Automatic offline spike sorting using SpikeCluster

Minggui Chen, Ph.D.

minggui.chen@gmail.com

Offline sorting?

- multi-electrode array
- signal quality
- manual sorting using Offline Sorter -- time-consuming
- customized codes -- which algorithm?
- isolation quality -- ‘well-isolated’ doesn’t work nowadays

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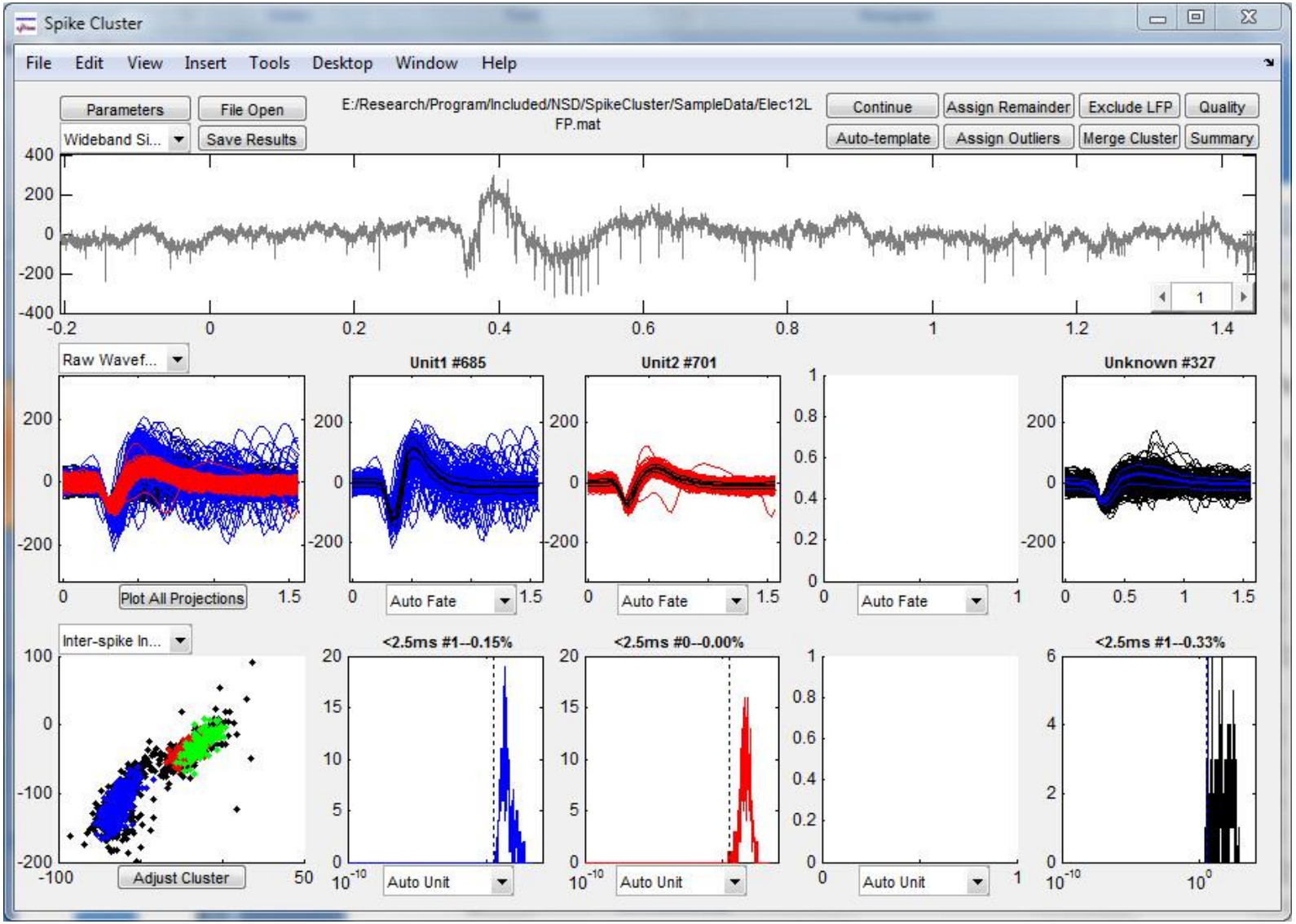
- isolation quality -- ‘well-isolated’ doesn’t work nowadays

