Model Checking Contest results for 2019

Fabrice Kordon — LIP6, Sorbonne Université, France
Hubert Garavel — Inria/LIG, France
Lom Messan Hillah — LIP6 & Université de Nanterre, France
Francis Hulin-Hubard — LSV, CNRS/ENS de Paris-Saclay, France

Emmanuel Paviot-Adet — LIP6 & Université Paris Descartes, France
Loïg Jézequel — LS2N, Université de Nantes, France

MCC 2019

Introduction

Objective 1 : promoting model checking tools

- Asynchronous systems
- Compare and debug
- Enhance reproducibility of results
- Encourage tools
  - **To enhance reliability**
  - **To increase their features**
- Encourage interoperability among tools

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Objective 2 : creating a common collection of benchmarks

- https://pnrepository.lip6.fr
- https://mcc.lip6.fr/models.php

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Remark

9 month period = very short!

Objective 2 : creating a common collection of benchmarks

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- https://mcc.lip6.fr/models.php

The MCC Team

Fabrice Kordon
(SU)

The MCC Team

Hubert Garavel
(Inria)

Lom Hillah
(UPN)

Managing Models

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Managing Models

Managing Execution + analysis

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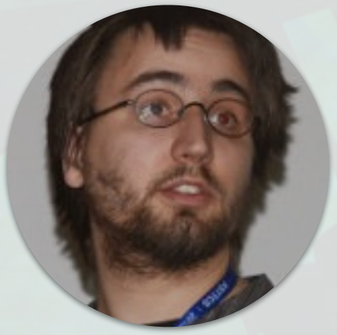

Loïg Jezequel (U. Nantes)

Emmanuel Paviot-Adet (UP5)

Managing Formulas

MCC 2019 The MCC Team

Hubert Garavel (Inria)

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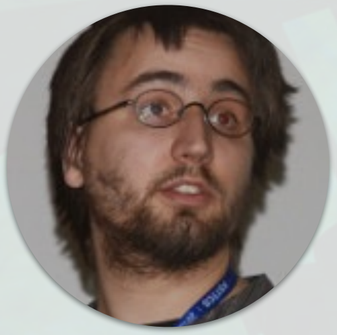

Emmanuel Paviot-Adet (UP5)

Managing Formulas

MCC 2019

New Models etc.

Categories of Models

«known» models

- Those from past years
  - **Test the tool as used by its developers**

«Surprise» models

- New models proposed by the community this year
  - **Test the tool as used by «non-expert» of the tool**
  - **new situations for the tool**

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- Model ➟ one Petri net, possibly with scaling parameter
- Instance ➟ one Petri-net with scaling parameters instantiated

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Coefficients in 2019

969 «known» instances (x 1)
49 «surprise» instances (x 4)

4 New Models for 2019

- **L. M. Hillah & F. Kordon**
  - CloudOpsManagement
    - **P/T**
- **L. M. Hillah**
  - FamilyReunion
    - **Colored + P/T**
- **W. Serwe & Z. Zhang**
  - NoC3x3
    - **P/T**
    - **+ NUPN**
- **P. Ballarini & B. Barbot**
  - VehicularWifi
    - **Colored only**

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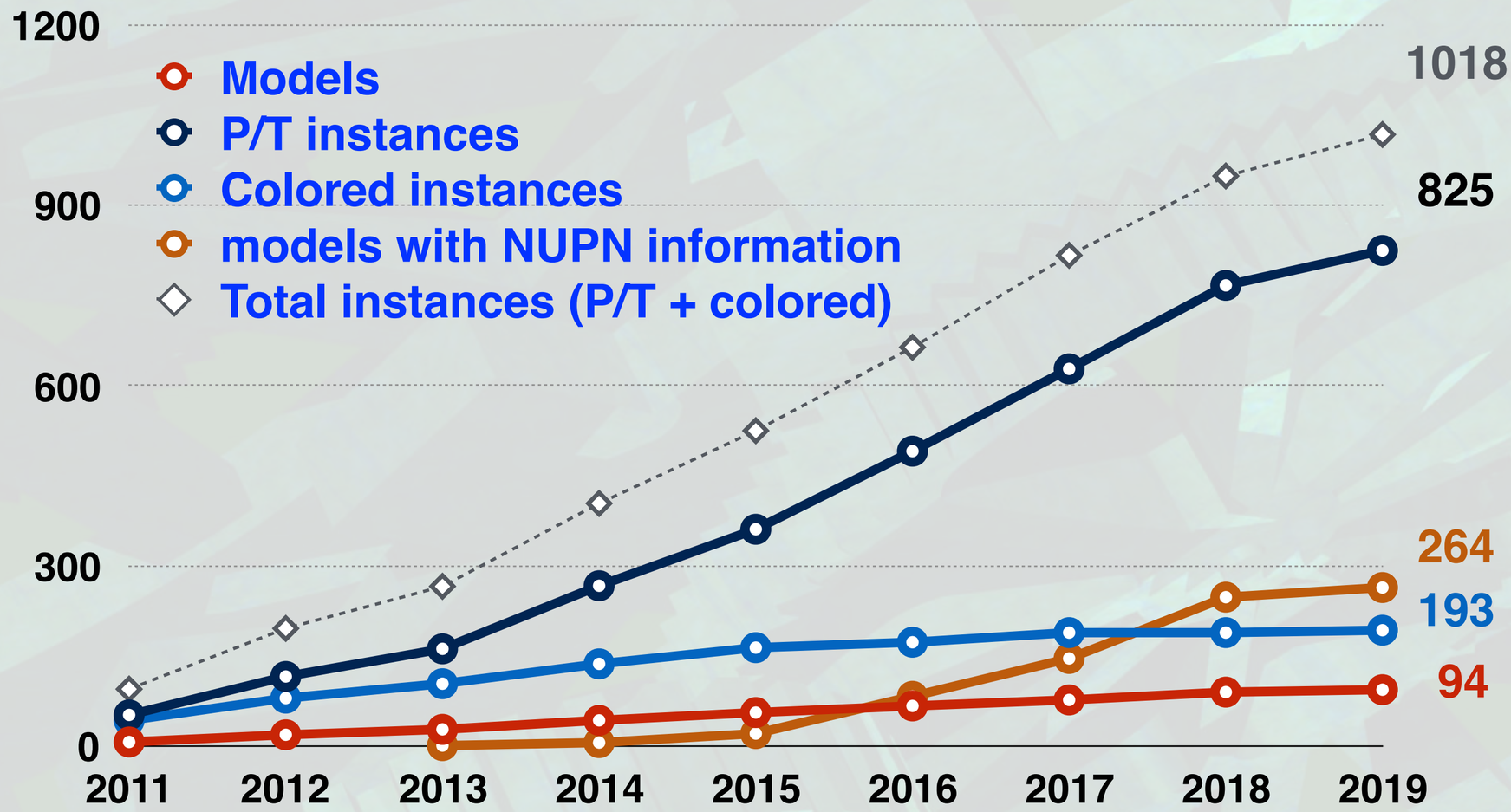
Thanks!!!

We really need different models

9 Editions of MCC — Benchmarks

Extending the collection of benchmarks every year



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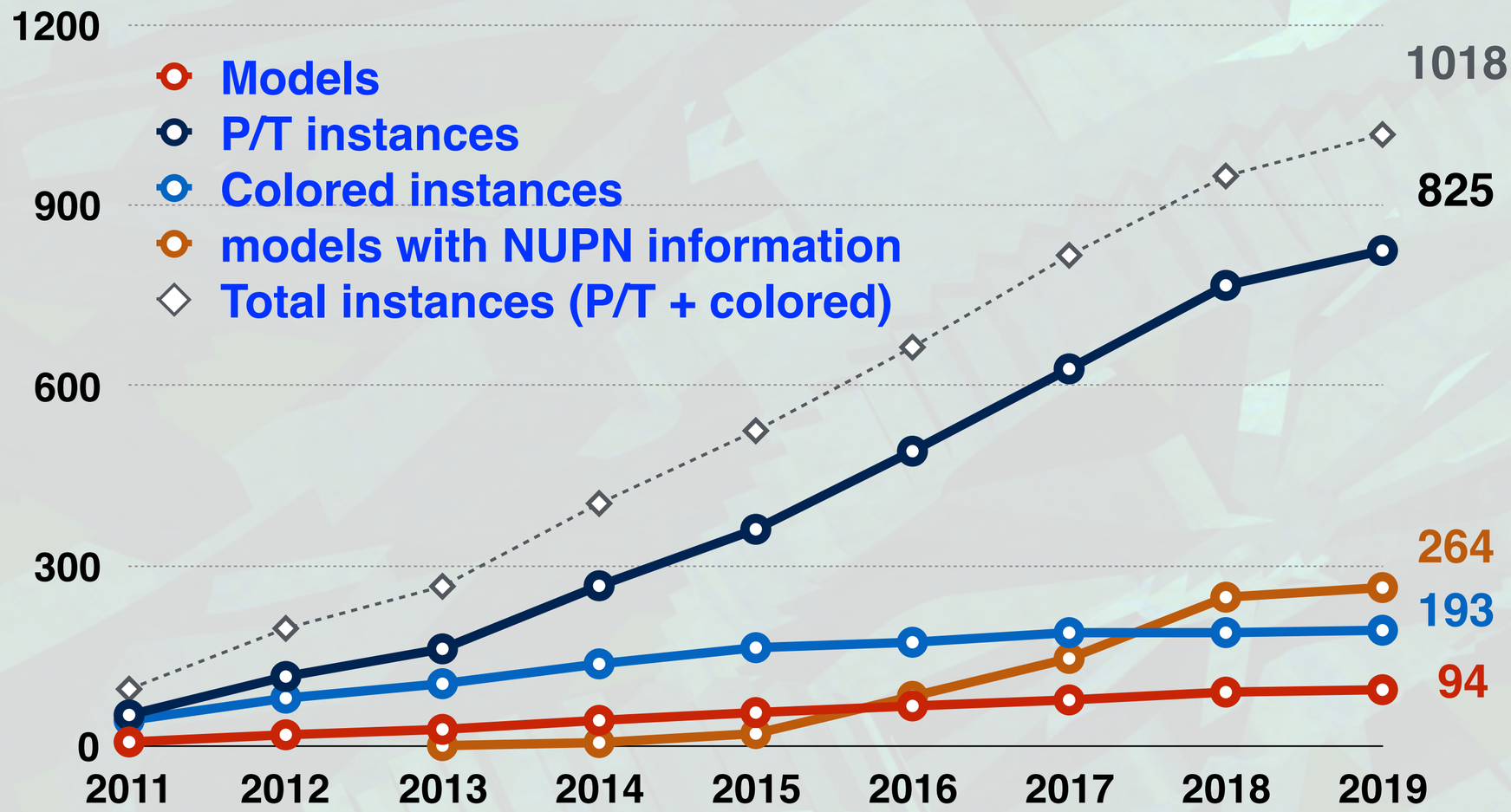

Data on the MCC	2011	2012	2013	2014	2015	2016	2017	2018	2019
% of colored instances	45,26 %	40,82 %	39,10 %	33,91 %	31,24 %	26,05 %	23,13 %	19,92 %	18,95 %
Number of selected instances	95	196	266	404	525	664	586	949	1018

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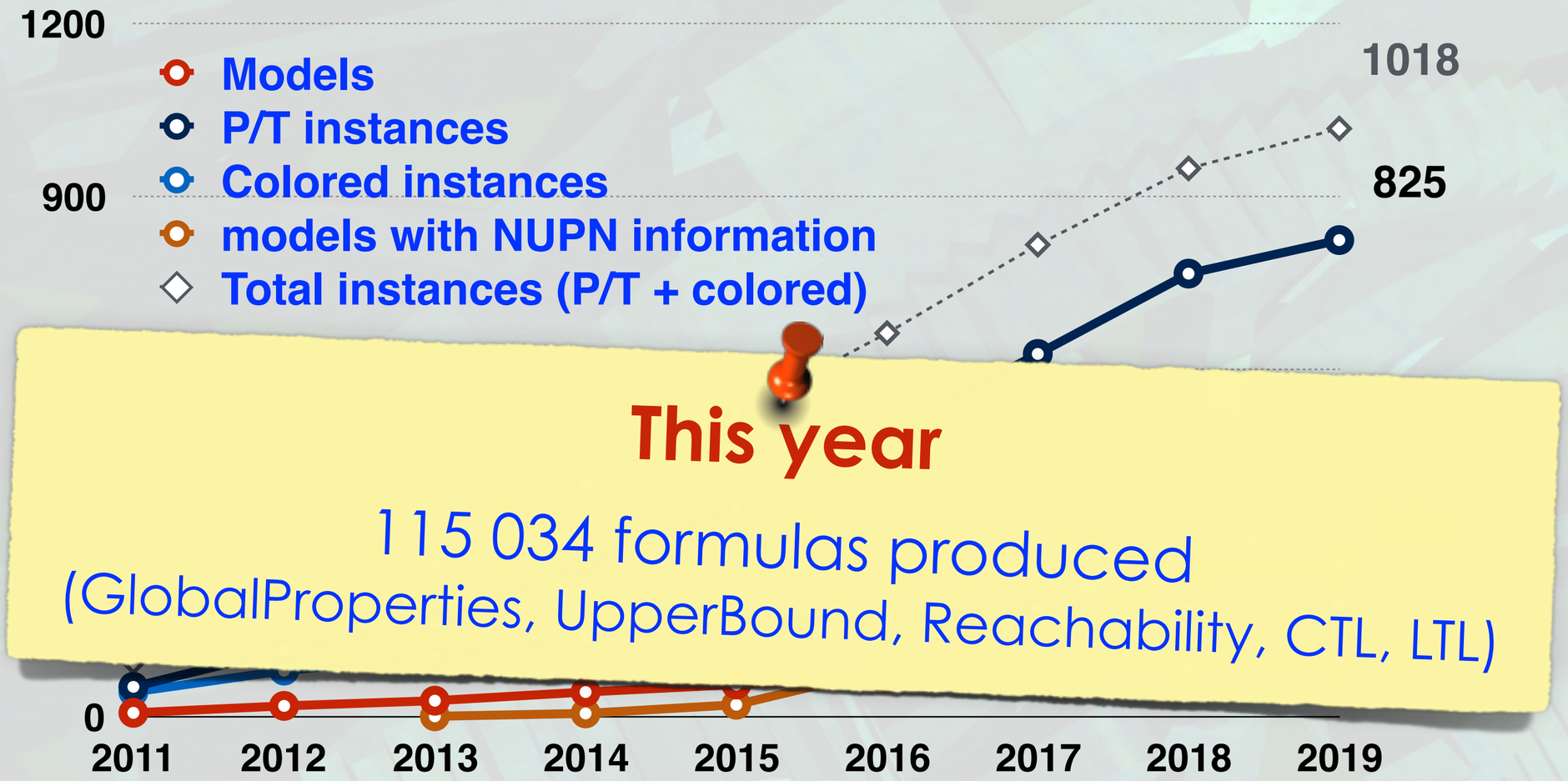

This year

115 034 formulas produced
(GlobalProperties, UpperBound, Reachability, CTL, LTL)

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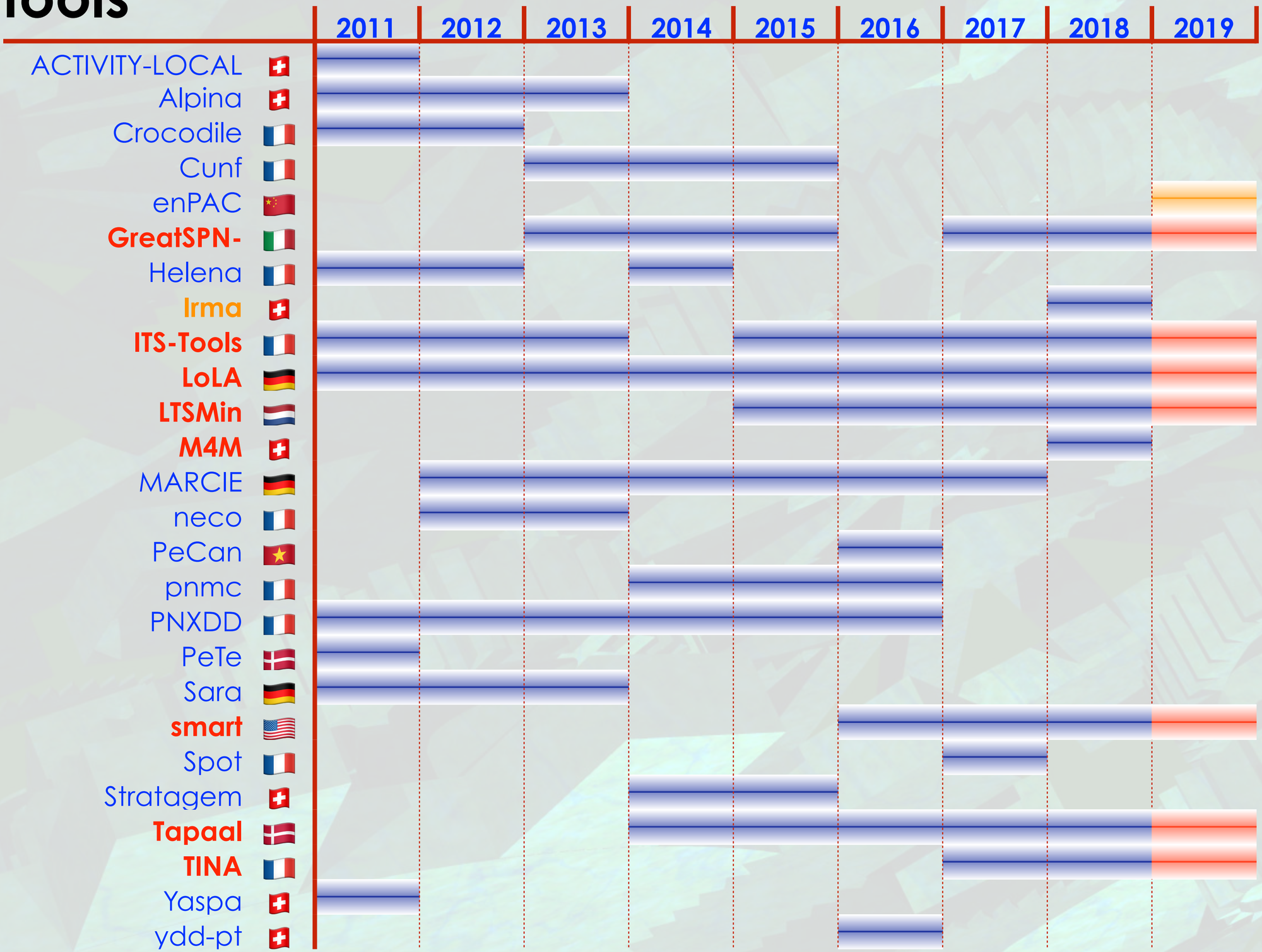
MCC 2019

Participating Tools

9 Editions of MCC — Tools over the Years

26 tools



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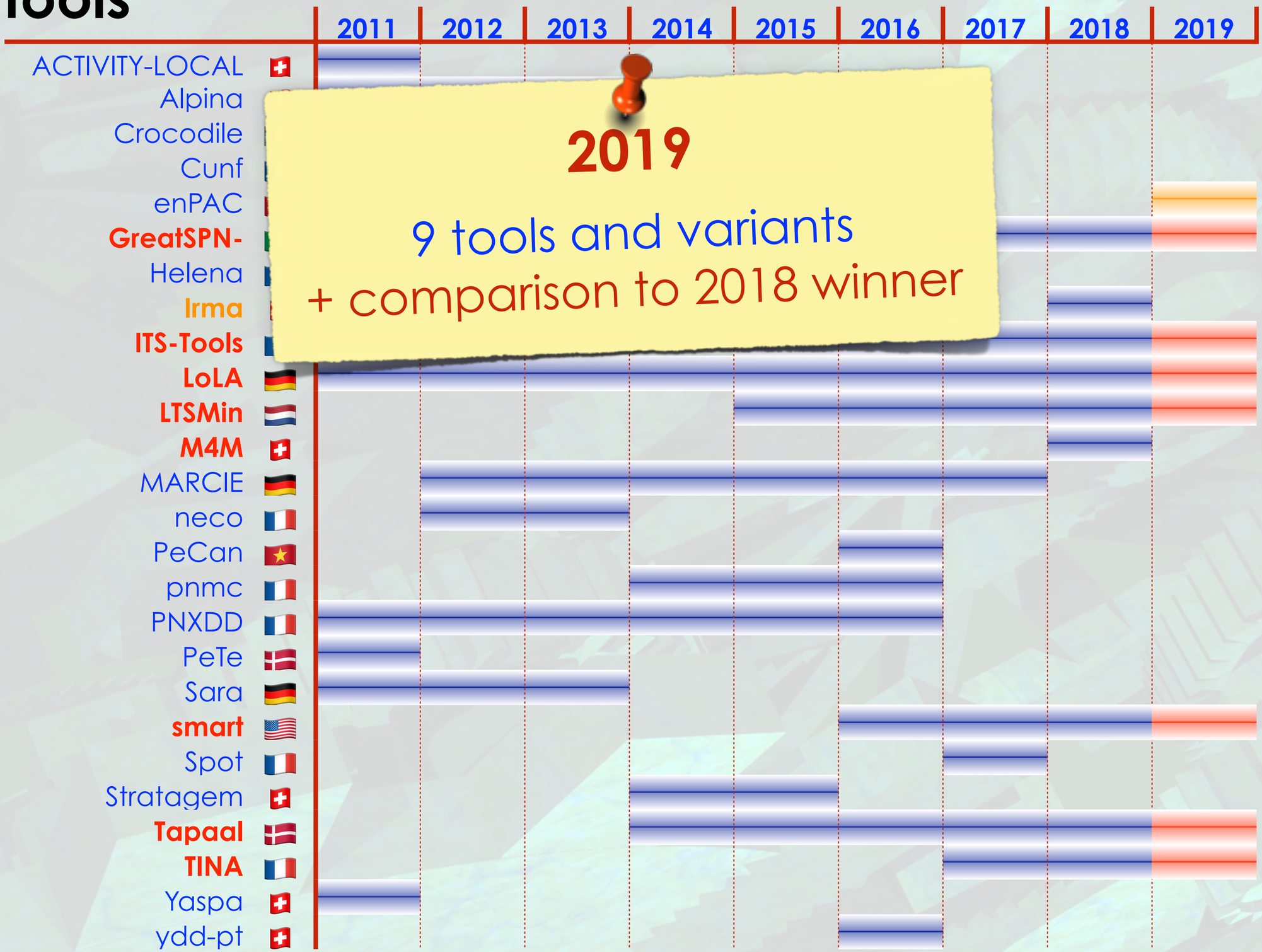

