Computing for HEP

Claudio Pica

Restricted ECFA meeting, 3 May 2013

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Particle Physics & Origin of Mass

University of Southern Denmark

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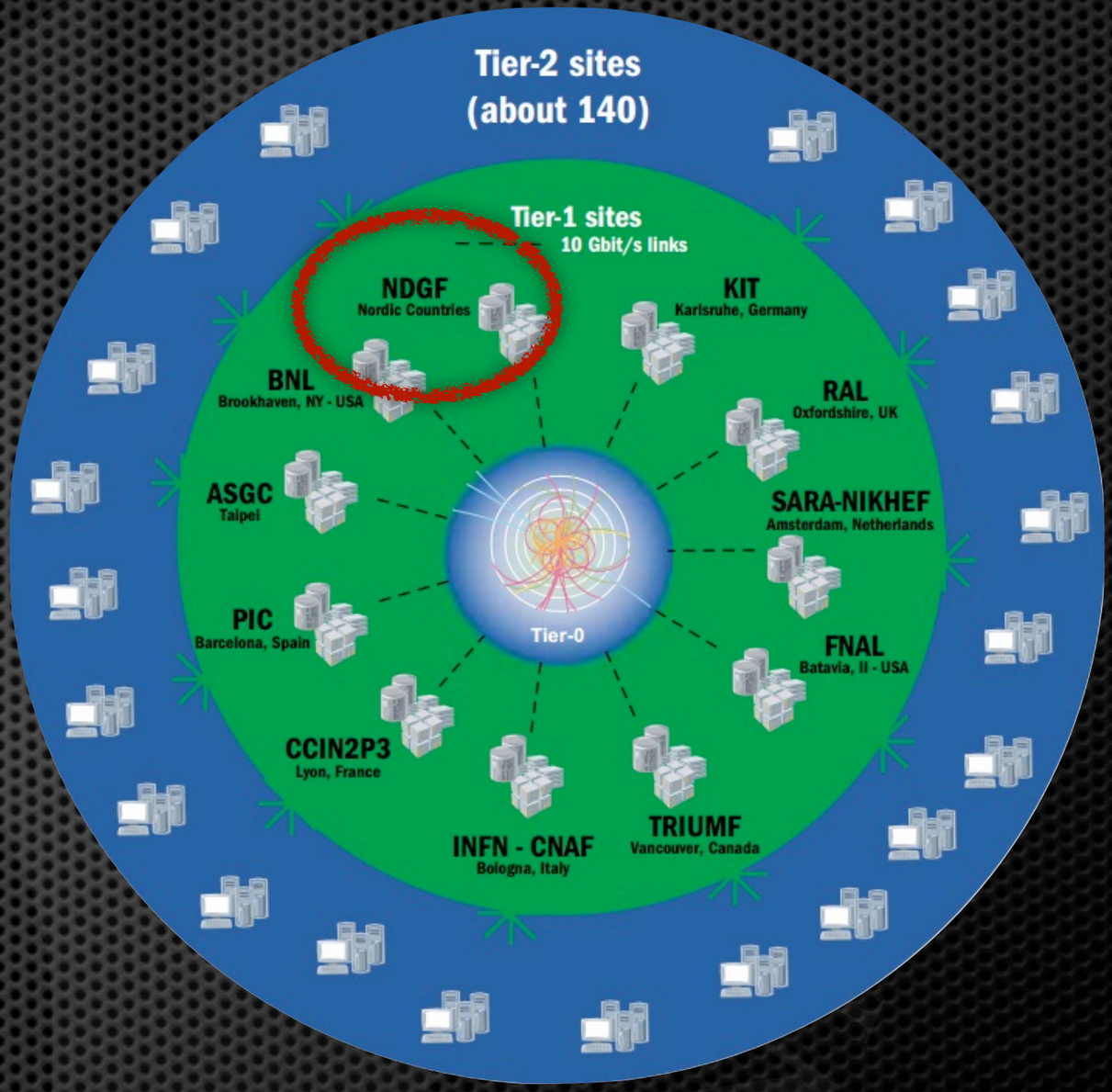
Status of Computing for HEP - Experiments

