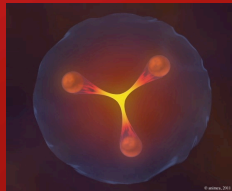


DE LA RECHERCHE À L'INDUSTRIE

cea

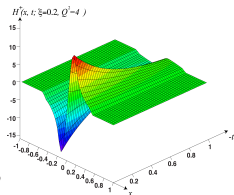
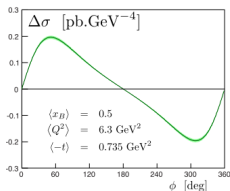
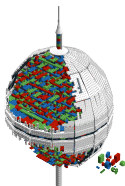


www.cea.fr

STRONG  
2020

PARTONS

## Status of PARTONS



3DPartons Week | Hervé MOUTARDE

Oct. 26, 2022

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093.

université  
PARIS-SACLAY

## Status of PARTONS

- 3DPartons gives access to **open-source code** necessary for high precision phenomenology in the field of 3D hadron structure, with a specific emphasis on GPDs and TMDs.
- It consists of **several libraries organized within a fully modular and open architecture**, which allows the possibility of permanent improvement by the addition of new models, channels or theoretical refinements.

## Context

### Virtual access

Expression of needs

### Development and dissemination

Ecosystem

New features

Administration

### Conclusion

### Abbreviations

## Aims

- 1 Make sure we can use existing codes **together**.
- 2 **Mutualize** common tools.
- 3 **Save time** for future developments by building on existing tools or solutions.
- 4 **Devise common solutions** for similar problems from **different subfields**.

## Status of PARTONS

### Context

Virtual access

Expression of needs

### Development and dissemination

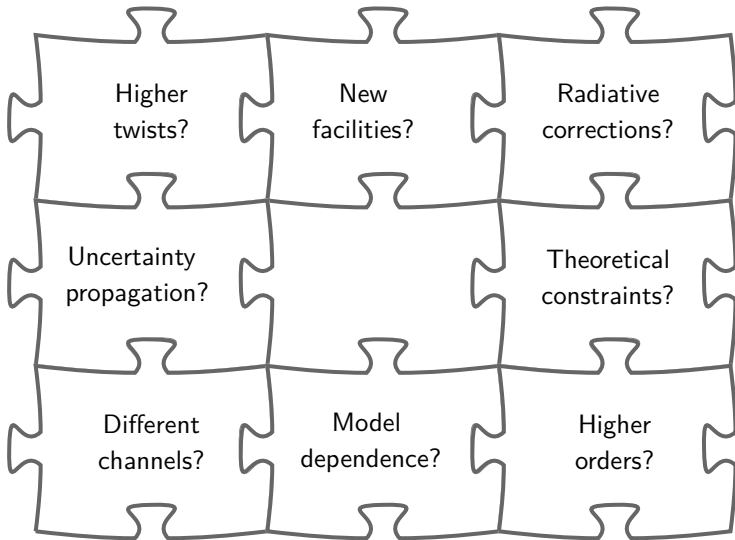
Ecosystem

New features

Administration

### Conclusion

### Abbreviations



## Status of PARTONS

### Context

Virtual access

Expression of needs

### Development and dissemination

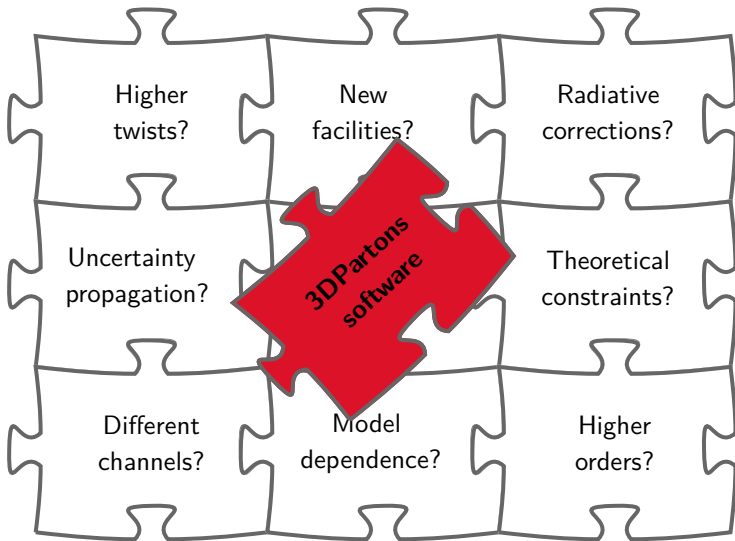
Ecosystem

New features

Administration

### Conclusion

### Abbreviations



## Status of PARTONS

### Context

Virtual access

Expression of needs

### Development and dissemination

Ecosystem

New features

Administration

### Conclusion

### Abbreviations



Pivotal year for GPDs

2011 situation  
GPDs and DVCS  
Leading twist, leading order  
Selected data

Status of GPD analysis

Extraction methods  
Universality  
Key results

Future orientations  
COMPASS-II  
JLab's 12 GeV upgrade  
Spin observables on an EIC

The PROPHET package

Conclusions

## PROPHET.

Platform for Representing the Organization of Partons inside Hadrons and Experimental Tomographies.

