Aubio Study Results

Results obtained with automated optimization through an Evolutionary Algorithm

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1 Results

The best f1-score results along with the latency metrics connected to them are presented in tables 1 and 2.

Table 1: The best f1-score avg. values are shown. Different combinations of Buffer size and Method produce different latency values, which are reported in the following tables. Bold values represent the points in the Pareto front defined by the points in the space of 2 objectives: the f1-score (to maximize) and the Inter Quartile Range (to minimize). More info in fig. 1 and table 3.

		Buffer size					
		64	128	256	512	1024	2048
Method	hfc	0.9337	0.9231	0.9126	0.8968	0.9015	0.8856
	energy	0.9410	0.9420	0.9480	0.9482	0.9558	0.9163
	complex	0.8371	0.8509	0.8680	0.8755	0.8666	0.8045
	phase	0.7620	0.8234	0.8740	0.8206	0.7426	0.7162
	specdiff	0.8667	0.9367	0.9535	0.9529	0.9549	0.9339
	kl	0.8517	0.8616	0.8795	0.8752	0.8919	0.8241
	mkl	0.8484	0.8590	0.8722	0.8696	0.8818	0.8814
	specflux	**0.8449**	0.9175	**0.9243**	0.9121	0.8797	0.8682
	mkl(noaw)	**0.9518**	0.9708	**0.9742**	0.9738	0.9730	0.9630

Table 2: The results of the latency recorded on the examples which f1-score is reported in table 1 are shown here. Each cell contains 3 values: the first and the last are the lower and upper Tukey fences with $k = 1.5$, which are defined starting from the Interquartile range and are commonly used to define outliers of a distribution, while the central value is the sample mean of the latency distribution.

		Buffer size					
		64	128	256	512	1024	2048
Method	hfc	2.4/4.5/6.5	2.7/5.0/7.1	3.7/6.0/8.1	5.0/7.4/9.6	9.0/11.5/14.0	11.8/14.9/17.8
	energy	1.8/4.0/6.1	2.6/4.8/6.9	3.9/5.9/7.9	5.8/7.9/9.9	9.1/11.8/14.5	12.0/15.4/18.9
	complex	2.6/5.0/7.1	3.0/5.3/7.4	3.6/6.2/8.6	4.0/6.5/8.9	4.7/7.7/10.6	5.5/8.3/11.0
	phase	0.5/2.6/4.4	2.1/4.2/6.2	2.7/4.6/6.5	3.5/5.3/7.1	3.9/5.9/7.9	4.5/7.2/9.9
	specdiff	2.4/4.5/6.4	3.0/5.0/6.9	3.8/5.9/8.0	5.0/7.1/9.2	6.6/9.1/11.9	9.6/13.2/17.9
	kl	1.9/4.2/6.2	2.3/4.6/6.7	3.4/5.9/8.2	5.3/7.9/10.5	7.5/11.5/15.8	12.9/16.3/20.2
	mkl	2.3/4.6/6.7	2.8/5.1/7.3	3.7/6.4/8.8	5.4/8.3/11.0	8.5/11.1/13.9	11.4/14.6/18.3
	specflux	2.2/3.8/5.3	2.6/4.3/5.8	3.1/4.8/6.3	3.7/5.6/7.3	4.4/6.4/8.2	5.2/7.3/9.3
	mkl(noaw)	2.7/4.5/6.2	3.2/5.1/6.8	4.2/6.0/7.7	5.4/7.4/9.3	8.3/10.9/13.3	10.5/13.6/16.5

Pareto front results are shown in table 3 and fig. 1 for the first analysis, and in table 4 and fig. 2 for the second one.

