CS1 - Closure Phase
Initial Analysis

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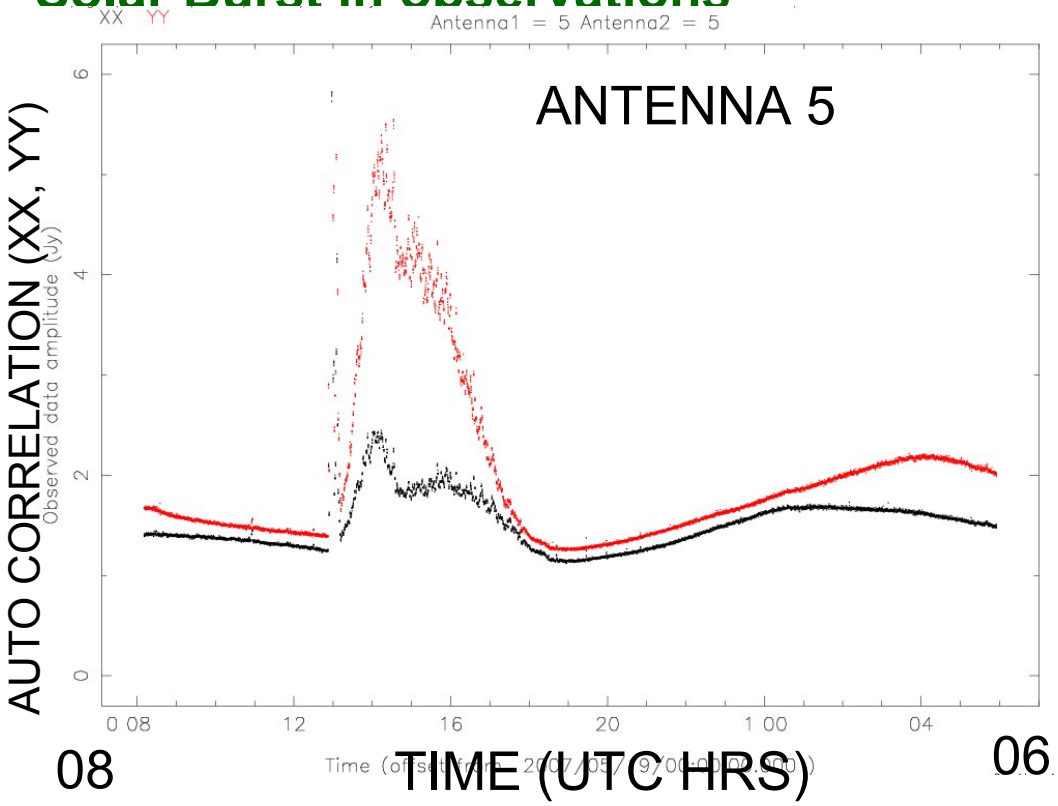
CS1 Meeting

May 31, 2007

Outline

Closure Phases (MS 2339, SB 23)

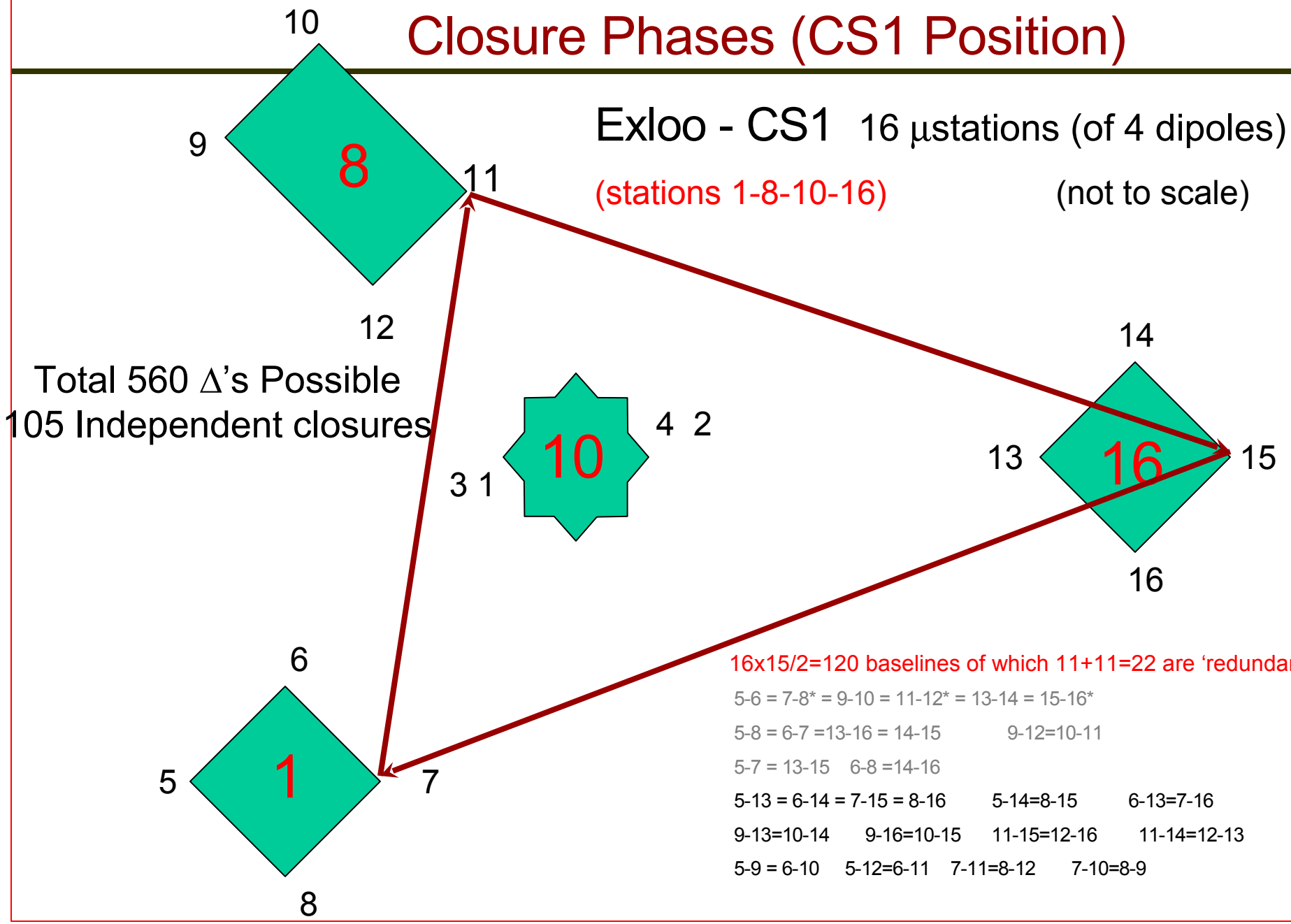
- **Observations on May 19, 2007 for 21 hrs (UTC 08:11hrs to 05:55 hrs)**
- **59.296875 MHz (Spectral Band 23), 256 channels, 156KHZ**
- **Solar Burst in observations**



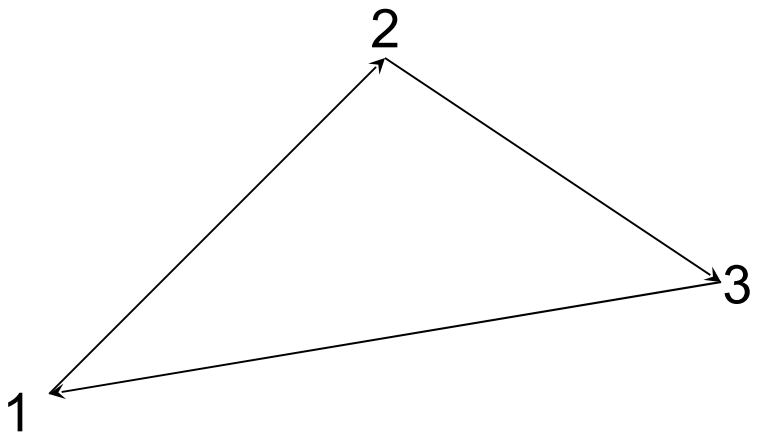
Sun dominates for a few hours
Closure phases - Calibration