- ① Comprehensive **database of experimental results.**
- ② Comprehensive **database of theoretical predictions.**
- ③ **Fitting engine.**
- ④ **Propagation** of statistic and systematic **uncertainties.**
- ⑤ **Visualizing software** to compare experimental results and model expectations.
- ⑥ Connection to **experimental set-up descriptions** to design new experiments.
- ⑦ **Interactive website** providing free access to model and experimental values.

## Status of PARTONS

### Context

Virtual access

Expression of needs

### Development and dissemination

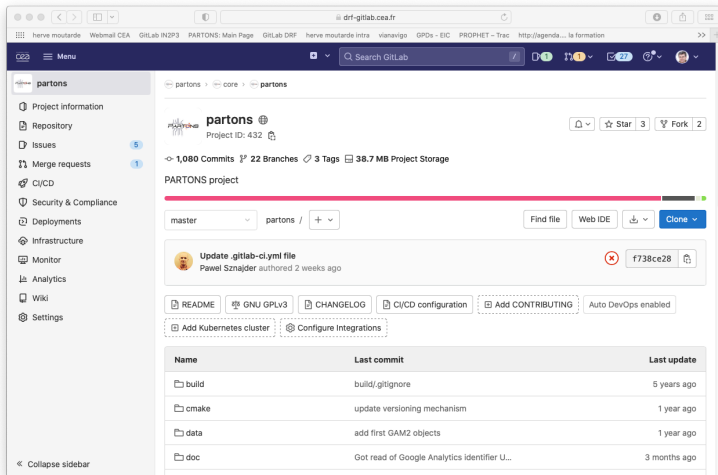
Ecosystem

New features

Administration

### Conclusion

### Abbreviations



partons

Project information

Repository

Issues 5

Merge requests 1

CI/CD

Security & Compliance

Deployments

Infrastructure

Monitor

Analytics

Wiki

Settings

partons > core > partons

partons   
 Project ID: 432

1,080 Commits 22 Branches 3 Tags 38.7 MB Project Storage

PARTONS project

master partons / +

Find file Web IDE Download Clone

Update .gitlab-ci.yml file   
 Pawel Sznajder authored 2 weeks ago   
 f738ce28

README GNU GPLv3 CHANGELOG CI/CD configuration Add CONTRIBUTING Auto DevOps enabled

Add Kubernetes cluster Configure Integrations

Name	Last commit	Last update
build	build/.gitignore	5 years ago
cmake	update versioning mechanism	1 year ago
data	add first GAM2 objects	1 year ago
doc	Got read of Google Analytics identifier U...	3 months ago

« Collapse sidebar

# Development and dissemination

## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features  
Administration

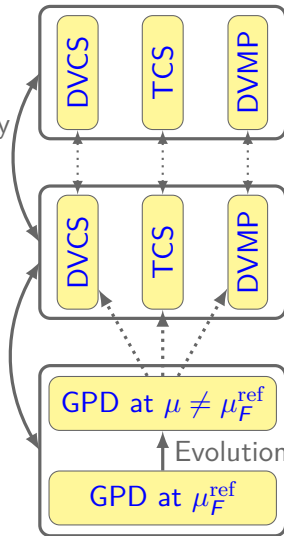
### Conclusion

### Abbreviations

Full processes  
Experimental data and phenomenology

Small distance  
Computation of amplitudes

Large distance  
First principles and fundamental parameters



PARtonic  
Tomography  
Of  
Nucleon  
Software

- Perturbative approximations.
- Physical models.
- Fits.
- Numerical methods.
- Accuracy and speed.

[Berthou et al. \(2015\)](#)



## Status of PARTONS

### Context

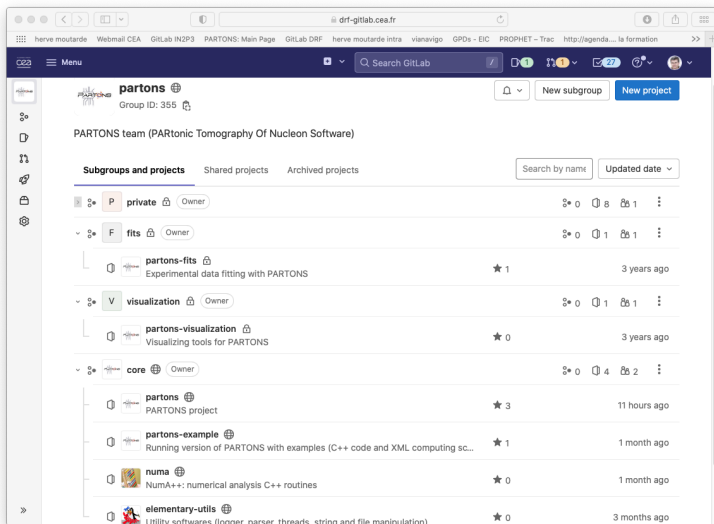
Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features  
Administration

### Conclusion

### Abbreviations



drf-gitlab.cea.fr

herve moutarde | Webmail CEA | GitLab IN2P3 | PARTONS: Main Page | GitLab DRF | herve moutarde intra | vianavigo | GPDs - EIC | PROPHET - Trac | http://agenda... la formation

