

ALICE MUON Software for run 3

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Outline

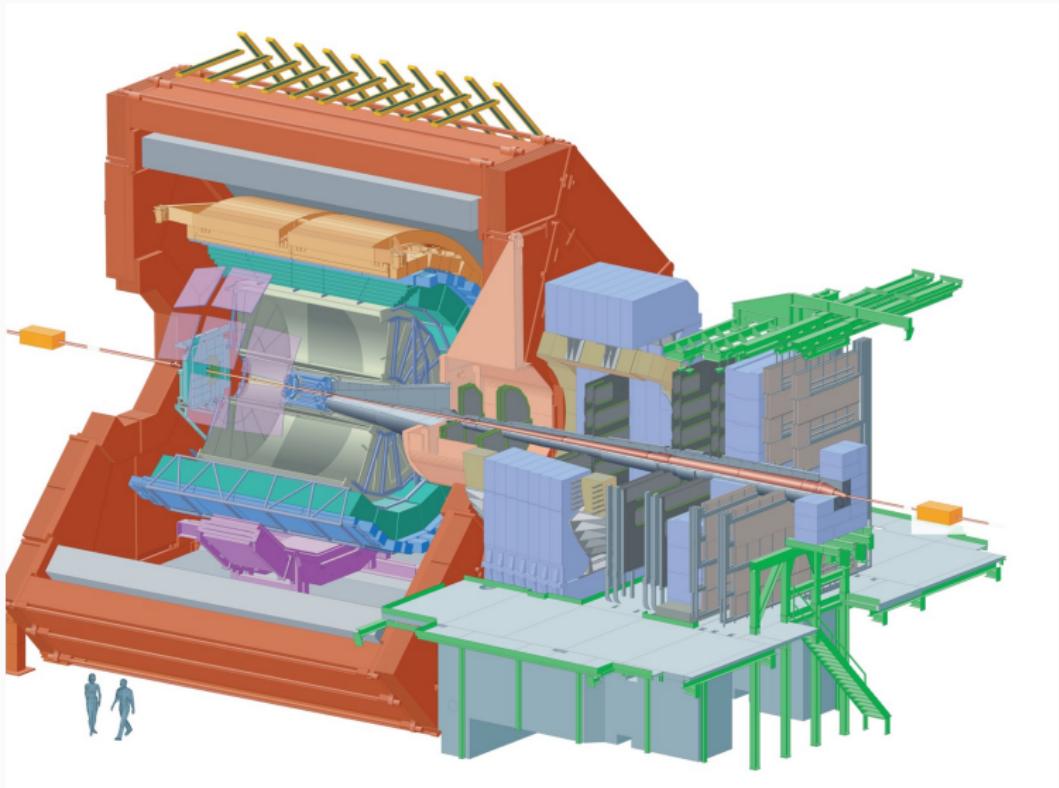
ALICE

O2 and Run3

ALICE Muons

Current MUON Software

Cluster Finder



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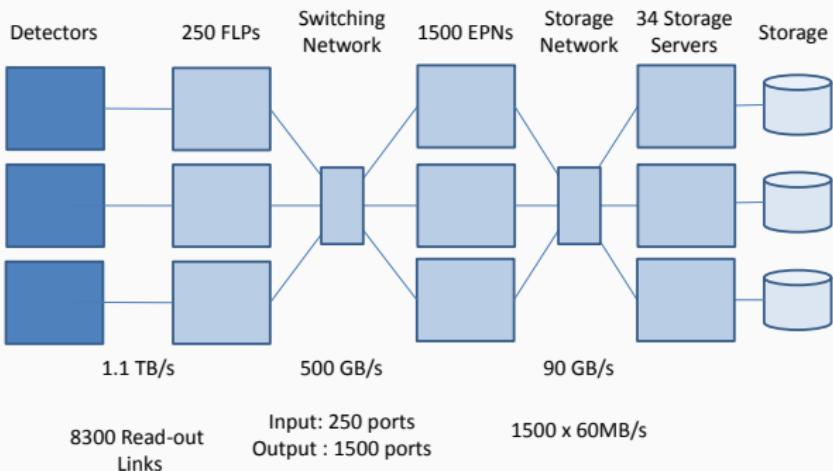
Cluster Finder

O2 Online/Offline

We will not go into depth, this is a whole another talk. Important numbers to take away :

- 50kHz event rate.
- 1.1 TB/s aggregate data rate, spikes upto 15.
- continuous read out for most detectors, tpc and muon sharing electronics.
- Completely new framework.
- merge HLT, data acquisition and offline into 1 code base and platform.
- calibration and reconstruction online.
- Collaboration with FAIR for new framework.

