Observing with the 3-bit samplers

EVLA

A how-to guide

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Atacama Large Millimeter/submillimeter Array

Expanded Very Large Array

Robert C. Byrd Green Bank Telescope

Very Long Baseline Array

NRAO

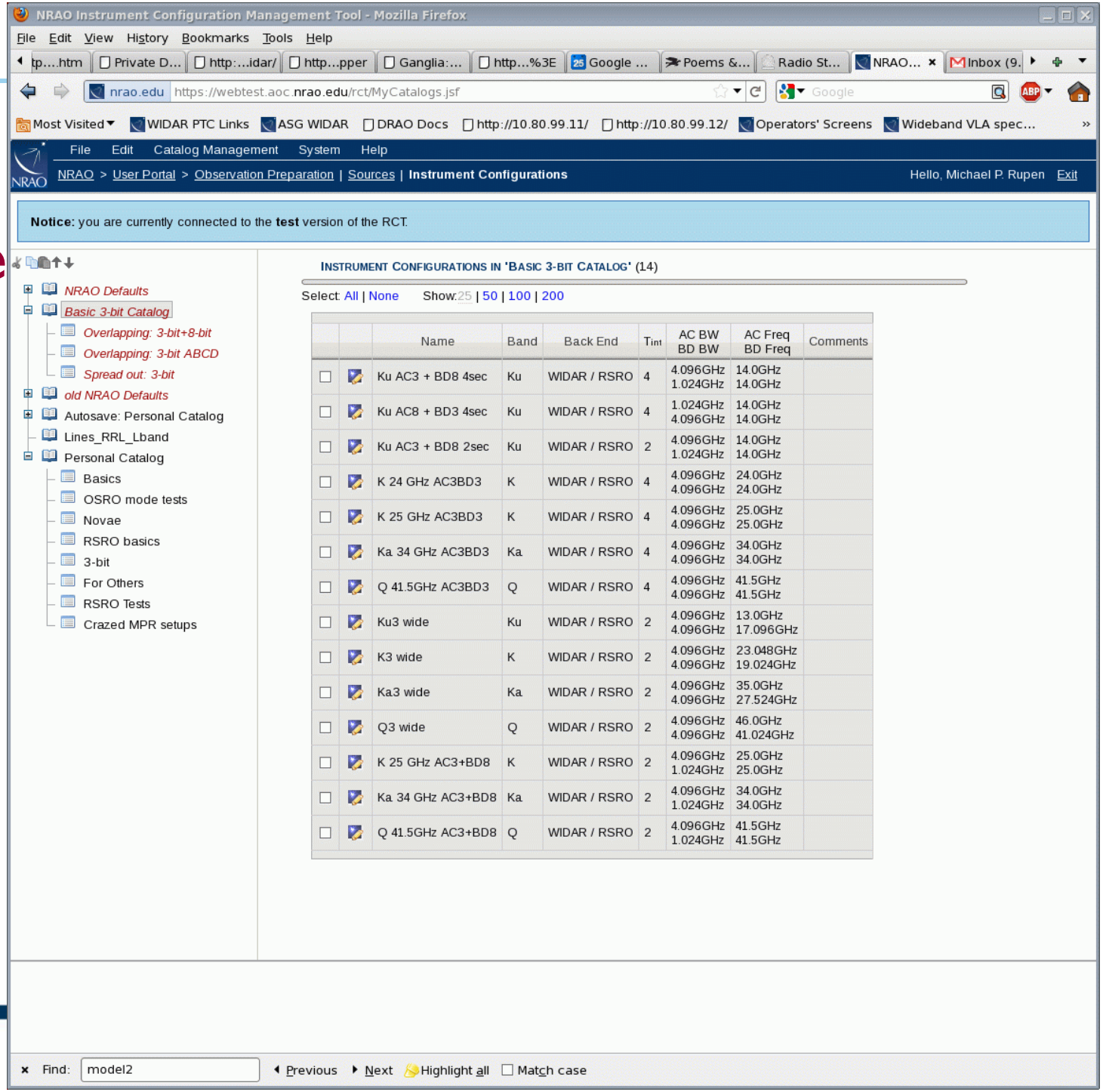
NRAO

Using the OPT

Use webtest!

