

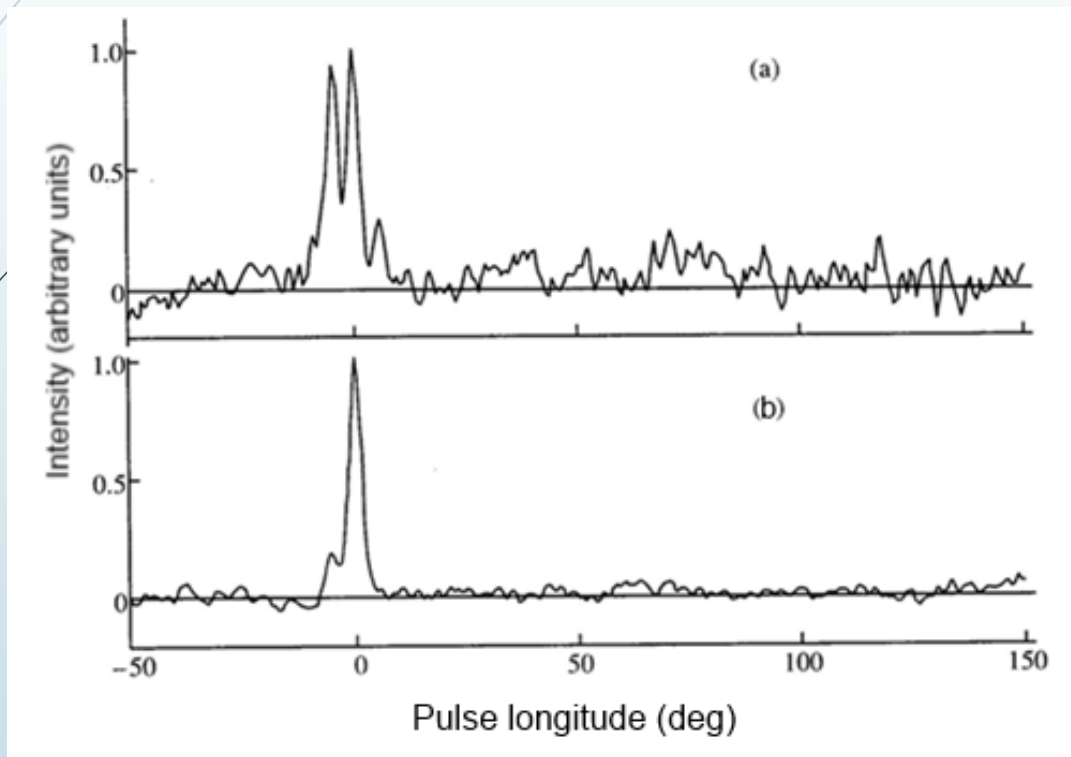


Detection of giant component from pulsar PSR J0653+8051

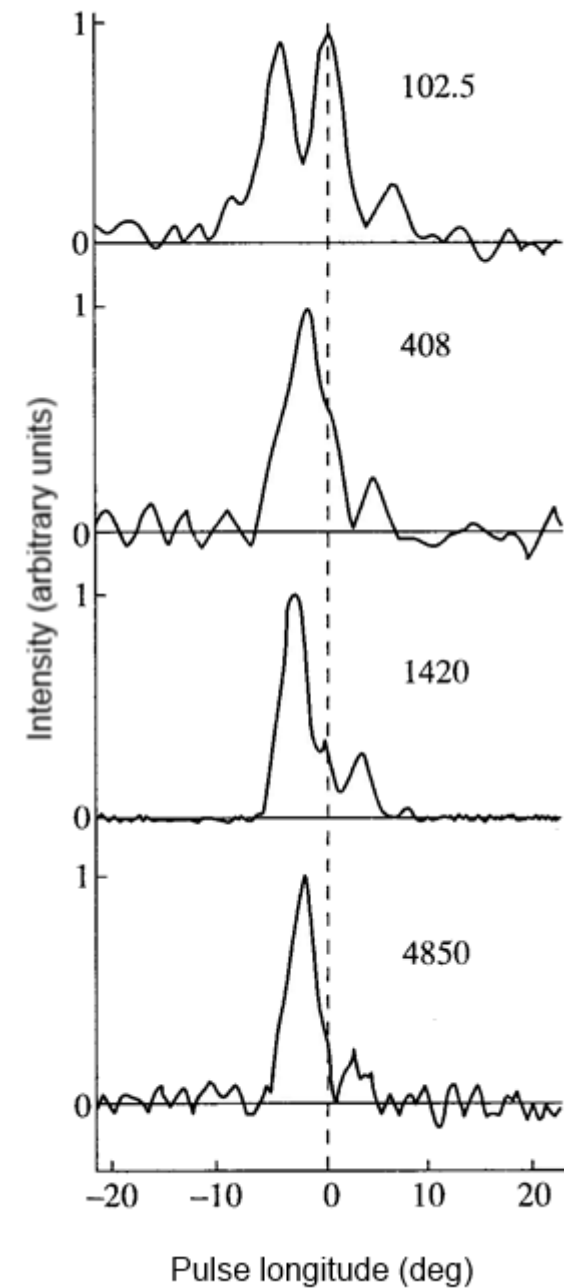
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Pushchino Radio Astronomy Observatory ASC LPI RAS

