TOW2023 - Maintenance Workshops

FS Operations

Alexander Neidhardt (TUM Wettzell)

Experience level: Beginners.

Description: This course describes the general structure of the NASA Field System, including important control files, program locations, handling, and so on. We will take a look into installation and setup. Main part is the use of the FS and the adaption of the PC for the Field System.

Thanks for input from Simon Seidl (TUM Wettzell),
Ed Himwich (NVI), Katherine Pazamickas (PERATON),
Christian Plötz (BKG Wettzell

Code: FSo1, FSo2

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FS Operations

Where can I get it from?
What is new?
How to install?
Where can I find what on the FS PC?
How to interact with the FS?
How to configure the FS?
What does a station has to offer to the FS?
How to command the FS?
How to run a schedule with the FS?
How to monitor system quality?

TOW2023 - Maintenance Workshops

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Where can I get it from?

FS Linux (FSL)
https://github.com/nvi-inc/fsl10
https://github.com/nvi-inc/fsl11

GitHub

Field System
https://github.com/nvi-inc/fs

Table 1. FSL distributions

FS Linux	Release Name	Debian Version	Linux kernel	Year
1		(Slackware)	*1.2.<x>*	1994
2	*bo*	*1.3.1*	*2.0.29*	1997
3	*hamm*	*2.0*	*2.0.34*	1998
	slink	*2.1*	*2.0.36*	1999
4	*potato*	*2.2*	*2.2.18*	2000
5	*woody*	*3.0*	*2.2.20/2.4.18*	2002
6	*sarge*	*3.1*	*2.4.27*	2005
7	*etch*	*4.0*	*2.6.18*	2007
8	*lenny*	*5.0*	*2.6.26*	2009
	squeeze	*6.0*	*2.6.32*	
9	*wheezy*	*7.0*	*3.2.0*	2014
	jessie	*8.0*	*3.16.0*	
10	*stretch*	*9.0*	*4.9.0*	2020
	buster	*10.0*	*4.19.0*	
11	*bullseye*	*11.0*	*5.10.0*	2023

32-bit

64-bit

Developer:
J.F.H. Quick
D.E. Horsley
W.E. Himwich

➔ Patch release FS 10.1.1 (2023-02-23)
➔ Aplha testing: FS 10.2
➔ Initial FSL11 release (2023-04-14)

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What is new?

https://github.com/nvi-inc/fsl10
https://github.com/nvi-inc/fsl11

New major features in FS 10.2:

- Support for FSL11.
- Support for the new longer IVS experiment names (session codes).
- The plotlog utility has been expanded to include plotting RDBE and DBBC3 data, and many other improvements.
- DBBC3 support has been improved, including support for personality DDC_E and swapping DBBC3 USB and LSB TPIs.

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How to install?

FS Linux 10 Installation Guide

J.F.H. Quick, D.E. Horsley, and W.E. Himwich – Version 1.6.0 - January 2022

https://nvi-inc.github.io/fsl10/

FS Linux 11 Installation Guide

J.F.H. Quick, D.E. Horsley, and W.E. Himwich – Version 1.0.0 - April 2023

https://nvi-inc.github.io/fsl11/

First stage installation

Debian installation

- In principal, a standard Debian installation
- Our suggestion: use PC with hardware RAID instead of SW RAID to get better performance and new on-the-fly harddrive changes
- Our suggestion: directly create account „oper“ instead of „Desktop user“ (4.8), otherwise fsadapt will create the user account
- Our suggestion: use standard GNOME desktop env., print server, SSH server, and standard system utilities

Second stage installation

Customization (for FS)

- FS Linux 10 package selection

```
git config -global http.proxy http://<<<your_proxy>>>
apt-get install git dselect
dselect update
cd /root
git clone https://github.com/nvi-inc/fsl10
cd fsl10
dpkg --set-selections < selections/fsl10_amd64.selections
(or dpkg --set-selections < selections/fsl10_i386.selections)
apt-get dselect-upgrade
apt-get clean
```

How to install?

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https://nvi-inc.github.io/fsl11/

Third stage installation

FS installation

- Call `./fsadapt` (=> shared mem.) as root

Window 1	Window 2	Window 3	Window 4
▪ gplot	▪ set_perms		▪ netssh
▪ systemd	▪ greeter		▪ netsmtp
▪ rtx	▪ serial		▪ netntp
▪ std..			▪ netipp
▪ fstab			▪ netmdns

- Set passwords and check groups
- Install FS

```
cd /usr2
git clone https://github.com/nvi-inc/fs fs-git
cd /usr2/fs-git
git checkout -q tag
make install
BECOME USER „prog"
cd /usr2/fs
make >& /dev/null
make -s

Eventually necessary to support GPIB (if previously deselected):
tar --no-same-owner -xvzf linux-gpib-4.0.3.tar.gz
cp ./gpib/linux-gpib-4.0.3/include/gpib_user.h /usr/include/gpib/.
```

How to install?

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Appendix

Tuning

- Optimise system as described in manual
- Individual software for local use:
  nvidia, autossh, automake, snmp, libmodbus, …
- Special suggestions for security/safefty:
  - Screensaver policy (for a machine control system deactivated);
    Settings=>Privacy=>Screen Lock; Settings=>Power=>Power Saving;
    edit /etc/systemd/sleep.conf and add:

```
AllowSuspend=no
AllowHibernation=no
AllowSuspendThenHibernate=no
AllowHybridSleep=no
```

  - Disable „root“ login via SSH and force key use in /etc/ssh/sshd_config:

```
PermitRootLogin no
PubkeyAuthentication yes
PasswordAuthentikation no
```

  - Set „xhost +“ in .bashrc of user „oper“ (or restrict it to „prog“ and „root“)

How to install?

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FS Linux 11 Installation Guide

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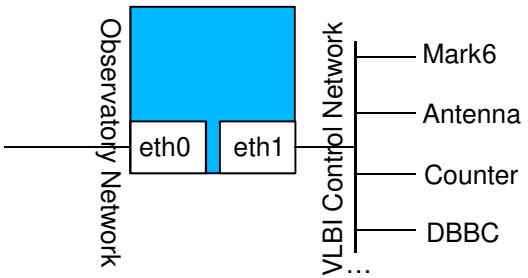
https://nvi-inc.github.io/fsl11/

Appendix cont.

Tuning

- Special suggestions for security/safefty (cont):
  - Use FS PC as dual-homed host (with filter tables)



  - Allways use firewall „ufw“ and define rules, e.g.

```
ufw allow from 192.168.4.25 to any port 10162
...
ufw enable
```

How to install?

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FS Linux 11 Installation Guide

J.F.H. Quick, D.E. Horsley, and W.E. Himwich – Version 1.0.0 - April 2023

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Appendix cont.

Tuning

- Special suggestions for customization:
  - Create shortcuts Ctrl – Shift – [2-7] for the different monit windows and Ctrl – Shift – t for fmset (see later)
    Debian-settings ➔ Kayboard ➔ Shortcuts, e.g.
    xterm –e /usr2/fs-git/bin/monit2 ➔ Shortcut Ctrl – Shift – 2
  - Define a Desktop icon to start the FS and set window positions, fonts, etc.

„/usr/share/application/fs.desktop"

```
[Desktop Entry]
Version=1.0
Name=Nasa Fieldsystem
Comment=Start Fieldsystem
Exec= /usr2/oper/Desktop/fsWindow.sh %U
Icon= /usr2/oper/Pictures/RTW.PNG
Terminal=true
StartupWMClass=fs
Type=Application
Categories=categroy of the application
MimeType=Type of application it should open
```

„/usr2/oper/Desktop/fsWindow.sh"

```
#! /bin/bash

xterm -e fs &
sleep 1
```

„/usr2/oper/.Xresources", e.g.

```
! oprin
oprin.title:              Operator Input
oprin*geometry:           95x5+0+1100
oprin*scrollBar:          true
oprin*saveLines:          100
oprin*VT100.Translations:       #override\
```

width in font size
height in font size
X-pos in pixel
Y-pos in pixel

How to install?

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J.F.H. Quick, D.E. Horsley, and W.E. Himwich – Version 1.6.0 - January 2022

https://nvi-inc.github.io/fsl10/

FS Linux 11 Installation Guide

J.F.H. Quick, D.E. Horsley, and W.E. Himwich – Version 1.0.0 - April 2023

https://nvi-inc.github.io/fsl11/

Or update older versions
Update < 10 ➔ 10.1 ➔ 10.2 ➔ 11

https://https://nvi-inc.github.io/fs/releases/10/0/10.0.0.html/

FS 10.0.0 Update Notes

E. Himwich, D. Horsley, J. Quick, J. Gipson – Version 3.7 - February 2023

But better (my personal opinion):

- Install a completely new computer with 64-bit Debian
- Install FSL10 or greater for 64-bit and latest FS version
- Copy your station code
- Go manually through control files and change them accordingly
- Go manually through your code and change it manually to int, where required (so that you can also validate address operations etc.)

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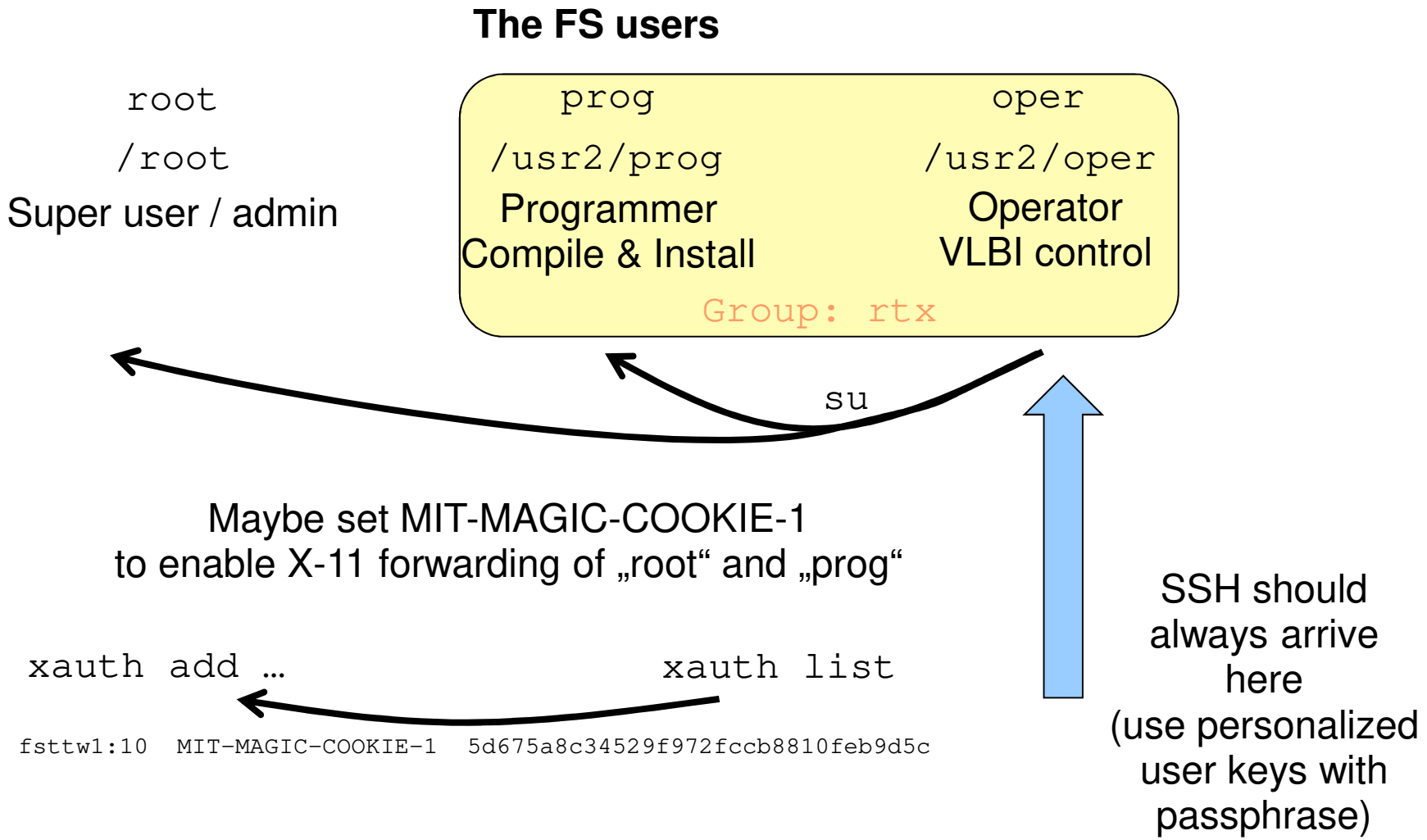
Where can I find what on the FS PC?



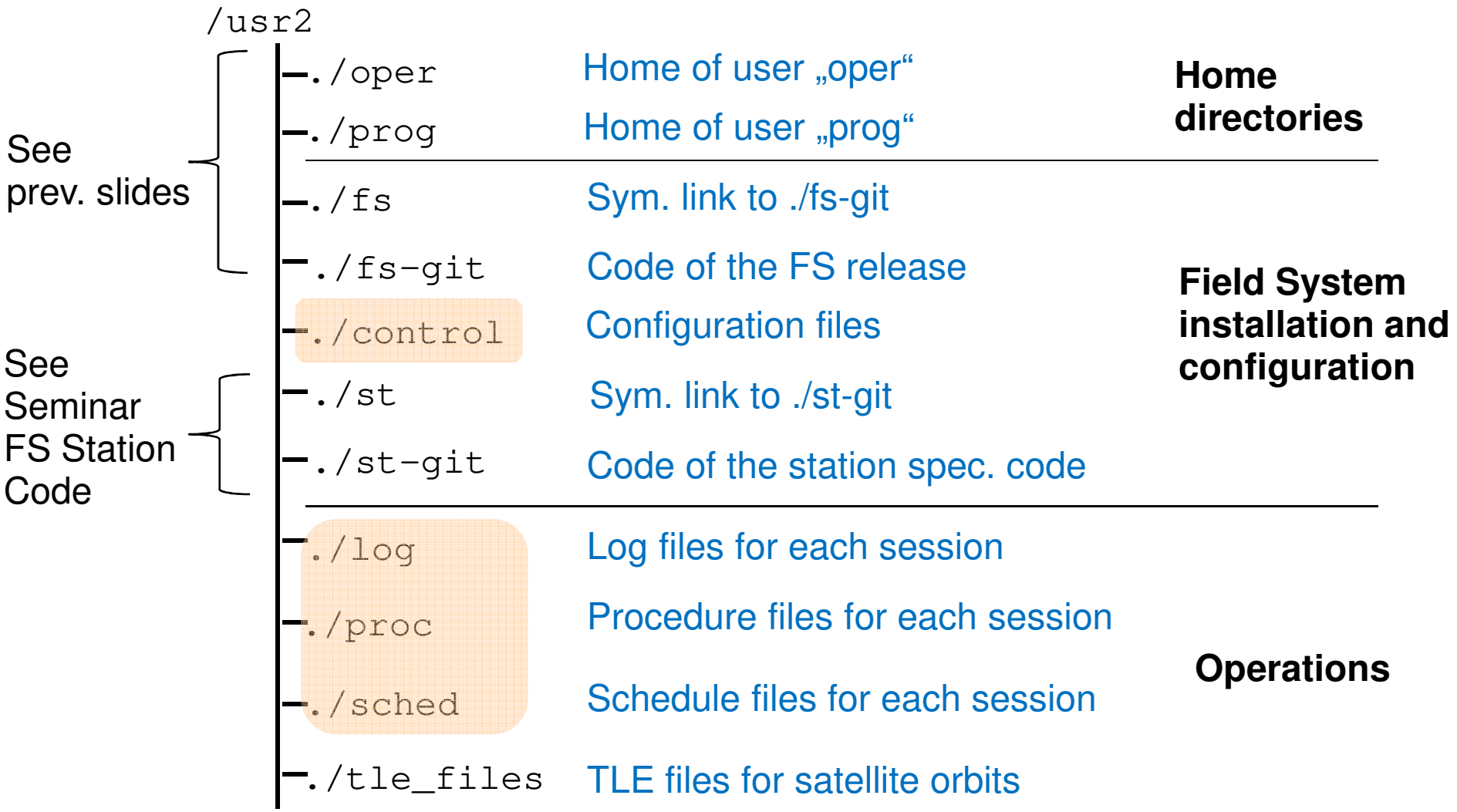
Where can I find what on the FS PC?

The directory structure

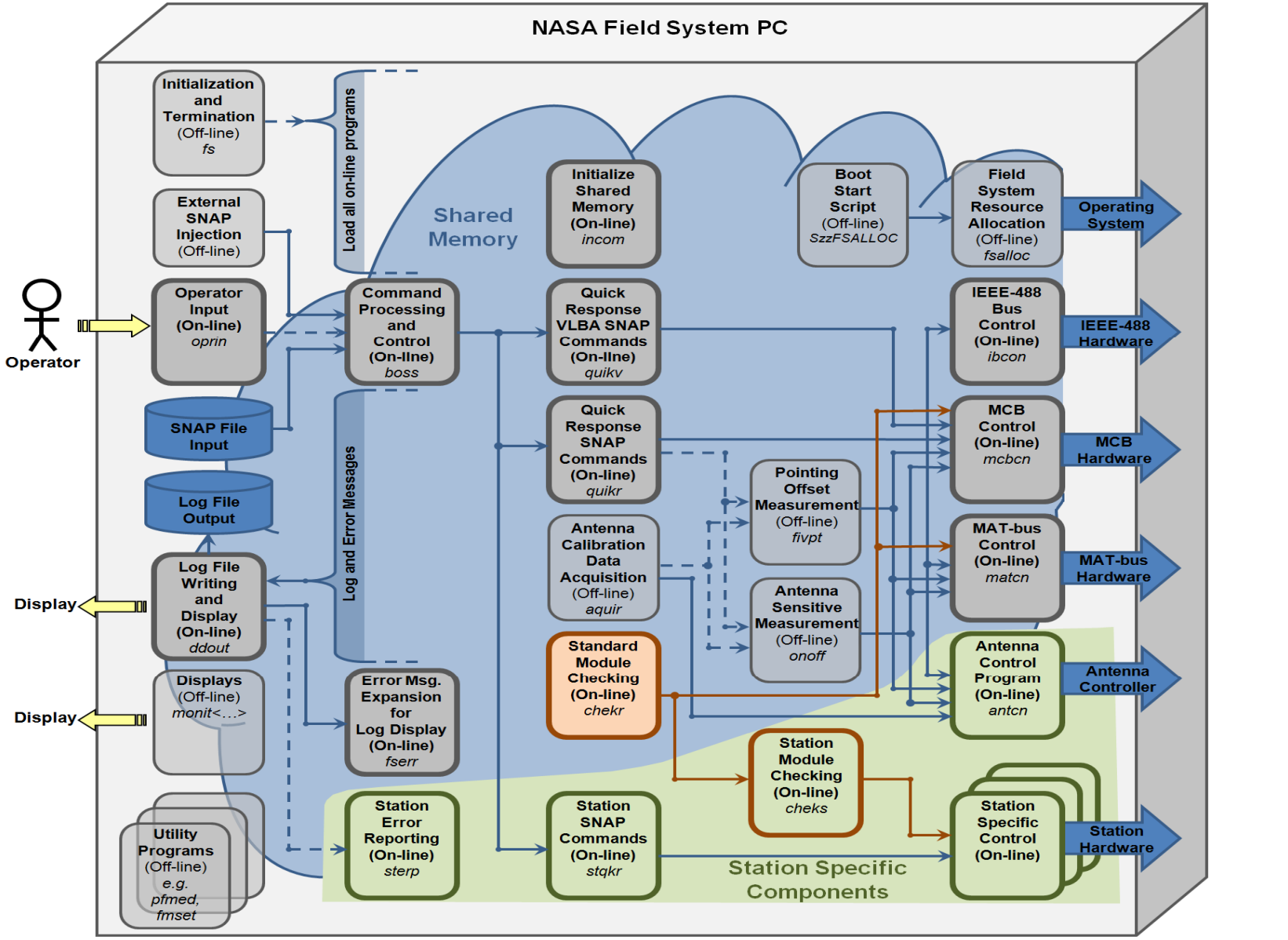
/usr2		
├─./oper	Home of user „oper“	**Home directories**
├─./prog	Home of user „prog“	
├─./fs	Sym. link to ./fs-git	**Field System installation and configuration**
├─./fs-git	Code of the FS release	
├─./control	Configuration files	
├─./st	Sym. link to ./st-git	
├─./st-git	Code of the station spec. code	
├─./log	Log files for each session	**Operations**
├─./proc	Procedure files for each session	
├─./sched	Schedule files for each session	
├─./tle_files	TLE files for satellite orbits	

Where can I find what on the FS PC?

