FAST Drift-Scan Pulsar Survey

Zhichen Pan

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FPS7, Guangzhou, China
2018-07-04

FAST Drift-Scan Pulsar Survey

The Ultra-w

At the beginning, we n
1, tracking; 2, data pro

Single Beam for 270-1(
System temperature <
Two polarizations
4096 channels >> 0.25
sampling time: 200 us,

For observation:
"real" observations

PMPS: 0.14 mJy for central beam (Manchester et al. 2001),

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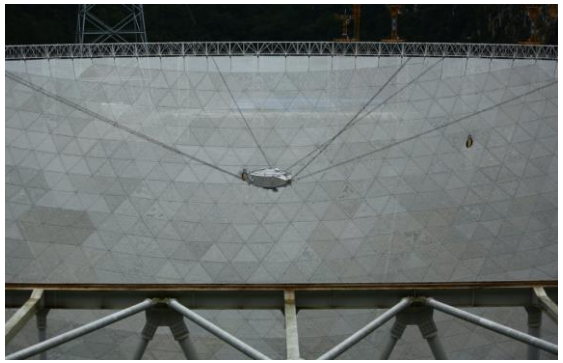
Overview



Telescope:
500 m aperture, using 300 m

Receiver:
ultra-wideband 19-beam

Computers in FAST site:
Data temporary storage and transferring

Data center and super computers:
Pulsar searching, including database for candidate filtering

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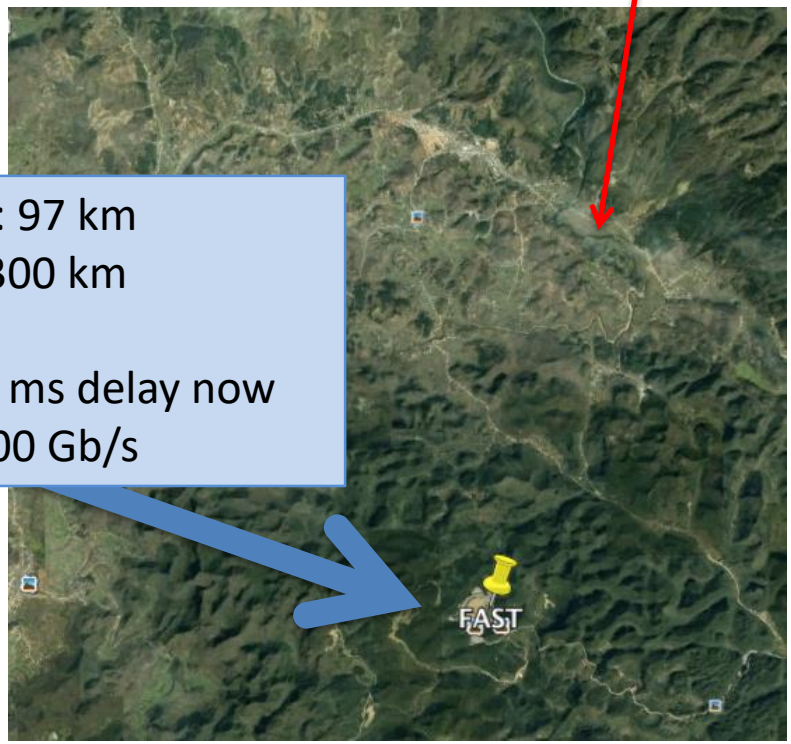
Data transfer

Guiyang Airport

Astronomical Town



Distance: 97 km
Fiber: ~300 km

2 Gb/s with ~10 ms delay now
will be 100 Gb/s

Images from Google Earth

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Data rate

One beam: 8-bit, 5 kHz sampling (200 us sampling), 4k channel, 2 polarization

Baseband: 8 (

Psrfits data: 8

For 19 beam:

