

# Yearly Meeting of the Alt-Ergo Users' Club



---

AdaCore



April 2021, Paris

OCaml **PRO**

# Alt-Ergo, An Introduction

- A French **open-source SMT solver** supporting multiple theories and quantified formulas
- Alt-Ergo specificities
  - Proof of software
  - Qualification DO178
- **Completes and competes with other state-of-the-art SMT solvers** like CVC4 and Z3
- Developed and maintained by OCamlPro, an **industrial R&D** lab, in partnership with LRI

## Alt-Ergo, A Brief History

- 2006 Alt-Ergo's development is started by Sylvain Conchon at LRI (Inria/CNRS joint Lab)
- 2013 OCamlPro takes over development and maintenance in partnership with LRI
- 2017 First discussions about the Alt-Ergo Club (Adacore, Trust-in-Soft, CEA)
- 2019 Adacore, first official member of the Alt-Ergo Club  
Followed by CEA and Trust-in-Soft  
First annual meeting on the roadmap
- 2020 MERCE (Mitsubishi Electric Research Center Europe) joins the Alt-Ergo Club  
and the Why3 team (LRI) joins as honorary partner

## Software Verification results

- Alt-Ergo's results complement other solvers' results
- 430 Goals are proved by Alt-Ergo only

	# buts	Alt-Ergo	CVC4	Z3
BWARE-DAB	860	<b>100% (45)</b>	94.5% (0)	81.9% (0)
BWARE-RCS3	2256	<b>99.0% (3)</b>	90.4% (0)	97.1% (0)
BWARE-P4	9341	<b>99.4% (144)</b>	97.5% (0)	85.2% (1)
BWARE-P9	371	<b>72.2% (36)</b>	50.% (0)	64.2% (6)
EACSL	959	92.4% (13)	<b>93.3% (4)</b>	77.6% (4)
SPARK	16773	84.7% (29)	85.5% (25)	<b>86.4% (133)</b>
WHY3	2003	<b>69.8% (160)</b>	65.7% (8)	59.4% (46)
Total	32563	<b>89.5% (430)</b>	87.9% (37)	84.5% (190)

## 2020 – SMTCOMP Participation

- Community benchmarks
- From diverse domains (not just software verification)
- Alt-Ergo is a competitive SMT solver

2020 (unsat)	ALIA	AUFLIA	AUFLIRA	AUFNIRA
Alt-Ergo	3rd (94.7%)	4th (73.7%)	4th (90.4%)	3rd (13.3%)
CVC4	2nd (94.7%)	2nd (75.2%)	2nd (92.6%)	2nd (19.7%)
SMTInterpol	4th (94.7%)	6th (57.2%)	6th (73.9%)	-
Vampire	5th (89.5%)	<b>1st (77.7%)</b>	<b>1st (92.7%)</b>	<b>1st (20.3%)</b>
veriT	6th (21.1%)	3rd (73.9%)	5th (79.7%)	-
z3	<b>1st (94.7%)</b>	5th (69.3%)	3rd (92%)	4th (11.3%)




# Purpose of the Alt-Ergo Users' Club

A place to foster collaborations and discussions between users on the Alt-Ergo roadmap

- **Guaranteeing Alt-Ergo's sustainability**
  - Improving Alt-Ergo
  - Strengthening collaboration with Formal Methods communities
- **Increasing the number of users**
  - Extending Alt-Ergo to new domains (Model Checking)
  - International visibility through articles and competitions
- **Initiating new projects and contracts**
  - Long term features require substantial funding

# The Alt-Ergo Users' Club Scientific Committee

---

President	Fabrice Le Fessant
Honorary President	Sylvain Conchon 
Scientific advisor	Mohamed Iguernlala 
Technical advisors	Steven de Oliveira
	Guillaume Bury
Technical advisors (substitute)	David Declerck
	Keryan Didier
	Adrien Champion
	Albin Coquereau 
Representative (AdaCore)	Yannick Moy
Representative (MERCE)	David Mentré
Representative (CEA)	François Bobot
Representative (Why3/LRI)	Claude Marché

---

## A substantial Formal Methods team around Alt-Ergo

- Fabrice Le Fessant – Founder of OCamlPro
- Sylvain Conchon – Creator of Alt-Ergo
- Mohamed Iguernlala – PhD on Alt-Ergo
- Steven de Oliveira – PhD on Model Checking
- Guillaume Bury – PhD on SMT
- Adrien Champion – PhD on Model Checking
- David Declerck – PhD on Model Checking
- Keryan Didier - PhD on real-time systems
- Thomas Sibut Pinote - PhD in Formal proofs
- Albin Coquereau – PhD on Alt-Ergo



# Membership levels

	Platine (50k€/an)	Gold (25k€/an)	Silver (10k€/an)	Bronze (5k€/an)
Apache license (dev branches)	✓			
Declare a substitute for the annual meeting	✓			
5 more “days of responsiveness”	✓			
Apache license (master/next)	✓	✓		
5 “days of responsiveness”	✓	✓		
Voting tokens	3 tokens	2 tokens	1 token	
Participation to the annual meeting	✓	✓	✓	✓
Developpement mailing list	✓	✓	✓	✓
Mutual logo display on websites	✓	✓	✓	✓

# Membership levels

- Gold members (Apache license on master/next branches) :
  - AdaCore (since 2018)
  - Merce (since 2020)
- Bronze members :
  - CEA-list (since 2018)
- Honorary member :
  - The Why3 Development team

- Alt-Ergo is licensed under the OCamlPro Non Commercial License. This licence gives freedom for academic use, and for experimenting or prototyping : [OCamlPro-Non-Commercial-License.pdf](#)
- Gold and Platinum members have access to the main and development versions of Alt-Ergo under the Apache 2.0 License

Available on github:

<https://github.com/OCamlPro/alt-ergo>

Contact and discussions:

- [alt-ergo@ocamlpro.com](mailto:alt-ergo@ocamlpro.com)
- Github's bug tracker

## Last year's topics of interests

- **Technical**

- Models
- Proof replay
- Theories

- **Accessibility**

- Documentation
- Build
- Standardisation

# Alt-Ergo's Roadmap

- Model generation
- Standardisation
- Build (JS worker, node and binary executables)
- Release 2.4.0
- Integration of Dolmen
- Fuzzing
- Preprocessing
- Interactivity (GUI/Report)
- Builtin integers
- Bitvectors (performant SAT)
- Improve Floating Point Arithmetic (Bit blasting)
- Proof Generation (Coq/Dedukti)
- Non lineal arithmetic
- Strings / Sequence ?



Thanks for supporting the Alt-Ergo Users' Club,  
and Alt-Ergo's long-term roadmap!

**Share the good word!**

Useful information's:

- [github.com/OCamlPro/alt-ergo](https://github.com/OCamlPro/alt-ergo)
- [alt-ergo@ocamlpro.com](mailto:alt-ergo@ocamlpro.com)
- [Github's bug tracker](#)