
Ingemar Häggström
EISCAT HQ

EISCAT data

- What is EISCAT data?
  - Raw data, Analysed data
- How to get data?
- What does is contain?
- What to do with it?
- How?
  - RTG
  - GUISDAP
    - vizu

EISCAT data

- Raw data (.mat files) Compatible with matlab, binary files
  - Name of the data file is the end time of the record in seconds from the beginning of year.
    - 8 characters long (padded with zeroes)
      - New Years Day at 1 UT -> 00003600.mat
  - d_ExpInfo (text string)
    - Experiment name, scan, owner
  - d_parbl (real vector)
    - Time, antenna and transmitter parameters
  - d_data (complex vector)
    - lagprofiles
      - one to thousands
      - Correlations of received samples
        - Depends on transmitter code and decoding procedure
  - d_raw (complex vector)
    - Raw amplitude samples
      - Transmitter code

Raw data dumps

Eros3 data format

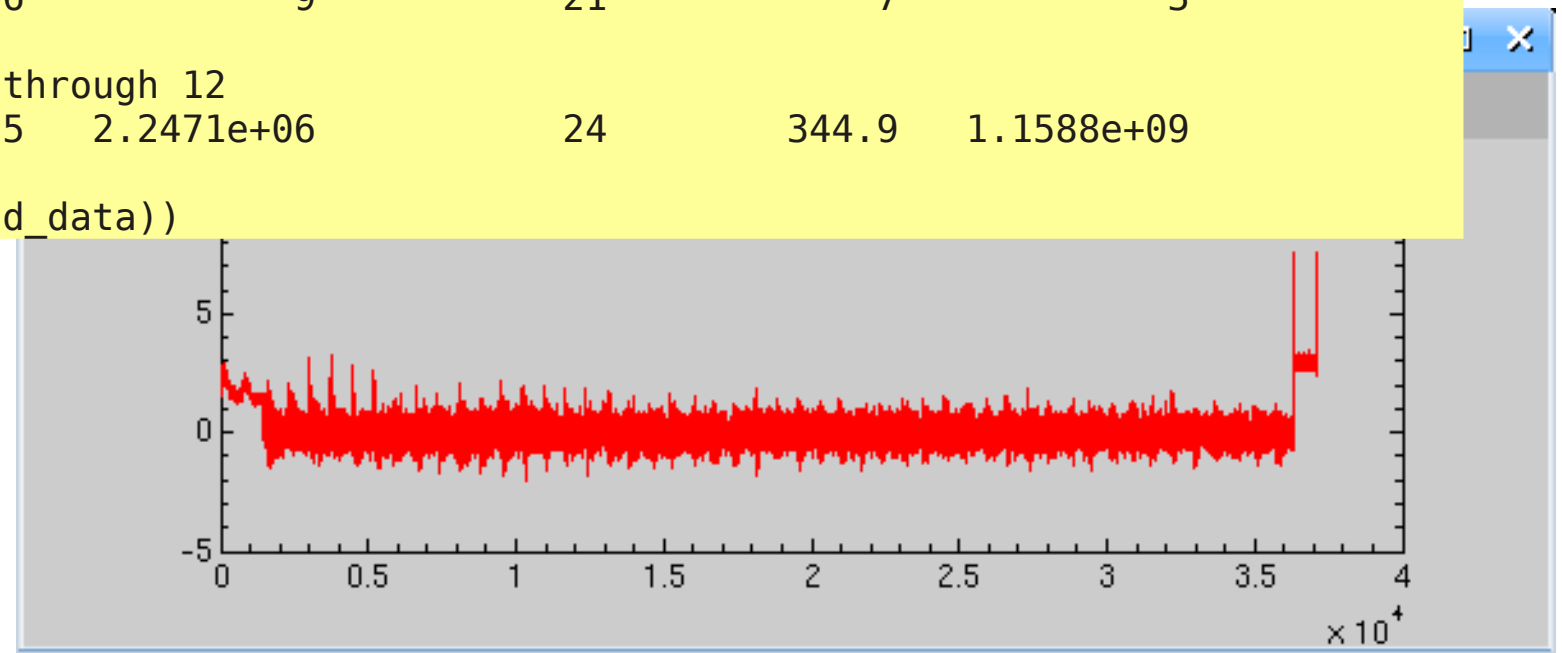
Data is recorded in the matlab4 data format and consists of several bloc
the experiment info, d_ExpInfo (ASCII string)
the antenna parameters (see below), d_parbl (32 bit reals)
the data, d_data (2x32 bit complex reals)
the raw samples (not always present), d_raw (2x16 bit complex integers

d_parbl

Entry	Value	Introduced
1	Dump end year	
2	Dump end month	
3	Dump end days	
4	Dump end hours	
5	Dump end minutes	
6	Dump end seconds	
7	Integration time, sec	
8	Combined output power, W	
9	Elevation, degrees	
10	Azimuth, degrees	
11	Dump end time, secs since 1970	
12	Dump sequence number	
13	% power tx1 klystron a (of 62.5 kW)	
14	% power tx1 klystron b	
15	% power tx2 klystron a	
16	% power tx2 klystron b	
17	% power tx3 klystron a	
18	% power tx3 klystron b	
19	% power tx4 klystron a	
20	% power tx4 klystron b	
21	Noise injection calibration, K	
22	Pre-integration factor	
23	% power tx5 klystron a	
24	% power tx5 klystron b	
25	% power tx6 klystron a	
26	% power tx6 klystron b	
27	% power tx7 klystron a	
28	% power tx7 klystron b	
29	% power tx8 klystron a	
30	% power tx8 klystron b	
31	rx frequency, channel 1 (MHz)	08/19/99
32	rx frequency, channel 2 (MHz)	08/19/99
33	rx frequency, channel 3 (MHz)	08/19/99
34	rx frequency, channel 4 (MHz)	08/19/99
35	rx frequency, channel 5 (MHz)	08/19/99
36	rx frequency, channel 6 (MHz)	08/19/99
37	rx frequency, channel 7 (MHz)	08/19/99
38	rx frequency, channel 8 (MHz)	08/19/99
39	rx frequency, channel 9 (MHz)	08/19/99
40	d_parbl version number	11/12/99
41	antenna ID (1-6)	11/12/99
42	Remote antenna intersection range, m	02/28/03
43-62	User parameters	07/23/03
63	High voltage reading (kV)	09/01/03
64	Loop counter	02/01/04
	Peak power read from wave guide, UHF (kW)	02/20/04
65	Peak power read from wave guide, ESR (kW)	10/01/04
66	RF duty cycle read from wave guide UHF system	03/20/04
65	VHF antenna elevation panel 1 VHF system (deg)	05/21/05
66	VHF antenna elevation panel 2 VHF system (deg)	05/21/05
67	VHF antenna elevation panel 3 VHF system (deg)	05/21/05
68	VHF antenna elevation panel 4 VHF system (deg)	05/21/05
69	VHF IF system setup see note 1 VHF system	05/21/05

Raw data

```
>> whos
  Name            Size                    Bytes  Class

  d_ExpInfo       1x24                       48  char array
  d_data      37101x1                    593616  double array (complex)
  d_parbl         1x66                      528  double array

Grand total is 37191 elements using 594192 bytes

>> d_ExpInfo
d_ExpInfo =
kst0 tau1u_cp3nk_1.30_CP
>> d_parbl(1:12)
ans =
  Columns 1 through 6
        2006           9          21           7           3
19.993
  Columns 7 through 12
           5   2.2471e+06          24       344.9   1.1588e+09
11560
>>plot(real(d_data))
```

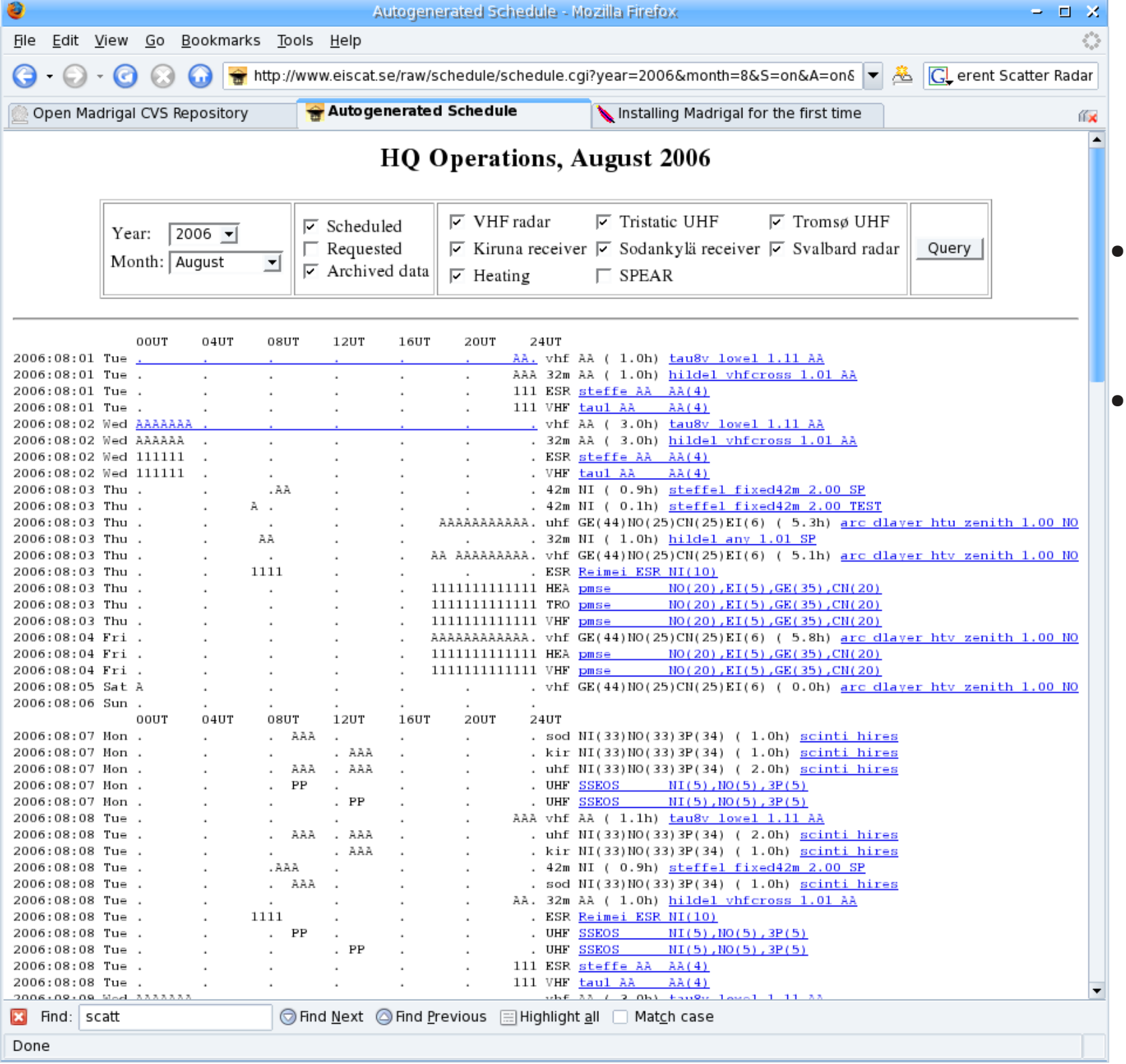


EISCAT data

- Analysed data
  - Derived ionospheric parameters
    - Ne, Ti, Te/Ti, Vi
  - Madrigal
    - NCAR format (madrigal)
      - Official product of EISCAT
      - http://www.eiscat.se/madrigal/cedarFormat.pdf
  - Guisdap outputs
    - Matlab vs 5 (not open)
      - r_param

EISCAT data access

- Raw data
  - Stored at the data base in Kiruna, Sweden
  - Downloadable via the web schedule
    - http://www.eiscat.se/schedule/schedule.cgi
      - Choose 'Archived'
    - Older data (>1 year) and Common Programmes
      - Allowed for all EISCAT countries
    - Recent data
      - Only accounted countries



- Common
  - CP UP AA
- Special
  - Country codes
  - SW,CN,FI..

EISCAT data access

- Analysed data
  - Stored in a distributed data base
  - Downloadable via the web
    - http://www.eiscat.se/madrigal

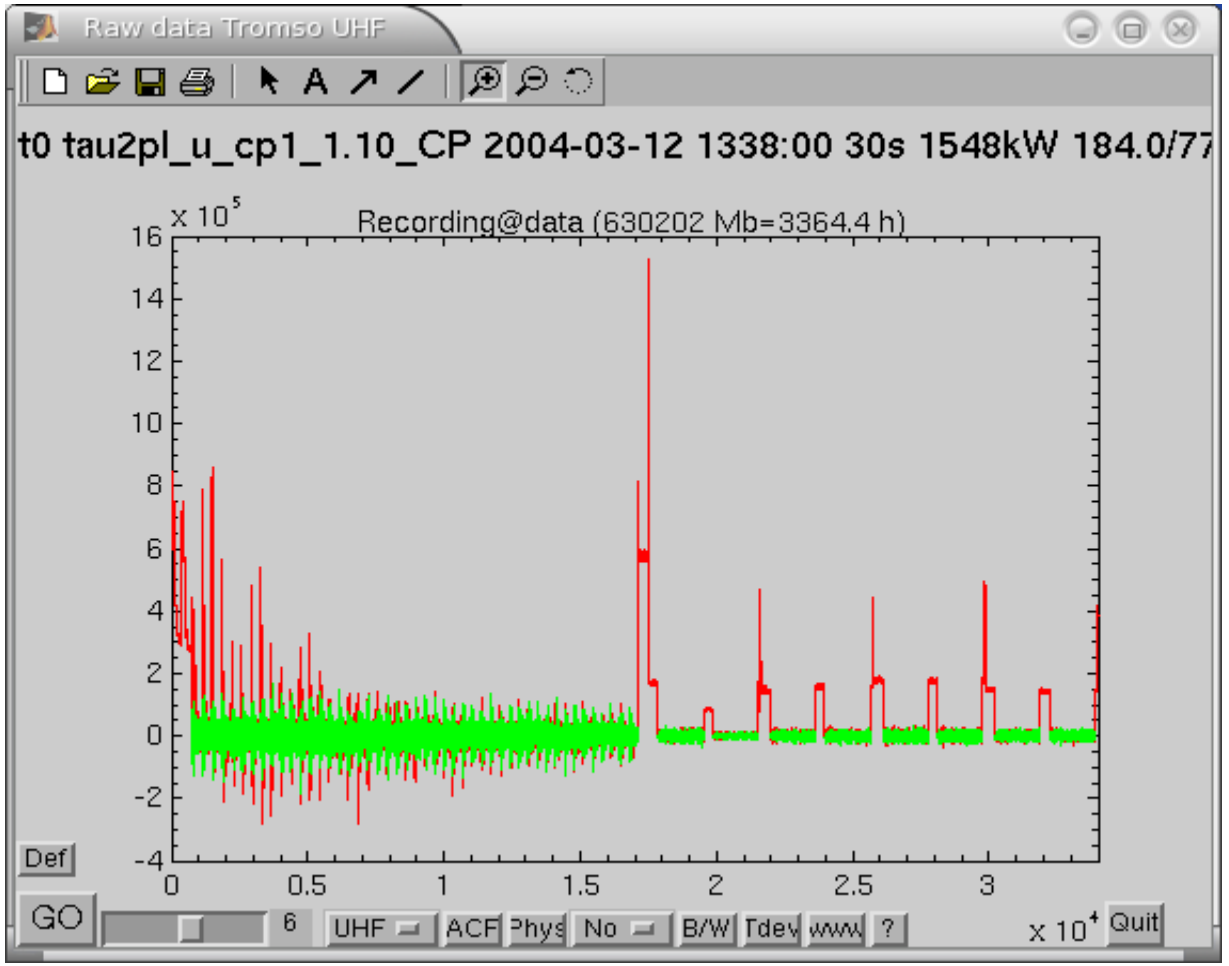
EISCAT data utilities

- Raw data
  - Real time graph (RTG)
    - The run-time display feature
    - To read/integrate data and plot profiles/spectra
  - GUISDAP
    - To analyse data and reduce into physical quantities
    - To integrate
    - Use the setups to understand the data layout for own analysis procedures
- Analysed data
  - vizu
    - To display analysed data

