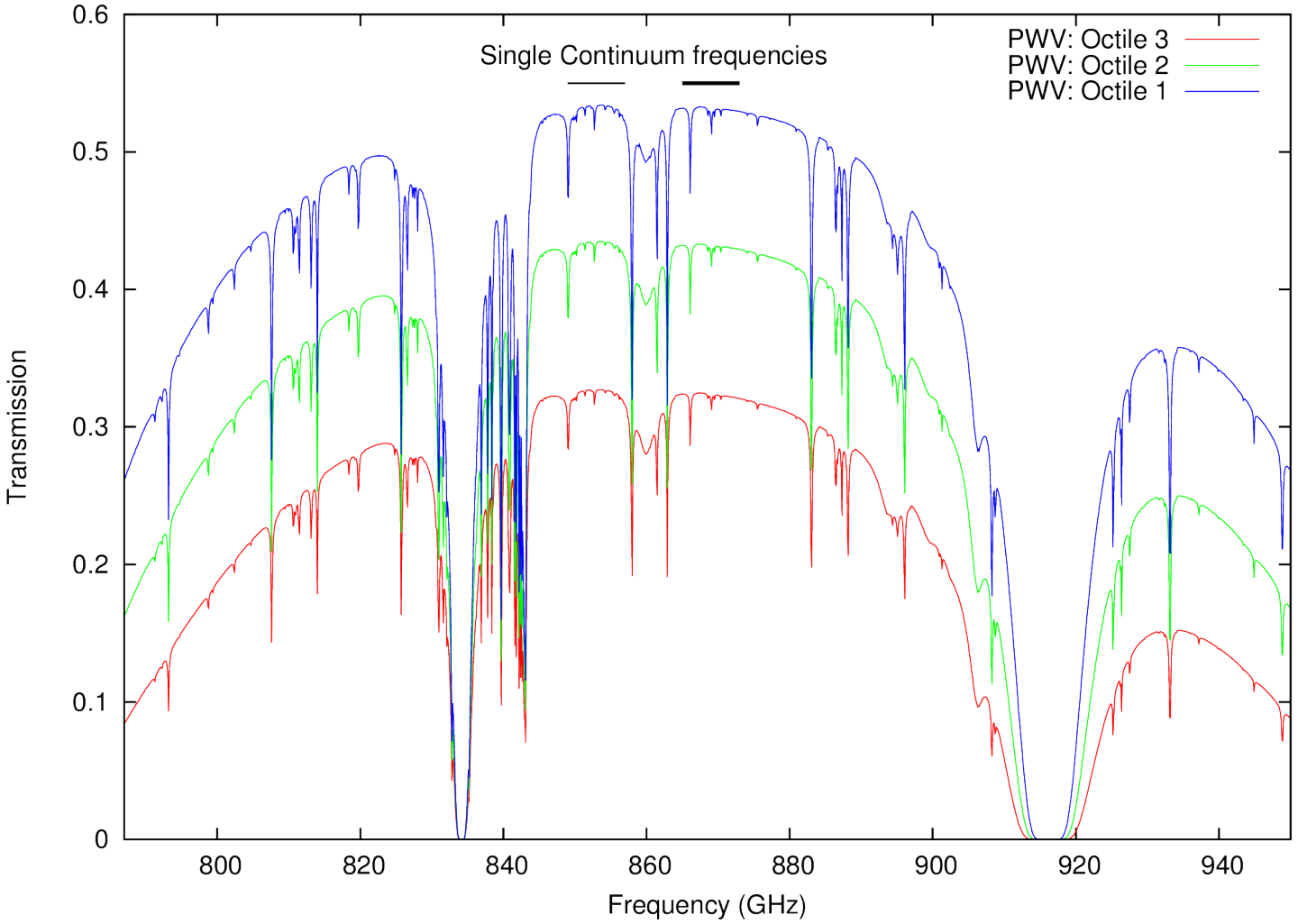
New ALMA capabilities for Cycle 3

- Band 10
- More antennas
- Baselines up to 10 km
- Expanded full-polarization tuning range
- ~~High spectral resolution (FDM) full polarization~~
- ~~TP at Bands 9 and 10~~

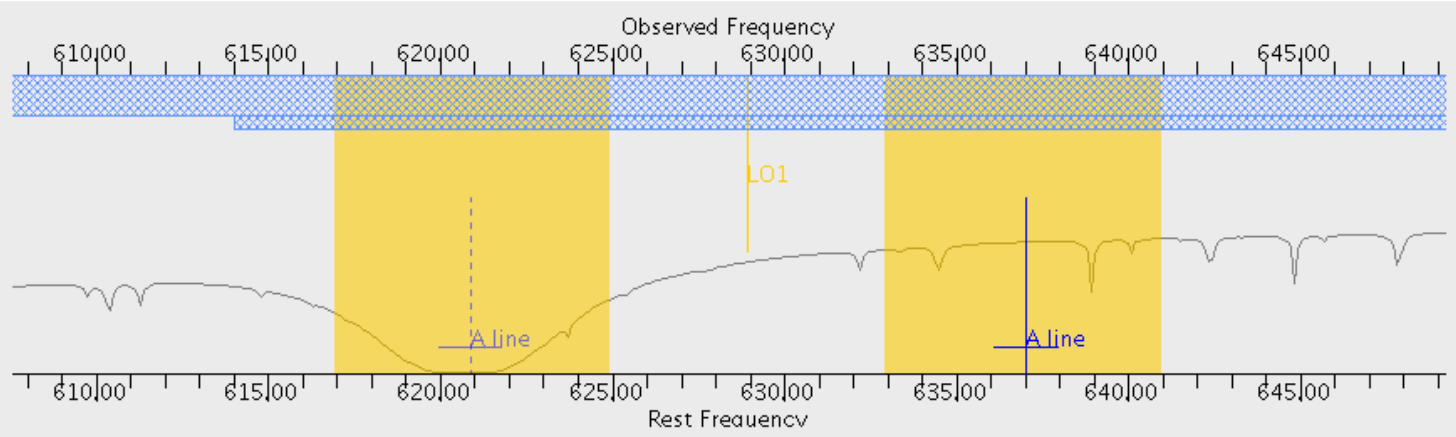
Band 10

- Frequency coverage
  - 787-950 GHz (381-316 μm)
- Angular resolution
  - 400-30 mas
- Receiver temperature
  - OT uses specification of 230 K (DSB) over 80% of band
- 1st octile of PWV across whole band
  - 0.452 mm
- No mosaics
  - Primary beam is not well characterised

