Francesco de Gasperin

Max Planck Institute for Astropysics

The Lofar Imaging Cookbook

October 5, 2010

ASTRON

Max-Planck-Insititut für Astrophysik

The LOFAR Imaging Cookbook

Initially written by Timothy Garn

Now maintained by

Roberto Pizzo

(pizzo@astron.nl)

Assumptions

- Basics idea of radio data reduction
- Basic knowledge of GNU/Linux systems

Aims

- Learn how to use LOFAR pipeline
- A few technical details
- See a general picture
- Save lots of time!

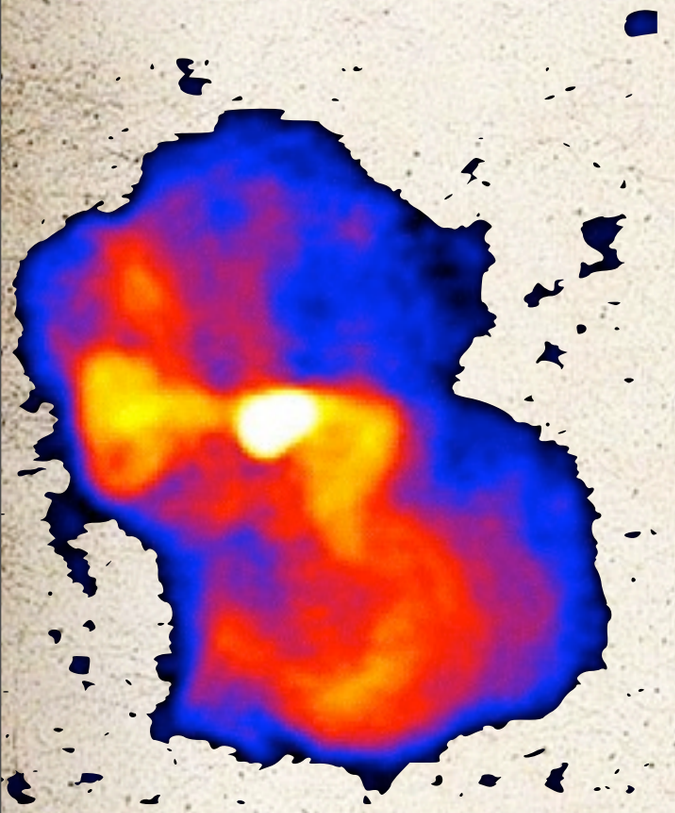
Chapters

I. The LOFAR cluster
II. LOFAR data
III. Pipeline
   a. NDPPP
   b. BBS
   c. MWImager

I. The Dofar Cluster

Cookbook chap. 1

The LOFAR Cluster



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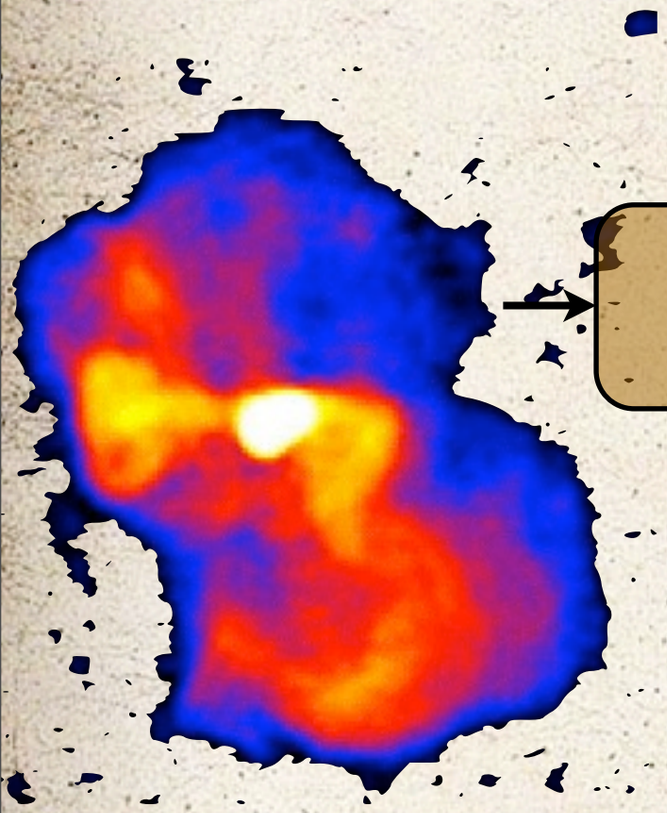
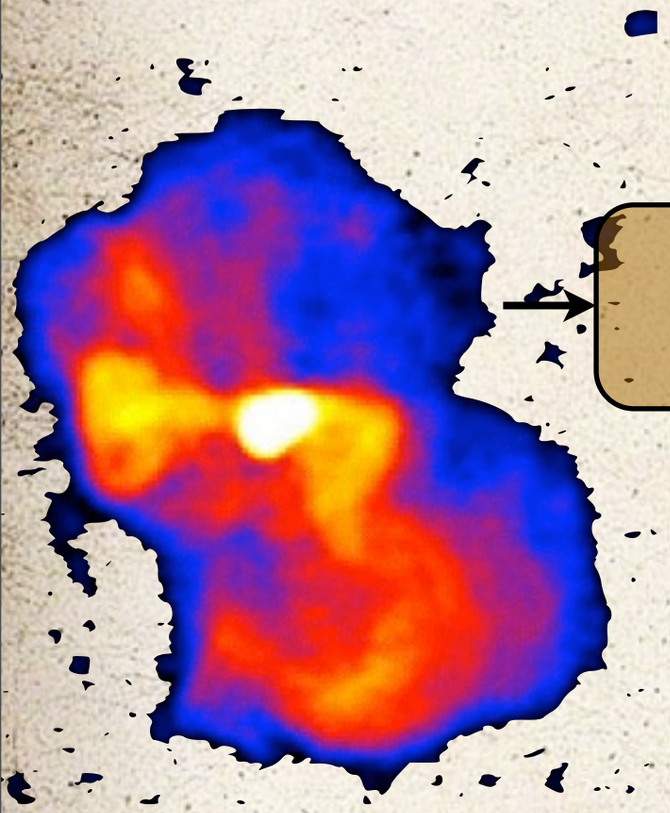
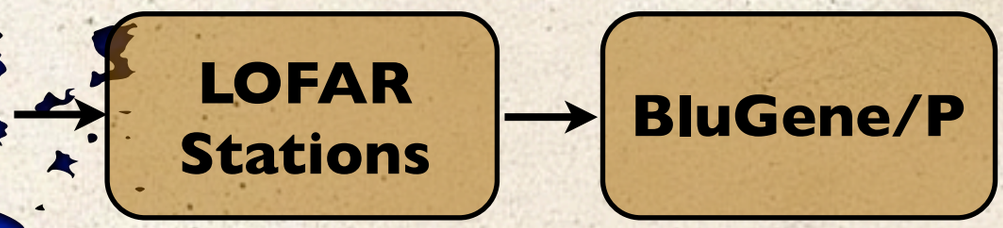


LOFAR Stations

The LOFAR Cluster





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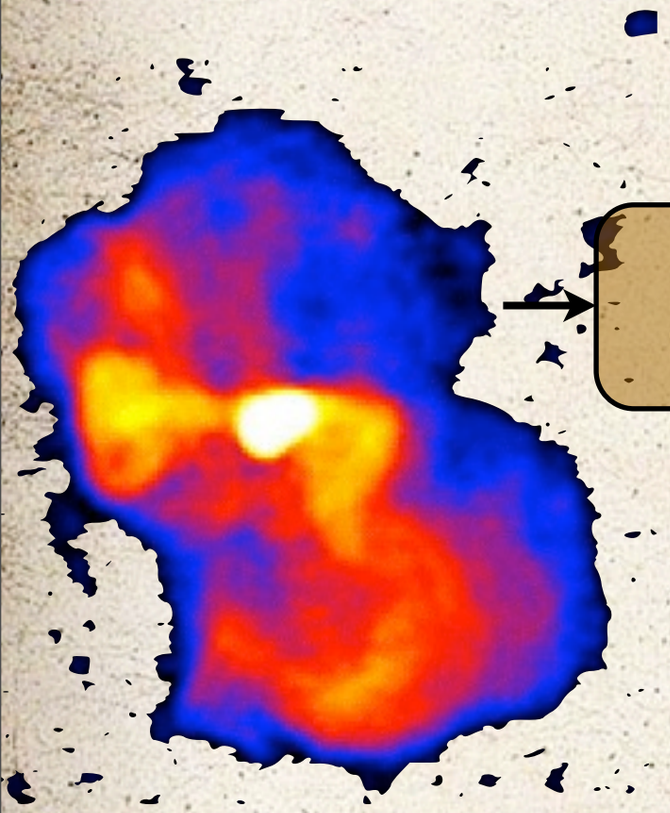

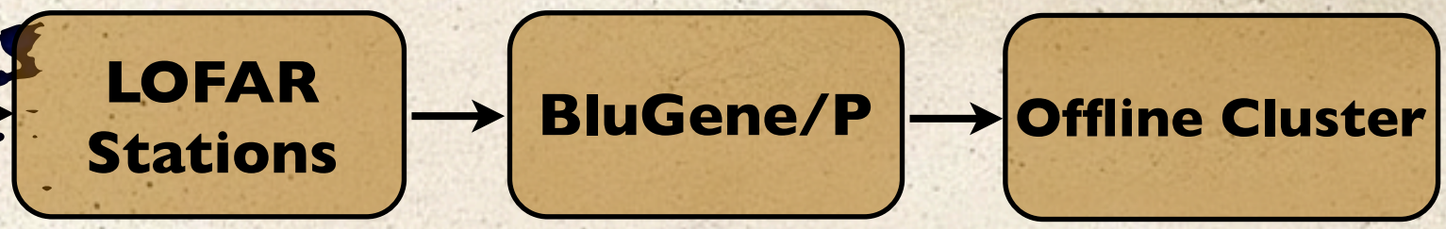

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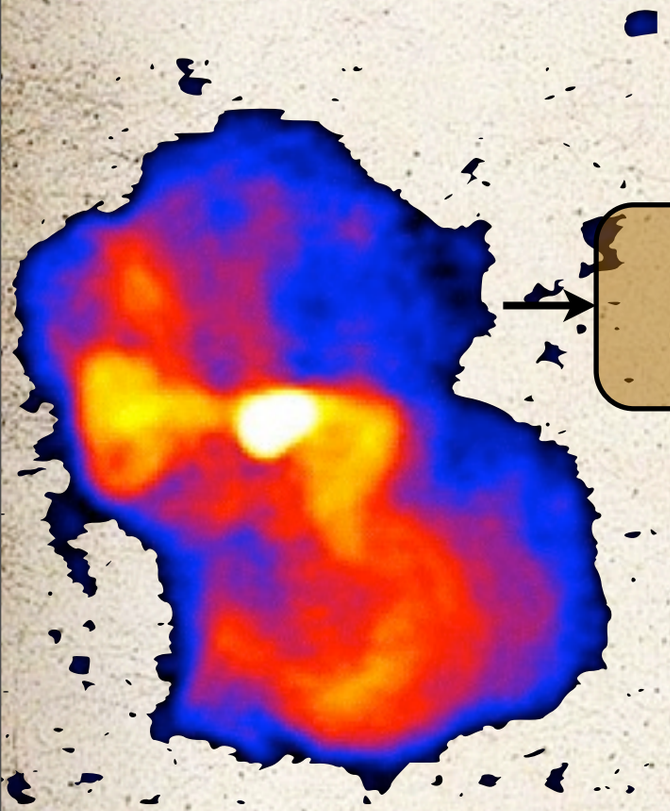
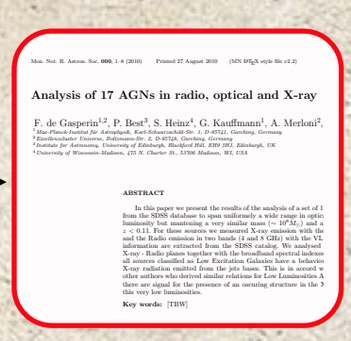


LOFAR Stations → **BluGene/P** → **Offline Cluster** →



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F. de Gasperin[1,2], P. Best[3], S. Heinz[4], G. Kauffmann[1], A. Merloni[2],
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Key words: [TBW]

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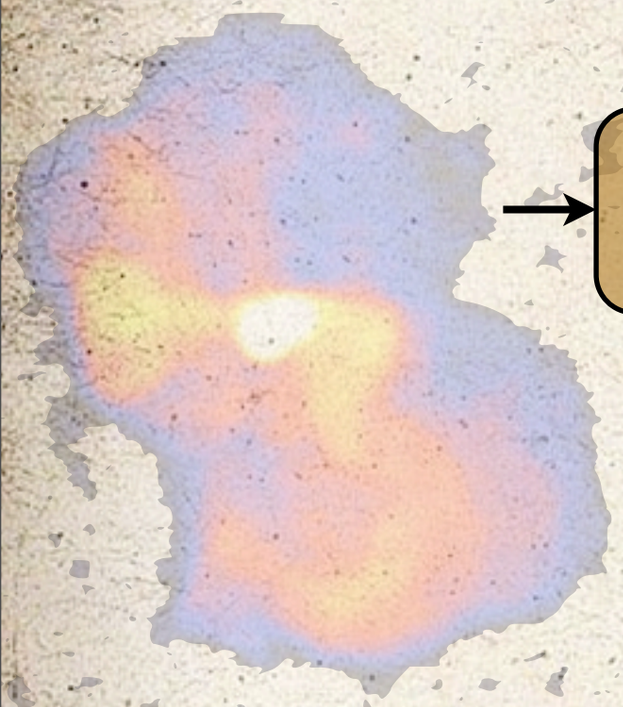

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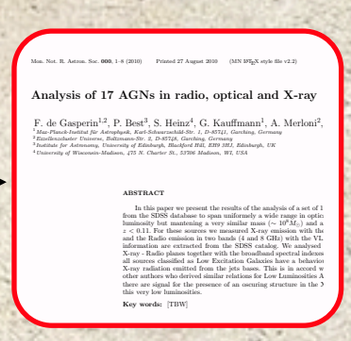

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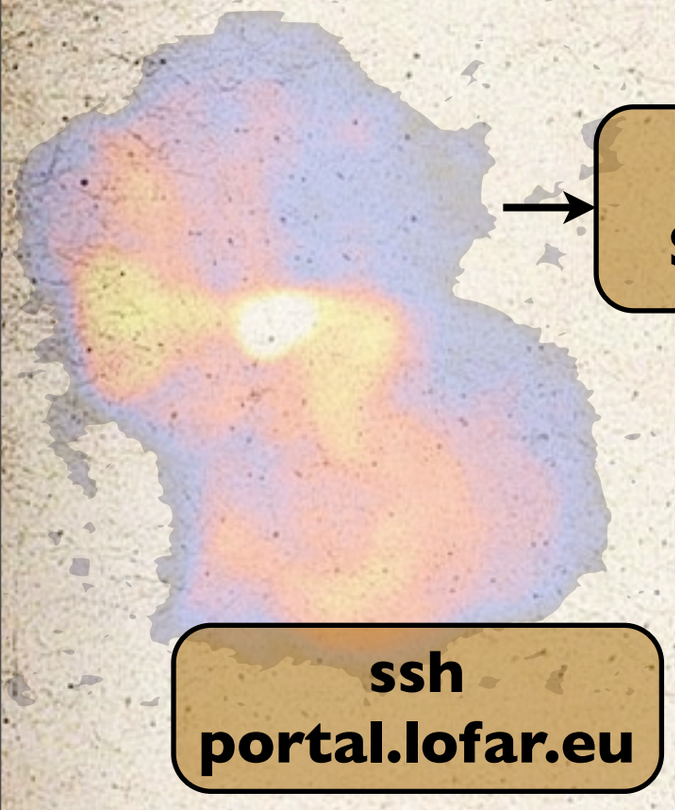

ssh portal.lofar.eu

Portal

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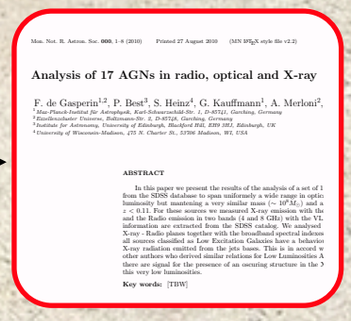