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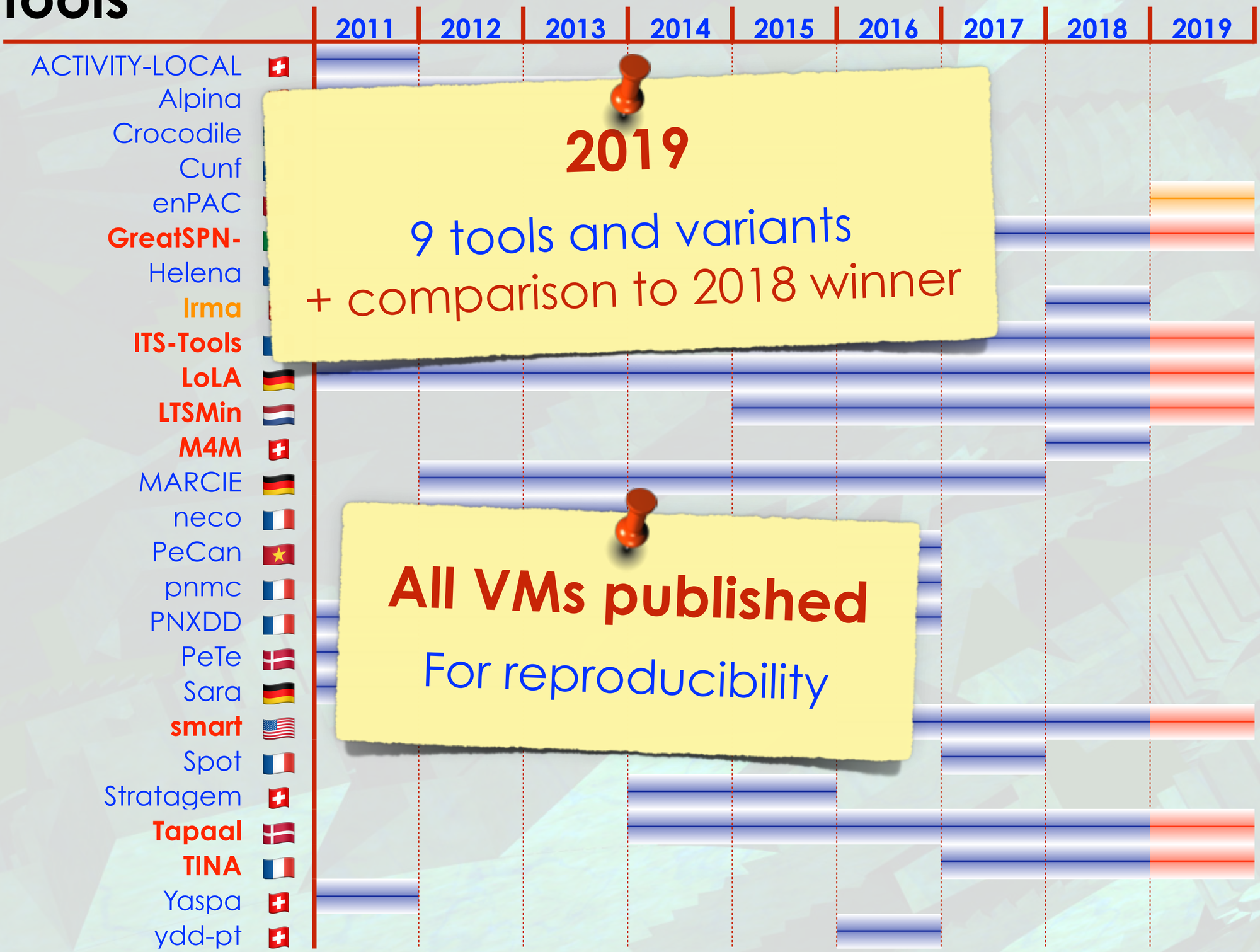

2019

9 tools and variants
+ comparison to 2018 winner

All VMs published

For reproducibility

Tools and Techniques Reported in 2019

Tools	PN type	parallelism	Techniques
enPAC	P/T	/	ABSTRACTIONS EXPLICIT LTLNFBA SEQUENTIAL TOPOLOGICAL
GreatSPN-Meddly	P/T & Col	/	DECISION_DIAGRAMS SEQUENTIAL_PROCESSING TOPOLOGICAL UNFOLDING_TO_PT USE_NUPN
smart	P/T	/	DECISION_DIAGRAMS IMPLICIT RELATIONS SEQUENTIAL_PROCESSING
Tina	P/T & Col	/	DECISION_DIAGRAMS EQUATIONAL_ABSTRACTION SEQUENTIAL_PROCESSING STRUCTURAL_REDUCTION UNFOLDING_TO_PT USE_NUPN
ITS-Tools	P/T & Col	Colat	BMC DECISION_DIAGRAMS EXPLICIT INITIAL_STATE K_INDUCTION PARTIAL_ORDER SAT_SMT STRUCTURAL_REDUCTION TAUTOLOGY TOPOLOGICAL USE_NUPN LTSMIN
ITS-Tools.M	P/T & Col	Colat	BMC COLLATERAL_PROCESSING DECISION_DIAGRAMS EXPLICIT INITIAL_STATE K_INDUCTION LTSMIN PARTIAL_ORDER SAT_SMT STRUCTURAL_REDUCTION TAUTOLOGY TOPOLOGICAL USE_NUPN
LoLA	P/T & Col	Colat	COLLATERAL_PROCESSING EXPLICIT SAT_SMT SEQUENTIAL_PROCESSING STATE_COMPRESSION STUBBORN_SETS SYMMETRIES TOPOLOGICAL UNFOLDING_TO_PT USE_NUPN
LTSMin	P/T	Par	DECISION_DIAGRAMS PARALLEL_PROCESSING USE_NUPN
Tapaal	P/T & Col	Colat	COLLATERAL_PROCESSING CPN_APPROX CTL_CZERO EXPLICIT LP_APPROX QUERY_REDUCTION SAT_SMT SIPHON_TRAP STATE_COMPRESSION STRUCTURAL_REDUCTION STUBBORN_SETS TOPOLOGICAL TRACE_ABSTRACTION_REFINEMENT UNFOLDING_TO_PT

MCC 2019

Examinations

Examinations

- **StateSpace**
- **GlobalProperties**
  - ReachabilityDeadlock
- **UpperBound** → new in 2019
- **Reachability**
  - ReachabilityCardinality → atomic propositions refer to tokens
  - ReachabilityFireability → atomic propositions refer to firing
- **CTL**
  - CTLCardinality → atomic propositions refer to tokens
  - CTLFireability → atomic propositions refer to firing
- **LTL**
  - LTLCardinality → atomic propositions refer to tokens
  - LTLFireability → atomic propositions refer to firing

9 Editions of MCC — Examinations & tools

Tools improve every year

Tool participation per examination	2011	2012	2013	2014	2015	2016	2017	2018	2019
Participating	10	9(+1)	9(+2)	9	10(+3)	10(+2)	9(+1)	9(+3)	8(+1)
Supporting Colored nets	4	4	4	2	4	2	8	10	6
Supporting NUPN				1	3	3	4	10	7
StateSpace	7	7	7	7	11	10	8	11	8
GlobalProperties									5
UpperBound						7	6	11	7
Struct. formulas	3	2							
Reachability	5	5	8	5	10	8	6	10	5
CTL		0	7	2	2	5	6	10	5
LTL		0	6	1	0	4	4	8	4
Answered examinations					15,60 %	22,22 %	26,30 %	40,47 %	—

MCC 2019

Schedule & Tool confidence

Submissions & timing

- **~February 15, delivery of disk images**
  - Qualification phase
  - Completed by early May
    - **~37 000 test runs**
- **Mach 10, starting to operate tools**
  - **91 619** runs distributed on 4 different machines over Europe
  - VM with 4 cores / 16GB
    - **ITS-Tools, ITS-Tools.M, LoLa, LTSMin, Tapaal**
  - VM with 1 core / 16 GB
    - **enPAC, GreatSPN-meddly, smart, TINA.tedd**
  - Time confinement, 1h
  - Only **physical cores** allocated to VMs
- **March 25, feedback sent to developers about their tool**

About Analysis of Outputs

Late march, consolidation + analysis of outcomes

- 25 GB of logs and CSV files
  - **Post analysis = ~18KLOC Ada + ~800 LOC bash**

Analysis process

- Pass 1, computing results for the majority in a «line»
  - **All tools for an examination for a model instance**
- Pass 2, evaluating tool confidence
  - **Only considering values with a large majority**
- Pass 3, reconstructing the results using tool confidence
  - **Help to decide when only 2 different answers**
  - **A result must be of confidence 0.98 or more (0.97 in 2018)**
  - **Some results are tagged «insecure»**
- Pass 4 computing scores
  - **«insecure» results not considered when counting points**

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Scoring (normalization)
per examination, [102..204] points

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Award

Fastest

Small footprint

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Award

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Penalty for mistakes

Twice the score for a good value

MCC 2019 Checks and Tool Confidence

Consistency checks

- Colored versus equivalent P/T nets

Computing the "confidence rate"

- Section III.2 in **http://mcc.lip6.fr/rules.php**
- Computing **V**, the set of values with a **majority of 3 or more tools**
- For each tool t, selecting $\mathbf{V_t}$, the values computed $\in \mathbf{V}$
- For each tool t, selecting $\mathbf{V_{tt}}$, the correct values computed $\in \mathbf{V_t}$
- Confidence rate = $\frac{|\mathbf{V_{tt}}|}{|\mathbf{V_t}|}$

Global Tool Confidence

Tools	Confidence	success	selected	Examinations
enPAC	85,63 %	2313	2701	3 StateSpace, LTLCardinality, LTLFireability
GreatSPN	100,00 %	32525	32525	7 StateSpace, GlobalProperties, UpperBounds,
smart	100,00 %	6725	6725	2 StateSpace, UpperBounds
TINA.tedd	100,00 %	2284	2284	1 StateSpace
ITS-Tools	100,00 %	63174	63174	9 StateSpace, GlobalProperties, UpperBounds,
ITS-Tools.M	99,95 %	61558	61585	9 StateSpace, GlobalProperties, UpperBounds,
LoLA	99,99 %	85034	85039	8 GlobalProperties, UpperBounds,
LTSMin	100,00 %	1086	1086	2 StateSpace, UpperBounds
Tapaal	100,00 %	66462	66462	7 StateSpace, GlobalProperties, UpperBounds,
2018-Gold	99,99 %	88922	88926	7 StateSpace, GlobalProperties, UpperBounds,

8 Editions of MCC — evolution of confidence

Evolution of the confidence since it was introduced

	2015	2016	2017	2018	2019
smallest confidence	62,30 %	37,40 %	79,59 %	99,71 %	85,53 %
average confidence	89,65 %	94,20 %	97,34 %	99,97 %	98,55 %
highest confidence	100 %	99,99 %	100 %	100 %	100,00 %

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Tools are improving

Industrial quality!

Computing Results in 2019

	Caserta	Ebro	Octoginta-2	Small (root) (cluster)	Total
Physcal cores	96 @ 2.2GHz	32 @ 2.7GHz	80 @ 2.4GHz	13x12 @ 2.4GHz	-
Memory (GB)	2048	1024	1536	13x64	-
Cores (1 per VM) for sequential tools	95 95 VM in //	31 31 VM in //	7, 7 VM in //	13x3, 13x3 VM //	-
Cores (4 per VM) for parallel tools	92, 23 VM in //	28, 7 VM in //	20 4 VM in //	13x8, 13x2 VM //	-
Number of runs	28 548	8 819	27 432	26 820	**91 619**
Total CPU required	604d, 3h, 48m, 27s	117d, 0h, 57m, 18s	573d, 13h, 56m, 15s	518d, 3h, 32m, 34s	**1812d, 22h, 14m, 34s**

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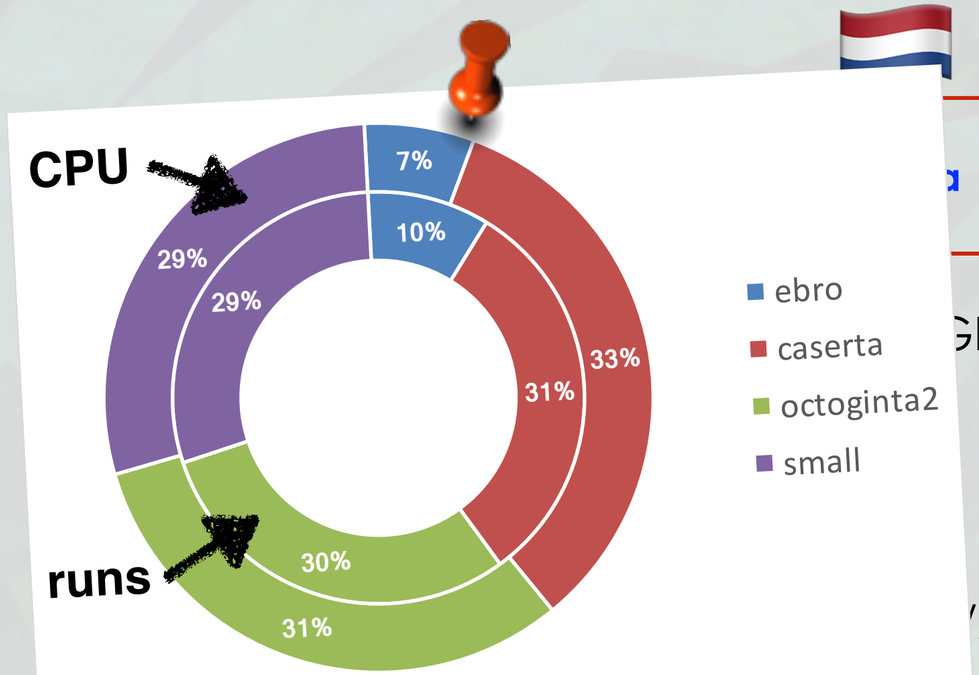
Total CPU	**About 4 years, 11 months and 17 days**				-
Time spent to complete benchmarks	**about 21 days**				-
VM boot time of VMs + management (overhead)	**About 8d, 21h (Included in total CPU)**				-

MCC 2019 Computing Results in 2019



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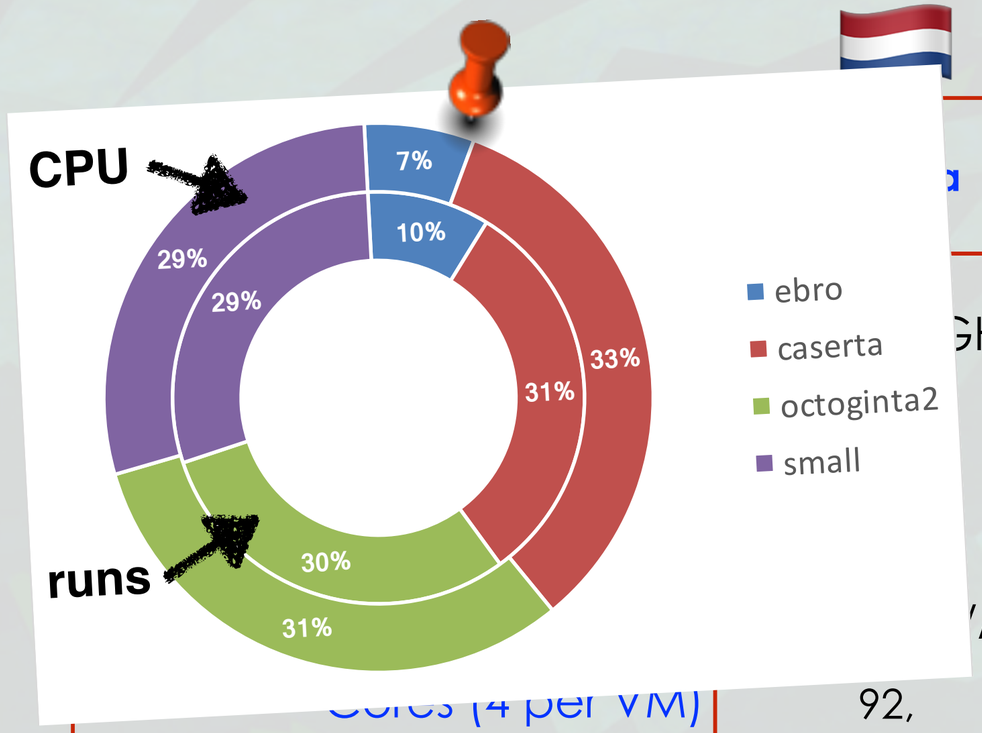

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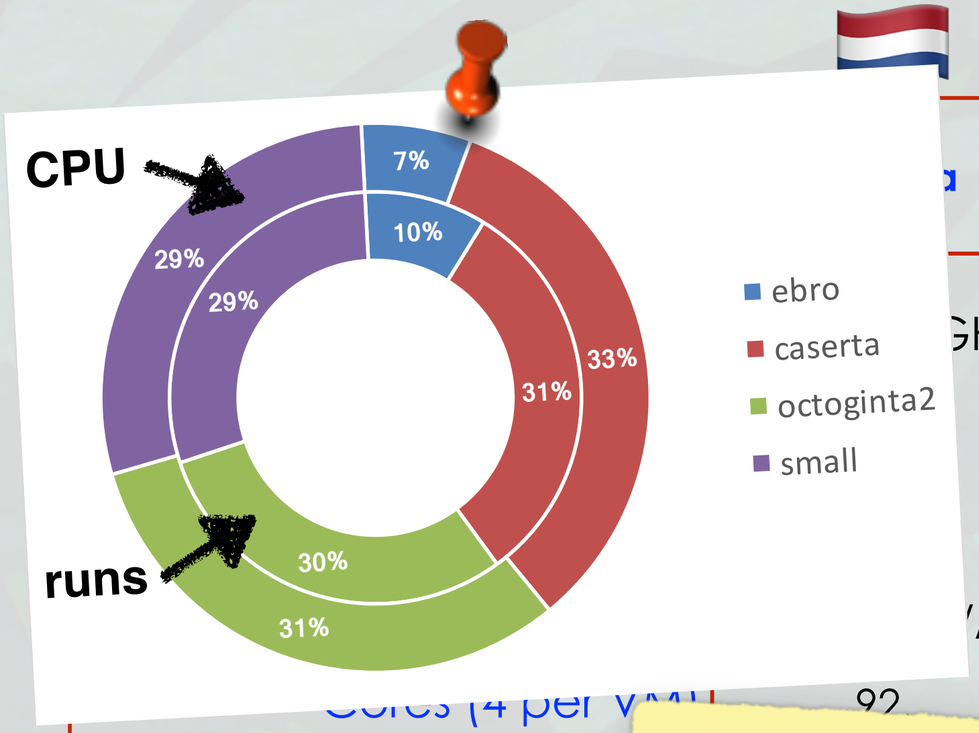
More CPU than in 2018

But **fewer** runs this year

MCC 2019 Computing Results in 2019



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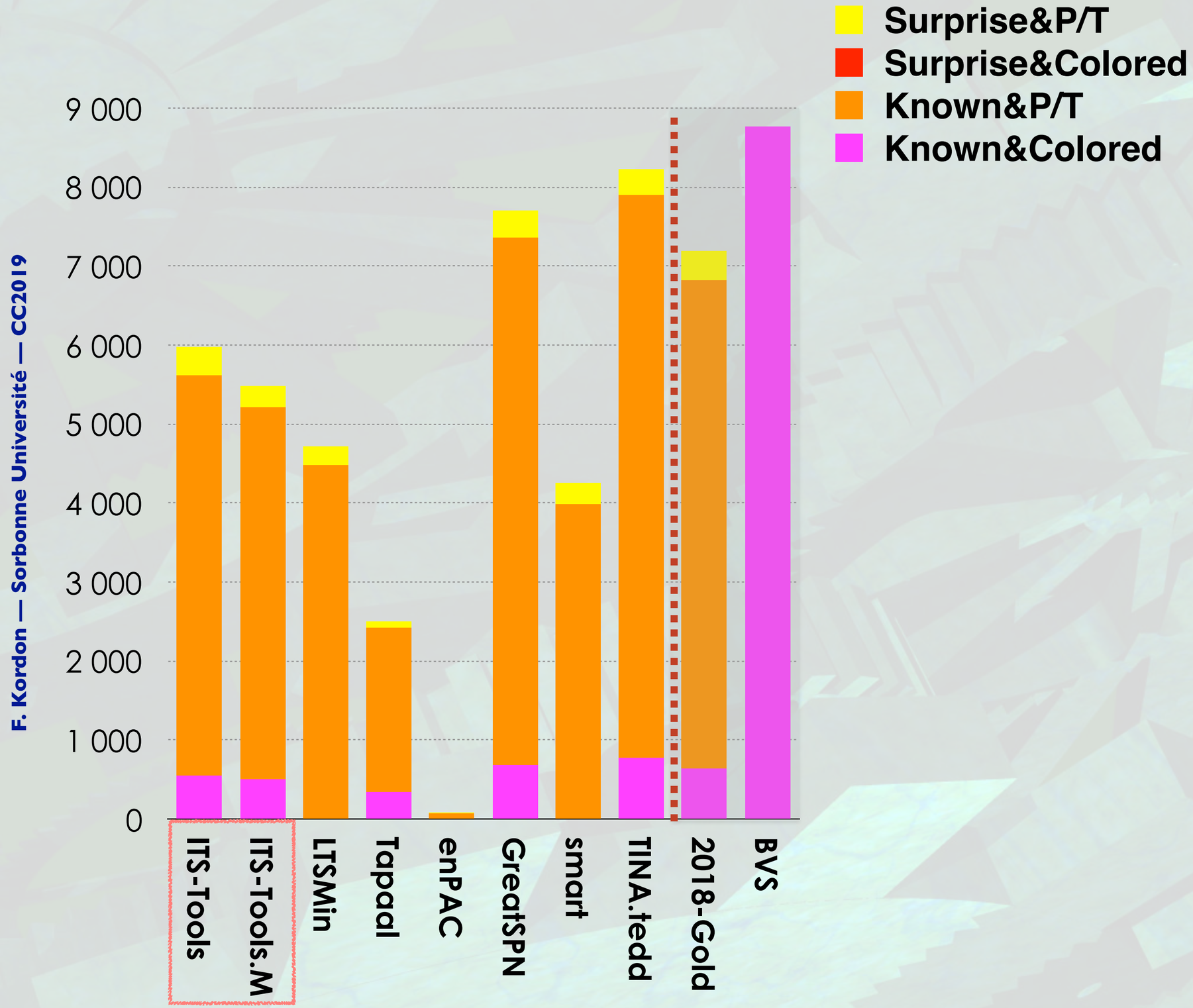
Thank you very much