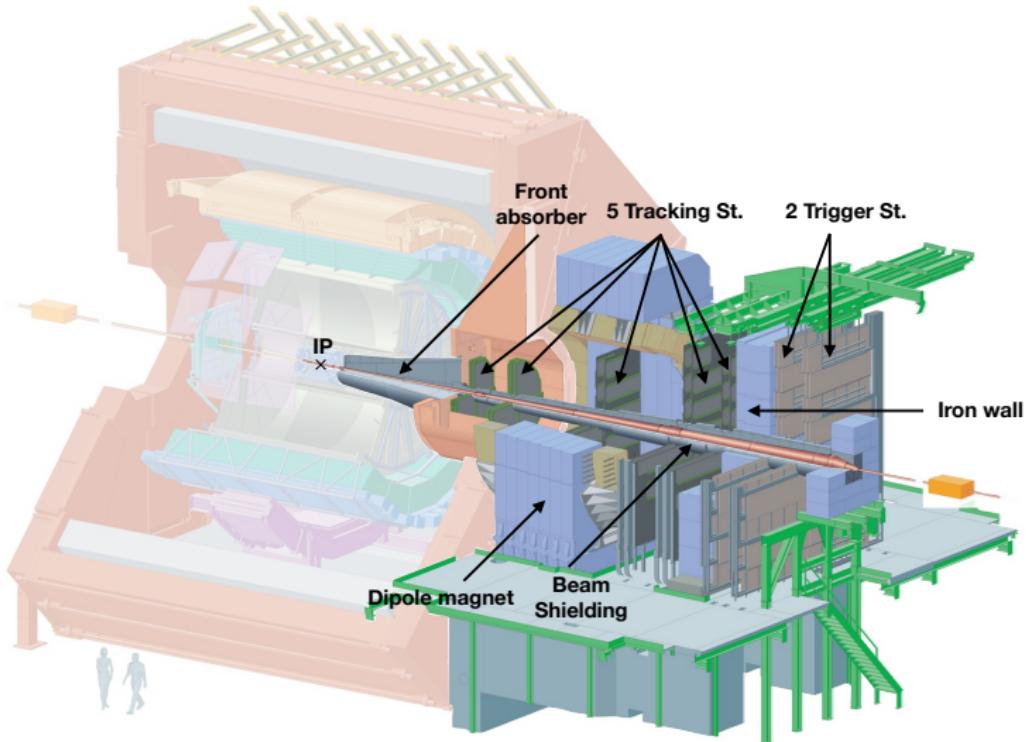
O2 Farm



MUON Links

Detector	Link type	Number of links			Read-out board type	Number of boards	
		DDL1	DDL2	GBT		C-RORC	CRU
ACO	DDL1	1			C-RORC	1	
CPV	DDL1	6			C-RORC	1	
CTP	GBT			14	CRU		1
EMC	DDL2		20		C-RORC	4	
FIT	DDL2		2		C-RORC	1	
HMP	DDL1	14			C-RORC	4	
ITS	GBT			495	CRU		23
MCH	GBT			550	CRU		25
MFT	GBT			304	CRU		14
MID	GBT			32	CRU		2
PHS	DDL2			16	C-RORC	4	
TOF	GBT			72	CRU		3
TPC	GBT			5832	CRU		324
TRD	Custom			1044	CRU		54
ZDC	GBT			1	CRU		1
Total		21	38	8344		15	447

