

# A RIVETing journey: Analysis Preservation and Generator Tuning in High Energy Physics

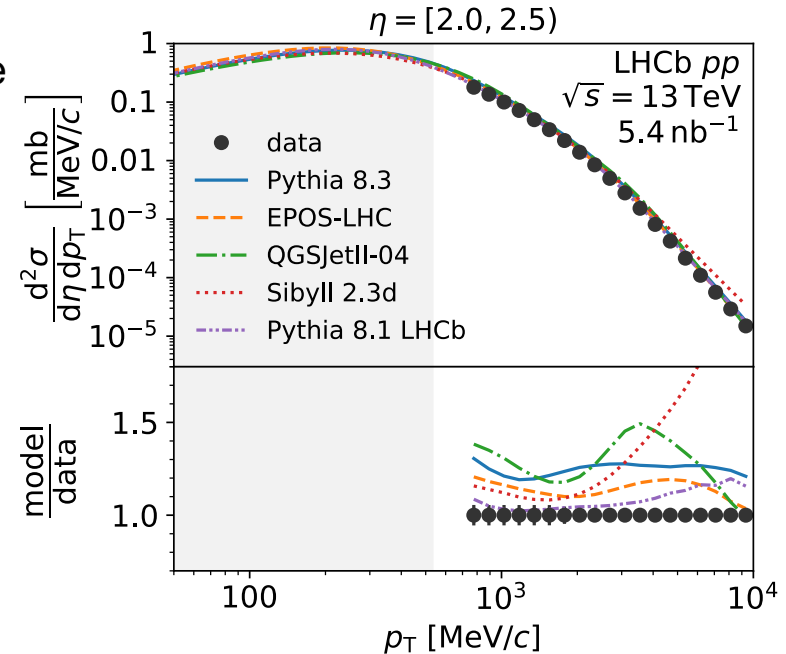
Johannes Albrecht, Hans Dembinski, **Lars Kolk**

Workshop on the tuning of hadronic interaction models

Wuppertal, 24.01.2024

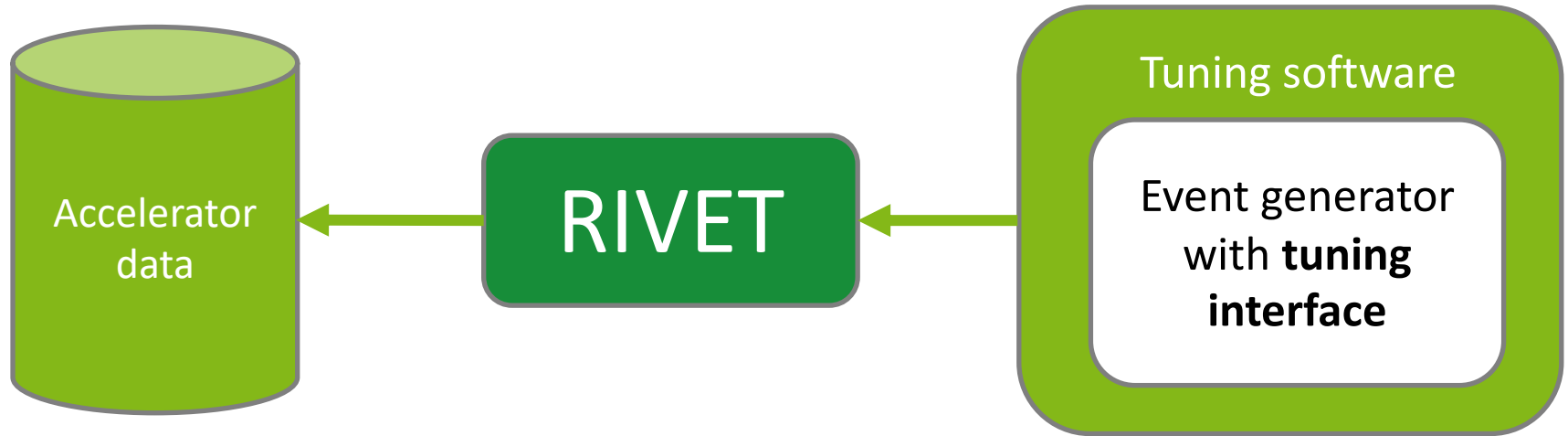
# Motivation

- Goal: Make paper results more accessible/usable
  - Make results publicly accessible
  - Provide results in machine readable format
  - Provide interface for **generator tuning**
- Archiving published analyses for public access
  - Promotes transparency and reproducibility
  - Increases impact of the analysis/paper
  - Improves utilisation of analysis for **generator tuning**
- Analysis preservation
  1. Data: [HEPdata](#)
  2. Analysis Code: [Rivet](#)