- https://webtest.aoc.nrao.edu/opt/
- You can transfer stuff from production but it's a pain

RCT: 3-bit resource



Name	Band	Back End	Tint	AC BW BD BW	AC Freq BD Freq	Comments
Ku AC3 + BD8 4sec	Ku	WIDAR / RSRO	4	4.096GHz 1.024GHz	14.0GHz 14.0GHz	
Ku AC8 + BD3 4sec	Ku	WIDAR / RSRO	4	1.024GHz 4.096GHz	14.0GHz 14.0GHz	
Ku AC3 + BD8 2sec	Ku	WIDAR / RSRO	2	4.096GHz 1.024GHz	14.0GHz 14.0GHz	
K 24 GHz AC3BD3	K	WIDAR / RSRO	4	4.096GHz 4.096GHz	24.0GHz 24.0GHz	
K 25 GHz AC3BD3	K	WIDAR / RSRO	4	4.096GHz 4.096GHz	25.0GHz 25.0GHz	
Ka 34 GHz AC3BD3	Ka	WIDAR / RSRO	4	4.096GHz 4.096GHz	34.0GHz 34.0GHz	
Q 41.5GHz AC3BD3	Q	WIDAR / RSRO	4	4.096GHz 4.096GHz	41.5GHz 41.5GHz	
Ku3 wide	Ku	WIDAR / RSRO	2	4.096GHz 4.096GHz	13.0GHz 17.096GHz	
K3 wide	K	WIDAR / RSRO	2	4.096GHz 4.096GHz	23.048GHz 19.024GHz	
Ka3 wide	Ka	WIDAR / RSRO	2	4.096GHz 4.096GHz	35.0GHz 27.524GHz	
Q3 wide	Q	WIDAR / RSRO	2	4.096GHz 4.096GHz	46.0GHz 41.024GHz	
K 25 GHz AC3+BD8	K	WIDAR / RSRO	2	4.096GHz 1.024GHz	25.0GHz 25.0GHz	
Ka 34 GHz AC3+BD8	Ka	WIDAR / RSRO	2	4.096GHz 1.024GHz	34.0GHz 34.0GHz	
Q 41.5GHz AC3+BD8	Q	WIDAR / RSRO	2	4.096GHz 1.024GHz	41.5GHz 41.5GHz	