ALICE MUON Arm



Outline

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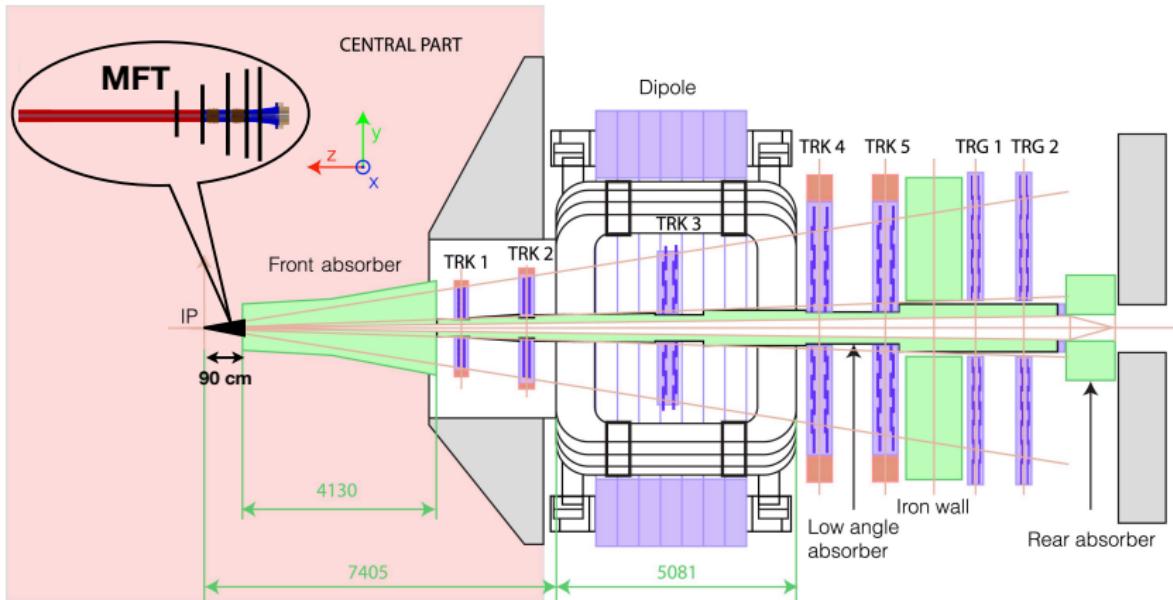
O2 and Run3