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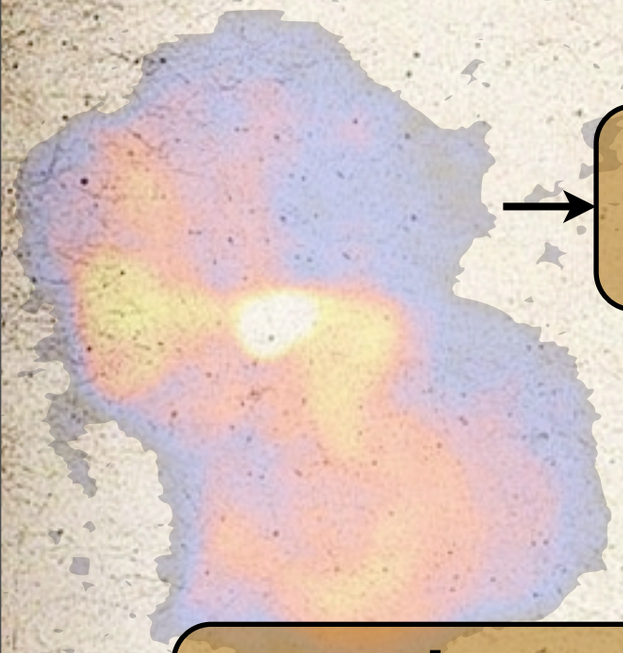
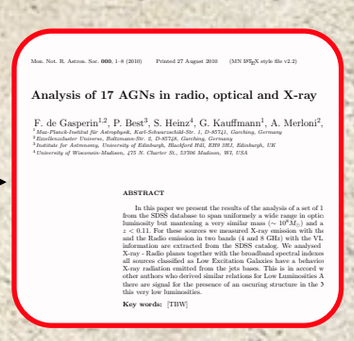


LOFAR Stations → BluGene/P → Offline Cluster →



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ssh portal.lofar.eu

Portal

→ lfe001 **Frontend**

→ lfe002

The LOFAR Cluster

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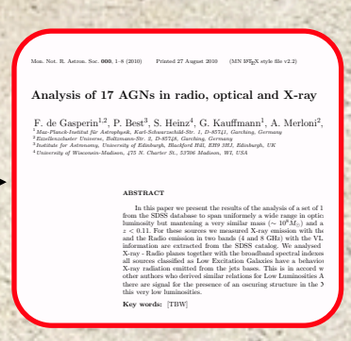

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Portal

lfe001

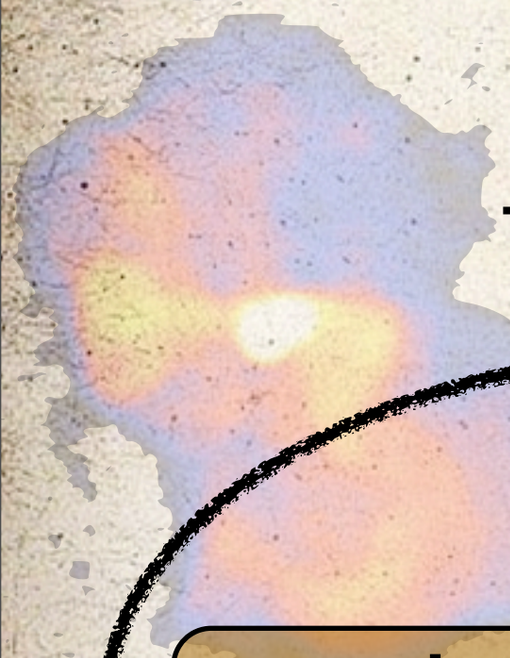
lfe002

Frontend

Sub-cluster

- sub1
- sub2
- sub3
- sub4
- sub5
- sub6
- sub7
- sub8

The LOFAR Cluster



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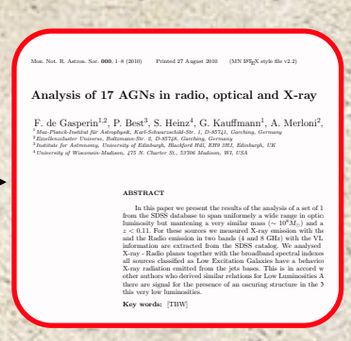

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Portal

→ lfe001 / lfe002

Frontend

→

Sub-cluster

- sub1
- sub2
- sub3
- sub4
- sub5
- sub6
- sub7
- sub8

The LOFAR Cluster

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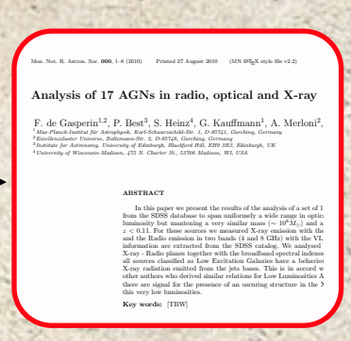

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Portal

lfe001

lfe002

Frontend

Sub-cluster

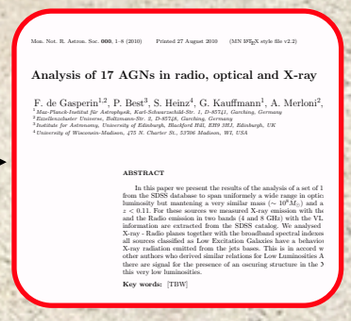
sub1 → lce001 … lce009 — **Processing Units**

sub2 … sub8

lse001 lse002 lse003 — **Storage Units**

The LOFAR Cluster

LOFAR Stations → BluGene/P → Offline Cluster



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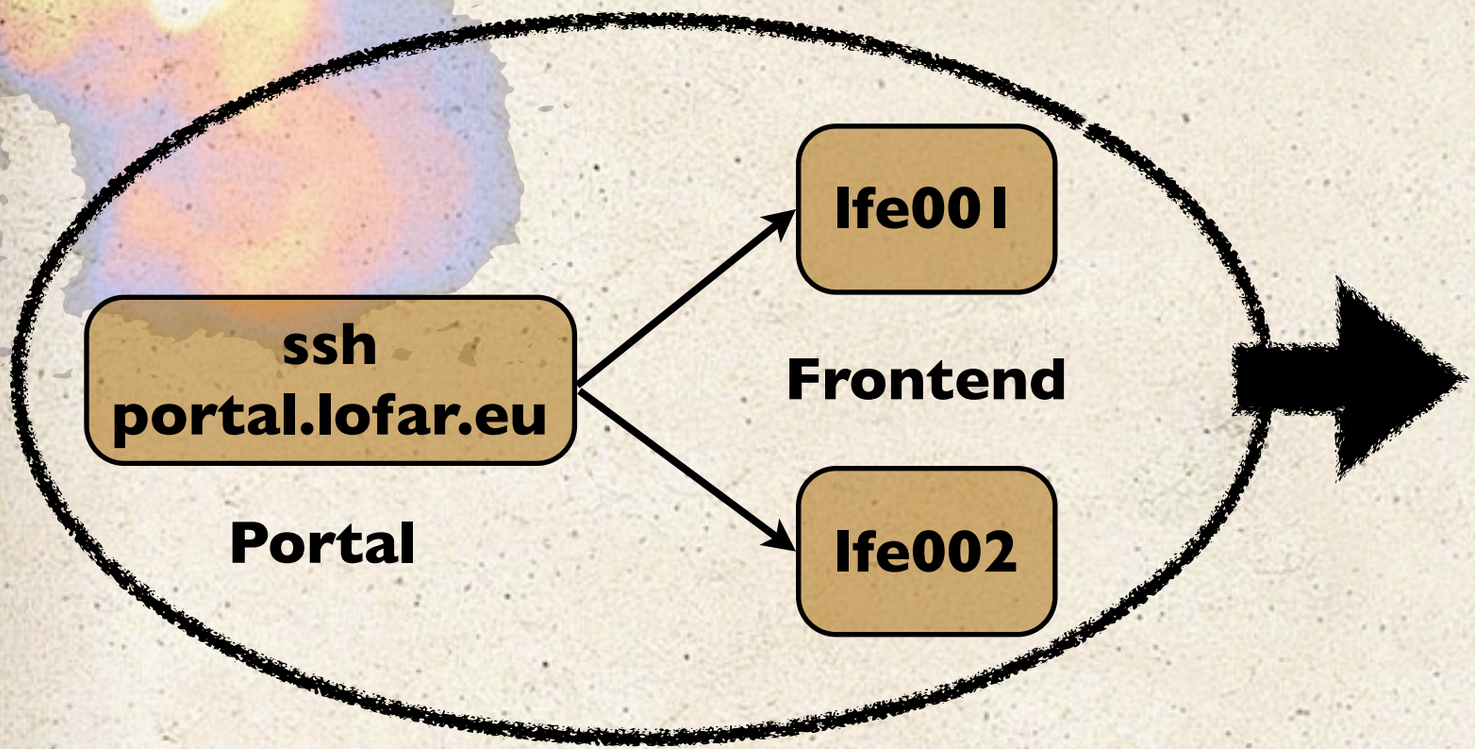

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Portal

lfe001

lfe002

Frontend

Sub-cluster

sub1

sub2

sub3

sub4

sub5

sub6

sub7

sub8

lce001
lce002
lce003
lce004
lce005
lce006
lce007
lce008
lce009

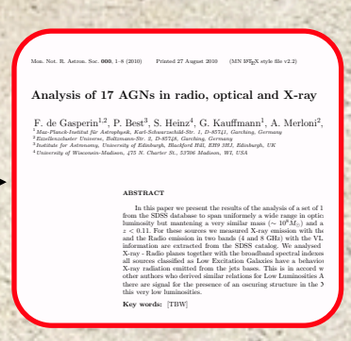
Processing Units

lse001
lse002
lse003

Storage Units

The LOFAR Cluster

LOFAR Stations → BluGene/P → Offline Cluster →



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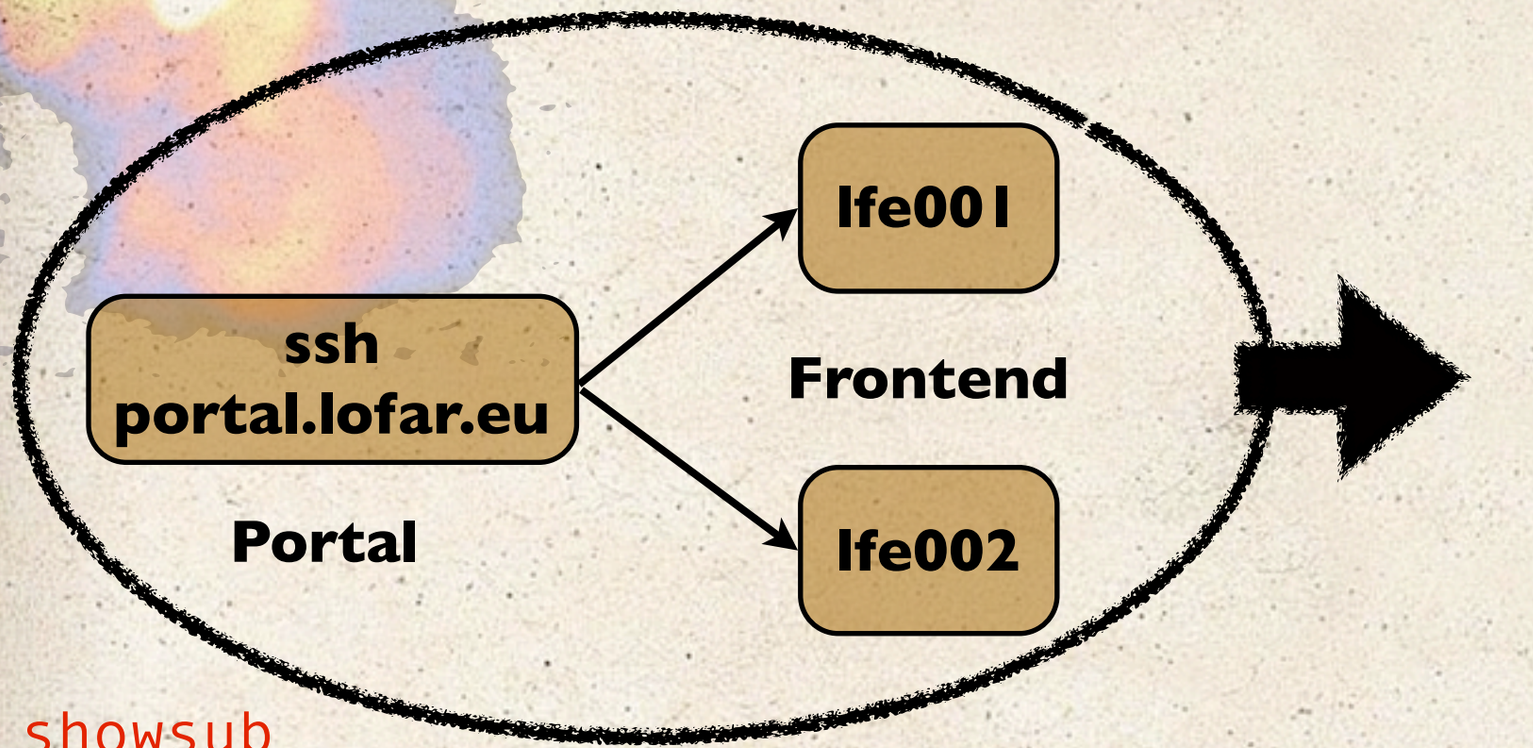
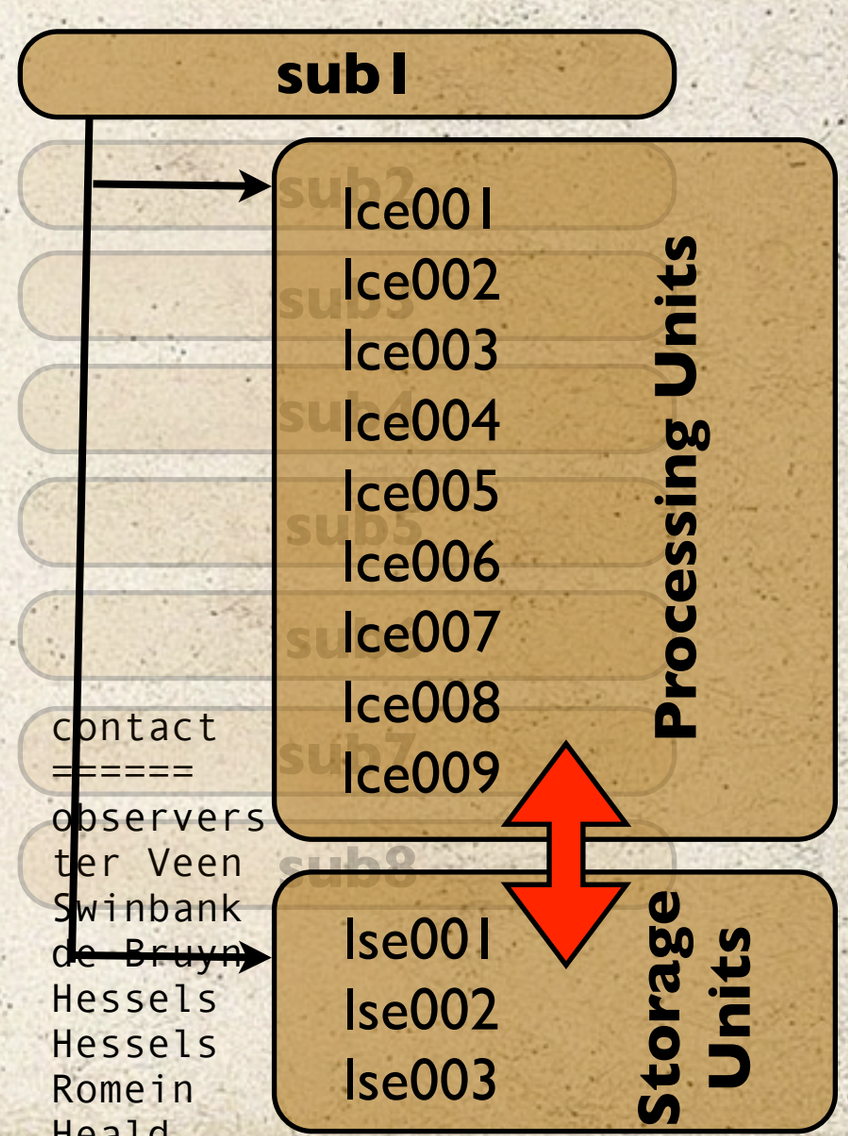


