



Netherlands Institute for Radio Astronomy

# DTC (Dynspec Toolkit Content)

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# DTC (Dynspec Toolkit Content)



What is DTC:

- Packages of tool for LOFAR Beam formed data (ICD3 format)
- 6 conversions tools (convert Beam formed data to dynspec format: ICD6 format)
- 3 processing tools
- 1 Visualization tool

In Practice:

- 8 C++ codes interfaced with python scripts
- 1 Graphical Interface (Tkinter) for visualization

# DTC (Dynspec Toolkit Content)



ICD3 format:

Nomenclature:

Lxxx\_SAPxxx\_Bxxx\_Sx\_Pxxx.h5

Lxxx\_SAPxxx\_Bxxx\_Sx\_Pxxx.raw

2 files for each:

- SAP (Sub-Array Pointing) i.e target
- Beam (direction)
- S (Stokes)
- Part (large observation are split in several part)

Data Matrix is 2D: time and frequency

# DTC (Dynspec Toolkit Content)



ICD6 format:

Nomenclature:

Dynspec\_Lxxx\_SAPxxx.h5

1 files for each:

- SAP (Sub-Array Pointing) i.e target

Data Matrix is 3D: time,frequency and Stokes

# DTC (Dynspec Toolkit Content)

## Hdfview:

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**HDFView** window showing the contents of two HDF5 files:

- Dynspec\_rebinned\_L23304.h5** (Table View):
  - Table: 29,5 = 4.30762738E14
  - Data (approximate values):
 

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0	2.967758...	2.846275...	2.832884...	4.916960...	3.375353...	5.873090...	8.405765...	6.196815...	6.882921...	4.242186...	3.031750...	1.839678...	3.314510...	7.236842...	2.693336...
1	3.023611...	2.894745...	2.550982...	4.991672...	5.591051...	6.014317...	5.875756...	5.987575...	6.566136...	4.240381...	3.070603...	1.886475...	3.015675...	7.382026...	2.688630...
2	3.052722...	2.909011...	2.826575...	5.139232...	3.125464...	6.019986...	8.809938...	6.192036...	6.383115...	4.210841...	2.990317...	1.992540...	3.401415...	8.094786...	2.693191...
3	3.081473...	3.012544...	2.980316...	5.249790...	5.465406...	5.769430...	8.811853...	6.210086...	6.150884...	4.192180...	3.006496...	1.8959323...	3.389444...	8.258399...	2.749212...
4	2.946776...	2.906363...	2.835826...	5.285225...	6.607917...	6.008978...	8.862767...	5.898868...	6.230500...	4.160982...	2.921388...	1.850569...	2.998146...	6.799795...	2.643909...
5	2.960548...	2.800342...	2.837780...	5.440089...	5.595995...	6.196207...	8.906864...	5.748766...	6.490866...	4.121943...	2.931259...	1.737619...	3.136947...	8.511348...	2.642540...
6	2.990547...	2.900705...	2.755148...	5.546160...	5.884011...	6.211815...	8.703830...	5.979137...	6.538178...	3.925482...	2.947877...	1.634744...	3.370729...	8.750592...	2.633304...
7	2.997795...	2.863834...	2.5474780...	5.461426...	5.376771...	5.565154...	8.482079...	5.791122...	6.565598...	3.791897...	3.003805...	1.590189...	3.292513...	8.488606...	2.640856...
8	3.016127...	2.841084...	2.837586...	5.260816...	5.939242...	5.237260...	8.635048...	5.646583...	6.733716...	3.696135...	2.818887...	1.482447...	2.874039...	7.919551...	2.671087...
9	3.024513...	2.869715...	2.718403...	4.923010...	5.805959...	5.237260...	8.635048...	5.646583...	6.733716...	3.696135...	2.818887...	1.482447...	2.874039...	7.919551...	2.671087...
10	3.115613...	2.930661...	2.805959...	4.578764...	5.814265...	5.341591...	8.825172...	5.804287...	6.695058...	3.781414...	2.861843...	1.819179...	3.372935...	9.418245...	2.974244...
11	3.025606...	2.901895...	2.589796...	4.148348...	3.411730...	5.307972...	8.731078...	5.725548...	6.780653...	3.493912...	3.037864...	2.311328...	2.976053...	7.836763...	2.815574...
12	3.024177...	3.035425...	2.596725...	3.970434...	3.390986...	5.016916...	8.696255...	5.449469...	7.176817...	3.494047...	3.132680...	2.228484...	3.061945...	9.651611...	2.790868...
13	3.038527...	3.356513...	2.679469...	3.937628...	6.516038...	4.319708...	8.723987...	5.177985...	7.499486...	3.331200...	2.972574...	2.221530...	3.307966...	9.839533...	2.899095...