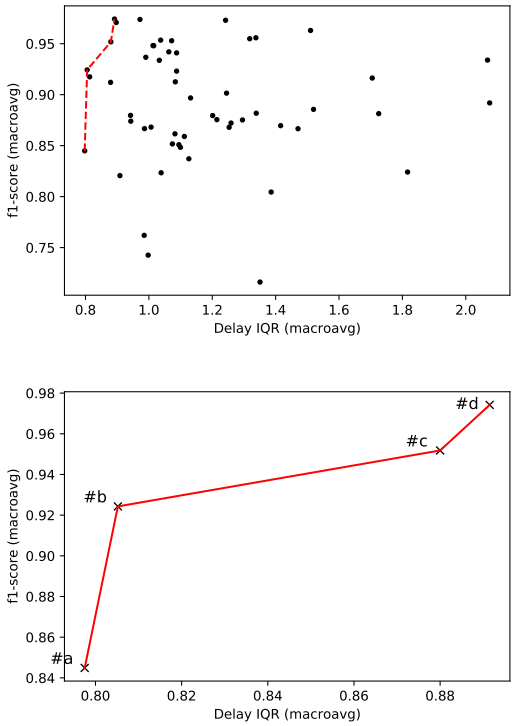

Figure 1: Pareto front computed for f1-score and the Interquartile Range of the latency distribution. The upper plot shows all the solution while the lower plot represents only the points in the front. The labels refer to the detailed information that can be found in table 3.

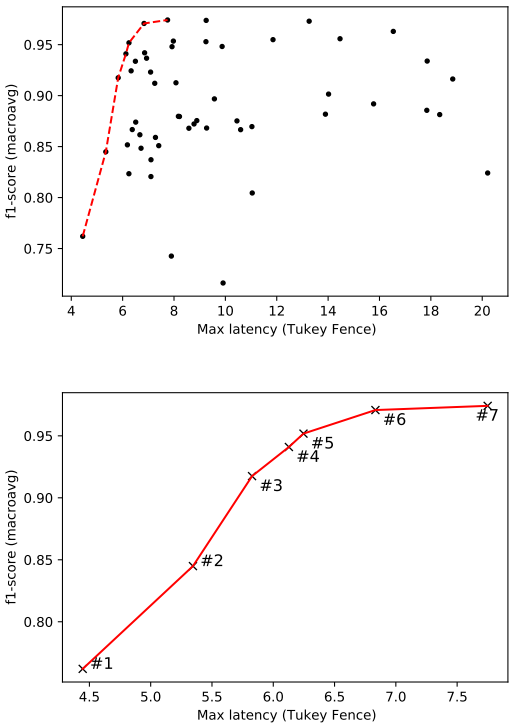

Figure 2: Pareto front computed for f1-score and upper Tukey fence. The upper plot shows all the solution while the lower plot represents only the points in the front. The labels refer to the detailed information that can be found in table 4.

Table 3: Pareto front solution with f1-score (macro average over all techniques) as the first objective and Interquartile Range of latency as the second.

#	Method	F1-score	Low Tukey fence (ms)	Delay mean (ms)	High Tukey fence (ms)	Onsets inside fences (%)	MAvg_t IQR
a	specflux	0.8449	2.1546	3.7841	5.3447	95.54	0.7975
b	specflux	0.9243	3.1097	4.8164	6.3303	93.52	0.8052
c	mkl(noaw)	0.9518	2.7264	4.5436	6.2465	96.89	0.8800
d	mkl(noaw)	0.9742	4.1830	6.0272	7.7491	96.11	0.8915

2 Appendix

Here the Pareto plots are reported with solutions from each method highlighted.

Table 4: Pareto front solution with f1-score (macro average over all techniques) as the first objective and maximum latency as the second, in the form of upper Tukey fence.