Sub-cluster




```
$ showsub
This script shows the subcluster definitions

sub   lce-nodes       lse-nodes       cexec-lce  cexec-lse  group     contact
====  ============    ============    =========  =========  ========  ======
sub1  lce001-lce009   lse001-lse003   lce:0-8    lse:0-2    product.  observers
sub2  lce010-lce018   lse004-lse006   lce:9-17   lse:3-5    TBB       ter Veen
sub3  lce019-lce027   lse007-lse009   lce:18-26  lse:6-8    imaging   Swinbank
sub4  lce028-lce036   lse010-lse012   lce:27-35  lse:9-11   pol/EOR   de Bruyn
sub5  lce037-lce045   lse013-lse015   lce:36-44  lse:12-14  pulsar    Hessels
sub6  lce046-lce054   lse016-lse018   lce:45-53  lse:15-17  pulsar    Hessels
sub7  lce055-lce063   lse019-lse021   lce:54-62  lse:18-20  develop.  Romein
sub8  lce064-lce072   lse022-lse024   lce:63-71  lse:21-23  bw5       Heald
```

The Cluster Environment

- Use the (t)csh
- Use package to set the environment
- Set `.mypackages` file

```
$ use <package name>
$ use LofIm <day>
```

Package	Description	Initialize	Update frequency	Comments
Casa	Browser, viewer, plotms, casapy	`use Casa`	infrequent	NRAO development
GDL	Gnu data language	`use GDL`	infrequent	Contains: GDL, GSL, PLPlot
LofIm	Lofar Imaging	`use LofIm`	daily	Contains: casacore, casarest, pyrap, LOFAR, ASKAPsoft
LUS (LOFAR User Software)	USG DAL and Pulsar tools	`use LUS`	daily	Provided by USG

The Cluster Environment

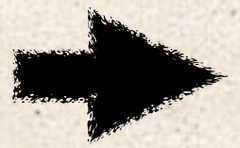
- Use the (t)csh
- Use package to set the environment
- Set `.mypackages` file

```
$ use <package name>
$ use LofIm <day>
```

Package	Description	Initialize	Update frequency	Comments
Casa	Browser, viewer, plotms, casapy	`use Casa`	infrequent	NRAO development
GDL	Gnu data language	`use GDL`	infrequent	Contains: GDL, GSL, PLPlot
LofIm	Lofar Imaging	`use LofIm`	daily	Contains: casacore, casarest, pyrap, LOFAR, ASKAPsoft
LUS (LOFAR User Software)	USG DAL and Pulsar tools	`use LUS`	daily	Provided by USG

The Cluster Environment

- Use the (t)csh
- Use package to set the environment
- Set `.mypackages` file



Follow cookbook chap. 1.3

```
$ use <package name>
$ use LofIm <day>
```

Package	Description	Initialize	Update frequency	Comments
Casa	Browser, viewer, plotms, casapy	`use Casa`	infrequent	NRAO development
GDL	Gnu data language	`use GDL`	infrequent	Contains: GDL, GSL, PLPlot
LofIm	Lofar Imaging	`use LofIm`	daily	Contains: casacore, casarest, pyrap, LOFAR, ASKAPsoft
LUS (LOFAR User Software)	USG DAL and Pulsar tools	`use LUS`	daily	Provided by USG

II. Lofar Data

Cookbook chap. 2

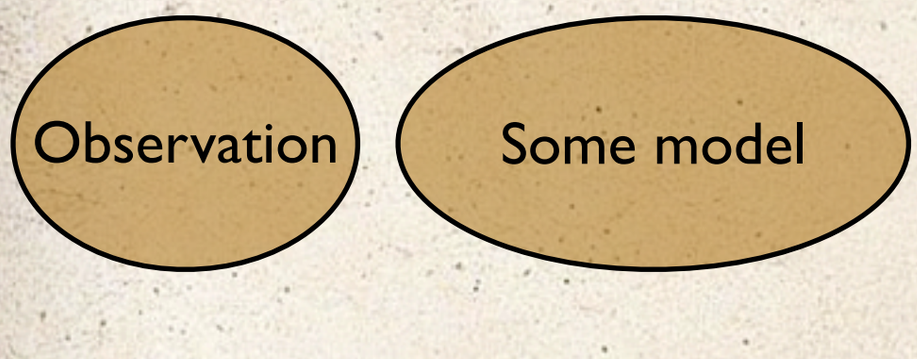
The LOFAR Measurement Set (.MS)

- Directory (not file)
- Table System
- Each row is a data

ANTENNA1	First antenna in baseline
ANTENNA2	Second antenna in baseline
FIELD_ID	Field (source no.) identification
TIME	Integration midpoint time
UVW	UVW coordinates
FLAG	cumulative data flags
WEIGHT	weight for a row
DATA	complex visibility data matrix
MODEL_DATA	visibility for the model
CORRECTED_DATA	data after calibration

The LOFAR Measurement Set (.MS)

- Directory (not file)
- Table System
- Each row is a data



ANTENNA1	First antenna in baseline
ANTENNA2	Second antenna in baseline
FIELD_ID	Field (source no.) identification
TIME	Integration midpoint time
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FLAG	cumulative data flags
WEIGHT	weight for a row
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The LOFAR Measurement Set (.MS)

- Directory (not file)
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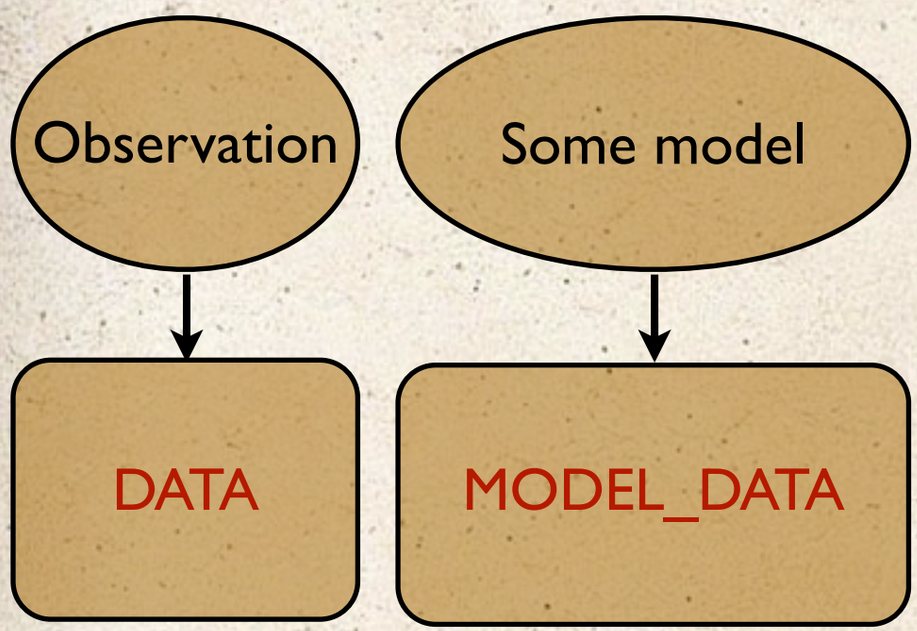

ANTENNA1	First antenna in baseline
ANTENNA2	Second antenna in baseline
FIELD_ID	Field (source no.) identification
TIME	Integration midpoint time
UVW	UVW coordinates
FLAG	cumulative data flags
WEIGHT	weight for a row
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- Directory (not file)
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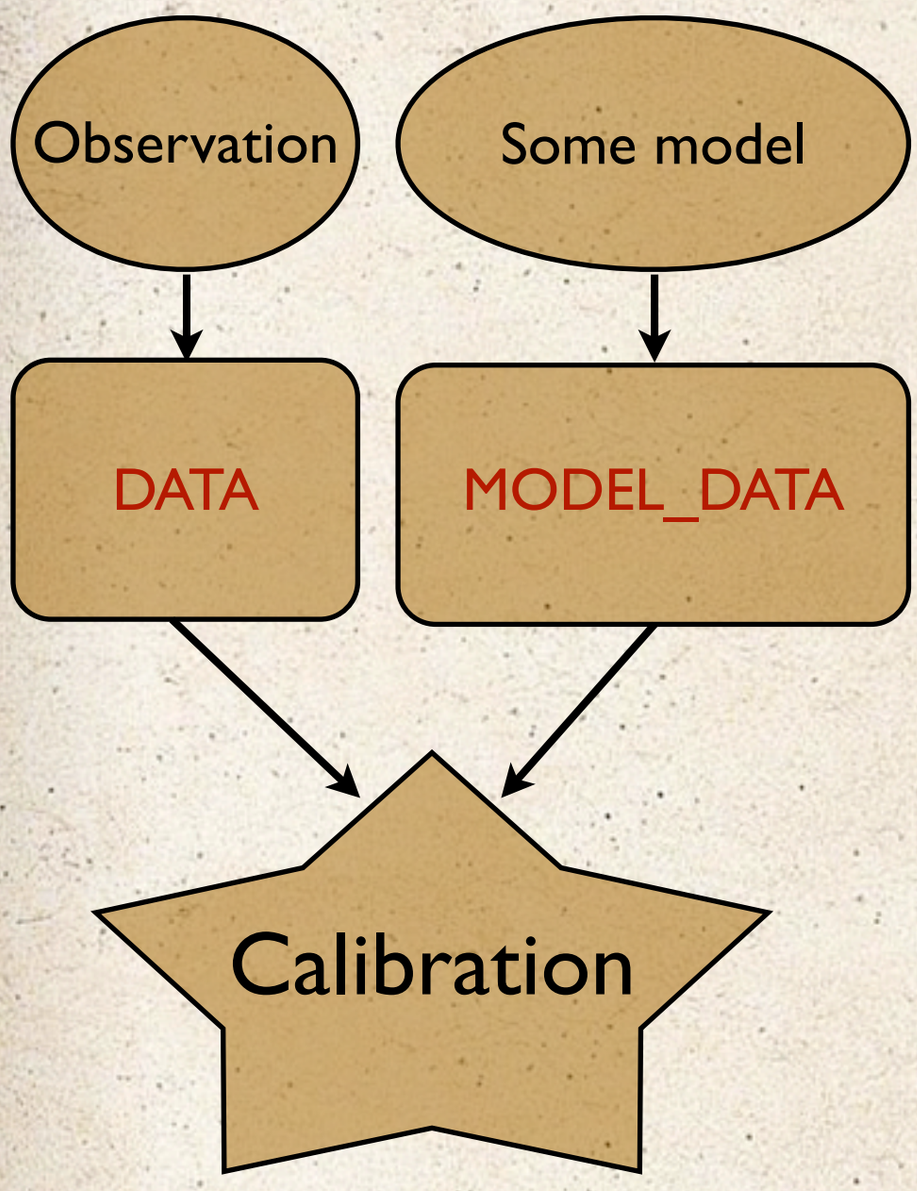
- Each row is a data



ANTENNA1	First antenna in baseline
ANTENNA2	Second antenna in baseline
FIELD_ID	Field (source no.) identification
TIME	Integration midpoint time
UVW	UVW coordinates
FLAG	cumulative data flags
WEIGHT	weight for a row
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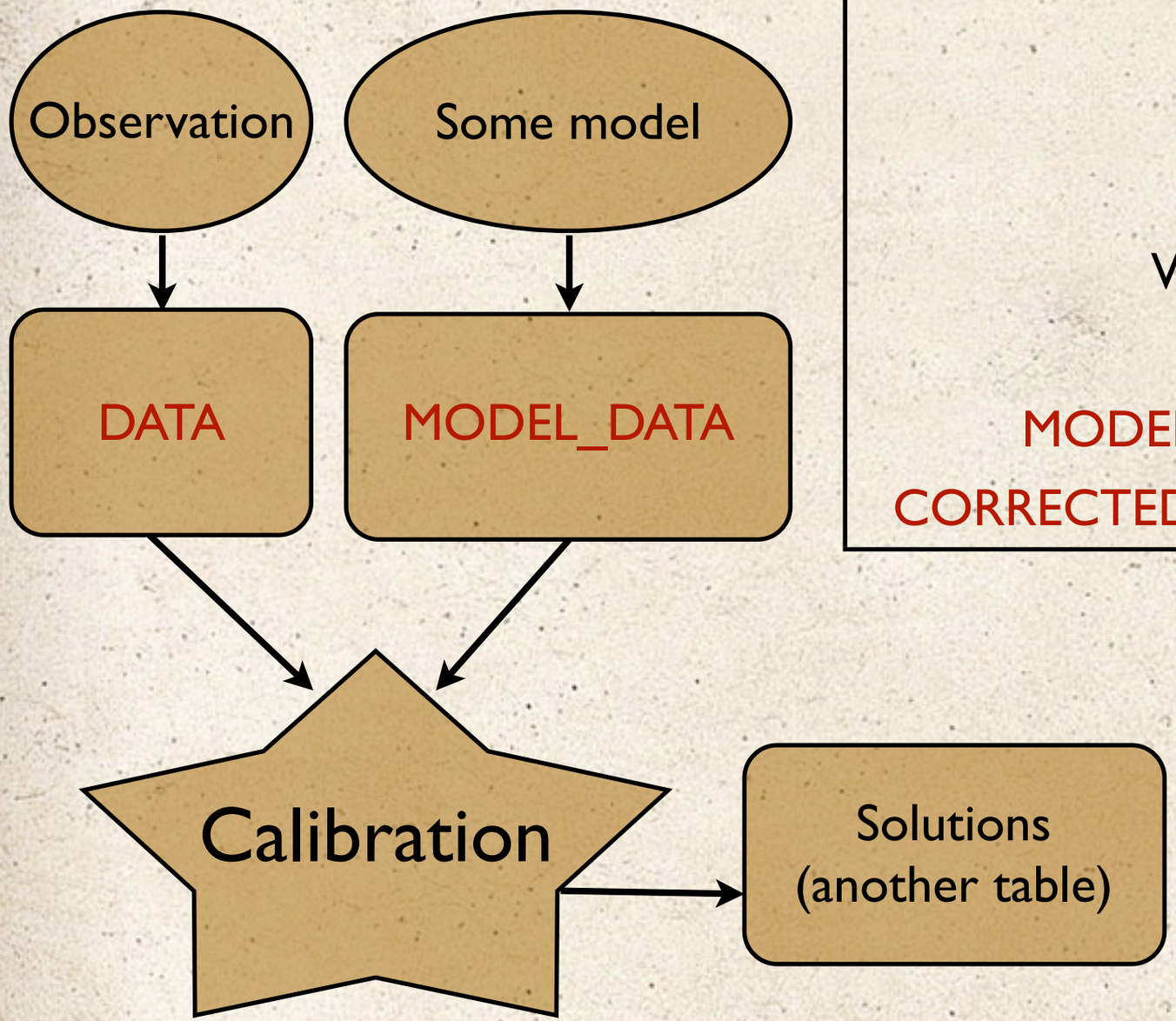
The LOFAR Measurement Set (.MS)