With 16 telescopes, 560 closed traingles possible

Closure Phases (CS1 Position)

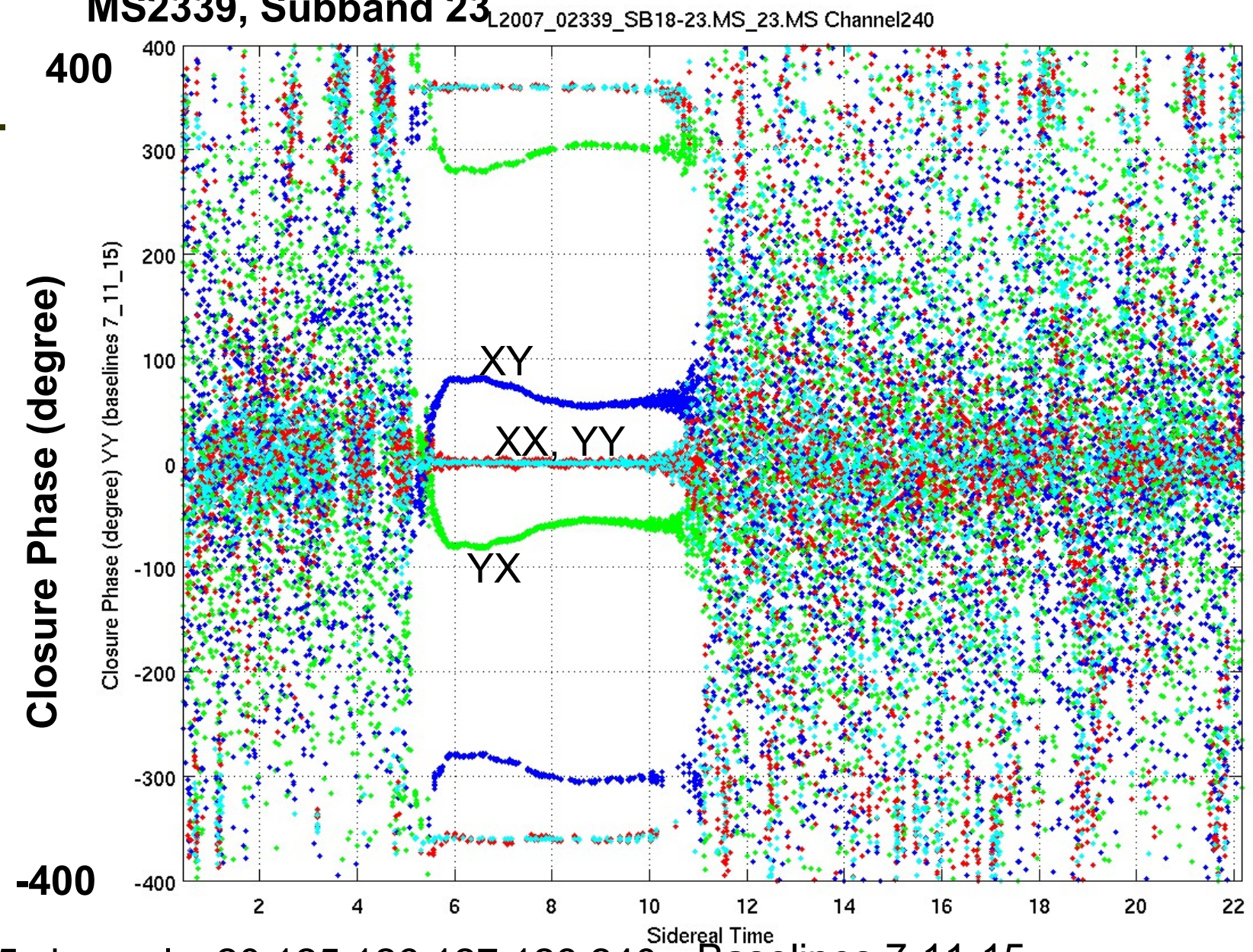


Closure Phase



$$\phi(123) = \phi(12) + \phi(23) + \phi(31)$$
$$= \phi(1) - \phi(2) + \phi(2) - \phi(3) + \phi(3) - \phi(1)$$

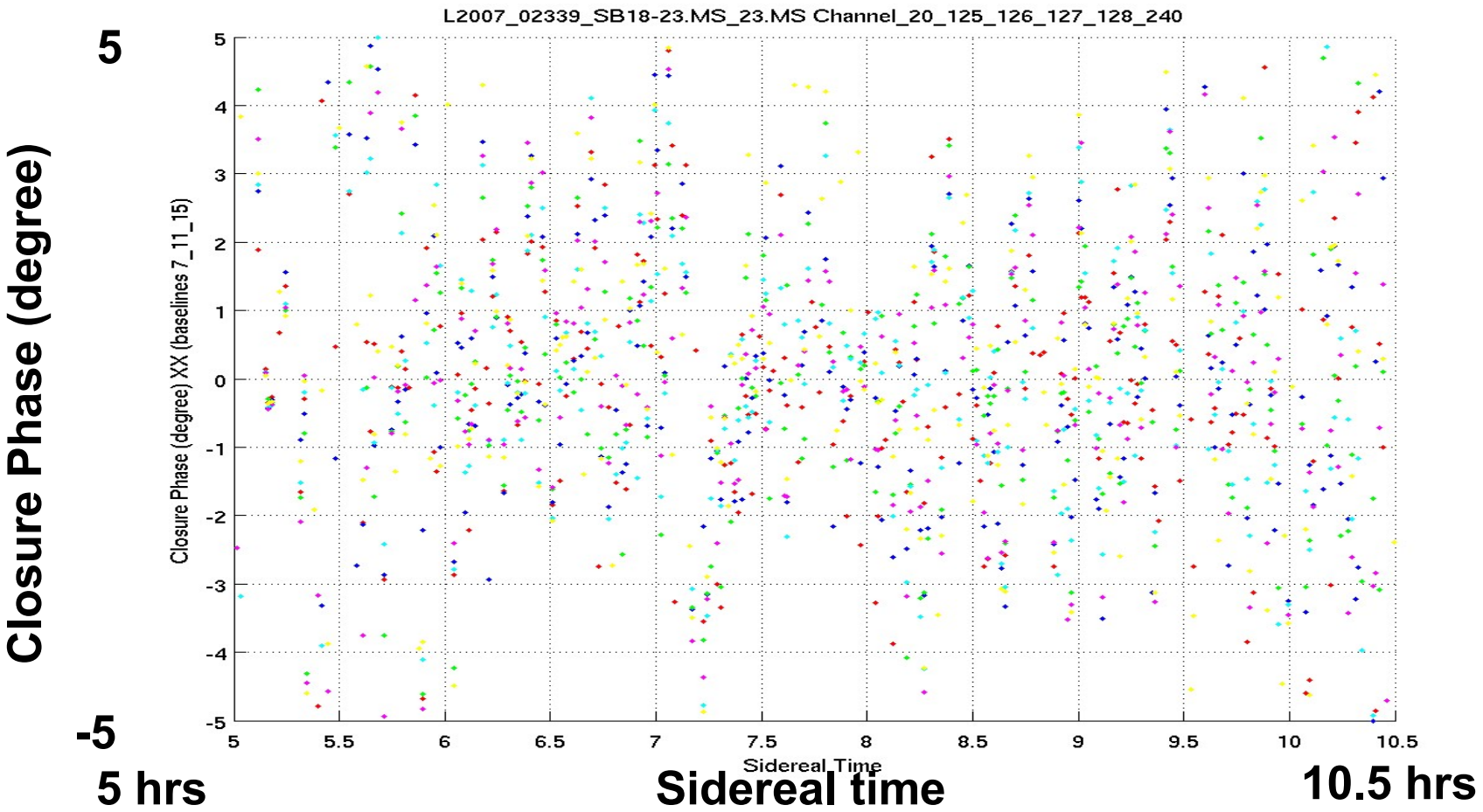
0 for sky dominated by point source



5 channels: 20,125,126,127,128,240 Baselines 7-11-15

Sun dominates but not completely, Structure of sky is reflected

XX - Closure Phases (MS 2339 7-11-15)