Menu | Search GitLab

**partons** | Group ID: 355

PARTONS team (PARTonic Tomography Of Nucleon Software)

Subgroups and projects | Shared projects | Archived projects

Visibility	Project Name	Description	Stars	Updated
Private	private		0	1
Private	fits		0	1
Private	partons-fits	Experimental data fitting with PARTONS	1	3 years ago
Private	visualization		0	1
Private	partons-visualization	Visualizing tools for PARTONS	0	3 years ago
Public	core		0	4
Public	partons	PARTONS project	3	11 hours ago
Public	partons-example	Running version of PARTONS with examples (C++ code and XML computing sc...	1	1 month ago
Public	numa	NumA++: numerical analysis C++ routines	0	1 month ago
Public	elementary-utils	Utility softwares (loopers, parser, threads, string and file manipulation)	0	3 months ago

## Status of PARTONS

### Context

Virtual access  
Expression of needs

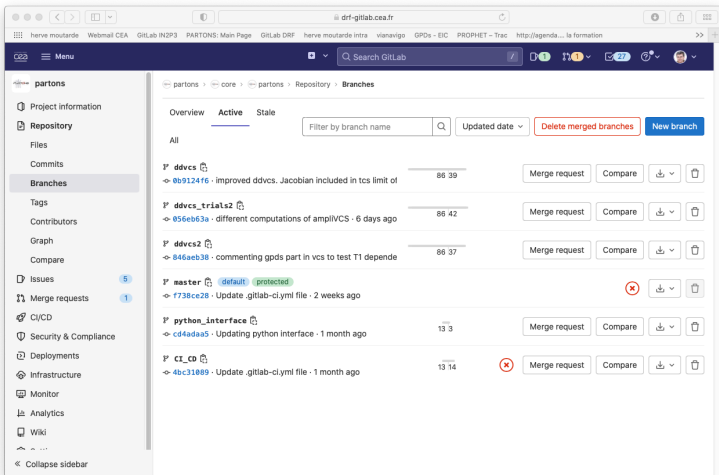
### Development and dissemination

#### Ecosystem

New features  
Administration

### Conclusion

### Abbreviations



The screenshot shows the GitHub web interface for the 'partons' repository. The left sidebar contains navigation options: partons, Project information, Repository, Files, Commits, Branches (selected), Tags, Contributors, Graph, Compare, Issues (5), Merge requests (1), CI/CD, Security & Compliance, Deployments, Infrastructure, Monitor, Analytics, Wiki, and Collapse sidebar. The main content area displays the 'Branches' page with tabs for Overview, Active, and Stale. A search bar and 'Updated date' dropdown are visible. The list of branches includes:

- ddvcs** (86 39): Improved ddvcs. Jacobian included in tcs limit of. Merge request, Compare, Download, Delete.
- ddvcs\_trials2** (86 42): Different computations of amplIVCS · 6 days ago. Merge request, Compare, Download, Delete.
- ddvcs2** (86 37): Commenting gpds part in vcs to test T1 depende. Merge request, Compare, Download, Delete.
- master** (default, protected, 2 weeks ago): Update .gitlab-ci.yml file. Merge request, Compare, Download, Delete.
- python\_interface** (13 3): Updating python interface · 1 month ago. Merge request, Compare, Download, Delete.
- CI\_CD** (13 14): Update .gitlab-ci.yml file · 1 month ago. Merge request, Compare, Download, Delete.

## Status of PARTONS

### Context

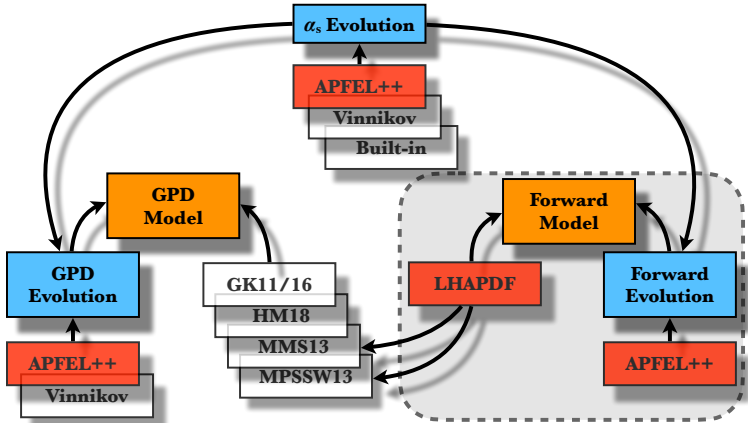
Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features  
Administration