- Directory (not file)
- Table System
- Each row is a data



ANTENNA1	First antenna in baseline
ANTENNA2	Second antenna in baseline
FIELD_ID	Field (source no.) identification
TIME	Integration midpoint time
UVW	UVW coordinates
FLAG	cumulative data flags
WEIGHT	weight for a row
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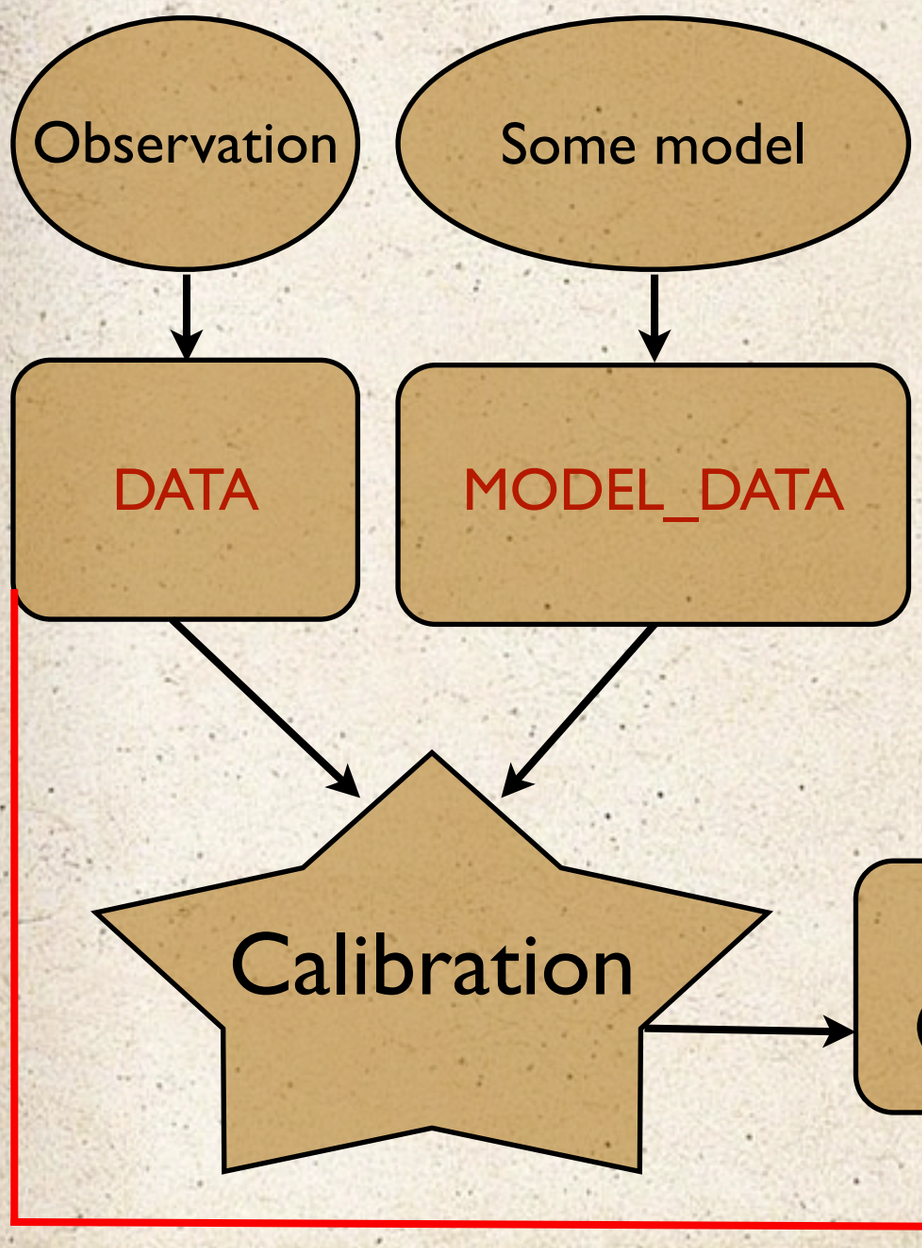
The LOFAR Measurement Set (.MS)

- Directory (not file)
- Table System
- Each row is a data



ANTENNA1	First antenna in baseline
ANTENNA2	Second antenna in baseline
FIELD_ID	Field (source no.) identification
TIME	Integration midpoint time
UVW	UVW coordinates
FLAG	cumulative data flags
WEIGHT	weight for a row
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The LOFAR Measurement Set (.MS)

- Directory (not file)
- Table System
- Each row is a data

ANTENNA1	First antenna in baseline
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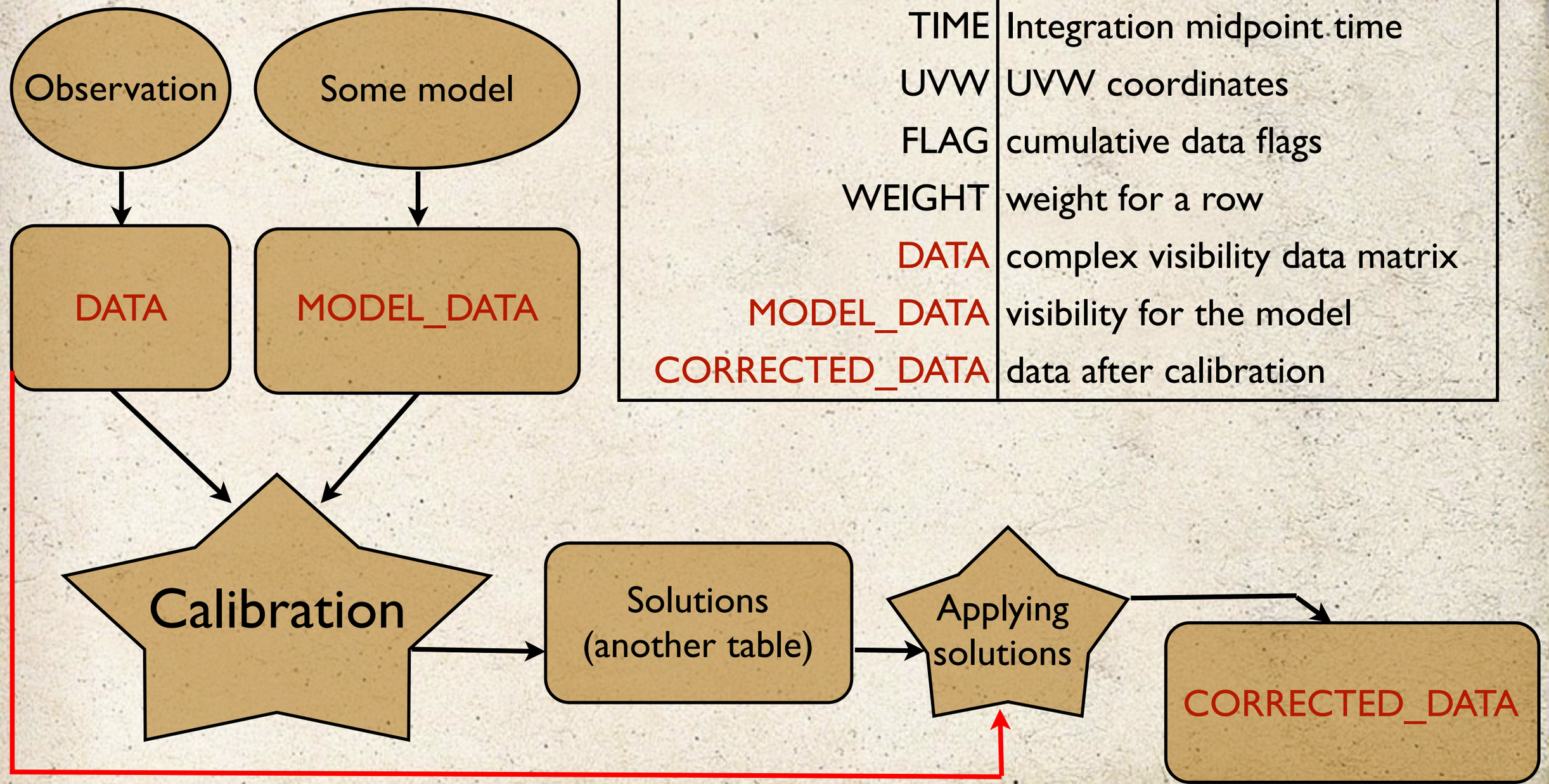

Looking inside a data file

Data is divided in frequency (one MS ∀ sub-band): SB###.MS

Looking inside a data file

Data is divided in frequency (one MS ∀ sub-band): SB###.MS

How the data look like?

Looking inside a data file

Data is divided in frequency (one MS ∀ sub-band): SB###.MS

Table Browser

File Edit View Tools Export Help

Casabrowser

SB171-10min.MS SB171-10min.MS

table data | table keywords | field keywords

	WEIGHT	ANTENNA1	ANTENNA2	FIELD_ID	INTERVAL	TIME	DATA	FLAG
0	1, 1, 1, 1]	0	0	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
1	1, 1, 1, 1]	0	1	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
2	1, 1, 1, 1]	0	2	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
3	1, 1, 1, 1]	0	3	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
4	1, 1, 1, 1]	0	4	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
5	1, 1, 1, 1]	0	5	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
6	1, 1, 1, 1]	0	6	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
7	1, 1, 1, 1]	0	7	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
8	1, 1, 1, 1]	0	8	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
9	1, 1, 1, 1]	0	9	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
10	1, 1, 1, 1]	0	10	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
11	1, 1, 1, 1]	0	11	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
12	1, 1, 1, 1]	0	12	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
13	1, 1, 1, 1]	0	13	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
14	1, 1, 1, 1]	0	14	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
15	1, 1, 1, 1]	0	15	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
16	1, 1, 1, 1]	0	16	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean
17	1, 1, 1, 1]	0	17	0	3.0199	2010-09-12-1...	[4, 256] Complex	[4, 256] Boolean

Restore Columns | Resize Headers

PAGE NAVIGATION | First | << | [1 / 61] | >> | Last | 1 | Go | Loading 1000 rows.

SB171-10min.MS[0, 20] = Complex Array of size [4 256].

	1	2
0	(0.232363,0)	(0.223193,0)
1	(-0.00653224,-0.00610921)	(-0.0088043,-0.002127
2	(-0.00653224,0.00610921)	(-0.0088043,0.002127
3	(0.231644,0)	(0.232478,0)

Close

SB171-10min.MS[1, 20] = Complex Array of size [4 256].

	0	1	
0	(-0,-0)	(-0.00549037,-0.00420813)	(-0.00874537,
1	(0,-0)	(0.00362067,-0.00394146)	(0.0033647,-0
2	(0,-0)	(-0.00012835,-0.00136508)	(-0.00489736,
3	(-0,-0)	(-0.00838815,0.00328957)	(-0.00454395,

Close

Close All

Browsing table: SB171-10min.MS

Looking inside a data file

Data is divided in frequency (one MS ∀ sub-band): SB###.MS

How the data look like?

Looking inside a data file

Data is divided in frequency (one MS ∀ sub-band): SB###.MS

Which average has been performed on my data?

Which frequency has this SB?

How the data look like?

Which antenna were included in this observation?

Looking inside a data file

Data is divided in frequency (one MS ∀ sub-band): SB###.MS

```
$ msinfo SB111.MS
Summary of UV data for SB111.MS
      # of visibilities:        1809456
      # of flagged vis.:        653140
      Phase center:              +19:59:28.4, +40:44:02.1
      Frequency range (MHz):     148.340  --  148.535
      Wavelength range (m):      2021  --  2.018
      Observation time span:     2010-09-11T17:00:00 -- 2010-09-11T22:59:58
      Duration (hrs):            6.00
      time bin / integration:    3.01990
      # of channels:             256
      channel width (KHz):       0.8
      # of polarizations:        4
      # of antennas:             22
```

Which average has been performed on my data?

Which frequency has this SB?

How the data look like?

Which antenna were included in this observation?

Looking inside a data file

Data is divided in frequency (one MS ∀ sub-band): SB###.MS

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      Duration (hrs):            6.00
      time bin / integration:    3.01990
      # of channels:            256
      channel width (KHz):       0.8
      # of polarizations:       4
      # of antennas:            22
```

Are my data full of RFI?

Which average has been performed on my data?

What was the elevation of the source?

Which frequency has this SB?

How the data look like?

Which antenna were included in this observation?

Looking inside a data file

Data is divided in frequency (one MS ∀ sub-band): SB###.MS

