

Percent Change and Power Calculation

NITP 2010

Outline

- Calculating %-change
 - How to do it
 - What featquery does

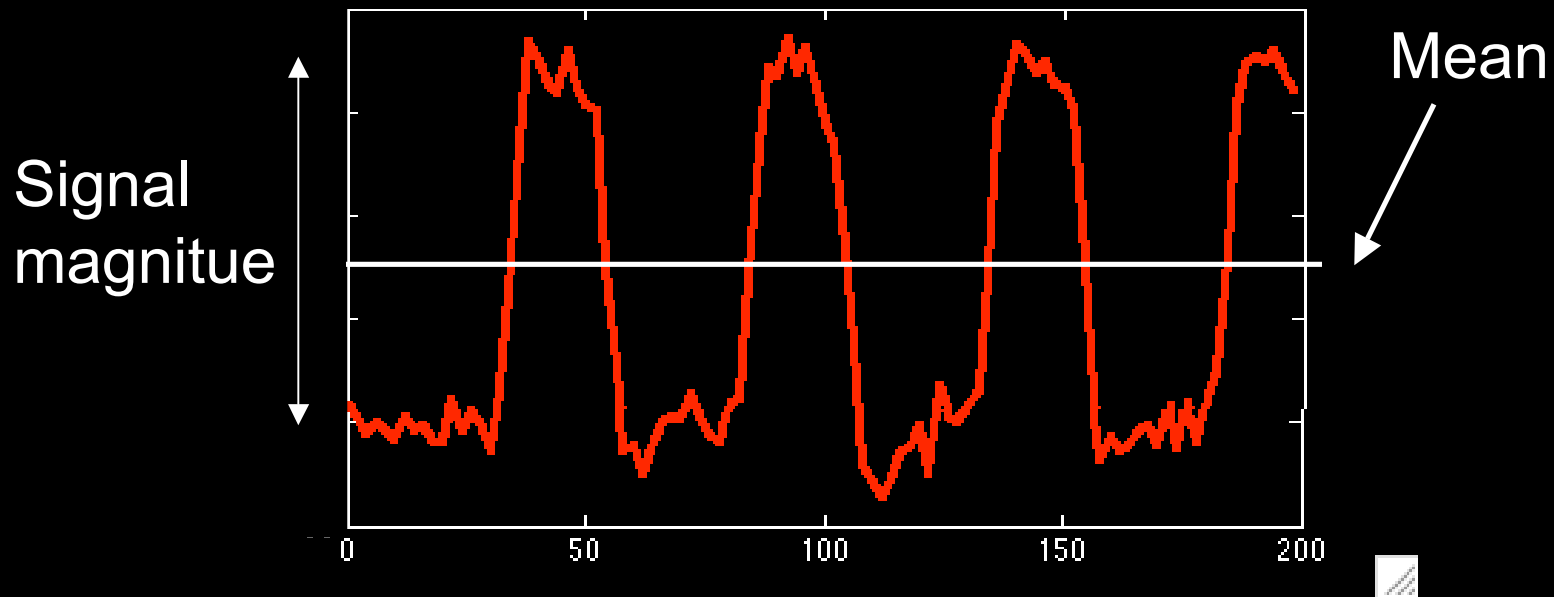
Why %-Change?

- As it is, parameter estimates do not reflect a specific unit
- T-stats are okay (they are unitless)
- What if we want to tell other people how large our activation was?
 - Convert to %-change

