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**Important notes and Changes to workflow**

* . **Vers 1.3:**
  + Added reference material from offlinesorter manual for PC space definitions and sorting statistics
  + Added extra steps to IV-i: Before judging sorting.
    - Make sure reset sorting start/end values
    - Make sure zoom on timeline to use all waveforms

# Pre-Cleaning Phototagging Analysis for Reference During Cutting

## Saving work in progress (WIP) data files

### Create a "WIP" folder in the split files folder

### After each channel is clean save a new .

### Save all spike sorting files into this folder

## Run Neuroxplorer preliminary analysis to create PowerPoint of raw data

* + - * NOTE: Need NeuroExplorer software and dongle and collection of Phototagging Templates and Scripts for NeuroExplorer, as well as several Matlab programs.
        + Dropbox Folder with scripts and templates: <http://bit.ly/2mdftMg>
        + Evernote Note with Explanation and Scripts/Templates <http://bit.ly/2nr04c6>

### Open unsorted .pl2 in Nex, from the scripts pane, find and run best overview phototagging script.

#### As of 03/03/17 it is Sparta\_OA\_DID\_overview-to-PPT\_MAP+Omni.nsc

#### It will soon be replaced by Sparta\_OA\_DID\_OVERVIEW\_PHOTOTAGGING\_preclean

### A powerpoint file will appear in data file’s folder and will fill with waveforms, perievent raster and histograms for light pulses and licks, session-long firing rate histogram

### Use this file as you clean to get an idea of what units were maybe phototagged.

#### Focus on not losing any putative phototagged neurons (unless clearly noise)

#### Potential phototagged to watch for

#### WFs/PER Lick for artifact channels

## Create a “Notes on Unit Sorting.txt” file in same folder as original data file

### On first line of file/notes, please put original data file’s name.

#### Put any notes about bad channels, or channels that should be re-examined in this text file.

### **If you take hand written notes**, please scan/take a picture of your notes and save in the same folder.

# Cleaning each channel's units / spike sorting in OfflineSorter

## Load data file and do preliminary invalidation and template recalculation

### Open unsorted .pl2 in Offline Sorter

### Invalidate obvious noise (various options)

#### Manually invalidating

#### Invalidate high-amplitude artifacts

#### Invalidate cross-channel artifacts.

### Re-threshold to eliminate low amplitude noise from earlier in session Threshold is shown as red dashed line on waveform window and starts set to the same value that was in use at the end of the recording session.

#### Re-threshold by either clicking (and barely moving) red dashed line on waveform view

#### Be careful that noise didn't fluctuate a lot (to cause you to remove whole blocks of time by accident)

### Re-calculate units and

#### Unit templates (t)

#### Fit tolerances (f)

#### PCA (z)

### Save this current sorting as "sorting 1" or as a sorting file

## Ensure all good phototagging/stimulated waveforms are included in a unit [‡]

### NOTE: ***This step may be repeated after any significant change in the sorting*** [‡]

### Set-up timeline viewing options:

#### On the Events tab, Turn on Event 25 (see below if missing). Tall lines should appear on the timeline view for every event timestamp.

##### Older files from the MAP system will have Event016 or Event016\_1 instead of Event 25

##### If file has BOTH Event016 AND Event016\_1, use the one that has more timestamps.

#### On timeline, Create time segments for phototagging sections

#### Change the settings for visible waveforms:

##### In the timeline view, turn on the check box on the left of the timeline that says “Control Display”

##### Select "Use Only Visible" [c] on the “Use” toolbar:

### Search phototagging section for any light-evoked waveforms that were missed (overlapping or immediately following the event lines on timeline)

#### Zoom in on timeline, scroll through phototagging events and look for waveforms immediately following the event that were missed

#### For fast screening:

##### Select “Show only unsorted” [x] waveforms

##### Zoom in just enough that you can see a unsorted waveform inside of a stimulation train (close-together event lines)

