



# **'The strong interaction at the frontier of knowledge: fundamental research and applications'**

*VA1 — Automated perturbative NLO calculation for heavy ions and quarkonia*

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IPNO

***STRONG-2020 Kick-off meeting***

*October 23-25, 2019*

# STRONGVA1-Virtual access to Automated perturbative NLO calculation...

*(Spokesperson: Jean-Philippe Lansberg)*

**Objectives :** NLOAccess gives 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.

## WP tasks

1. Setting-up an international assessment board of 8 researchers
2. Elaboration of online user manuals for the main current application: (i) nuclear beams, (ii) meson beams and (iii) quarkonium-related reactions
3. Extension of the existing portal (selecting coherent sets of parameters for quarkonium observables)
4. Extension of the existing portal (automatic generation : nuclear modification factors for the case of proton-nucleus and nucleus-nucleus collisions using global fit of nuclear PDFs)
5. Organisation of a workshop and of yearly meetings to improve the portal based on the feed-back of early users
6. Key studies advertising the performance offered by the portal
7. Publication : the hadronic add-ons of MADGRAPH and the extension of HELAC-ONIA
8. Investigation of the possibility for users to run the generated codes on their own computing facilities

# **STRONG** **2020** ***VA1-Virtual access to Automated perturbative NLO calculation...***

## **Outreach to new users:**

- submit abstracts for oral communication in multiple international scientific meetings
- organise a workshop aiming at,
  - collecting suggestions and help for improvements and additions for advanced users,
  - introducing other colleagues to both the automated codes behind the portal and the best usage of the portal.

