

EISCAT metadata and data formats

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1 Introduction

The purpose of this document is to

1. describe the types and volumes of radar and ionosonde data archived at the Headquarters of EISCAT Scientific Association (henceforth EISCAT);
2. summarize the sources, formats and volumes of metadata available for these data.

1.1 EISCAT systems

EISCAT operates

1. Three incoherent scatter radars

EISCAT runs three high power large aperture radars for incoherent scatter and other purposes. Two of these are on the northern Scandinavian mainland: the 930 MHz UHF (UHF or TRO) and the 224 MHz VHF (VHF or EIS) radars at Ramfjordmoen near Tromsø, Norway. There are also remote receivers in Kiruna, Sweden (KIR) and Sodankylä, Finland (SOD). These were originally part of the UHF radar, but due to interference in the 930 MHz band they were converted to receive the VHF frequency during 2012.

The third system is the EISCAT Svalbard radar (ESR) in Longyearbyen, Svalbard, which operates at 500 MHz with one transmitter and two antennas (LYR 32 m and LYR 42 m).

2. An ionospheric HF heater in Tromsø (with HF radar capabilities since 2009)
3. Ionosondes (Dynasonde type), currently one at the Tromsø site (TR). There was also one on Svalbard (LR), operational from September 2009 until the beginning of June 2015.

2 Data products and formats

2.1 Incoherent scatter radar data

EISCAT archives incoherent scatter data at levels 2 (correlated data) and 3 (analysed parameters), and to a limited extent at level 1 (voltage domain samples). See the Data level document <https://www.eiscat.se/about/experiments2/>

`eiscat-data-levels/at_download/file` for a description of how EISCAT data levels are defined. The archival and data retrieval systems are entirely different for levels 2(+1) and level 3.

Data archives

1. Level 2 data files (which for some experiments also contain data at level 1). The files are in .mat format, compatible with Matlab® version 4, and are stored in a RAID archive. These files are indexed in a MySQL database. A web-based search and retrieval system is implemented in Apache + Python CGI.

Approximate volume of data since 1981: Around 110 TB

2. Analysed data (level 3) are produced with the Matlab based analysis software GUISDAP. After each GUISDAP run at Eiscat, we call a routine that collects the output Matlab files into a file in our own HDF5 data format. These files are subsequently converted to the Madrigal database format. Madrigal is a de facto standard for distributing incoherent scatter data. It is a distributed system where each site stores data from its own instruments locally whereas metadata are shared between the sites. A Madrigal site is based on a directory structure with analysed and derived parameters stored in Madrigal's own HDF5 files format. The HDF5 files contain sufficient metadata to be mostly self-explanatory. Note however that the files are separated according to Madrigal's concept of "kind of data" or "kindat".

In Madrigal, file indices and other local and shared metadata are in plain text files. The system has a comprehensive set of web services for data retrieval (Apache, CGI and APIs for several languages). See <https://cedar.openmadrigal.org/openmadrigal> and the EISCAT install at <https://madrigal.eiscat.se/madrigal>.

Approximate volume of data since 1981: 100 GB

2.2 HF radar (heating)

The EISCAT Heater transmitter and receiver systems are nowadays similar to the incoherent scatter radar controllers and therefore use the same format of control files as the radars. Before the upgrade there were no radar capabilities, only transmission.

2.3 EISCAT ionosondes

The EISCAT Tromsø ionosonde was originally an HF radar built at NOAA in the 1970's. It uses the Dynasonde (DSND) pulse transmission and decoding software, most recently developed at the University of Colorado by Bill Wright, Nikolay Zabotin and coworkers. DSND derives direction of arrival, density profiles, and several other ionospheric parameters. The method of identifying the echoes has varied, with a hardware signal processing card being used earlier in Tromsø and on Svalbard, and a software, largely phase-based, method being used in Tromsø in recent years.

The system on Svalbard was similar but was stopped and mothballed in 2015 due to land lease issues.

