

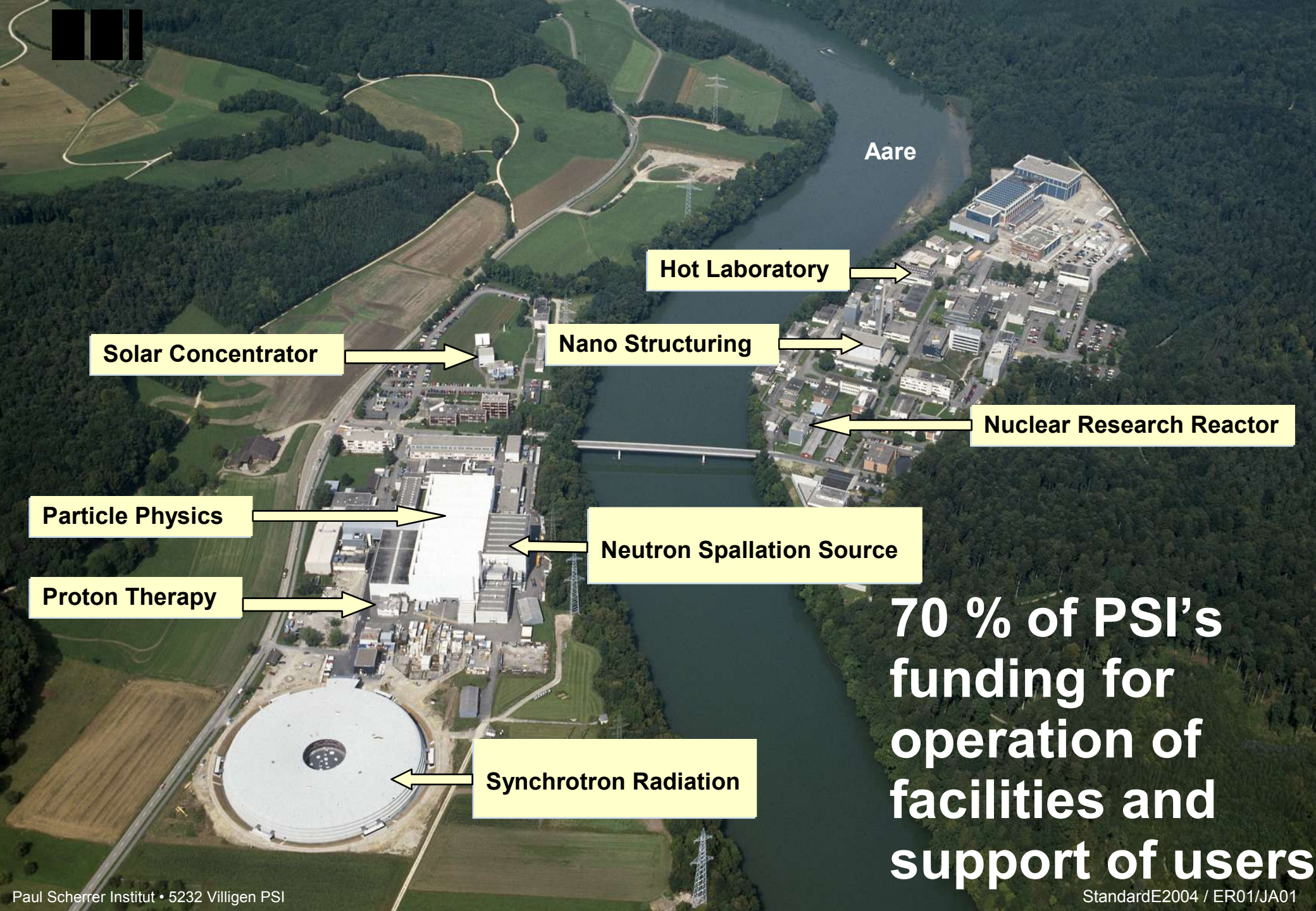
Horizon - a Zbox based 10 Tflop System for Switzerland and beyond

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Joachim Stadel and Ben Moore (University Zurich)

- HPC- a user based demand for Tflops
- Aims of the Horizon project
- The Base for Horizon - the Zbox
- The Roadmap of the Horizon Project



