Muon Physics & Reconstruction Software Organization

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Muon week, 7/11/00

Summary:

- Software projects re-organization in CMS
- Muon-HLT : activity and results achieved so far
- Future perspective : from “Muon Phys.Group” to Phys.&Rec.Softw. (PRS) organization

CMS Software & Computing

- Evolve the organization to build a complete and consistent Physics Software
- Recognize cross-project nature of key deliverables
  - Core Software and Computing *CSW&C*
    - More or less what US calls SW&C “Project”
  - Physics Reconstruction & Selection *PRS*
    - Consolidate Physics Software work between the detector groups targeted at CMS deliverables (HLT design, test-beams, calibrations, Physics TDR…)
  - Trigger and Data Acquisition *TRIDAS*
    - Online Event Filter Farm + online software framework

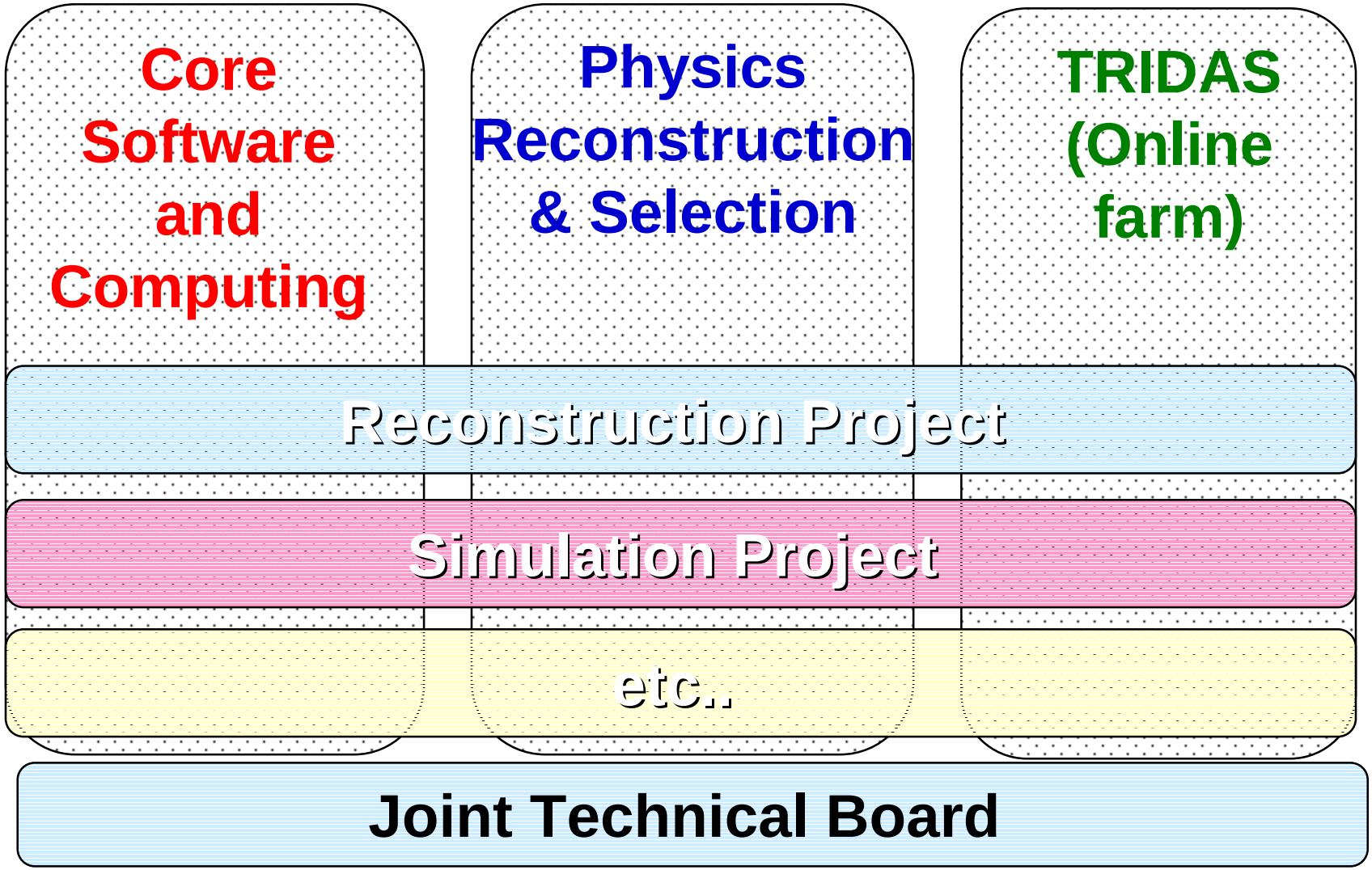
Evolution of software project(s) in CMS

- Basic idea is more synergy between various software activities.
  - The PRS group(s) are going to be the place where most (if not all, in some cases) software/physics work for each detector will be carried out, discussed, planned and presented
- We (PRS) have two sister projects:
  - Trigger/DAQ and Core Software/Computing
  - The three projects are “linked” at the level of the three project managers who discuss all issues relevant to the work TBD.
- PRS project is special:
  - No institution board (equivalent body is CMS Collaboration Board)
  - No MOUs, no institutional resources, essentially a project based on volunteers
    - This is where the help of the corresponding detectors will be most important. Our workers come from the detector projects.