Université de Genève
University of Twente
Rostock University
Université Nanterre
Sorbonne Université

MCC 2019

Results

StateSpace Examination



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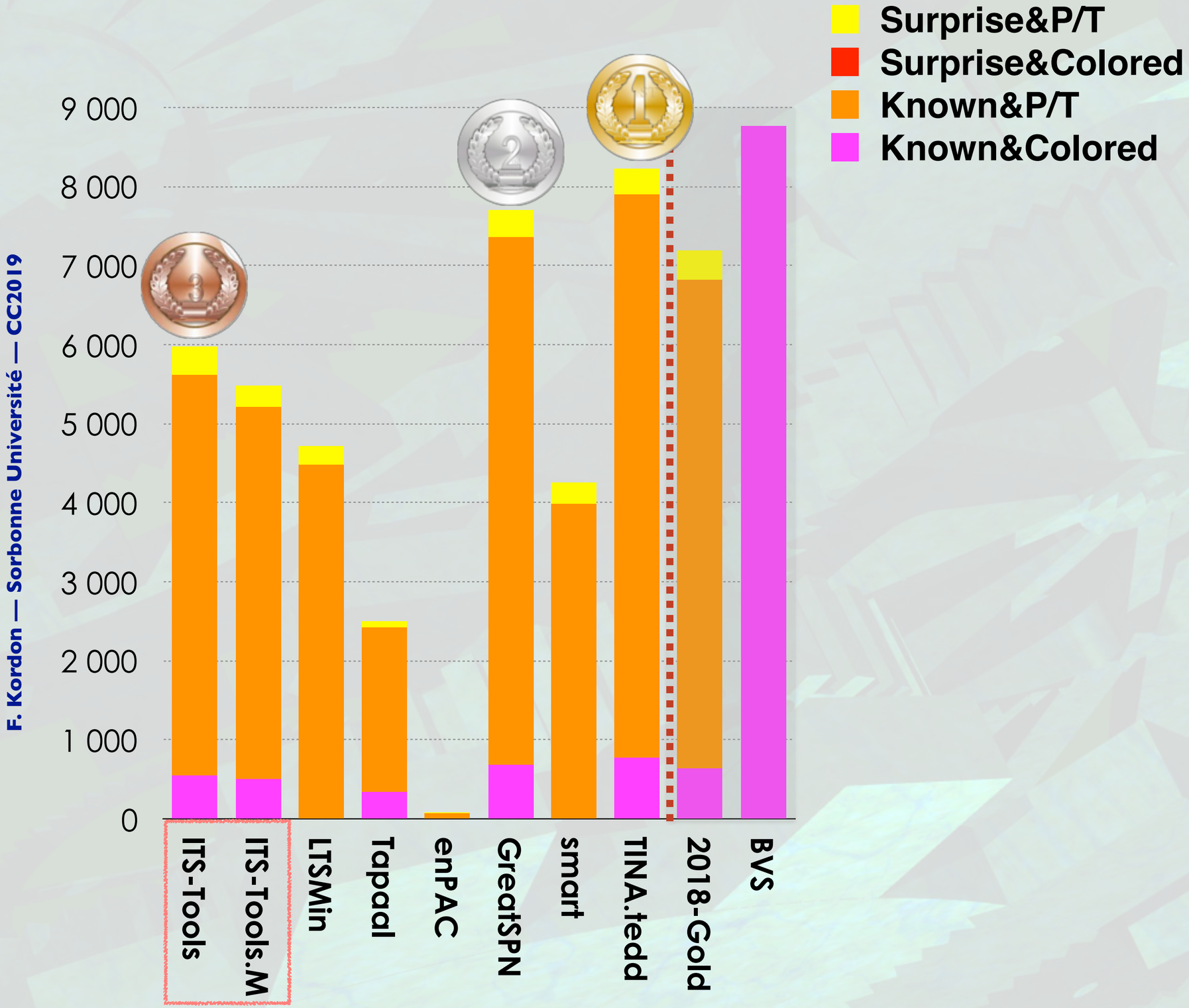

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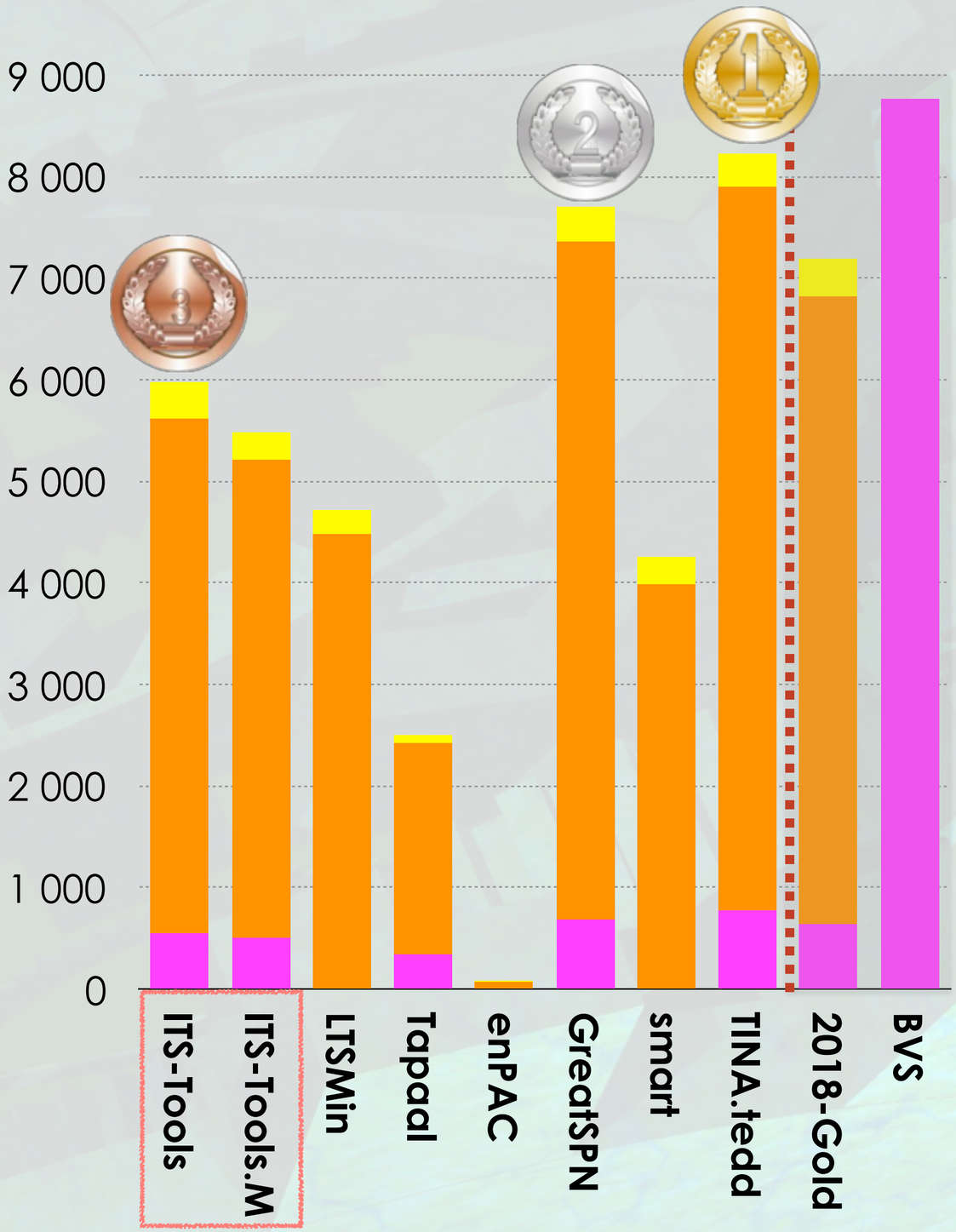
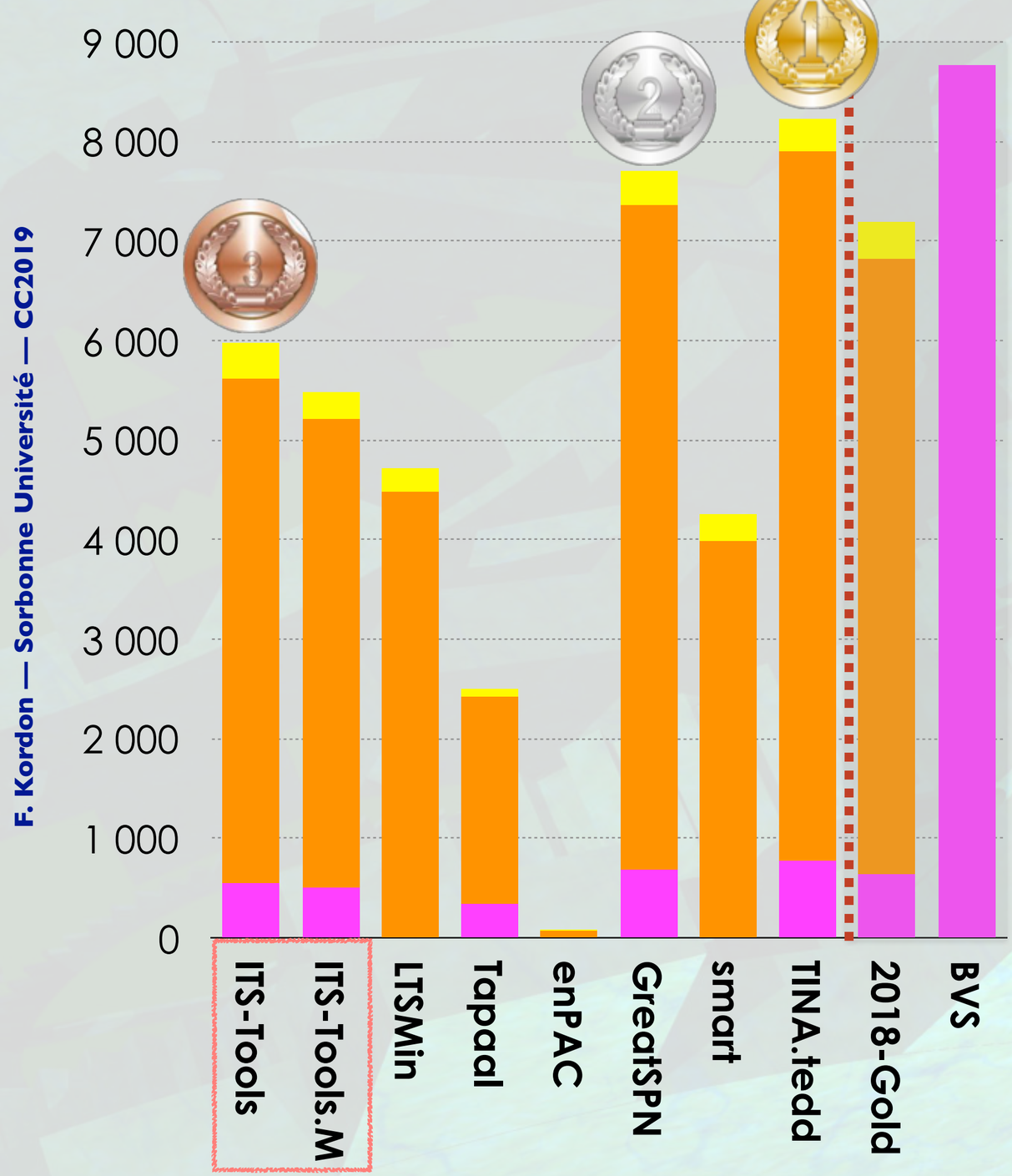


- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

TINA.tedd

2018-Gold

MCC 2019 StateSpace Examination

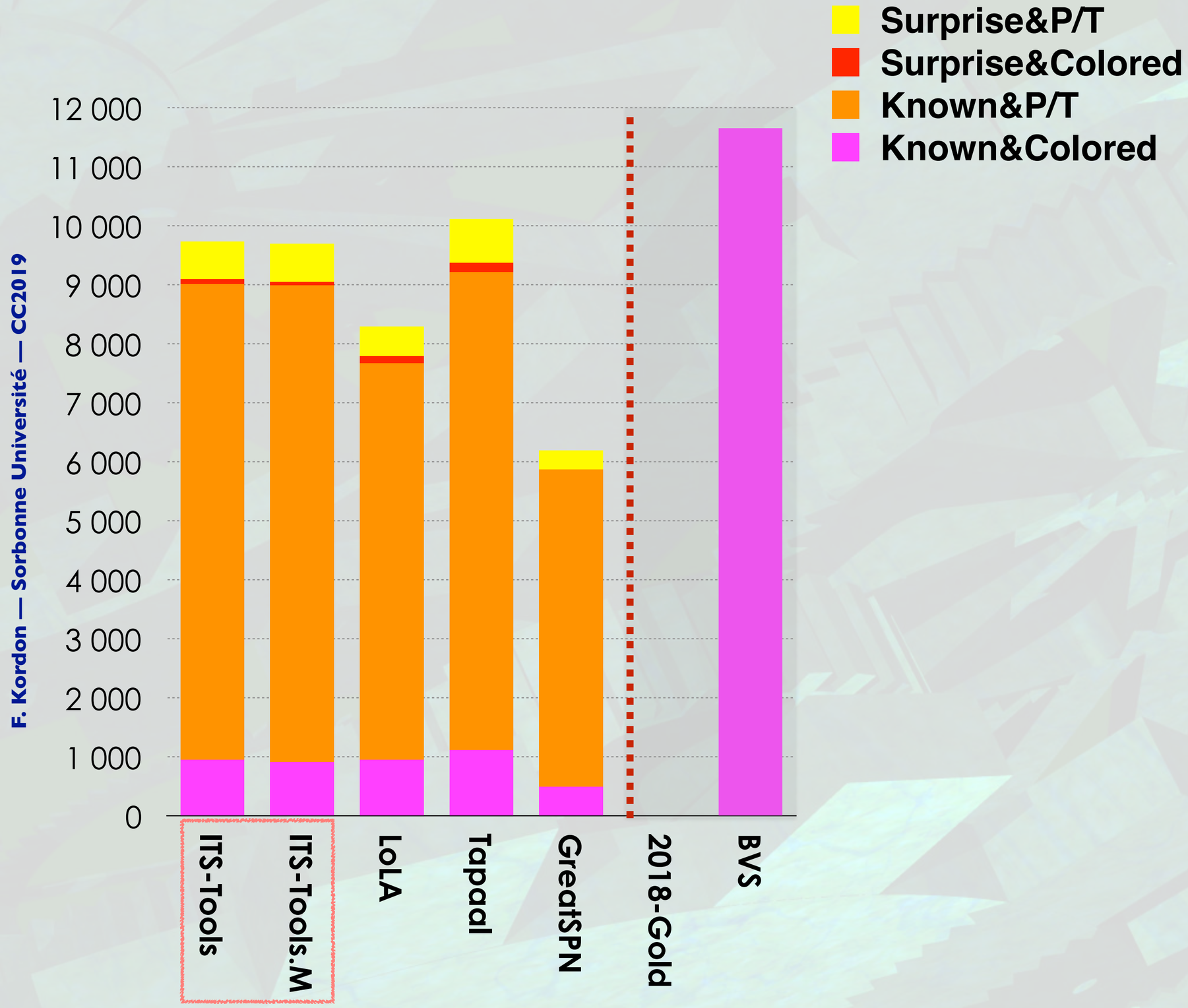


TINA.tedd

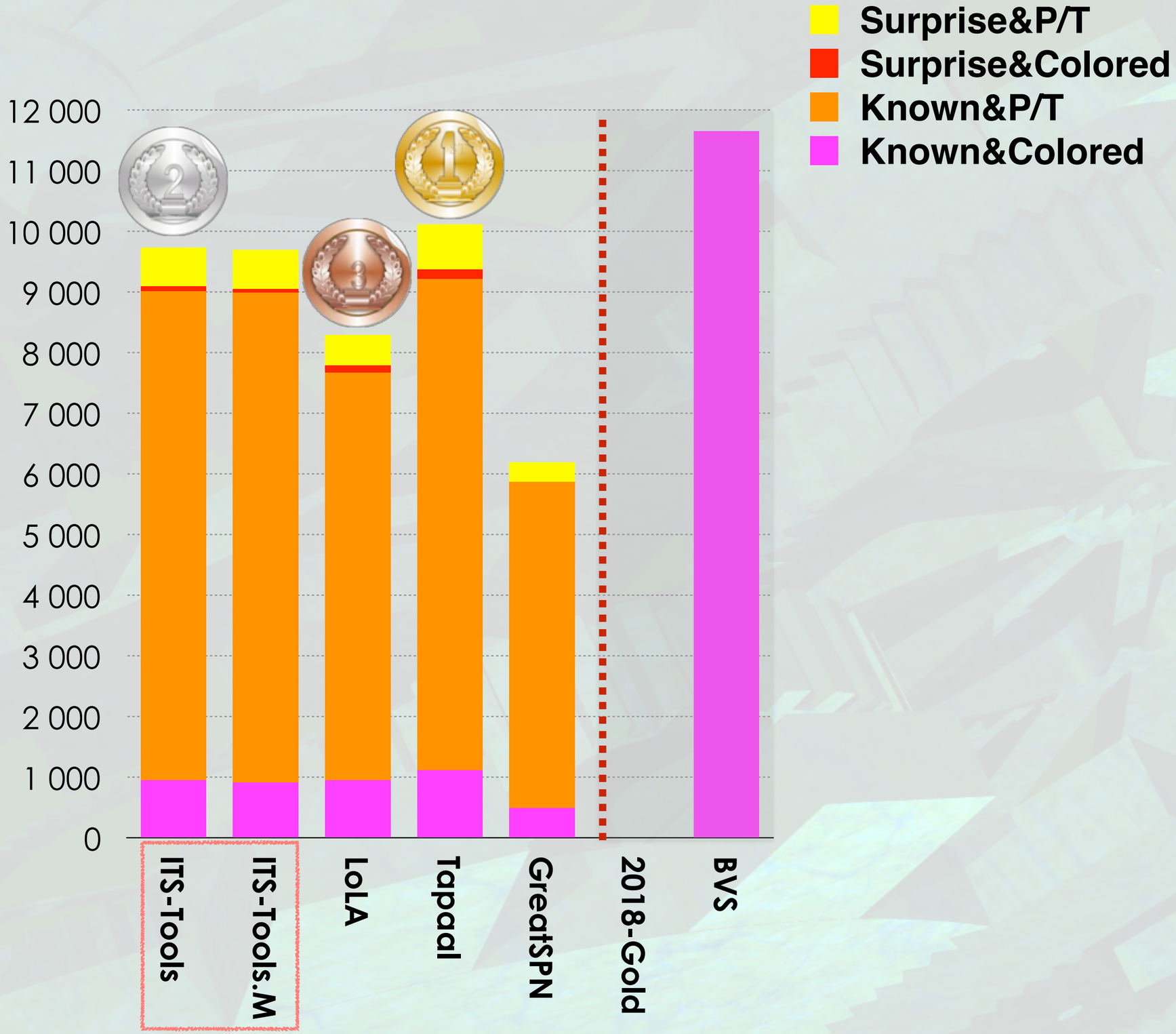
2018-Gold

StateSpace	confidence	success	selected
enPAC	78,31 %	65	83
LTSMin	100,00 %	1086	1086
Tapaal	100,00 %	645	645
ITS-Tools	100,00 %	1482	1482
ITS-Tools.M	100,00 %	1373	1373
GreatSPN	100,00 %	2260	2260
smart	100,00 %	1212	1212
TINA.tedd	100,00 %	2284	2284
2018-Gold	100,00 %	2129	2129

