



ACAT 2014

– bridging disciplines

1-5 September 2014

Faculty of Civil Engineering
Europe/Prague timezone



EUROPEAN
social fund in the
czech republic



MINISTRY OF EDUCATION,
YOUTH AND SPORTS



INVESTMENTS IN EDUCATION DEVELOPMENT

PLATINUM



BROOKHAVEN
NATIONAL LABORATORY



GOLD

DataDirect
NETWORKS

M computers

SILVER

Bright Computing

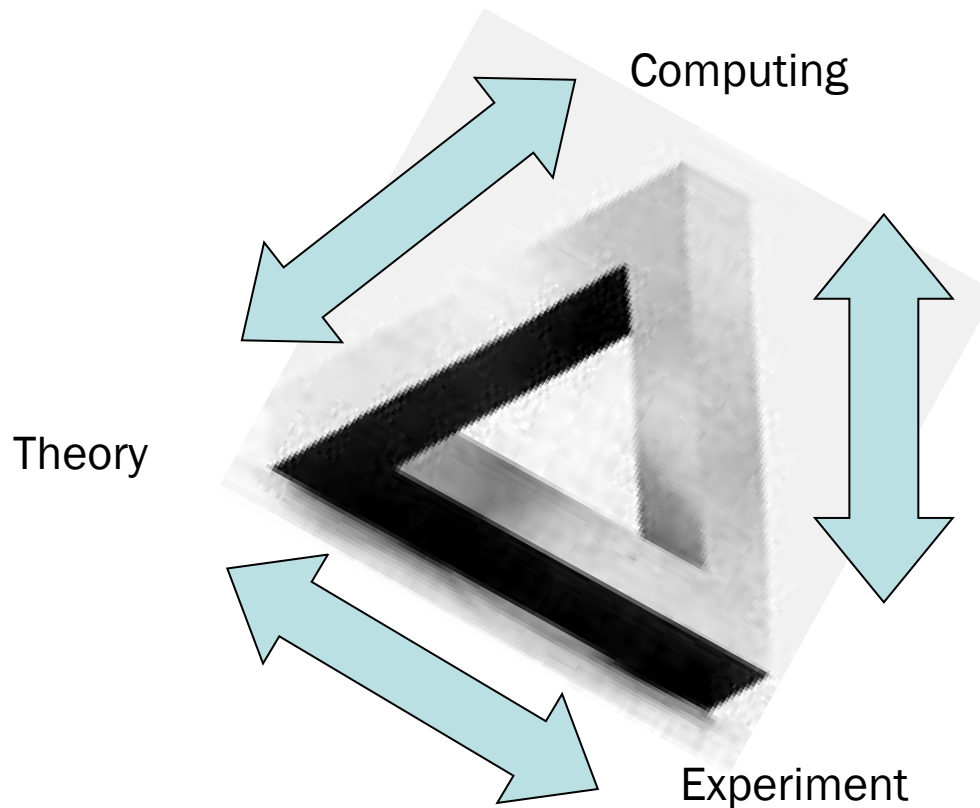
ACAT 2014

PRAQUE

Bridging Disciplines

Advanced Computing and Analysis Technologies
in Physics Research

Bridging Disciplines

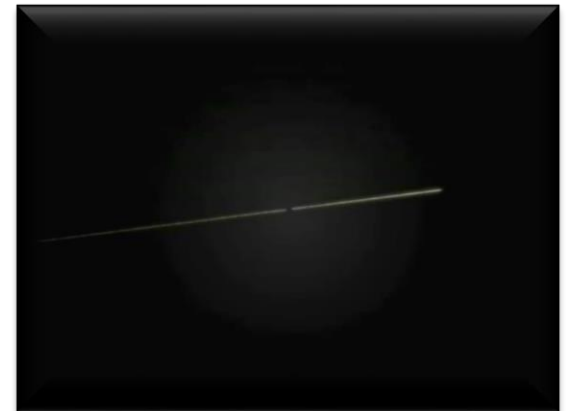
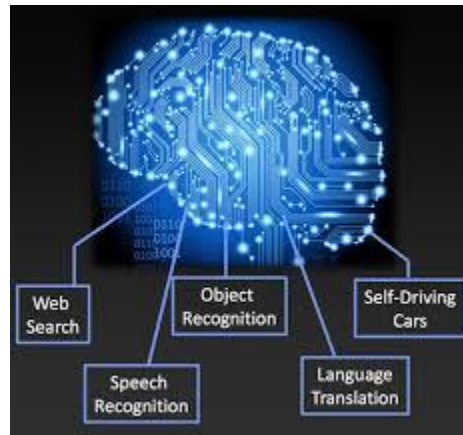
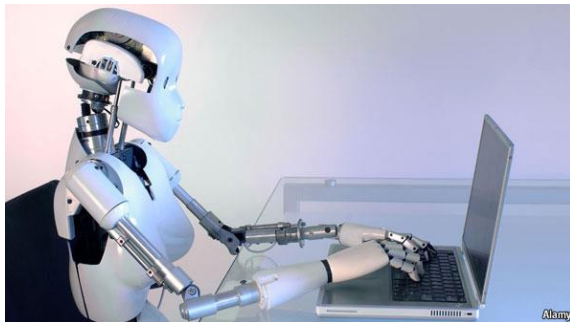
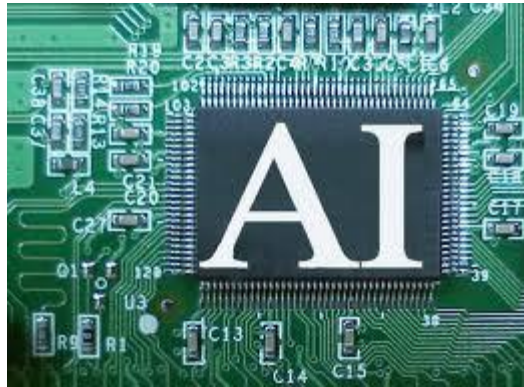


Bridging Communities

Computers can do more ...

Than mere number crunching

AIHENP
ACAT



Track 1
Computing tools for computing

Track 2
Computing tools for analysis

Track 3
Computing tools for theory

Track 1: Computing Technology for Physics Research

1. Languages, Software quality, IDE and User Interfaces

- Languages (new C++ standard, Java, ...)
- Software quality assurance; code reflection; documentation, performance and debugging tools
- IDE and frameworks
- User Interfaces, Common Libraries.

2. Distributed and Parallel Computing

- Multilevel parallelism
- Distributed computing
- GRID and Cloud computing

3. New architectures, many and multi-cores

- Many-core
- Accelerator-based computing (GPU, etc)
- High precision computing (hardware)

4. Virtualisation

5. Online Computing

- Advanced Monitoring, Diagnostics and Control
- Scalable distributed data collectors
- High Level Triggering (HLT)
- Stream event processing & High Throughput Computing (HTC)

Track 2: Data Analysis - Algorithms and Tools

1. Machine Learning

- Neural Networks and Other Pattern Recognition Techniques
- Evolutionary and Genetic Algorithms
- Automation of Science: Data to formula

2. Advanced Data Analysis Environments

- Statistical Methods, Multivariate analysis
- Data mining

3. Simulation, Reconstruction and Visualisation Techniques

- Detector and Accelerator Simulations, MC and fast MC
- Reconstruction Algorithms
- Visualization Techniques; event displays

4. Advanced Computing

- Quantum Computing
- Bio Computing: life process simulation, brain simulation, Quantum biology

Track 3:

Computations in Theoretical Physics: Techniques and Methods

1. Automatic Systems

- Automatic Computation Systems: from Processes to Event Generators
- Multi-dimensional Integration and Event Generators
- Intensive High Precision Numerical Computations: Algorithms and Systems
-