#	Method	F1-score	Low Tukey fence (ms)	Delay mean (ms)	High Tukey fence (ms)	Onsets inside fences (%)
1	phase	0.7620	0.5048	2.6409	4.4454	93.19
2	specflux	0.8449	2.1546	3.7841	5.3447	95.54
3	specflux	0.9175	2.5741	4.2824	5.8269	94.88
4	energy	0.9410	1.7774	4.0118	6.1275	97.03
5	mkl(noaw)	0.9518	2.7264	4.5436	6.2465	96.89
6	mkl(noaw)	0.9708	3.2457	5.1005	6.8334	96.74
7	mkl(noaw)	0.9742	4.1830	6.0272	7.7491	96.11

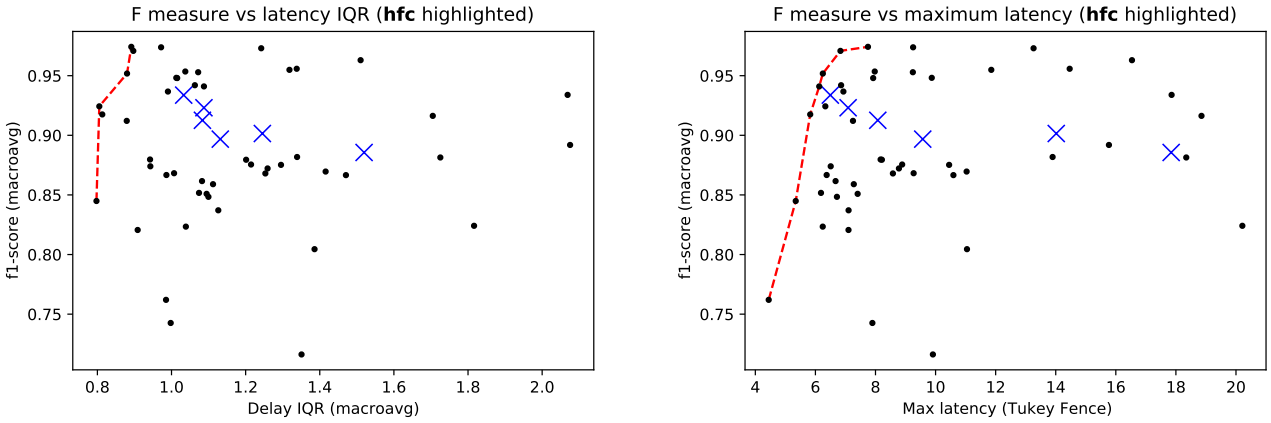

Figure 3: Solutions with hfc

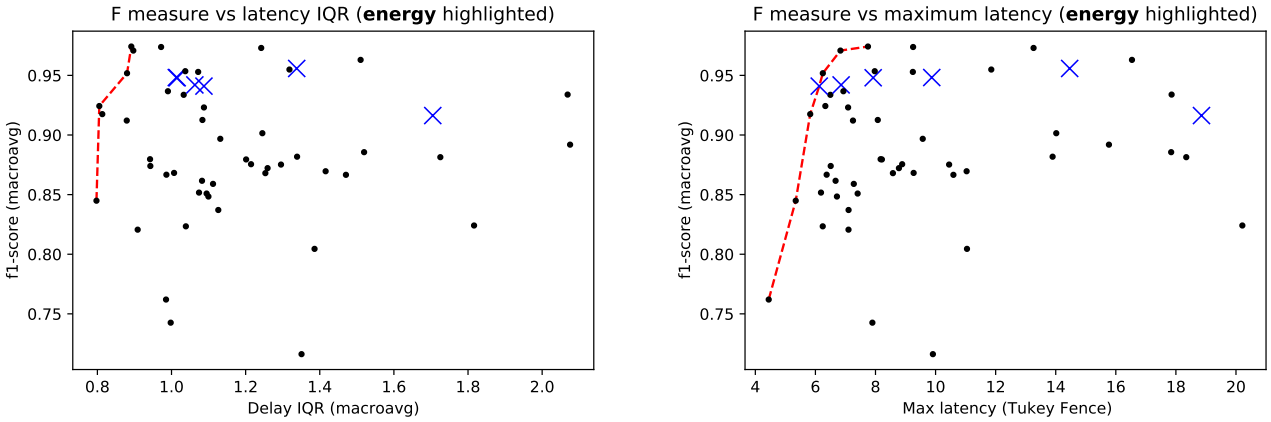

Figure 4: Solutions with energy

Table 5

Method	Buffer Size	Manual Result	EA Result
hfc	64	**0.9341**	0.9337
hfc	128	0.9229	**0.9231**
hfc	256	0.9120	**0.9126**
hfc	512	0.8962	**0.8968**
hfc	1024	0.8993	**0.9015**
hfc	2048	0.8775	**0.8856**
energy	64	0.9364	**0.9410**
energy	128	0.9419	**0.9420**
energy	256	0.9470	**0.9480**
energy	512	0.9444	**0.9482**
energy	1024	0.9533	**0.9558**
energy	2048	**0.9164**	0.9163
complex	64	0.8351	**0.8371**
complex	128	0.8422	**0.8509**
complex	256	0.8579	**0.8680**
complex	512	0.8720	**0.8755**
complex	1024	0.8623	**0.8666**