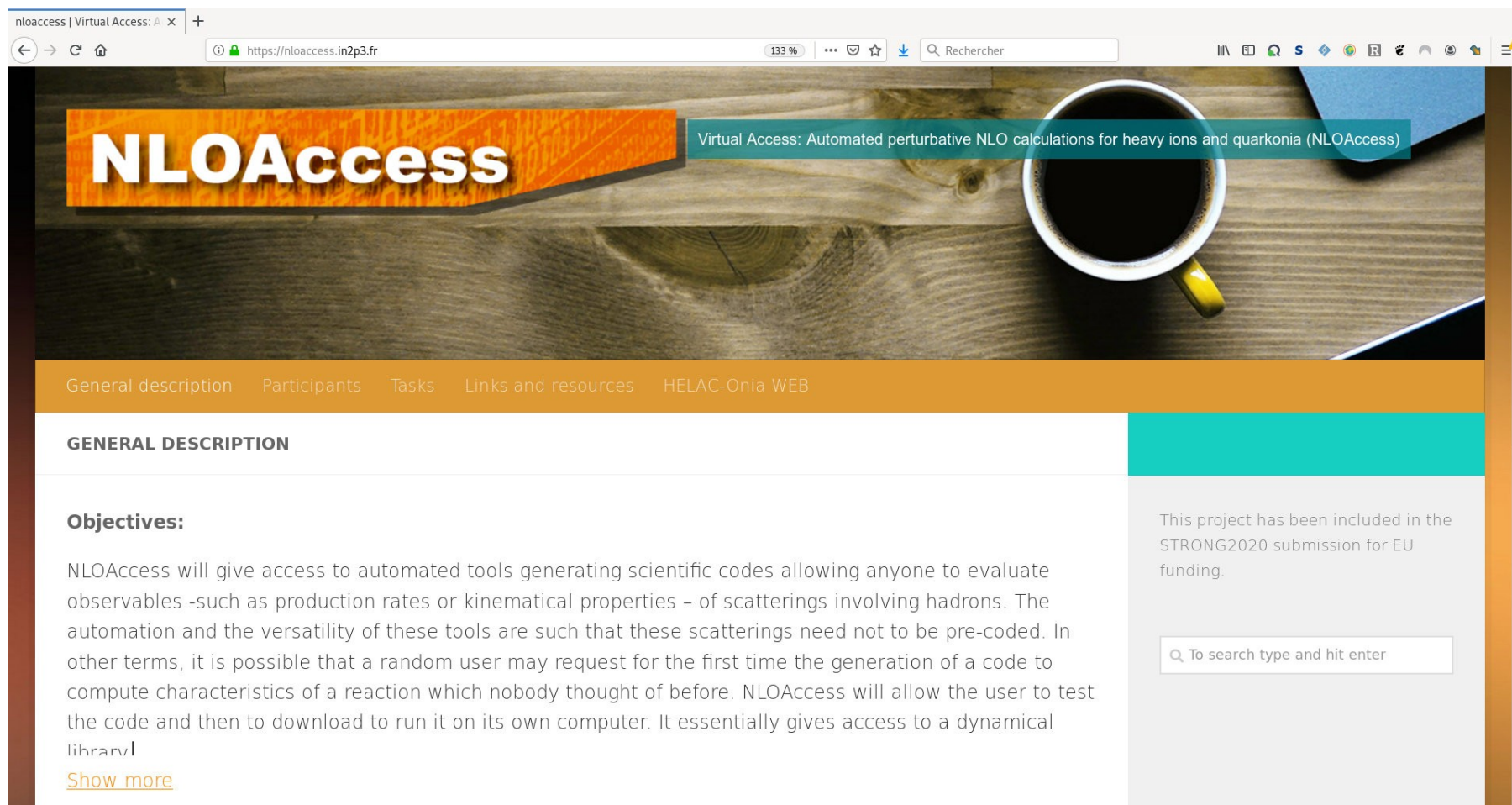
## **VA1: NLOAccess**

### ***Update on progress***

- « Cloudification »
- Webportal running (<https://nloaccess.in2p3.fr/>)
- Users & processes database OK
- Storage of results in dedicated cloud space
- Security issues + New user registration process OK
  - providing access to local computing resources is exercised with care
  - ⇒ resources login accounting (behind the scene)

# VA1: NLOAccess

## Update on progress



The screenshot shows the NLOAccess website. The header features the 'NLOAccess' logo on an orange banner and a teal banner with the text 'Virtual Access: Automated perturbative NLO calculations for heavy ions and quarkonia (NLOAccess)'. Below the header is a navigation bar with links: 'General description', 'Participants', 'Tasks', 'Links and resources', and 'HELAC-Onia WEB'. The main content area is titled 'GENERAL DESCRIPTION' and includes a section for 'Objectives:' which describes the project's goal of providing automated tools for NLO calculations. A 'Show more' link is provided at the end of the text. On the right side, there is a teal sidebar with a search bar and a note about the project's inclusion in the STRONG2020 submission for EU funding.

**NLOAccess**

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

General description Participants Tasks Links and resources HELAC-Onia WEB

**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.

[Show more](#)