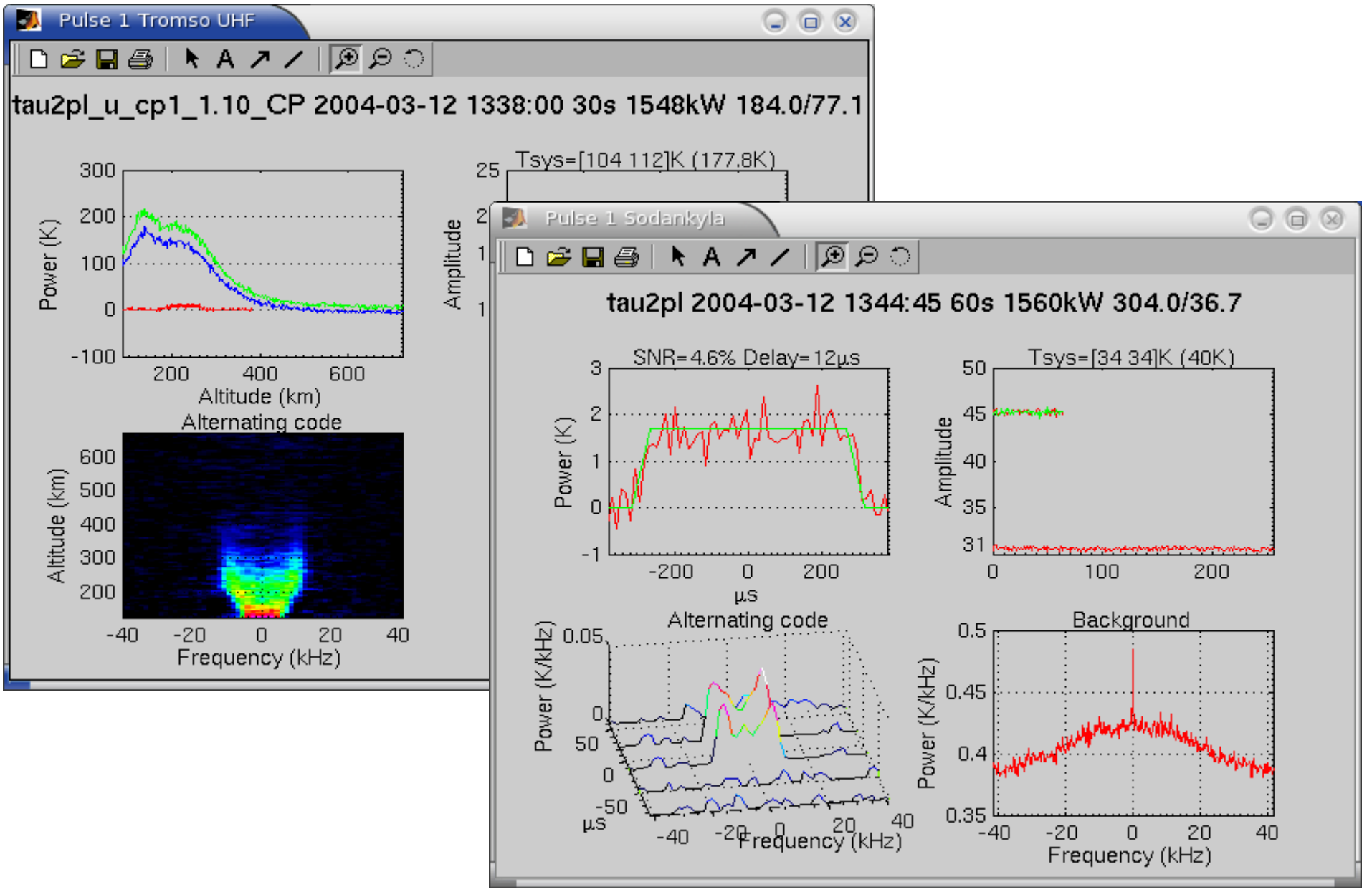
EISCAT Real Time Graph

- Written in Matlab
- Downloadable from www.eiscat.se
  - Runs in post experiment mode as well
- CP setups
  - Mainly for the operators
  - Rather technical information
- Own setups
  - Can do some analysis
  - May use only the integrator for easy access to data