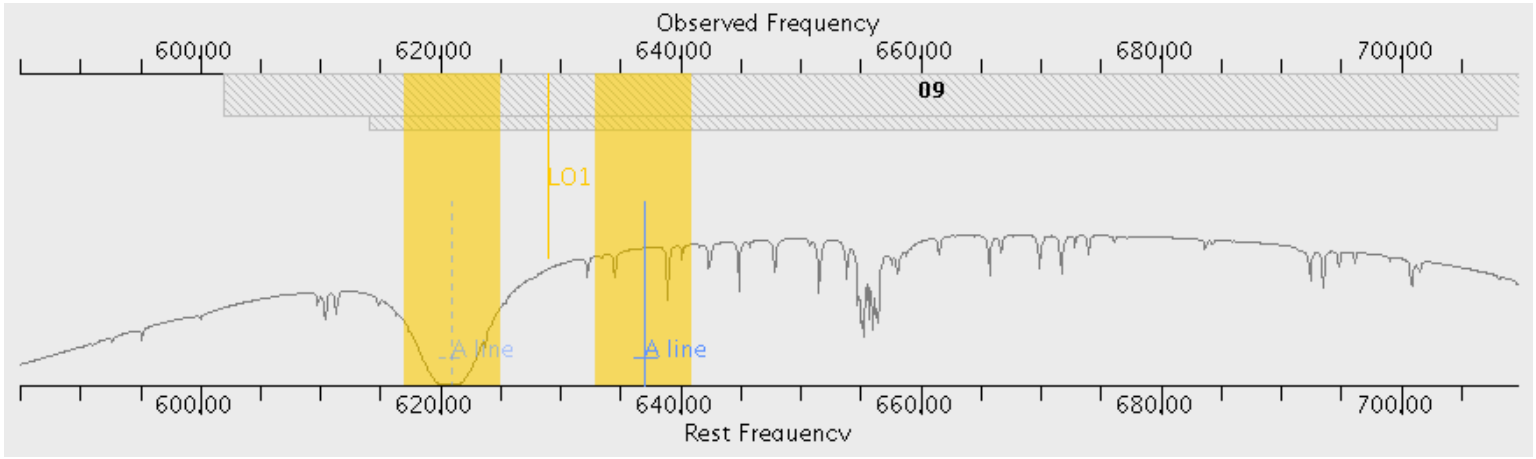
Band-10 Transmission



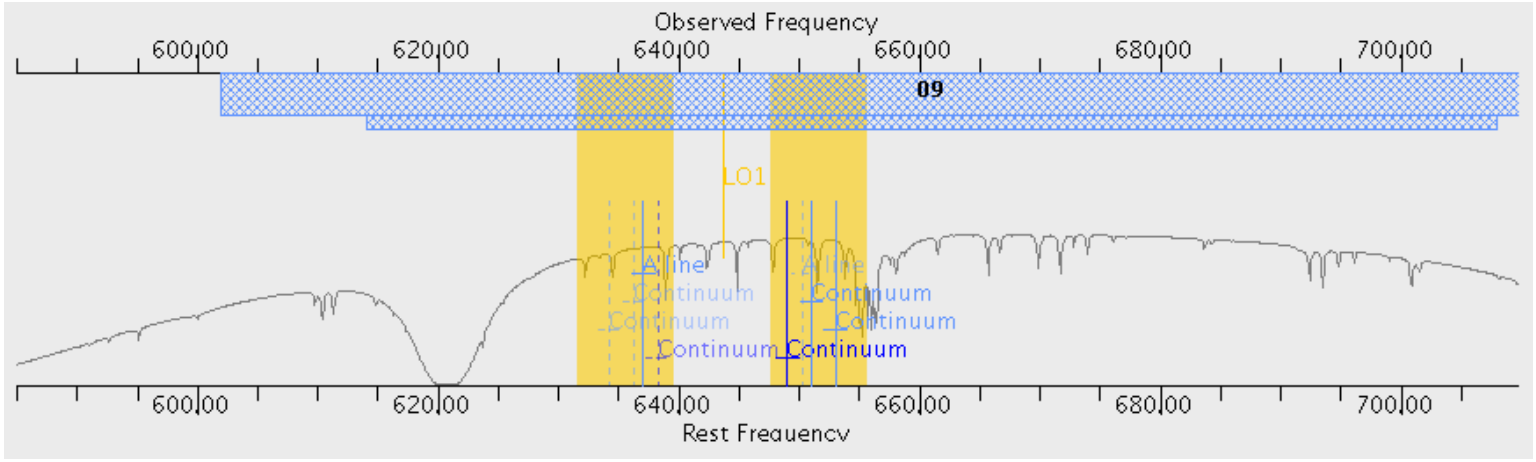
DSB-receiver time estimates



- Noise from “image” sideband contributes to “signal” spw
  - Only an issue for DSB receivers (Bands 9 and 10)
  - (Astronomical signal **is** supressed)
- Noise is higher where atmospheric opacity is high
  - Atmospheric absorption lines should be avoided
- OT time estimates now include image noise explicitly
  - Visual editor shows location of image spws



Single spw – defaults to Upper Sideband (6.05 min on source)