complex	2048	0.7909	**0.8045**
phase	64	0.7587	**0.7620**
phase	128	0.8227	**0.8234**
phase	256	**0.8742**	0.8740
phase	512	0.8178	**0.8206**
phase	1024	0.7421	**0.7426**
phase	2048	0.7160	**0.7162**
specdiff	64	0.8524	**0.8667**
specdiff	128	0.9330	**0.9367**
specdiff	256	0.9511	**0.9535**
specdiff	512	0.9523	**0.9529**
specdiff	1024	0.9528	**0.9549**
specdiff	2048	0.9294	**0.9339**
kl	64	**0.8532**	0.8517
kl	128	0.8610	**0.8616**
kl	256	0.8658	**0.8795**
kl	512	0.8702	**0.8752**
kl	1024	0.8919	0.8919
kl	2048	**0.9079**	0.8241
mkl	64	0.8482	**0.8484**
mkl	128	0.8522	**0.8590**
mkl	256	0.8718	**0.8722**
mkl	512	0.8661	**0.8696**
mkl	1024	0.8690	**0.8818**
mkl	2048	0.8706	**0.8814**
mkl(noaw)	64	0.9511	**0.9518**
mkl(noaw)	128	0.9702	**0.9708**
mkl(noaw)	256	**0.9764**	0.9742
mkl(noaw)	512	0.9731	**0.9738**
mkl(noaw)	1024	**0.9732**	0.9730
mkl(noaw)	2048	0.9613	**0.9630**
specflux	64	0.8446	**0.8449**
specflux	128	**0.9185**	0.9175
specflux	256	**0.9255**	0.9243
specflux	512	0.9067	**0.9121**
specflux	1024	**0.8799**	0.8797
specflux	2048	0.8659	**0.8682**