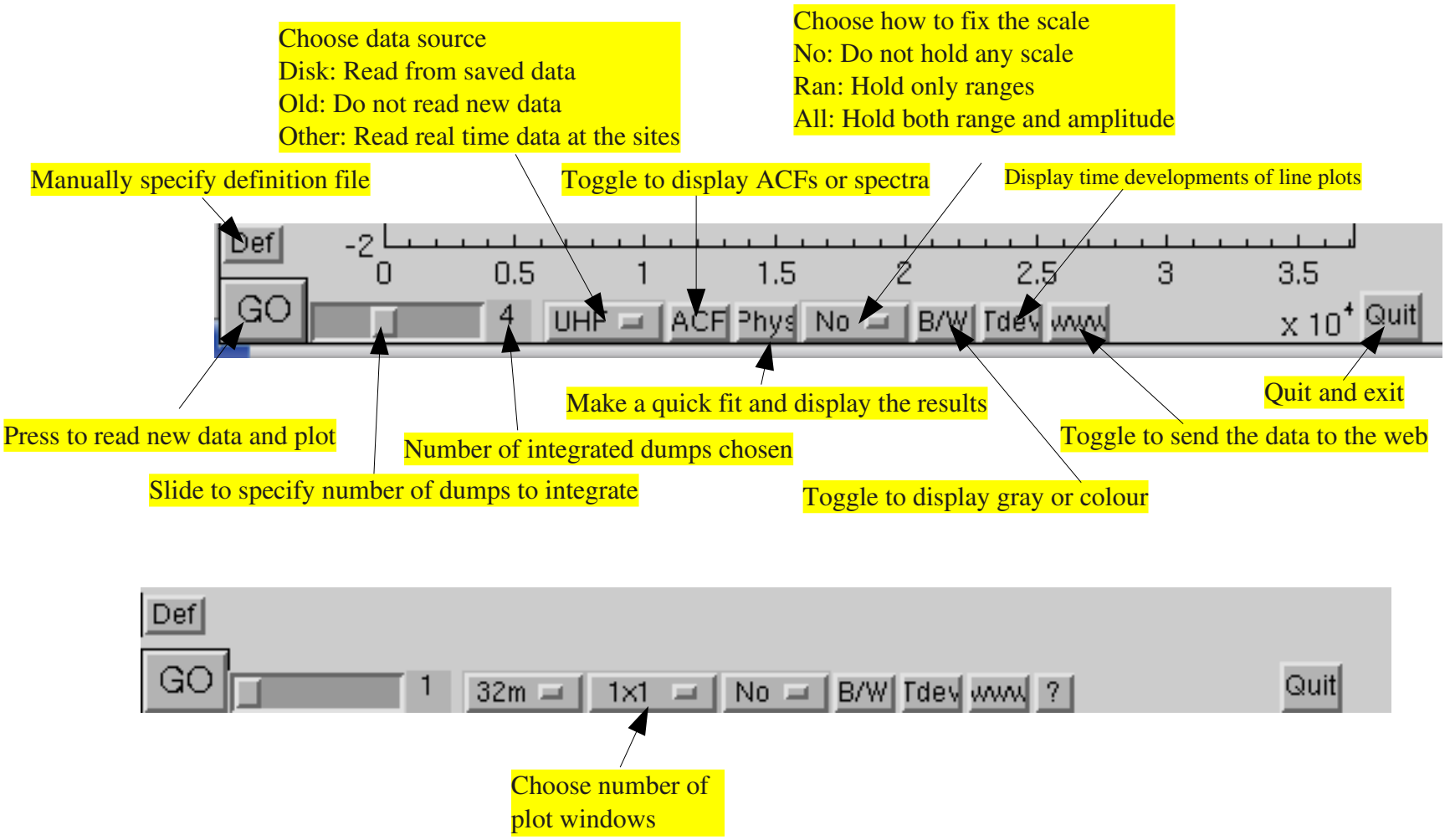
Raw data window



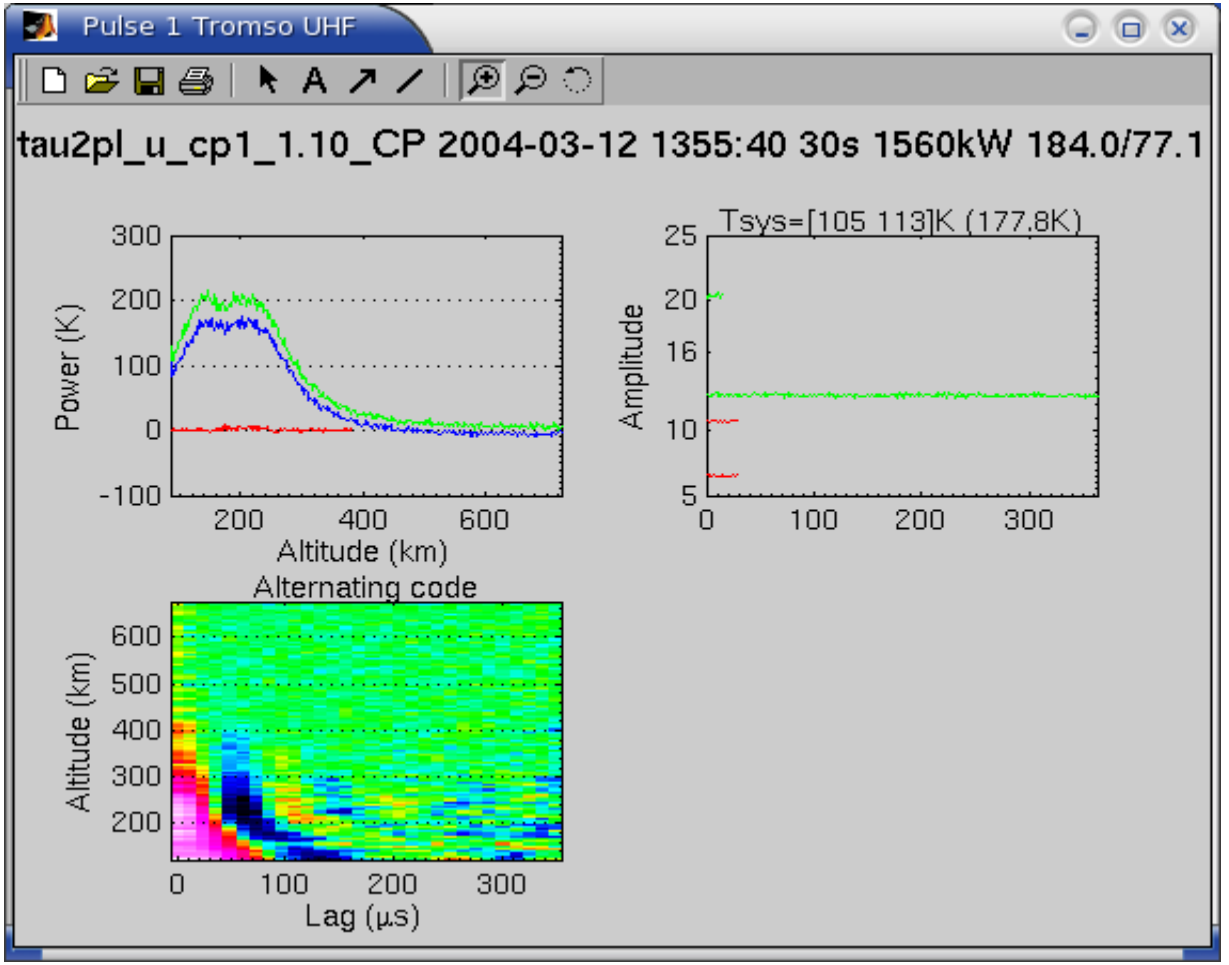
Pulse windows



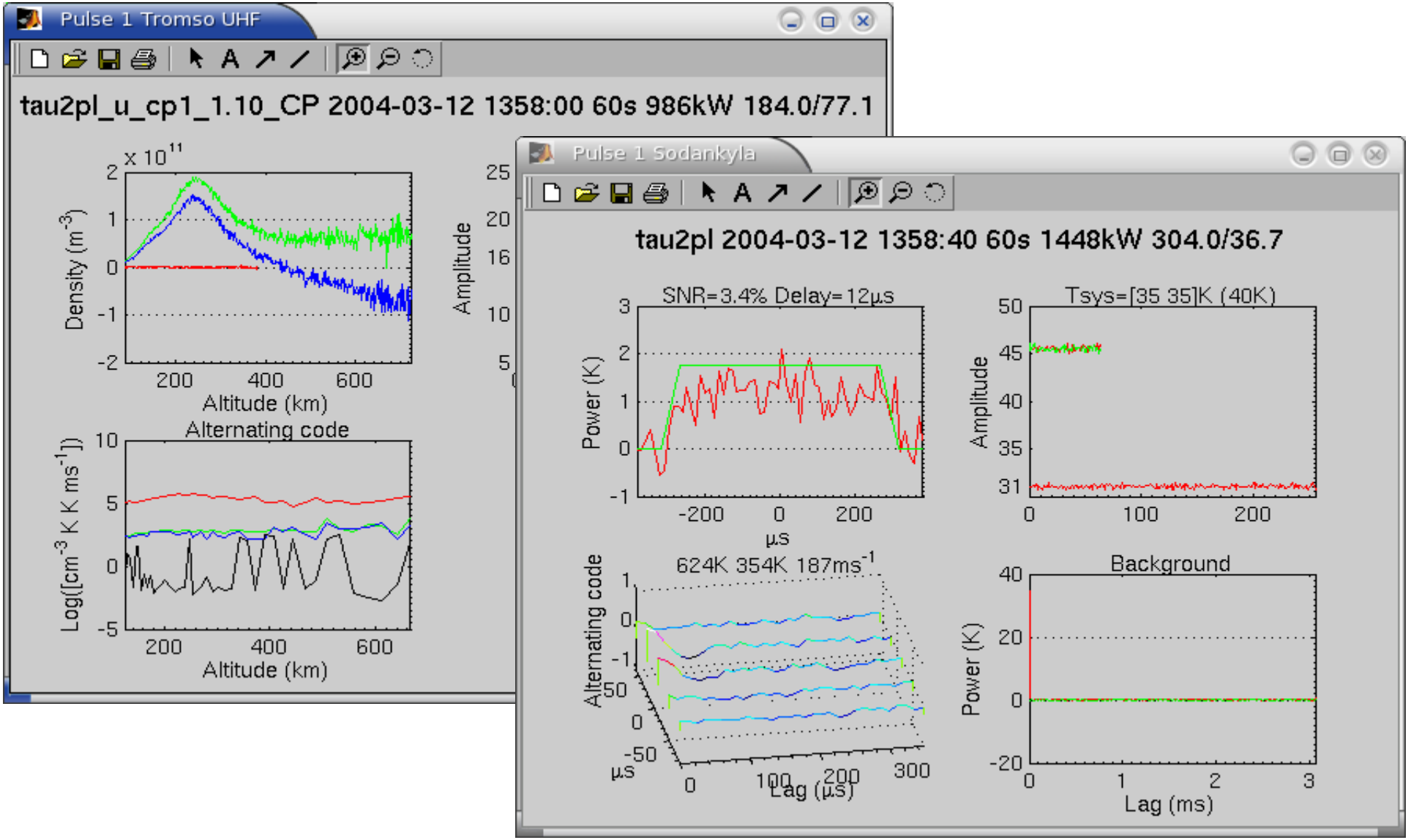
RTG buttons


Choose data source
Disk: Read from saved data
Old: Do not read new data
Other: Read real time data at the sites
Choose how to fix the scale
No: Do not hold any scale
Ran: Hold only ranges
All: Hold both range and amplitude
Manually specify definition file
Toggle to display ACFs or spectra
Display time developments of line plots
Def
-2
0
0.5
1
1.5
2
2.5
3
3.5
GO
4
UHF
ACF
Phys
No
B/W
Tdev
www
x 10^4
Quit
Quit and exit
Make a quick fit and display the results
Press to read new data and plot
Number of integrated dumps chosen
Toggle to send the data to the web
Slide to specify number of dumps to integrate
Toggle to display gray or colour
Def
GO
1
32m
1x1
No
B/W
Tdev
www
?
Quit
Choose number of
plot windows

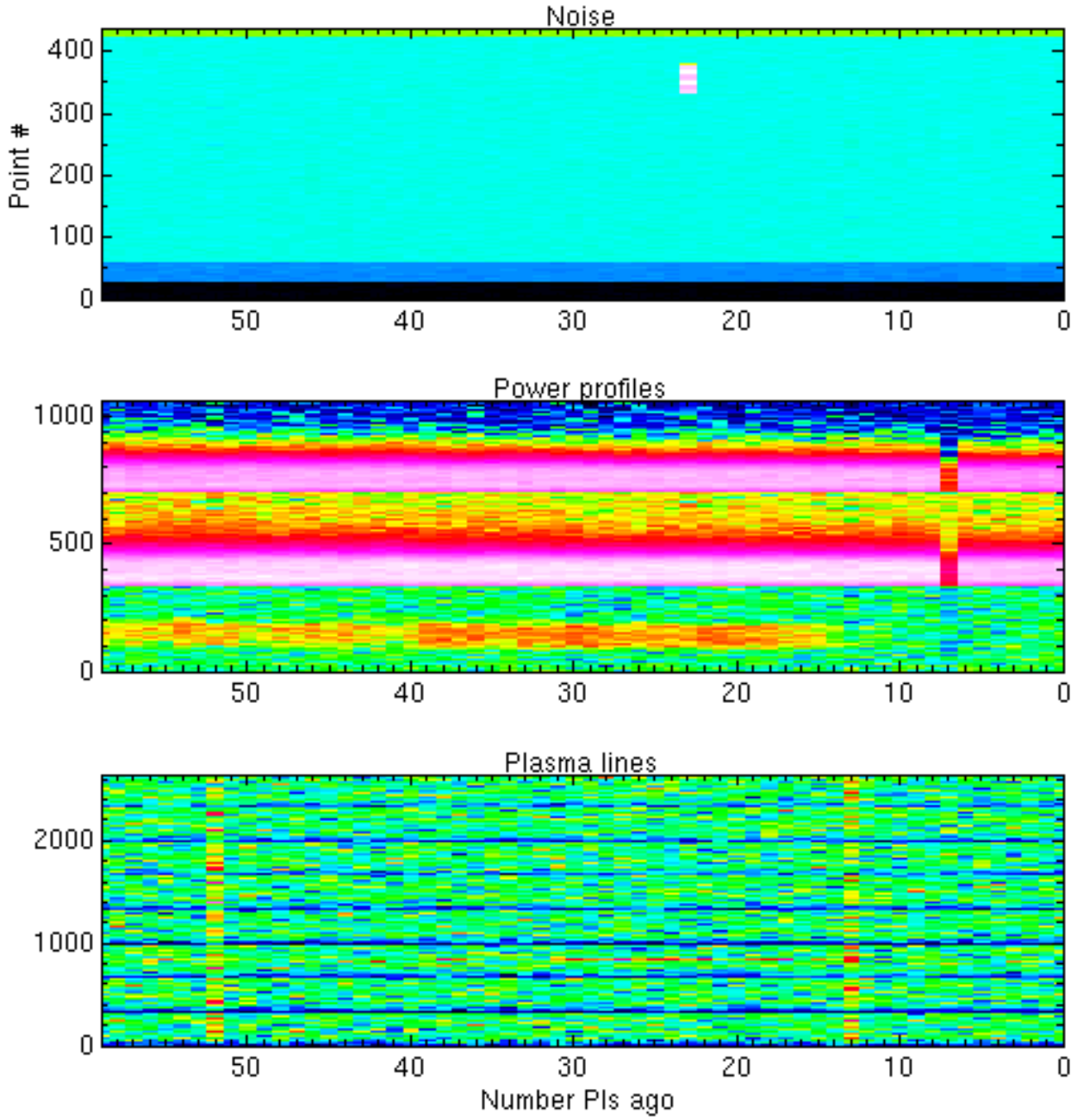
ACFs


Pulse 1 Tromso UHF
tau2pl_u_cp1_1.10_CP 2004-03-12 1355:40 30s 1560kW 184.0/77.1
Power (K)
300
200
100
0
-100
200
400
600
Altitude (km)
Tsys=[105 113]K (177.8K)
Amplitude
25
20
16
10
5
0
100
200
300
Alternating code
Altitude (km)
600
500
400
300
200
0
100
200
300
Lag (µs)

Quick fits


Pulse 1 Tromso UHF
tau2pl_u_cp1_1.10_CP 2004-03-12 1358:00 60s 986kW 184.0/77.1
x 10^11
Density (m^-3)
Altitude (km)
Alternating code
Log([cm^-3 K K ms^-1])
Altitude (km)
Amplitude
Pulse 1 Sodankyla
tau2pl 2004-03-12 1358:40 60s 1448kW 304.0/36.7
SNR=3.4% Delay=12µs
Power (K)
µs
Tsys=[35 35]K (40K)
Amplitude
624K 354K 187ms^-1
Alternating code
µs
Lag (µs)
Background
Power (K)
Lag (ms)

Time development



RTG on the web

EISCAT-Kiruna Real Time Graph - Konqueror <2>

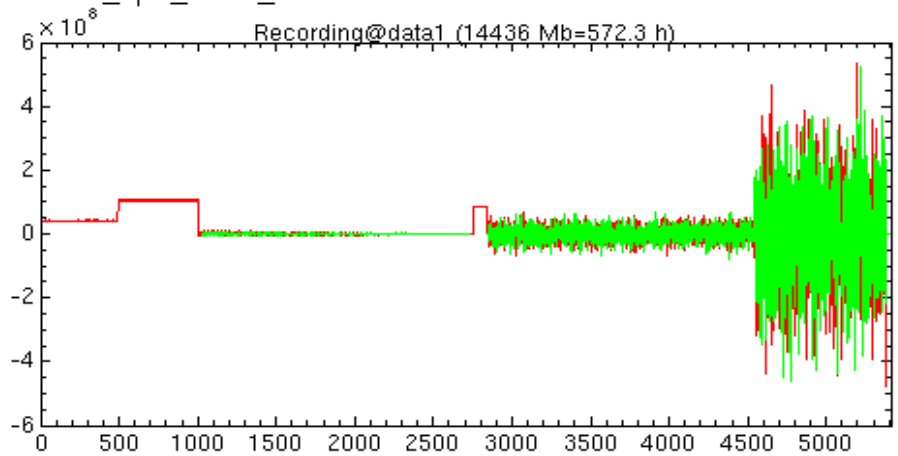
Location Edit View Go Bookmarks Tools Settings Window Help

Location: http://www.eiscat.se/rtg/rtg.cgi?K

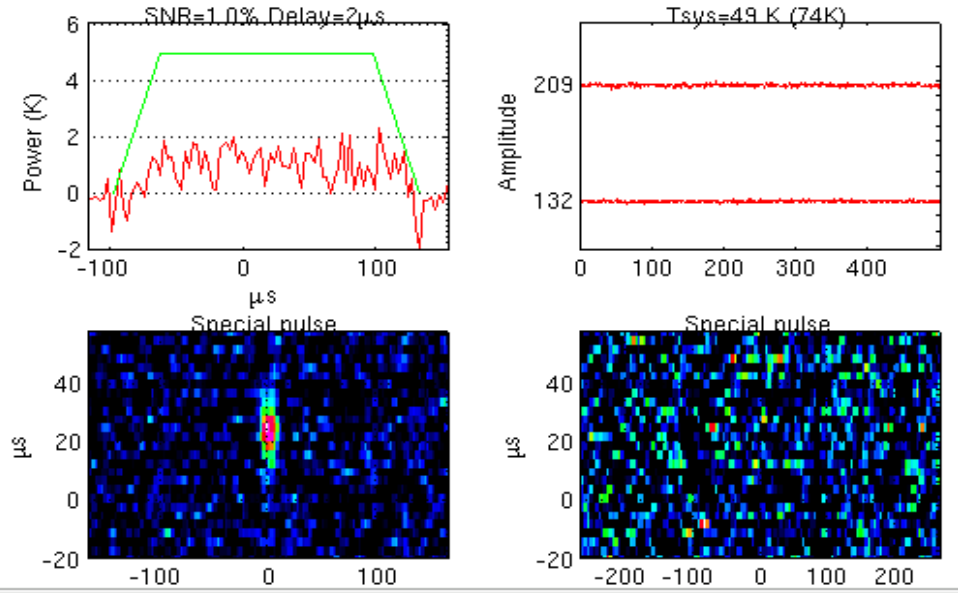
EISCAT SCIENTIFIC ASSOCIATION

What is EISCAT?
Organisation
Experiments
» Schedule
» **Real time graphs**
· » Tromsø UHF
· » Tromsø VHF
· » Sodankylä
· » **Kiruna**
· » ESR 32m
· » ESR 42m
· » ESR 32m PL
» Programmes
» Procedure
» Documents
» Get experiment data
» Submit new experiment
» Guidelines
» Latest analysis results
EISCAT sites
» Phone numbers
» Tromsø, Norway
» Sodankylä, Finland
» Longyearbyen, Svalbard
» **Kiruna, Sweden**
· » Visitors guide
· » Current weather

kst0 manda_cp1_1.00r_CP 2005-08-13 1230:36 60s 1327kW 341.9/44.8



manda_cp1_1.00r_CP 2005-08-13 1230:36 60s 1327kW 341.9/44.8



Page loaded.