Aare

Hot Laboratory

Solar Concentrator

Nano Structuring

Nuclear Research Reactor

Particle Physics

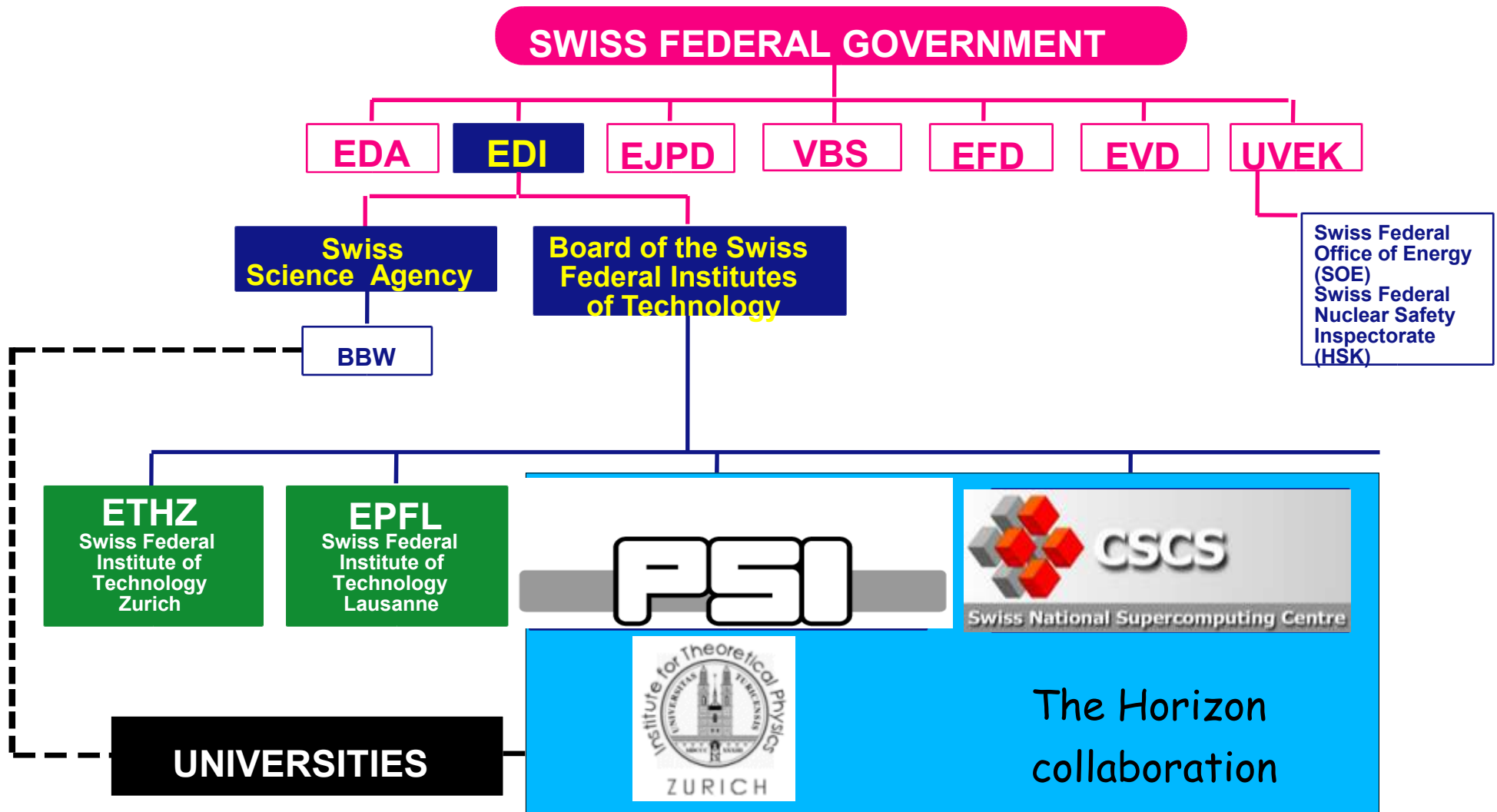
Neutron Spallation Source