# DTC (Dynspec Toolkit Content)



## Where to find it ?

- Documentation page + Tutorial on LOFAR wiki:  
<http://www.lofar.org/operations/doku.php?id=dynspec>

## How to install it ?

- Dependencies:
  - DAL (Data access Library)
  - Hdf5 librairies
  - H5py (python package)
- Installation (see documentation page)
  - Svn LUS (Lofar User Software)
  - Cmake installation

# DTC (Dynspec Toolkit Content)



## 3 Sub-Packages:

- **CEP2 sub-package:**

Process LOFAR Beam formed data:

- Beam2Dynspec-Quick: Generate a Quicklook of the data in dynspec format and a jpeg image
- Beam2Dynspec-Complete: do a complete conversion without selection, rebining of the data to a dynspec
- Beam2Dynspec-Rebin: possibility to select a time and frequency window; possibility to rebin in time and in frequency.

# DTC (Dynspec Toolkit Content)



## 3 Sub-Packages:

- **Stand-alone sub-package:**

Process Single Station LOFAR Beam formed data,

Convert XX,XY,YX,YY to I,Q,U,V:

- Beam2Dynspec-Standalone-Quick: Generate a Quicklook of the data in dynspec format and a jpeg image
- Beam2Dynspec-Standalone-Complete: do a complete conversion without selection, rebining of the data to a dynspec
- Beam2Dynspec-Standalone-Rebin: possibility to select a time and frequency window; possibility to rebin in time and in frequency.

# DTC (Dynspec Toolkit Content)



## 3 Sub-Packages:

- **TOOLS sub-package:**

Playing with Dynspec and Visualize them:

- Dynspec-LinPol: Convert I, Q, U, V polarization to I, Linear, PA, Total
- Dynspec-Rebin: Rebin and select a dynpec in time and frequency (avoid to reprocess the original data)
- Dynspec-Subtract: Do the subtraction of 2 beam like: Beam1-(k Beam2) with k a number
- Dynspec-Visu: Visualization tool

