BBS
Progress update & Status

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CS1 meeting..

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Outline

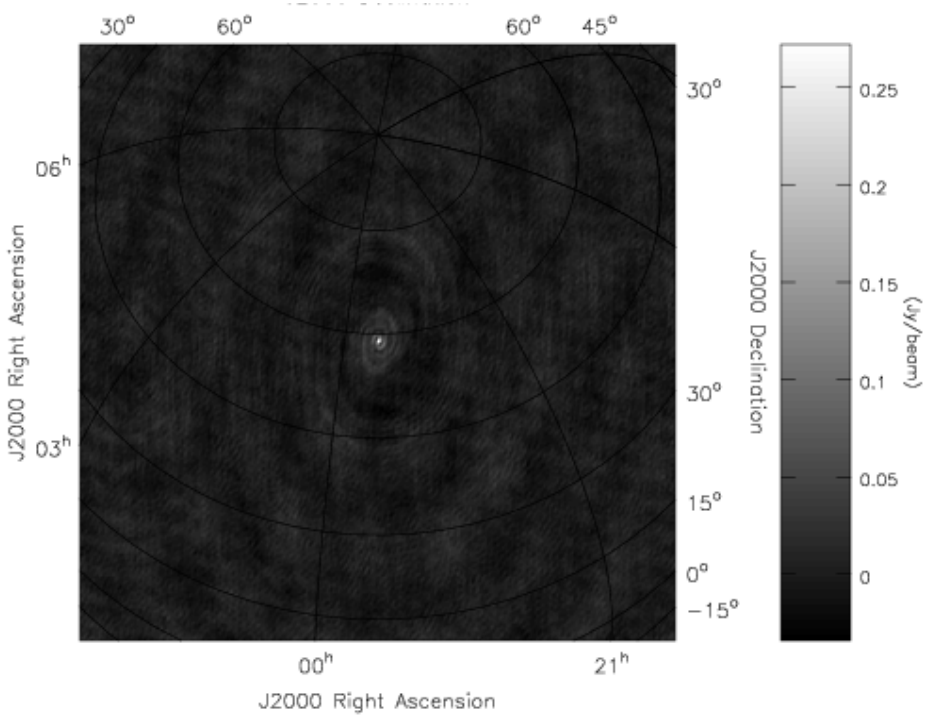
1. BBS calibration
2. Issues related to Imager
3. BBS Predict
4. Status - Conclusions/Next steps

MS1810

- Observation 30 March - 31 March, 2007
  UTC (14h:31m to 06h:44m, Integration time 60s, 59.9 MHz, 0.6Khz)
- Tracking done on CasA (23:23:24, +58:48:54)
- Data Set is ok (Fringes seen due to CasA and even beating between CasA and CygA)
- Flagging done
- Calibration attempted using BBS

Output Image

Calibrated Image



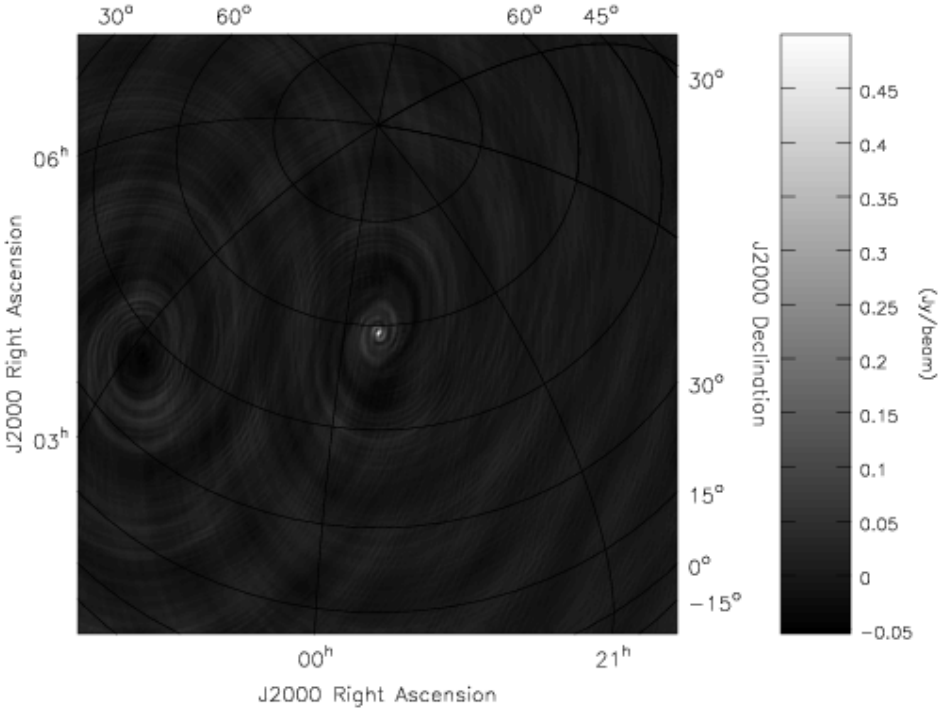
The output image has

- CasA clearly seen
- CygA barely visible
- CygA position on the other (wrong) side of CasA (along RA)