### Conclusion

### Abbreviations



## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features  
Administration

### Conclusion

### Abbreviations

```

18 <!-- Define physics assumptions -->
19 <computation_configuration>
20
21 <!-- Select collinear distribution model -->
22 <module type="CollinearDistributionModule" name="CollinearDistributionLHAPDF">
23
24   <!-- Indicate name of the LHAPDF set, member, and type -->
25   <param name="setName" value="CT14nnlo" />
26   <param name="member" value="0" />
27   <param name="collinear_distribution_type" value="UnpolPDF"/>
28
29   <!-- Select collinear distribution evolution model and its parameters -->
30   <module type="CollinearDistributionEvolutionModule" name="CollinearDistributionEvolutionApfel">
31     <param name="muF2Ref" value="1.677025" />
32     <param name="qcd_order_type" value="NNLO" />
33     <param name="collinear_distribution_type" value="UnpolPDF" />
34     <param name="thresholds" value="0,0,0,1.3,4.75,172" />
35     <param name="masses" value="0,0,0,1.3,4.75,172" />
36     <param name="subgridNodes" value="100,60,50,50" />
37     <param name="subgridLowerBounds" value="0.0001,0.1,0.6,0.8" />
38     <param name="subgridInterDegrees" value="3,3,3,3" />
39     <param name="tabNodes" value="100" />
40     <param name="tabLowerBound" value="1" />
41     <param name="tabUpperBound" value="1000" />
42     <param name="tabInterDegree" value="3" />
43
44     <!-- Select alpha_s model -->
45     <module type="RunningAlphaStrongModule" name="RunningAlphaStrongVinnikov">
46       </module>
47     </module>
48   </module>
49 </computation_configuration>

```

## Status of PARTONS

### Context

Virtual access  
Expression of needs

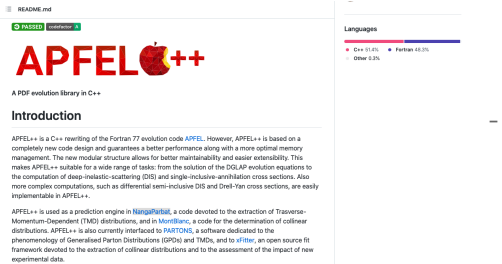
### Development and dissemination

Ecosystem  
New features  
Administration

### Conclusion

### Abbreviations

- Evolution code for PDFs, GPDs and TMDs.
- APFEL++ numerically solves evolution equations in  $x$ -space.
- Fully modular.
- Heavy quark threshold crossing.



README.md

APFEL++

A PDF evolution library in C++

### Introduction

APFEL++ is a C++ rewriting of the Fortran 77 evolution code [APFEL](#). However, APFEL++ is based on a completely new code design and guarantees a better performance along with a more optimal memory management. The new modular structure allows for better maintainability and easier extensibility. This makes APFEL++ suitable for a wide range of tasks: from the solution of the DGLAP evolution equations to the computation of deep-inelastic-scattering (DIS) and single-inclusive-annihilation cross sections. Also more complex computations, such as differential semi-inclusive DIS and Drell-Yan cross sections, are easily implementable in APFEL++.

APFEL++ is used as a prediction engine in [NangaParati](#), a code devoted to the extraction of Transverse-Momentum-Dependent (TMD) distributions, and in [MontBlanc](#), a code for the determination of collinear distributions. APFEL++ is also currently interfaced to [PARTONS](#), a software dedicated to the phenomenology of Generalized Parton Distributions (GPDs) and TMDs, and to [sFitter](#), an open source fit framework devoted to the extraction of collinear distributions and to the assessment of the impact of new experimental data.

Languages

- C++ 91.4%
- Fortran 48.3%
- Other 0.2%

 Bertone *et al.* (2022)

 See Valerio's talk on Friday and Hervé's talk on Wednesday

## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

#### Ecosystem

New features  
Administration

### Conclusion

### Abbreviations



EpIC: Monte Carlo generator for exclusive processes

This page:

[about](#)  
[installation](#)  
[usage](#)  
[license](#)  
[acknowledgements](#)  
[contact](#)

View project on GitHub:  
[link](#)

View Doxygen documentation:  
[link](#)

View reference article:  
[arXiv](#) [inspire](#)

Hosted on GitHub Pages  
Theme based on [minimal](#)  
2022-05-05 13:20 UTC

## About

### What is EpIC?

EpIC is a modern and versatile Monte Carlo generator used in studying exclusive processes. These processes are sensitive to generalised parton distributions (GPDs), which describe the 3D partonic structure of hadrons in the language of quantum chromodynamics (QCD). EpIC has been developed to support the current and future experimental programmes, like [electron-ion collider \(EIC\)](#) to be constructed in Brookhaven National Laboratory.

EpIC is based on [PARTONS framework](#), which provides the basic elements of its architecture. PARTONS is also used to evaluate Born cross-sections, which together with radiative corrections implemented in EpIC, are used to generate unweighted Monte Carlo events.

Exclusive processes currently available in EpIC are:

- deeply virtual Compton scattering (DVCS)
- time-like Compton scattering (TCS)
- deeply virtual meson production (DVMP), only  $\pi^0$  case

We refer to [PARTONS documentation of modules](#) for information on theory developments (like GPD models) available for the evaluation of Born cross-sections.

EpIC is written in C++. It utilises paradigms of the modular programming. Each step of the generation of Monte Carlo events is well distinguished from the others, allowing for the encapsulation of specific pieces of the code into easy-to-develop modules. The flow of data between the modules is supervised by services.

