NLOAccess: where do we stand?

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FTE@LHC & NLOAccess STRONG 2020
joint kick-off meeting

Nov., 7th 2019

Outline

1. The NLOAccess framework

2. HELAC-Onia and its web realisation

3. What's next?

4. Conclusions

1. The NLOAccess framework

The NLOAccess project

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- MadGraph and extension for nPDFs to be included
- ✓ HELAC-Onia is included

2. HELAC-Onia and its web realisation

HELAC-Onia

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- based on off-shell recursion relations

HELAC-Onia - Basic methodology

NRQCD factorisation:

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

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- $\langle \mathcal{O}_n^{\mathcal{Q}} \rangle$ are the LDMEs

HELAC-Onia - 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

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- built with Flask Python microframework
- file input as first way to submit a run

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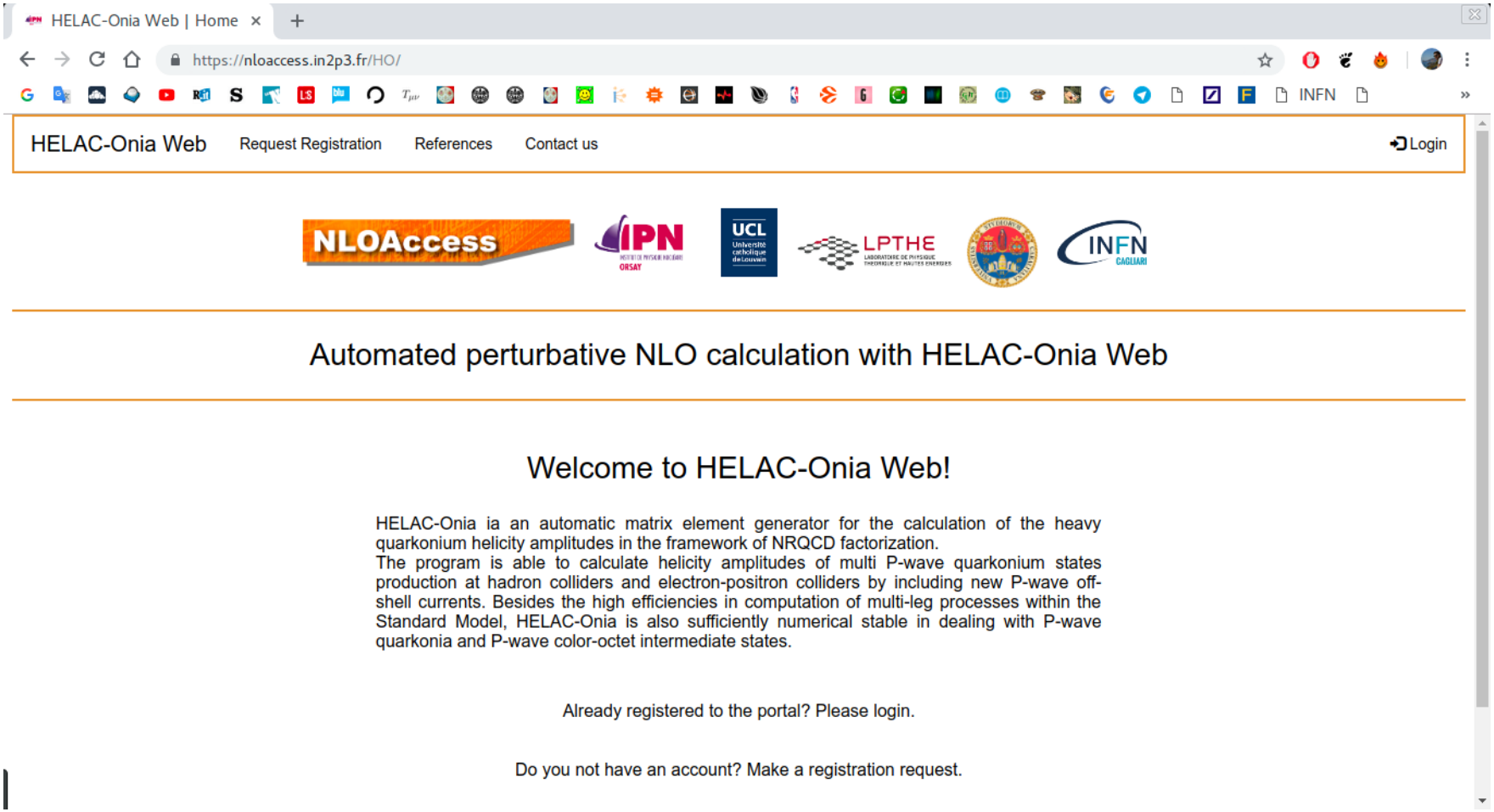
  *online guide still missing

HELAC-Onia Web - Homepage



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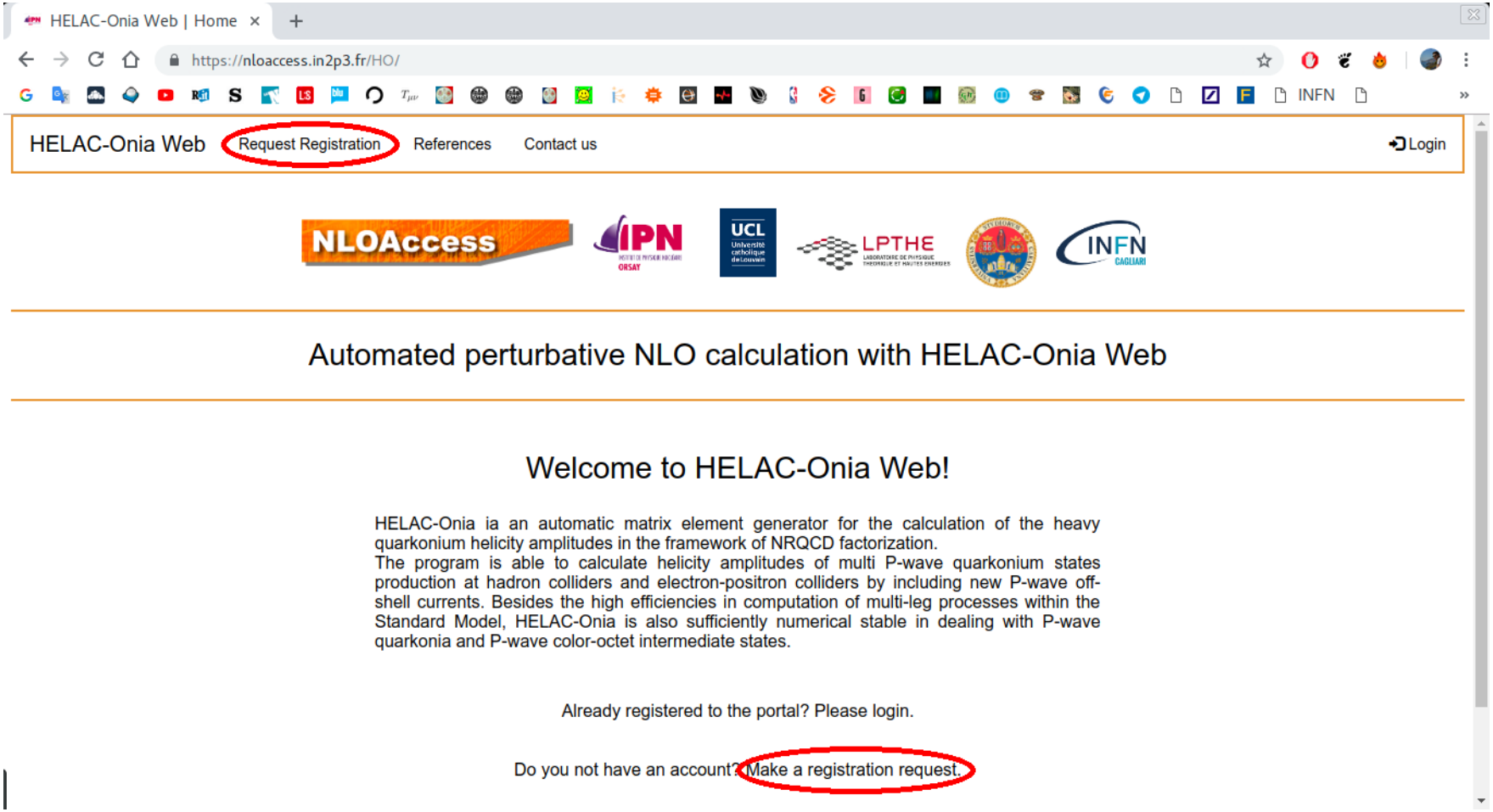