Analysis

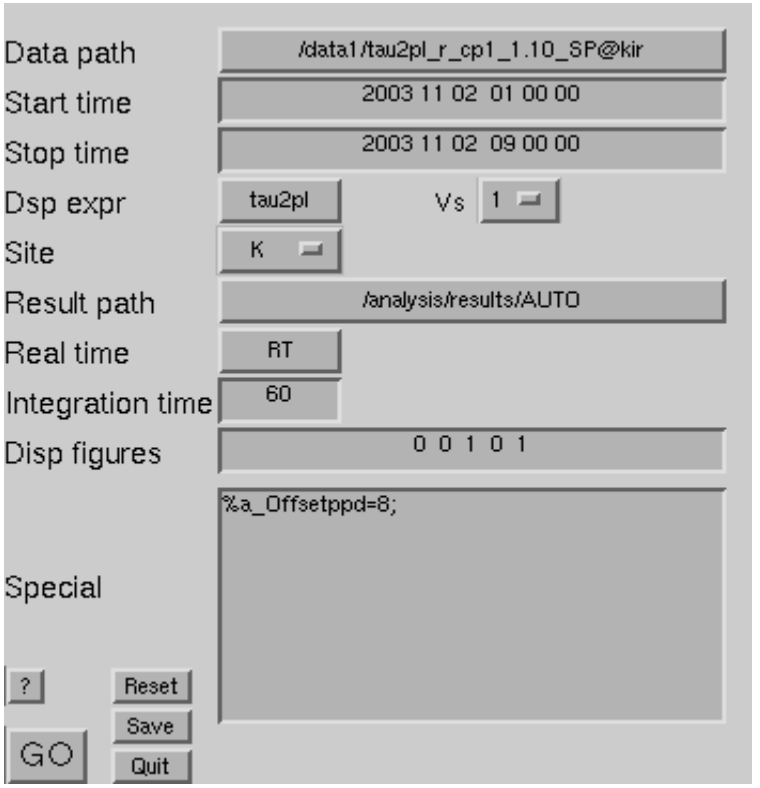
GUISDAP

% guisdap -a
• or
% guisdap
> analyse

Brings up the gfd setup window

Detailed instruction also at
http://www.eiscat.se/GUISDAP/howto.html

•Special
- Hundreds of parameters to tune if wanted

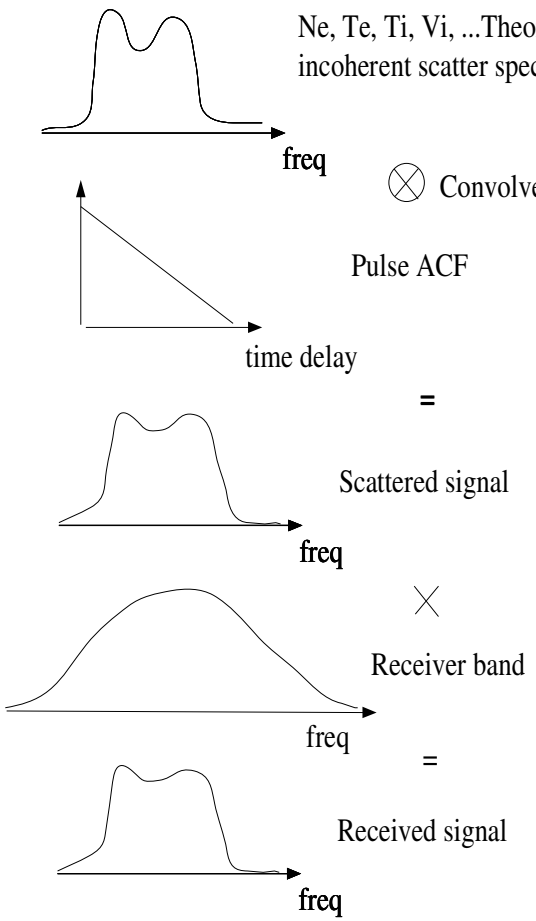


Received signal

- Incoherent scatter theory very exact
  - Spectrum depends on ionospheric parameters
- Received signal
  - Transmitted waveform
    - Pulse coding
  - (Direction – only for directions close to perpendicular)
  - Receiver filters
- Analysis
  - Compare theoretical with measured
    - Need to correct for the waveform and receiver filter

GUISDAP

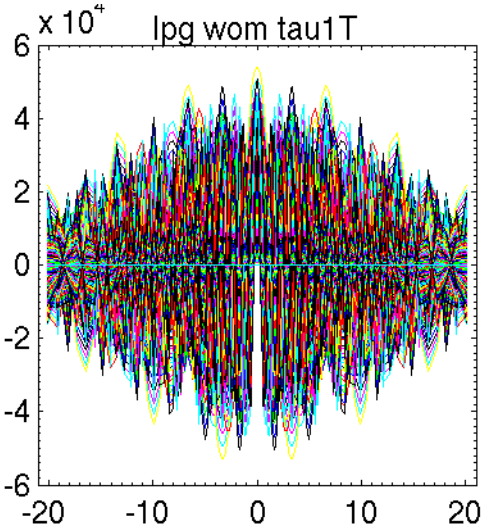
Classic analysis



Compare this with the measurements, after proper transformation

Guisdap analysis

Initialisation calculates the spectral ambiguity function for all points in the data dump, lpg_wom
This contains the transmitting pulse shape (pulse ACF), receiver band and transformations



The initialisation file

Describes the radar experiment in full detail

Initialisation simulates the experiment

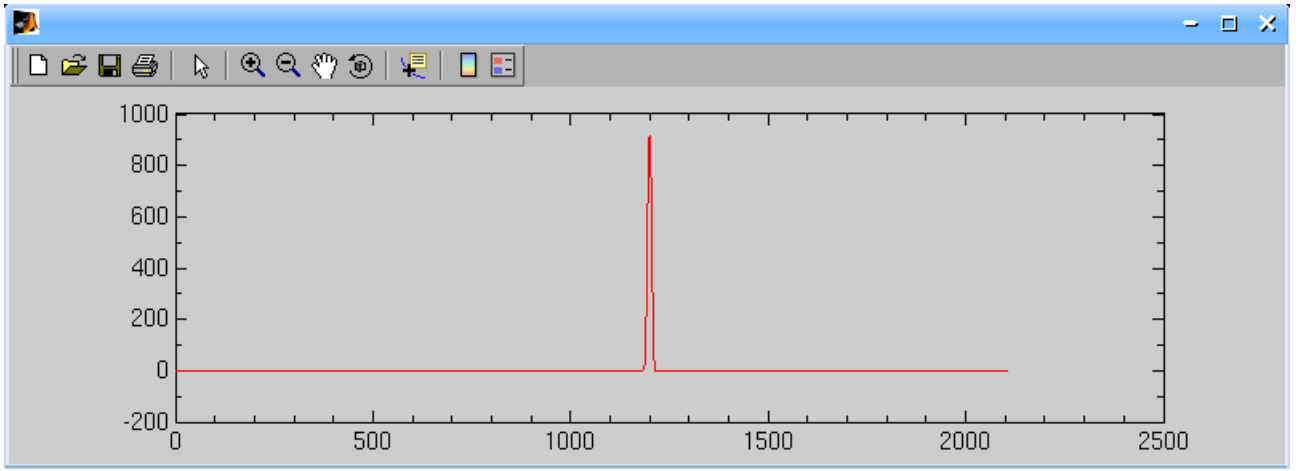
Only the ion line correlated part (the lag profiles)

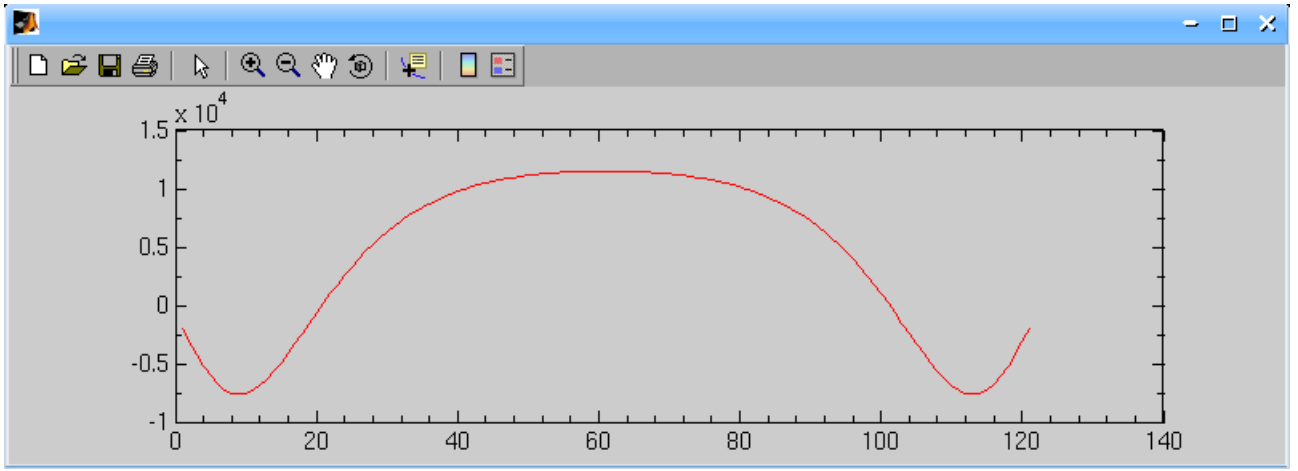
```
>> load /opt/guisdap8/exps/tau1/tau1Tinit
>> who

Your variables are:

GUP_iniver   lpg_cal      lpg_nt       p_N0         p_om0        vcg_penv
ch_fradar    lpg_code     lpg_ra       p_R0         vc_ch
   vcg_penvabs
ch_gain      lpg_dt       lpg_ri       p_RECloc     vc_group
lp_vc        lpg_h        lpg_w        p_T0         vc_penvo
lpg_ND       lpg_lag      lpg_wom      p_XMITloc    vc_routine
lpg_T        lpg_lpdata   lpg_wr       p_dtau       vcg_Aenv
lpg_bac      lpg_lpend    nameexpr     p_m0         vcg_Ap
lpg_bcs      lpg_lpstart  p_D0         p_om         vcg_Apenv
```

- lpg_
  - Lag profile **group**
  - Each lpg contains several lag profiles (1-1000s)
    - The lag profile is formed in a 'mini-experiment' within the exp (1 tx, 1 rec, 1 cal)
  - The lpg_ parameters describes each point in the data file (d_data)
    - lag, range, extent, type, background, calibration, injected noise, sampling interval, number of additions, group, range distribution, filter,....

The initialisation file

```
>> [lpg_ND(17) lpg_T(17) lpg_bac(17) lpg_bcs(17) lpg_cal(17) lpg_code(17)]
ans =
   960     0     0   115   629     1
>> [lpg_dt(17) lpg_h(17) lpg_lag(17) lpg_nt(17) lpg_ra(17) lpg_ri(17) lpg_w(17)]
ans =
          12         1200           12          657         1526            1       14.598
>> plot(lpg_wr(:,17))
>> plot(real(lpg_wom(17,:)))
```





The ambiguity vectors

- Spectral ambiguity function
  - lpg_wom
  - Used in fitting process
- Range ambiguity function
  - lpg_wr
  - Space debris detection
  - Bistatic volumes

Fitted Parameters

Parameter	Unit	Fitted quantity	Min	Max
Electron density	m^{-3}	$\log(N_e/N_0)$	10^6	10^{14}
Ion temperature	K	$\log(T_i/T_0)$	1	20000
Temperature ratio		$\log(T_e/T_i)$	0.01	100
Collision frequency	Hz	$\log(\nu_i/\nu_0)$	1	10^9
Ion drift velocity	ms^{-1}	$\text{asinh}(v_i/v_0/2)$	-20000	20000
Composition		p_i	-0.01	1.01
Dcspike	K	asinh(D/2)	-100	10000
Broadband	K	asinh(B/2)	-100	10000

GUISDAP vocabulary

- name_
  - experiment, site
- analysis_
  - parameters to set before analysis
    - range gating, integration time, antenna cycling
  - most transferred to a_ to override defaults
- d_
  - parameters that comes from the data
    - time, parameter block, data dump, variances
- ad_
  - parameters for specific addresses in the dump
- ch_, (radar_)
  - parameters specific to the data channel (radar)
    - gain, efficiency, frequency, tx power, direction
- p_
  - physical parameters
    - ion masses, scale parameters
- r_
  - result parameters
    - time, position, densities, temperatures
- local.
  - localitites
    - printername, hostname

Analysis defaults

- ionospheric model, (iono_model)
  - IRI-2012 (International Reference Ionosphere)
  - Sets initiall values of parameters
- Gating
  - analysis_altit
    - A vector defining heights to group the data together
      - Increased spacing with height
    - Assumes all points inside each interval describing the same plasma
  - analysis_maxwidth
    - Data points covering too large height interval will be skipped
      - Set to the gate spacing

Fit parameters

Default fit parameters and heights

Parameter	UHF (930 Mhz)	VHF (224 Mhz)	ESR (500 MHz)
Electron density	All heights	All heights	All heights
Ion temperature	Above 80 km	Above 100 km	Above 90 km
Temperature ratio	107-1500 km	120-1500 km	113-1500 km
Collision frequency	90-107 km	Never	Never
Ion drift velocity	All heights	All heights	All heights
Ion composition	Never	Never	Never

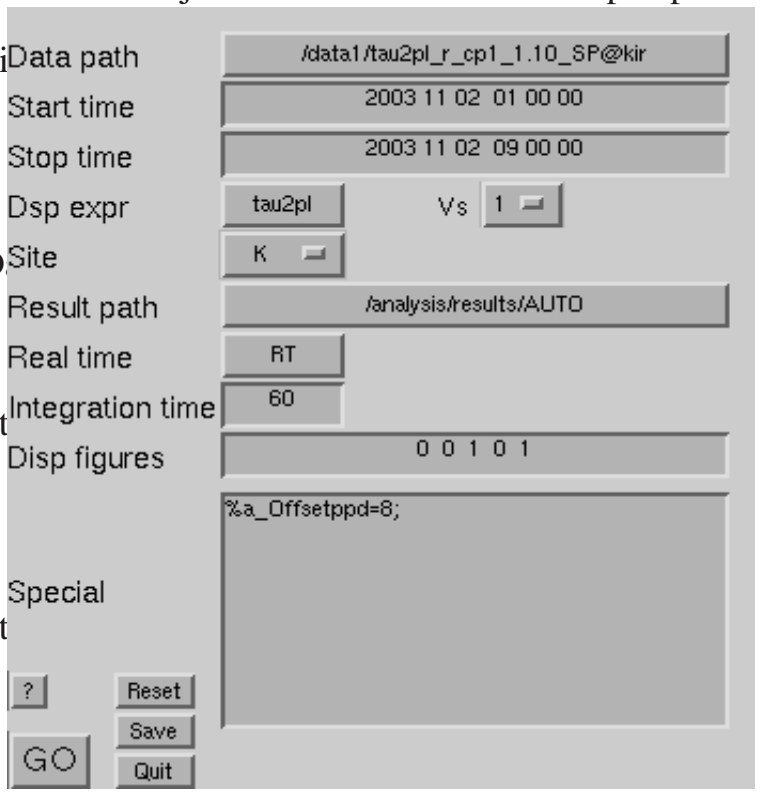
Can be changed by fit_altitude variable

fit_altitude([Ne Ti Tr Coll Vi Comp1 Comp2],[h1 h2 dh a_priori_error rel_error_flag])

```
fit_altitude=[0  Inf 0 1e2 1
              80  Inf 0 1e4 0
             107 1500 0 1e1 0
              90  107 0 1e2 1
               0  Inf 0 1e5 0
               0    0 0   1 0
               0    0 0   1 0];
```

Running GUISDAP 8

- Dsp expr
  - The "radar controller" experiment
- Vs
  - The major version number of the dsp expr
- Si
- D
- St
- St



- Result path
  - The directory where the results should go. If the last part of it is "AUTO", it is rewritten using the start date, dsp expr and site
- Real time
  - If running the analysis in realtime
- Integration time
  - Number of seconds to integrate. For scanning experiments, often 0.
- Disp figures
  - Guisdap may produces some plots during the analysis: the data dump, a power profile, the actual fit(s), height profiles, vizu
- Special
  - Almost any matlab command before starting analysis.