[Aschenauer et al. \(2022\)](#)

See Kemal's, Daria's and Salvatore's talks on Wednesday

## Status of PARTONS

### Context

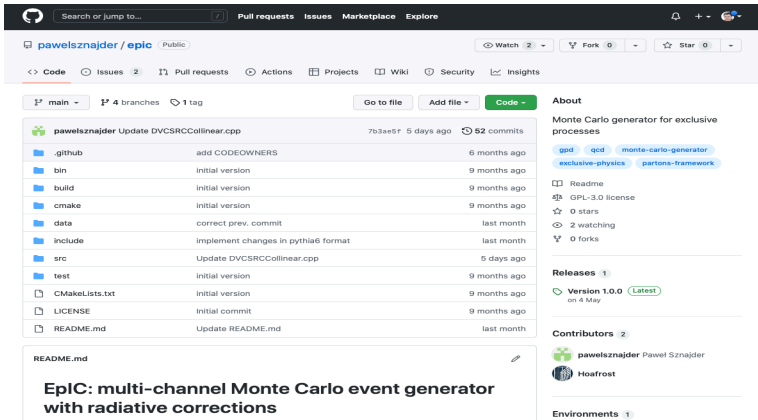
Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features  
Administration

### Conclusion

### Abbreviations



The screenshot shows the GitHub repository page for 'pawelsznajder / epic'. The repository is public and has 4 branches and 1 tag. The main branch is selected. The repository description is 'Monte Carlo generator for exclusive processes'. The repository has 52 commits, 0 stars, and 2 watchers. The latest release is 'Version 1.0.0' (Latest) on 4 May. The repository has 2 contributors: Pawel Sznajder and Hoafrost. The README.md file is visible, with the title 'EpIC: multi-channel Monte Carlo event generator with radiative corrections'.

**Repository: pawelsznajder / epic** (Public)

Search or jump to... Pull requests Issues Marketplace Explore

Watch 2 Fork 0 Star 0

Code Issues 2 Pull requests Actions Projects Wiki Security Insights

main 4 branches 1 tag Go to file Add file Code

File	Commit Message	Commit Hash	Time Ago	Commits
.github	add CODEOWNERS	7b3ae5f	5 days ago	52 commits
bin	initial version		9 months ago	
build	initial version		9 months ago	
cmake	initial version		9 months ago	
data	correct prev. commit		last month	
include	implement changes in pythia6 format		last month	
src	Update DVCSRCCollinear.cpp		5 days ago	
test	initial version		9 months ago	
CMakeLists.txt	initial version		9 months ago	
LICENSE	initial commit		9 months ago	
README.md	Update README.md		last month	

**About**

Monte Carlo generator for exclusive processes

gpd qcd monte-carlo-generator exclusive-physics partons-framework

Readme  
GPL-3.0 license  
0 stars  
2 watching  
0 forks

**Releases 1**

Version 1.0.0 (Latest)  
on 4 May

**Contributors 2**

pawelsznajder Pawel Sznajder  
Hoafrost

**Environments 1**

**README.md**

## EpIC: multi-channel Monte Carlo event generator with radiative corrections

## Status of PARTONS

	.gitignore	test SIDIS	7 months ago
	CMakeLists.txt	Fixed typo	5 months ago
	LICENSE	Adding LICENSE	2 years ago
	README.md	Update README.md	6 months ago

## Languages



## Context

Virtual access  
Expression of needs

## Development and dissemination

Ecosystem  
New features  
Administration

## Conclusion

## Abbreviations

### ☰ README.md



## Nanga Parbat: a TMD fitting framework

Nanga Parbat is a fitting framework aimed at the determination of the non-perturbative component of TMD distributions.

See Valerio's talk on Wednesday





## Status of PARTONS

### PROGRAM SUMMARY

*Computer for which the program is designed and others on which it is operable:* any with standard C++, tested on Linux and Mac OS systems

*Programming Language used:* C++

*High-speed storage required:* No

*Separate documentation available:* No

*Keywords:* QCD, TMD factorization, high-energy factorization, TMD PDFs, TMD FFs, unintegrated PDFs, small- $x$  physics.

*Other programs used:* LHAPDF (version 6) for access to collinear parton distributions, ROOT (any version > 5.30) for plotting the results

*Download of the program:* <http://tmdlib.hepforge.org>

*Unusual features of the program:* None

*Contacts:* H. Jung ([hannes.jung@desy.de](mailto:hannes.jung@desy.de)), A. Bermudez Martinez ([armando.bermudez.martinez@desy.de](mailto:armando.bermudez.martinez@desy.de))

*Citation policy:* please cite the current version of the manual and the paper(s) related to the parameterization(s).

 See Valerio's talk on Wednesday

## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem

### New features

Administration

### Conclusion

### Abbreviations

## ■ Exclusive diphoton photoproduction $\gamma p \rightarrow \gamma\gamma p$

- Implementation at LO and NLO.
- Direct treatment of  $i\epsilon$ -prescription and MC multi-dimensional integrations.
- Demanding: heavy use of a computing farm.

 See Lech's talk on Wednesday

 Grocholski *et al.* (2021)

## ■ DDVCS $\gamma^* p \rightarrow \gamma^* p$

- Preliminary integration of cross-sections and LO CFFs.
- Possible mismatch in original papers and recalculation of analytic expressions partially done.

