The **new DMoff veto** for Einstein@Home searches for **continuous gravitational waves**

Sylvia J. Zhu[1,2], Maria Alessandra Papa[1,2,3], Sinéad Walsh[3]

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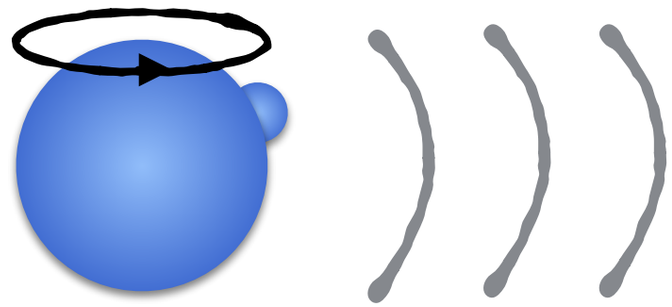
Original full title:



Looking for truffles in trash:

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Problem (from S. Walsh's talk):

Follow-up

Follow-up	T_{coh} [hours]	N segments	N candidates surviving
0	210	12	36246
1	500	5	14694
2	1260	2	8709
3	2512	1	6550

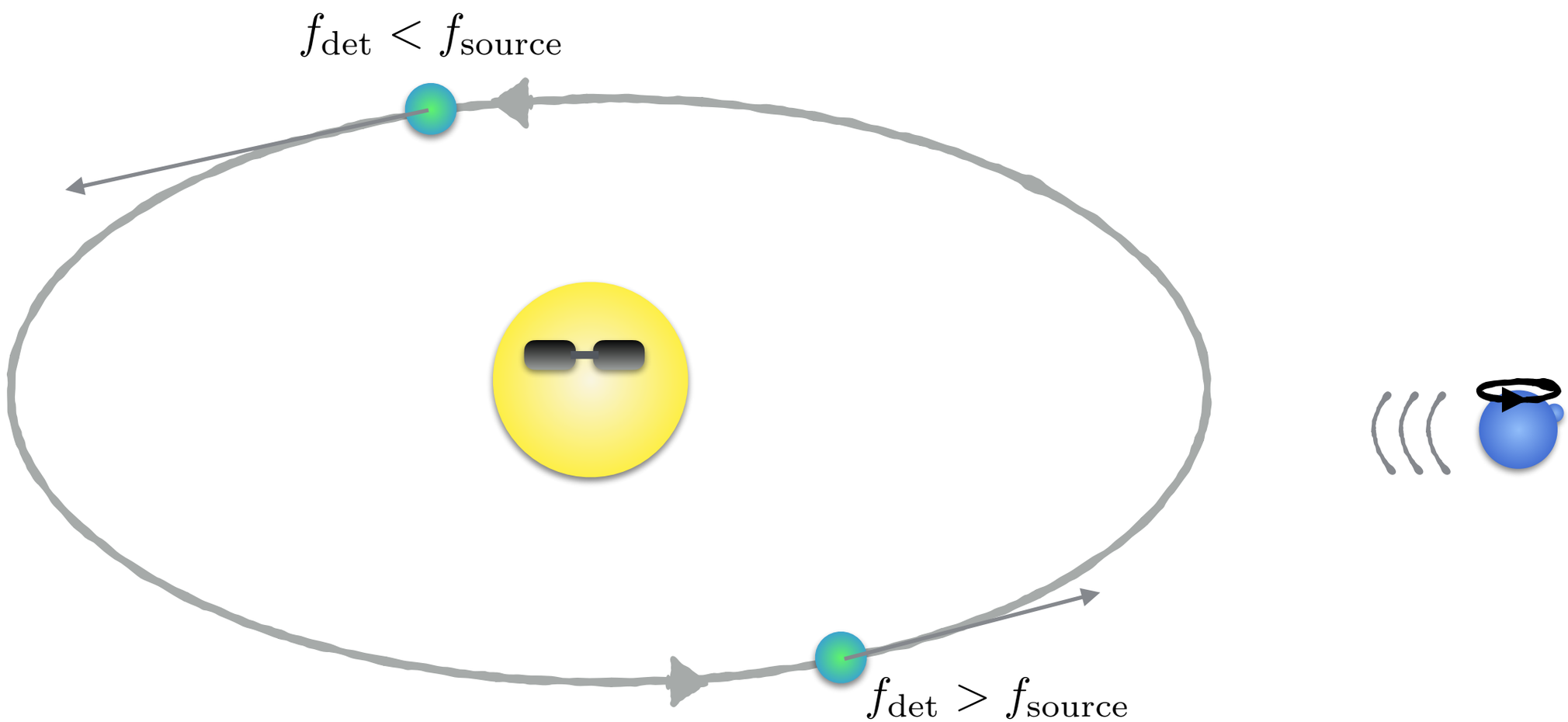
Based on hierarchical follow-up procedure developed in S6 [Papa et al, PRD94, 2016]