```
$ msinfo SB111.MS
Summary of UV data for SB111.MS
      # of visibilities:        1809456
      # of flagged vis.:        653140
      Phase center:             +19:59:28.4, +40:44:02.1
      Frequency range (MHz):    148.340  --  148.535
      Wavelength range (m):     2021  --  2.018
      Observation time span:    2010-09-11T17:00:00 -- 2010-09-11T22:59:58
      Duration (hrs):           6.00
      time bin / integration:   3.01990
      # of channels:            256
      channel width (KHz):      0.8
      # of polarizations:       4
      # of antennas:            22
```

I want to see some plots!

Are my data full of RFI?

Which average has been performed on my data?

What was the elevation of the source?

Which frequency has this SB?

How the data look like?

Which antenna were included in this observation?

uvplot

uvplot.py GUI frontend

Input MS: /data/scratch/fdg/busywed/3c465/SB034_DPPP-adv.M — Browse...

Plot device: /xs — Options?

X-axis type: time

Y-axis type: amp — Unwrap phases?

X-axis min,max

Y-axis min,max

Num. subplots x,y: 3,2

Column to plot: DATA — Show a

Timeslots to plot/avg: 0,0

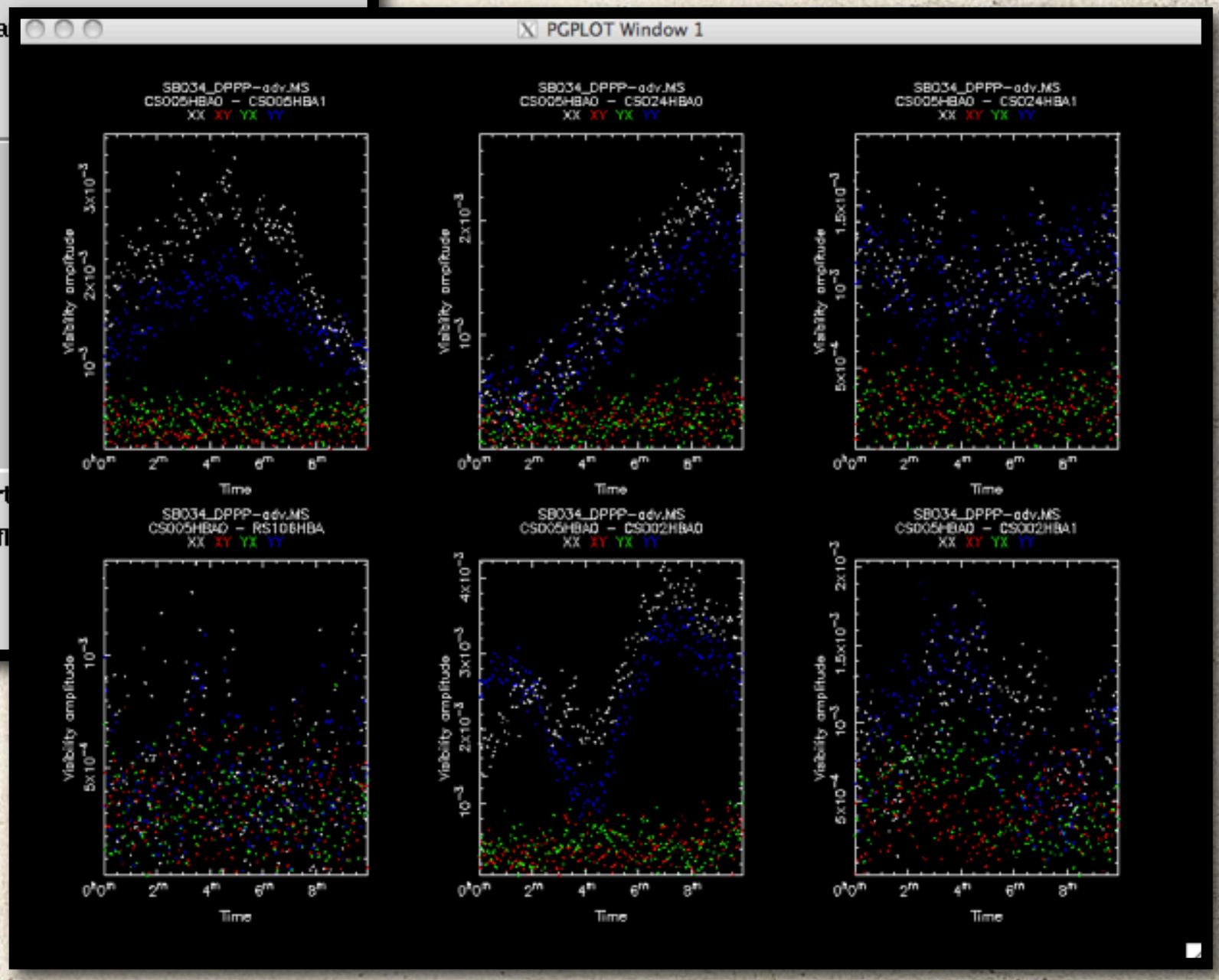
Channels to plot/avg: 0,0

Antennas to plot:
CS005HBA0
CS005HBA1
CS024HBA0
CS024HBA1
RS106HBA
CS002HBA0
CS002HBA1
CS003HBA0
CS003HBA1
CS103HBA0

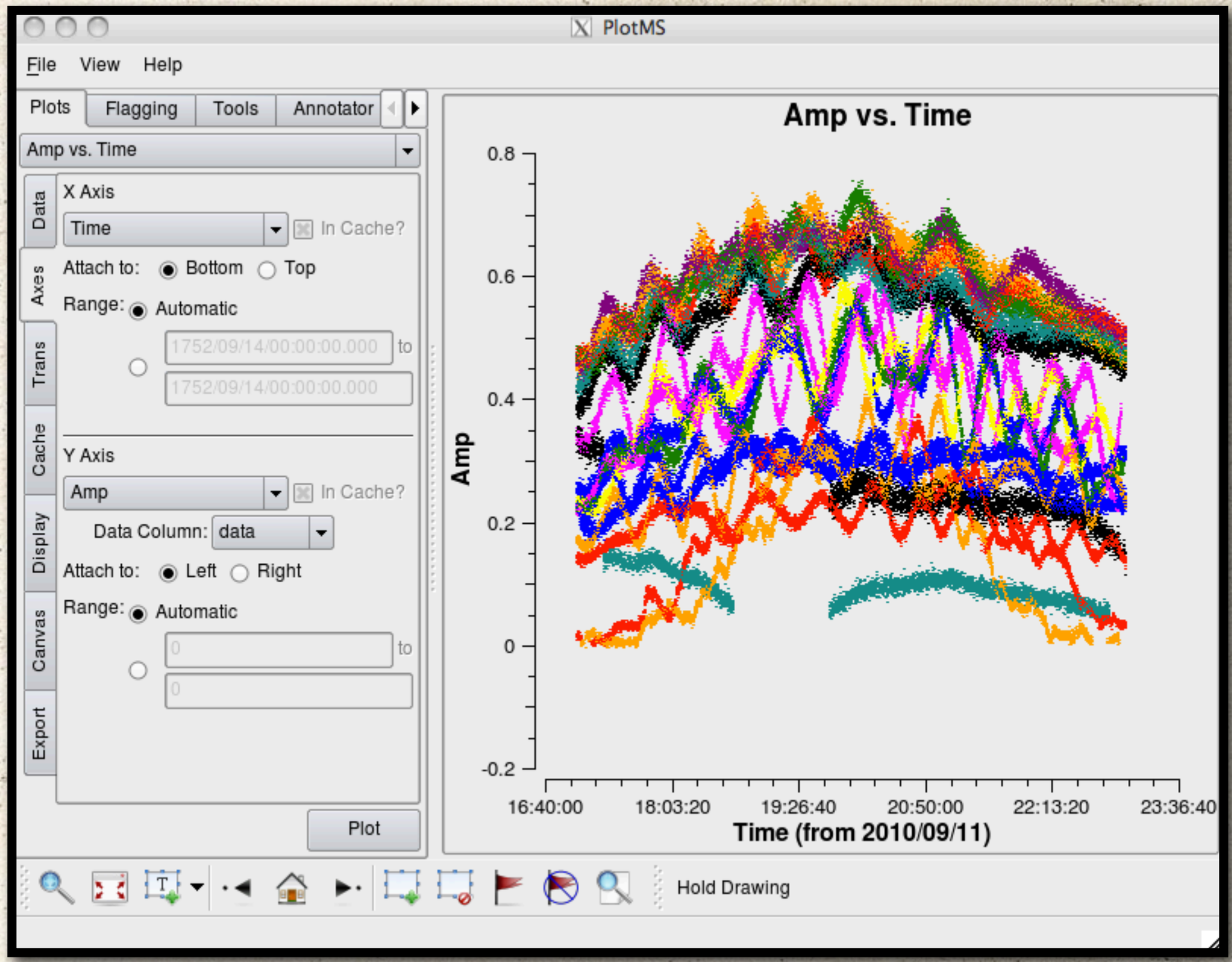
Polarizations: 0,1,2,3 — Convert

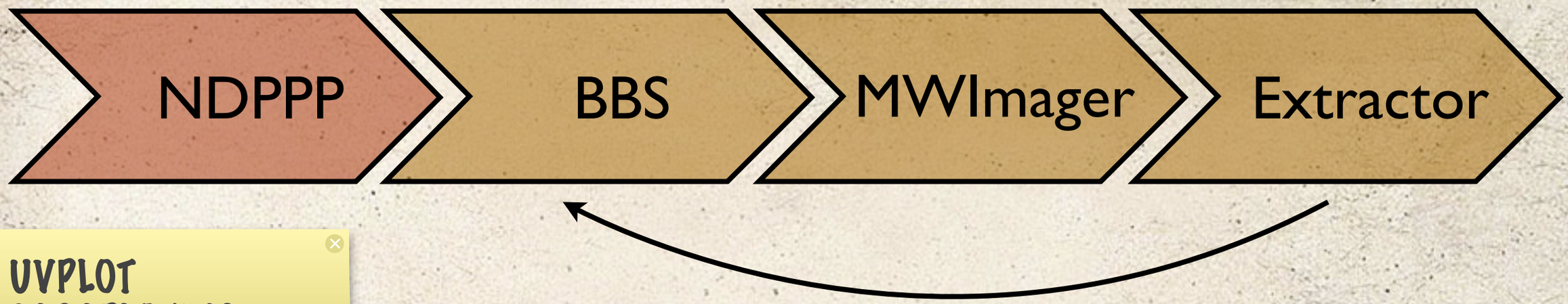
Flag column: FLAG — Show fl

Plot



casaplotms

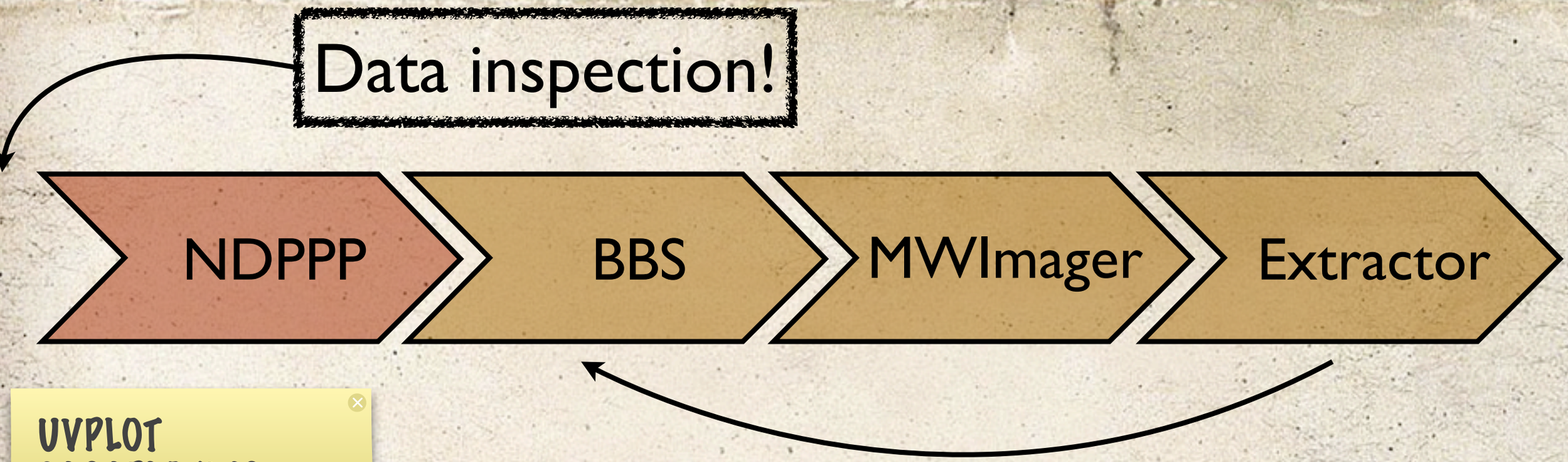

PlotMS
File View Help
Plots Flagging Tools Annotator
Amp vs. Time
Data
Axes
Trans
Cache
Display
Canvas
Export
X Axis
Time
In Cache?
Attach to: Bottom Top
Range: Automatic
1752/09/14/00:00:00.000
to
1752/09/14/00:00:00.000
Y Axis
Amp
In Cache?
Data Column: data
Attach to: Left Right
Range: Automatic
0
to
0
Plot
Amp vs. Time
0.8
0.6
0.4
0.2
0
-0.2
Amp
16:40:00
18:03:20
19:26:40
20:50:00
22:13:20
23:36:40
Time (from 2010/09/11)
Hold Drawing



UVPLOT
CASAPLOTMS

III. Lofar Pipeline

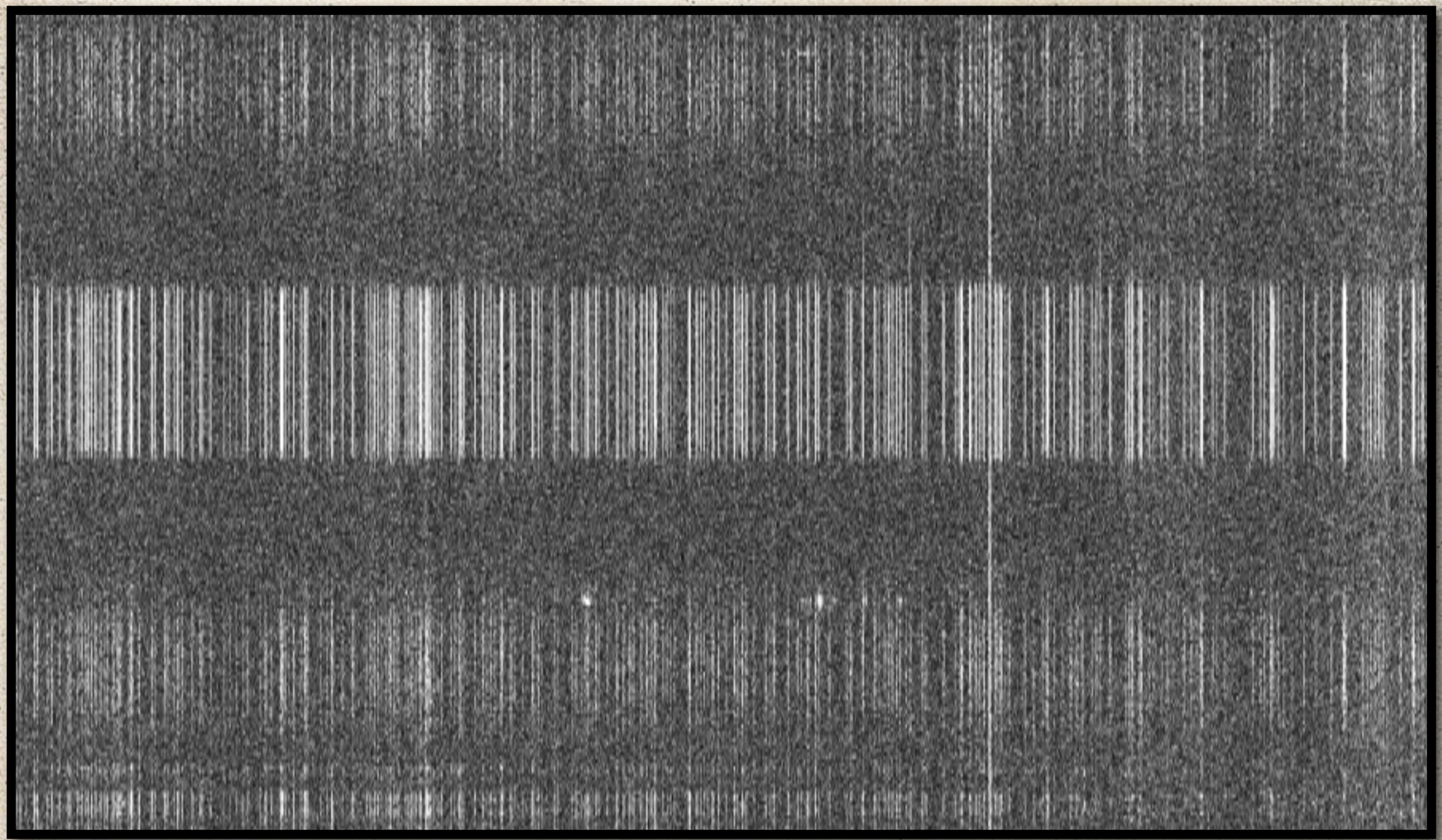
Cookbook chap. 4



III. Lofar Pipeline

Cookbook chap. 4

NDPPP (New Default Pre-Processing Pipeline): Flagging and squashing!



NDPPP (New Default Pre-Processing Pipeline): Flagging and squashing!

Specify parameters in a NDPPP.parset file:

```
$ NDPPP NDPPP.parset
```

```
msin = SB111.MS
msin.datacolumn = DATA
msin.startchan = 8
msin.nchan = 240

msout = "SB111_DPPP.MS"
msout.datacolumn = DATA

steps = [preflag,flag1,avg1,flag2,avg2,count]


preflag.type=preflagger
preflag.corrtype=auto

flag1.type=madflagger
flag1.threshold=4
flag1.freqwindow=31
flag1.timewindow=5
flag1.correlations=[0,3]

avg1.type = squash
avg1.freqstep = 240

flag2.type=madflagger
flag2.threshold=3
flag2.timewindow=51

avg2.type = squash
avg2.timestep = 5
```

NDPPP (New Default Pre-Processing Pipeline): Flagging and squashing!

Specify parameters in a NDPPP.parset file:

```
$ NDPPP NDPPP.parset
```

```
msin = SB111.MS
msin.datacolumn = DATA
msin.startchan = 8
msin.nchan = 240

msout = "SB111_DPPP.MS"
msout.datacolumn = DATA

steps = [preflag,flag1,avg1,flag2,avg2,count]


preflag.type=preflagger
preflag.corrtype=auto

flag1.type=madflagger
flag1.threshold=4
flag1.freqwindow=31
flag1.timewindow=5
flag1.correlations=[0,3]

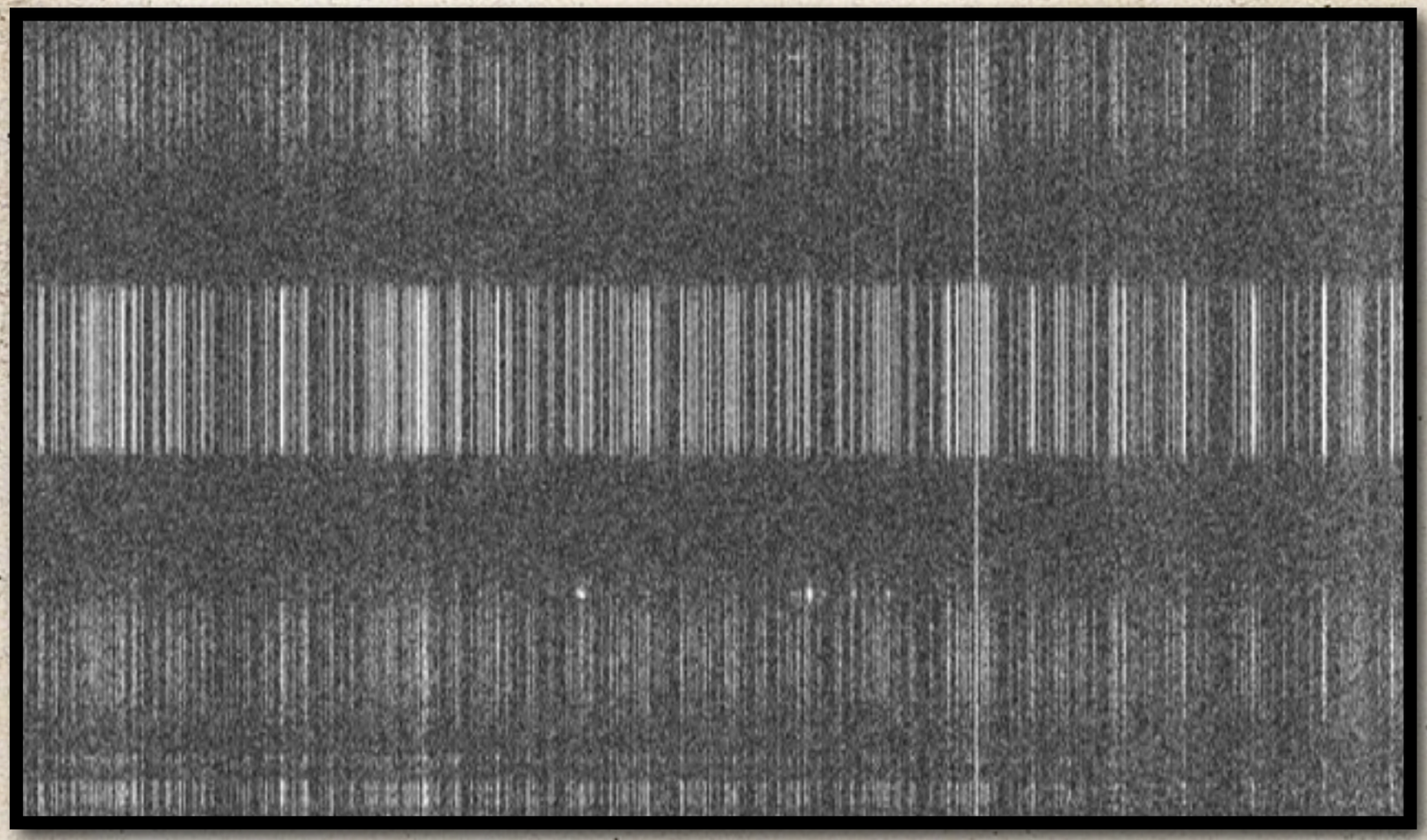
avg1.type = squash
avg1.freqstep = 240

flag2.type=madflagger
flag2.threshold=3
flag2.timewindow=51

avg2.type = squash
avg2.timestep = 5
```

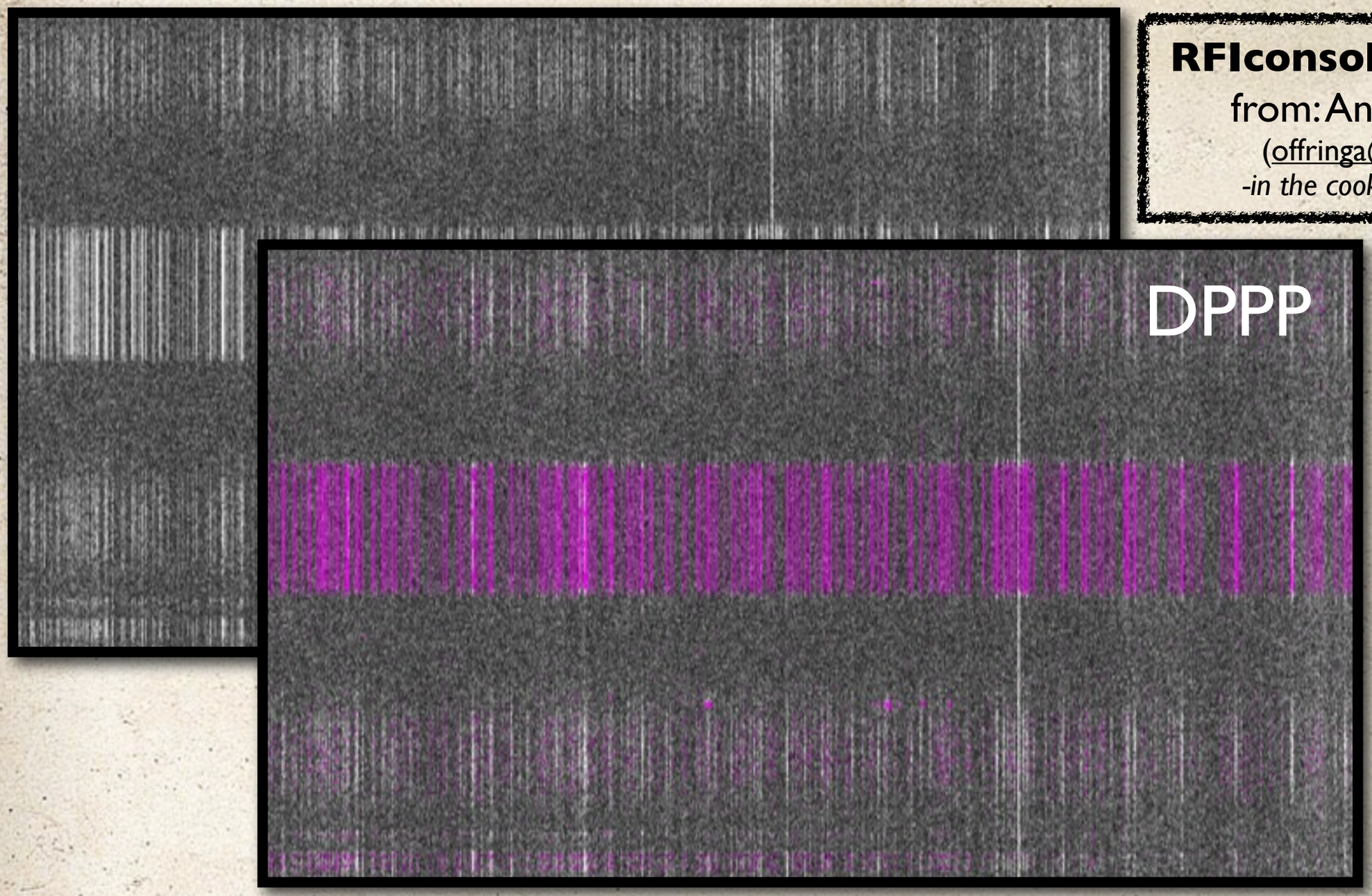
Time, baseline, elevation, azimuth, uv-distance, channel, frequency, amplitude, phase, real, and imaginary.

NDPPP (+RFIconsole): Flagging and squashing!



RFIconsole, a new flagger
from: André Offringa
(offringa@astro.rug.nl)
-in the cookbook from v3.1-

NDPPP (+RFIconsole): Flagging and squashing!



RFIconsole, a new flagger
from: André Offringa
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-in the cookbook from v3.1-

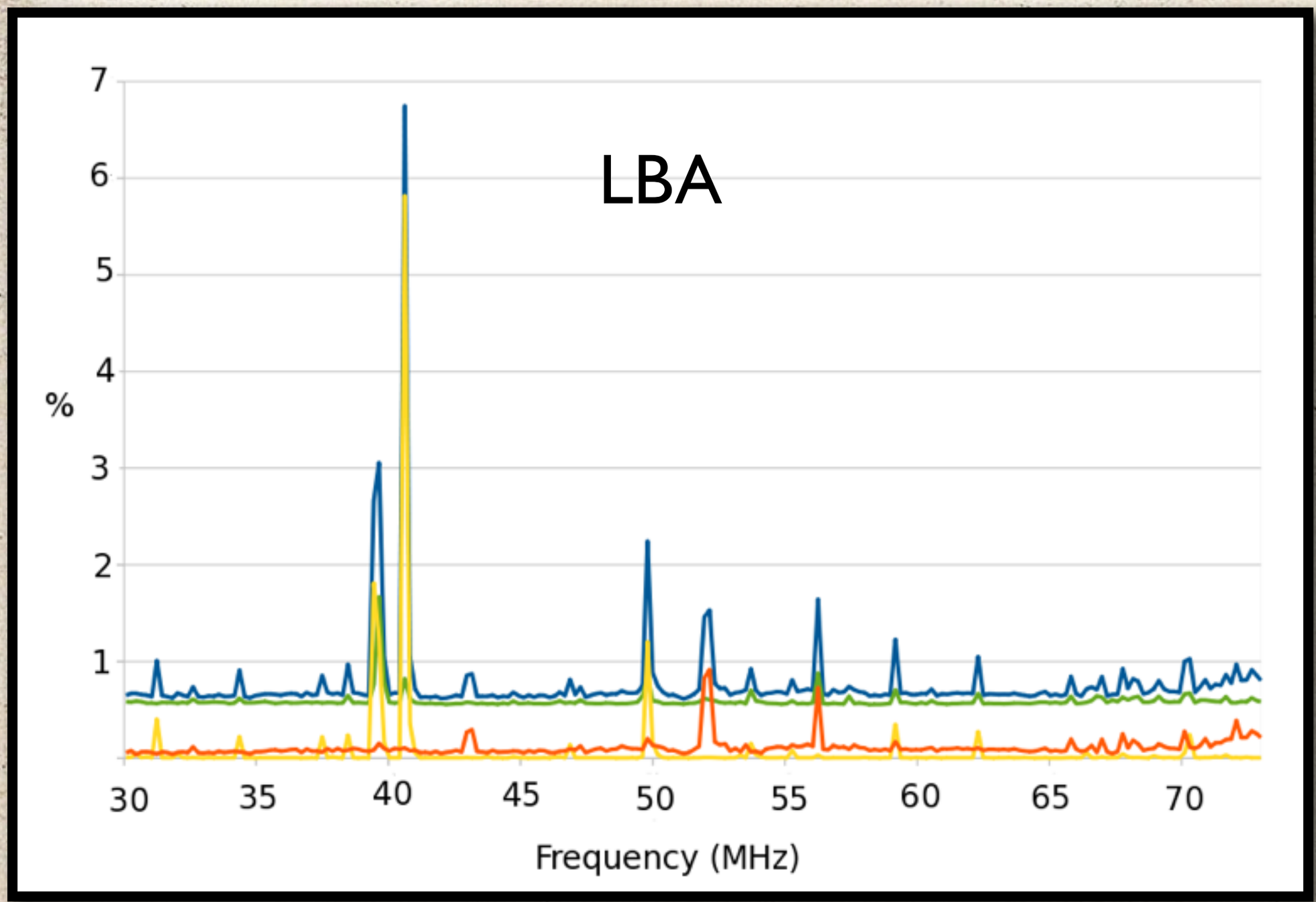
NDPPP (+RFIconsole): Flagging and squashing!

RFIconsole, a new flagger
from: André Offringa
(offringa@astro.rug.nl)
-in the cookbook from v3.1-

DPPP

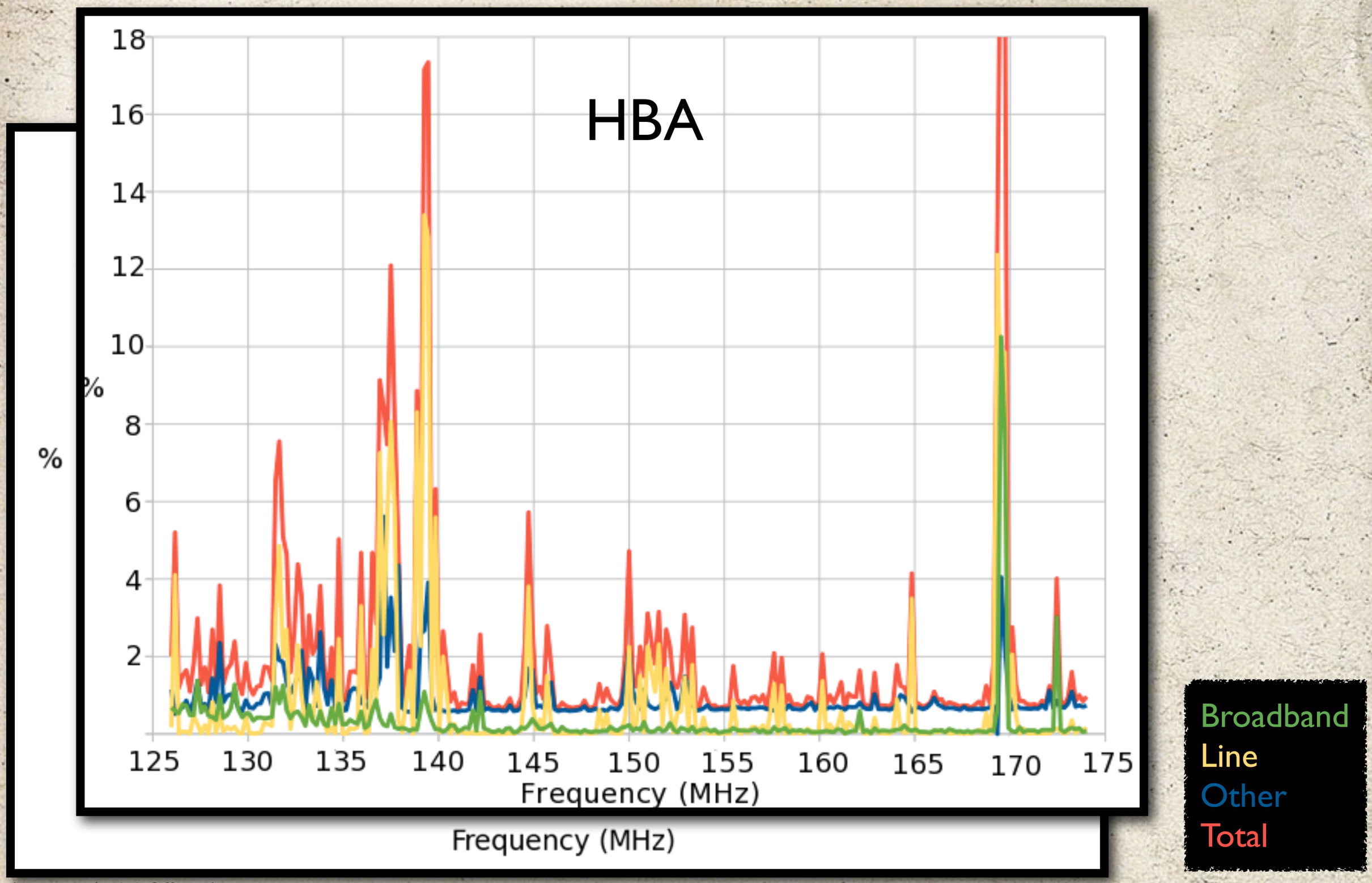
RFIconsole

NDPPP (+RFIconsole): Flagging and squashing!

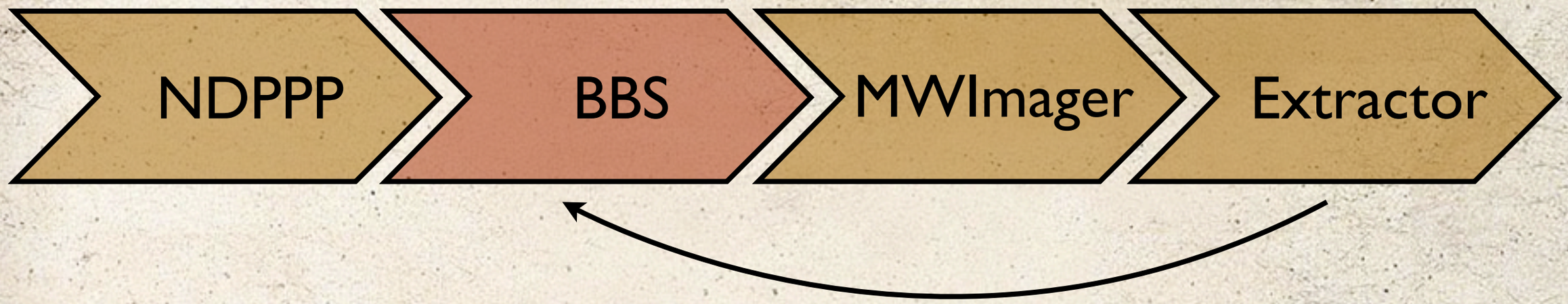


(courtesy André Offringa)

NDPPP (+RFIconsole): Flagging and squashing!



(courtesy André Offringa)

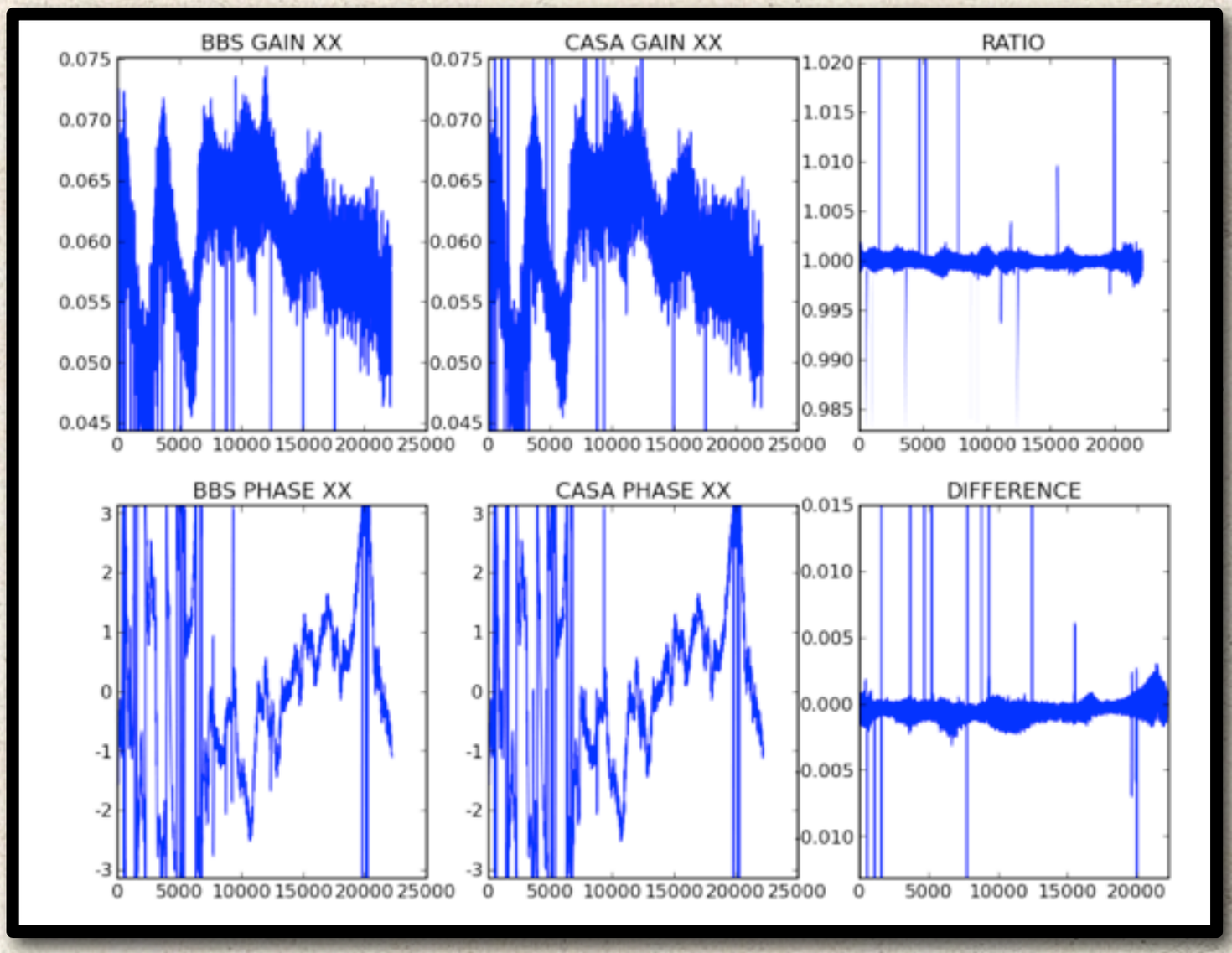


III. Lofar Pipeline

Cookbook chap. 5

BBS (BlackBoard Selfcal): Calibrating!

- Calibration (also directional)
- Source subtraction
- Model data creation
- Ionosphere and beam corrections



(courtesy J. van Zwieten)

BBS (BlackBoard Selfcal): Calibrating!