# DTC (Dynspec Toolkit Content):

*Example with L183020:*



1 SAP => The Sun

92 Beams => 92 Beams on the sun

4 Stokes => I,Q,U,V

400 Sub-bands with 16 channels each

=> 6400 frequency channels

Time resolution 0.083 s

Observation duration 1 hour => 42914 time pixels

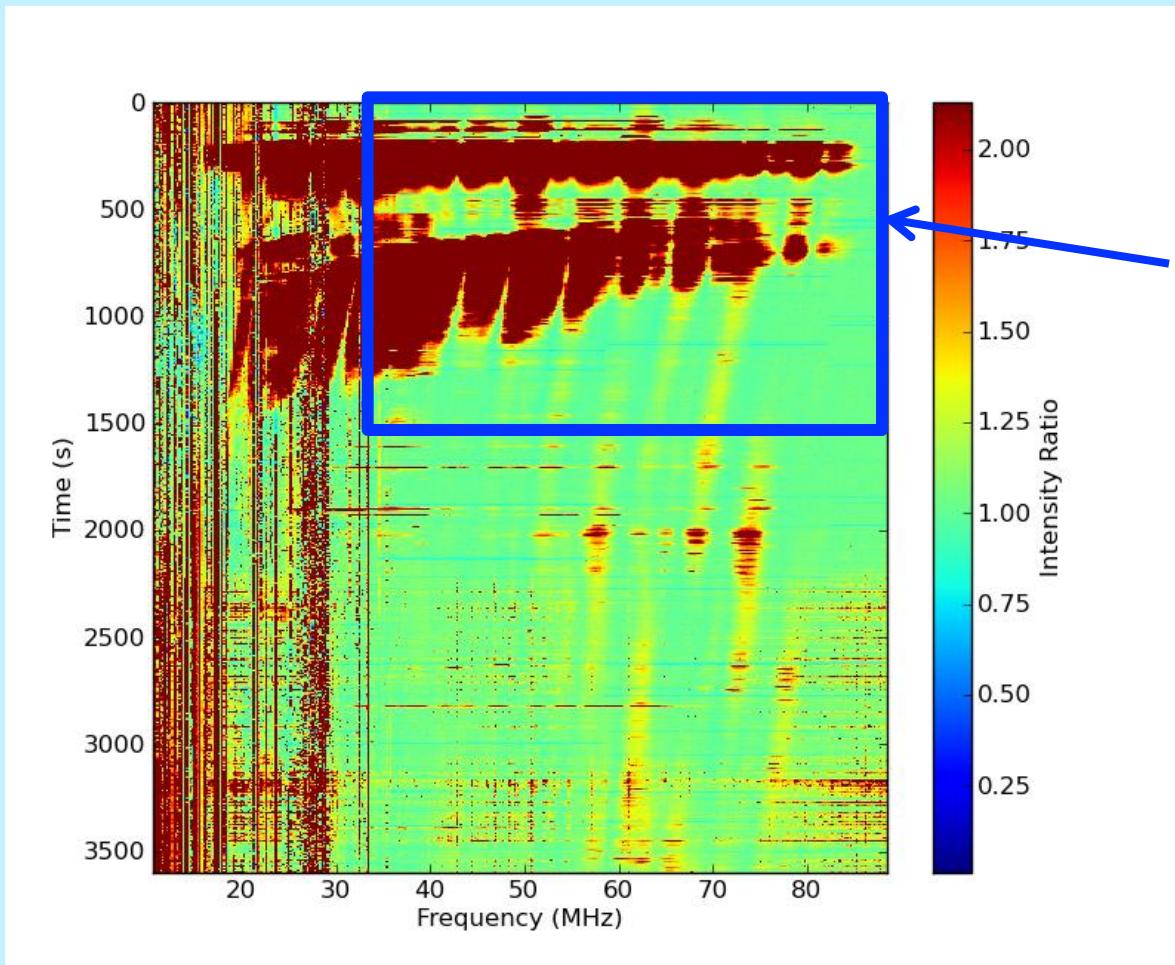
Total size => **377 Gb in (1x92x4x1)x2=736 files**