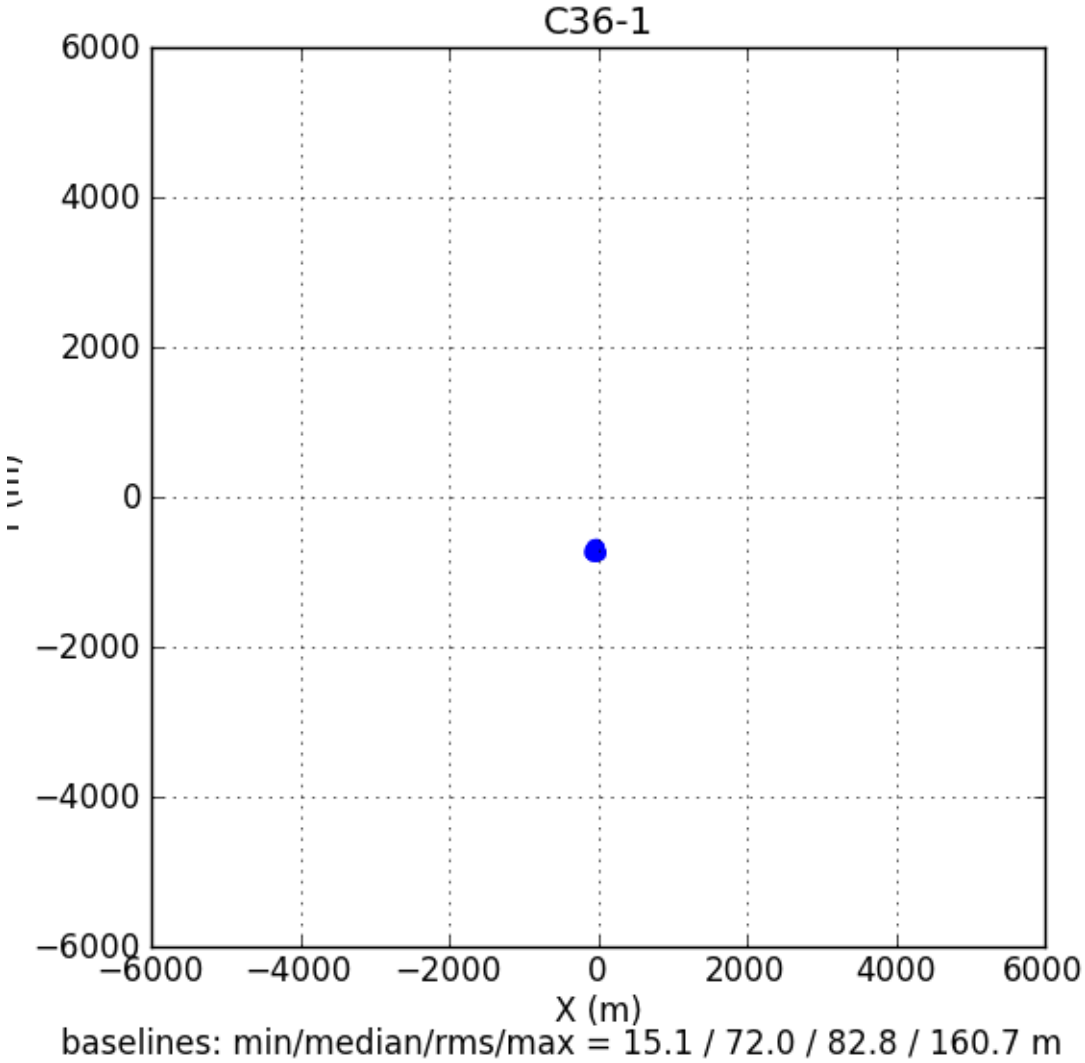
Place continuum spws such that line is forced into LSB (4.03 min on source)

