

# Issues and conventions for variation weights

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## Weight name characters

- Rivet3 expects a weight name to be a sequence of alphanumeric characters
- the following special characters are also supported:
  - equal sign (=), underscore (\_), full stop (.), plus (+) and minus (-)
  - note: maths symbols might cause issues when trying to save branches in ROOT
  - please don't use 'new line' or 'tab' characters in a weight name ...
- other special characters are currently not supported, e.g. the colon, which we use to attach tags to output files on the command line (`output.yoda:Title="MC"`)
- white space characters are in principle supported but have been a source of numerous headaches: please avoid white space in weight names
  - "Name" vs " Name " vs " Name " (these are all distinct keys)
- ideally, the weight name should include the LHAPDF ID where applicable
  - "MUR1\_MUF1\_PDF123456" ✓
  - " PDF set= 12345 " ✗
  - "Member 0 of sets NNPDF30\_lo\_as\_0118" ✗
- awkward floating point representation
  - " muR=1.000000E+00 muF=2.000000E+00 " ✗
  - " dyn= -1 muR=0.10000E+01 muF=0.10000E+01 " ✗

## Identifying the nominal weight

- Rivet writes out histograms using the nominal weight like `/path/histo_name` and histograms using a variation weight like `/path/histo_name[variation_name]`
- hence Rivet's preferred nominal weight name is the empty string:  
Rivet will look for that first
- if the empty string is not found, Rivet goes through the weight names and looks for "0", "DEFAULT", "NOMINAL", or "WEIGHT" (all case insensitive)
- the first match will be treated as the nominal weight
  - Rivet still writes out the histogram as if the nominal weight was labelled with the empty string
  - Rivet prints a warning if more than one weight matches (it does happen ...)
  - if there is no match, Rivet writes out all weights like a variation weight
- please don't leave the user guessing
  - " PDF set= 262000 " really not an obvious name choice for the default weight

## Overruling Rivet's (lack of) default choice

→ at run time:

```
analysisHandler.setNominalWeight("MayOrMayNotBeTheNominal")
```

→ at plotting time:

```
rivet-mkhtml output.yoda:DefaultWeight="MayOrMayNotBeTheNominal"
```

## Skipping all multi-weights

- `analysisHandler.skipMultiWeights(true)`  
de-selects all variation weights apart from the nominal
- in case no nominal identified/specified, Rivet will just run on the first weight

## Skipping a subset of the multi-weights

- `analysisHandler.selectMultiWeights(string)` and `analysisHandler.deselectMultiWeights(string)` can be used to (de-)select variation weights apart from the nominal
  
- the `string` argument can be a comma-separated list of weight names or regular expressions to be (de-)selected, e.g.
  - `analysisHandler.selectMultiWeights("Weight1,Weight2,Weight3")`
  - `analysisHandler.selectMultiWeights("MUR.*MUF.*PDF123456")`
  
- this is based on indices and can therefore only work if the variation weights are in the same position for every event (more on that later)

## Auxiliary weights

- Rivet will always deselect weights that contain an all-caps `AUX` or `DEBUG` in their name
- the Rivet plotting scripts will ignore all histograms with an all-caps `AUX`, `DEBUG` or `NO PLOT` in the name
- this is aiming at generator-internal parameters which typically shouldn't end up in a histogram

## Length of the weight vector

- Rivet's treatment of multi-weights is based on the assumption that the weight vector has the same length for every event
- it turns out this is not necessarily true  
e.g. for some setups using correlated NLO sub-events
- in principle this is still OK, e.g. if these weights are marked with AUX or DEBUG and are always written out *after* the set of weights that is fixed for every event
- if there are any other pitfalls we should be aware of – this would be useful feedback



## Summary: proposal for weight-name conventions

- Allowed characters: A-Z a-z 0-9 = \_ . + -
  - any others desperately needed?
  
- Nominal weight: empty string, 0, nominal, default, weight (all case insensitive)
  - default weight should be *unambiguous*
  
- weights should be written out for *every event* and in the *same position*
  - variations that do not exist for every event can be added add the end of the fixed weight sequence, but should include a key word, so they can be easily skipped (e.g. DEBUG or AUX)
  - variations that do exist for every event but should not end up in the histogram should include a key word, so that they can be easily skipped (e.g. NOPLOT)
  
- if histogrammable, the weight should be *final*
  - the user should never have to combine multiple weights before the histogram can be filled