2. Higher orders

- One-loop event generators
- Multi-loop Calculations and Higher Order Corrections

3. Computer Algebra Techniques and Applications

4. Computational physics, Theoretical and simulation aspects

- Lattice QCD,
- Cosmology, Universe Large Scale Structure, Gravitational waves
- Nuclear physics N-body computation,
- Plasma physics,
- Earth Physics, climate, earthquakes

ACAT highlights

Computational
theory
1990

World Wide
Web
1992

Multi-Loops
1993

Neural Nets,
ROOT
1995

Parallel,
distributed
Computing
1996

Large scale
simulation
2000

Quantum
computing
2007

Many cores
2009

Cloud
computing
2011

Earth and
astro sciences
2013

16th ACAT workshop

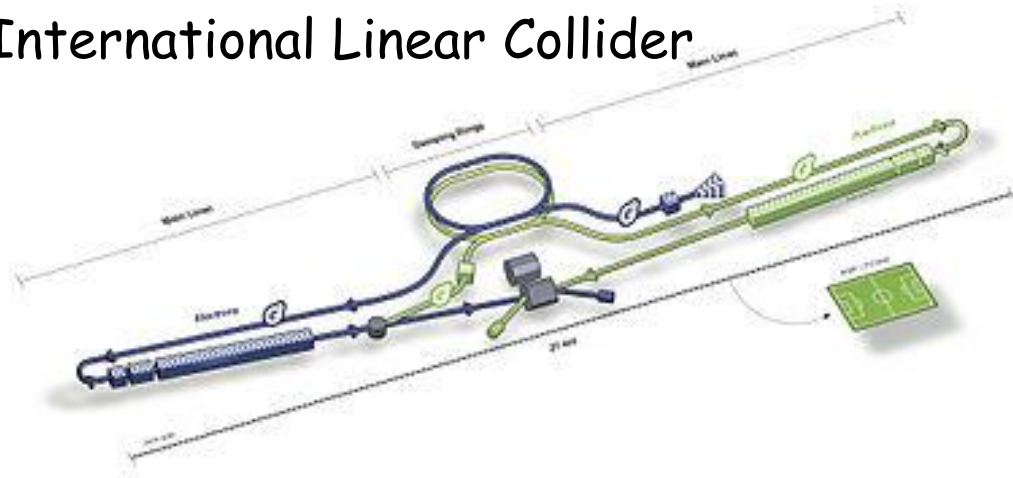
A well crafted scientific program

Round table:

Expanding software collaboration beyond HEP:
pros, cons, dos and donts

Forecasting...

International Linear Collider



LSST petascale data challenge



Large Synoptic Survey Telescope, 30 Tb/night



Future Circular Colliders

Forecasting...

What are the needs dictated by the physics case:

- Hardware/Software:
more/better CPU power ? more/better storage ?, faster/better networks, better FP precision,
- Education/training:
more/better computer experts, more/better physicists, ...

What's trending in the computing industry and research ?

- Cloud and HPC, cloud and mobile computing
- HPC for HEP
- Computing with complex systems: many-cores, hybrid systems GPUs, memory access bottleneck → redesigning applications
- Methodology: Agile software development
- Software sustainability
- Green servers
- What else?

International Advisory Coordination Committee

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- Institute of Physics, Academy of Sciences of the Czech Republic
 - Lukas Fiala
 - Milos Lokajicek
 - Nina Tumova
- Nuclear Physics Institute, Academy of Sciences of the Czech Republic
 - Dagmar Adamova
 - Michal Sumbera

Thank You

More ...

Agile software development

Manifesto for Agile Software Development

We are uncovering better ways of developing software by doing it and helping others do it.

Through this work we have come to value:

Individuals and interactions over processes and tools

Working software over comprehensive documentation

Customer collaboration over contract negotiation

Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.