Field System
Status and New Features

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FS Linux Distributions

- FSL11 - Current
  - Based on Debian *Bullseye*
    - LTS expired in August 2026
  - 32- and 64-bit support
  - Improved RAID support
  - *gfortran* is stricter
  - *python2* support is weak (no *numpy*)
  - Expanded hardening for IT support
  - Requires FS *10.2*
- FSL12
  - Potential release last quarter 2026
  - Based on Debian *Trixie*
    - LTS expected until 2030
  - No *i386 (*no 32-bit support*)*
  - Stricter C compiler
  - No *python2*
  - Streamlined IT hardening (when available)
  - Other features TBD

FS *10.2.1* – Current Patch Release

- Tag *10.2.1* released in June 2025
- Five bugs fixed
  - Very long recorder `mk5_status/fb_status` response crash
  - `terminate` command refusing to terminate
  - *autoftp* not working for FSL11
  - `satellite` command failing after many uses
  - DBBC3 time display incorrect after changing to/from DDC_V personality or first use of DDC_V after boot
- https://nvi-inc.github.io/fs/releases/10/2/10.2/1.html
- You must install FS 10.2 before upgrading

FS *10.2.0* – Latest Feature Release

- Tag *10.2.0* released in December 2023
- Support for FSL11
  - FORTRAN typographic changes
    - Handling of hex/octal/binary constants, etc.
  - All *python* scripts are converted to *python3*
    - *python2* versions are still available
- Support up to 16-character experiment names
- DBBC3 support expanded
- DBBC3 T_{sys} display filtering for RFI
- Display server shuts down on FS `terminate`
- Simpler operator display for *onoff* output
- *plotlog* handles RDBE and DBBC3 log data
- *streamlog* utility to stream log and display data
- See the FS update notice for all the changes:
  - Uses “collapsible boxes” to simplify listing of changes
  - https://nvi-inc.github.io/fs/releases/10/2/10.2.html
- You must install FS 10.1 before upgrading

FS *10.3* – Fourth Quarter 2026

- Expanded DBBC3 support
- New required local SNAP procedures for setup
  - *skedf.ctl* keyword `lo_config` becomes a no-op
- `rxg_reload` command to reload *.rxg* files on the fly
  - If error in reloading, old values are retained
- `none` detector for *fivpt* and *onoff*
- *drudg* will handle phase-cal spacings >= 10.0 MHz
- *fesh* checking (`-C`) to verify files are up-to-date
  - With promoting to update if not
  - Files checked: *.skd*, *.vex*, *.txt*, *.snp*, and *.prc*
  - For astro *drudg* output is not updated
    - Running *drudg* is not supported for astro
    - Future: add running *drudg* for astro?
- *plog* redacts IP addresses from logs by default
- FSL12 support
- Other improvements

FS *10.3* – New Local SNAP Procedures

- Calls emitted by *drudg*
- `dbbc3_synth` – DBBC3 synthesiser configuration
  - Called from `setup`*`XX`*
- `ifd_local` – Local IF/LO commands
  - Called from `ifd`*`XX`*
  - Replaces `lo_config` procedures/commands
    - Existing ones can be called from `ifd_local`
  - *skedf.ctl* keyword `lo_config` becomes a no-op
- `setup_local` – Additional local commands
  - Called from `setup`*`XX`*
- *`mk6_config`* – Mark 6 recorder configuration
  - Analogous to `fb_config`, but for Mark 6
  - Called from `setup`*`XX`*

FS *10.3* – Expanded DBBC3 support

- New `core3h_mode reset` usage options
- More firmware versions supported
- Reworked handling of multicast time-outs
- T_{sys} monitor display enhanced
- Reliable Core3H time monitoring
- *fmset* implemented
- Synthesiser support
- Gain locking fix for onoff/fivpt?