Three follow-up stages in O1

SNR of signal increases with T_{coh}, exclude more noise at each stage

Parameter uncertainty decreases after each stage

Astrophysical signals show **Doppler modulation**;
detector artifacts do not



Previous all-sky Einstein@Home search on LIGO S6 data

PHYSICAL REVIEW D **94,** 122006 (2016)

Hierarchical follow-up of subthreshold candidates of an all-sky Einstein@Home search for continuous gravitational waves on LIGO sixth science run data

Maria Alessandra Papa,[1,2,4,*] Heinz-Bernd Eggenstein,[2,3] Sinéad Walsh,[1,2] Irene Di Palma,[1,2,5] Bruce Allen,[2,4,3] Pia Astone,[5] Oliver Bock,[2,3] Teviet D. Creighton,[7] David Keitel,[2,3,6] Bernd Machenschalk,[2,3] Reinhard Prix,[2,3] Xavier Siemens,[4] Avneet Singh,[1,2,3] Sylvia J. Zhu,[1,2] and Bernard F. Schutz[8,1]

stage, we have five million. At the end of the third stage, we have one million. At the end of the fourth stage we are left with only 10 candidates.

The paper is organized very simply. Section II introduces

real analysis.

None of the investigated candidates survived the five stages, apart from those arising from the two fake signals injected in the detector for control purposes. These fake

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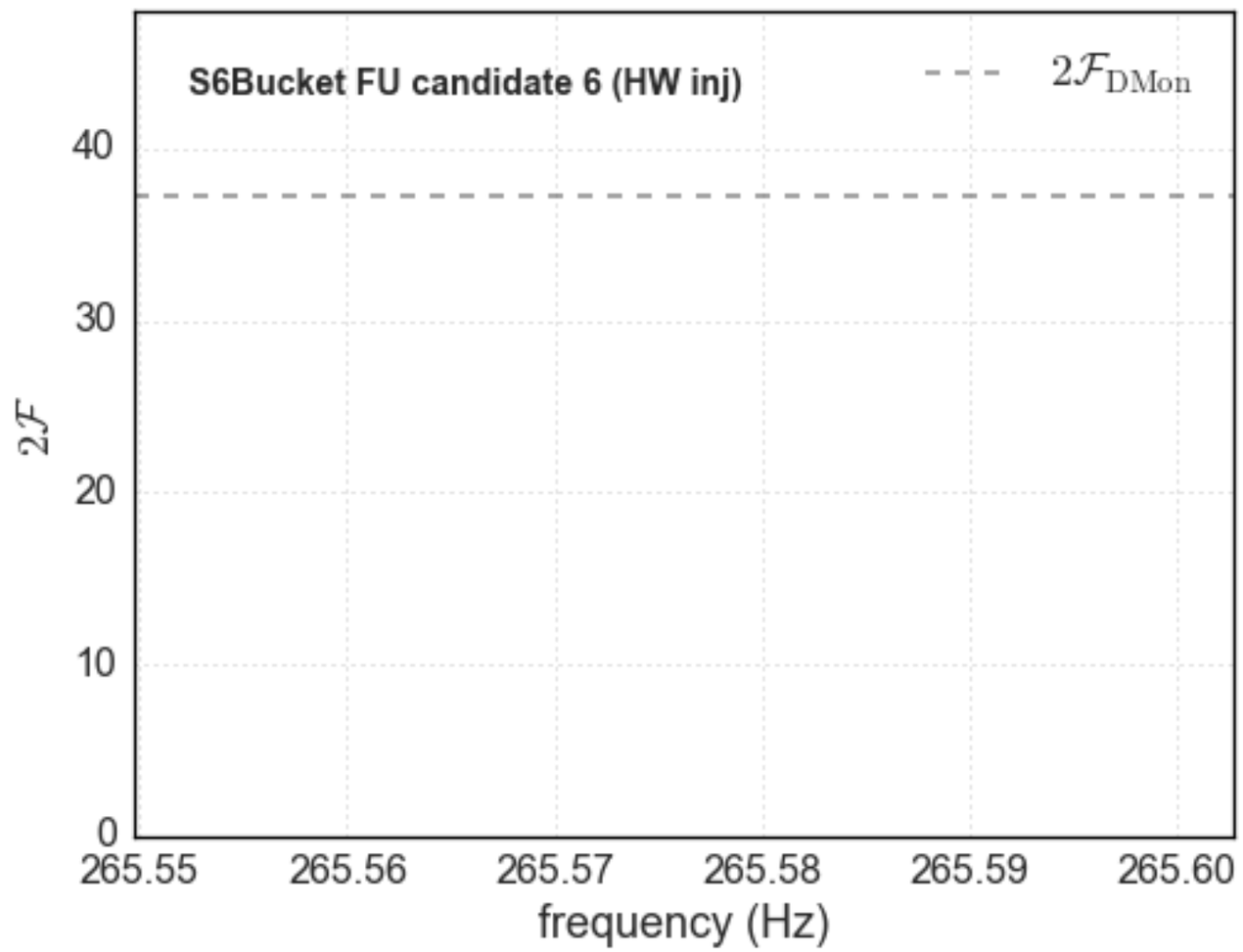
Candidate 6 was a **known hardware injection**