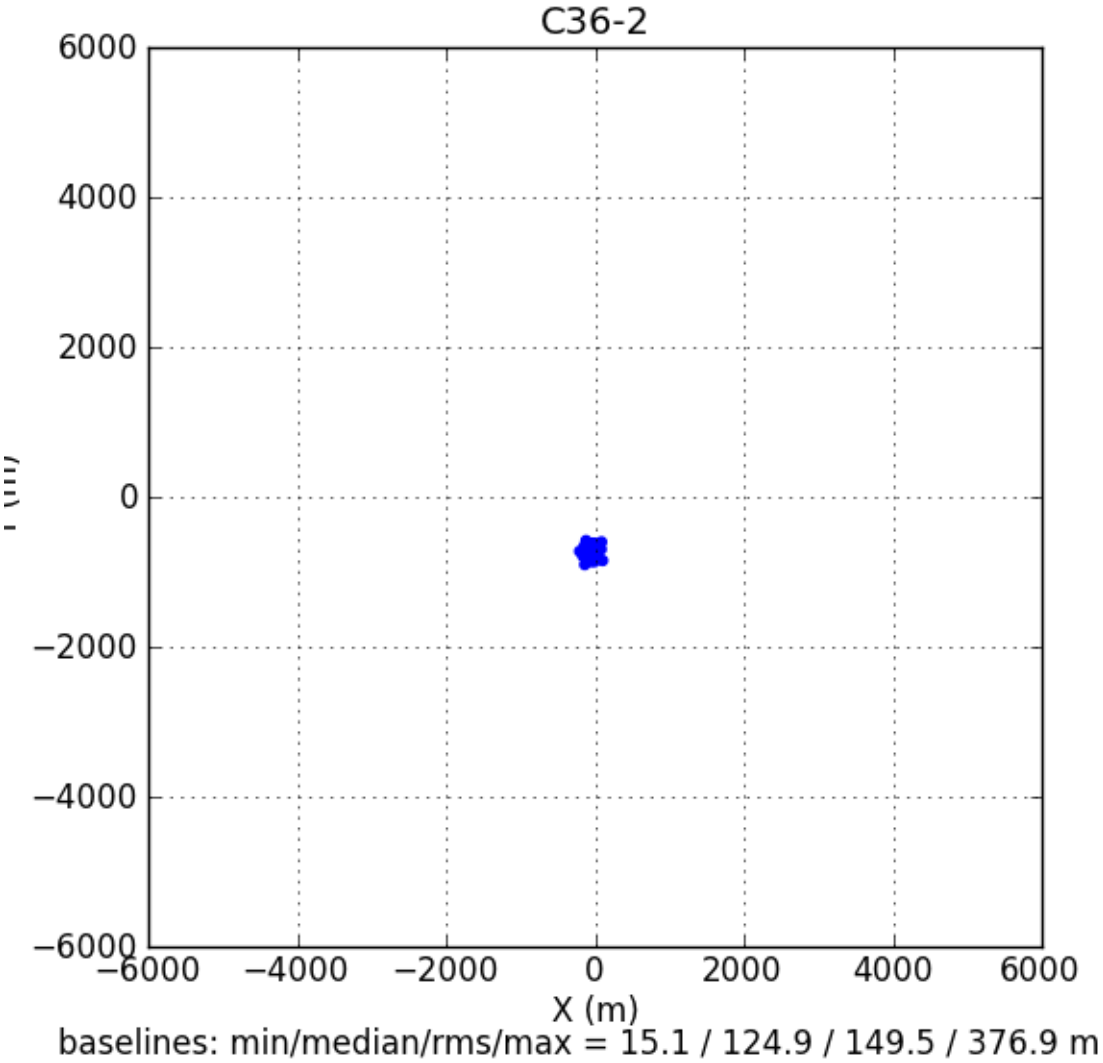
Number of antennas

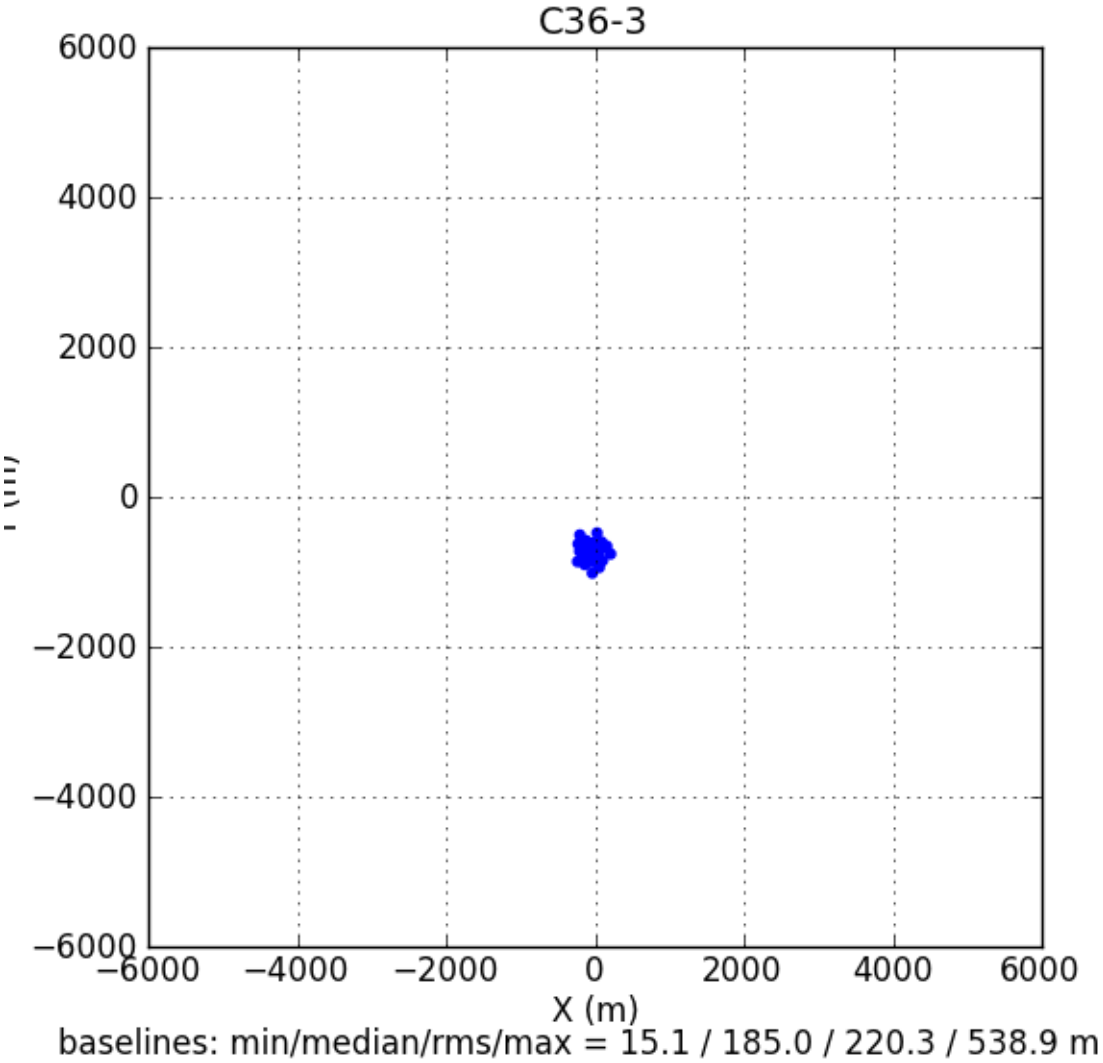
- Expected (minimum) number of antennas
  - 12-m array: 36 [Cycle 2: 34]
  - 7-m array: 10 [9]
  - TP array: 2 [2]
- Modest increase in sensitivity
- Improvement in (u,v) coverage is better
  - 12% more 12-m baselines
  - Better calibration and imaging