# DTC (Dynspec Toolkit Content):

## Quicklook:

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```
Beam2Dynspec-Quick --id=L183020 --obsDIR=/staging4/fallows/Sun/BF/L183020/  
--outputDIR=/data/scratch/vilchez/dynspec2/ --percentTimeData=0.05  
--percentSpectralData=0.1 --transpose=no --nofPart=1
```



Time Computing: 202.1 s

### Region of interest:

0-1500 s  
35-88 MHz  
Time scale: 1 s  
1 ch/SB

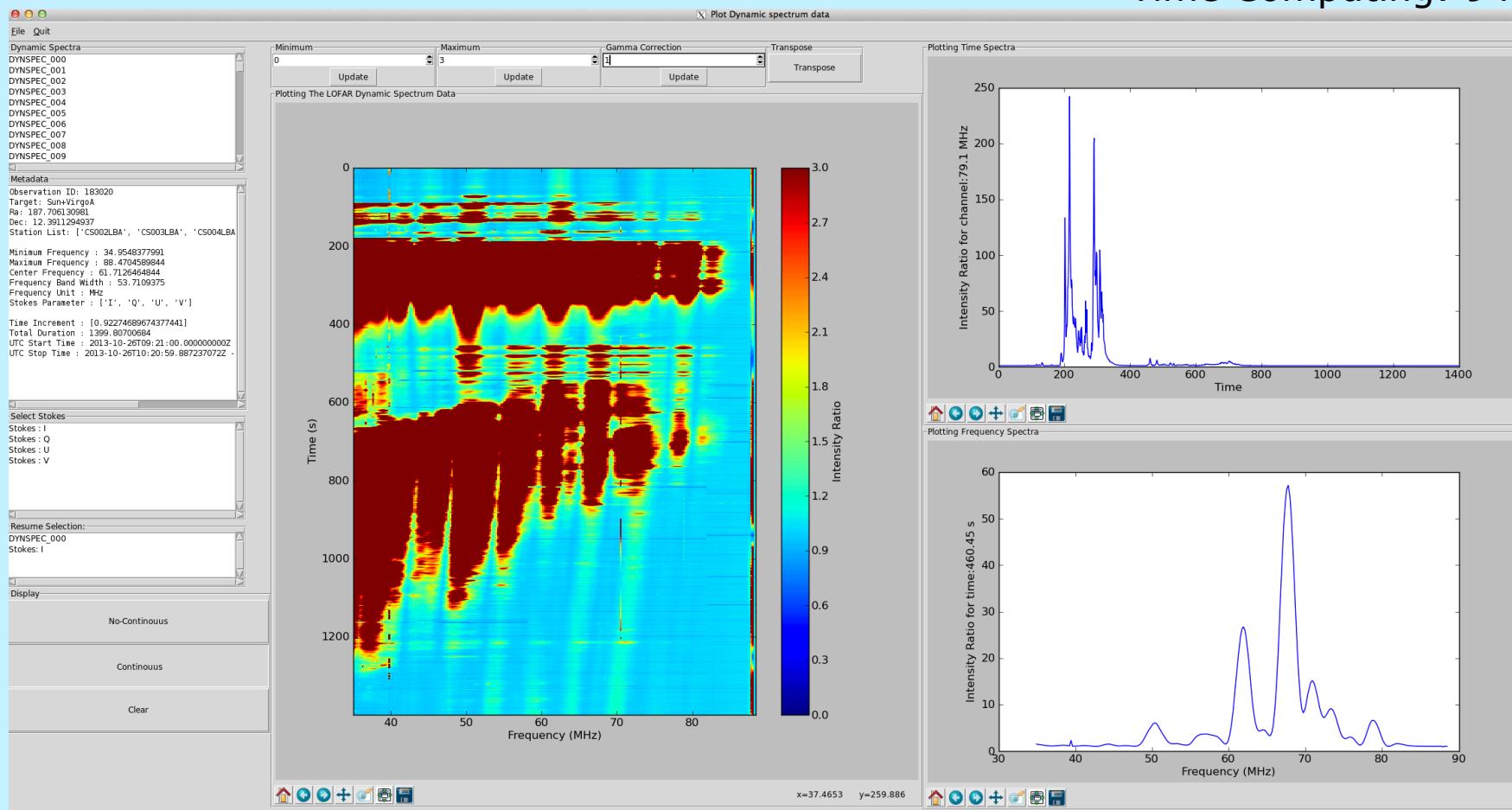
# DTC (Dynspec Toolkit Content):

## Rebin:

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```
Beam2Dynspec-Rebin --id=L183020 --obsDIR=/staging4/fallows/Sun/BF/L183020/  
--outputDIR=/data/scratch/vilchez/dynspec --tmin=0 --tmax=1500 --tscale=1 --fmin=35 --fmax=88  
--chanPerSubband=1 --RAM=1 --Npart=1 --RebinAll=yes
```