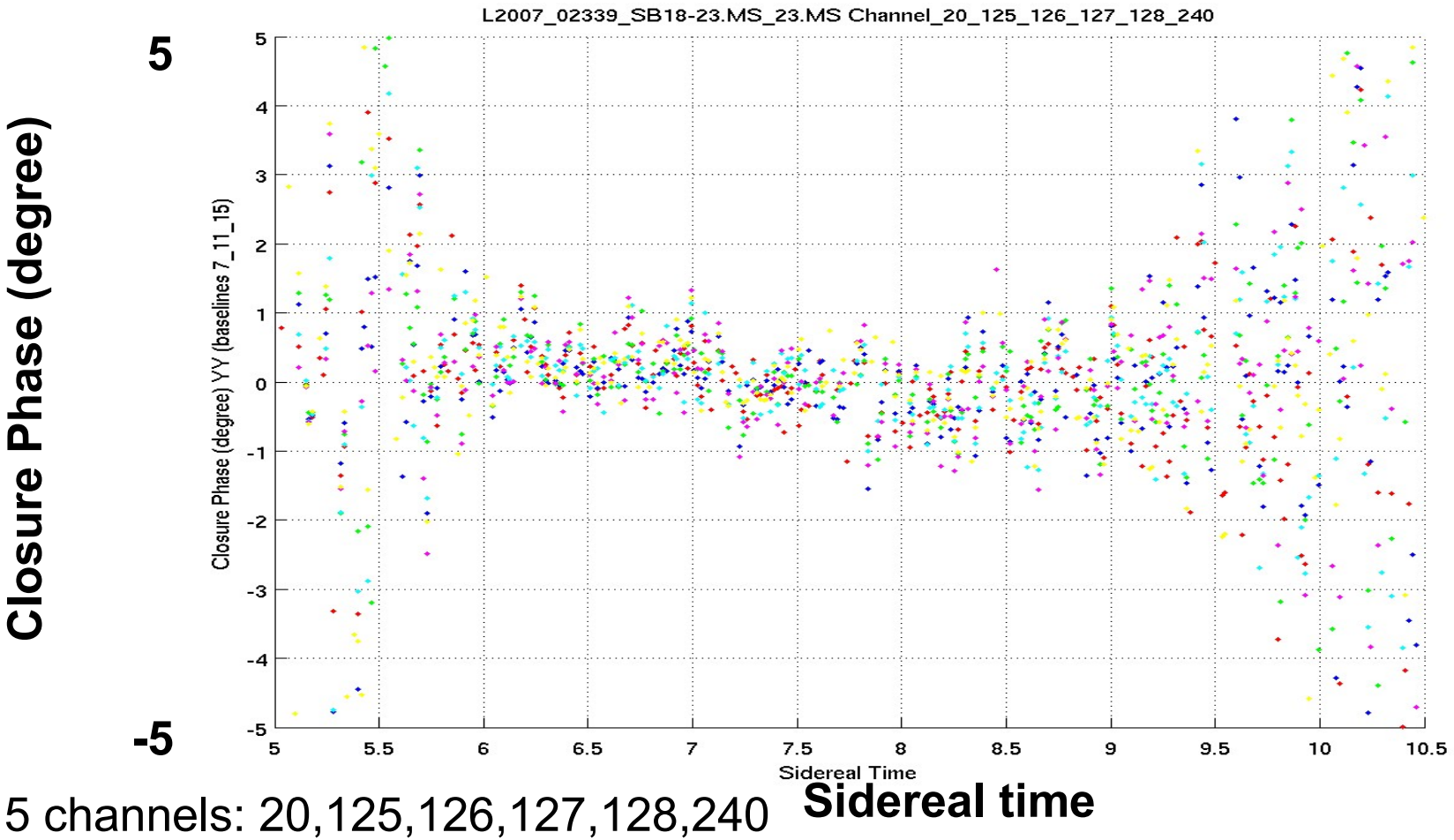
5 channels: 20,125,126,127,128,240

Sun dominates but not completely, Structure of sky is reflected

Closure phase noise : < 1 degree

Correlated from channel to channel

YY- Closure Phases (MS 2339 7-11-15)