##### Scroll slowly through all phototagging events and look for any unsorted wfs next to an event line

#### If see possible waveforms to add:

##### Click on wave in timeline to highlight the waveform in all views

##### Compare shape of missed waveform to template by either:

###### Using the waveform inspector view to decide if its close to template or noise

###### OR, show all units again (x to undo show unsorted) and compare waveform with the other waves in the unit

## Make a new unit from the original unit’s waveforms from phototagging section [‡]

* + - * Zoom the timeline to phototagging segment and examine the visible waveforms
      * Make sure proper view options are selected:   
         
        + Turn on “Use Only Visible”
        + Turn on “Show only current unit” [ c ]
        + Verify that timeline is still set to “control display”
      * Add a new unit by drawing a line across the current visible waveforms from the old unit
      * If the phototagging section is too messy to find a nice shape for the template:
        + Zoom in closer in time, but zoomed out enough that you see a bundle of waves on screen
        + scroll through phototagging section for best bundle of waveforms in terms of template shape, use this sub-set instead
      * Remove noisy waveforms to get a representative template with the ideal shape
      * Template should have tight dashed standard deviation lines that do not bulge out excessively. See example below:  
         
      * Recalculate templates, fit tolerances, and PCA (t,f,z)

## Test template sorting with current template and check for lost phototagged waveforms [‡]

### **Check the waveforms and that they are clean and have a representative shape**

* + - * Verify you have recalculated templates, tolerance, and PCA (T,F,Z)

### **Test if template will still capture light-evoked waveforms from phototagging**

#### Can first test JUST phototagging section, or do whole file{

* + - * + To do JUST the phototagging section

View options:

Use only visible

Show only current unit

Timeline controls displays

Select User-created interval time segment for phototagging

Right click on timeline and select Zoom Window to Current Time Segment

* + - * + To do to whole file

View options

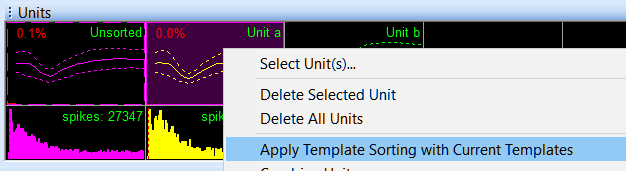
Turn OFF use only visible

Turn OFF show only current unit

Can leave on timeline controls displays if you want

Does not matter what portion of data is in view, but recommend still focusing on phototagging time segment

### **Apply template sorting with current templates**

* + - * + Right click on the units window and select “Apply Template Sorting with Current Templates”
        + Can also do Menu: Sort > Apply Template Sorting with Current Templates

### **Judging the template sorting result and adjusting if dissatisfied**

#### Remove obvious noisy outlier waveforms

* + - * + After sorting, look at result and if there are any very obviously noisy waveforms that are outside the bundle and should be removed
        + Inspect the shape of the temple’ s mean (solid line) ± SD lines (dashed lines) on unit display.
      * *[TIP] If there are messy waveforms you want to remove, but want to verify they are not light-evoked waveforms from phototagging:*
        + *View options:*

*Uncheck timeline controls displays*

*Check timeline Center Selected (next to control displays button)*

* + - * + *When you mouse over a wf in the waveform or 2D/3D cluster windows, the timeline jumps to show the current waveform.*

*Make sure you still have the Event for light pulse turned on and visible*

* + - * Judging the quality of the sorting results
        + Compare the shape of the template means and SD lines before v after sorting

First make sure that BEFORE you applied template sorting, that you had recalculated the template and fit tolerance

Now, inspect the solid mean and dashed SD lines on the template

Examine of the shape of the template and how curvey it is,

Examine how high the peaks are and how low the valleys are

WATCH THE TEMPLATE LINES and re-calculate template (T) and fit tolerance (F)

* + - * + *If the shape of the template mean changed significantly, and is more flat (especially in first 0-200 usec ):*

Undo (control Z)

Recalculate template and fit tolerance (T, F)

Manually decrease Fit Tolerance value in units window.