The ionosonde data are important as radar metadata, since the critical frequency of the F2 layer (foF2) is related to the electron density at the F2 peak and is often used for absolute calibration of radar electron density retrieval.

Raw data Raw in-phase and quadrature (IQ)- sampled data from identified echoes are archived on CDs and DVDs at the Heating site in Ramfjord. For the volume of discs for both sounders see http://www.eiscat.uit.no/heating/Dynasonde/logs/dyn_soundings_index.html.

SQL database A database (MySQL) stores parameters of identified volumetric radio echoes as well as a set of several automatically analysed ionospheric parameters including critical frequencies and density profiles. The total volume of data is around 1.5 TB.

3 Incoherent scatter radar metadata

Several disparate sources of metadata are required in order to fully specify and understand a radar experiment. In the following the incoherent scatter radar metadata sources and their formats and present volumes are described.

3.1 Radar schedule

The online radar schedule <http://portal.eiscat.se/schedule/> is the primary source of information on radar operations. It is also the preferred portal for level 2 (raw correlated and integrated) data and offers online reanalysis of these data.

Interface Web-based, Apache + CGI scripts mainly in Python, own development

Schedule database Directory structure with text files, size about 46 MB

Level 2 data index SQL database

Reanalysis Text file written when user selects reanalysis, cron script on analysis computer checks this file, calls Matlab® and emails the results to the user.

3.2 Radar experiment and analysis specifications

The highest level of metadata (in addition to experiment scheduling) in an EISCAT radar experiment is the experiment configuration loaded at runtime by the EISCAT Realtime Operating System (EROS) and by the GUISDAP (originally Grand Unified Incoherent Scatter Design and Analysis Package) data analysis software. Each experiment is defined by a number of files in an experiment directory and can be thought of as two separate fast and slow parts: the transmitted and received code, and the antenna scan pattern, respectively.

Location Information directories adjacent to the data, main site computers, GUISDAP analysis software distribution

Size GUISDAP distribution (gitlab) total some 15 GB

3.2.1 Old (pre-2000) system

The mainland radars, which were designed in the 1970's, used hardware correlators and Norsk Data (ND) minicomputers, running EROS on ND's own operating system SINTRAN. The ND systems were in operation until 2000 and stored data on magnetic tapes. The experiments were defined by the following files, most of which should be available in info directories together with the archived data (to the extent it has been possible to copy the tapes to the archive):

Configuration files

- Main experiment script: Experiment Language (ELAN) script
- Definition of transmission and reception: Transmit and Receive Language (TARLAN) text file, compiled to binary code for the radar controllers
- Configuration of the correlator: Correlator Language (CLAN) file
- Graphics definition: GDEF file, text file describing format of data
- Information and metadata can often be found in experiment description (desc) and log files

Notes The experiments were usually named for intended Common Programme runs: `cpN` where N is a number. Each ELAN experiment file contained commands to load radar configurations and set up antenna scan patterns.

3.2.2 New system (Svalbard radar and mainland since 2000)

The Svalbard radar was designed in the 1990's using a system based on digital signal processing channel boards and SUN Sparc computers, and the mainland radars were upgraded with new digital receiver and transmitter hardware in 2000.

The Sparc/Solaris computers have later been replaced by normal PC hardware running Ubuntu at all sites except Sodankylä.

Configuration files Some of the configuration files have the same structure as those of the old systems and a number of new configurations have been added.

- Main experiment script: Experiment Language (ELAN) script
- Antenna scan patterns: ELAN script subroutines
- Definition of transmission and reception: Transmit and Receive Language (TARLAN) text file, compiled to binary code for the radar controllers
- Exciter frequency setting (frq) files
- Channel board frequency setting (nco) files
- Configuration of channel boards and decoder software: Filter (fil) file, compiled to binary code
- Configuration of alternating code: code file
- Configuration of real time graph: Matlab file `rtg_def.m`

Notes

- The code programs have names many of which were originally acronyms: **beata**, **manda**, etc. Most of these are alternating codes, each designed for a certain time and range resolution. Several files are required to define a code experiment and the usual procedure is to write a Python program which generates those files.
- The antenna scan programs are usually named for their intended use: **cp1** for Common Programme 1 operation, etc.

