NLOAccess: a Virtual Access to automated pertubative QCD computations

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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 extension for nPDFs to be included

✓ HELAC-Onia is included

HELAC-Onia

HELAC-Onia is an automatic matrix element and event generator for heavy quarkonium physics [H.-S. Shao, CPC 184 (2013) 2562-2570 & CPC 198 (2016) 238-259]

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

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NRQCD factorisation:

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

- $f_{i/p}(x_1)$, $f_{j/p}(x_2)$ are the PDFs
- $\hat{\sigma}(ij \to Q\bar{Q}[n] + X)$ 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)
- $\langle \mathcal{O}_n^{\mathcal{Q}} \rangle$ are the LDMEs

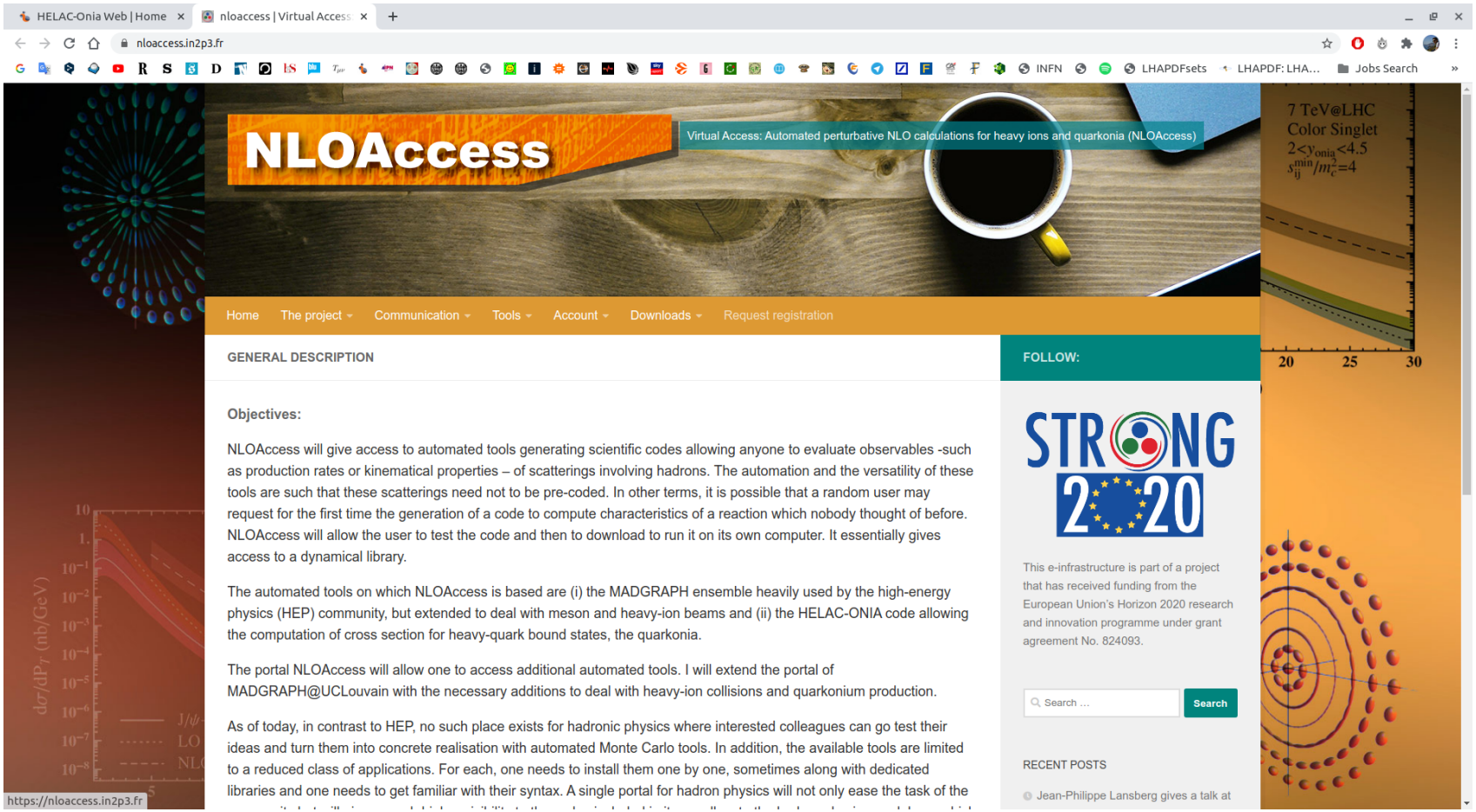
NLOAccess & HELAC-Onia Web

Some facts about NLOAccess:

- general information at https://nloaccess.in2p3.fr
- HELAC-Onia Web: https://nloaccess.in2p3.fr/HO/
- note: not definitive working version
- 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 - Homepage

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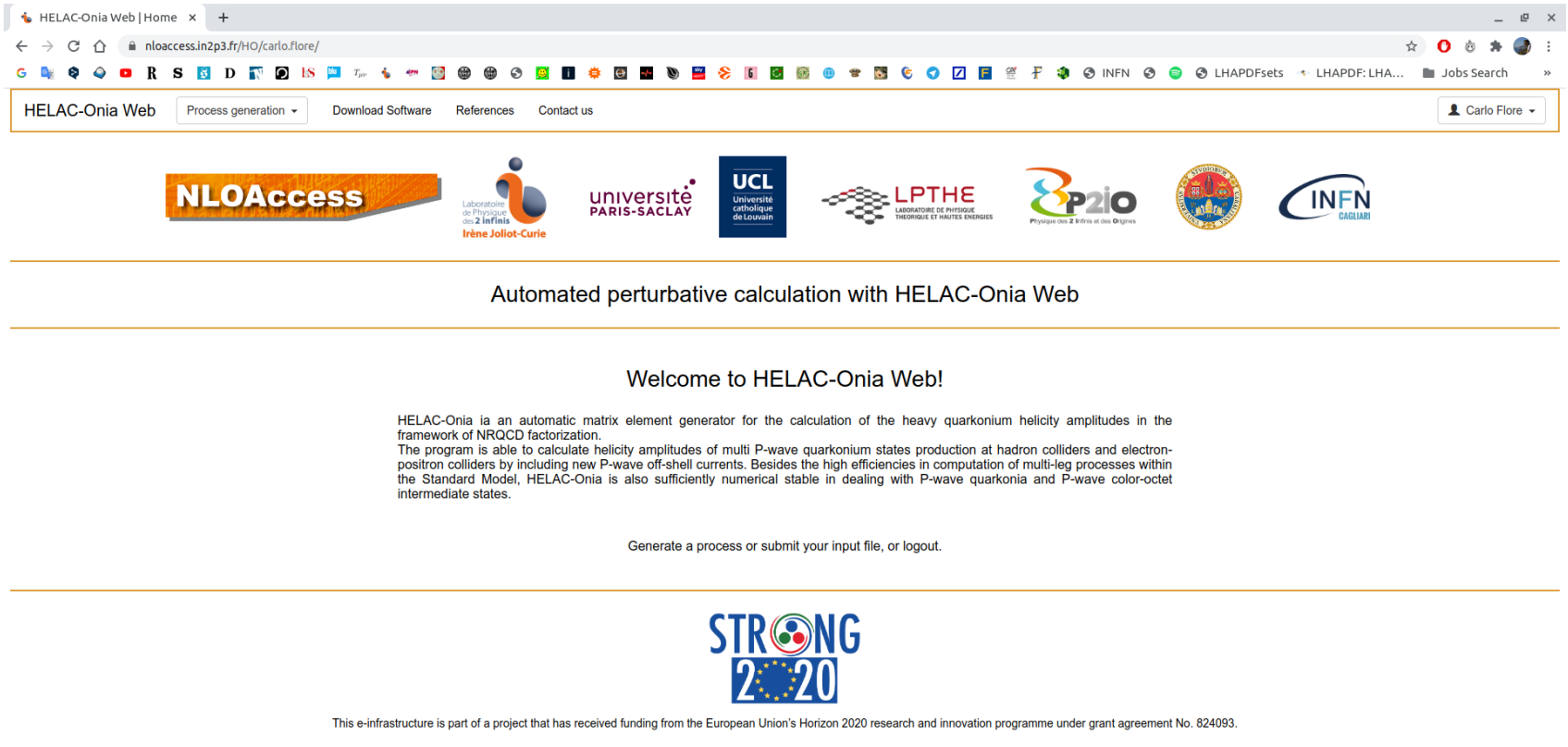
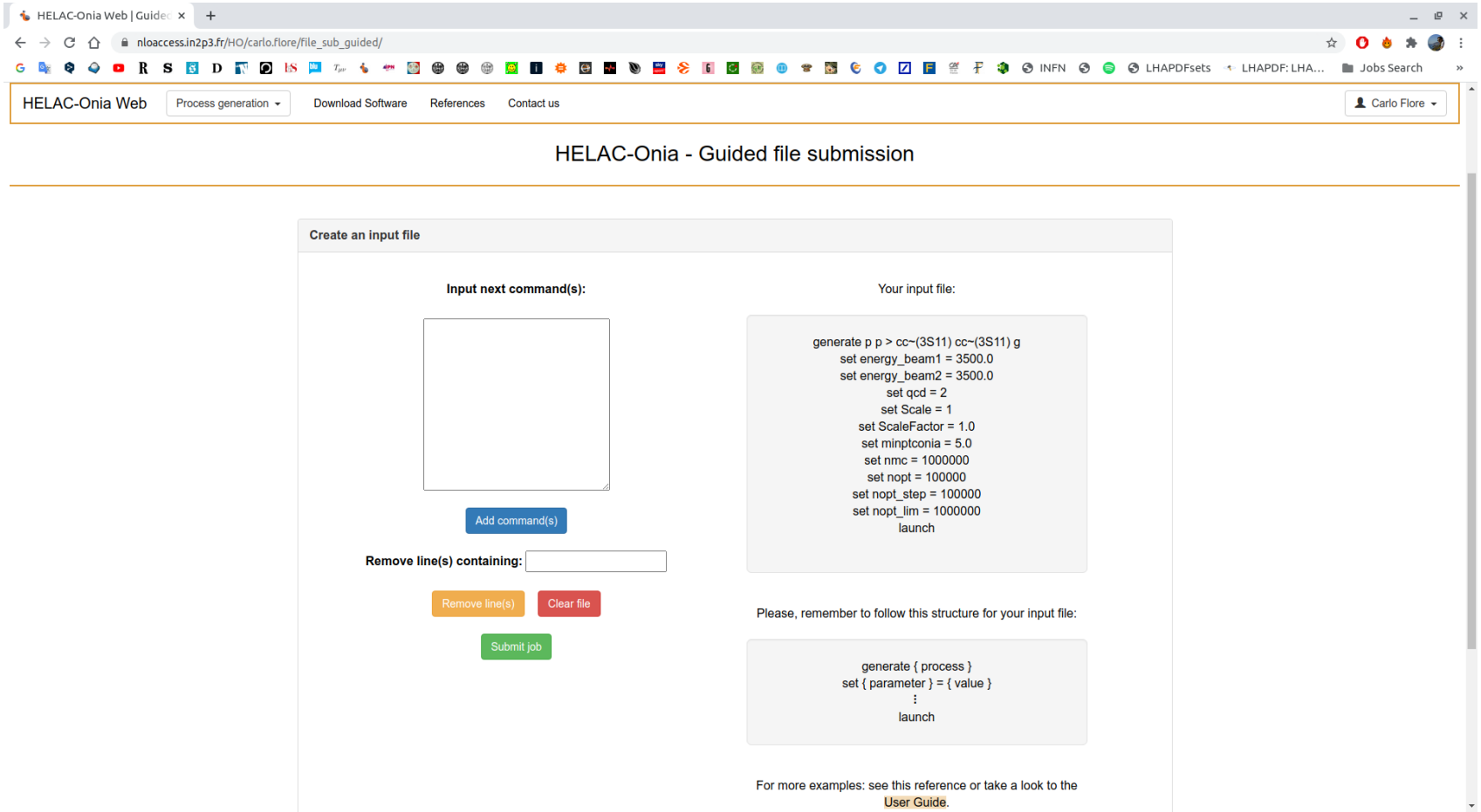
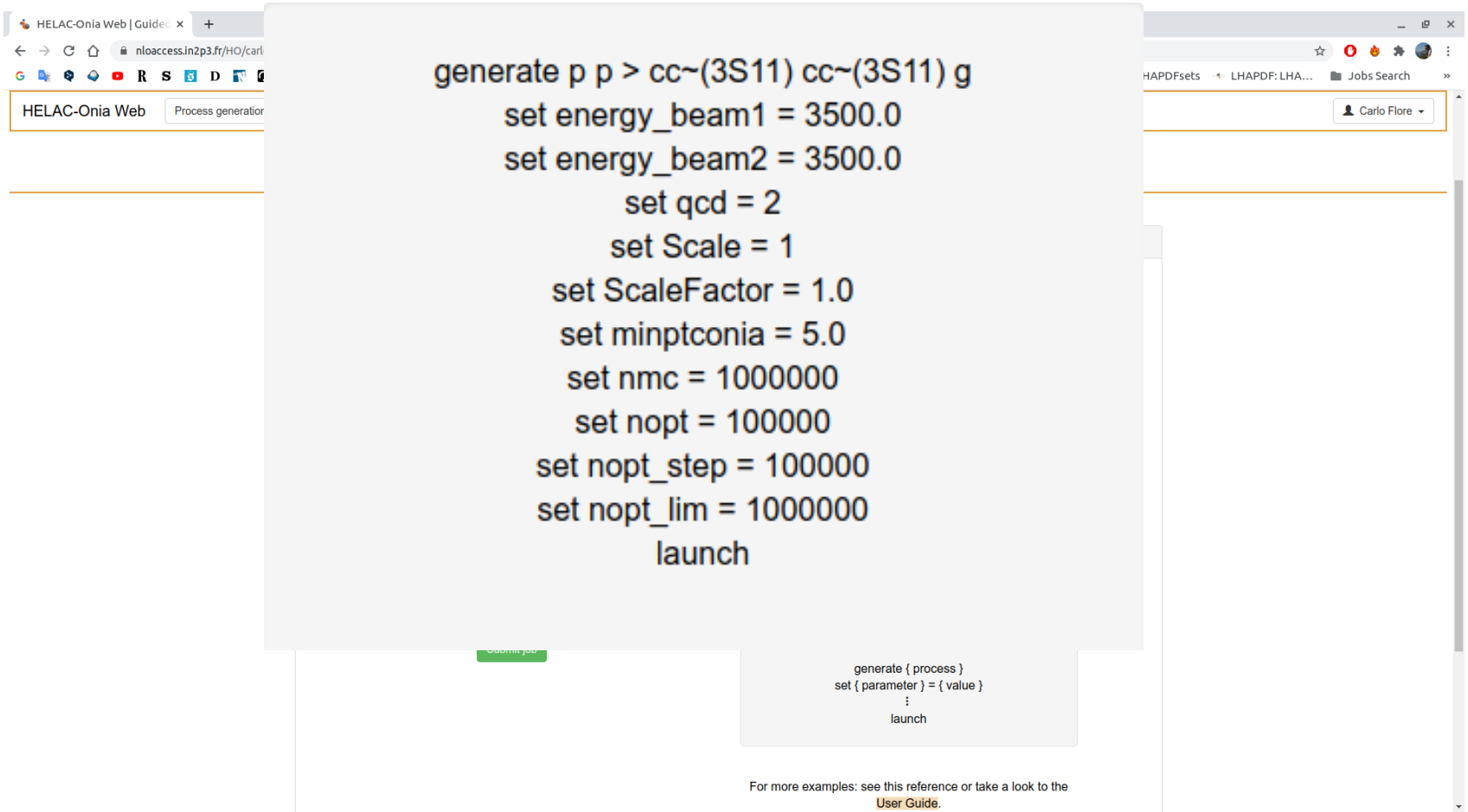