An integrated toolbox to

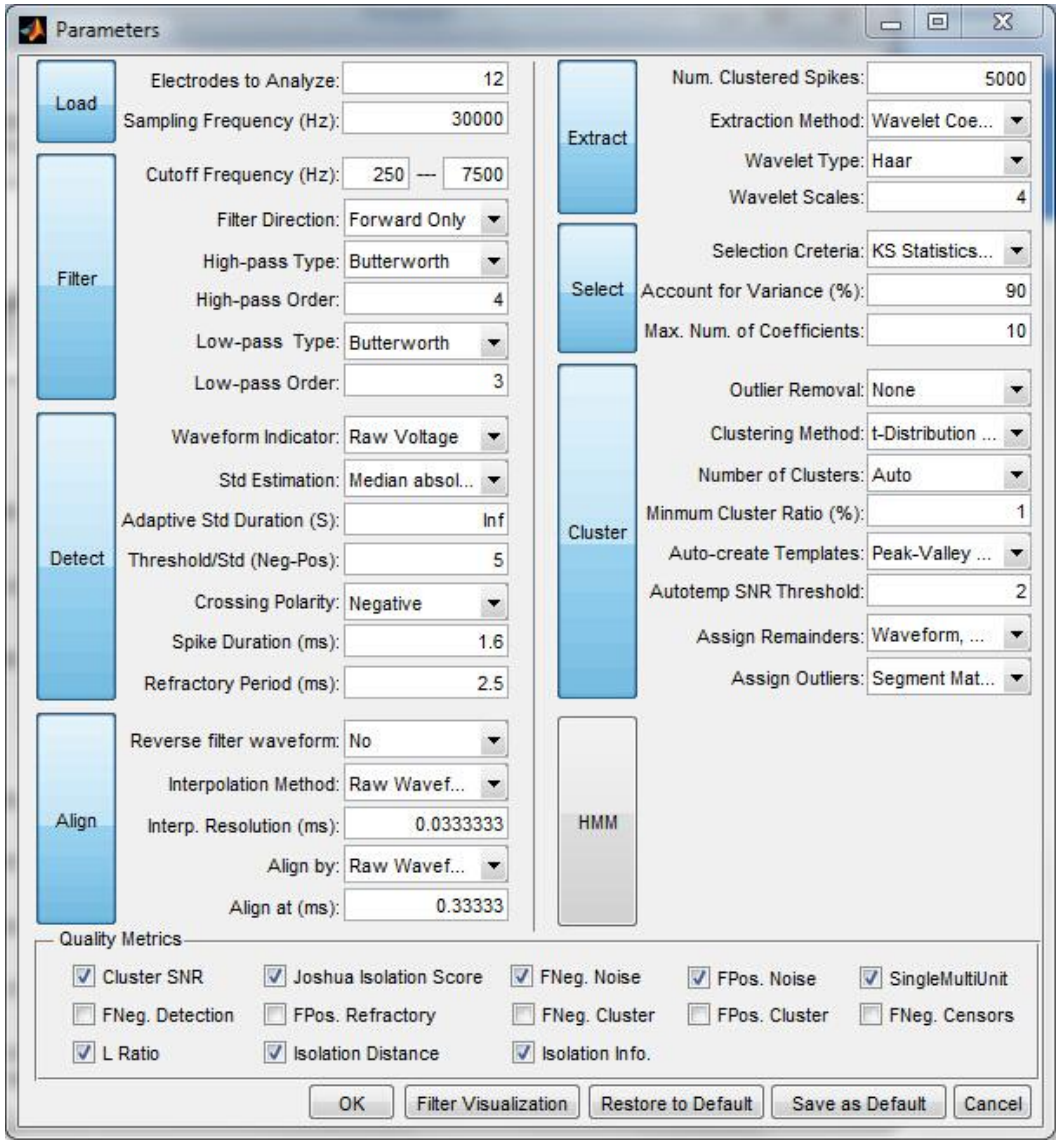
1) **automatically sort action potentials,**
2) **quantify the isolation quality.**