Analysis configuration The analysis uses the Matlab® analysis software package GUISDAP. Analysis configurations, i.e. information on how data are arranged in the data dumps, are compiled from the experiment configurations. Importantly, the range and time resolution properties of the radar code are used to calculate so-called spectral ambiguity functions, which are used to convert theoretical parametric scatter spectra to the correlation time lag domain.

3.3 Level 1+2 data

This archive is on a ZFS server located at EISCAT Headquarters in Kiruna. It is behind a NAT firewall and thus does not have a public IP address, but file download is possible through the schedule interface at <https://portal.eiscat.se/schedule> which redirects to the data server, which listens on a public TCP port via forwarding.

A backup copy is kept on a similar ZFS system on Svalbard.

3.3.1 Metadata at experiment and storage level

- Directory names
The raw data directories are sorted as a three-level tree:
 1. Year
 2. Experiment name: Pulse code, antenna scan, version, and country code (for accounting of EISCAT hours per associate country)
 3. Date and hour
- File names: 8 digit integers, seconds since 1 January 00:00 of the year + **.mat.bz2**
- Experiment setup, from name and version of experiment, EROS configuration on site server

3.3.2 SQL databases

The index of the data archive consists of two MySQL databases as follows.

- `disk_archive`, the active database of experiment data
- `tape_archive_tapes`, index of historical tapes that have been converted to files on RAID

The databases index: experiments run: name, country and instrument, start and stop times and time used, and directories at the hourly level. The table structure is identical:

experiments

| experiment_id | experiment_name | country | antenna | comment |
|---------------|-----------------|---------------------|-------------|---------|
| Number | String | 2 char country code | 3 char name | |

resource

| resource_id | experiment_id | start | end | comment | type | account |
|-------------|---------------|-------|------|---------|------|---------|
| Number | Number | Date | Date | | | string |

storage

| location | resource_id | priority | bytes | comment |
|----------|-------------|----------|--------|---------|
| String | Number | Number | Number | |

tape_comments

| tape_nr | comment |
|---------|---------|
| Number | String |

3.3.3 Data and metadata in the archive files

The EISCAT archive .mat files are compatible with Matlab® since version 4 and can be opened with all compatible software. In addition to Matlab®, libraries are available for several common programming languages such as Python and GNU R. The files contain the following data vectors. The indexing of these data vectors is different for different experiments and it is often most convenient to work out the formats from the corresponding `rtg_def` or `gdef` files.

1. `d_ExpInfo` A short text string, name of experiment
2. `d_raw` Level 1 samples (16-bit complex integers), **saved only for special experiments.** `d_raw` is most often used for transmitter samples. For dedicated experiments, such as meteors and space debris, also in-phase and quadrature signals after digital mixing to base-band and decimating filters, data rate 15/M MHz where M is the decimation factor)
3. `d_data` Data dumps (complex floating point values): Correlated signal, lag dumps of all possible lags decoded from one or more sets of pulse codes and frequencies, including calibration signals (noise injected at antennas). Ion and plasma line receiver data as well as ion line data from the two antennas of ESR may be combined.
4. `d_parb1` Parameter block. The parameter block is a vector of up to 128 numbers. The format is described in Sect. 6

3.4 Level 3 data

The calibrated level 2 autocorrelation domain data are analysed by the software package GUISDAP. GUISDAP runs under Matlab® and stores the result in Matlab version 6 or higher .mat files. GUISDAP also stores information files and an overview plot for each run. After completed analysis the results are also archived as HDF5 files in EISCAT- and Madrigal-specific formats.

The Madrigal database is the authoritative archive of level 3 data. Metadata in Madrigal are based on text files indexing the experiments. The order and numbering of these files may change every time data are added, so it is highly advisable to use the Madrigal APIs or web GUI to retrieve (meta)data from the Madrigal system. Documentation is available at <http://madrigal.haystack.mit.edu/madrigal/madContents.html>.