The directory structure



Where can I find what on the FS PC?



TOW2023 - Maintenance Workshops

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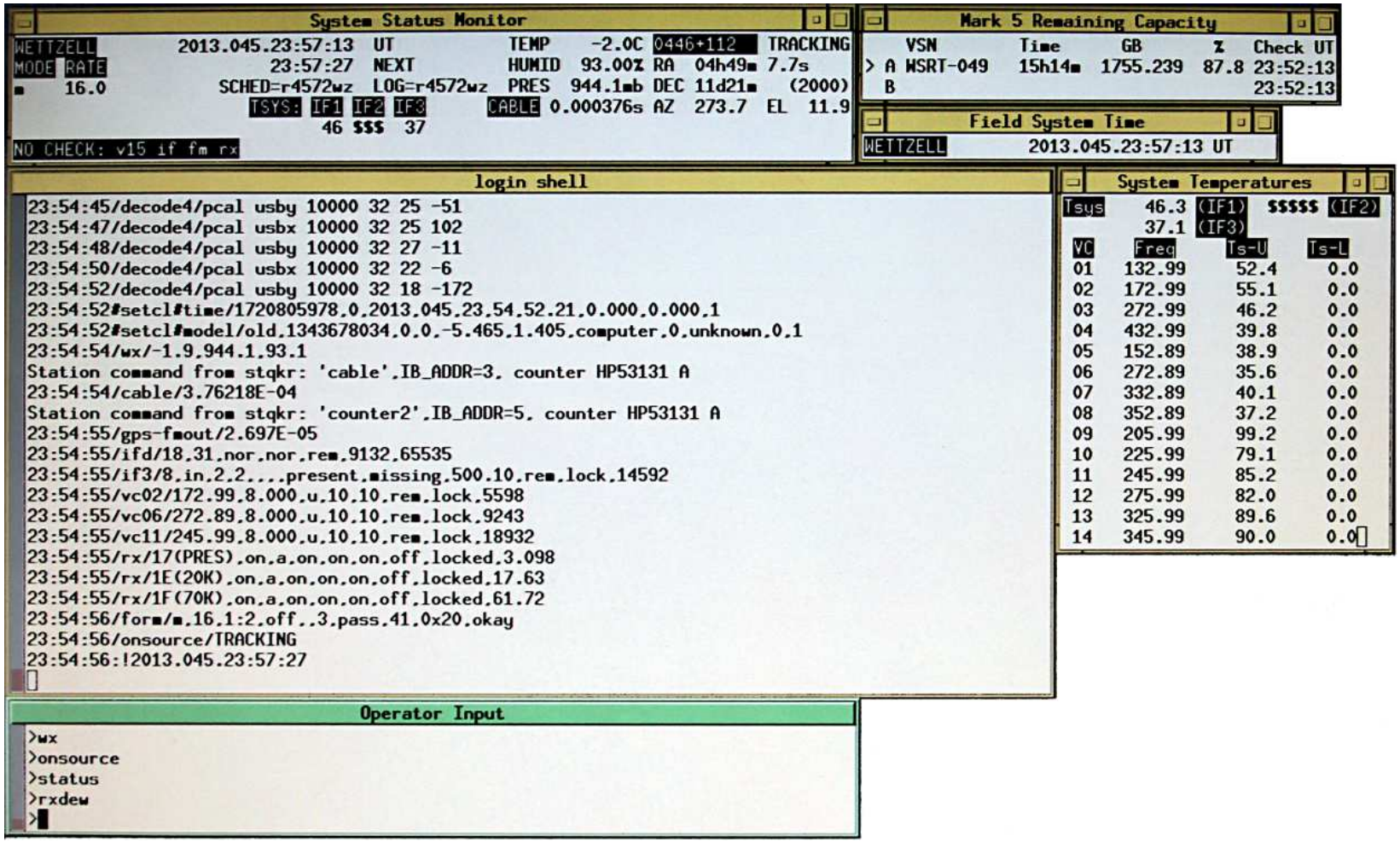
How to interact with the FS?

Start and stop the FS

Start: Enter `fs` in an xterm or in the login shell



Stop: Enter `terminate` in the Operator Input and confirm with „Y“es

How to interact with the FS?

FS Windows
„System Status Monitor“
(`monit2`)

```
WETTZELL          2023.108.21:46:42  UT            TEMP      7.2C 0133+476    SLEWING
MODE  RATE                21:49:42  NEXT          HUMID   99.70% RA   01h36m58.6s
                 SCHED=none         LOG=station   PRES   951.5mb DEC  47d51m    (2000)
                    TSYS:  IFA  IFB  IFC  IFD  CABLE 0.006382s AZ   347.7  EL    8.4
                            43   75  102  -35

NO CHECK: rx
```

How to interact with the FS?

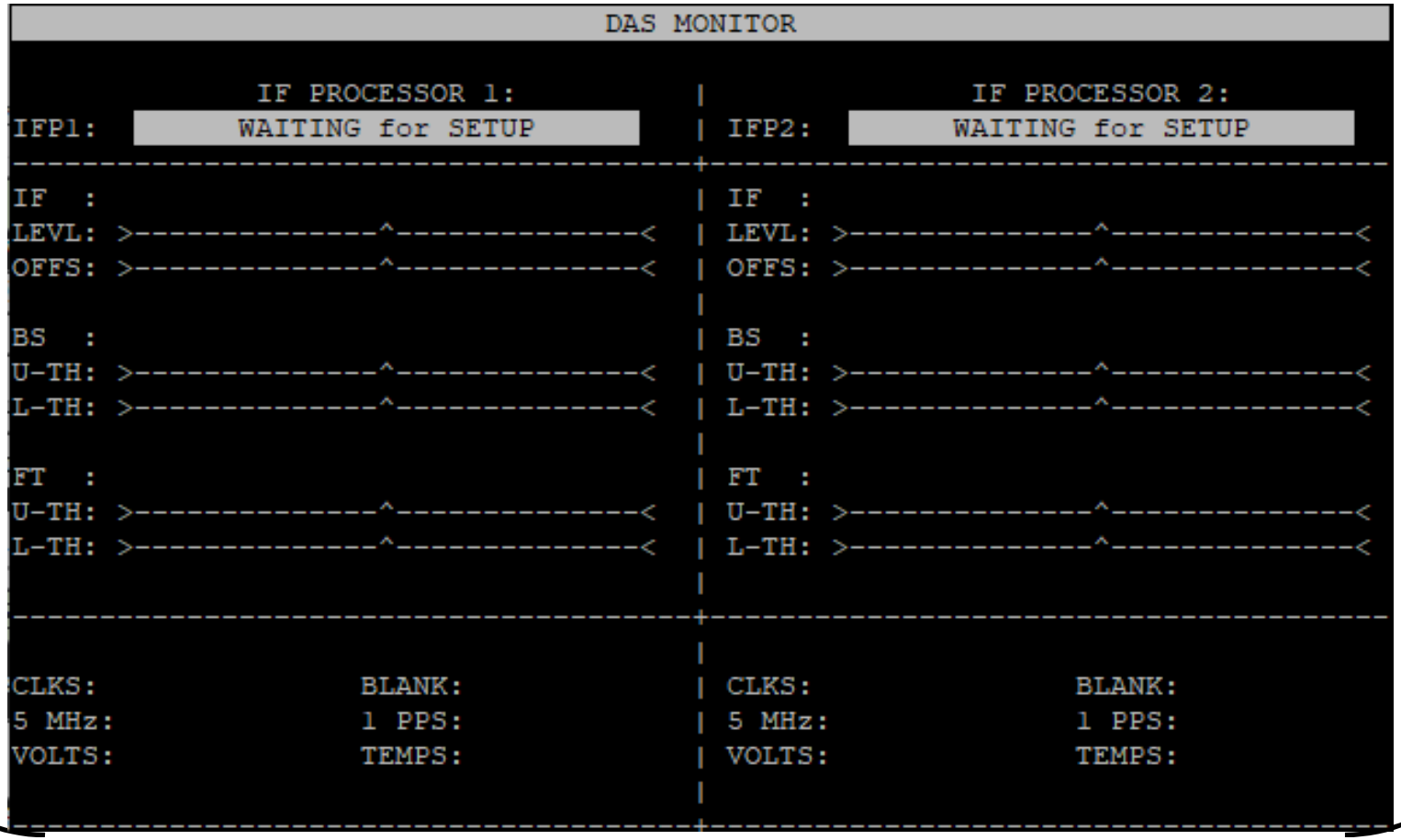
FS Windows
„System Temperatures“
(`monit3`)

Tsys	42.6	(IFA)	74.7	(IFB)
	101.5	(IFC)	-35.7	(IFD)

BBC	Freq	Ts-U	Ts-L
01	132.99	57.3	55.6
02	172.99	64.9	
03	272.99	48.3	
04	432.99	48.4	
05	652.99	57.0	
06	772.99	47.8	
07	832.99	47.9	
08	852.99	53.3	49.8
09	205.99	74.5	
10	225.99	81.2	
11	245.99	97.5	
12	275.99	108.9	
13	325.99	85.8	
14	345.99	81.7	
15			
16			

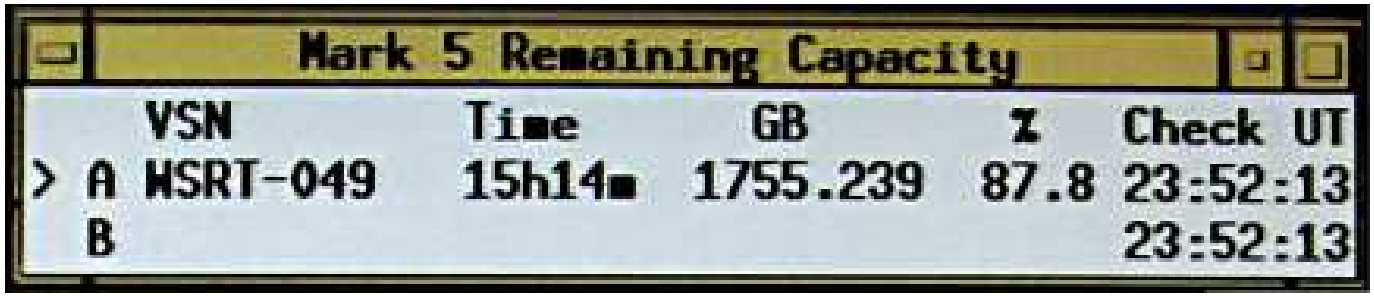
How to interact with the FS?

FS Windows
„LBA Data Acquisition System Monitor“
(monit4)



How to interact with the FS?

FS Windows
„Mark5 Remaining Capacity“
(`monit5`)



How to interact with the FS?

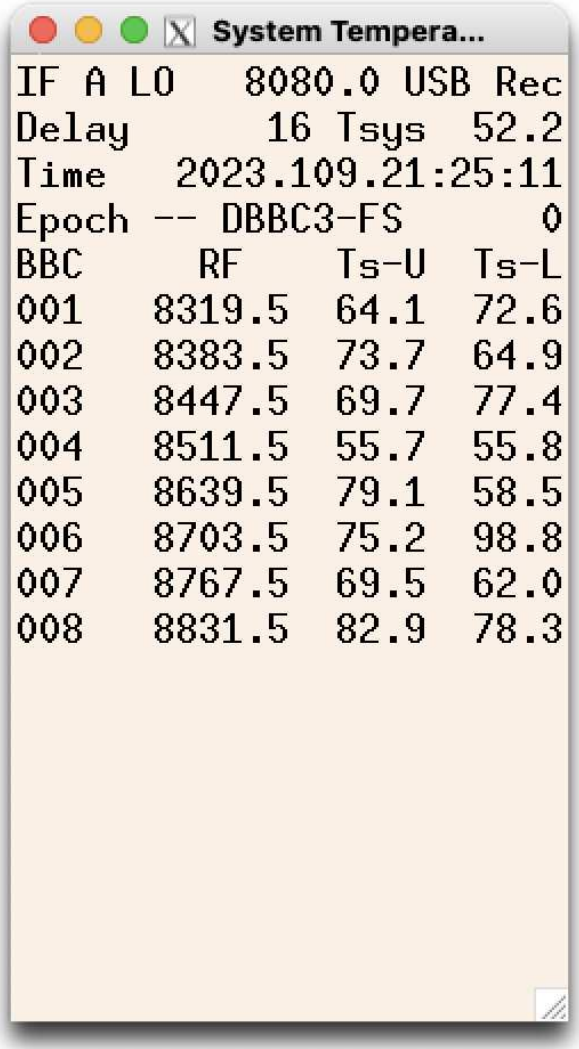
FS Windows
„RDBE Monitoring“
(`monit6`)

RDBE Monitor

RDBE	DOT	EPOCH	DOT2GPS	DOT2PPS	IF	RMS	IF0	TSys	IF1	TSys	Tone	Amp	Phase
a	2023.108.22:25:01	46	-71.121	-0.020	1	2.5	Avg	$$$$$	Avg	$$$$$	1a0030	0.1	-152.9
b	2023.108.22:25:01	46	-71.125	-0.020	1	19.9	Avg	34.6	Avg	41.8	1b0030	88.0	-161.4
c	2023.108.22:25:01	46	-71.121	-0.020	1	19.1	Avg	29.2	Avg	32.6	1c0030	64.7	-10.0
d	2023.108.22:25:01	46	-71.125	-0.020	1	20.1	Avg	43.1	Avg	39.5	1d0030	25.0	-102.?

How to interact with the FS?

FS Windows
„System Temperatures of DBBC3“
(`monit7`)



How to interact with the FS?

FS Windows
„ fmset“

```
fmset - VLBA & Mark IV formatter/S2-DAS/S2-RT/Mark5B/FiLa10G time set

     FiLa10G         22:03:47.0 UT  18 Apr (Day 108) 2023
     Field System    22:03:47.1 UT  18 Apr (Day 108) 2023 model: computer
     Computer        22:03:47.1 GMT 18 Apr (Day 108) 2023 NTP: unknown

     Use '+'     to increment FiLa10G time by one second.
         '-'     to decrement FiLa10G time by one second.
         '='     to be prompted for a new FiLa10G time.
         '.'     to set FiLa10G time to Field System time.
         's'/'S' to sync FiLa10G (VERY rarely needed)
         <esc>   to quit: DON'T LEAVE FMSET RUNNING FOR LONG.
```

How to interact with the FS?

Individual FS Station Windows
„ Antenna Monitoring“

Antenna Monitoring		
RTW ([2023].108.22:02:52:714 (Offset: 0 msec))		
Azimuth	Source: Stop	Elevation
59.9789	Actual Pos.	25.0383
	Pos. Graph	
59.9789	Commanded Pos.	25.0383
350.4344	NASA FS Pos.	7.8963
0.0000	Com. Pos. Offset	0.0000
STOP	Status	STOP
Status messages		
[Azimuth] Stop Stow pin retracted	[General] ACU type: RTW Reduced internal limits che Green mode inactive	[Elevation] Stop Stow pin retracted
Error messages		

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How to configure the FS?

Control files `/usr2/control`

`antenna.ctl`	Antenna control file (diameter, speed, …)
`dev.ctl`	Devices (GPIB, Mark III, **antcn**, …)
`time.ctl`	FS Timing (**Computer NTP**, Recorder, …)
`skedf.ctl`	Drudg (Printer, …)
`location.ctl`	Location of the site (Long, Lat, Height, …)
`flagr.ctl`	Antenna on/off-source check interval
`rxg_files/s.rxg`	Receiver parameter S-band
`rxg_files/x.rxg`	Receiver parameter X-band
`equip.ctl`	Equipment control file (BBC, recorder, …)
`rdbe.ctl`	RDBE control file
`fila10g_cfg.ctl`	FILA10g control file
`dbbad.ctl`	Control file for first DBBC (**IP, Port,** …)
`dbba2.ctl`	Control file for second DBBC (**IP, Port,** …)
`mk5ad.ctl`	Mark5 control file (**IP, Port,** …)
`mk6ca.ctl`	Mark6 control file (**IP, Port,** …)
`sterr.ctl`	Station error numbers and corresponding text
`stcmd.ctl`	Station specific commands
`stpgm.ctl`	Start of station specific programs
`...`	

See Seminar FS Station Code

How to configure the FS?

Control files `/usr2/control`

`antenna.ctl`	Antenna control file (diameter, speed, …)
`dev.ctl`	Devices (GPIB, Mark III, **antcn**, …)
`time.ctl`	FS Timing (**Computer NTP**, Recorder, …)
`skedf.ctl`	Drudg (Printer, …)
`location.ctl`	Location of the site (Long, Lat, Height, …)
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`rxg_files/s.rxg`	Receiver parameter S-band
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`equip.ctl`	Equipment control file (BBC, recorder, …)
`rdbe.ctl`	RDBE control file
`fila10g_cfg.ctl`	FILA10g control file
`dbbad.ctl`	Control file for first DBBC (**IP, Port,** …)
`dbba2.ctl`	Control file for second DBBC (**IP, Port,** …)
`mk5ad.ctl`	Mark5 control file (**IP, Port,** …)
`mk6ca.ctl`	Mark6 control file (**IP, Port,** …)
`sterr.ctl`	Station error numbers and corresponding text
`stcmd.ctl`	Station specific commands
`stpgm.ctl`	Start of station specific programs
`...`	

See Seminar FS Station Code

How to configure the FS?

Control files `/usr2/control/antenna.ctl`

```
*******  Antenna Control File  *******
*
   13.2         Antenna Diameter (meters)
  720.          HA/AZ/X Slew Speed (deg/min)
  360.          DEC/EL/Y Slew Speed (deg/min)
  -90.0         HA/AZ/X Lower Limit (deg)
  450.0         HA/AZ/X Upper Limit (deg)
    0.0         DEC/EL/Y Lower Limit (deg)
  115.0         DEC/EL/Y Upper Limit (deg)
   azel         Antenna Axis Type (AZEL,HADC,XYEW,XYNS)
```

How to configure the FS?

Control files `/usr2/control/location.ctl`

```
********* Location Control File *********
*
WETTZ13S        Station Name
 -12.878278     WEST Longitude
 49.143415      Latitude
 672.5798       Station Elevation (meters)
* Horizon mask
* azl ell az2 el2 . . . .
0 10 360
```

How to configure the FS?

