

Cluster EFW Operations

Boundary conditions

- EFW is part of WEC
- Master Science Plan regulates telemetry allocation to WEC, and thus all our possibilities. Available at <http://jsoc1.bnsc.rl.ac.uk/>
- JSOC coordinates all instrument planning
- DWP team in Sheffield coordinates WEC
- Planning lead time about 3.5 weeks
- Some params can be changed ~1 week in advance

Most used real time sampling

- NM telemetry (1.4 kbit/s):
 - 2 E-field signals (V12, V34), 25 S/s, 10 Hz filter
 - 180 Hz filter on SC2 (also all s/c August 2001)
 - SC1 and SC3 up to Sep 2003: (V2, V34)
 - SC1 and SC3 from Oct 2003: (V23, V34)
 - 4 single probe signals, 5 S/s, 10 Hz filter
- BM1 telemetry (15 kbit/s):
 - 2 E-field signals (V12, V34), 450 S/s, 180 Hz filter
 - SC1 and SC3 as for NM above
 - 4 single probe signals, 5 S/s, 10 Hz filter

E-field bias settings

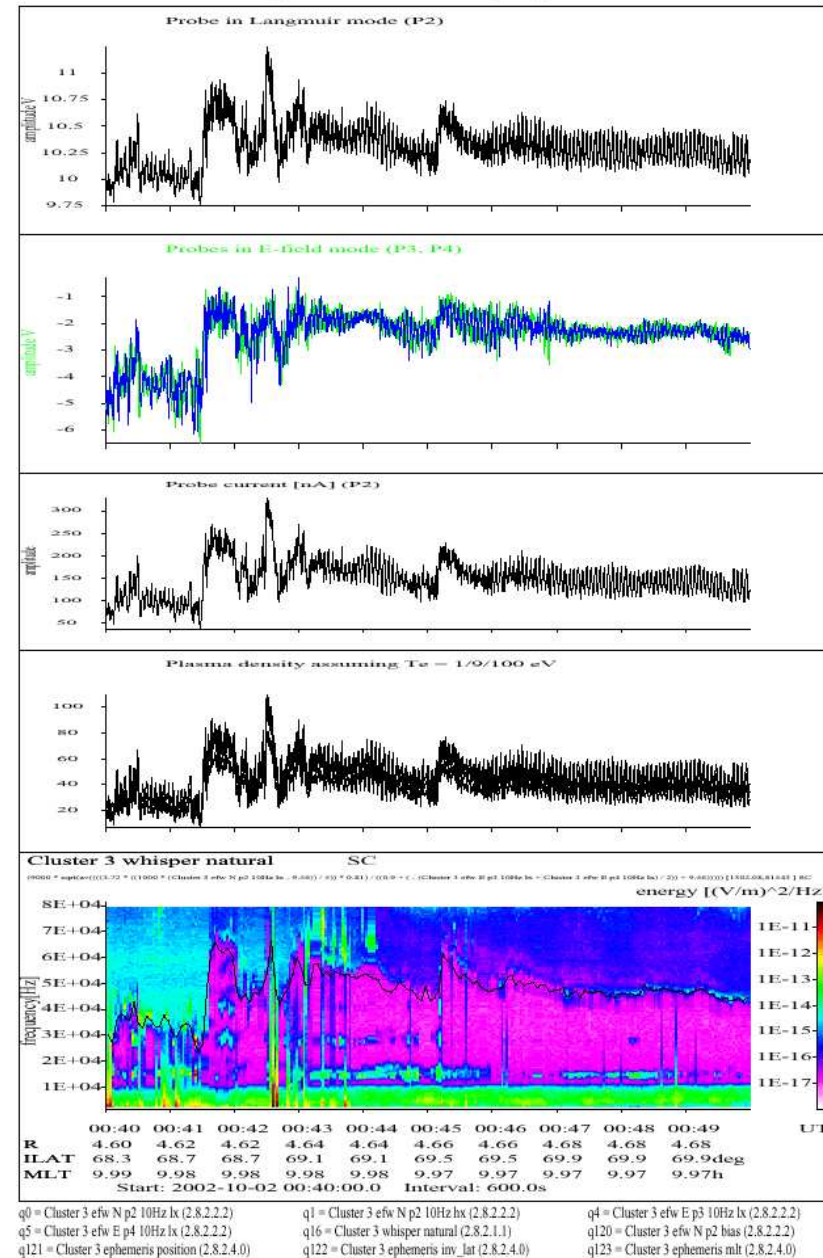
- Bias current set to probe
 - until April 2001: P12 -180 nA, P34 -220 nA
 - May 2001: -180 nA on all
 - June 2001 onwards: -140 nA on all
- Voltage offset on puck +1 V
- Voltage offset on guard -6 V
- Extensive tests during commissioning

