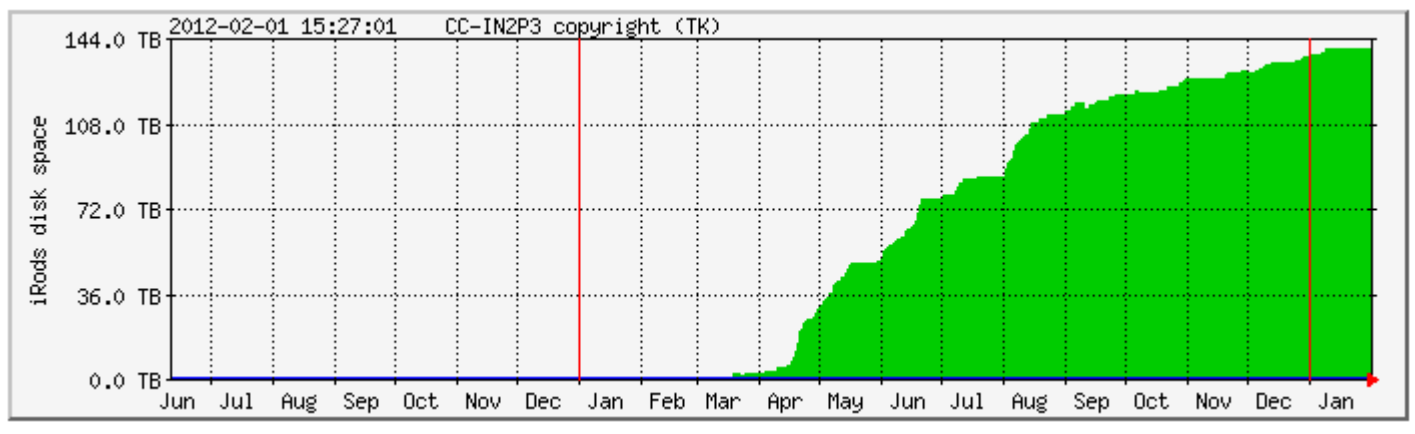
Amas Processing Status

J.E Campagne (LAL) 3/2/12-Meudon

- Data proc. Status
- Calibrator sources analysis
- Abellxyz: zoom freq. band for HI signal
- Noise: introduction to A.S Torrento's talk

Data



- 500 cycles ON-OFF Abell85
- 240 cycles ON-OFF Abell2440
- 900 cycles ON-OFF Abell1205
- Few 3C161, 3C273, NGC4383 runs both ON-OFF & DR

1 cycle ON-OFF 2min total: 30sec x 30% ON + 30sec x 30% OFF
1 cycle DR ~3min total: 170sec x 30% x corr. fact

Data processing on Irods @ CCIN2P3 (short list)

1. Median ov. 5120 BAO paq. ON/Gain or OFF/Gain
2. Mean of 5 medians => med. spectrum (FITS files)
3. Mean on each cycle
4. For each cycle (ON-OFF)/OFF_f
    1. Result of (ON/G-OFF/G)/(OFF/G)_f
    2. G=Gain med. Filtered 3MHz
    3. (OFF/G)_f= (OFF/Gain) med. Filtered 2MHz
5. For each cycle too < (ON-OFF)/OFF_f > ov. $[\nu_1, \nu_2]$

Limitation due to batch queue parameters although we are using LONG & HUGE ! In particular: median filtering limited ~5120 paq; cycles with 170sec (Drift) are the maximum but for ON-OFF it could be non-particable as then we should split the run into individual cycles and we are limited by <20 simultaneous jobs accessing Irods.

Calibrator Sources
3C273, 3C261, NGC4383

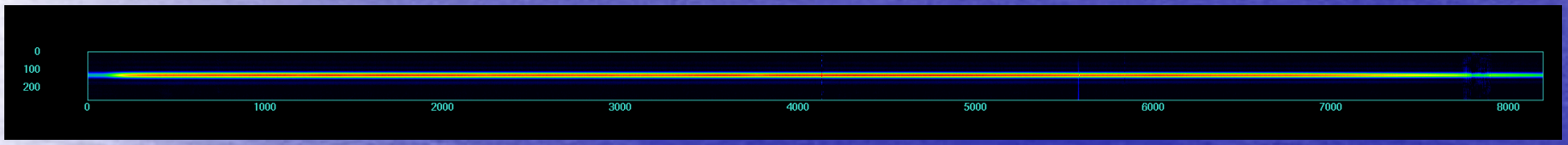
3C161 Drift Scan

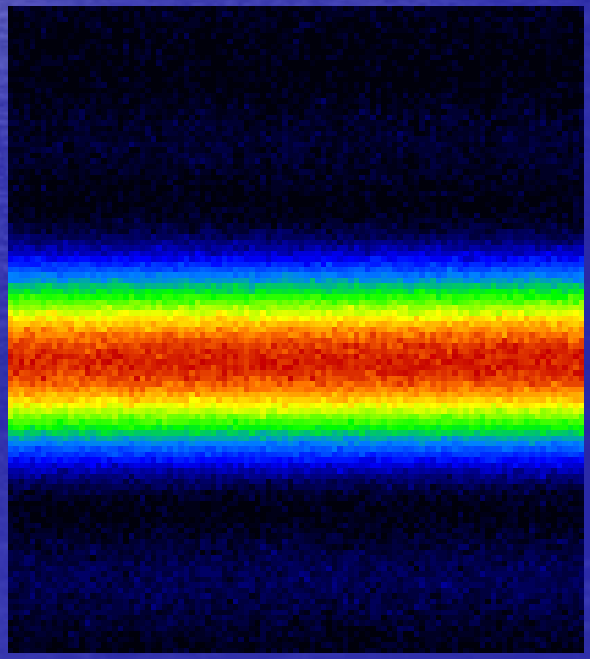
158451.171 & 158452.171

Data

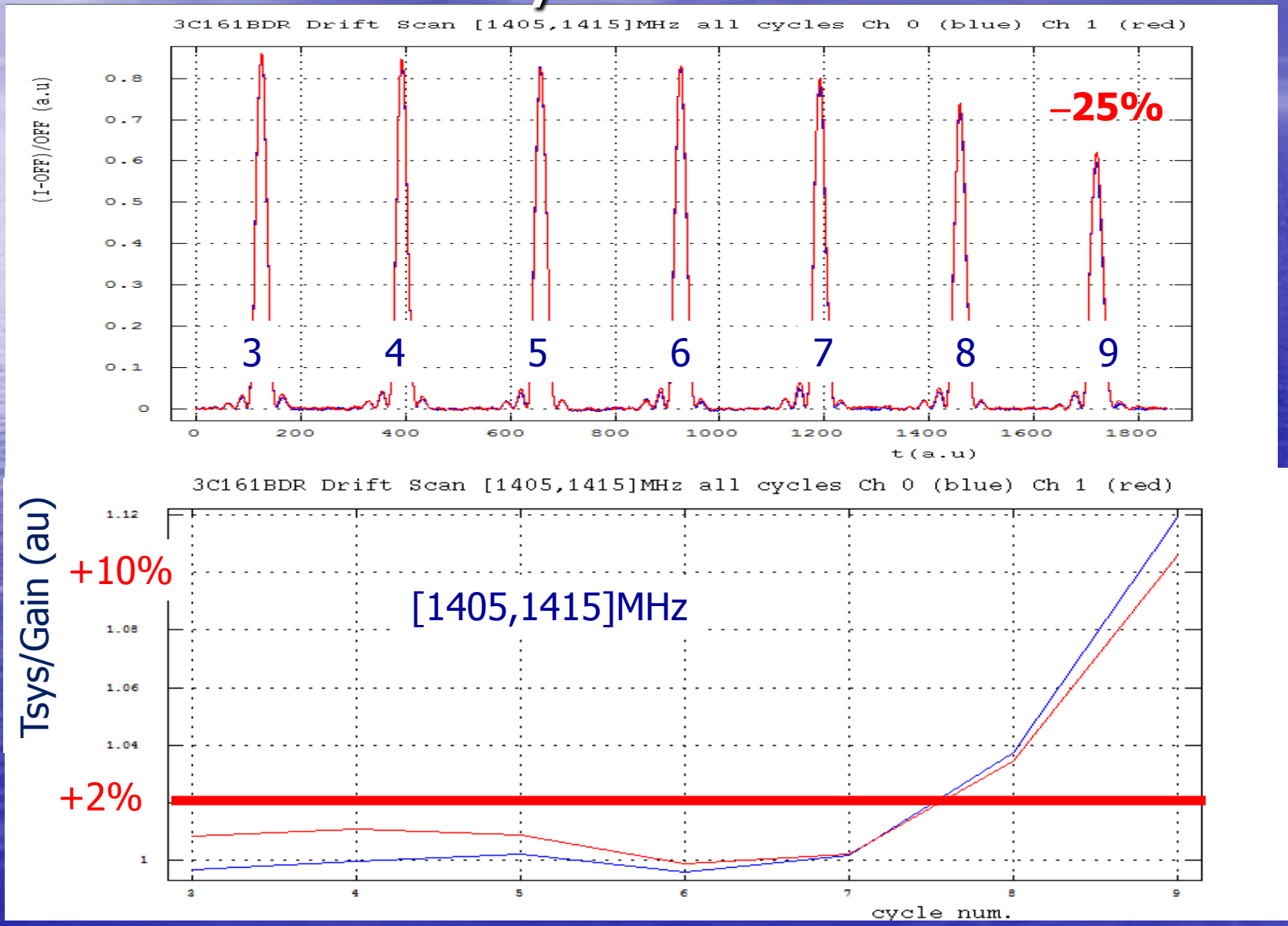
- 2 runs 2011-12-09
  - 3C161 : 0:57:21 start
    - 3 cycles/4 available 2-4
  - 3C161B : 1:11:50
    - 7 cycles/9 available 3-9
- 1 cycle = 170 sec ON-like
- Add the images time-freq. and use the first 30sec as “0”
- No use of DAB

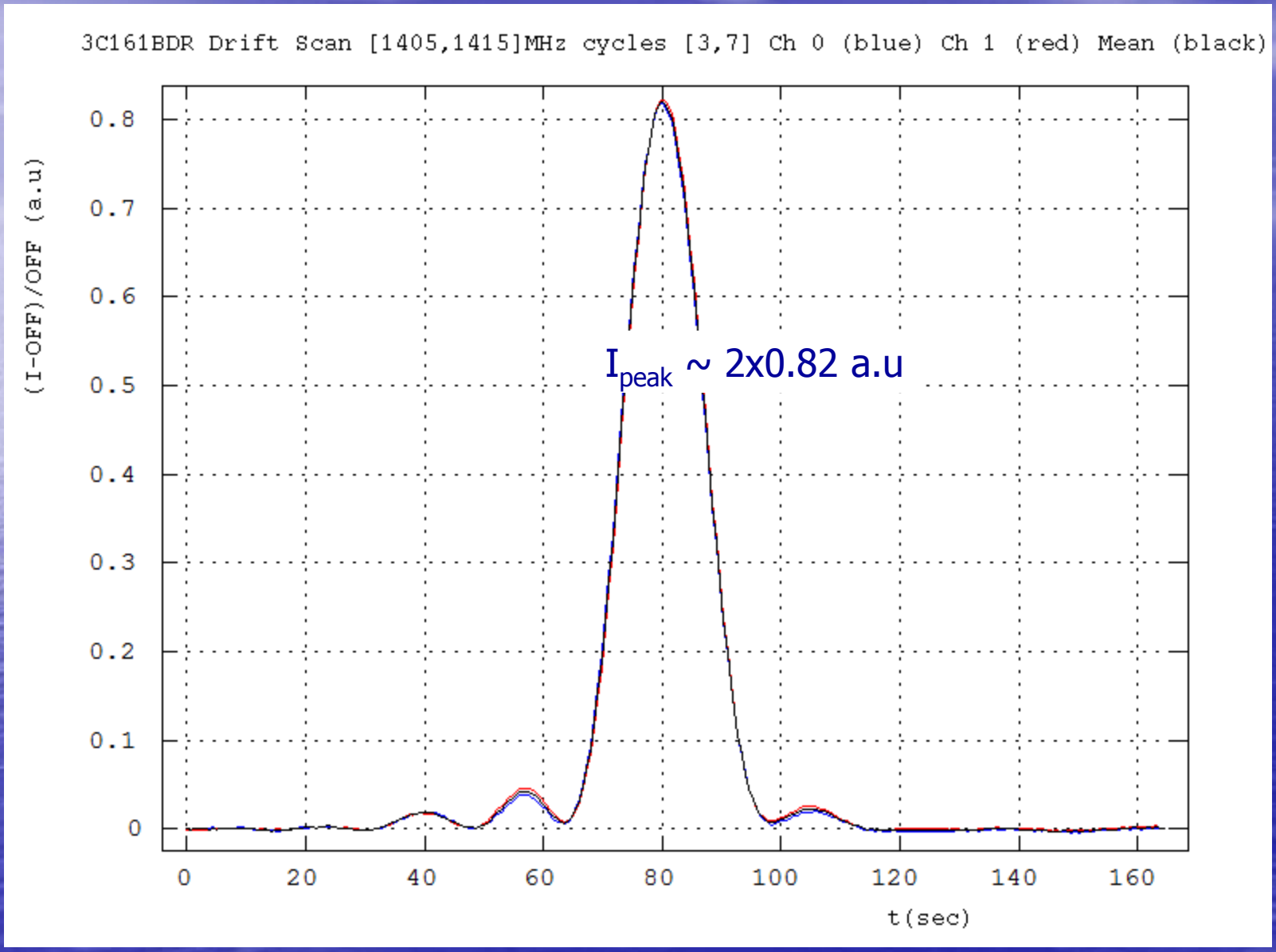
Image time-Freq.