Single Channel (110) 0.6Khz , Entire observation

Possible causes

Model Image
(predicted using BBS)



- Calibration not working
- *uvw* convention in BBS flipped (as compared to in the MS)
- Confirmed by predicting model data using BBS and imaging it back.
- The source away from phase center has a dip rather than peak
- If we use w projection this dip becomes positive but positions do not change.
- Imager ?? Usage?
- Reordering of data set for BBS

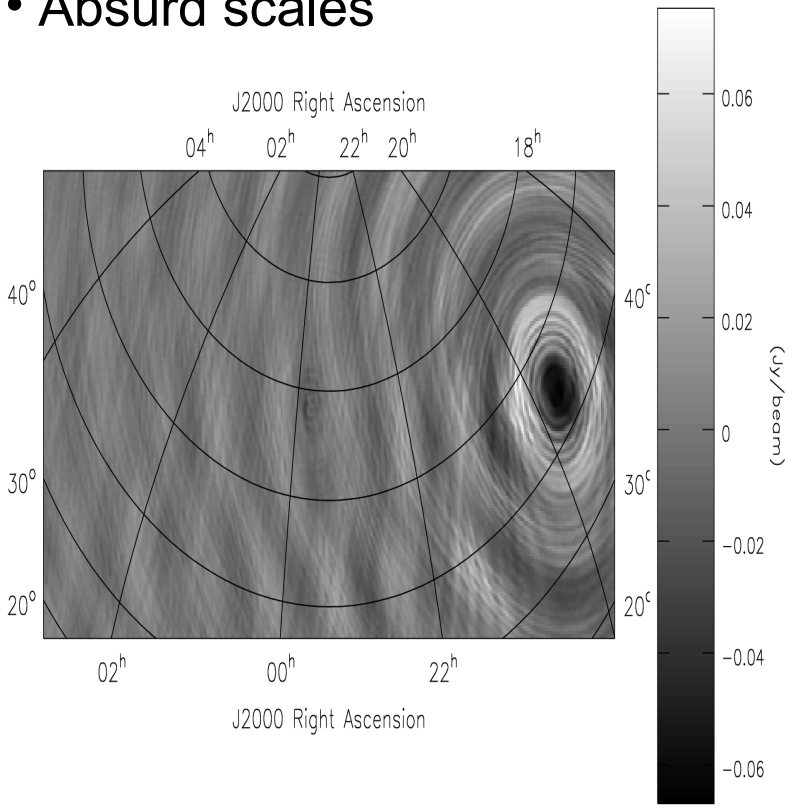
Debugging

- Imager Issues ?
- Compare AIPS++ and BBS (Model Data and Model Image)
- Next stage to worry about solutions