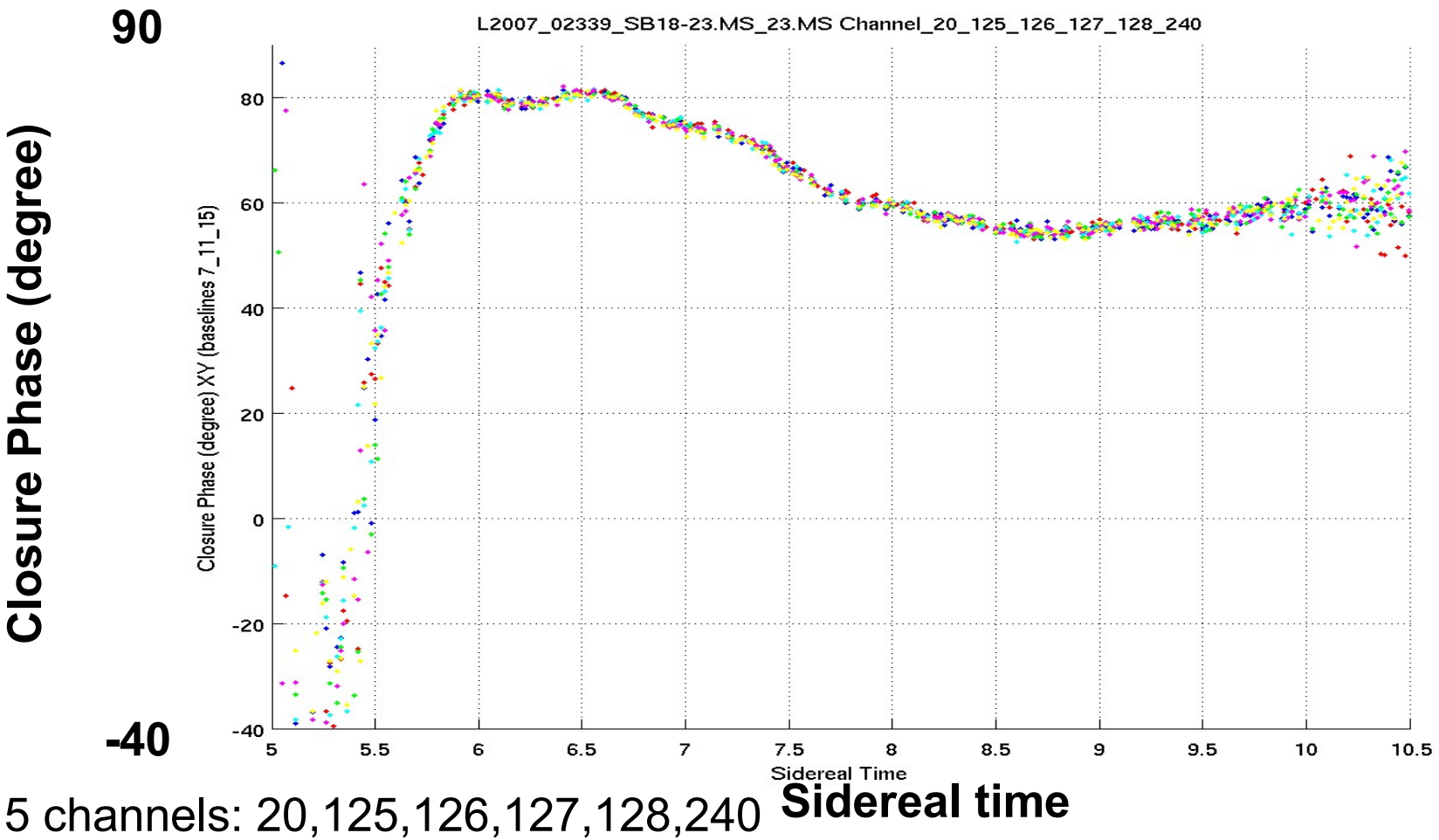
5 channels: 20,125,126,127,128,240

Structure of sky is reflected But less phase variation compared to XX

Closure phase noise : < 1 degree

Correlated from channel to channel

XY-Closure Phases (MS 2339 7-11-15)



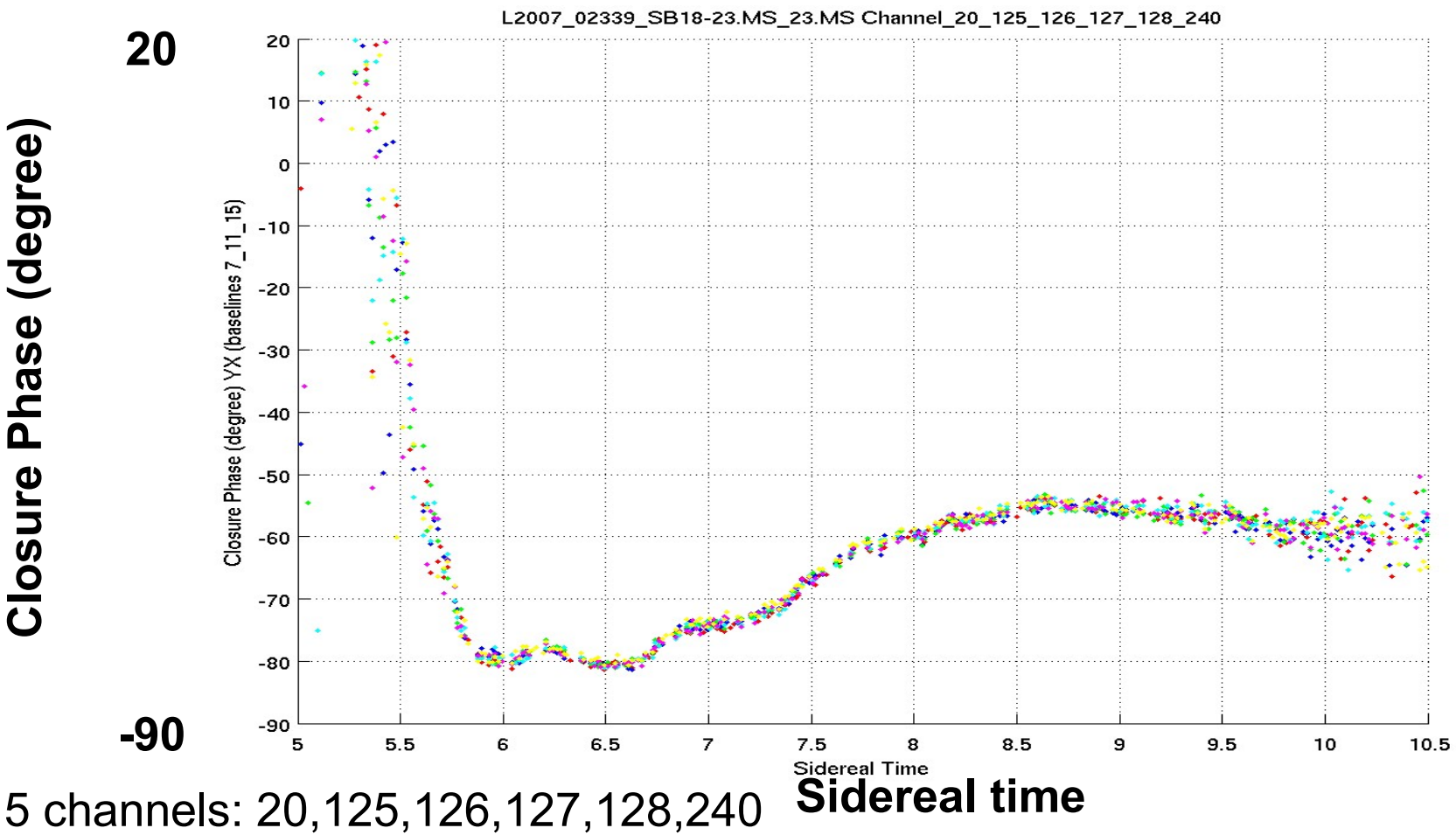
5 channels: 20,125,126,127,128,240

Structure of sky is reflected ?, Phase Shift about 80-90 degree

Closure phase noise : < 1 degree

Correlated from channel to channel

YX- Closure Phases (MS 2339 7-11-15)



5 channels: 20,125,126,127,128,240

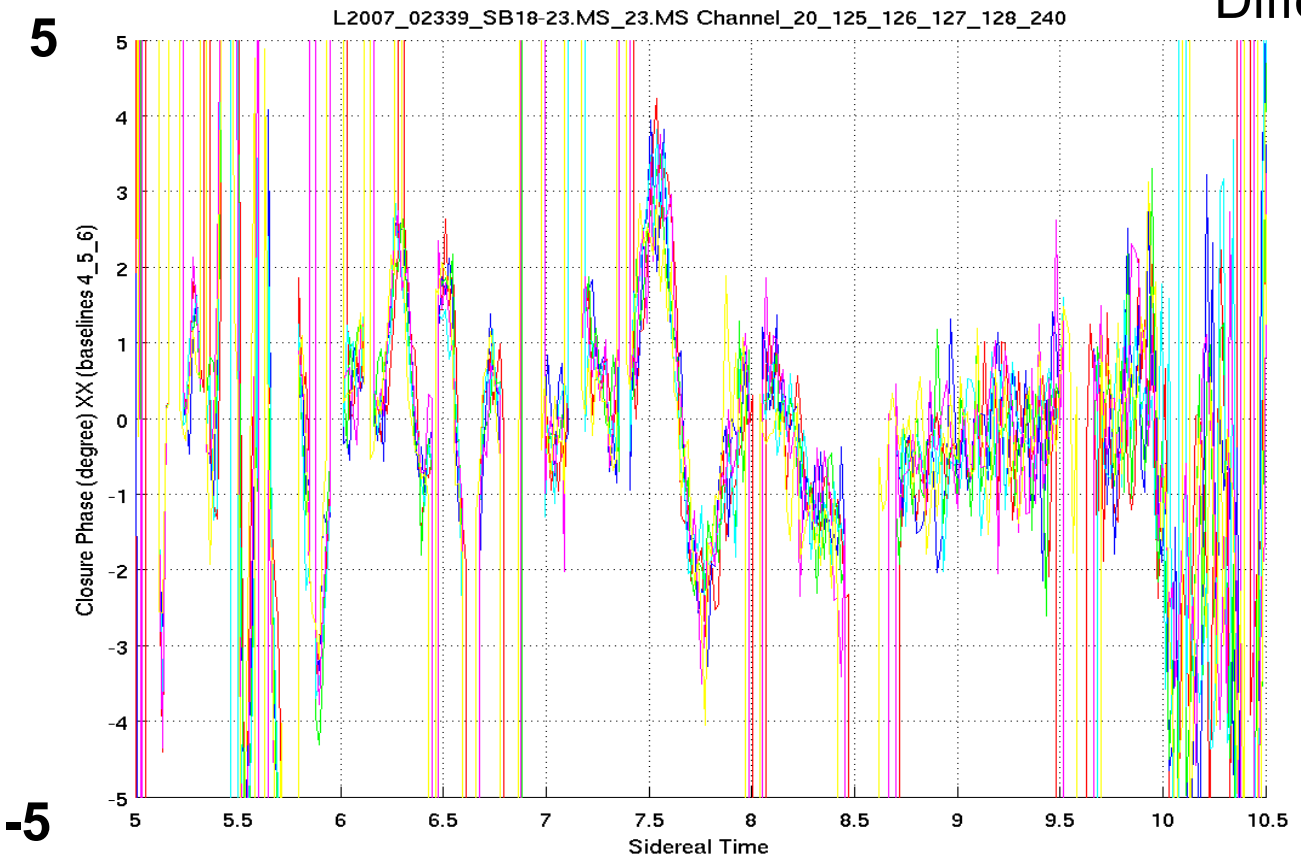
Structure of sky is reflected ? , an phase shift about -80 degree