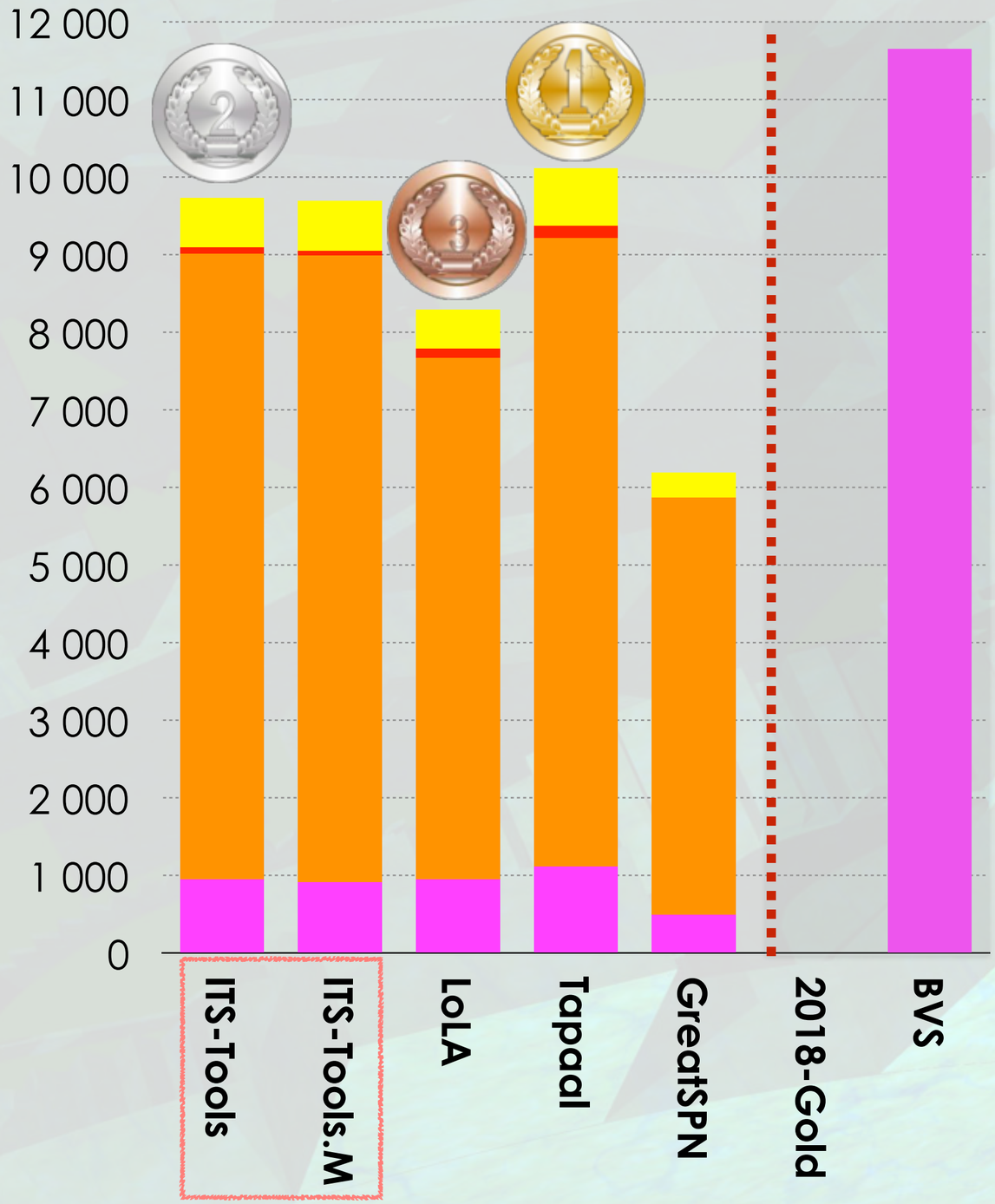
GlobalProperties Examination



GlobalProperties Examination



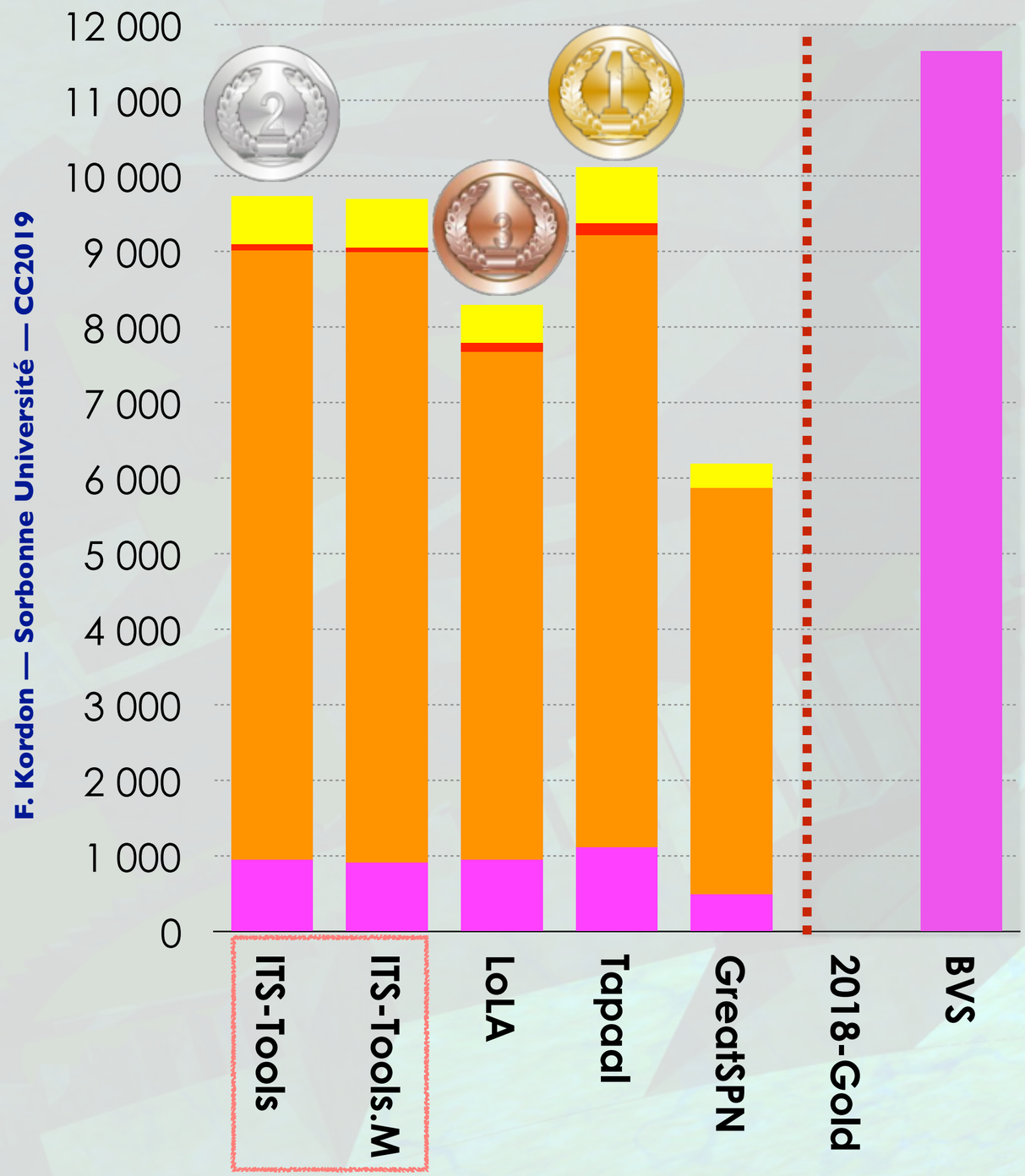
GlobalProperties Examination



Tapaal

Tapaal

MCC 2019 GlobalProperties Examination



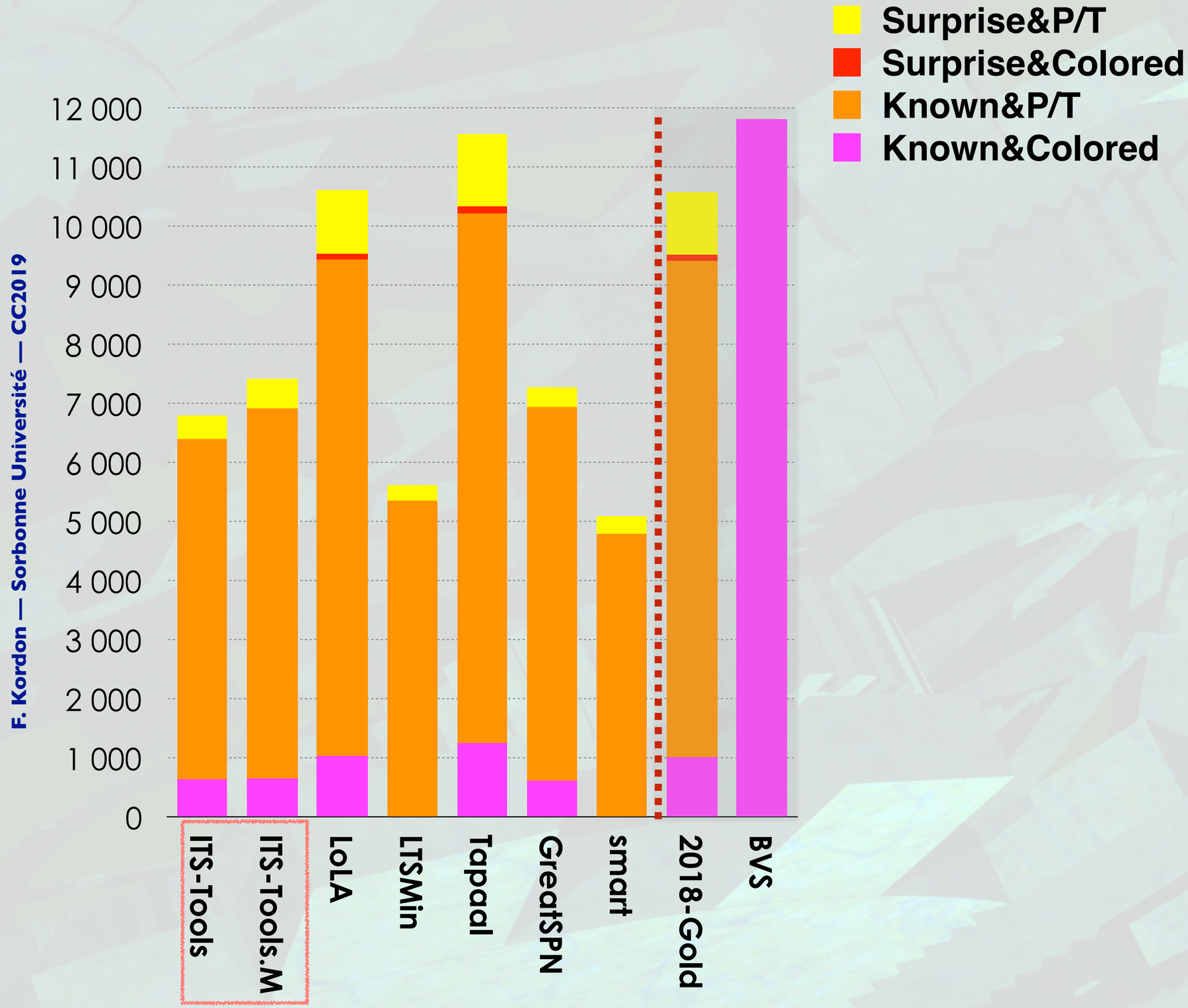
- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Tapaal

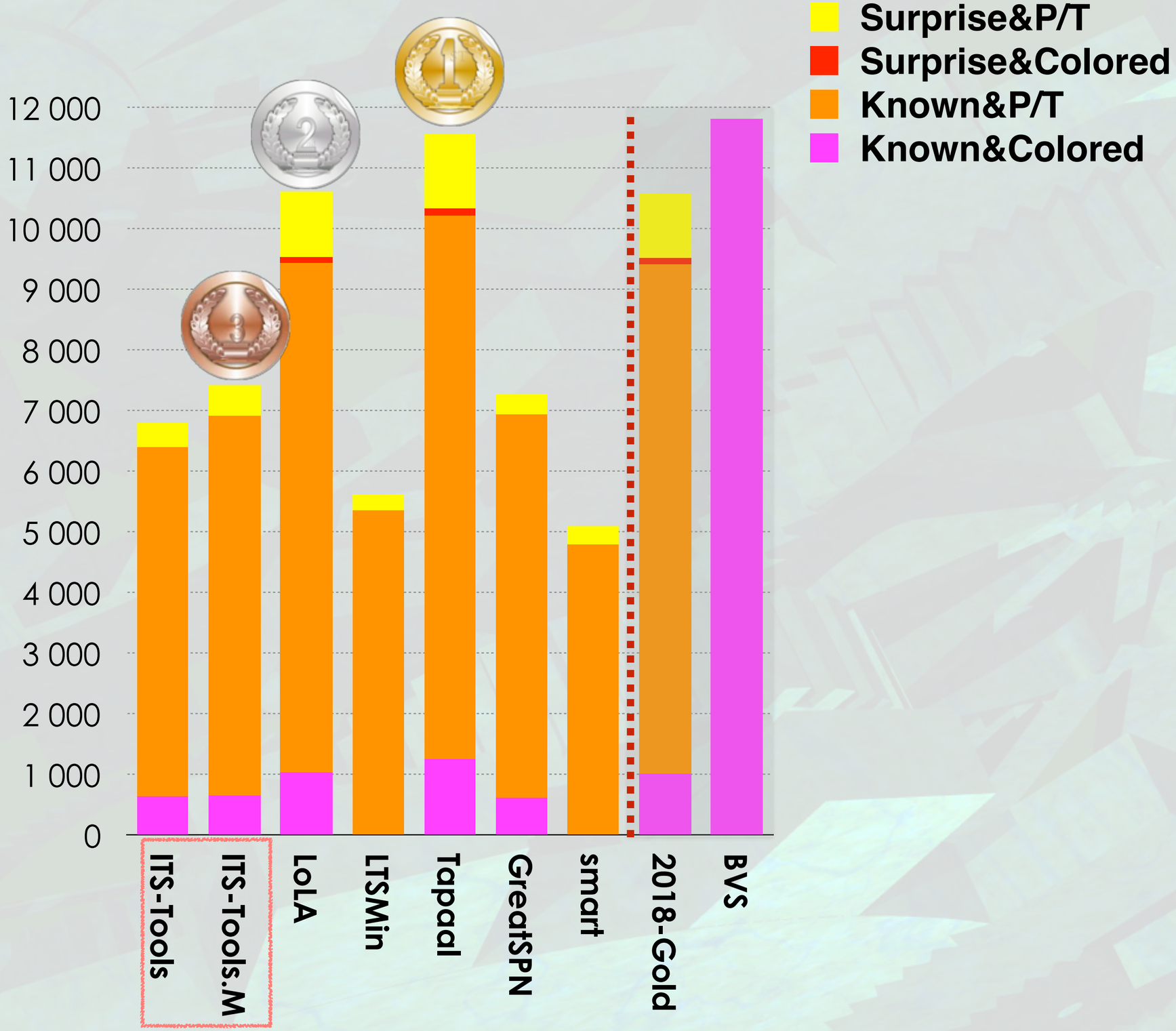
Tapaal

UpperBound	confidence	success	selected
Tapaal	100,00 %	719	719
LoLA	100,00 %	620	620
ITS-Tools	100,00 %	728	728
ITS-Tools.M	100,00 %	739	739
GreatSPN	100,00 %	438	438