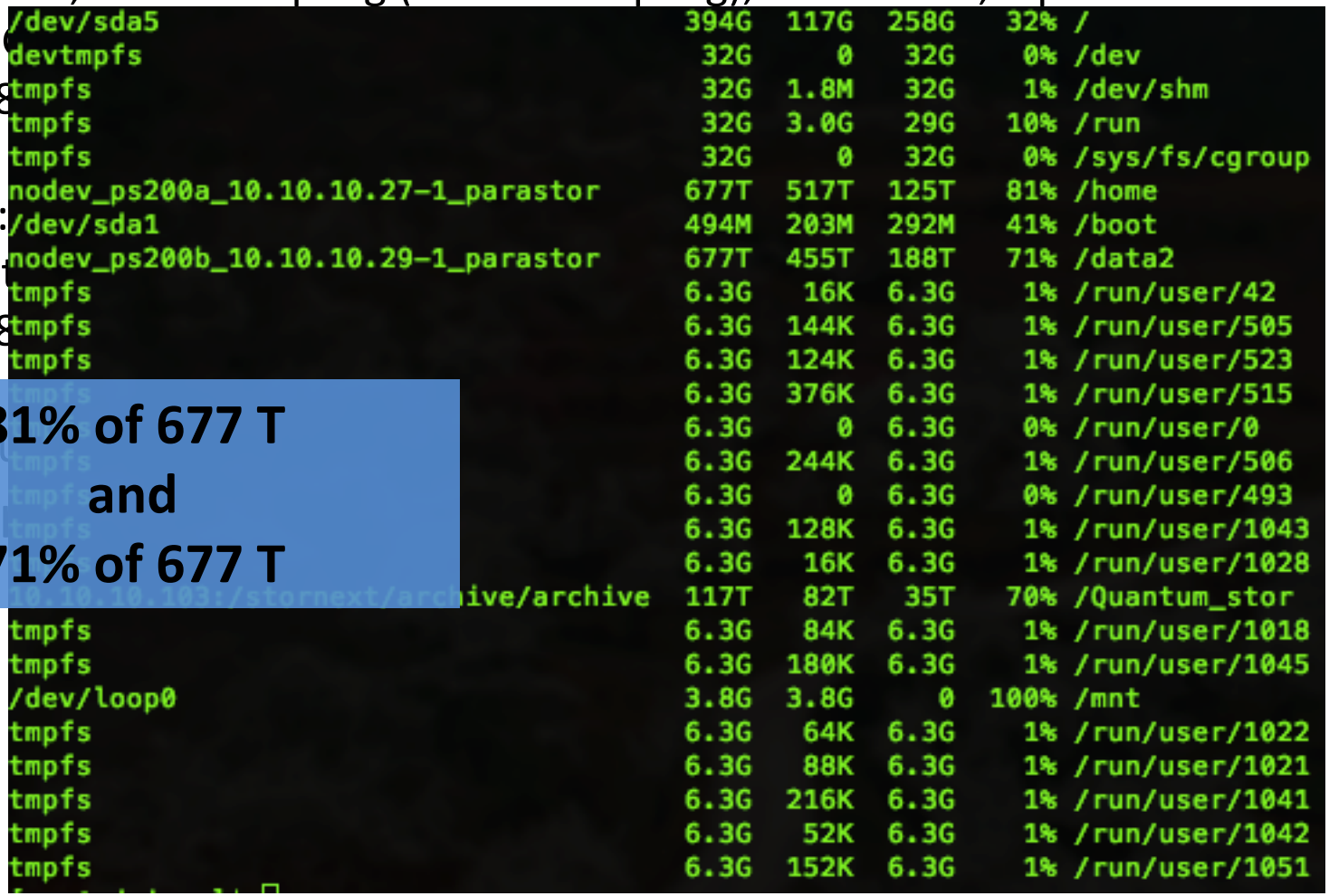
Baseband dat

Psrfits data: 8

Datarate redu

One polar

81% of 677 T
and
71% of 677 T



```
/dev/sda5                                   394G  117G  258G   32% /
devtmpfs                                     32G     0   32G    0% /dev
tmpfs                                        32G  1.8M   32G    1% /dev/shm
tmpfs                                        32G  3.0G   29G   10% /run
tmpfs                                        32G     0   32G    0% /sys/fs/cgroup
nodev_ps200a_10.10.10.27-1_parastor         677T  517T  125T   81% /home
/dev/sda1                                   494M  203M  292M   41% /boot
nodev_ps200b_10.10.10.29-1_parastor         677T  455T  188T   71% /data2
tmpfs                                       6.3G   16K  6.3G    1% /run/user/42
tmpfs                                       6.3G  144K  6.3G    1% /run/user/505
tmpfs                                       6.3G  124K  6.3G    1% /run/user/523
tmpfs                                       6.3G  376K  6.3G    1% /run/user/515
tmpfs                                       6.3G     0  6.3G    0% /run/user/0
tmpfs                                       6.3G  244K  6.3G    1% /run/user/506
tmpfs                                       6.3G     0  6.3G    0% /run/user/493
tmpfs                                       6.3G  128K  6.3G    1% /run/user/1043
                                            6.3G   16K  6.3G    1% /run/user/1028
10.10.10.103:/stornext/archive/archive      117T   82T   35T   70% /Quantum_stor
tmpfs                                       6.3G   84K  6.3G    1% /run/user/1018
tmpfs                                       6.3G  180K  6.3G    1% /run/user/1045
/dev/loop0                                  3.8G  3.8G     0  100% /mnt
tmpfs                                       6.3G   64K  6.3G    1% /run/user/1022
tmpfs                                       6.3G   88K  6.3G    1% /run/user/1021
tmpfs                                       6.3G  216K  6.3G    1% /run/user/1041
tmpfs                                       6.3G   52K  6.3G    1% /run/user/1042
tmpfs                                       6.3G  152K  6.3G    1% /run/user/1051
```

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Band Selections

Band separated by backends: 0-1 GHz, 1-2 GHz

For search:

290-340 MHz (fully processed)
500-750 MHz (10%)
1149-1679 MHz (test)
290-802 MHz (fully processed)
270-526? MHz (?)
410-538 MHz (fully processed)

Data Length Selection:

lambda/D * cos **θ** * 1, 1.22, 1.5, or even 2?

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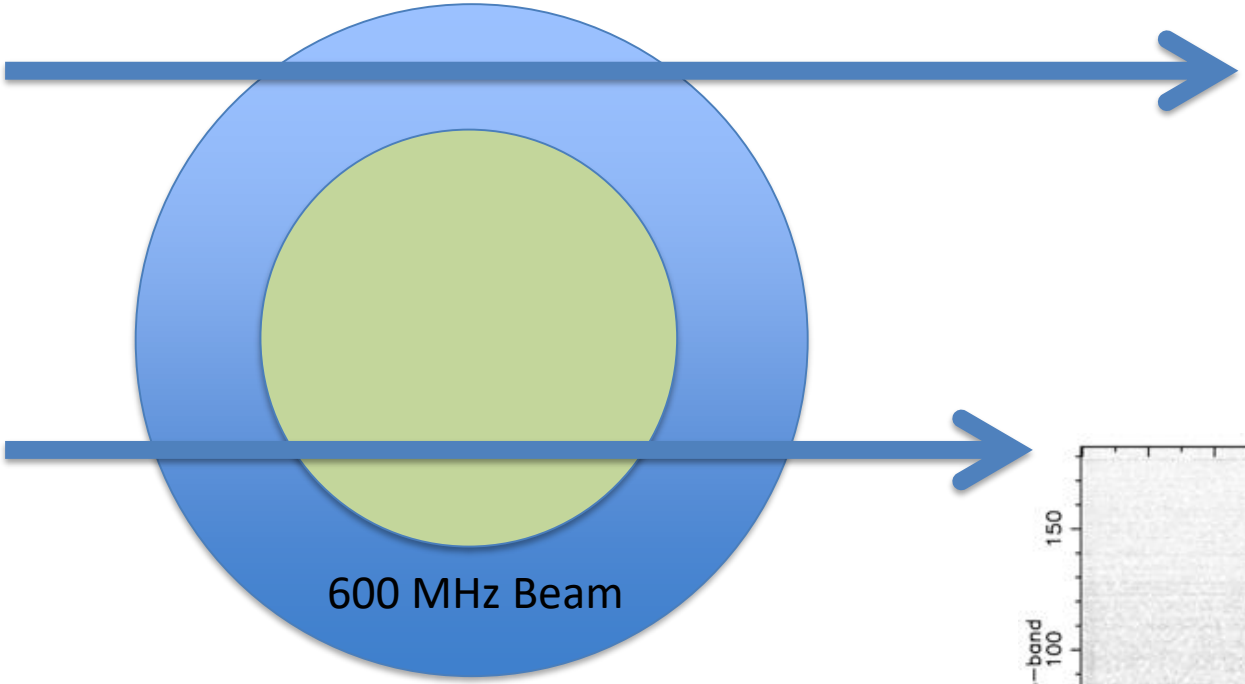
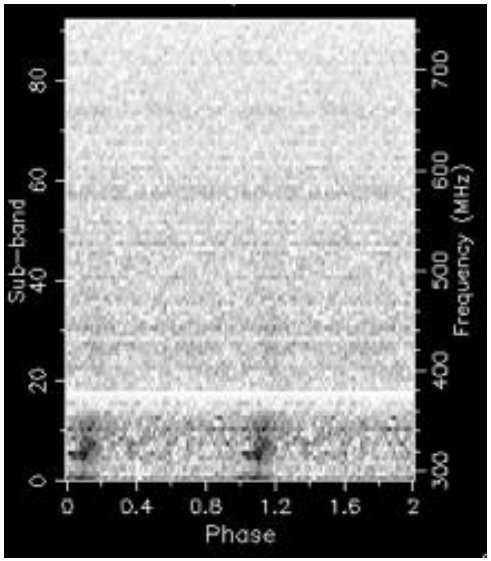
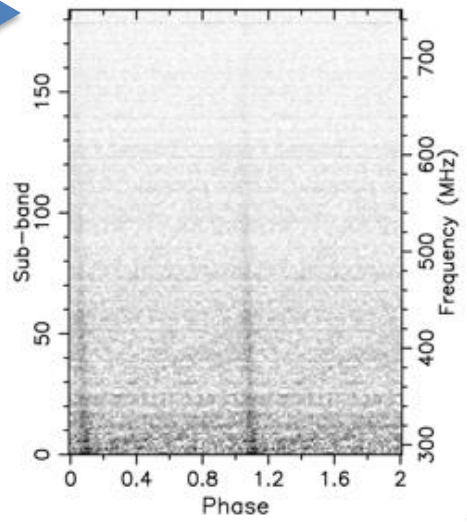
Band Selections







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Algorithms and Softwares

Search Method	Target in drift scan	Code	Platform	Tested
FFT	p0 < 0.5 s ?	PRESTO, SigProc	CPU, GPU, etc	Yes
FFA	0.5 s <= p0 <= 3 s ?	ffa in SigProc, ffancy	CPU, GPU?	No
Single Pulse	p0 > 3 s	python code in PRESTO, Heimdall, ZWW's	GPU	Partially

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Hardwares

Hardware	CPU Cores	GPU	Toolkit	Search for

作业列表 | 状态视图

作业提交

刷新成功!