Running GUISDAP 8

- GUISDAP for dummies
  - When ready, press GO
- The output might look something like this:

```
2003/03/07  16:43:45-16:43:60 integrated
 alt   Ne/1e11      Ti     Te/Ti    coll/1e3   velocity [O+]/Ne resid status
249.5 1.32:0.05 1518: 57 1.63:0.09  0.0: 0.0  126.8:11.2  0.70  11.45  OK
canon: /analysis/results/2003-03-07_tau2@kir/05676239
```

- Check that the results go where you expected it to go.
  - Here:/analysis/results/2003-03-07_tau2@kir
- If you are running in realtime, the analysis will pause when reaching the end of the data. Here the vizu window will show up, and the program gets each new dump as it arrives. The timeout for waiting for new data is presently set to 5 minutes. Can be reset by releasing the "RT" button.
- When the analysis is finished the vizu plot is saved together with the data.
  - Created /analysis/results/2003-03-07_tau2@Kir/2003-03-07_tau2@Kir.eps and .png
- When finished, hit the Quit button.

Special (or in ana_def.m)

- f_[parameter]
  - Will force almost any parameter read from the data
    - f_ch_Pt Transmitter power (+ analysis_txlimit=0)
    - f_calTemp Calibration temperature
    - will try to evaluate strings, f_ch_Pt='d_parbl(65)*1000';
- a_Offsetppd[0]
  - Number of microseconds the remote site clock differs from Tromso
- Magic_const[1]
  - To tune the fitted electron densities, compared to plasmaline / ionosonde readings
- d_saveintdir[0]
  - Save the integrated data with measured variance to specified directory
  - Maybe together with analysis_do=0 or analysis_altit=[] (check tx,sat)
- analysis_code[]
  - Choose only lpg's with specified code (VHF, sliced data)

Special cont.

- analysis_intfixed[1]
  - integrate even if “fixed” parameters changes (elevation, azimuth, loop counter)
- analysis_save[1]
  - save results to a result directory
- display_results[0]
- display fitted parameters or only status
- analysis_control
  - a_control(1) Error limit of Ne for fit [100000]
  - a_control(2) Step limit for iteration [0.01]
  - a_control(3) Maximum number of iterations [10]
  - a_control(4) Variance calculation [1]
    - 1 estimated from data
    - 2 estimated using ambiguity functions

Variances

- Calculated from the data (default)
  - Fast
  - more than 6 dumps integrated
    - Variation between dumps
  - One dump
    - Variation over the lag profile
  - 2-5 dumps
    - mixture
  - Skip point if only one estimate
- Estimated from the setup parameters
  - Slow, but more accurate

Space Debris ('satellite') checking

- Satellites (unwanted hard targets) need to be removed
- Not beam filling
  - not easy to fit for them
- Increases variance over the whole pulse range
- a_satch[] parameter
  - a_satch.do [0] Enables/disables check. Default disabled, enabled for Cps
  - a_satch.sigma [4]Detection limit in signal, number of standard deviations
  - a_satch.skip [0] No points to skip, needs sometimes adjusting due to ground clutter
  - a_satch.plot [0] Plot window for satellite detection plots
  - more parameters in satch.m file

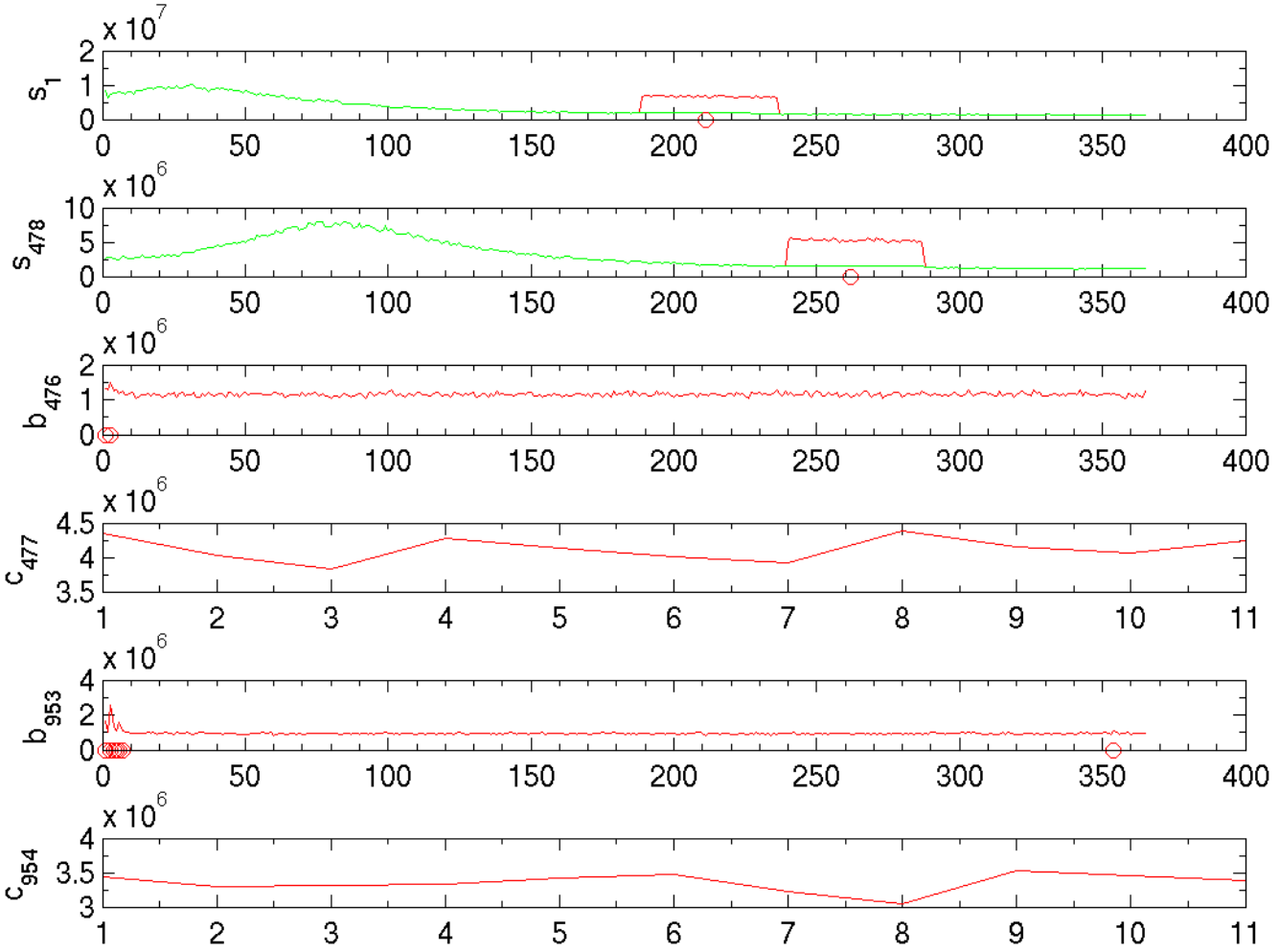
```
Warning: Satellite detection (2 10.7 251) -- skipping dump
Warning: Satellite detection (4 14.1 262) -- skipping dump
01-Feb-2002 10:04:03-10:05:39 integrated
Status: 22222300023000000000000000000000000000000010000000 1.0MW
181/82 57K
/home/ingemar/tmp/2002-02-01_tau0_120@42m/02714739.mat
```

Here: 2 dumps skipped

2 satellites found, 10.7 largest amplitude at position 251 in lag profile
(tau0 has 2 frequencies, so both detects the satellite)

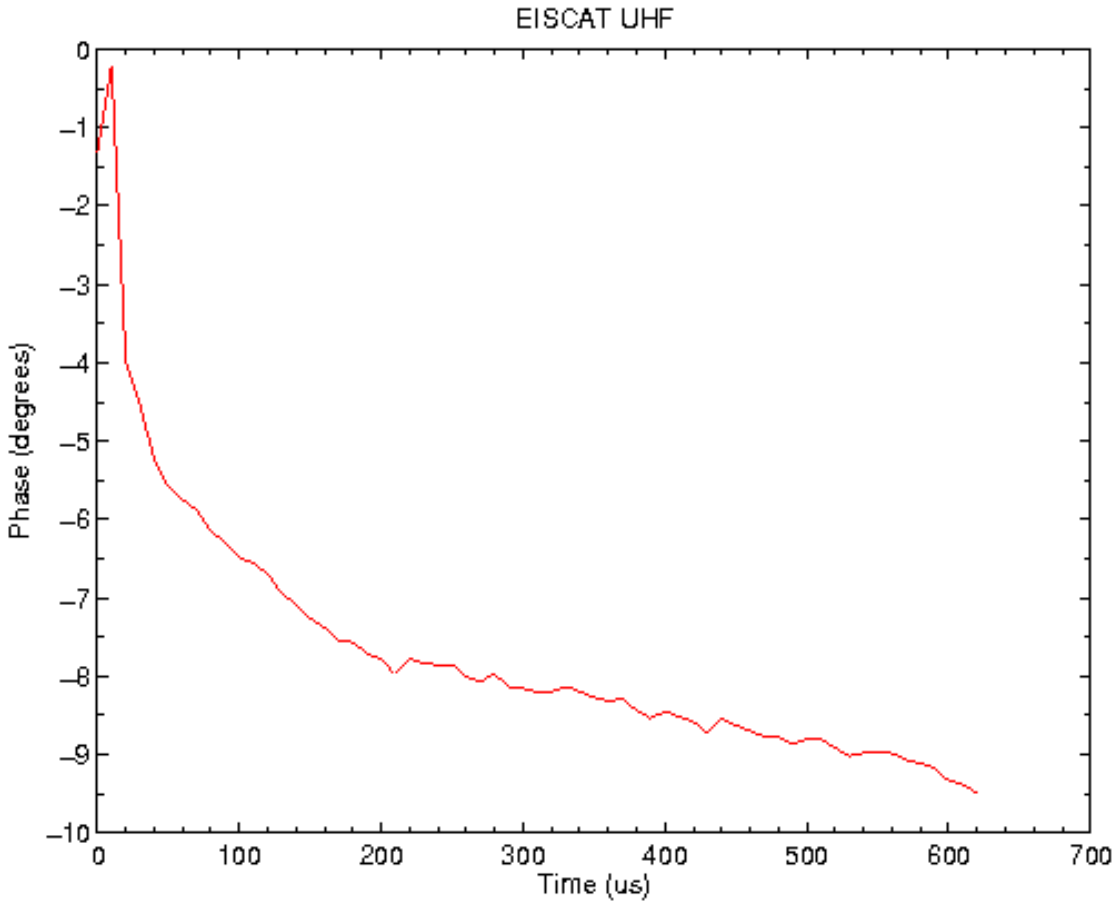
Space debris plot

a_satch.plot=8



Analysis

- Phase pushing calcs/corrections
  - UHF + ESR
    - transmitter samples
    - ~20-30 Hz
      - 4-10 m/s
  - VHF
    - no tx samples yet

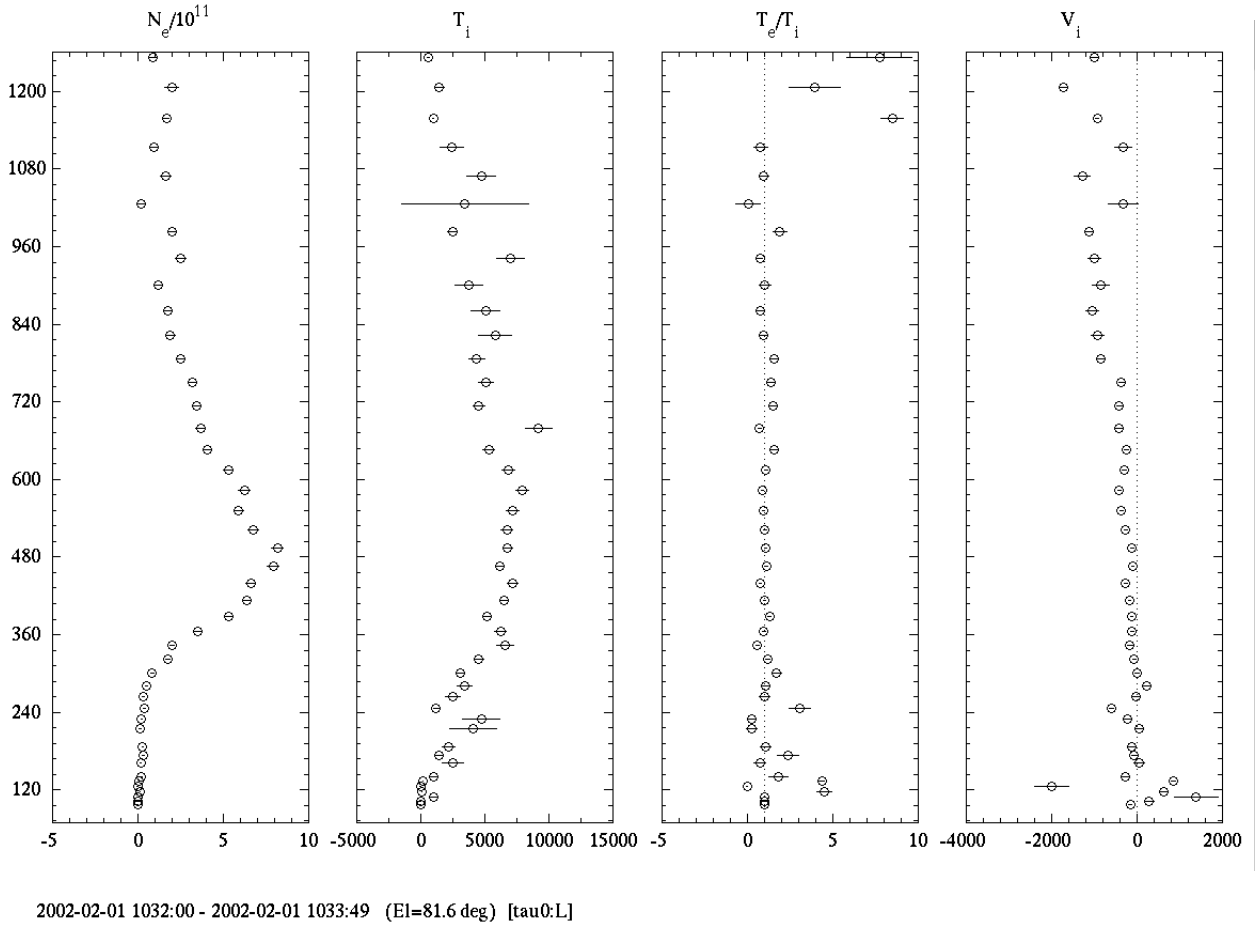


Directory setup

- Main distribution
  - guisdap8/bin
    - The executable guisdap
  - guisdap8/anal/
    - analysis scripts
  - guisdap8/init/
    - initialisation scripts
  - guisdap8/matfiles
    - analysis data files
  - guisdap8/exps
    - CP setups
  - guisdap8/mex6 or guisdap8/mex7
    - compiled scripts
  - guisdap8/lib
    - libraries to mex routines
  - guisdap8/mexsources, guisdap8/models
    - source files to mex and libs
  - guisdap8/doc
- Additions
  - ~/gup/mygup
    - personal scripts
    - edited distribution scripts
      - fullinit.m
      - start_GUP.m
        - local structure
  - ~/gup/exps
    - SP setups
  - guisdap8/NW/mex6, guisdap8/NW/lib
    - Nigel Wade integration package

