



Yoda 2.0.0 (Scatter) Format Documentation

More details: <https://yoda.hepforge.org/> & arXiv: [2312.15070](https://arxiv.org/abs/2312.15070)

Introductory remarks

- To keep things as simple as possible, we finally decide to do not use the powerful yoda histograms (allowing e.g. for combination of statistical independent runs... and hence maybe containing more information than necessary for our purpose), but stay with **Yoda scatter objects** instead, which might be enough if plotting/comparing results is the main goal.
- If you use Rivet4, you **can convert your Yoda histograms** into Yoda scatters by using WriterFlat.cc which is shipped together with your Yoda2 installation (find example C++ program on next slide). The later usually comes together with your Rivet-Installation.
- For Rivet3/Yoda1 users, there is the yoda2flat.py script (also shipped with Yoda installation that comes with Rivet), but the resulting format is not the same as for Yoda2 (see e.g. yoda2flat-ref.dat in your Yoda folder), so here unfortunately manual conversion is necessary.
- Rivet provides a powerful plotting tool via the **rivet-mkhtml.py Python script** which can be used to plot the Yoda results, if desired. Some explanations about the plotting script and the features of the plotting routine can be found here: <https://gitlab.com/hepcedar/rivet/-/blob/release-4-0-x/doc/tutorials/plotting.md> & <https://gitlab.com/hepcedar/rivet/-/blob/release-4-0-x/doc/tutorials/makeplots.md>

Conversion Yoda Histograms → Yoda Scatters (Yoda2)

```
#include "YODA/WriterFLAT.h"
#include "YODA/AnalysisObject.h"
#include "YODA/ReaderYODA.h"
#include "YODA/IO.h"

int main(){

    std::string path("<Resultspath>");
    // yoda results file name without .yoda ending
    std::string filenameYODA("<Your_yoda_filename>");
    // flat results file name
    std::string filenameFLAT("<Your_flat_filename>");

    vector<YODA::AnalysisObject*> aos;
    // read in yoda analysis objects (single histograms) except RAW & TMP histograms
    YODA::read(path+filenameYODA+".yoda.gz", aos,
    "/COMETA_ZZ_production_analysis/[a-zA-Z_]+", "/(RAW|TMP)/[a-zA-Z_]+");

    // convert yoda to flat and write resulting scatters into new file
    std::ofstream my_output_file(filenameFLAT + ".dat");
    for (size_t i(0); i<aos.size(); ++i) YODA::WriterFLAT::write(my_output_file, *aos[i]);

    return EXIT_SUCCESS;

}
```

Usage:

1. source yodaenv.sh
(in YODA-2.0.0 folder of your Rivet installation)
2. compile program e.g.
g++ <scriptname>.cc
-o
<executable_name>
'yoda-config --cflags
--libs' --std=c++17
3. ./<executable_name>

General Scatter format

```

BEGIN SCATTER2D /COMETA_ZZ_production_analysis/mee
Path=/COMETA_ZZ_production_analysis/mee
ScaledBy=9.99998242665057471e-05
Title=~
# val1      err1-      err1+      val2      err2-      err2+
8.125000e+01 2.500000e-01 2.500000e-01 4.945342e-02 9.029025e-04 9.029025e-04
8.175000e+01 2.500000e-01 2.500000e-01 5.424823e-02 9.402363e-04 9.402363e-04
8.225000e+01 2.500000e-01 2.500000e-01 6.285460e-02 1.026120e-03 1.026120e-03
8.275000e+01 2.500000e-01 2.500000e-01 6.923683e-02 1.071034e-03 1.071034e-03
8.325000e+01 2.500000e-01 2.500000e-01 7.982090e-02 1.152341e-03 1.152341e-03
8.375000e+01 2.500000e-01 2.500000e-01 8.968544e-02 1.220170e-03 1.220170e-03
8.425000e+01 2.500000e-01 2.500000e-01 1.031315e-01 1.313027e-03 1.313027e-03
8.475000e+01 2.500000e-01 2.500000e-01 1.185190e-01 1.400164e-03 1.400164e-03
8.525000e+01 2.500000e-01 2.500000e-01 1.403832e-01 1.542893e-03 1.542893e-03
8.575000e+01 2.500000e-01 2.500000e-01 1.638069e-01 1.644151e-03 1.644151e-03

```

...

```

9.825000e+01 2.500000e-01 2.500000e-01 9.604157e-02 1.266019e-03 1.266019e-03
9.875000e+01 2.500000e-01 2.500000e-01 8.476515e-02 1.189967e-03 1.189967e-03
9.925000e+01 2.500000e-01 2.500000e-01 7.523343e-02 1.128530e-03 1.128530e-03
9.975000e+01 2.500000e-01 2.500000e-01 6.542163e-02 1.049296e-03 1.049296e-03
1.002500e+02 2.500000e-01 2.500000e-01 5.657205e-02 9.653697e-04 9.653697e-04
1.007500e+02 2.500000e-01 2.500000e-01 5.252337e-02 9.359950e-04 9.359950e-04
END SCATTER2D

```

Name of Histogram: includes here name of Rivet-Analysis used & name of histogram
→ Use this analysis name even if you are not using the provided analysis (or the Rivet3 version), so that the [Rivet plotting script](#) recognizes all histograms as coming from the same analysis & plot them in the same histogram.