%-change

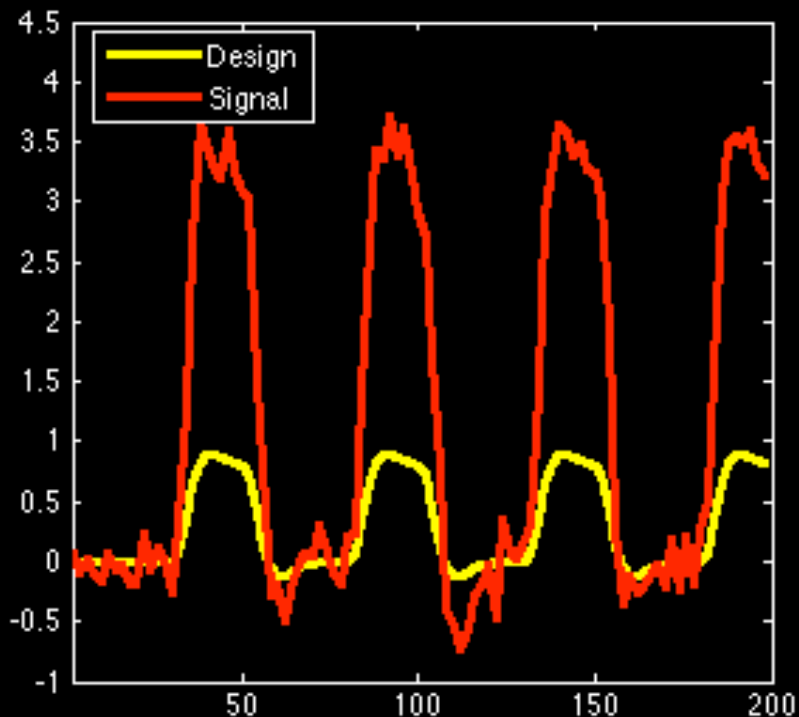
- How big is the signal magnitude relative to baseline?

$$\% \text{-change} = \frac{\textit{sig. magnitude}}{\textit{mean}} \times 100$$

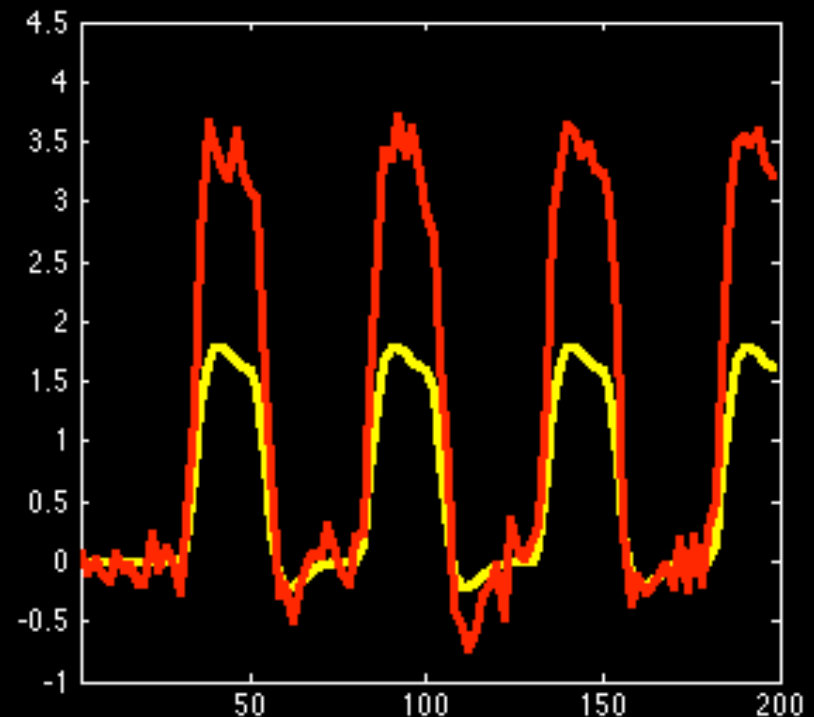


Block Design

- How to get the signal magnitude from parameter estimates...



