

Introduction of AIPS

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AIPS for VLBI

- ◆ AIPS is a set of programs for the analysis of continuum and line observations, and is widely used with VLBI data.
- ◆ AIPS covers both Calibration and Imaging for VLBI data analysis.
- ◆ VLBI data analysis needs some VLBI-specified procedures, like fringe fitting. This could require more work than the connected interferometric data.

The philosophy of AIPS

“ Data are sacrosanct ”

- ◆ The raw data are never touched during the calibration process.
- ◆ All calibration information is stored in tables attached to the data file.
- ◆ These tables can be edited, merged, smoothed, interpolated, extrapolated, even deleted. Improve the calibration solutions through trial and error.

The philosophy of AIPS

$$\boxed{\text{UVDATA}} + \text{CL}.n + \text{FG}.1 + \text{BP}.1 = \text{Calibrated UVDATA}$$

Raw data **Calibration table** **Flag table** **Bandpass table**

Raw data	Calibration table	Calibration solutions	Calibration stage
UVDATA Never touched	CL.1 Upgrade CL.2 Upgrade CL.3 Upgrade CL.4	SN.1 SN.2 SN.3	Amplitude Calibration Phase Calibration Fringe Fitting

The philosophy of AIPS

◆ Multi-source uvdata

- The uvdata in a file which contains several sources (target sources, calibration sources).
- **Not-modified uvdata** + tables.

◆ Single-source uvdata

- There is always one source per file.
- You convert a multi-source file into single-source files, applying calibration and editing tables (CL, BP, FG). => **Modified uvdata**
- Does not have CL tables.

The AIPS words definitions

◆ Files & Tables

- A FITS file is loaded in AIPS environment as an AIPS “file”.
- The “file” has several “tables”.

File	Table
UVDATA	CL.1 SN.1 FG.1 BP.1 CL.2 SN.2 CL.3 SN.3 CL.4 ⋮ ⋮

The AIPS words definitions

◆ File's name

- AIPS file's name consists of three parts, **name**, **class** and **number**.
- You have to define **name**.
- If you do not define **class** and **number**, AIPS gives some default class and number.

Example :

R10120A. UVDATA. 1

name

class

number

The AIPS words definitions

◆ Table species

- AN : antenna table, contains information on the geometry of the array.
- BP : bandpass table, contains bandpass correction functions to the visibilities.
- CL : calibration table, contains all the current calibration information that the user wishes to apply.
- FQ : frequency table, contains frequency setup information.
- FG : flag table, data flagging information.

The AIPS words definitions

◆ Table species (cont.)

- GC : Gain table, contains gain information for each antenna.
- HI : history table, lists what you did to the data file.
- NX : index table, contains various pieces of information about the each scan.
- SN : solution table, contains calibration solutions from an AIPS task.
- TY : Tsys table, contains Tsys and Tant information for each antenna.

The AIPS words definitions

◆ Task & verb

- sort of command to execute AIPS applications
- task :
 - ▶ may take several minutes or hours to run completion
 - ▶ can run independently (run one or more simultaneously)
- verb :
 - ▶ simple and run quickly, interactively

◆ Adverb

- to send parameters to both tasks and verbs
 - ▶ real numbers, character strings, arrays