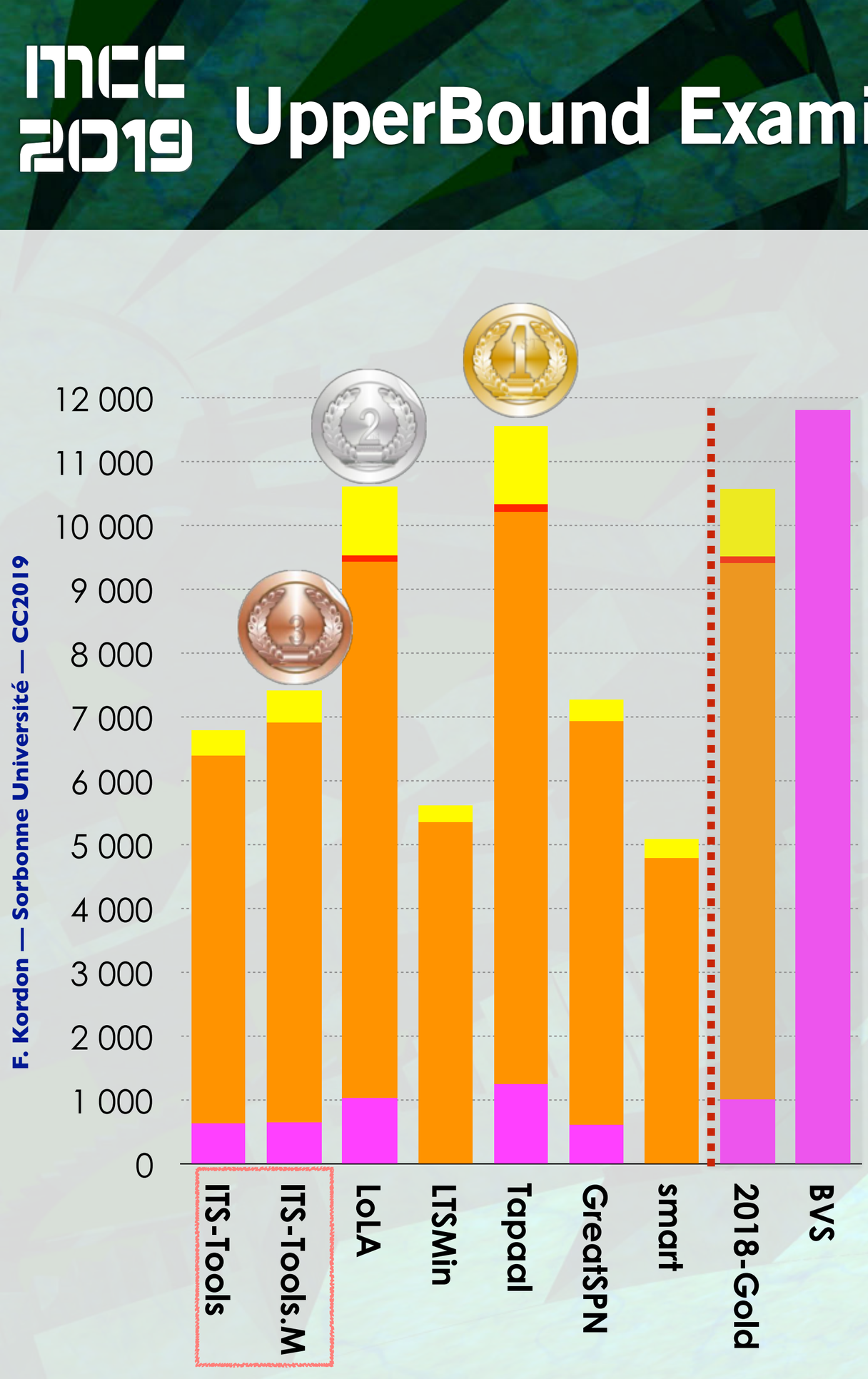
UpperBound Examination



UpperBound Examination



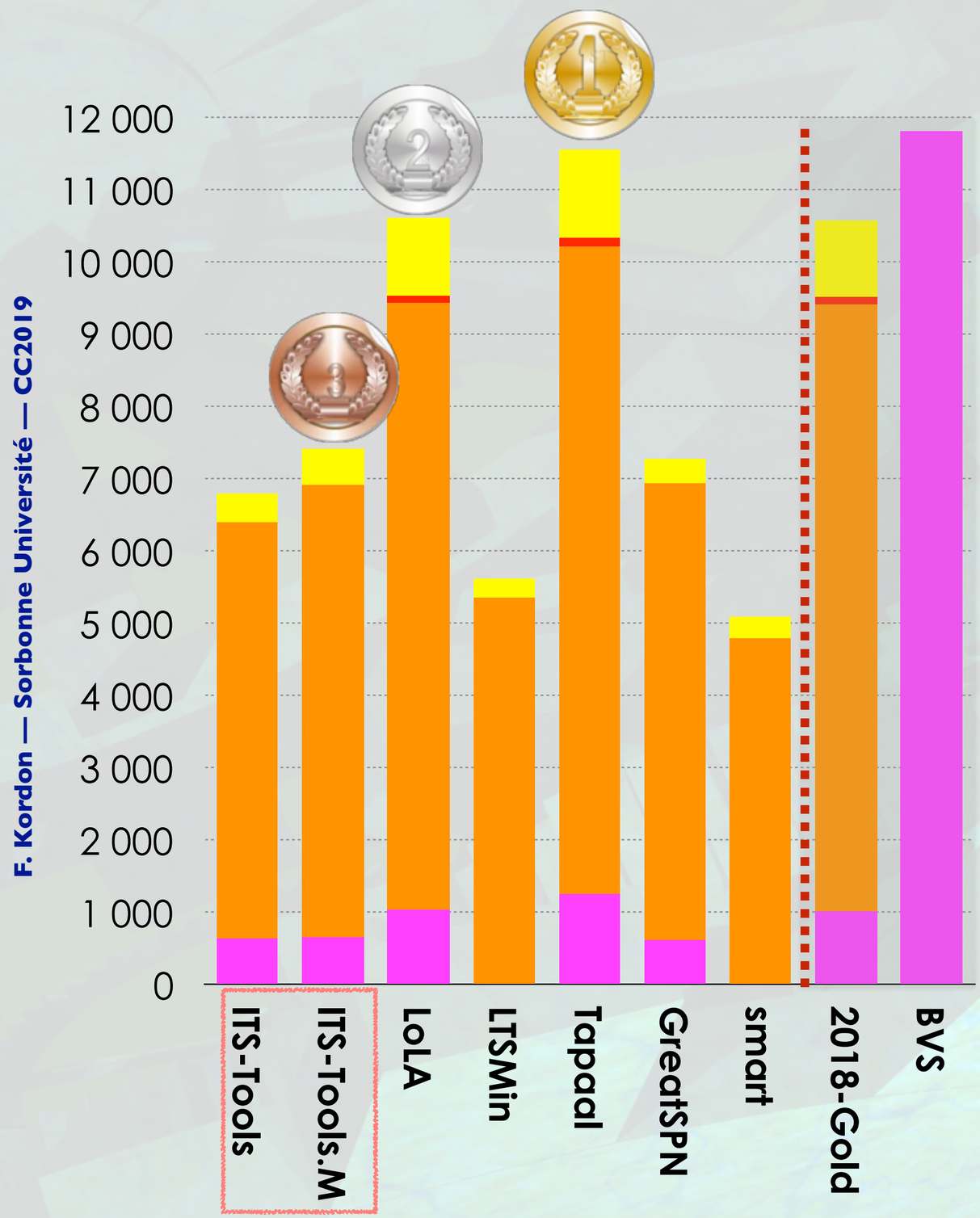
MCC 2019 UpperBound Examination



Gold-2018

Gold-2018

MCC 2019 UpperBound Examination



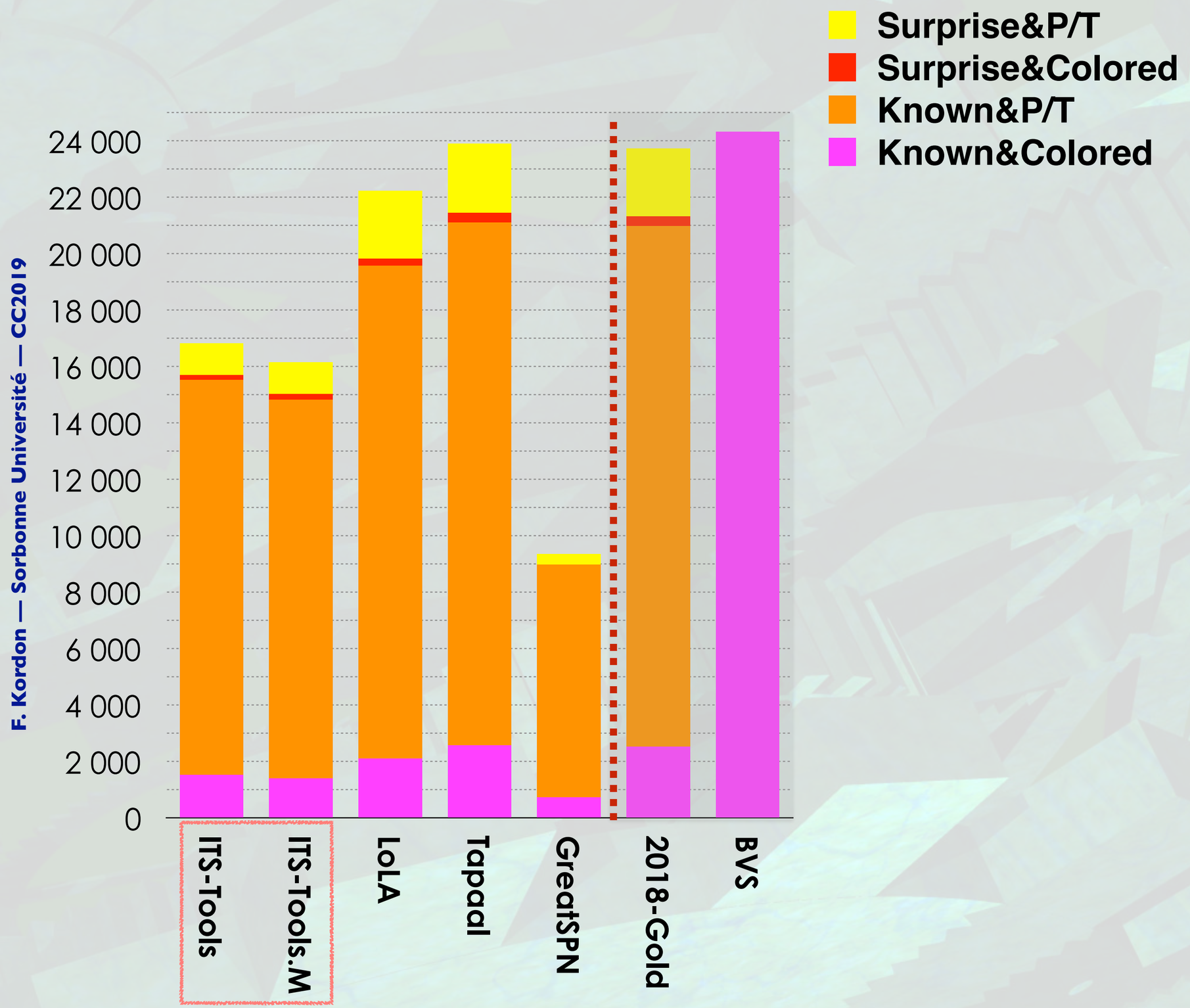
Surprise&P/T
Surprise&Colored
Known&P/T
Known&Colored

Gold-2018

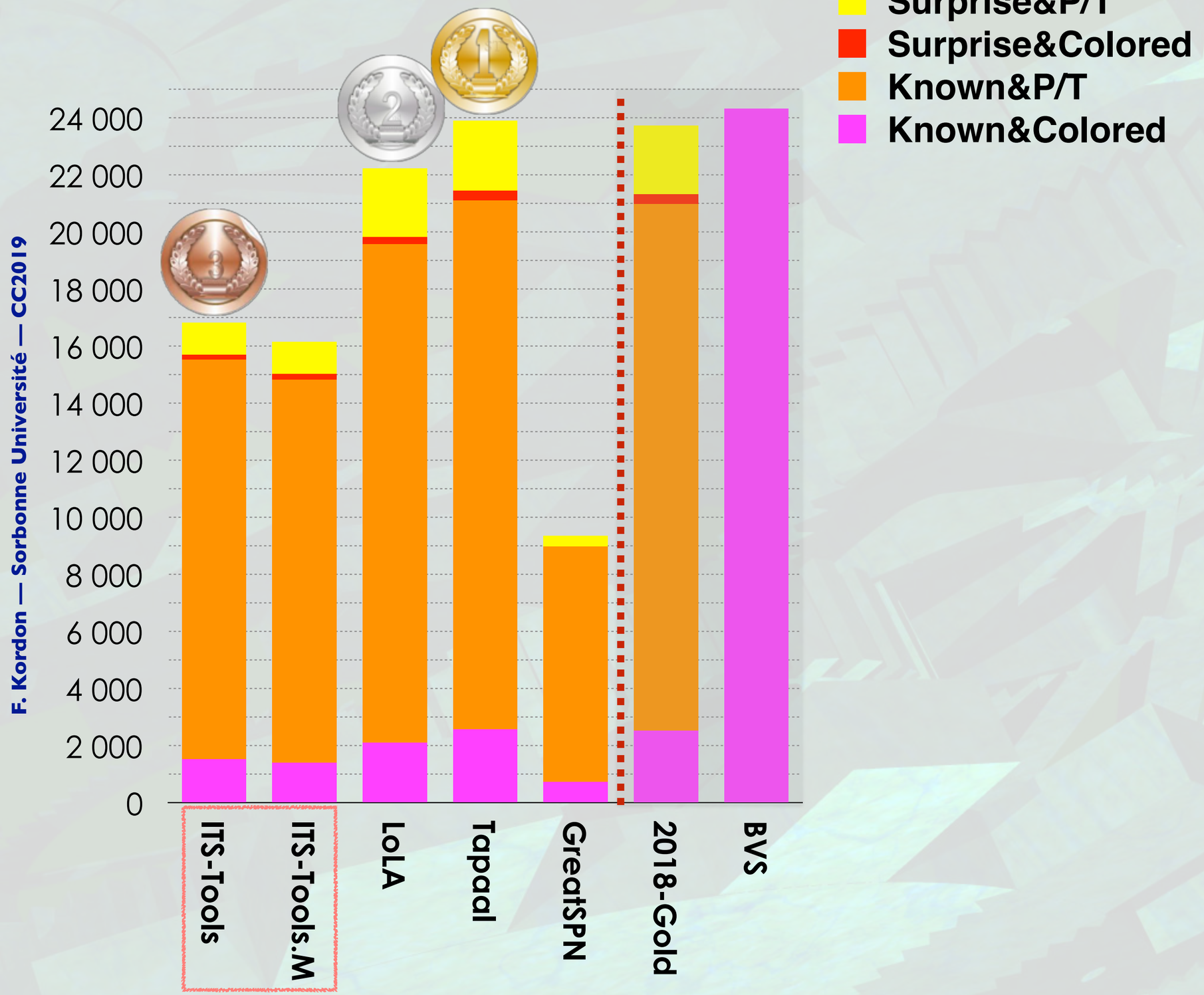
Gold-2018

UpperBound	confidence	success	selected
LTSMin	100,00 %	6267	6267
Tapaal	100,00 %	13156	13156
LoLA	100,00 %	12575	12575
ITS-Tools	100,00 %	8048	8048
ITS-Tools.M	99,90 %	8760	8769
GreatSPN	100,00 %	8936	8936
smart	100,00 %	5513	5513
Gold-2018	100,00 %	12547	12547

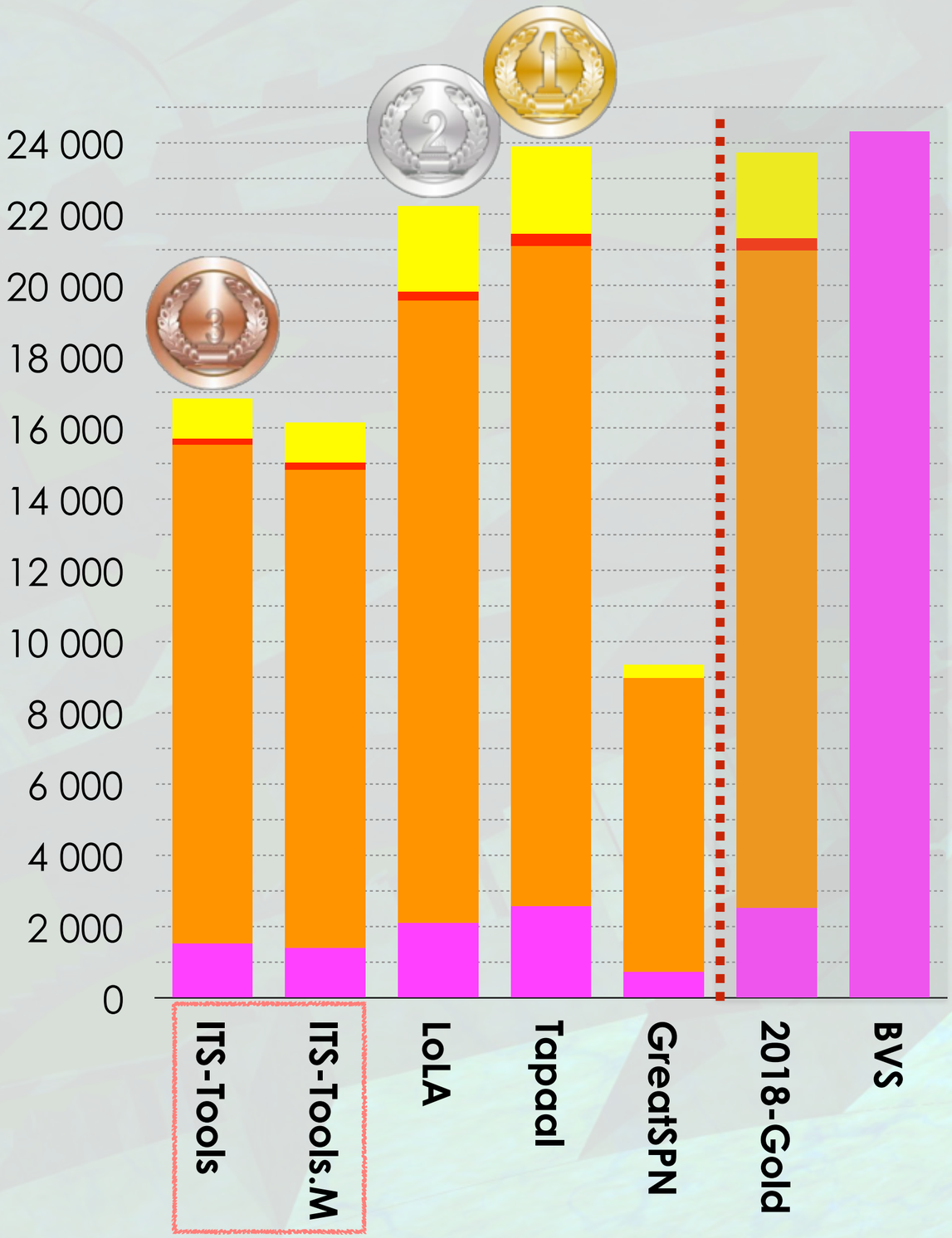
Reachability Examinations



MCC 2019 Reachability Examinations



Reachability Examinations

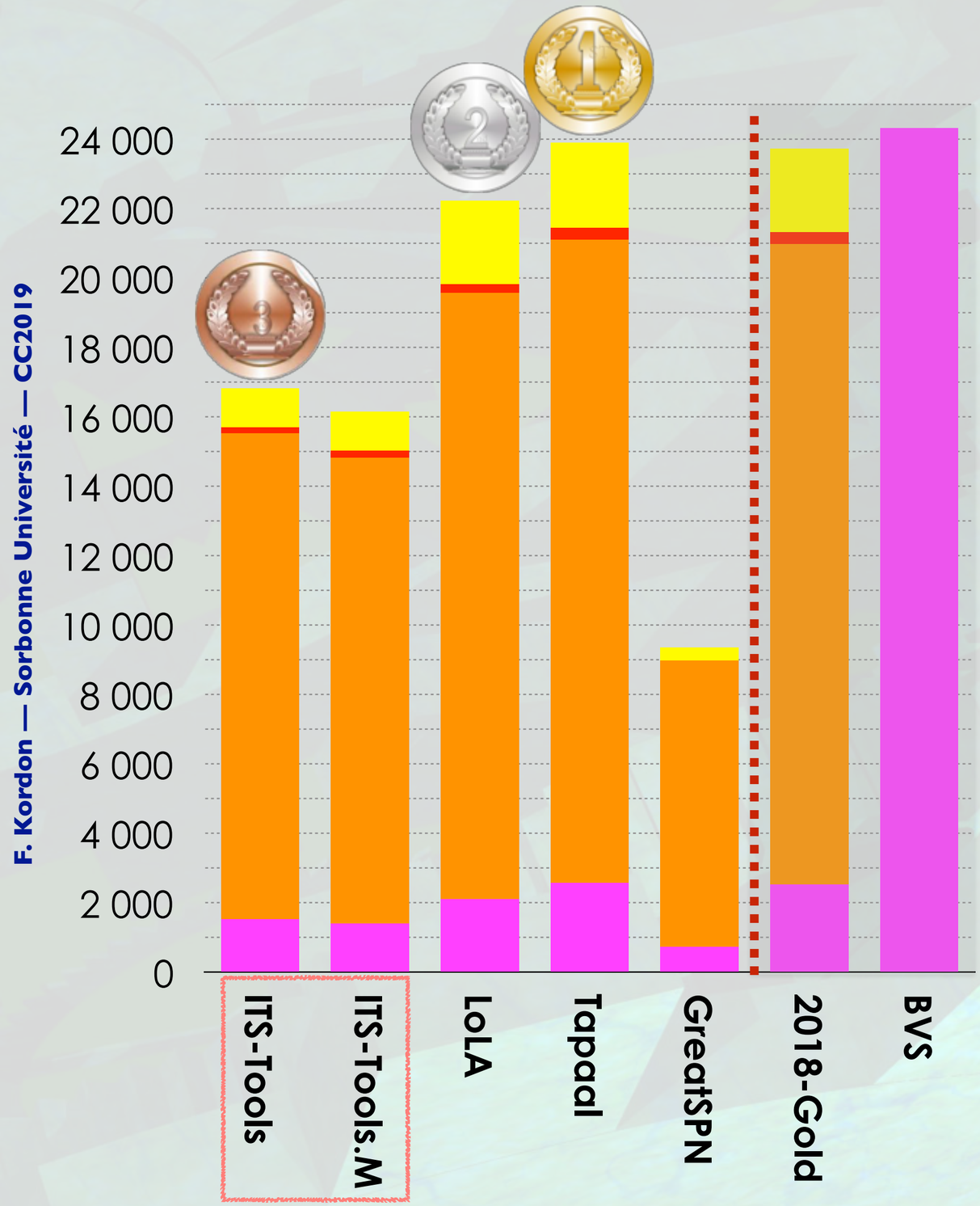


- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

LoLA

Tapaal

MCC 2019 Reachability Examinations

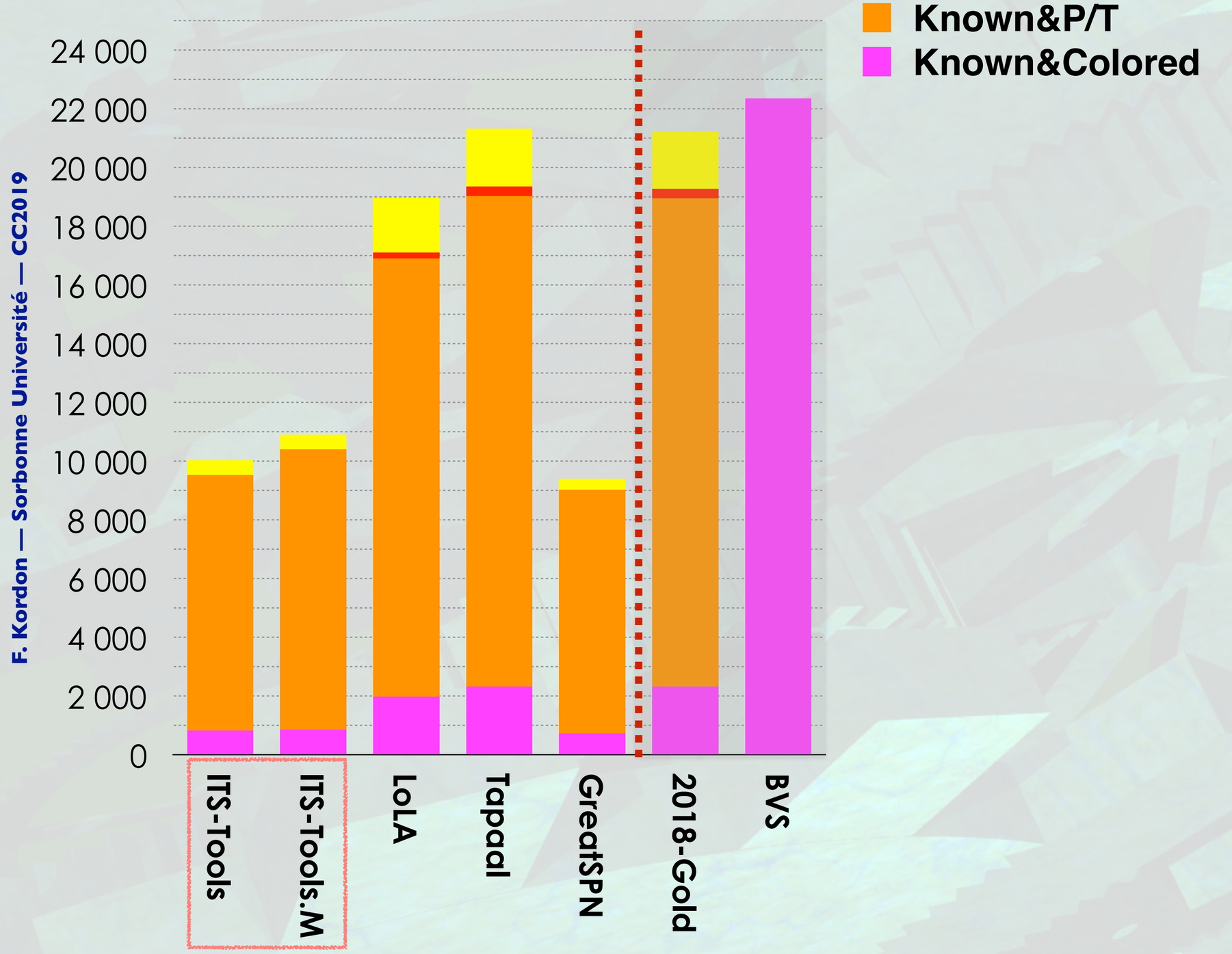


LoLA

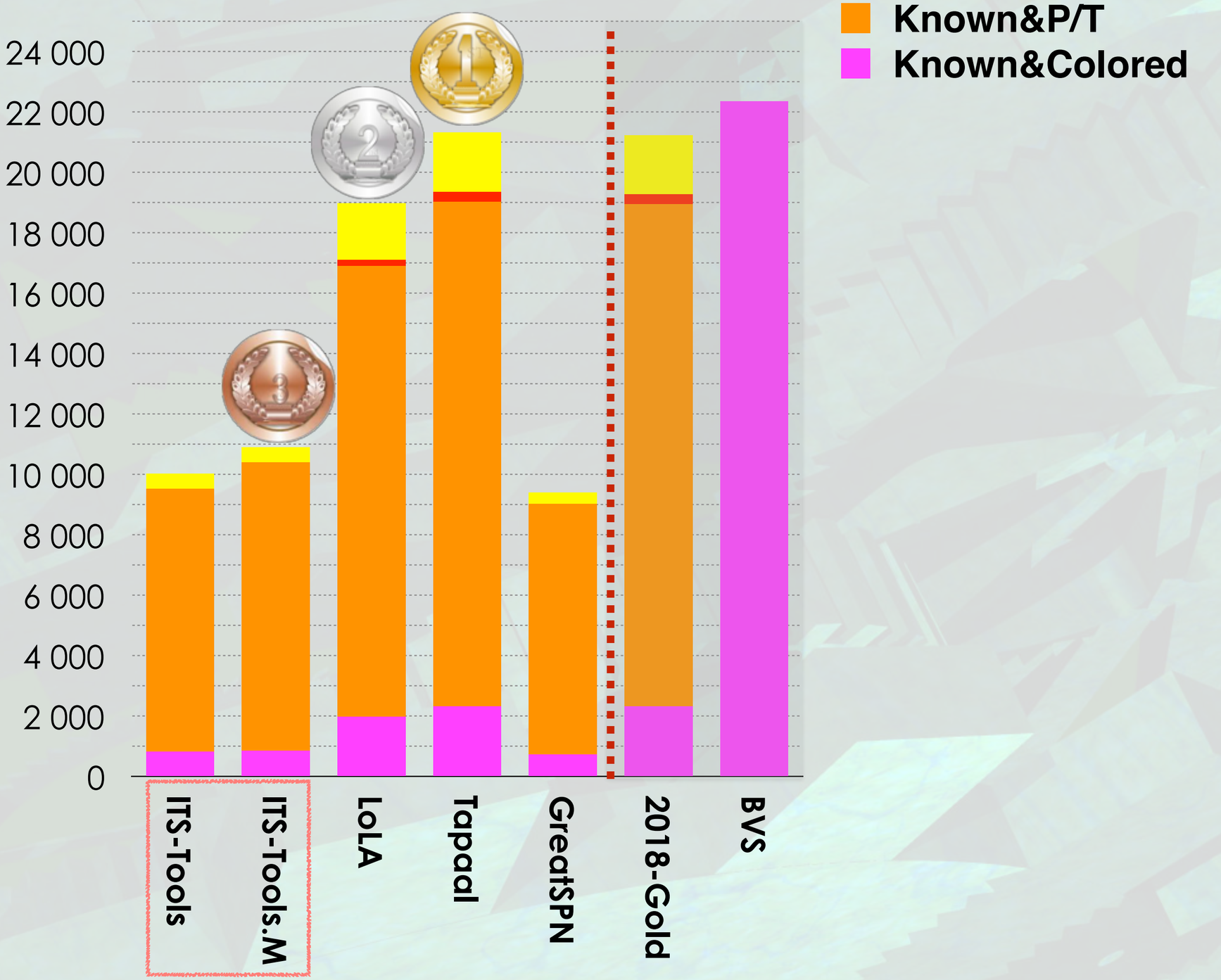
Tapaal

Reachability	confidence	success	selected
Tapaal	100,00 %	28370	28370
LoLA	99,98 %	26915	26918
ITS-Tools	100,00 %	20072	20072
ITS-Tools.M	99,97 %	18784	18789
GreatSPN	100,00 %	10546	10546
2018-Gold	100,00 %	28377	28377