Proton Therapy

Synchrotron Radiation

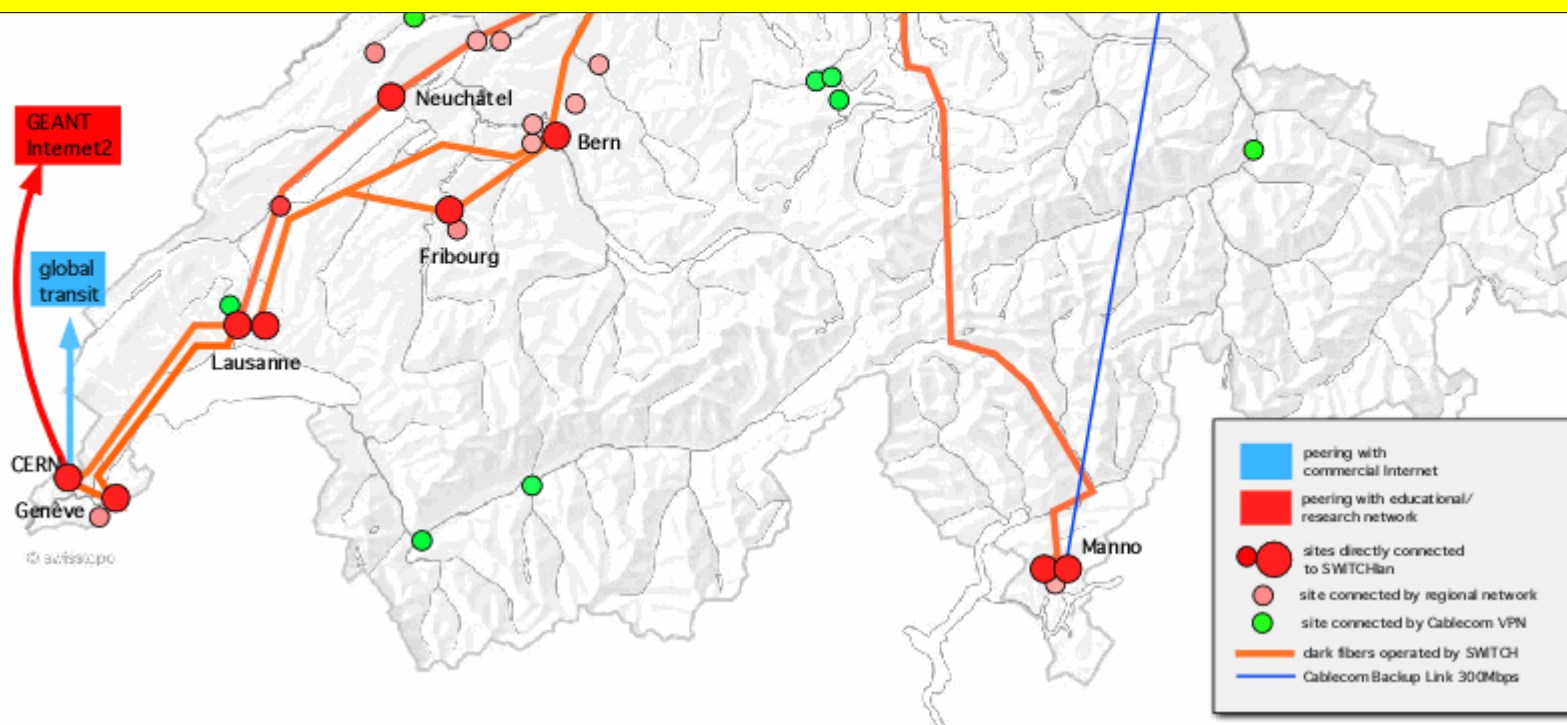
70 % of PSI's funding for operation of facilities and support of users

