README.txt, 5 Aug 2009
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This directory contains selected listings of EISCAT space debris measurement results. The measurements were done at the Svalbard Radar from 13 March 2007 to 10 Feb 2009. There are results for 101 days which are listed in the file days_list.txt.

The event listing files, of name "events_YYMMDD.txt", are in day-wise subfolders of directories ipy/ and ipy_wide/. The selected days are the days when the radar has been operating in the standard IPY non-scanning mode at least for most of the day, especially, there are no significant data gaps during or near the crossing of the FY 1C debris ring.

Summary plots of the data given in the listings are available via the web page

    http://www.sgo.fi/~jussi/spade/ipy/index.html

The events_YYMMDD.txt files ___SHOULD NOT___ be used as given, for they still contain uncertain and even duplicate events, and the RCS is more wrong than it can be.

The directory

    matlab

contains Matlab function

    ipy_read_events.m

that may be used to read an event list file and filter out the spurious data and also correct for the incorrect antenna gain used in the analysis. Refer to the header of the file ipy_read_events.m file for some dedails. As delivered, the function is parametrised in the same way as it was used for the plots on the web page.

The reason I have not filtered the events_YYMMDD.txt files myself is that the filtering is rather heavy-handed and kills also considerable number of "obvious" debris events. So it may be possible to increase the effective detection sensitivity by more carefull adjustment of the filtering.

There are two sets of event_YYMMDD.txt files, one under ipy/ and the other under ipy_wide/. This is because the initial range coverage of the measurement was increased by a factor of 0.8 starting from May 05. Since that date, the analysed altitude windows have been 149-489 km, 706-1047 km, 1264-1605 km, and 1823-2164 km. Before, the altitude windows were 224-415km, 780-973 km, 1339-1531 km, and 1897-2089 km. The altitude refers to the true altitude above reference spheroid. The range windows from May 5 onwards are

```
 151 --  494 km      (zone 1)
 713 -- 1057 km      (zone 2)
1258 -- 1619 km      (zone 3)
1838 -- 2181 km      (zone 4)
```

and before that date,

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 226 --  419 km      (zone 1)
 788 --  982 km      (zone 2)
1351 -- 1544 km      (zone 3)
1913 -- 2106 km      (zone 4)
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The ESR 42m antenna (gain 45.3 dBi) has been used for transmission, the ESR 32m antenna (gain 42.5 dBi) for reception, which corresponds to an effective monostatic beam 3dB point at 0.46 degr off-axis (see the provided file gain_pattern.pdf). Both antennas have been pointed to azimuth 182.1, elevation 81.6. A constant transmission power of 0.85 MW has been assumed in the analysis, though a constant 0.80 MW would have been more accurate.

The ESR site is located at 78degr 09m N, 16degr 02m E (geographic), at an altitude of about 440 m.

The IPY measurement uses a 900 us pulse, with (a very high) 3750 repetion period. 64 such pulses are (coherently) integrated for detection.

A constant system noise temperature of 75 K, and receiver noise equivalent bandwidth of 500 kHz (matched to the 500 kHz complex sampling rate) has been used in the analysis.

The event_YYMMDD.txt files contain the following parameters

```
TM  Time of max Ratio, UT.
TX  Transmission power MW.
AZ  Azimuth degr, N=0, E = 90.
EL  Elevation degr.
RT  Max Ratio ( = estimate of sqrt(SNR_N)).
RG  Range km.
RR  Range rate (km/s).
VD  Doppler velocity (km/s), positive away from radar.
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AD Acceleration from VD, km/s^2.
DI Effective diameter cm. Estimated using Tsys 75K, Power and Range as in the table,
    Antenna gain 45.3 dB, Wavelength 0.600 m.
CS log10 of a lower bound of radar cross section, unit = 0.1 mm^2. Estimated as DI.
TS (Transmission sample power)/(Noise power), dB, arbitrary reference point.
EN Event number.
ED Event duration, seconds.
TP Transmission sample power, dB, arbitrary reference point.
MT Flag, set if multiple target in the data suspected.

XI = ipy_5000

NaN = Bad.