p.e.=4, EV height=1
1x4=signal magnitude



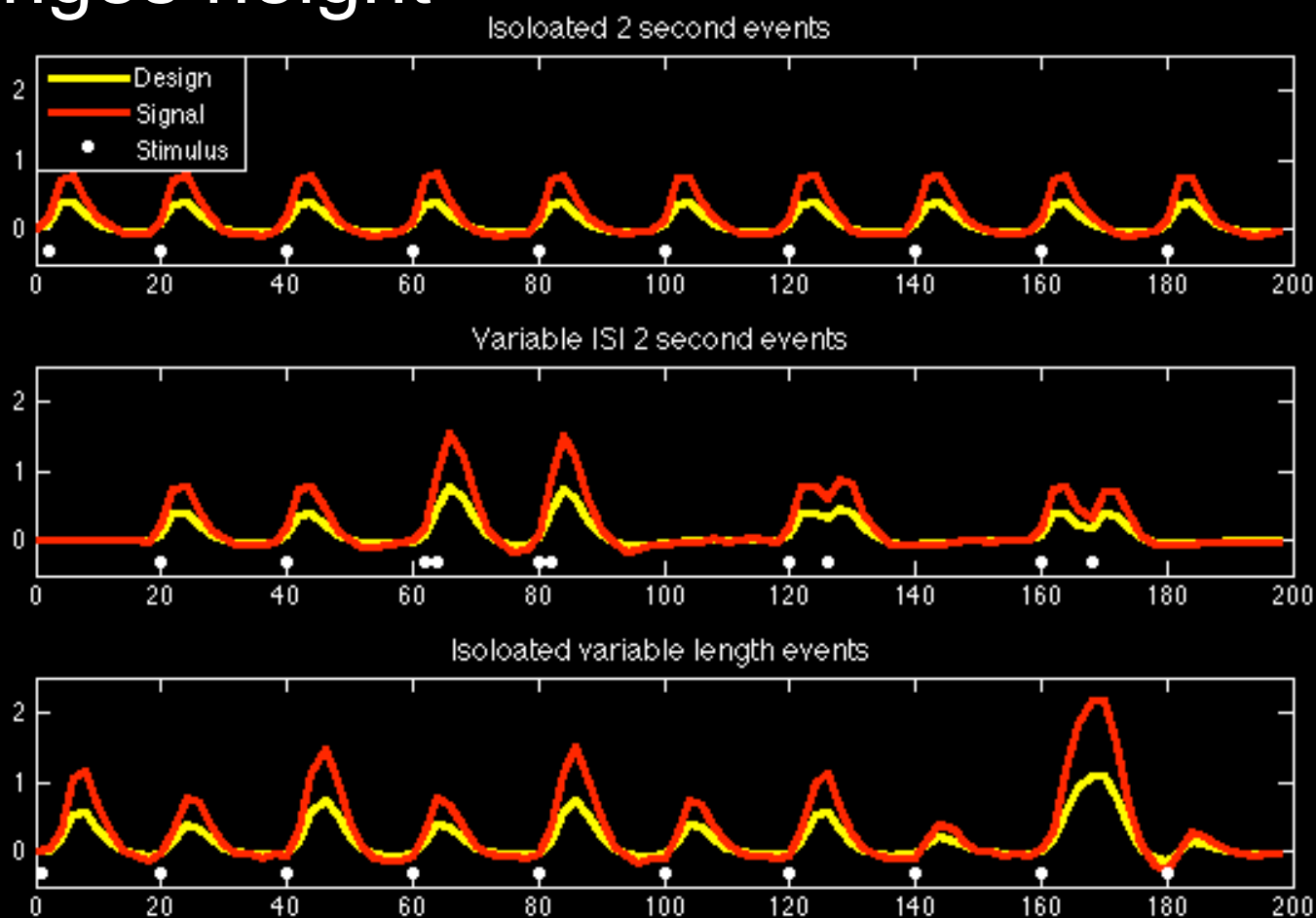
p.e.=2, EV height=2
2x2=signal magnitude

Block Design

- To make life easier, set min/max range of EV's=1!
 - In FSL the Grand Mean Scaling sets mean $\sim 100^2$ in all voxels
 - PE/100=%-change! (roughly)
 - To be completely accurate you should divide by the true mean

Event Related Design

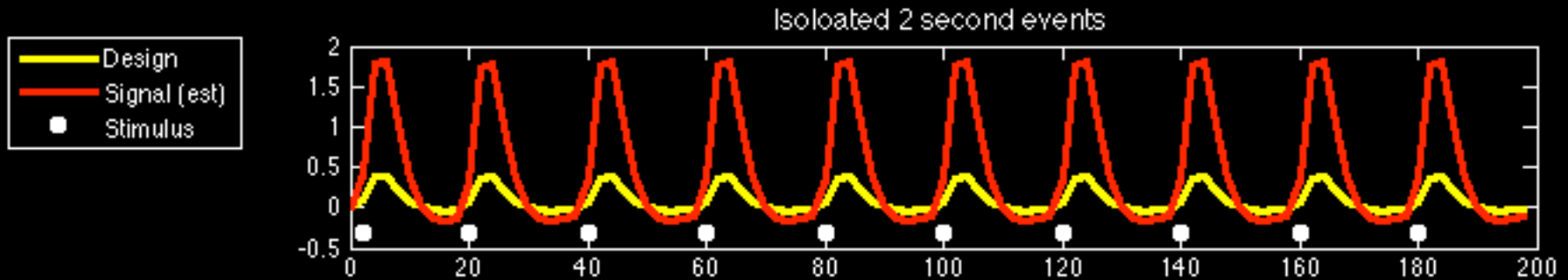
- Tricky! Proximity and length of events changes height