HEP-EX: WLCG NDGF-T1

- Nordic Data Grid Facility
- project inside NeIC
- Denmark, Norway Sweden, Finland
- support the LHC experiments with a Tier-1
- support regional T2 / T3



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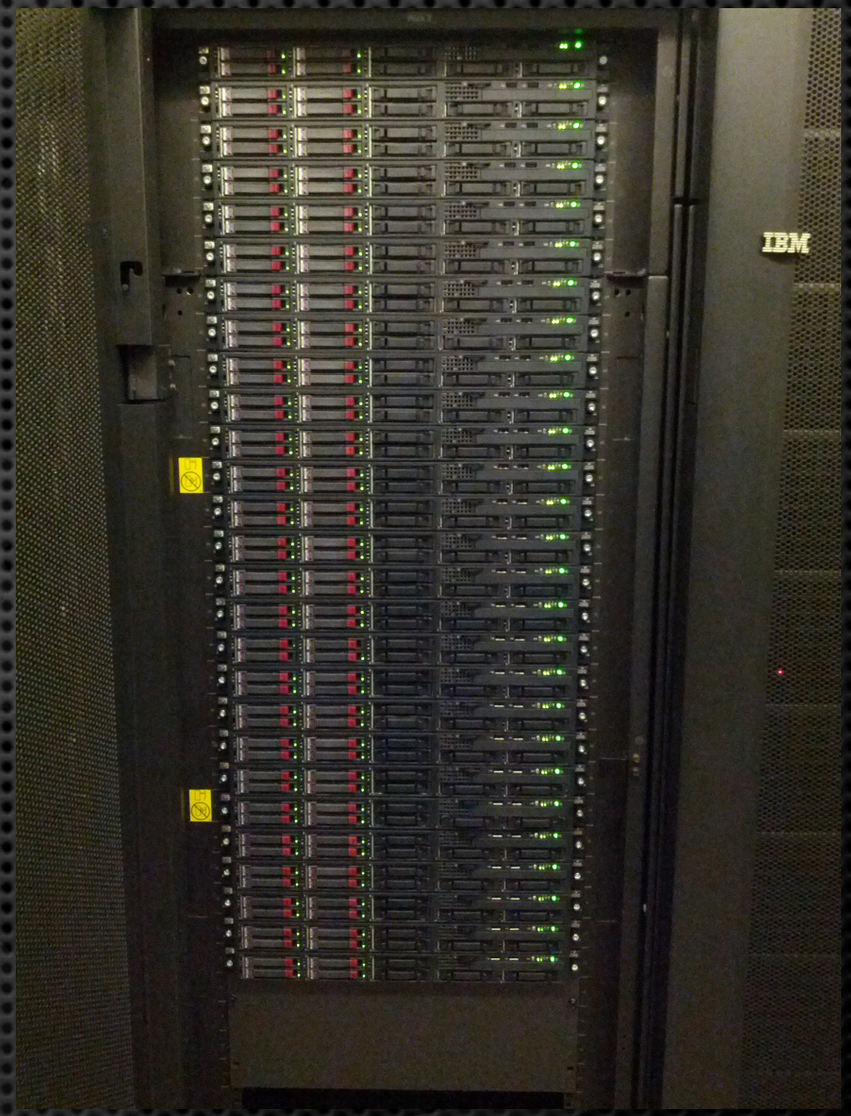
HEP-EX: compute

- 27× HP DL165 G7
- 2× AMD 6276 CPUs (32 cores)
- 96GB memory
- 4× 300GB 10k SAS disks
- HEP-SPEC06: ~6k



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HEP-EX: storage

- 7× HP DL360 G6
  - 3× HP MDS600
  - 210× 2TB disks
- 6× HP DL180
- Total: 0.5 PB