Control files `/usr2/control/equip.ctl`

```
********* equip.ctl Equipment Control File *********
* Please refer to the Control Files Manual in Volume 1 of the
* Field System Documentation
*
*  VLBI equipment
dbbc_pfb/fila10g     type of rack (mk3, vlba, vlbag, mk4, vlba4, mk5, vlba5
*                     k41, k41u, k41/k3, k41u/k3, k41/mk4, k41u/mk4,
*                     k42, k42a, k42b, k42bu, k42c, k42/k3, k42a/k3,
*                     k42bu/k3, k42/mk4, k42a/mk4, k42b/mk4, k42bu/mk4
*                     k42c/mk4, lba, lba4, s2, dbbc_ddc, dbbc_ddc/fila10g,
*                     dbbc_pfb, dbbc_pfb/fila10g, vlbac, cdas, rdbe,
*                     dbbc3_ddc_u, dbbc3_ddc_v, or none)
mk6          type of recorder 1 (mk3, vlba, vlba2, vlbab, vlba4, vlba42, mk4,
*                    mk4b, s2, k41, k41/dms, k42, k42/dms, mk5a, mk5a_bs,
*                    mk5b, mk5b_bs, mk5c, mk5c_bs, flexbuff, mk6, or none)
none     type of recorder 2 (mk3, vlba, vlba2, vlbab, vlba4, vba42, mk4,
*                           mk4b, or none)
none     type of decoder (mk3, dqa, mk4, or none)
*
* Mark III/IV rack parameters
 500.10 IF3 LO Frequency
   3    hex mask indicating which IF3 switches are installed, sw N ~ 2^(N-1)
*
* VLBA/4 rack parameters
  a/d   VLBA formatter cross-point switch (a/d or dsm)
101     Hardware ID for VLBA rack (assigned by GSFC)
*
* CDP S/X Receiver Parameters
60      Receiver 70K Stage Check Temperature
20      Receiver 20K Stage Check Temperature
* pcal control
none    type of phase cal control (if3 or none)
*mk iv fm firmware version
41      pre-40 versions have no barrel-rolling or data modulation
*
* LBA/4 rack parameters
   1    No of LBA DAS installed (up to MAX_DAS - see "params.h")
  in    160MHz IF input filters (in or out)
  8bit  Digital input setting (8bit internal sampler or 4bit external at ATCA)
* met sensor type
*default choice for metserver is  50001 localhost, cdp or met3 server port, use cdp if you don't have either
cdp     cdp or met3 server port, use cdp if you don't have either
* default mk4 form command synch test value
3     off or 0, 1, ..., 16
*mk4 decoder transmission terminator
 return return, $, or %
```

How to configure the FS?

Control files `/usr2/control/equip.ctl (cont.)`

```
*DBBC DDC version
v105_1   v100, v101, v102, v104, v105, v105e, v105f, ...
*DBBC PFB version
v16_1  v12    v15_1 or later
*DBBC Cores per CoMo, Max of 4 values, range of values 0-4,
* total of values <= 4, one value for each CoMo present in order: A B C D
  1 1 1 1
*DBBC IF power conversion factors, one for each module specified above, no trailing comments or extra fields
15000 15000 15000 15000
*VSI-H/Mark5B clock rate (MHz): "nominal" is:
*                                          32 for rack=Mark5 or VLBA5,
*                                                 rack=DBBC DDC, any letter,
*                                                      v104 or less,
*                                                      with and without
*                                                      FiLa10G
*                                                 rack=DBBC DDC, letter ' ',
*                                                      v105-v106,
*                                                      with and without
*                                                      FiLa10G
*                                                 rack=VLBAC
*                                          64 for rack=DBBC DDC, letters E/F,
*                                                      v105 or greater,
*                                                      with and without
*                                                      FiLa10G
*                                                 rack=CDAS
*                                                 rack=DBBC DDC, letter ' ',
*                                                      v107 or later,
*                                                      without FiLa10G
*                                         128 for rack=DBBC DDC, letter ' ',
*                                                      v107 or later,
*                                                      with FiLa10G
*                                           0 otherwise except rack=none
*                                     "nominal" is not allowed for rack=none
* a clock rate value of "none" will suppress clock_set command in FMSET
   nominal    one of: none, nominal, 2, 4, 8, 16, 32, 64, 128
*FiLa10G input select, one of: vsi1, vsi2, vsi1-2, vsi1-2-3-4, gps, tvg
vsi1
```

How to configure the FS?

Control files `/usr2/control/mk6ca.ctl`

```
*mk6ca.ctl example file
* line 1: host(IP address or name) port(2620) time-out(centiseconds)
* using an IP address avoids name server and potential network problems
* example: remote host uses a long time-out
*   mark5-04.haystack.mit.edu
*   192.52.61.178  2620 500
* example: local host uses a short time-out
127.0.0.1 14241 500
```

How to configure the FS?

Control files `/usr2/control/stpgm.ctl`

FS programs

Station programs

```
* Put site-specific programs here that should
* be started by the Field System.
* antcn should not be here.
erchk x xterm -name erchk -e erchk &
moni2 x xterm -name monit2 -e monit2 &
scnch x xterm -name scnch -e 'fsclient -n -w -s | grep /!\*scan_check..' &
wx2fs n wx2fs > /dev/null 2> /dev/null &
stqkr n stqkr /usr2/st/control/stqkr.conf &
cable2fs n cable2fs /usr2/st/control/cable2fs.conf &
patch_mark6.sh x /usr2/st/bin/patch_mark6.sh init:192.168.208.99:14241 &
```

Remember
„`/usr2/oper/.Xresources`“
to set positions and fonts etc.

TOW2023 - Maintenance Workshops

FS Operations

Where can I get it from?
What is new?
How to install?
Where can I find what on the FS PC?
How to interact with the FS?
How to configure the FS?
What does a station has to offer to the FS?
How to command the FS?
How to run a schedule with the FS?
How to monitor system quality?

What does a station has to offer to the FS?

Station-specific programs
➔ See Seminar „FS Station Code“

Antenna Control („`antcn`“) — Activated in `dev.ctl`

Station specific commands („`stqkr`“) — Activated in `stpgm.ctl`

Station specific programs to fill shared memory („`wx2fs`“, „`cable2fs`“) — Activated in `stpgm.ctl`

Station specific programs do local tasks (e.g. local data monitoring)

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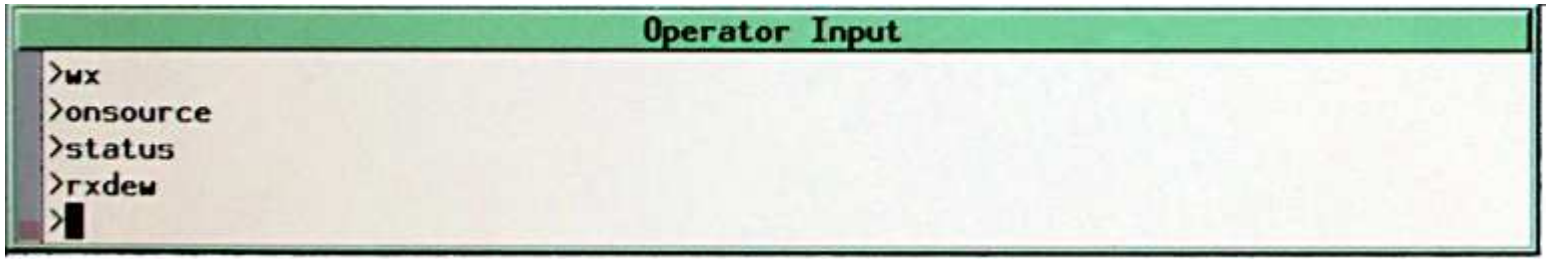
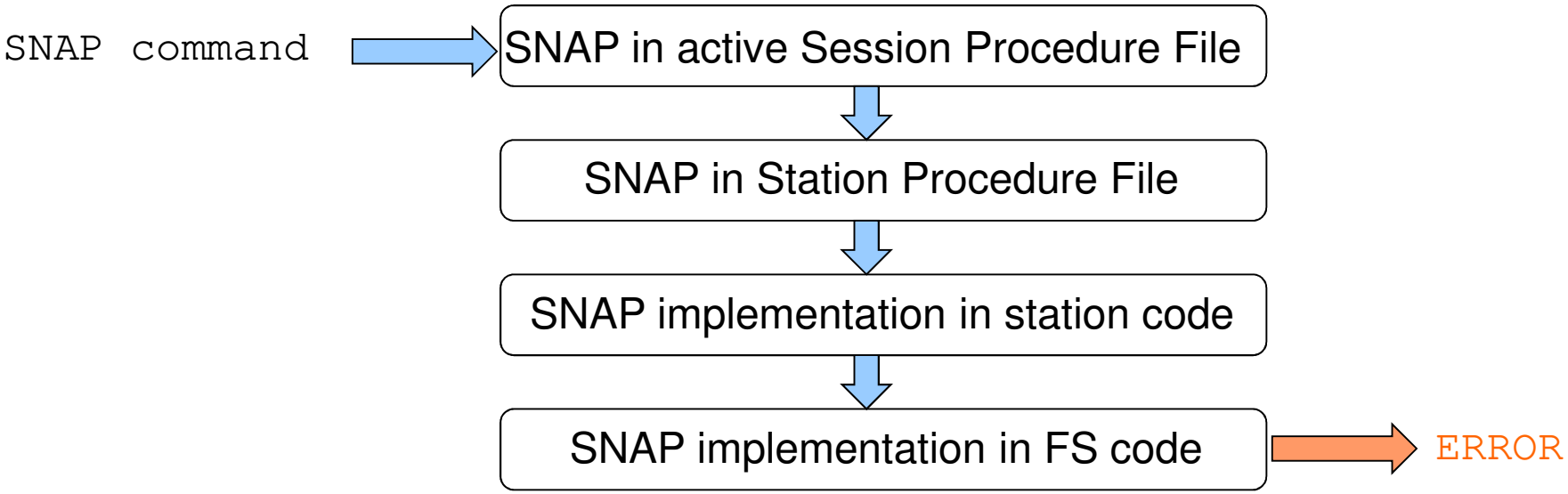
How to command the FS?

Operator input („oprin")



SNAP commands
(Standard Notation for Astronomical Procedures)

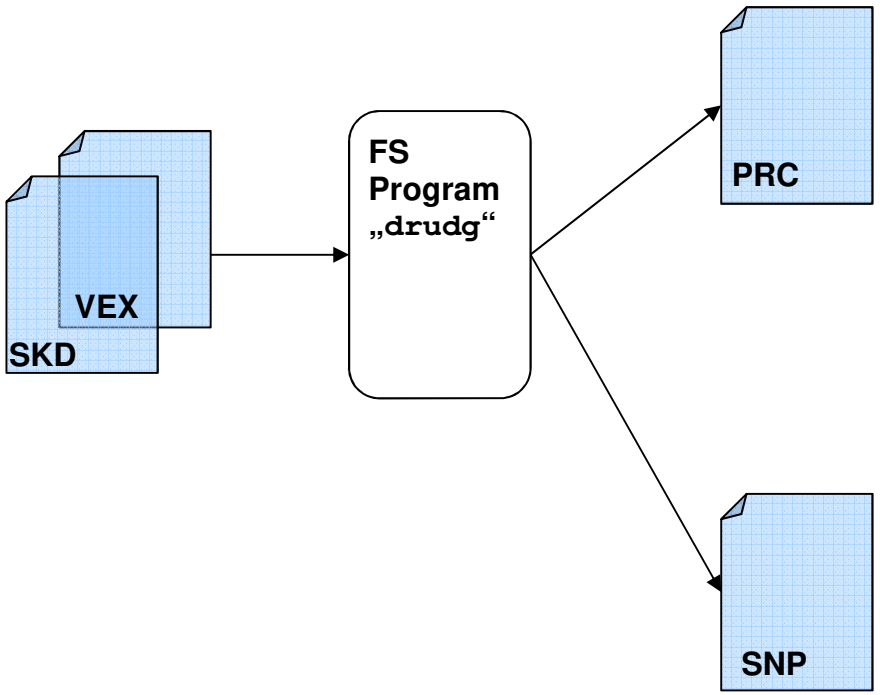


How to command the FS?

SNAP commands
(Standard Notation for Astronomical Procedures)

SNAP in active Session Procedure File

/usr2/proc/<sessionname>.prc
<sessionname> = <session><antennacode>
e.g. r4125wz.prc



Legacy:
exper_initi
setupsx
dbbcsx8
ifdsx

VGOS-DBBC:
fila10g_cfg
sched_initi
fila10gbb
...

e.g.

```
define  dbbcsx8        21140193218x
bbc01=132.99,a,8.00
bbc02=172.99,a,8.00
bbc03=272.99,a,8.00
bbc04=432.99,a,8.00
bbc05=652.99,b,8.00
bbc06=772.99,b,8.00
bbc07=832.99,b,8.00
bbc08=852.99,b,8.00
bbc09=205.99,c,8.00
bbc10=225.99,c,8.00
bbc11=245.99,c,8.00
bbc12=275.99,c,8.00
bbc13=325.99,d,8.00
bbc14=345.99,d,8.00
enddef
```

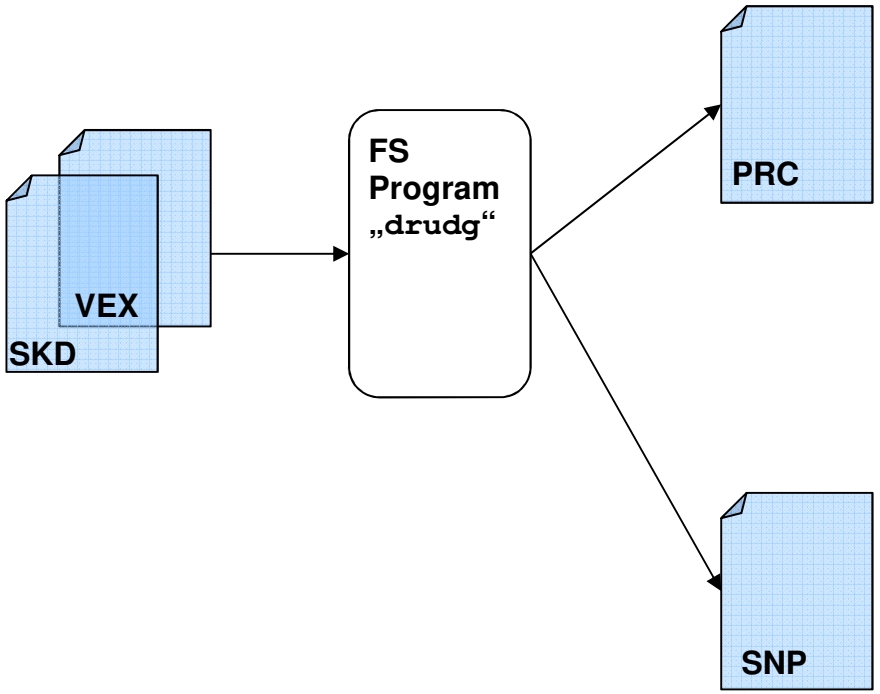
Procedures are selections of other SNAP calls

How to command the FS?

SNAP commands
(Standard Notation for Astronomical Procedures)

SNAP in active Session Procedure File

/usr2/proc/<sessionname>.prc
<sessionname> = <session><antennacode>
e.g. r4125wz.prc



SNP-files are sequences of time-tagged SNAP commands

e.g.

```
" R4999     2021 WETTZELL V Wz
" V WETTZELL AZEL  .0000 240.0    2  251.5  831.0  90.0    2    5.0   89.0 20.0 Wz 33
" Wz WETTZELL  4075539.50530   931735.66250  4801629.61560 72247801
" 33   WETTZELL    0    17640
" drudg version 2019Sep23 compiled under FS  9.13.02
" Rack=DBBC_DDC  Recorder 1=FlexBuff  Recorder 2=none
scan_name=140-1933,r4999,wz,60,60
source=3c418,203837.03,511912.7,2000.0,ccw
setupsx
!2021.140.19:33:07
preob
!2021.140.19:33:17
sy=cmd2flexbuff.py net2file=open:/raid/r4999wz/r4999_wz_140-1933,n ;
data_valid=on
midob
!2021.140.19:34:17
data_valid=off
sy=cmd2flexbuff.py net2file = close
postob
scan_name=140-1935,r4999,wz,60,60
source=0552+398,055530.81,394849.2,2000.0,ccw
```

How to command the FS?

SNAP commands
(Standard Notation for Astronomical Procedures)

SNAP in Station Procedure File

`/usr2/proc/station.prc`

sched_initi	Tasks at schedule start
preob	Tasks before scan recording
midob	Tasks while scan recording
postob	Tasks after scan recording
…	

Attention: Changes of station.prc require that the TS is not running.

e.g.

```
define  midob         23108183001x
onsource
antenna=status
wx
rx=dewar?
cable
ifa
ifb
ifc
ifd
bbc01
bbc05
bbc09
bbc13
" the shown order of the commands from here to the end of this procedure is
" strongly recommended
"add your station command to measure the gps to fm output clock offset
"gps-fmout=c2
mk5c_mode
!+1s
"mk5=dot?
sy=run setcl adapt &
enddef
```

Procedures are selections of other SNAP calls

How to command the FS?

SNAP commands
(Standard Notation for Astronomical Procedures)

SNAP implementation in station code

„stqkr“

wx	Print meteo values
dotmon	Print gps-fmout
dotmon2	Print gps-fmout of 2. DBBC2
cable	Print cable measurement
rx=	Print or set receiver values
…	

„antcn“

source=	Point antenna to new source
onsource	Check if antenna points
antenna=	Print or set antenna values

See Seminar FS Station Code

How to command the FS?