3.4.1 Sources of level 3 metadata

- Experiment and analysis setups as described above
- File names, should always contain
 - Date
 - Experiment name
 - Integration time
 - Instrument name
- Madrigal index files and APIs
- HDF5 files in the Madrigal experiment directory structure. These files contain parameters like
 - Date and time
 - Antenna pointing (azimuth, elevation)
 - System temperature
 - Power
 - Fitted parameters with error limits, as function of range
 - Derived parameters like scatter angle, ground altitude
- Overview plots of
 1. electron density
 2. electron temperature
 3. ion temperature
 4. line of sight velocity
 5. the following parameters:
 - System temperature
 - Power
 - Azimuth
 - Elevation

4 Heating (HF radar) metadata

The authoritative source of metadata on heater operation is a hand-written paper logbook. Scanned copies of the logbooks are available online at http://www.eiscat.uit.no/DataBases/heating_logs/ which is password protected.

Information can also be typed into the web-based information system of the transmitter site but this is typically rarely used. Since 1999 the most important transmitter parameters were logged to files which are archived.

In 2009 the heater system was upgraded with a radar controller similar to those of the incoherent scatter radars and direct digital synthesis (DDS) exciters, and one antenna array was converted for reception. Thus the heater is now a HF radar controlled by EROS. The configuration files can be found in their own experiment directories.

5 Ionosonde metadata

The ionosondes store both metadata and data in one SQL database per site, *tromso* and *svalbard*. A search interface is available at <http://dynserv.eiscat.uit.no>.

6 Appendix: Parameter block format

This appendix describes the format of `d_parb1` in the EISCAT `.mat`-compatible archive files. Not all parameters are used at all radar sites and parameters have been introduced as needed since operations started. See also the Notes following the list of parameters.

6.1 Old (pre-2000) format

| Entry | Value |
|-------|--|
| 1 | Site code |
| 2-4 | Time of dump |
| 2 | $(year - 1900) * 100 + month$ |
| 3 | $day * 100 + hour$ |
| 4 | $min * 100 + second$ |
| 5 | UHF commanded azimuth $int(az * 10. + 0.5)$ |
| 6 | UHF current true azimuth |
| 7 | UHF uncorrected hardware azimuth $int((az - 360) * 100. + .5)$ |
| 8 | UHF commanded elevation $int(el * 10. + 0.5)$ |
| 9 | UHF current true elevation |
| 10 | UHF uncorrected hardware elevation $int((el - 360) * 100. + .5)$ |
| 11 | UHF local range $int(rn * 10. + 0.5)$ in 0.1 km to center of common volume |
| 12 | UHF height of center of common volume in 0.1 km |
| 5 | VHF phase steering index for "W": -17...0...+17 |
| 6 | VHF phase steering index for "E" |
| 7 | VHF angle W (segment 1) $elevation * 10$ |
| 8 | VHF hardware angle W $elevation * 10$ |
| 9 | VHF angle E (segment 3) $elevation * 10$ |
| 10 | VHF hardware angle E $elevation * 10$ |
| 11 | VHF beam mode |
| 12 | VHF nvstat |
| 14 | VHF azimuth 1 |
| 15 | VHF azimuth 2 |
| 14 | UHF polarisation phase 0-409 degrees |
| 15 | UHF polarisation amplitude ratio, -127-127 in 0.25 dB steps |
| 13 | First local oscillator frequency (MHZ*10) |
| 16 | Signal path switch |
| 17-18 | Signal attenuators of path X and Y, 0-63 dB |
| 19-26 | Second local oscillator frequency for channel 1-8 (kHz*10) |
| 27-34 | Channel attenuator settings of channel 1-8, 0-63 dB |
| 35-42 | Filter bandwidth settings of channel 1-8, (kHz*10) |
| 43-44 | Noise injection control |
| 45 | Correlator program start address |
| 46-61 | Correlator APB stack |
| 62-77 | Correlator APM stack |
| 78-85 | ADC sampling intervals for channels 1-8 |
| 86 | High-precision synthesizer channels for LO2 |
| 87-88 | Filter type used in channels 1-8 |