ALICE Muons

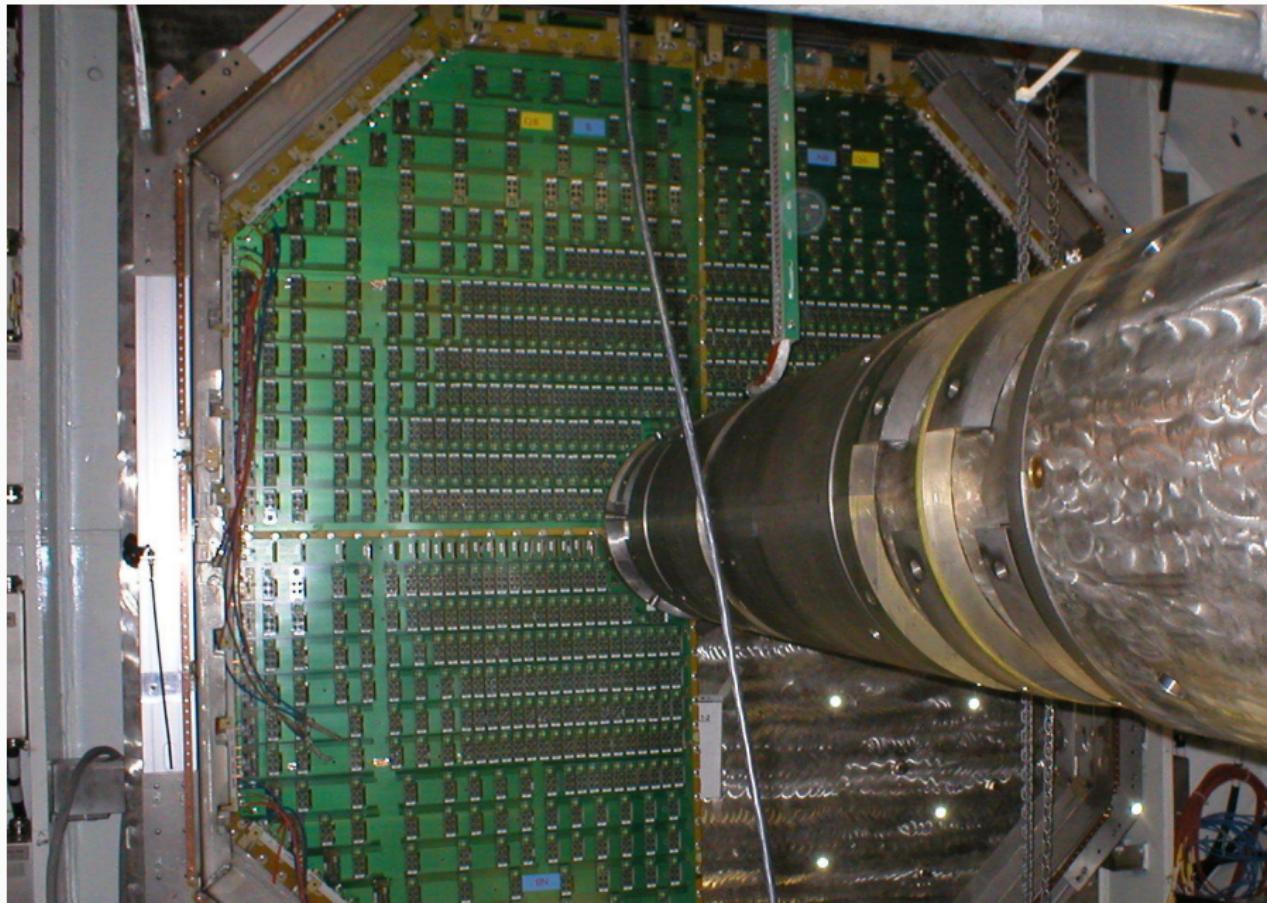
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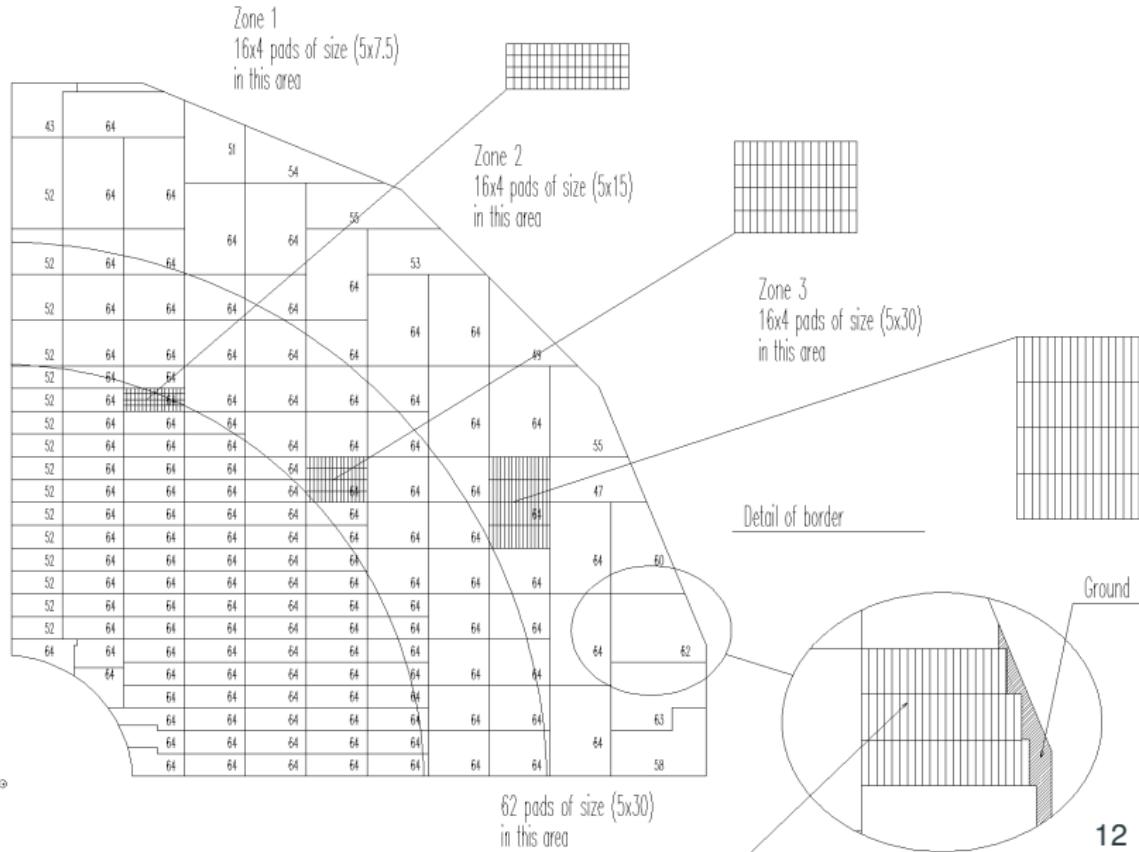
ALICE MUON diagram