SNAP commands
(Standard Notation for Astronomical Procedures)

SNAP implementation in FS code

`"ls /usr2/fs/help"` or SNAP-command `"help="` in oprin

schedule=	Start new schedule
halt	Interrupt running schedule
cont	Continue schedule
mk5=	Print or set Mark5 values
mk6=	Print or set Mark6 values
sy=	Do a system call
scan_check	Run a scan check on Mark5 or Mark6
log=	Set log file
proc=	Set new procedure file
fivept	Run automated pointing test
onoff	Run antenna calibration test (SEFD)
acquire	Run a pointing test schedule
…	

TOW2023 - Maintenance Workshops

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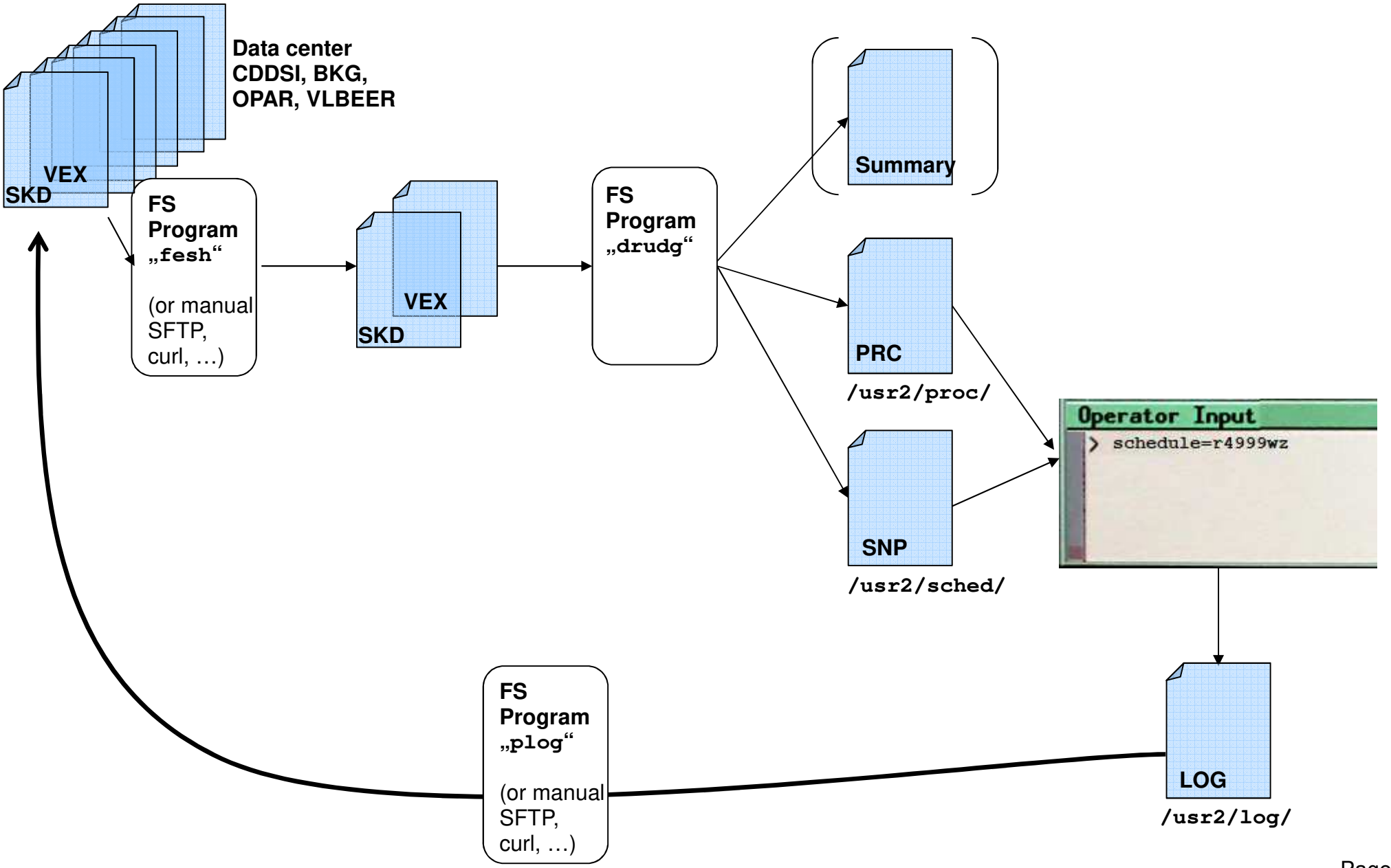
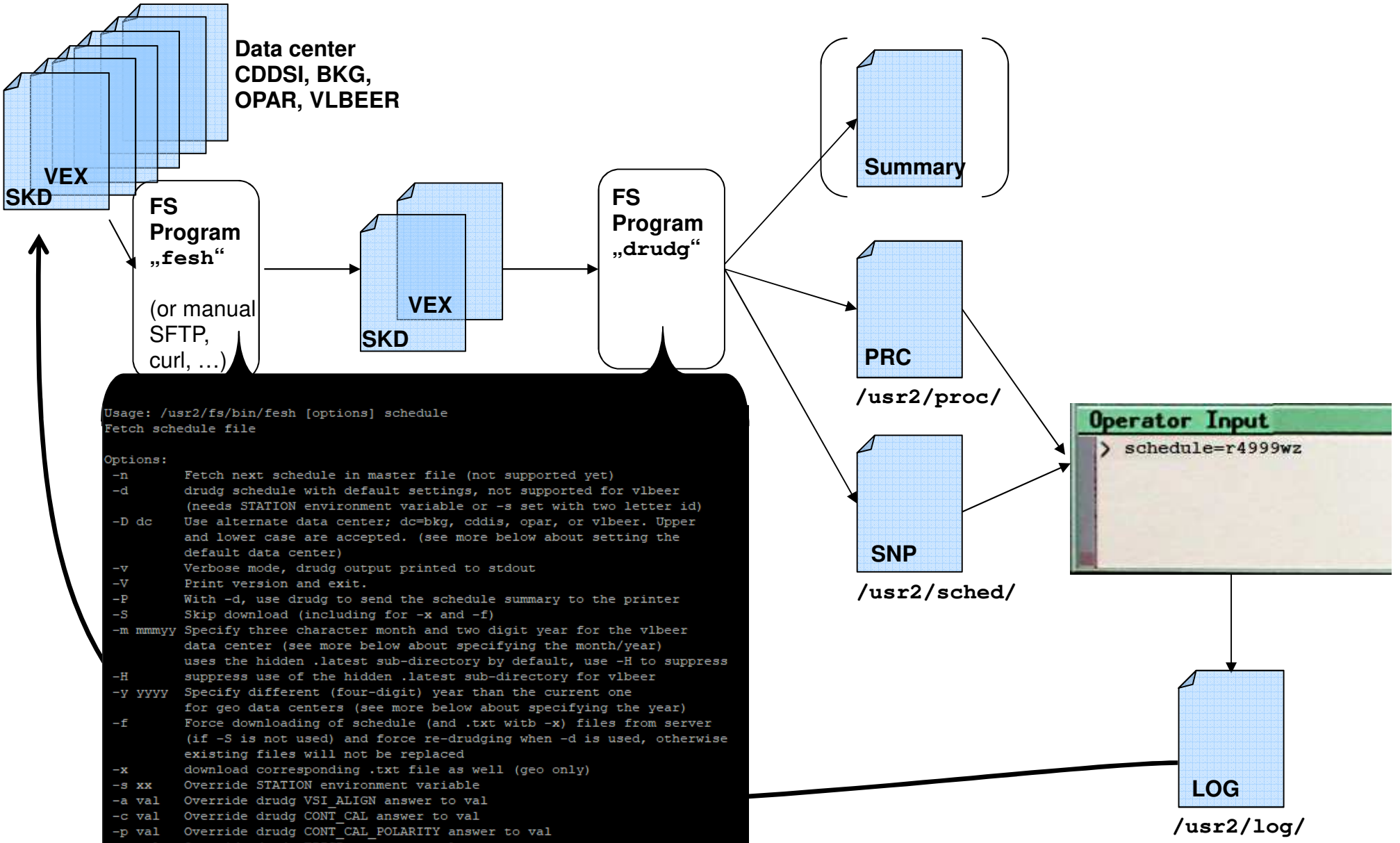
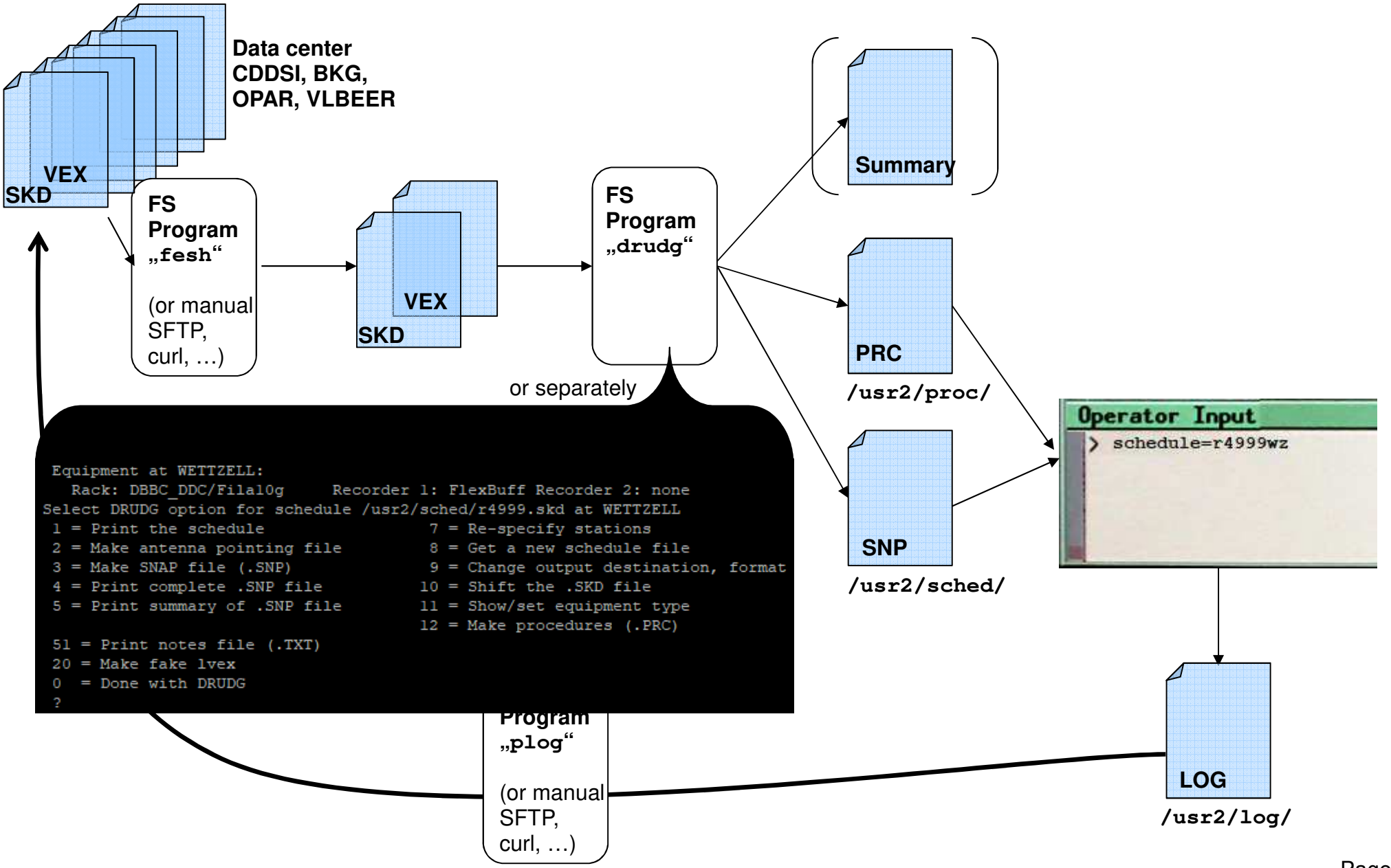
How to run a schedule with the FS?



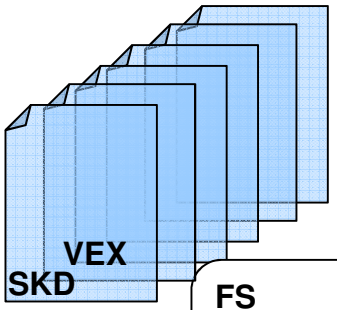
How to run a schedule with the FS?



How to run a schedule with the FS?



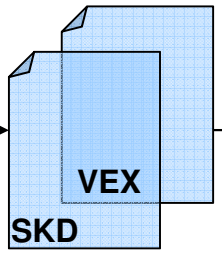
How to run a schedule with the FS?



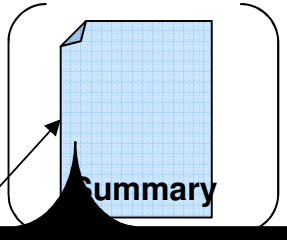
Data center
CDDSI, BKG,
OPAR, VLBEER

FS Program „fesh“

(or manual SFTP, curl, …)



FS Prog „dr

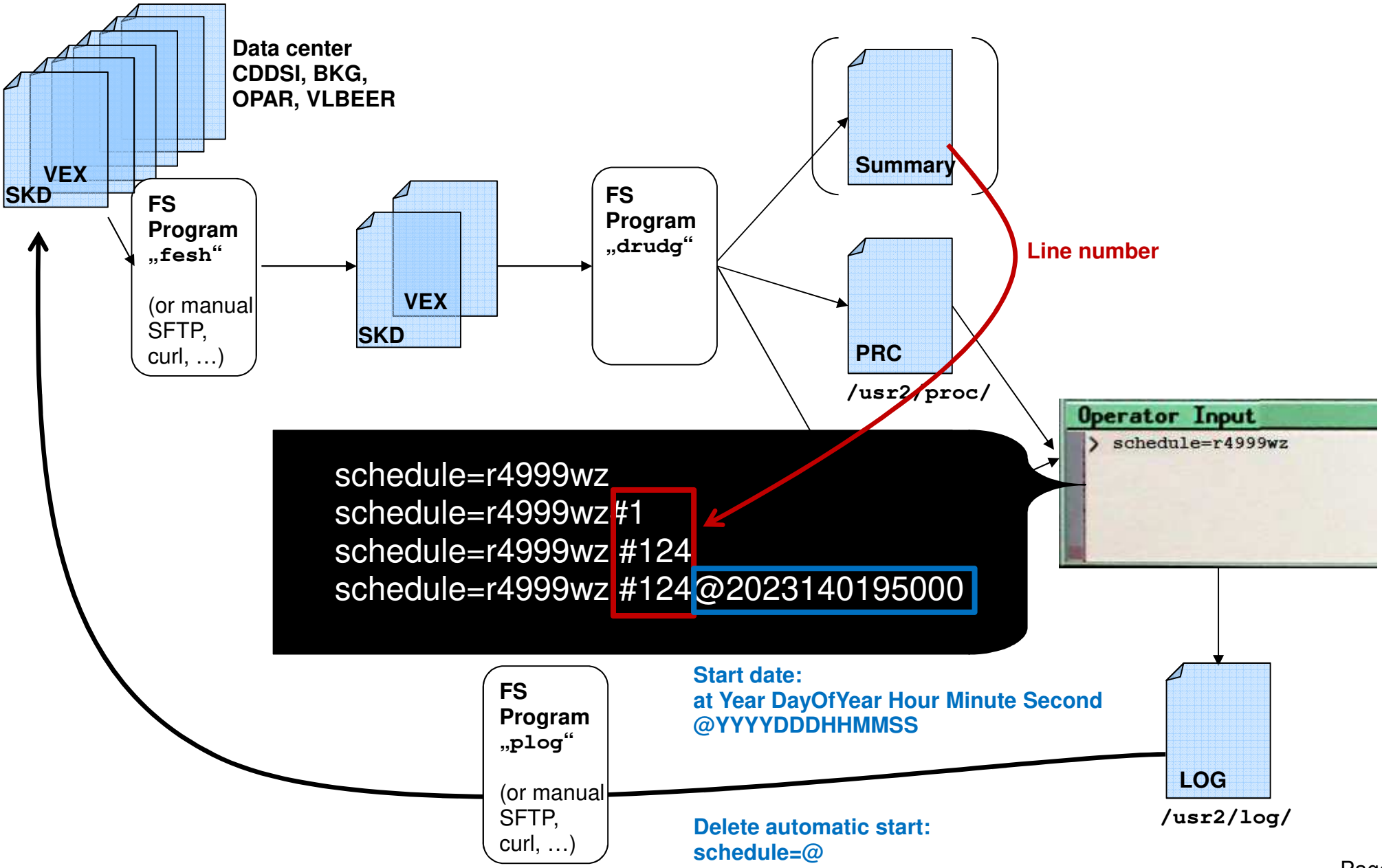



```
Schedule file:    r4999wz.snp           Page   1
Station:          WETTZELL (Wz) (V)     Session:         R4999
Tape motion:      START&STOP Recorder type:   DISK
Rack:             DBBC_DDC/Fila10g
Recorder 1:       FlexBuff              Early start:      0 sec
Recorder 2:       none                  Late  stop:       0 sec
Mode 1 Setup proc(s): setupsx      IFD proc: ifdsx

Times are in the format hh:mm:ss
Scan    = scan_name command in .snp file
Line#   = line number in .snp file where this scan starts
Dur     = time interval of on-source data (Start Data to  Stop Data) in mmm:ss
Gbyte   = Gigabytes at start of scan
Info:  XXX    or Rec1=start recorder 1, Rec2=start recorder 2
           *=parity check, @=no tape motion

                                                  Start      Stop
 Scan         Line#  Source    Az El Cable        Data       Data       Dur    Gbyte  Info
date = 202 1MAY20   DOY = 140
 140-1933       7   3C418      33 21 CCW      19:33:17   19:34:17     1:00      .0   XXX
 140-1935      20   0552+398  302 25 CCW      19:35:39   19:36:39     1:00     1.9    *
 140-1937a     33   0716+714  331 50 CCW      19:37:26   19:38:26     1:00     3.8    *
 140-1939      46   0613+570  316 39 CCW      19:39:20   19:40:20     1:00     5.8    *
 140-1942      59   0016+731    1 33 CCW      19:42:17   19:43:17     1:00     7.7    *
 140-1944      72   1803+784   18 49 CCW      19:44:55   19:45:55     1:00     9.6    *
 140-1947a     85   1034-293  205  7 NEUTR    19:47:00   19:48:00     1:00    11.5    *
 140-1948a     98   0748+126  264 22 CW       19:48:36   19:49:36     1:00    13.4    *
 140-1950a    111   0544+273  297 13 CW       19:50:27   19:54:49     4:22    15.4    *
 140-1955     124   1244-255  179 15 NEUTR    19:55:37   19:56:37     1:00    23.7    *
 140-1958b    137   1351-018  158 36 NEUTR    19:58:28   19:59:28     1:00    25.7    *
```

FS Program „plog“

(or manual SFTP, curl, …)

How to run a schedule with the FS?



How to run a schedule with the FS?

```
2021.140.19:32:00.00@Log Opened: Mark IV Field System Version 9.13.2
2021.140.19:32:00.00@release,9.13.2
2021.140.19:32:00.00@location,WETTZELL,-12.88,49.15,661.2
2021.140.19:32:00.00@horizon1,0.,10.,360.
2021.140.19:32:00.00@antenna,20.0,240.0,90.0,-118.0,475.5,5.0,88.5,azel
2021.140.19:32:00.00@equip,dbbc_ddc/fila10g,flexbuff,none,none,500.10,3,a/d,101,70,25,none,41,1,in,8bit,cdp,3,return,v105_1,v15_1,1,1,1,1
,15000,15000,15000,15000,32,vsi1
2021.140.19:32:00.00@time,0.000,1.000,computer
2021.140.19:32:00.00@flagr,200
2021.140.19:32:00.00@fsserver,disabled
2021.140.19:32:00.00:" R4999     2021 WETTZELL V Wz
2021.140.19:32:00.00:" V WETTZELL AZEL  .0000 240.0    2  251.5  831.0  90.0    2    5.0   89.0 20.0 Wz 33
2021.140.19:32:00.00:" Wz WETTZELL  4075539.50530   931735.66250  4801629.61560 72247801
2021.140.19:32:00.00:" 33   WETTZELL    0    17640
2021.140.19:32:00.00:" drudg version 2019Sep23 compiled under FS  9.13.02
2021.140.19:32:00.00:" Rack=DBBC_DDC  Recorder 1=FlexBuff  Recorder 2=none
2021.140.19:32:00.00:exper_initi
2021.140.19:32:00.00&exper_initi/proc_library
2021.140.19:32:00.00&exper_initi/sched_initi
2021.140.19:32:00.00&exper_initi/mk5=dts_id?
2021.140.19:32:00.00&exper_initi/mk5=os_rev?
2021.140.19:32:00.00&exper_initi/mk5_status
2021.140.19:32:00.00&exper_initi/dbbc=version
2021.140.19:32:00.00&exper_initi/fila10g=version
2021.140.19:32:00.00&proc_library/" r4999      wettzell  wz
2021.140.19:32:00.00&proc_library/" drudg version 2019sep23 compiled under fs  9.13.02
2021.140.19:32:00.00&proc_library/"< dbbc_ddc/fila10g     rack >< flexbuff recorder 1>
2021.140.19:32:00.00&sched_initi/azeloff=0d,0d
2021.140.19:32:00.00&sched_initi/!+2s
2021.140.19:32:00.00&sched_initi/check=all,-rx
2021.140.19:32:00.00&sched_initi/sy=/usr2/st/bin/errorfilter.sh &
2021.140.19:32:00.00&sched_initi/sy=/usr2/st/bin/checkflexbuffrecording.sh &
2021.140.19:32:00.00&sched_initi/jive5ab=version?
2021.140.19:32:00.00&sched_initi/fila10g_cfg
2021.140.19:32:00.00&sched_initi/fila10g_mac
2021.140.19:32:00.00&sched_initi/fila10gbb
2021.140.19:32:00.00&sched_initi/fila10g=time
2021.140.19:32:02.03/jive5ab/!version?  0 :  jive5ab : 3.0.0 : 64bit : Release : flexbuff2 : 22-Mar-2020 : 14h16m48s : nossapi :  ;
2021.140.19:32:02.03&fila10g_cfg/"fila10g=reboot
2021.140.19:32:02.03&fila10g_cfg/"!+2s
2021.140.19:32:02.03&fila10g_cfg/fila10g=splitmode off
2021.140.19:32:02.03&fila10g_cfg/fila10g=inputselect vsi1
2021.140.19:32:02.03&fila10g_cfg/fila10g=vsi_inputwidth 32
2021.140.19:32:02.03&fila10g_cfg/fila10g=vsi_samplerate 32000000 2
2021.140.19:32:02.03&fila10g_cfg/fila10g=vsi_bitmask 0xffffffff
2021.140.19:32:02.03&fila10g_cfg/"fila10g=reset
2021.140.19:32:02.03&fila10g_cfg/"!+1s
2021.140.19:32:02.03&fila10g_cfg/fila10g=vdif_station wz
2021.140.19:32:02.03&fila10g_cfg/fila10g=vdif_frame 2 16 8000
2021.140.19:32:02.03&fila10g_cfg/fila10g=arp off
2021.140.19:32:02.03&fila10g_cfg/fila10g=tengbcfg eth0 ip=192.168.1.40 gateway=192.168.1.1
2021.140.19:32:02.03&fila10g_cfg/fila10g=tengbcfg eth0 mac=ba:dc:af:e4:be:f0
2021.140.19:32:02.03&fila10g_cfg/fila10g=tengbcfg eth0 nm=27
2021.140.19:32:02.03&fila10g_cfg/fila10g=tengbcfg eth1 ip=192.168.1.41 gateway=192.168.1.1
2021.140.19:32:02.03&fila10g_cfg/fila10g=tengbcfg eth1 mac=ba:dc:af:e4:be:f1
2021.140.19:32:02.03&fila10g_cfg/fila10g=tengbcfg eth1 nm=27
2021.140.19:32:02.03&fila10g_cfg/" connection to flexbuff1 (98)
```