Re-apply template sorting with current templates

* + - * + *If the shape of the mean is similar in shape, but the dashed SD lines changed significantly:*

Inspect SD lines on Units window and identify what sections of the template SD lines became more larger/less defined

See example below with a poorly defined valley  


Remove erroneous waveforms from the bulging part of the template’s dashed lines.

Recalculate template (T) and fit tolerance (F) and see if the template improves

### **Verify that no phototagged waveforms were lost from the unit**

* + - * For directions, see:  
         II.ii. *Ensure all good phototagging/stimulated waveforms are included in a unit [‡]*
      * **If happy with the results of new template**, we move on to applying it to whole file and cleaning up the whole session’s waveforms.

## Apply new template sorting to the entire session and clean unit clusters

### Apply template sorting with current templates to whole session

#### Good idea to go ahead and save a .sort file before applying to whole session

#### For directions on how to apply template sorting, see:

##### *II. iv. 3: aboveApply template sorting with current templates*

### For optional helpful methods of cleaning and separating clusters, see: *V. ADDITIONAL HELPFUL, OPTIONAL, PROCEDURES TO USE FOR SORTING (below)*

### **Use several 3D views to help remove erroneous waveforms: Will expand this section further for how I like to visualize/clean data**

#### For flat waveforms:

##### PC1 x Valley FWHM x Energy

##### Remove those close to and on opposite side of axis

#### For bad waveforms with a low-amplitude waveform "heads" (first 0-200 usec)

##### Peak FWHM x Slice 1 x Energy

##### Slice 1 (set ~0-100 usec)

#### For noisy waveforms that are not aligned correct waveforms, but closely overlap:

##### Peak-valley x Valley FWHM x Peak Tick/Valley Tick

##### May notice one tick value's waveforms are all invalid, so invalidate

# Finishing a channel: final steps and required criteria for clean units

## Before judging sorting, reset sorting settings and timeline display settings

### **Remove short inter-spike interval (ISI) waveforms**

### To remove them, use Tools > Remove Short ISI Wfs

* + - * + Use 1200 us as the refractory period.   
           (Could go up to 2 ms, but I decided to be more conservative)
        + Remove from just the current channel (but it’s okay if you accidentally do all channels)

### Explanation:

* + - * Short ISI waveforms are two waveforms with timestamps that occur closer together in time than the refractory period. They cause errors in the data analysis software and must be removed
        + Refractory period is defined under Tools > Options > Refractory Period [set to 1200 us if using my options file]
      * In 2D/3D cluster views, these waveforms are identified by a line connecting the two waveforms
    1. **Reset sort start and sort end**
       - On the left info pane, re-set the default times for sorting
         * Sort start=0
         * Sort end=800
    2. **Ensure use waveforms from full session** 
       - Uncheck the Control Displays box on the timeline window
       - OR zoom out fully in time on timeline
    3. **Switch batch to PC1 x PC2 x PC3 and recalculate principle components (Z)**

## Criteria for judging if a unit is clean and usable:

### IMPORTANT: Criteria stats use *current feature space* selected. To do so:

* + - * Set feature space to **PC1 x PC2 x PC3.**
      * Recalculate principle components (z) to make sure accurate.
      * Switch to the “Stats” tab or “Plexon”/”Sorting Summary” for judging criteria.

### If there are multiple units, mainly use MANOVA significance:

* + - * Ideally, want MANOVA 2D & 3D to be <0.05, BUT:
        + If 2D/3D has one significant, and one not sig:

If you can't do any additional sorting to fix, and the clusters look reliably different to you in PC1xPC2xPC3, and one or two other views, then accept.

* + - * Do not need to include unsorted waveforms (see options> stats)
      * For >2 units that may overlap:
        + check pairwise sort quality
        + Consider combining units (or deleting and re-assigning to remaining units)

### If there is one unit, harder to be confident, but there are several possible options:

* + - * Can turn on Include Unsorted Waveforms in Stats
        + Low signal to noise ratio makes this very unlikely to show significance
      * Focus on getting a good L-Ratio ( <0.05 )
      * Check J3 statistic. [?]