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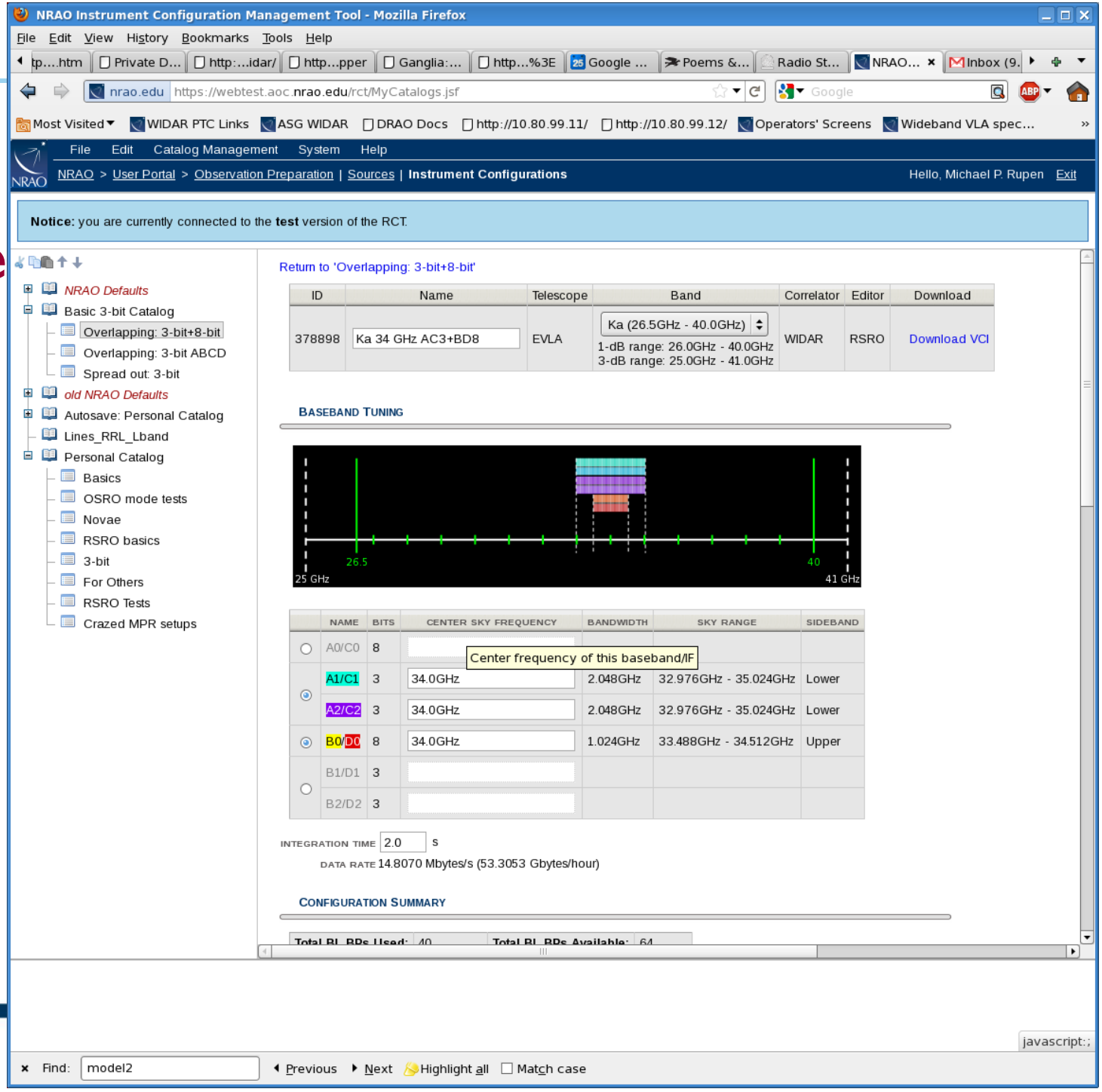