Observations of B0643+8051 in 1996



Malofeev et al., 1998



Observations

LPA: 111.5 ± 1.5 MHz,

$3.3 \text{ m} / \cos \delta$, $A_{\text{ef}} \approx 20\,000 \text{ m}^2$

Digital receiver: 512×5 kHz, $\Delta t = 2.45; 5.12$ ms

Apr.2012 – Apr.2014

360 observation sessions

1 observation session = 994 periods

B0643+80 (J0653+8051)

$p = 1,214 \text{ s}$

$p' = 3,8 \cdot 10^{-15} \text{ s/s}$

$T = 5 \cdot 10^6 \text{ years}$

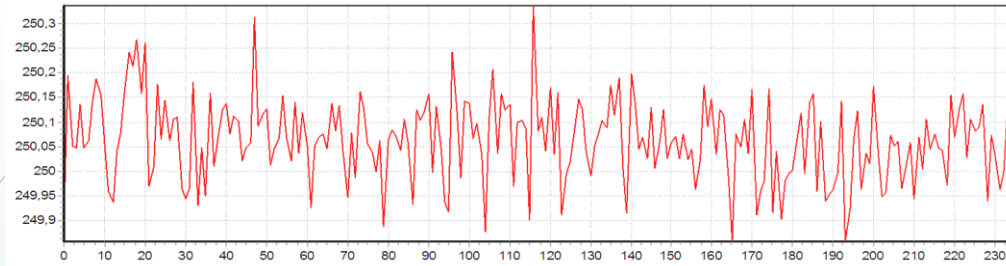