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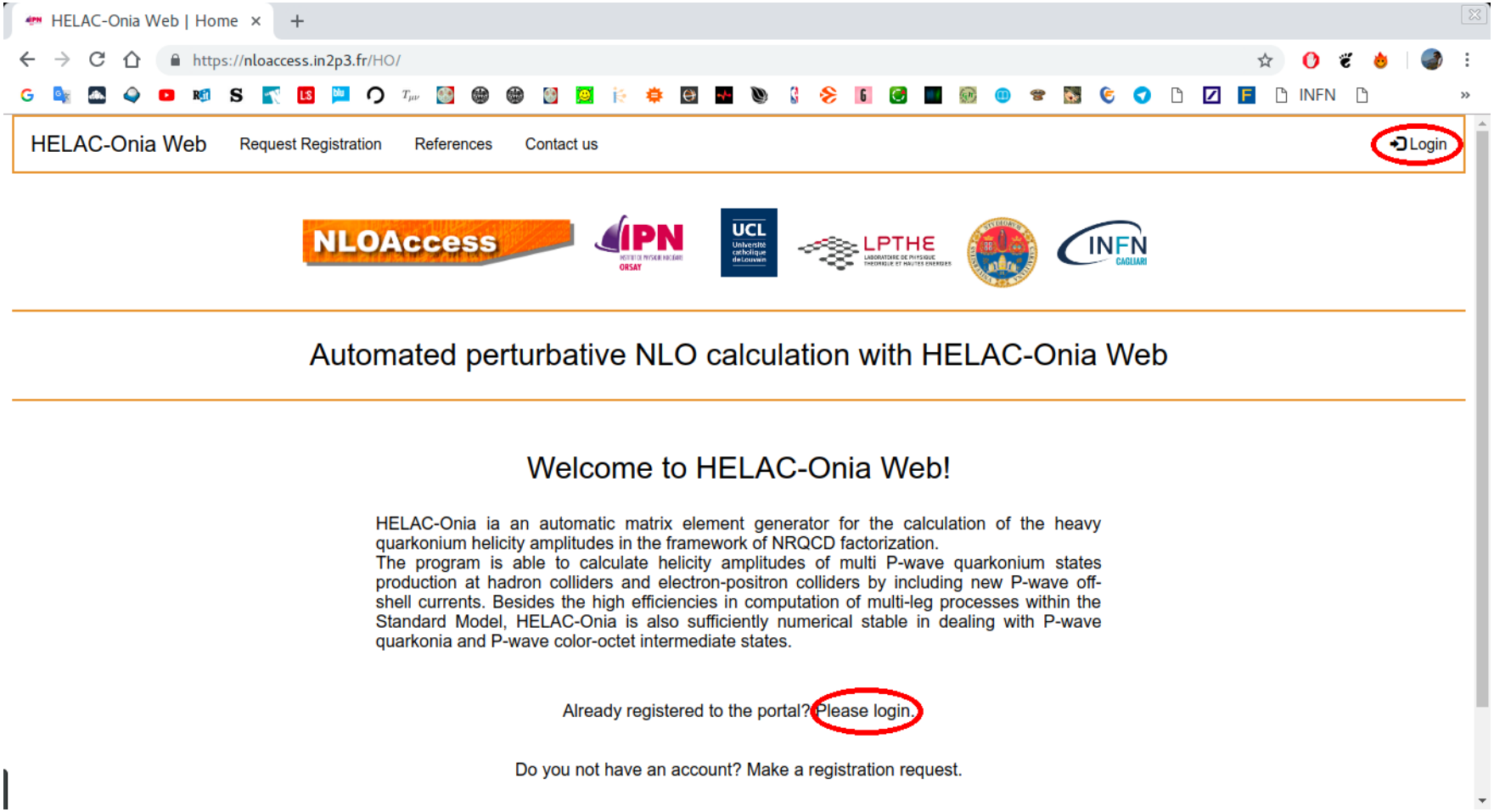