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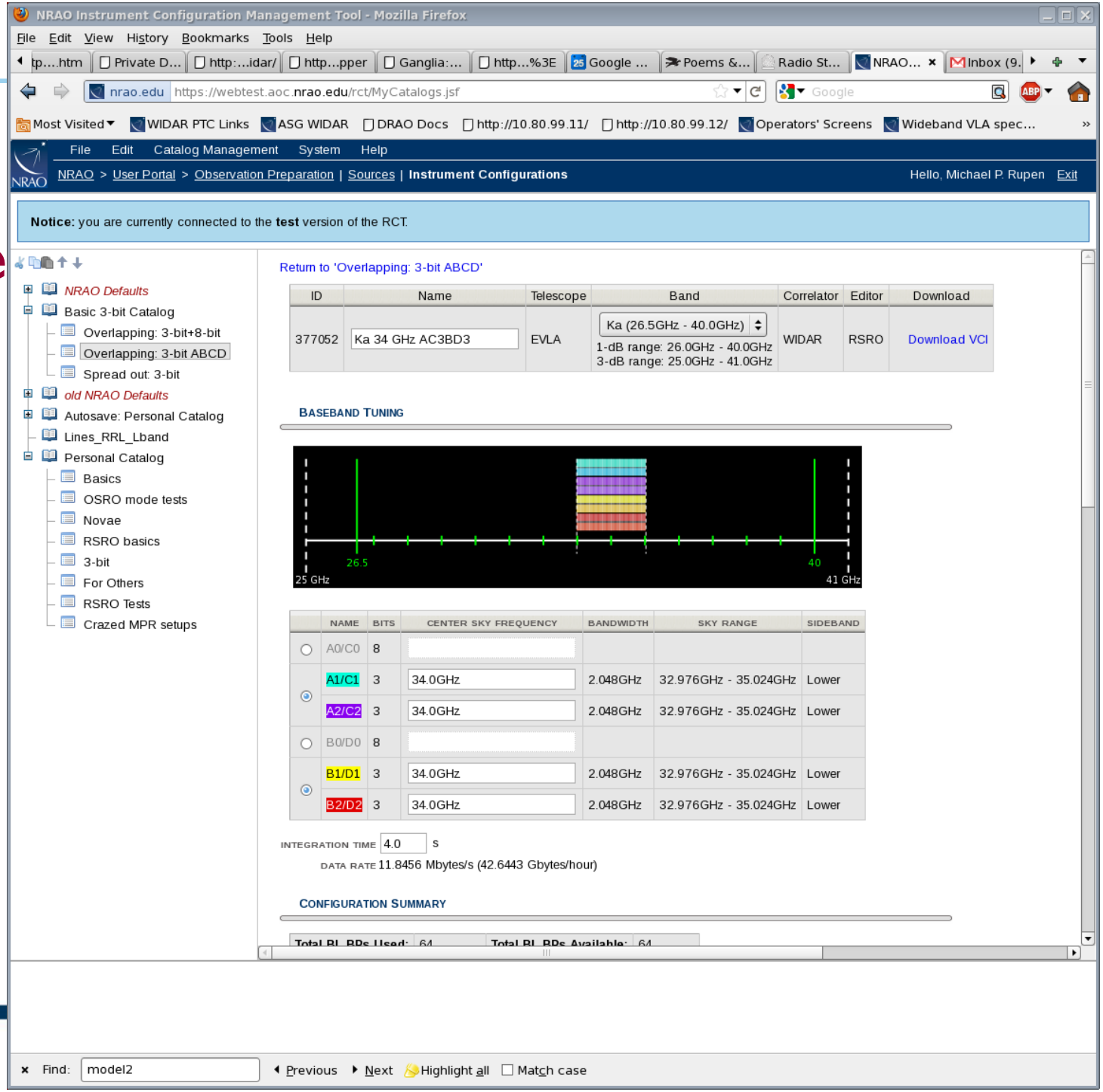