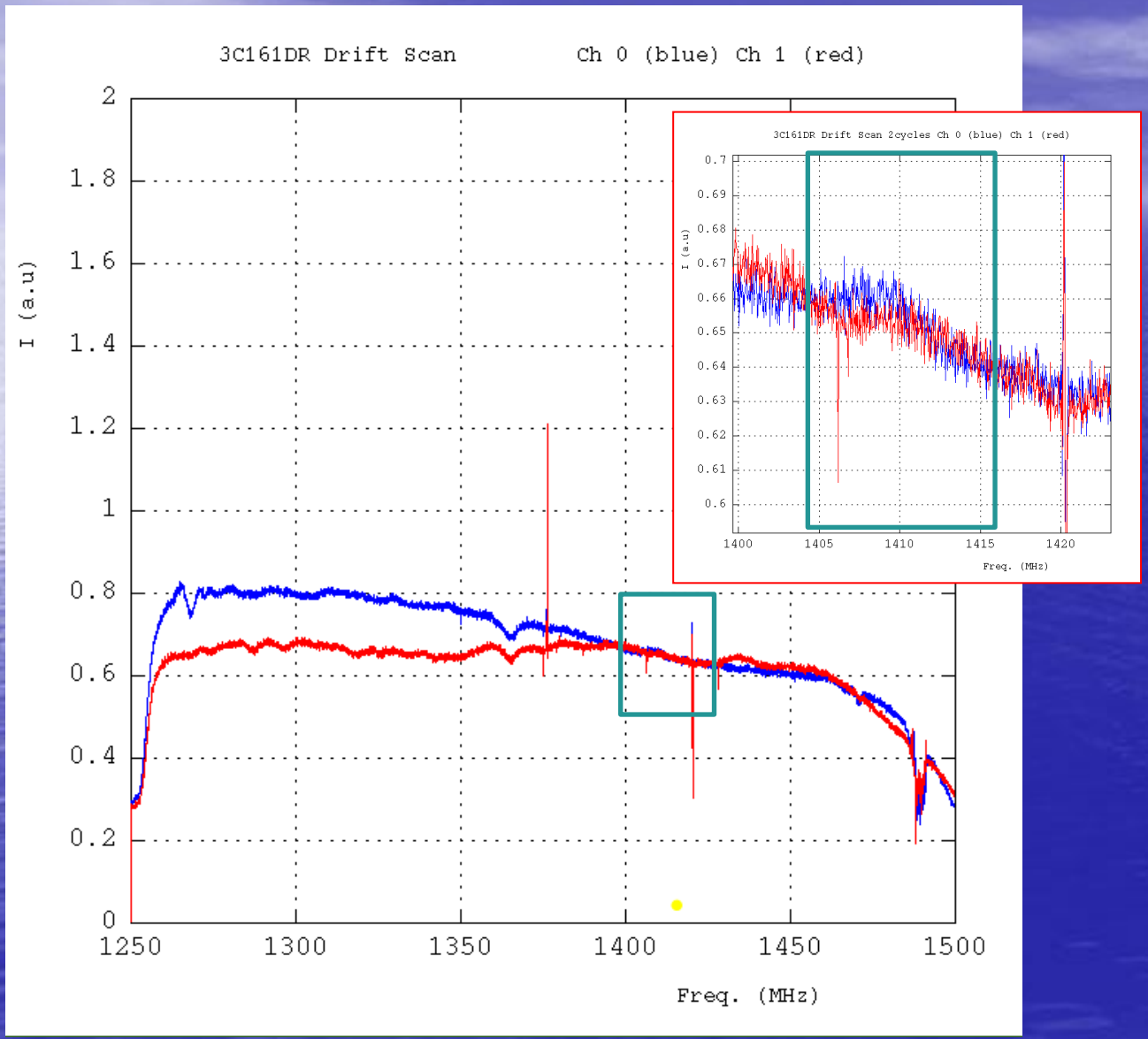


Peak int. & Tsys variations: 3C161B





Timing: 8.22kHz



Spectra integrated during the FWHM of the drift.

Differences wrt the 3C273 spectra Polarization?

Calibration

$$(I_{max}^{Pol1} + I_{max}^{Pol2})(a.u) \times C_{mean\ polar} = I_{tot}(Jy)$$

3C161 0624-05 (Baars et al 1977)

Freq MHz	1250	1280	1380	1410
Flux Jy	20,636	20,294	19,233	18,937

Ott et al. , 1994

Freq. MHz	Flux Jy	date Obs.
1408	18.58 (0.09)	Feb. 1990

3C161

1410MHz

2 x 0.819 x C = 18.58

11.3 ± 0.3 Jy/a.u (*)

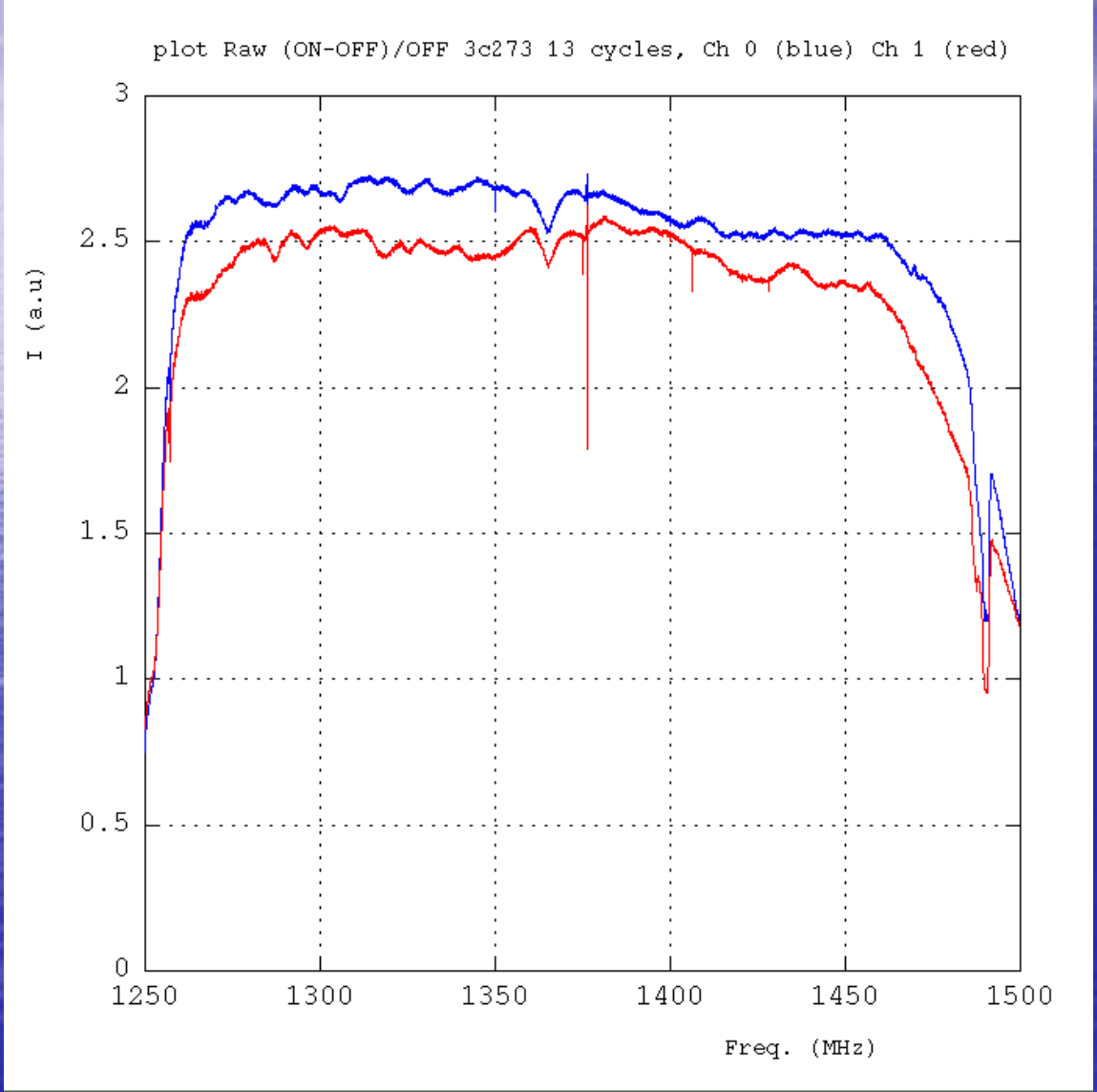
3% from litt. Meas.

(*): be careful this is to be applied to the SUM of the 2 polarizations, not the MEAN