Event Related Design

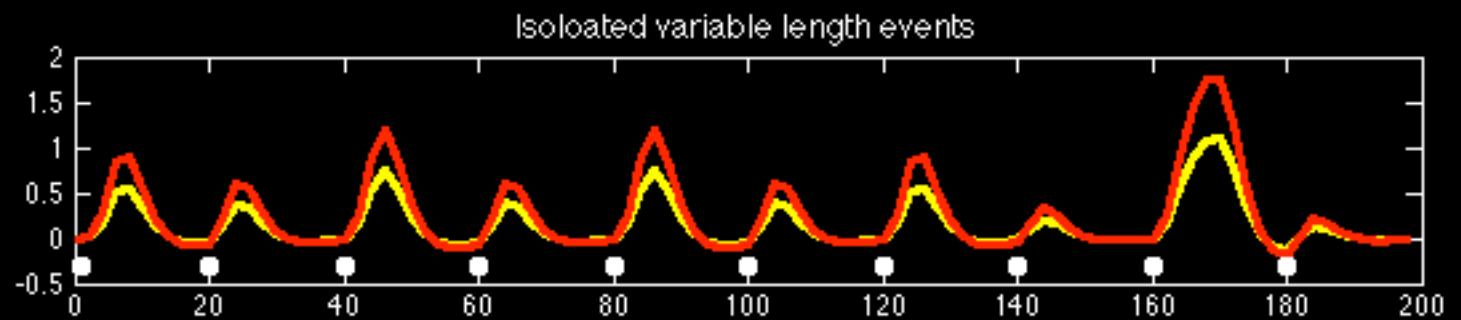
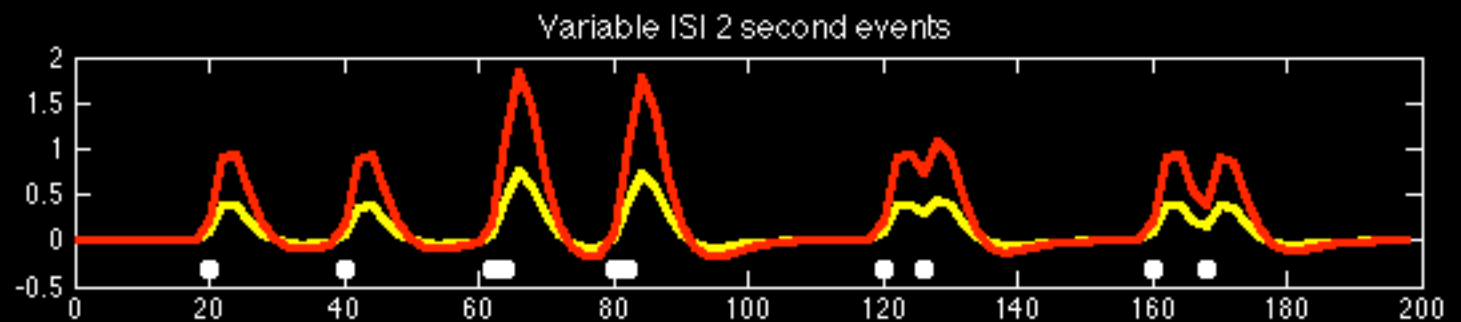
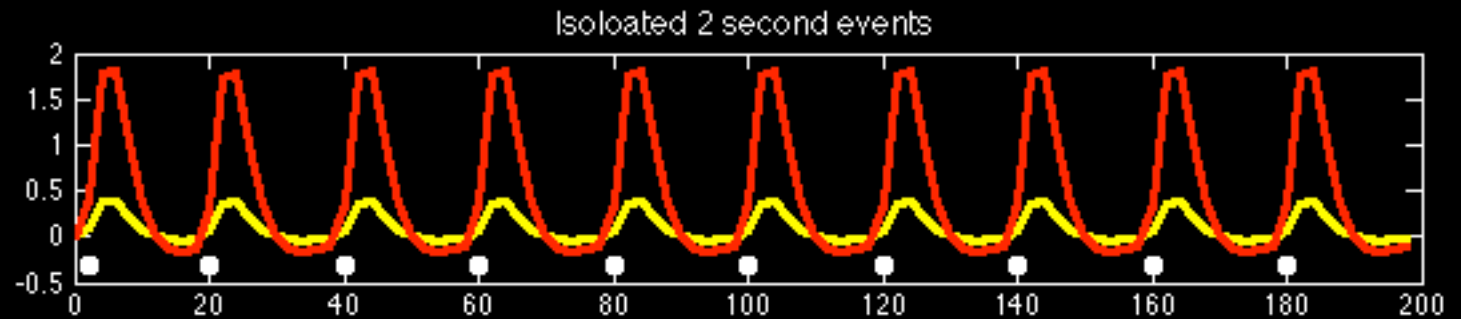
- How about using min/max range?
 - Is it interpretable?
 - I tell you I found a 2% change, calculated using the min/max range. Can you interpret this with your own design?