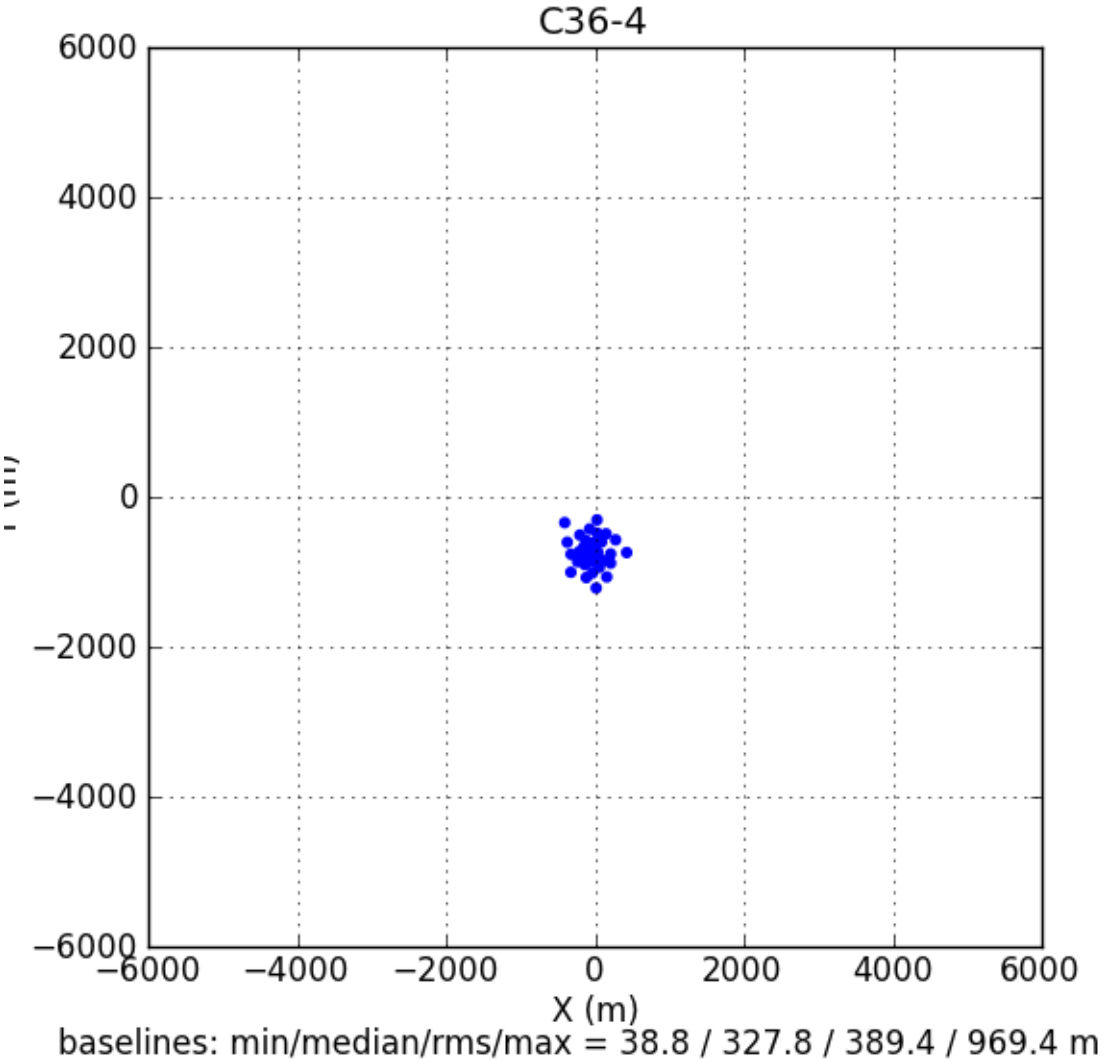
Antenna configurations

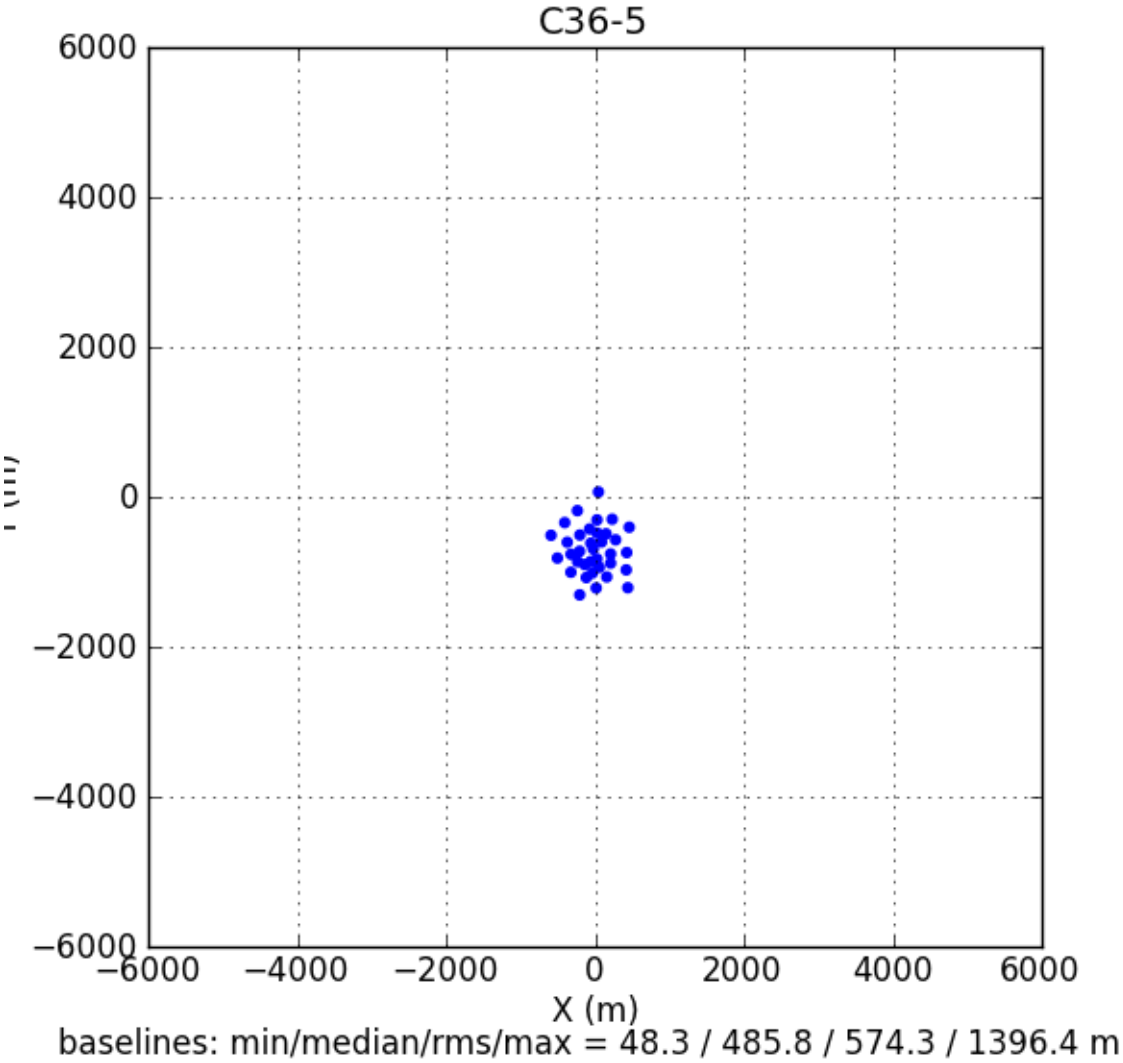
- 8 12-m array configurations in total
  - C36-1: 14.7 l 160.7 [min l max baseline (m)]
  - C36-2: 14.7 l 376.9
  - C36-3: 14.7 l 538.9
  - C36-4: 38.6 l 969.4
  - C36-5: 47.9 l 1396.4 (close to Cycle-2 C34-7)
  - C36-6: 77.3 l 2299.6
  - **C36-7: 248.3 l 6074.2**
  - **C36-8: 346.5 l 9743.7**
- 1 ACA configuration
  - 8.7 l 32.1