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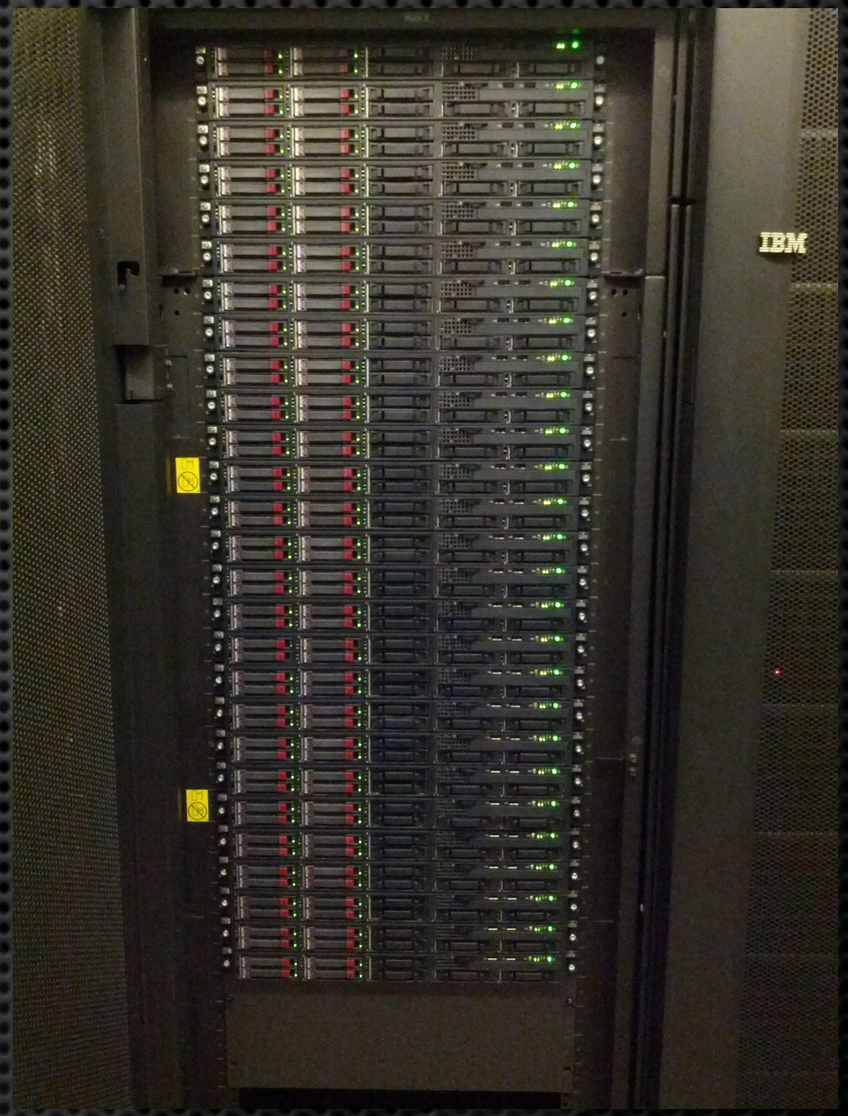
HEP-EX: tape

- 2× IBM TS3500 libraries
  - Room for ~1500 tapes
- 6× LTO-4 drives
- 2× TSM servers
  - IBM P520
  - 24× disk IBM DS3400
- Only ~125TB online