3C273 – 2011/12/09
ON/OFF & Drift

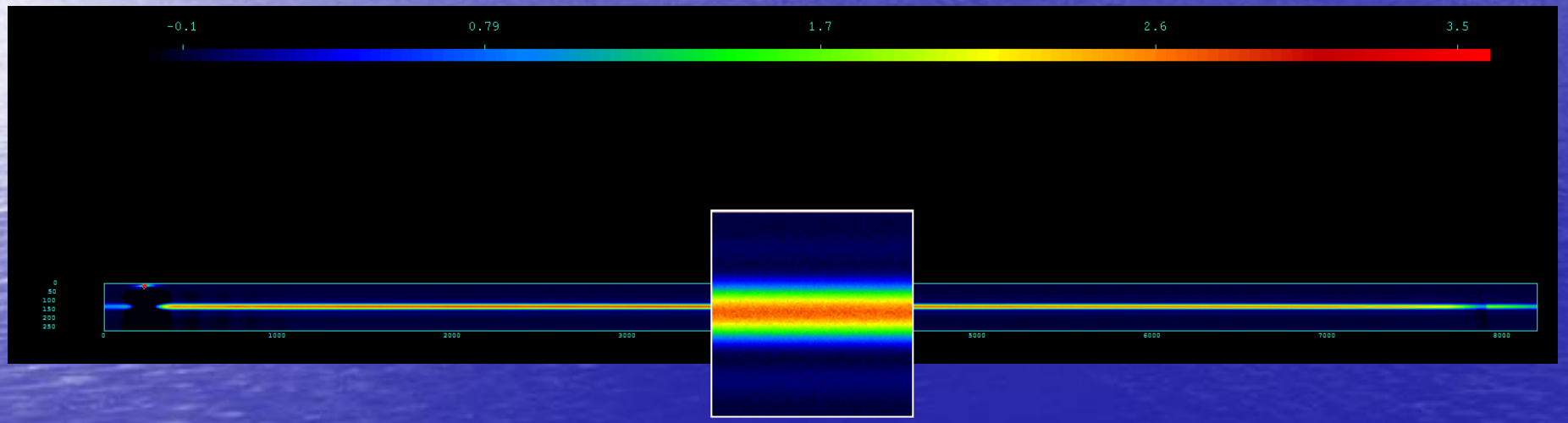
158461.171 & 158462.171

(ON-OFF)/OFF-filtered

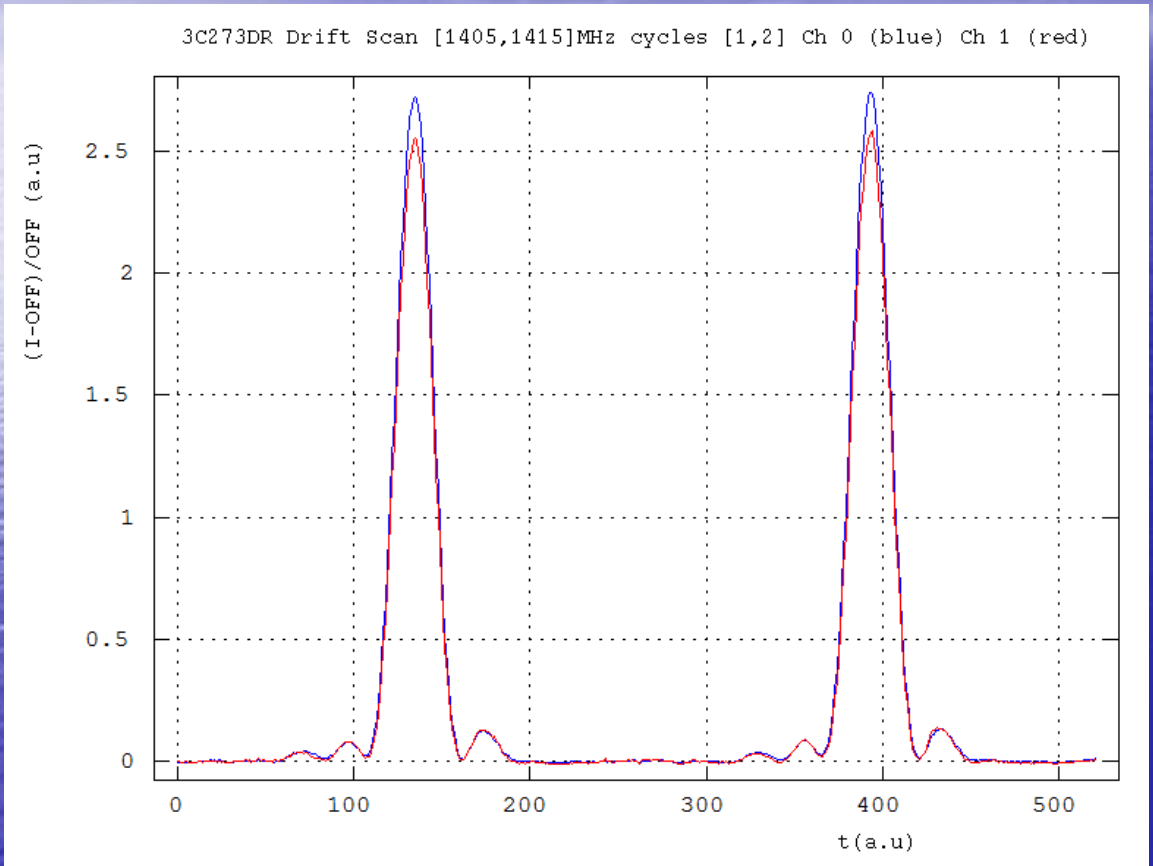


13 cycles 30sec each (30% eff.)

Drift Scan: I(time, frequency)



Drift Scan: time evolution

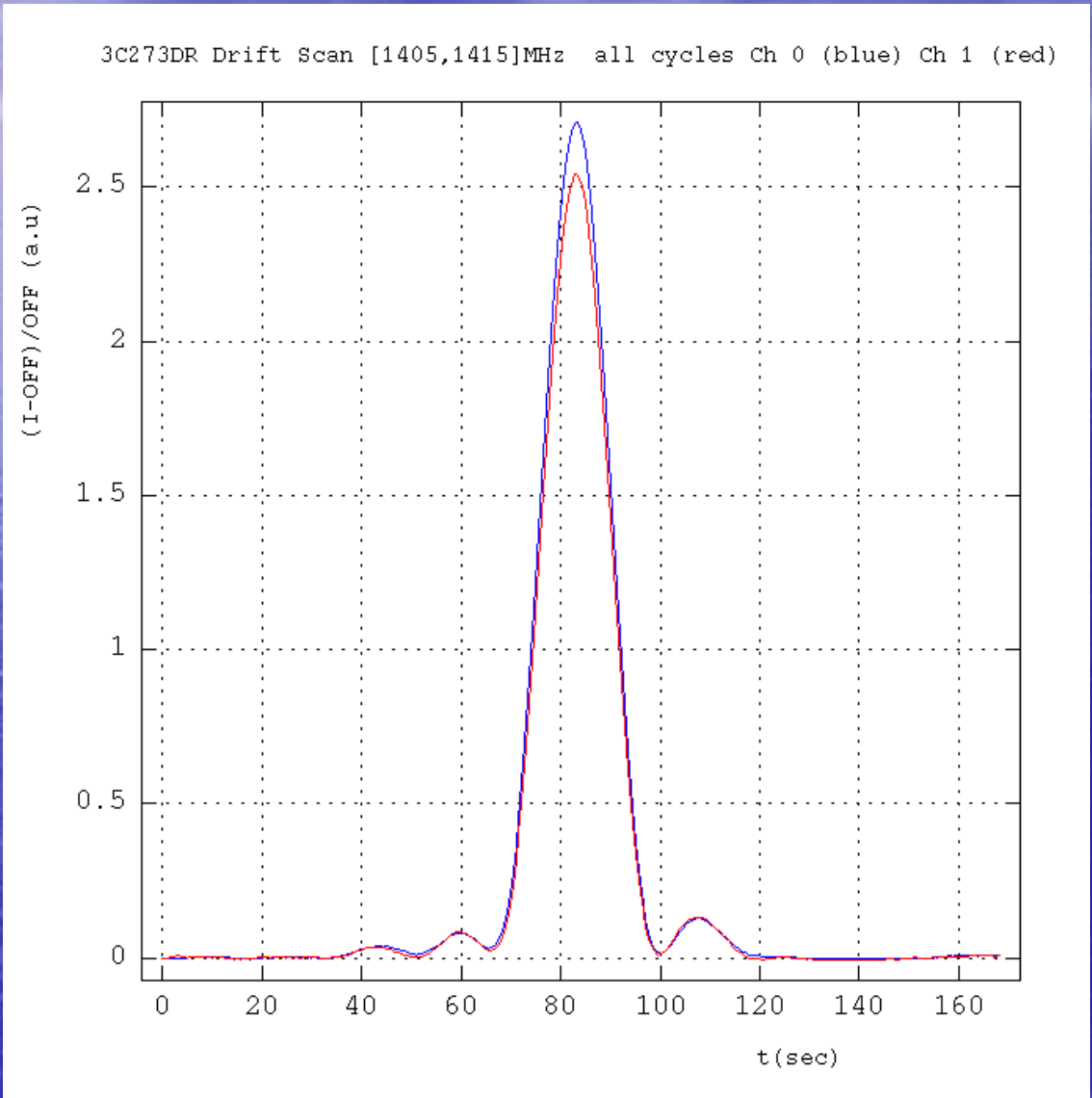


2 cycles 170sec (*) (30% eff.)

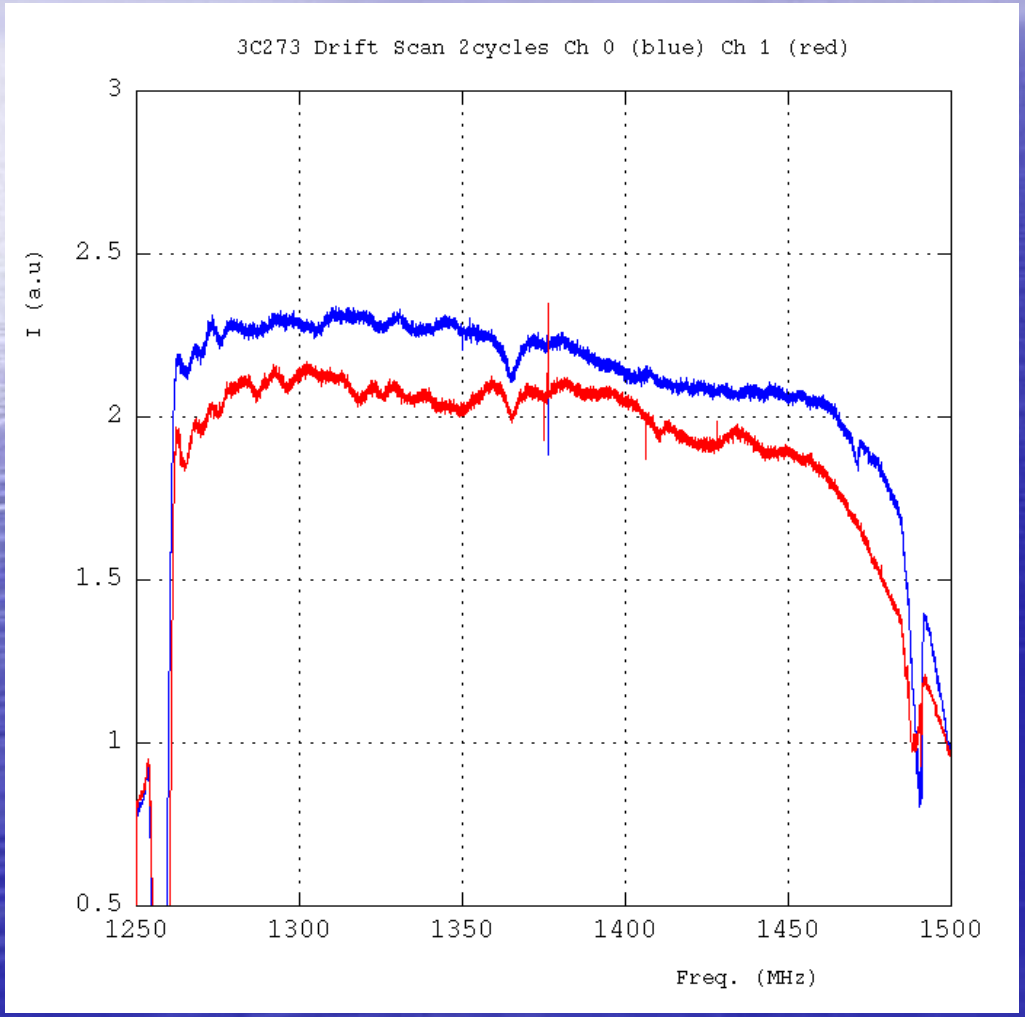
"0FF" done with the first 30sec

Mean of the band [1405,1415]MHz

Drift Scan: time evolution



Drift Scan: Frequency



Mean over the time FWHM (absolute value not to be compared to ON-OFF)

Same behavior as ON-OFF

3C273

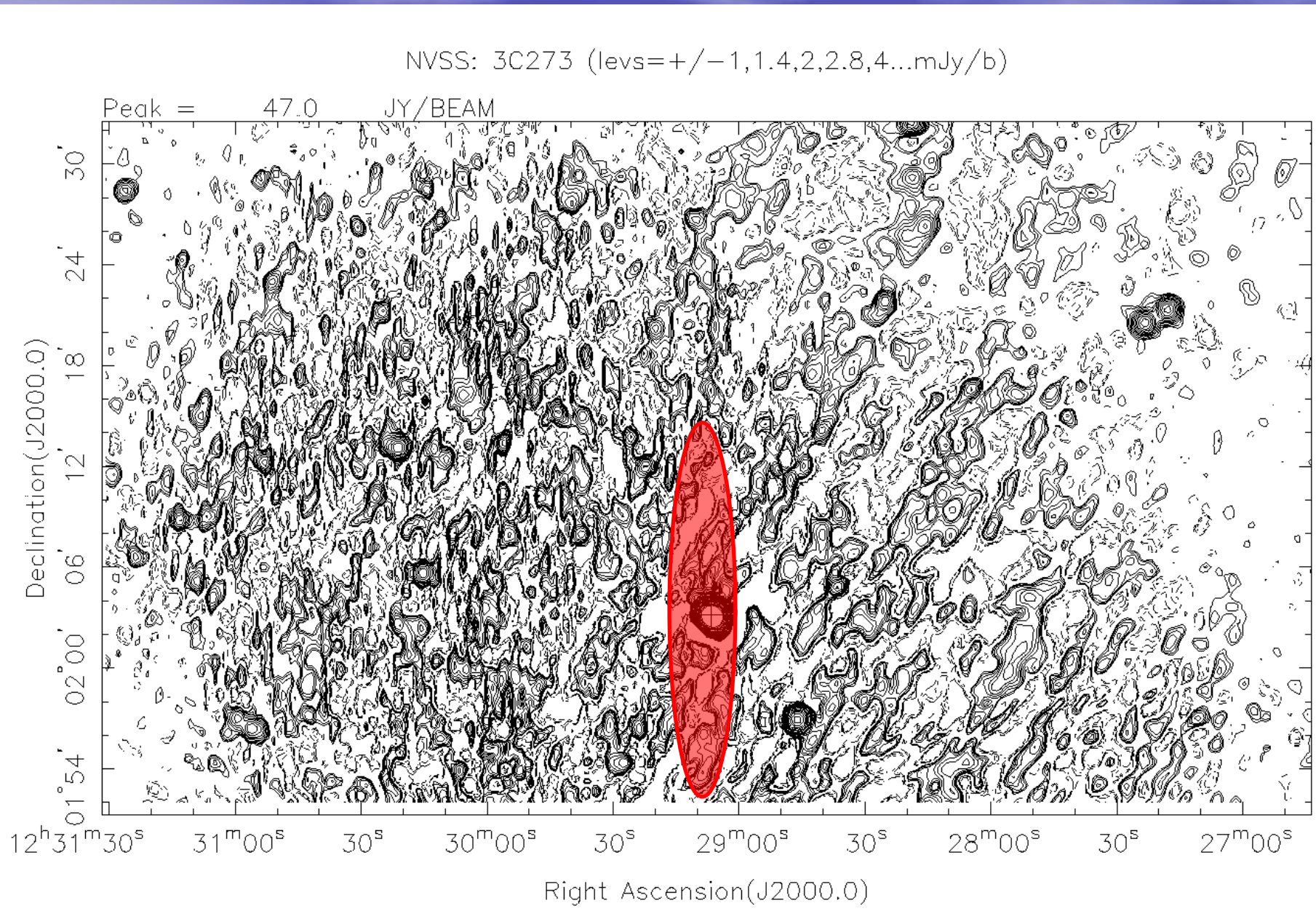
-Bridle et al., 1972: I(1400 MHz) : 38.84 (0.70) Jy