作业ID	作业名	所有者	队列	状态	开始时间	运行时间
2598.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:16:21	00:00:58
2599.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:16:59	00:01:03
2600.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:17:14	00:01:08
2601.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:17:54	00:00:59
2602.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:18:08	00:01:12
2603.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:18:46	00:01:47
2604.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:19:03	00:01:41
2605.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:19:45	00:01:05
2606.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:19:57	00:01:01
2607.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:20:33	00:01:08
2608.admin	FP20170601_0-1G_unkn...	pzc	low	完成	2017-06-22 09:20:47	00:01:00
2609.admin	FP20170601_0-1G_unkn...	pzc	low	运行	2017-06-22 09:21:26	
2610.admin	FP20170601_0-1G_unkn...	pzc	low	运行	2017-06-22 09:21:46	

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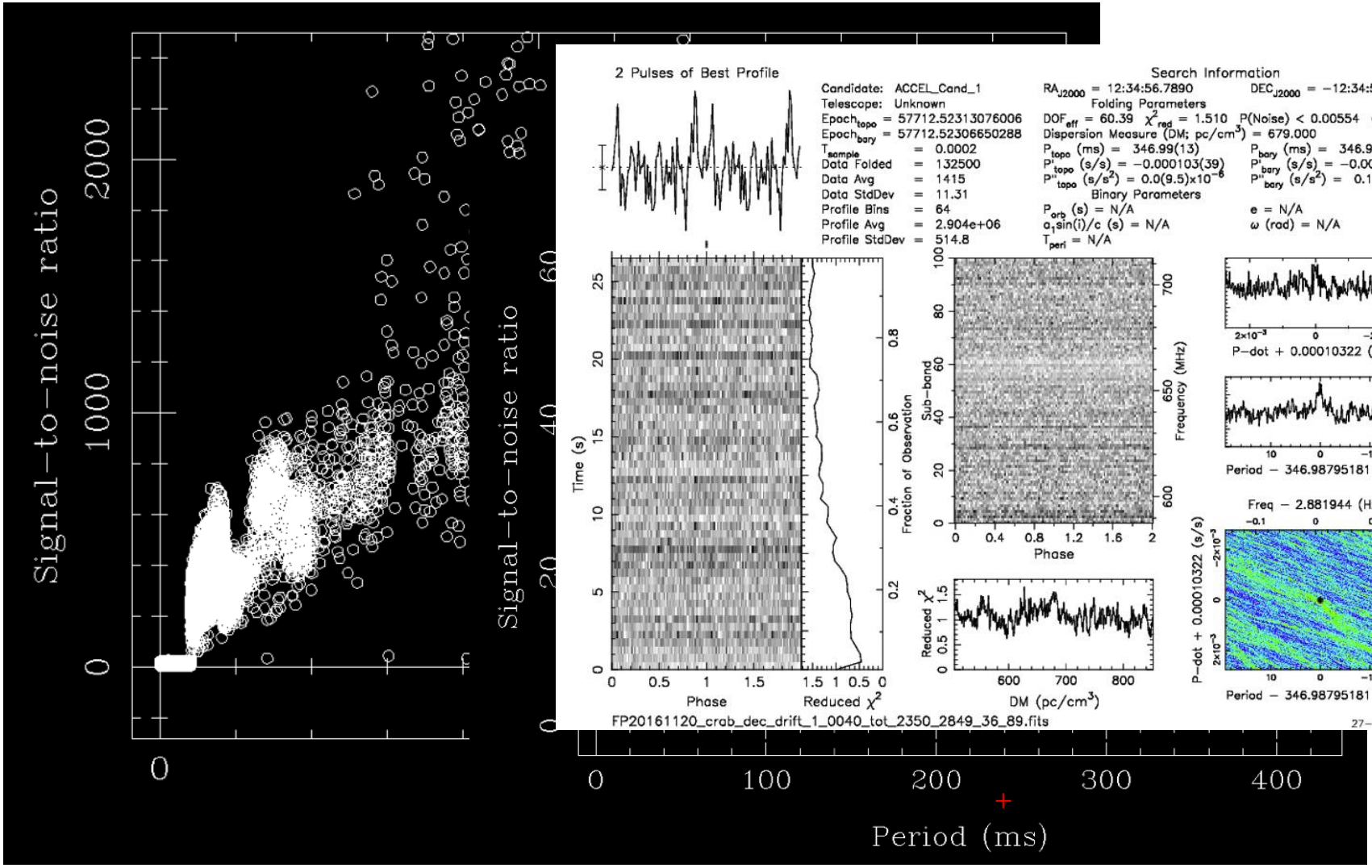
Candidate Selection - Diagrams



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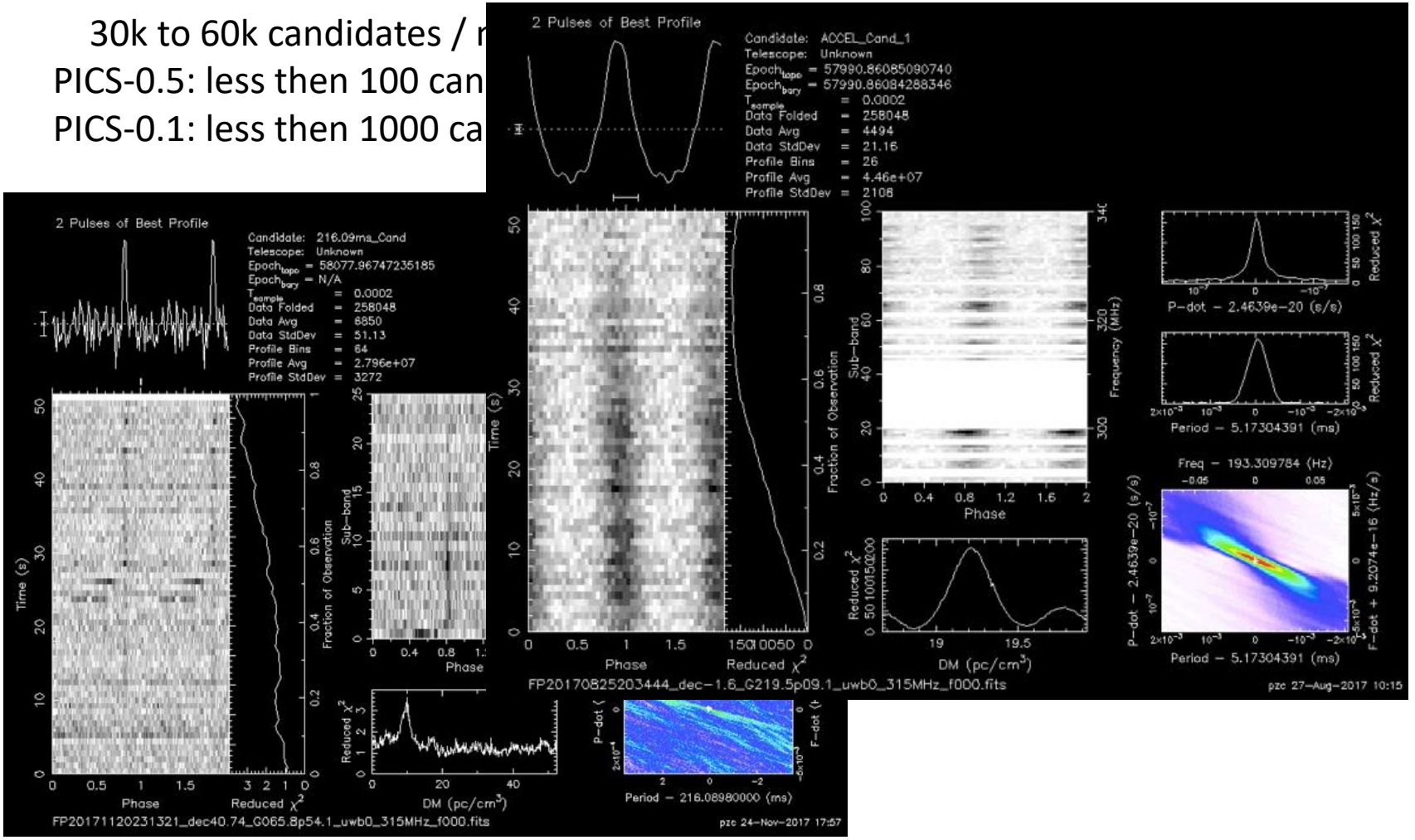
Candidate Selection – AIs (e.g. PICS, Zhu et al. 2013)