Histogram section begin and end
SCATTER2D: yoda scatter object for 1D Histograms

```
BEGIN SCATTER2D /COMETA_ZZ_production_analysis/mee
Path=/COMETA_ZZ_production_analysis/mee
ScaledBy=9.99998242665057471e-05
Title=~
```

# val1	err1-	err1+	val2	err2-	err2+
8.125000e+01	2.500000e-01	2.500000e-01	4.945342e-02	9.029025e-04	9.029025e-04
8.175000e+01	2.500000e-01	2.500000e-01	5.424823e-02	9.402363e-04	9.402363e-04
8.225000e+01	2.500000e-01	2.500000e-01	6.285460e-02	1.026120e-03	1.026120e-03
8.275000e+01	2.500000e-01	2.500000e-01	6.923683e-02	1.071034e-03	1.071034e-03
8.325000e+01	2.500000e-01	2.500000e-01	7.982090e-02	1.152341e-03	1.152341e-03
8.375000e+01	2.500000e-01	2.500000e-01	8.968544e-02	1.220170e-03	1.220170e-03
8.425000e+01	2.500000e-01	2.500000e-01	1.031315e-01	1.313027e-03	1.313027e-03
8.475000e+01	2.500000e-01	2.500000e-01	1.185190e-01	1.400164e-03	1.400164e-03
8.525000e+01	2.500000e-01	2.500000e-01	1.403832e-01	1.542893e-03	1.542893e-03
8.575000e+01	2.500000e-01	2.500000e-01	1.638069e-01	1.644151e-03	1.644151e-03

XS / sum of weights
*only important for
 combination of statistically
 independent runs, can be set
 to 1, if not available*

can be set like in this
 example

...

9.825000e+01	2.500000e-01	2.500000e-01	9.604157e-02	1.266019e-03	1.266019e-03
9.875000e+01	2.500000e-01	2.500000e-01	8.476515e-02	1.189967e-03	1.189967e-03
9.925000e+01	2.500000e-01	2.500000e-01	7.523343e-02	1.128530e-03	1.128530e-03
9.975000e+01	2.500000e-01	2.500000e-01	6.542163e-02	1.049296e-03	1.049296e-03
1.002500e+02	2.500000e-01	2.500000e-01	5.657205e-02	9.653697e-04	9.653697e-04
1.007500e+02	2.500000e-01	2.500000e-01	5.252337e-02	9.359950e-04	9.359950e-04

END SCATTER2D


```
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8.225000e+01	2.500000e-01	2.500000e-01	2.500000e-01	6.285460e-02	1.026120e-03	1.026120e-03
8.275000e+01	2.500000e-01	2.500000e-01	2.500000e-01	6.923683e-02	1.071034e-03	1.071034e-03
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8.375000e+01	2.500000e-01	2.500000e-01	2.500000e-01	8.968544e-02	1.220170e-03	1.220170e-03
8.425000e+01	2.500000e-01	2.500000e-01	2.500000e-01	1.031315e-01	1.313027e-03	1.313027e-03
8.475000e+01	2.500000e-01	2.500000e-01	2.500000e-01	1.185190e-01	1.400164e-03	1.400164e-03
8.525000e+01	2.500000e-01	2.500000e-01	2.500000e-01	1.403832e-01	1.542893e-03	1.542893e-03
8.575000e+01	2.500000e-01	2.500000e-01	2.500000e-01	1.638069e-01	1.644151e-03	1.644151e-03

Bin center

...

9.825000e+01	2.500000e-01	2.500000e-01	9.604157e-02	1.266019e-03	1.266019e-03
9.875000e+01	2.500000e-01	2.500000e-01	8.476515e-02	1.189967e-03	1.189967e-03
9.925000e+01	2.500000e-01	2.500000e-01	7.523343e-02	1.128530e-03	1.128530e-03
9.975000e+01	2.500000e-01	2.500000e-01	6.542163e-02	1.049296e-03	1.049296e-03
1.002500e+02	2.500000e-01	2.500000e-01	5.657205e-02	9.653697e-04	9.653697e-04
1.007500e+02	2.500000e-01	2.500000e-01	5.252337e-02	9.359950e-04	9.359950e-04

END SCATTER2D

Bin center down/up error:
in our case just half of bin width