SpikeCluster



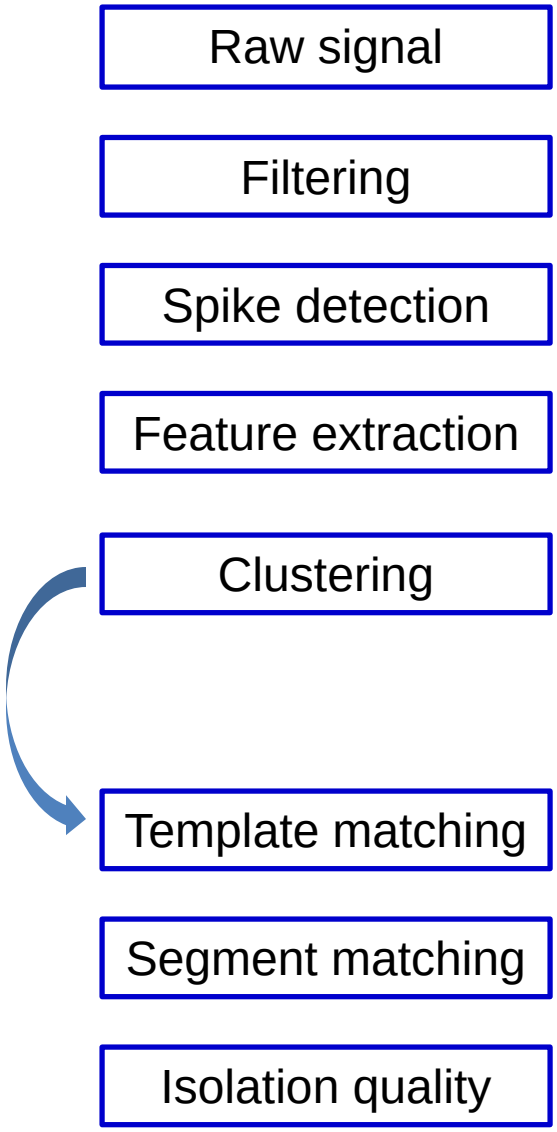
A similar GUI to WAVE_CLUS by Quiroga, R.Q.