AIPS in practice

◆ Environment in the AIPS directory

- Copy your FITS files in **FITS** directory

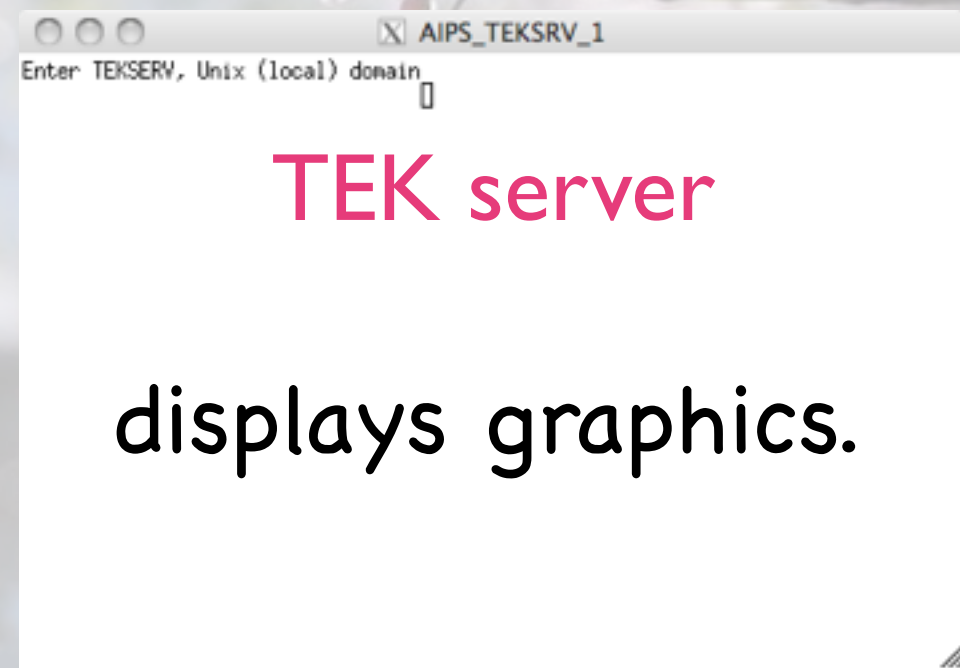
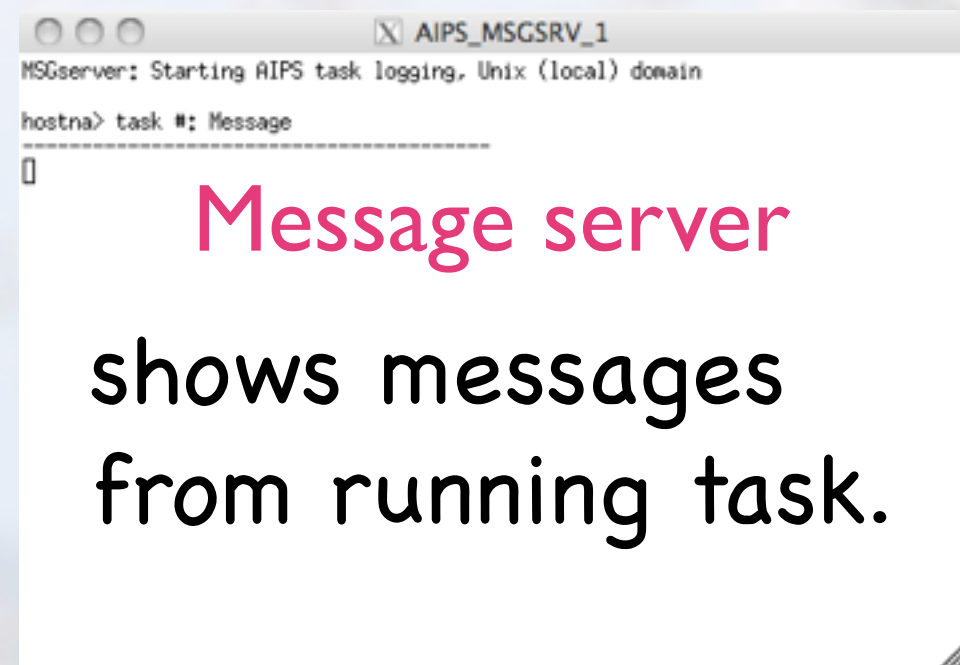
```
$ ls -F
31DEC10/      DATA/      PRDEVS.SH*  START_TVSERVERS*
31DEC11/      FITS/      PRINT/      TEXT/
AIPS.BOOT*    HOSTS.CSH*  RUN/        TVALT*
AIPSASSN.CSH* HOSTS.LIST* SETNAME*     TVDEVS.SH*
AIPSASSN.SH*  HOSTS.SH*   SETUNAME*    install.pl
AIPSPATH.CSH* LOGIN.CSH*  START_AIPS*
AIPSPATH.SH*  LOGIN.SH*   START_QMNGR*
DA00/         OFM/        START_TPSERVERS*
```

AIPS in practice

◆ Starting up AIPS

- three windows appear

```
% ./LOGIN.SH  
% $CDTST  
% aips tv=local
```



AIPS in practice

◆ Starting up AIPS (cont.)