Plots

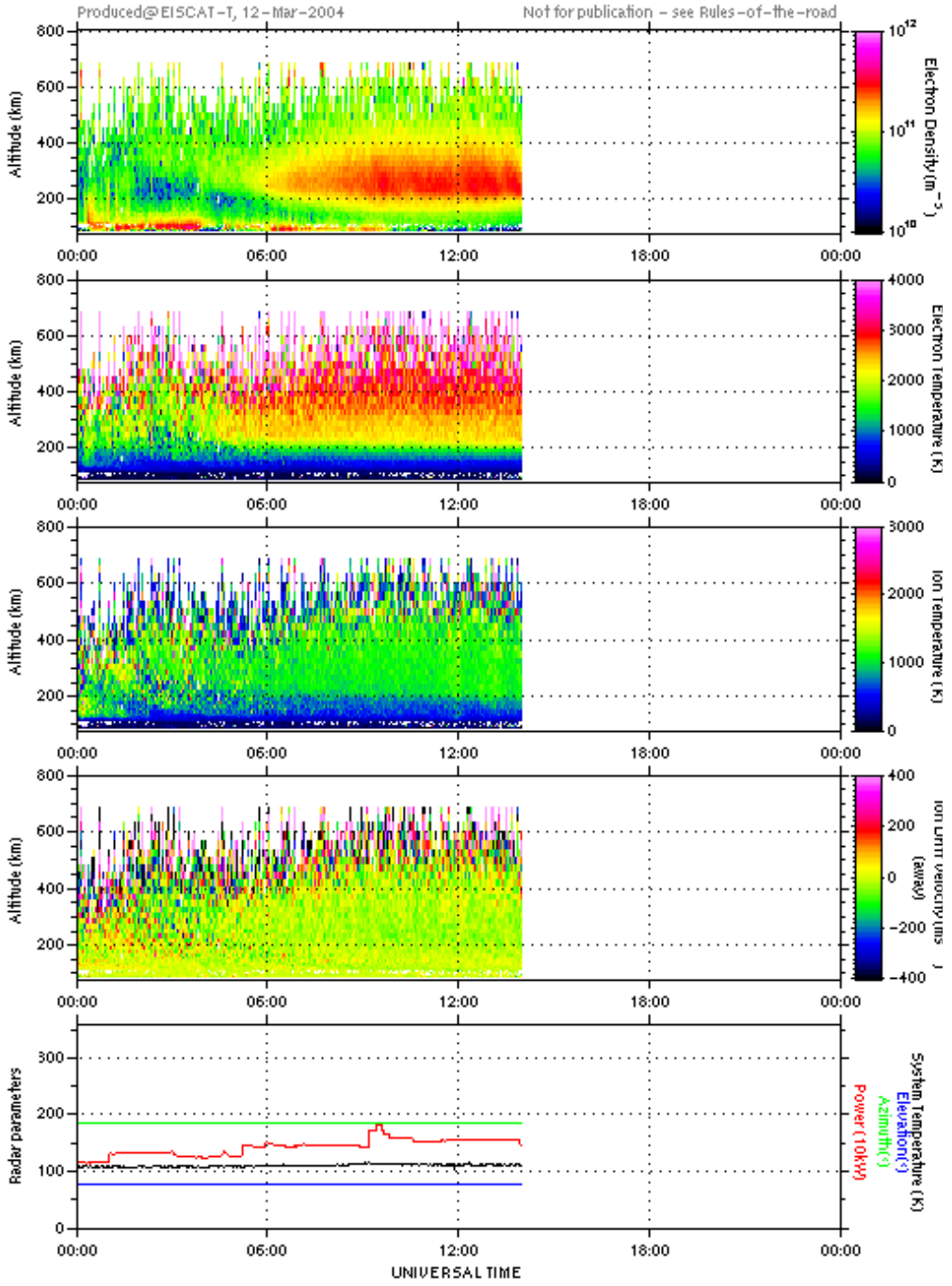
- Correlator dump
  - Plot of used part of the dump
  - Calibrated
  - Check that is corresponds to the data dump
- Power profile (Not remote)
  - Check that the densities are in proper range
- Fits
  - Plots the measurements versus the best theoretical fit
  - used parts of lag profiles (-1: spectra, inversion might need adjustment)
- Altitude profiles (Not remote)
  - -1 spectra
- Vizu
  - Summary plot of all analysed parameters
  - final check that experiment/analysis is correct



EISCAT Scientific Association

EISCAT UHF RADAR

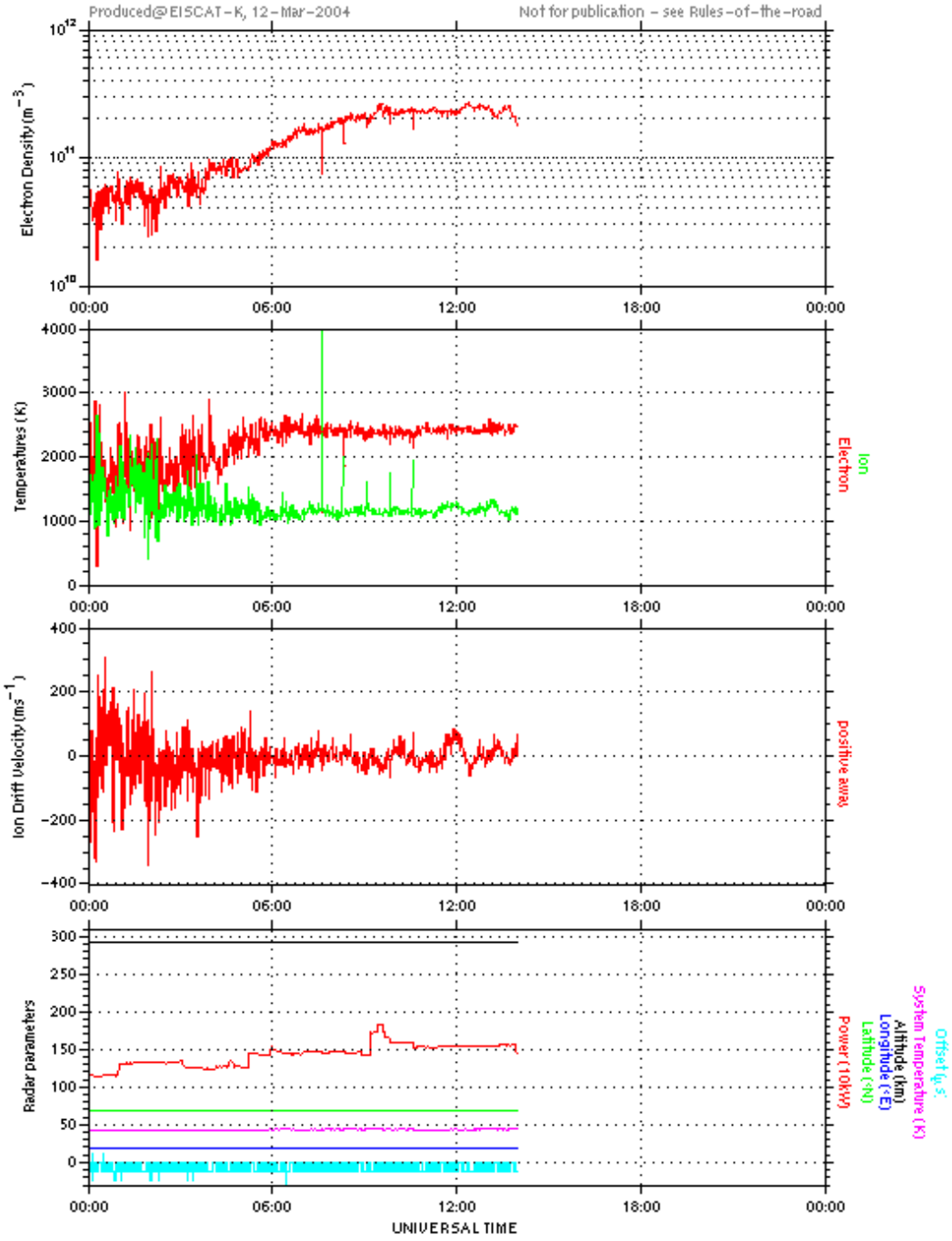
CP, uhf, tau2pl, 12 March 2004



EISCAT Scientific Association

EISCAT UHF RADAR

CP, kir, tau2pl, 12 March 2004



Result file

variable	*size*	*contents*
r_ver	(1,1)	version number of the GUISDAP program
name_expr	(1,:)	Name of the experiment
name_site	(1,1)	measurement site
name_ant	(1,3)	measurement antenna
r_time	(2,6)	start and end times of the integration period in order: year, month, day, hour, minutes, seconds
r_az	(1,1)	antenna azimuth (from parameter block)
r_el	(1,1)	antenna elevation (from parameter block)
r_Pt	(1,1)	power of the transmitter (from parameter block)
r_m0	(1,1..3)	masses of ions in the fit in atom mass units
r_range	(Ng,1)	range in km to the scattering volume
r_h	(Ng,1)	altitude in km of the scattering volume
r_param	(Ng,n)	result of the fit, $p_1 \ldots p_n$, order: density, ion temperature, temperature ratio, collision frequency, ion specie contents, DC spike, broadband noise
r_error	(Ng,1)	errors and correlations of the parameters, order: $\Delta p_1 ... \Delta p_n$, $Corr(p_1, p_2)$, $Corr(p_2,p_3)$, $Corr(p_3,p_4) ... Corr(p_1,p_n)$
r_res	(Ng,1)	residual of the fit with standard deviation
r_status	(Ng,1)	status of the fit, values: 0 = fit OK 1 = max number of iterations exceeded 2 = No fit done, because data too noisy 3 = Fit fail (outside limits)
r_dp	(Ng,1)	ion composition [0+]/ N,
r_apriori	(Ng,1)	a priori values for $p_1 \ldots p_n$
r_apriorierror	(Ng,1)	a priori errors for $p_1 \ldots p_n$
r_pp	(:,1)*	uncorrected densities (T_e=T_i)
r_pprange	(:,1)*	uncorrected densities ranges
r_XMITloc	(1,3)	transmitter location, order: Latitude(deg), longitude(deg), height (km)
r_RECloc	(1,3)	receiver location, order: Latitude(deg), longitude(deg), height (km)
r_SCangle	(1,1)	scattering angle, rad
r_Tsys	(1,:)	System temperatures (K)
r_Offsetppd	(1,1)*	estimated ppd offset (μs)
r_Magic_const	(1,1)	magic constan used

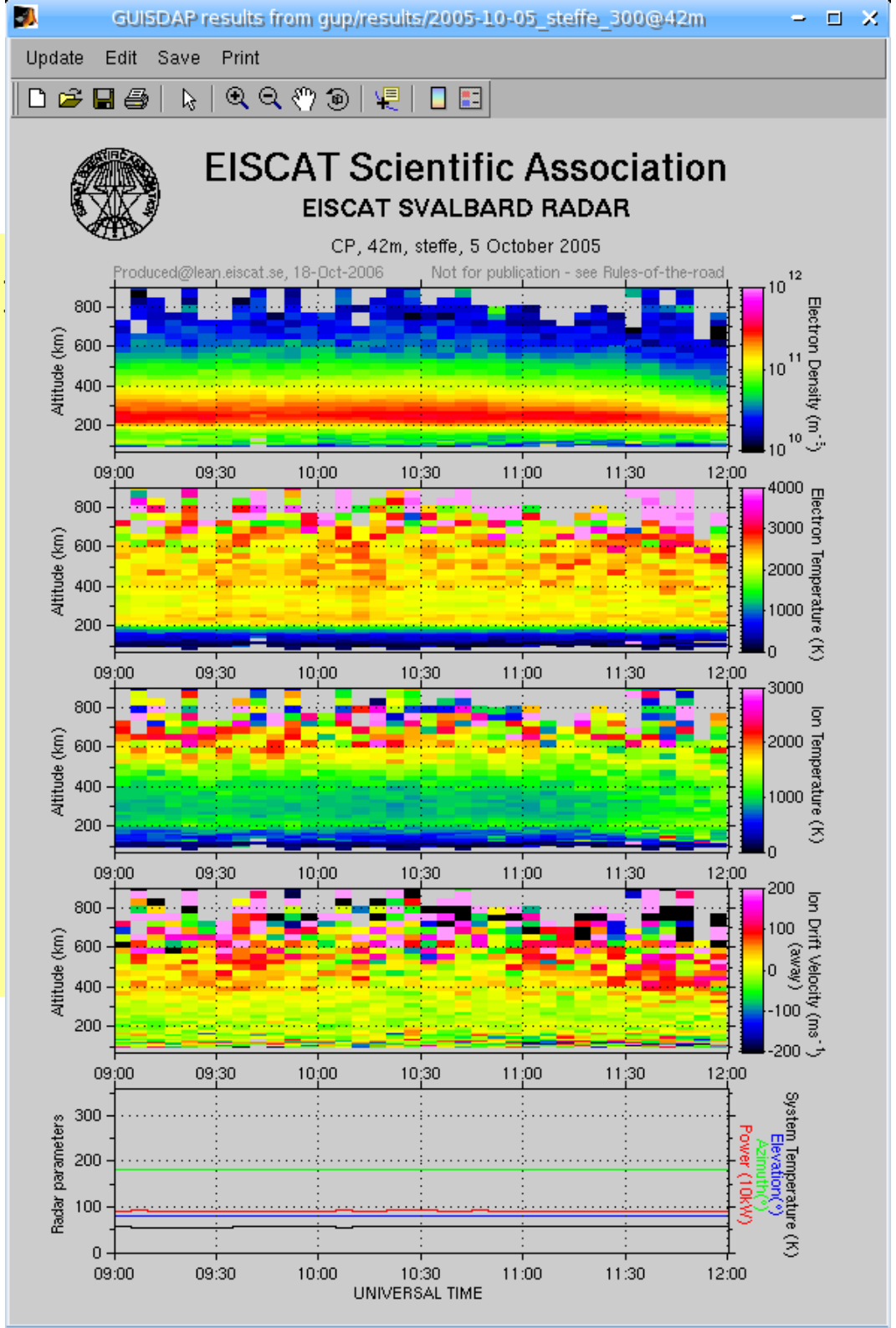
vizu plotting routine

- Main display routine for the GUISDAP output
- Default panels
  - Electron density
  - Electron temperature
  - Ion temperature
  - Ion drift velocity
  - Radar parameters
    - Tx, Pointing, System

```
function [varargout]=vizu(action,a2,a3)
% Plot GUISDAP results
% To plot with default dir names:
% >> vizu
% To plot without interaction:
% >> vizu dir exp_type antenna
% To update the plot with new files:
% >> vizu update
% To send the figure to the default printer:
% >> vizu print [printer]
% To save the current figure in .eps and
.png %  formats:
% >> vizu save [extra tail]
% To get more selection possibilities
% >> vizu verbose
% To get even more selection possibilities
% >> vizu VERBOSE
% To run realtime inside guisdap
% >> vizu rtgup
% To reset and start over:
% >> vizu new [action]
```