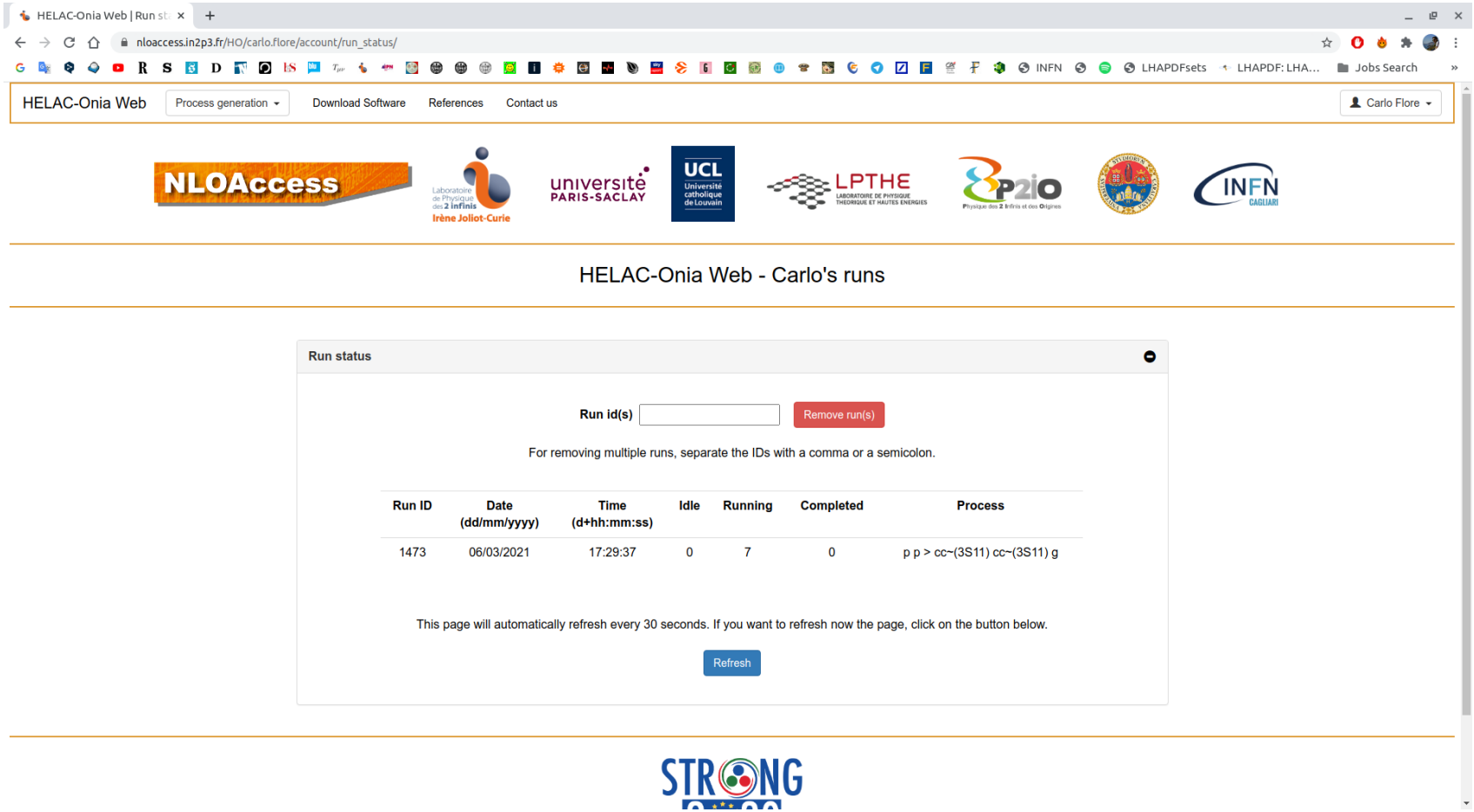
HELAC-Onia Web - Run submission



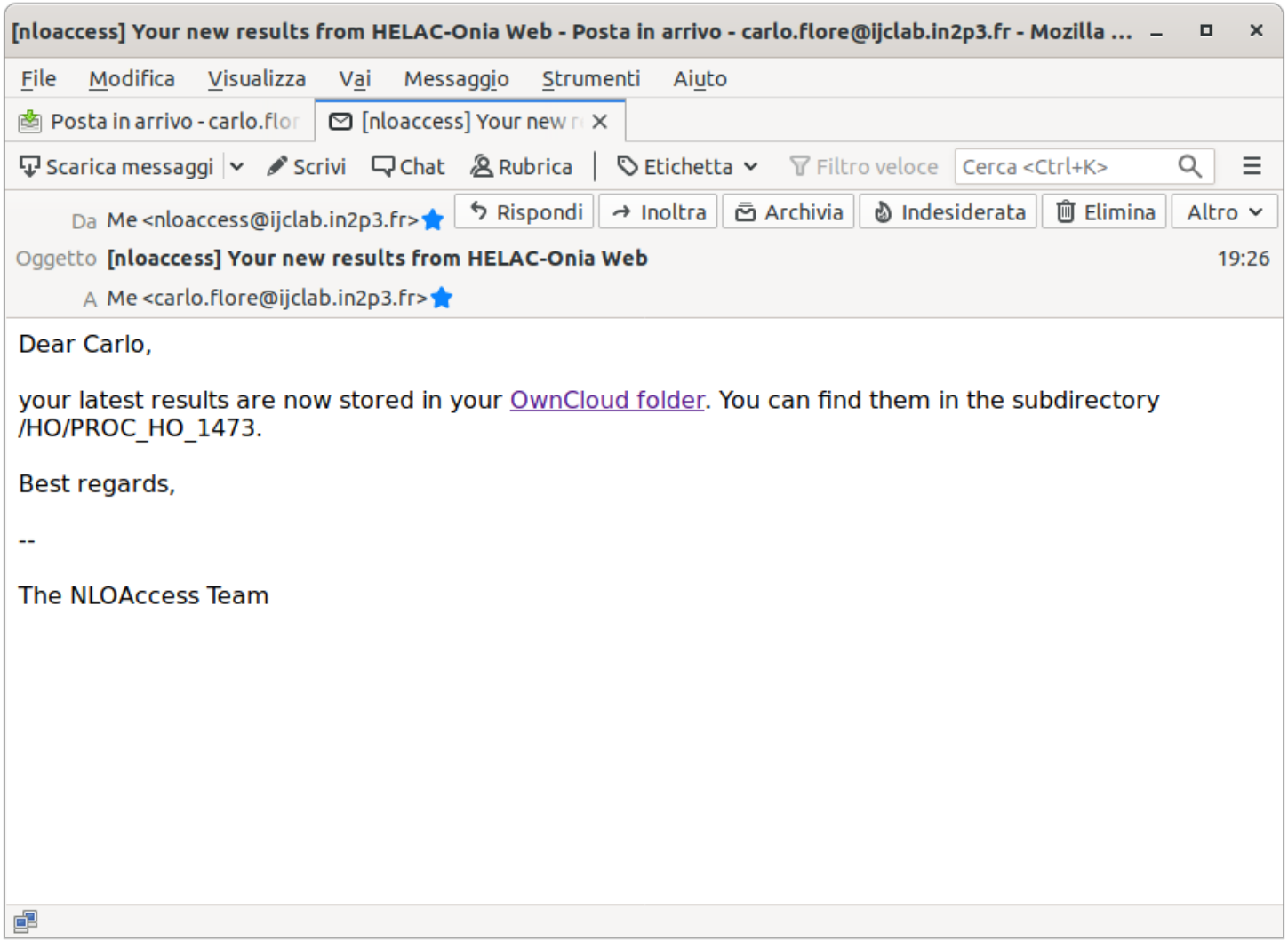
HELAC-Onia Web - Run submission



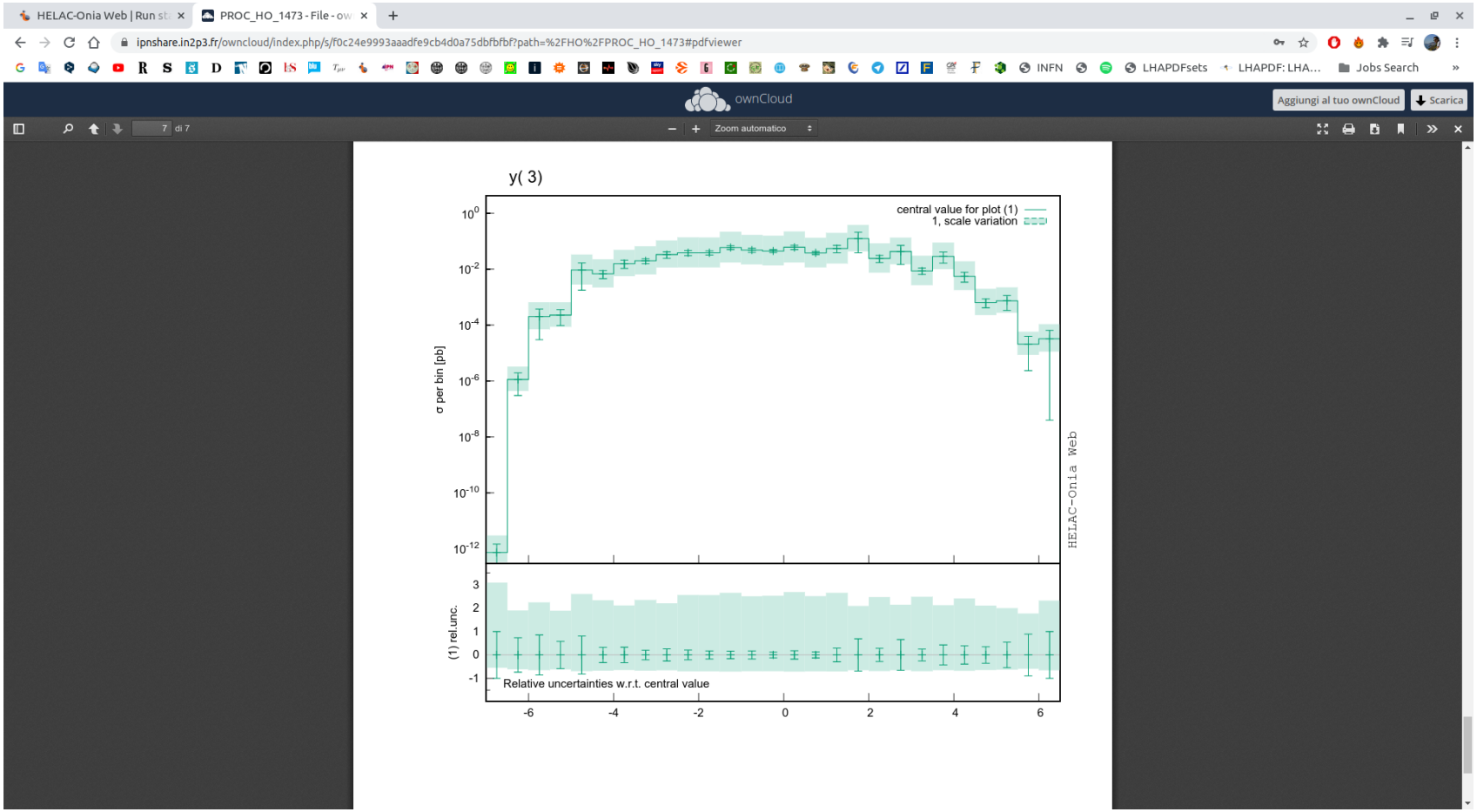