Time Computing: 948.4 s

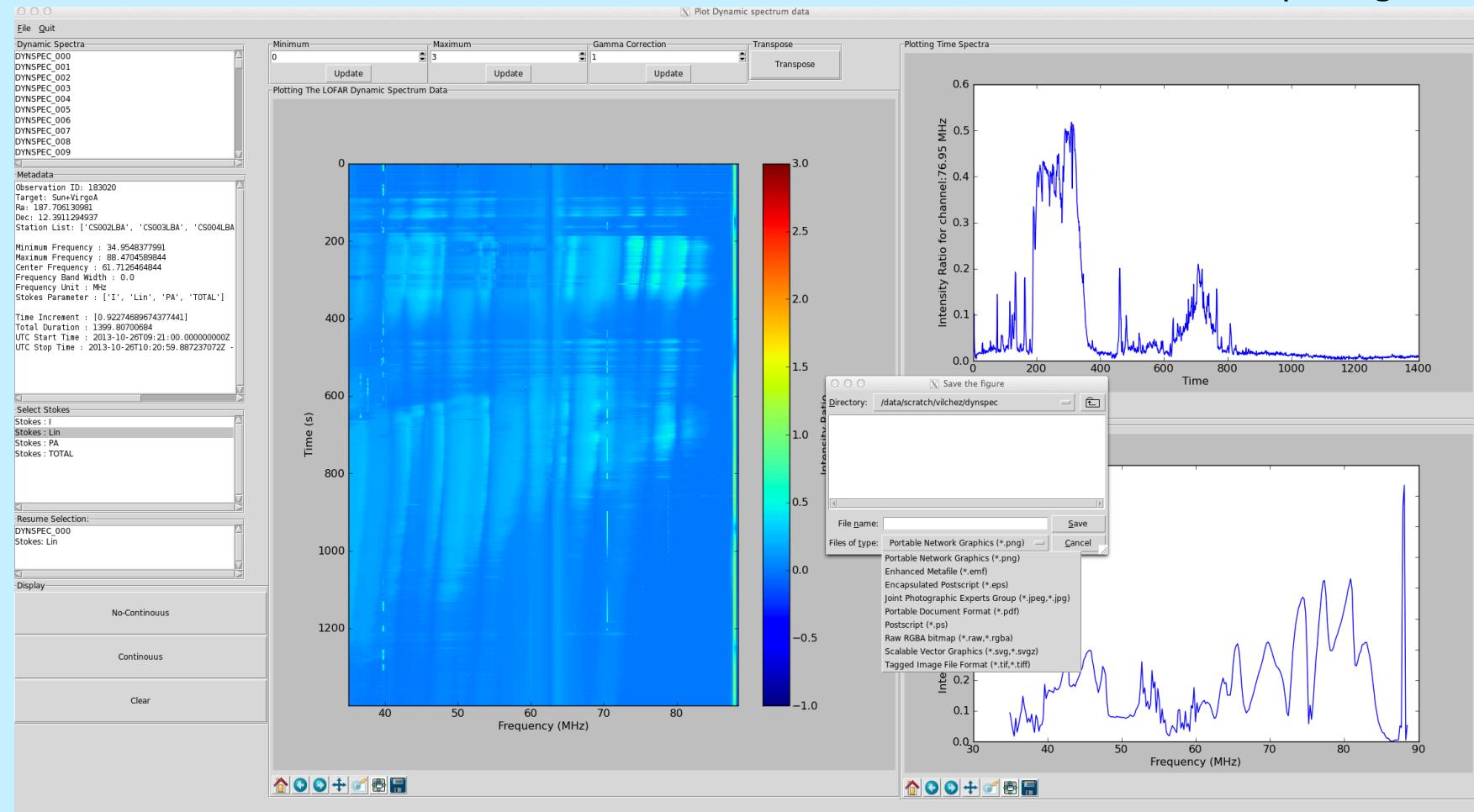


# DTC (Dynspec Toolkit Content): *Linear, PA, Total polarisation:*

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```
Dynspec-LinPol --outDir=/data/scratch/vilchez/dynspec/ --ID=183020  
--filename=/data/scratch/vilchez/dynspec/Dynspec_rebinned_L183020_SAP000.h5 --RAM=1
```

Time Computing: 4.94s

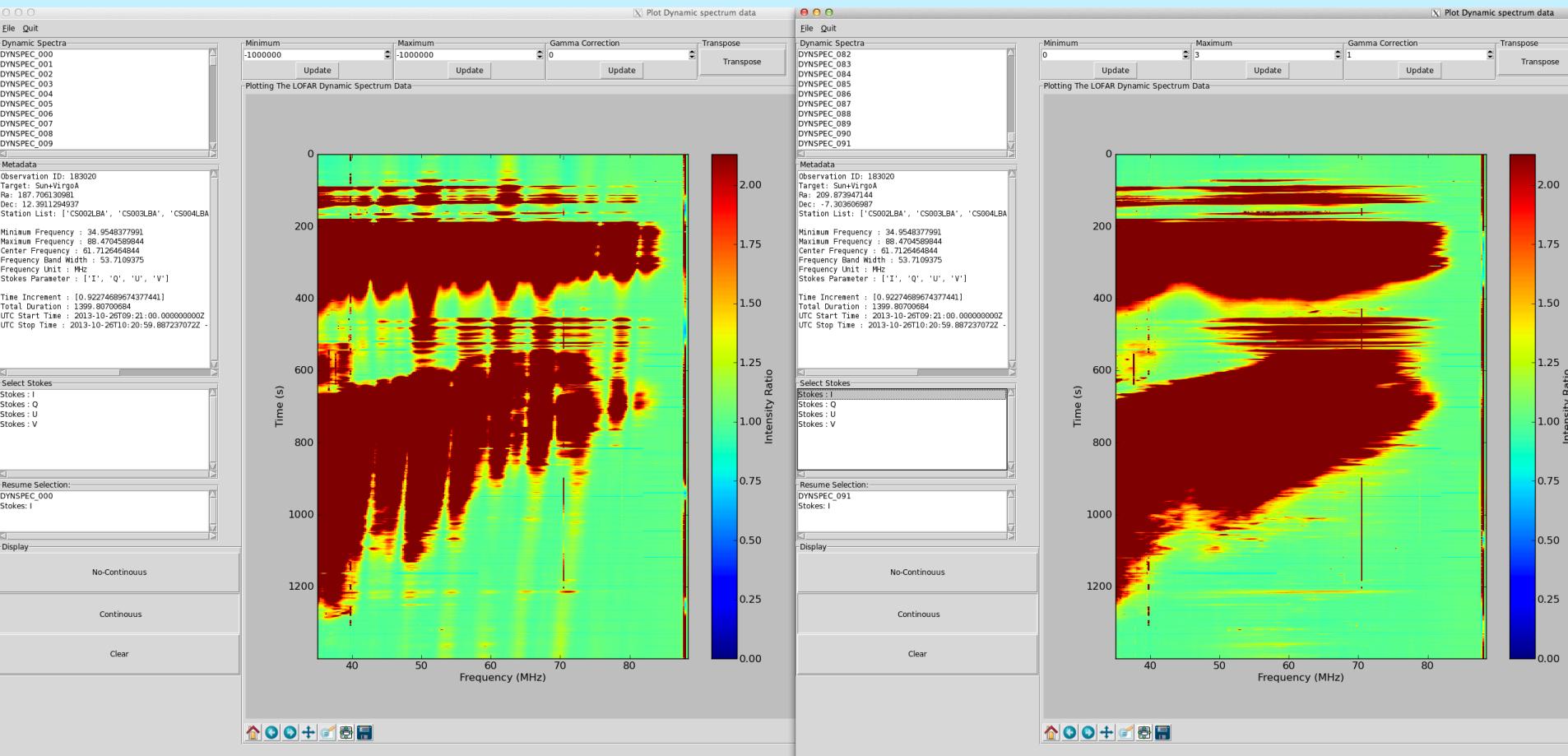


# DTC (Dynspec Toolkit Content):

## Beam Subtraction: DYNSPEC\_000-(1xDYNSPEC\_091)

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```
Dynspec-Subtract --outDir=/data/scratch/vilchez/dynspec/ --id1=L183020 --file1=/data/scratch/vilchez/dynspec/  
Dynspec_rebinned_L183020_SAP000.h5 --dynspec1=DYNSPEC_000 --id2=183020 --file2=/data/scratch/vilchez/  
dynspec/Dynspec_rebinned_L183020_SAP000.h5 --dynspec2=DYNSPEC_091 --k=1 --RAM=1
```