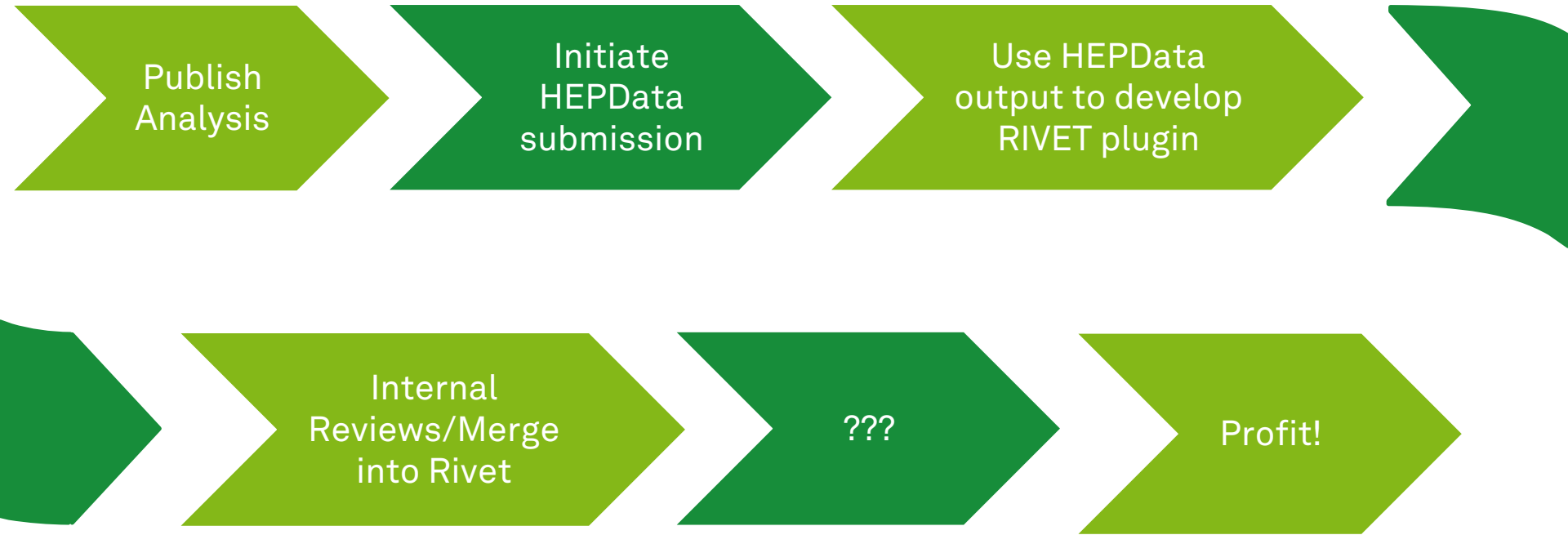
LHCb Collaboration, *JHEP* 01 (2022) 166

# HEP Generator tuning in a nutshell



Modified from H. Dembinski

# Analysis Preservation Roadmap



# HEP DATA

# HEPData

- HEPData: Open-access repository used to preserve and share experimental data
  - Maintained by CERN
  - Huge catalogue of preserved analyses
  - Ensures long-term preservation of experimental results
- HEPData Entries
  - Can be searched via many categories
  - Come with abstract and proper citation
  - Store data in tables

The screenshot displays the HEPData website interface. At the top, there is a search bar with the text "Search HEPData" and a "Search" button. To the right of the search bar, there are links for "About", "Submission Help", "File Formats", and "Sign in". Below the search bar, there are filters for "LHCb" and "Advanced", and a "JSON" button. The main content area shows search results for "Showing 10 of 82 results". A sidebar on the left contains filters for "Date" (with a histogram), "Collaboration" (LHCb: 82), "Subject\_areas" (hep-ex: 82, nucl-ex: 3, Phenomenology-HEP: 1), "Phrases" (Proton-Proton Scattering: 16, Inclusive: 15, Cross Section: 10), "CM Energies (GeV)" (0.0 ≤ √s < 1.0, 1.0 ≤ √s < 2.0, 2.0 ≤ √s < 5.0, 5.0 ≤ √s < 10.0, 10.0 ≤ √s < 100.0), and "Authors" (Charmentier, Philippe: 63). The main content area displays two search results. The first result is titled "Measurement of prompt charged-particle production in proton-proton collisions at a centre-of-mass energy of 13 TeV" by the LHCb collaboration, published in JHEP 01 (2022) 166, 2022. The second result is titled "Measurement of antiproton production in pHe collisions at √sNN = 110 GeV" by the LHCb collaboration, published in Phys.Rev.Lett. 121 (2018) 222001, 2018.

# Example HEPData entry

HEPData Search HEPData Search

Sandbox About Submission Help File Formats Dashboard Log out

Q Browse all Aaij, Roel et al. Last updated on 2023-05-26 13:02 Accessed 254 times 99 Cite Watch Record JSON

Hide Publication Information

## Measurement of prompt charged-particle production in proton-proton collisions at a centre-of-mass energy of 13 TeV

The LHCb collaboration

Aaij, Roel, Abellán Beteta, Carlos, Ackernley, Thomas, Adeva, Bernardo, Adinolfi, Marco, Afshar, Hossein, Aida, Christina Angela, Aiola, Salvatore, Ajlouni, Ziad, Akar, Simon

JHEP 01 (2022) 166, 2022.  
<https://doi.org/10.17182/hepdata.136099.v1>

Journal INSPIRE Resources

**Abstract**  
 The differential cross-section of prompt inclusive production of long-lived charged particles in proton-proton collisions is measured using a data sample recorded by the LHCb experiment at a centre-of-mass energy of  $\sqrt{s} = 13$  TeV. The data sample, collected with an unbiased trigger, corresponds to an integrated luminosity of  $5.4 \text{ fb}^{-1}$ . The differential cross-section is measured as a function of transverse momentum and pseudorapidity in the ranges  $p_T \in [0.08, 10] \text{ GeV } c^{-1}$  and  $\eta \in [2.0, 4.8]$  and is determined separately for positively and negatively charged particles. The results are compared with predictions from various hadronic-interaction models.