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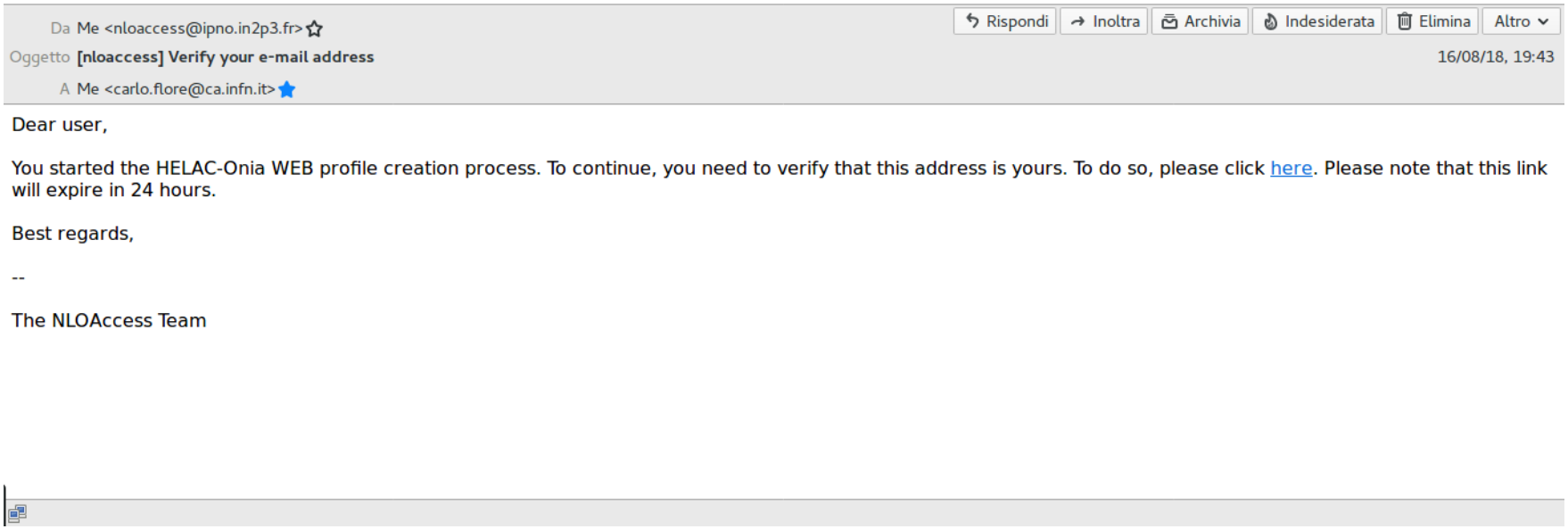

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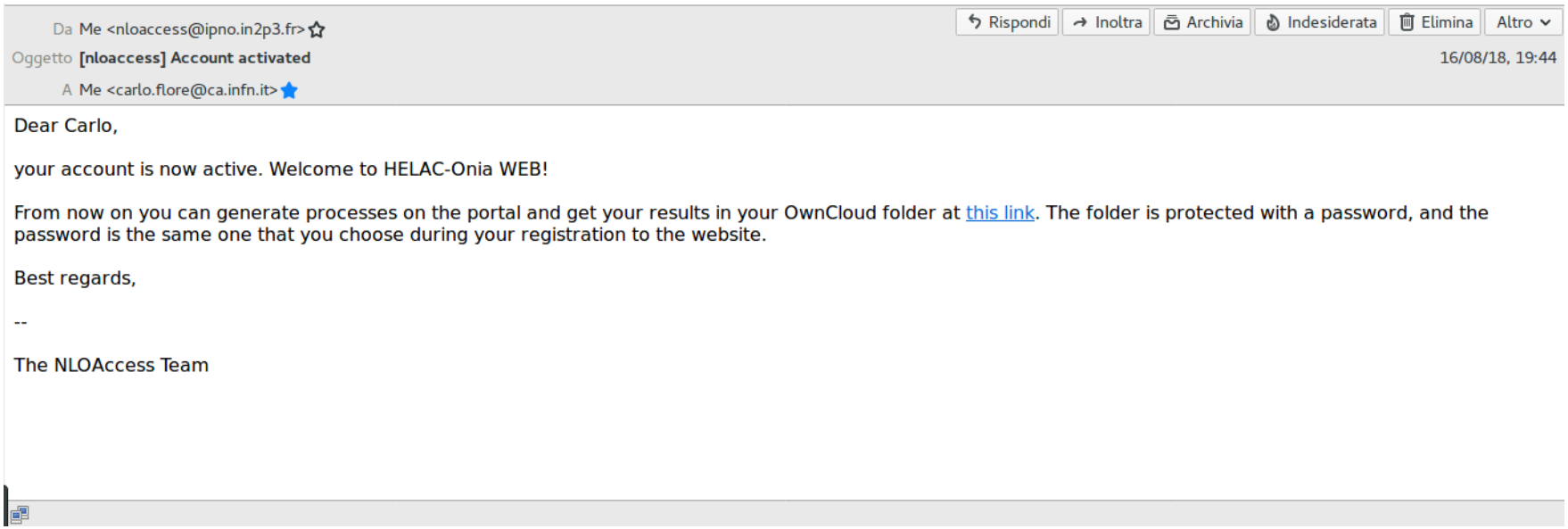