But SpikeCluster has…

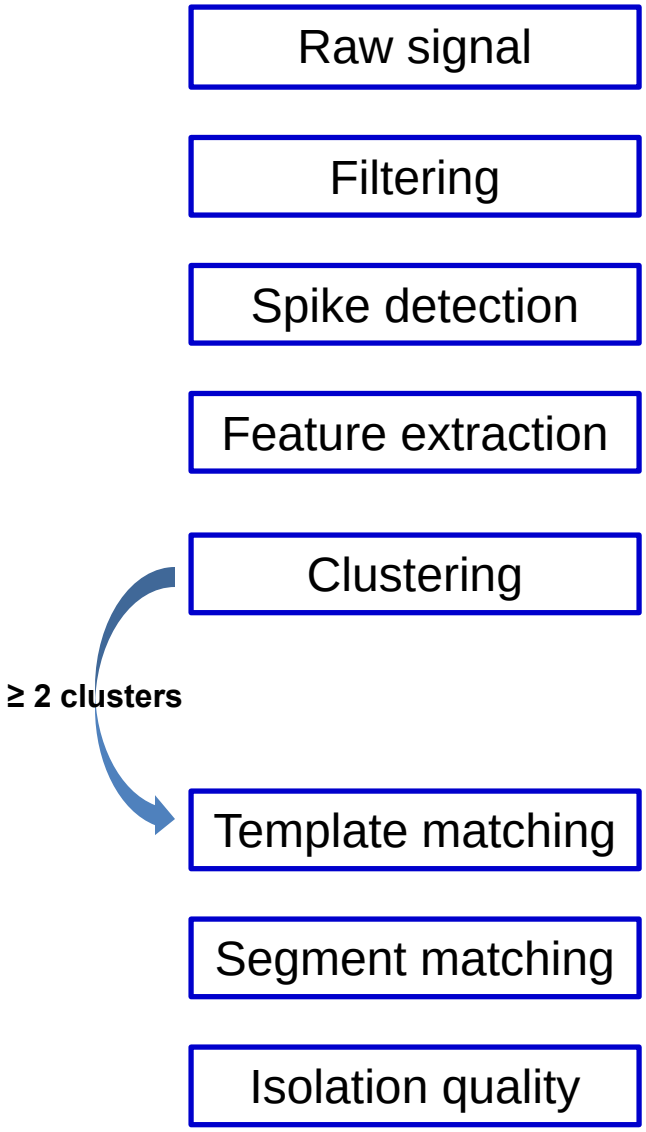


Aims to automate spike sorting and qualification

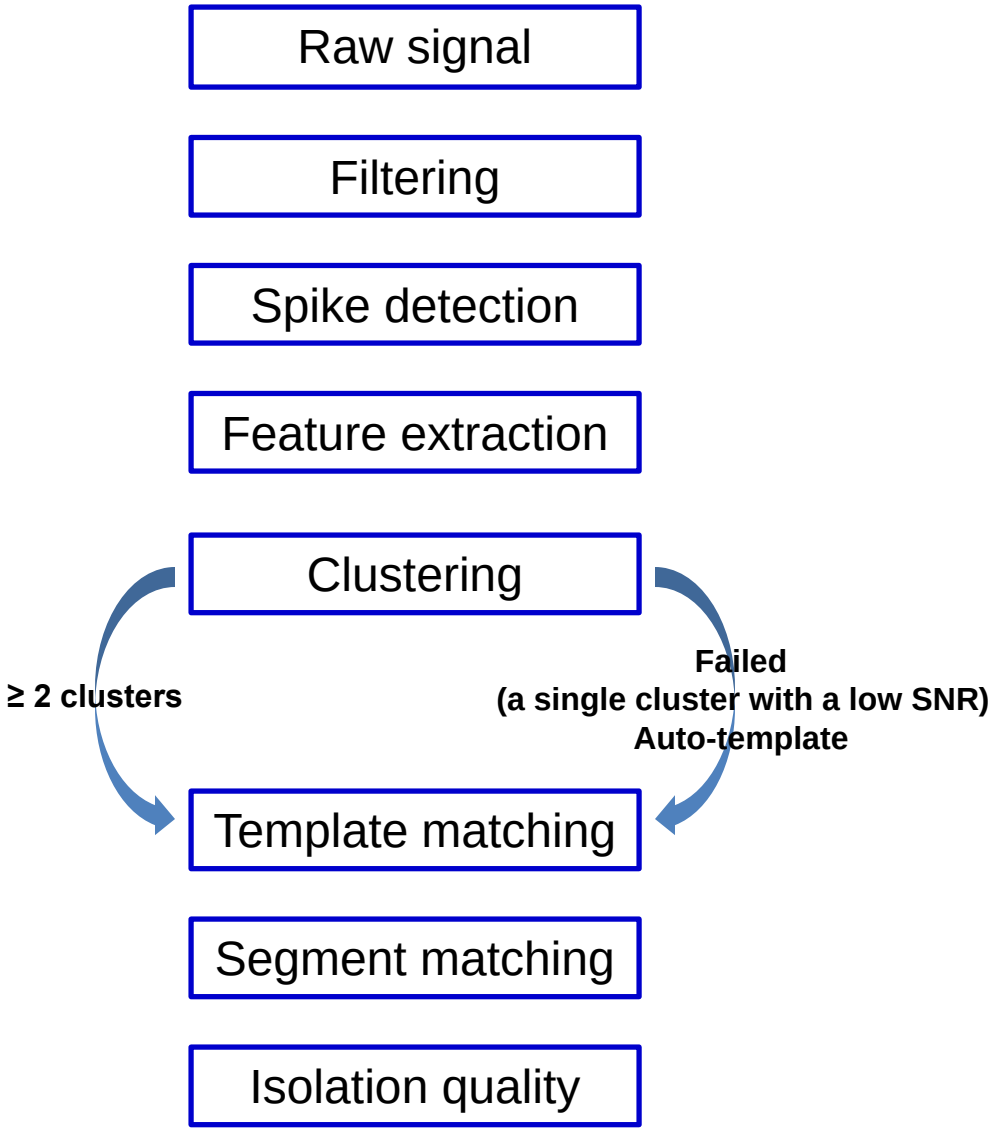
Overall scheme of SpikeCluster



Overall scheme of SpikeCluster



Overall scheme of SpikeCluster



Time for demos

Data format for online spikes (*.mat)

Spike ×

Spike <27x1 cell>

	1
1	<62x1 double>
2	<56x1 double>
3	<63x1 double>
4	<69x1 double>
5	<82x1 double>

Trial #

Spike × Spike{1, 1} ×

Spike{1, 1} <62x1 double>

	1	2
1	0.0368	
2	0.0636	
3	0.1052	
4	0.1535	
5	0.1815	
6	0.2979	
7	0.3980	
8	0.4336	
9	0.4429	
10	0.4783	

Spike times

Data format for online spikes (*.mat)

Spike

Spike <27x1 cell>

	1
1	<62x1 double>
2	<56x1 double>
3	<63x1 double>
4	<69x1 double>
5	<82x1 double>

Trial #

Waveform

Waveform <27x1 cell>

	1
1	<62x48 single>
2	<56x48 single>
3	<63x48 single>
4	<69x48 single>
5	<82x48 single>

Trial #

Spike | Spike{1, 1}

Spike{1, 1} <62x1 double>

	1	2
1	0.0368	
2	0.0636	
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9	0.4429	
10	0.4783	

Spike times

Waveform | Waveform{1, 1}

Waveform{1, 1} <62x48 single>

	1	2
1	-3.5994	0.6929
2	-4.8965	-3.6488
3	16.6380	12.9574
4	0.5093	-0.6713
5	-13.4670	-9.9565
6	-17.7466	-9.0644
7	-17.5532	-10.0999
8	-8.8918	-8.2720
9	-2.9978	3.2478
10	2.5089	-0.6256

waveforms

Data format for online spikes (*.mat)

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Spike <27x1 cell>

	1
1	<62x1 double>
2	<56x1 double>
3	<63x1 double>
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Trial #

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Waveform <27x1 cell>

	1
1	<62x48 single>
2	<56x48 single>
3	<63x48 single>
4	<69x48 single>
5	<82x48 single>

Trial #

Unit

Unit <27x1 cell>

	1
1	<62x1 uint8>
2	<56x1 uint8>
3	<63x1 uint8>
4	<69x1 uint8>
5	<82x1 uint8>

Trial #

Spike | Spike{1, 1}

Spike{1, 1} <62x1 double>

	1	2
1	0.0368	
2	0.0636	
3	0.1052	
4	0.1535	
5	0.1815	
6	0.2979	
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waveforms