FS *10.3* – `core3h_mode reset` Options

- Possible path to mode changes without re-syncing
- Previously only “checking” (default) or `force` (setting)
  - Checking only verifies Core3H configuration
  - `force` require a re-sync afterwards
- New options:
  - `keepsync` – add `keepsync` to `reset`
  - `noreset` – skip `reset`
  - `resetlast` – move `reset` after `vdif_frame`
  - `keepsynclast` – `resetlast` but add `keepsync`
- Users can experiment to find out what works
  - Initial tests suggest that `keepsync` may be good
  - If one is reliable, it can be made the default locally
    - `FS_DBBC3_CORE3H_MODE_FORCE_DEFAULT`
      - This environment variable changes the default
      - *drudg* output uses the default

FS *10.3* – More Firmware Versions Supported

- Fully support DDC_E v126
  - This was only partially supported before
- Support for new versions (differences from priors)
  - DDC_E v127, v128
    - `splitmode off`
    - `inputselect vsi1-2`
  - DDC_V v126
    - Up to 32 channels (16 BBCs)
    - `inputselect vsi1-2`
    - Multicast has time, includes VDIF epoch

FS *10.3* – Improved Multicast Handling

- Multicast does not arrive every second for some firmware versions
  - Calibration data is decimated by period of the messages
    - For example, if messages are every other second only half the calibration data is available
- Time-out is now five seconds
  - Only significant problems should cause a time-out
- The delay can be set, per version, in *dbbc3.ctl*
- If more than 10% of the expected message are lost
  - A warning issued
  - The threshold is adjustable

FS *10.3* – T_{sys} Monitor Display Enhanced

- New optional “panel” mode
  - All IFs in use are displayed
    - Row x Columns: 1x1, 1x2, 1x3, 1x4, 2x3, 2x4
    - Option to separate them by polarization (aceg/bdfh)
  - All BBCs in use are displayed
  - Can set minimum number of IFs and BBCs to display
  - 2x4 IFs was pioneered by Abel Garcia-Castellano at Santa Maria
- Tells the user if the window is not big enough
  - User can drag the window to the needed size
  - Can interactively switch back to 1x1 (non-panel)
  - The size needed for *.Xresources* is displayed
- Non-panel can optionally display one polarization only
  - Could use two non-panel windows, one per pol
- Side-band order of T_{sys} now agrees with IF/RF display selection
- `Time` is only displayed for firmware versions that send time in multicast
  - Seems obvious, but initially it was comforting to always see “ticking”
- Now `Arrival` time is true arrival relative to PPS
  - Not modulo 100 centiseconds
  - Can be used to set arrival time in *dbbc3.ctl*
- New `Age` value (seconds) shows how long since last message

FS *10.3* – Core3H Time Monitoring

- Multicast is not a reliable way to monitor time
  - But can be to find one second boundaries
    - FS *setcl* time model uses multicast arrival time
- New `core3h_time` command
  - Checks one Core3H board at a time
  - Displays number of seconds off from FS time
    - `0` is the expected value
  - Should not be used during recording
    - Calibration data will be lost
  - Requires NTP or FS time model defined by *setcl*
- `dbbc3_time` procedure checks all Core3H boards
  - Can be used in `sched_initi` or other times when not recording
- `core3h_time=next` check “next” board cyclically
  - Can be used in `checkfb` to progressively check all boards

FS *10.3* – *fmset* Implemented

- Allows checking and setting Core3H board times
  - Only use when not recording
- = command sets arbitrary time
- Includes + and − commands for one second adjustments
- `s` command sends `pps_sync`
- Provides a guided path for setting/checking time:
  - Verify all `pps_delay` values are small, sync if not
  - Check all Core3H board times, correct if wrong
  - Reverify `pps_delay` values,
    - If resync needed, repeat entire process
- Similar to `core3h_time`
  - Requires NTP or FS *setcl* time model