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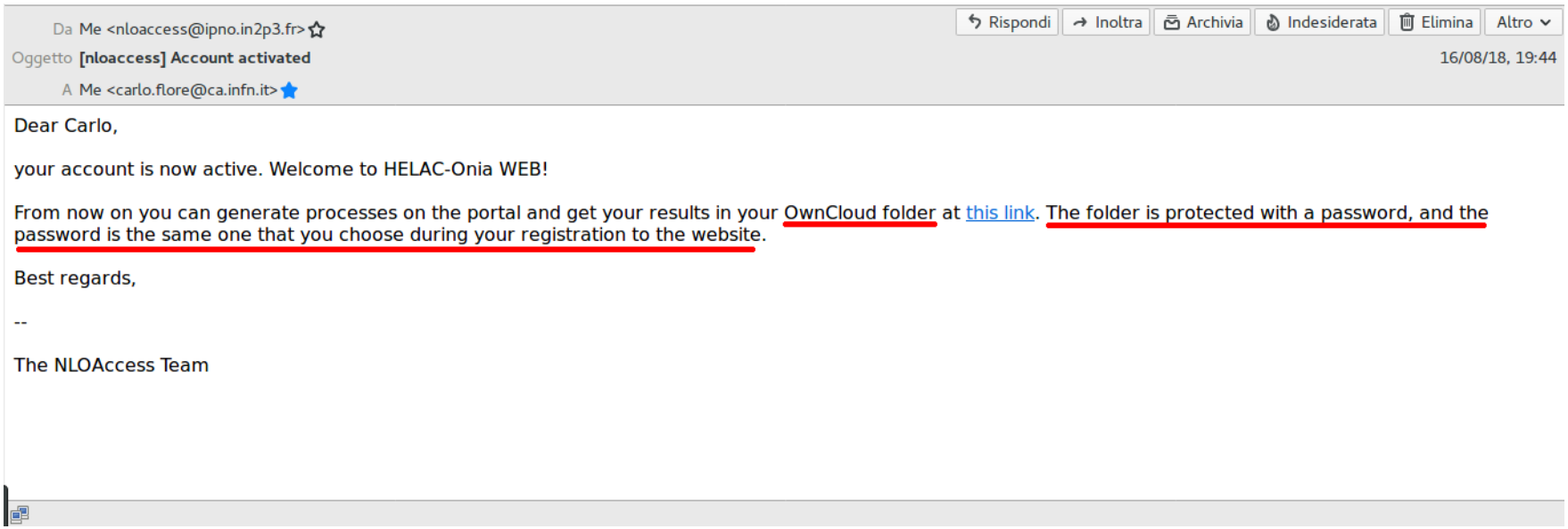
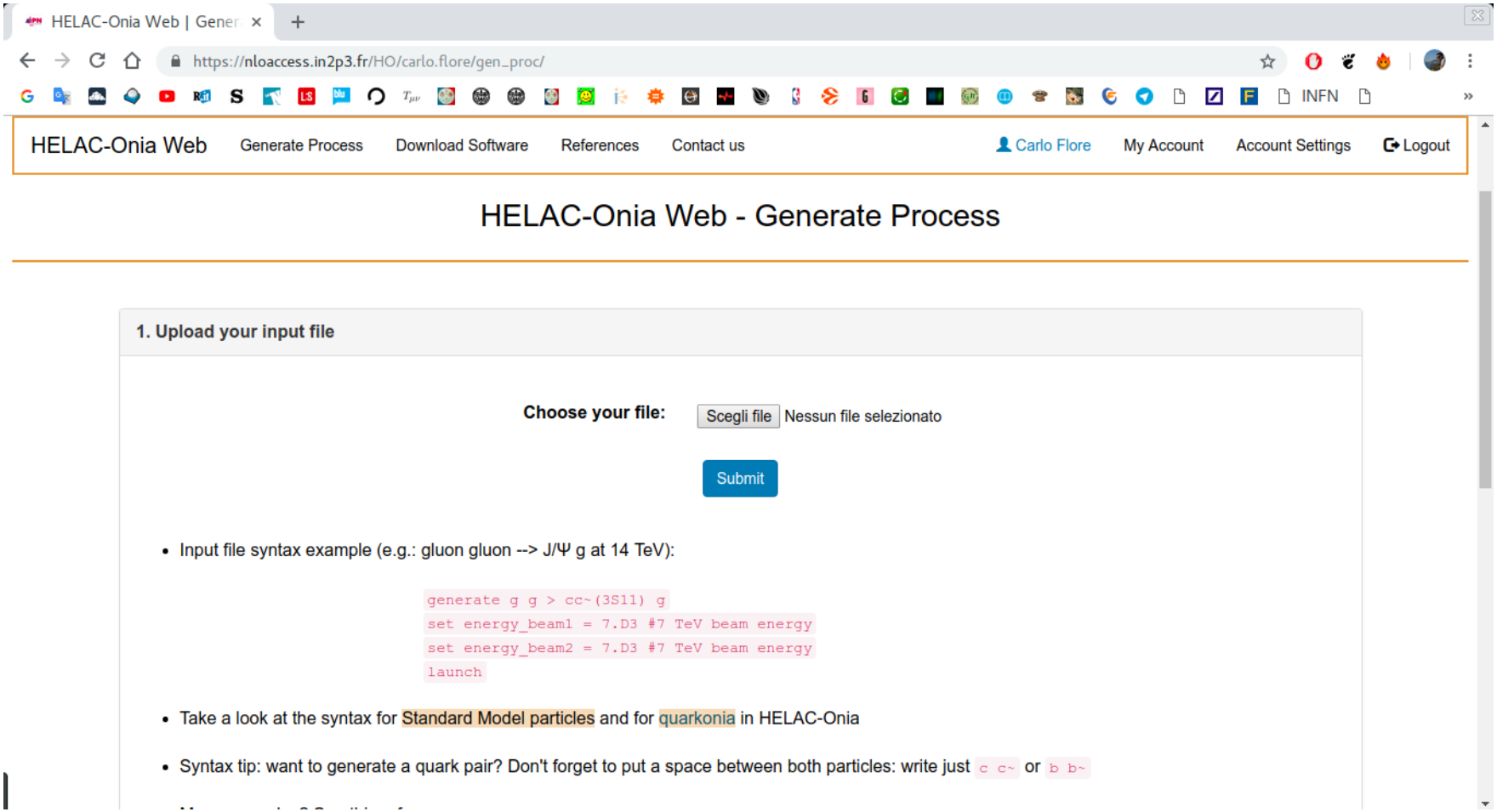


HELAC-Onia Web - Run submission (I)



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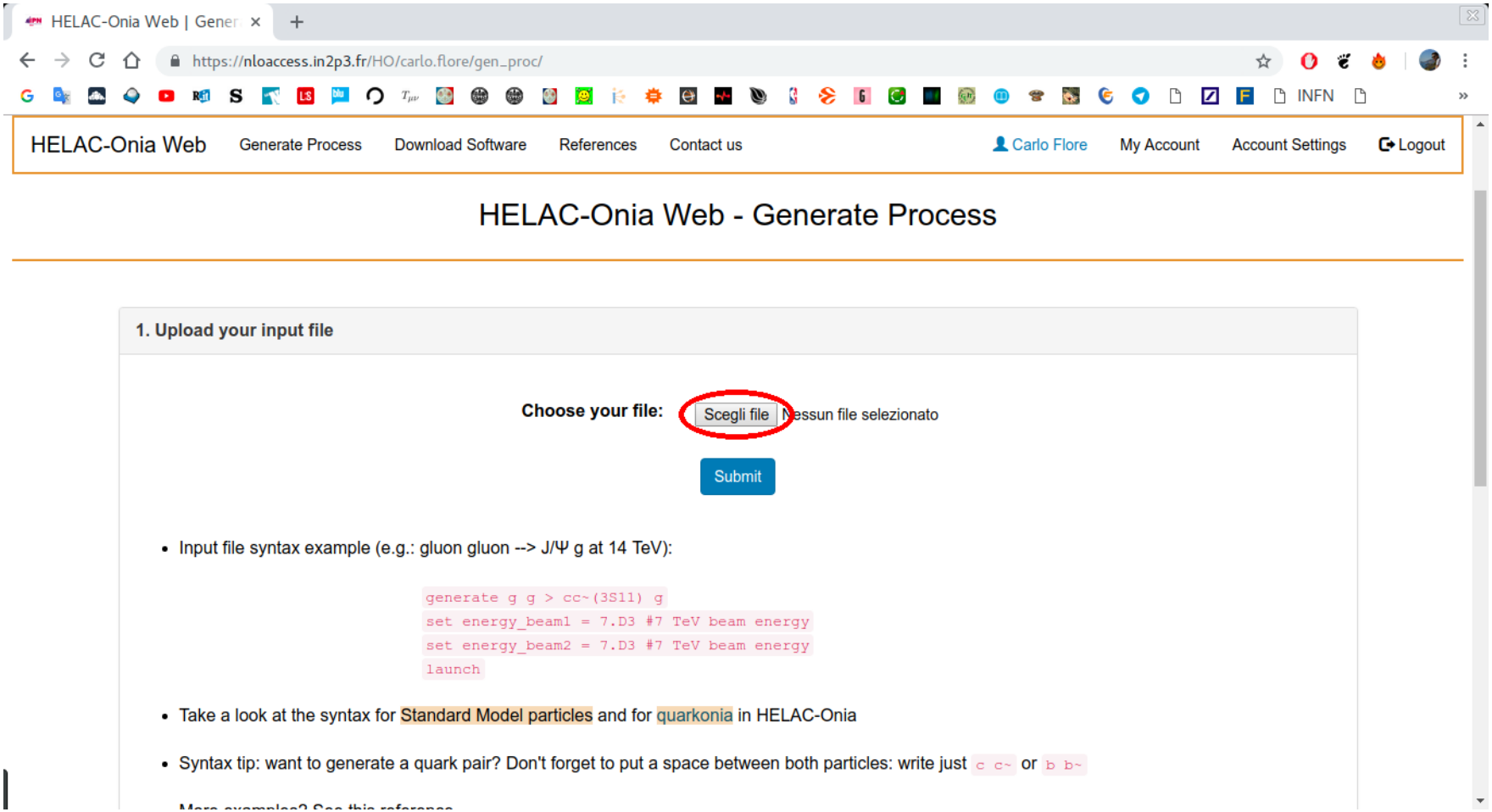