- Kühr et al., 1981 & NED

Freq.(MHz)	Flux (Jy)	
1400	41.28 1.23	Witzel et al. 1971
1400	46.30 2.30	Kellerman et al. 1969
1410	45.17 1.07	Wills 1975
1410 MHz	42.00 ...	Jy -> Wright et al. 1990, Parkes
1400 MHz	45.0 +/- 5 %	Jy -> PAULINY-TOTH et al., 1966
1400 MHz	39.62 ± 0.38	Jy -> idem
1.4 GHz (ATCA)	35.82 ...	Jy -> Tingay et al., 2003, PASJ
1.40 GHz	50100	...milliJy -> White et al., 1992, 300ft, -> Condon et al. 1985,1986
1.4GHz	**54992.1 ± 1900.3 milliJy**	**-> Condon et al. 1998, NVSS**

Our measurement : ~2 x 2.62 au x 11.3 Jy/au ~ 59.2 Jy

3C161


NVSS: 3C273 (levs=+/−1,1.4,2,2.8,4...mJy/b)
Peak = 47.0 JY/BEAM
Declination(J2000.0)
30′
24′
18′
12′
06′
02°00′
01°54′
12h31m30s
31m00s
30s
30m00s
30s
29m00s
30s
28m00s
30s
27m00s
Right Ascension(J2000.0)

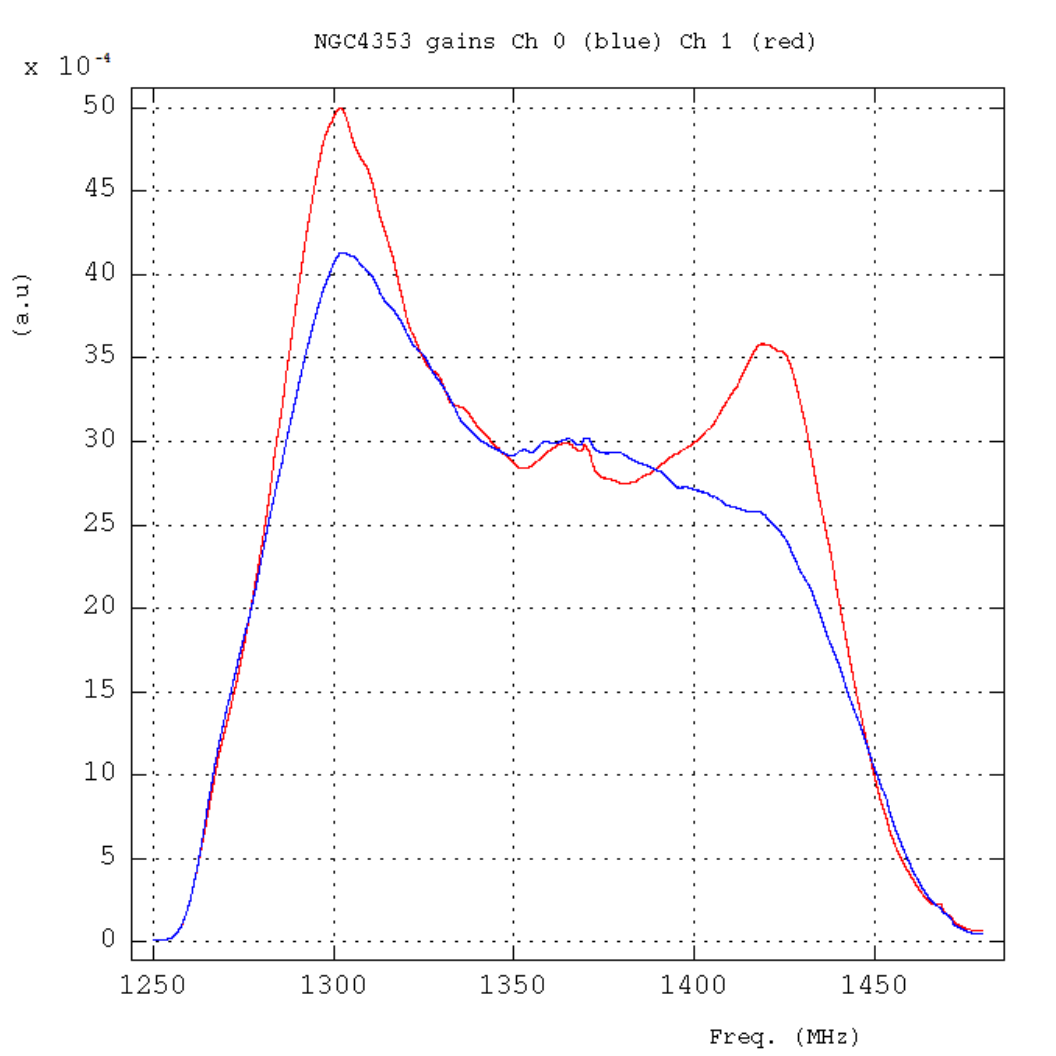
NGC4383 ON-OFF

SCA156855.171

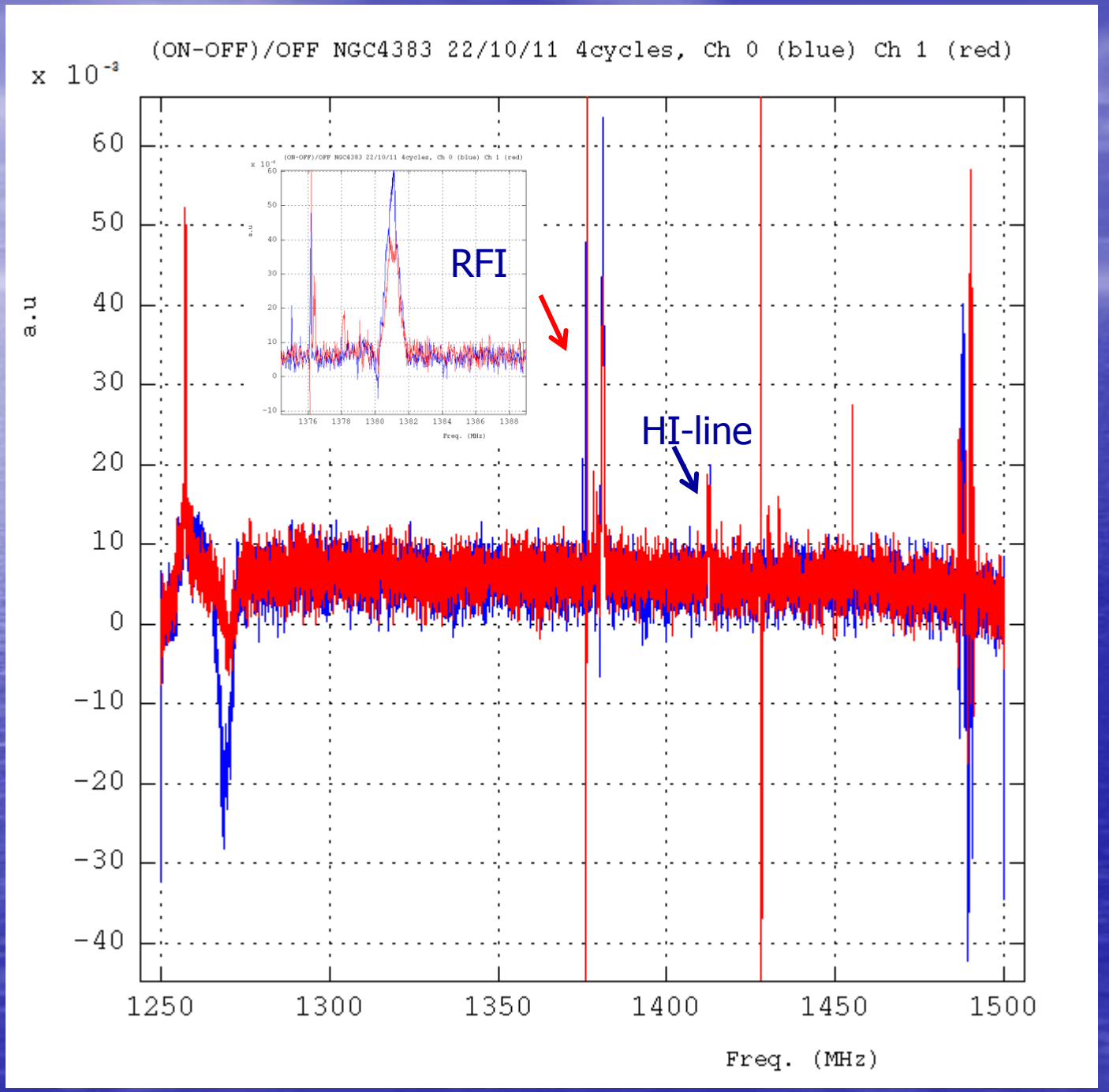
Date 2011-10-22

Cycles 1-15 foreseen but 12-15 only !

Gains cycle #13



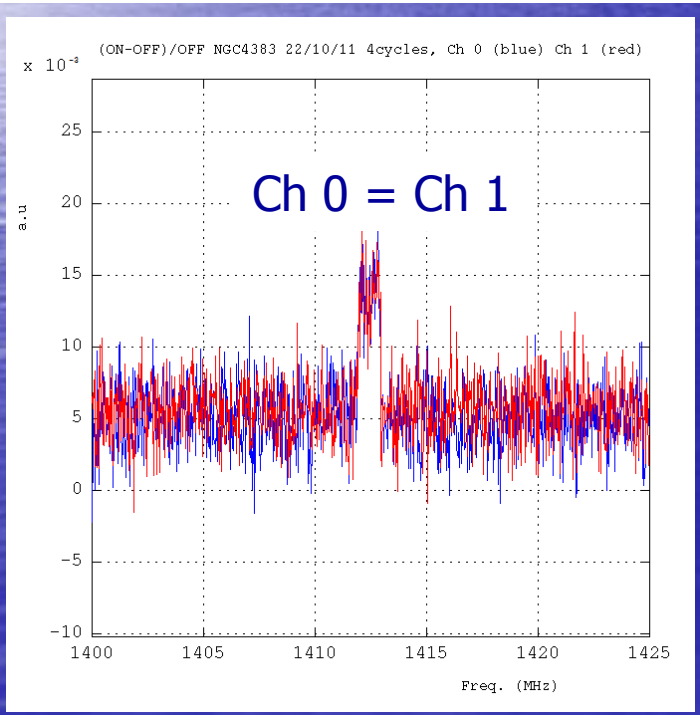
Gains different shape as I was expecting. But confirmed by Ana that they have changed since 7th July…


(ON-OFF)/OFF NGC4383 22/10/11 4cycles, Ch 0 (blue) Ch 1 (red)
x 10⁻³
a.u
60
50
40
30
20
10
0
-10
-20
-30
-40
1250
1300
1350
1400
1450
1500
Freq. (MHz)
RFI
HI-line