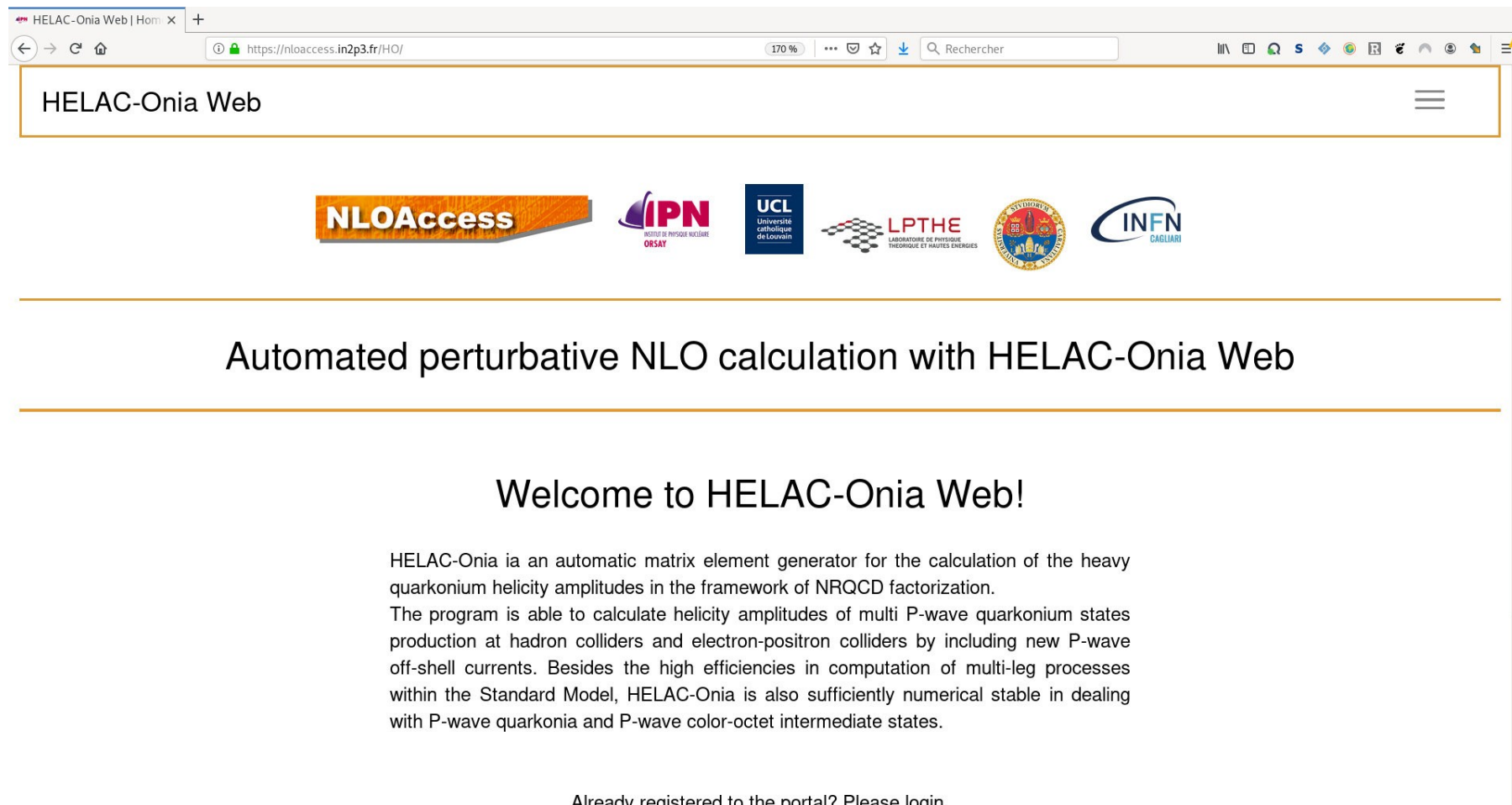
This project has been included in the STRONG2020 submission for EU funding.

To search type and hit enter

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

# VA1: NLOAccess

## Update on progress



The screenshot shows a web browser window with the URL <https://nloaccess.in2p3.fr/HO/>. The page header includes the text "HELAC-Onia Web" and a navigation menu. Below the header, there is a row of logos for NLOAccess, IPN (Institut de Physique Nucléaire d'Orsay), UCL (Université catholique de Louvain), LPTHE (Laboratoire de Physique Théorique et Hautes Energies), and INFN (Istituto Nazionale di Fisica Nucleare). The main content area features the heading "Automated perturbative NLO calculation with HELAC-Onia Web" and a sub-heading "Welcome to HELAC-Onia Web!". The text describes HELAC-Onia as an automatic matrix element generator for heavy quarkonium helicity amplitudes in the NRQCD factorization framework. It mentions the program's ability to calculate multi-P-wave quarkonium states and its numerical stability. At the bottom, there is a link for users already registered to the portal to login.