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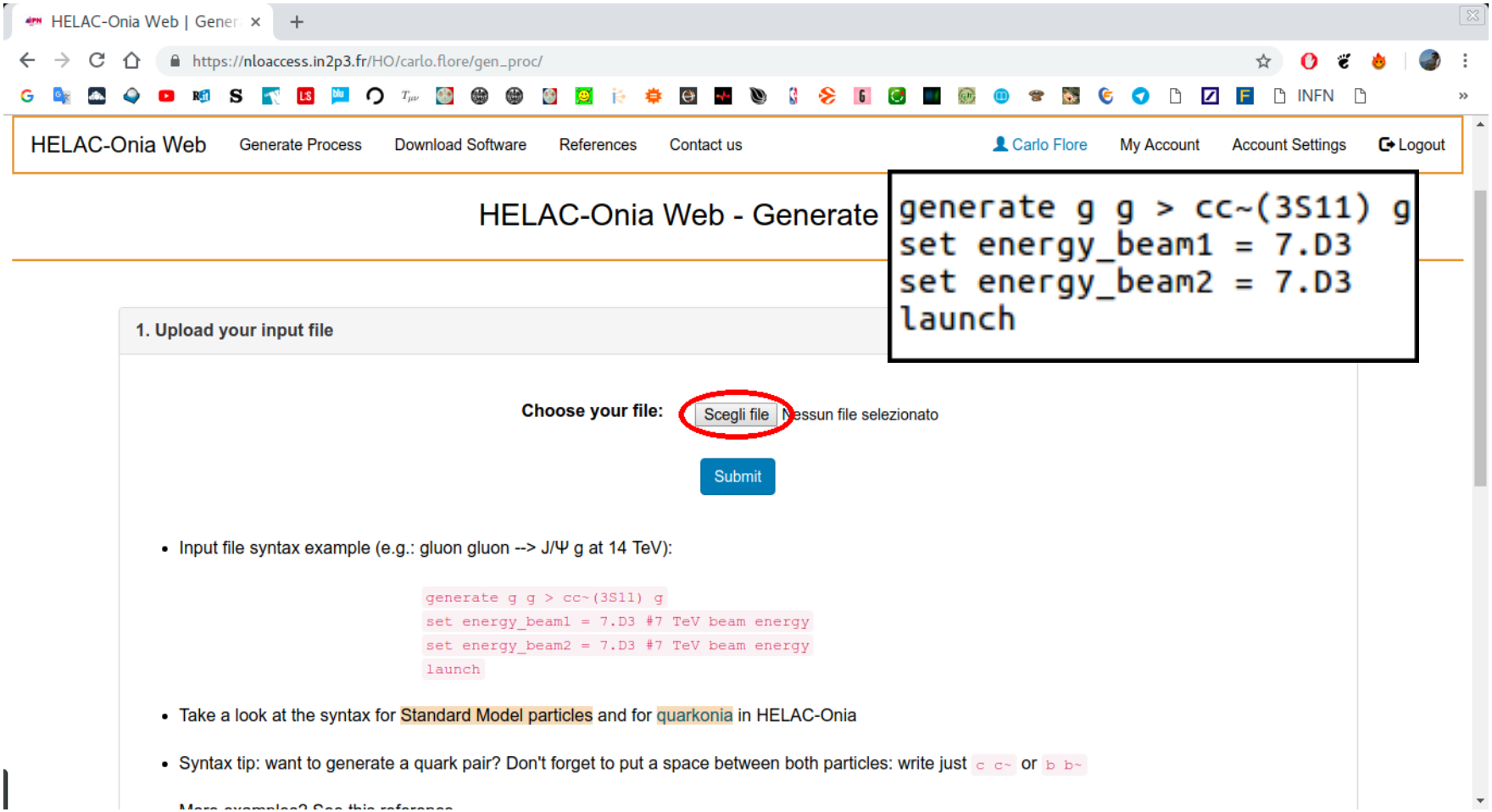
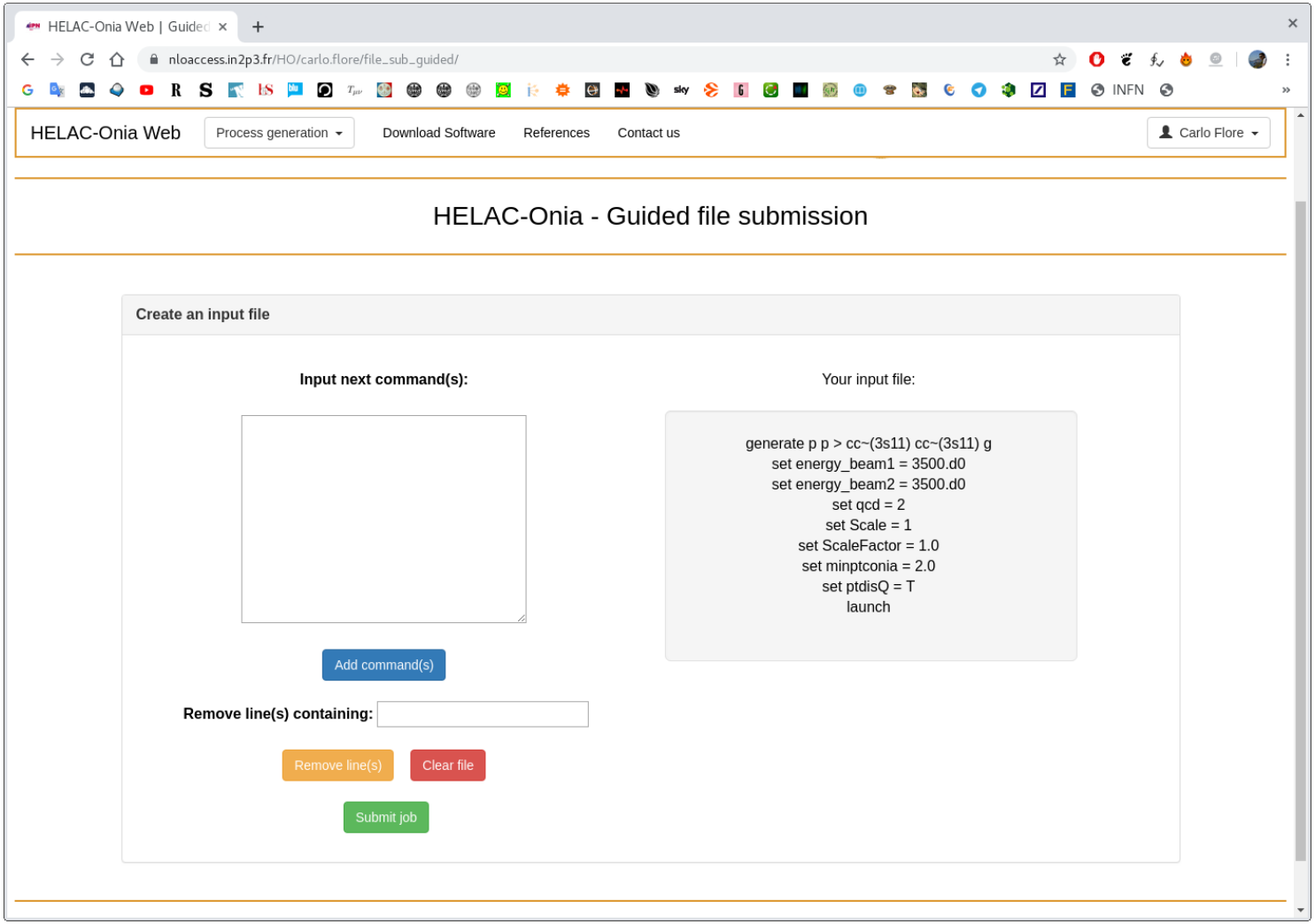