Closure phase noise : < 1 degree

Correlated from channel to channel

XX - Closure Phases (MS 2339, SB 23 4-5-6)

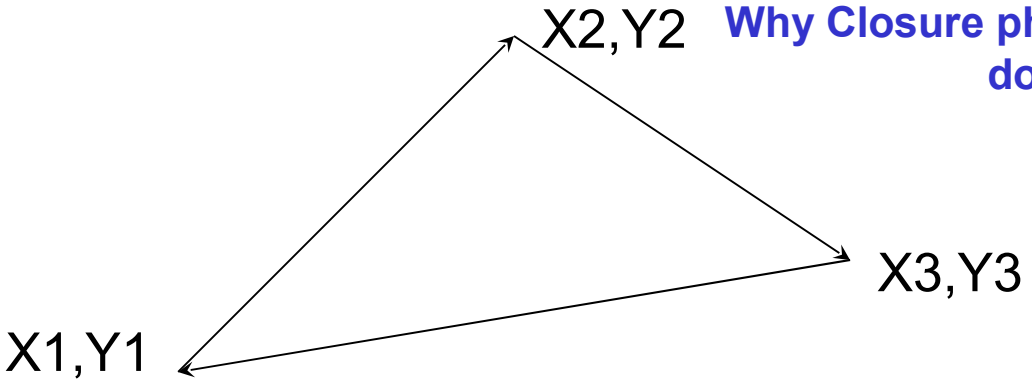
Different Triangle (SBL)



Closure Phase (degree)

5 channels: 20,125,126,127,128,240
Correlated from channel to channel

Closure Phases (MS 2339)



Why Closure phase for XY and YX polarisation does not sum to zero

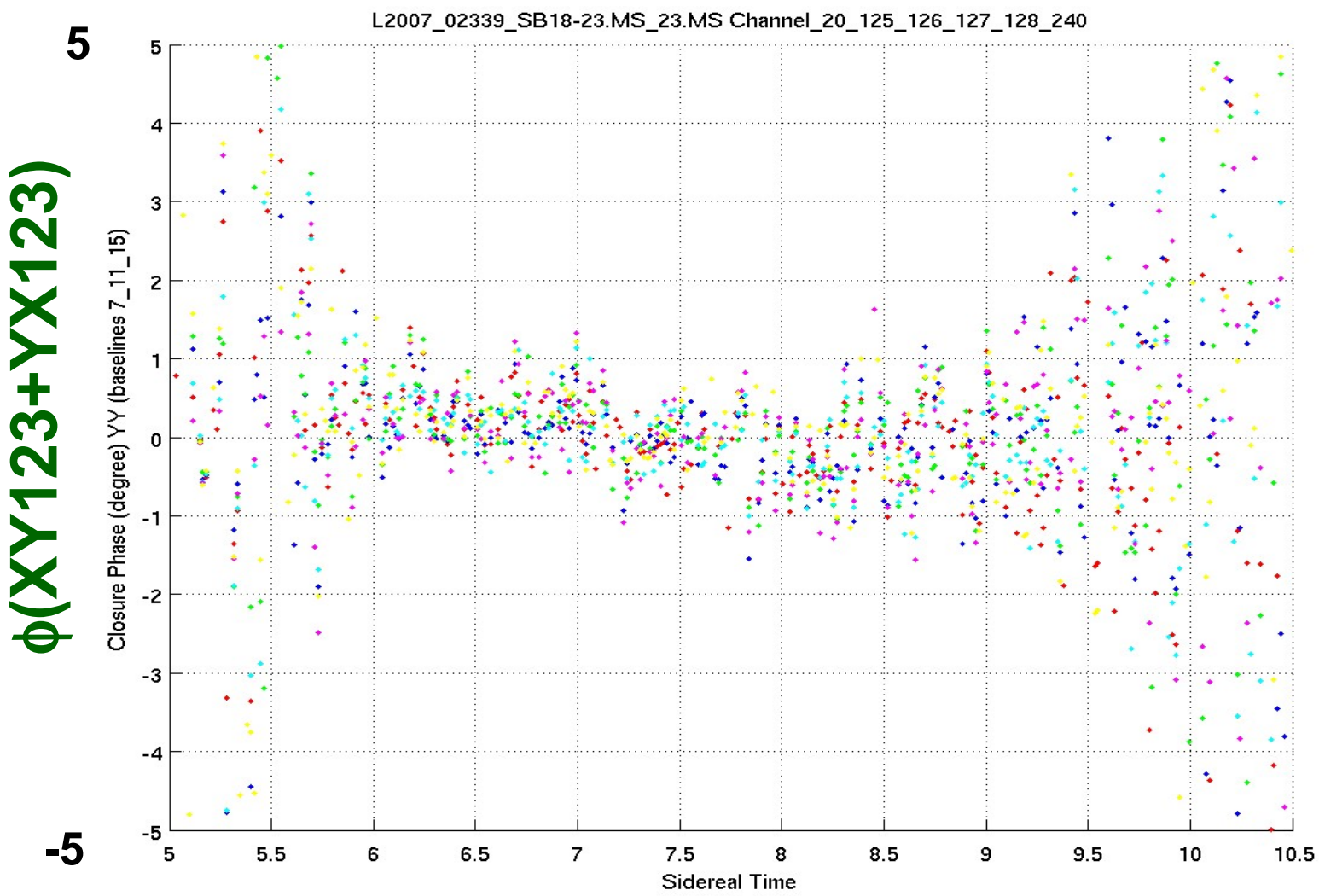
$$\phi(XY123) = \phi(X1Y2) + \phi(X2Y3) + \phi(X3Y1)$$
$$= \phi(X1) - \phi(Y2) + \phi(X2) - \phi(Y3) + \phi(X3) - \phi(Y1)$$

$$\phi(YX123) = \phi(Y1X2) + \phi(Y2X3) + \phi(Y3X1)$$
$$= \phi(Y1) - \phi(X2) + \phi(Y2) - \phi(X3) + \phi(Y3) - \phi(X1)$$

