

# Outputting Actema Proofs

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## Context

Coq is a well-known proof system, based on type theory whose development is organized by Inria. Actema is a prototype of a novel user interface for building formal proofs, developed at LIX; it builds on theoretical tools coming from Deep Inference, and is based on the idea that the user can easily point to subterms of either the goal or hypotheses. A description can be found in [1]. A first version of Actema, restricted to first-order logic can be tested online (<http://actema.xyz/>). A new version acts as a front-end for Coq (<https://github.com/Champitoad/coq-actema/>)

## Goal

This Coq-Actema implementations includes Actema as a front-end, which has been adapted by Pablo Donato and Mathis Bouverot to present Coq proof states, and export the Actema actions back to Coq. Specialized tactics, written by Benjamin Werner and Mathis Bouverot, translate these actions into the type theory of Coq.

The resulting Coq proof term, however, is hard to read. There are several open paths for rendering Actema proofs in a readable manner; among others:

- Finding a readable textual output which could be re-run by Coq in textual mode.
- Some kind of video output, « replaying » the proof.

Although this can be discussed, the first idea would probably be the primary goal of the internship. This involves a good understanding of the deep inference tactics, and probably some rewriting of them. A nice side-effect could be providing a usable version of these tactics for users of textual Coq.

## Assessment

There should be a fair balance between theory and implementation in the work to be done. Knowledge of Coq, logic, and a taste for functional programming are mandatory. There also may be some more algorithmic questions to tackle.

## Bibliography

[1] Kaustuv Chaudhuri. Subformula Linking for Intuitionistic Logic with Application to Type Theory *CADE 2021*.

[2] Pablo Donato, Pierre-Yves Strub, Benjamin Werner. A Drag-and-Drop Proof Tactic. CPP 2022. <https://hal.science/hal-03823357v2>

[3] Pablo Donato, Benjamin Werner, Kaustuv Chaudhuri. Integrating Graphical Proofs in Coq. Talk at CoqPL 2023. <https://www.lix.polytechnique.fr/Labo/Pablo.DONATO/abstracts/coqpl23.pdf>