



STRONG-2020 & NLOAccess

Jean-Philippe Lansberg

Laboratoire de Physique des 2 Infinis
Irène Joliot-Curie (IJCLab), Paris-Saclay U., CNRS, Orsay

**Atelier “Physique Théorique des deux infinis”
(virtual meeting)**

June 7, 2021

The STRONG-2020 initiative

Project duration: from 1 June 2019 to 31 May 2023

Total Budget: 10 M €

32 Work Packages (WPs):

- **MAN:** Management and Coordination
- **DISCO:** Dissemination and Communication
- 7 Transnational Access Research Infrastructures (**TA**)
- 2 Virtual Infrastructures (**VA**)

Experimental /Theoretical /Instrumentation Activities:

- 7 Networking Activities (**NA**)
- 14 Joint Research Activities (**JRA**)



Web site: <http://www.strong-2020.eu/>

The STRONG-2020 consortium



Consortium Agreement

- **45 participating institutions** (beneficiaries) in
- **16 countries:**
- Austria, Belgium, Switzerland, Germany, Spain, Finland, France, Croatia, Ireland, Italy, Montenegro, Netherlands, Poland, Portugal, Sweden, United Kingdom
- **Location details can be found on online [Google map](#)**
- **134 other Involved Institutions** (not receiving EU funding)

The STRONG-2020 infrastructures

Transnational Access

TA1-COSY Dieter Grzonka (Julich)

TA3-LNF Catalina Curceanu/Carlo Guaraldo (INFN, Frascati)

TA5-GSI Yvonne Leifels (GSI, Darmstadt)

TA7-CERN David d'Enterria (CERN, Geneva)

TA2-MAMI Achim Denig (Mainz)

TA4-FTD/ELSA Hartmut Schmieden (Bonn)

TA6-ECT* Gert Aarts (Jochen Wambach) (Trento)

Virtual Access:

Provide open-access to state-of-the-art computer codes necessary for the high-precision phenomenology of heavy ion reactions and studies of the quark gluon plasma as well as for nucleon and nuclei parton structure research.

VA1-NLOAccess *Automated perturbative NLO calculations for heavy ions and quarkonia*

Jean-Philippe Lansberg (CNRS, Orsay) : *Extension of the well-known MadGraph automated on-line code for the novel computation of perturbative QCD cross sections in high-energy hadronic collisions at next-to-leading-order (NLO) accuracy, using meson and heavy-ion beams, and for quarkonia final-states.*

Web page: <https://nloaccess.in2p3.fr/HO/>

VA2-3DPartons *Virtual Access to 3DPartons*

Hervé Moutard (CEA, Saclay) : *Development of a new combined framework to extract generalized (GPDs) and transverse momentum-dependent (TMDs) parton distributions, with higher-order fixed and twist corrections, from fits to experimental e-p and p-p data (handled in a Rivet-like format).*

Web page: <http://partons.cea.fr/partons/doc/html/index.html>

The STRONG-2020 research activities

Hadron Physics:

JRA7-HaSP *Light-and heavy-quark hadron spectroscopy* Marco Battaglieri (INFN, Genova), Juan Nieves (UVEG, Valencia)

NA1-FAIRnet *QCD physics at GSI/FAIR* Fritz-Herbert Heinsius (RUB, Bochum)

NA5-THEIA *Strange Hadrons and the Equation-of-State of Compact Stars* Josef Pochodzalla (Umainz)

NA6-LatticeHadrons *LatticeHadrons* Michael Peardon (TCD, Dublin)

Precision Physics:

NA4-PREN *Proton Radius European Network* Dominique Marchand (CNRS, Orsay), Randolph Pohl (UMainz)

JRA3-PrecisionSM *Precision Tests of the Standard Model* Mikhail Gorshteyn (UMainz), Andrzej Kupsc (University of Uppsala)

Heavy Ions:

JRA1-LHC-Combine *Inter-experiment combination of heavy-ion measurements at the LHC* Raphaël Granier de Cassagnac (CNRS, Palaiseau)