$B = 2 \cdot 10^{12} \text{ G}$

$DM = 32,5 \text{ pc/cm}^3$



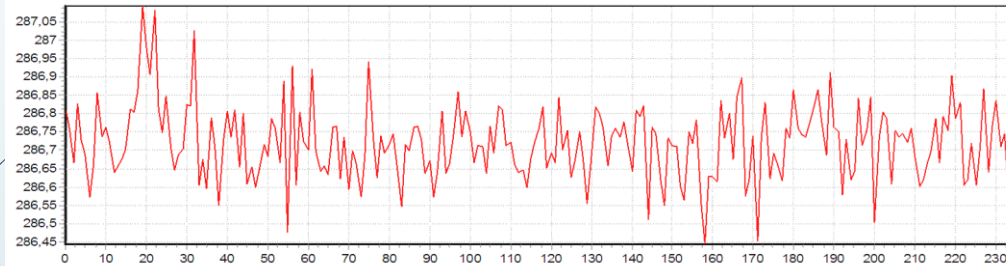
Examples of integrated profiles

Intensity in arbitrary units



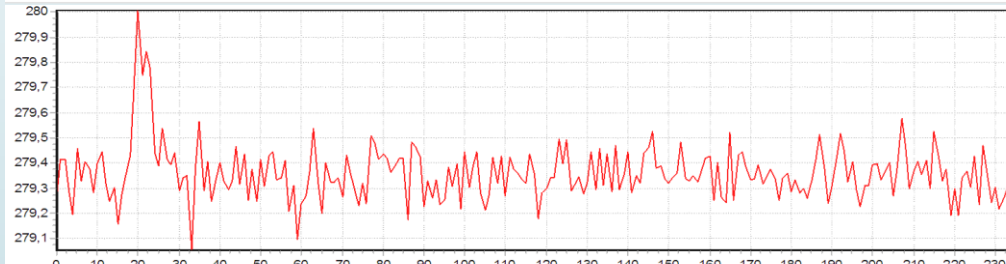
22.03.2013

$S/n < 3$
26.5%



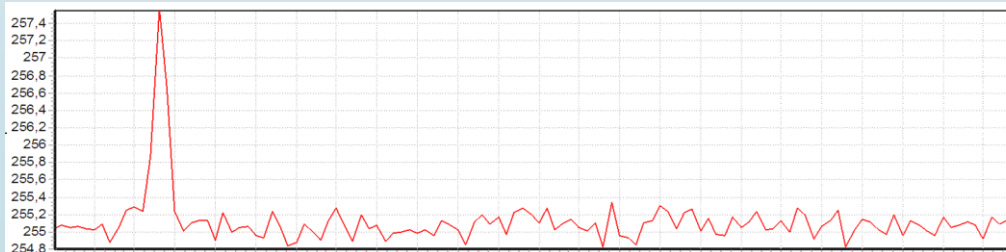
31.12.2012

$3 < S/n < 5$
62%



12.12.2012

$S/n > 5$
12%



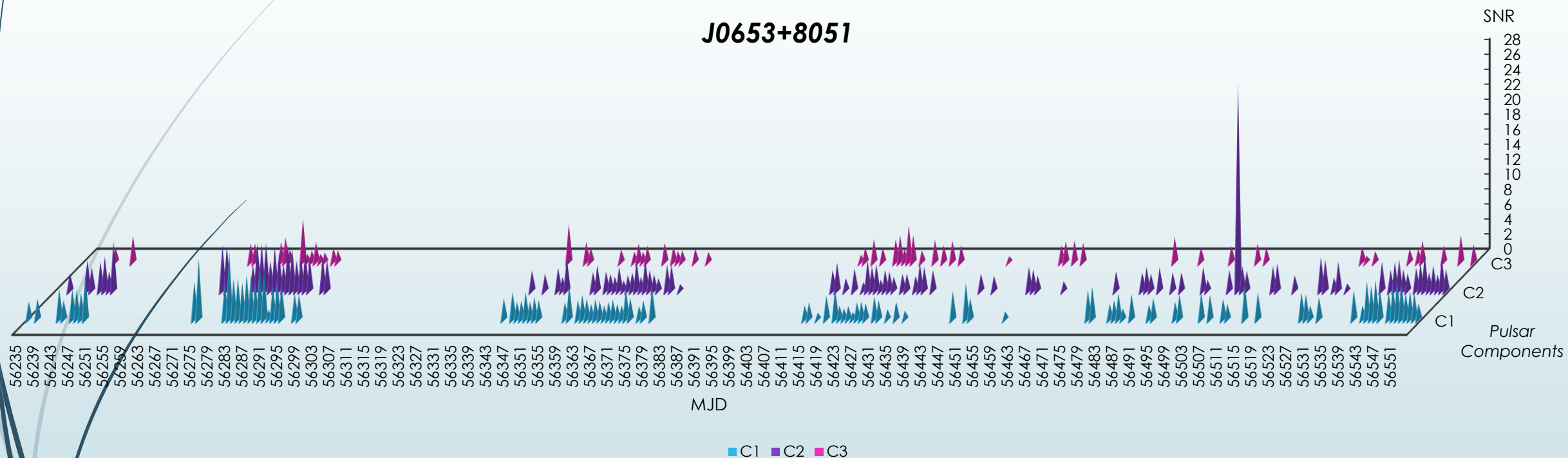
1.08.2013

$S/n > 10$
0,4%

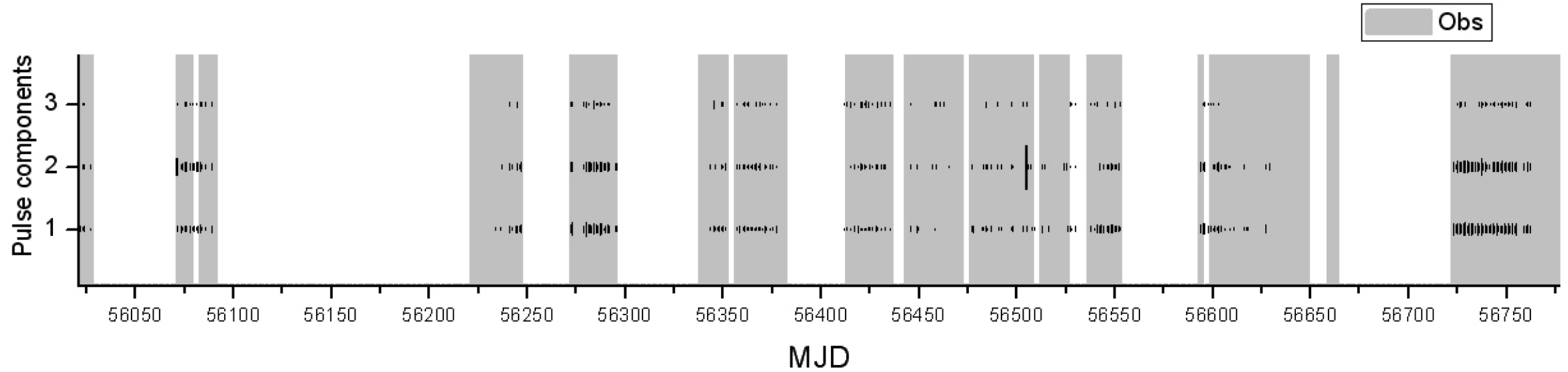
Pulse longitude (samples)

