



# NLOAccess progress report

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**Joint workshop GDR-QCD/FTE LHC/3DPartons/NLOAccess  
(virtual meeting)  
02 Jun 2021**

# 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 bash could be added
- ✓ MadGraph and its extension to nPDFs are being included
- ✓ HELAC-Onia is included

# 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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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**

# NLOAccess & HELAC-Onia Web

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Some facts and figures about NLOAccess:

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

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- **+100 users** from **~ 20 countries**
- **+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](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 ...

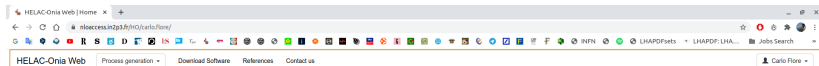
### RECENT POSTS

© Jean-Philippe Lansberg gives a talk at

<https://nloaccess.in2p3.fr>

# 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/110/carlo/onia/file_sub_guided/`. The page title is "HELAC-Onia - Guided file submission". The navigation bar includes "HELAC-Onia Web", "Process generation", "Download Software", "References", and "Contact us". A user profile for "Carlo Flore" is visible in the top right.

The main content area is titled "Create an input file" and is divided into two columns:

- Input next command(s):** A large empty text box for entering commands. Below it is a blue "Add command(s)" button. A "Remove line(s) containing:" input field is also present, with "Remove line(s)" and "Clear file" buttons below it. A green "Submit job" button is at the bottom of this section.
- Your input file:** A grey box containing a sample input file content:

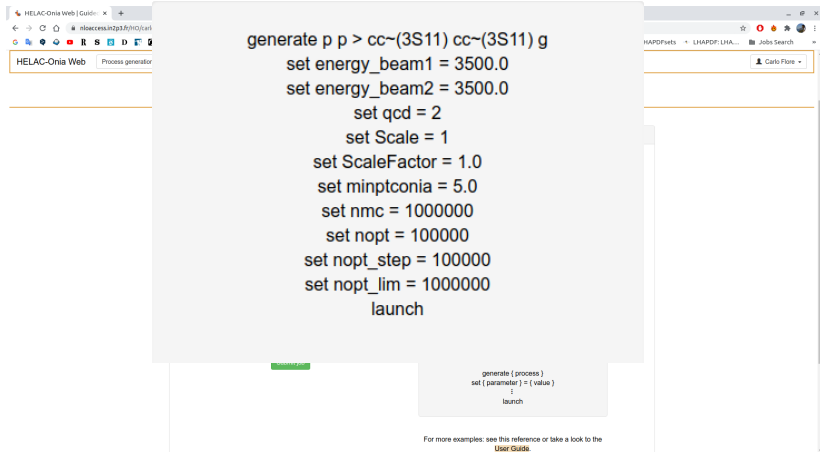
```
generate p p > cc-(3S11) cc-(3S11) g
set energy_beam1 = 3500.0
set energy_beam2 = 3500.0
set qcd = 2
set Scale = 1
set ScaleFactor = 1.0
set minptonia = 5.0
set nmc = 1000000
set nopt = 100000
set nopt_stop = 100000
set nopt_lim = 1000000
launch
```

Below the "Your input file" box, there is a note: "Please, remember to follow this structure for your input file:" followed by a grey box showing the required structure:

```
generate [ process ]
set ( parameter ) = ( value )
:
launch
```

At the bottom of the page, a note states: "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:

```
generate p p > cc~(3S11) cc~(3S11) g
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launch
```