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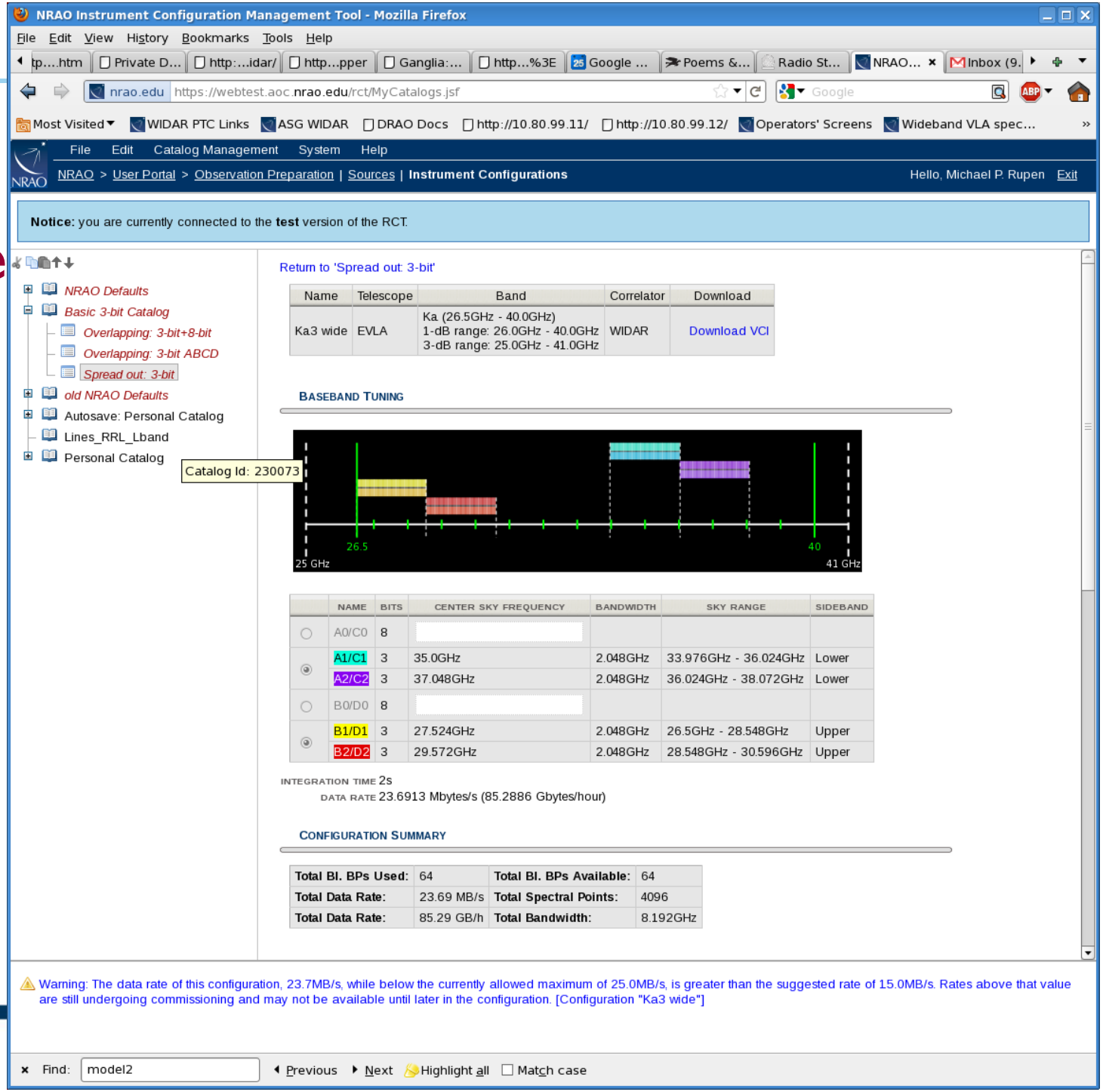


RCT: 3-bit resources

- Watch for…
  - –Tuning restrictions
  - –RCT bugs
  - –Data rates: 2sec → **23.6 MB/s, 85 GB/hr**
- "Fill subbands" is very useful for 3-bit!

RCT: 3-bit resources

- 3-bit in all basebands requires **all 64 BIBPs**

RCT: 3-bit resources

- **Focus on 2013 general observing**
- 128 MHz/subband; no stacking/recirc
  - –Full pol'n products: 2 MHz/channel
  - –Dual p.p.: 1 MHz/channel
  - –One p.p.: 0.5 MHz/channel

RCT: 3-bit resources

- High frequencies only (for now): [Ku] K Ka Q
  - –Avoid RFI
  - –Band-dependent delays
  - –Include Ku (not general observing) as it does not suffer from these effects, and allows observing in somewhat poorer weather

3-bit schedules

- 3-bit requires…
  - –Setting attenuators & gain-slope equalizers ("set-and-remember")
  - –Setting requantizer gains

3-bit set-and-remember

- The 1st scan with a given 3-bit LO setting is used to set the attenuators & gain-slope equalizers
  - Should be at a reasonable elevation
  - Takes 4-5 minutes (conservative)
  - Done automatically by model2script – cannot (yet) be called explicitly in OPT