**Table 1** 10.17182/hepdata.136099.v1/1  
 Supplementary information  
 Differential cross-sections of prompt inclusive production of long-lived positively and negatively charged particles as a function of transverse momentum and...

**Table 2** 10.17182/hepdata.136099.v1/2  
 Supplementary information  
 Differential cross-sections of prompt inclusive production of long-lived positively and negatively charged particles as a function of transverse momentum and...

**Table 3** 10.17182/hepdata.136099.v1/3  
 Supplementary information  
 Correlation for the uncertainties of the differential cross-section of prompt inclusive production of long-lived charged particles.

**Table 4** 10.17182/hepdata.136099.v1/4  
 Supplementary information  
 Correlation for the uncertainties of the differential cross-section of prompt inclusive production of long-lived charged particles.

**Table 5** 10.17182/hepdata.136099.v1/5  
 Supplementary information  
 Correlation for the uncertainties of the differential cross-section of prompt inclusive production of long-lived charged particles.

**Table 6** 10.17182/hepdata.136099.v1/6  
 Supplementary information  
 Correlation for the uncertainties of the differential cross-section of prompt inclusive production of long-lived charged particles.

**Table 1** 10.17182/hepdata.136099.v1/1  
 Supplementary information  
 Differential cross-sections of prompt inclusive production of long-lived positively and negatively charged particles as a function of transverse momentum and pseudorapidity.

**cmenergies** 13000

**observables** DSIG/DETARAP/DPT

**phrases** QCD forward particle and resonance minimum

**reactions** p p -> charged X

Showing 50 of 156 values Show All 156 values

RE	p p -> charged X	
sqrt(s)	13000 GeV	
Charge_1	-1 e	
ETARAP	PT [GeV/c]	SIG/DETARAP/DPT [millibarn / (GeV c <sup>-1</sup> )]
2.0-2.5	0.7244 - 0.8318	8.978e+1 ±8.94e+0
2.0-2.5	0.8318 - 0.955	6.846e+1 ±8.77e+0
2.0-2.5	0.955 - 1.0965	5.058e+1 ±8.77e+0
2.0-2.5	1.0965 - 1.2589	3.619e+1 ±1.88e+0
2.0-2.5	1.2589 - 1.4454	2.515e+1 ±1.38e+0
2.0-2.5	1.4454 - 1.6596	1.6941e+1 ±8.24e-1
2.0-2.5	1.6596 - 1.9055	1.1036e+1 ±8.18e-1
2.0-2.5	1.9055 - 2.1878	6.957e+0 ±8.46e-1
2.0-2.5	2.1878 - 2.5119	4.232e+0 ±8.15e-1
2.0-2.5	2.5119 - 2.884	2.4854e+0 ±8.31e-1
2.0-2.5	2.884 - 3.3113	1.4032e+0 ±8.42e-1
2.0-2.5	3.3113 - 3.8019	7.631e-1 ±1.88e-1

**Visualize**

Brushing Enabled?

X Axis: ETARAP  
 Y Axis: PT [GeV/c]

# Example HEPData entry

HEPData

Search

Sandbox
About
Submission Help
File Formats
Dashboard
Log out

Q Browse all
Aaji, Roel et al.

Last updated on 2023-07-25 08:40
Accessed 255 times
Cite
Watch Record
JSON

[Hide Publication Information](#)

## Measurement of prompt charged-particle production in proton-proton collisions at a centre-of-mass energy of 13 TeV

The LHCb collaboration

Aaji, Roel , Abellán Beteta, Carlos , Ackemaey, Thomas , Adeva, Bernardo , Adinolfi, Marco , Akhshami Housseini , Aida, Christine Angela , Aiola, Salvatore , Ajaltouni, Ziad , Akar, Simon

**JHEP 01 (2022) 166, 2022.**

<https://doi.org/10.17182/hepdata.136099.v2>

Journal
INSPIRE
Resources

**Abstract**

The differential cross-section of prompt inclusive production of long-lived charged particles in proton-proton collisions is measured using a data sample recorded by the LHCb experiment at a centre-of-mass energy of  $\sqrt{s} = 13$  TeV. The data sample, collected with an unbiased trigger, corresponds to an integrated luminosity of  $5.4 \text{ fb}^{-1}$ . The differential cross-section is measured as a function of transverse momentum and pseudorapidity in the ranges  $p_T \in [0.08, 10] \text{ GeV } c^{-1}$  and  $\eta \in [2.0, 4.8]$  and is determined separately for positively and negatively charged particles. The results are compared with predictions from various hadronic-interaction models.

**Version 2 modifications:** The format of some of the tables was changed to ease development (and testing) of an associated RIVET plugin.

**Table 1** [10.17182/hepdata.136099.v2/t1](#)

Supplementary information

10.17182/hepdata.136099.v2/t1

Double differential cross-sections of prompt inclusive production of long-lived negatively charged particles as a function of transverse momentum and pseudorapidity.

Double differential cross-sections of prompt inclusive production of long-lived negatively charged particles as a function of transverse momentum and pseudorapidity.