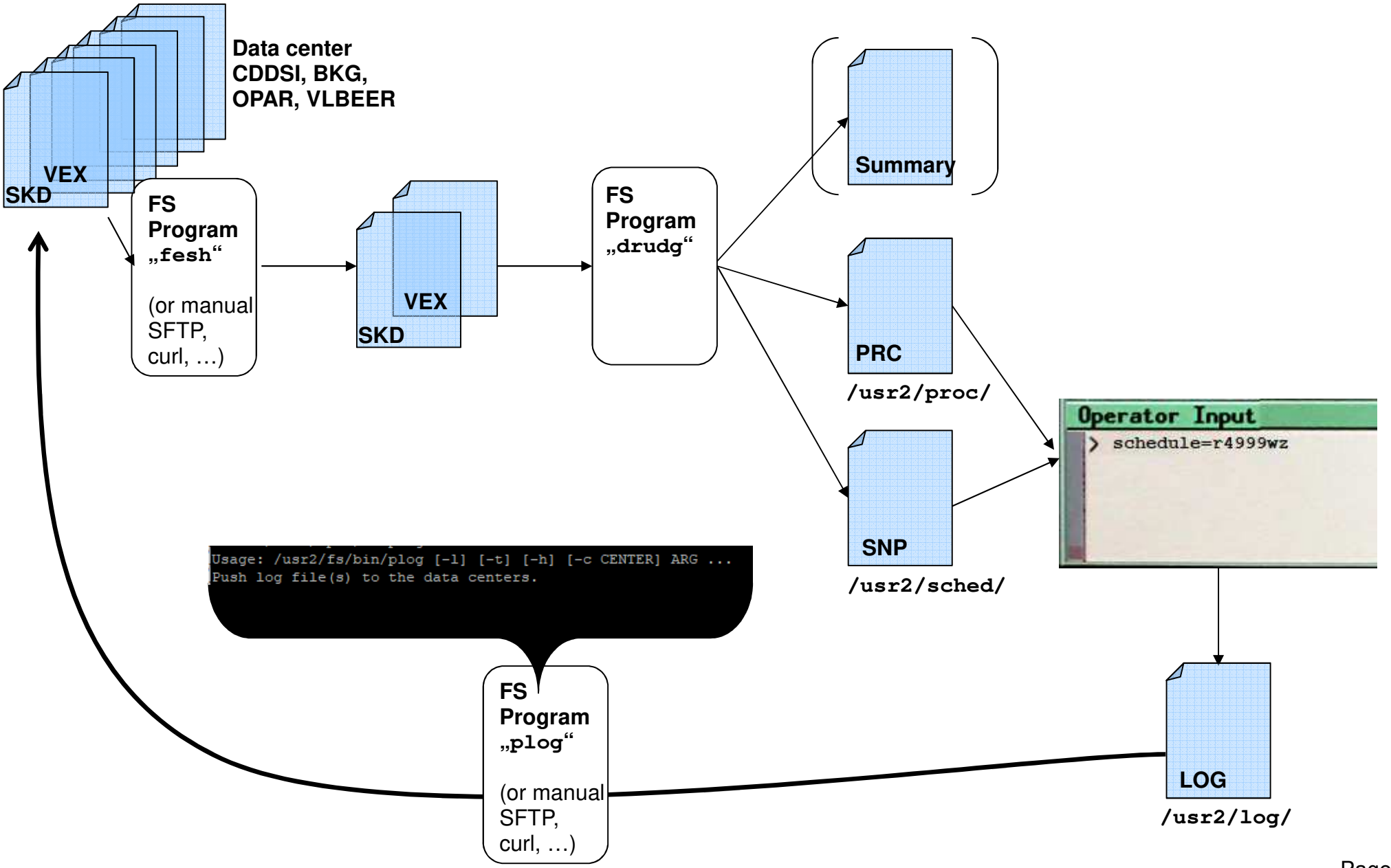
erator Input

schedule=r4999wz

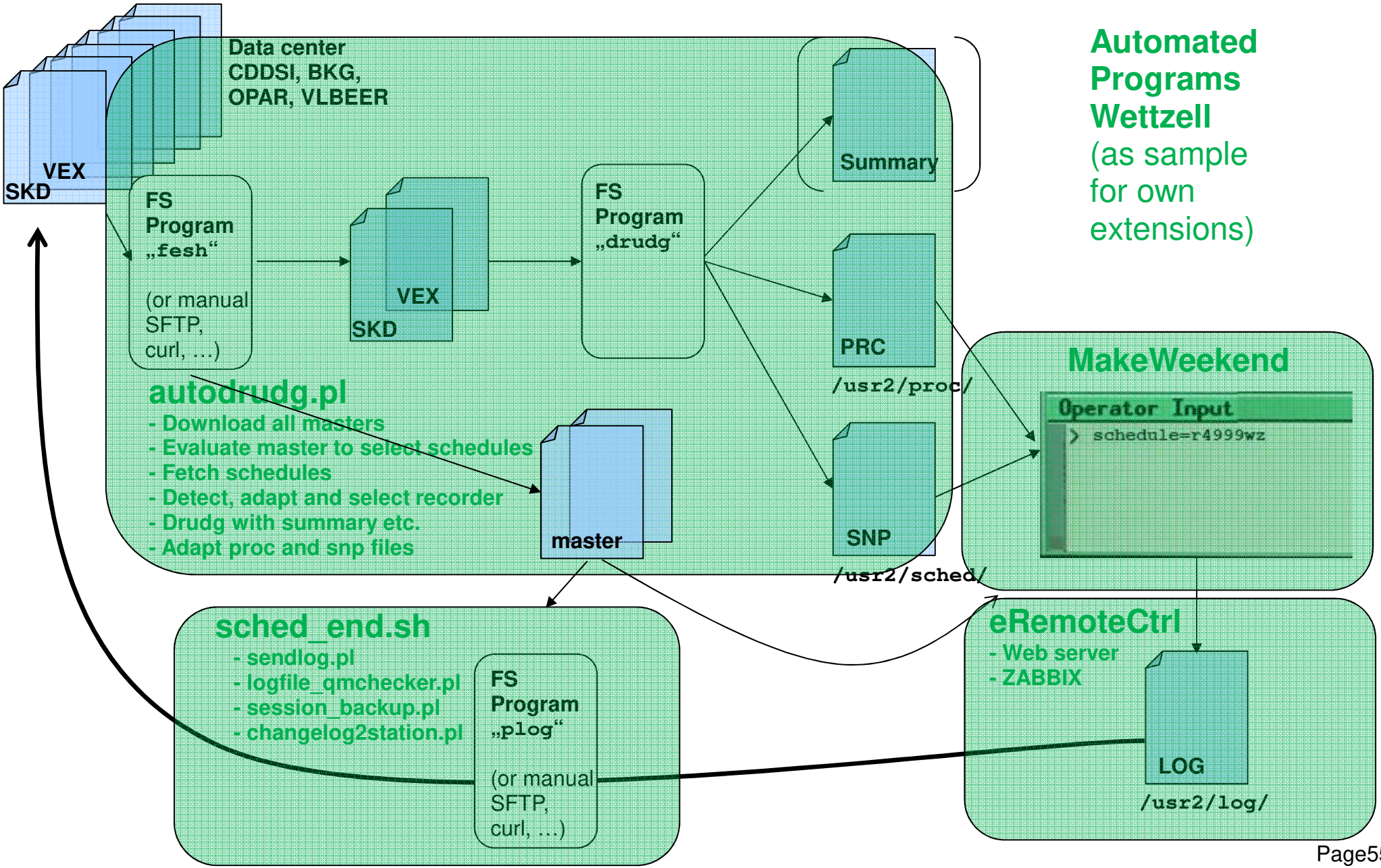
LOG

/usr2/log/

How to run a schedule with the FS?



How to run a schedule with the FS?



Automated Programs Wettzell (as sample for own extensions)

TOW2023 - Maintenance Workshops

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How to monitor system quality?

Automated Pointing Model

Also see: E. Himwich, „Automated Pointing Models Using the FS“

Setup:

„`antcn`“ must support ONSOURCE modes
➔ see Seminar FS Station Code

Configure „`s.rxg`“ and „`x.rxg`“

Customize „`point.prc`“

Customize „`parpo.ctl`“

Customize „`mdlpo.ctl`“ (no changes requ.)

Check „`flux.ctl`“ (no changes requ.)

(If you have a non-standardized system, e.g. no noise diode or iondividual detector, check documentation.)

How to monitor system quality?

Automated Pointing Model

Also see: E. Himwich, „Automated Pointing Models Using the FS“

Setup:

„antcn“ must support ONSOURCE modes
➔ see Seminar FS Station Code

Configure „s.rxg“ and „x.rxg“

Customize „point.prc“

Customize „parpo.ctl“

Customize „mdlpo.ctl“ (no changes requ.)

Check „flux.ctl“ (no changes requ.)

(If you have a non-standardized system, e.g. no noise diode or iondividual detector, check documentation.)

„x.rxg“ sample

S/X

```
1. Line (LO)
fixed 8080
2. Line (File date)
2022 04 17
3. Line (Model beamwitdh)
frequency 1.0
4. Line (Polarization)
rcp
5. Line (Degrees Per Flux Unit)
0.00126
6. Line (Gain curve)
ELEV POLY 1.0
7. Line (Tcal vs. frequ)
rcp 8080.0  20.8
end_tcal_table
...
```

VGOS (DBBC)

```
fixed 7580 7580
rcp 8200.0   6.4
rcp 8400.0   6.5
rcp 8600.0   6.2
rcp 8800.0   6.2
end_tcal_table
```

How to monitor system quality?

Automated Pointing Model

Also see: E. Himwich, „Automated Pointing Models Using the FS“

Setup:

„antcn“ must support ONSOURCE modes
➔ see Seminar FS Station Code

Configure „s.rxg“ and „x.rxg“

Customize „point.prc“

Customize „parpo.ctl“

Customize „mdlpo.ctl“ (no changes requ.)

Check „flux.ctl“ (no changes requ.)

(If you have a non-standardized system, e.g. no noise diode or iondividual detector, check documentation.)

```
...

define  initp          23107122005
"setupa
caloff
"sample fivept set-up for azel antenna
" with Mark III/IV rack
"fivept=azel,-2,9,.4,1,i1,120
"sample fivept set-up for azel antenna
" with VLBA/4 rack or DBBC
"... axis,rep,pts,stepsize,integ_period,dev,wait_on_onsource
fivept=azel,2,9,0.5,5,ia,120
" sample onoff set-up for Mark III/IV
"onoff=2,1,75,3,,120,all
" sample onoff set-up for VLBA/4 or DBBC
"onoff=2,1,75,3,,120,allu,ia,ib,ic
sy=brk onoff &
"... rep,integ_period,cutoff_elev,dist_offsource,snap_proc,
"wait_on_onsource,devices
onoff=2,1,75,3,,120,formbbc,ia,ib,ic
check=
sy=go aquir &
enddef

...
```

How to monitor system quality?

Automated Pointing Model

Also see: E. Himwich, „Automated Pointing Models Using the FS“

Setup:

„`antcn`“ must support ONSOURCE modes
➔ see Seminar FS Station Code

Configure „`s.rxg`“ and „`x.rxg`“

Customize „`point.prc`“

Customize „`parpo.ctl`“

Customize „`mdlpo.ctl`“ (no changes requ.)

Check „`flux.ctl`“ (no changes requ.)

(If you have a non-standardized system, e.g. no noise diode or iondividual detector, check documentation.)

1. Line (Telescope)
WETTZELL azel

2. Line (Parameters)
0 0.075 0.115 1.25

3. Line (Model beamwitdh)
3

How to monitor system quality?

Automated Pointing Model

`log=pointing`	Define log file
`proc=r41097wz`	Set procedure with BBC, IF, … settings
`setupsx`	Setup BBC, IF, … settings
`proc=point`	Define pointing procedure
`cygnusa`	Point to source
`initp`	Init fivept
`ifman`	Local command to switch AGC off
`fivept`	Start fivept ➔ offsets
`onoff`	Start onoff ➔ SEFDs

Process „fivept“ and „onoff“

How to monito

Automate

```
log=pointing
proc=r41097wz
setupsx
proc=point
cygnusa
initp
ifman
fivept
onoff
```

Define log file
Set procedure with B
Setup BBC, IF, … set
Define pointing proce
Point to source
Init fivept
Local command to sw
Start fivept ➔ offsets
Start onoff ➔ SEFDs

Process „fivept“ and „onoff“

```
2023.107.14:15:48.26;fivept
2023.107.14:15:48.26#fivpt#source cygnusa    195928.4 +404402 2000.0 2023.107.14:15:48
2023.107.14:15:48.26#fivpt#site WETTZELL -12.8772  49.1450  20.00 xxxx   0  1.00  0.00
2023.107.14:15:48.26#fivpt#fivept azel   2   9 0.50  5 ia    20.8  0.1256     183.5
2023.107.14:15:48.26#fivpt#origin   0.0000   0.0000   0.0016   0.0047   0.0000   0.0000
2023.107.14:15:48.30;calofffp
2023.107.14:15:48.30&calofffp/caloff
2023.107.14:15:48.30&calofffp/sy=go fivpt &
2023.107.14:15:48.30&calofffp/!+1s
2023.107.14:15:48.30&calofffp/sy=go fivpt &
2023.107.14:15:54.49;calonfp
2023.107.14:15:54.49&calonfp/calon
2023.107.14:15:54.49&calonfp/sy=go fivpt &
2023.107.14:15:54.49&calonfp/!+1s
2023.107.14:15:54.49&calonfp/sy=go fivpt &
2023.107.14:15:54.49&calon/"turn cal on
2023.107.14:15:54.49&calon/"sy=ssh -l oper fs3rtw /usr2/fs/bin/inject_snap -w calon &
2023.107.14:15:54.49&calon/"sy=ssh -l oper fs3rtw /usr2/fs/bin/inject_snap -w check=-rx &
2023.107.14:15:54.49&calon/sy=python /usr2/oper/bin/ncal.py -o on &
2023.107.14:16:00.68;calofffp
2023.107.14:16:00.68#fivpt#tsys 324.720   9.285  40.295  0.4653
2023.107.14:16:06.90#fivpt#lat   1  51364.  -0.2545    0.131  0.518
2023.107.14:16:13.14#fivpt#lat   2  51371.  -0.1897   -0.301  0.481
2023.107.14:16:19.37#fivpt#lat   3  51377.  -0.1249   -0.068  0.486
2023.107.14:16:25.59#fivpt#lat   4  51383.  -0.0601    4.782  0.944
2023.107.14:16:31.83#fivpt#lat   5  51389.   0.0047   13.495  1.105
2023.107.14:16:38.06#fivpt#lat   6  51396.   0.0695    8.042  1.868
2023.107.14:16:44.29#fivpt#lat   7  51402.   0.1343   -0.164  0.448
2023.107.14:16:50.50#fivpt#lat   8  51408.   0.1991   -0.420  0.573
2023.107.14:16:56.74#fivpt#lat   9  51414.   0.2639   -0.688  0.707
2023.107.14:16:56.74#fivpt#latfit   0.01544  0.1223 14.3875 -0.4502 -0.0145   5
2023.107.14:16:56.74#fivpt#laterr   0.00174  0.0042  0.4128  0.1768  0.0083   0.3875
2023.107.14:17:02.96#fivpt#lon   1  51420.  -0.2610   -0.145  0.486
2023.107.14:17:09.23#fivpt#lon   2  51427.  -0.1954    0.488  0.357
2023.107.14:17:15.46#fivpt#lon   3  51433.  -0.1297   -0.048  0.110
2023.107.14:17:21.68#fivpt#lon   4  51439.  -0.0640    7.081  1.818
2023.107.14:17:27.89#fivpt#lon   5  51445.   0.0016   13.124  0.551
2023.107.14:17:34.13#fivpt#lon   6  51452.   0.0673    6.138  2.490
2023.107.14:17:40.40#fivpt#lon   7  51458.   0.1330   -0.077  0.419
2023.107.14:17:46.66#fivpt#lon   8  51464.   0.1986    0.139  0.600
2023.107.14:17:52.87#fivpt#lon   9  51470.   0.2643    0.220  0.614
2023.107.14:17:52.87#fivpt#lonfit  -0.00165  0.1252 13.4354 -0.0806  0.0022   5
2023.107.14:17:52.87#fivpt#lonerr   0.00311  0.0072  0.6568  0.2874  0.0135   0.6265
2023.107.14:17:52.87#fivpt#perform    0.646   550.2    0.644   15.975
2023.107.14:17:52.87#fivpt#offset   325.5681    9.1794  -0.00165   0.01544  1  1
2023.107.14:17:59.08#fivpt#lat   1  51477.  -0.2438    1.137  0.350
2023.107.14:18:05.31#fivpt#lat   2  51483.  -0.1790    0.472  0.612
2023.107.14:18:11.53#fivpt#lat   3  51489.  -0.1142    1.457  0.361
2023.107.14:18:17.75#fivpt#lat   4  51495.  -0.0494    7.907  1.763
2023.107.14:18:23.97#fivpt#lat   5  51501.   0.0154   13.316  0.827
2023.107.14:18:30.20#fivpt#lat   6  51508.   0.0803    4.084  0.827
2023.107.14:18:36.44#fivpt#lat   7  51514.   0.1451   -0.291  0.570
2023.107.14:18:42.66#fivpt#lat   8  51520.   0.2099   -0.360  0.525
2023.107.14:18:48.90#fivpt#lat   9  51526.   0.2747   -0.744  0.446
2023.107.14:18:48.90#fivpt#latfit   0.00405  0.1172 13.5436  0.1138 -0.0344   4
2023.107.14:18:48.90#fivpt#laterr   0.00105  0.0025  0.2414  0.1001  0.0048   0.2231
2023.107.14:18:55.13#fivpt#lon   1  51533.  -0.2642    0.058  0.491
2023.107.14:19:01.35#fivpt#lon   2  51539.  -0.1986    1.038  0.350
2023.107.14:19:07.59#fivpt#lon   3  51545.  -0.1329    0.942  0.479
2023.107.14:19:13.81#fivpt#lon   4  51551.  -0.0673    6.464  1.457
2023.107.14:19:20.07#fivpt#lon   5  51558.  -0.0017   13.285  0.201
2023.107.14:19:26.30#fivpt#lon   6  51564.   0.0640    7.110  1.423
2023.107.14:19:32.54#fivpt#lon   7  51570.   0.1296    0.957  0.388
2023.107.14:19:38.77#fivpt#lon   8  51576.   0.1952    0.505  0.522
2023.107.14:19:45.01#fivpt#lon   9  51582.   0.2609    0.491  0.513
2023.107.14:19:45.01#fivpt#lonfit   0.00058  0.1267 12.9197  0.4393 -0.0003   3
2023.107.14:19:45.01#fivpt#lonerr   0.00201  0.0047  0.4043  0.1785  0.0084   0.3869
2023.107.14:19:45.01#fivpt#perform    0.621   572.2    0.619   15.362
2023.107.14:19:47.26#fivpt#offset   325.8820    9.0075   0.00058   0.00405  1  1
2023.107.14:19:47.26#fivpt#xoffset  325.8820    9.0075   0.00058   0.00405  0.00198  0.00105 1 1 ia   cygnusa
```