If you really can’t reliably see the difference in 3D clusters, then considering deleting unit

## AFTER EACH CHANNEL HAS PASSED REQUIRED CRITERIA

### Export sorting summary page for each channel to powerpoinb:

#### Switch to the “Plexon”/”Sorting Summary” tab. [called sorting summary in the menu, but the tab’s label only says “Plexon”]

#### Set feature space back to PC1 x PC2 x PC3 and recalculate principle components (z)

#### Open destination PowerPoint file

##### Save to same ppt as pre-cleaning Nex results.

###### If do not have a pre-clean ppt, save a new PowerPoint file to the data file’s folder.

#### Send sorting summary to PowerPoint

##### EITHER click PP button on top of sorting summary page

##### OR right click page and select “Send to PowerPoint”

### Save each channel’s sorting to a “**-FIN.sort”** file. This will remember what waveforms were sorted and which ones were invalidated.

#### Click Sort> Save sorting to .SORT file > Save as File > [Dialog box opens]

##### Change the pre-filled .sort file name from “[DATA FILE NAME]\_chanX.sort”

##### Add “-FIN” to the name before the .sort extension

##### Should say “[DATA FILE NAME]\_chanX-FIN.sort”

### Save new work-in-progress Plexon data file as a .pl2

#### Add “-Ch##done.pl2" where ## is clean channel’s #

# WHEN ENTIRE RECORDING SESSION DATA FILE IS COMPLETE:

## Save final data file (.pl2)

### Once all channels are cleaned, create a new folder called “FINISHED” in the data file’s main folder

### Save the final, fully cleaned, datafile as a .pl2 with the original file name and add -FIN to name [**…-FIN.pl2]**

### Move the **-FIN.sort** files to this folder

### Move the text file or scanned copy of your notes to this folder as well.

### May also create DIDSessionInts.csv file for this data

### See section below called: “Saving session intervals for accurate session-wide firing rate data [creating ‘DIDSessionInts.csv’”

### This must be done before the clean data can be analyzed using NeuroExplorer.

# ADDITIONAL HELPFUL, OPTIONAL, PROCEDURES TO USE FOR SORTING

## Additional options to help decide # of units, templates, etc.

### Browse feature vs feature view:

* + - * Look for comparisons that separate the overlapping units
      * Double click to change current PC space to match
      * Clean in 2D/3D

### Use the waveform/template comparison view:

* + - * Helps decide which waveforms belong to which overlapping units
      * [BOOKMARK]

## Procedure: run valley seeking scan:

### Why use Valley Seeking Scan?

* + - * Helps decide how many units may be present
      * Helps decide which clusters should be considered

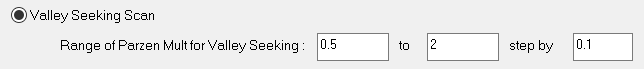
### Using the Valley Seek Scan automatic sorting method

NOTE: This should only be performed after initial invalidation of obvious noise is complete.

* + - * Save a .sort file before you initiate sorting   
        Undo-ing the sorting takes MANY steps, easier to Sort >Restore Sorting from .sort file
      * Settings/Parameters for Valley Seeking scan:
        + Make sure PCA is using Enhanced PCA (Tools > Options > Feature Calc > Use Enhanced PCA)
        + Recalculate PCA (z)
      * Select Sort > Perform Automatic Sorting
        + Parameters to use:

Current Channel only

Sort in 3D space

Valley seeking Scan

Range of Parzen Multiplyer:

0.5 to ~2

Step by ~0.1

#### Statistics/qualities to look for:

* + - * + Can generally trust **J3 results (**Larger number the higher quality the cluster)
        + Signifcant MANOVA p value
        + L ratio <0.05
        + No ISI peak at 0-1ms

# Saving session intervals for accurate session-wide firing rate data [creating "DIDSessionInts.csv"

### In same folder as final cleaned data file, save a new Excel workbook as a .csv file called "DIDSessionInts.csv"

#### This .csv file will determine the good, non-phototagging, non-erroneous intervals that Nex uses for using data for firing rate histograms

