



Level-1 Trigger Efficiency and Rate

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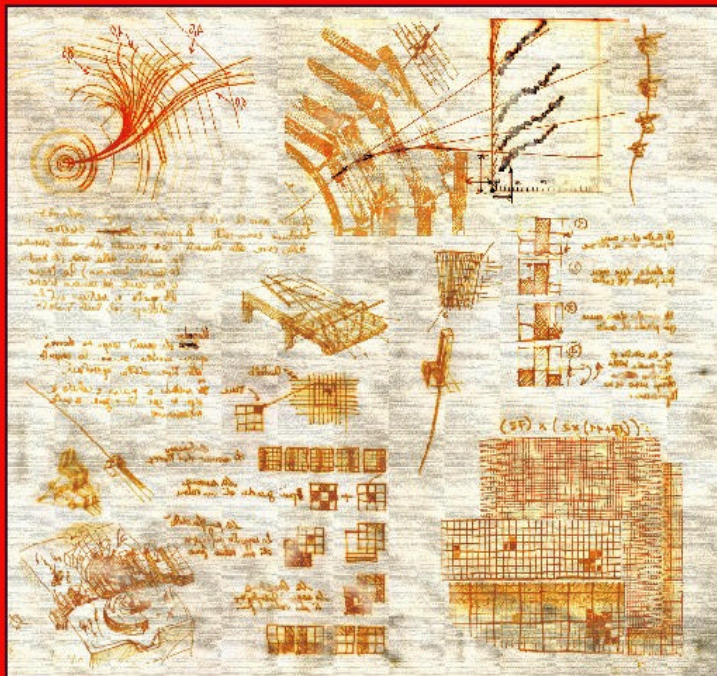


Technical Design Report

LABORATOIRE EUROPEEN POUR LA PHYSIQUE DES PARTICULES
CERN EUROPEAN LABORATORY FOR PARTICLE PHYSICS

CERN/LHCC 00-xx
CMS TDR 6.1
November 2000

CMS



The TriDAS project. Volume I
The Trigger Systems

- Trigger TDR is completed!
- A large amount effort went not only into the 630 pages, but into CSC Track-Finder prototypes, tests, and **simulations**
- Final simulation results on the CSC Trigger rate and efficiency based on ORCA4 reported here



State of the CSC Trigger Simulation

It is finally working with realistic results in ORCA 4.3.0—just in time for the L1 TDR

Trigger primitives:

- Time coincidences implemented in CLCT
 - But only 3/6 rather than 4/6 because of low efficiency
- Offsets in j assignment fixed in Sector Receiver
 - Resolves problems between m^+ and m^- P_T assignment

Track-Finder:

- P_T assignment has been re-tuned on CMSIM118 and parameterized by a set of functions
- This offers flexibility:
 - P_T binning may be changed
 - 50% or 90% thresholds (or anything else) can be used
- Bugs in quality/ P_T assignment fixed



P_T Resolution and Efficiency

Title:
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Creator:
HIGZ Version 1.26/04
Preview:
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PostScript printer, but not to
other types of printers.

← $5 < P_T < 50 \text{ GeV}$
 $1.2 < h < 2.0$

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**90% Efficiency
Threshold** →



CSC Trigger Efficiency vs. Eta

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— Any 2 stations

— ME1 or MB1 +
any station

— ME1 or MB1 +
any 2 stations



Configurations chosen for TDR

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other types of printers.

**“loose” = 2 or more stations
including ME1 in endcap,
but any two in DT/CSC
overlap region**

Title:
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**“tight” = 3 or more stations
including ME1 in endcap
and MB1 in DT/CSC overla**

← 92%

← 70%



Global Muon Trigger Efficiency

Using “loose” criteria for CSC trigger

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Adobe Illustrator(TM) 6.0
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CSC L1 Trigger Rate at $L=10^{34}$

Title:
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**In-time pile-up
included, but not
out-of-time b.x. or
neutrons**

**5 kHz rate at 25 GeV
threshold for “tight”
criteria**

**Threshold defined
at 90% efficiency**



Global Muon Trigger Rate

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Adobe Illustrator(TM) 6.0
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PostScript printer, but not to
other types of printers.

Algorithm	Efficiency	Ghosts	Rate $P_T > 25$
OR	97.6%	1.6%	23 kHz
AND	89.7%	0.07%	7.2 kHz
optimized	96.1%	0.18%	8.1 kHz

Using “loose” criteria for CSC trigger

The GMT optimized algorithm gives an efficiency close to the “OR” of RPC and CSC, but a rate close to the “AND” of the two.

Optimized \supset RPC coincidence required in certain regions, choose lowest P_T reported by RPC and DT/CSC when matched



P_T Assignment Improvements

Precision

- Current SP prototype performs a 3-station P_T measurement using a 2 MB SRAM
 - 27% resolution up to 35 GeV (20% for $P_T < 5$ GeV)
- Resolution can improve further with 1 or 2 more bits of precision on D_j ₂₃
 - 22% resolution up to 35 GeV
 - Use larger SRAM or multiple chips
- Likewise, anticipated improvements on j resolution in CLCT and SR should extend this resolution up to 50 GeV
- Stronger background rejection, higher efficiency

DT/CSC Overlap

- Tracks bend back between MB1 and ME2 at low P_T
 - Ambiguity in assigning P_T based on D_j
- Will investigate using j_{bend} and D_j ₁₂ for P_T assignment in place of 3-station measurement for this region
- Won't help tracks without MB1
 - No bending between ME1 and ME2