**cmenergies**

13000

**observables**

DSIG/DETARAP/DPT

**phrases**

QCD, forward physics, particle and resonance production, minimum bias, cross section

**reactions**

p p → charged X

RE	p p → charged X					
<b>sqrt(s)</b>	13000 GeV					
<b>Charge_1</b>	-1 e					
<b>YRAP</b>	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-4.8
<b>PT [GeV/c]</b>	<b>SIG/DETARAP/DPT [millibarn / (GeV c<sup>-1</sup>)]</b>					
0.0794 - 0.0912	-	-	-	-	-	199 <small>stat</small>
0.0912 - 0.1047	-	-	-	-	-	228 <small>stat</small>
0.1047 - 0.1202	-	-	-	-	264 <small>stat</small>	251 <small>stat</small>
0.1202 - 0.138	-	-	-	-	285 <small>stat</small>	272 <small>stat</small>
0.138 - 0.1585	-	-	-	-	300 <small>stat</small>	289 <small>stat</small>
0.1585 - 0.182	-	-	-	-	306 <small>stat</small>	299 <small>stat</small>
0.182 - 0.2089	-	-	-	334 <small>stat</small>	308 <small>stat</small>	304 <small>stat</small>

**Visualize**

**Sum errors**  **Log Scale (X)**  **Log Scale (Y)**

Deselect variables or hide different error bars by clicking on them.

**Variables**

SIG/DETARAP/DPT (millibarn / (GeV c<sup>-1</sup>))

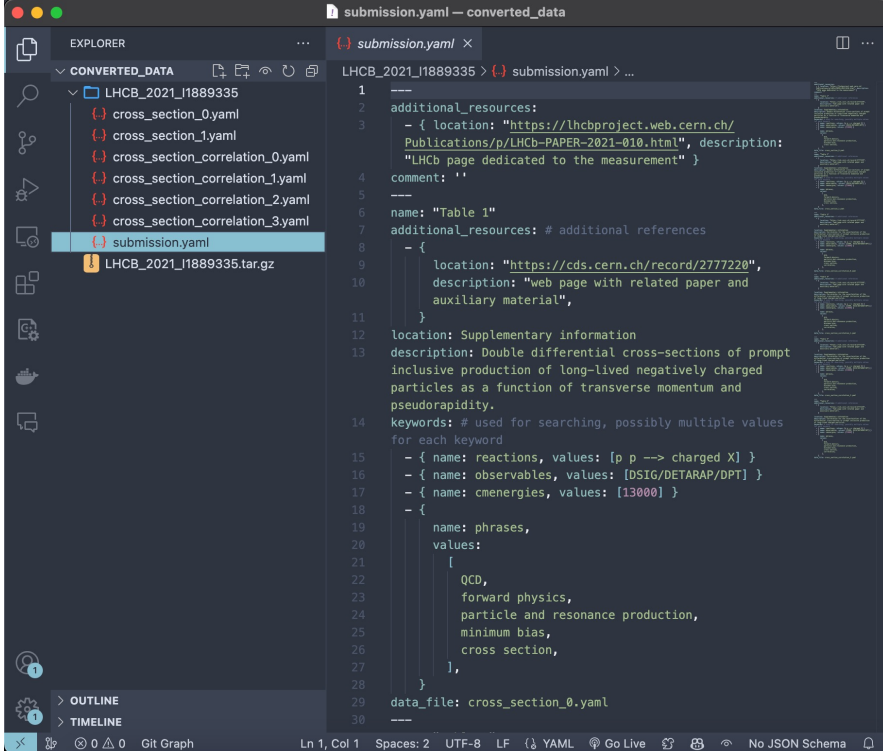
YRAP: 4.5-4.8

Summed error



# HEPData-Submissions

- Each submission consists of ...
- One `submission.yaml`
  - Links to every table in the submission
  - Provides metadata for the HEPData entry
- One `.yaml` file for every table in the entry
  - Contain data points, errors
- Refer to [documentation](#) or previously uploaded entries : )
- Contact your [coordinator](#) to initiate a submission
- Use [hepdata-validator](#) or [HEPData sandbox](#) to validate your files



```
1  ---
2  additional_resources:
3  - { location: "https://lhcbproject.web.cern.ch/
4    Publications/p/LHCB-PAPER-2021-010.html", description:
5    "LHCB page dedicated to the measurement" }
6  comment: ''
7  ---
8  name: "Table 1"
9  additional_resources: # additional references
10 - {
11   location: "https://cds.cern.ch/record/2777220",
12   description: "web page with related paper and
13   auxiliary material",
14 }
15 location: Supplementary information
16 description: Double differential cross-sections of prompt
17 inclusive production of long-lived negatively charged
18 particles as a function of transverse momentum and
19 pseudorapidity.
20 keywords: # used for searching, possibly multiple values
21 for each keyword
22 - { name: reactions, values: [p p --> charged X] }
23 - { name: observables, values: [DSIG/DETARAP/DPT] }
24 - { name: cnergies, values: [13000] }
25 - {
26   name: phrases,
27   values:
28     [
29       QCD,
30       forward physics,
31       particle and resonance production,
32       minimum bias,
33       cross section,
34     ],
35 }
36 data_file: cross_section_0.yaml
37 ---
```