### Use timeline view with EventPulse (Event25/MAP Data event?) turned on to find timestamps.

#### Bottom of offlinesorter has a status bar that displays the voltage and time at the location of the mouse cursor.

### Identify timestamp of last light pulse, then use mouse to find timestamp shortly thereafter

#### If theres a gap immediately following, use timestamp of first wave after gap.

#### If no gap and no obvious change in spikes on timeline, then use ~100ms+ as timestamp

### In DIDSessionInts.csv, each interval to include is a separate row [Need at least one interval]

### Each interval row needs 2 columns to define intervals that are included in the DID session

### If there's NO wide gaps or bad time periods to remove:

### If there's large gaps or bad data periods to exclude:

**----------------------------------------END OF CLEANING / SORTING PROCEDURES--------------------------------------------**

# OfflineSorter Definitions and Excerpts

## OfflineSorter Features Available for Sorting [6.4 in manual]

You can choose each dimension of the 2D or 3D feature space used in the software from the list of available features. Any of the following features can be made “active”, so that they appear in the X axis, Y axis and Z axis feature drop-lists in the toolbar. See “Axis Selection” under Section 3.7.2, "Clusters Views Common Functionality” on page 54 .   
In the following,

### **Definitions for Algorithm Notation**

* w(t) = [w(1),…,w(n)] is the waveform (n=number\_of\_points\_in\_waveform)
* p1(t)=[p1(1),…,p1(n)] is the first principal component vector
* p2(t)=[p2(1),…,p2(n)] is the second principal component vector
* p3(t)=[p3(1),…,p3(n)] is the third principal component vector
* S represents a sum over t

### **All Available Features**

* **PC1 –** The waveform projection onto the first principal component
  + PC1 = S p1(t)\*w(t)
* **PC2 –** The waveform projection onto the second principal component
  + PC2 = S p2(t)\*w(t)
* **PC3 –** The waveform projection onto the third principal component
  + PC3 = Sp3(t)\*w(t)
* **PC4-PC8 –** The waveform projections onto higher principal components
* **Slice 1** – The waveform height at a selected position in time. You can select
  + the time position in the Control Grid or the Waveform display.
  + Slice 1 = w(i) :the waveform voltage at time t=i
* **Slice 2** – The waveform height at a selected position in time. You can select
  + the position in the Control Grid or the Waveform display.
  + Slice 2 = w(j) :the waveform voltage at time t=j
* **Slice 3** – The waveform height at a selected position in time. You can select
  + the position in the Control Grid or the Waveform display.
* Slice 3 = w(k) :the waveform voltage at time t=k
* **Slice 4** – The waveform height at a selected position in time. You can select
  + the position in the Control Grid or the Waveform display.
  + Slice 4 = w(l) :the waveform voltage at time t=l
* **Peak** – The maximum voltage amplitude across the entire waveform length
  + Peak = max(w(t))
* **Val l ey** – The minimum voltage amplitude across the entire waveform length
  + Valley = min(w(t))
* **Peak-Valley** – The difference between the maximum and minimum
  + waveform amplitude
  + Peak-Valley = max(w(t))-min(w(t))
* **Peak, Valley** **FWHM –** The “Full Width at Half Maximum” for the peak or
  + valley of the waveform, expressed in milliseconds. The exact points where
  + the waveform crosses the half max value are obtained by interpolation.
* **Peak, Valley** **Tick –** The clock tick (as measured from the beginning of the
  + captured waveform) at which the peak or valley occurs. No interpolation or
  + waveform fitting is done, so these values are “quantized” to integer values.
* **Area** – The total integrated area underneath the waveform
  + Area = S abs(v(t))
* **Energy** – The waveform energy, as it is calculated for spike detection. See
  + “Waveform Detection View” on page 74.
  + Energy=(1/width)å v(t)v(t)
* **Sqrt(Energy) –** The square root of the above-mentioned waveform energy.
* **Non-Linear Energy –** The non-linear waveform energy, as it is calculated for
  + spike detection. See “Waveform Detection View” on page 74.
  + Non Linear–Energy Energy=(1/width)å [v(t)v(t) - v(t-1) v(t+1)]
* **ISI(Previous), ISI(Next) –** For waveform i, ISI(Previous) is the amount of
  + time (in mSecs) between the waveform i-1 and i, while ISI(Next) is the
  + amount of time between waveform i and i+1. Both values are capped at 9999
  + mSecs to avoid large gaps from over-extending the range of values.
* **Timestamp –** The timestamp of the waveform in the file. Note: Selecting the
  + timestamp as one of the dimensions in the **Clusters** views allows the viewing
  + of the other feature(s) as a function of time. Discontinuities or drifts in time
  + can indicate a change in the electrode position or the recording conditions.
* **Per-Electrode Features –** (Only available for stereotrode or tetrode data.)
  + Most of the above features are available calculated per-electrode. For
  + example, the feature “Peak EL 1” is the peak value of the waveform within
  + the first electrode in a stereotrode (or tetrode). “Peak EL 2” is the peak value
  + within the second electrode of the stereotrode (or tetrode).
* **Per-Electrode Ratio Features –** (Only available for Stereotrode or Tetrode
  + data) These features are formed by taking the ratio of Per-Electrode feature
  + values. For example, the feature “Peak EL 1/EL 2” is “Peak EL 1” divided by
  + “Peak EL 2”. Ratios with a denominator value of 0 are arbitrarily set to 0. For

