Orlando and trigger

R. Lietava

Content

- WA94/WA97/NA57
- ALICE

Hadron Structure 91

WA85 results on strangeness production in heavy ion collisions

O. Villalobos Baillie, S. Abatzis, F. Antinori, R.P. Barnes, Maurice Benayoun et al. (1991)

Contribution to: Hadron Structure 91, 94-105

Stara Lesna , Czechoslovakia

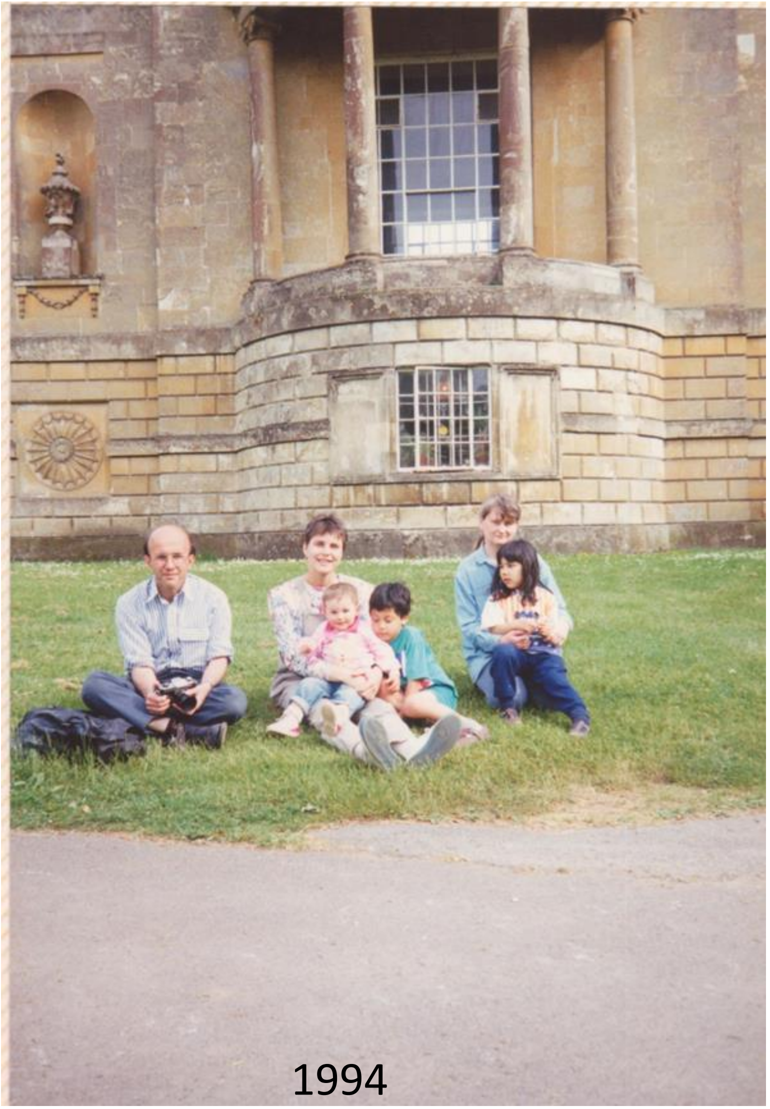
RL Context

- 1987-1991 Phd Student, Institute of Physics, Bratislava , Slovakia
- 1989 - Fall of the Iron curtain/Velvet revolution
- 1991
  - Defended PhD thesis: J/\psi suppression in heavy ion collisions
  - Hadron Structure 91 **=> Orlando**
- 1993/94 - International fellowship of the Royal Society at the University of Birmingham **=> Orlando**
- 1998/99 - CERN Scientific Associate
- 2002-2023 - Research fellow, University of Birmingham **=> Orlando**

Exploring England with Orlando

Stowe:

- Stowe house: grade listed country house
- Stowe gardens: significant example of English garden
- From 1923 home to independent school: Orlando attended between 1968-1972



1994

Exploring England - Oxford

Merton College

- Undergraduate 1972-1975
- Married in chapel 27/09/1975

Punting:
punts are a flat-bottomed boat and punting is the act of propelling the boat along the water using a long stick to push the bottom of the river

WA94

ELSEVIER

Nuclear Physics A590 (1995) 317c-332c

NUCLEAR PHYSICS A

Strange particle production in sulphur-sulphur interactions at 200 GeV/c per nucleon

Presented by J. B. Kinson
The University of Birmingham

WA94 Collaboration

S Abatzis[1], E Andersen[3], A Andrighetto[10], F Antinori[5], R P Barnes[4], A C Bayes[4], M Benayoun[6], W Beusch[5], J Bohm[7], J N Carney[4], N Carrer[10], B de la Cruz[9], J P Davies[4], D Di Bari[2], D Elia[2], D Evans[4], K Fanebust[3], R Fini[2], B R French[5], B Ghidini[2], H Helstrup[3], A K Holme[3], A Jacholkowski[5], J Kahane[6], V A Katchanov[11], J B Kinson[4], A Kirk[5], K Knudson[5], I Kralik[7], P Ladrón de Guevara[9], J C Lassalle[5], V Lenti[2], Ph Leruste[6], R Lietava[4], R A Loconsole[2], G Løvhøiden[3], V Manzari[2], S Monaro[8], M Morando[10], F Navach[2], J L Narjoux[6], F Pellegrini[10], E Quercigh[5], R Ricci[8], L Sandor[7], K Šafařík[5], G Segato[10], A V Singovsky[11], M Sené[6], R Sené[6], T F Thorsteinsen[3], J Urban[7], G Vassiliadis[1], O Villalobos Baillie[4], M Venables[4], A Volte[6], M F Votruba[4], and P Zavada[7].

1. Athens University, Athens, Greece
2. Dipartimento di Fisica dell'Università and Sezione INFN, Bari, Italy
3. Universitetet i Bergen, Bergen, Norway
4. University of Birmingham, Birmingham, UK
5. CERN, Geneva, Switzerland
6. Collège de France, IN2P3, Paris, France.
7. Institute of Experimental Physics, Košice, Slovakia.
8. Laboratorio Nazionale di Legnaro, Legnaro, Italy.
9. CIEMAT, Madrid, Spain.
10. Dipartimento di Fisica dell'Università and Sezione INFN, Padua, Italy
11. IHEP, Protvino, Russia