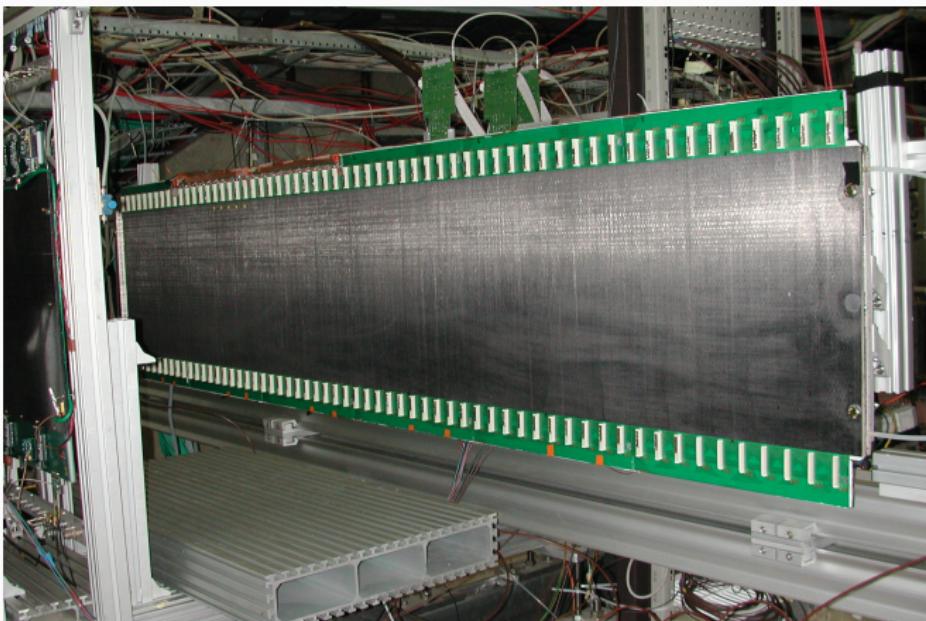
Detector Structure Station1



Detector Structure Station1 quadrant



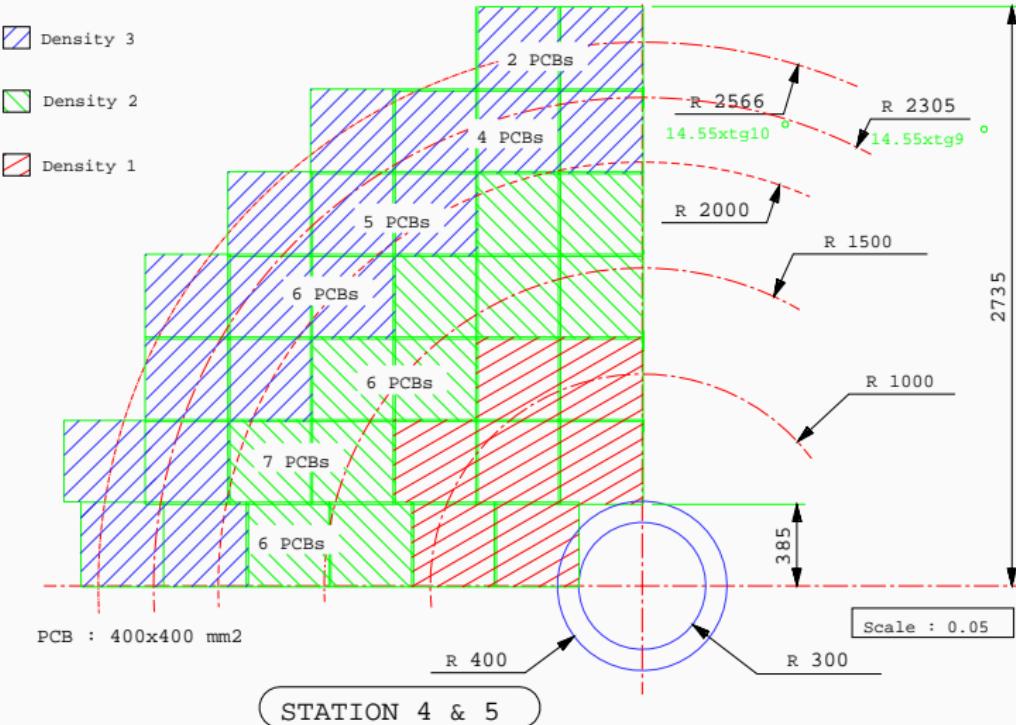
Detector Slats



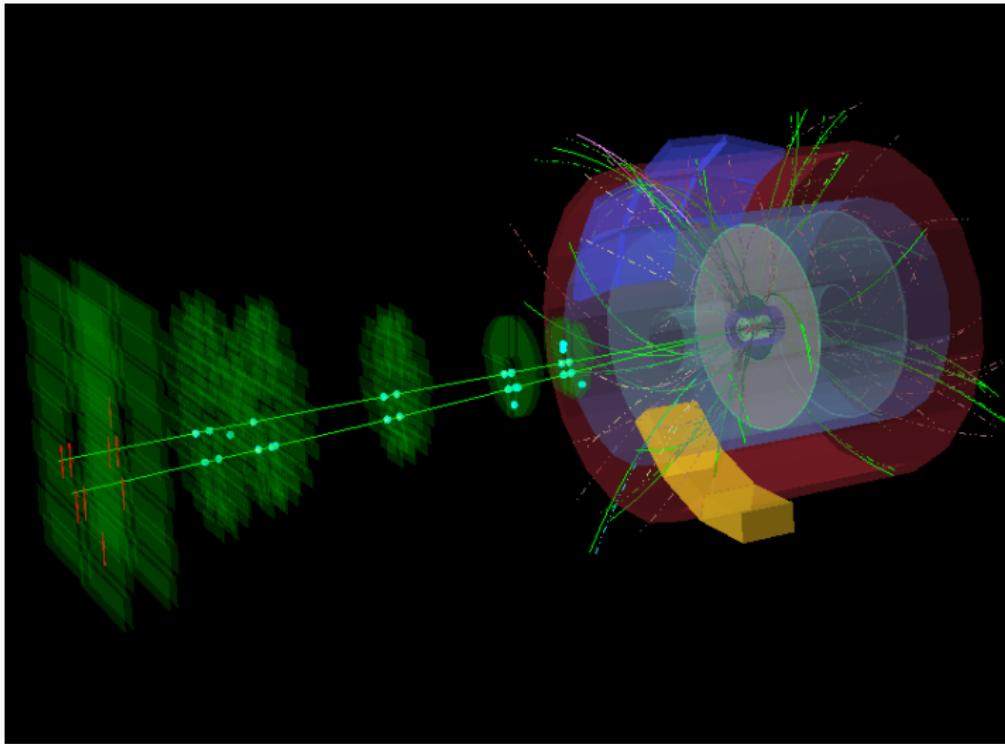
MUON Slats through the Dipole



Detector Slats schematic



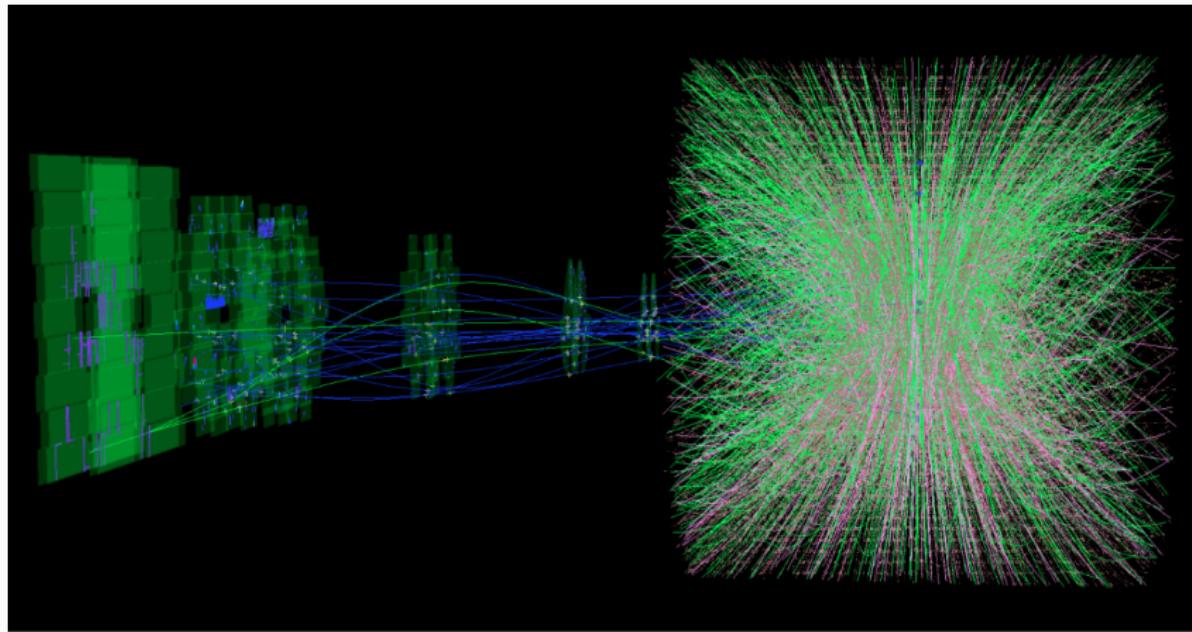
Nominal pp event



pp at $\sqrt{s}=7\text{TeV}$, 2010

Nucl.Phys. A862-863 (2011) 223-230

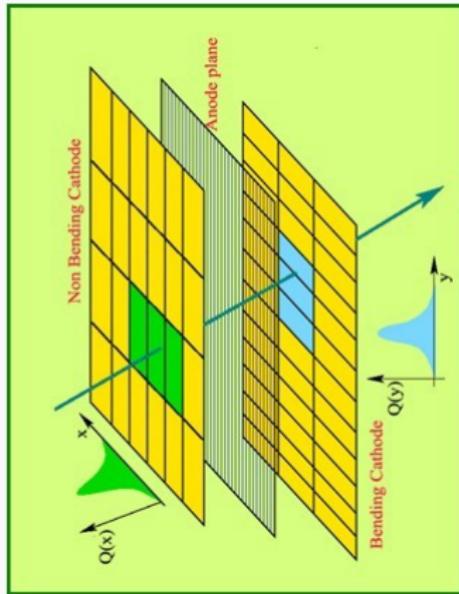
Nominal PbPb event



PbPb at $\sqrt{s}=7$ TeV, 2015

Diagram of detection

- 100m² total area
- 1.4 million channels
- Wire diameter = $20\mu m$
- Wire Pitch : 2mm St1
2.5mm St 2,3,4,5
- Pad sizes
 - 1. 5x7.5mm
 - 2. 5x15mm
 - 3. 5x30mm



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Current MUON reconstruction Software

- Raw Data Decoding
- Raw Data Filtering
- Pre Clustering
- Clusterise, locate cluster interaction point.