Periodic search:

30k to 60k candidates / r

PICS-0.5: less then 100 can

PICS-0.1: less then 1000 ca



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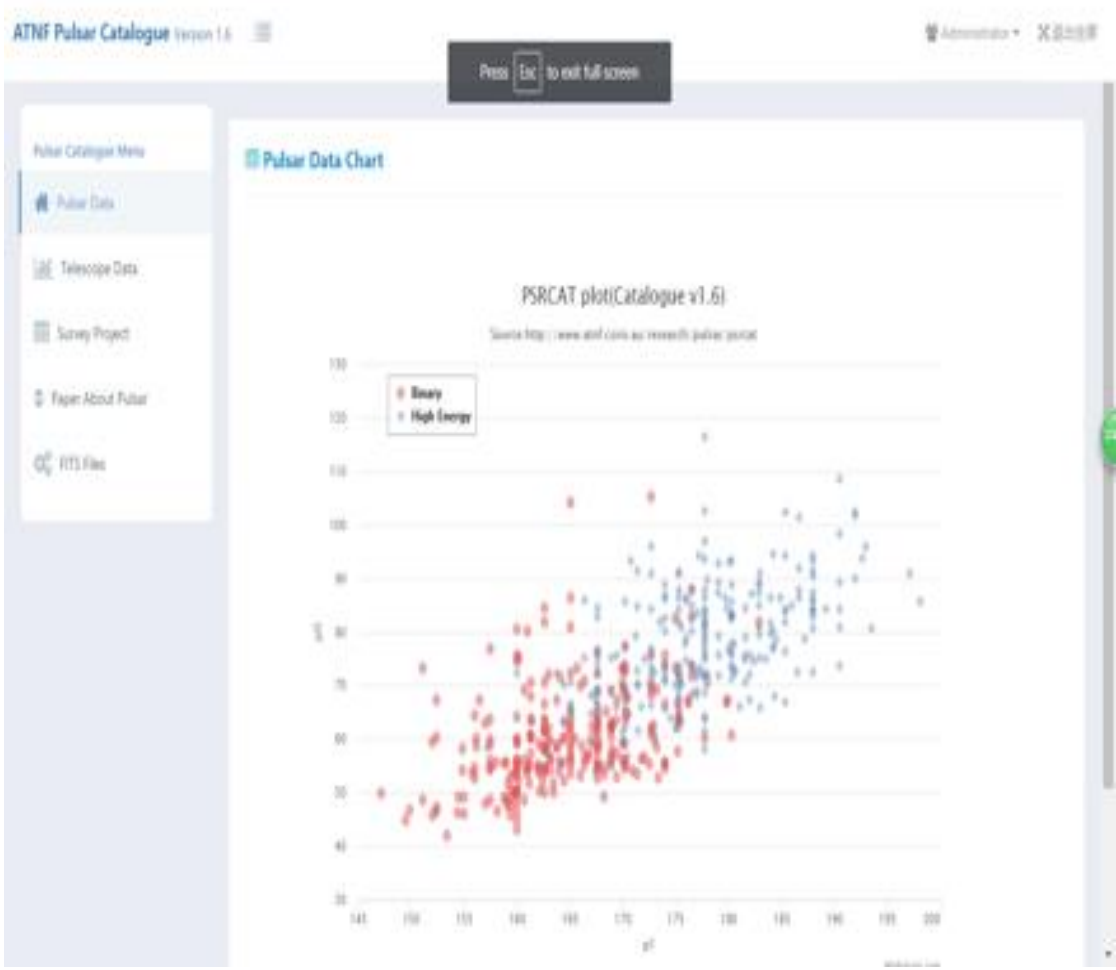
Database



From Hui Zhang's PPT

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Numbers

Total:

60 (3 to be known pulsars, 2 also shown in LOFAR page) from drifting and 4 (2 Fermi, 1 by luck, 1 GC) from tracking

Confirmed by other telescopes and published in CRAFTS website:

42 + 1(2?)

Confirmed by FAST (may also confirmed by other telescopes):

25 (should be more now) + 1

In addition:

Pulsar J0848+16 in AO 327 drifting scan page (http://www.naic.edu/~deneva/drift-search/) has a DM value of 38.2 and a period of 452.26 ms. From FAST drifting scan data, its period should be 2*452.26 ms. This pulsar was detected in 20171217 data.

Already told AO 327 people and confirmed.

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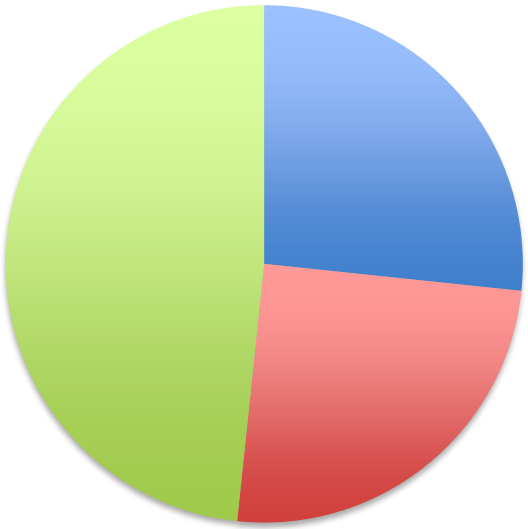
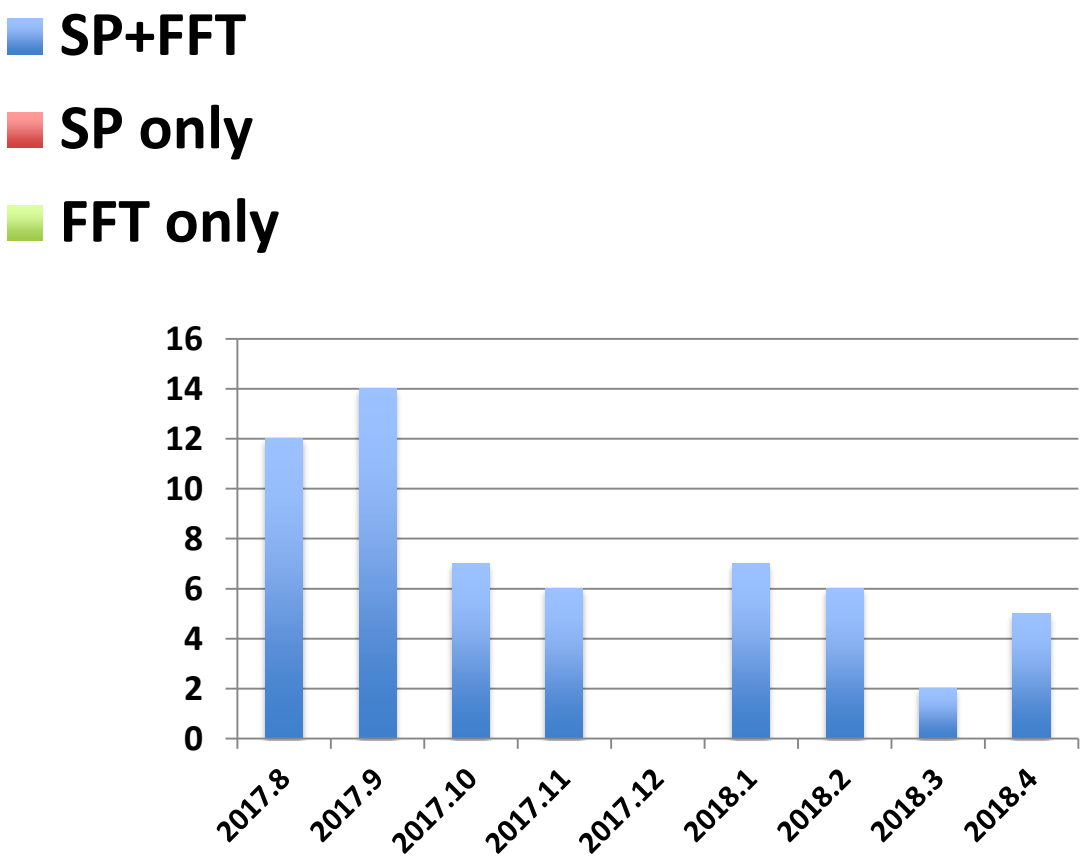
Search Results