HELAC-Onia Web - Run submission (II)



HELAC-Onia Web - Input file

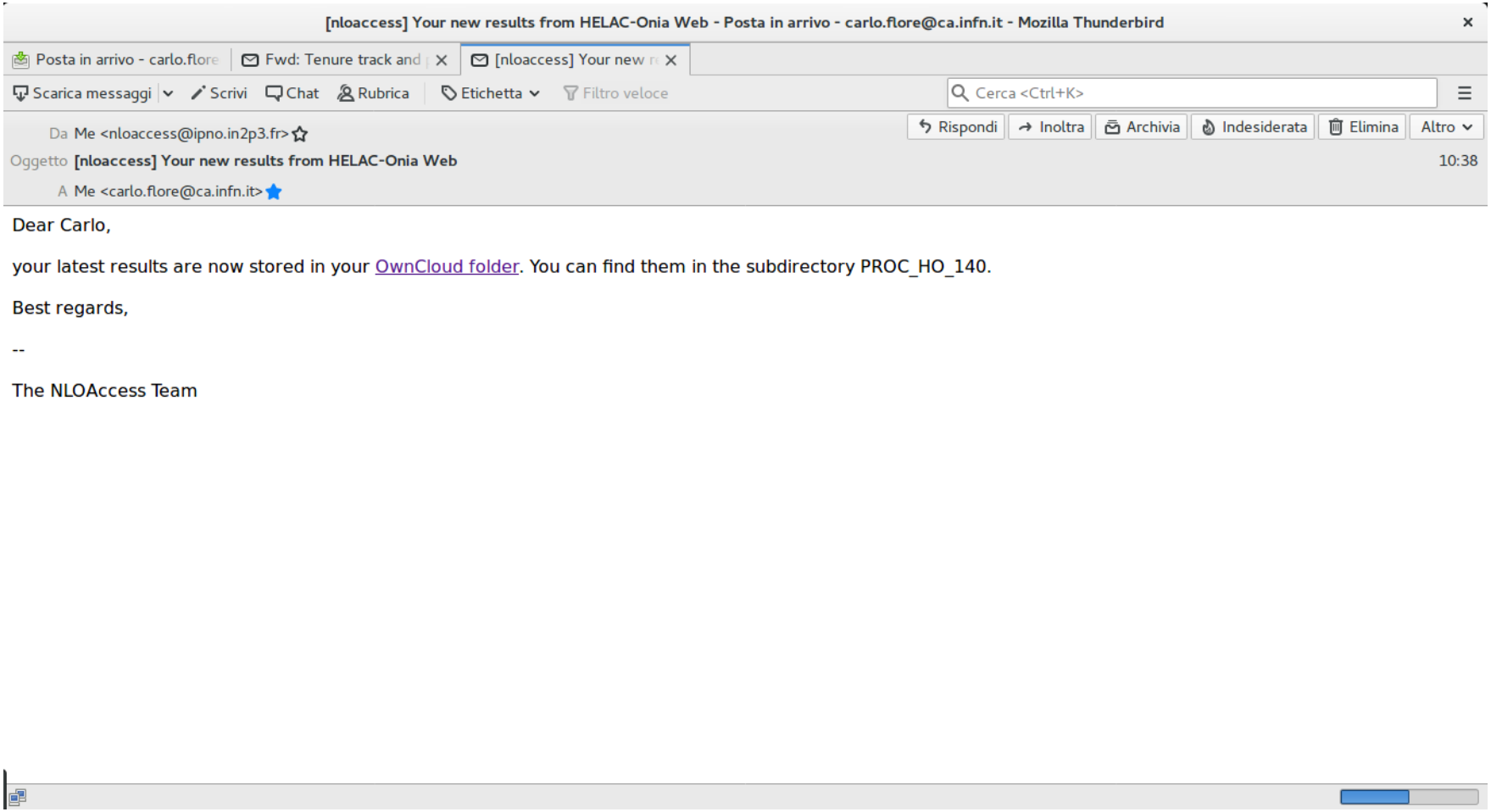
The input file should be in the following form:

```
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).
- kind of output (ROOT, Gnuplot, TopDrawer or LHE)

HELAC-Onia Web - Results



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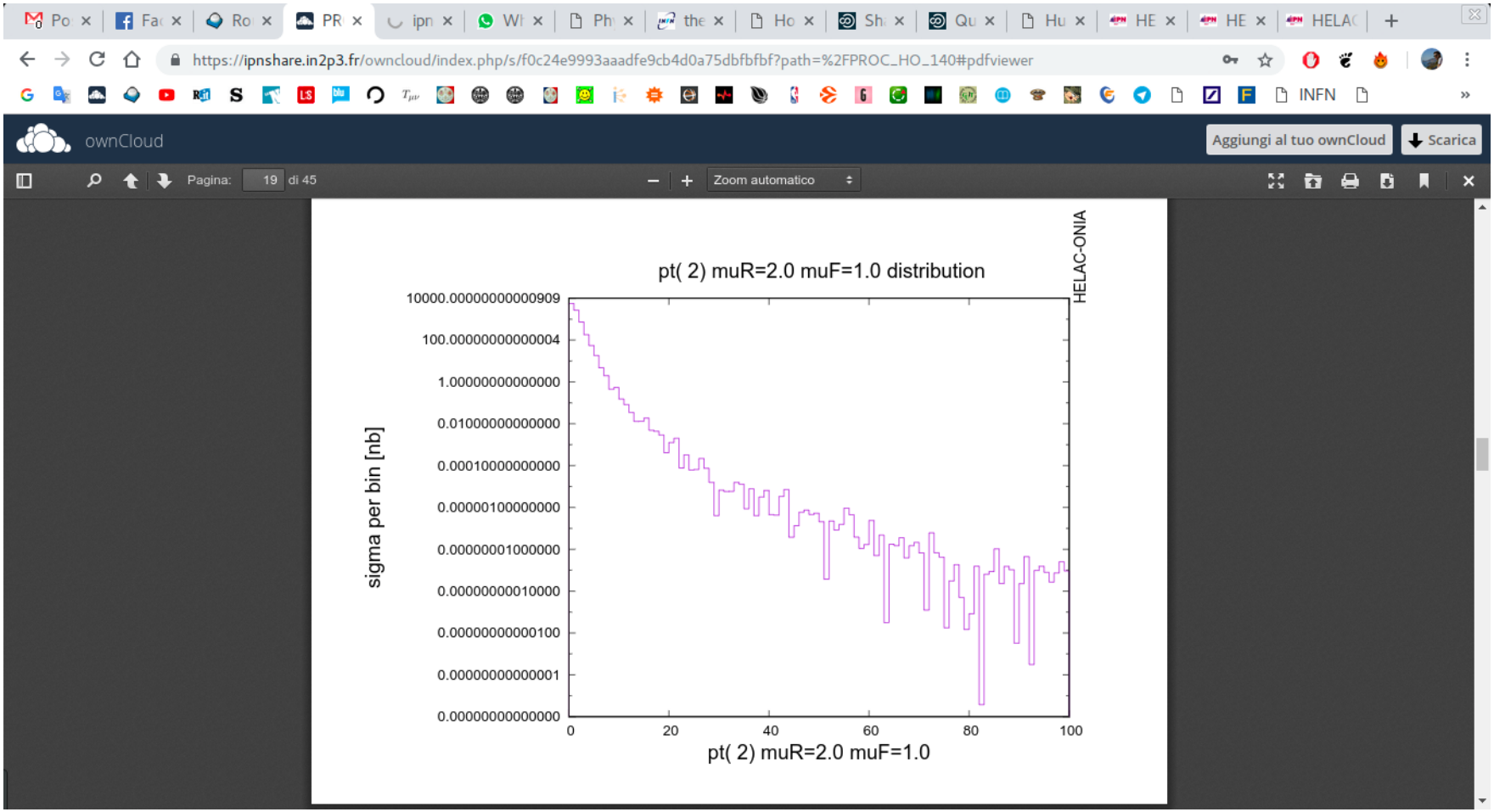
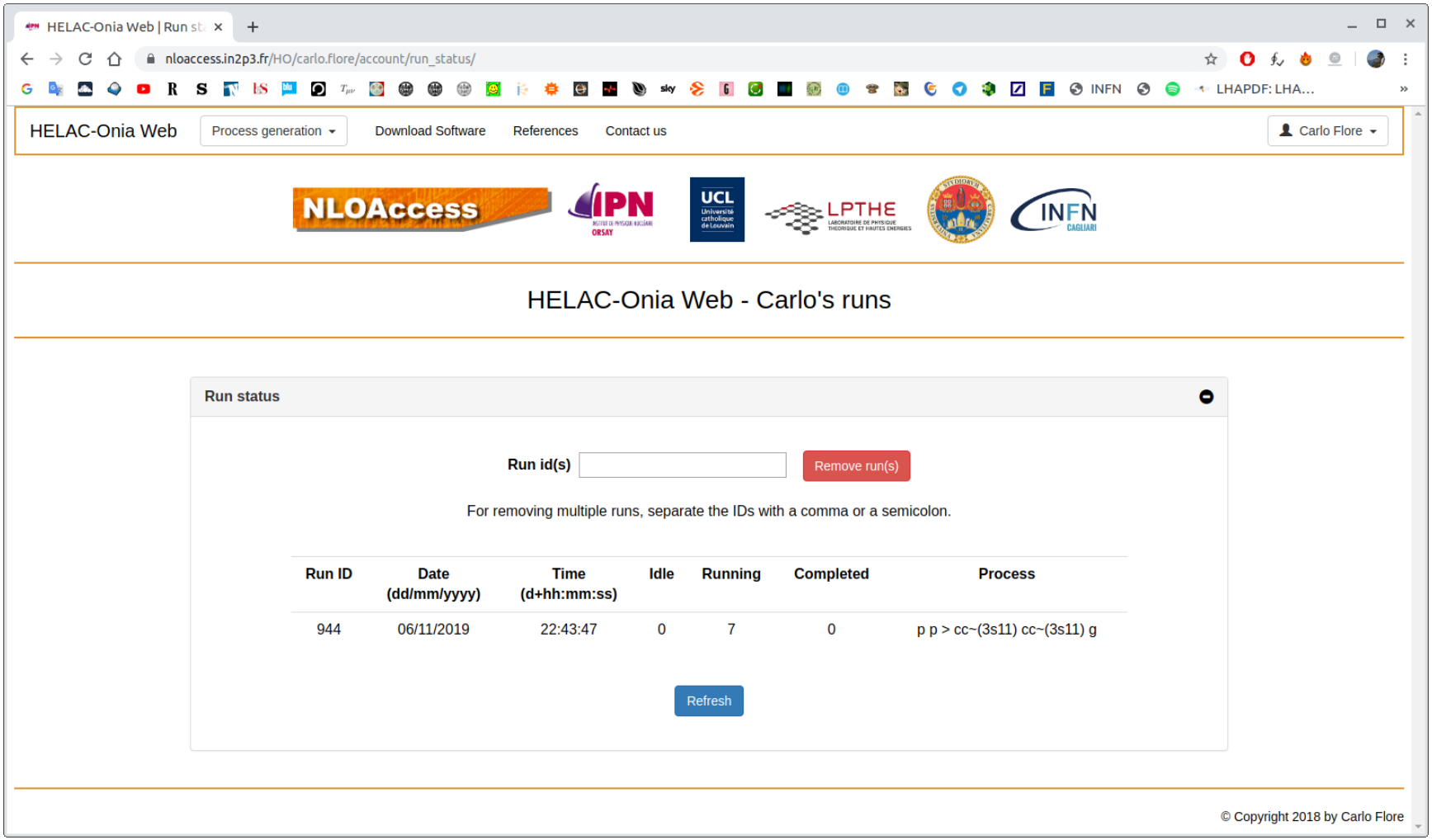


HELAC-Onia Web - Run status and history



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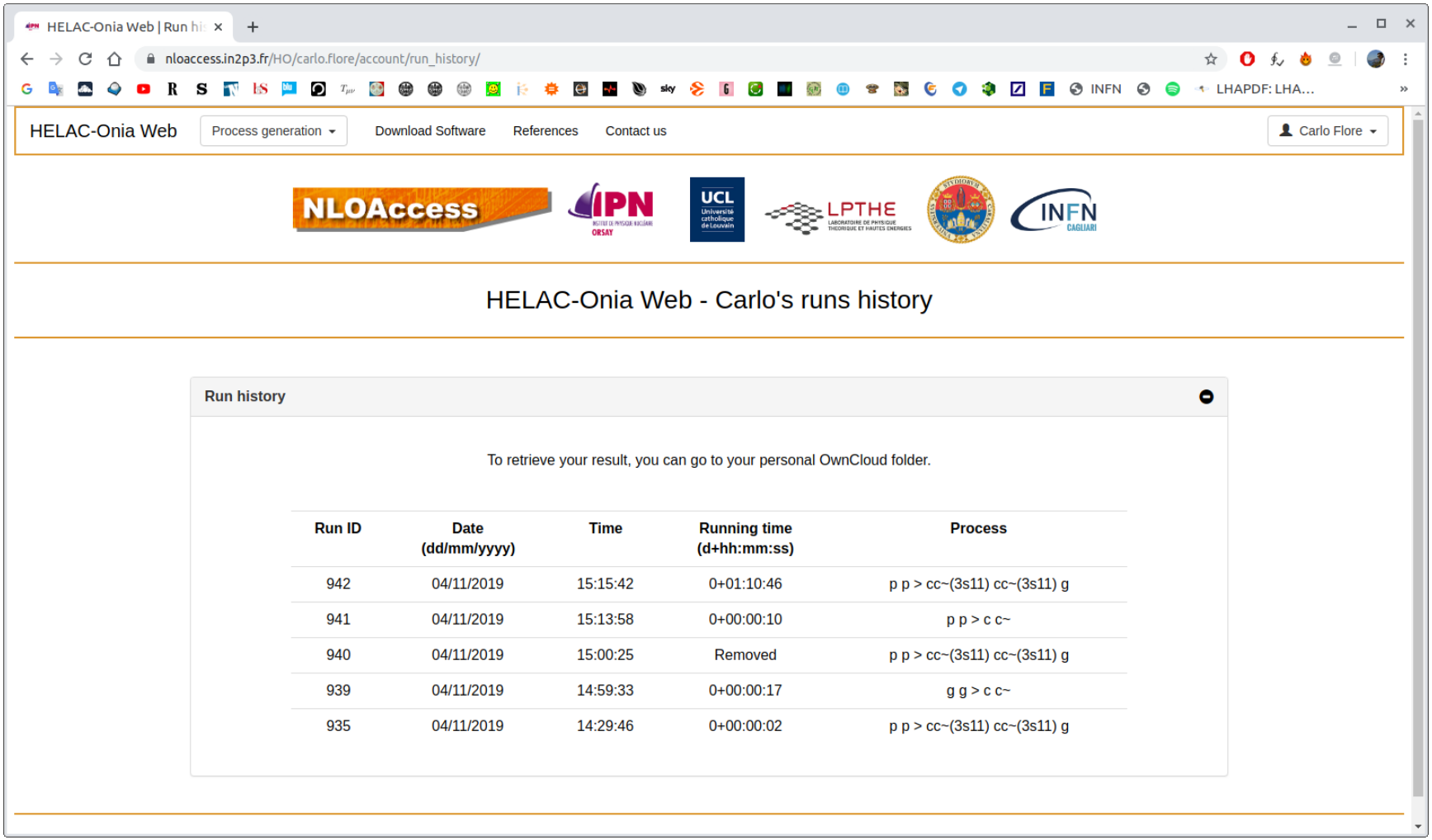

Run ID	Date (dd/mm/yyyy)	Time	Running time (d+hh:mm:ss)	Process
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941	04/11/2019	15:13:58	0+00:00:10	p p > c c~
940	04/11/2019	15:00:25	Removed	p p > cc~(3s11) cc~(3s11) g
939	04/11/2019	14:59:33	0+00:00:17	g g > c c~