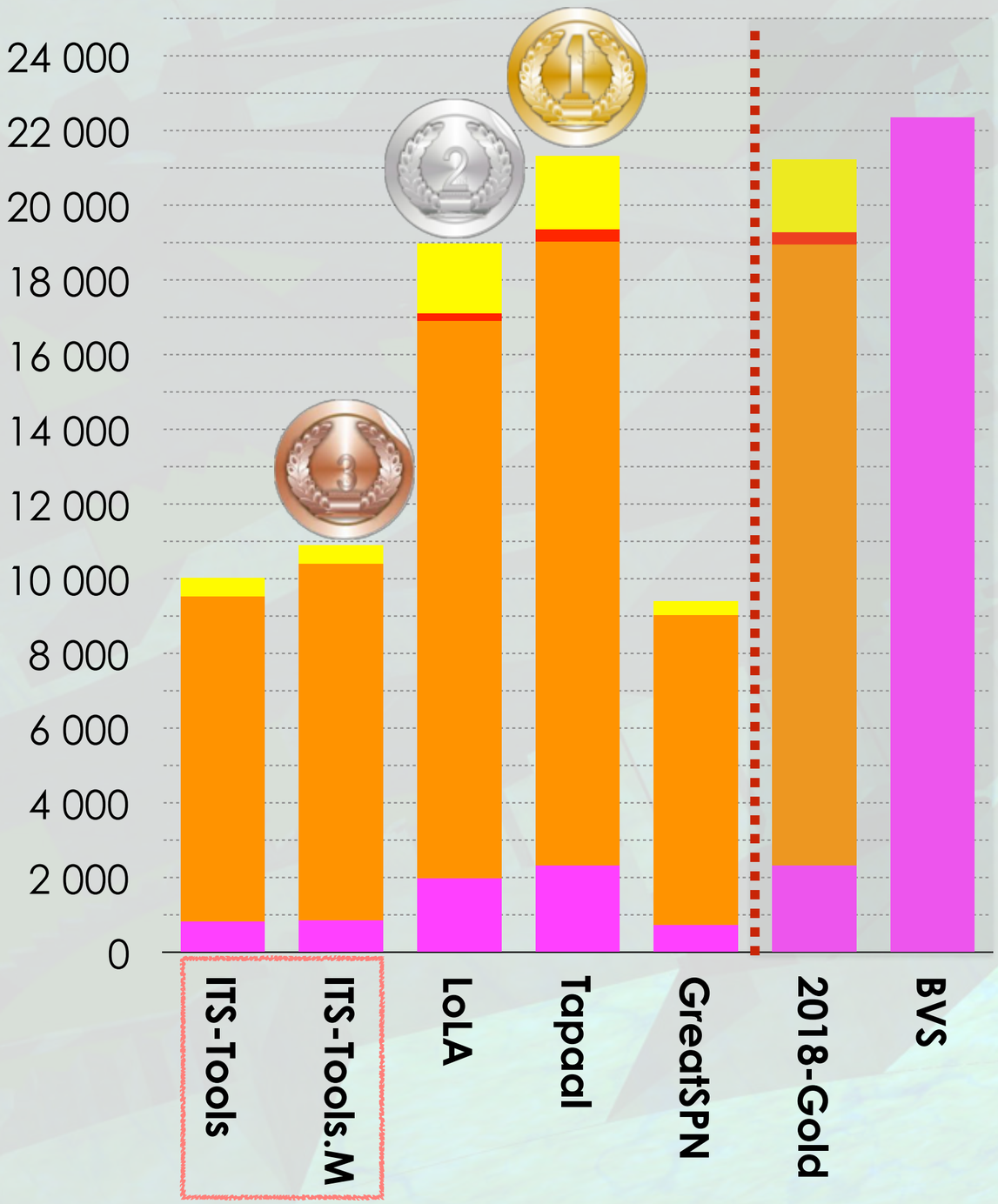
CTL Examinations



CTL Examinations



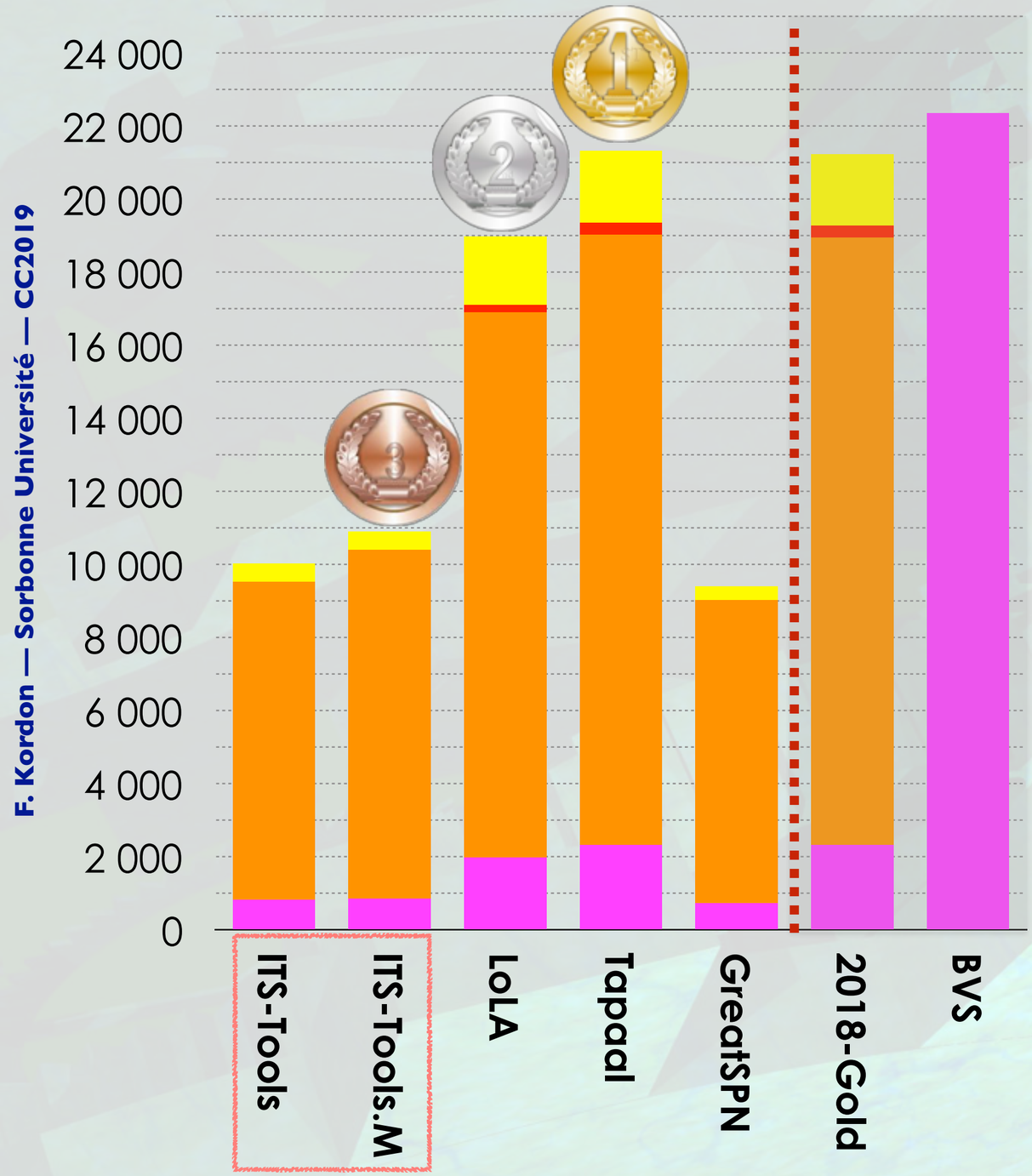
CTL Examinations



GreatSPN

GreatSPN

CTL Examinations

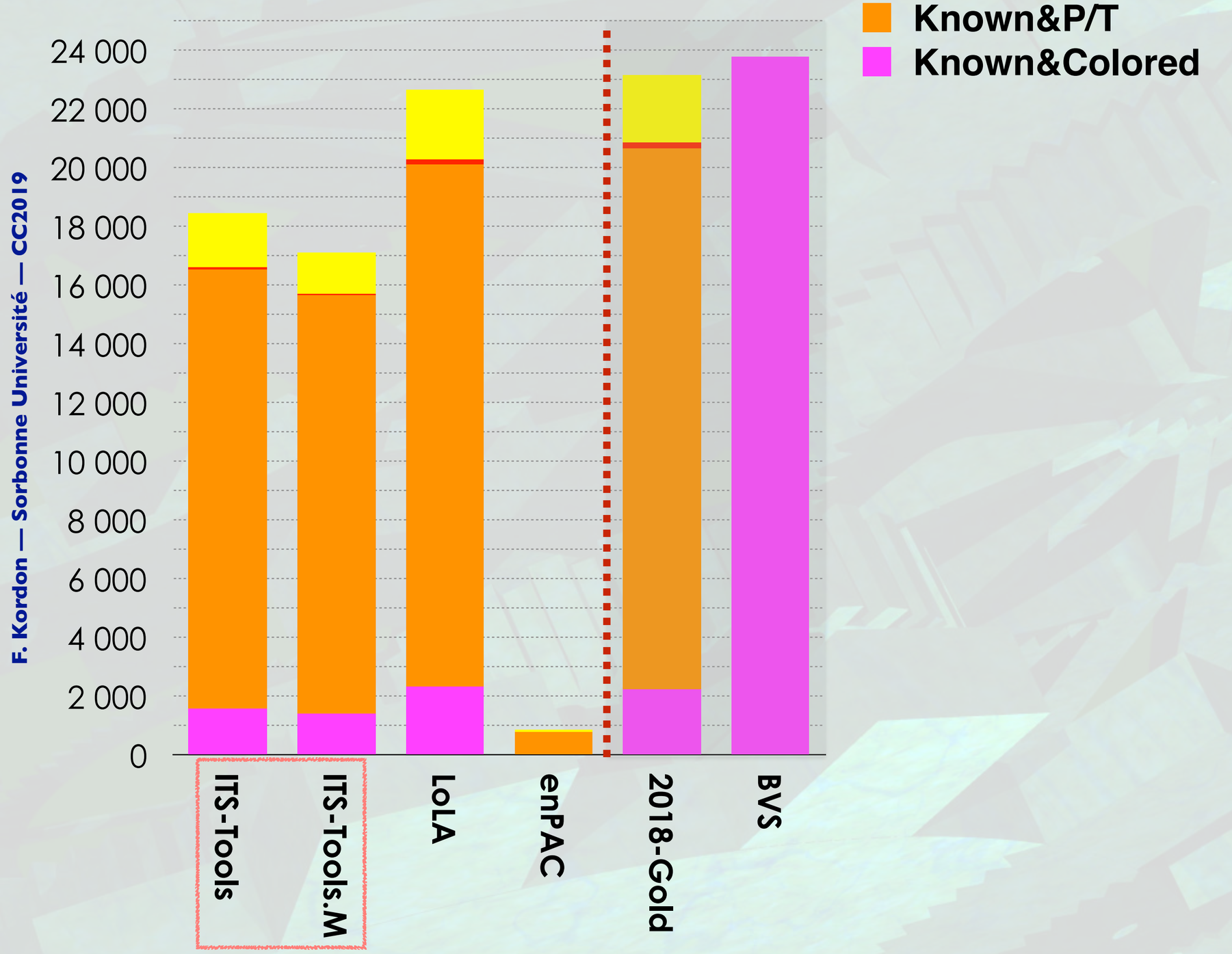


GreatSPN

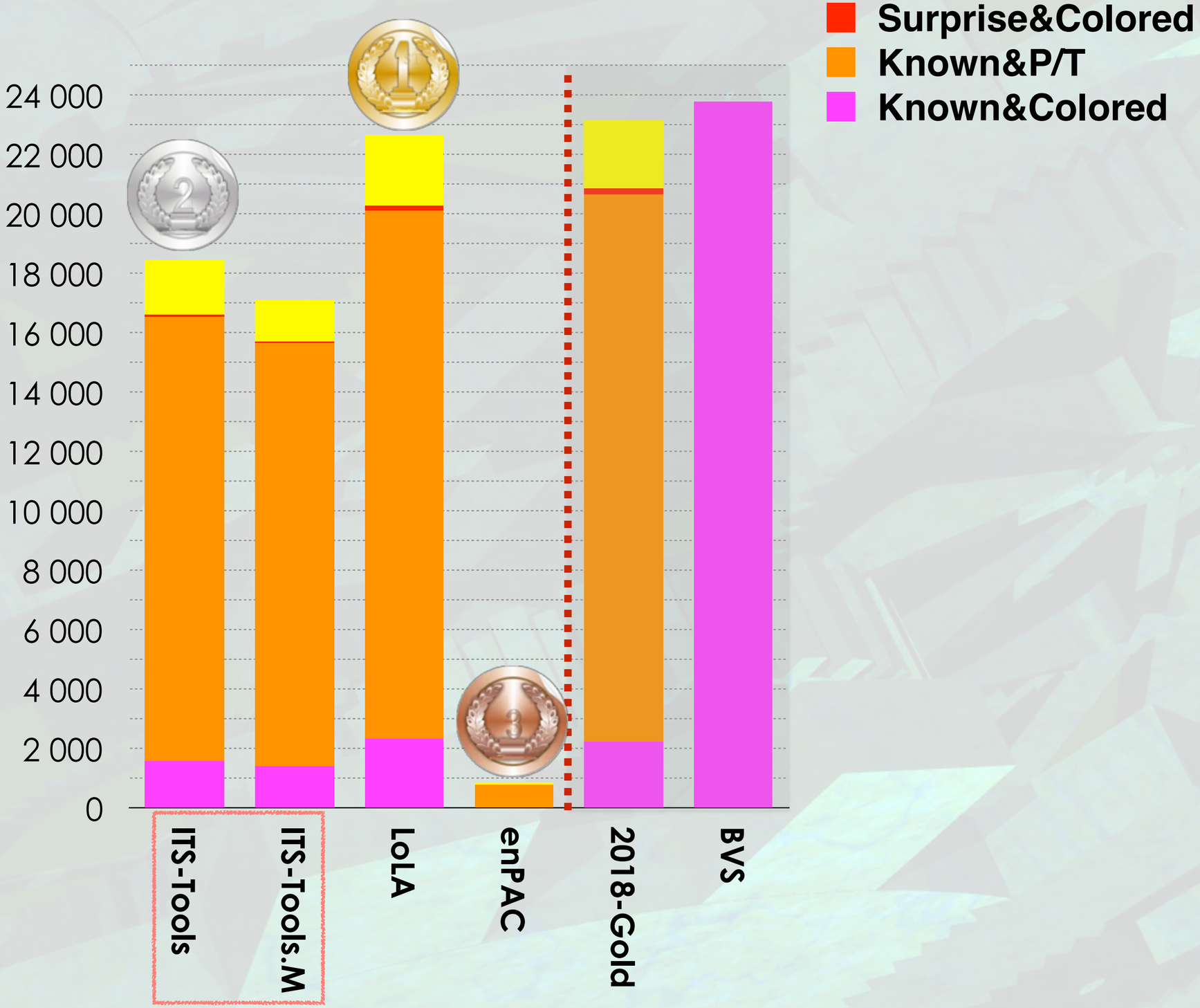
GreatSPN

CTL	confidence	success	selected
Tapaal	99,99 %	23572	23573
LoLA	99,99 %	12751	12756
ITS-Tools	100,00 %	11044	11044
ITS-Tools.M	99,99 %	11829	11832
GreatSPN	100,00 %	10345	10345
Gold-2018	99,97 %	23566	23573