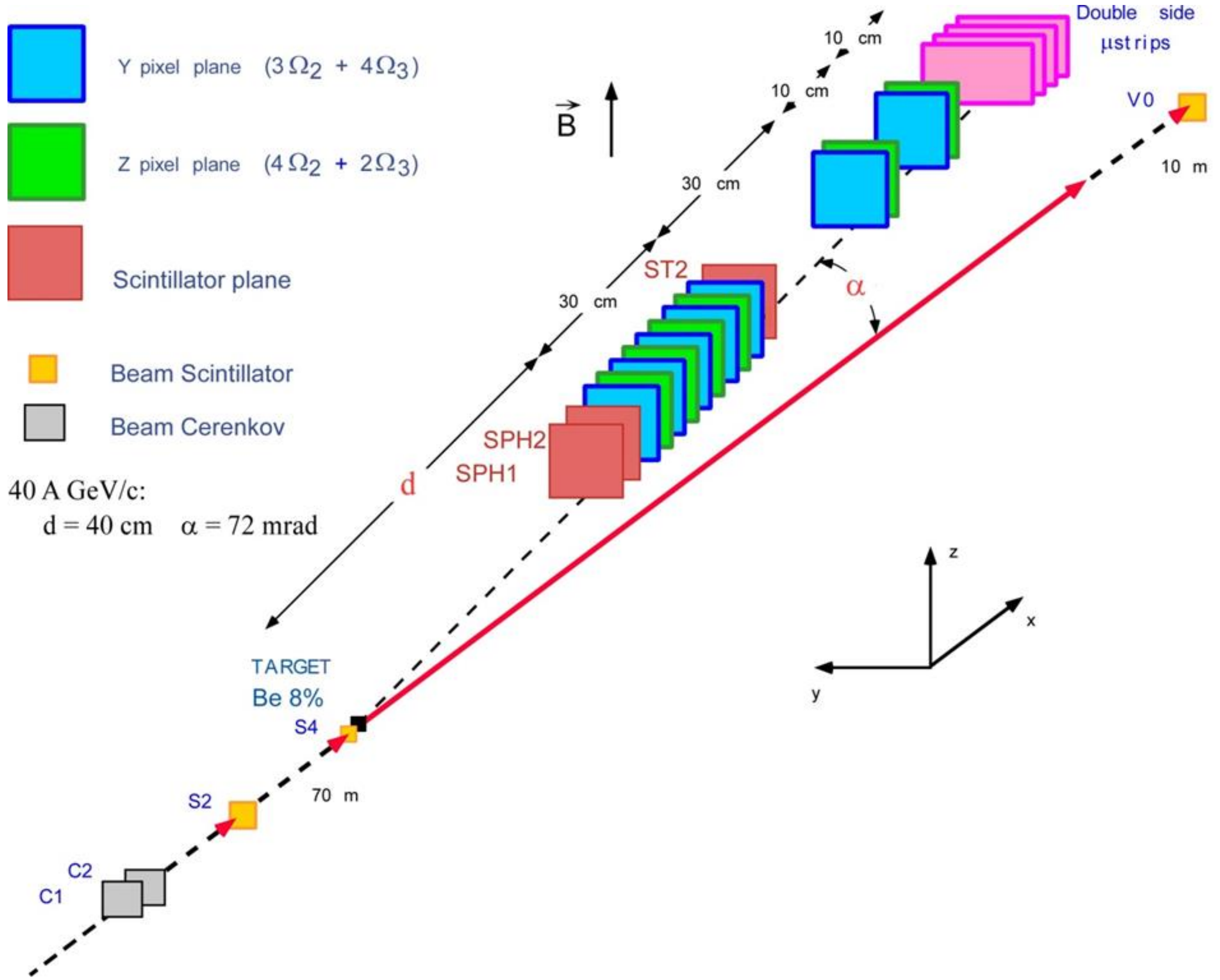
Budapest SQM 1996

Trip from Bratislava to Budapest:
Meeting Birmingham people

WA97/NA57 experiment

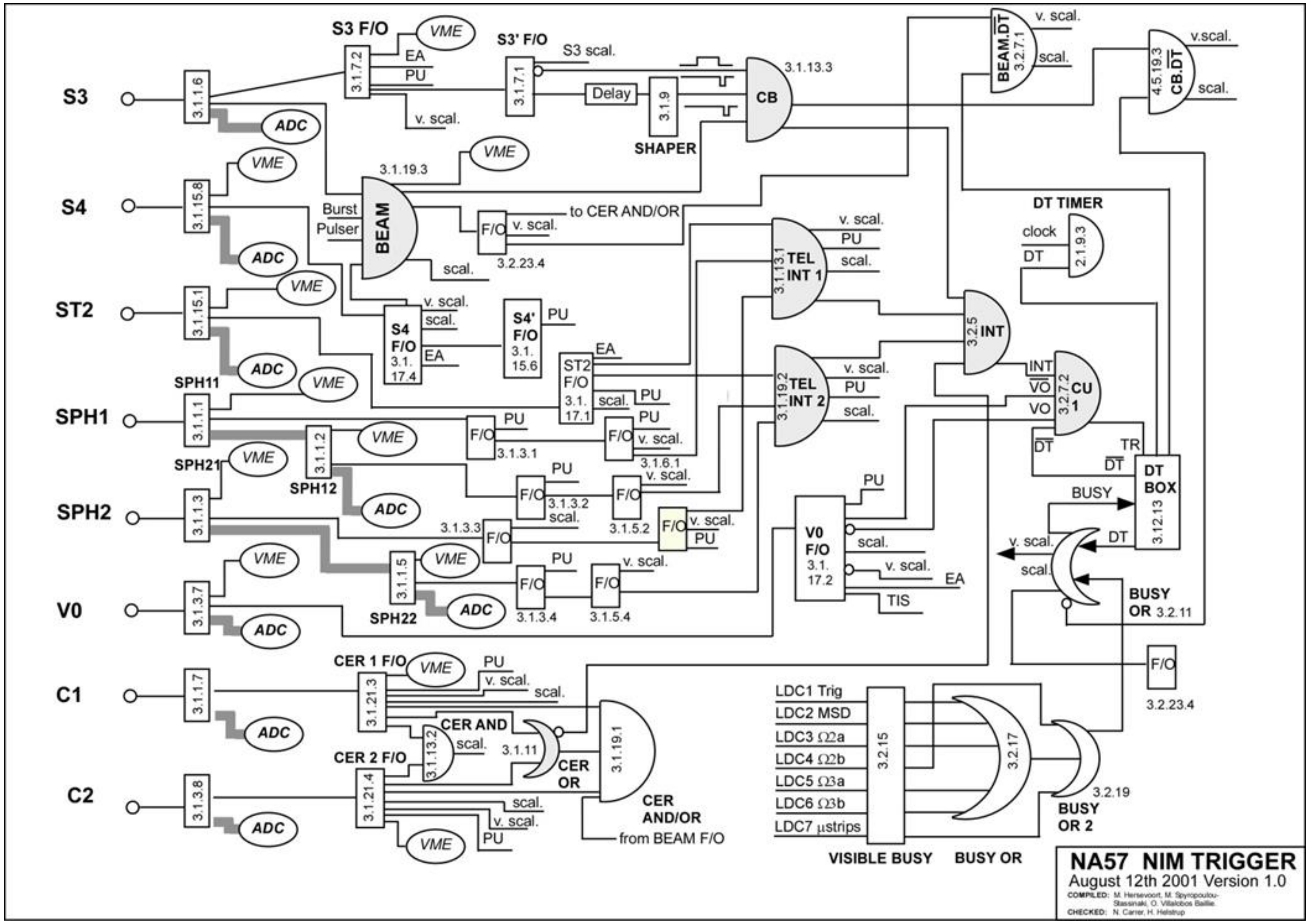
- The WA97/NA57 experiment, a heavy ion experiment designed to measure strange and multi-strange particle production in pBe and Pb-Pb collisions
- The experiment ran from 1990 to 2001.
  - NA57 trigger was used to test many ideas later implemented in the ALICE experiment, and represents a transition from the "old-style" approach with modular NIM based electronics to purpose-built triggers.
- In the pBe mode (shown) the trigger had to select events where at least two tracks entered the Silicon telescope. This was done by looking at pulse heights in two scintillators, and requiring both to be consistent with two tracks. (Requiring this in one only would not be sufficient owing to the long Landau tail in the pulse height distribution.)
- The beam rate was about 10^7 protons per SPS burst, and the trigger rate about 1800 per burst.
- Trigger was implemented in two ways:
  - Nuclear Instrument Module (NIM) based trigger
  - Electronic board