3-bit requantizer gain setting

- 2nd scan with given LO setting after set-and-remember, and 1st scan in ALL subsequent groups
  - There is no memory
  - Takes 90 sec – 1st 60sec will be useless

Typical 3-bit SB

- K3 setup 5mins set 3-bit attn/GSE
- X8 setup 1min set 8-bit attn
- X8 ptg 2m40s single subband RefPtg
- K3 setRQ 1m30s set 3-bit RQ
- K3 loop
  - K3cal
  - K3src

Scheduling 3-bit

- Can't use OST
- M2s by hand: Michael, Debra, Vivek, …

Known problems

Lack of receivers

- Ku: 3 8 9 15 28
- K: none!
- Ka: 4
- Q: 8

Lost BDFs

- Sometimes no BDFs for an entire 3-bit configuration
- Actively working on this!!

Hardware issues

- Individual sampler pairs
  - Ea28 B2D2
  - Ea18 A2C2
  - Ea21 B2D2
  - Ea04
  - Suckouts: ea24 B2D2, ea27 A2

Hardware issues

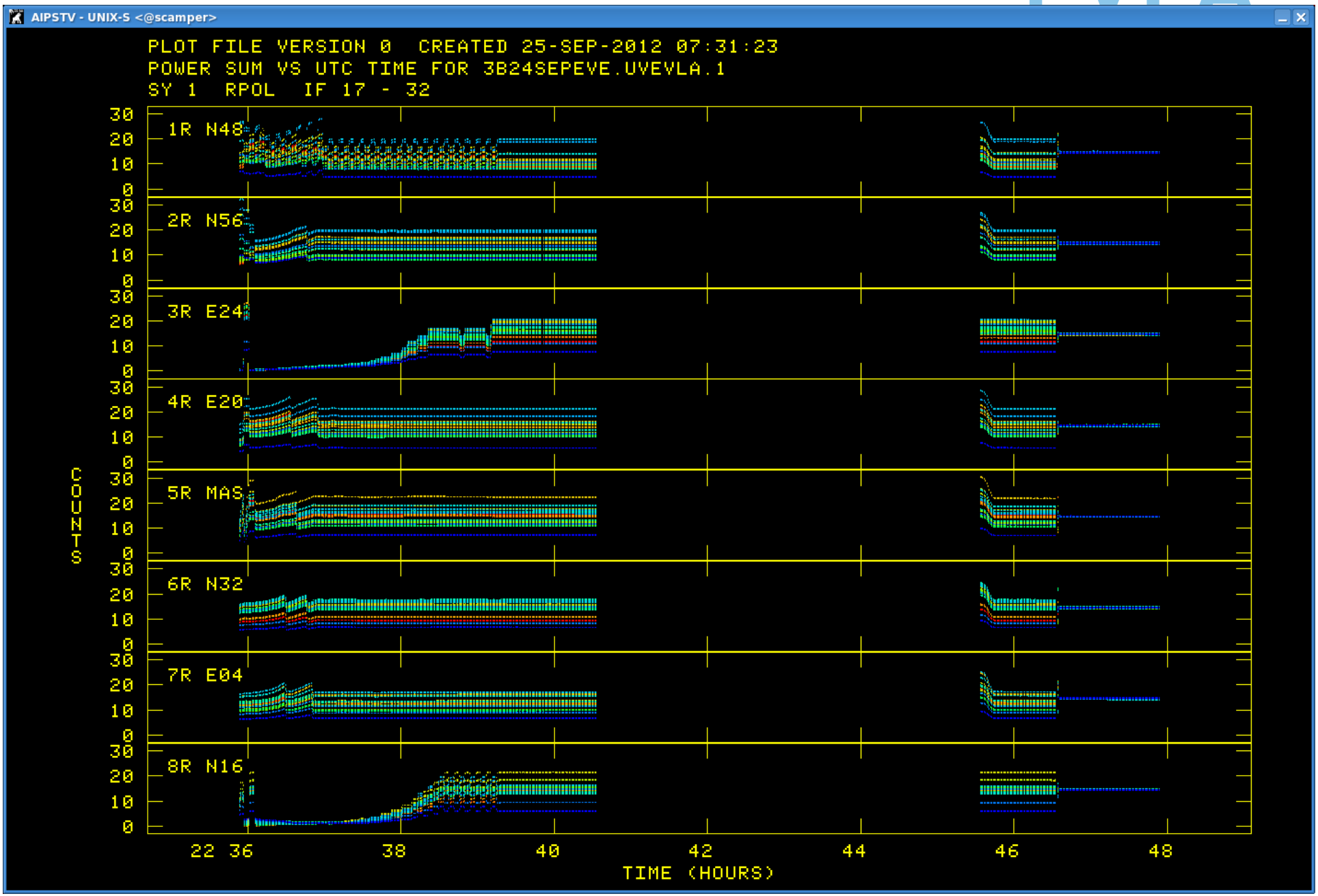
- Lots of one-offs
  - –Not powered on
  - –Manual resets
  - –Unstable
- You may see sampler-dependent oddities:
  - –No fringes
  - –Unstable delays
  - –"Lumpy bumpy" within subband/baseband