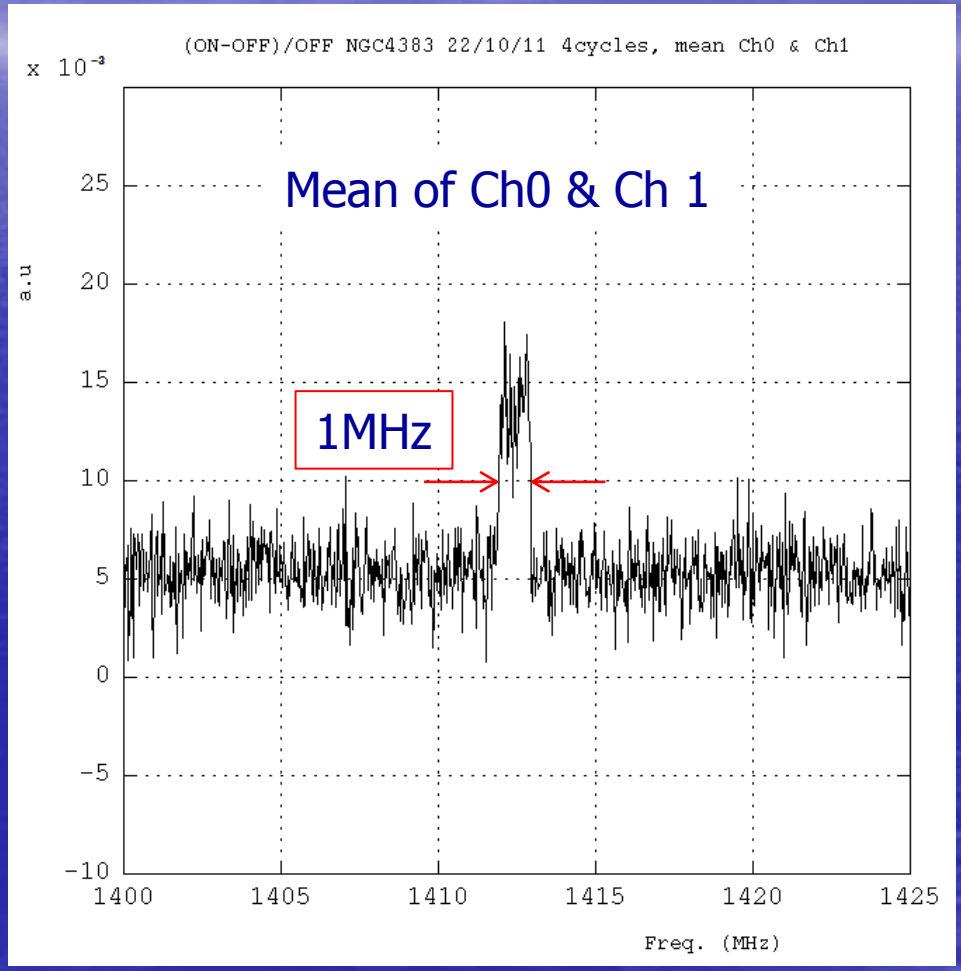
Continuum & line

Continuum: ~ 44.3 ± 4.1 mJy
HI Line:
- width ~213km/s ~1MHz
- int. 48.4 ± 5.1 Jy km/s ~230mJy

A. Chung et al, VLA IMAGING OF VIRGO SPIRALS IN ATOMIC GAS (VIVA). I., The Astronomical Journal, 138:1741–1816, 2009 December
THE ATLAS AND THE Hi PROPERTIES



Zoom of HI line



1420.20/(1+0.0057) = 1412.15 MHz = 1700 km/s OK

The HI line intensity

Integral in the range [1412-1413] MHz

$$\int HI(\nu)d\nu = 2_{polar} \times \left(\sum_i (S_i - Conti_i)\right) \Delta\nu$$
$$= 2 \times (447 - 175)\ 10^{-3}[a.u] \times 30\ 10^{-3}[MHz] \times 213[km/s/MHz] \times C_{mean\ polar}$$
$$= 3.48[a.u.km/s] \times C_{mean\ polar}$$
$$= 48.4 \pm 5.1\ [\mathrm{Jy.km/s}]$$