```
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Path=/COMETA_ZZ_production_analysis/mee
ScaledBy=9.99998242665057471e-05
Title=~
```

#	val1	err1-	err1+	val2	err2-	err2+
8.125000e+01	2.500000e-01	2.500000e-01	2.500000e-01	4.945342e-02	9.029025e-04	9.029025e-04
8.175000e+01	2.500000e-01	2.500000e-01	2.500000e-01	5.424823e-02	9.402363e-04	9.402363e-04
8.225000e+01	2.500000e-01	2.500000e-01	2.500000e-01	6.285460e-02	1.026120e-03	1.026120e-03
8.275000e+01	2.500000e-01	2.500000e-01	2.500000e-01	6.923683e-02	1.071034e-03	1.071034e-03
8.325000e+01	2.500000e-01	2.500000e-01	2.500000e-01	7.982090e-02	1.152341e-03	1.152341e-03
8.375000e+01	2.500000e-01	2.500000e-01	2.500000e-01	8.968544e-02	1.220170e-03	1.220170e-03
8.425000e+01	2.500000e-01	2.500000e-01	2.500000e-01	1.031315e-01	1.313027e-03	1.313027e-03
8.475000e+01	2.500000e-01	2.500000e-01	2.500000e-01	1.185190e-01	1.400164e-03	1.400164e-03
8.525000e+01	2.500000e-01	2.500000e-01	2.500000e-01	1.403832e-01	1.542893e-03	1.542893e-03
8.575000e+01	2.500000e-01	2.500000e-01	2.500000e-01	1.638069e-01	1.644151e-03	1.644151e-03

Bin value

Statistical errors up/down:
absolute value same for up & down

...

9.825000e+01	2.500000e-01	2.500000e-01	9.604157e-02	1.266019e-03	1.266019e-03
9.875000e+01	2.500000e-01	2.500000e-01	8.476515e-02	1.189967e-03	1.189967e-03
9.925000e+01	2.500000e-01	2.500000e-01	7.523343e-02	1.128530e-03	1.128530e-03
9.975000e+01	2.500000e-01	2.500000e-01	6.542163e-02	1.049296e-03	1.049296e-03
1.002500e+02	2.500000e-01	2.500000e-01	5.657205e-02	9.653697e-04	9.653697e-04
1.007500e+02	2.500000e-01	2.500000e-01	5.252337e-02	9.359950e-04	9.359950e-04

```
END SCATTER2D
```


Scale variations

Separate histograms for scale variations

```
BEGIN SCATTER2D /COMETA_ZZ_production_analysis/mee[MUR=2__MUF=1__LHAPDF=325100]
Path=/COMETA_ZZ_production_analysis/mee[MUR=2__MUF=1__LHAPDF=325100]
ScaledBy=9.99998242665057471e-05
Title=~
# val1      err1-      err1+      val2      err2-      err2+
8.125000e+01 2.500000e-01 2.500000e-01 4.945342e-02 9.029025e-04 9.029025e-04
8.175000e+01 2.500000e-01 2.500000e-01 5.424823e-02 9.402363e-04 9.402363e-04
8.225000e+01 2.500000e-01 2.500000e-01 6.285460e-02 1.026120e-03 1.026120e-03
8.275000e+01 2.500000e-01 2.500000e-01 6.923683e-02 1.071034e-03 1.071034e-03
8.325000e+01 2.500000e-01 2.500000e-01 7.982090e-02 1.152341e-03 1.152341e-03
8.375000e+01 2.500000e-01 2.500000e-01 8.968544e-02 1.220170e-03 1.220170e-03
8.425000e+01 2.500000e-01 2.500000e-01 1.031315e-01 1.313027e-03 1.313027e-03
8.475000e+01 2.500000e-01 2.500000e-01 1.185190e-01 1.400164e-03 1.400164e-03
8.525000e+01 2.500000e-01 2.500000e-01 1.403832e-01 1.542893e-03 1.542893e-03
8.575000e+01 2.500000e-01 2.500000e-01 1.638069e-01 1.644151e-03 1.644151e-03
```

Central value
should appear
without a
weight label
(as in previous
slides)
*rivet plotting script
then automatically
detect the nominal
histogram*

recognizable by
additional weight name
in BEGIN and Path:
line

[MUR=2__MUF=1__LHAPDF=325100]

μ_R

μ_F

Weight Naming

PDF number in lhapdf
*different from nominal PDF if
PDF variations are considered*