We are effectively using six dipoles? Pointed By Jan Noordam

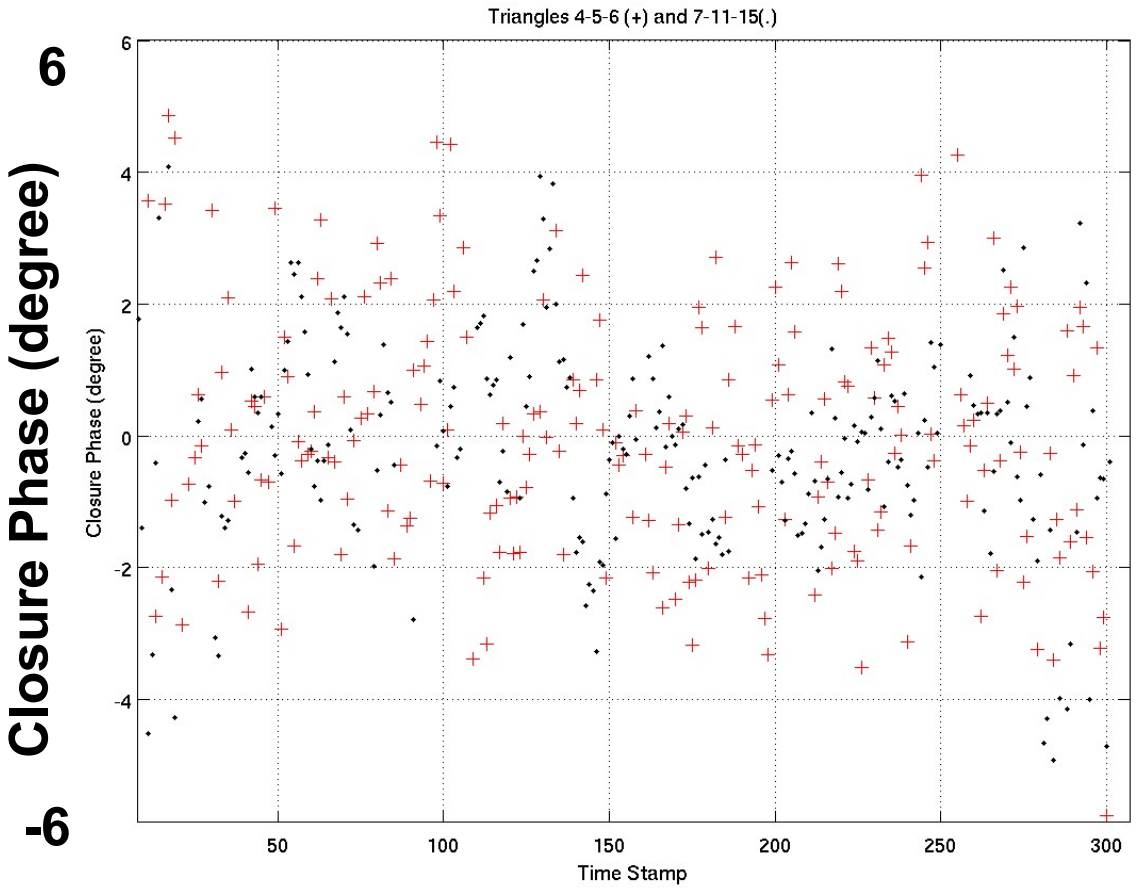
$$\phi(XY123+YX123) = \phi(XY123) + \phi(YX123) = 0$$

(XY+YX) Closure Phases (MS 2339 7-11-15)



We Get the total closure phase (Hexagonal?) as zero !!

XX- Closure Phases - Diff Triangles



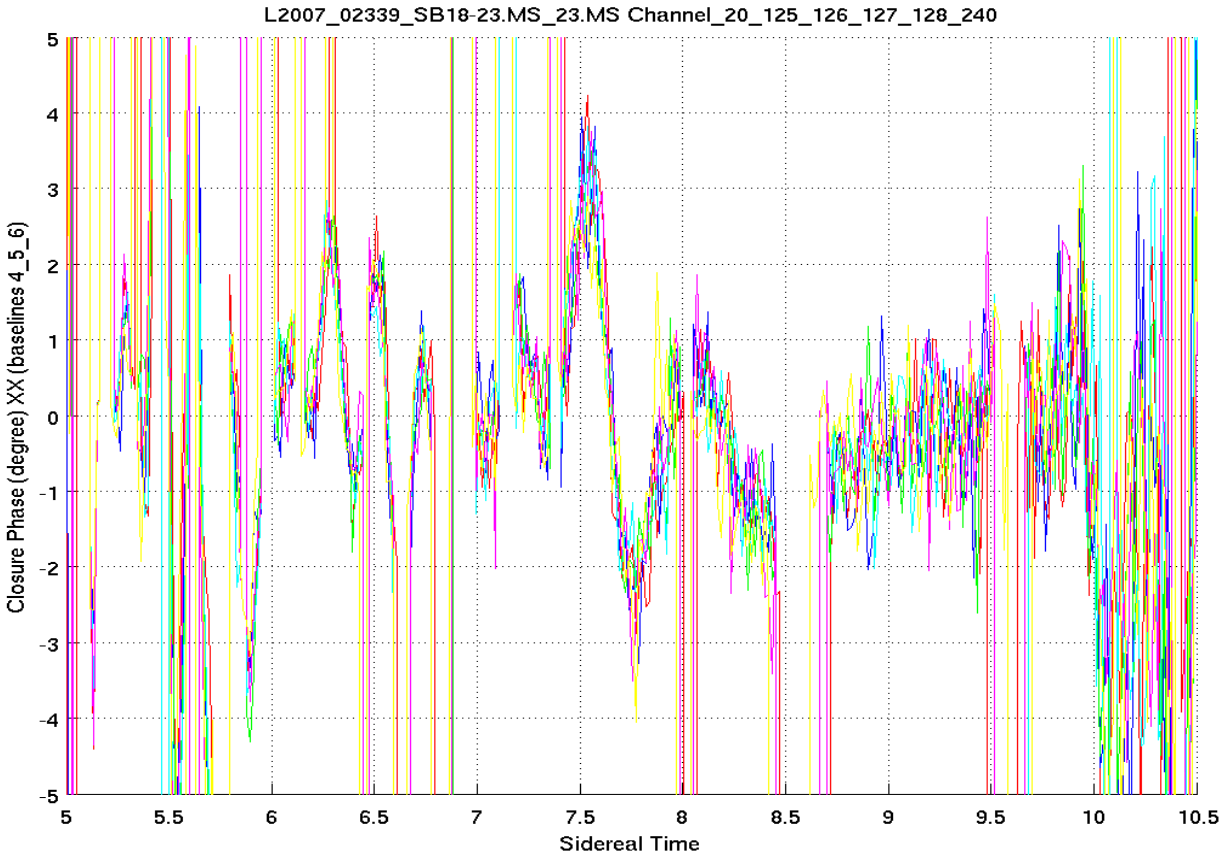
One channel (5), Triangle's formed by 4-5-6(+) and 7-11-15(.)
Uncorrelated !! (As expected)
Very Preliminary :-> Still to analyse and digest

Conclusions / Next Steps

- Observations such as these dominated by Sun can be exploited very well for deep data analysis..
- Closure Phase noise are within 1 degree
- Closure Phases are correlated from one channel to another across the entire subband (expected)
- Closure Phases on short baselines show more structure (expected)
- Closure Phases XY and YX have 90 degree phase shifts (compared to XX and YY). Why they have shapes?
- Closure phase formed by considering XY and YX together sum up to zero. -> Important !! -> Open Questions -> Link between X and Y phase, Ejones (Beam shapes) similar for diff antennas?
- Closure phases for different Triangles are independent as expected.
- Still very preliminary.. ! Detailed analysis to be carried out..
- Closure Amplitudes and Redundant baseline calibration