PSI & HPC- a user based demand for Tflops





Many small/medium scale HPC platforms



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High Profile App. CSCS

..... Marie-Christine's talk & more to come

Profiles and Substructure of Halos

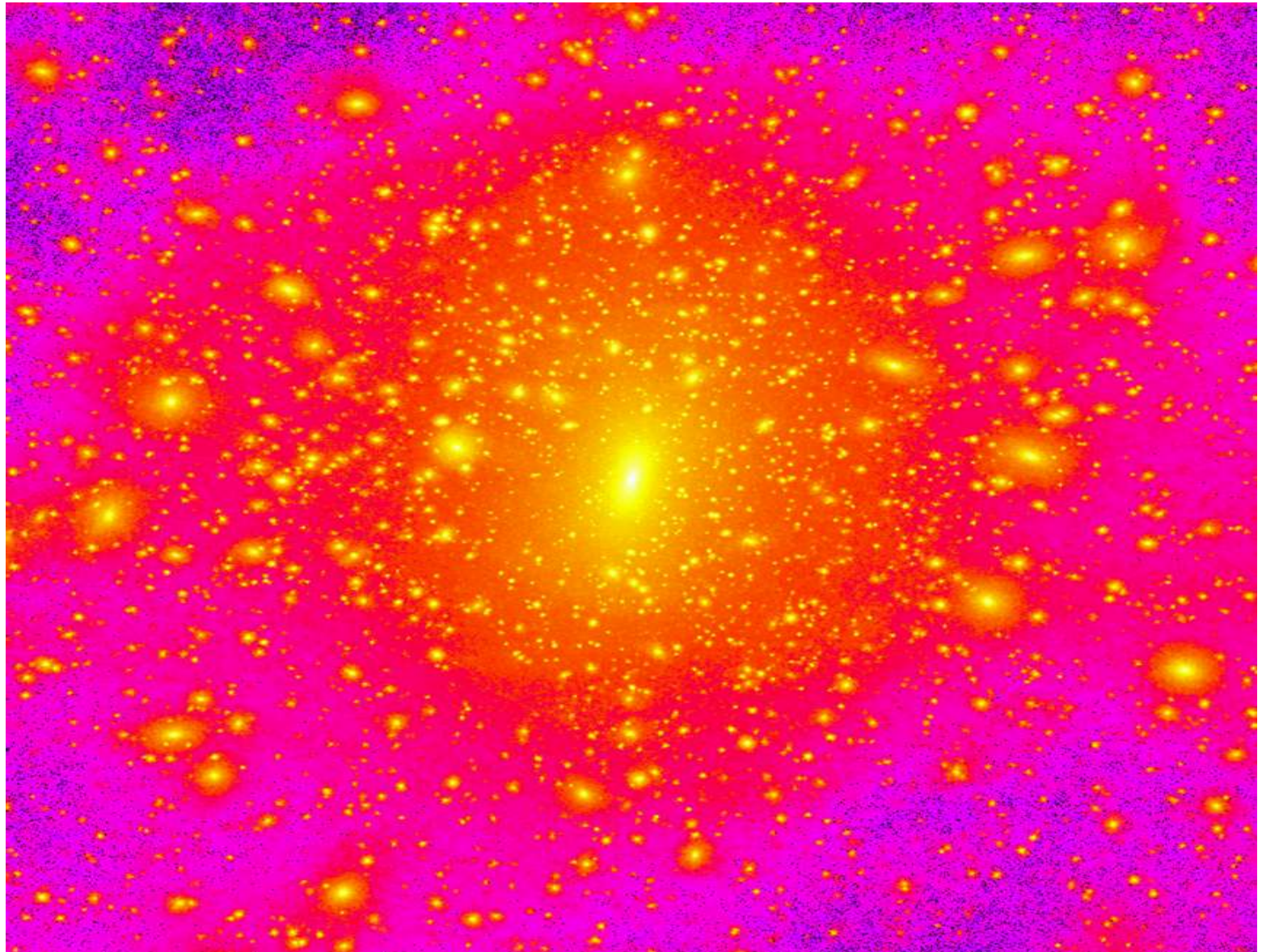
Diem and Moore
Stadel 2003

Highest
resolution
numerical
simulations of
the structure of
dark matter
halos

10^5 steps

10^8 particles

High mass and
force resolution



Project	CPU [khrs/year]	#CPUs	Memory [GB]
Size Effects	2000(8000)	128(512)	500(1000)
X-Ray FEL	360	128(256)	64(256)
PIC	100	128(512)	1000
Cyclotron Sim.	1145	64(512)	400(600)
Parsec	> 200	256(4096)	256(4096)
Radiation Heat Transfer	20	32	64
Rector Physics	225	60	60
Random Field Models	20	64(128)	100
Radionuclide Migration	> 720	32(128)	0.1(0.5)
Coupled Flow Transport	50	256	256
MEG	200	32	16
CMS	100	15	15
Computational Fluid Dynamics	400	48	192
Total	5540(11540)		

Extreme 3D Poisson on SEABORG

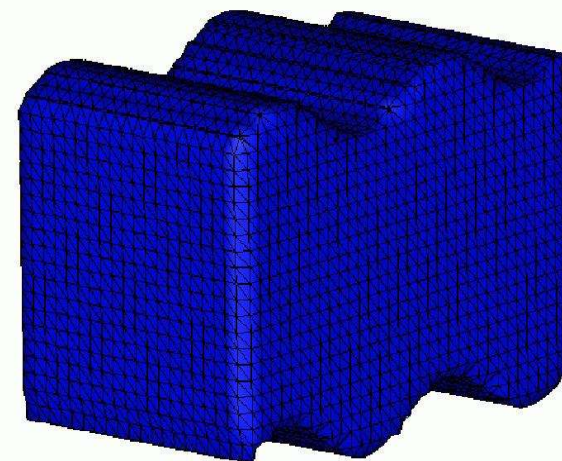
Finite Element Discretization

Semi Structured Grid

Scalable Parallel Grid generation

Scalable Multigrid

Computational Kernel for future largest scale
3D Particle simulations (electron-cloud)



w. Ch. Pflaum Univ. Erlangen

Processors	Problem Size	Time / sec
1884	401e6	1727
4048	875e6	1724

Linear Scaling with 4k Processors

Aims of the Horizon project

Combined effort leading to a 10+ Tflop system

A joint effort (self made machine) has added value:

Enable queue with terabytes of memory for largest problems

Bring the Swiss HPC community back on the "Map"