- You are required to type ID number.
- Keep your assigned ID number(s), especially in the case that you share the computer.

```
AIPS 1: Enter user ID number
```

```
?445
```

```
AIPS 1:                               31DEC11 AIPS:
```

```
AIPS 1:          Copyright (C) 1995-2011 Associated Universities, Inc.
```

```
AIPS 1:          AIPS comes with ABSOLUTELY NO WARRANTY;
```

```
AIPS 1:          for details, type HELP GNUGPL
```

```
AIPS 1: This is free software, and you are welcome to redistribute it
```

```
AIPS 1: under certain conditions; type EXPLAIN GNUGPL for details.
```

```
AIPS 1: Previous session command-line history recovered.
```

```
AIPS 1: TAB-key completions enabled, type HELP READLINE for details.
```

```
AIPS 1: Recovered POPS environment from last exit
```

```
>
```

← prompt : you can type tasks/verbs here

AIPS in practice

◆ Setup a task

```
> task 'fitld'  
> inp
```

```
AIPS 1: FITLD: Task to store an image or UV data from a FITS tape  
AIPS 1: Adverbs      Values      Comments  
AIPS 1: -----  
AIPS 1: INTAPE        1           Input tape drive # (0 => 1)  
AIPS 1: NFILES        0           # of files to advance on tape  
AIPS 1: DATAIN       ' '         Disk file name  
AIPS 1: OUTNAME       ' '         File name (name)  
AIPS 1: OUTCLASS     ' '         File name (class)  
AIPS 1: OUTSEQ        0           File name (seq. #)  
AIPS 1:                0 => highest unique number  
AIPS 1:                => matching (on VLBA)  
AIPS 1:                -1 => FITS tape value  
AIPS 1: OUTDISK       1           Disk drive # (0 => any)  
AIPS 1: OPTYPE       ' '         Type of data to load,  
AIPS 1:                ' ' => all types  
AIPS 1:                'UV' => UV data  
AIPS 1:                'IM' => images  
AIPS 1: NCOUNT      0           Number of files to load.  
AIPS 1: DOTABLE      1           True (1.0) means load tables  
AIPS 1:                for images.  
AIPS 1: DOUVCOMP     1           >0 => compressed data (FITS)  
AIPS 1: ** press RETURN for more, enter Q or next line to quit print **
```

AIPS in practice

◆ Setup a task (cont.)

```
> datain 'fits:r10120a_s_03.fits.1'
> inp
```

```
AIPS 1: FITLD: Task to store an image or UV data from a FITS tape
AIPS 1: Adverbs      Values      Comments
AIPS 1: -----
AIPS 1: INTAPE        1           Input tape drive # (0 => 1)
AIPS 1: NFILES        0           # of files to advance on tape
AIPS 1: DATAIN       'FITS:R10120A_S_03.FITS' Disk file name
AIPS 1:                '.1'
AIPS 1: OUTNAME        ' '         File name (name)
AIPS 1: OUTCLASS       ' '         File name (class)
AIPS 1: OUTSEQ         0           File name (seq. #)
AIPS 1:                0 => highest unique number
AIPS 1:                => matching (on VLBA)
AIPS 1:                -1 => FITS tape value
AIPS 1: OUTDISK        1           Disk drive # (0 => any)
AIPS 1: OPTYPE         ' '         Type of data to load,
AIPS 1:                ' ' => all types
AIPS 1:                'UV' => UV data
AIPS 1:                'IM' => images
AIPS 1: NCOUNT         0           Number of files to load.
AIPS 1: DOTABLE        1           True (1.0) means load tables
AIPS 1:                for images.
AIPS 1: DOUVCOMP       1           >0 => compressed data (FITS)
AIPS 1: ** press RETURN for more, enter Q or next line to quit print **
```