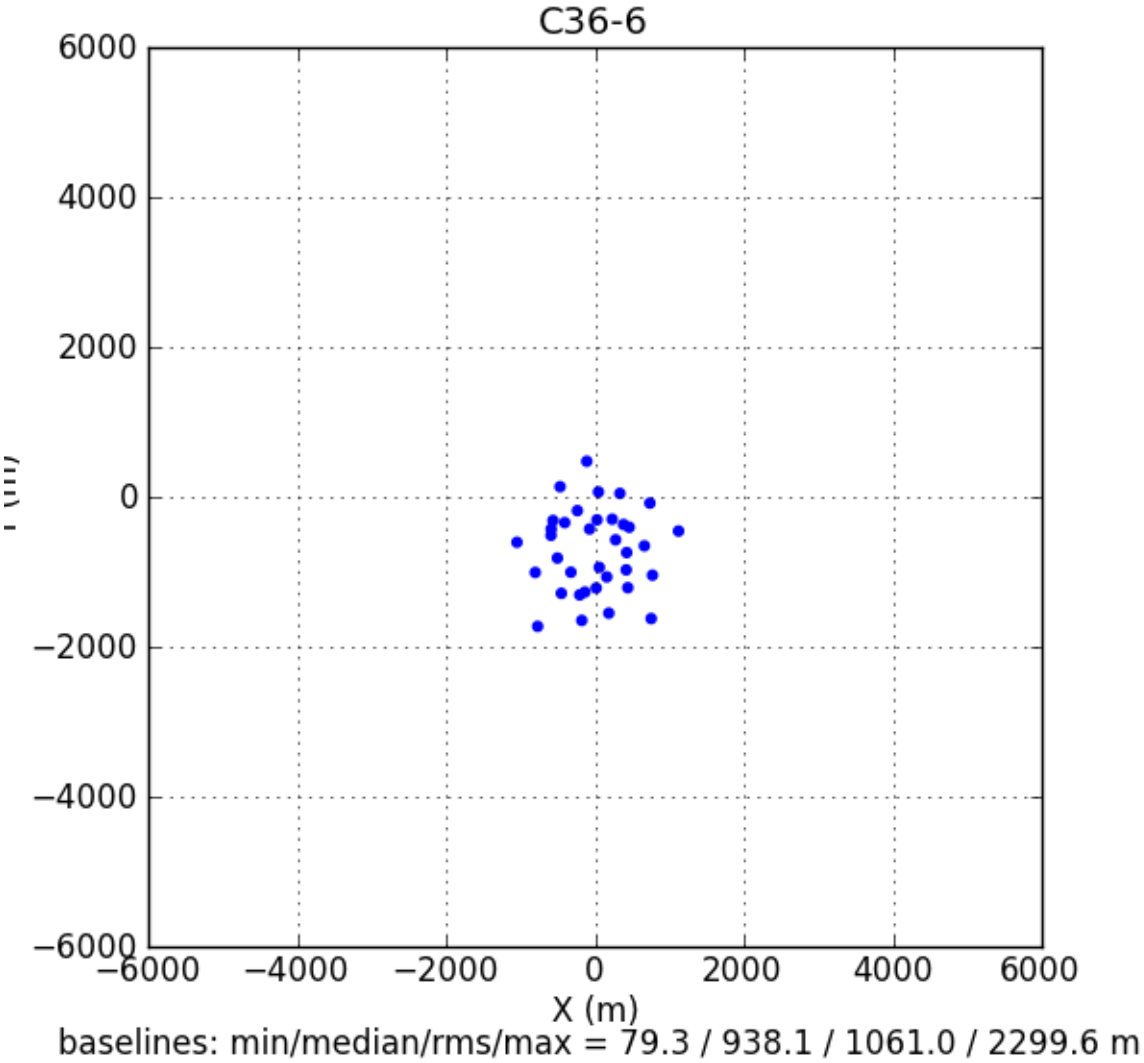

C36-1
6000
4000
2000
0
−2000
−4000
−6000
−6000
−4000
−2000
0
2000
4000
6000
X (m)
baselines: min/median/rms/max = 15.1 / 72.0 / 82.8 / 160.7 m

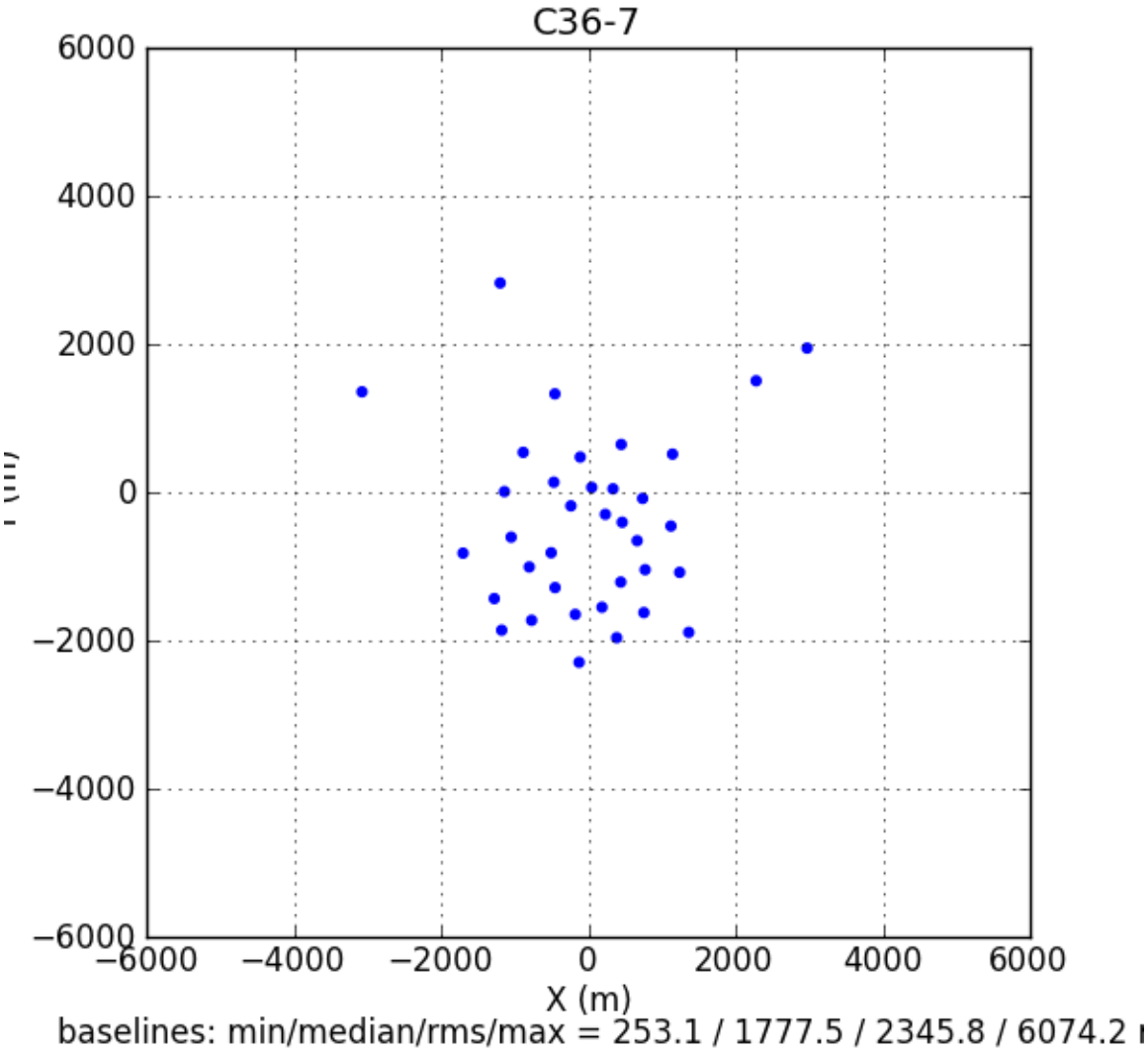

C36-2
6000
4000
2000
0
−2000
−4000
−6000
−6000
−4000
−2000
0
2000
4000
6000
X (m)
baselines: min/median/rms/max = 15.1 / 124.9 / 149.5 / 376.9 m