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- Each submission consists of ...
- One `submission.yaml`
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  - Provides metadata for the HEPData entry
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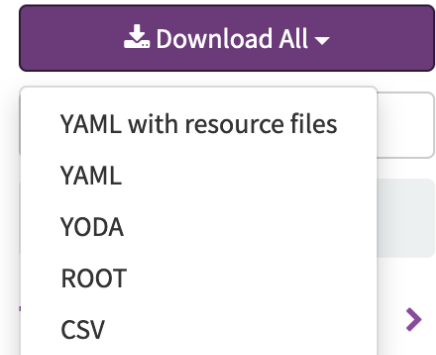
```
1 dependent_variables:
2   - header: {name: SIG/DETARAP/DPT, units: millibarn / (GeV
3     c^-1)}
4   qualifiers:
5     - {name: RE, value: p p -> charged X}
6     - {name: sqrt(s), units: GeV, value: 13000}
7     - {name: Charge_1, units: e, value: -1}
8     - {name: YRAP, value: 2.0-2.5}
9   values:
10     - {value: '-'}
11     - {value: '-'}
12     - {value: '-'}
13     - {value: '-'}
14     - {value: '-'}
15     - {value: '-'}
16     - {value: '-'}
17     - {value: '-'}
18     - {value: '-'}
19     - {value: '-'}
20     - {value: '-'}
21     - {value: '-'}
22     - {value: '-'}
23     - {value: '-'}
24     - {value: '-'}
25     - value: '90'
26     errors:
27       - {symerror: '5'}
28     - value: '68'
29     errors:
30       - {symerror: '4'}
31     - value: '50.6'
32     errors:
33       - {symerror: '2.8'}
34     - value: '36.2'
35     errors:
36       - {symerror: '2.0'}
```

# RIVET



# Rivet

- **Rivet**: Most widespread way by which analysis code from the LHC and other high-energy collider experiments is preserved.
  - Used for generator tuning
  - Provides set of experimental analyses
  - Rivet [wishlist](#), [installation](#)
- Analysis name: <Experiment>\_<publication\_year>\_l<InspireID>
  - E.g.: LHCb\_2021\_l1889335
- Each Rivet-analysis consists of one ...
  - **.cc** file containing the analysis code
  - **.yoda** file containing the data points (from HEPData)
  - **.info** file containing metadata
  - **.plot** file setting plotting options



# Rivet Analysis Code

- An analysis is usually written in **one .cc** file containing
  - A no-argument constructor
  - Three analysis event loop methods:
    1. **init**: book histograms, initialise counters, etc.
    2. **analyze**: per event: select particles, apply cuts, construct observables, fill histograms etc.
    3. **finalize**: normalize/scale/divide histograms, tuples, etc.
  - A minimal hook into the plugin system
- Projections: observable calculator objects that are called by the analysis' **apply(event)** method.
  - Refer to projection declared in **init** method
- Compiled via **rivet-build <NAME>.cc**
  - Generates a **RivetAnalysis.so** file

```
1 // -cvs-
2 #include "Rivet/Analysis.hh"
3 #include "Rivet/Projections/AliceCommon.hh"
4
5 namespace Rivet
6 {
7
8   // @brief Inelastic section in pp collisions at 13 TeV for charged particles in LHCb acceptance
9   class LHCB_2021_I1889335 : public Analysis
10  {
11  public:
12    // Constructor
13    RIVET_DEFAULT_ANALYSIS_CTOR(LHCB_2021_I1889335);
14
15    // @name Analysis methods
16    // @/
17
18    // Book histograms and initialise projections before the run
19    void init()
20    {
21      // Register projection for primary particles
22      declare ALICE::PrimaryParticles(Cuts::etaIn(ETAMIN, ETAMAX) && Cuts::abscharge > 0, "APRIM");
23
24      (HistoDPtr tmp: _h_ppInel_neg.add(2.0, 2.5, book(tmp, 1, 1)));
25      (HistoDPtr tmp: _h_ppInel_neg.add(2.5, 3.0, book(tmp, 1, 2)));
26      (HistoDPtr tmp: _h_ppInel_neg.add(3.0, 3.5, book(tmp, 1, 3)));
27      (HistoDPtr tmp: _h_ppInel_neg.add(3.5, 4.0, book(tmp, 1, 4)));
28      (HistoDPtr tmp: _h_ppInel_neg.add(4.0, 4.5, book(tmp, 1, 5)));
29      (HistoDPtr tmp: _h_ppInel_neg.add(4.5, 4.0, book(tmp, 1, 6)));
30
31      (HistoDPtr tmp: _h_ppInel_pos.add(2.0, 2.5, book(tmp, 2, 1)));
32      (HistoDPtr tmp: _h_ppInel_pos.add(2.5, 3.0, book(tmp, 2, 2)));
33      (HistoDPtr tmp: _h_ppInel_pos.add(3.0, 3.5, book(tmp, 2, 3)));
34      (HistoDPtr tmp: _h_ppInel_pos.add(3.5, 4.0, book(tmp, 2, 4)));
35      (HistoDPtr tmp: _h_ppInel_pos.add(4.0, 4.5, book(tmp, 2, 5)));
36      (HistoDPtr tmp: _h_ppInel_pos.add(4.5, 4.0, book(tmp, 2, 6)));
37
38    }
39
40    void analyze(const Event &event)
41    {
42      const Particles cfs = apply<ALICE::PrimaryParticles>(event, "APRIM").particles();
43
44      for (const Particle& myp : cfs)
45      {
46        if (myp.charge() < 0)
47        {
48          _h_ppInel_neg.fill(myp.pseudorapidity(), myp.momentum().pT());
49        }
50        else
51        {
52          _h_ppInel_pos.fill(myp.pseudorapidity(), myp.momentum().pT());
53        }
54      }
55    }
56
57    // Normalise histograms etc., after the run
58    void finalize()
59    {
60      const double scale_factor = crossSection() / millibarn / sumOfWeights();
61      std::vector<double> binWidths = {0.5, 0.5, 0.5, 0.5, 0.5, 0.3};
62      for (size_t i = 0; i < binWidths.size(); i++)
63      {
64        _h_ppInel_neg.histos()[i] *= scale_factor / binWidths[i];
65        _h_ppInel_pos.histos()[i] *= scale_factor / binWidths[i];
66      }
67    }
68
69    // @name Histogram
70    BinnedHistogram _h_ppInel_neg;
71    BinnedHistogram _h_ppInel_pos;
72
73    // Cut constants
74    const double ETAMIN = 2.0, ETAMAX = 4.0;
75  };
76  RIVET_DECLARE_PLUGIN(LHCB_2021_I1889335);
77 }
78 }
```