Unit | Unit{1, 1}

Unit{1, 1} <62x1 uint8>

	1	2
1	2	
2	1	
3	2	
4	3	
5	2	
6	2	
7	2	
8	2	
9	1	
10	2	

unit #

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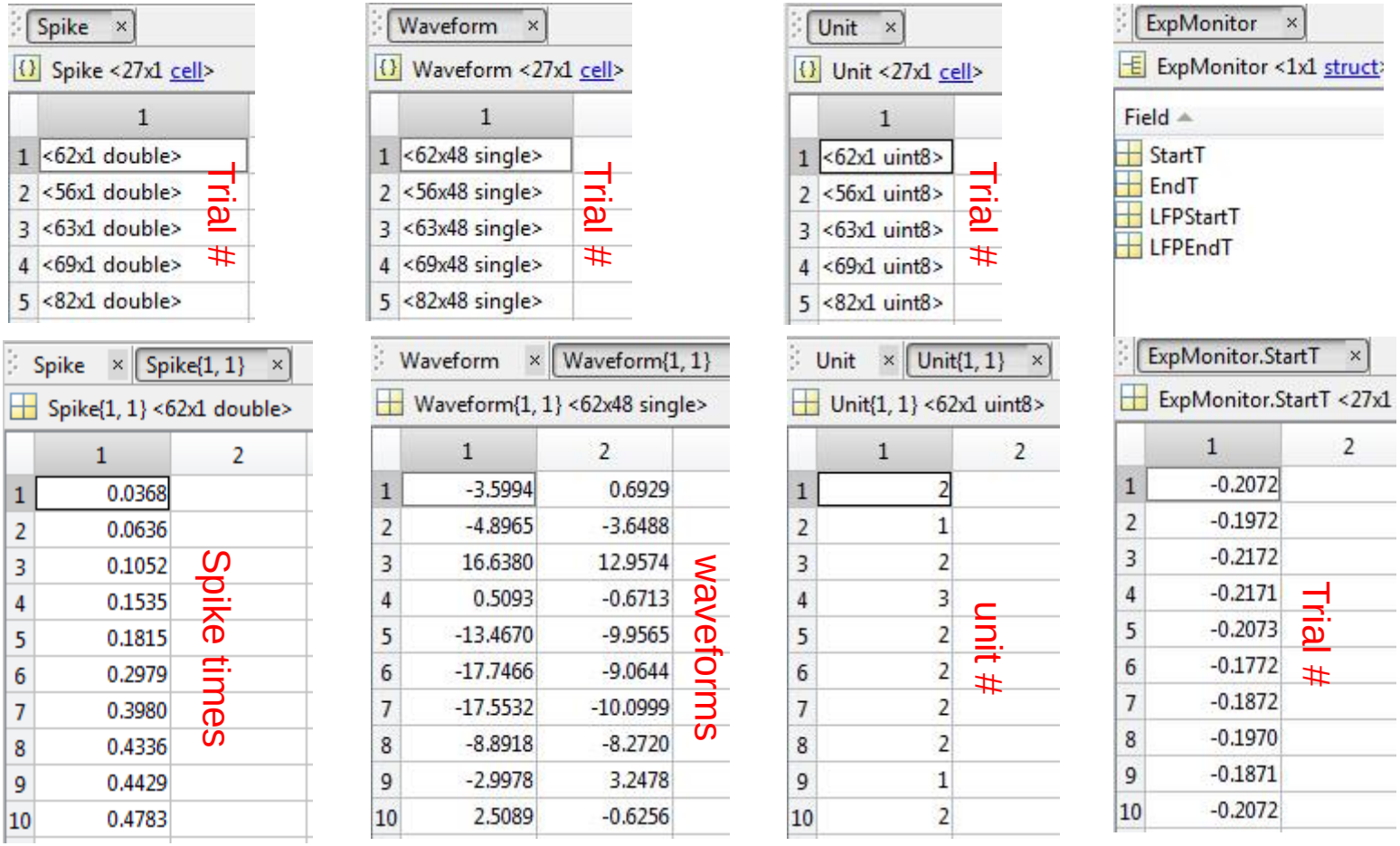