| | |
|---------|---|
| 89 | Pulse propagation delay offset, microseconds |
| 90 | Pulse propagation delay, local relative to Tromsø, antenna position dependent |
| 91 | Counter for outermost DO-loop in ELAN program |
| 92 | Radar controller program number |
| 93 | Pulse repetition period, unit 10 microseconds |
| 94 | Integration time, seconds |
| 95 | Status word |
| 96 | Average transmitter power, UHF, VHF klystron A, kW |
| 97 | Average transmitter high voltage, UHF, VHF klystron A, kV |
| 98 | 100/(RF duty cycle) |
| 99 | Derived peak power UHF, VHF klystron A |
| 100 | Average transmitter power, VHF klystron B, kW |
| 101 | Derived peak power, VHF klystron B |
| 102 | Reserved for outside temperature |
| 111–125 | User parameters |
| 126 | Line number of last executed ELAN statement when this dump was done |
| 127 | Source |
| 128 | Parameter block version |

Notes

- Parameter 1:
 - 1 Kiruna
 - 2 Tromsø
 - 4 Sodankylä
- Parameters 2–4: End of dump to nearest second
- VHF parameter 5–6: Corresponding to -21.3 degrees to +21.3 degrees in steps of about 1.25
- UHF parameters 11–12: if range or height $> 2^{15} - 1$ their value is replaced by $-(value - 2^{15})$
- VHF parameter 11:
 1. Setting not defined to EROS
 2. Single beam (all horizontal dipoles connected to one klystron, all vertical dipoles to the other, polarization depends on radar controller program)
 3. Dual beam (each klystron feeds one antenna half, only circular polarization possible)
- VHF parameter 12:
 - 0 Access ok, all segments under computer control and in position,
 - 1 interface sequence read error, status undefined
 - <-1 Port access error, SINTRAN operating system error, code=abs(nvstat)

>0 VHF antenna segment related bit pattern

Bit N Segment N in manual or slave mode ($N = 1..4$)

Bit $N + 4$ Segment N moving ($N = 1..4$)

Bit 9 Segments 1/2 ("W") misaligned, see status bit 3

Bit 10 Segments 3/4 ("E") misaligned, see status bit 4

- Parameter 16:

0 X to CH 2,4,6,8, Y to 1,3,5,7

1 Y to CH 1,2,3,4,5,6,7,8

2 X to CH 1,2,3,4,5,6,7,8

3 X to CH 1,3,5,7, Y to CH 2,4,6,8

- Parameters 43–44: Always 0, noise injection is fixed and activated by radar controller
- Parameters 78–85: unit 0.05 microseconds for channels 1–2, 0.1 microseconds for channels 3–8
- Parameter 86: Bits 1 to 8 are used, corresponding to LO2 channels 1–8. If the bit is set, then a high precision oscillator is used on the channel. For those channels, errors in the frequency setting are not indicated by bit 5 of the status word, as the synthesizers cannot be read back.
- Parameters 87–88: 4-bit code,
 1. Butterworth
 2. linear
 3. wideband filter

Parameter 88 contains codes for channels 1–4 with the channel 1 code in the least significant 4 bits. Parameter 87 contains channels 5–8 with the channel 8 code in the most significant 4 bits.

- UHF parameter 95:

Bit 0 UHF transmitter off

Bit 1 Azimuth not in position

Bit 2 Elevation not in position

Bit 3 Polarizer phase not in position,

Bit 4 Polarizer amplitude not in position

Bit 5 Receiver settings differ from commanded values

Bit 6 Error in correlator- or DMA dump,

Bit 7 Communication to Tromsø interrupted (transmitter status bit 0 is then meaningless in KIR and SOD)

Bit 8 Heating facility transmitter in standby (Tromsø only)

Bit 9 Heating facility transmitter on (Tromsø only)