NA57 experiment



NA57 example

NA57 Trigger Logic NIM

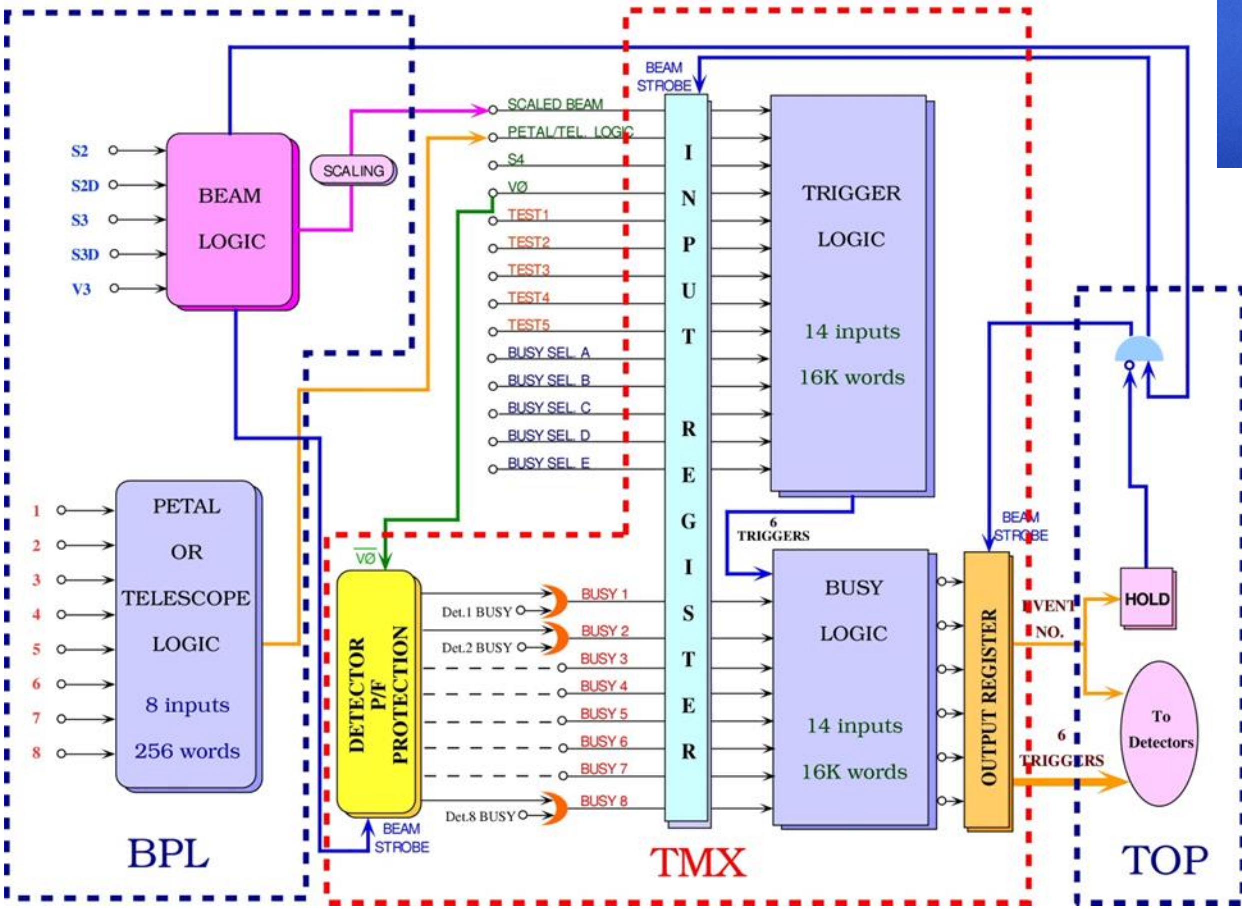


NA57 Trigger Logic NIM

NA57 Trigger Logic VME

ALICE trigger prototype

NA57 TRIGGER ELECTRONICS

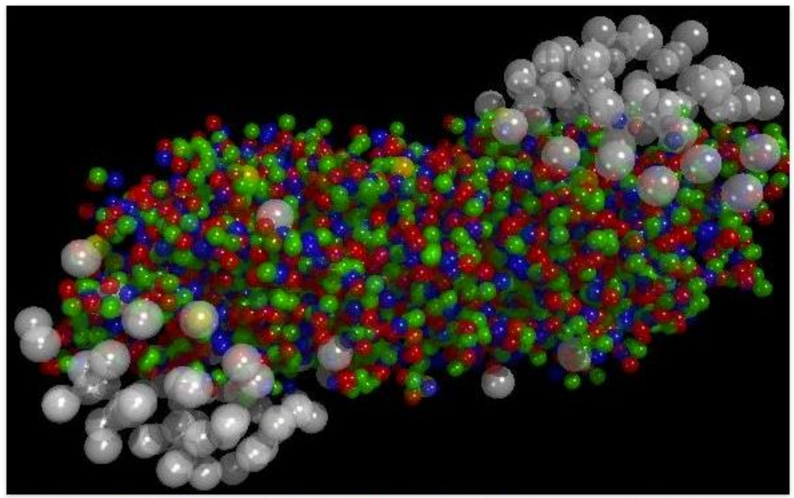


VME =
Versa
Module
Europe
= electronic bus standard

New state of Matter

New State of Matter created at CERN

10 FEBRUARY, 2000



Geneva, 10 February 2000. At a special seminar on 10 February, spokespersons from the experiments on CERN[1]'s Heavy Ion programme presented compelling evidence for the existence of a new state of matter in which quarks, instead of being bound up into more complex particles such as protons and neutrons, are liberated to roam freely.

See Federico's presentation for full story

Peron near Geneva (~2001)