```
$ makevds sub1.clusterdesc <MS file>
```

Clusterdesc: Describes the layout of the cluster nodes

VDS file: Describe content and location of the MS files

BBS (BlackBoard Selfcal): Calibrating!

```
$ makevds sub1.clusterdesc <MS file>

$ combinevds <output file>.gds <vds file 1> [<vds file 2> ...]
```

Clusterdesc: Describes the layout of the cluster nodes

VDS file: Describe content and location of the MS files

GDS file: Describe location of all the VDS files

BBS (BlackBoard Selfcal): Calibrating!

```
$ makevds sub1.clusterdesc <MS file>

$ combinevds <output file>.gds <vds file 1> [<vds file 2> ...]

$ calibrate -f --key test --cluster-desc sub1.clusterdesc


--db ldb001 --db-user postgres <global gds file>


bbs.parset bbs.skymodel <directory>
```

Clusterdesc: Describes the layout of the cluster nodes

VDS file: Describe content and location of the MS files

GDS file: Describe location of all the VDS files

BBS parameters

BBS (BlackBoard Selfcal): Calibrating!

```
$ makevds sub1.clusterdesc <MS file>

$ combinevds <output file>.gds <vds file 1> [<vds file 2> ...]

$ calibrate -f --key test --cluster-desc sub1.clusterdesc
```

session name

cluster description file

```
--db ldb001 --db-user postgres <global gds file>
```

database info

GDS file

```
bbs.parset bbs.skymodel <directory>
```

parameters file (Cookbook chap. 5.3)

sky model

working directory

Clusterdesc: Describes the layout of the cluster nodes

VDS file: Describe content and location of the MS files

GDS file: Describe location of all the VDS files

BBS parameters

BBS (BlackBoard Selfcal): Calibrating!

```
$ makevds sub1.clusterdesc <MS file>

$ combinevds <output file>.gds <vds file 1> [<vds file 2> ...]

$ calibrate -f --key test --cluster-desc sub1.clusterdesc
```

session name

cluster description file

```
--db ldb001 --db-user postgres <global gds file>
```

database info

GDS file

```
bbs.parset bbs.skymodel <directory>
```

parameters file (Cookbook chap. 5.3)

sky model

working directory

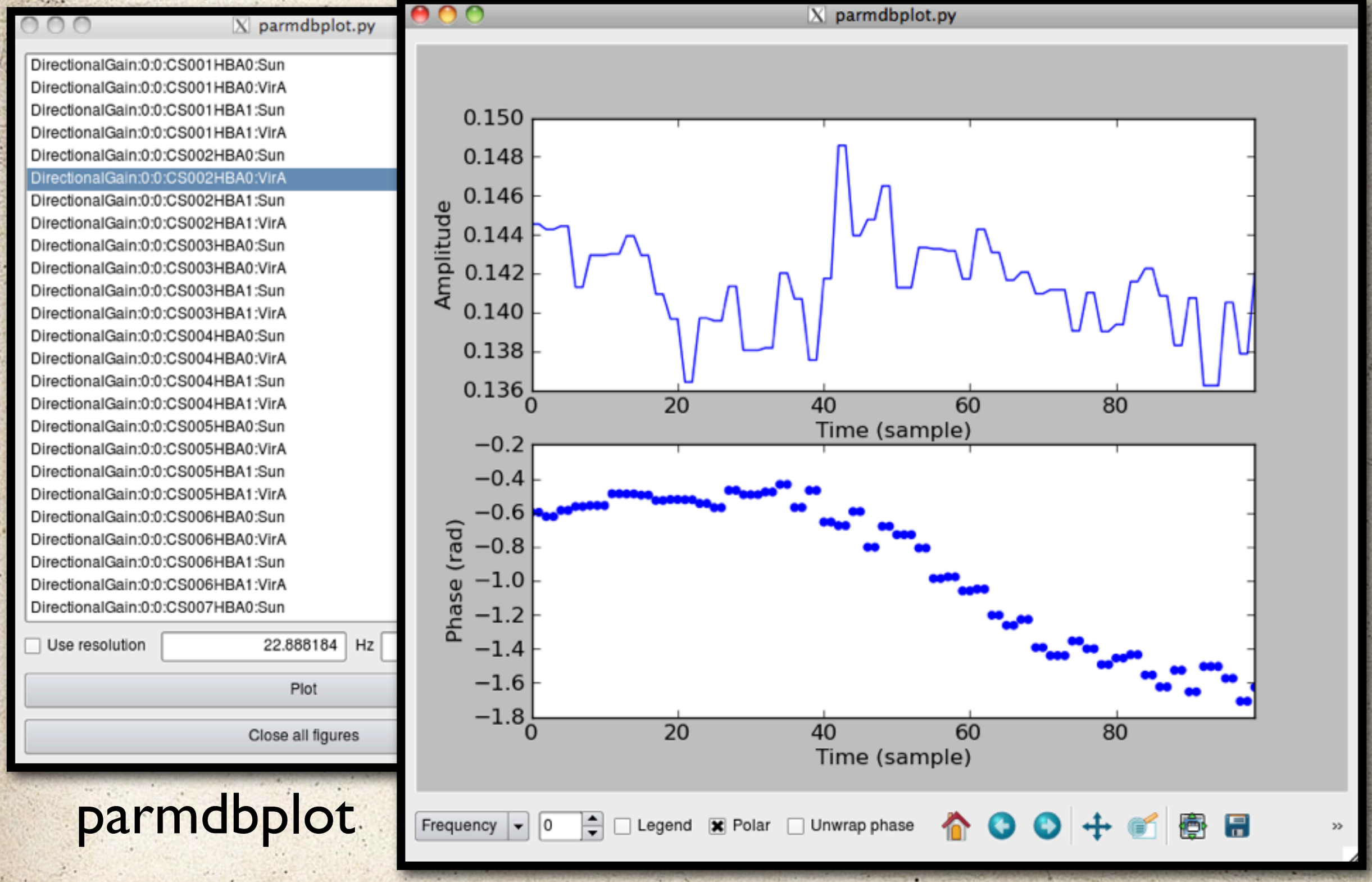
```
# (Name, Type, Ra, Dec, I, Q, U, V, ReferenceFrequency='55.468e6', \
SpectralIndexDegree='0', SpectralIndex:0='0.0', SpectralIndex:1='0.0', \
MajorAxis, MinorAxis, Orientation) = format

CygA.E, POINT, 19:59:31.60000, +40.43.48.3000, 1.25
CygA.W, POINT, 19:59:25.00000, +40.44.15.7000, 1.0
```

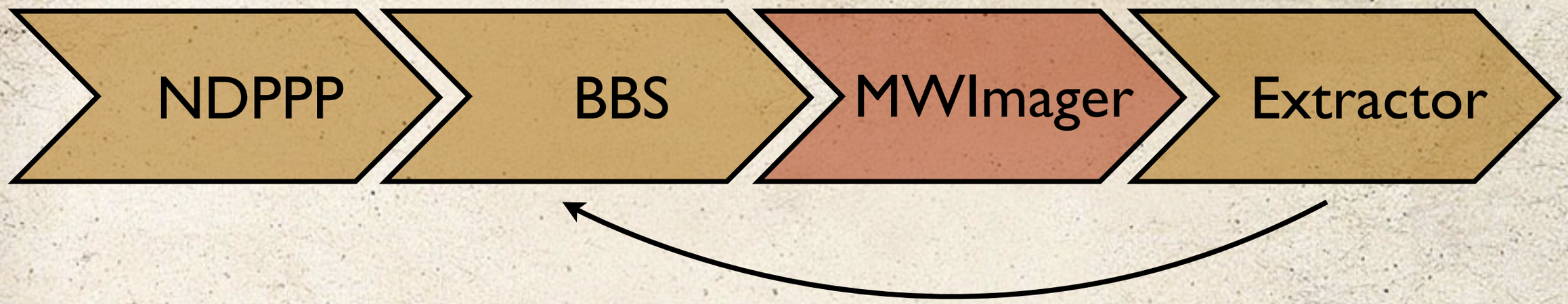
BBS (BlackBoard Selfcal): Calibrating!