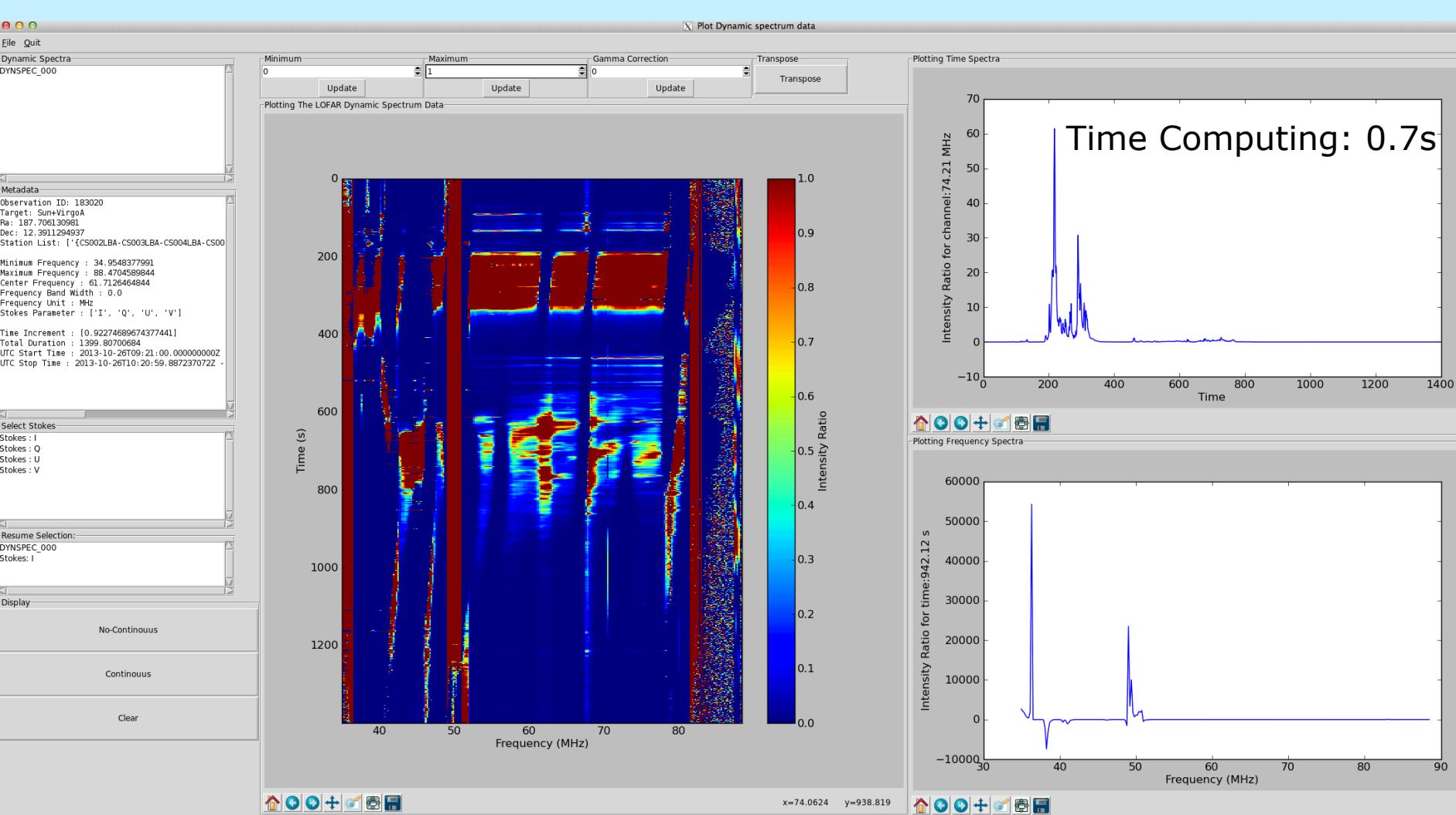
DYNSPEC\_000

DYNSPEC\_091

# DTC (Dynspec Toolkit Content):

*Beam Subtraction: DYNSPEC\_000-(1xDYNSPEC\_091)*

ASTRON

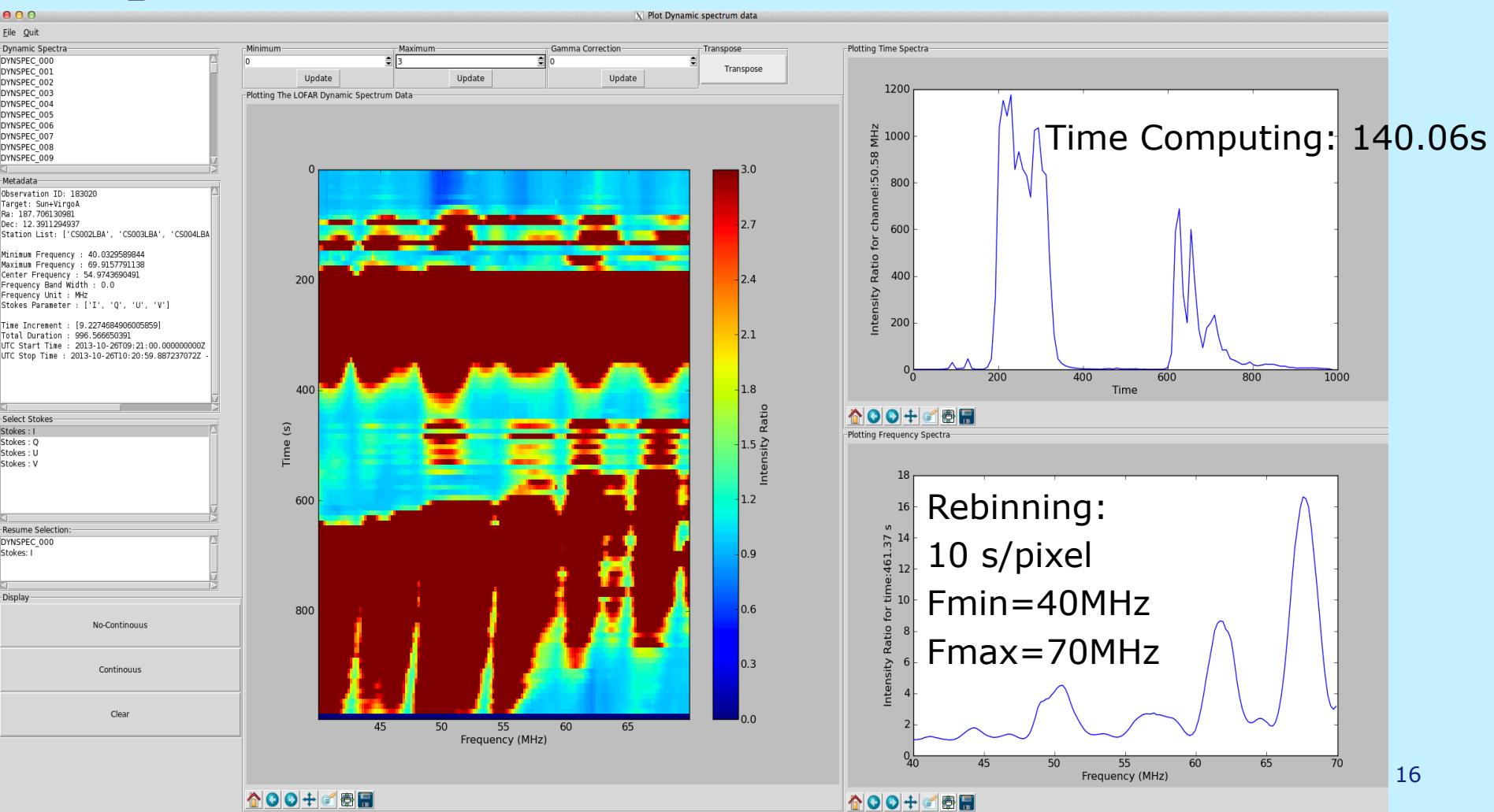


# DTC (Dynspec Toolkit Content):

## Dynspec Rebin:

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```
Dynspec-Rebin --Pathfile=/data/scratch/vilchez/dynspec/Dynspec_rebinned_L183020_SAP000.h5  
--obsname=L183020 --outputFile=/data/scratch/vilchez/dynspec/Dynspec_rebinned_at10second_40-70MHz_  
L183020_SAP000.h5 --tmin=0 --tmax=1000 --tscale=10 --fmin=40 --fmax=70 --chanPerSubband=1 --RAM=1
```



# Perspectives:



- No future developments really planned
- Maintenance done by N.Vilchez ([vilchez@astron.nl](mailto:vilchez@astron.nl))
- Update the R.O “QuickImager” with the Quicklook  
(> To have also an automatic quicklook after a Beam formed data observation)
- Dynspec Toolkit Content paper (Vilchez et al, in prep)
- Solar Physics conference (Jan-Feb 2015)

# Time to a demonstration of the viewer ?



ssh -XY Ice010 (CEP1)

use Dynspec

use Pythonlibs

use DAL

Dynspec-Visu

Load in the GI /data/scratch/vilchez/dynspec/  
Dynspec\_rebinned\_L183020\_SAP000.h5