 See Victor's talk on Friday

## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem

### New features

Administration

### Conclusion

### Abbreviations

- DVCS off a pion target  $\gamma^* \pi \rightarrow \gamma \pi$ 
  - NLO CFFs + LO evolution + various GPD models.
  - Ready for phenomenology with EIC/ElcC-focused papers.
    - ✍ Morgado Chavez *et al.* (long) (2021)
    - ✍ Morgado Chavez *et al.* (short) (2021)
- Ultra-peripheral collisions and GPDs
  - See Jakub's talk on Wednesday
- GPD modeling with neural networks
  - See Pawel's talk on Thursday
- GPD modeling from double distributions
  - See Pietro's talk on Friday

## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem

### New features

Administration

### Conclusion

### Abbreviations

- Simplify connection to **popular libraries** on e.g.
  - machine learning
  - plotting
  - statistical data analysis
- Convenient for a **wide community of new users**, in particular PhD students of postdocs.
- **Facilitates dissemination of research** through e.g. Jupyter notebooks.
- Remaining work on documentation and dissemination before public release

## Status of PARTONS

### Context

Virtual access

Expression of needs

### Development and dissemination

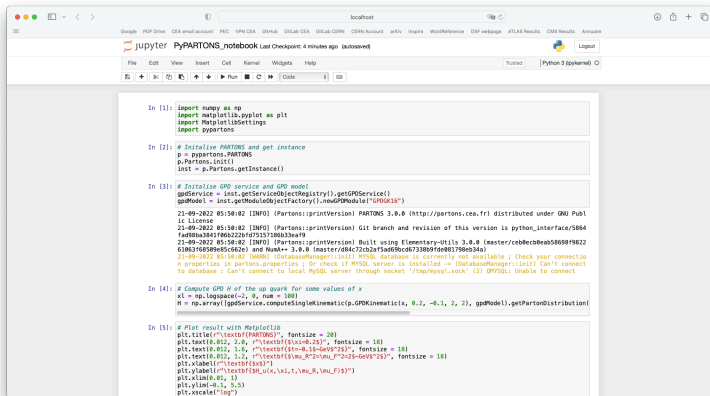
Ecosystem

**New features**

Administration

### Conclusion

### Abbreviations



```

In [1]: import numpy as np
import matplotlib.pyplot as plt
import MatplotlibSettings
import pyartons

In [2]: # Initialize PARTONS and get instance
p = pyartons.PARTONS
p.PARTONS.init()
inst = p.PARTONS.getInstance()

In [3]: # Initialize GPD service and GPD model
gpdService = inst.getServiceRegistry().getGPDService()
gpdModel = inst.getModelObjectFactory().newGPDModule("GPDx18")

21-09-2022 05:58:02 [INFO] (PARTONS:printVersion) PARTONS 3.0.0 (http://partons.cea.fr) distributed under GNU Public License
21-09-2022 05:58:02 [INFO] (PARTONS:printVersion) Git branch and revision of this version is python_interface/5864
fa88ba3843780a228fd7552980329e9
21-09-2022 05:58:02 [INFO] (PARTONS:printVersion) Built using Elementary-Utils 3.0.0 (master/ceb7ecb8eb5869ff79e22
61063f68599e6c662e) and NumA+ 3.0.0 (master/d84c72cb2af5a959cc6733809fde0b790e34a)
21-09-2022 05:58:02 [WARN] (DatabaseManager:init) MySQL database is currently not available | Check your connectio
n properties in partons.properties | Or check if MySQL server is installed => (DatabaseManager:init) Can't connect
to database: Can't connect to local MySQL server through socket '/tmp/mysql.sock' (2) @MySQL: unable to connect

In [4]: # Compute GPD H of the up quark for some values of x
xl = np.linspace(-2, 0, num = 100)
H = np.array(gpdService.computeSingleKinematic(p.GPDKinematic(x, 0.2, -0.1, 2, 2), gpdModel).getPartonDistribution()

In [5]: # Plot result with Matplotlib
plt.title("textbf(PARTONS)", fontsize = 20)
plt.text(0.02, 2.0, r"textbf(sx=0.25)", fontsize = 18)
plt.text(0.02, 1.0, r"textbf(sim=0.15=0.05^2)", fontsize = 18)
plt.text(0.02, 1.2, r"textbf(svm_0^2=|vm_u|^2=25=5e15)", fontsize = 18)
plt.xlabel(r"textbf(sx)")
plt.ylabel(r"textbf(spl_u(x), x, t, |vm_u|^2, |vm_u|^2)")
plt.xlim(0.01, 1)
plt.ylim(0.1, 5.5)
plt.scale("log")

```

## Status of PARTONS

### Context

Virtual access

Expression of needs

### Development and dissemination

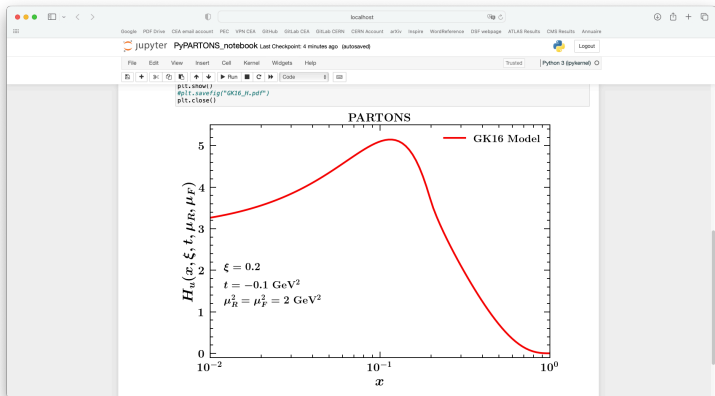
Ecosystem

**New features**

Administration

### Conclusion

### Abbreviations



## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features

### Administration

### Conclusion

### Abbreviations

## What is PARTONS?

PARTONS is a software framework dedicated to the phenomenology of 3D hadron structure, in particular Generalized Parton Distributions (GPDs) and Transverse Momentum Dependent (TMDs) parton distribution functions.