JRA2-FTE@LHC *Fixed Target Experiments at the LHC* Cynthia Hadjidakis (CNRS, Orsay), Pasquale Di Nezza (INFN, Frascati)

NA3-Jet-QGP *Quark-Gluon-Plasma characterisation with jet* Marco van Leeuwen (Nikhef, Amsterdam), Guilherme Milano (LIP, Lisbon)

NA7-Hf-QGP *Quark-Gluon Plasma characterisation with heavy flavour probes* Joerg Aichelin (CNRS, Nantes), Giuseppe Bruno (INFN, Bari)

GPD/TMD/PDFs:

JRA4-TMD-neXt *3D structure of the nucleon in momentum space* Alessandro Bacchetta (INFN, Pavia)

JRA5-GPD-ACT *Generalized Parton Distributions* Silvia Nicolai (CNRS, Orsay), Kresimir Kumericki (UNIZG, Zagreb)

JRA6-Next-DIS *Challenges for next generation DIS facilities* Daria Sokhan (UGlasgow), Francesco Bossu (CEA, Saclay)

NA2-Small-x *Small-x Physics at the LHC and future DIS experiments* Néstor Armesto (USC, Santiago de C.), Tuomas Lappi (JYU, Jyväskylä)

The NLOAccess framework

The STRONG-2020 WP **VA1-NLOAccess**:

- a **virtual access** for automated perturbative calculation for heavy ions and quarkonia
- **automation** and **versatility**:
 - everyone would be able to evaluate physical observables related to hadron scatterings
 - no need to pre-code
 - test the code
- any code that could be compiled and launched via a shell could be added
- ✓ MadGraph and its extension to nPDFs are being included
- ✓ HELAC-Onia is included

NLOAccess & HELAC-Onia Web

Some facts and figures about NLOAccess:

- general information at <https://nloaccess.in2p3.fr>

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- **+1800 runs**
- features:
 - **secure two-step registration** process
 - **protected OwnCloud storage** is given
 - **file input** as first way to submit a run
 - **live user run status** and **run history**
 - guided input file creation and submission for HO:
https://nloaccess.in2p3.fr/HO/downloads/HO_online_guide_v01.pdf

NLOAccess - Homepage

(<https://nloaccess.in2p3.fr>)

HELAC-Onia Web | Home x nloaccess | Virtual Access x +

nloaccess.in2p3.fr

NLOAccess

Virtual Access: Automated perturbative NLO calculations for heavy ions and quarkonia (NLOAccess)

7 TeV LHC
Color Singlet
 $2 < \chi_{\text{min}} < 4.5$
 $\frac{\sigma_{\text{NLO}}}{\sigma_{\text{LO}}} = 4$

Home The project Communication Tools Account Downloads Request registration

GENERAL DESCRIPTION

Objectives:

NLOAccess will give access to automated tools generating scientific codes allowing anyone to evaluate observables - such as production rates or kinematical properties - of scatterings involving hadrons. The automation and the versatility of these tools are such that these scatterings need not to be pre-coded. In other terms, it is possible that a random user may request for the first time the generation of a code to compute characteristics of a reaction which nobody thought of before. NLOAccess will allow the user to test the code and then to download to run it on its own computer. It essentially gives access to a dynamical library.

The automated tools on which NLOAccess is based are (i) the MADGRAPH ensemble heavily used by the high-energy physics (HEP) community, but extended to deal with meson and heavy-ion beams and (ii) the HELAC-ONIA code allowing the computation of cross section for heavy-quark bound states, the quarkonia.

The portal NLOAccess will allow one to access additional automated tools. I will extend the portal of MADGRAPH@UCLouvain with the necessary additions to deal with heavy-ion collisions and quarkonium production.

As of today, in contrast to HEP, no such place exists for hadronic physics where interested colleagues can go test their ideas and turn them into concrete realisation with automated Monte Carlo tools. In addition, the available tools are limited to a reduced class of applications. For each, one needs to install them one by one, sometimes along with dedicated libraries and one needs to get familiar with their syntax. A single portal for hadron physics will not only ease the task of the

FOLLOW:

STRONG 2020

The e-infrastructure is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 624093.