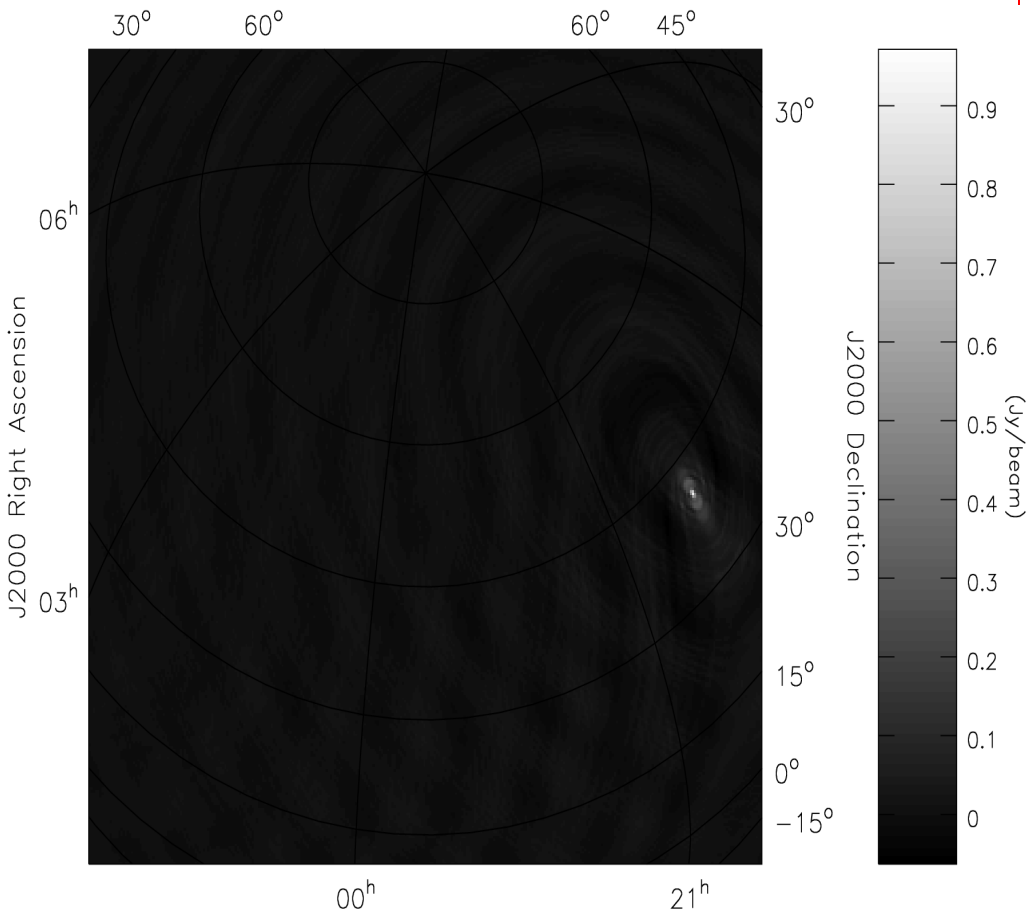
Imager Issues

CygA predicted by aips++ and imaged back (1024x512)

- Dip
- Absurd scales



CygA predicted by aips++ and imaged back (1024x1024)