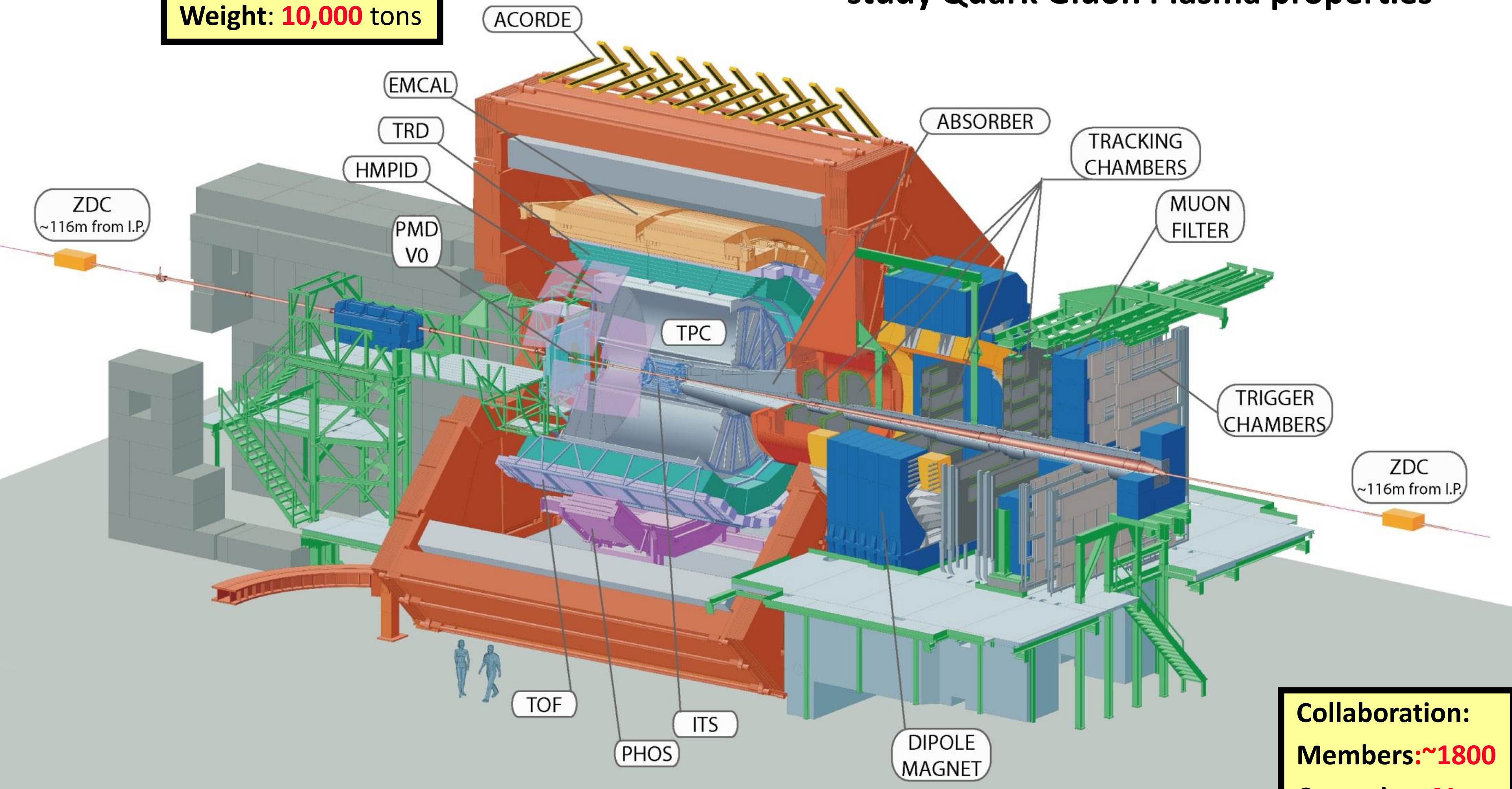
Discussion with Orlando on new Birmingham position

Technologies: 18
Tracking: 7
PID: 6
Calo. : 5

ALICE

Detector:
Size: 16 x 26 meters
Weight: 10,000 tons

Physics goal:
study Quark Gluon Plasma properties



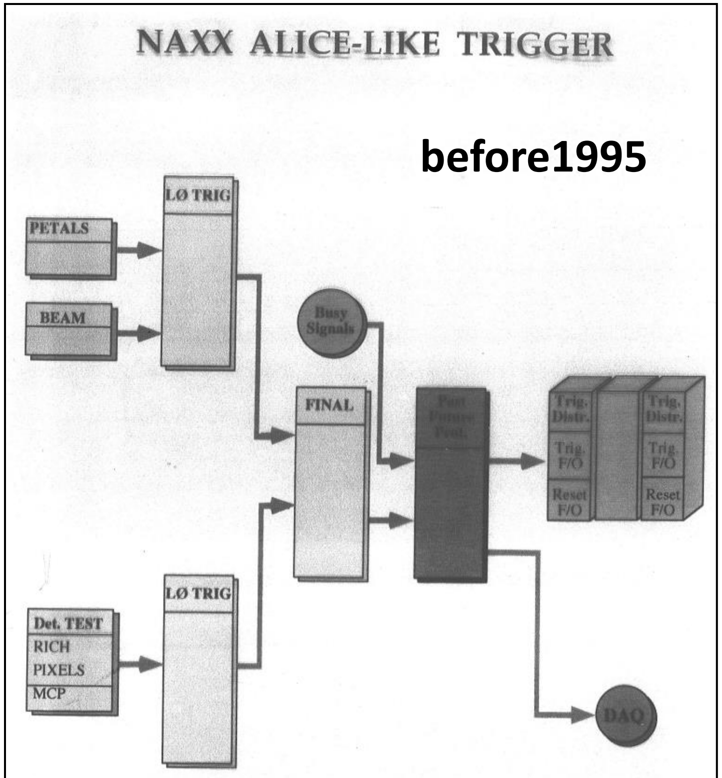
Collaboration:
Members: ~1800
Countries: 41
Institutes: 177

Run2 ALICE trigger challenges

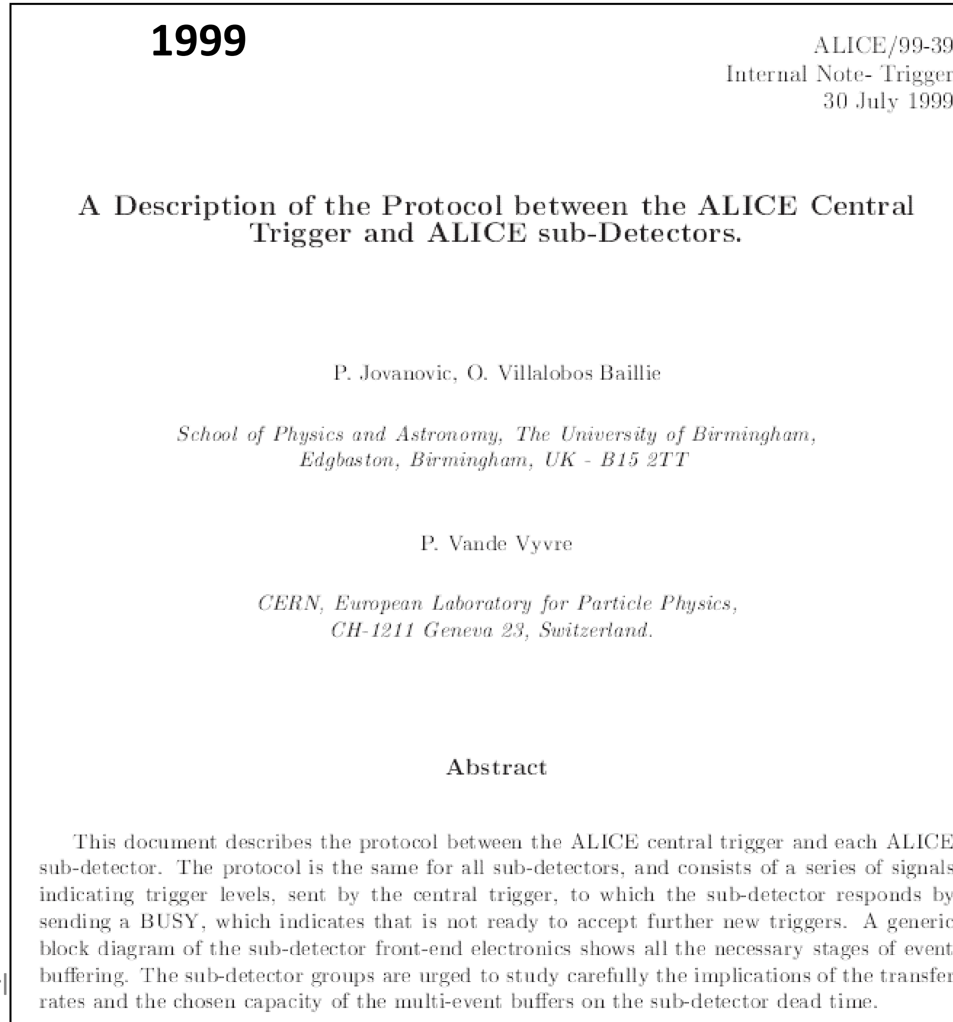
- **Select different physics**
  – Different triggering detectors
- **Optimise use of detectors with widely different busy times** (generally no pipelining)
  – Detector grouping – trigger clusters
- **Different latency requirements**
  – 3 trigger levels
- **Optimise for different running scenarios**
  – pp, pA, AA – with different interaction rates
  – Interaction record and past-future protection
- **Optimise rates according to physics requirements**
  – Downscaling