AIPS in practice

◆ run a task

- after you finish all adverb setting

```
> go
```

- Some messages appear in the Message server window.

```
FITLD1: Task FITLD (release of 31DEC11) begins
FITLD1: UV data will be written in compressed format
FITLD1: Create R10120A .UVDATA. 1 (UV) on disk 1 cno 461
FITLD1: Sky frequencies (MHz) before re-ordering occurs:
FITLD1: Incoming FREQID # 1
FITLD1: .....
FITLD1: .....
FITLD1: .....
FITLD1: Appears to have ended successfully
```

AIPS in practice

◆ run an adverb “**pcat**” to list files

```
> pcat
```

```
AIPS 1: Catalog on disk 1
AIPS 1:  Cat Usid Mapname      Class   Seq  Pt      Last access      Stat
AIPS 1:    1  445 R10120A      .UVDATA.    1  UV  08-APR-2011 12:04:59
```

- The file “R10120A.UVDATA.1” is created.
 - ▶ Catalog number : 1
 - ▶ User ID : 445
 - ▶ Data type : UVDATA
 - ▶ Status : not reading or writing

AIPS in practice

◆ How to treat a task :

> <code>task 'task_name'</code>	to call the task
> <code>go/go task_name</code>	to send the task into execution
> <code>abort/abort task_name</code>	to kill the task

◆ How to treat a verb :

> <code>adverb_name</code>	to execute the adverb
----------------------------	-----------------------

AIPS in practice

- ◆ a verb **imheader** to get header information of the file

```
> imheader
```

```
AIPS 1: Image=MULTI      (UV)      Filename=R10120A      .UVDATA.      1
AIPS 1: Telescope=VERA      Receiver=VLBA
AIPS 1: Observer=r10120a      User #=      3
AIPS 1: Observ. date=17-APR-2010      Map date=07-JAN-2011
AIPS 1: # visibilities      159068      Sort order TB
AIPS 1: Rand axes: UU-L-SIN VV-L-SIN WW-L-SIN TIME1 BASELINE
AIPS 1:      SOURCE  FREQSEL  INTTIM  CORR-ID  WEIGHT  SCALE
AIPS 1: -----
AIPS 1: Type      Pixels      Coord value      at Pixel      Coord incr      Rotat
AIPS 1: COMPLEX      1      1.00000000E+00      1.00      1.00000000E+00      0.00
AIPS 1: STOKES      1      -2.00000000E+00      1.00      -1.00000000E+00      0.00
AIPS 1: FREQ      512      4.2803014E+10      1.00      3.1250000E+04      0.00
AIPS 1: IF      2      1.00000000E+00      1.00      1.00000000E+00      0.00
AIPS 1: RA      1      00 00 00.000      1.00      0.000000      0.00
AIPS 1: DEC      1      00 00 00.000      1.00      0.000000      0.00
AIPS 1: -----
AIPS 1: Coordinate equinox 2000.00
AIPS 1: Maximum version number of extension files of type HI is      1
AIPS 1: Maximum version number of extension files of type GC is      1
AIPS 1: Maximum version number of extension files of type AT is      1
AIPS 1: Maximum version number of extension files of type IM is      1
AIPS 1: Maximum version number of extension files of type CT is      1
AIPS 1: Maximum version number of extension files of type FQ is      1
AIPS 1: Maximum version number of extension files of type AN is      1
AIPS 1: Maximum version number of extension files of type SU is      1
AIPS 1: Maximum version number of extension files of type TY is      1
AIPS 1: Keyword = 'OLDRFQ'      value =      4.28030137D+10
```

} tables

AIPS knacks

◆ Check the Message server window so frequently whether the task finished running successfully.

- Successful case

```
FITLD1: Task FITLD (release of 31DEC00) begins  
FITLD1: Appears to have ended successfully
```

- Unsuccessful case

```
SNPLT1: Task SNPLT (release of 31DEC00) begins  
SNPLT1: TABINI: REQUESTED SN FILE 5 DOES NOT EXIST  
SNPLT1: ERROR 2 OPENING SN TABLE NO. 5  
SNPLT1: Purports to die of UNNATURAL causes
```

AIPS knacks

- ◆ Check whether new table/file is created, using **imheader** and **pcat**.