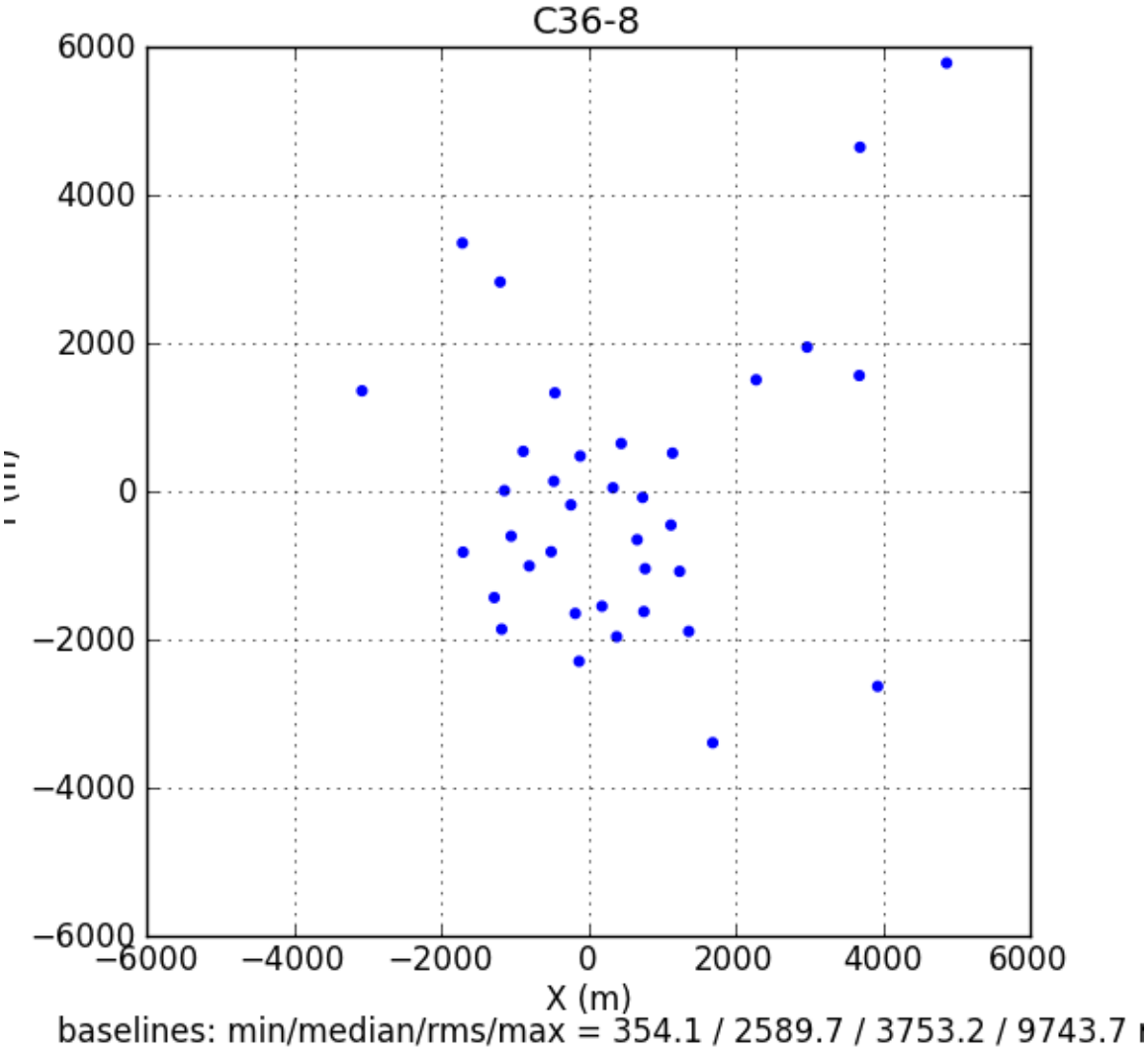

C36-3
6000
4000
2000
0
−2000
−4000
−6000
−6000
−4000
−2000
0
2000
4000
6000
X (m)
baselines: min/median/rms/max = 15.1 / 185.0 / 220.3 / 538.9 m


C36-4
6000
4000
2000
0
−2000
−4000
−6000
−6000
−4000
−2000
0
2000
4000
6000
X (m)
baselines: min/median/rms/max = 38.8 / 327.8 / 389.4 / 969.4 m


C36-5
6000
4000
2000
0
−2000
−4000
−6000
−6000
−4000
−2000
0
2000
4000
6000
X (m)
baselines: min/median/rms/max = 48.3 / 485.8 / 574.3 / 1396.4 m


C36-6
6000
4000
2000
0
−2000
−4000
−6000
−6000
−4000
−2000
0
2000
4000
6000
X (m)
baselines: min/median/rms/max = 79.3 / 938.1 / 1061.0 / 2299.6 m


C36-7
6000
4000
2000
0
−2000
−4000
−6000
−6000
−4000
−2000
0
2000
4000
6000
X (m)
baselines: min/median/rms/max = 253.1 / 1777.5 / 2345.8 / 6074.2


C36-8
6000
4000
2000
0
−2000
−4000
−6000
−6000
−4000
−2000
0
2000
4000
6000
X (m)
baselines: min/median/rms/max = 354.1 / 2589.7 / 3753.2 / 9743.7

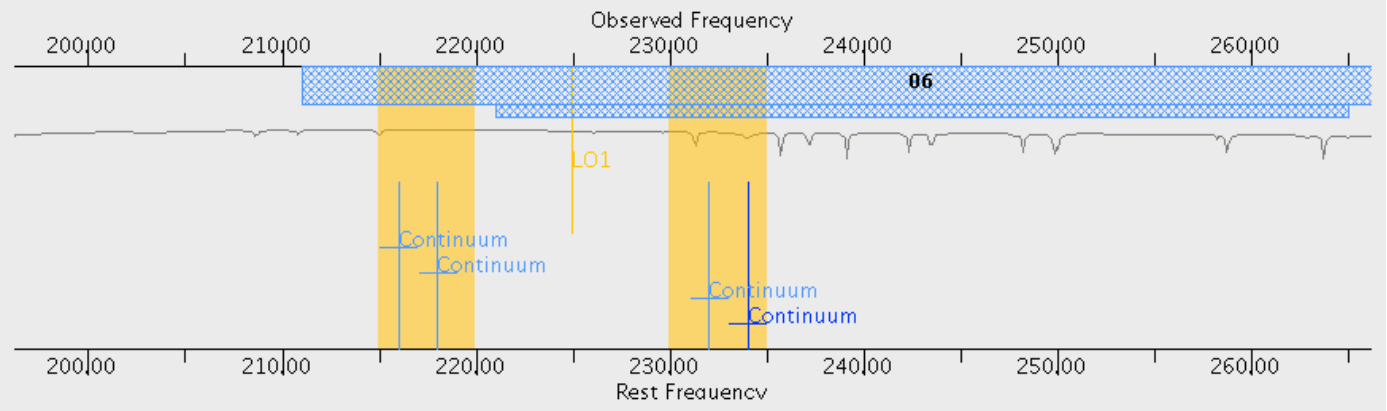
“Long”-baseline configurations

- C36-7 and -8
- Available configurations will be band-dependent
  - B3, 4 and 6: ≤ 10 km
  - B7: ≤ 6 km
  - B8, 9 and 10: ≤ 2.5 km
- More frequent phase referencing
  - Approximately every minute
  - Time estimates are therefore relatively high