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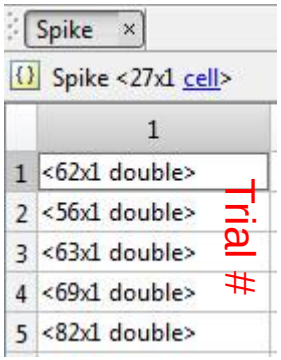
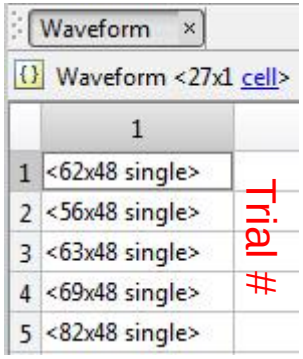
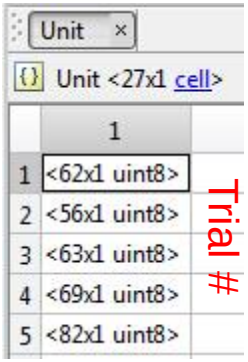
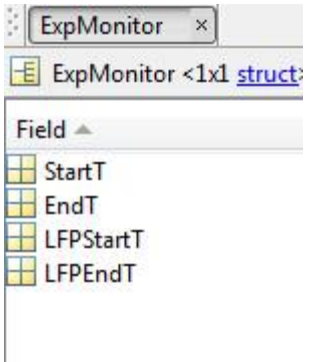
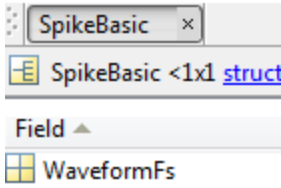
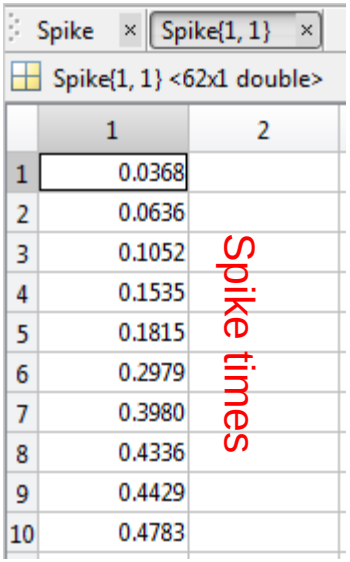


