



IRFU computing strategy workshop

Online computing

Computing strategy for distributed,
heterogeneous and time-critical systems

Shebli Anvar & Ozgur Sahin



Online computing X distributed systems across scales

Distribution is necessary at every scale

CPUs, GPUs, FPGAs and ASICs must work as one scientific system.

Scale	Hardware	Dominant design constraints
Detector edge	FPGAs and ASICs	Nanosecond inference, fixed latency and synchronisation
Onboard systems	Embedded platforms	Power, telemetry and autonomy
Online farms	CPUs and GPUs	Throughput, data movement and load balancing
Compute sites	HPC / data services	Data locality, orchestration and reproducibility

Going down to nanosecond scale, links and synchronization becomes the biggest consumer of the budget.

Priorities: co-design, portable software and validation of the full chain



Online computing X AI strategy at the LHC

CERN AI, ATLAS AI and CMS AI strategy groups

Puts strong emphasis on online computing and AI integration

Not only for data processing but also data quality monitoring and validation, detector operations: intelligent

Genesis Mission (US DoE)

Connect scientific facilities, data and AI/HPC resources

Next Generation Triggers (NGT)

A concrete R&D programme for ATLAS and CMS at the HL-LHC and beyond

Common software for heterogeneous architectures

Hardware-aware AI and fast inference on trigger systems

This afternoon's programme

Online Data Pipelines and Onboard Software

Session

1:30 – 1:35 PM

Introduction

Speakers

Mehmet Ozgur Sahin, Shebli Anvar

1:35 – 2:10 PM

Data-processing in LHCb at 30 MHz

Speaker

Dorothea Vom Bruch

2:10 – 2:45 PM

Microseconds to nanoseconds, edge processing for LHC and Future Accelerators

Speaker

Thea Aarrestad

2:45 – 2:55 PM

Break

2:55 – 3:30 PM

Astrometry with the Habitable World Observatory, the challenge of on-board processing

3:30 – 4:05 PM

Future High-Performance Test Benches for Development, Validation & Production

Speaker

Shebli Anvar