candidates. Only candidates 3, 4, and 6 have a detection statistic value above the detection threshold $2\overline{\mathcal{F}} = 15.0$, but unfortunately they are ascribable to fake signals hardware injected in the detector to test the detection pipelines. The



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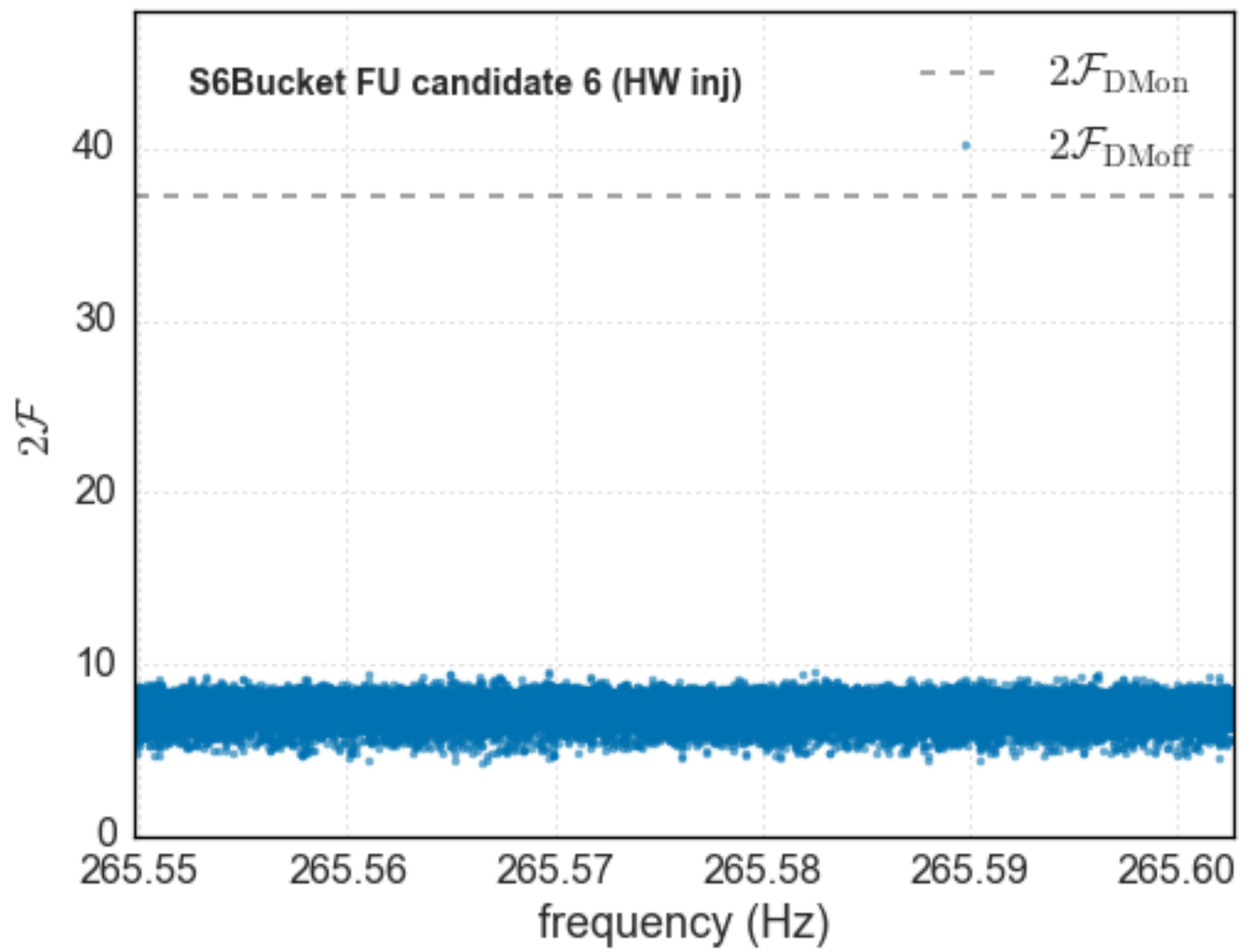
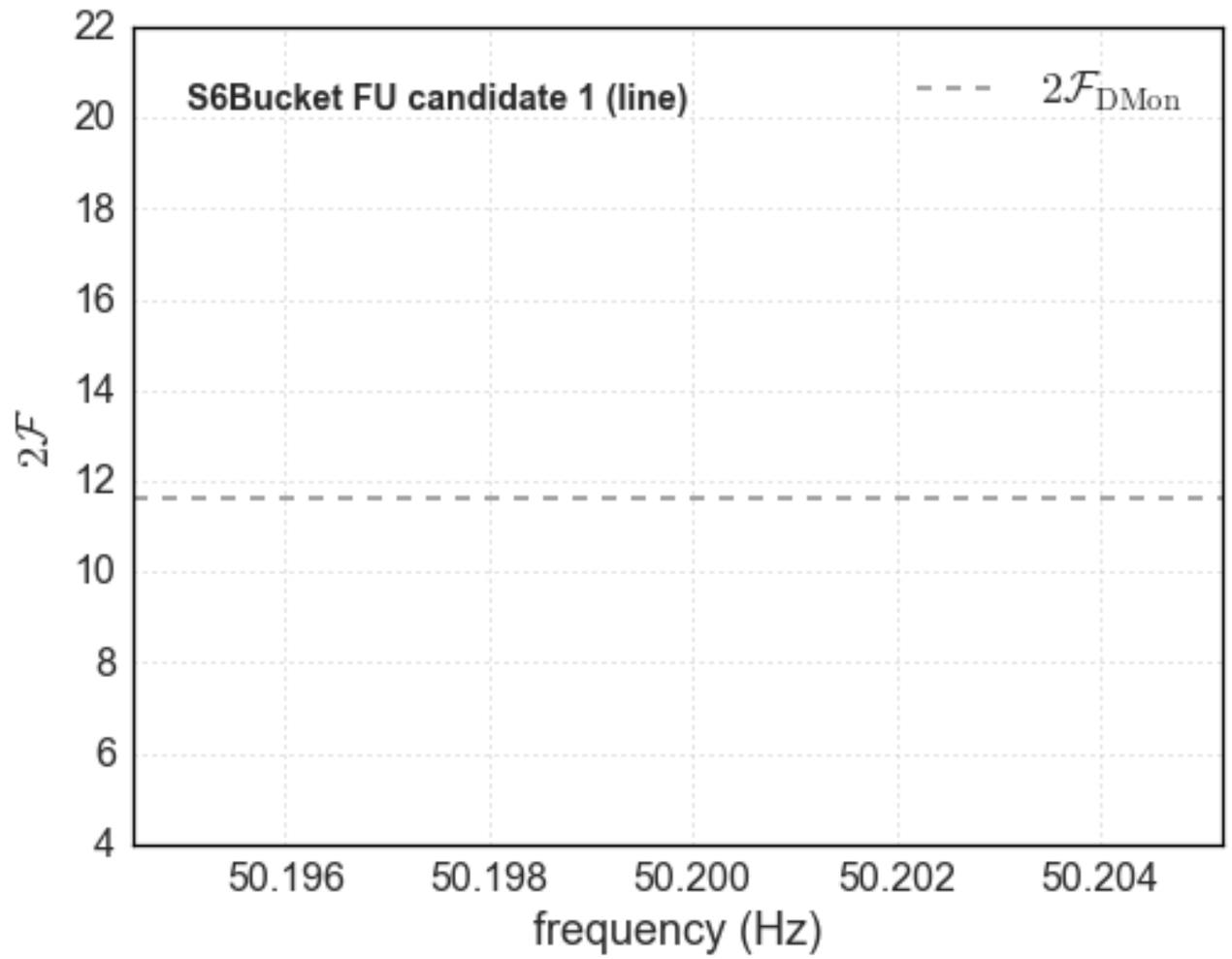