Array selection

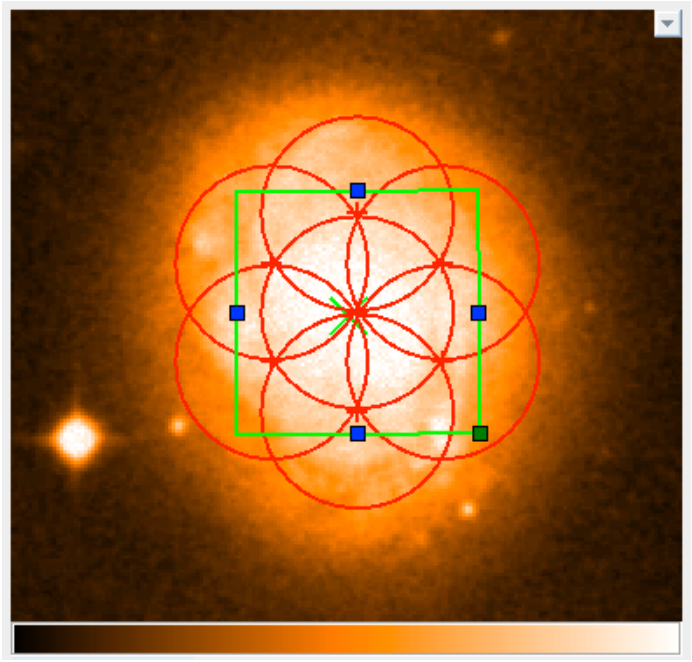
- Parameters for selection
  - Requested angular resolution ($\Delta\theta$)
  - Largest angular scale in source (LAS)
  - Max recoverable scale of array (MRS, set by min baseline)
- Procedure
  - Choose smallest 12-m configuration that achieves $\Delta\theta$
  - Until MRS > LAS, add
    - A smaller 12-m configuration (if first was C36-6, -5 or -4)
    - The 7-m array
    - The TP array
- Special restriction for “long”-baseline configuration
  - No other configurations allowed

Expanded full-polarization tuning range



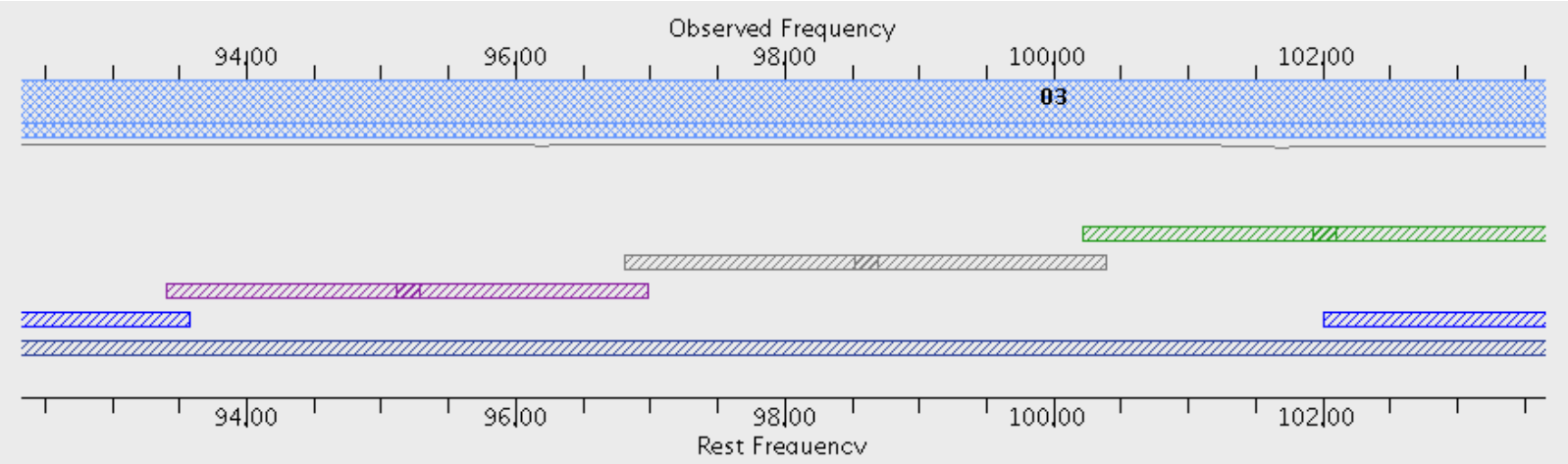
- Cycle 3
  - "Single continuum" setups at arbitrary frequencies
- Continuing restrictions
  - Still only Bands 3, 6 and 7
  - On-axis only (single pointings)
  - Only **linear** polarization officially supported
  - Only one tuning per SG
  - 3-hour minimum time estimate will remain

Antenna beamsize



- HPBW of antenna
  - Also known as ‘primary beam’
  - Sets Field of View
- New definition: 1.13 λ / D
  - OT had previously assumed 1.2 λ / D
- The number of mosaic pointings will not change
  - Mosaic spacing remains at λ / (√3 D)
  - This number is appropriate for triangularly-spaced mosaics

Spectral Scan overlaps



- Quality of edge channels can be poor
  - Ringing
  - Bad T_{sys} measurements
  - This is in addition to the TDM channels that are usually flagged
- An overlap will therefore be enforced in Cycle 3
  - Only a few TDM channels
  - Exact overlap depends on bandwidth of spw

“Non-standard” modes

- Broadly defined as projects that can’t be pipelined
  - These can make up 25% of available **12-m** time
- Complete list
  - Bands 8, 9 & 10
  - Narrow aggregate bandwidth (<1 GHz)
  - Full polarization
  - Spectral Scans
  - Long baselines (C36-7 or -8)
  - User-defined calibrations
- Will be indicated to PI on cover sheet

Additional new OT features

- Multiple rectangular fields per Science Goal
- Import and export of field source pointings
- TJ node overhauled
- Improved time constrained interface
- Improved time estimate dialogue
- Various improvements to ALMA Sensitivity Calculator