ALICE CTP History

- Pre 1995: first CTP schema
- 1995 – ALICE Technical Proposal
- 1999 July - Trig Protocol ALICE INT note



ALICE Trigger Processor schema
Date: before 1995
Source: O. Villalobos-Baillie



1999

ALICE/99-39
Internal Note- Trigger
30 July 1999

A Description of the Protocol between the ALICE Central Trigger and ALICE sub-Detectors.

P. Jovanovic, O. Villalobos Baillie

School of Physics and Astronomy, The University of Birmingham, Edgbaston, Birmingham, UK - B15 2TT

P. Vande Vyvre

CERN, European Laboratory for Particle Physics, CH-1211 Geneva 23, Switzerland.

Abstract

This document describes the protocol between the ALICE central trigger and each ALICE sub-detector. The protocol is the same for all sub-detectors, and consists of a series of signals indicating trigger levels, sent by the central trigger, to which the sub-detector responds by sending a BUSY, which indicates that is not ready to accept further new triggers. A generic block diagram of the sub-detector front-end electronics shows all the necessary stages of event buffering. The sub-detector groups are urged to study carefully the implications of the transfer rates and the chosen capacity of the multi-event buffers on the sub-detector dead time.

History

- Pre 1995: first CTP schema
- 1995 – ALICE Technical Proposal
- 1999 July - Trig Protocol ALICE INT note
- 2000 June – first draft User Requirement Document
- 2002 October 10 – LTU design Review
- 2003 - Technical design report
- 2004 July - LTU production started
- 2004 July 8 - CTP Design Review
- 2005 June – 2006 June: CTP boards production
- 2006 July - CTP installed in CERN CTP lab and connected with DAQ
- 2007 May - CTP installation in P2
- 2008 September 10 – first beam
- 2009 November 23 - collisions at 450 GeV
- 2010 April 30 - collisions at 7 TeV
- 2013-2015 - LS1 CTP upgrade
- 2015 5/4 – first beam of run2
- 2015 3/6 - collisions at 13 TeV

2018 - December 2 – LAST TRIGGER:
Run 297624
Period=2
Orbit=0xd4063b

Birmingham CTP meeting

2006

Memory from 1-st Košice-Birmingham Trigger meeting

~2006

First Collisions Run1

Orlando’s Bottle of Wine

Kept for more than 10 years for this occasion

ALICE Integrated Luminosity

A. Kalweit / Nuclear Physics A 982 (2019) 1–7

System	Year(s)	$\sqrt{s_{NN}}$ (TeV)	L_{int}
Pb-Pb	2010-2011	2.76	$\approx 75\ \mu b^{-1}$
	2015	5.02	$\approx 250\ \mu b^{-1}$
	by end of 2018	5.02	$\approx 1\ nb^{-1}$
Xe-Xe	2017	5.44	$\approx 0.3\ \mu b^{-1}$
p-Pb	2013	5.02	$\approx 15\ nb^{-1}$
	2016	5.02, 8.16	$\approx 3\ nb^{-1}$, $\approx 25\ nb^{-1}$
pp	2009-2013	0.9, 2.76	$\approx 200\ \mu b^{-1}$, $\approx 100\ nb^{-1}$
		7, 8	$\approx 1.5\ pb^{-1}$, $\approx 2.5\ pb^{-1}$
	2015,2017	5.02	$\approx 1.3\ pb^{-1}$
	2015-2017	13	$\approx 25\ pb^{-1}$

RUN1 and RUN2 integrated luminosity collected/inspected with Birmingham trigger

Looking forward to having more discussion, walks and beers with Orlando !

Extra Slides

RUN2 upgrade

L0 board replaced with NEW LM board

New functionality:

- New trigger level LM (Level Minus One) with latency ~ 0.8 μs at detector
    - Increase TRD cluster trigger effciency
- 100 Classes (50 before upgrade)
- Trigger Input switch part of the LM board
- New Past- Future protection
- New additional DDL link from CTP to DAQ:
    – Interaction record with all 48 inputs available