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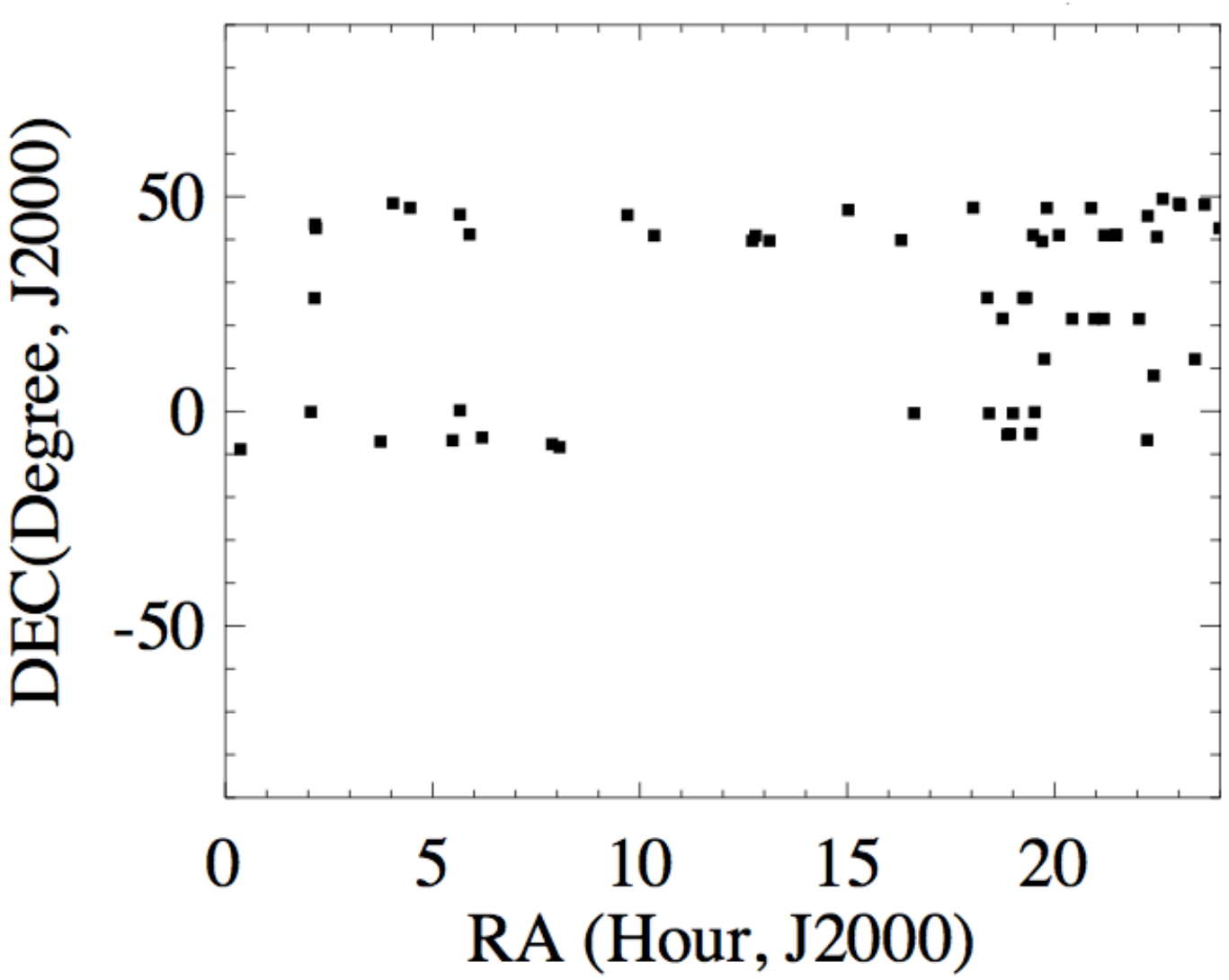
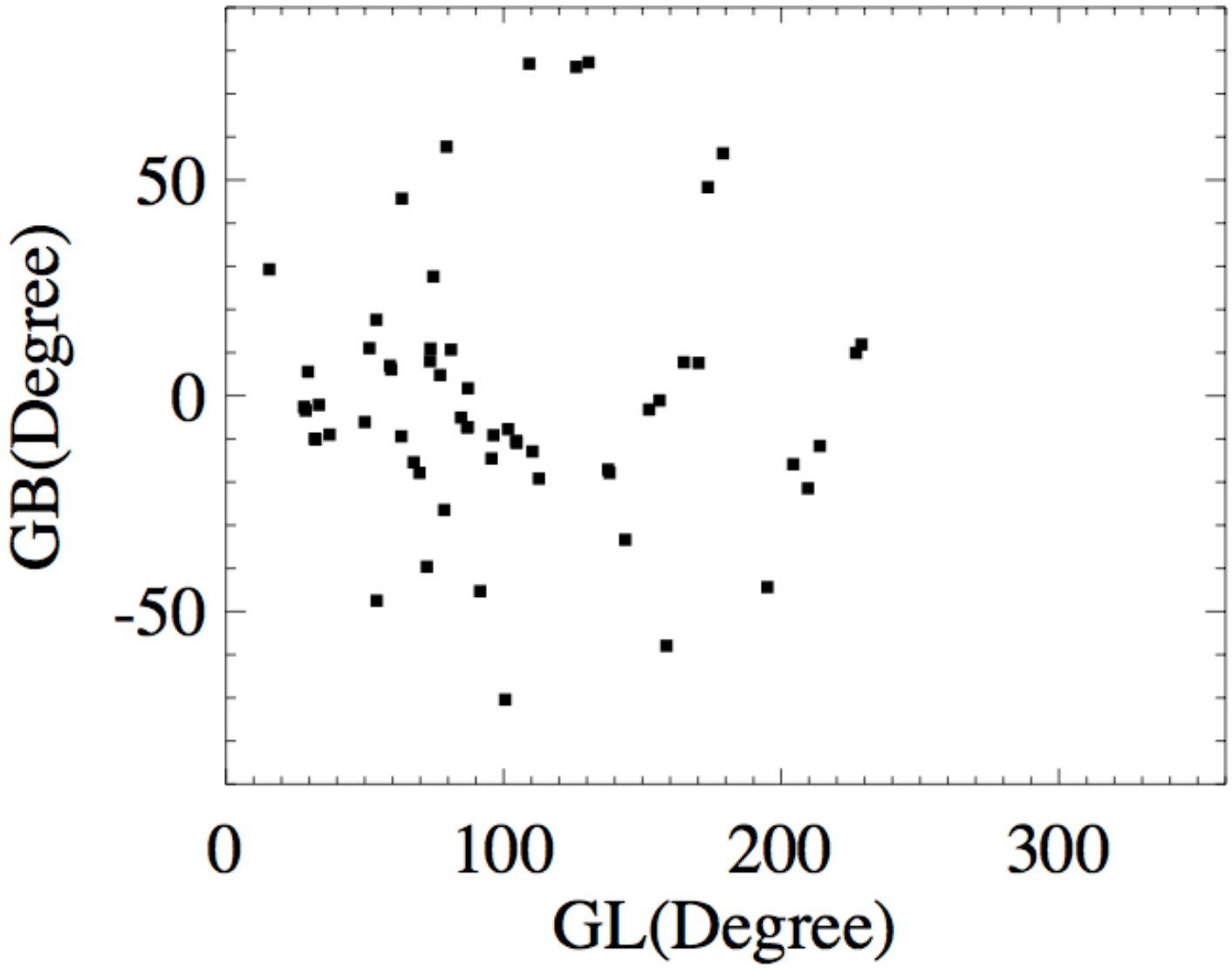
Search Results