ER design

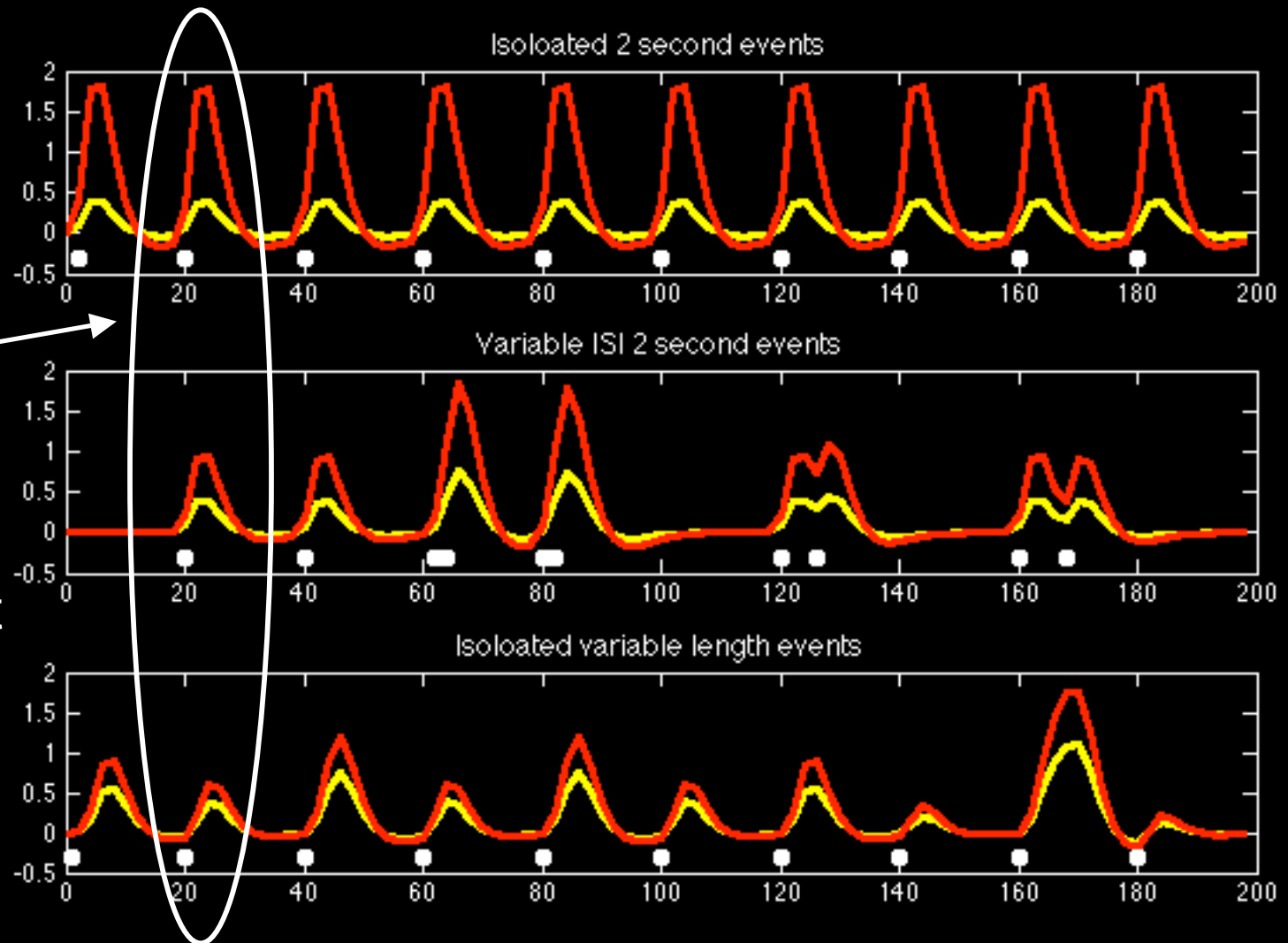


- Assume mean=100
- %-change=(PE)(Min/Max range)
- $2=PE*(0.5) \Rightarrow PE=4$

ER design