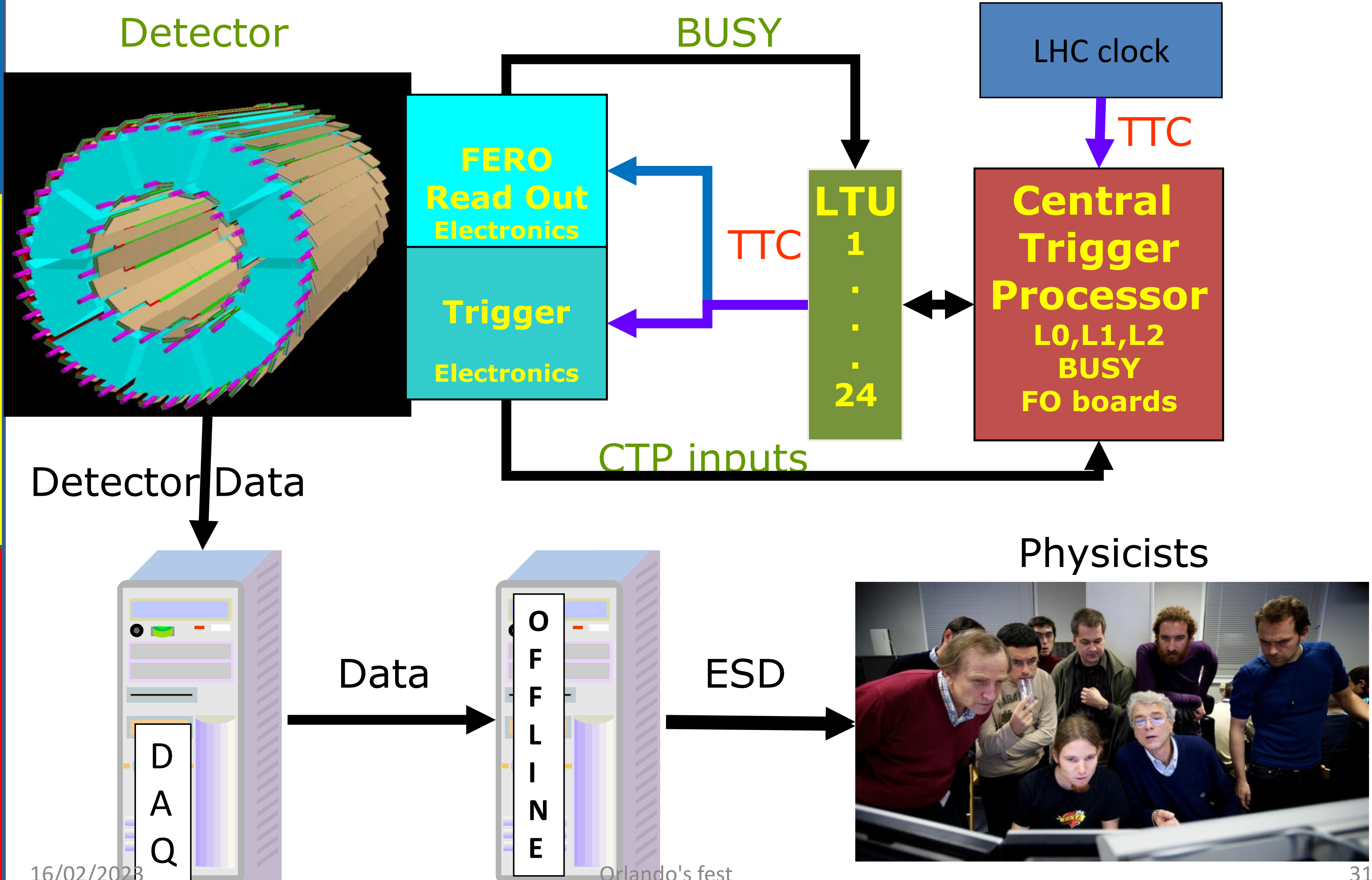
Preparing for RUN3

Trigger Meeting Košice 2018

Run2 summary

- Fast inspection of all interactions
  - reduce rate by hardware trigger selection
  - Reduce data volume by compressing selected events
- maximum read out rate limited to 500 Hz for Pb-Pb events (TPC read out)
  - In case the trigger rate exceeds a sub-detector read-out capability, the system saturates and asserts a busy signal