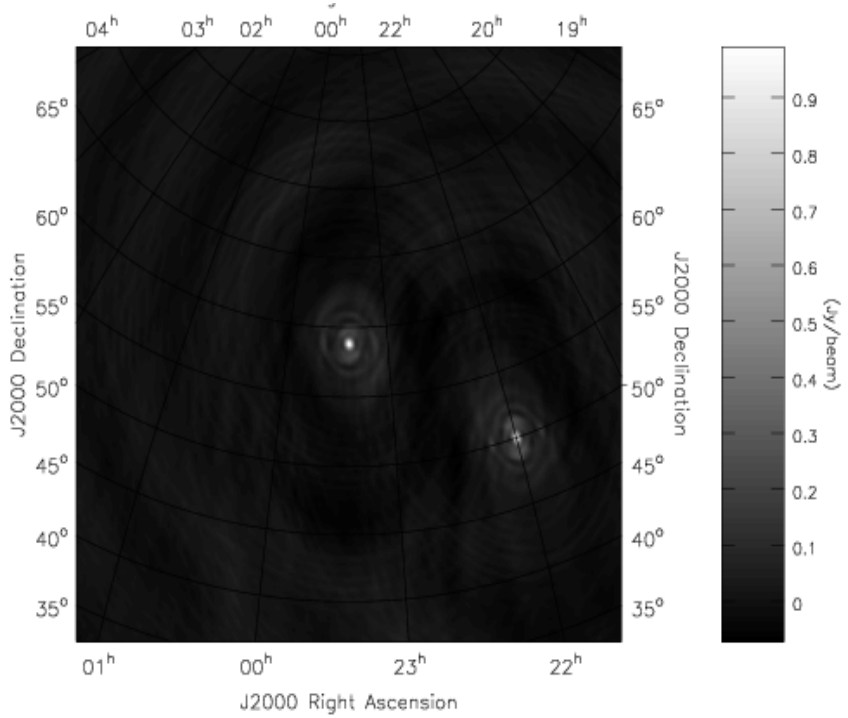


Imager does not behave correctly for non-square images

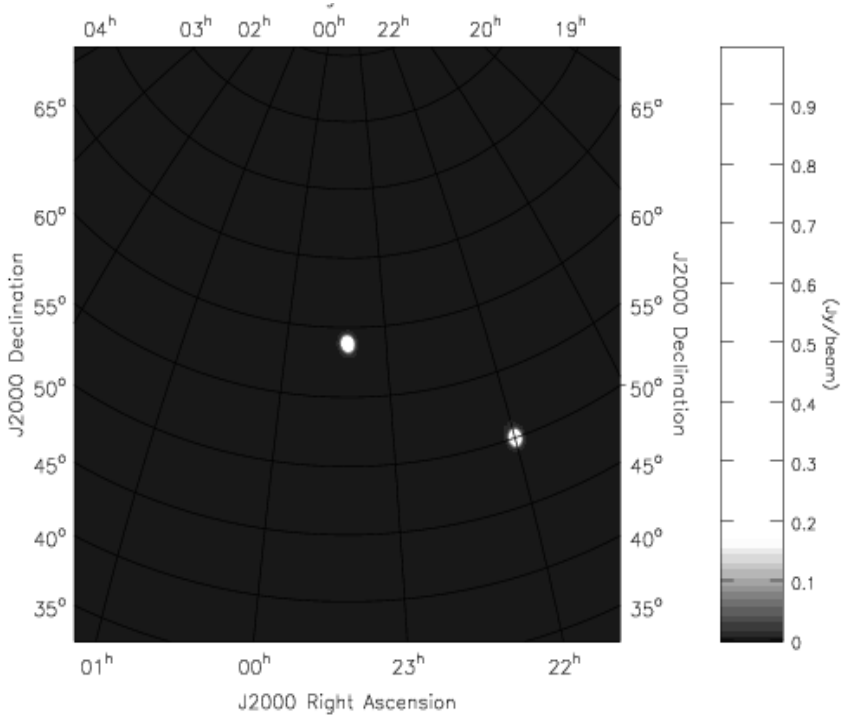
Imager

- Two sources each of 1.0Jy
- predicted by aips++ and Imaged using AIPS++ (w projection, *uvw* from MS)
- Fluxes and positions all come out correctly (within 0.5% and arc seconds)
- So our Usage of Imager is correct.