ER design



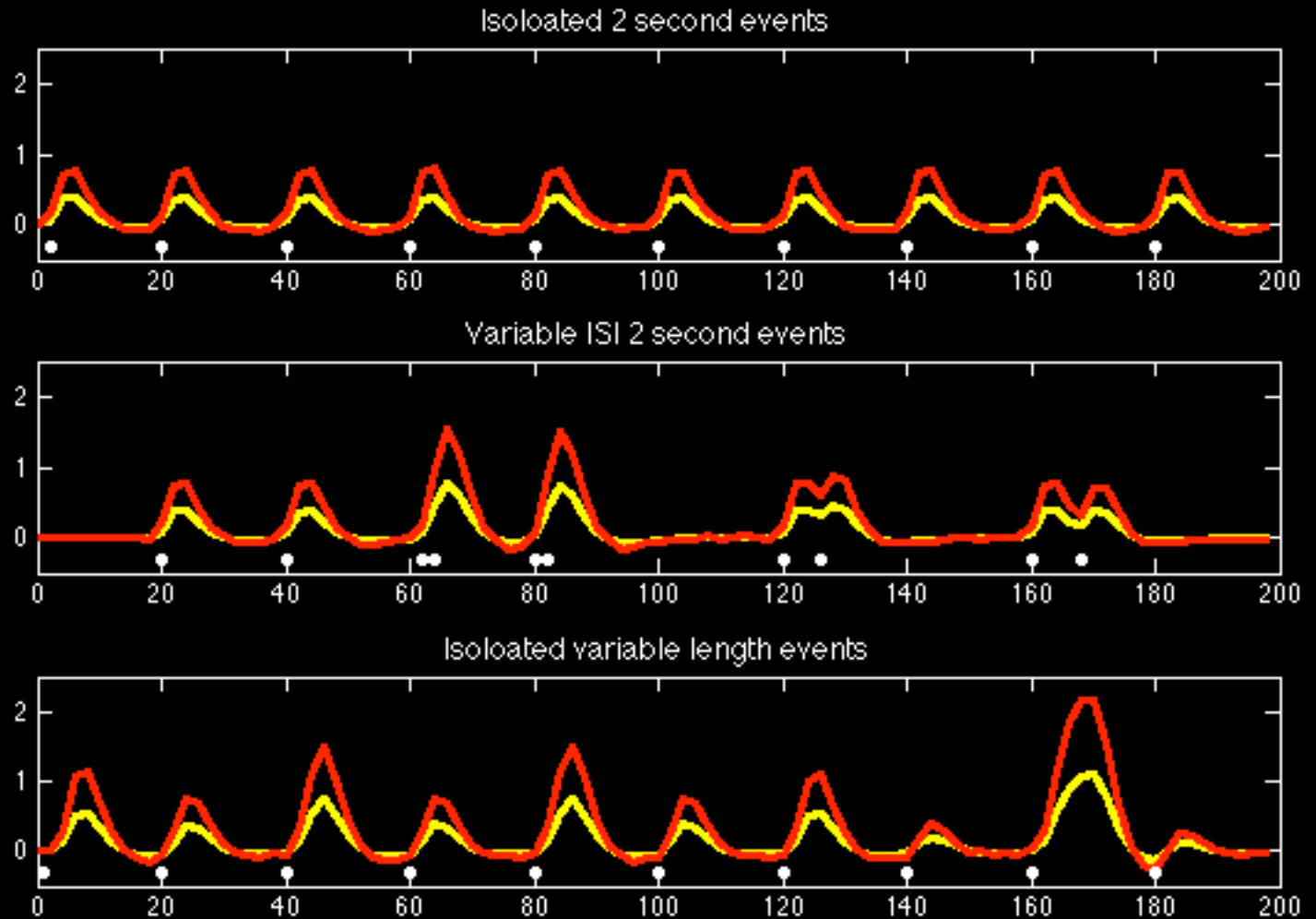
All designs have an isolated 2 second event **BUT** the estimated signal is very different!