Reassemble and stimulate a part of the Swiss HPC community

Aims of the Horizon project

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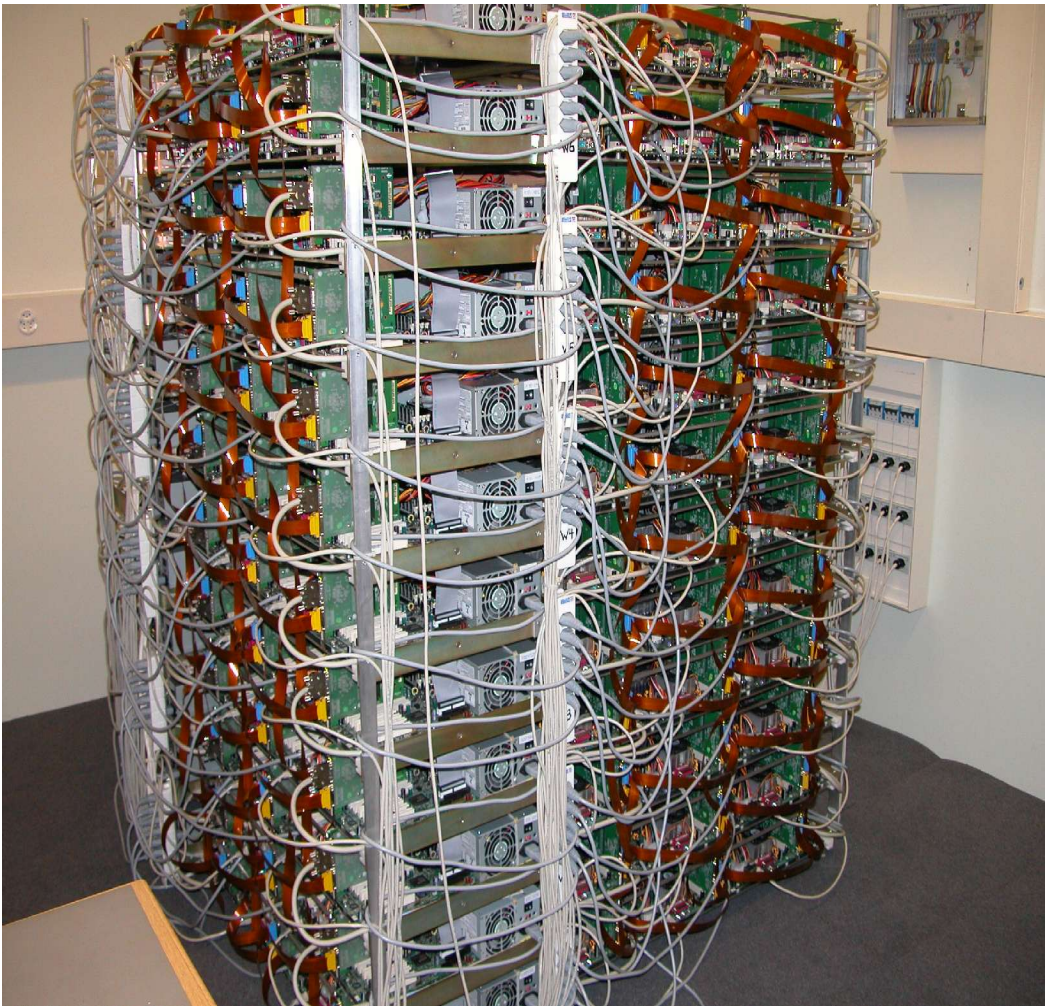
Opens the gate to ultrascale computing

We propose constructing a high performance
10+ teraflop supercomputer with:

- high bandwidth low latency network
- ≥ 2 terabyte memory
- 100 terabyte - 1 petabyte disk

The Base for Horizon - the Zbox

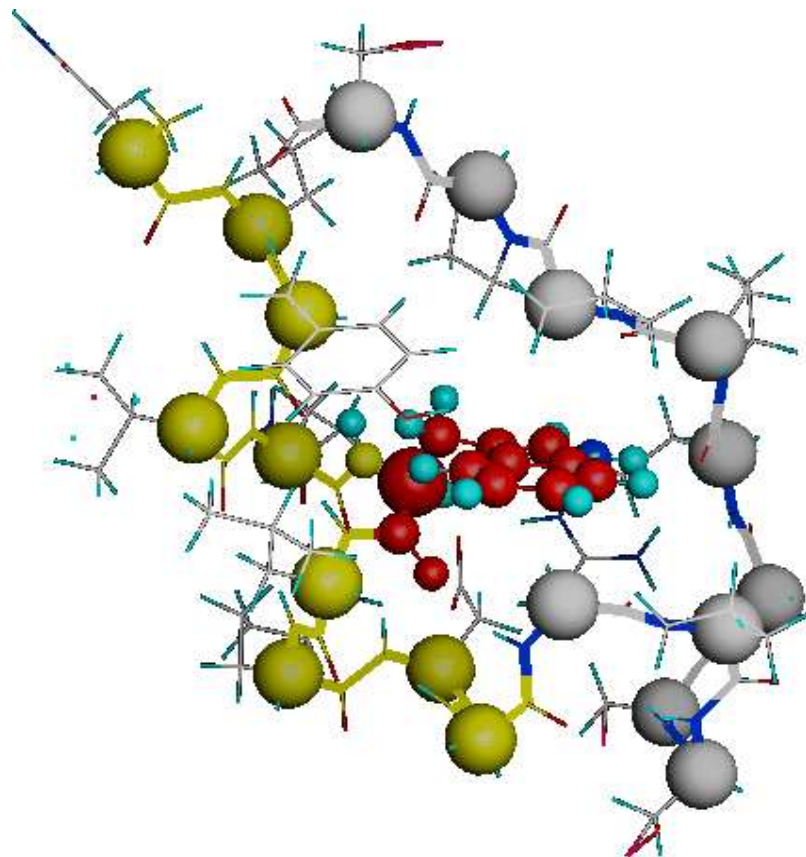
<http://krone.physik.unizh.ch/~stadel/zBox/>