Candidate 1 was considered likely to be a **stationary line**

them. Candidates 1 and 2 are close in frequency and are very likely due to the same root cause. The frequencies are also very close to being exact multiples of 0.1 Hz, which is a known comb of spectral artifacts, and the positions are close to the ecliptic poles, which is where stationary lines in the detector frame aggregate in the search results. The



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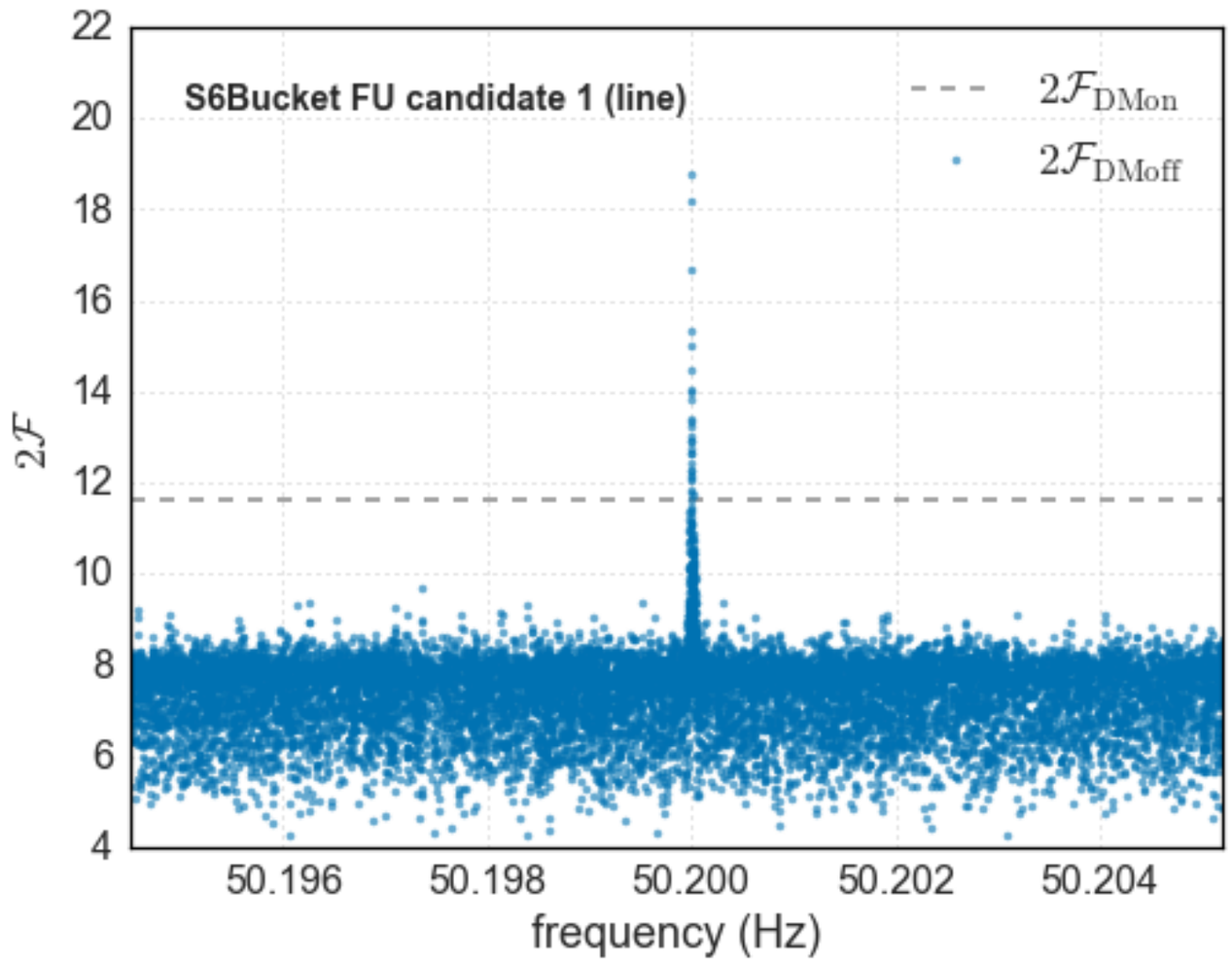