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

```
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](#)."

The background shows a browser window with the URL `nloaccess.in2p3.fr/H10/carl` and a "Process generator" button. The right side of the browser shows a search bar with the name "Carlo Flore" and a "Jobs Search" button.

# 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.

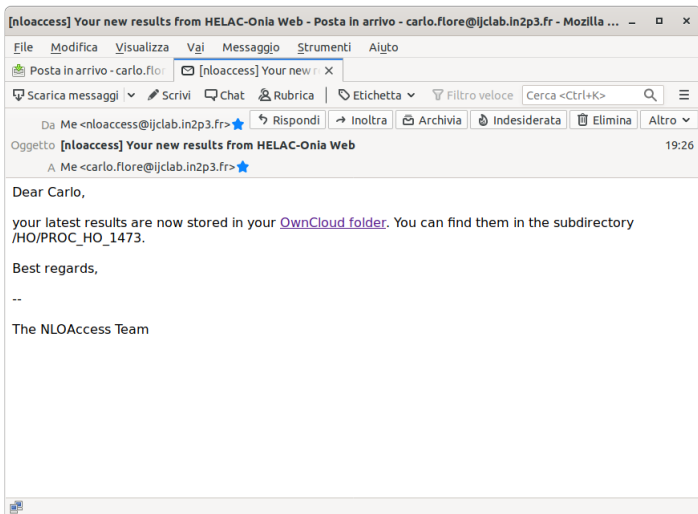
Run ID	Date (dd/mm/yyyy)	Time (d+hh:mm:ss)	Idle	Running	Completed	Process
1473	06/03/2021	17:29:37	0	7	0	p p > cc-(3511) cc-(3511) g

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

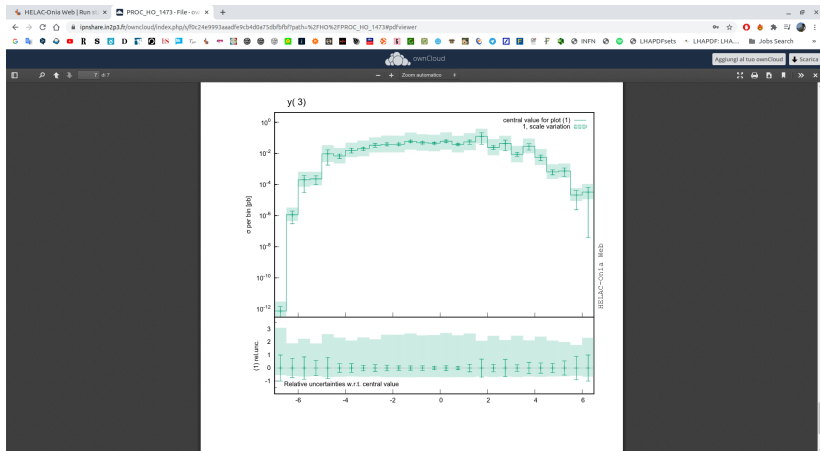
[Refresh](#)

STRONG

# HELAC-Onia Web - Results (I)



# HELAC-Onia Web - Results (II)





# HELAC-Onia Web - Run history

HELAC-Onia Web | Run history | HO - File-ownCloud | Impostazioni - Password

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

NLOAccess | Université Paris-Saclay | UCL | LPTHE | P2IO | INFN

## HELAC-Onia Web - Carlo's runs history

### Run history

To retrieve your results, you can go to your personal OwnCloud folder.

Run ID	Date (dd/mm/yyyy)	Time	Running time (d+hh:mm:ss)	Process
1470	05/03/2021	11:07:59	0+04:23:34	p p > cc-(3S11) cc-(3S11) g
1469	04/03/2021	16:03:52	0+00:00:16	g g > c c-
1468	04/03/2021	15:41:24	Removed	p p > cc-(3S11) cc-(3S11) g
1467	04/03/2021	15:38:32	Removed	p p > cc-(3S11) cc-(3S11) g
1466	04/03/2021	15:29:06	Removed	p p > cc-(3S11) cc-(3S11) g
1465	04/03/2021	15:29:00	Removed	p p > cc-(3S11) cc-(3S11) g
1464	04/03/2021	15:28:03	Removed	p p > cc-(3S11) cc-(3S11) g

Total number of runs: 375  
Total running time (days, hh:mm:ss): 1 day, 19:28:35

- MadGraph online version is only limited to LO calculation

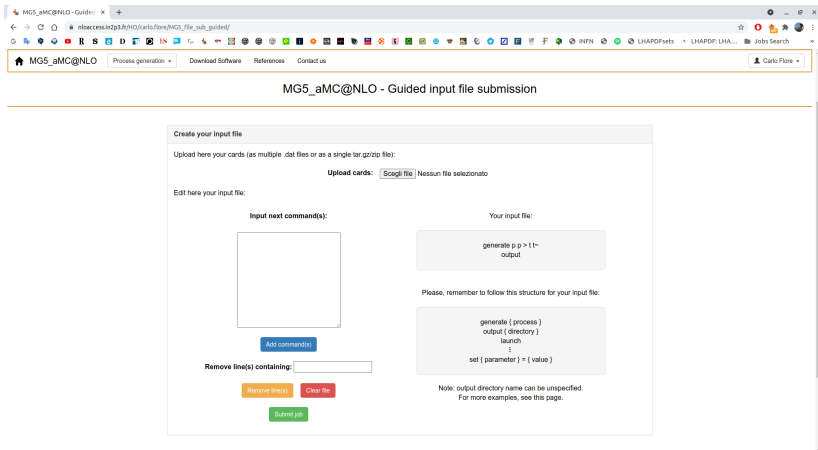
# MG5\_aMC@NLO

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

# MG5\_aMC@NLO - Run submission (new!)

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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 interface includes a navigation bar with "MG5\_aMC@NLO", "Process generation", "Download Software", "References", and "Contact us".

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):" with a large text input area and an "Add command(s)" button.
- Text: "Your input file:" with a button containing the text: `generate p p > tt-  
output`
- Text: "Please, remember to follow this structure for your input file:"
- Text: `generate { process }  
output { directory }  
launch  
:  
set { parameter } = { value }`
- Text: "Remove line(s) containing:" with a text input field, "Remove line(s)", and "Clear file" buttons.
- Text: "Note: output directory name can be unspecified. For more examples, see this page."
- Text: "Submit job" button.

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- separation of code generation and running phases for MadGraph

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

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[**next talk by A. Safronov**]

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**Thank you**