Bit 10 Heating facility feed lines arcing (Tromsø only)

- VHF parameter 95:

Bit 0 VHF transmitter RF off

Bit 1 Antenna "W" half not in position or not accessible

Bit 2 Antenna "E" half not in position or not accessible

Bit 3 Antenna segments "W" (1/2) misaligned

Bit 4 Antenna segments "E" (3/4) misaligned

Bits 5–10 as UHF

- Source parameter 127:

Bit 0 1=VHF antenna, 0=UHF antenna

Bit 1 1=Spectrum analyser

Bit 2 1=Special device

Bit 3 1=VHF correlator, 0=UHF correlator

Bit 4 1=Passive experiment, 0=Active experiment

- Version parameter 128:

6 After 1984-06-13

7 After 1985-01-01

8 After 1985-12-01

9 After 1987-08-17

10 After 1992-03-01

6.2 Current (post-2000) format

| Entry | Value | Introduced/Notes |
|-------|---|----------------------|
| 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 | ESR % power tx1 klystron a (of 62.5 kW) | 0 on mainland |
| 14 | ESR % power tx1 klystron b | |
| 15 | ESR % power tx2 klystron a | |
| 16 | ESR % power tx2 klystron b | |
| 17 | ESR % power tx3 klystron a | |
| 18 | ESR % power tx3 klystron b | |
| 19 | ESR % power tx4 klystron a | |
| 20 | ESR % power tx4 klystron b | |
| 21 | Noise injection calibration, K | |
| 22 | Pre-integration factor | Always 1 on mainland |
| 23 | ESR % power tx5 klystron a | 0 on mainland |
| 24 | ESR % power tx5 klystron b | |
| 25 | ESR % power tx6 klystron a | |
| 26 | ESR % power tx6 klystron b | |
| 27 | ESR % power tx7 klystron a | |
| 28 | ESR % power tx7 klystron b | |
| 29 | ESR % power tx8 klystron a | |
| 30 | ESR % power tx8 klystron b | |
| 31 | Rx frequency, channel 1 (MHz) | 1999-08-19 |
| 32 | Rx frequency, channel 2 (MHz) | 1999-08-19 |
| 33 | Rx frequency, channel 3 (MHz) | 1999-08-19 |
| 34 | Rx frequency, channel 4 (MHz) | 1999-08-19 |
| 35 | Rx frequency, channel 5 (MHz) | 1999-08-19 |
| 36 | Rx frequency, channel 6 (MHz) | 1999-08-19 |
| 37 | Rx frequency, channel 7 (MHz) | 1999-08-19 |
| 38 | Rx frequency, channel 8 (MHz) | 1999-08-19 |
| 39 | Rx frequency, channel 9 (MHz) | 1999-08-19 |
| 40 | d_parbl version number | 1999-11-12 |
| 41 | Antenna ID (1-8) see notes | 1999-11-12 |
| 42 | Remote antenna intersection range, m | 2003-02-28 |
| 43-62 | User parameters | 2003-07-23 |
| 63 | High voltage reading (V) | 2003-09-01 |
| 64 | Loop counter | 2004-02-01 |

Parameters 65– ESR

| | | |
|----|---|------------|
| 65 | Peak power read from power meter (W) | 2004-02-20 |
| 66 | RF duty cycle calculated from RC binary | 2004-03-20 |
| 67 | SPEAR Tx status | 2007-03-22 |
| 68 | LO settings | 2007-05-14 |
| 69 | CHI attenuator settings (dB) | 2007-05-14 |
| 70 | CHII attenuator settings (dB) | 2007-05-14 |
| 71 | Peak power in wave guide 32m antenna (kW) | 2008-05-24 |
| 72 | Peak power in wave guide 42m antenna (kW) | 2008-05-24 |
| 73 | Start time of RC1 (seconds) | 2015-10-23 |
| 74 | Start time of RC1 (microseconds) | 2015-10-23 |
| 75 | Start time of RC2 (seconds) | 2015-10-23 |
| 76 | Start time of RC2 (microseconds) | 2015-10-23 |
| 77 | Start time of RC3 (seconds) | 2015-10-23 |
| 78 | Start time of RC3 (microseconds) | 2015-10-23 |