- General purp. MIMD Parallel Computer, mostly commodity parts
- 288 AMD Athlon-MP 2200+
- 144 Gbytes of RAM
- 11.5 + 7 TB of Disk (Distributed + Raid 5)
- Fast 2-D Toroidal SCI Network with 96 Gbit/s bisection bandwidth (Dolphins)
- Custom rack and cooling design achieving very high density
- 0.57 TFlop/s LINPACK sustained

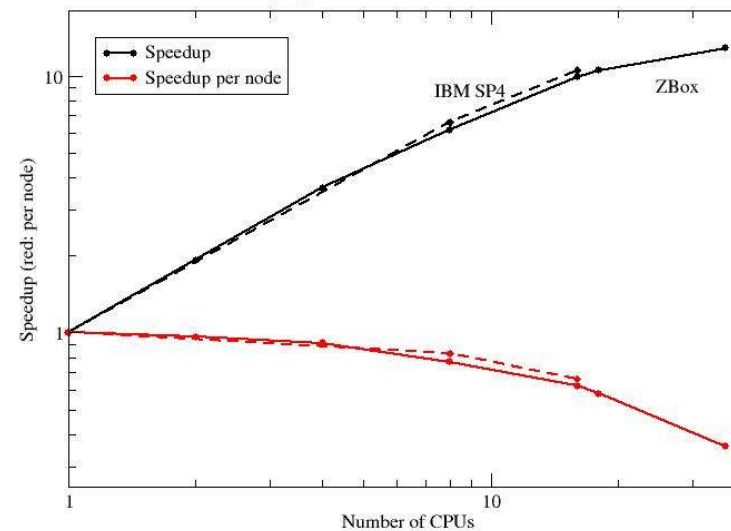
Charm Performance

Gianluca Interlandi - UniZH



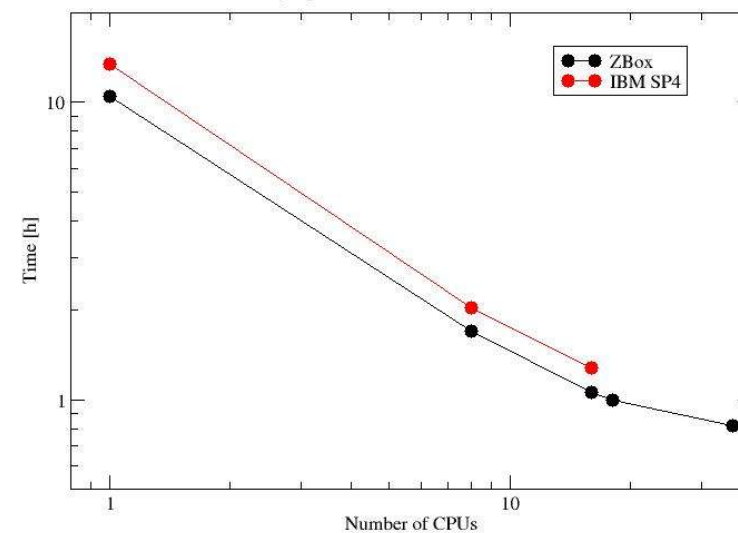
Scalability of zBox versus IBM SP4

TrpCage in Box of 14 H₂O, 8062 atoms

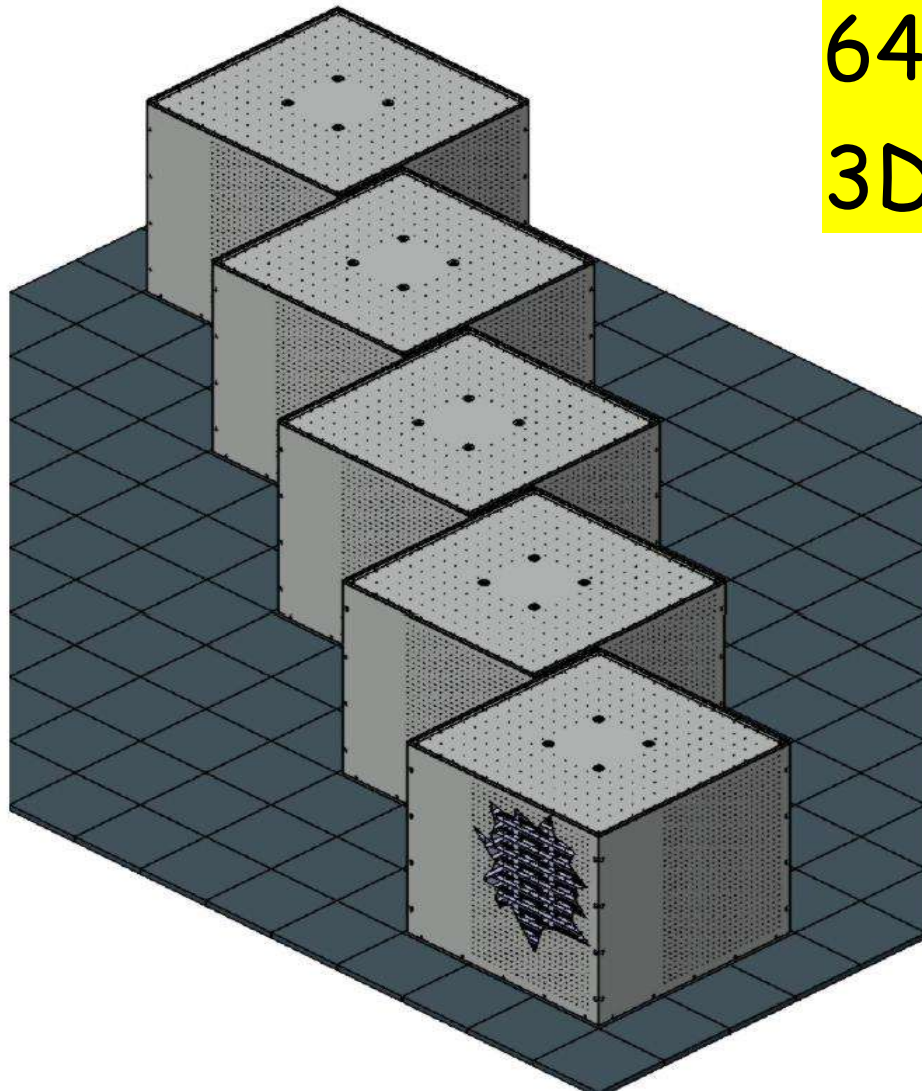


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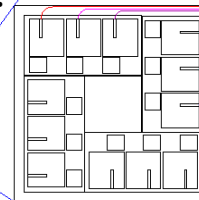