Measure Tsys off source to calibrate scale

Calibrate both axis

Gaussian fit + offset + slope
Opt.:
Repeat if not well

Leave telescope „peaked“ on source

How to monito

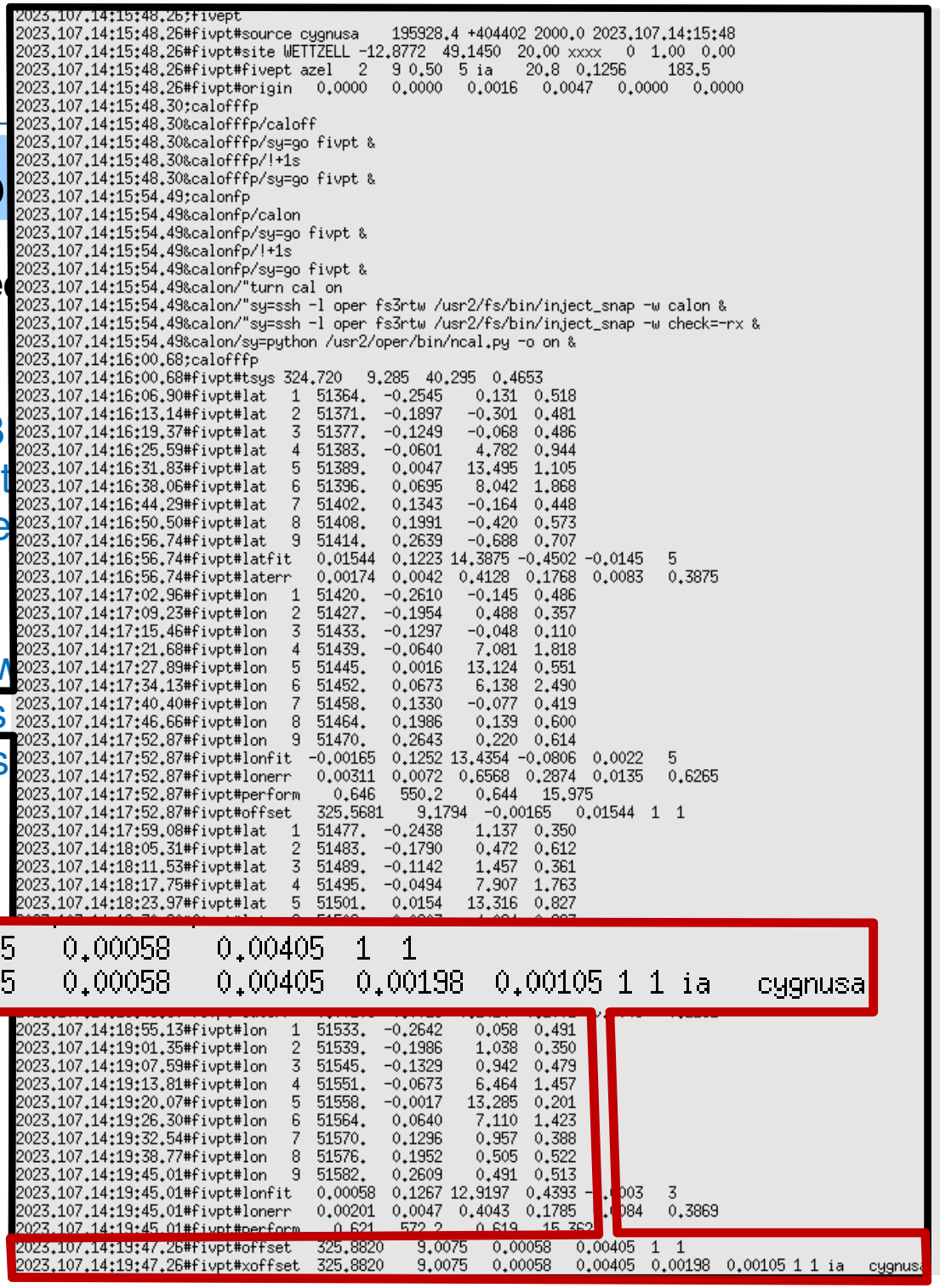
Automate

`log=pointing`	Define log file
`proc=r41097wz`	Set procedure with B
`setupsx`	Setup BBC, IF, … set
`proc=point`	Define pointing proce
`cygnusa`	Point to source
`initp`	Init fivept
`ifman`	Local command to sw
`fivept`	Start fivept ➔ offsets
`onoff`	Start onoff ➔ SEFDs

Raw encoder offsets:
azimuth and elevation

```
2023.107.14:19:47.26#fivpt#offset   325.8820    9.0075   0.00058   0.00405  1  1
2023.107.14:19:47.26#fivpt#xoffset  325.8820    9.0075   0.00058   0.00405  0.00198  0.00105 1 1 ia   cygnusa
```

Offsets corrected for the cosine of second coordinate:
cross-elevation and elevation



How to monitor system quality?

Automated Pointing Model

`log=pointing`	Define log file
`proc=r41097wz`	Set procedure with BBC, IF, … settings
`setupsx`	Setup BBC, IF, … settings
`proc=point`	Define pointing procedure
`cygnusa`	Point to source
`initp`	Init fivept
`ifman`	Local command to switch AGC off
`fivept`	Start fivept ➔ offsets
`onoff`	Start onoff ➔ SEFDs

Power on source (#ONSO)
Power on source with noise diode on (#ONSC)
Power off source with noise diode on (#OFFC)
Power off source with noise diode off (#OFFS)
Power off source with no signal for „zero“ (#ZERO)
Result:

	source	Az	El	De	I	P	Center	Comp	Tsys	SEFD	Tcal(j)	Tcal(r)
2023.107.14:20:40.51#onoff#	source	Az	El	De	I	P	Center	Comp	Tsys	SEFD	Tcal(j)	Tcal(r)
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	1l	1	r	8208.99	0.9474	49.97	735.0	305.954	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	8l	2	r	8928.99	0.9596	44.57	741.7	346.158	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	1u	1	r	8216.99	0.9452	52.07	742.9	296.768	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	2u	1	r	8256.99	0.9409	63.27	861.9	283.311	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	3u	1	r	8356.99	0.9531	45.06	702.7	324.382	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	4u	1	r	8516.99	0.9499	44.92	673.3	311.766	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	5u	2	r	8736.99	0.9568	52.05	833.2	332.974	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	6u	2	r	8856.99	0.9619	40.85	732.8	373.038	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	7u	2	r	8896.99	0.9592	43.07	739.3	357.040	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	8u	2	r	8936.99	0.9606	47.81	788.7	343.127	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	9u	3	r	2229.99	0.6986	63.06	1722.8	584.645	0.03
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	au	3	r	2249.99	0.6780	66.75	1680.2	538.700	0.03
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	bu	3	r	2269.99	0.6684	70.32	1694.9	515.783	0.03
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	cu	3	r	2299.99	0.6602	76.89	1748.4	486.595	0.03
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	du	4	r	2349.99	0.6929	64.34	1573.3	523.284	0.03
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	eu	4	r	2369.99	0.6931	61.49	1481.0	515.371	0.03
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	ia	1	r	8341.00	1.0557	40.44	576.8	296.611	0.02
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	ib	2	r	8848.00	0.7727	49.08	596.5	252.805	0.01
2023.107.14:20:40.51#onoff#VAL	cygnusa	326.1	8.9	ic	3	r	2281.00	5.0987	388.5	3423.4	188.538	0.01
2023.107.14:20:40.51#onoff#	source	Az	El	De	I	P	Center	Comp	Tsys	SEFD	Tcal(j)	Tcal(r)

Process „fivept“ and „onoff“

How to monitor system quality?

Automated Pointing Model

Video

System Status Monitor

WETTZELL		2023.107.14:14:25		UT		TEMP	12.2	cygnusa			SLEWING
MODE	RATE	14:18:52		NEXT		HUMID	52.0	RA	19h 59m 28.40s		
		SCHED=	none	LOG=	station	PRES	948.4	DEC	40d 44m		(2000)
	TSYS:	IFA	IFB	IFC	IFD	CABLE	0.006372	AZ	325.1453	EL	9.4158
		0	0	0	0	WIND	23.04	DIR	36		

NO CHECK: rx

Mark 5 Remaining Capacity

		VSN	Time	GB	%	Check UT
	A					
	0%					100% (Volume)
>	B					
	0%					100% (Volume)

Select Quality Monitoring: System Temperatures

System Temperatures

Tsys	0.00 (IFA)	0.00 (IFB)
	0.00 (IFC)	0.00 (IFD)

BBC	Freq	Ts-U	Ts-L
01	132.99		
02	172.99		
03	272.99		
04	432.99		
05	652.99		
06	772.99		
07	812.99		
08	852.99		
09	205.99		
10	225.99		
11	245.99		
12	275.99		
13	325.99		
14	345.99		
15	0.00		
16	0.00		

Antenna Monitoring

RTW ([2023].107.14:14:25:109 (Offset: 0 msec))

Azimuth	Source: Az/El Pos	Elevation
59.9465	Actual Pos.	25.0048
	Pos. Graph	
60.0000	Commanded Pos.	25.0000
325.1446	NASA FS Pos.	9.4163
0.0016	Com. Pos. Offset	0.0047
PRESET	Status	PRESET

Status messages

[Azimuth] Preset Stow pin retracted

[General] ACU type: RTW Reduced internal limits che Green mode inactive

[Elevation] Preset Stow pin retracted

Error messages

Station Monitoring

Dewar

Time:	2023.107.14:13:46 (2023-04-17)	
70K:	74.15	K
20K:	21.70	K
Pressure:	1.27	10^-6 mbar
Amb. Temp.:	16.68	°C

Master Clock Offset

Time:		
EFOS39:	-.6 (= - 0.6)	µsec
TAC2:		µsec

Local Frequency

No active session!

Pointing (fivept)

Time:	2023.107.08:23:34	
Source:	cygnusa	
Position:	271 deg / 58 deg	
Az. Offset:	0.02565	deg
Az. Offset:	0.01305	deg
Status:	OK	

Log

(Load separately)

Error

2023.107.12:32:03.03?ERROR q1 -307 WARNING: Source structure correction greater than 20% for detector 11.
2023.107.12:32:34.35?ERROR nf -7 WARNING: Source structure correction greater than 20% for detector 11.
2023.107.12:32:45.52?ERROR q1 -307 WARNING: Source structure correction greater than 20% for detector 11.
2023.107.12:33:16.46?ERROR nf -7 WARNING: Source structure correction greater than 20% for detector 11.
2023.107.12:41:18.58?ERROR q1 -307 WARNING: Source structure correction greater than 20% for detector 11.
2023.107.12:41:50.05?ERROR nf -7 WARNING: Source structure correction greater than 20% for detector 11.

Log

2023.107.14:13:39.45#onoff#VAL cygnusa 324.9 9.5 eu 4 r 2369.99 0.7264 64.27 1436.9 478.438 0.03
2023.107.14:13:39.45#onoff#VAL cygnusa 324.9 9.5 ia 1 r 8341.00 1.0494 39.11 562.8 299.305 0.02
2023.107.14:13:39.45#onoff#VAL cygnusa 324.9 9.5 ib 2 r 8848.00 0.8646 50.90 715.3 292.280 0.02
2023.107.14:13:39.45#onoff#VAL cygnusa 324.9 9.5 ic 3 r 2281.00 0.7447 68.60 2004.2 625.191 0.04
2023.107.14:13:39.45#onoff# source Az El De I P Center Comp Tsys SEFD Tcal(j) Tcal(r)
2023.107.14:13:52.74;antenna=safepos
2023.107.14:13:52.74#antcn#ACU: move to standard stow position
2023.107.14:13:52.76/antenna/ACK
2023.107.14:13:58.63#flagr#flagr/antenna,off-source

xsamba.wtz(neidh)

fsrtw:/usr2/oper/:> oprin

How to monitor system quality?

Schedule an Automated Pointing Model with „acquire“

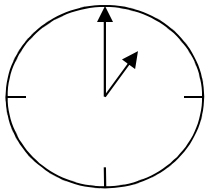
Setup:

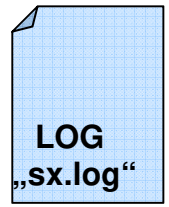
Configure „`ctlpo.ctl`“

```
 3C84       031948.16 +413042.1 2000 PREP    -1 10  0  0 POSTP    -2
* 3C123       043704.17 +294015.1 2000 PREP    -1 10  5  0 POSTP    -2
* 0521M365    052257.98 -362730.9 2000 PREP    -1 10  5  0 POSTP    -2
 TAURUSA     053432.   +220058   2000 PREP    -1 10  5  0 POSTP    -2
* ORIONA      053516.   -052322.  2000 PREP    -1 10  5  0 POSTP    -2
* 3C147       054236.14 +495107.2 2000 PREP    -1 10  5  0 POSTP    -2
* 0552P398    055530.8  +394849.  2000 PREP    -1 10  0  0 POSTP    -2
* 3C161       062710.10 -055304.8 2000 PREP    -1 10  5  0 POSTP    -2
* OJ287       085448.9  +200631.  2000 PREP    -1 10  0  0 POSTP    -2
* 3C218       091805.7  -120544.  2000 PREP    -1 10  5  0 POSTP    -2
* 4c39d25     092703.0  +390221.  2000 PREP    -1 10  0  0 POSTP    -2
* 3C273B      122906.70 +020308.6 2000 PREP    -1 10  0  0 POSTP    -2
* VIRGOA      123049.42 +122328.0 2000 PREP    -1 10  5  0 POSTP    -2
* 3C279       125611.17 -054721.5 2000 PREP    -1 10  0  0 POSTP    -2
* 3C286       133108.29 +303033.0 2000 PREP    -1 10  5  0 POSTP    -2
* 3C295       141120.65 +521209.1 2000 PREP    -1 10  5  0 POSTP    -2
* 3C345       164258.81 +394837.0 2000 PREP    -1 10  0  0 POSTP    -2
* 3C348       165108.2  +045933.  2000 PREP    -1 10  5  0 POSTP    -2
* 3C353       172028.2  -005848.  2000 PREP    -1 10  5  0 POSTP    -2
* 3C380       182931.72 +484447.0 2000 PREP    -1 10  5  0 POSTP    -2
* 3C391       184923.4  -005529.  2000 PREP    -1 10  5  0 POSTP    -2
* 1921M293    192451.06 -291430.1 2000 PREP    -1 10  0  0 POSTP    -2
 CYGNUSA     195928.4  +404402.  2000 PREP    -1 10  5  0 POSTP    -2
* 2134P004    213638.59 +004154.2 2000 PREP    -1 10  0  0 POSTP    -2
* 3C454D3     225357.75 +160853.6 2000 PREP    -1 10  0  0 POSTP    -2
 CASA        232324.8  +584859.  2000 PREP    -1 10  5  0 POSTP    -2
* SUN         000000.    000000   2000 PRESUN  -1 10  5  0 POSTSUN  -1
* MOON        000000.    000000   2000 PREMOON -1 10  5  0 POSTMOON -2
```