Parameters 65– UHF

| | | |
|----|-------------------------------------|------------|
| 65 | Peak power read from wave guide (W) | 2004-02-20 |
| 66 | RF duty cycle read from wave guide | 2004-03-20 |
| 67 | Power status on Tromsø systems | 2006-11-01 |

Parameters 65– VHF

| | | |
|----|--------------------------------------|------------|
| 65 | Antenna elevation panel 1 (deg) | 2005-05-21 |
| 66 | Antenna elevation panel 2 (deg) | 2005-05-21 |
| 67 | Antenna elevation panel 3 (deg) | 2005-05-21 |
| 68 | Antenna elevation panel 4 (deg) | 2005-05-21 |
| 69 | IF system setup see note 1 | 2005-05-21 |
| 70 | Peak power read from wave guide (W) | 2006-10-30 |
| 71 | RF duty cycle read from wave guide | 2006-10-30 |
| 72 | Power status on Tromsø systems | 2006-11-01 |
| 73 | CHI attenuator settings (dB) | 2008-04-21 |
| 74 | CHII attenuator settings (dB) | 2008-04-21 |
| 75 | Average power read in wave guide(kW) | 2008-12-11 |
| 76 | Start time of RC1 seconds | 2015-10-23 |
| 77 | Start time of RC1 microseconds | 2015-10-23 |
| 78 | Start time of RC2 seconds | 2015-10-23 |
| 79 | Start time of RC2 microseconds | 2015-10-23 |
| 80 | Start time of RC3 seconds | 2015-10-23 |
| 81 | Start time of RC3 microseconds | 2015-10-23 |

Notes

- Antenna ID parameter 41:

1. 32m ESR
2. 42m ESR
3. VHF
4. UHF
5. Kiruna
6. Sodankylä
- 7.
8. 32p ESR

- User parameters 43–62

These are set by calling the UPAR command in ELAN files. Some experiments make use of these parameters in an almost standardized way — the following are used by **beata**:

43 (upar 1): ESR filter width

47–49 (upar 5–7) plasma line frequency offsets

57 (upar 15): experiment version

- ESR parameter 67

1. SPEAR all tx off
2. SPEAR low power radar
3. SPEAR high power radar
4. SPEAR heating

- ESR parameter 68

1. Lower plasma line LO1 set to 492 MHz and upper plasma line LO1 to 502 MHz
2. Lower plasma line LO1 set to 496 MHz and upper plasma line LO1 to 502 MHz
3. Lower plasma line LO1 set to 492 MHz and upper plasma line LO1 to 506 MHz
4. Lower plasma line LO1 set to 496 MHz and upper plasma line LO1 to 506 MHz

- UHF parameter 67 (not available at UHF remotes) and VHF parameter 72 give the power status on the Tromsø systems as follows:

Bit 0 UHF RF on

Bit 1 UHF HV on

Bit 2 UHF power on

Bit 3 VHF RF on

Bit 4 VHF HV on

Bit 5 VHF power on

Bit 6 Heating RF on

Bit 7 Heating power on

- VHF parameter 69 is decoded as follows:

Bits 0:1 Antenna phasing

0 all B

2 all A

3 split

Bits 2:5 IF setup

Bit 2 lo1/chI 0 298 MHz 1 290 MHz

Bit 3 lo1/chII 0 298 MHz 1 290 MHz

Bit 4 lo2/chI 0 84 MHz 1 78 MHz

Bit 5 lo2/chII 0 84 MHz 1 78 MHz

7 Appendix: Documentation of EROS experiment configurations

Links

- <https://eiscat.se/scientist/user-documentation/eight-annotated-eiscat-experiments/>
- <https://portal.eiscat.se/jussi/eiscat/erosdoc/index.html>
- https://portal.eiscat.se/jussi/eiscat/Eros_talk_050816.pdf