Central Trigger System

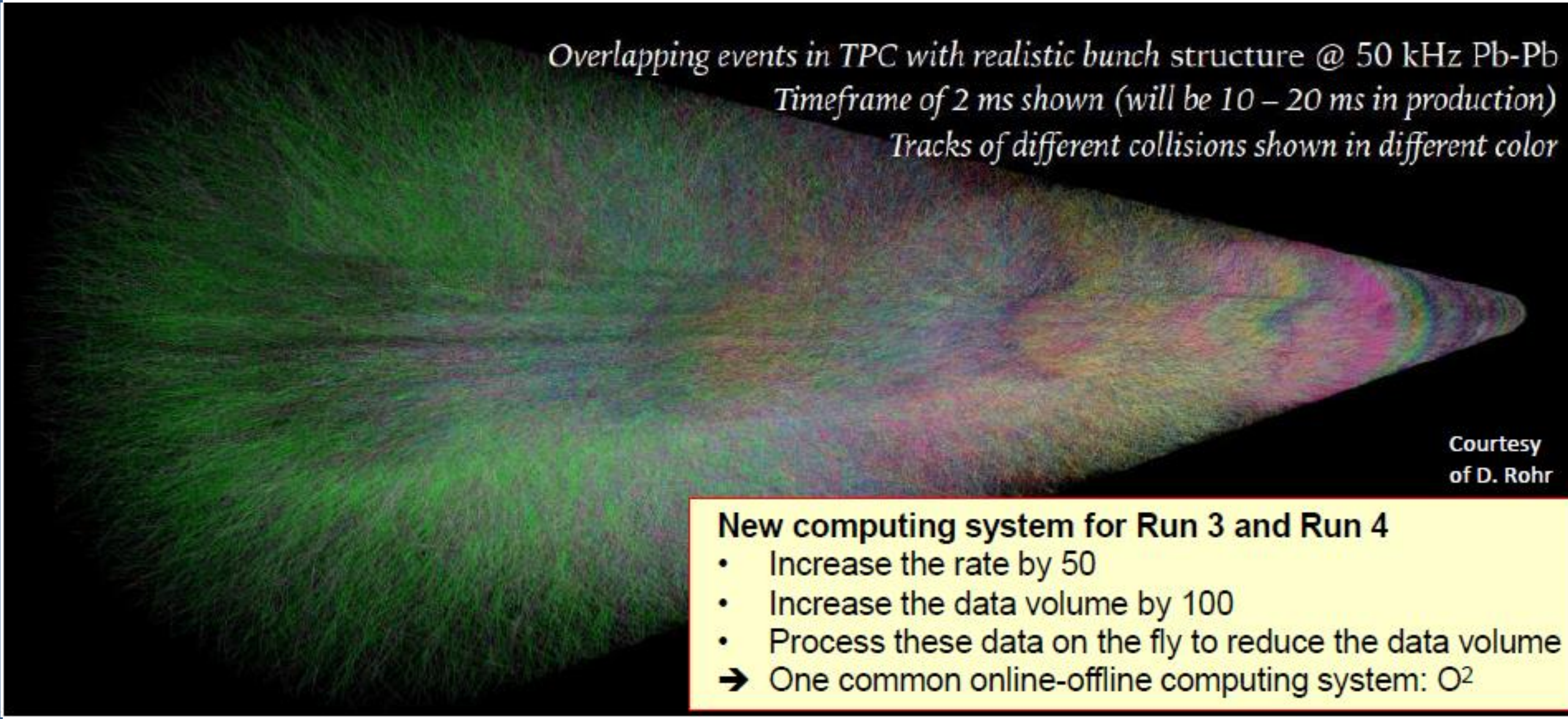


Starting the Run2

3/6/2015

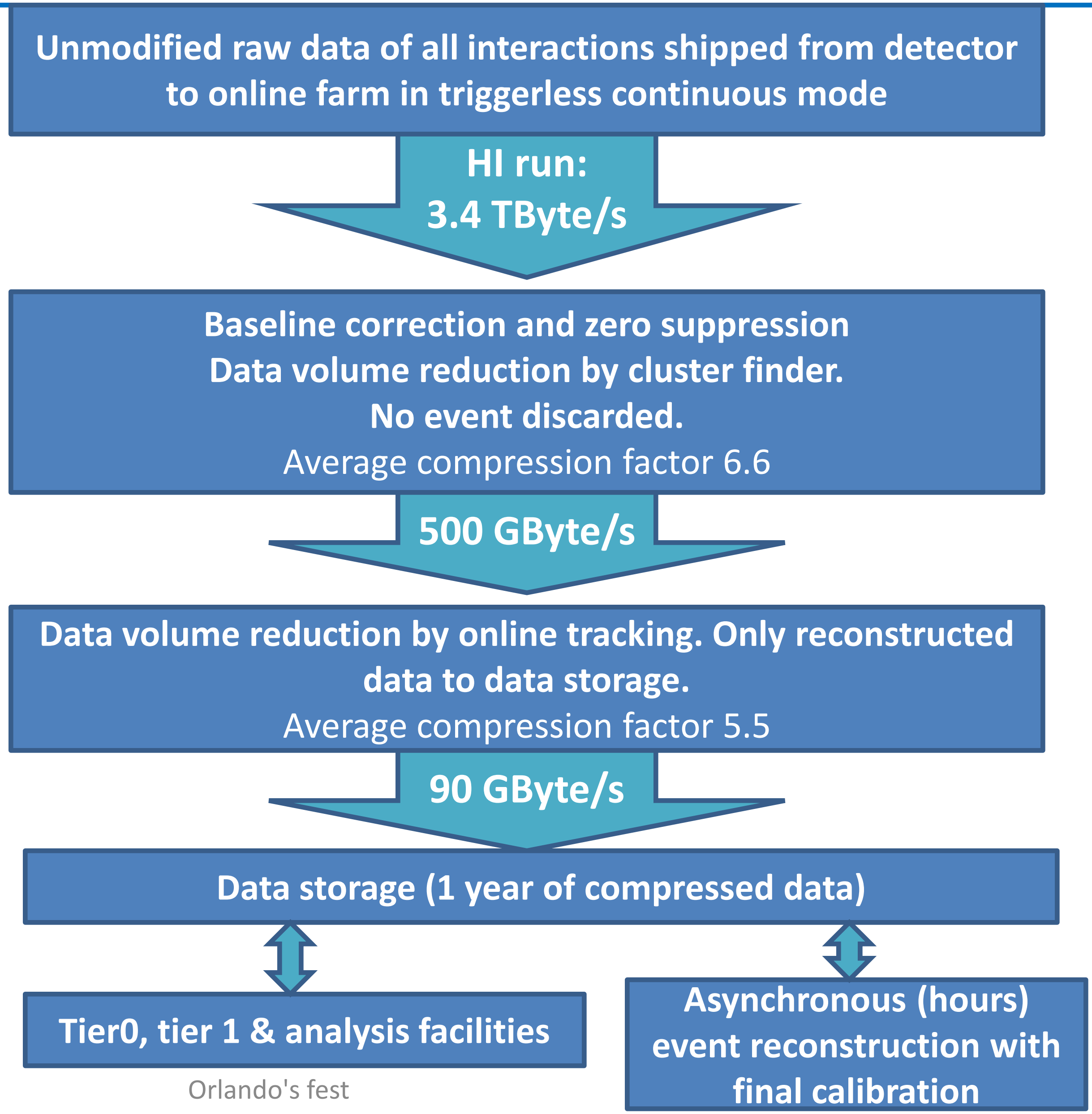
Run3 and Run4

50 kHz Pb-Pb interaction rate



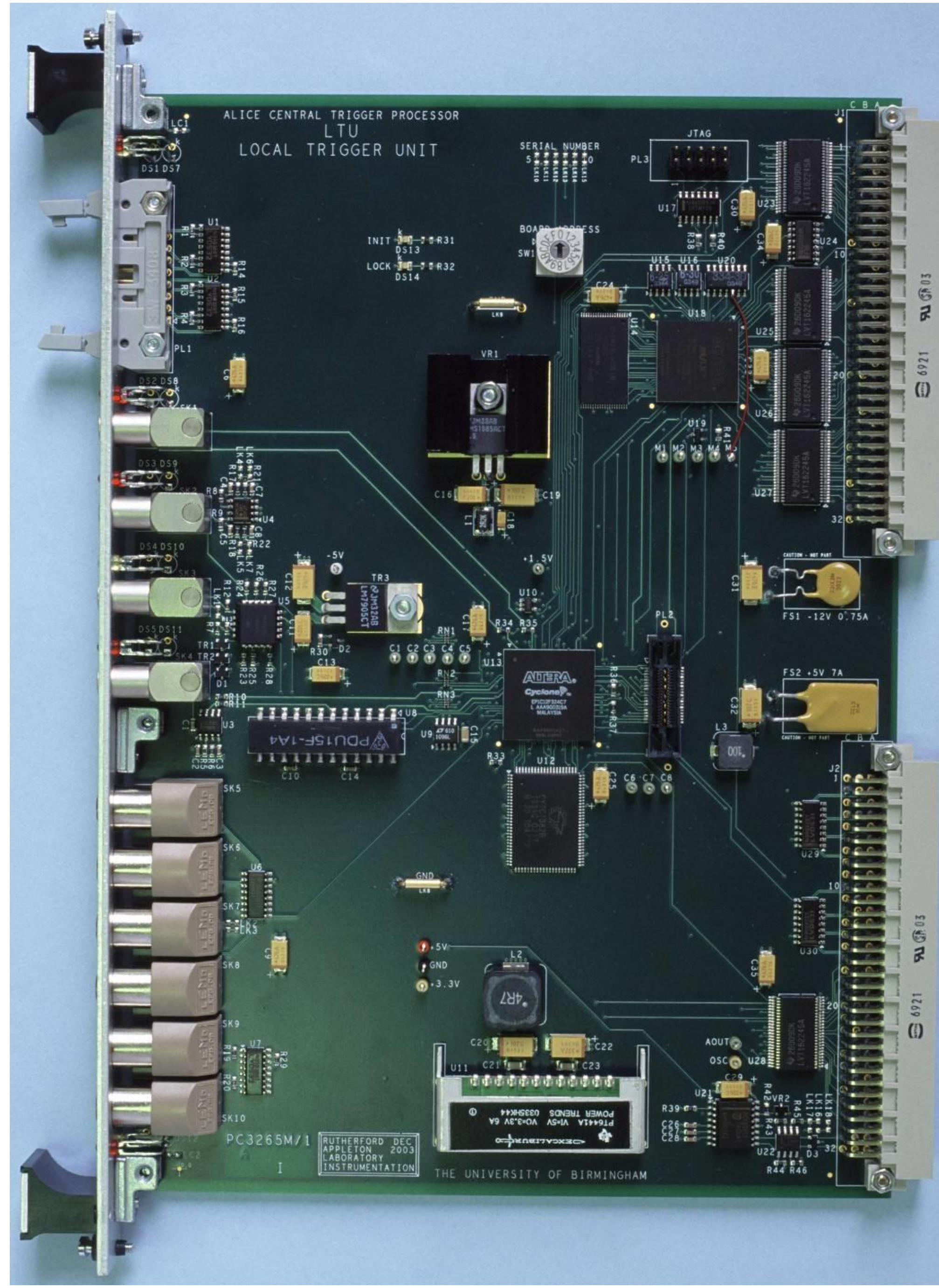
New ALICE O^2 system

- Read-out data of all interactions
- Compress these data by online reconstruction
- One common online-offline system