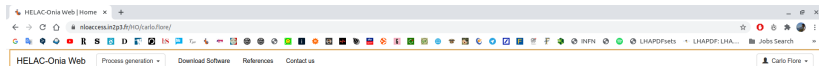
Q Search ... Search

RECENT POSTS

© Jean-Philippe Lansberg gives a talk at

HELAC-Onia Web - Homepage

(<https://nloaccess.in2p3.fr/H0/>)



Automated perturbative calculation with HELAC-Onia Web

Welcome to HELAC-Onia Web!

HELAC-Onia is an automatic matrix element generator for the calculation of the heavy quarkonium helicity amplitudes in the framework of NRQCD factorization. The program is able to calculate helicity amplitudes of multi P-wave quarkonium states production at hadron colliders and electron-positron colliders by including new P-wave off-shell currents. Besides the high efficiencies in computation of multi-leg processes within the Standard Model, HELAC-Onia is also sufficiently numerical stable in dealing with P-wave quarkonia and P-wave color-octet intermediate states.

Generate a process or submit your input file, or logout.



This e-infrastructure is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 824093.

HELAC-Onia Web - Run submission

The screenshot shows a web browser window with the URL `nlaaccess.in2p3.fr/10/carlo/onia/file_sub_guided/`. The page title is "HELAC-Onia Web" and the navigation menu includes "Process generation", "Download Software", "References", and "Contact us". The user is logged in as "Carlo Flore".

HELAC-Onia - Guided file submission

Create an input file

Input next command(s):

[Add command\(s\)](#)

Remove line(s) containing:

[Remove line\(s\)](#) [Clear file](#)

[Submit job](#)

Your input file:

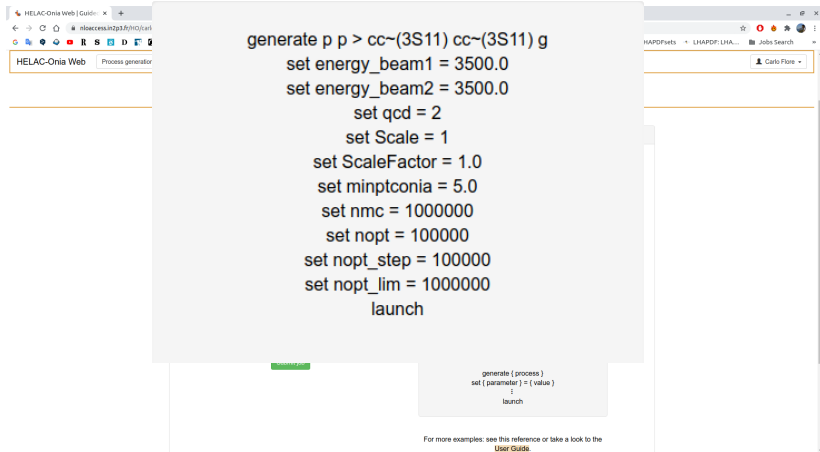
```
generate p p > cc-(3S11) cc-(3S11) g
set energy_beam1 = 3500.0
set energy_beam2 = 3500.0
set qcd = 2
set Scale = 1
set ScaleFactor = 1.0
set minpctonia = 5.0
set nmc = 1000000
set nopt = 100000
set nopt_stop = 100000
set nopt_lim = 1000000
launch
```

Please, remember to follow this structure for your input file:

```
generate [ process ]
set [ parameter ] = [ value ]
[ ]
launch
```

For more examples: see [this reference](#) or take a look to the [User Guide](#).