HEP-EX: local Tier-3

- analysis farm
- same hardware as Tier1
- ~150 cores + 80 TB disks



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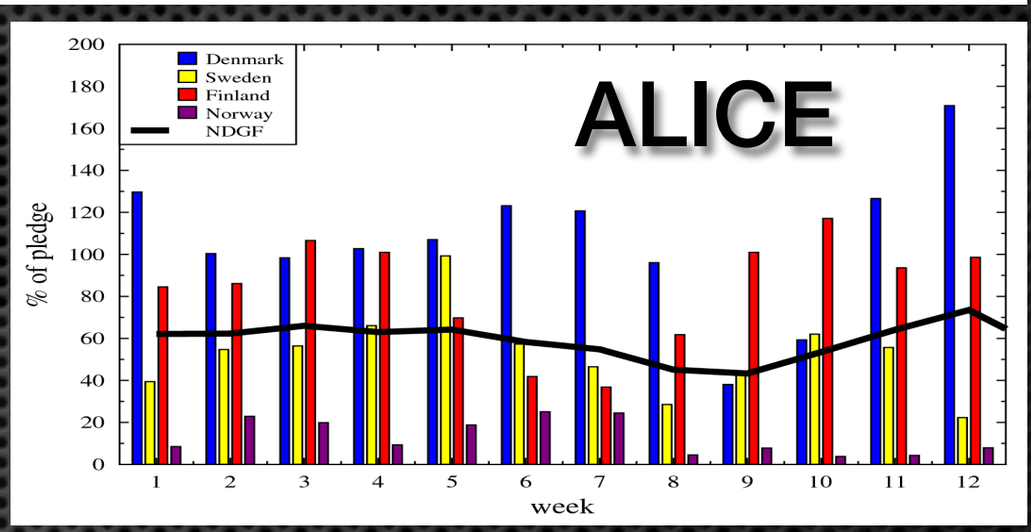
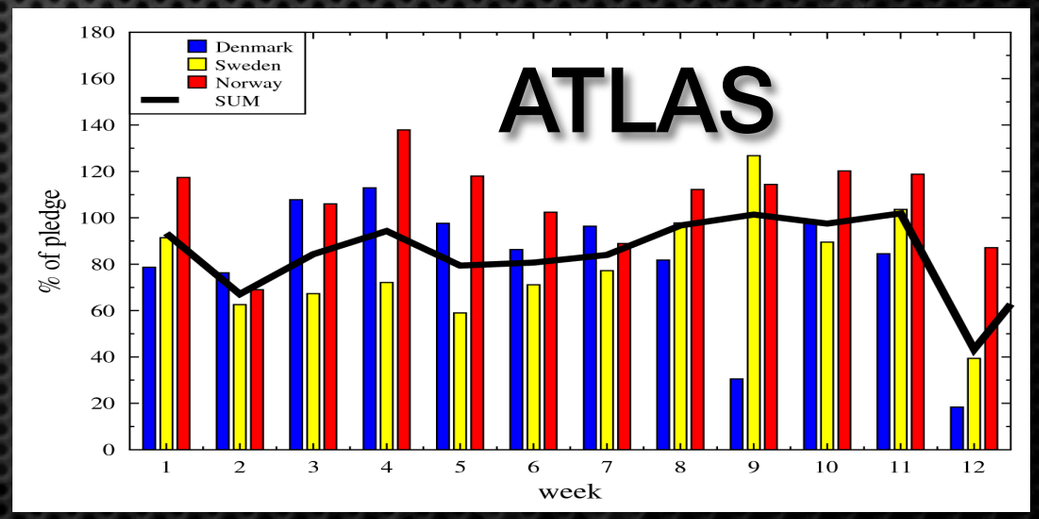
NDGF Tier 1

NDGF Tier1	2012	2013	2014	Split 2013	ALICE	ATLAS	CMS	LHCb	SUM 2013
CPU (HEP-SPEC06)	25764	29010	28752	Offered	11775	17235			29010
				% of Total	10%	5%			7%
Disk (Tbytes)	2690	2710	2687	Offered	1080	1630			2710
				% of Total	10%	5%			6%
Tape (Tbytes)	3672	4280	4251	Offered	2155	2125			4280
				% of Total	10%	5%			7%