# Rivet Analysis Code

C++ LHCb\_2021\_I1889335.cc 3 x

C++ LHCb\_2021\_I1889335.cc > ...

```
1  |// -*-C++ - *-
2  |#include "Rivet/Analysis.hh"
3  |#include "Rivet/Projections/AliceCommon.hh"
4
5  |namespace Rivet
6  |{
7
8  |    /// @brief Inelastic section in pp collisions at 13 TeV for charged particles in LHCb acceptance
9  |    class LHCb_2021_I1889335 : public Analysis
10 |    {
11 |    public:
12 |        /// Constructor
13 |        RIVET_DEFAULT_ANALYSIS_CTOR(LHCb_2021_I1889335);
14 |
15 |        /// @name Analysis methods
16 |        //@{
17 |
18 |        /// Book histograms and initialise projections before the run
```

# Rivet Analysis Code

```
18 // book histograms and initialise projections before the run
19 void init()
20 {
21
22     // Register projection for primary particles
23     declare(ALICE::PrimaryParticles(Cuts::etaIn(ETAMIN, ETAMAX) && Cuts::abscharge > 0), "APRIM");
24
25     {HistodPtr tmp; _h_ppInel_neg.add(2.0, 2.5, book(tmp, 1, 1, 1));}
26     {HistodPtr tmp; _h_ppInel_neg.add(2.5, 3.0, book(tmp, 1, 1, 2));}
27     {HistodPtr tmp; _h_ppInel_neg.add(3.0, 3.5, book(tmp, 1, 1, 3));}
28     {HistodPtr tmp; _h_ppInel_neg.add(3.5, 4.0, book(tmp, 1, 1, 4));}
29     {HistodPtr tmp; _h_ppInel_neg.add(4.0, 4.5, book(tmp, 1, 1, 5));}
30     {HistodPtr tmp; _h_ppInel_neg.add(4.5, 4.8, book(tmp, 1, 1, 6));}
31
32     {HistodPtr tmp; _h_ppInel_pos.add(2.0, 2.5, book(tmp, 2, 1, 1));}
33     {HistodPtr tmp; _h_ppInel_pos.add(2.5, 3.0, book(tmp, 2, 1, 2));}
34     {HistodPtr tmp; _h_ppInel_pos.add(3.0, 3.5, book(tmp, 2, 1, 3));}
35     {HistodPtr tmp; _h_ppInel_pos.add(3.5, 4.0, book(tmp, 2, 1, 4));}
36     {HistodPtr tmp; _h_ppInel_pos.add(4.0, 4.5, book(tmp, 2, 1, 5));}
37     {HistodPtr tmp; _h_ppInel_pos.add(4.5, 4.8, book(tmp, 2, 1, 6));}
38 }
39
```

# Rivet Analysis Code

```
38     }
39
40     void analyze(const Event &event)
41     {
42
43         const Particles cfs = apply<ALICE::PrimaryParticles>(event, "APRIM").particles();
44
45         for (const Particle& myp : cfs)
46         {
47             if (myp.charge() < 0)
48             {
49                 _h_ppInel_neg.fill(myp.pseudorapidity(), myp.momentum().pT());
50             }
51             else
52             {
53                 _h_ppInel_pos.fill(myp.pseudorapidity(), myp.momentum().pT());
54             }
55         }
56     }
57 }
```