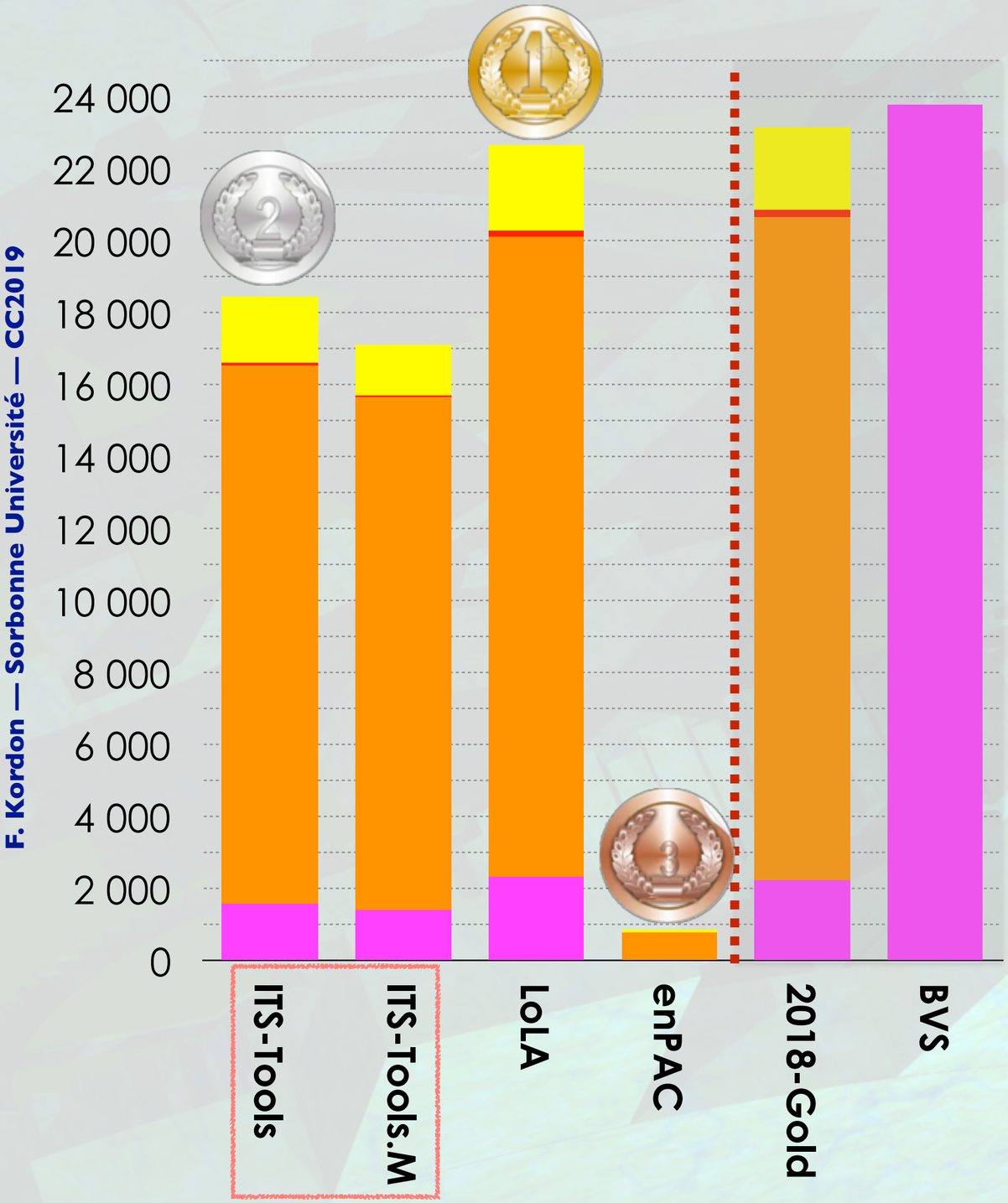
LTL Examinations



LTL Examinations



MCC 2019 LTL Examinations

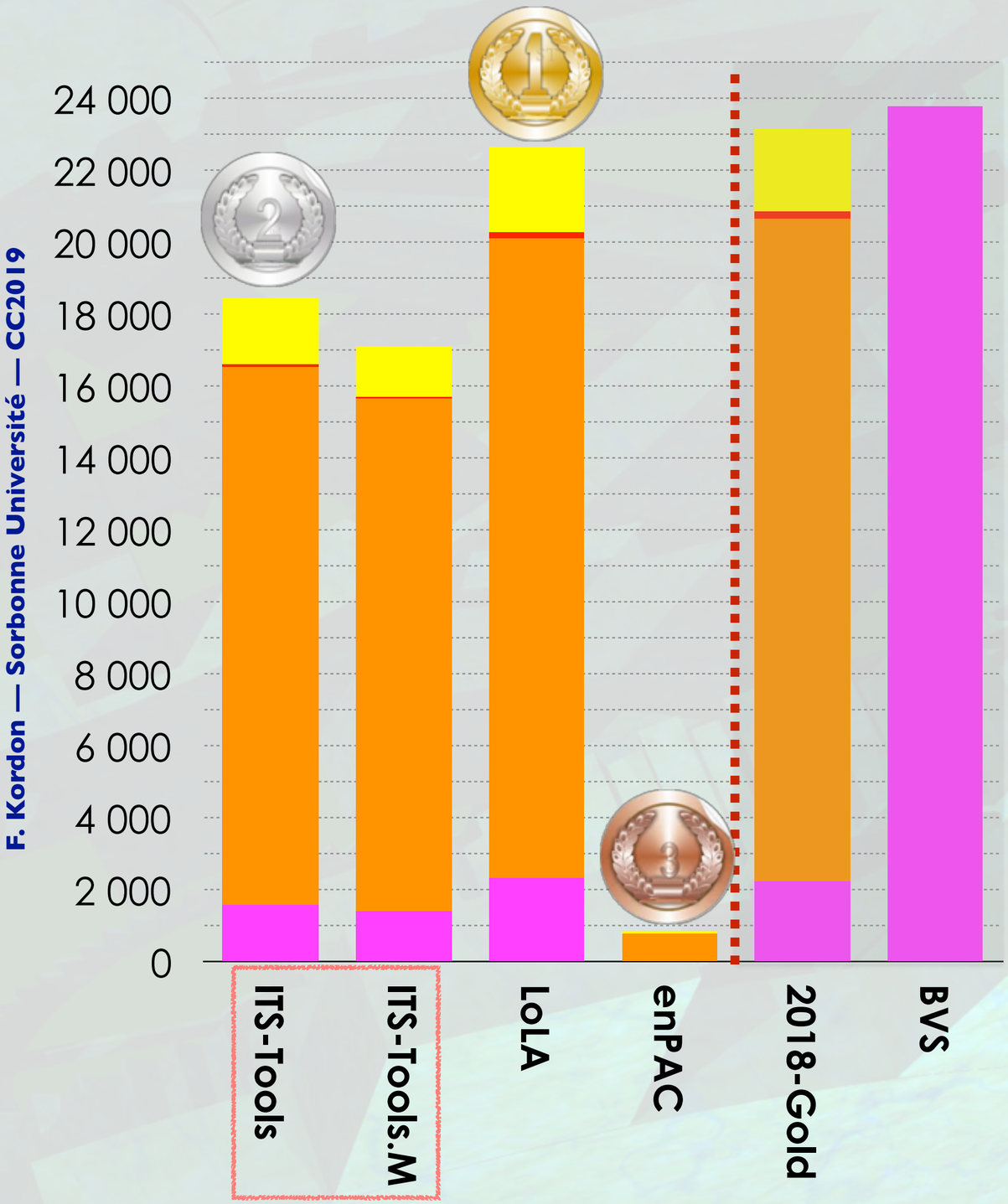


- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Gold-2018

Gold-2018

LTL Examinations



- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Gold-2018

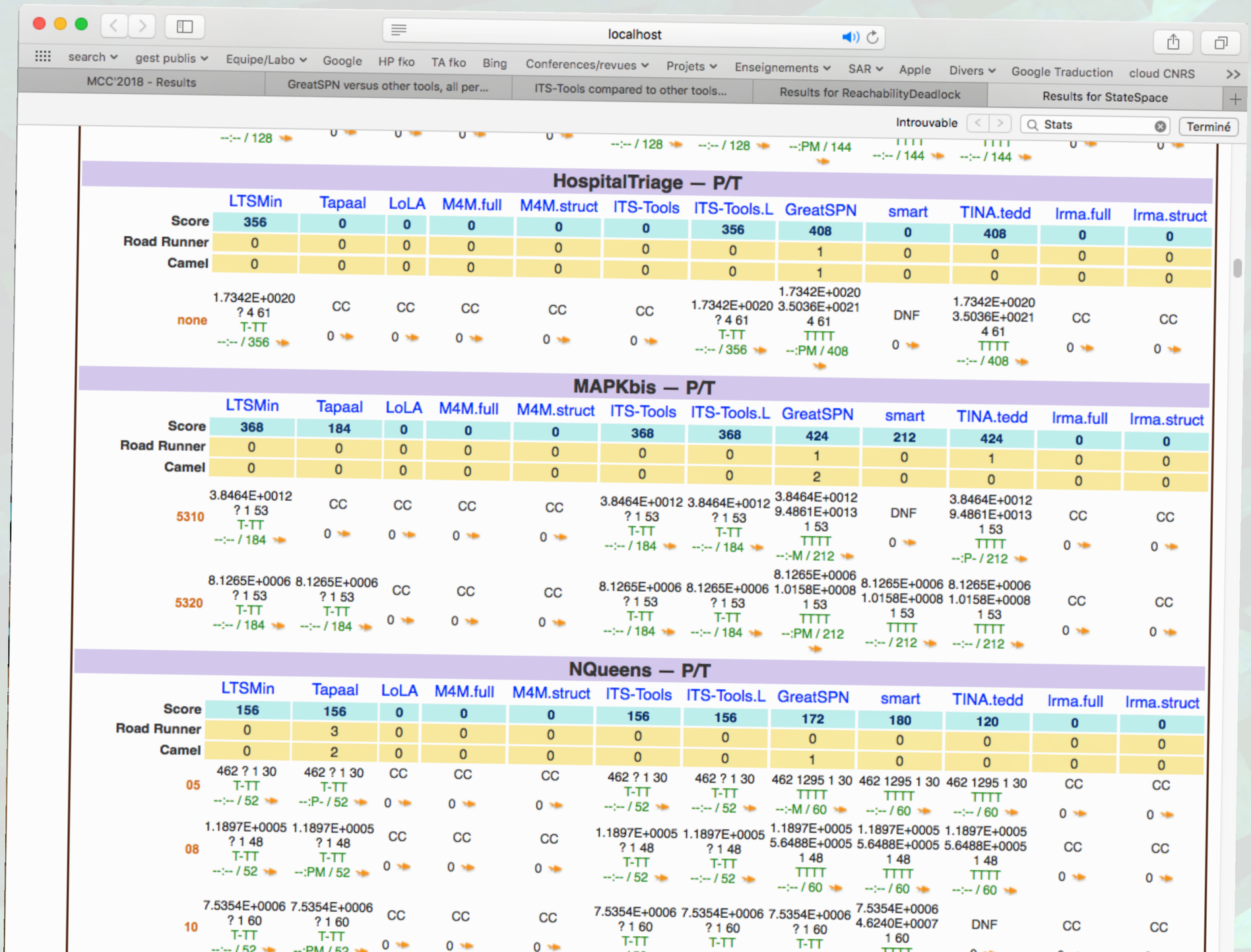
Gold-2018

LTL	confidence	success	selected
enPAC	85,87 %	2248	2618
LoLA	99,99 %	22163	22164
ITS-Tools	100,00 %	21800	21800
ITS-Tools.M	100,00 %	20073	20073
Gold-2018	99,98 %	22303	22306

Conclusive remarks

Detailed HTML Report

Many generated web pages (more than 85K in 2018)



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MCC'2018 - Results | GreatSPN versus other tools, all per... | ITS-Tools compared to other tools... | Results for ReachabilityDeadlock | Results for StateSpace

Introuvable | Stats | Terminé

--:-- / 128 | 0 | 0 | 0 | 0 | --:-- / 128 | --:-- / 128 | --:PM / 144 | --:-- / 144 | --:-- / 144 | 0 | 0

HospitalTriage — P/T

	LTSMin	Tapaal	LoLA	M4M.full	M4M.struct	ITS-Tools	ITS-Tools.L	GreatSPN	smart	TINA.tedd	Irma.full	Irma.struct
Score	**356**	**0**	**0**	**0**	**0**	**0**	**356**	**408**	**0**	**408**	**0**	**0**
Road Runner	0	0	0	0	0	0	0	1	0	0	0	0
Camel	0	0	0	0	0	0	0	1	0	0	0	0
none	1.7342E+0020 ? 4 61 T-TT --:-- / 356	CC 0	CC 0	CC 0	CC 0	CC 0	1.7342E+0020 ? 4 61 T-TT --:-- / 356	1.7342E+0020 3.5036E+0021 4 61 TTTT --:PM / 408	DNF 0	1.7342E+0020 3.5036E+0021 4 61 TTTT --:-- / 408	CC 0	CC 0

MAPKbis — P/T

	LTSMin	Tapaal	LoLA	M4M.full	M4M.struct	ITS-Tools	ITS-Tools.L	GreatSPN	smart	TINA.tedd	Irma.full	Irma.struct
Score	**368**	**184**	**0**	**0**	**0**	**368**	**368**	**424**	**212**	**424**	**0**	**0**
Road Runner	0	0	0	0	0	0	0	1	0	1	0	0
Camel	0	0	0	0	0	0	0	2	0	0	0	0
5310	3.8464E+0012 ? 1 53 T-TT --:-- / 184	CC 0	CC 0	CC 0	CC 0	3.8464E+0012 ? 1 53 T-TT --:-- / 184	3.8464E+0012 ? 1 53 T-TT --:-- / 184	3.8464E+0012 9.4861E+0013 1 53 TTTT --:-M / 212	DNF 0	3.8464E+0012 9.4861E+0013 1 53 TTTT --:P- / 212	CC 0	CC 0
5320	8.1265E+0006 ? 1 53 T-TT --:-- / 184	8.1265E+0006 ? 1 53 T-TT --:-- / 184	CC 0	CC 0	CC 0	8.1265E+0006 ? 1 53 T-TT --:-- / 184	8.1265E+0006 ? 1 53 T-TT --:-- / 184	8.1265E+0006 1.0158E+0008 1 53 TTTT --:PM / 212	8.1265E+0006 1.0158E+0008 1 53 TTTT --:-- / 212	8.1265E+0006 1.0158E+0008 1 53 TTTT --:-- / 212	CC 0	CC 0

NQueens — P/T

	LTSMin	Tapaal	LoLA	M4M.full	M4M.struct	ITS-Tools	ITS-Tools.L	GreatSPN	smart	TINA.tedd	Irma.full	Irma.struct
Score	**156**	**156**	**0**	**0**	**0**	**156**	**156**	**172**	**180**	**120**	**0**	**0**
Road Runner	0	3	0	0	0	0	0	0	0	0	0	0
Camel	0	2	0	0	0	0	0	1	0	0	0	0
05	462 ? 1 30 T-TT --:-- / 52	462 ? 1 30 T-TT --:P- / 52	CC 0	CC 0	CC 0	462 ? 1 30 T-TT --:-- / 52	462 ? 1 30 T-TT --:-- / 52	462 1295 1 30 TTTT --:-M / 60	462 1295 1 30 TTTT --:-- / 60	462 1295 1 30 TTTT --:-- / 60	CC 0	CC 0
08	1.1897E+0005 ? 1 48 T-TT --:-- / 52	1.1897E+0005 ? 1 48 T-TT --:PM / 52	CC 0	CC 0	CC 0	1.1897E+0005 ? 1 48 T-TT --:-- / 52	1.1897E+0005 ? 1 48 T-TT --:-- / 52	1.1897E+0005 5.6488E+0005 1 48 TTTT --:-- / 60	1.1897E+0005 5.6488E+0005 1 48 TTTT --:-- / 60	1.1897E+0005 5.6488E+0005 1 48 TTTT --:-- / 60	CC 0	CC 0
10	7.5354E+0006 ? 1 60 T-TT --:-- / 52	7.5354E+0006 ? 1 60 T-TT --:PM / 52	CC 0	CC 0	CC 0	7.5354E+0006 ? 1 60 T-TT	7.5354E+0006 ? 1 60 T-TT	7.5354E+0006 ? 1 60 T-TT	7.5354E+0006 4.6240E+0007 1 60	DNF	CC	CC

Detailed HTML Report

Many genera

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MCC'2018 - Results | GreatSPN versus other tool

--:-- / 128 0 0

	LTSMin	Tapaal	LoLA
Score	356	0	0
Road Runner	0	0	0
Camel	0	0	0

none	1.7342E+0020 ? 4 61 T-TT --:-- / 356	CC 0	CC 0

	LTSMin	Tapaal	LoLA
Score	368	184	0
Road Runner	0	0	0
Camel	0	0	0

5310	3.8464E+0012 ? 1 53 T-TT --:-- / 184	CC 0	CC 0
5320	8.1265E+0006 ? 1 53 T-TT --:-- / 184	8.1265E+0006 ? 1 53 T-TT --:-- / 184	CC 0

	LTSMin	Tapaal	LoLA
Score	156	156	0
Road Runner	0	3	0
Camel	0	2	0

05	462 ? 1 30 T-TT --:-- / 52	462 ? 1 30 T-TT --:P- / 52	CC 0
08	1.1897E+0005 ? 1 48 T-TT --:-- / 52	1.1897E+0005 ? 1 48 T-TT --:PM / 52	CC 0
10	7.5354E+0006 ? 1 60 T-TT --:-- / 52	7.5354E+0006 ? 1 60 T-TT --:PM / 52	CC 0

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MCC'2018 - Execution of r284-csrt-152749174900307

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Model Checking Contest 2018

8th edition, Bratislava, Slovakia, June 26, 2018

Execution of r284-csrt-152749174900307

Last Updated
June 18, 2018

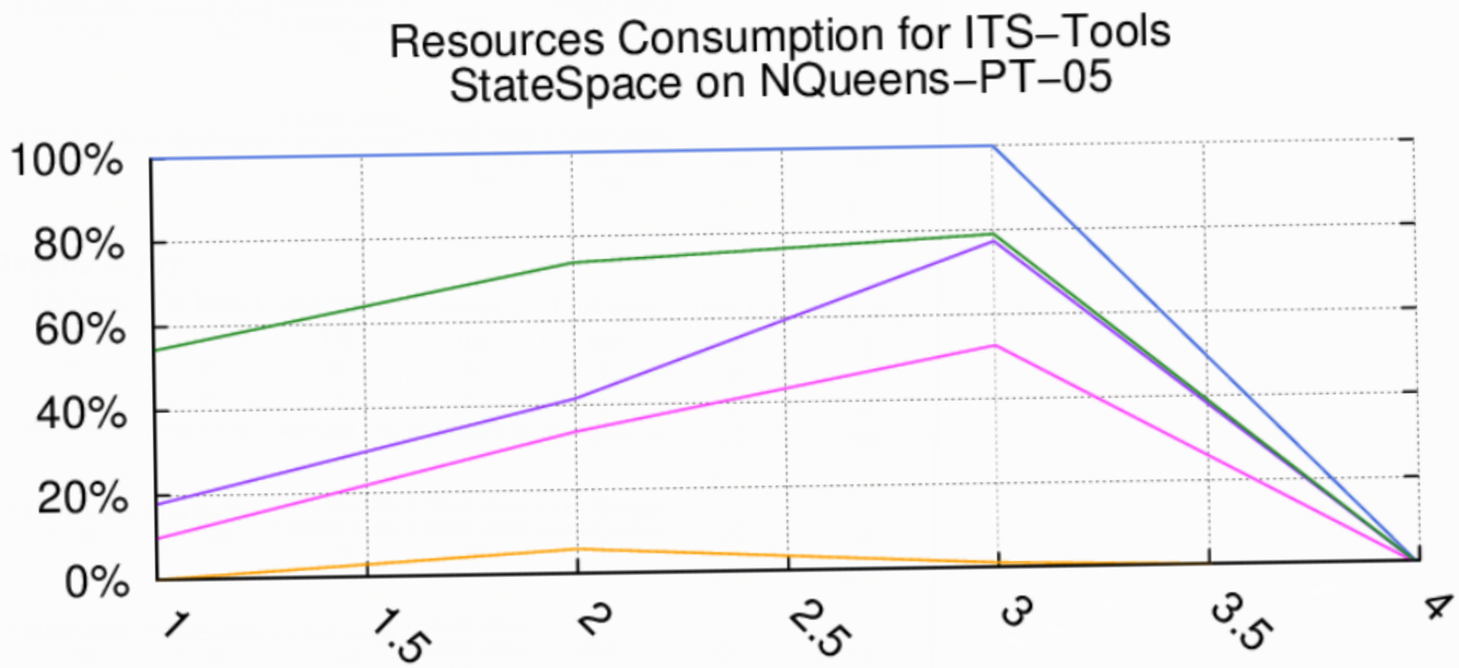
About the Execution of ITS-Tools for NQueens-PT-05

Execution Summary

Max Memory Used (MB)	Time wait (ms)	CPU Usage (ms)	I/O Wait (ms)	Computed Result	Execution Status
15757.060	2367.00	5170.00	68.20	462 ? 1 30	normal

Execution Chart

We display below the execution chart for this examination (boot time has been removed).



Detailed HTML Report

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MCC'2018 - Execution of r284-csrt-152749174900307

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MCC'2018 - Results | versus other tools, all performance... | compared to other tools («All» mo... | Results for ReachabilityDeadlock | MCC'2018 - Results for StateSpace

Some statistics are displayed below, based on ***1894*** runs (947 for GreatSPN and 947 for M4M.struct, so there are 947 plots on each of the two charts). Each execution was allowed ***1 hour*** and ***16 GByte*** of memory. Then performance charts comparing GreatSPN to M4M.struct are shown (you may click on one graph to enlarge it).

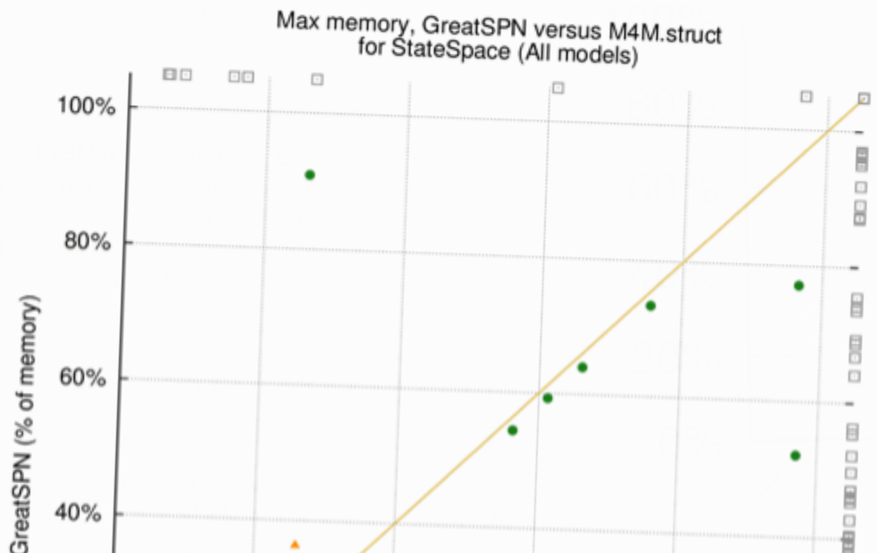
Statistics on the execution

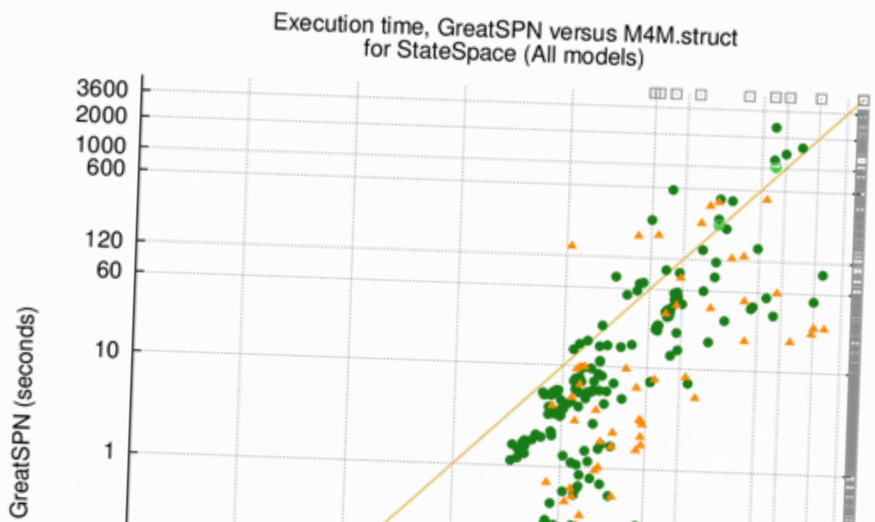
	GreatSPN	M4M.struct	Both tools
All computed OK	346	8	169
GreatSPN = M4M.struct	—	—	2
GreatSPN > M4M.struct	—	—	67
GreatSPN < M4M.struct	—	-	0
Do not compete	0	0	0
Error detected	0	0	0
Cannot Compute + Time-out	8	346	355

	GreatSPN	M4M.struct
	Smallest Memory Footprint	
Times tool wins	568	24
	Shortest Execution Time	
Times tool wins	557	35

On the chart below, ● denote cases where the two tools did computed all results without error, ◒ denote cases where the two tool did computed the same number of values (but not al values in the examination), ▲ denote cases where GreatSPN computed more values than M4M.struct, ▼ denote cases where GreatSPN computed less values than M4M.struct, ◆ denote the cases where at least one tool did not competed, ⊙ denote the cases where at least one tool computed a bad value and ⊡ denote the cases where at least one tool stated it could not compute a result or timed-out.

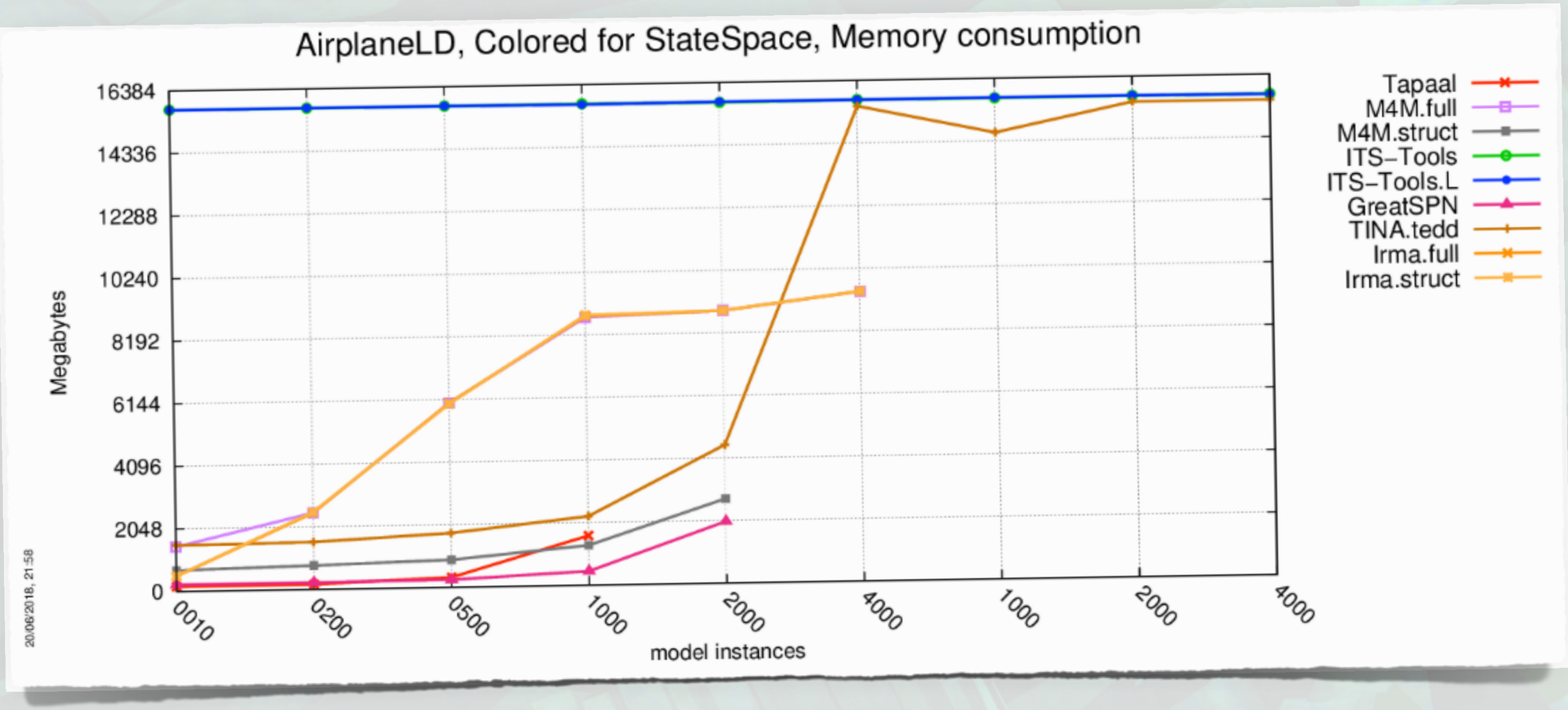
GreatSPN wins when points are below the diagonal, M4M.struct wins when points are above the diagonal.