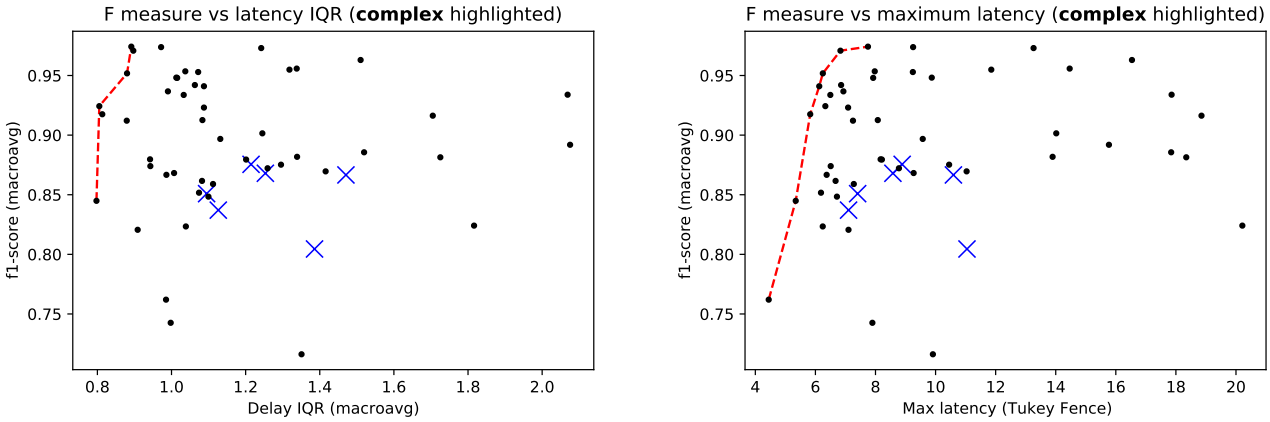

Figure 5: Solutions with complex

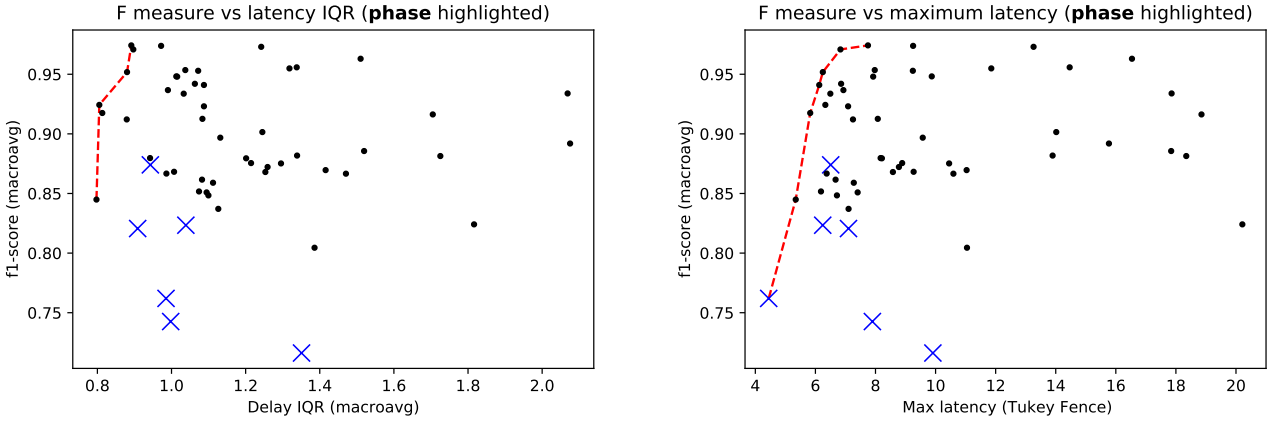

Figure 6: Solutions with phase

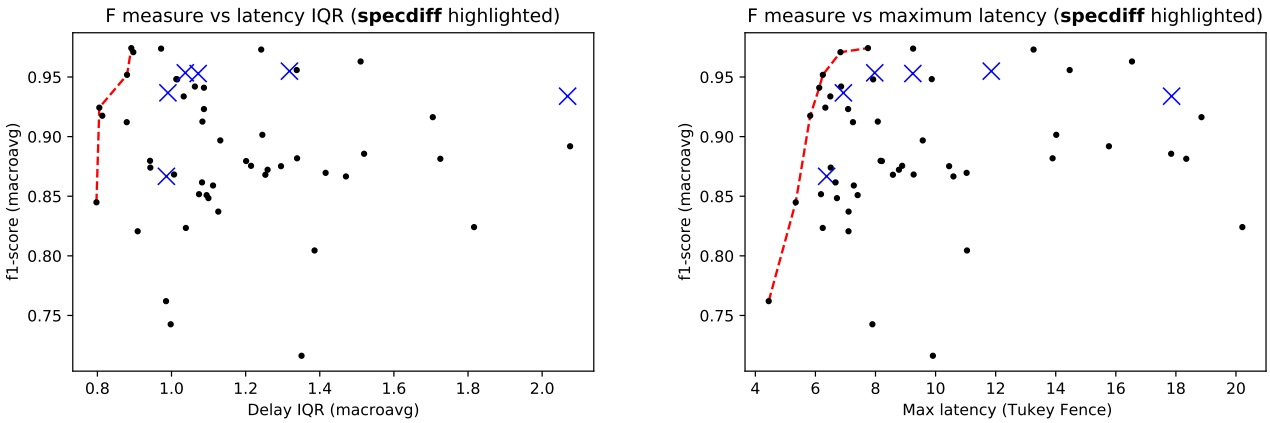