The experimental program devoted to study GPDs and TMDs has been carrying out by experiments in several facilities, like CERN, DESY, Fermilab, Jefferson Lab and BNL. The 3D structure of hadrons will be also a key component of the physics case for the future US electron ion collider (EIC) and Chinese electron ion collider (EicC). PARTONS is useful to theorists to develop new models, phenomenologists to interpret existing measurements and to experimentalists to design new experiments.

PARTONS provides a necessary bridge between GPD models and experimental data measured in various channels, like for example deeply virtual Compton scattering (DVCS), timelike Compton scattering (TCS) and hard exclusive meson production (HEMP).



## What is 3DPartons?

3DPartons is a [virtual access infrastructure](#) supported by the European project [STRONG-2020](#). 3DPartons gives access to open-source computing codes necessary for high precision phenomenology in the field of 3D hadron structure. Benefiting from the experience of decades of parton distribution function (PDF) studies, the GPD and TMD communities can find in 3DPartons a forum where they can mutualize knowledge and know-how about scientific and technical problems related to the complexity of the GPD and TMD computing chains.

The virtual access infrastructure 3DPartons has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093.

[NangaParbat](#) is a fitting framework for the determination of TMDs from experimental data, like for example Drell-Yan measurements. The corresponding fitted TMDs can also be accessed through [TMDlib](#). [MontBlanc](#) is a fitting framework for the determination of FFs from experimental data for single inclusive annihilation (SIA) and semi inclusive deep inelastic scattering (SIDIS). [xFitter](#) is a fitting framework for the determination of collinear distributions from a vast body of experimental channels. PARTONS, NangaParbat, MontBlanc and xFitter share the common feature of being interfaced to [APFEL++](#) which solves QCD evolution equations for various parton distributions, and to [LHAPDF](#) which provides access to modern PDF sets.

[EpIC](#) is a generic Monte Carlo event generator for exclusive processes. It is fully compatible with PARTONS: it can be used to generate events for all exclusive processes and all models provided by PARTONS.



## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features

### Administration

### Conclusion

### Abbreviations

CHANGELOG.md 1.92 KB



### 3.0

#### Updates:

- improve configuration with CMake
  - Qt is version either Qt 4 or 5 can be used
  - printing of versions improved
  - automatic population of environment\_configuration.dat file
- add new GPD types, namely for transversity and higher-twist GPDs
- add Docker configuration file with description
- remove MSTW files (now one can choose PDF with LHAPDF)

#### Physics:

- addition of new exclusive production channel - DVMP
- addition of objects for collinear distributions, including services, DB connection, evolution
- addition of APFEL interface
- addition of LHAPDF interface
- addition of subtraction constant module related to Eur.Phys.J.C 81 (2021) 4, 300
- addition of GPD module related to Phys.Rev.D 103 (2021) 11, 114019
- addition of GPD model used in Phys. Lett. B 805 (2020) 135454
- addition of few observable modules, like for the evaluation of backward-forward asymmetry for TCS, or total cross-section for DVCS
- addition to new running coupling and threshold modules, mostly related to APFEL

## Status of PARTONS

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features

### Administration

### Conclusion

### Abbreviations

## Geographical repartition of users

	Continent	+	Visitors ↓	Sessions	Bounce rate	Goal conversions	Goal conversion rate	🔊 Sum of goal revenue
			505	610	63,11%	0	0%	
<input type="checkbox"/>	Europe		322 63,76%	367 60,16%	60,22%	0	0%	No data
<input type="checkbox"/>	North America		105 20,79%	146 23,93%	71,92%	0	0%	No data
<input type="checkbox"/>	Asia		74 14,65%	91 14,92%	60,44%	0	0%	No data
<input type="checkbox"/>	Africa		4 0,79%	4 0,66%	75%	0	0%	No data
<input type="checkbox"/>	South America		2 0,4%	2 0,33%	50%	0	0%	No data

## Status of PARTONS

## Most interested countries

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features

### Administration

### Conclusion

### Abbreviations

	Country	+	Visitors ↓	Sessions	Bounce rate	Goal conversions	Goal conversion rate	📍 Sum of goal revenue
			<b>505</b>	<b>610</b>	<b>63,11%</b>	<b>0</b>	<b>0%</b>	
<input type="checkbox"/>	France		175 34,65%	175 28,69%	71,43%	0	0%	No data
<input type="checkbox"/>	United States		102 20,2%	142 23,28%	72,54%	0	0%	No data
<input type="checkbox"/>	Germany		50 9,9%	60 9,84%	21,67%	0	0%	No data
<input type="checkbox"/>	Spain		31 6,14%	31 5,08%	38,71%	0	0%	No data
<input type="checkbox"/>	Russia		24 4,75%	24 3,93%	100%	0	0%	No data
<input type="checkbox"/>	China		23 4,55%	27 4,43%	59,26%	0	0%	No data
<input type="checkbox"/>	Poland		20 3,96%	49 8,03%	51,02%	0	0%	No data
<input type="checkbox"/>	South Korea		13 2,57%	18 2,95%	44,44%	0	0%	No data
<input type="checkbox"/>	India		9 1,78%	9 1,48%	88,89%	0	0%	No data
<input type="checkbox"/>	Italy		7 1,39%	9 1,48%	77,78%	0	0%	No data