## OfflineSorter Unit Sorting Quality Statistics

### **MANOVA p**

* + - * Assumes parametric
      * Normal p value (p<.05 means significantly different units)

### **J3**

* + - * Non parametric
      * J3=J2/J1
        + J2=average distance between clusters
        + J1=average distance between points in a cluster
      * Maximum value for compact, well separated clusters

### **PseudoF(PsF)**

* + - Same as J3, but adjusted for # of WFs and # of units.
    - Maximum value for compact, well separated clusters.(?)

### **Davies-Bouldin**

* + - Non parametric validity measure
    - Summation of the distance between points in clusters (2 clusters), divided by the average distance between centroids of two units
    - Small values for well-separated clusters (since denominator is distance between centroids)

### **Dunn**

* + - Maximum value for clusters that are compact and well separated.
      * Distance between centroids is numerator

## Per-Unit Sort Quality Metrics:

### **L-ratio**

* + - Measure of amount of "noise" near the unit (where noise is unassigned waveforms)
    - Low -ratio means unit is well separated and not contaminated by nearby spikes
    - Weighted sum so forein spikes close to the center hurt the ratio more

### **Isolation Distance**

* + - Measure of distance of non-unit spikes to the unit being analyzed
    - Visualized by an ellipsoid with equal # of WFs within unit and not (noise)
      * Not defined if more spikes in unit than not
    - Large values indicate well-separated units

# DATA ANALYSIS METHODS AFTER UNITS ARE SORTED AND CLEANED

## Run primary phototagging analysis script in Neuroexplorer:

### **NOTE RE: NEX PHOTOTAGGING SCRIPTS.**

* + - * Current= Sparta\_OA\_DID\_overview-to-PPT\_MAP+Omni.nsc  
        Eventually:SPARTA\_OA\_DID\_OVERVIEW\_PHOTOTAGGING\_PRECLEAN.NSC ]
      * Current one does not require DIDSessionInts to exist.