Model Raw Image



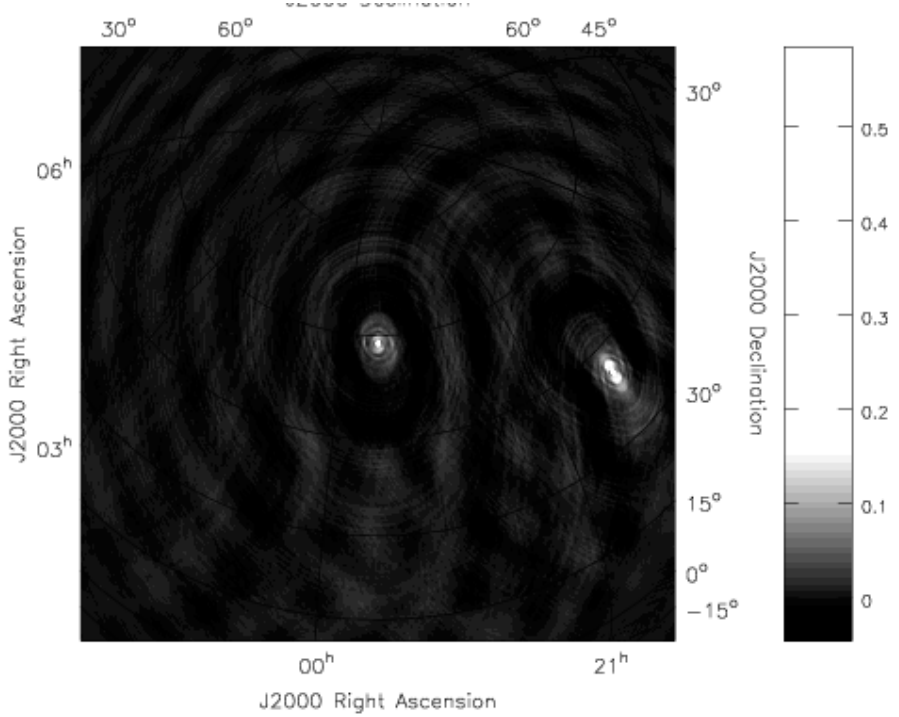
Model Cleaned Image



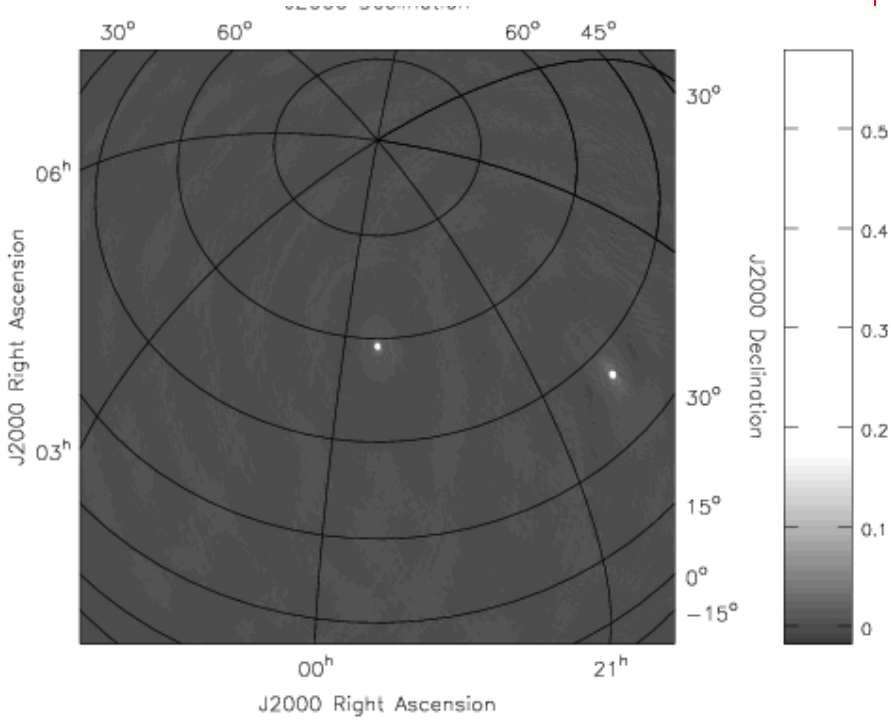
BBS (uvw as in MS)

- Two sources each of 1.0Jy
- predicted by BBS and Imaged using AIPS++ (w projection, uvw from MS)
- Positions all come out correctly (arc seconds, beam 0.5 degree)
- BBS (an extra factor of half), so we expect the output flux as 0.5 each.
- Phase center source Flux 0.5 Jy, but off center source Flux 0.6Jy.
- Flux definitely ambiguous in prediction by BBS