Then $C_{mean\ polar} = 13.9 \pm 1.5\ [Jy/a.u]$ To be compared to 11.3 Jy/au

Or 3.48 x 11.3 = 39.3 [Jy.km/s] To be compared to 48.4 Jy.km/s

3C161

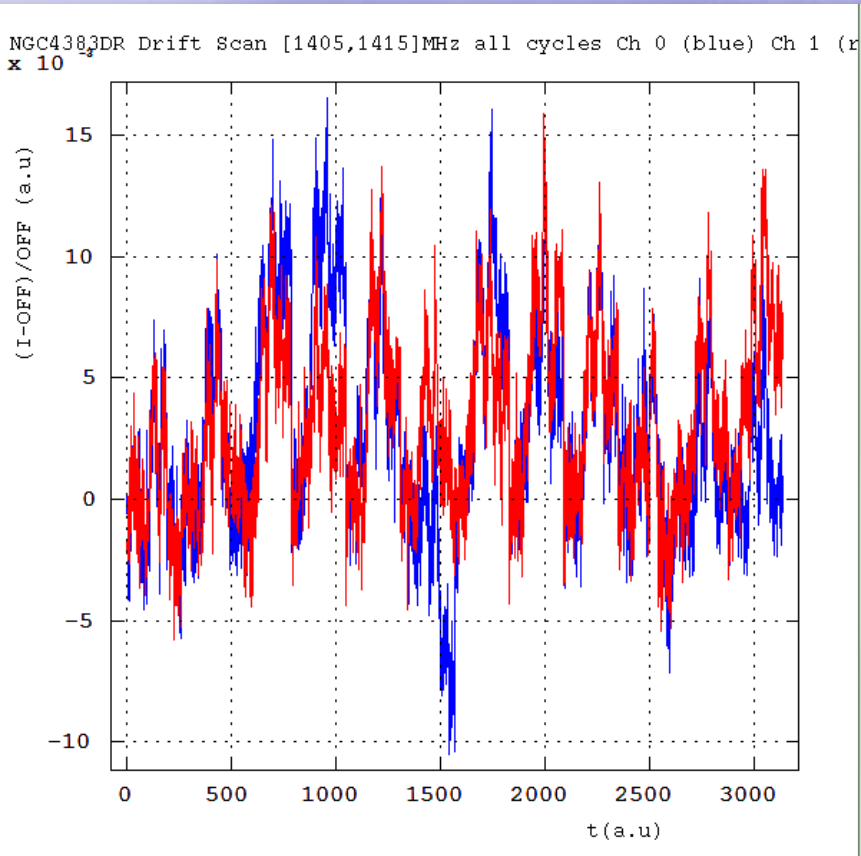
NGC4383 Drift Scan

SCA157756.171

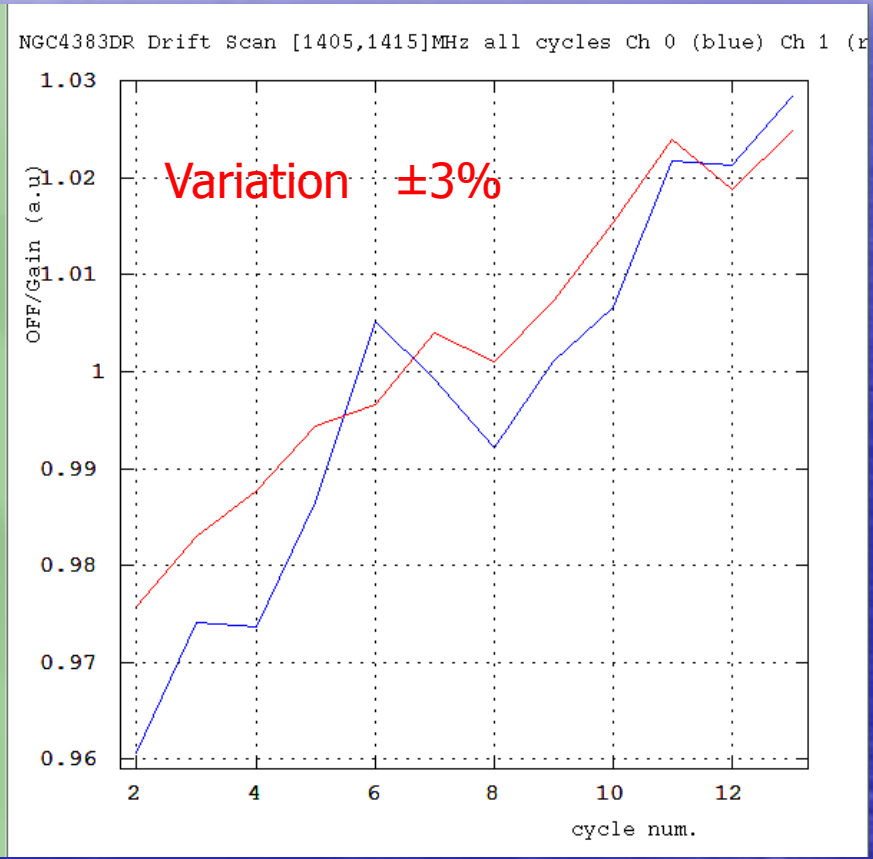
Date 2011-11-19

Cycles 2-15

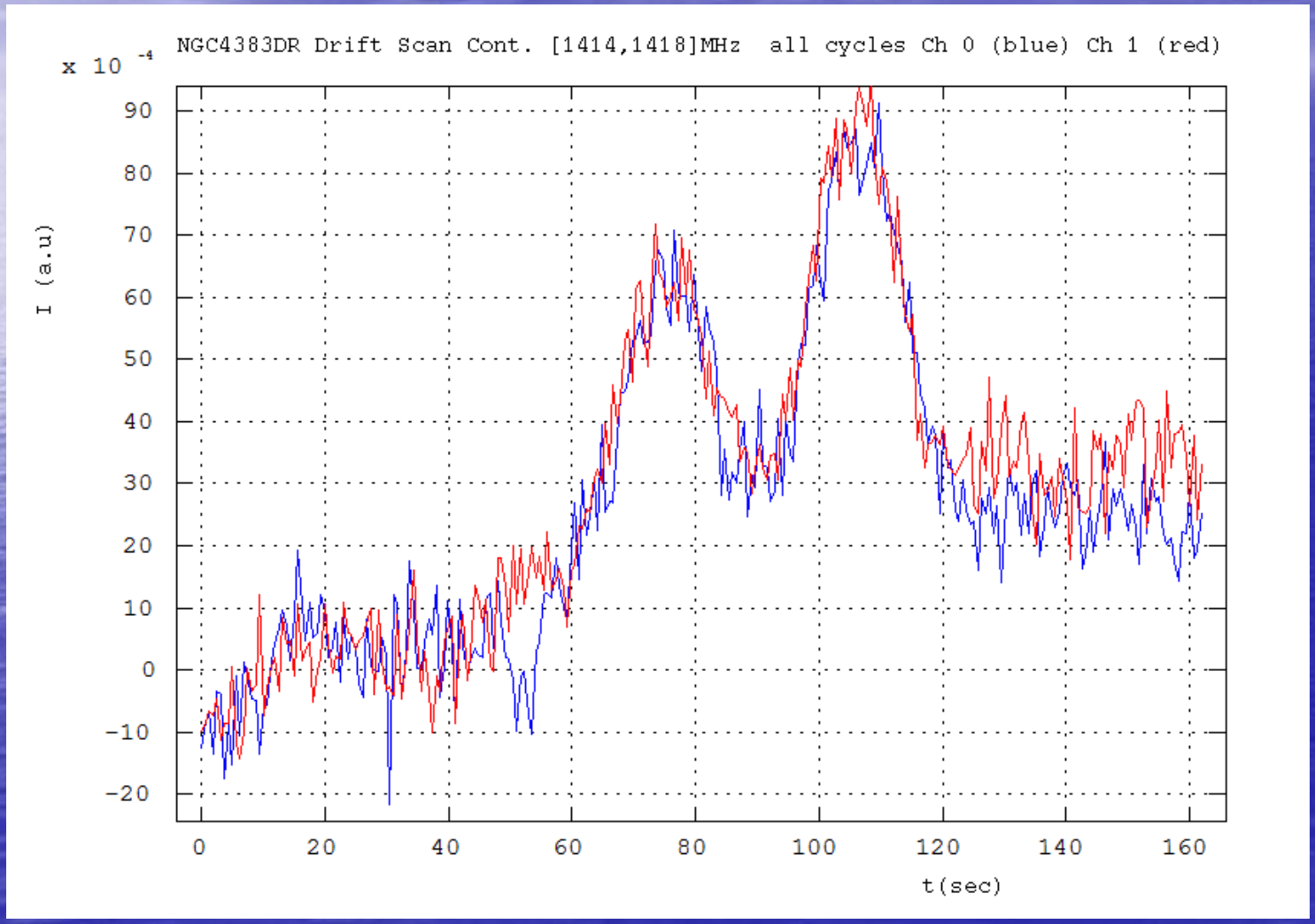
(I-OFF)/OFF



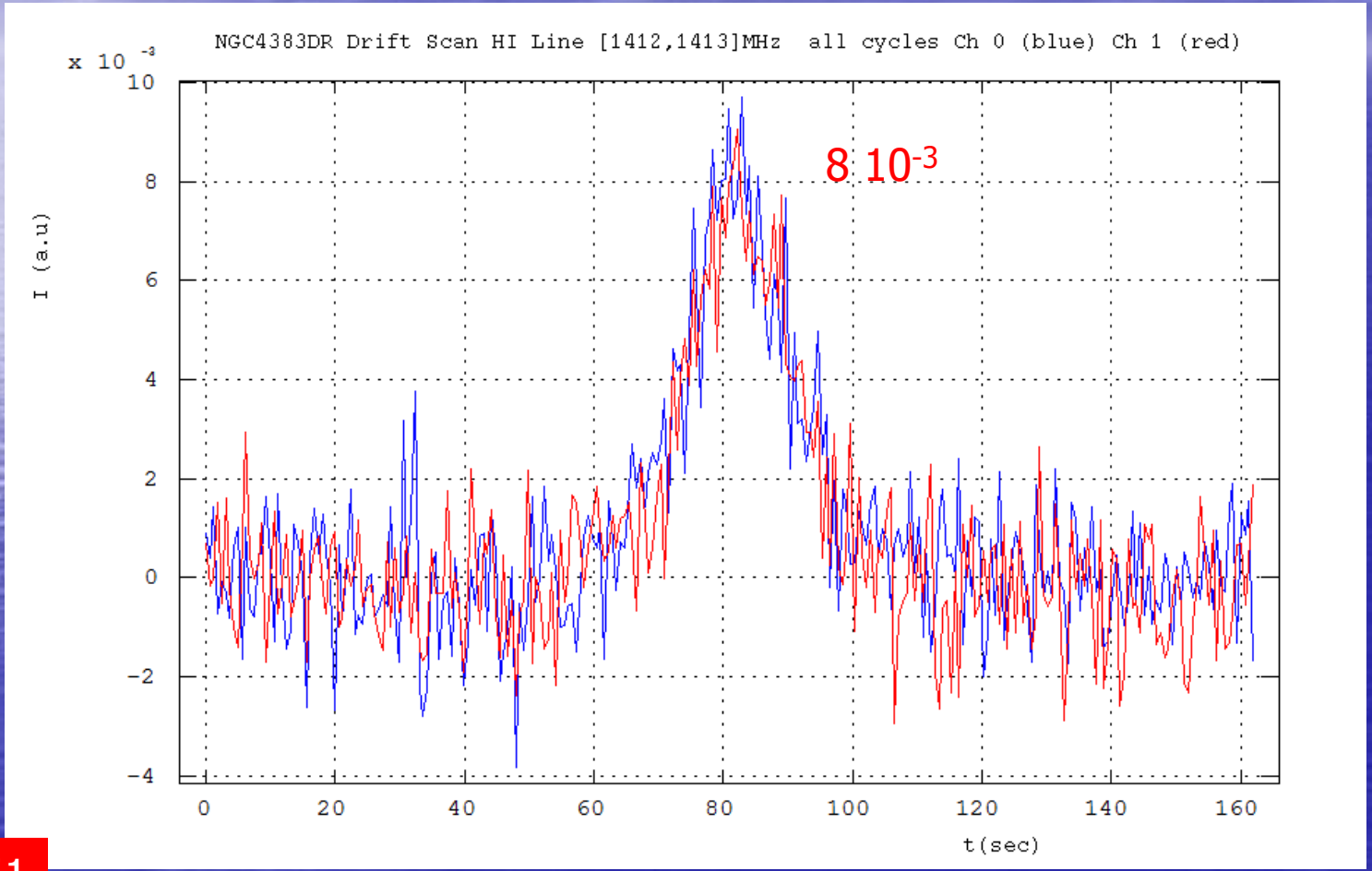
OFF/Gain



Continuum evolution



HI Line evolution



3C161

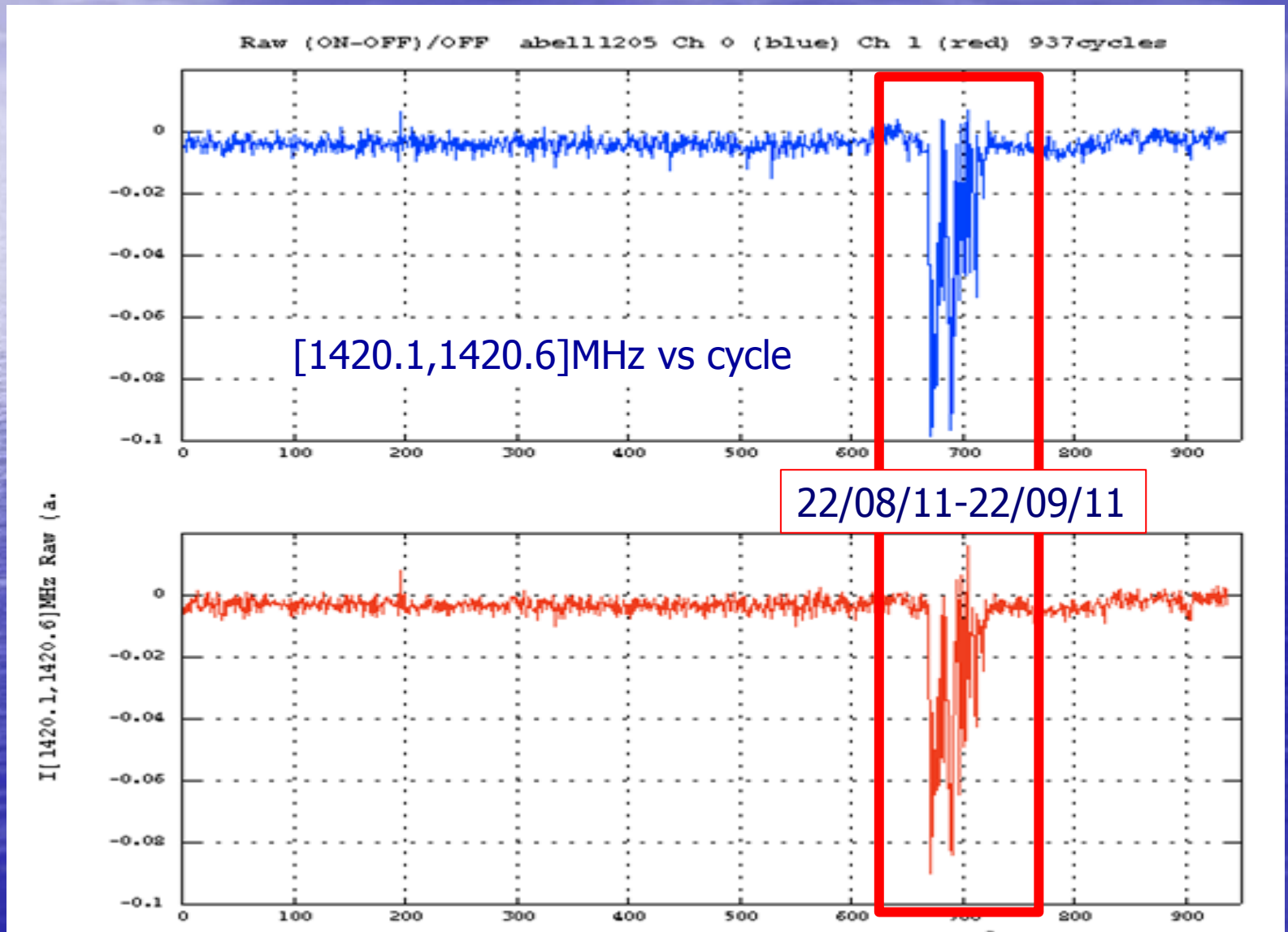
11.3Jy/au x 2 x 8 10^{-3} (au) = (181±5) mJy to be compared to (230±24m)Jy

Summary

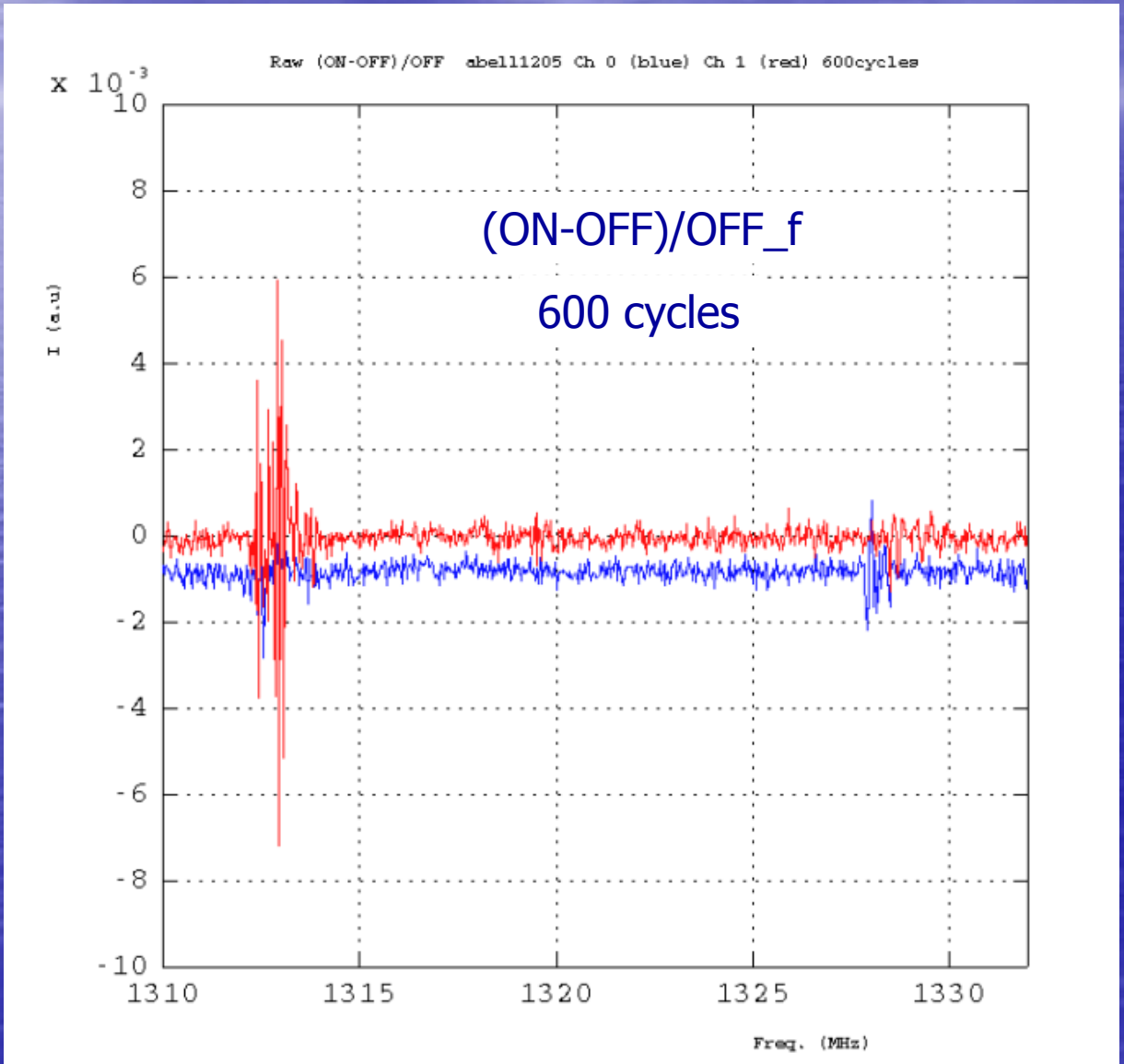
- 3C161 @ 1410MHz gives 11.3±0.3 Jy/au
- Overestimation of 3C273 continuum
- Underestimation of HI NGC4383
- Close to Ch 1 DAB (Est) calibrated thanks to PKS1127-14 WIBAR DAQ.
- How to calibrate another freq. although the BAO spectra are quite stable in freq.