### In Neuroexplorer, open data file and run the current Nex Phototagging Script (see above).

### The phototagging script will produce several files in PowerPoint, Excel, Matlab:

* + - * Powerpoint file in data folder called "…NexRes.ppt"
        + WF comparisons

All, 10ms post, all BUT 10ms post

* + - * + PER (spk/sec) & PEH (Z-score) for Pulses and Licks
        + Autocorrelograms
        + ISI Histograms
        + Session-wide firing rate data
        + Burst analysis
      * Èxcel data file:
        + …
      * Matlab .mat data file and exported waveform figures:
        + .Mat has DATA structure all of each units data

For a flowchart map of the DATA structure and its contenst:

<http://bit.ly/2mdoPrg>

* + - * + Sub-folder includes .PNG figures for each unit with stim-evoked waveforms [PASTE INTO NEXRES.PPT]

Includes correlation and cross correlation values in legend.

Cross-correlation at 0ms time lag used to decide phototagged or not

* + - * + Optional:

Copy the slides from the pre-cleaned nex analysis to this new powerpoint [optional]

* + - * + **[SAVE .NEX5 FILE AFTER SCRIPT TO FINAL DATA FOLDER]**

# INVENTORY OF FINAL DATA CONTENTS AFTER ANALYSIS:

* + - * Cleaned .pl2 file ["…FIN.pl2"]
      * .Nex5 version *of SAME* data file
      * DIDSessionInts.csv
      * Master Nex Powerpoint ("…NexRes.ppt")
      * Matlab folder:
      * .mat with firing rate and waveform data
      * .png files from matlab output
      * Excel document [what in it?]

# REFERENCE MATERIAL/LINKS

* **Evernote and OneNote Reference Links**
  + Criteria/methods in offlinesorter notes:
    - [Summary Ephys Recording/Unit Separation Methods](onenote:#Summary%20Ephys%20Recording\Unit%20Separation%20Methods&section-id={C9E4F406-0778-45D1-9A14-D32718C1D581}&page-id={59C684A5-B43E-4614-AEFB-2291920015A1}&end&base-path=https://d.docs.live.net/da1539a57ca961cd/Documents/Fundamentals%20of%20Electrophysiology) [OneNote Summary]
    - [Methods for separating units - Nicolelis et al 2003](onenote:#Methods%20for%20separating%20units%20-%20Nicolelis%20et%20al%202003%20&section-id={C9E4F406-0778-45D1-9A14-D32718C1D581}&page-id={C5508321-CA68-4541-959D-963C2D7587ED}&end&base-path=https://d.docs.live.net/da1539a57ca961cd/Documents/Fundamentals%20of%20El)
    - [Ephys Methods - Jennings/Tye](onenote:#Ephys%20Methods%20-%20Jennings\Tye&section-id={C9E4F406-0778-45D1-9A14-D32718C1D581}&page-id={E616D754-0E41-432F-A49F-8D359E26F586}&end&base-path=https://d.docs.live.net/da1539a57ca961cd/Documents/Fundamentals%20of%20Electrophysiology/WORKFLOW%20%5eM%20Sp)
  + Evernote Workflow Notes:
    - [MASTER SCRIPT LIST of Phototagging Scripts & Workflow](https://www.evernote.com/shard/s567/nl/31702/ea6d9a2e-6dcc-42bd-a11c-717554122277)
    - [UPDATE- My Old Spike Sorting / Cell Cutting Methods Using Offline Sorter - For Omniplex Recordings](https://www.evernote.com/shard/s567/nl/31702/d995c1f1-749e-4573-ac65-65e8926dc00b)
    - [Save cut Rate Histograms from nex using DIDSessionInts.csv to remove bad intervals](https://www.evernote.com/shard/s567/nl/31702/9ef688c3-8325-4e38-89ae-ac459c6df53f)
* **Materials/Programs Needed:**
* External HD with raw .pl2 data
* Copy of lab notebook for current session
* OfflineSorter v4
* Powerpoint
* Matlab 2015
* Neuroexplorer v5
  + PRIMARY PHOTOTAGGING SCRIPT:
    - Sparta\_OA\_DID\_OVERVIEW\_PHOTTAGGING
  + See [MASTER SCRIPT LIST of Phototagging Scripts & Workflow](https://www.evernote.com/shard/s567/nl/31702/ea6d9a2e-6dcc-42bd-a11c-717554122277) For templates and sripts