FS *10.3* – DBBC3 Synthesiser Support

- New `synth_mode` command for setting/checking
  - Should not be used during recording
    - Calibration data will be lost
- New `ext_lo` command to define external LO configuration
  - The `lo=…` command defines the net LO
    - Schedules do not include the local external LOs
  - `ext_lo` defines a table of external LO values per net LO
    - All net LOs can be included
  - `synth_mode` uses `ext_lo` information to select the synthesiser value for an IF
- Each DBBC3 station defines a local `dbbc3_synth` procedure
  - Called from `setup`*`XX`*
  - Uses `ext_lo` and `synth_mode`
  - In principle, does not to be changed for different bands
- `synth_check` procedure checks all synthesisers
  - Can be used when `setup`*`XX`* had been run AND not recording
- `synth_mode=next,*,*,check` checks “next” synthesiser cyclically
  - Can be used in `checkfb` to progressively check all synthesisers
- See `help=synth_mode` and `help=ext_lo` for details
  - The former includes a table of useful external and net LO frequency and sideband combinations and the needed pre-filter sidebands

FS *10.3* – Gain Locking for `onoff`/`fivpt`

- We are still working on this
- Automatic IF gain locking appears to be unreliable
- Attempt to manually set gain to the current value
  - This also appears to be unreliable
  - Iterate
    - If it fails too many times, end with an error
      - Returned to AGC

DBBC3 T_{sys} Filtering (FS *10.2*)

- Goal: Remove RFI from T_{sys} display to make more useful
- T_{sys} values are averaged for continuous cal
- Sets a per IF threshold for data clipping
- `cont_cal=on,,,,,1,`*`ifa`*`,…,`*`ifh`*
  - `1` -- enable filtering
  - `if`*`x`* – percentage of average for clipping
    - For example, if *`ifa`* is `20`
      - Data more than ±20% from average is clipped
  - Average is in color if clipping is occurring
    - 1-2 times in a row, background color is green
    - 3-5: yellow
    - 6 or more: red
  - Hidden short-term average
    - If red clipping and short-term average is more than the set percentage from long-term average, then the long-term average is reset to the short-term average
    - When a reset occurs the background is blue one time
  - Can also reset all manually with `tpicd=reset`

FS Future Features

- DBBC3 8-bit support
- Inclusion of `atm`
- Support for chopper wheel T_{sys}
  - *.rxg* file change
  - *antabfs* support?
- *drudg* VEX2 support for current 1/2-bit
- Phase-cal detection/display
- `holog` improvements
  - Improved horizon mask tools
  - Add termination procedure
  - Support for FlexBuff
- Other solar system objects
- Provide mean coordinates for Sun and Moon
- Allow station *.ctl* files to be in */usr2/st/control* (Better *git* support)
- DBBC3 firmware v13*x*

plotlog – plot log data utility

- Plots many types of ancillary data found in logs:
  - weather, clocks, T_{sys}, Recorder performance
  - Phase-cal, Cable, CDMS, Receiver
  - More can be added
- Using it is simple, e.g., to plot to X11 display:

```
cd /usr2/log
plotlog vo2230oe.log
```

- Command line options available for:
  - File output
  - Selecting which items to include
  - Different slices of:
    - DBBC3/RDBE T_{sys}
    - RDBE Phase-cal
  - Control scaling of some plots
- Command line options can be placed in script or alias
  - Easy reuse

plotlog - improvements in FS *10.2*

- DBBC3 and RDBE data
- Wind speed and direction
- Expand clock coverage:
  - `maser`, `fmout`, `gps`, `dot2gps`, `dot2pps`, `pps2dot`, `setcl`
  - Multicast and command output for DBBC3, RDBE
- Recorder performance
  - Late start, recording short, missing bytes
- CDMS
- Support *giza* for FSL11
- *plotlog* with no log specified
  - Current FS log, plotted on display
- More command line options to control features
- Other improvements …, see **`plotlog -h`**

plotlog - possible future improvements

- Hardcoded
  - Late `preob` - schedule is running late
  - `preob` running long
  - Late onsource
  - Onsource time lost in scans
  - Station specific data – contact Ed
  - Limited syntax for user extensions
  - Other suggestions …
- A different option: *logpl*
  - Offers user extensible selections
  - Plot data versus time or versus other data
  - Can be run interactively or from a script