ER Design

- Min/max range doesn't work as well for event related design
 - Doesn't translate well to other designs.
 - *warning* Featquery uses min/max range
- Instead of min/max range, choose something specific (isolated 2 second event) and make sure to report what you used!

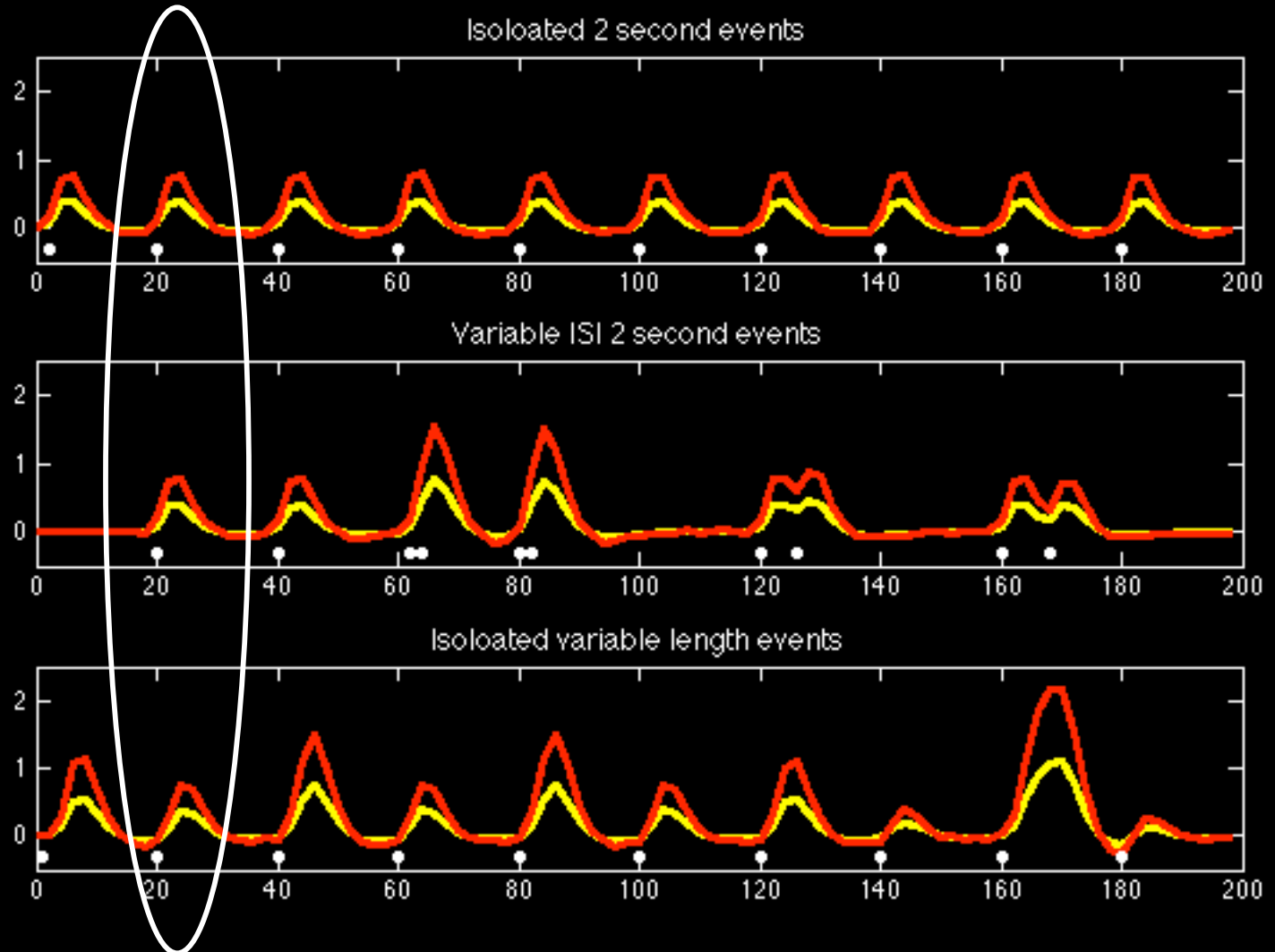
ER Design

- 1% change based on height of isolated 2-s event



ER Design

- 1% change based on height of isolated 2-s event
- Now we can compare across designs!



A note about contrasts

- What does the contrast $[1 \ 1 \ -1 \ -1]$ mean?
 - $(\beta_1 + \beta_2) - (\beta_3 + \beta_4)$
 - beta's are mean activations for 4 levels of subjects performing some task (beginners, some training, medium training, experts)
 - Test beginners/some training - med/experts
 - $\beta_1 = 2, \beta_2 = 2.5, \beta_3 = 5, \beta_4 = 5.2$
 - $\beta_1 + \beta_2 = 4.5$ and $\beta_3 + \beta_4 = 10.2$
 - Difference is twice the mean difference!

A note about contrasts

- Although $[1 \ 1 \ -1 \ -1]$ implies a difference that is twice the original scale, our test statistic is okay
- Since we're interested in preserving scale, use contrast that give us means
 - Positive parts sum to 1
 - Negative parts sum to -1

Rules to get *almost* %-change in FSL

- Baseline is already $\sim 100^2$
- EV is constructed appropriately
 - Boxcar height = 1
 - ER design: Specified event has height=1
 - I like to ignore the post stimulus undershoot
- Construct contrast that follow the rules
 - Positive parts sum to 1
 - Negative parts sum to -1
- $PE * 100 \sim \text{%-change}$

What if you didn't follow the rules

- Calculate the height of regressor as it was
 - Height of block
 - Height of specified typed of event
- Calculate contrast fix