Abell85, 2440, 1205 zoom on HI

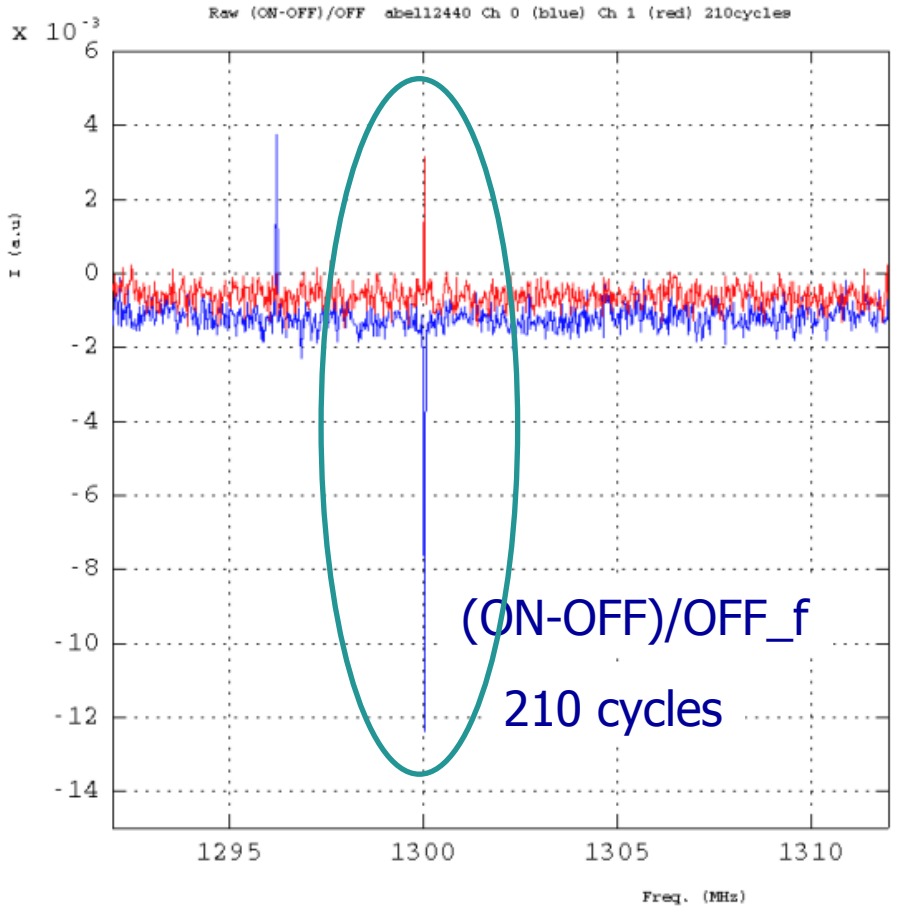
Abell 1205: DAQ stability

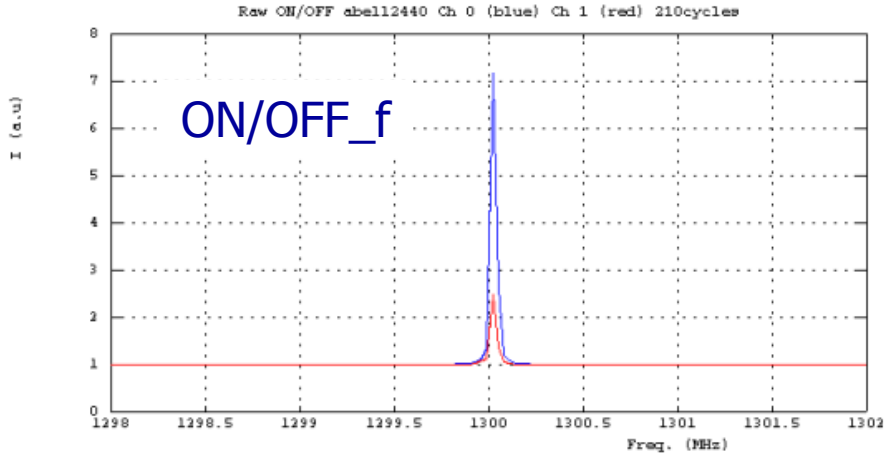


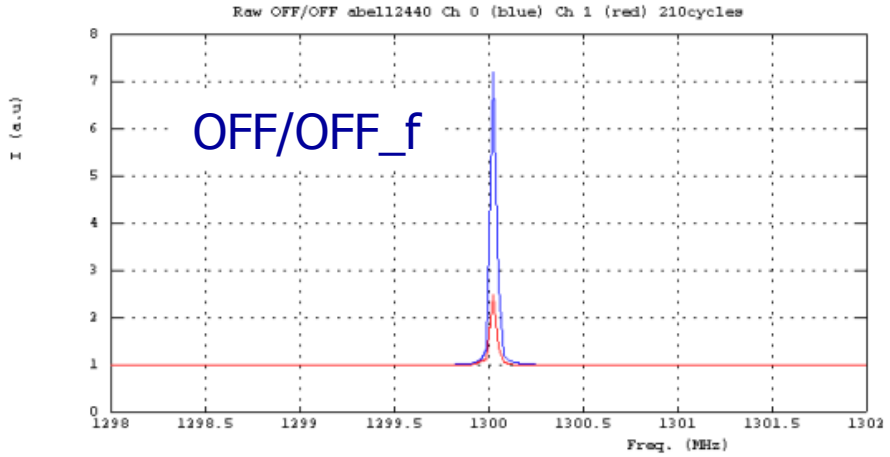
Abell1205


Raw (ON-OFF)/OFF abell1205 Ch 0 (blue) Ch 1 (red) 600cycles
X 10^-3
I (a.u)
10
8
6
4
2
0
-2
-4
-6
-8
-10
1310
1315
1320
1325
1330
Freq. (MHz)
(ON-OFF)/OFF_f
600 cycles

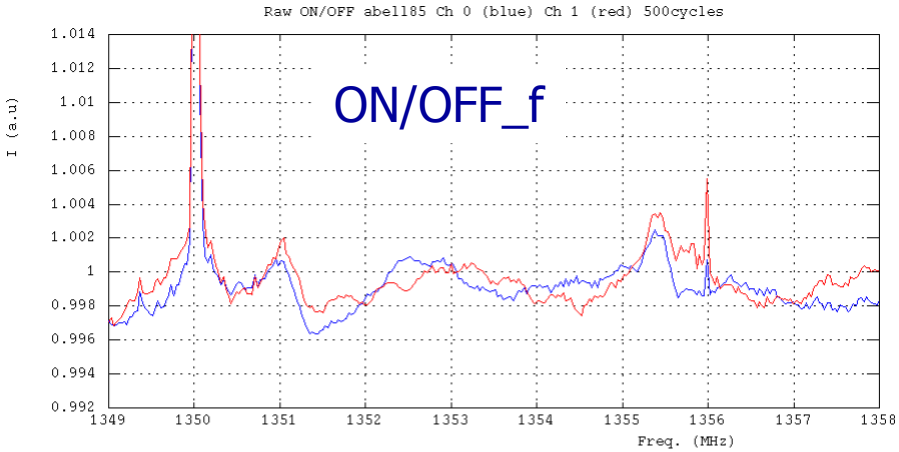
Abell2440

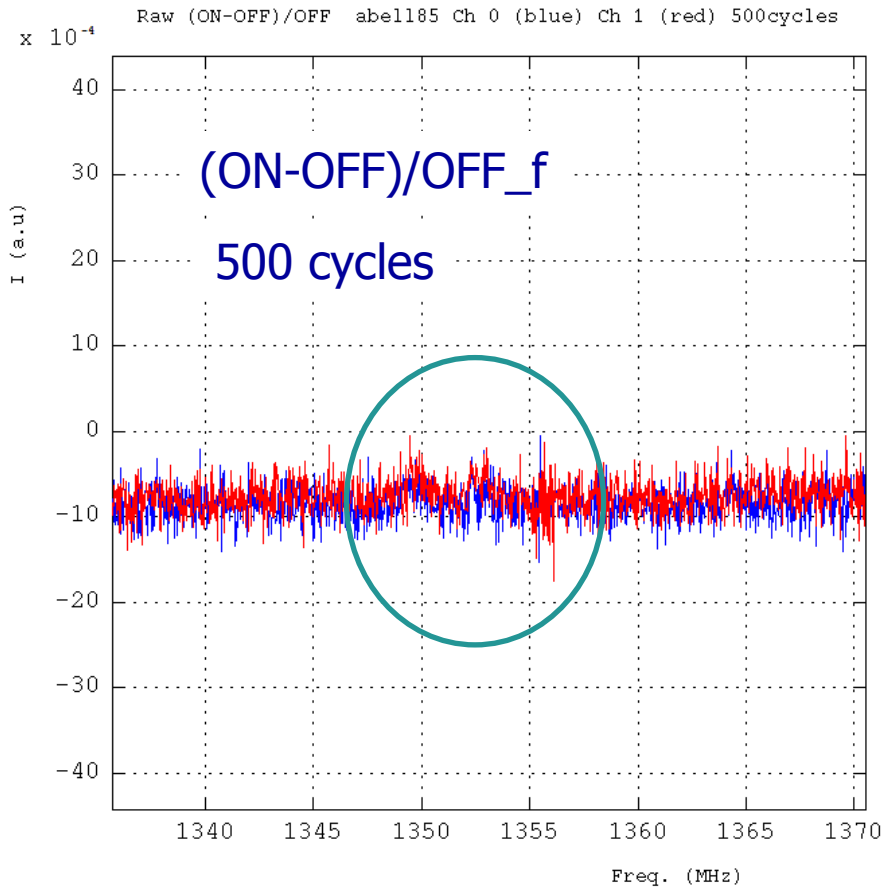

Raw (ON-OFF)/OFF abell2440 Ch 0 (blue) Ch 1 (red) 210cycles
x 10^-3
I (a.u)
Freq. (MHz)
(ON-OFF)/OFF_f
210 cycles

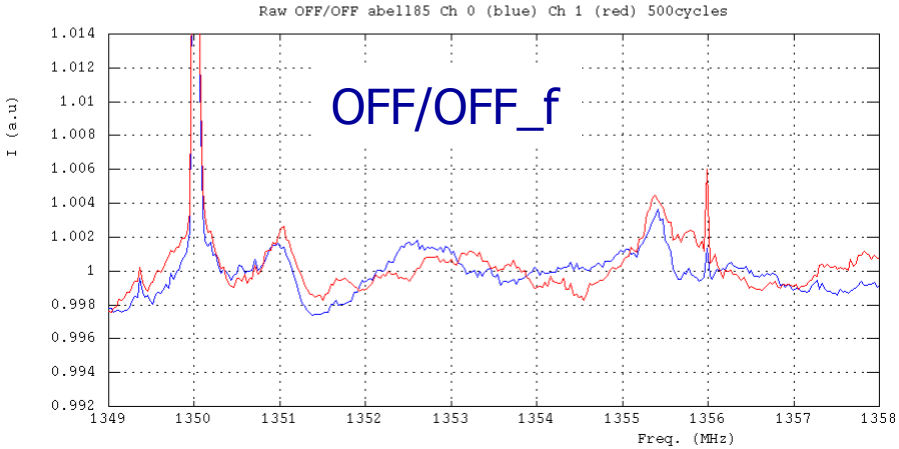

Raw ON/OFF abell2440 Ch 0 (blue) Ch 1 (red) 210cycles
I (a.u)
ON/OFF_f
Freq. (MHz)


Raw OFF/OFF abell2440 Ch 0 (blue) Ch 1 (red) 210cycles
I (a.u)
OFF/OFF_f
Freq. (MHz)

Abell85


Raw ON/OFF abell85 Ch 0 (blue) Ch 1 (red) 500cycles
ON/OFF_f
I (a.u)
Freq. (MHz)

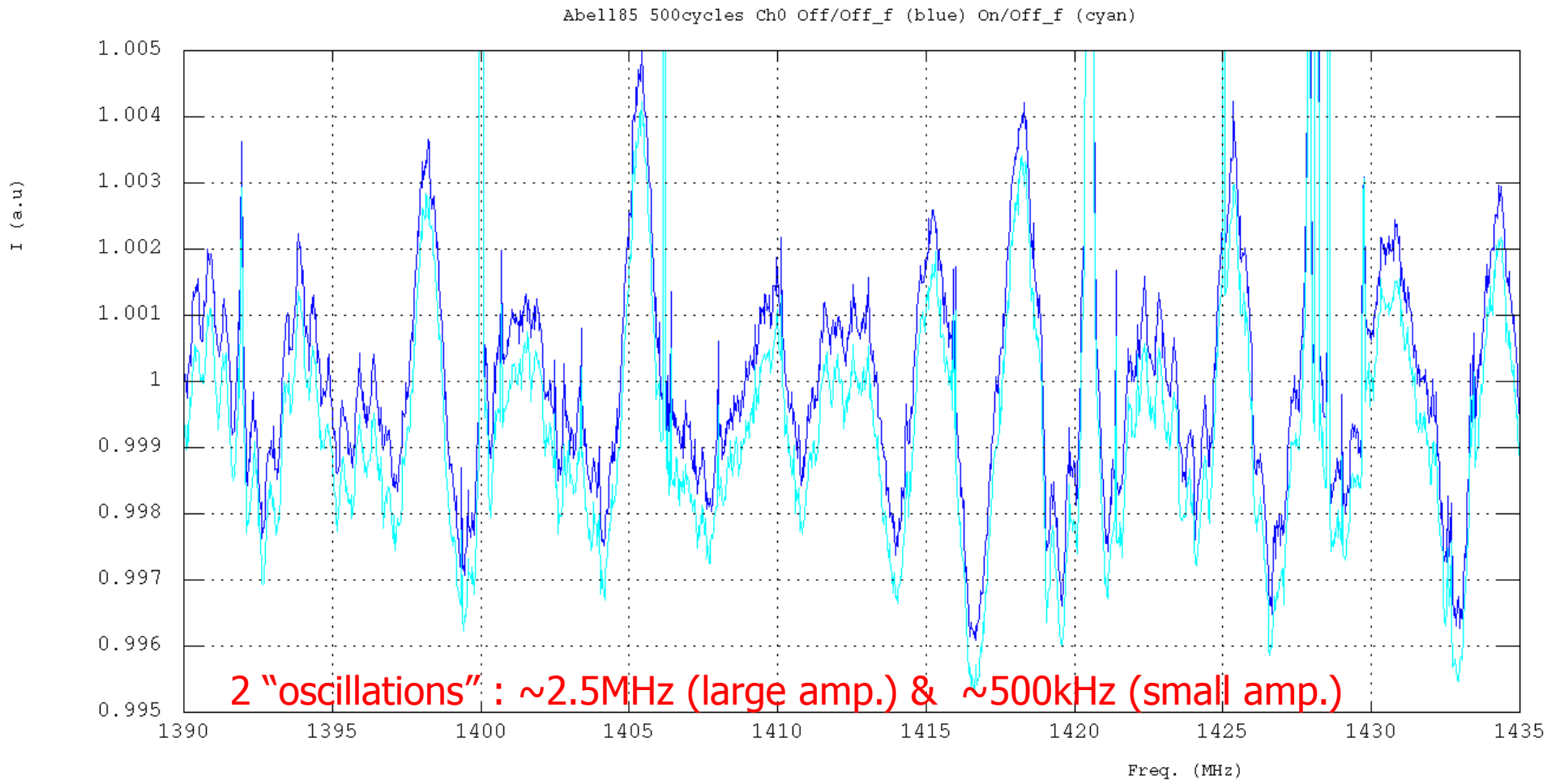

Raw (ON-OFF)/OFF abell85 Ch 0 (blue) Ch 1 (red) 500cycles
x 10⁻⁴
(ON-OFF)/OFF_f
500 cycles
I (a.u)
Freq. (MHz)