The fluctuations of the component intensity

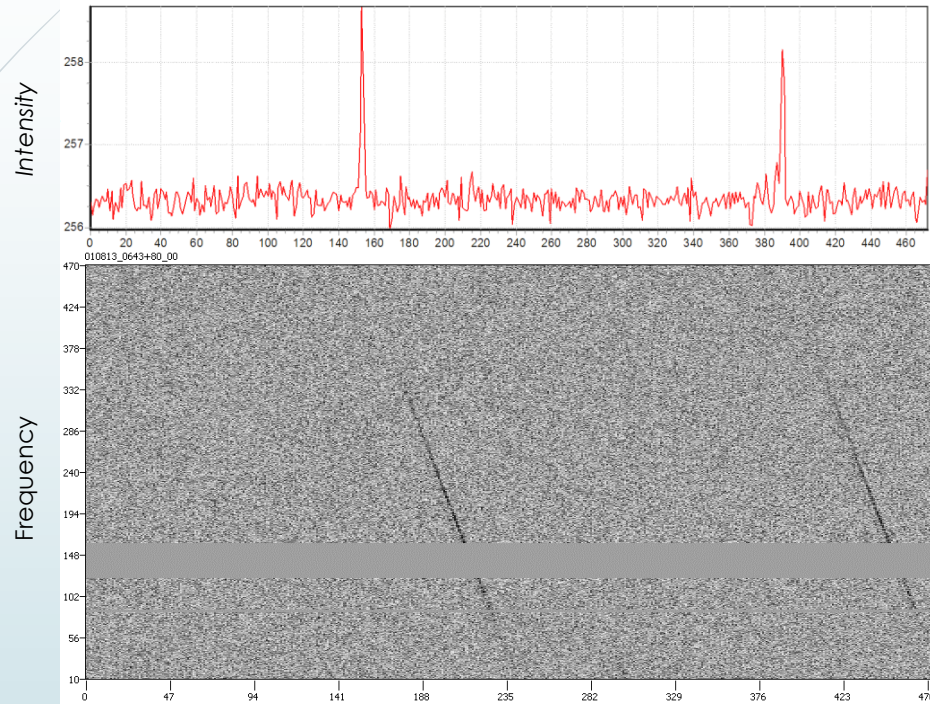
J0653+8051



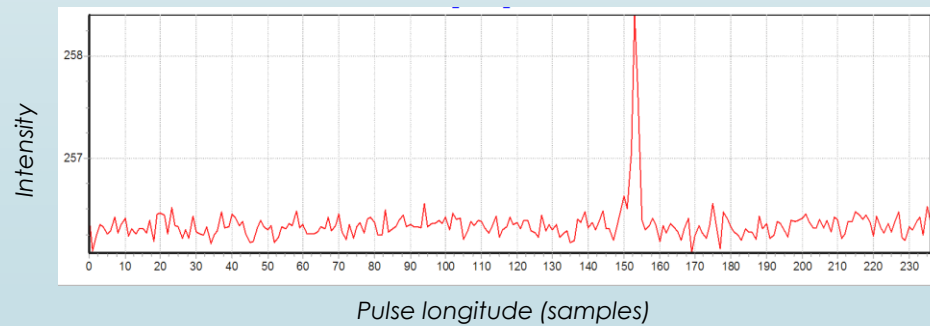
The fluctuations of the component intensity



Outburst (1.08.2013)



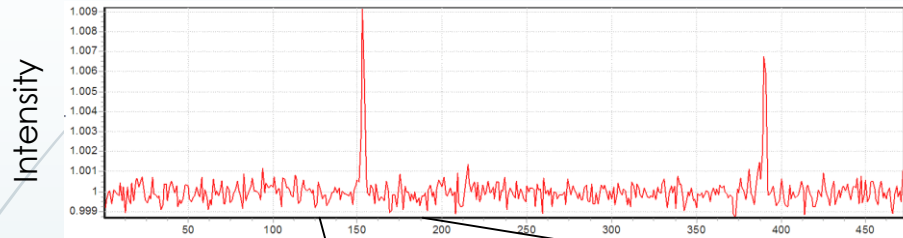
Sum of 408 double periods



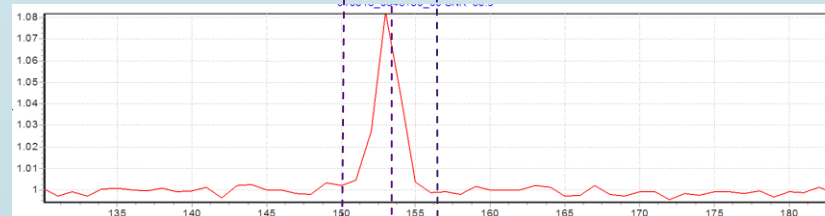
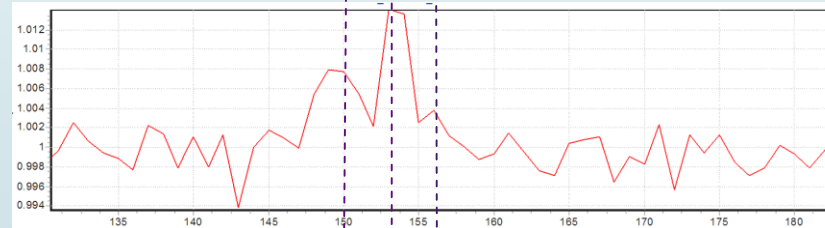
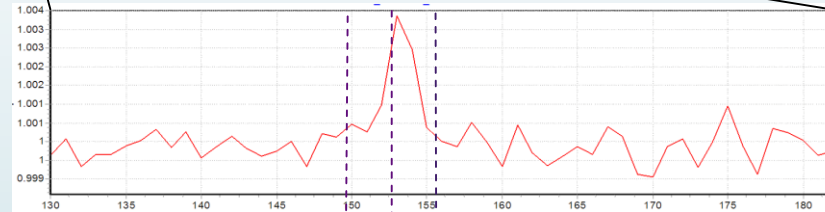
Integrated pulse profile

Sum of 816 pulses

Outburst (1.08.2013)