Occasionally used modes

- In BM1 telemetry, EFW can get more than 15 kbit/s (at the expense of other WEC instruments), allowing:
 - 3 signals (V12, V3, V4) at 450 samples/s
 - 4 signals (V1, V2, V3, V4) at 450 samples/s
 - **Can be used after motivated requests! Please!**
- Possible to put ± 40 V voltage bias on any probe (Langmuir mode)

Langmuir mode

- Probe at bias voltage
- Intricate calibration:
 - $I = (V_{\text{meas}} - V_{\text{bias}})/R$
 - $R = 5 \text{ Mohm}$
 - Different calibration for V_{meas} and V_{bias}
- Occasionally used on P2 on SC13
- Works well in dense plasmas
- More spin modulation than in V_{ps}
- Scientific and diagnostics use
- Not studied in detail by anybody
- Used on demand = very seldom, essentially autumn 2002



EFW bias sweeps

- Brief (few seconds) bias sweeps are routinely made to determine:
 - photoelectron emission
 - sheath resistance (wave diagnostics)
 - plasma
- Current as well as voltage sweeps made
- Current sweeps too fast until spring 2003
- Bug made sweeps too infrequent until Dec 2002
- Voltage sweeps apparently buggy
- Room for improvement!

EFW internal bursts

- We have two ADCs sampling at 36 kS/s and can sample:
 - with loss of real-time TM: 2 x 36, 4 x 18, 8 x 9 kS/s
 - without loss: 2 x 18, 4 x 9, 8 x 4.5, 8 x 2.25, 8 x 0.9, 8 x 0.45 kS/s
- Internal memory of 1 Mbyte
- Analog quantities that can be sampled
 - Unfiltered: V1, V2, V3, V4
 - 50 Hz - 8 kHz filter: V12, V34
 - 4 kHz filter: V1, V2, V3, V4, BX, BY, BZ (STAFF)
 - 180 Hz filter: V1, V2, V3, V4, V12, V34
- Can trig burst on signal level
 - Any EFW quantity can be used to trig, or time tag
 - FGM trigger never fully tested (even by FGM team)

Burst settings

- Default settings used for pre-planned BM1 (~50% of all bursts)
- Default June 2001
 - V12, V34 at 18 kS/s, 50 Hz - 8 kHz, trig on BP12
- Default July 2001 - October 2002
 - V1, V2, V3, V4 at 9 kS/s, unfiltered, trig on V12M
- Default November 2002 - January 2004
 - V1, V2, V3, V4 at 9 kS/s, 4 kHz filter, trig on V12M
- Default from February 2004
 - V1, V2, V3, V4, BX, BY, BZ, 4 kHz filter, at 4.5 kS/s, trig on V12M or BP34
- Specials for SC1 and SC3 (broken P1):
 - Replace V1H by V3U, and V1U by V3H, trig on BP12
- Often used by manual commanding:
 - V1, V2, V3, V4, BX, BY, BZ at 450 S/s or 4.5 kS/s
 - Unfiltered data