- Tracking (MCH)
- Tracking (MID)
- Track Matching MCH-MID

where to start

There is no doubt that the grail of efficiency leads to abuse. Programmers waste enormous amounts of time thinking about, or worrying about, the speed of noncritical parts of their programs, and these attempts at efficiency actually have a strong negative impact when debugging and maintenance are considered. We should forget about small efficiencies, say about 97% of the time: premature optimization is the root of all evil. Yet we should not pass up our opportunities in that critical 3%. A good programmer will not be lulled into complacency by such reasoning, he will be wise to look carefully at the critical code; but only after that code has been identified.

Donald Knuth, ACM Computing Surveys, Vol 6, No. 4, Dec. 1974 (see p.268)

Time Spent

Function	Time in %		
	pp 16	PbPb 11	PbPb 15
Raw Data Decoding	4		
Raw Data Filtering	2		
Pre Clustering	10		
Clustering	63		
Tracking MCH	7		
Tracking MID	6		
Track matching	8		

Graphically

include graphic of table.

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What is a cluster finder

picture of a couple of clusters.

MLEM Algorithm

explain mlem

MLEM

Logical Parts

- Add Virtual pads if necessary
- Find Center of Gravity given maximal pixel
- MLEM

Effect of not adding Virtual Pads

graph of radius of like clusters.

Effect of limiting the convergence to 5

graph of radius of like clusters.

Speed up

- look for dead code
- change data or reorder to hit caches better.
- get a faster cpu. sadly not going to happen
- gpu x3
- fpga - try to avoid.

Performed on a i7 with nvidia gtx 980, will have to be repeated on other hardware.

Something else

Look at the physics, and figure out a way to optimise based on the physics ...