Raw OFF/OFF abell85 Ch 0 (blue) Ch 1 (red) 500cycles
OFF/OFF_f
I (a.u)
Freq. (MHz)

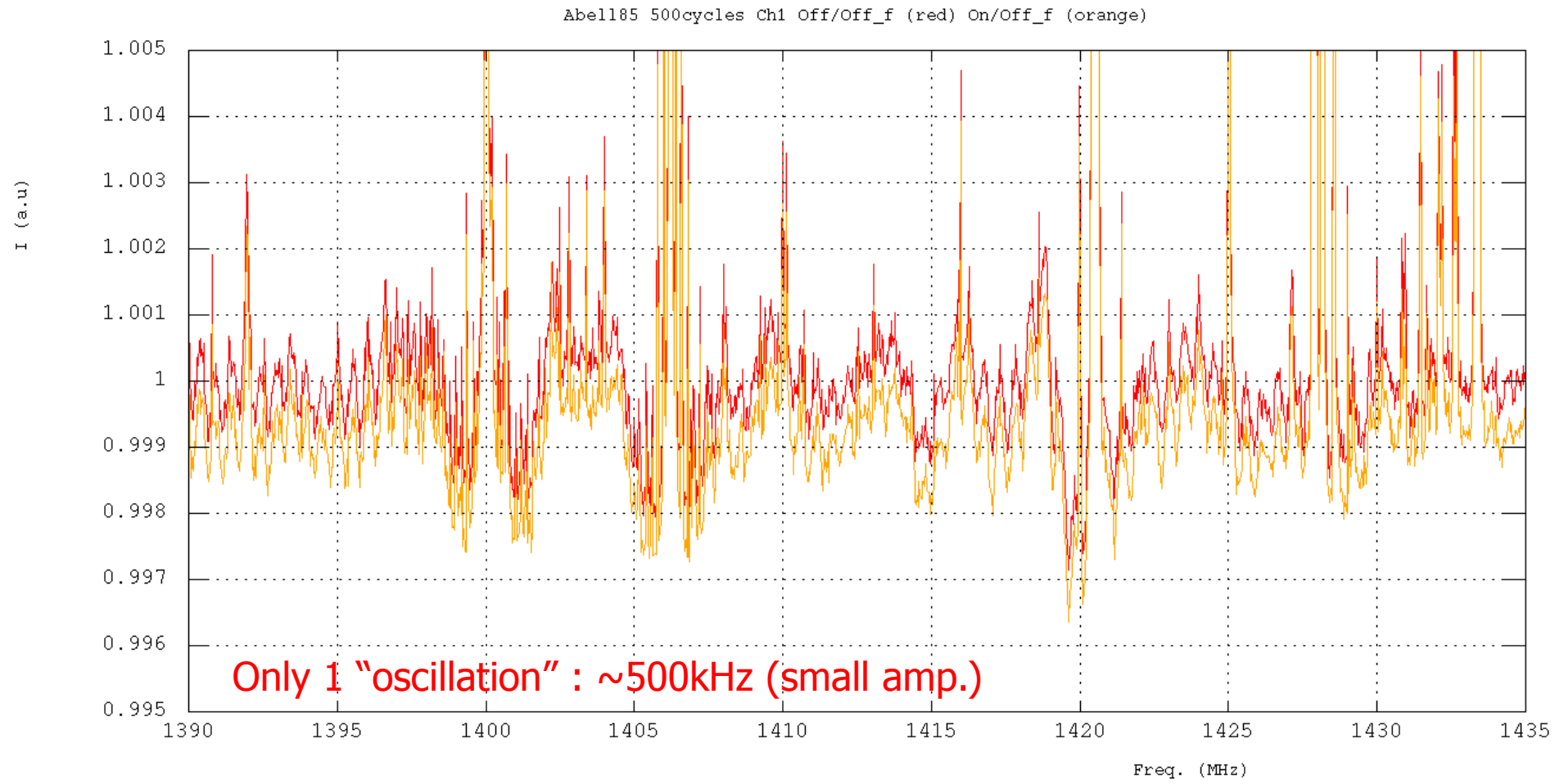
Noise: introduction

Zoom of the Abell85 normalized spectra obtained with 500cycles

Ch. 0 (On & Off)/Off_filtered



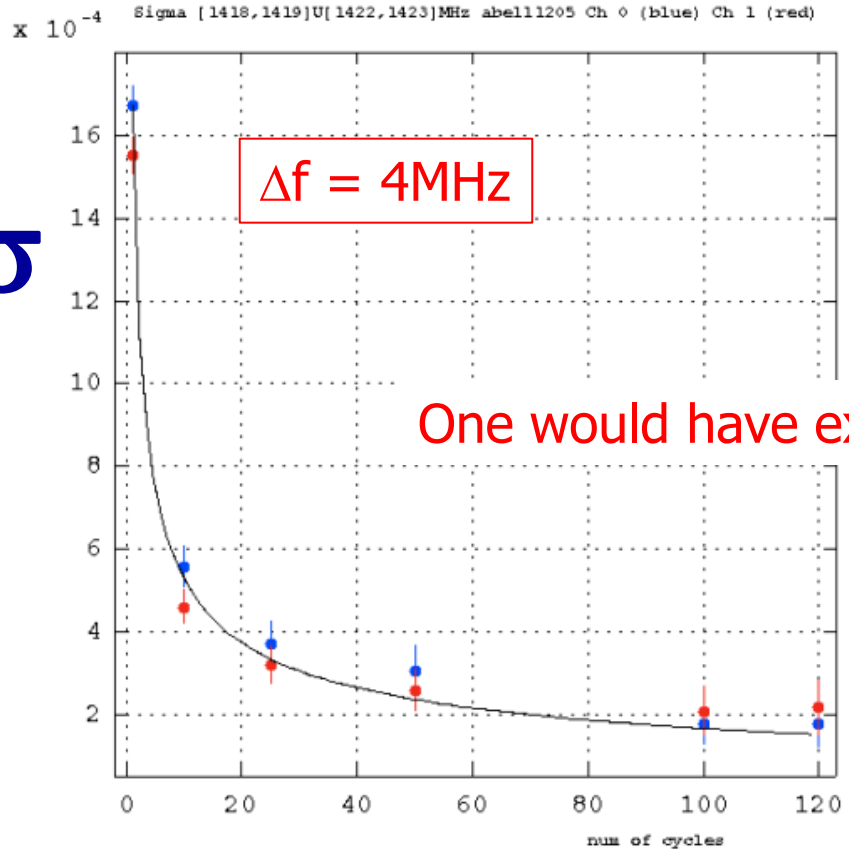
Ch. 1 (On & Off)/Off_filtered

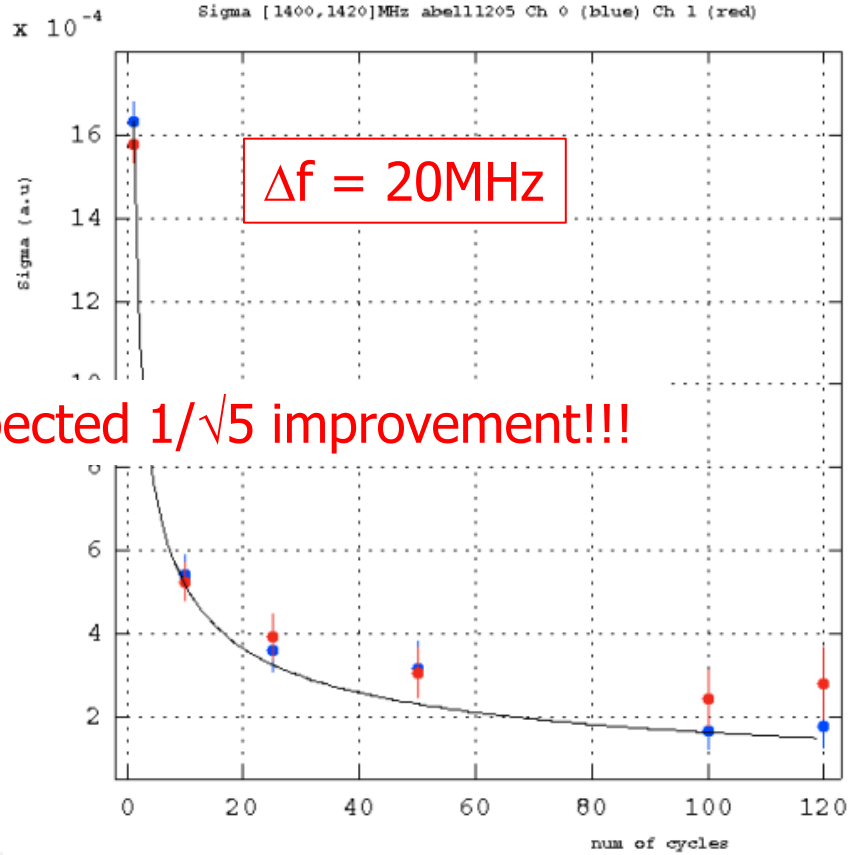


Some facts

- The large oscillations are visible with only few data taking < 1min.
- The small ones need summation so normalized spectra are the gain change...
- The noises are present on all data: Abell, 3C, NGC.
- The 500kHz noise was in fact present since Juil. 2010 in the UGC4358 on non normalized spectra for both channels.

σ





One would have expected 1/√5 improvement!!!

Figure 9. Baseline standard deviation as a function of number of cycles per mean value (see text), for the ON-OFF signal integrated in the HI-line side-bands ([1418,1419] ∪ [1422,1423] MHz) (left) and the RFI-protected band [1400,1420] MHz.

Extracted from Abell1205 MEMO 23/11/11

Data processing on Irods @ CCIN2P3

1. Median ov. 5120 BAO paq. ON/Gain or OFF/Gain
2. Mean of 5 medians => med. spectrum (FITS files)
3. Mean on each cycle
4. For each cycle (ON-OFF)/OFF_f
    1. Result of (ON/G-OFF/G)/(OFF/G)_f
    2. G=Gain med. Filtered 3MHz
    3. (OFF/G)_f= (OFF/Gain) med. Filtered 2MHz
5. For each cycle too < (ON-OFF)/OFF_f > ov. [ν_1, ν_2]

Sigma

Estimation

1. <ON/Gain>(ν) ~ <OFF/Gain>(ν) ~ 1 (no signal & def.)
2. σ[OFF/OFF_f] ≪ σ[ON/OFF_f] (at leats it is a fact)
3. σ_{med} =med/(ln2 $\sqrt{N_{paq}}$) and med[ON/Gain] ~ med[OFF/Gain] ~1

$$\sigma \approx \frac{\sqrt{2}}{\ln 2} \times \frac{1}{\sqrt{N_{med/medspec} \times N_{medspec/cycle} \times N_{pad/med} \times \Delta f}}$$

(a.u)

1 cycle 5 ~9 5120

σ (1cycle) ∝ 1/√Δf and σ(n cycles) ∝ σ(1)/√n

Evolution of sigma computation

- The sigma may be affected by the noise (see Ana's talk)
- To avoid artifact we use now the inter quartile range IQR normalized

$$\sigma \equiv \frac{Q_3 - Q_1}{1.34898}$$

IQR for Normal dist. with σ=1