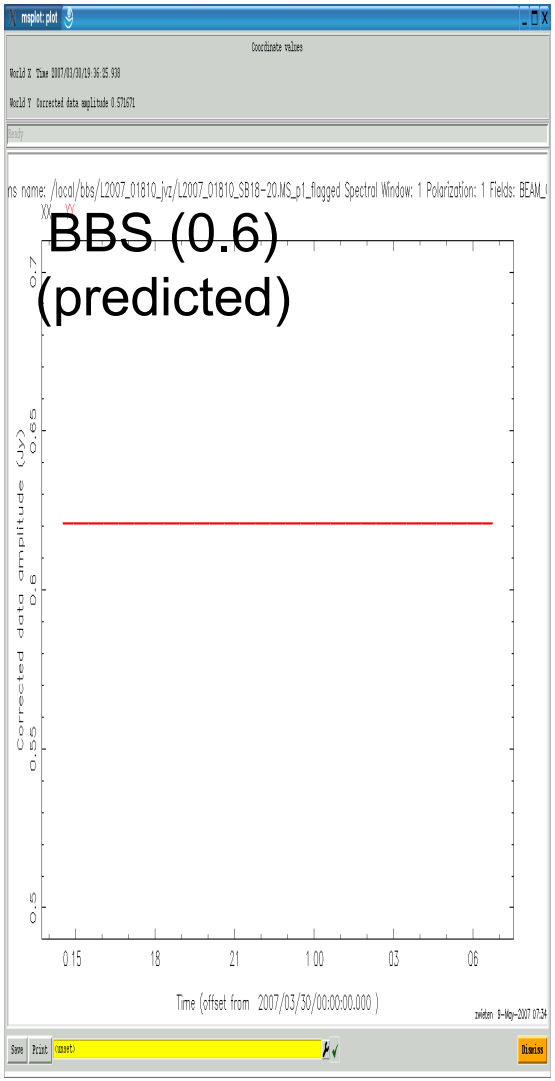
Model Raw Image

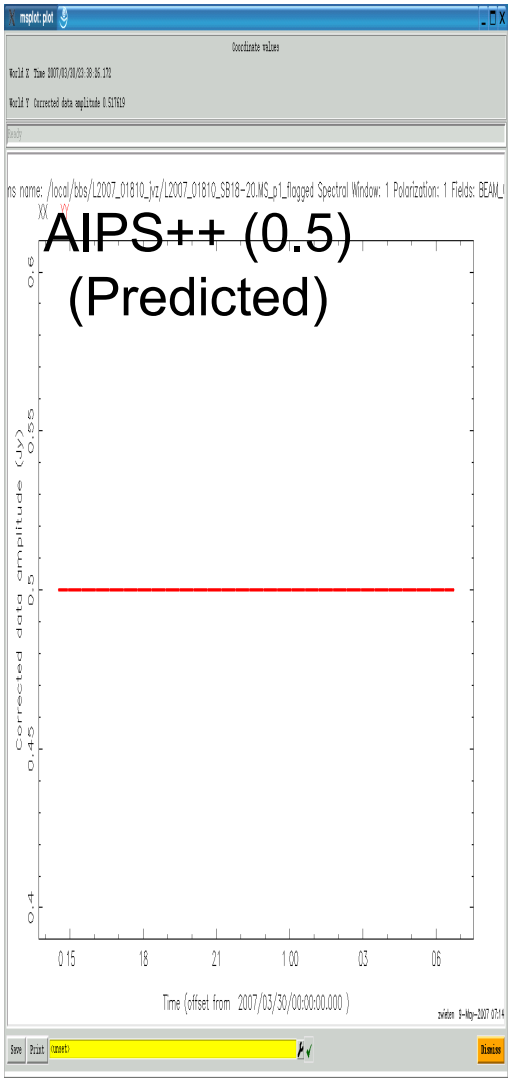


Model Cleaned Image



Model Amplitude Comparison(AIPS++ & BBS)



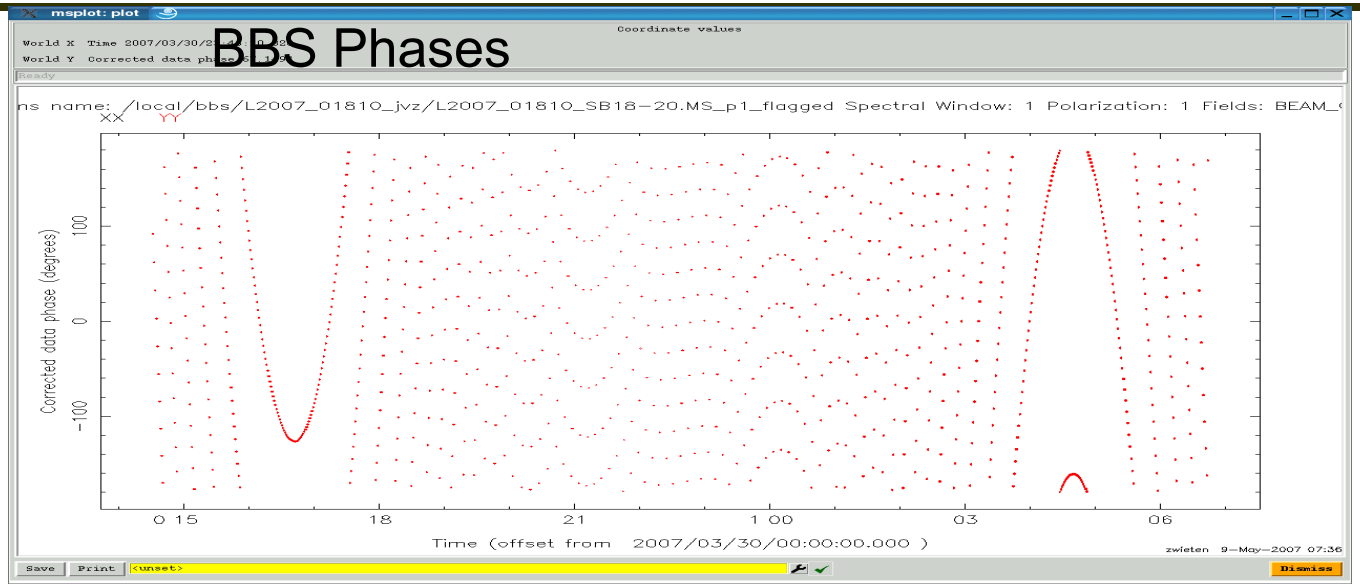


For only 1 source (away from phase center)