Closure Phases (MS 2339 7-11-15)

XX - Closure Phases (MS 2339, SB 23 4-5-6)



5 channels: 20,125,126,127,128,240
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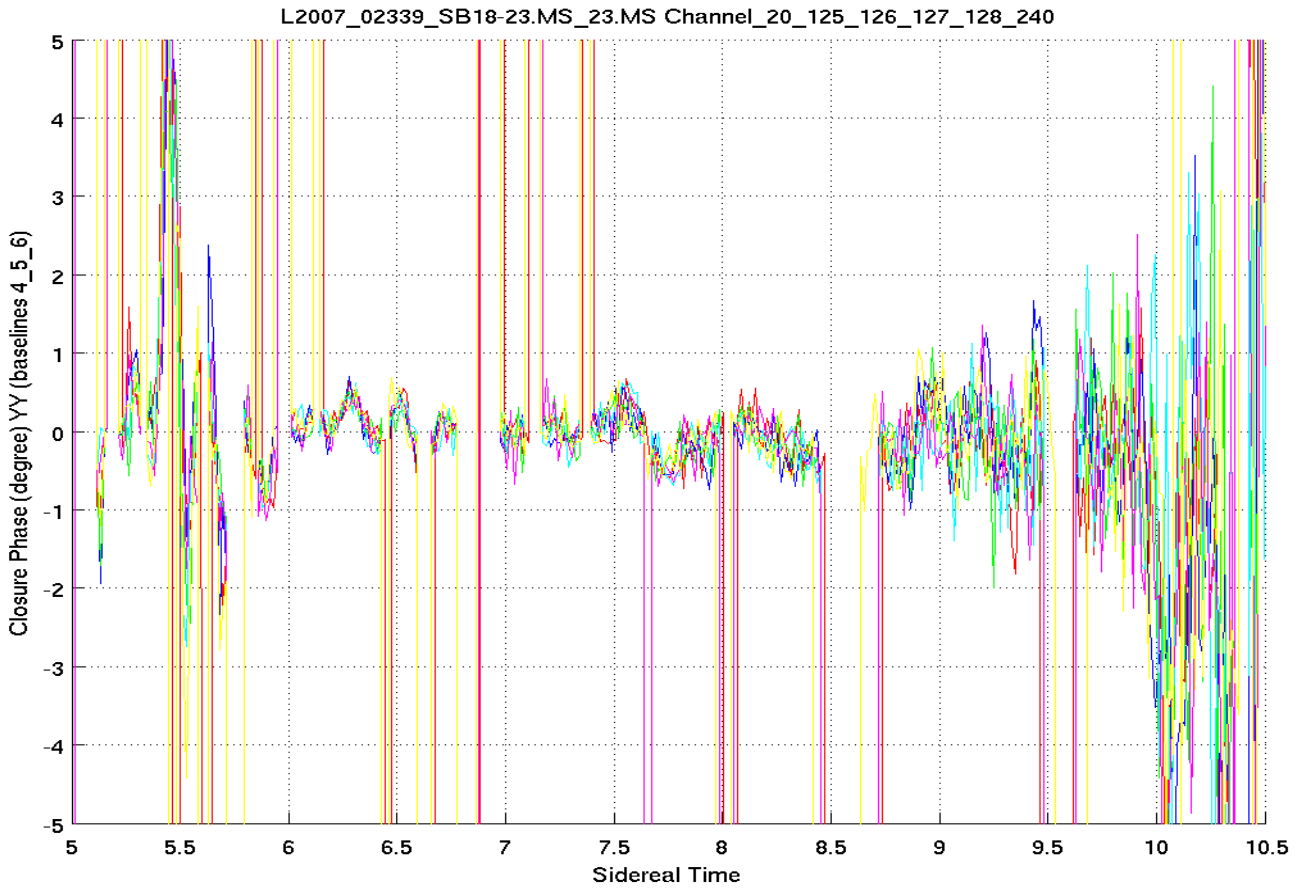
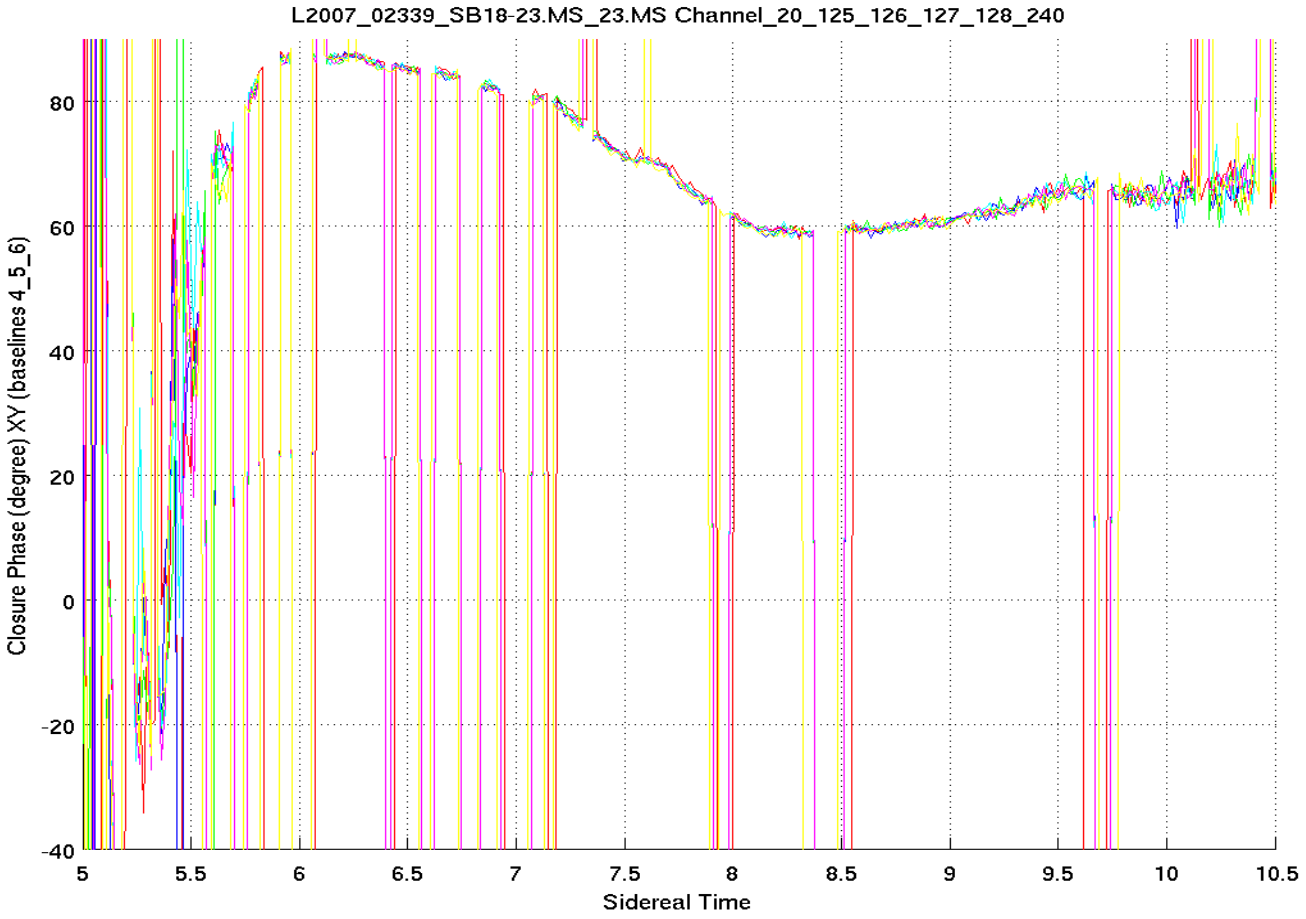