HELAC-Onia Web - Run submission



The image shows a screenshot of the HELAC-Onia Web interface. A large grey text box is overlaid on the page, containing the following submission script:

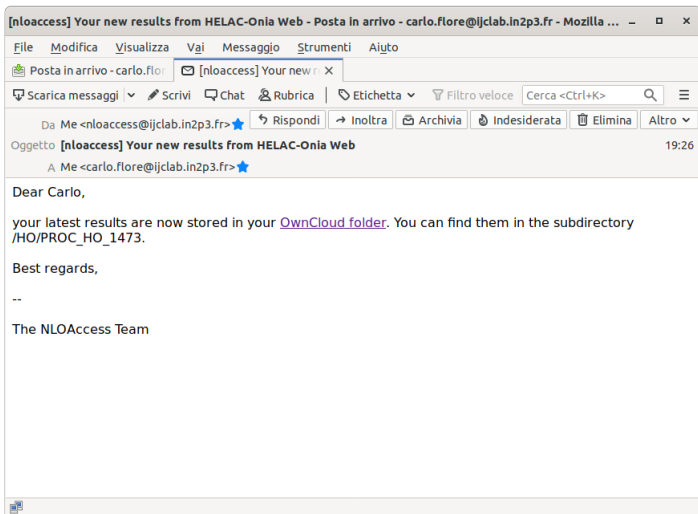
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launch
```

Below the main text box, there is a smaller box with the following text:

```
generate { process }
set { parameter } = { value }
:
launch
```

At the bottom of the page, there is a note: "For more examples: see this reference or take a look to the [User Guide](#)."

HELAC-Onia Web - Results (I)



[nloaccess] Your new results from HELAC-Onia Web - Posta in arrivo - carlo.flore@ijclab.in2p3.fr - Mozilla ...

File Modifica Visualizza Vai Messaggio Strumenti Aiuto

Posta in arrivo - carlo.flore [nloaccess] Your new results from HELAC-Onia Web

Scarica messaggi Scrivi Chat Rubrica Etichetta Filtro veloce Cerca <Ctrl+K>

Da Me <nloaccess@ijclab.in2p3.fr> Rispondi Inoltra Archivia Indesiderata Elimina Altro

Oggetto [nloaccess] Your new results from HELAC-Onia Web 19:26

A Me <carlo.flore@ijclab.in2p3.fr>

Dear Carlo,

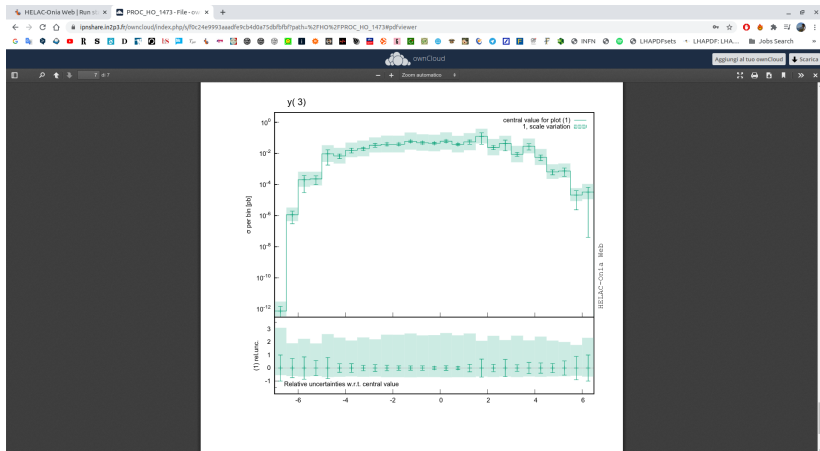
your latest results are now stored in your [OwnCloud folder](#). You can find them in the subdirectory /HO/PROC_HO_1473.

Best regards,

--

The NLOAccess Team

HELAC-Onia Web - Results (II)



- MadGraph online version is only limited to LO calculation

MG5_aMC@NLO

- MadGraph online version is only limited to LO calculation
- NLO version will be soon available on NLOAccess

MG5_aMC@NLO - Run submission (new!)

- MadGraph online version is only limited to LO calculation
- NLO version will be soon available on NLOAccess

The screenshot shows a web browser window with the URL `nloaccess.in2p3.fr/HO/carlofiore/MG5_file_sub_guided/`. The page title is "MG5_aMC@NLO - Guided input file submission". The user is logged in as "Carlo Fiore".

The main content area is titled "Create your input file" and contains the following elements:

- Text: "Upload here your cards (as multiple .dat files or as a single tar.gz/zip file):"
- Text: "Upload cards: Nessun file selezionato"
- Text: "Edit here your input file:"
- Text: "Input next command(s):" followed by a large empty text area.
- Text: "Your input file:" followed by a text box containing the command: `generate p p > tt-
output`
- Text: "Please, remember to follow this structure for your input file:" followed by a text box containing the structure: `generate { process }
output { directory }
launch
:
set { parameter } = { value }`
- Text: "Note: output directory name can be unspecified.
For more examples, see this page."
- Buttons: "Add command(s)", "Remove line(s)", "Remove line(s)", "Clear file", "Submit job"
- Text: "Remove line(s) containing:

NLOAccess - What's next?

- separation of code generation and running phases for MadGraph