 - Number you'd have to divide contrast by to fix it

- $\% \text{ change} = \frac{PE(\text{EV height})}{(\text{contrast fix})(\text{baseline})} \times 100$

Example

- Study with subjects that were beginners, some training, medium training, experts
- Level 1, isolated 2 second event (using the gamma HRF) has height=0.2917
- Level 2, I used the contrast [1 1 -1 -1]
- COPE=500 (from contrast estimate)
- $\% \text{ change} = \frac{(500)(0.2917)}{(2)(100^2)} \times 100 = 0.729$

Featquery

- Featquery calculates %-change for ROI's
- Uses min/max range of 'effective regressor height'
 - Roughly speaking effective regressor corrects violation of the contrast rule and correlation between regressors
- Probably works fine for block design
- Very bad to run separately on first level runs for ER studies!
 - Will use a different scale factor for each subject
- Min/Max range isn't best for ER design

Baseline/max

- To calculate, you don't even need data
 - In Feat GUI set TR to something really small
 - Create a text file in 3 col format with the length of event you want to use
 - Load text file into GUI and set hrf to what you want
 - Turn off HP filter
 - Save design
 - Load design into matlab and calculate height

Baseline/max

- OR just use this table

Stimulus Length (s)	Height with Gamma HRF	Height with double Gamma
0.1	0.0149	0.0211
1	0.1485	0.2088
2	0.2917	0.4075
3	0.4247	0.5872
4	0.5439	0.7421
5	0.6471	0.8689

What to do instead of featquery?

- There's a writeup with some code that uses fslstats and fslmaths located here
 - http://mumford.fmripower.org/perchange_guide.pdf
- Some isolated event heights are in a table in this document
 - Isolated event height should be calculated from a design with *very* small TR for best resolution