• Generates a RivetAnalysis.S0 file

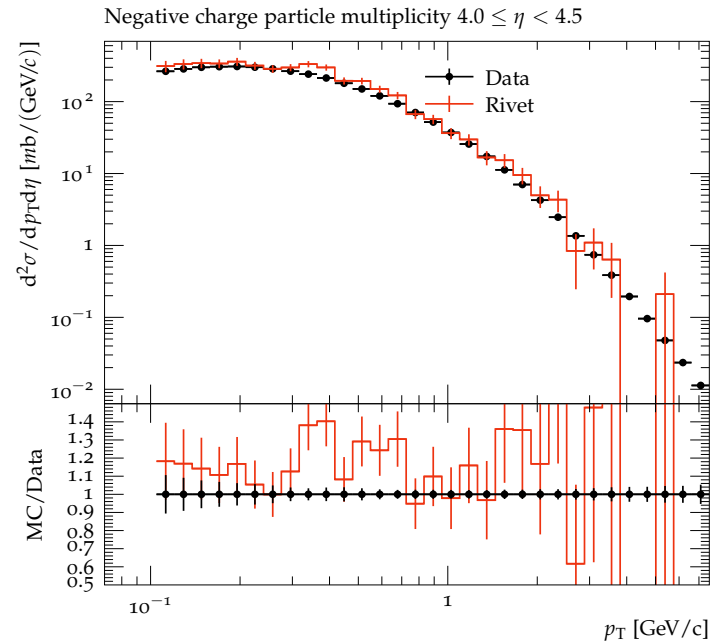


# Rivet Analysis Code

```
58 // Normalise histograms etc., after the run
59 void finalize()
60 {
61     const double scale_factor = crossSection() / millibarn / sumOfWeights();
62     std::vector<double> binWidths = {0.5, 0.5, 0.5, 0.5, 0.5, 0.3};
63     for (size_t i = 0; i < binWidths.size(); i++)
64     {
65         _h_ppInel_neg.histos()[i]->scaleW(scale_factor / binWidths[i]);
66         _h_ppInel_pos.histos()[i]->scaleW(scale_factor / binWidths[i]);
67     }
68 }
69
70 // @name Histogram
71 BinnedHistogram _h_ppInel_neg;
72 BinnedHistogram _h_ppInel_pos;
73
74 // Cut constants
75 const double ETAMIN = 2.0, ETAMAX = 4.8;
76 };
77
78 RIVET_DECLARE_PLUGIN(LHCB_2021_I1889335);
79 }
```

# Running and submitting a Rivet-plugin

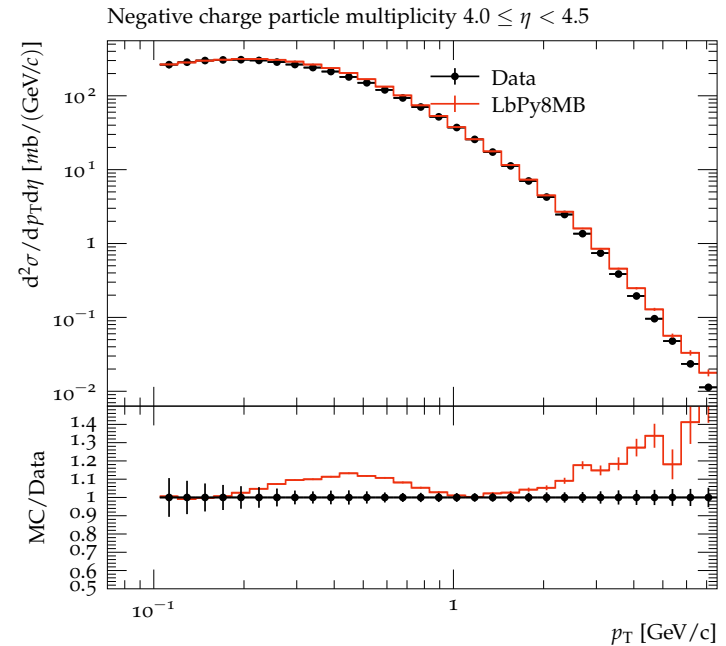
- You can run your compiled code via `rivet -a <Name> <inputfile>`
  - inputfile: **.hepmc** file
  - Style: **.plot** file
  - Rivet provides [example files](#) to test on
  - Alternative: Let your favourite generator generate some events for you!
  - Produces **Rivet.yoda** file
- Plotting: `rivet-mkhtml --errs Rivet.yoda`
- Outputs look sane → Internal Review /MR in [RIVET](#)



$10^3$  MB events - LHC-13-Minbias.hepmc.gz

# Running and submitting a Rivet-plugin

- You can run your compiled code via `rivet -a <Name> <inputfile>`
  - inputfile: `.hepmc` file
  - Style: `.plot` file
  - Rivet provides [example files](#) to test on
  - Alternative: Let your favourite generator generate some events for you!
  - Produces `Rivet.yoda` file
- Plotting: `rivet-mkhtml --errs Rivet.yoda`
- Outputs look sane → Internal Review /MR in [RIVET](#)