- plans to upgrade the Danish tape system





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Computing for HEP - Theory

HEP-TH: compute

8% of HorseShoe6

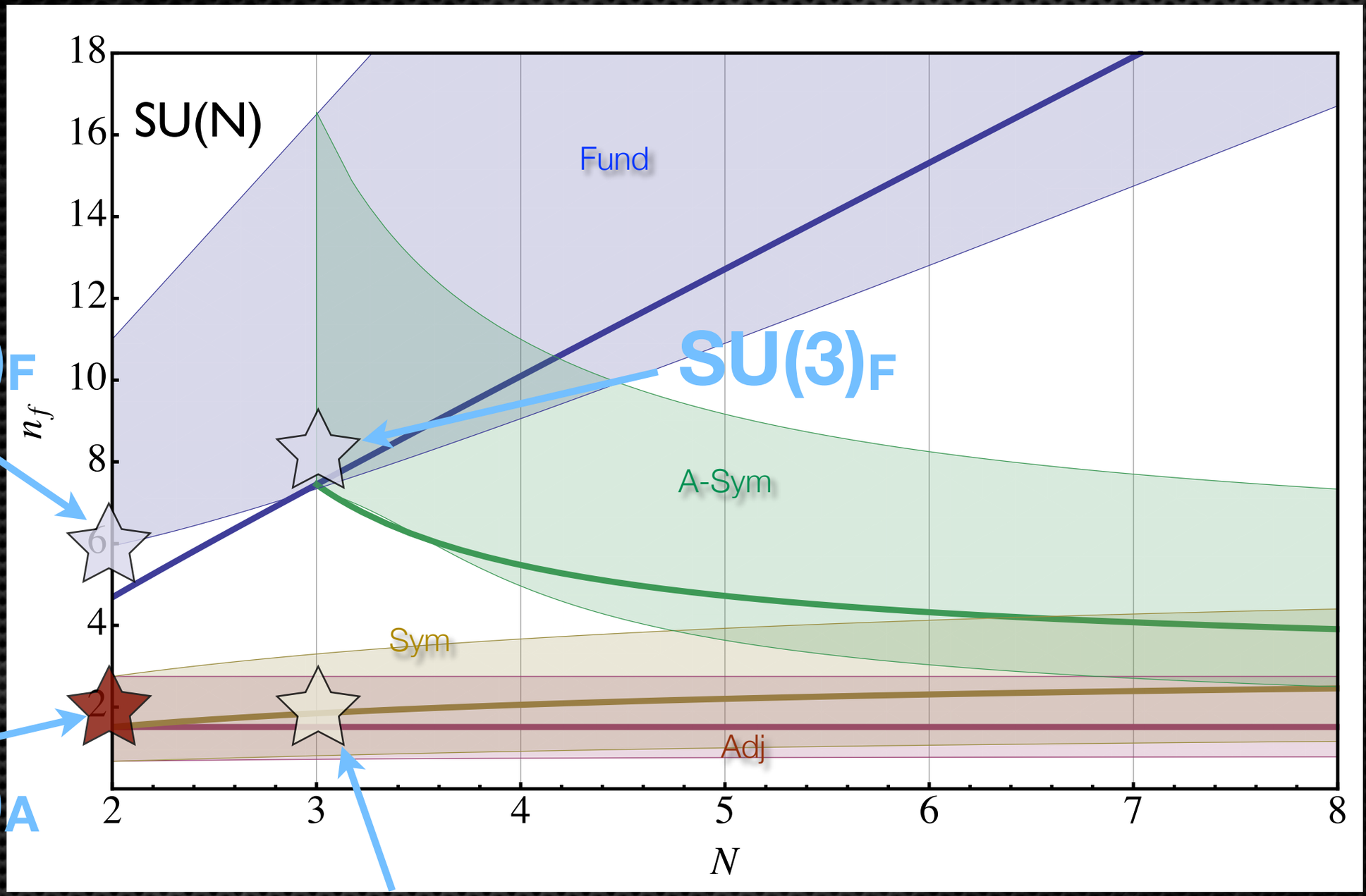
- 264× IBM iDataPlex dx-360 m2
- 2× Intel X5550 CPUs (8 cores)
- 24GB memory
- 168 TB disk storage
- Infiniband interconnections
- Peak performance: 44,7 TFLOPS

HEP-TH: compute

50% of HorseShoe7

- 12× Fujitsu Celcius R670
- 2× Intel X5670 CPUs (8 cores)
- 2× NVidia C2070/2075 GPUs
- 16GB memory
- 48 TB disk storage
- Infiniband interconnections
- Peak performance: 14/25 TFLOPS (DP/SP)