Figure 7: Solutions with specdiff

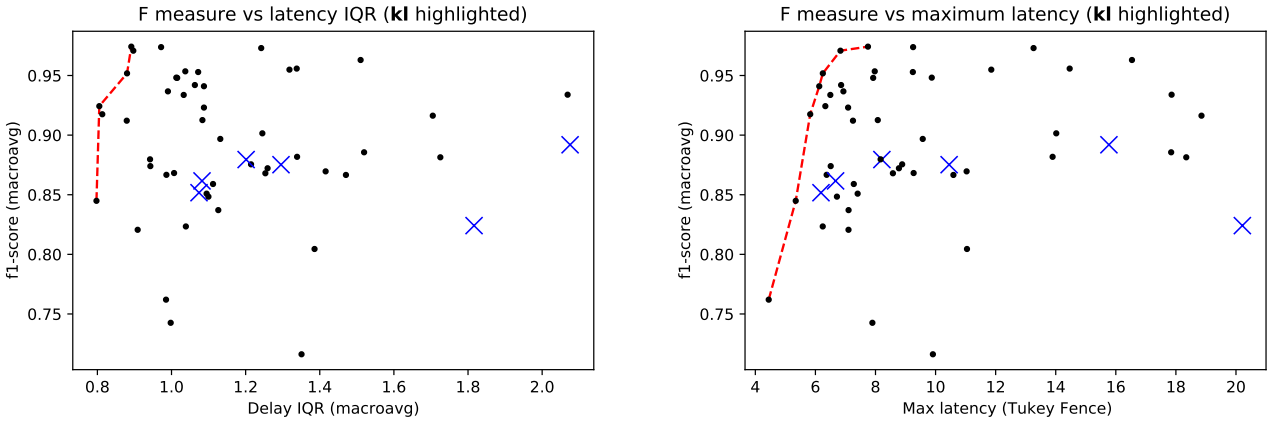

Figure 8: Solutions with kl

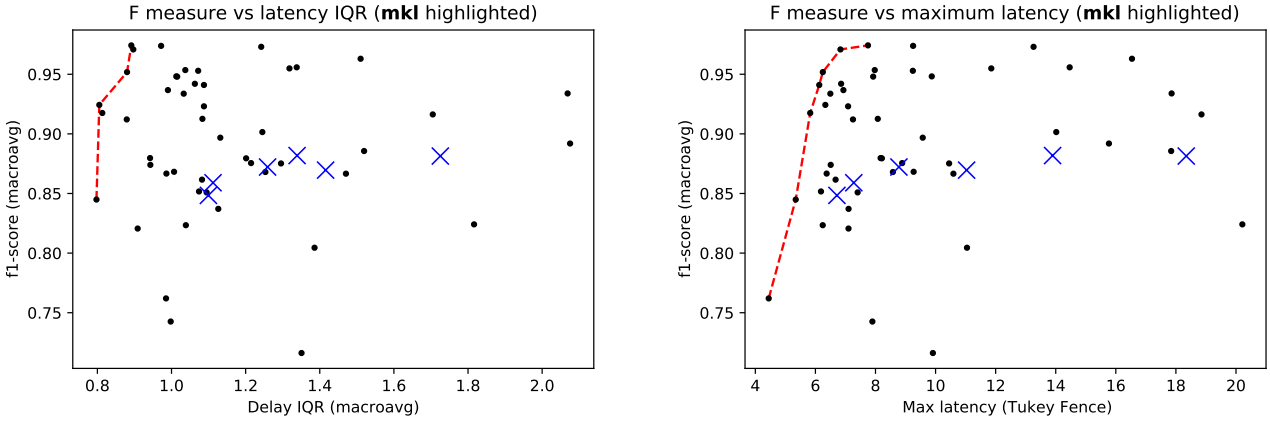

Figure 9: Solutions with mkl