HELAC-Onia Web

NLOAccess IPN UCL LPTHE INFN

### Automated perturbative NLO calculation with HELAC-Onia Web

#### Welcome to HELAC-Onia Web!

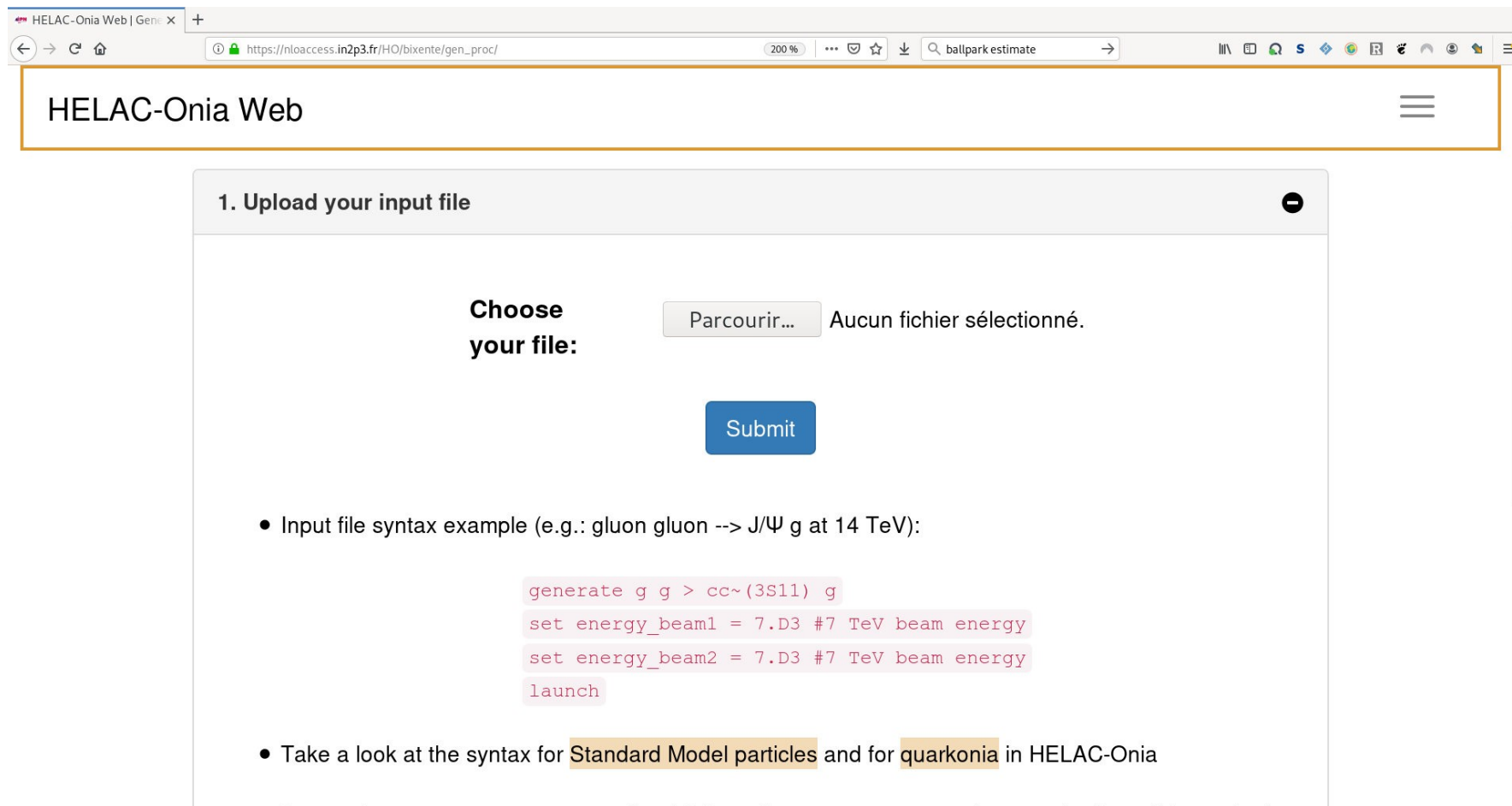
HELAC-Onia is an automatic matrix element generator for the calculation of the heavy quarkonium helicity amplitudes in the framework of NRQCD factorization. The program is able to calculate helicity amplitudes of multi P-wave quarkonium states production at hadron colliders and electron-positron colliders 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.

[Already registered to the portal? Please login.](#)

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# VA1: NLOAccess

## Update on progress



The screenshot shows a web browser window with the URL `https://nloaccess.in2p3.fr/HO/bixente/gen_proc/`. The page title is "HELAC-Onia Web". The main content area is titled "1. Upload your input file" and contains the following elements:

- A section labeled "Choose your file:" with a "Parcourir..." button and the text "Aucun fichier sélectionné."
- A blue "Submit" button.
- A bullet point: "Input file syntax example (e.g.: gluon gluon --> J/Ψ g at 14 TeV):"
 