Process „acquire“:

```
proc=r41097wz
setupsx
proc=point
initp
acquire
```

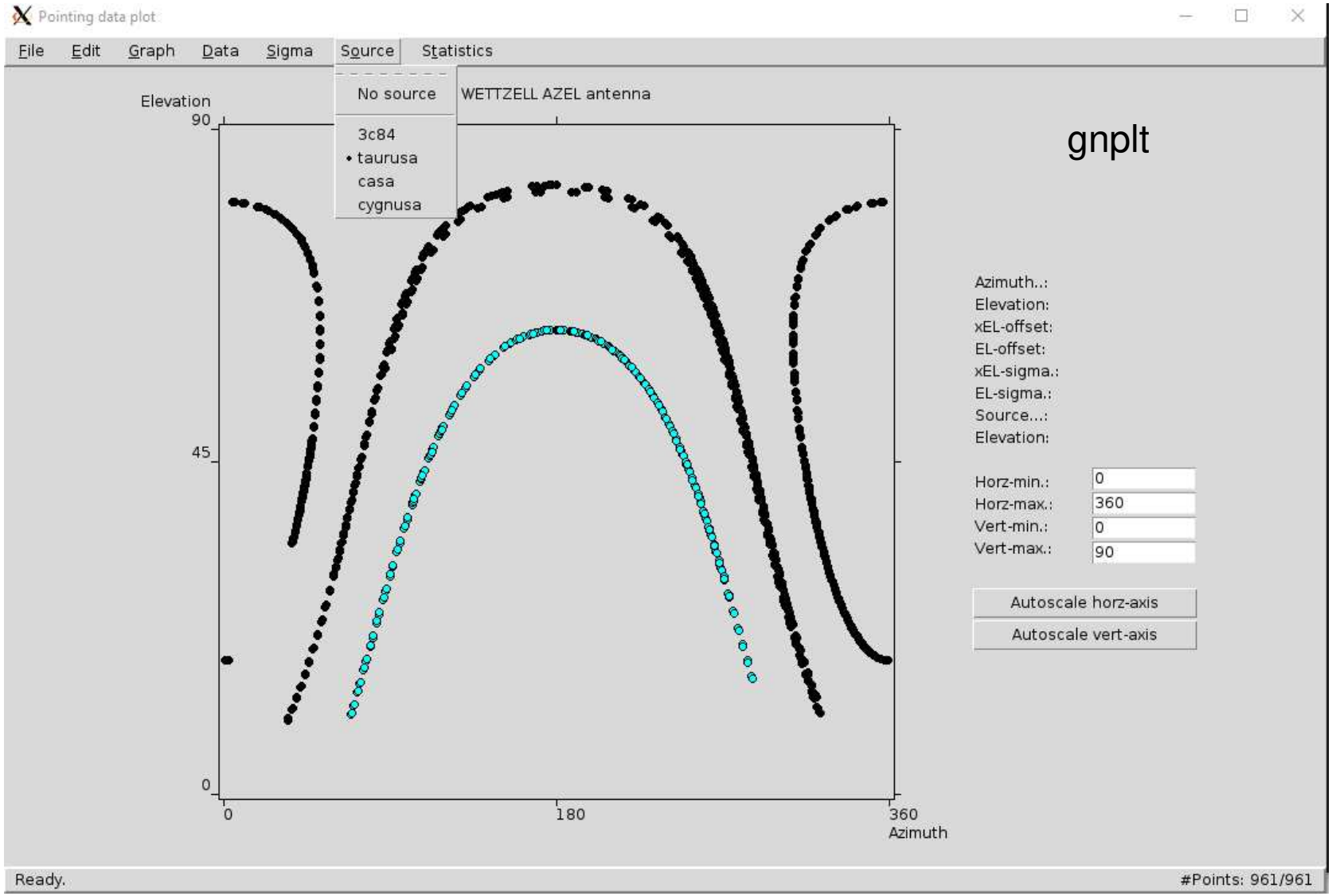





```
kill
```

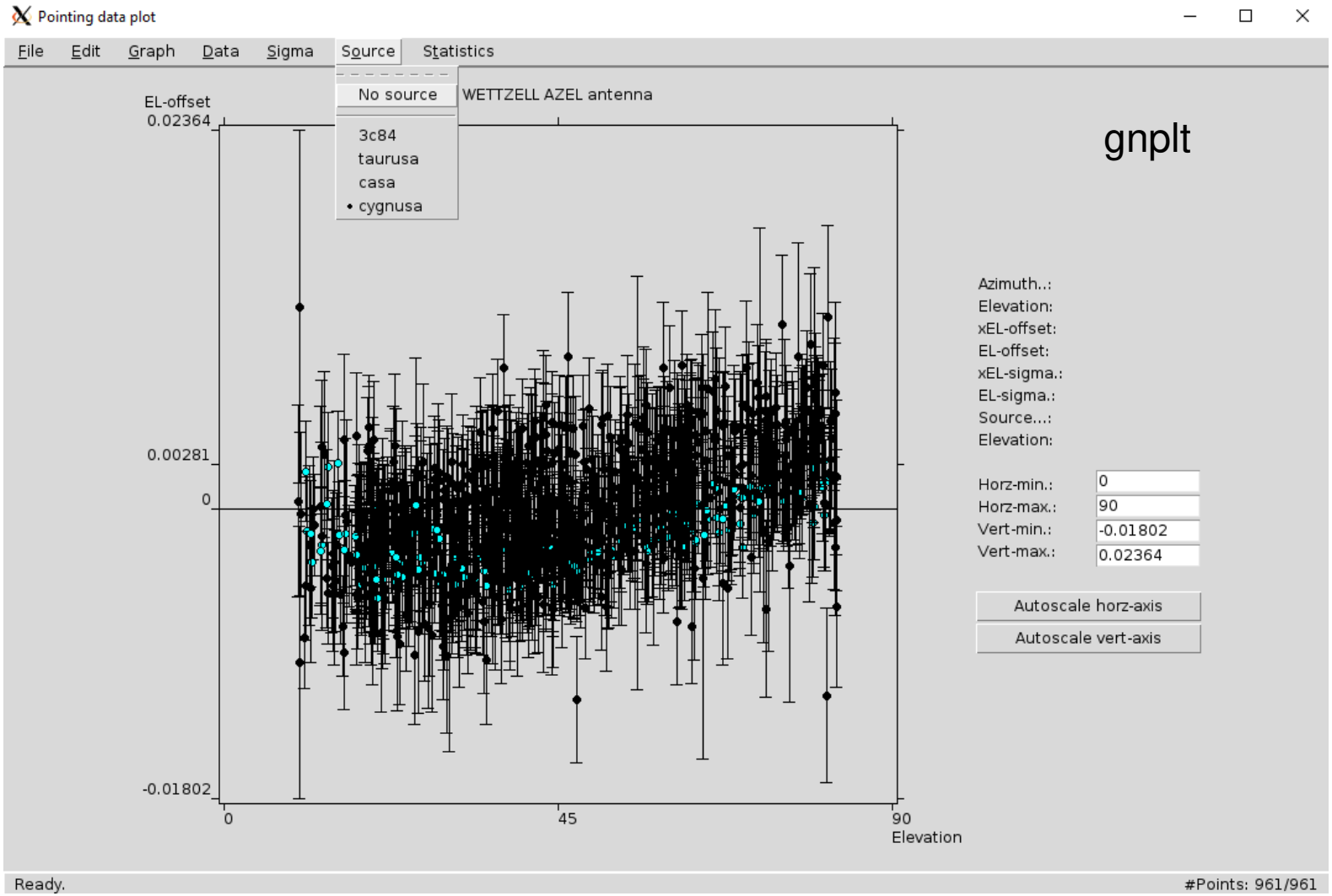
How to monitor system quality?

Schedule an Automated Pointing Model with „acquire“



How to monitor system quality?

Schedule an Automated Pointing Model with „acquire“



How to monitor system quality?

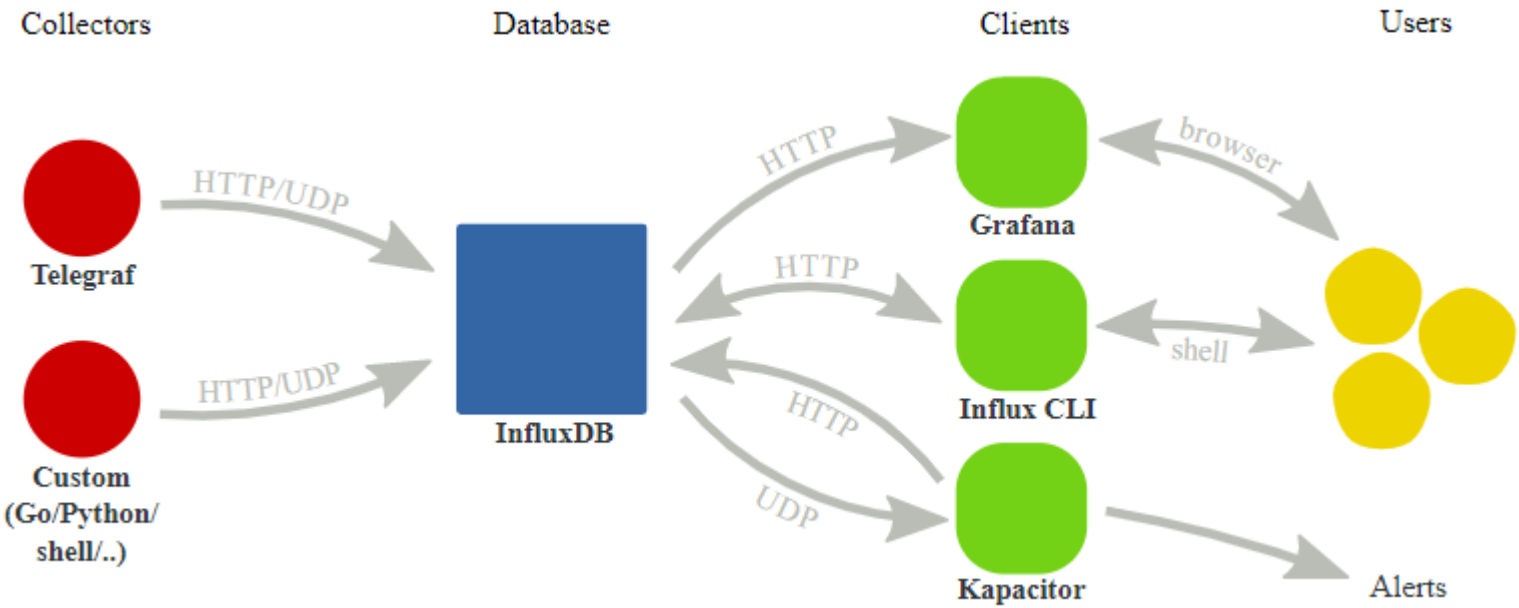
Additional monitoring

- VLBI Station Monitoring and Archival System (MAS) & FS Display Server: NASA FS
- eRemteCtrl & ZABBIX & SysMon: Wettzell Observatory
- “MoniCA”, “openMoniCA”: Australia Telescope National Facility and AuScope geodetic VLBI Telescopes
- Radboud Radio Lab VLBI monitor: EVN, mm-VLBI
- …

How to monitor system quality?

Additional monitoring

VLBI Station Monitoring and Archival System (MAS)

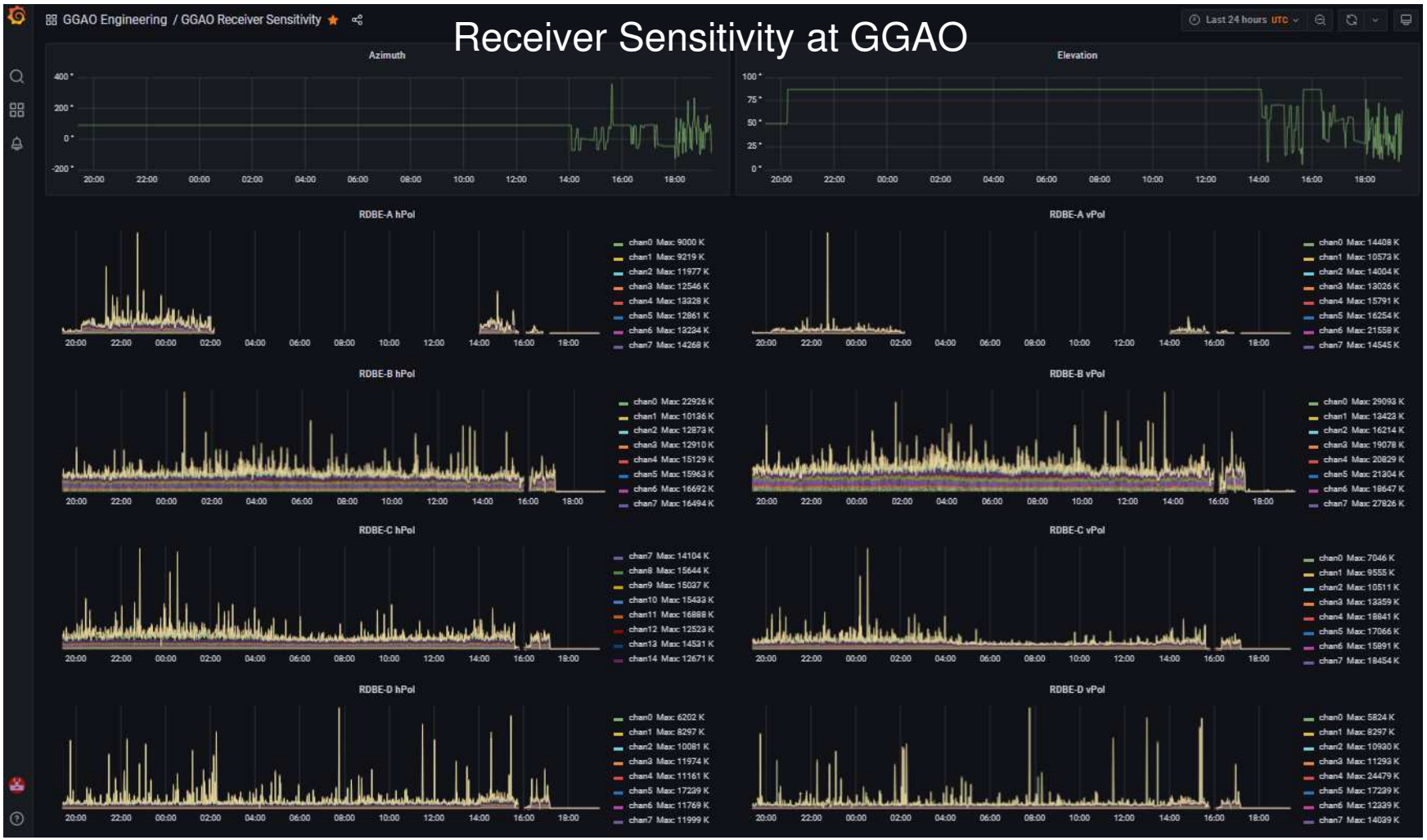


https://nvi-inc.github.io/mas/

How to monitor system quality?

Additional monitoring

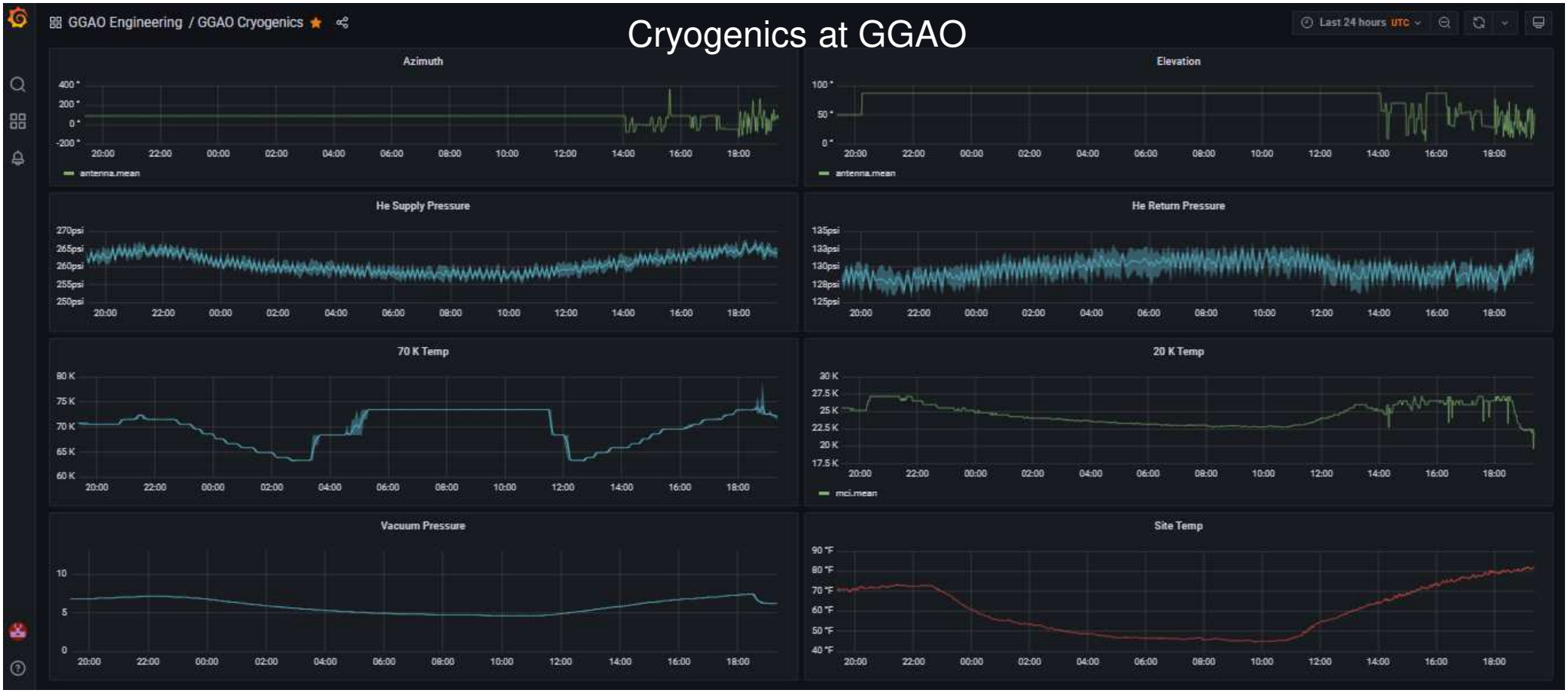
VLBI Station Monitoring and Archival System (MAS)



How to monitor system quality?

Additional monitoring

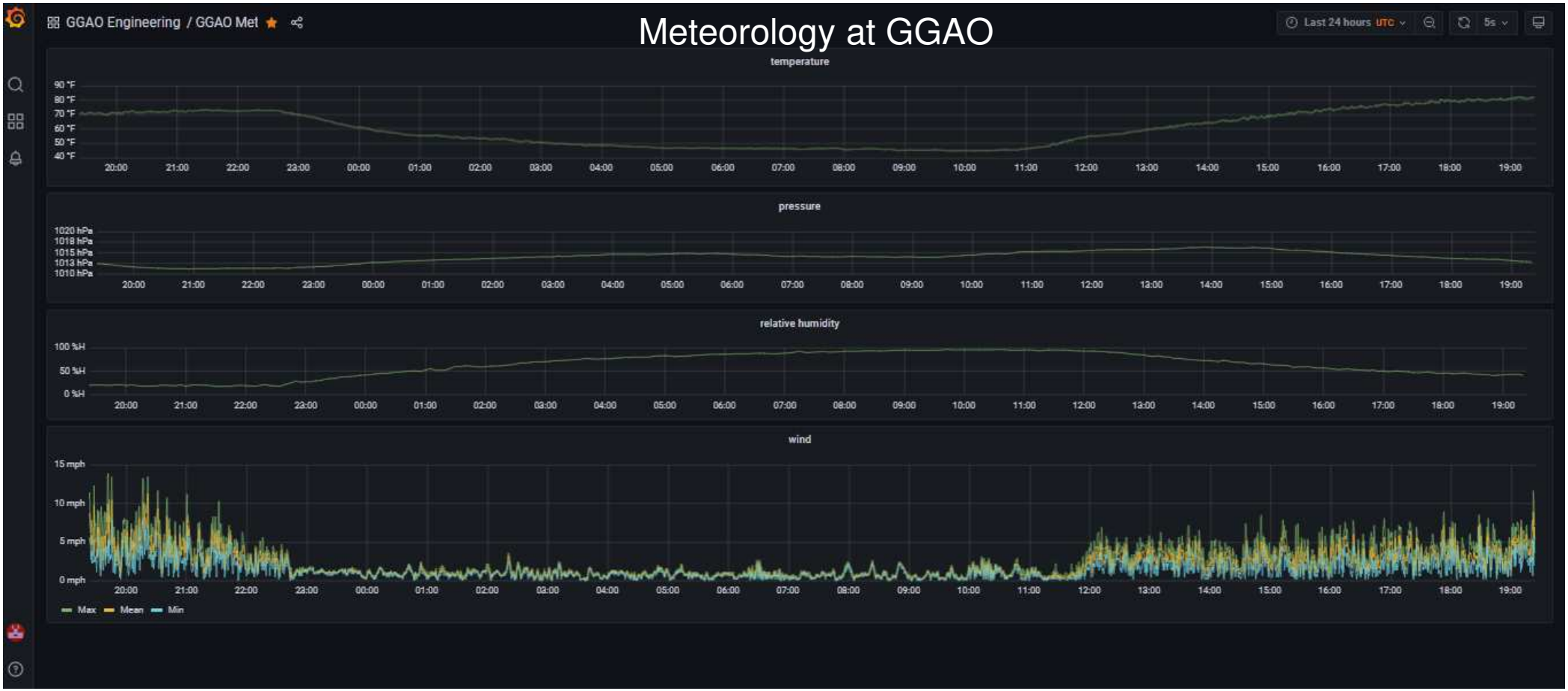
VLBI Station Monitoring and Archival System (MAS)



How to monitor system quality?

Additional monitoring

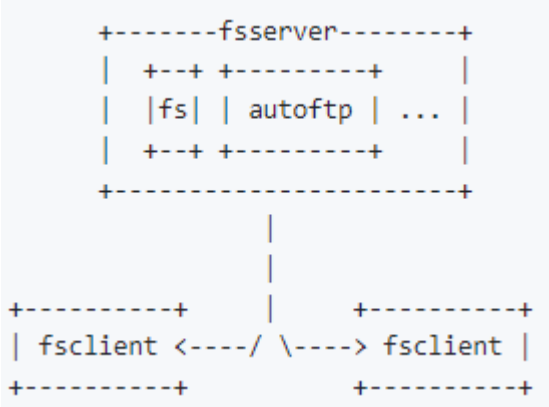
VLBI Station Monitoring and Archival System (MAS)



How to monitor system quality?

Additional monitoring

FS Display Server to get log messages



https://github.com/nvi-inc/fs/blob/main/misc/display_server.md

How to monitor system quality?