Burst operations

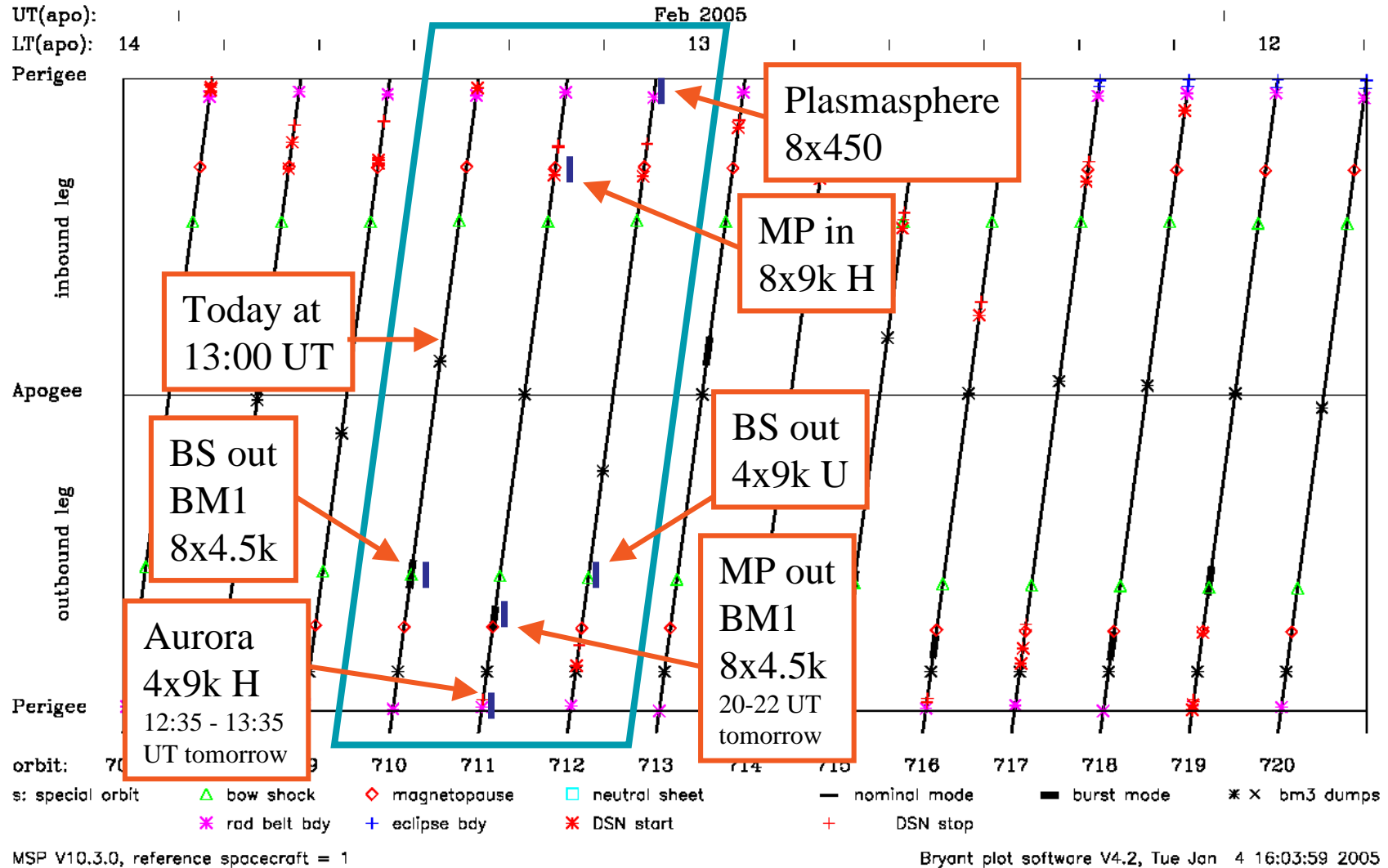
- Dumping of 1 MB memory unrealistic in NM telemetry (1.4 kbit/s)
- Special "BM3 dumps" get 6 minutes twice per orbit scheduled => 2 bursts/orbit
- Burst enabled almost all the time in 2001
- Now the burst is enabled for an interval of 30 min to a few hours in "interesting" regions