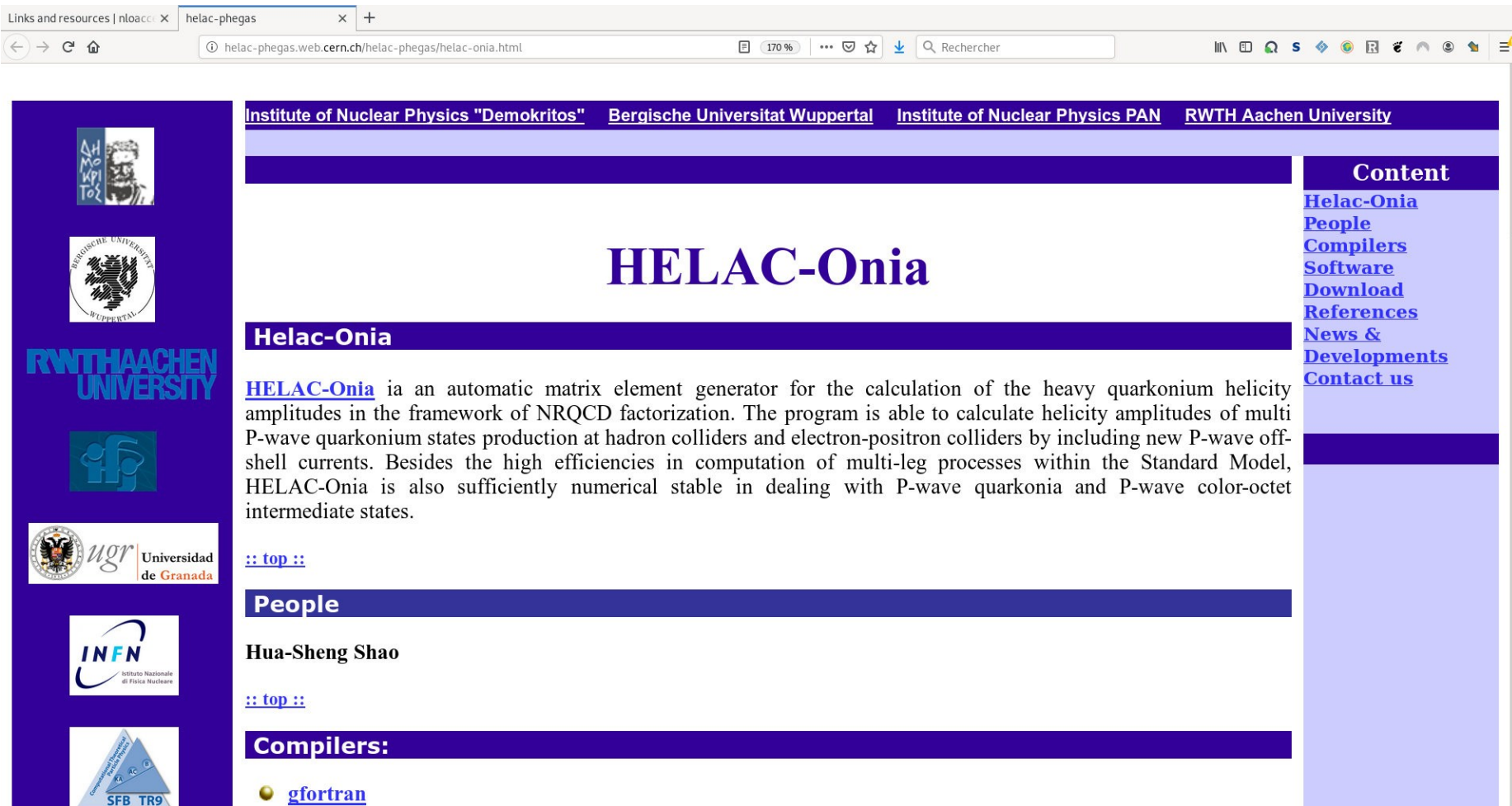
```
generate g g > cc~(3S11) g
set energy_beam1 = 7.D3 #7 TeV beam energy
set energy_beam2 = 7.D3 #7 TeV beam energy
launch
```
- A bullet point: "Take a look at the syntax for **Standard Model particles** and for **quarkonia** in HELAC-Onia"