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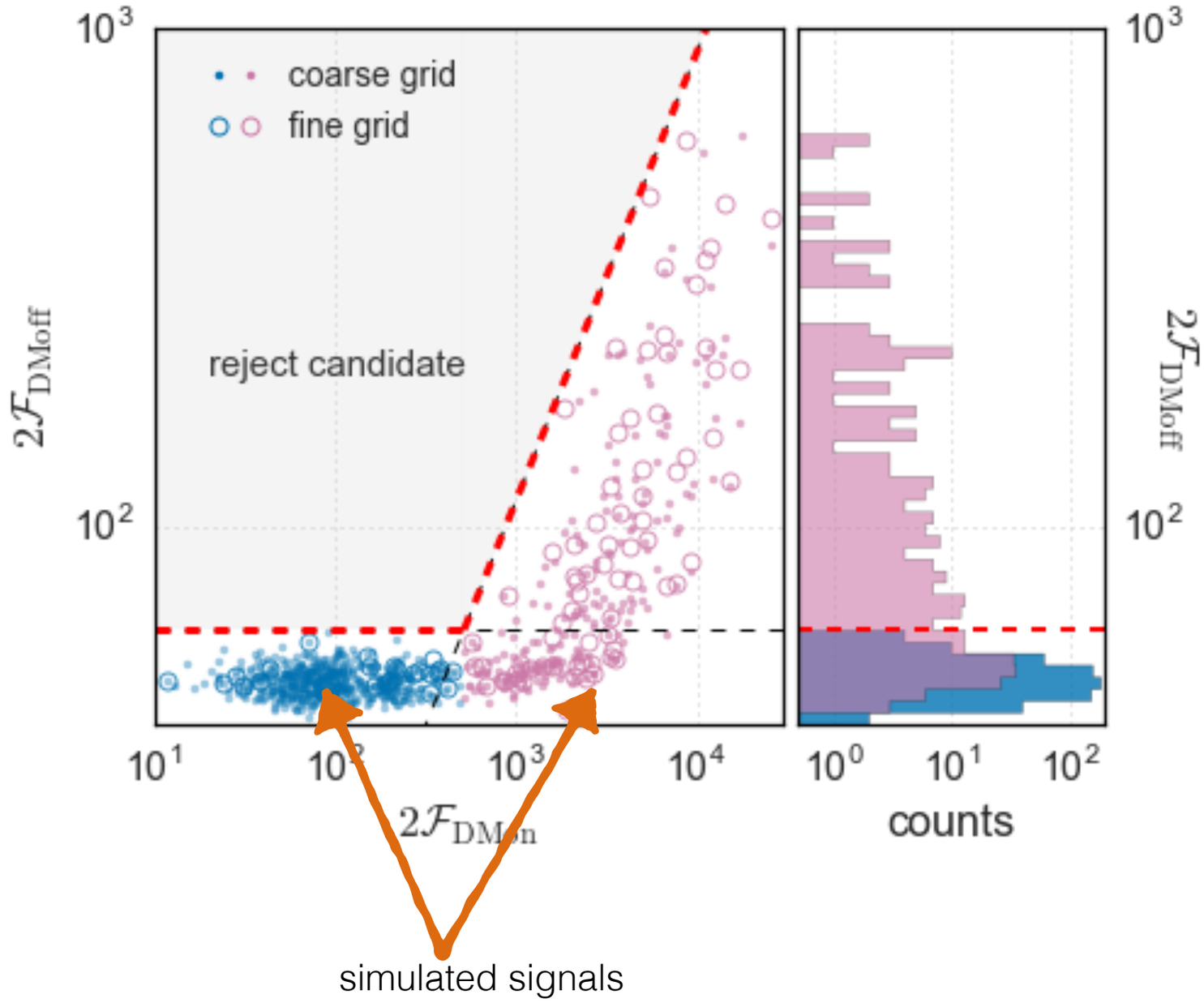
Veto: “Does this candidate act unlike a signal?”