FAST Drift-Scan Pulsar Survey

Search Results



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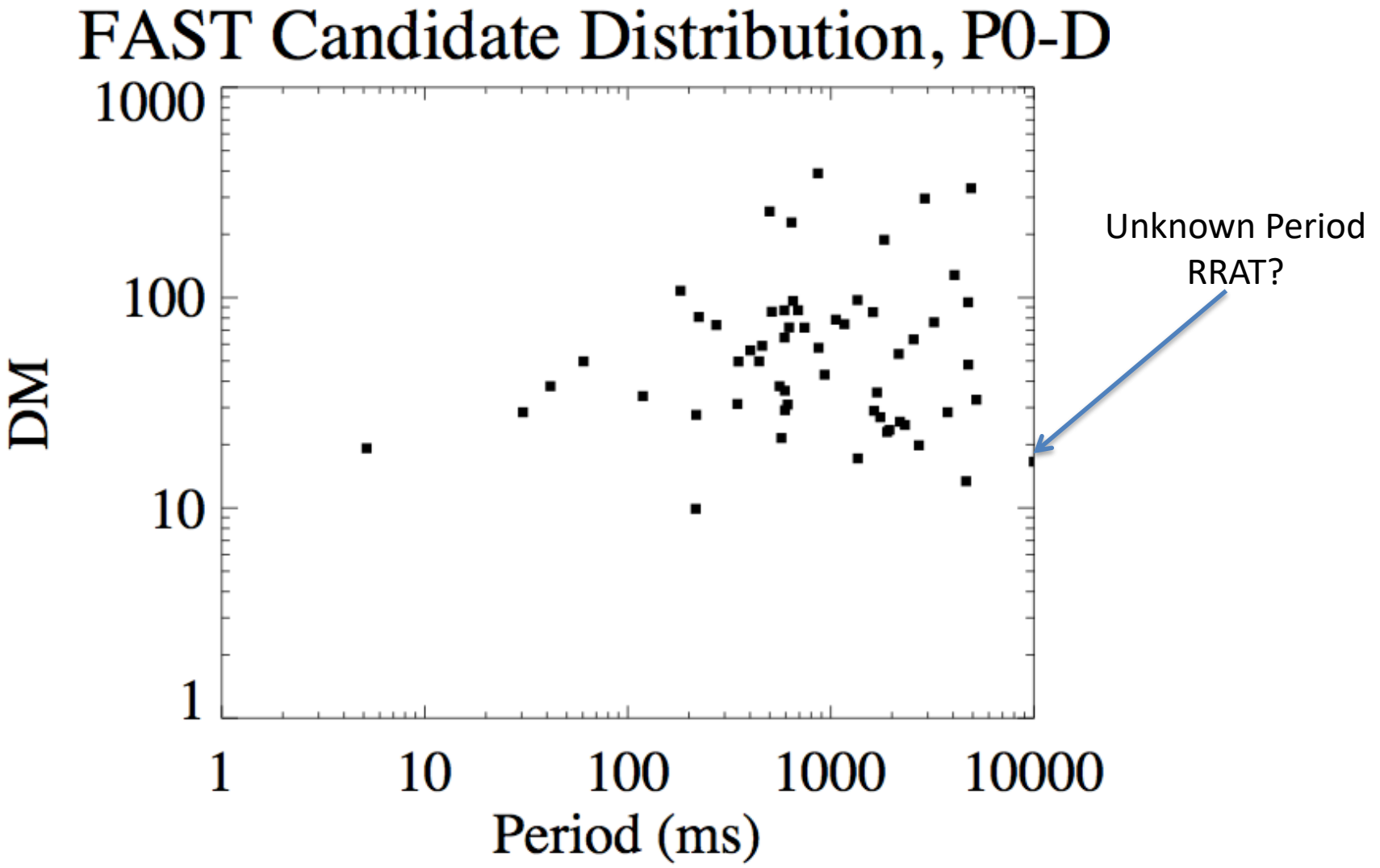
Search Results