HEP-TH: Lattice MWT



SU(2)F

SU(3)F

SU(2)A

SU(3)S

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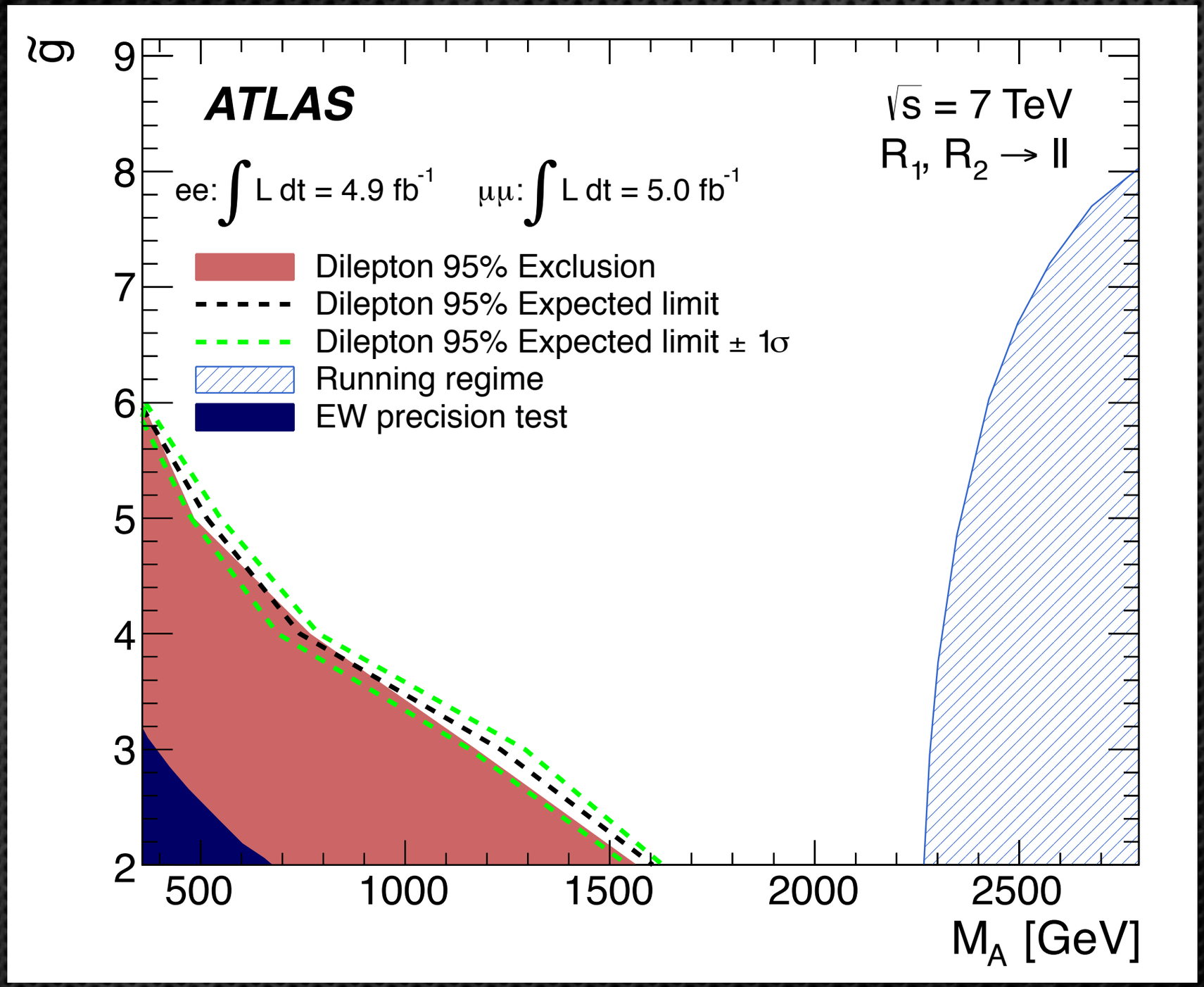
MWT searches at LHC