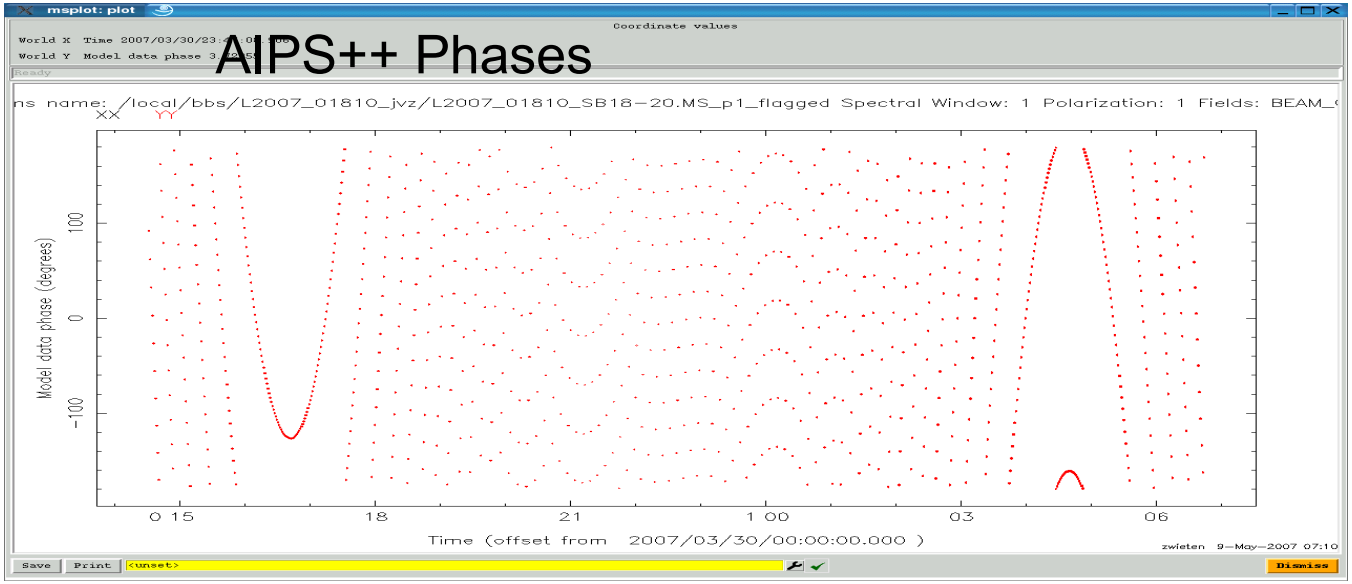
Amplitude comparison

- BBS predicts higher amplitude (for source away from phase center)
- For source at phase center both agree

Model Phase Comparison(AIPS++ & BBS)



BBS Phases



AIPS++ Phases

Phases agree 1 part in 10^6 (Long baseline CS1-CS8)

BBS - extra *n* term?

- **Calibrated visibilities -> dirty image**

$$V^{\circ}(u,v,w) = \int\int I(l,m) e^{-2\pi\imath\left[ul+vm+w\left(\sqrt{1-l^2-m^2}-1\right)\right]} \frac{dl\,dm}{\sqrt{1-l^2-m^2}}$$

$$F(l,m,n) = \left[\frac{I(l,m)\delta\left(\sqrt{1-l^2-m^2}-n\right)}{\sqrt{1-l^2-m^2}} \right] * P(l,m,n)$$

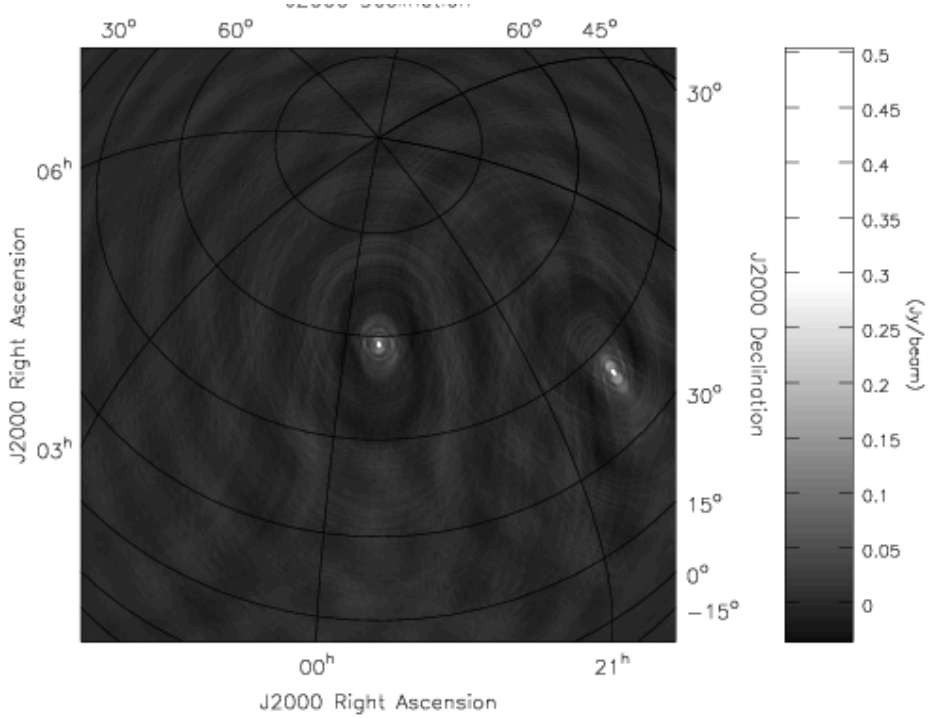
- **Physically meaningful on surface of a sphere of unit radius ($l^2+m^2+n^2=1$)**