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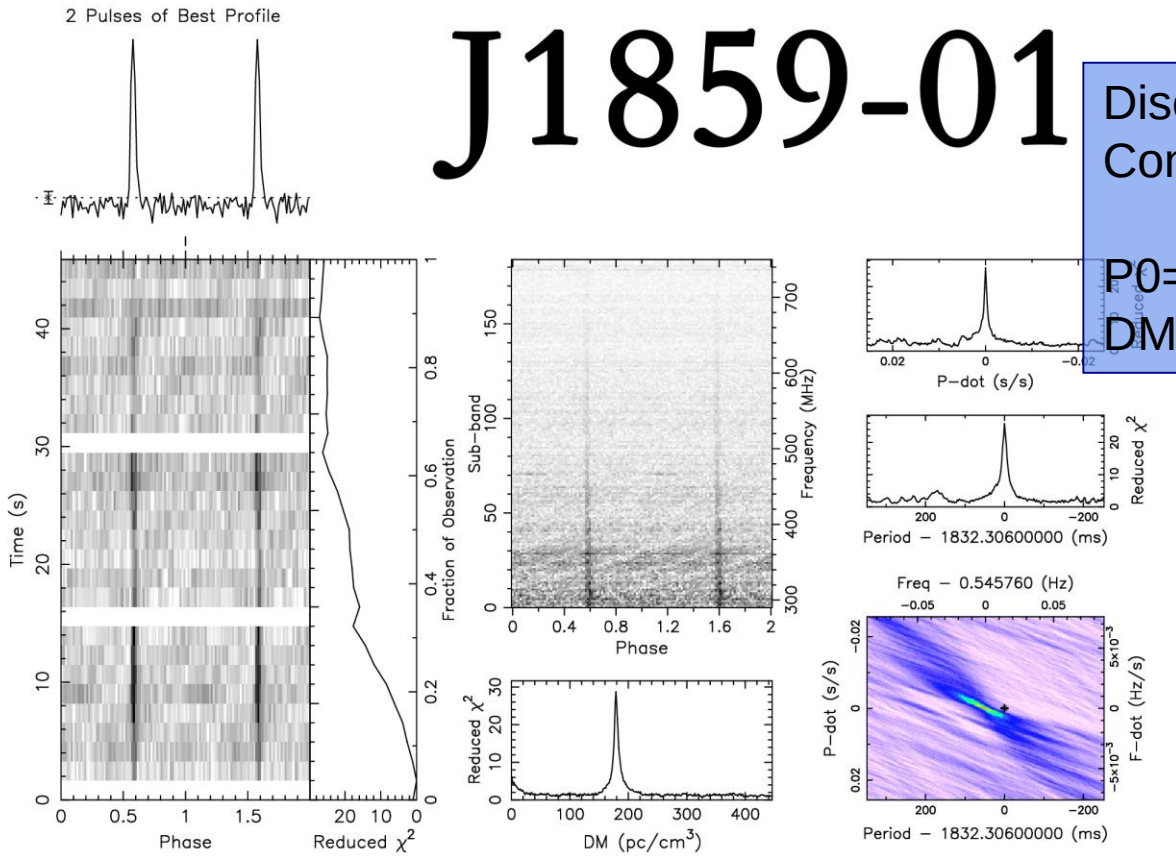
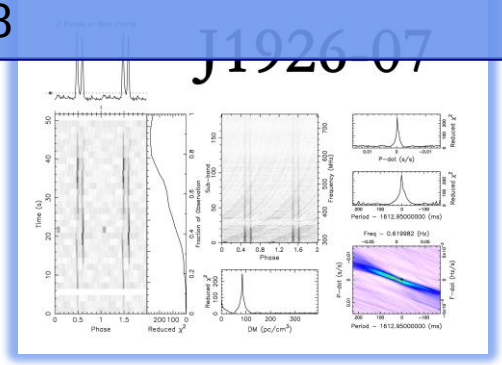
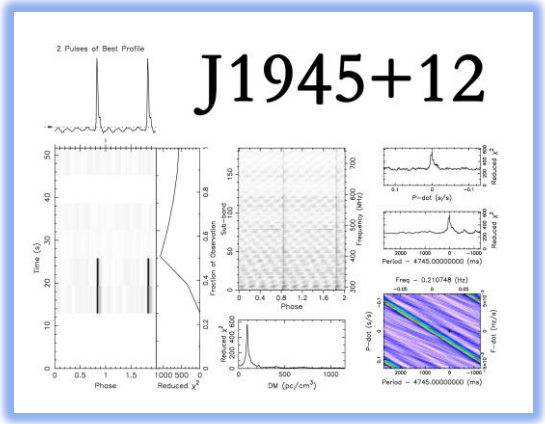
Some New Pulsars

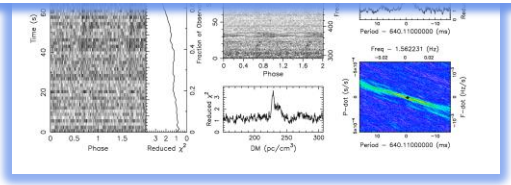


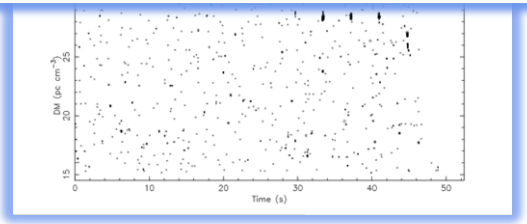
Discovery: 2017-08-22
Confirm: 2017-09-10 (Parkes)

P0=1832 ms
DM=188









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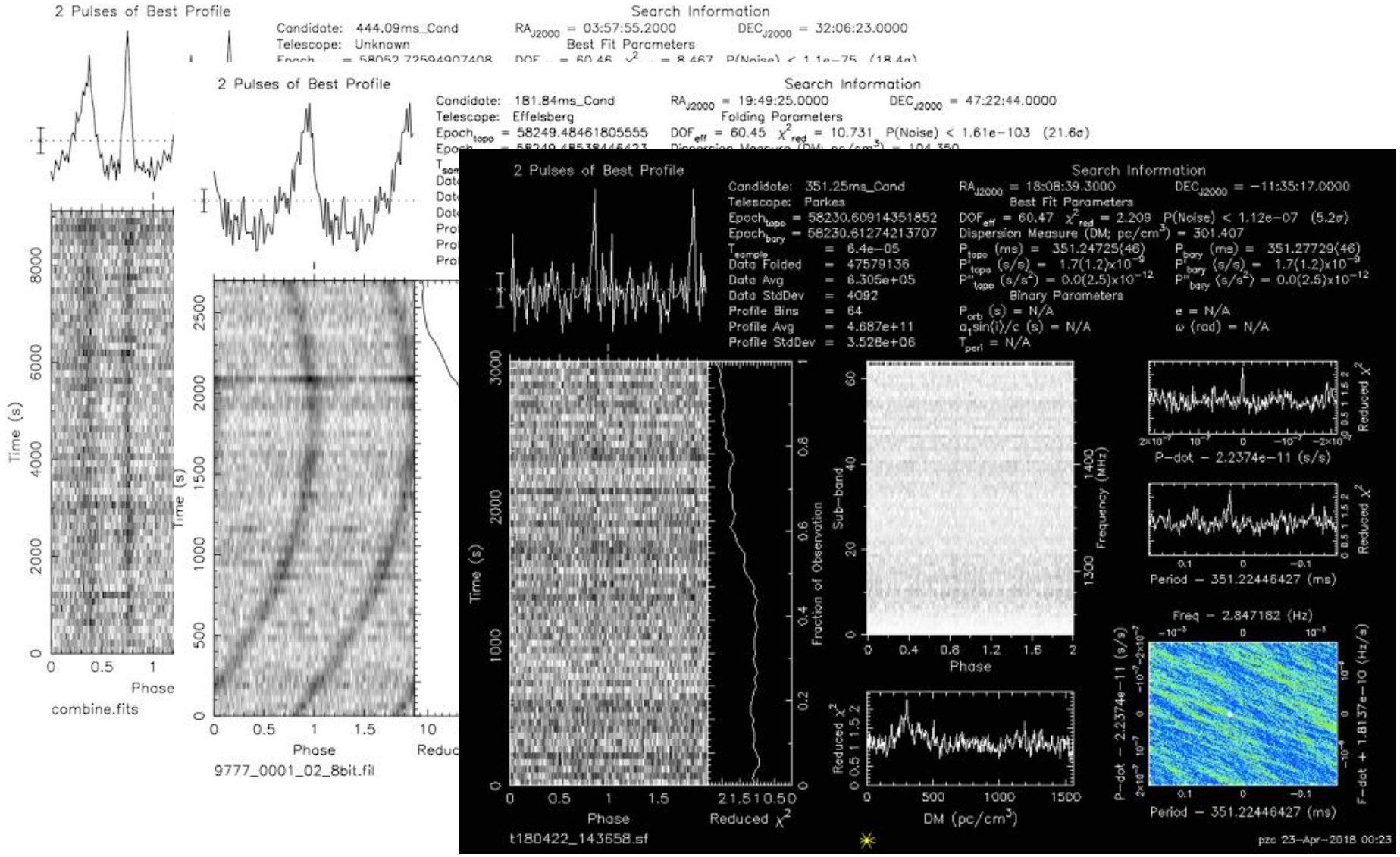
Some New Pulsars