Intensity in arbitrary units



C1 C2 C3

Pulse longitude (samples) = 80 deg

158 pulses (C2 – 134) $S/n \geq 2.5$

56 pulses (C2 – 56) $S/n \geq 5$

16 pulses (C2 – 16) $S/n \geq 10$

Sum of 378 pulses: $S/n(C2) < 5$

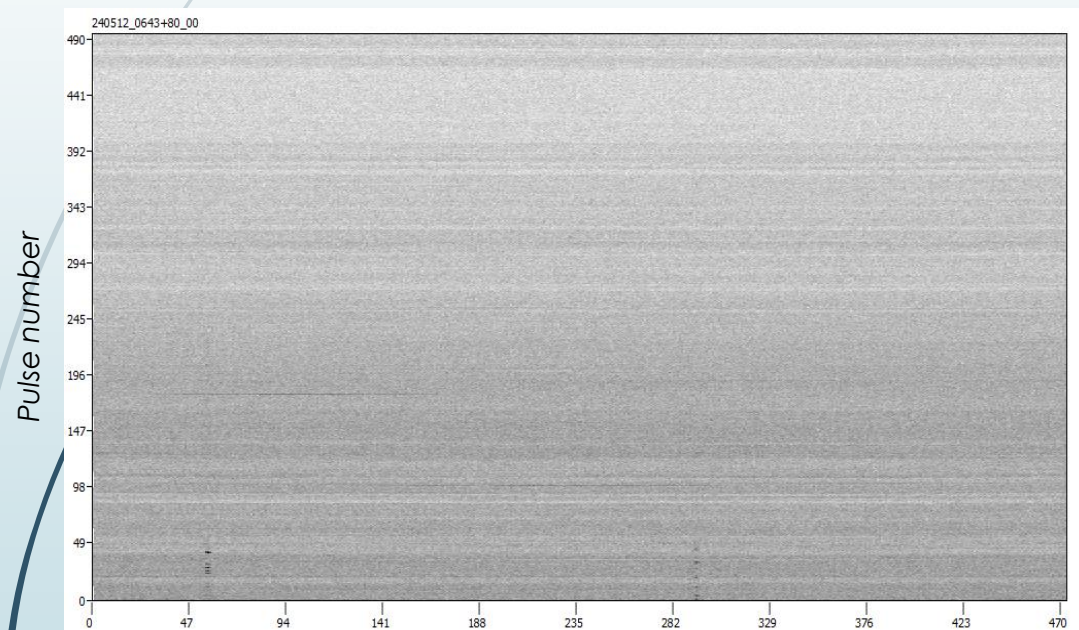
Sum of 31 pulses: $S/n(C1, C3) > 2.5$,
 $S/n(C2) < 5$

Sum of 32 pulses: $S/n > 5$

Intensity variations of pulses during “outburst” sessions

24.05.2012

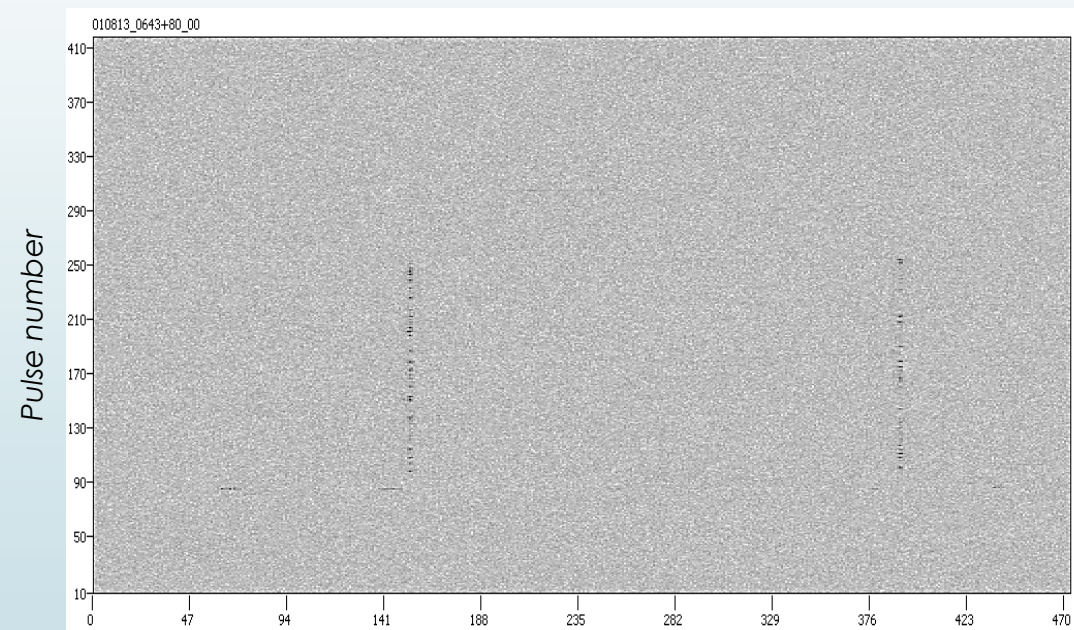
Double period



Pulse longitude in sample
(1 sample = 5,12 ms)