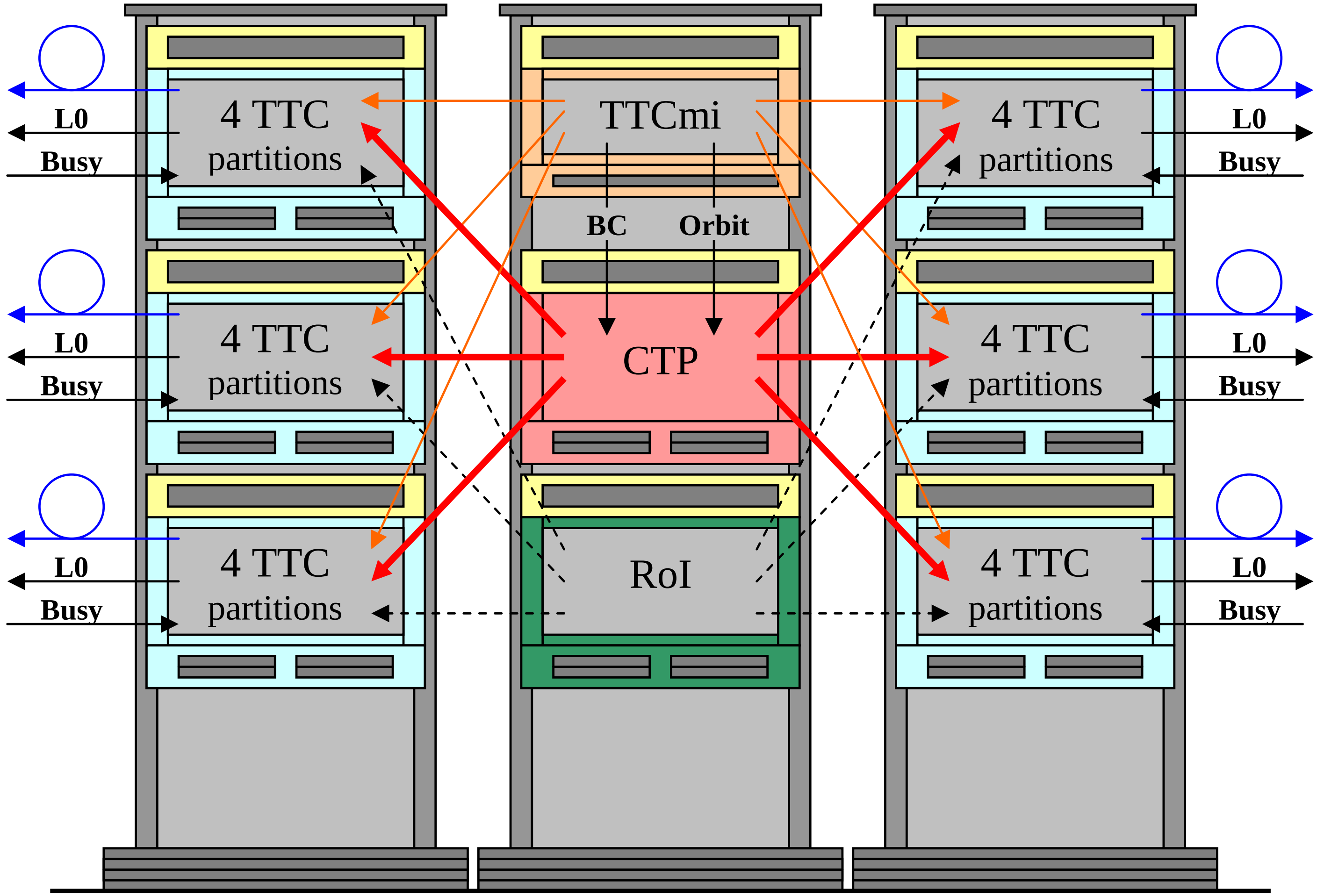


Local Trigger Unit (LTU) Run1/2

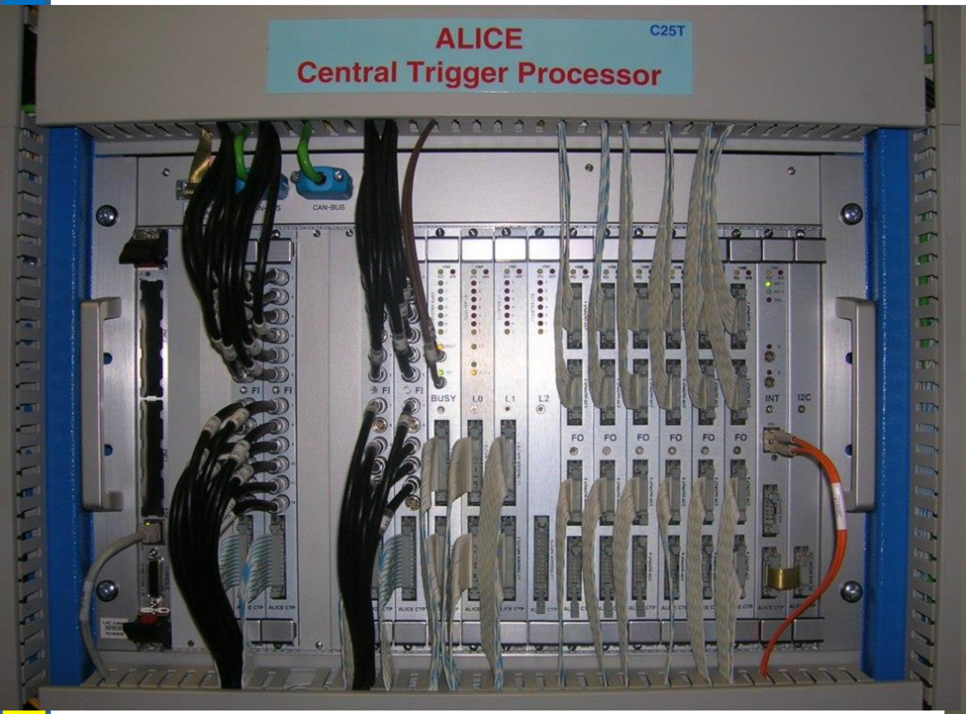
- ***Uniform*** interface between the CTP and sub-detectors:
  - easier control
  - easier mods/upgrades
- Unique features:
  - Full CTP emulation (*stand-alone* mode)
  - Error emulation (front-end tests)
- VME, 6U form-factor
- Similar to other CTP boards

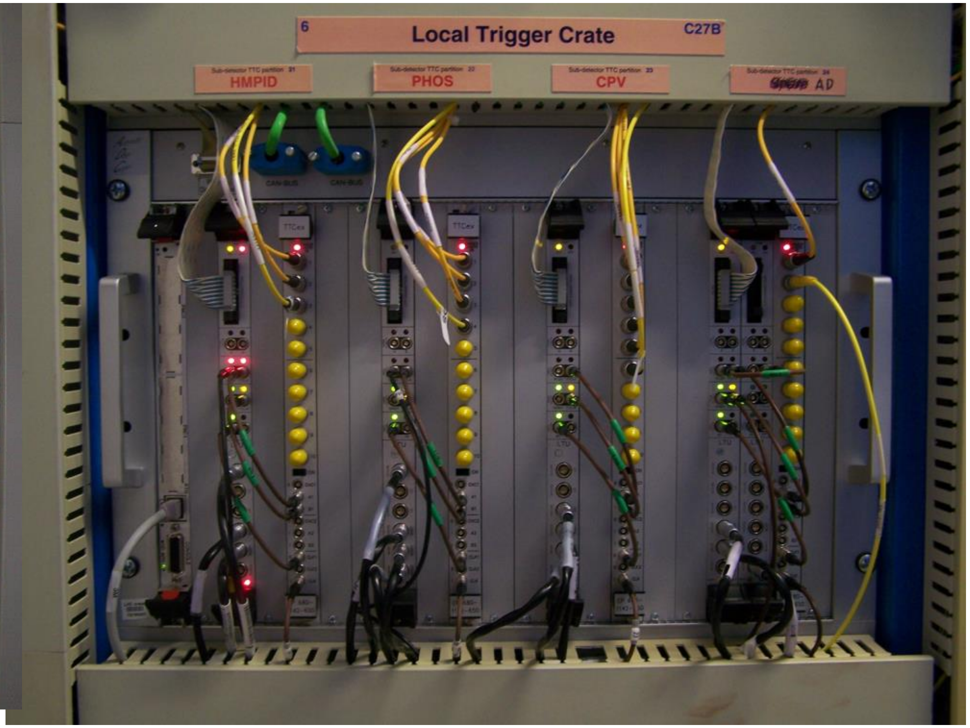


Layout of ALICE trigger system Run1/2



Central Trigger System Run1





Central Trigger Processor

6U VME boards

Trigger inputs are LVDS

Outputs are sent to Local Trigger Units (LTUs) where conversion to output format occurs