Sketch of the Horizon Machine



64(32)-bit technology
3D SCI torus

~10 feet



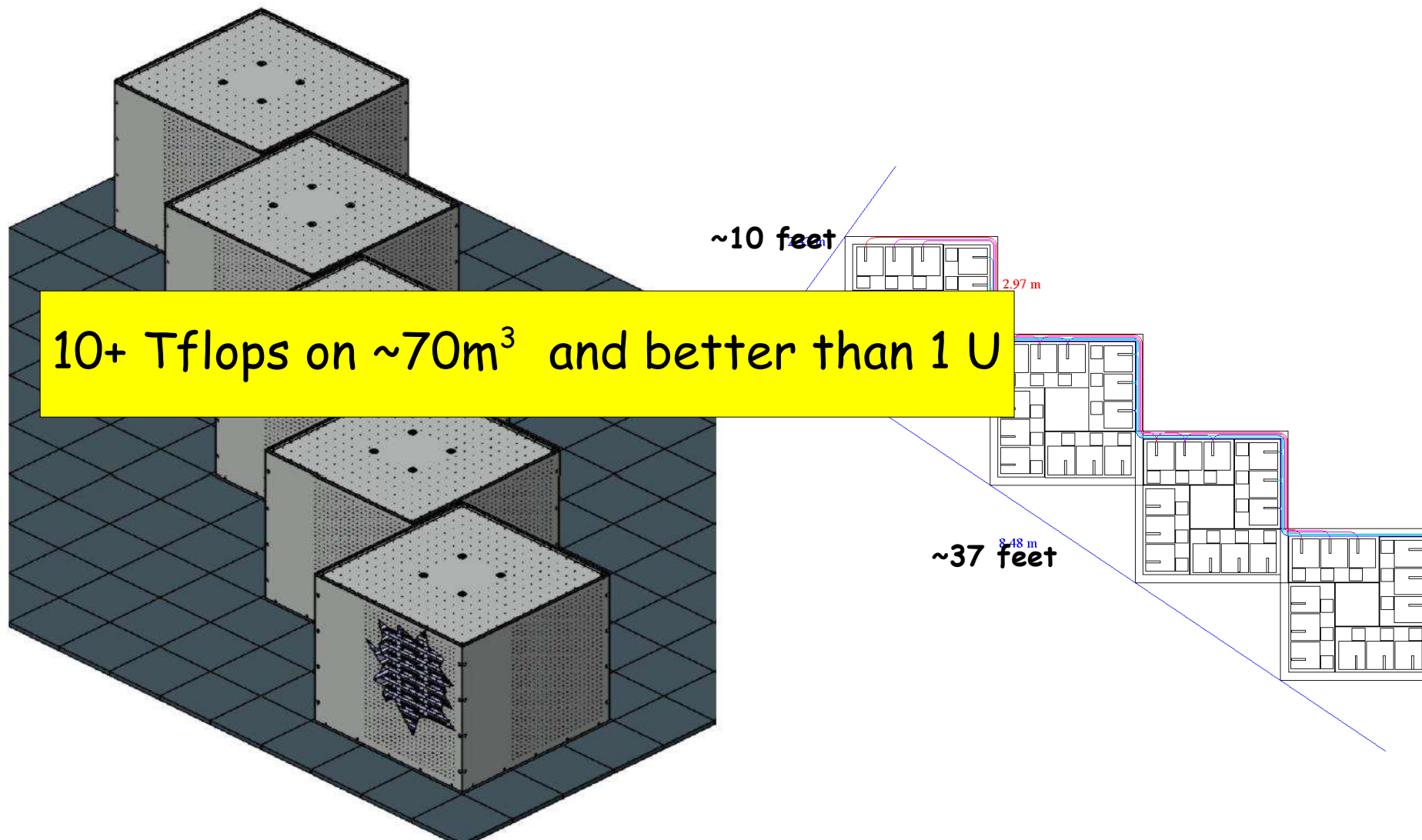
2.97 m

~37 feet

8.48 m



Sketch of the Horizon Machine



Possible Configurations

Dual boards

Quad boards

$5 \times 16 \times 12 \times 2 = 1920$ cpu's $5 \times 12 \times 12 \times 4 = 2400$ cpu's

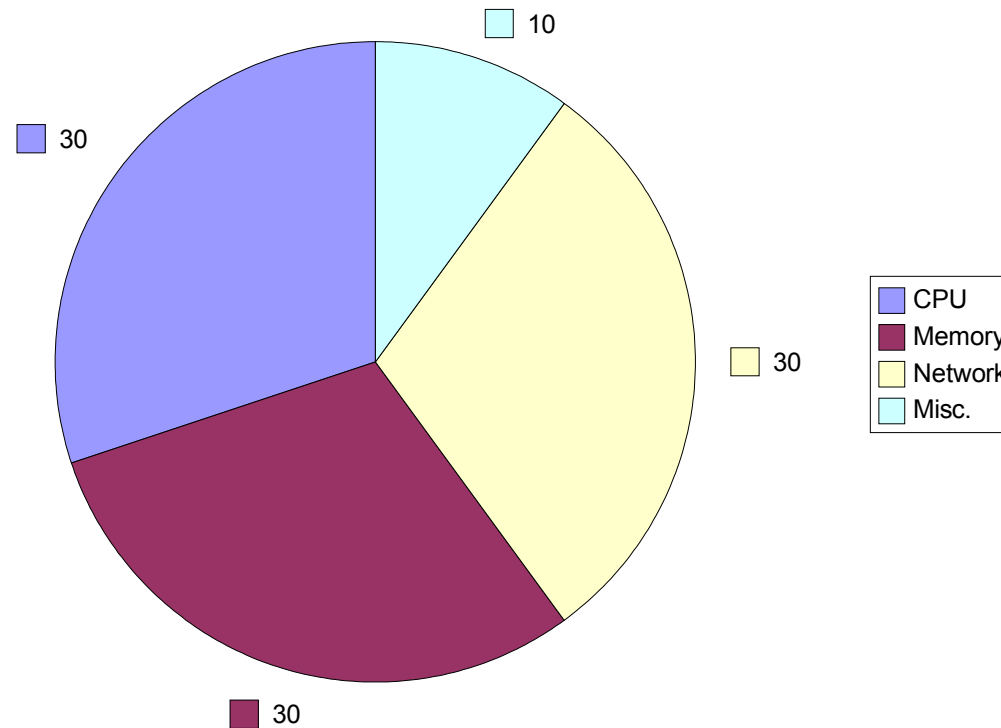
Memory: 2-4 Tbyte

Bandwidth/Latency

$R_{\text{peak}} \sim 10$ Tflops

Well balanced system for a variety of applications

Distribution of costs:



O & M costs

The Roadmap of the Horizon Project

May 2004:

- detailed design done
- funding approved

June-October 2004:

- call for tender
- prepare infrastructure

The Roadmap of the Horizon Project

1Q 2005:
Horizon is on-line

Thank you !