vizu

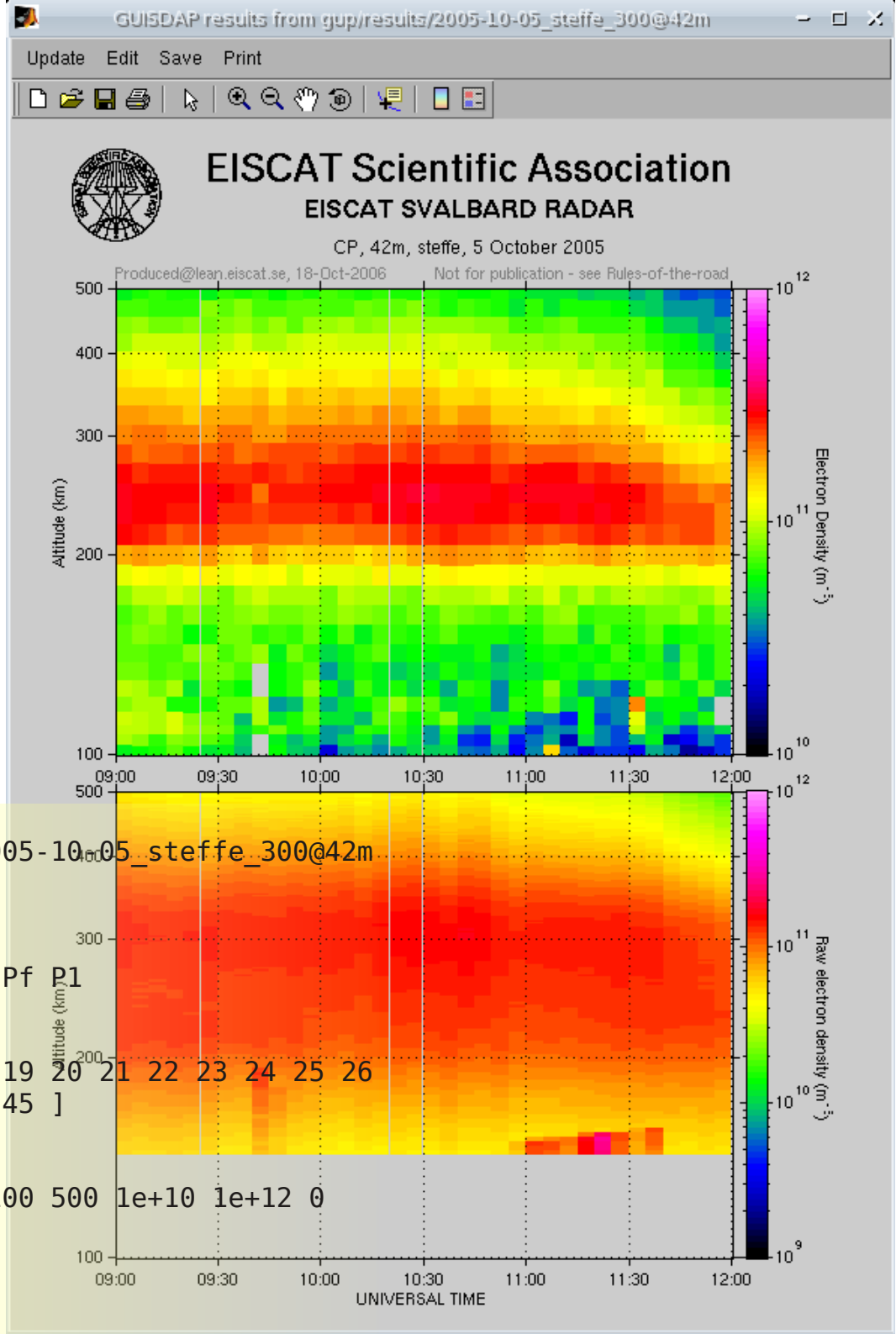
```
>> vizu verbose
Data path? [/home/ingemar/gup/results/
gup/results/2005-10-05_steffe_300@42m
Start time? [ 2005 10 5 6 32 27 ]
  End time? [ 2005 10 5 12 0 2 ]
Altitude scale? [ 70 900 ]
Parameters: Ne Te Ti Vi AE TT LL Rs O+
Co Nr Lf L1 Ls Pf P1
Choose? [Ne Te Ti Vi AE]
Type of experiment? [CP]
>>
```



vizu

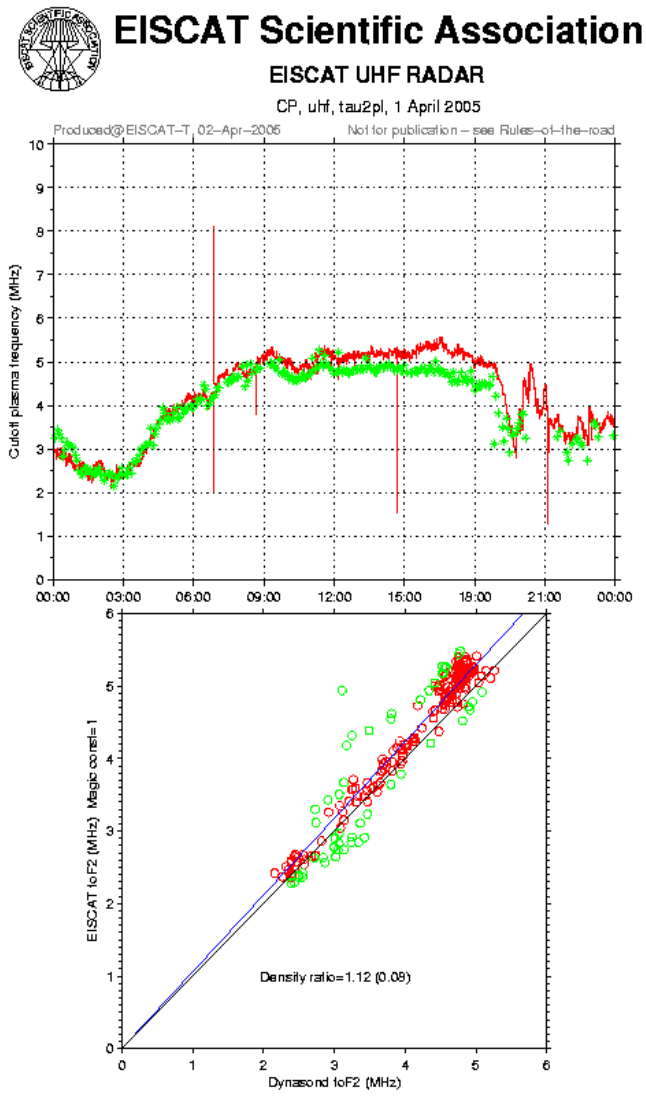
- Maximum verbose mode

```
>> vizu new VERBOSE
Data path? [/home/ingemar/gup/results/] gup/results/2005-10-05_steffe_300@42m
Start time? [ 2005 10 5 6 32 27 ]2005 10 5 9 0 0
  End time? [ 2005 10 5 12 0 2 ]
Altitude scale? [ 70 900 ]100 500
Parameters: Ne Te Ti Vi AE TT LL Rs O+ Co Nr Lf L1 Ls Pf P1
Choose? [Ne Te Ti Vi AE] Ne Nr
Type of experiment? [CP]
Gates? [ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 ]
Y parameter (Ran-1 Alt-2 Lat-3)? [ 2 ]
Y scale type? [linear] log
Scales (Ran Alt Ne Te Ti Vi Coll Comp Res)? [ 50 900 100 500 1e+10 1e+12 0
4000 0 3000 -200 200 1 100000 0 1 0.1 10 ]
Scale (rawNe)? [ 1e+09 1e+12 ]
Strech secs? [ 65 ]0
```

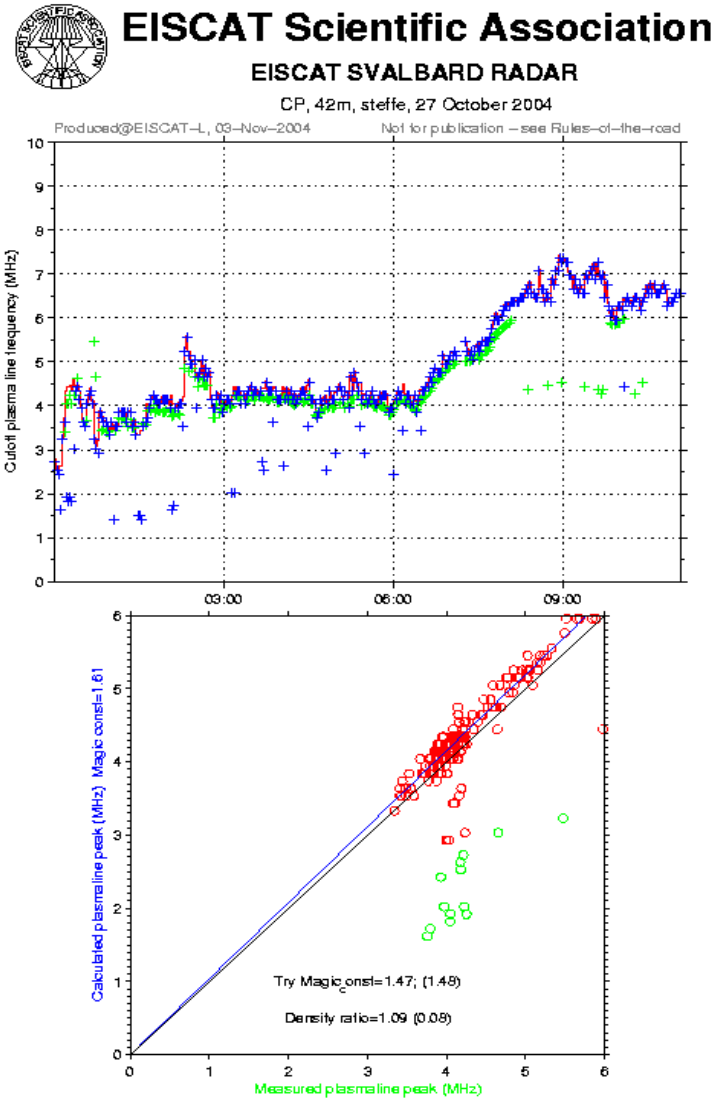


Calibration

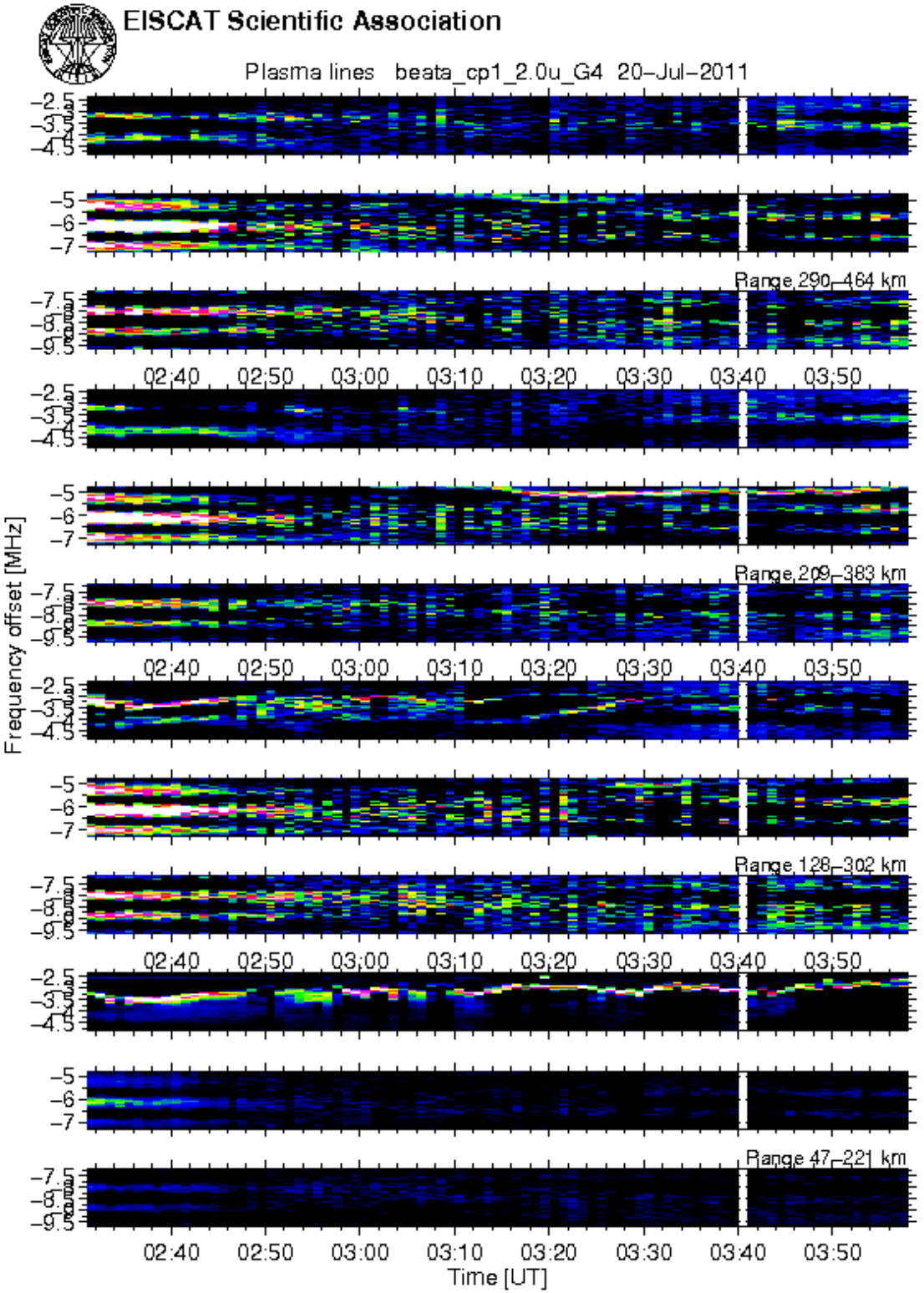
- calib_ne
  - to calibrate against dynasonde (rather vertical)