- **need to check once again this equation in code**
- **here I(l,m) is brightness, for a point source perhaps we are not doing this division by $\sqrt{1-l^2-m^2}$ properly.**
- ***d(Ω)=dl dm/n, the integral gives the flux density***
- **We have commented this extra term for the time being.**

BBS (without the extra ? *n* term)

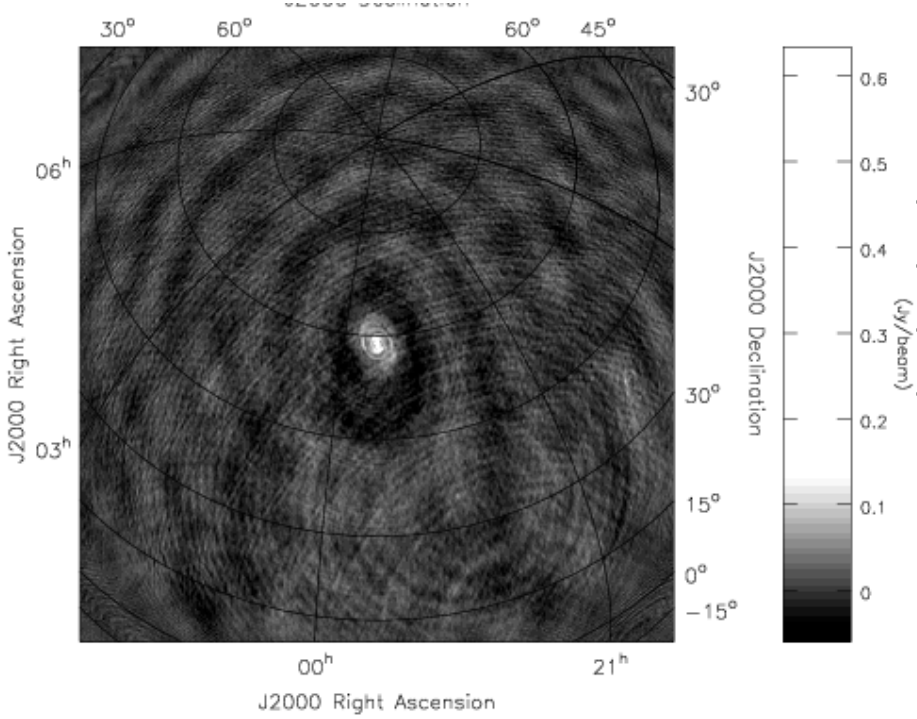
Model Image

Fluxes are now correct (both 0.5 Jy as input)



Amplitude and phases of visibilities both agree with that of AIPS++ predict

Retry calibration with BBS



- Still does not improve much
- CygA barely visible
- No negative dips now
- CygA not in the wrong direction?

Conclusions / Next Steps

- We have been able to verify predict stage of BBS. After changes, It agrees both in amplitude and phase with AIPS++ predictions.
- Usage of Imager is not an issue.
- Scripts to predict visibilities in glish and Matlab (done).
- Reordering of MS for BBS is not the reason, *uvw* also not the reason.
- Introduce artificial gains, put it in DATA column and let BBS solve back? -- Yes --> go to apply gains else as below !
- Add Noise and check the solutions obtained.
- Add Beam and check the solutions.
- Introduce polarization leakage and check.
- If needed Matlab can be used in parallel to check the solutions.
- If we can do the above, we are bound to succeed.

Thanks to Gianni for discussions and help (future also!!)