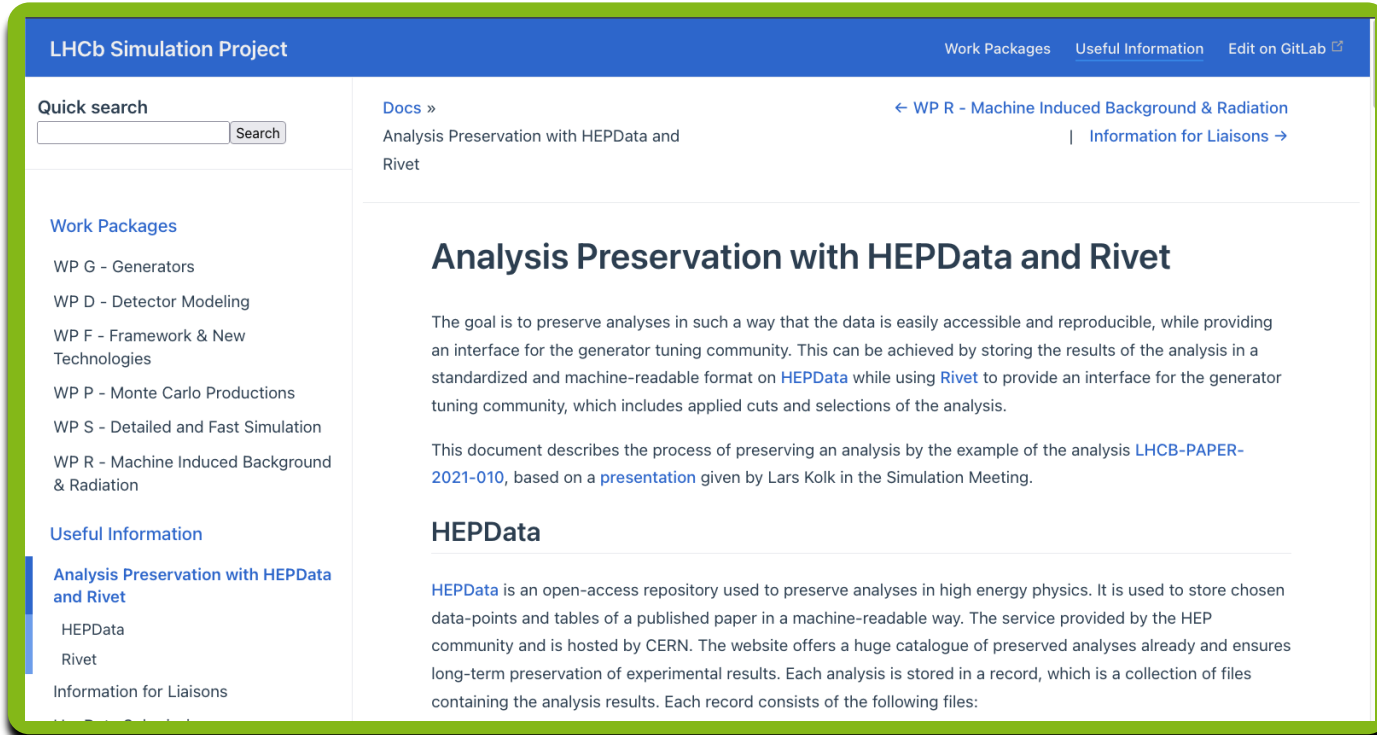
10<sup>6</sup> MB events - Gauss v56r4  
provided by A. Grecu

# Additional Remarks



# Analysis Preservation Guide

- Written [Analysis Preservation Guide](#), including all important steps



The screenshot shows the LHCb Simulation Project website. The main content area is titled "Analysis Preservation with HEPData and Rivet". The page includes a navigation menu on the left with sections for "Work Packages" and "Useful Information". The "Work Packages" section lists: WP G - Generators, WP D - Detector Modeling, WP F - Framework & New Technologies, WP P - Monte Carlo Productions, WP S - Detailed and Fast Simulation, and WP R - Machine Induced Background & Radiation. The "Useful Information" section lists: Analysis Preservation with HEPData and Rivet, HEPData, Rivet, and Information for Liaisons. The main content area has a breadcrumb trail: "Docs » <- WP R - Machine Induced Background & Radiation | Information for Liaisons ->". The main heading is "Analysis Preservation with HEPData and Rivet". The text below the heading states: "The goal is to preserve analyses in such a way that the data is easily accessible and reproducible, while providing an interface for the generator tuning community. This can be achieved by storing the results of the analysis in a standardized and machine-readable format on HEPData while using Rivet to provide an interface for the generator tuning community, which includes applied cuts and selections of the analysis." Below this, it says: "This document describes the process of preserving an analysis by the example of the analysis LHCb-PAPER-2021-010, based on a presentation given by Lars Kolk in the Simulation Meeting." The next section is titled "HEPData" and contains the text: "HEPData is an open-access repository used to preserve analyses in high energy physics. It is used to store chosen data-points and tables of a published paper in a machine-readable way. The service provided by the HEP community and is hosted by CERN. The website offers a huge catalogue of preserved analyses already and ensures long-term preservation of experimental results. Each analysis is stored in a record, which is a collection of files containing the analysis results. Each record consists of the following files:"

# Connection to SFB1491

- F3 & F4 Deliverables: “Selected LHCb analyses will have been adopted for the use with Rivet”
- Provide plugins for generator tuning in (astro)-particle physics
- Several rivet plugins written by Chloé, e.g.
  - [NA61SHINE\\_2019\\_I1754136](#)
  - [HARP\\_2008\\_I778842](#)
  - [HARPCDP\\_2010\\_I863735](#)
  - [LHCB\\_2011\\_I891233](#)
- Pion/Kaon/Proton projectile against carbon target in forward rapidity regions

# Summary

- Archiving published analyses for public access
  - Promotes transparency and reproducibility
  - Increases impact of analyses
- Analyses can be archived ...
  - Data: HEPData
  - Code: Rivet
- Preservation procedure shown by example LHCb\_2021\_I1889335
- Written guide to help with analysis preservation
- Rivet plugins are important deliverables for the SFB
- Rivet plugins can be used by **anybody's** generators based off **your** results!