- calib_pl_ne
  - to calibrate against measured plasma lines

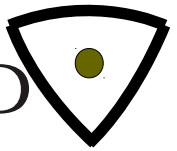


Plasma line overview



Slices

- Multibeam
  - VHF/ESR/EISCAT_3D



    - Analyse separately
- Time Slicing
  - Arc1,beata
    - Analyse separately

Setup parameters

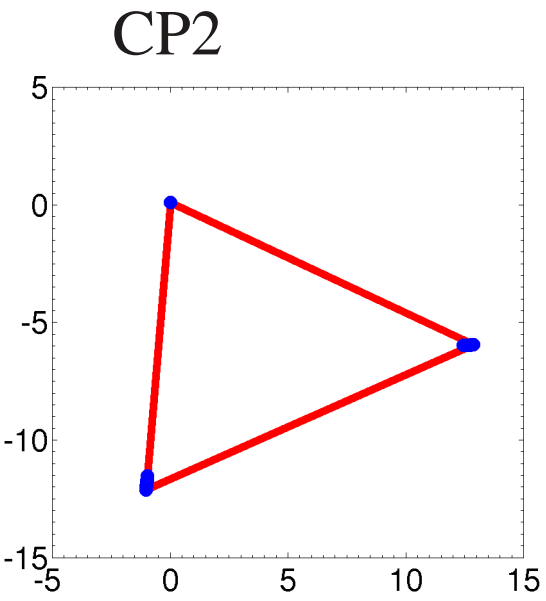
- Saved at
  - $TMPDIR/.gup
    - load -mat $TMPDIR/.gup
  - *result_path*/.gup
  - *result_path*/gfd_setup.m
    - executable script
- Next session starts with the same setups
  - Easy to correct
  - Use 'Reset' button to clear
- Rerun with
  - > go_on *setupfile*

gfd_setup.m

```
name_expr= 'steffe';
siteid= 5;
data_path= '/mnt/nfs/steffe_l_fix2_1.00_CP@32m';
result_path= '/home/ingemar/tmp/AUTO/';
t1=[ 2003 9 1 0 0 0];
t2=[ 2003 9 30 24 0 0];
rt= 0;
intper= 0;
path_exps= '/opt/guisdap8/exps/';
figs=[ 1 1 1 1 1];
extra=[ '%a_Offsetppd=8;                          '
 '%d_saveintdir="/home/ingemar/tmp/intdata";'
 '%analysis_altit=[];                          '
 '%analysis_do=0;                               '
 'a_satch.skip=40;                             '];
```

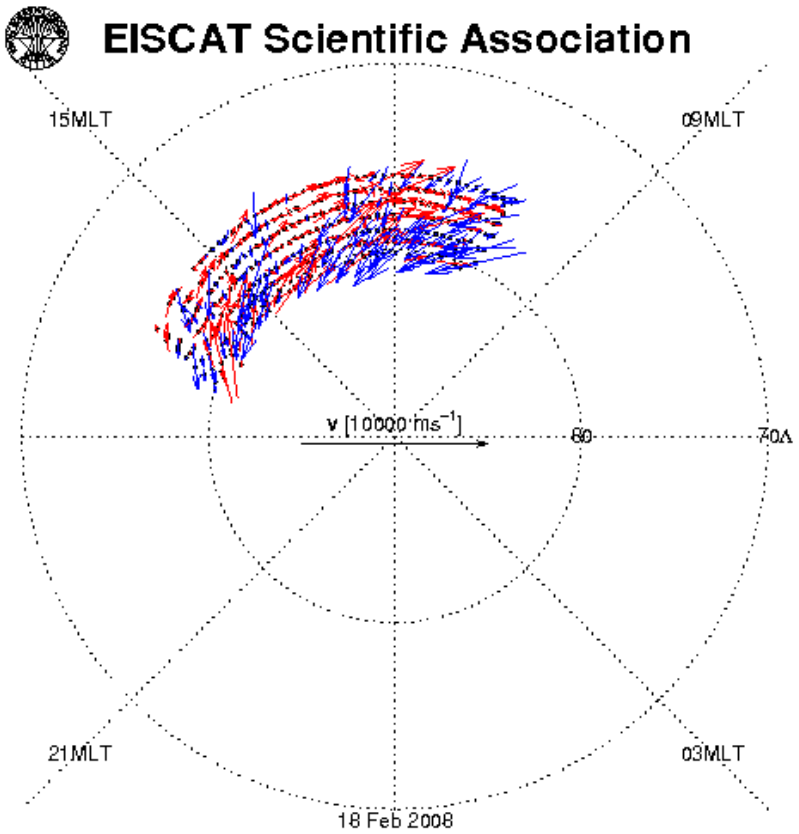
Vector velocities

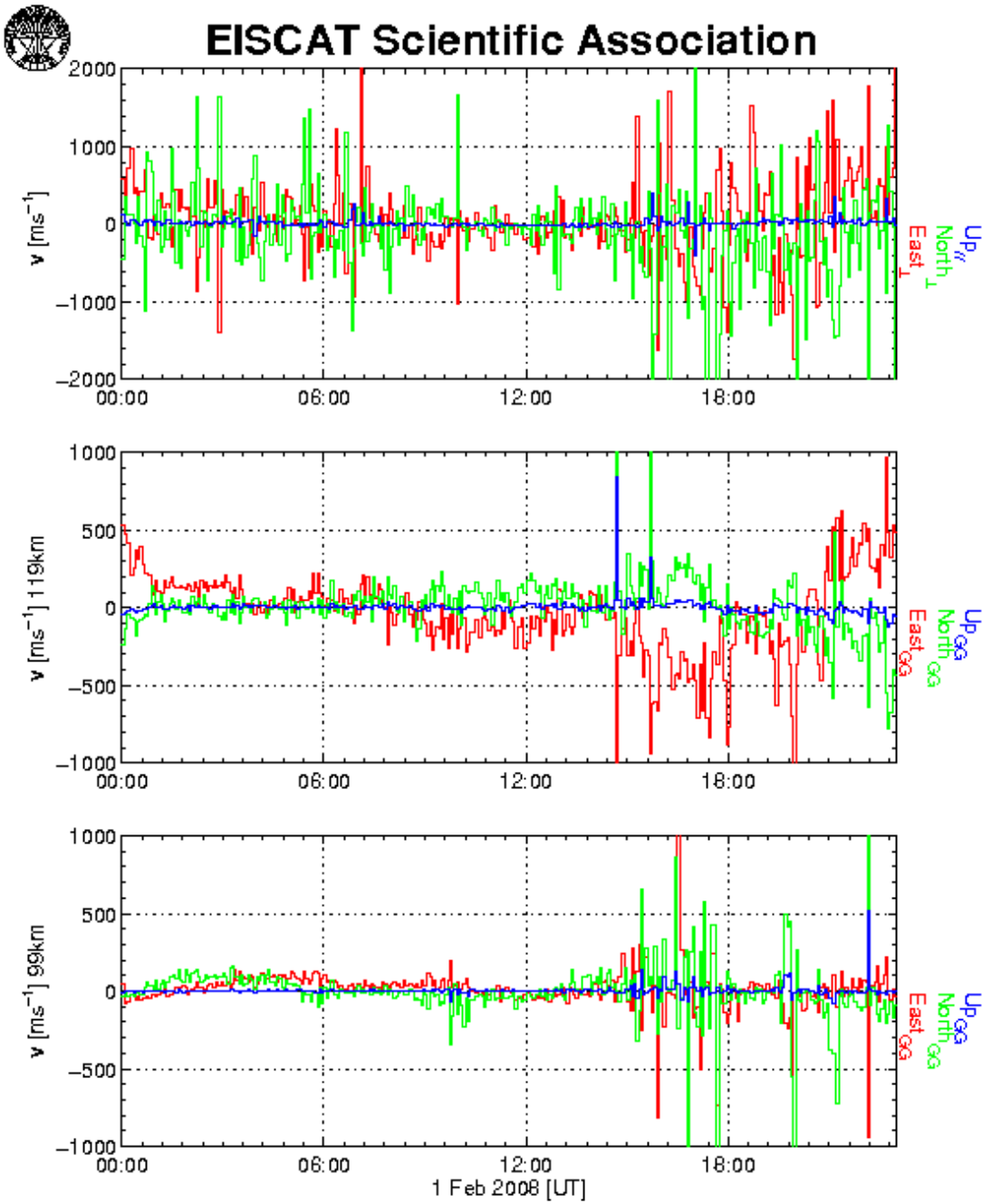
- mono- and bi- and multistatic
  - Beamswing, sweeping
    - CP2, CP3, CP4,...
  - Cluster VHF/ESR
  - Normal KST tristatic
- “Goodness”
  - convex hull of directions (>3)
    - Area > 10° triangle
  - Covariance matrix
- Geographic coordinates



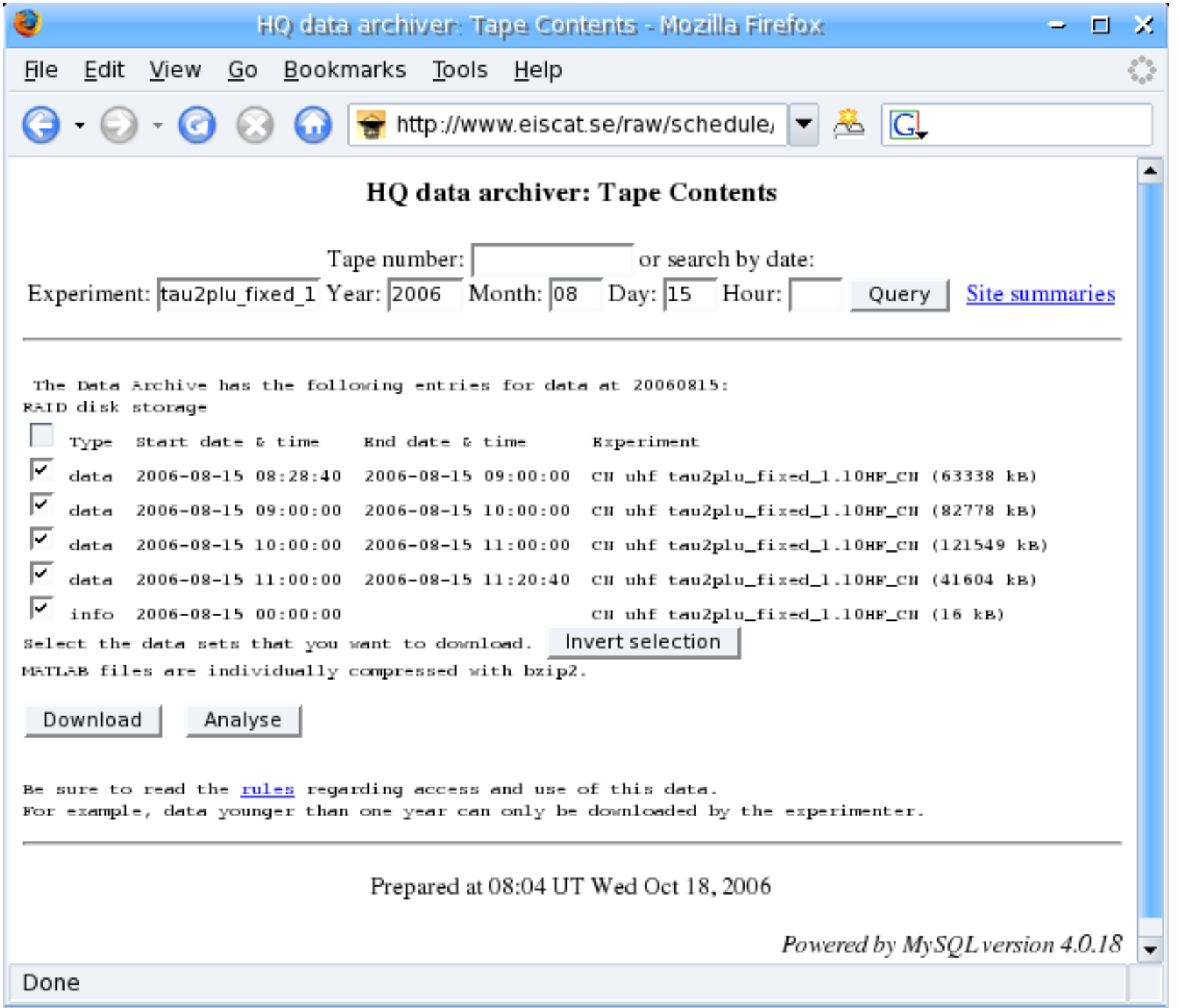
- Vectors

CP3


EISCAT Scientific Association
15MLT
09MLT
v [10000 ms^{-1}]
60
70Λ
21MLT
03MLT
18 Feb 2008


EISCAT Scientific Association
v [ms^{-1}]
2000
1000
0
−1000
−2000
00:00
06:00
12:00
18:00
Up$_{\parallel}$
North$_{\perp}$
East$_{\perp}$
v [ms^{-1}] 119km
1000
500
0
−500
−1000
Up$_{GS}$
North$_{GS}$
East$_{GS}$
v [ms^{-1}] 99km
1 Feb 2008 [UT]

Web analysis



Web analysis

- Very similar to matlab
- Results sent by e-mail
  - NCAR file, vizu plots, guisdap output
- Pros
  - don't have to download large data sets
  - don't need matlab license
  - latest GUISDAP version
- Cons
  - hard to find problems