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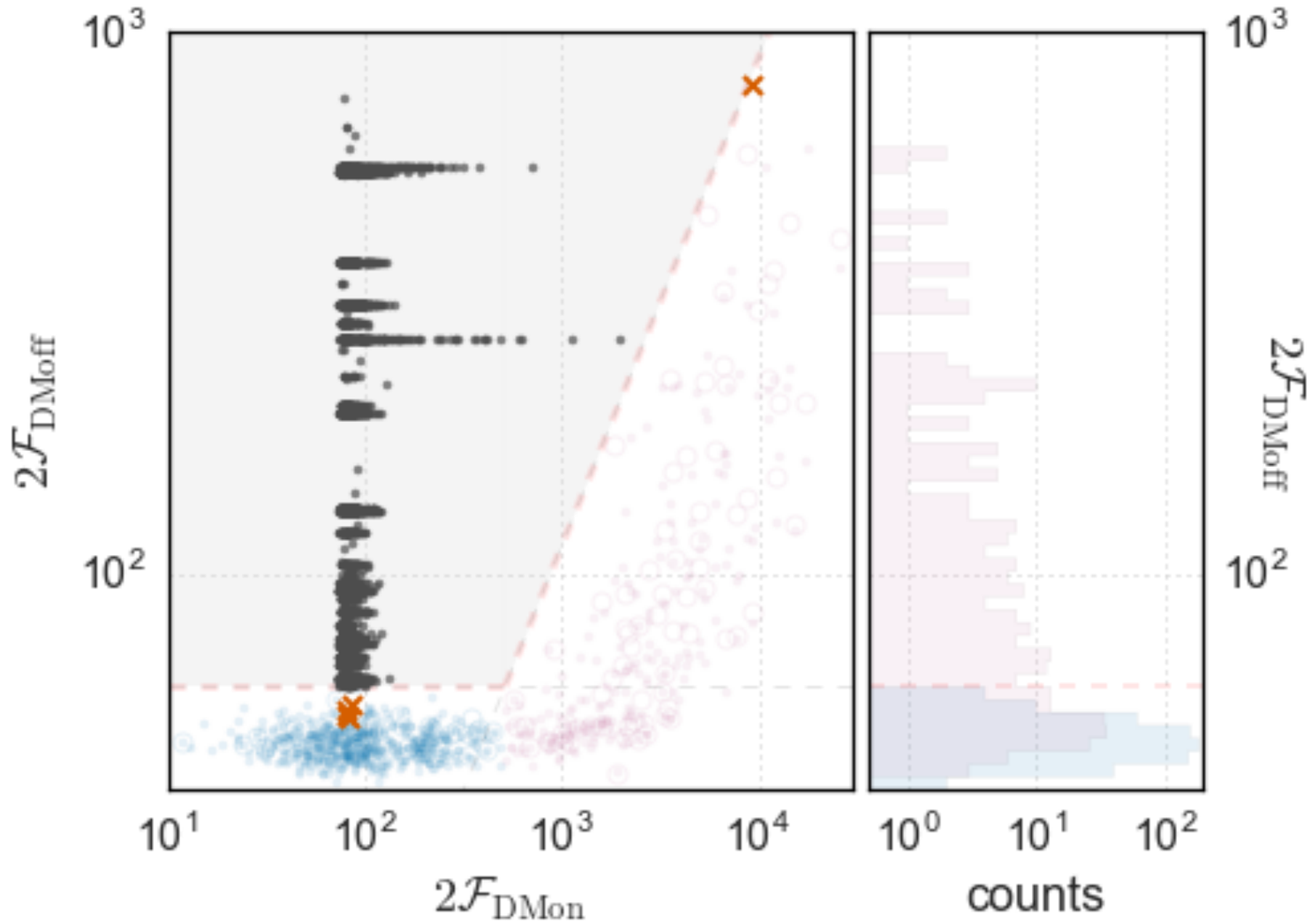