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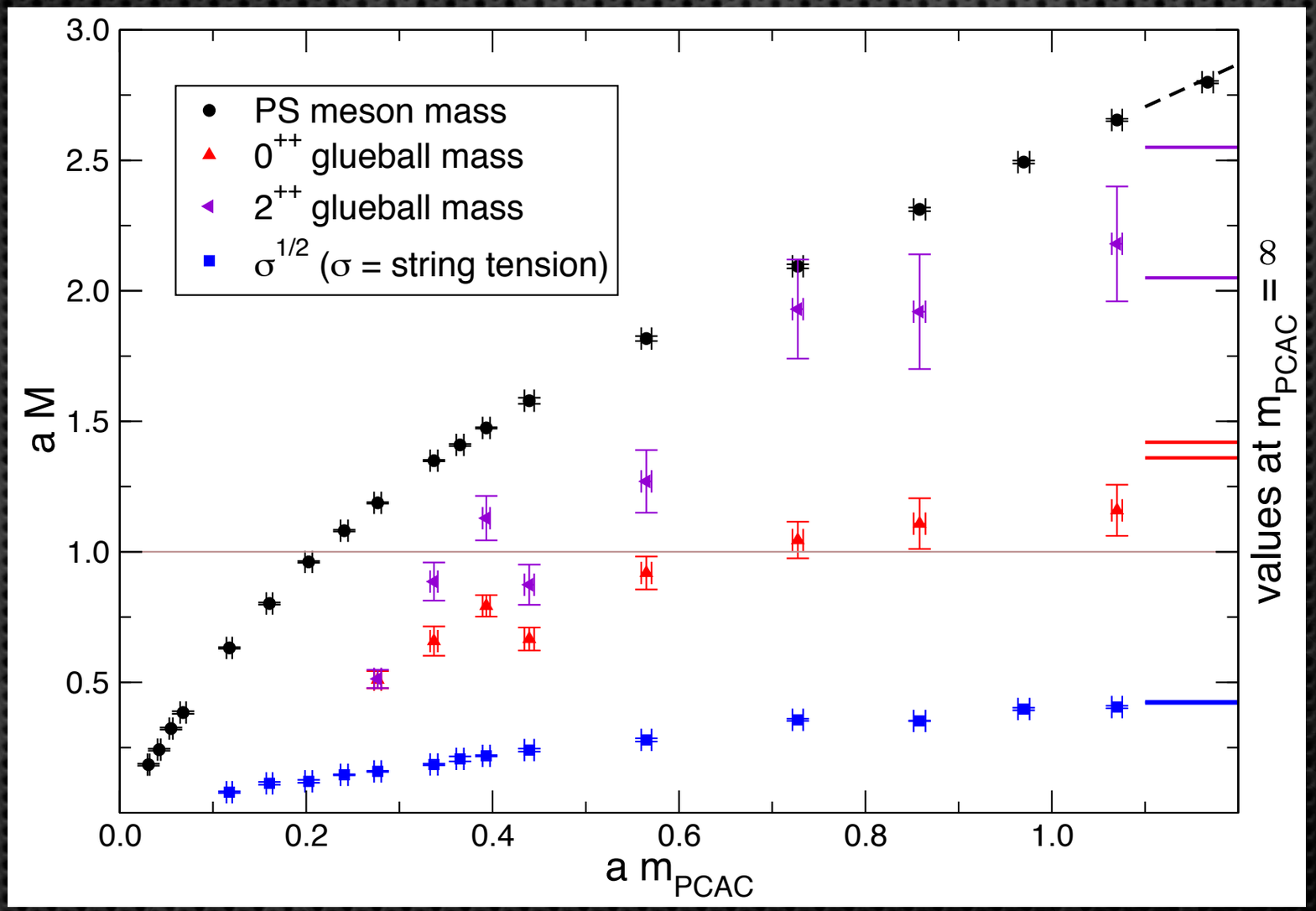
HEP-TH: Lattice MWT

- Lattice numerical simulations can greatly help in the search at the LHC providing accurate predictions for the spectrum and couplings