> Imheader

```
AIPS 1: Maximum version number of extension files of type HI is 1
AIPS 1: Maximum version number of extension files of type IM is 1
AIPS 1: Maximum version number of extension files of type GC is 1
AIPS 1: Maximum version number of extension files of type TY is 1
AIPS 1: Maximum version number of extension files of type NX is 1
AIPS 1: Maximum version number of extension files of type CL is 2
AIPS 1: Maximum version number of extension files of type FQ is 1
AIPS 1: Maximum version number of extension files of type AN is 1
AIPS 1: Maximum version number of extension files of type SU is 1
```

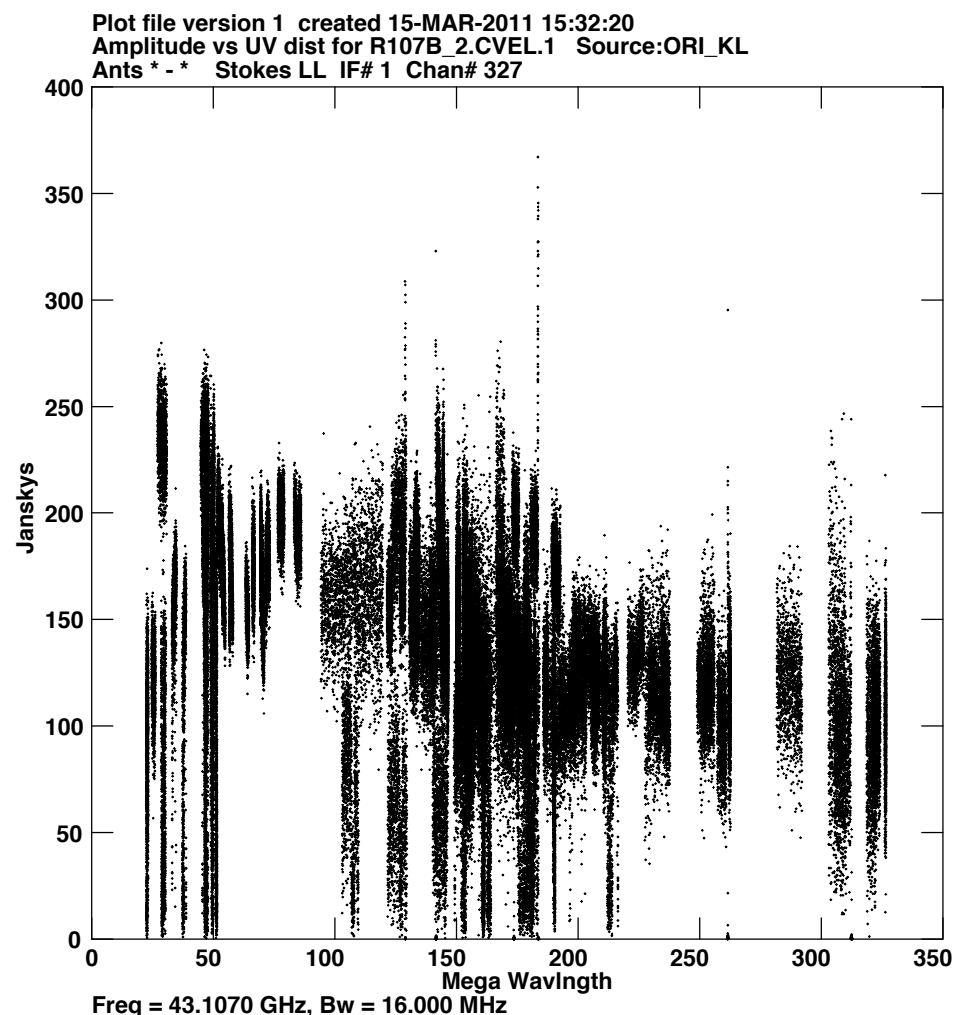
> pcat

```
AIPS 1: Catalog on disk 1
AIPS 1:  Cat Usid Mapname      Class   Seq  Pt      Last access      Stat
AIPS 1:    1  445 R10120A      .UVDATA.    1  UV  11-SEP-2011 16:27:21
AIPS 1:    2  445 R10120A      .MSORT .    1  UV  12-SEP-2011 13:17:32 WRITE
```