```
$ parmdbplot.py SB111.MS/instrument/
```

BBS (BlackBoard Selfcal): Calibrating!

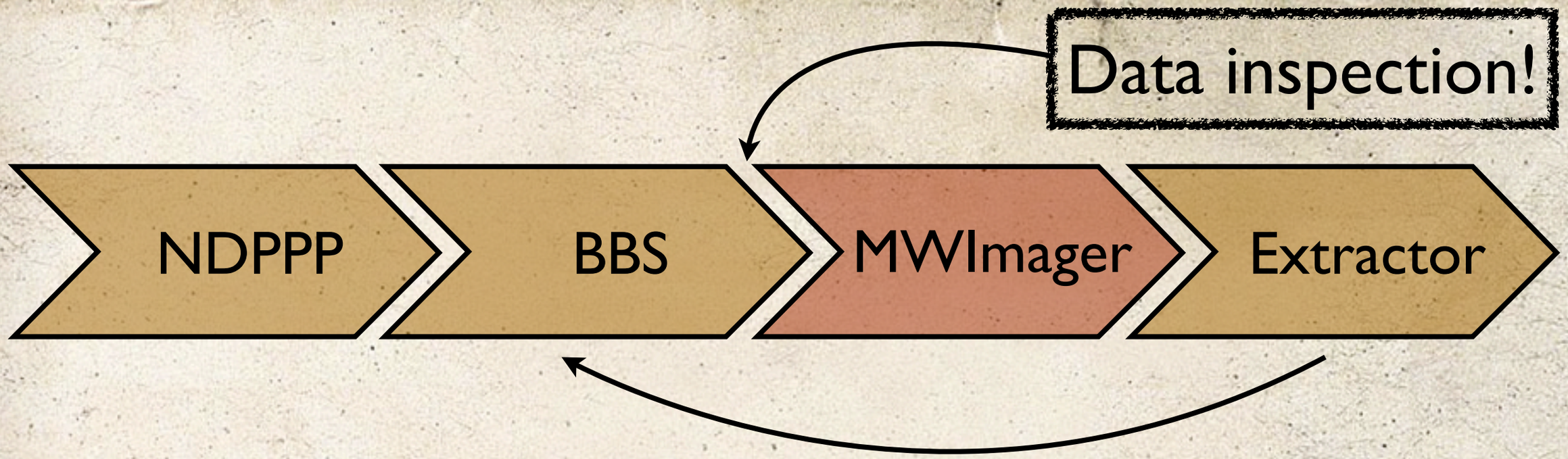


parmdbplot



III. Lofar Pipeline

Cookbook chap. 5



III. Lofar Pipeline

Cookbook chap. 5

casaplotms

Data inspection!

PlotMS

File View Help

Plots | Flagging | Tools | Annotator

Amp vs. Time

Data | Axes | Trans | Cache | Display | Canvas | Export

X Axis

Time In Cache?

Attach to: Bottom Top

Range: Automatic

1752/09/14/00:00:00.000 to

1752/09/14/00:00:00.000

Y Axis

Amp In Cache?

Data Column: corrected

data
corrected
model
residual

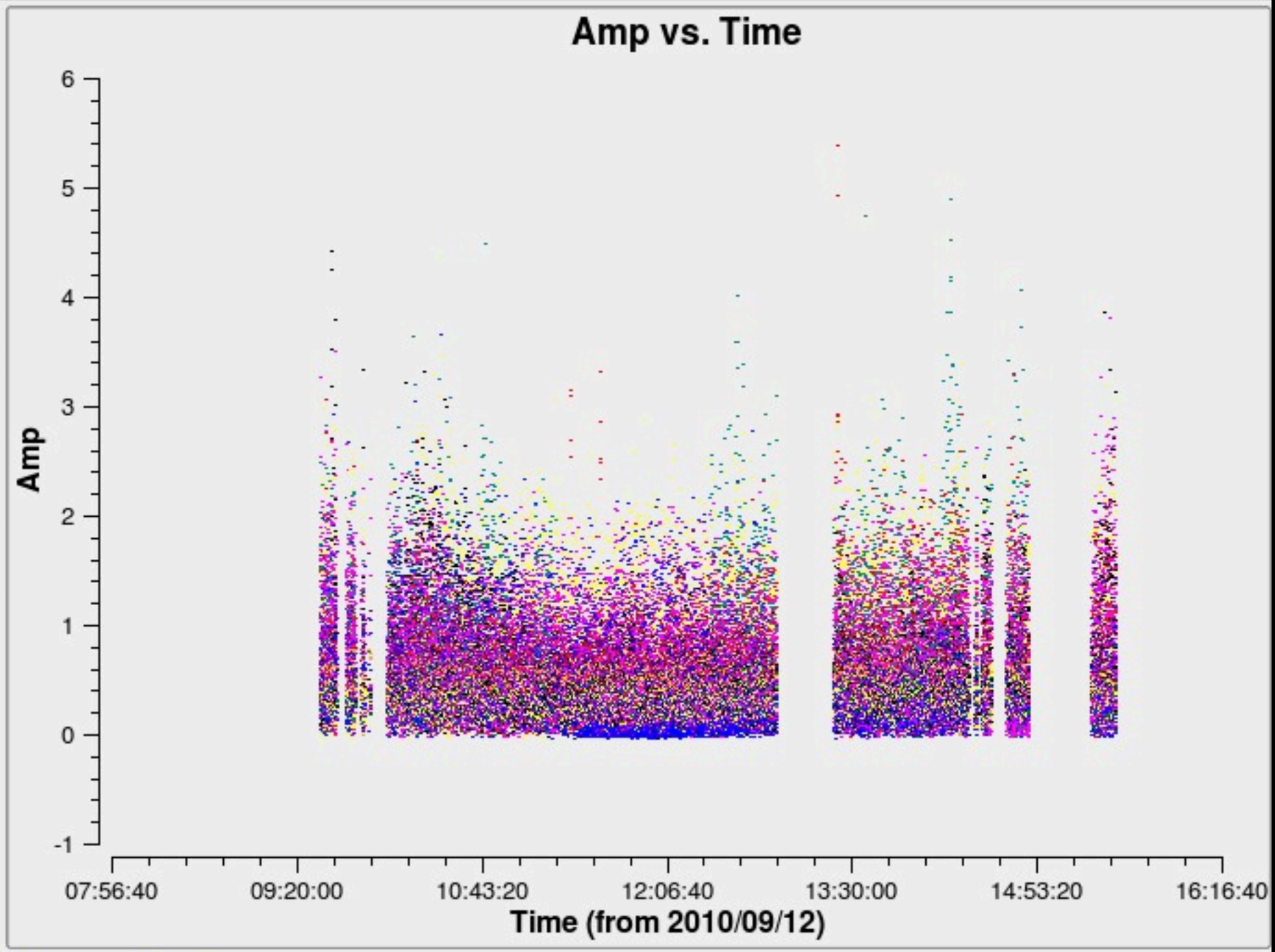
Attach to: Lef

Range: Automa

0 to

0

Plot



Hold Drawing

casaplotms

Data inspection!

PlotMS

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Amp vs. Time

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Time In Cache?

Attach to: Bottom Top

Range: Automatic

1752/09/14/00:00:00.000 to

1752/09/14/00:00:00.000

Y Axis

Amp Cache?

Data Column: corrected

data
corrected
model
residual

Attach to: Lef

Range: Automa

to

0

Plot

Amp vs. Time

Amp

6
5
4
3
2
1
0
-1

07:56:40 09:20:00 10:43:20 12:06:40 13:30:00 14:53:20 16:16:40

Time (from 2010/09/12)

Hold Drawing

MWImager (Master-Worker Imager): Imaging!

MWimager is a wrapper for:

- **cimager**: developed for ASKAP and LOFAR observations
- **lwimager**: using CASA imaging libraries

- imaging from the DATA, MODEL DATA, or CORRECTED DATA column
- imaging individual channels
- multi-frequency synthesis
- imaging of all Stokes
- wide-field imaging using facets or W-projection (or combination)
- deconvolution (though not all clean algorithms are supported by both imagers).

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```
$ mwimager mwimager.parset sub1.clusterdesc
```

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parameters file (Cookbook chap. 6.2)

cluster description file

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parameters file (Cookbook chap. 6.2)

cluster description file

```
$ casaviewer
$ image2fits in=<input image> out=<output image>
```

MWImager (M

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```
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```

parameters file (Cookbook chap. 6.2)

```
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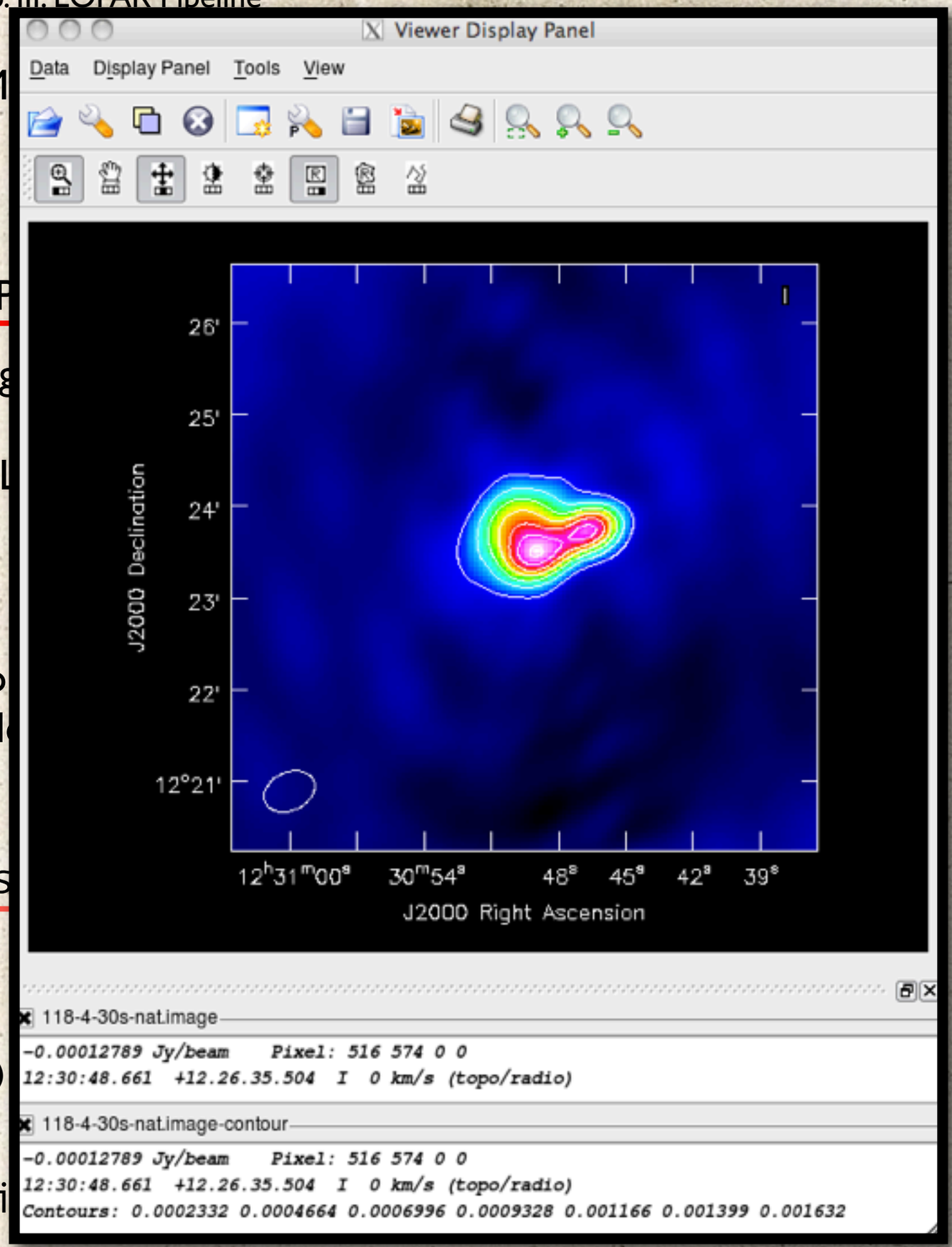
$ image2fits in=<input i
```



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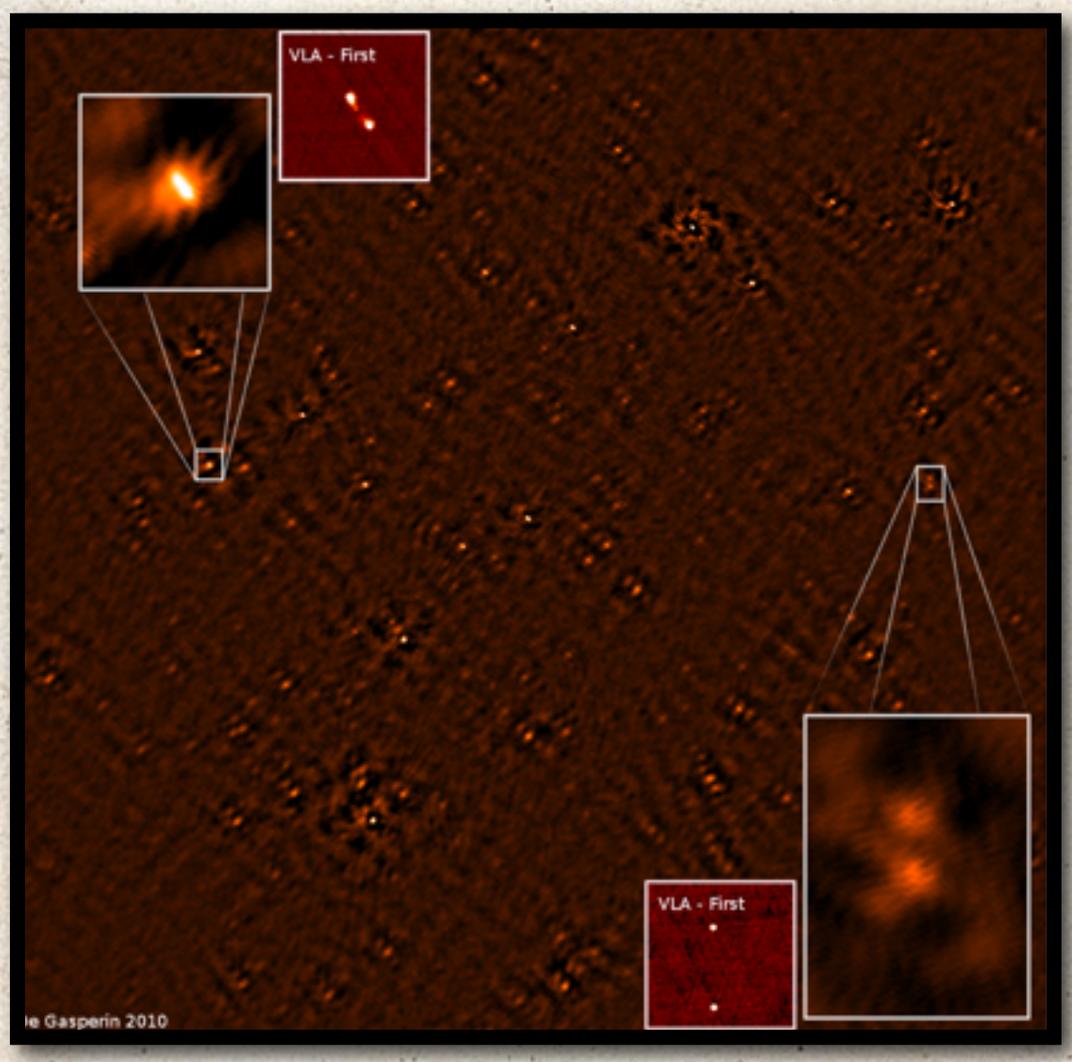
Official download page:

www.mpa-garching.mpg.de/~fdg/LOFAR_cookbook/

Last version: 3.0 - 22/07/2010



The End