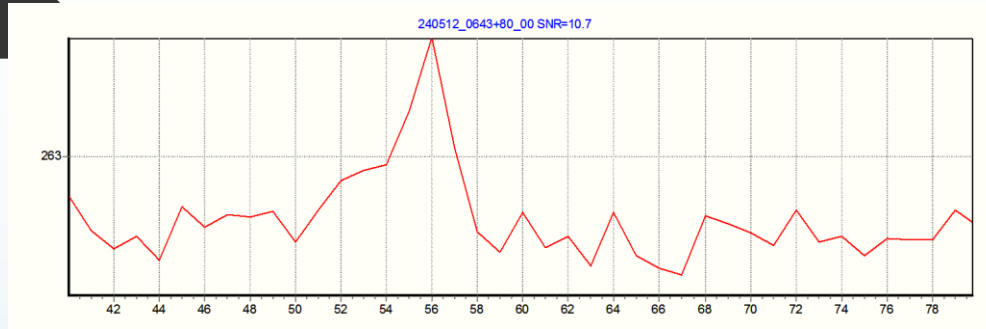
1.08.2013

Double period



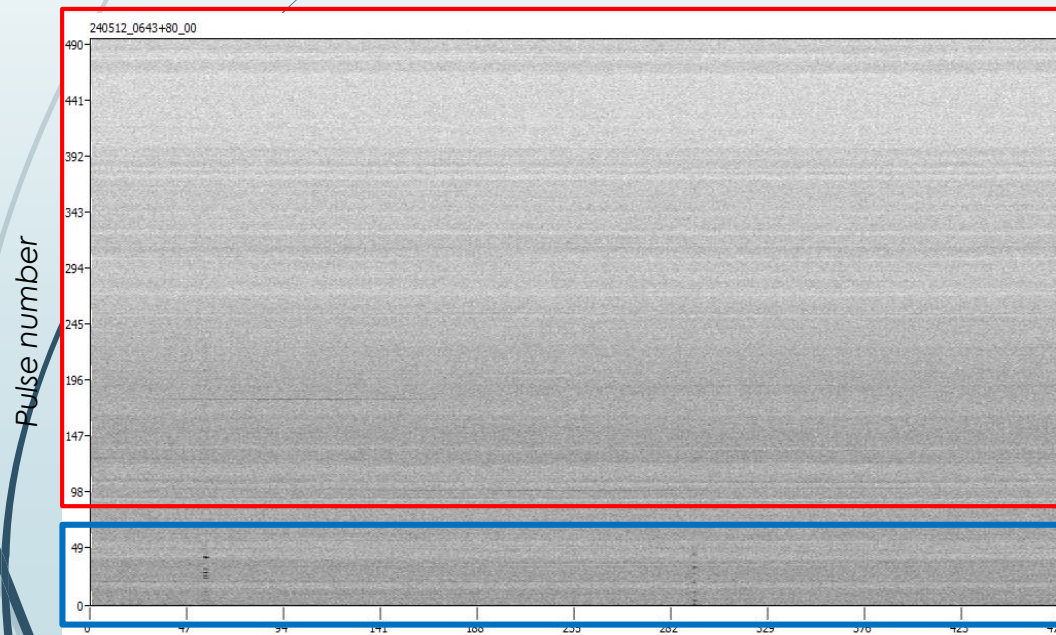
Pulse longitude in sample
(1 sample = 5,12 ms)

Intensity variations of pulses during session of 24.05.2012

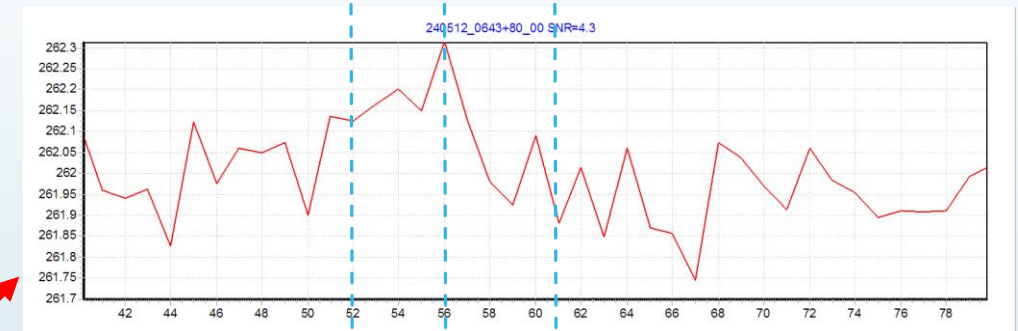


Sum of 495 double pulses

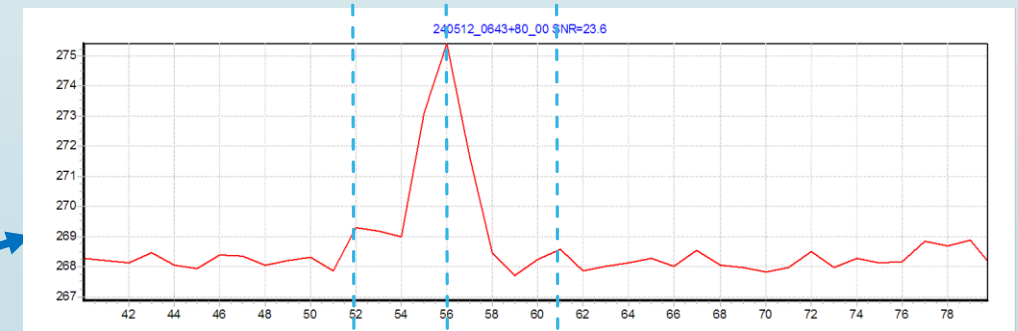
Double period



Pulse longitude in sample
(1 sample = 5,12 ms)