## Status of PARTONS

## Analytics

### Context

Virtual access  
Expression of needs

### Development and dissemination

Ecosystem  
New features

### Administration

### Conclusion

### Abbreviations

### Audience overview

Export

...

Visitors

505

Sessions

610

Page views

1593

Conversion rate

0%

Events per session

5,04

% of returning visitors

6,34%

Conversions

0

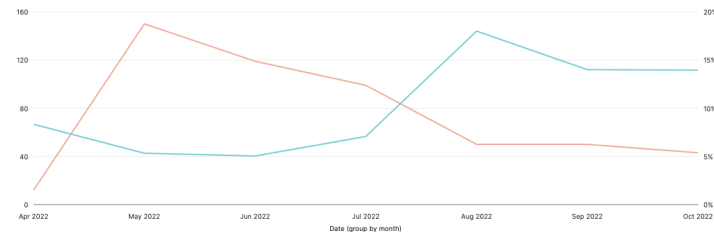
Plot series

▼

Group by month

...

— Visitors — % of returning visitors



## Status of PARTONS

### Context

Virtual access

Expression of needs

### Development and dissemination

Ecosystem

New features

Administration

### Conclusion

### Abbreviations

## Access to the website

	Page title	+	Page views	Unique page views	Entries	Page bounce rate	Average time on page	Exit rate
			<b>1593</b>	<b>1119</b>	<b>606</b>	<b>63,53%</b>	<b>2m 51s</b>	<b>100%</b>
<input type="checkbox"/>	<a href="#">PARTONS: Main Page</a>		528 33,15%	377 33,69%	344 56,77%	63,08%	1m 54s	75,2%
<input type="checkbox"/>	<a href="#">PARTONS: Download PARTONS</a>		344 21,59%	220 19,66%	129 21,29%	67,44%	6m 21s	74,29%
<input type="checkbox"/>	<a href="#">PARTONS: Quick guide</a>		63 3,95%	46 4,11%	9 1,49%	55,56%	5m 26s	43,48%
<input type="checkbox"/>	<a href="#">PARTONS: Using PARTONS</a>		60 3,77%	37 3,31%	15 2,48%	86,67%	3m 22s	50%
<input type="checkbox"/>	<a href="#">PARTONS: User's guide</a>		56 3,52%	35 3,13%	6 0,99%	33,33%	3s	8,57%
<input type="checkbox"/>	<a href="#">PARTONS: Tutorials</a>		48 3,01%	32 2,86%	1 0,17%	0%	9s	3,13%
<input type="checkbox"/>	<a href="#">PARTONS: PARTONS with our provided virtual machine</a>		47 2,95%	25 2,23%	6 0,99%	66,67%	2m 58s	52%
<input type="checkbox"/>	<a href="#">PARTONS: Contact and support</a>		39 2,45%	32 2,86%	2 0,35%	50%	2m 0s	15,63%
<input type="checkbox"/>	<a href="#">PARTONS: PARTONS Namespace Reference</a>		32 2,01%	20 1,79%	0 0%	0%	1m 14s	25%
<input type="checkbox"/>	<a href="#">PARTONS: PARTONS on GNU/Linux</a>		30 1,88%	27 2,41%	8 1,32%	50%	4m 34s	55,56%

# Conclusion

## Status of PARTONS

- Wide set of computing tools publicly available.
- Some unique physics studies made possible.
- Possible connections to lattice QCD and TMDs.
- Need for **multi-channel** analysis **beyond LO** on a **wide kinematic coverage**. EIC and ElcC much needed!
- The GPD deconvolution problem is **ill-posed**. **Huge sensitivity** to numerical noise or experimental uncertainties.

## Context

Virtual access  
Expression of needs

## Development and dissemination

Ecosystem  
New features  
Administration

## Conclusion

## Abbreviations



- Development of the **software ecosystem** PARTONS for 3D hadron structure studies.
- Need for **coordinated effort** involving fits, computing chains, continuum and lattice QCD to make the best from experiments.

# Abbreviations



## Status of PARTONS

ANN	artificial neural network
APFEL	a PDF evolution library
DDVCS	double deeply virtual Compton scattering
DVCS	deeply virtual Compton scattering
DVMP	deeply virtual meson production
EIC	electron-ion collider
EICc	electron-ion collider in China
FF	fragmentation function
GPD	generalized parton distribution
LO	leading order
NLO	next-to-leading order
PDF	parton distribution function
TCS	timelike Compton scattering
TMD	transverse momentum dependent PDF

## Context

Virtual access  
Expression of needs

## Development and dissemination

Ecosystem  
New features  
Administration

## Conclusion

## Abbreviations

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