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# VA1: NLOAccess

## Update on progress




The screenshot shows a web browser displaying the HELAC-Onia website. The browser's address bar shows the URL: `helac-phegas.web.cern.ch/helac-phegas/helac-onia.html`. The website has a dark blue header with navigation links: [Institute of Nuclear Physics "Demokritos"](#), [Bergische Universität Wuppertal](#), [Institute of Nuclear Physics PAN](#), and [RWTH Aachen University](#). The main content area features the title "HELAC-Onia" in large white letters. Below the title, a section titled "Helac-Onia" contains a paragraph describing the program: "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." Below this text is a link [:: top ::](#). A section titled "People" lists "Hua-Sheng Shao" with another [:: top ::](#) link. A section titled "Compilers:" lists [gfortran](#). On the right side, a "Content" sidebar lists links: [Helac-Onia](#), [People](#), [Compilers](#), [Software](#), [Download](#), [References](#), [News & Developments](#), and [Contact us](#). The left sidebar contains logos of partner institutions: [AMPT](#), [Bergische Universität Wuppertal](#), [RWTH Aachen University](#), [if](#), [Universidad de Granada](#), [INFN Istituto Nazionale di Fisica Nucleare](#), and [SFB TR9](#).

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# VA1: NLOAccess

## Update on progress



The screenshot shows the MadGraph5\_aMC@NLO homepage. At the top, it says "Center for Particle Physics and Phenomenology - CP3". Below this, there are two Feynman diagrams: a t-channel exchange on the left and an s-channel exchange on the right. The central text reads "The MadGraph5\_aMC@NLO homepage" followed by "UCL UIUC Launchpad" and "by the MG/ME Development team". At the bottom, there are several links: "Generate Process", "Register", "Tools", "My Database", "Cluster Status", "Downloads (needs account)", "Wiki", "Answers", and "Bug reports".

## Generate processes online using MadGraph5\_aMC@NLO

To improve our web services we request that you register. Registration is quick and free. You may register for a password by clicking [here](#).  
**Please note the correct reference for MadGraph5\_aMC@NLO, [arXiv:1405.0301 \[hep-ph\]](#).**

Code can be generated either by (only LO process can be generated online):

I. Fill the form:

Model:

Input Process:

Example:  $p p > w + j j$  QED=3,  $w + > l + \nu_l$

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# VA1: NLOAccess

## Update on progress

- **Hiring a dedicated computing engineer with physics background has started:**  
(in progress, will occur before the end of year 2019)
- *L'ingénieur(e) d'études recruté(e) aura pour mission d'assurer la maintenance du portail virtuel NLOAccess et d'y inclure de nouveaux codes et le cas échéant d'optimiser leur fonctionnement, de faire la publicité scientifique du portail virtuel ainsi que d'assurer le support aux contributeurs au portail et à la communauté des utilisateurs.*
- **Activités :**
  - • Maintenance du portail virtuel NLOAccess (interface web ; base de données des utilisateurs et reporting des usages ; mise à jour des codes inclus ; définition, mise en place et mise à jour de la politique d'usage ; ...)
  - • Inclusion de nouveaux codes (en plus de Madgraph et HELAC-Onia) en collaboration avec leurs auteurs et le cas échéant optimisation de ceux-ci
  - • Support au développement de Madgraph et HELAC-Onia dans le cadre des objectifs de NLOAccess (automatisation avec calculs de corrections radiatives)
  - • Rédiger et mettre à niveau les documentations techniques et fonctionnelles
  - • Support aux contributeurs et aux utilisateurs (création de comptes, gestions des bugs, accès à la documentation se rapportant aux codes, rédaction d'un guide de l'utilisateur, réponse aux questions, ...)

# VA1: NLOAccess

## Deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D10.1	Virtual Access provision - multi annual implementation plan over the first 18 months (month 1-18) (D10.1)	1 - CNRS	Report	Confidential, only for members of the consortium (including the Commission Services)	18
D10.2	Virtual Access provision - multi annual implementation plan over the next 18 months (month 19-36) (D10.2)	1 - CNRS	Other	Public	36
D10.3	Virtual Access provision - multi annual implementation for the whole duration of the project (month 1-48) (D10.3)	1 - CNRS	Other	Public	48
D10.4	Assesment Report on the services and the statistics on the access (months 12, 24, 36 and 48) (D10.4)	1 - CNRS	Report	Public	48

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## VA1: NLOAccess Outreach

**Organizing a Masterclass** : this site is good for providing insight in cross-sections with hands-on experimentation. The expert can share physics and the students can play with all kind of parameters including center of mass energy, angular and energy cuts, couplings... The usual hassle of code installation and configuration is already dealt with, allowing the teacher and the students to focus on the physics.