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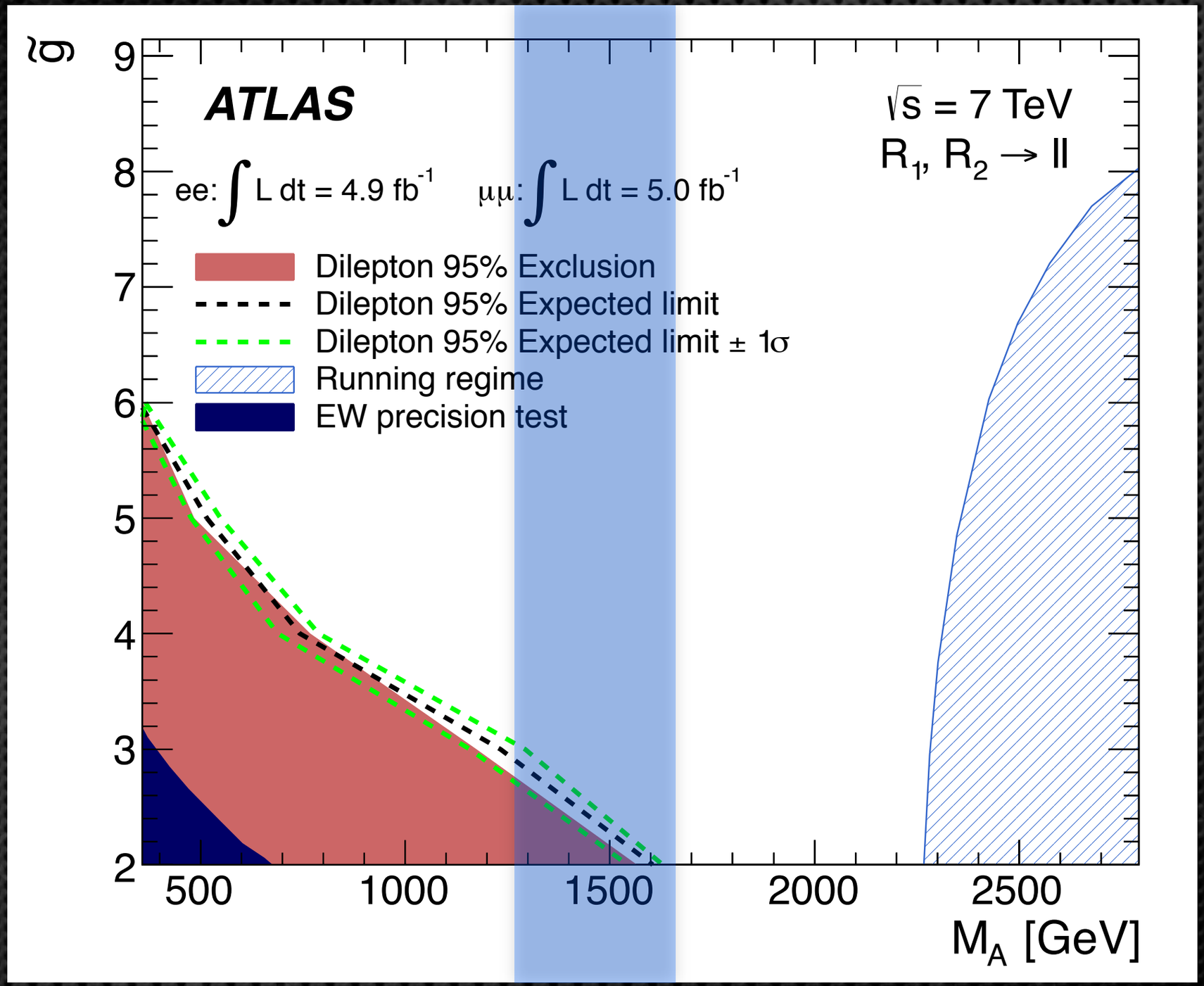
HEP-TH: Lattice MWT



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HEP-TH: tools for LHC

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Tools for Discovering Technicolor

The recent theoretical progress in uncovering the phase diagram of strongly coupled theories, has lead us to identify a number of models which can dynamically break the electroweak gauge symmetry and pass the precision tests.

The simplest of these models are:

- Minimal Walking Technicolor (MWT) – which include a new strong sector based on the SU(2) gauge group with two Dirac flavors in the adjoint representation;
- Next to Minimal Walking Technicolor (NMWT) - similar to MWT but based on the SU(3) gauge theory with two flavors in the two-index symmetric representation.

To close the gap between the theoretical community and the experimentalists working at particle colliders, we provide a public implementation of our models, to investigate their phenomenology.

We have implemented MWT and NMWT using the FeynRules package. We also provide the MadGraph and CalcHEP interfaces.

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Resources

- Origin of Mass on Supercomputers
- StrongBSM

http://cp3-origins.dk/research/tc-tools

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HEP computing: funding

- No national funding allocated to HEP computing
- In the past:
  funding via research grants from DCSC (Danish Centre for Scientific Computing)
- Now: DCSC merged into DeIC (Danish e-Infrastructure Cooperation)

- one last call for provide HPC and data storage access currently in progress