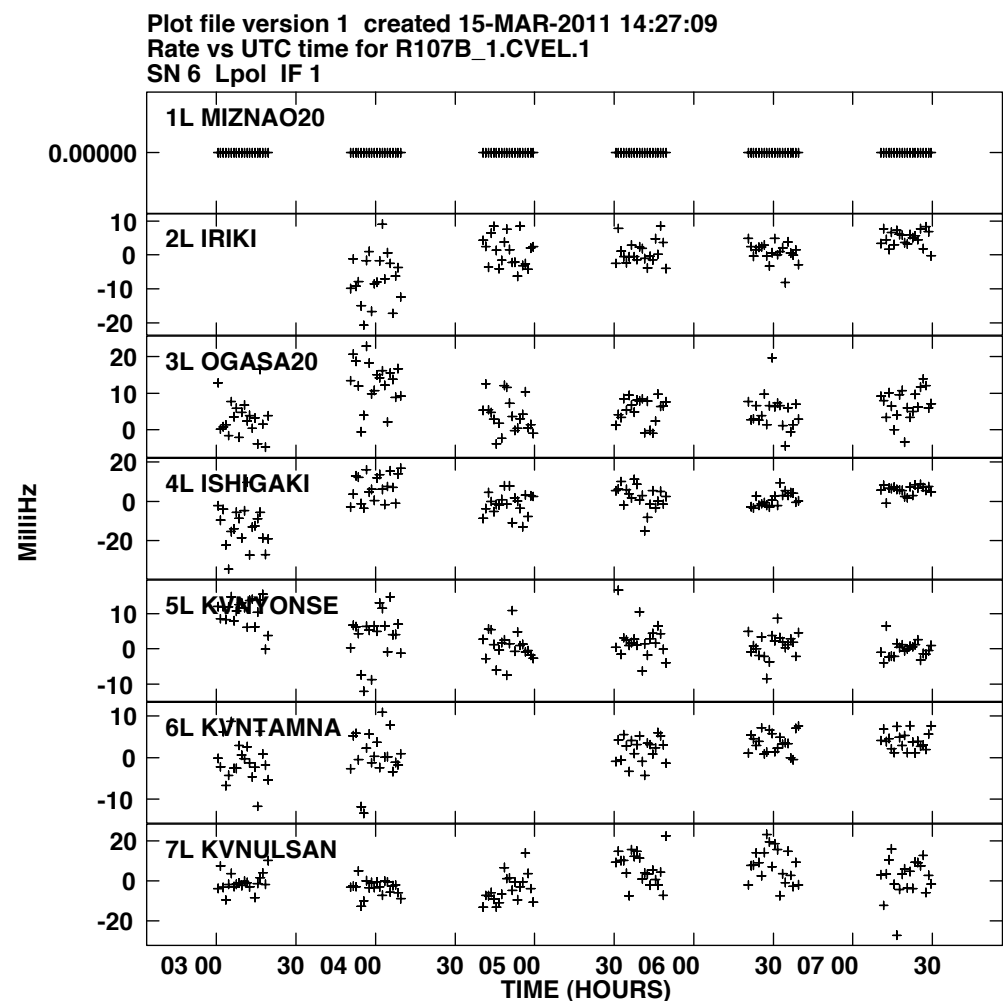
AIPS knacks

- ◆ Check inside data in the files/tables, using several plotting tasks.

UVPLT plot visibilities in file



SNPLT plot data in table



Documentations

◆ AIPS cookbook

- <http://www.aips.nrao.edu/CookHTML/CookBook.html>

◆ EA Radio Astronomy School

- <http://veraserver.mtk.nao.ac.jp/VERA/kurayama/WinterSchool/TableOfContents.htm>