HELAC-Onia Web - Run status



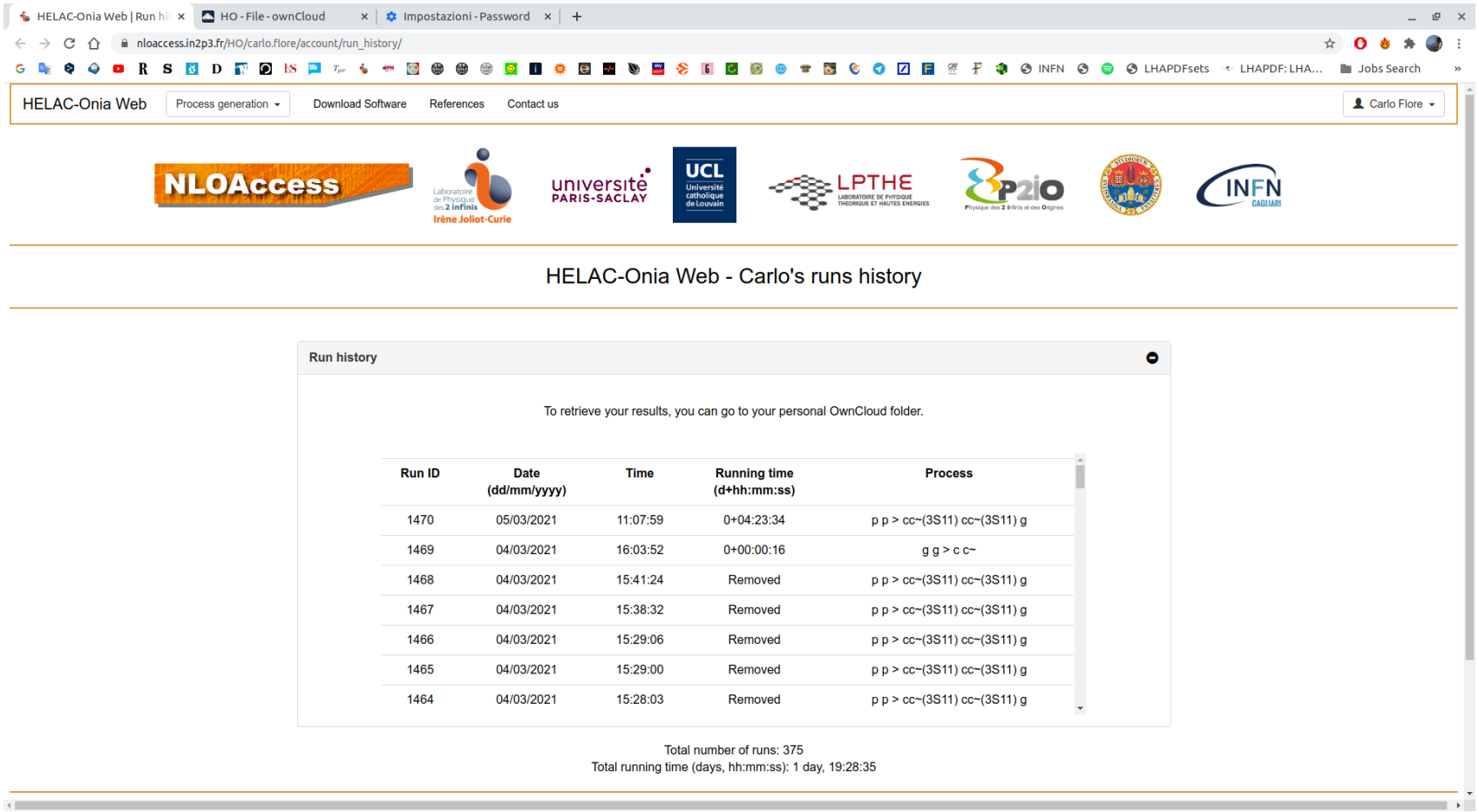
HELAC-Onia Web - Results (I)



HELAC-Onia Web - Results (II)



HELAC-Onia Web - Run history



NLOAccess - What's next?

MadGraph:

- MadGraph online version is only limited to LO calculation
- NLO preliminary version has already been tested (not public)
- extension to nPDFs $\Rightarrow$ extend calculation to other observables (e.g. R_{pA} or R_{AA})

HELAC-Onia developements:

- NLO calculations
- inclusion of TMD effects
- helpful for future fixed-target programs at the LHC

Thank you