Additional monitoring

eRemteCtrl & ZABBIX & SysMon: Wettzell Observatory

System Status Monitor

WETTZELL		2023.110.13:39:04	UT		TEMP	8.7			SLEWING
MODE	RATE	18:15:00	NEXT		HUMID	73.6	RA	00h 00m 0.00s	
		SCHED=	none	LOG=	station	PRES	941.9	DEC	00d 00m	( )
		TSYS:	IFA	IFB	IFC	IFD	CABLE	0.006389	AZ	0.0000	EL	0.0000
			0	0	0	0	WIND	15.12	DIR	309		

NO CHECK: rx

Mark 5 Remaining Capacity

		VSN	Time	GB	%	Check UT
	A					
	0%					100% (Volume)
>	B					
	0%					100% (Volume)

Select Quality Monitoring: System Temperatures

System Temperatures

Tsys	0.00	(IFA)	0.00	(IFB)
	0.00	(IFC)	0.00	(IFD)

BBC	Freq	Ts-U	Ts-L
01	0.00		
02	0.00		
03	0.00		
04	0.00		
05	0.00		
06	0.00		
07	0.00		
08	0.00		
09	0.00		
10	0.00		
11	0.00		
12	0.00		
13	0.00		
14	0.00		
15	0.00		
16	0.00		

Antenna Monitoring

RTW ([2023].110.13:39:04:168 (Offset: 0 msec))

Azimuth	Source: Stop	Elevation
60.0492	Actual Pos.	25.0192
	Pos. Graph	
60.0182	Commanded Pos.	24.9996
0.0000	NASA FS Pos.	0.0000
0.0310	Com. Pos. Offset	0.0196
STOP	Status	STOP

Status messages

[Azimuth]	[General]	[Elevation]
Stop	ACU type: RTW	Stop
Stow pin retracted	Reduced internal limits che	Stow pin retracted
	Green mode inactive	

Error messages

Station Monitoring

Dewar

Time:	2023.110.13:38:52 (2023-04-20)	
70K:	71.04	K
20K:	20.46	K
Pressure:	0.87	10^-6 mbar
Amb. Temp.:	12.81	°C

Master Clock Offset

Time:		
EFOS39:	-.6 (= - 0.6)	µsec
TAC2:		µsec

Local Frequency

No active session!

Pointing (fivept)

Time:	2023.107.14:19:47	
Source:	cygnusa	
Position:	325 deg / 9 deg	
Az. Offset:	0.00058	deg
Az. Offset:	0.00405	deg
Status:	OK	

Log

(Load separately)

Error

2023.109.15:58:47.09?ERROR nf -7 WARNING: Source structure correction greater than 20% for detector 11.
2023.109.16:04:16.76?ERROR AN -5 Error return from antenna.
2023.109.16:08:34.85?ERROR AN -5 Error return from antenna.
2023.109.16:12:40.19?ERROR q1 -307 WARNING: Source structure correction greater than 20% for detector 11.
2023.109.16:13:13.86?ERROR nf -7 WARNING: Source structure correction greater than 20% for detector 11.
2023.109.16:13:23.00?ERROR aq -1(br) Break Detected in AQUIR

Log

2023.110.13:22:41.52;antenna=casa
2023.110.13:22:41.52#antcn#ACU: move to position of Cassiopeia A
2023.110.13:22:41.52#antcn#Refraction corr.: 8.90 deg Cel., 942.00 hPas, 74.70 %, NO RAIN
2023.110.13:22:41.56#antcn#[ERROR] ACU: [Azimuth] Axis disabled
2023.110.13:22:41.56#antcn#[ERROR] ACU: [Elevation] Axis disabled
2023.110.13:22:41.56/antenna/ACK
2023.110.13:22:45.29;antenna=safepos
2023.110.13:22:45.29#antcn#ACU: move to standard stow position
2023.110.13:22:45.30/antenna/ACK

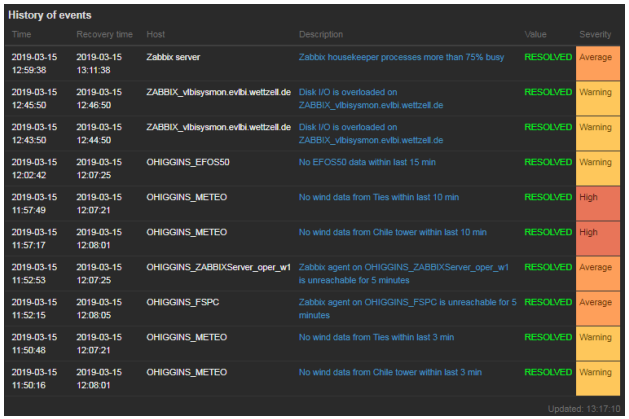
FS Web Server

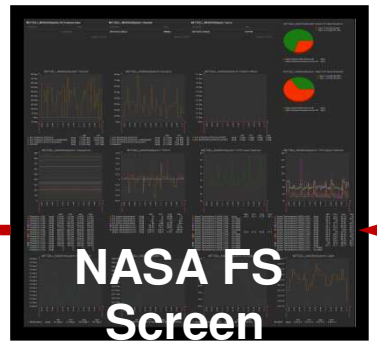
How to monitor system quality?

Additional monitoring

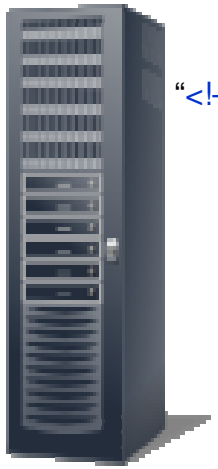
eRemteCtrl & ZABBIX & SysMon: Wettzell Observatory

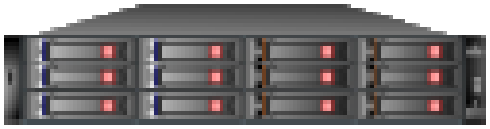
Global Network Status

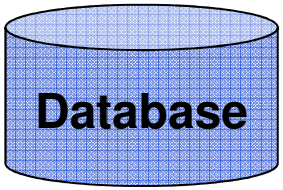




ZABBIX Server







Pattern extraction
e.g.
"941.9"
is extracted from
"<!—ERC::PRESSURE--> 941.9<!-- -->"

NASA FS Output remotely accessable

Monitoring-Bypass

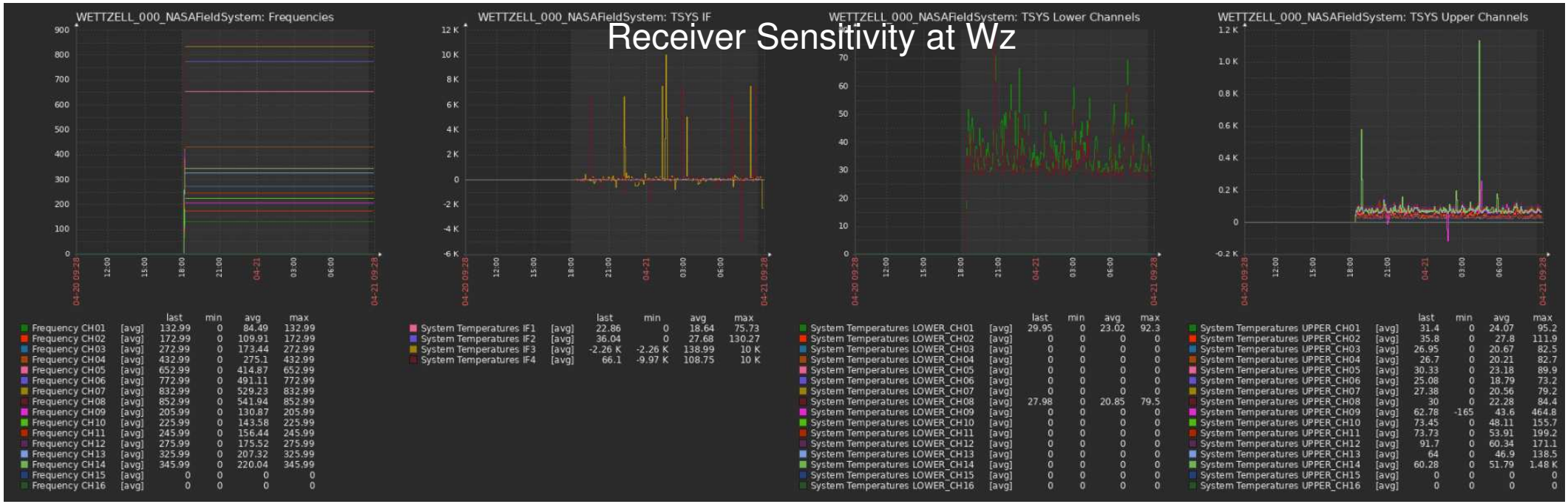
➔ see Lecture IVS Seamless Auxiliary Data Archive (SADA)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730884 - JUMPING JIVE

How to monitor system quality?

Additional monitoring

eRemteCtrl & ZABBIX & SysMon: Wettzell Observatory



		last	min	avg	max
Frequency CH01	[avg]	132.99	0	84.49	132.99
Frequency CH02	[avg]	172.99	0	109.91	172.99
Frequency CH03	[avg]	272.99	0	173.44	272.99
Frequency CH04	[avg]	432.99	0	275.1	432.99
Frequency CH05	[avg]	652.99	0	414.87	652.99
Frequency CH06	[avg]	772.99	0	491.11	772.99
Frequency CH07	[avg]	832.99	0	529.23	832.99
Frequency CH08	[avg]	852.99	0	541.94	852.99
Frequency CH09	[avg]	205.99	0	130.87	205.99
Frequency CH10	[avg]	225.99	0	143.58	225.99
Frequency CH11	[avg]	245.99	0	156.44	245.99
Frequency CH12	[avg]	275.99	0	175.52	275.99
Frequency CH13	[avg]	325.99	0	207.32	325.99
Frequency CH14	[avg]	345.99	0	220.04	345.99
Frequency CH15	[avg]	0	0	0	0
Frequency CH16	[avg]	0	0	0	0

		last	min	avg	max
System Temperatures IF1	[avg]	22.86	0	18.64	75.73
System Temperatures IF2	[avg]	36.04	0	27.68	130.27
System Temperatures IF3	[avg]	-2.26 K	-2.26 K	138.99	10 K
System Temperatures IF4	[avg]	66.1	-9.97 K	108.75	10 K

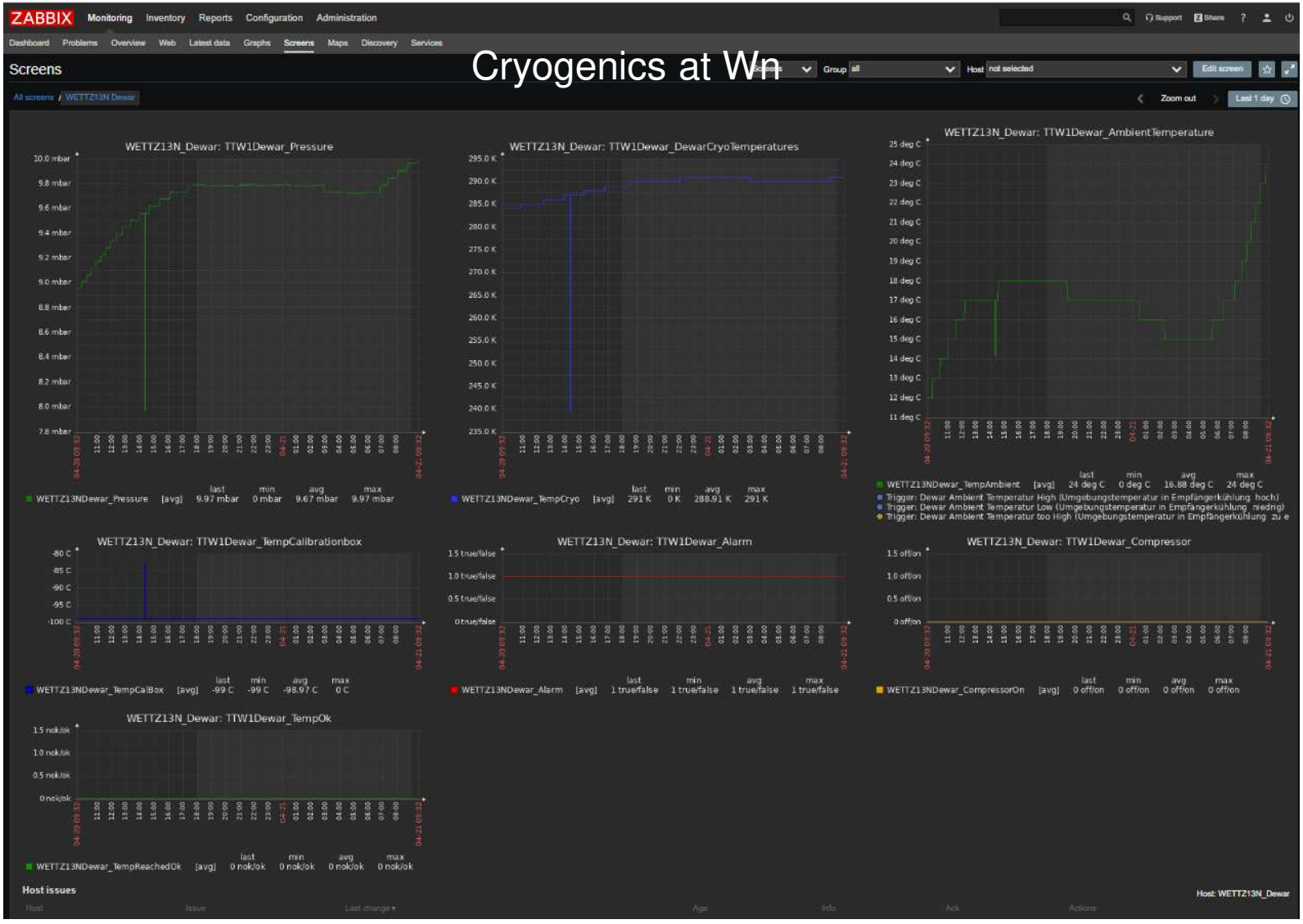
		last	min	avg	max
System Temperatures LOWER_CH01	[avg]	29.95	0	23.02	92.3
System Temperatures LOWER_CH02	[avg]	0	0	0	0
System Temperatures LOWER_CH03	[avg]	0	0	0	0
System Temperatures LOWER_CH04	[avg]	0	0	0	0
System Temperatures LOWER_CH05	[avg]	0	0	0	0
System Temperatures LOWER_CH06	[avg]	0	0	0	0
System Temperatures LOWER_CH07	[avg]	0	0	0	0
System Temperatures LOWER_CH08	[avg]	27.98	0	20.85	79.5
System Temperatures LOWER_CH09	[avg]	0	0	0	0
System Temperatures LOWER_CH10	[avg]	0	0	0	0
System Temperatures LOWER_CH11	[avg]	0	0	0	0
System Temperatures LOWER_CH12	[avg]	0	0	0	0
System Temperatures LOWER_CH13	[avg]	0	0	0	0
System Temperatures LOWER_CH14	[avg]	0	0	0	0
System Temperatures LOWER_CH15	[avg]	0	0	0	0
System Temperatures LOWER_CH16	[avg]	0	0	0	0

		last	min	avg	max
System Temperatures UPPER_CH01	[avg]	31.4	0	24.07	95.2
System Temperatures UPPER_CH02	[avg]	35.8	0	27.8	111.9
System Temperatures UPPER_CH03	[avg]	26.95	0	20.67	82.5
System Temperatures UPPER_CH04	[avg]	26.7	0	20.21	82.7
System Temperatures UPPER_CH05	[avg]	30.33	0	23.18	89.9
System Temperatures UPPER_CH06	[avg]	25.08	0	18.79	73.2
System Temperatures UPPER_CH07	[avg]	27.38	0	20.56	79.2
System Temperatures UPPER_CH08	[avg]	30	0	22.28	84.4
System Temperatures UPPER_CH09	[avg]	62.78	-165	43.6	464.8
System Temperatures UPPER_CH10	[avg]	73.45	0	48.11	155.7
System Temperatures UPPER_CH11	[avg]	73.73	0	53.91	199.2
System Temperatures UPPER_CH12	[avg]	91.7	0	60.34	171.1
System Temperatures UPPER_CH13	[avg]	64	0	46.9	138.5
System Temperatures UPPER_CH14	[avg]	60.28	0	51.79	1.48 K
System Temperatures UPPER_CH15	[avg]	0	0	0	0
System Temperatures UPPER_CH16	[avg]	0	0	0	0

How to monitor system quality?

Additional monitoring

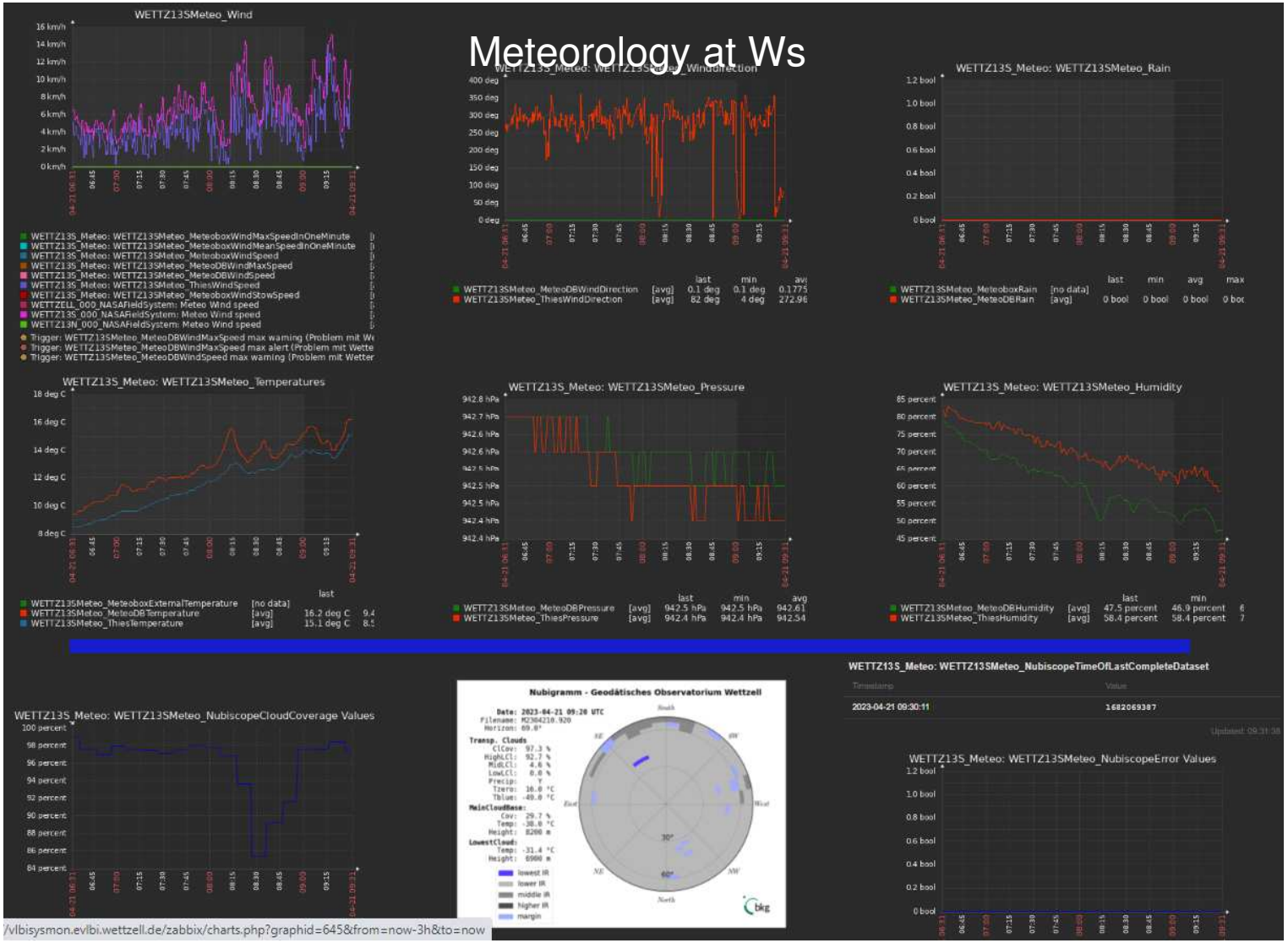
eRemteCtrl & ZABBIX & SysMon: Wettzell Observatory



How to monitor system quality?

Additional monitoring

eRemteCtrl & ZABBIX & SysMon: Wettzell Observatory



TOW2023 - Maintenance Workshops

FS Operations

Thank you …