[will allow **code re-usage** for a specific process]

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- extension to nPDFs \Rightarrow extend NLO calculation to other observables (e.g. R_{pA} or R_{AA})
[PhD of A. Safronov; Glue@NLO IN2P3 project \rightarrow Talk by I. Schienbein]

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[PrecisOnium ANR \rightarrow Talk by H.S. Shao]

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Thank you

Backup

HELAC-Onia (I)

H.-S. Shao, CPC 184 (2013) 2562-2570 & CPC 198 (2016) 238-259

HELAC-Onia is an automatic matrix element and event generator for heavy quarkonium physics

- based on NRQCD framework
- based on off-shell recursion relations

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- based on **NRQCD** framework
- based on **off-shell recursion relations**

NRQCD factorisation:

$$\sigma(pp \rightarrow Q + X) = \sum_{i,j,n} \int dx_1 dx_2 f_{i/p}(x_1) f_{j/p}(x_2) \hat{\sigma}(ij \rightarrow Q\bar{Q}[n] + X) \langle \mathcal{O}_n^Q \rangle$$

- $f_{i/p}(x_1), f_{j/p}(x_2)$ are the **PDFs**
- $\hat{\sigma}(ij \rightarrow Q\bar{Q}[n] + X)$ is the **partonic cross section** for producing a heavy quark pair in the Fock state n
- $n = {}^{2S+1}L_J^c$, with $c = 1, 8$ (color singlet or color octet)
- $\langle \mathcal{O}_n^Q \rangle$ are the **LDMEs**

Main features:

- **Standard Model** calculations but BSM extension is feasible
- different kind of calculation: multiple quarkonia production, event generation, yields vs polarisation, angular distributions of quarkonia decays...
- reweighting method for estimating renormalisation/factorisation scale and PDF uncertainties
- interface with **LHAPDF**
- interface with **PYTHIA 8, QEDPS**

HELAC-Onia Web - Input file

The input file should be in the following form:

```
generate { process }  
set { parameter }={ value }  
  
:  
launch
```

Users can have control on several kind of parameters via the set command:

- collisions parameters;
- theory parameters;
- MC setup variables;
- PDFs parameters;
- kinematical cuts;
- quarkonium specific parameters (e.g. the values of different LDMEs);
- physical constants (both EW and QCD sectors, e.g. M_Z or M_W , or m_q , or couplings).
- kind of output (ROOT, Gnuplot, TopDrawer or LHE)

HELAC-Onia Web - Run status

HELAC-Onia Web | Run status

HELAC-Onia Web | Process generation | Download Software | References | Contact us | Carlo Flore

NLOAccess | Université PARIS-SACLAY | UCL | LPTHE | P2IO | INFN

HELAC-Onia Web - Carlo's runs

Run status

Run id(s) [Remove runs](#)

For removing multiple runs, separate the IDs with a comma or a semicolon.

Run ID	Date (dd/mm/yyyy)	Time (d+hh:mm:ss)	Idle	Running	Completed	Process
1473	06/03/2021	17:29:37	0	7	0	p p > cc-(3511) cc-(3511) g

This page will automatically refresh every 30 seconds. If you want to refresh now the page, click on the button below.

[Refresh](#)

STRONG