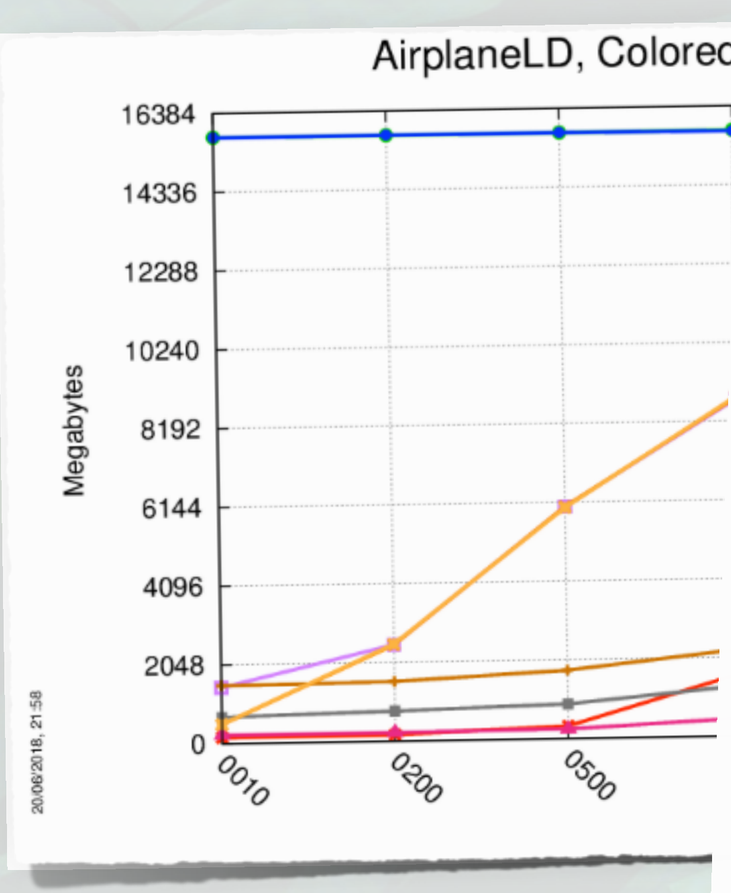
Generated Charts

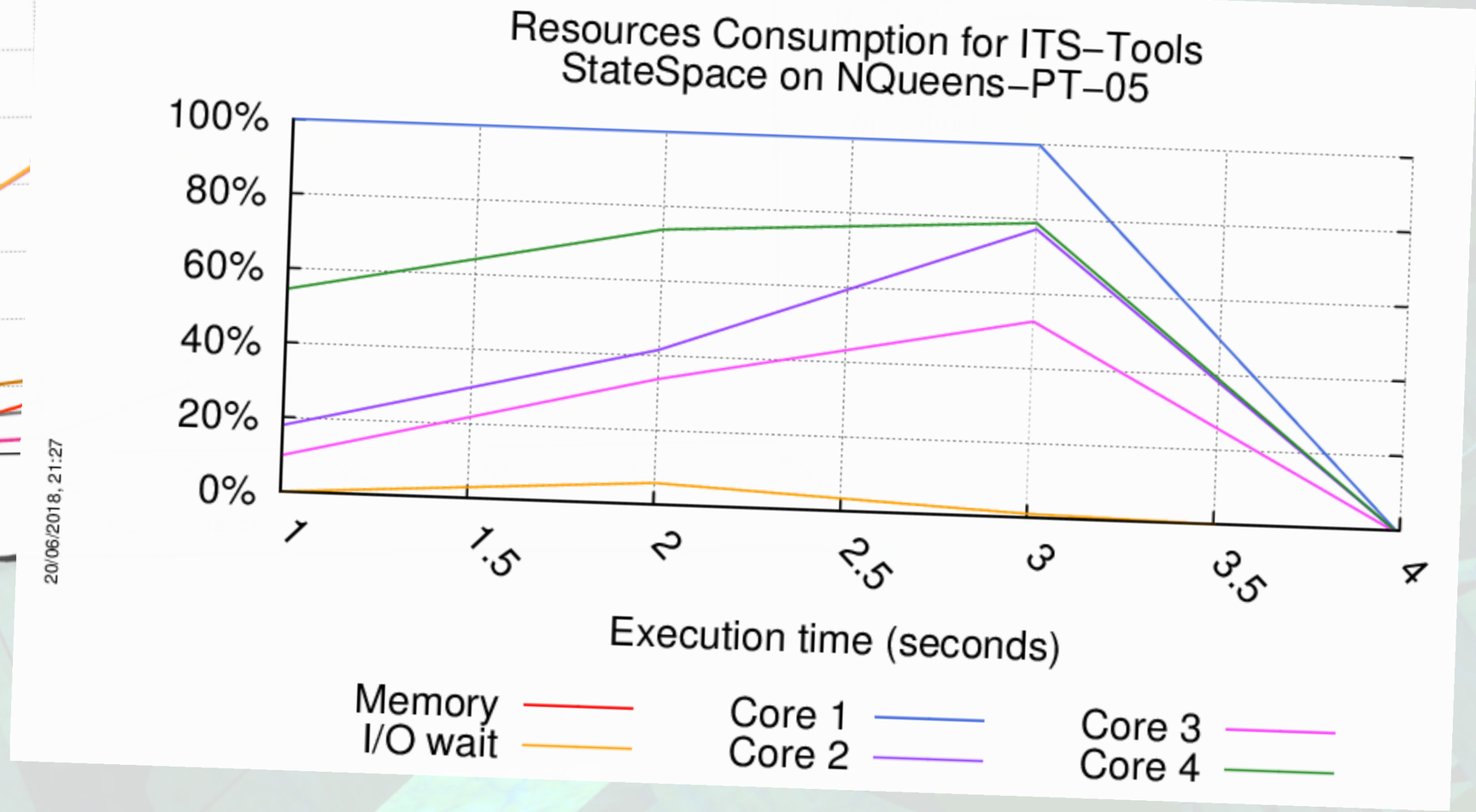
Numerous generated charts (88 867 in 2018)



Generated Charts

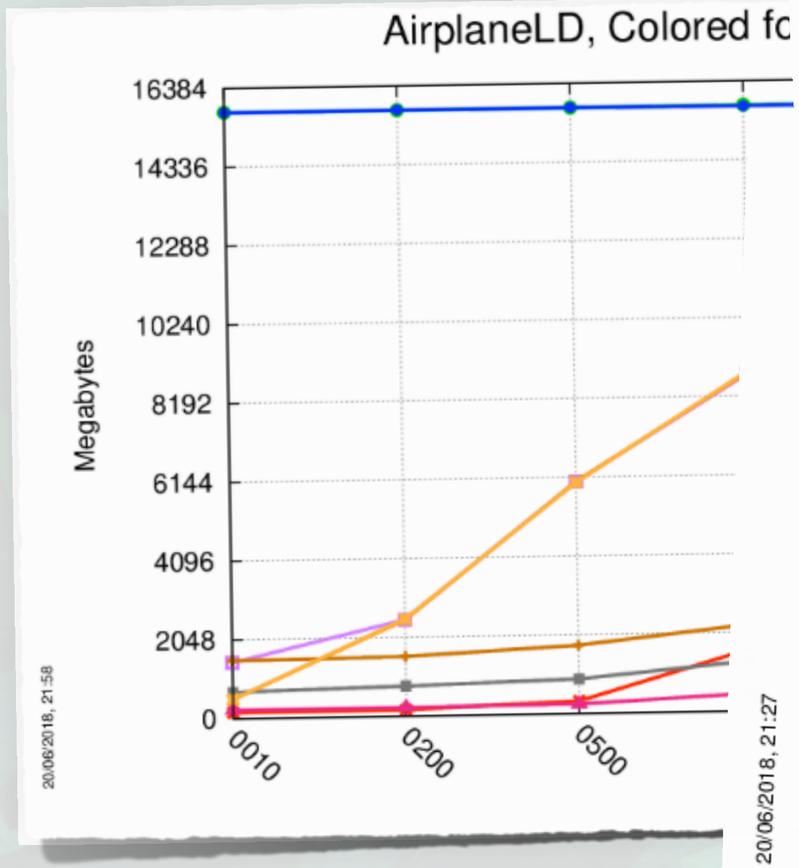
Numerous generated charts (88 867 in 2018)

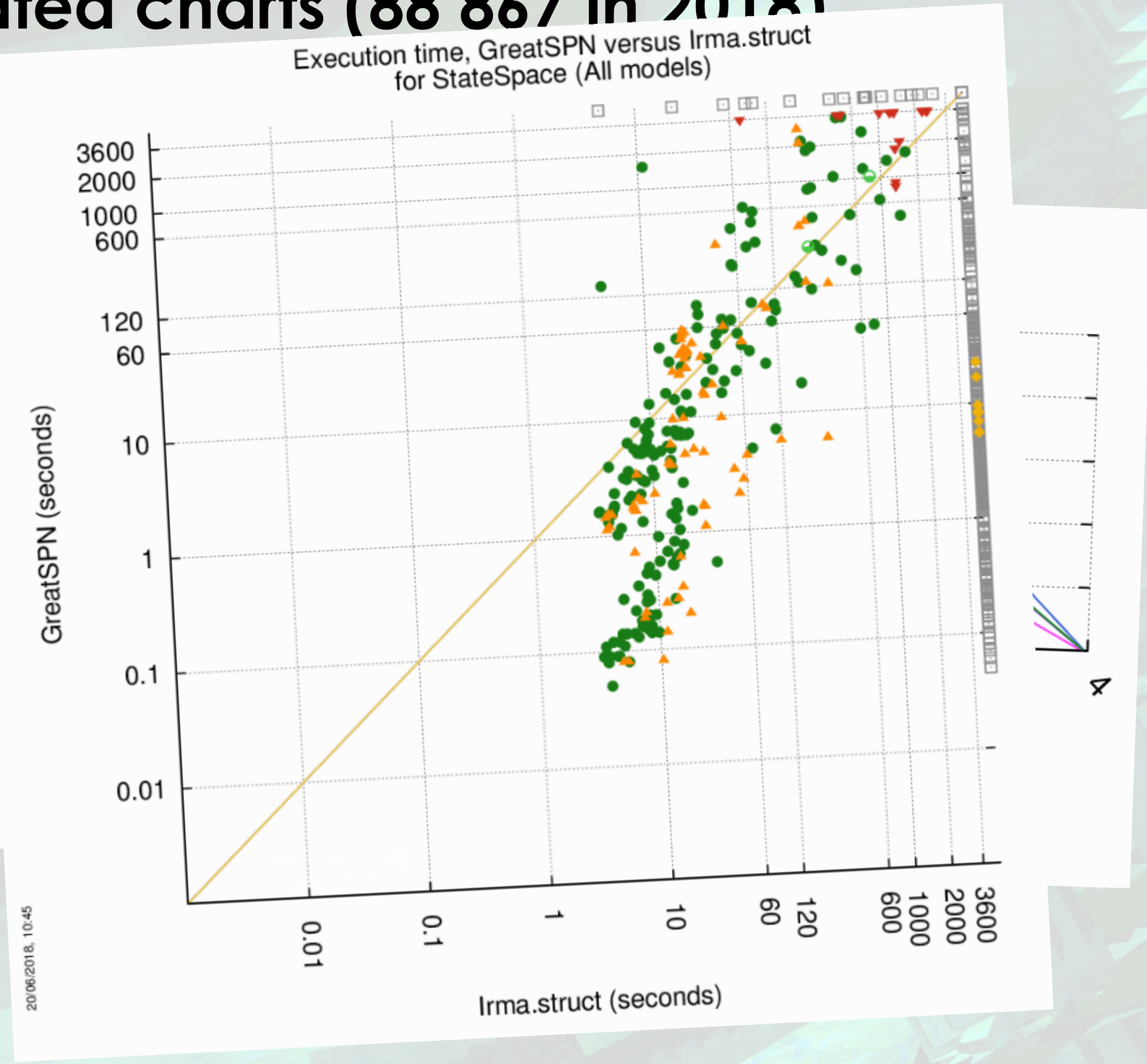




Generated Charts

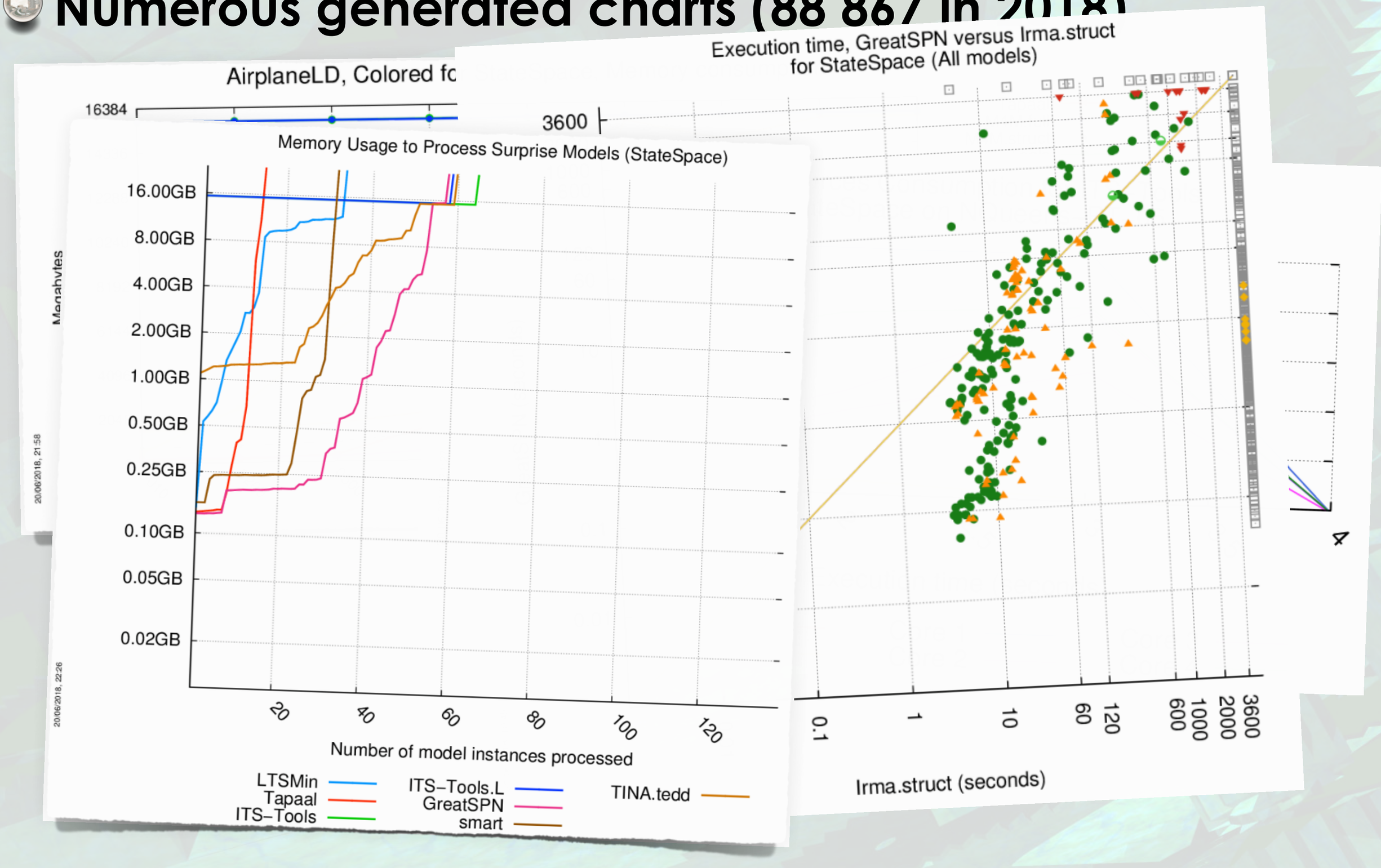
Numerous generated charts (88 867 in 2018)





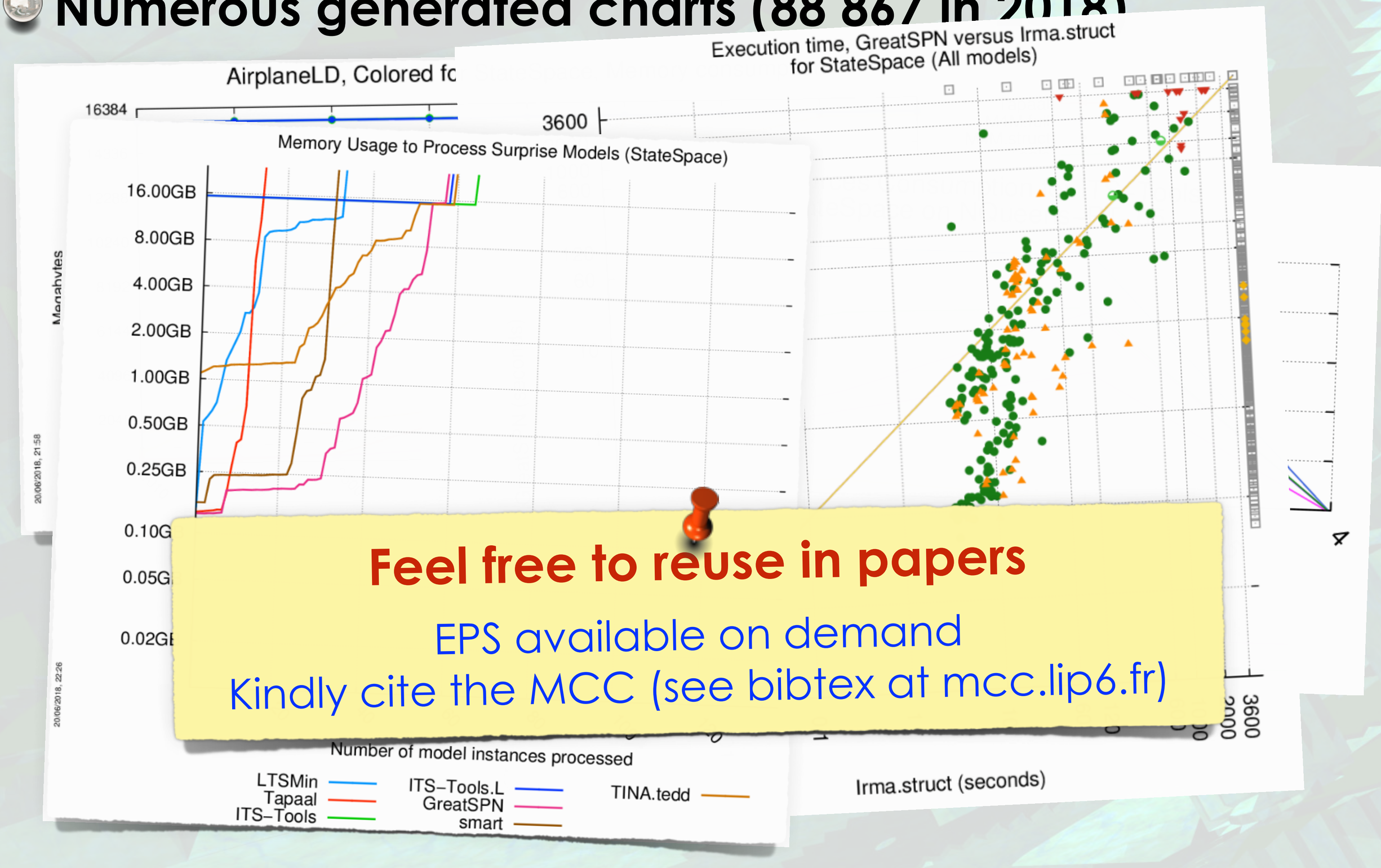
Generated Charts

Numerous generated charts (88 867 in 2018)



Generated Charts

Numerous generated charts (88 867 in 2018)



Feel free to reuse in papers

EPS available on demand

Kindly cite the MCC (see bibtex at mcc.lip6.fr)

Next year?

- **Handling some rare bugs in models**
  - Unexpected infinite instances in RefineWG
- **Improving verdicts**
  - Instance-based verdict
- **Best Virtual Tool**
  - Better measure than Best Virtual Score tool

Next year?

- **Handling some rare bugs in models**
  - Unexpected infinite instances in RefineWG
- **Improving verdicts**
  - Instance-based verdict
- **Best Virtual Tool**
  - Better measure than Best Virtual Score tool

- **Lessons learnt, 6 weeks was too short for running MCC**
  - 15 months until the next edition

LIP6

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And now...
let's have time for discussion

MCC 2019