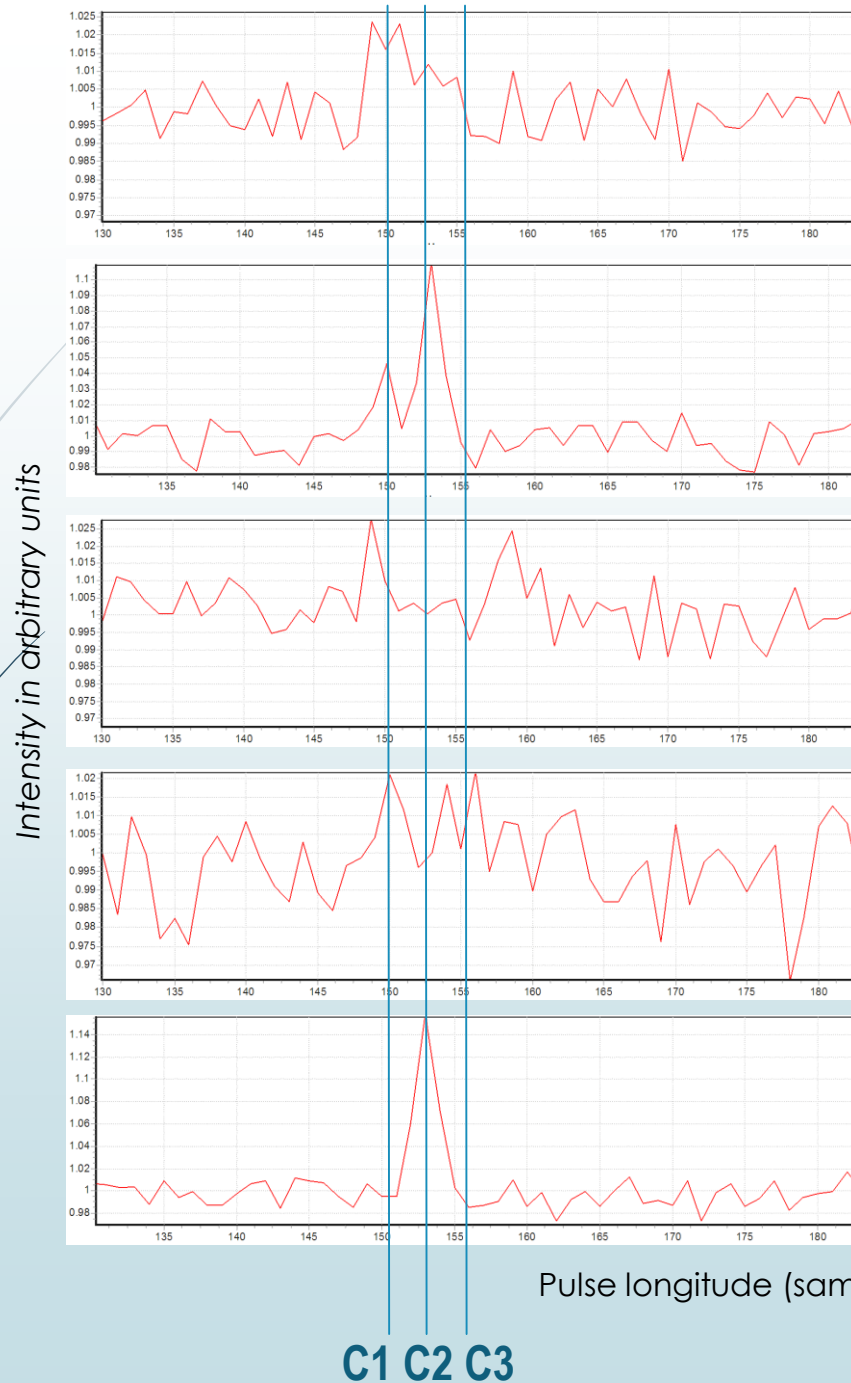
Sum of 439 double pulses



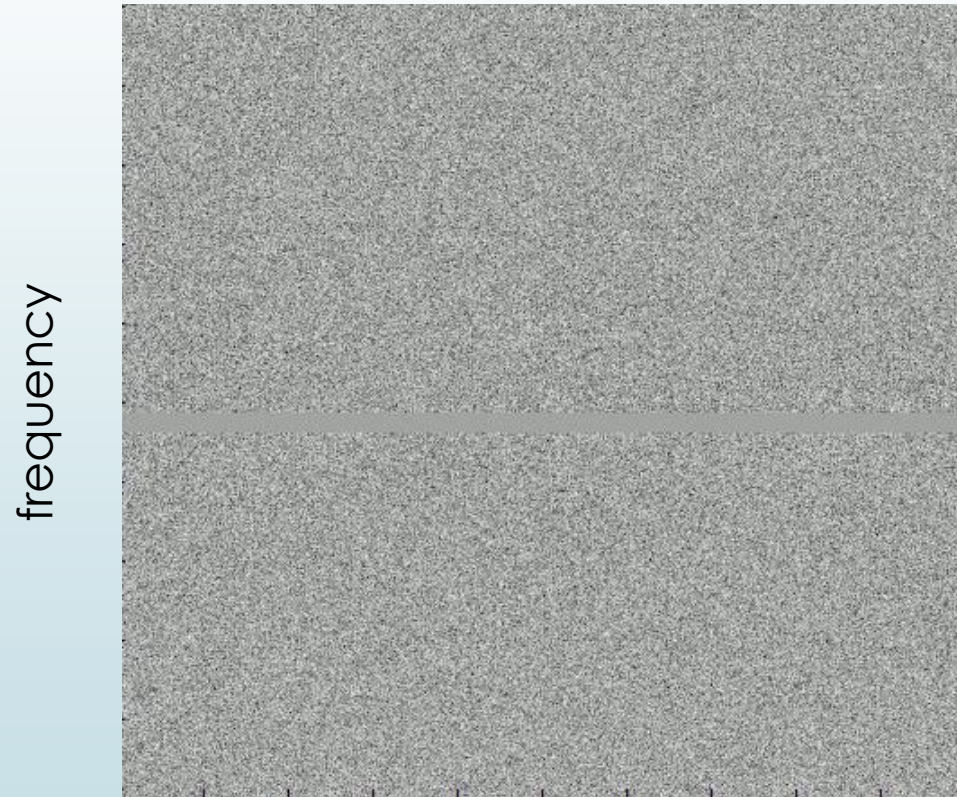
C1 C2 C3

Sum of 30 double pulses

The examples of the individual pulses (1.08.2013)



The dispersion slope in time-frequency plane



16 pulses

Time (2 periods)

Nature of events

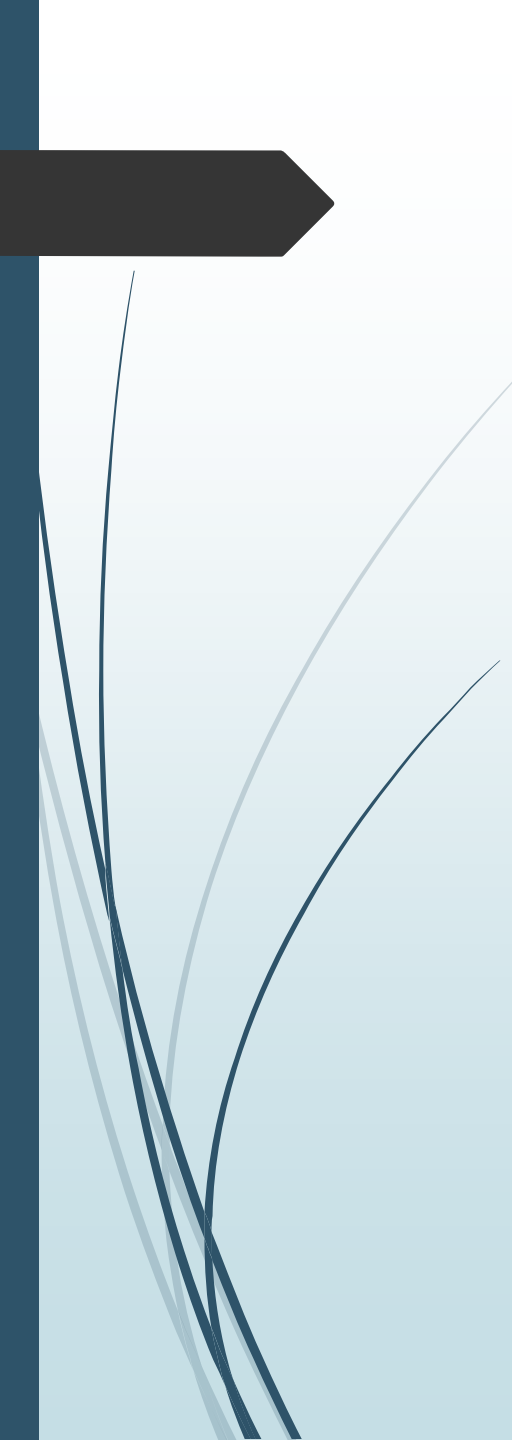
- **Mode-switching** – **NO** (very rare event)
- **Giant pulses** – **NO** (very wide pulses ~ 10 ms)
- **RRATs** (*McLaughlin et al., 2006*) – **POSSIBLE**

Duration of pulses is 2 – 30 ms and burst rates ranging: 0,4 – 0,01%

We have 20 pulses with $\frac{I}{\langle I \rangle} \geq 100$ ($S/n \geq 10$), total number of pulses is $\sim 10^5$ and our bursts rates is 0.01%.

Bright radio burst of B0656+14 (*Weltevrede et al., 2006*) has wide emission window $\sim 40^\circ$, B0643+80 has emission window $\sim 5^\circ$.

- **Core emission** - **?** (*Empirical model core-cone emission by J.Rankin*)
- **Giant component** - **?**



Summary

- We confirmed the presence of the bursts in second component of three-components profile (Malofeev et al., 1998)
- We detected that intensity of this component can be a factor 170 higher than its mean value. The duration of the bursts is about 300 periods (~6 min) and such event is extremely rare ~ 0.01% of observing time
- We find the long-time (a few months) variation of intensity of all components, then this value changed in two times with the average intensity of pulse emission.