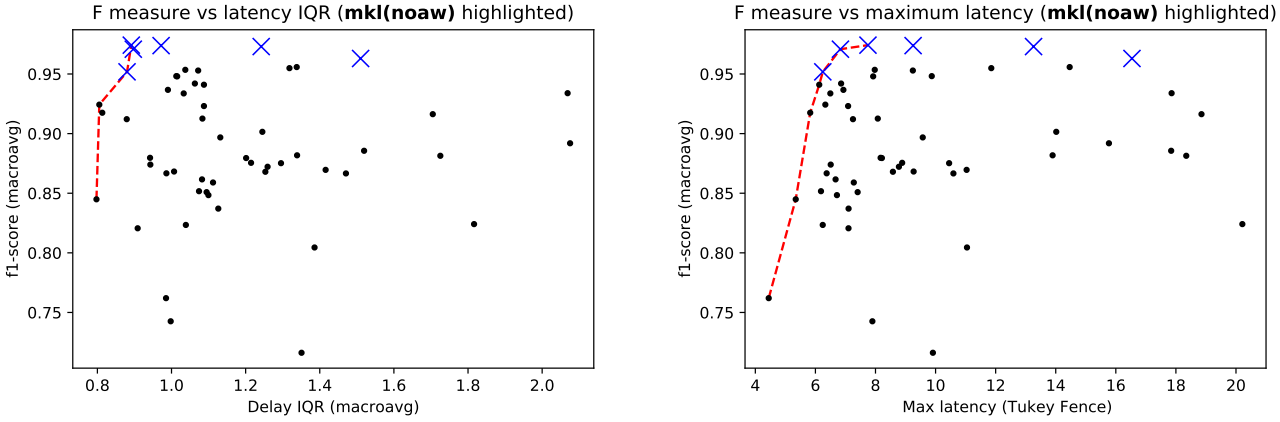

Figure 10: Solutions with mkl (No whitening)

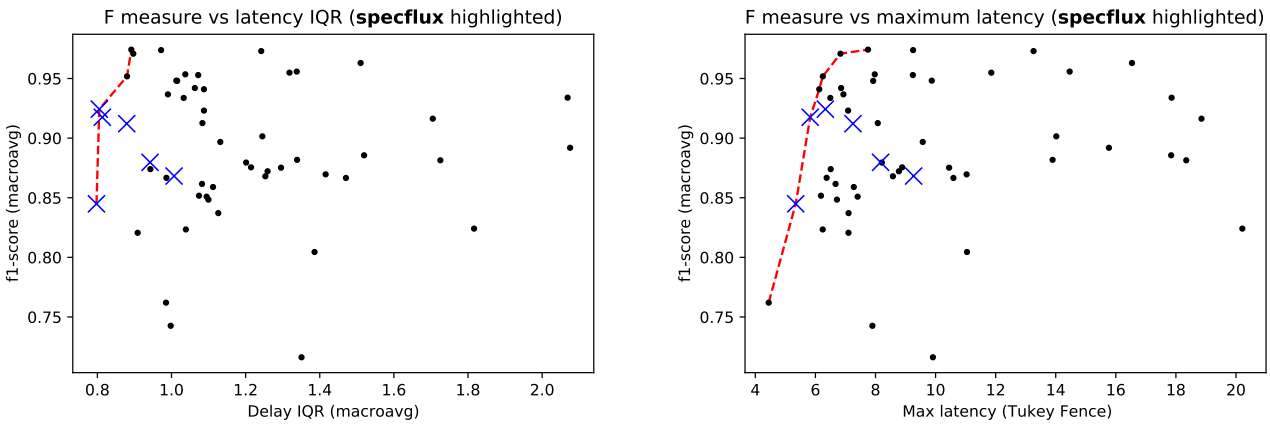

Figure 11: Solutions with specflux