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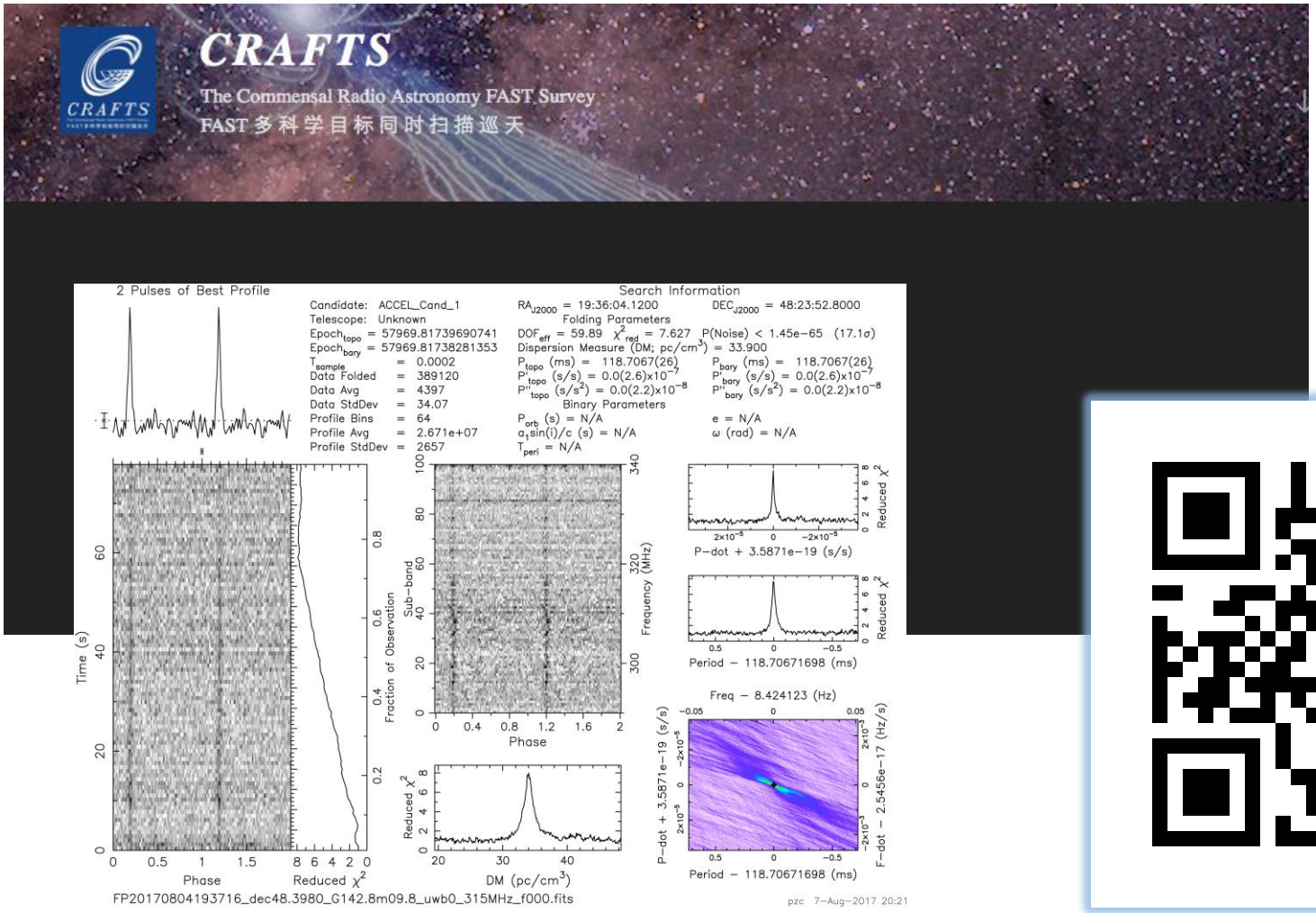
Future – CRAFTS



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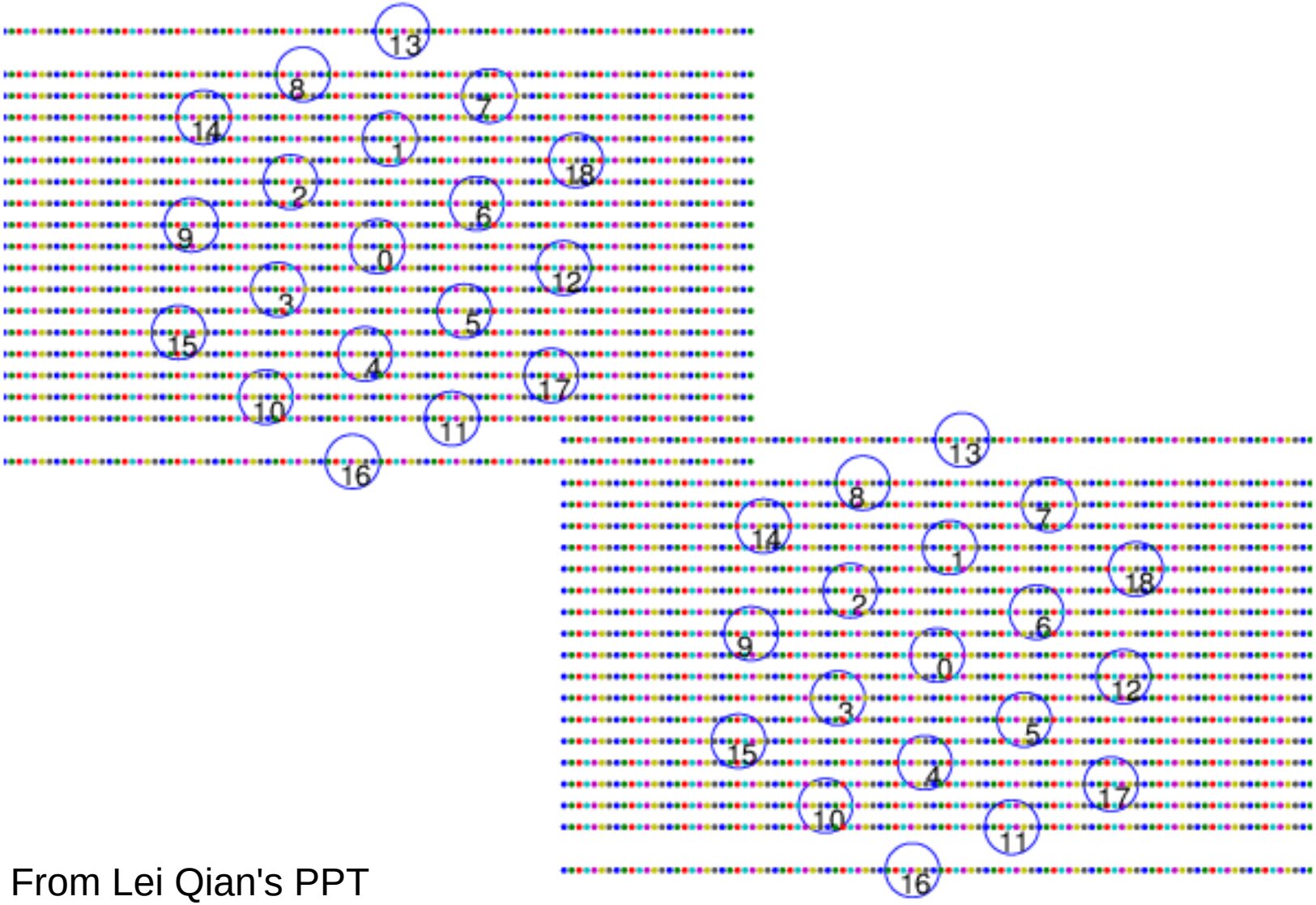
Future – CRAFTS and 19-beam



From Lei Qian's PPT

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Thank you!

Zhichen Pan

Weiwei Zhu, Di Li, Youling Yue, Lei Qian, Pei Wang, ...

IPTA 2018, Albuquerque, NM
2018-06-21

Photo Credit: Zachary and Shana