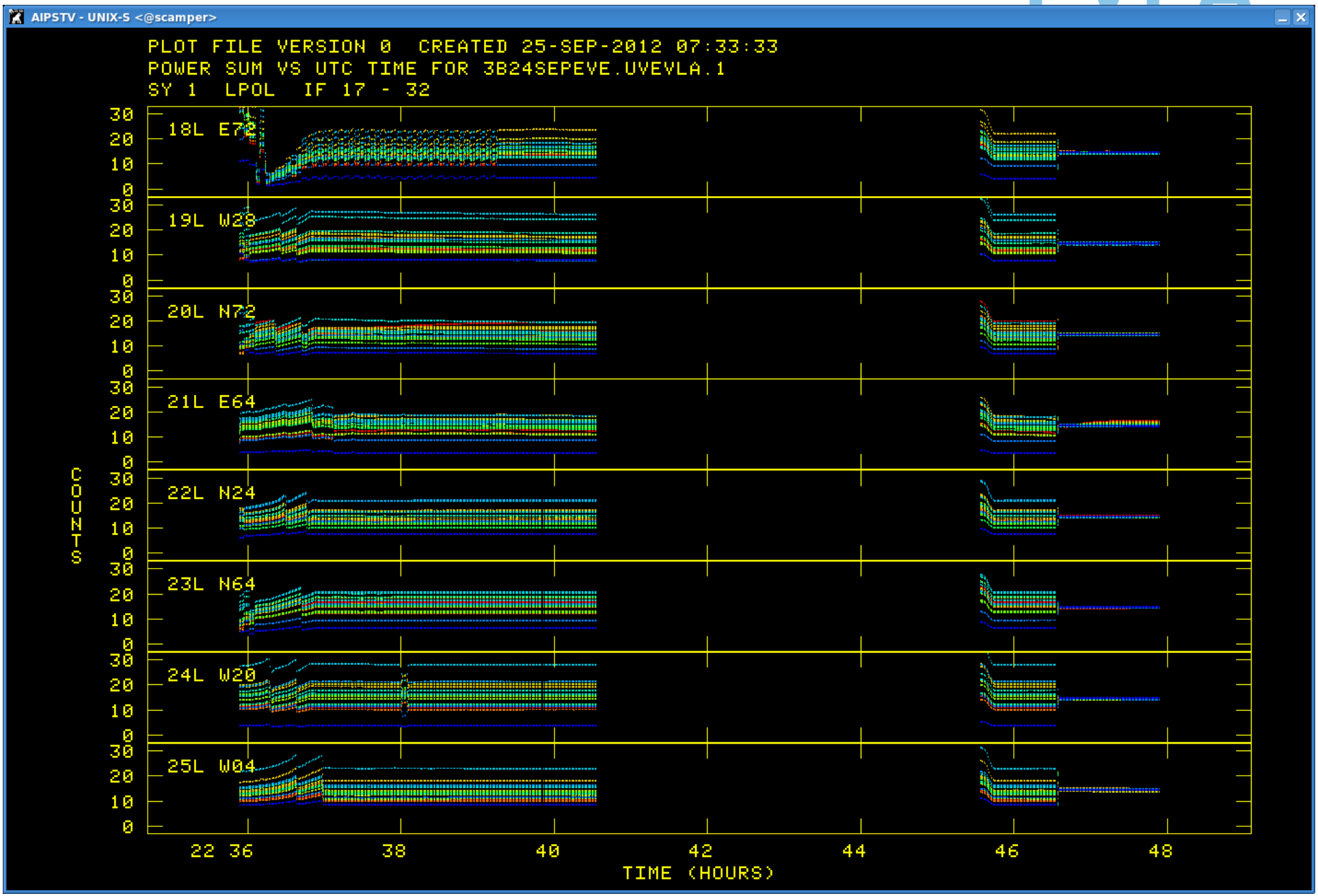
Hardware issues

- Delays
  - –Sometimes not set as rapidly as 8-bit
  - –Set at K-band
  - –There are unexplained band-dependent delay offsets – high bands seem similar; low bands have big offsets

Post-processing

Psum is a great diagnostic


AIPSTV - UNIX-S <@scamper>
PLOT FILE VERSION 0 CREATED 25-SEP-2012 07:31:23
POWER SUM VS UTC TIME FOR 3B24SEPEVE.UVEVLA.1
SY 1 RPOL IF 17 - 32
1R N48
2R N56
3R E24
4R E20
5R MAS
6R N32
7R E04
8R N16
COUNTS
0
10
20
30
22 36
38
40
42
44
46
48
TIME (HOURS)


AIPSTV - UNIX-S <@scamper>
PLOT FILE VERSION 0 CREATED 25-SEP-2012 07:33:33
POWER SUM VS UTC TIME FOR 3B24SEPEVE.UVEVLA.1
SY 1 LPOL IF 17 - 32
18L E72
19L W28
20L N72
21L E64
22L N24
23L N64
24L W20
25L W04
COUNTS
0
10
20
30
22 36
38
40
42
44
46
48
TIME (HOURS)

Note that…

- LOTS of data
- Overlapping basebands is very useful
  - –3-bit matches 8-bit; 3-bit matches 3-bit
- AIPS: BDF2AIPS doesn't know about basebands
  - –CASA can select by baseband
- CASA/AIPS: IFs/SpWs for "overlapping" setups are:
  - –A1C1 A2C2 B1D1 B2D2
  - –Normally 16 subbands per 3-bit baseband; 8 per 8-bit baseband (128 MHz/subband)

We believe…

- Visibilities (correlations) are pretty linear – 5-10%?
- Pdiff are NOT linear, and should not be used
- Very little done with autocorrelations so far
- 3- bit matches 8-bit (phase, bandpass, etc.)

What is to be done

Basic tests

- Multiple tunings
- Multiple bands – Rick?
- Polarization tests (PolCal) – Dave Roberts/Steve
- Gain transfer/consistency
  - –Wide range of elevations & source strengths – Vivek
  - –Do we need to change GSE/attn in a run? When?
- Effects of changing GSE/attn with time

Basic tests

- Long observations
- Long-term bandpass stability
- Auto-flagging/pipelining – Hsi-Wei
  - –Easy ways to find Evil Samplers (cf. Vivek's plots)
  - –Birdies in a/c & flagging channels
- Use of REWAY et al.
- Spectral line survey/search – Juergen

Longer term

- Use of switched power – Rick/Vivek
- Lower bands – Lorant
- Tuning ranges – Lorant?

On-going work

- Hardware robustness
- Time required for GSE/attn setting
- Various software stuff resulting from tests (e.g., OPT, RCT, etc.)