Burst scheduling

- Always a burst between memory dumps -- no wasted opportunities
- Baseline priorities for burst scheduling:
 - BM1 period (EFW 450 S/s)
 - Specific requests (e.g. E-parallel in aurora)
 - WBD period
 - MP, BS, aurora, NS, plasmopause, ...
- Requests **welcome!**

Operations example: PP247 (Feb 6-13, 2003)

CLUSTER Master Science Plan, Feb 2005



— Burst enabled

EFW operations

EFW team meeting 050207

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Information on operations

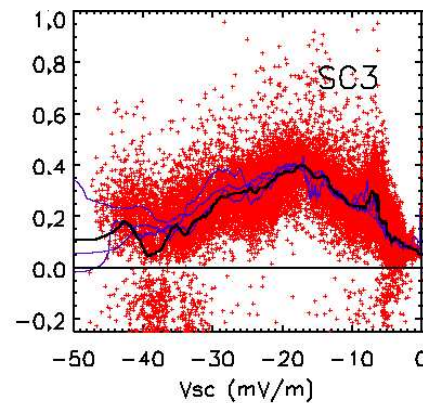
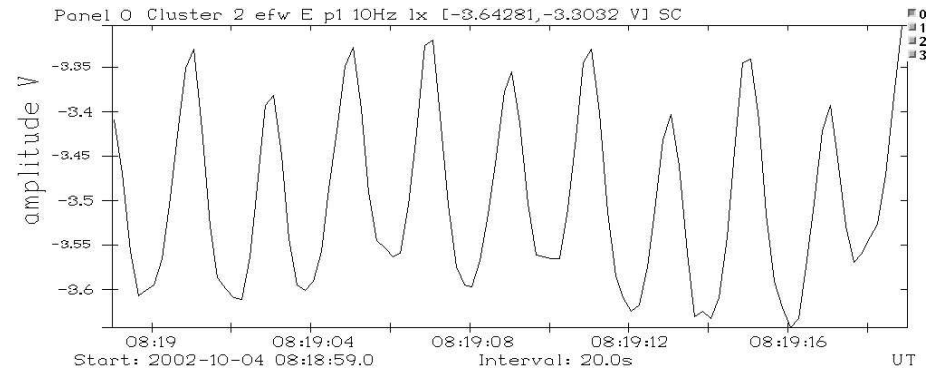
- JSOC - MSP, event files, ...
<http://jsoc1.bnsc.rl.ac.uk/>
- EFW operations page
<http://www.cluster.irfu.se/efw/ops>
 - Now in public domain, though some ESA info remain under access control

Who does what?

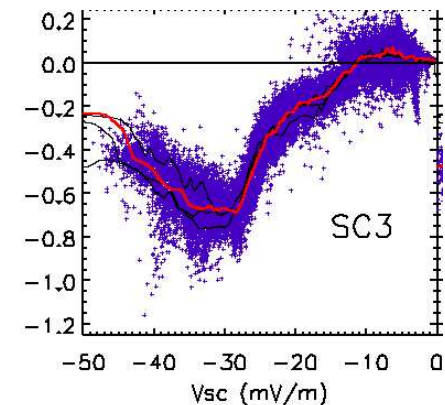
- JSOC presents MSP, iterated with Pis
- Sheffield (Ieuan Willis, Keith Yearby) coordinates WEC (weekly) through WEC ops group. *They do an important but laborious and rather thankless task to keep WEC running -- many thanks to Sheffield!*
- Anders E (aie@irfu.se) prepares EFW commands (weekly)
- Per-Arne (lindqvist@plasma.kth.se) fixes urgent problems
- Mail us (AIE, PAL, MA) if you discover a problem or **when you have an idea of something you want to do!**

Nominal data: Vps

- Probe-to-s/c potential often used as density proxy
- Spin modulation
- Will depend on
 - Total bias current
 - EDI current
 - ASPOC!



2 x fspin



4 x fspin

Nominal data: E

E-field offsets

- In spinning frame:
 - Probes are individuals
 - Boom length differences
 - Electronics offsets (ADCs)
- In despun frame:
 - Mainly due to photoelectron asymmetries in probe environment