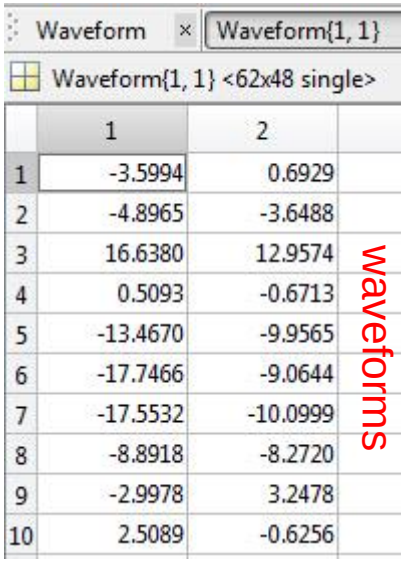


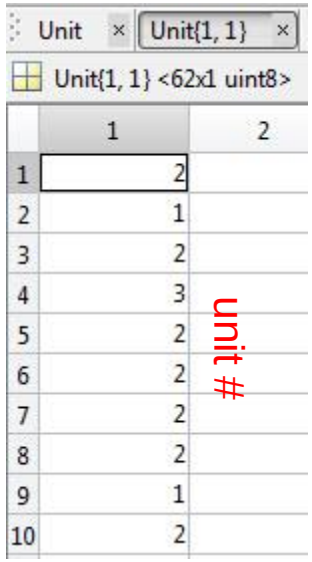


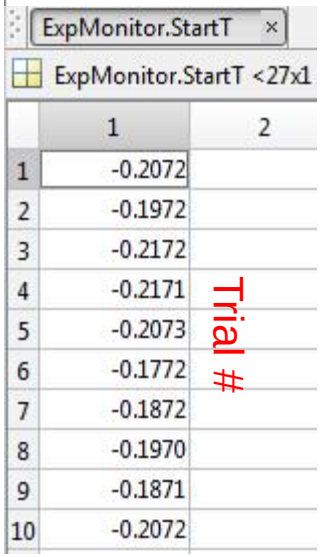




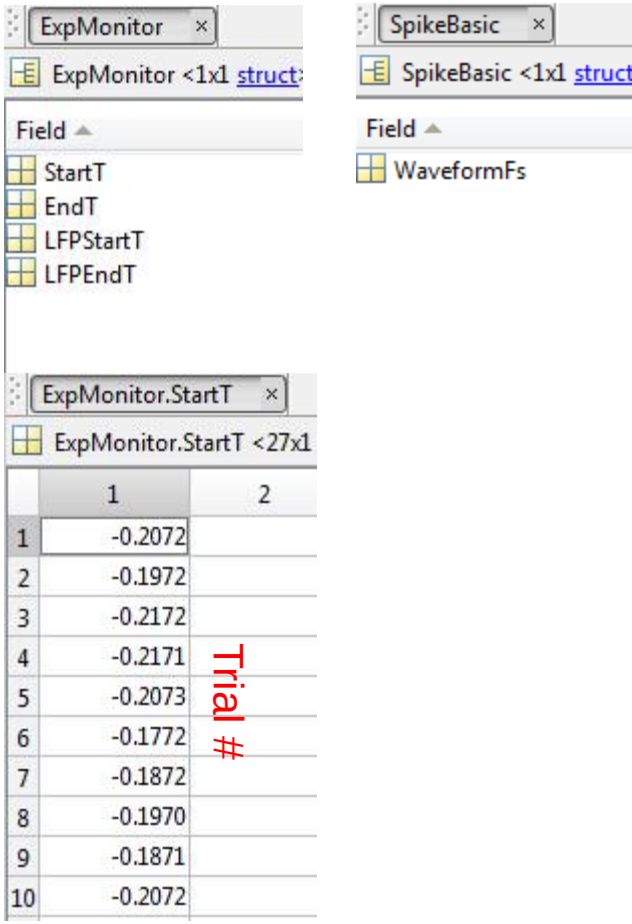








Data format for unfiltered LFP (*.mat)



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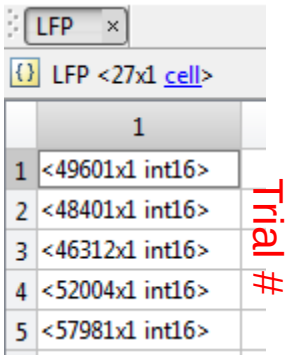

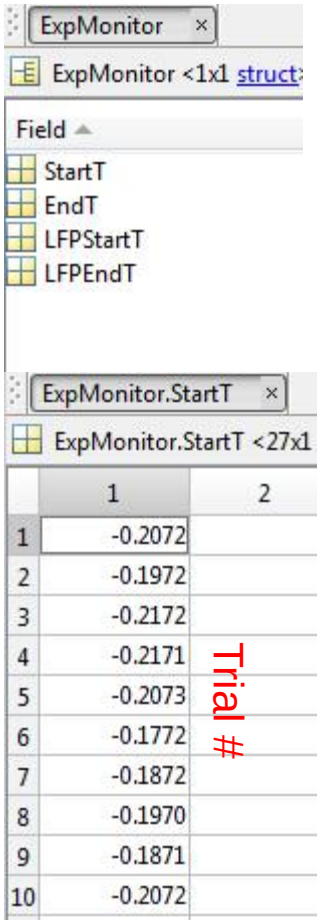

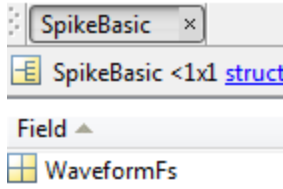

Automated analysis

- individual *.mat file -- open the mat file directly

- batch mat files -- open *Batch.m directly

```
% Edit file paths here ***************************************
FilePath = {
    'E:\Research\Program\Included\NSD\SpikeCluster\SampleData\Elec12LFP.mat';
    'E:\Research\Program\Included\NSD\SpikeCluster\SampleData\Elec12LFP.mat';
};
```

- batch all channels in multiple files -- open *FileBatch.m directly

```
% Edit file paths & electrodes here ***************************************
FilePath = {
    'E:\Research\Program\Included\NSD\SpikeCluster\SampleData.sss';
    'E:\Research\Program\Included\NSD\SpikeCluster\SampleData.sss';
};
ElecNum = {
    [12 12];
    [12 12];
};
```

- called as a function

```
% Edit file paths here ***************************************
ArgIn.FileType = 3;
ArgIn.FilePath = {
    'E:\Research\Program\Included\NSD\SpikeCluster\SampleData\Elec12Waveform.mat';
    'E:\Research\Program\Included\NSD\SpikeCluster\SampleData\Elec12Waveform.mat';
    };
SpikeCluster(ArgIn);
```