935	04/11/2019	14:29:46	0+00:00:02	p p > cc~(3s11) cc~(3s11) g

3. What's next?

What's next? (I)

HELAC-Onia Web is just the first step needed for building the NLOAccess framework.

- HELAC-Onia can be further developed
- MadGraph5_aMC@NLO will be included on the portal
- extension to nuclear PDFs
- more observables (not only cross sections) could be calculated (open to suggestions!)

What's next? (II)

HELAC-Onia developements:

- NLO calculations
- inclusion of TMD effects
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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})

4. Conclusions

Conclusions

- NLOAccess:
  - aim to create a single portal for hadronic physics
  - automation and virtual access to a dynamical library
- HELAC-Onia: automated perturbative calculation for quarkonia production
- HELAC-Onia Web: improved portal is online
- MadGraph is going to be included

Suggestions are welcome!

Thank you

Backup

HELAC-Onia Web: available PDF sets

The following PDF sets are available for the web version of HELAC-Onia:

- CT10
- CT14LO
- CT14NLO
- CTEQ6L1
- CTEQ66
- nCTEQFullNucMod_208_82
- EPPS16+CT14nlo_Pb208
- NNPDF3.0_NLO_as_0118

References

- HELAC-Onia:
  - "HELAC-Onia: an automatic matrix element generator for heavy quarkonium physics", Hua-Sheng Shao, Comput. Phys. Commun. 184 (2013) 2562 (https://doi.org/10.1016/j.cpc.2013.05.023)
  - "HELAC-Onia 2.0: an upgraded matrix-element and event generator for heavy quarkonium physics", Hua-Sheng Shao, Comput. Phys. Commun. 198 (2016) 238 (https://doi.org/10.1016/j.cpc.2015.09.011)
  - download at http://hshao.web.cern.ch/hshao/helaconia.html
- NLOAccess: https://nloaccess.in2p3.fr
- Flask: http://flask.pocoo.org/