5 channels: 20,125,126,127,128,240
Correlated from channel to channel

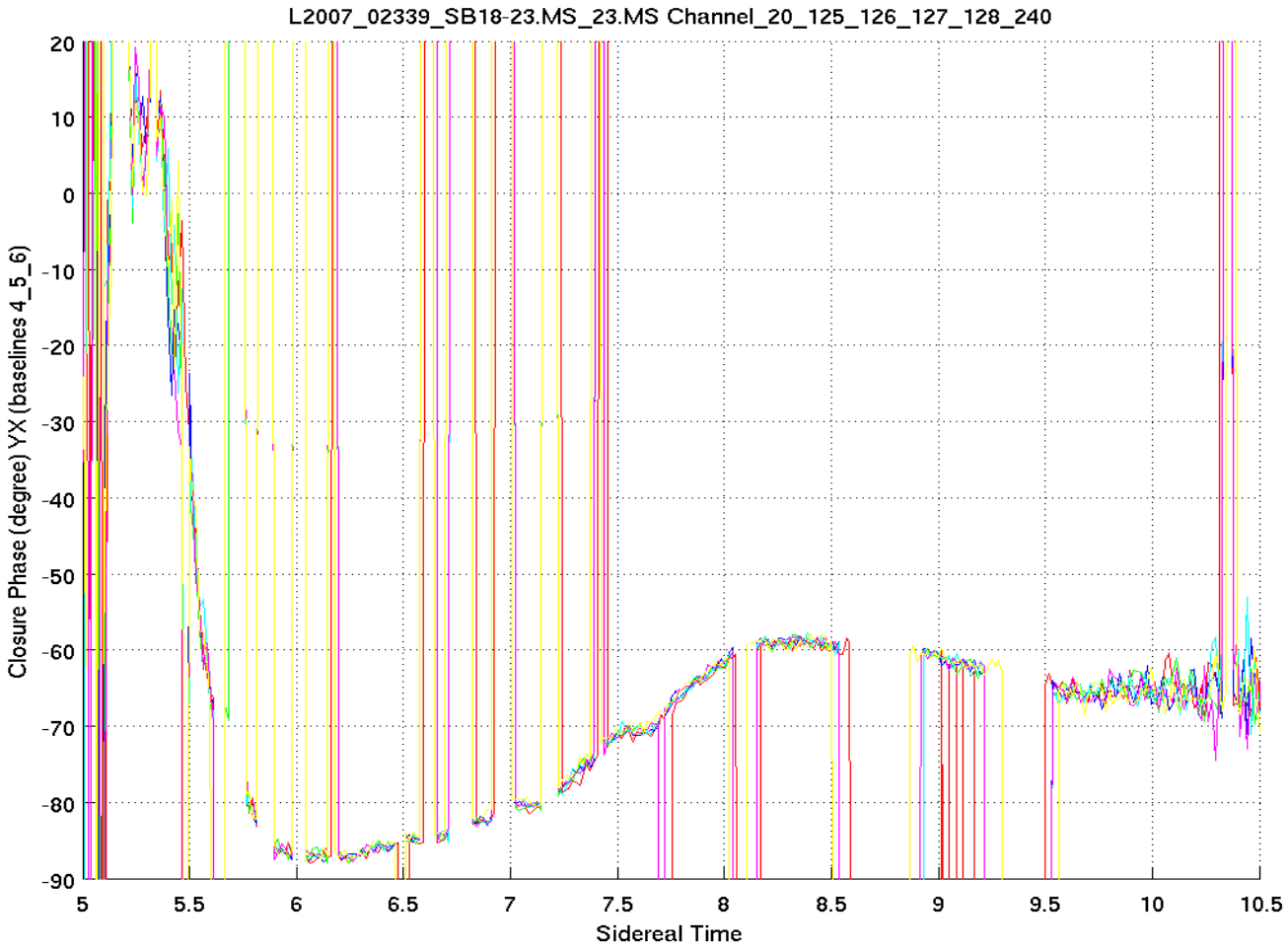
XY - Closure Phases (MS 2339, SB 23 4-5-6)



5 channels: 20,125,126,127,128,240

Correlated from channel to channel, 90 degree off from XX

YX - Closure Phases (MS 2339, SB 23 4-5-6)



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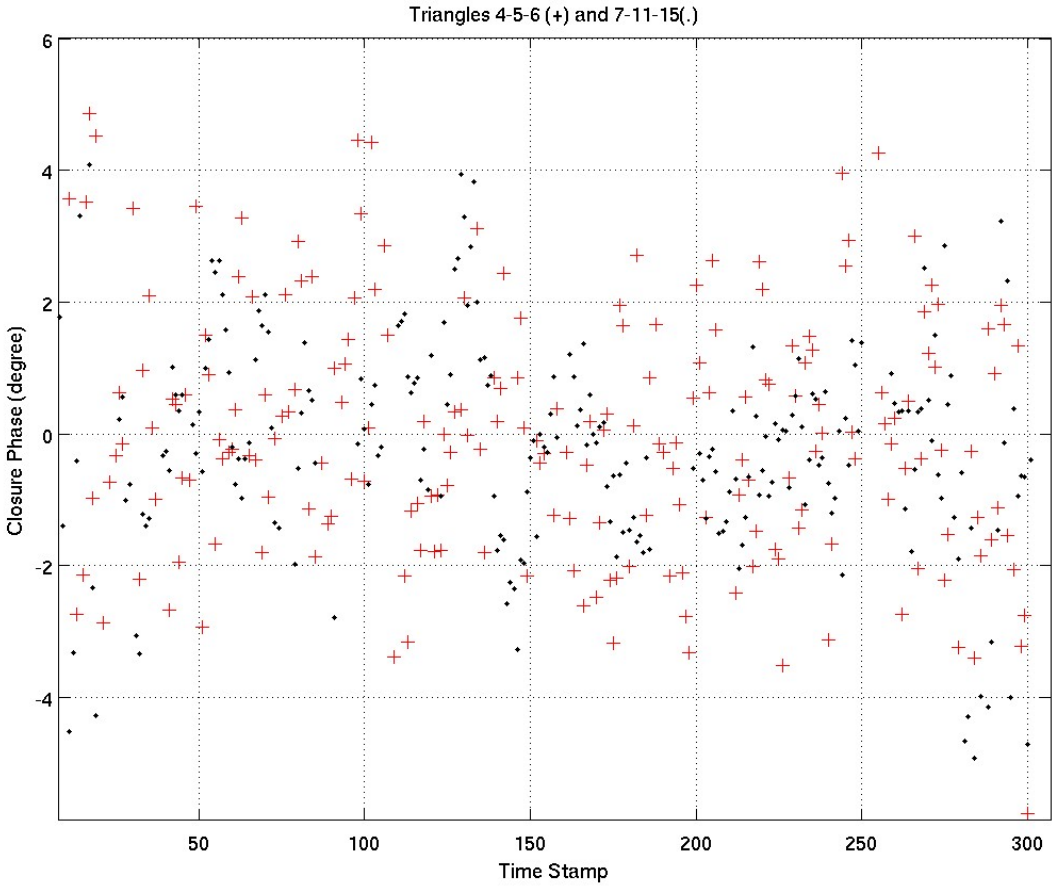
Correlated from channel to channel

Closure Phases - Diff Triangles



One channel (5), traingles 4-5-6 and 7-11-15
Uncorrelated !!
Very Preliminary :-> Still to analyse and digest