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Nothing so far :(

Follow-up in O2 data

Follow-up candidates using first 3 months of O2 data

Loudest 2F expected from random noise: 52 +- 3

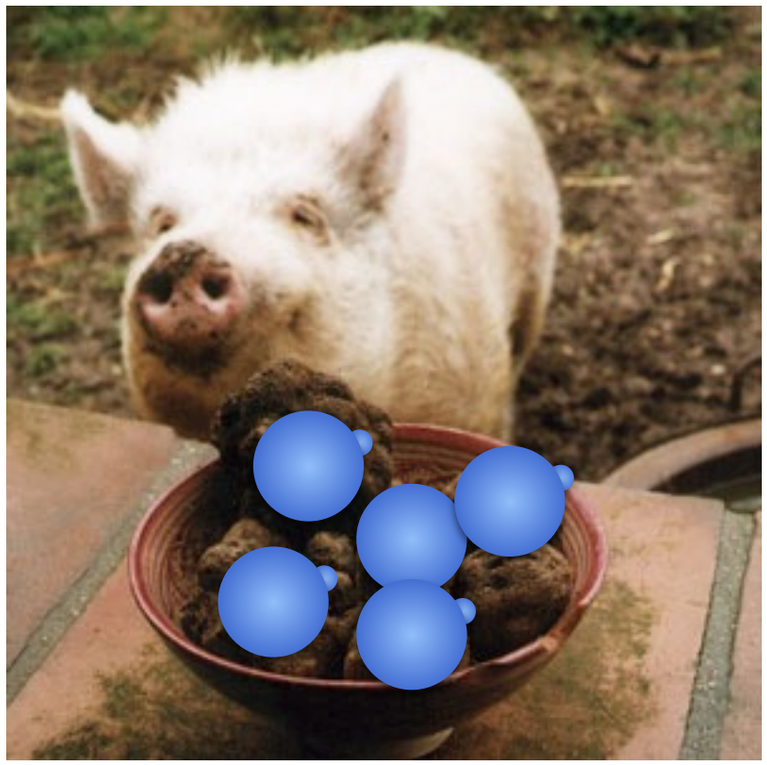
Can predict detection statistic in O2 search for signal candidates

- PSD around candidates is better in O2
- Coherent time is 2160 h in O2, compared with 2512 h in O1 third follow-up

Candidate frequency band	Measured 2F in O1	Expected 2F in O2 if signal +- 1 sigma	Loudest measured 2F in O2
58Hz	81	85 +- 18.2	44
62Hz	82	90 +- 18.8	52
97Hz	86	84 +- 18.1	49
99Hz	80	77 +- 17.3	47

The O2 results are all more consistent with noise than with signal.

but maybe one day …



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