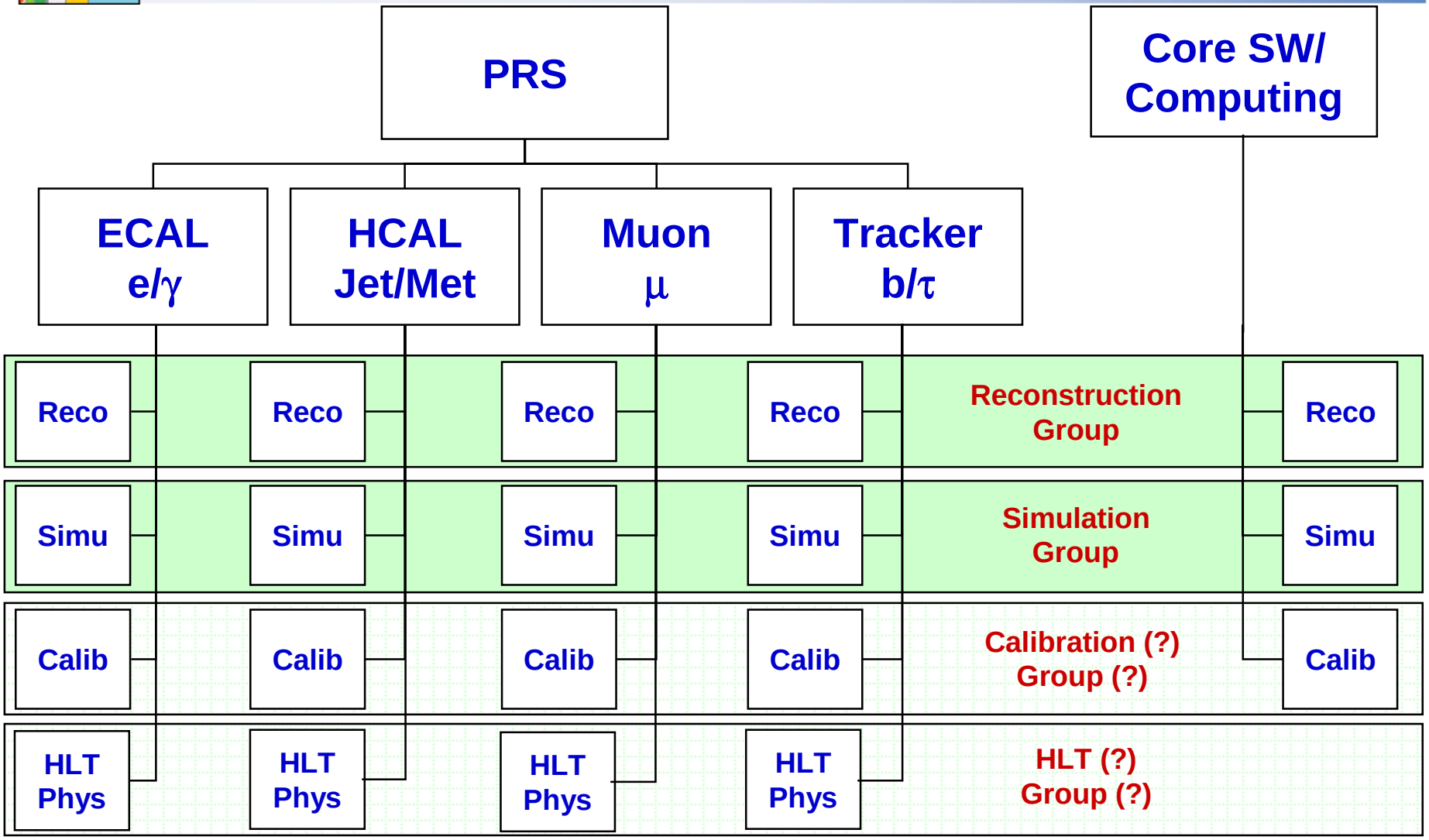
Scope of the project

- The PRS groups will work on (and will also have responsibility for) the following tasks:
  - Detector simulation
  - Detector reconstruction
  - Detector calibration
  - Monitoring
  - Physics object reconstruction and selection (HLT)
  - Test beam analysis
- CoreSW/Comp will carry all other (offline) software not included above, plus, for each task above, a corresponding core activity and integration responsibility.
- Ditto for Trigger/DAQ (but scope of overlap smaller)

Cross-Project Working Groups



PRS project organization



CPT weeks

- The current CoreSW/Comp and TriDAS weeks, along with the would-be PRS weeks are merged in a single week.
  - Aim: bring all people working on these three projects together.
- Layout of the CPT week:

Mon	Tue	Wed	Thu	Fri
Parallel sessions	Parallel sessions	Topical/ workshop	Plenary/ Common sessions	Plenary/ Common sessions

- CPT weeks in 2001: April 23, Nov 5

Weekly schedule

- New format of the working week:
  - All meetings start after 16:00 (to accommodate US, including California)
  - You are encouraged to attend all meetings; as a minimum, we should all be on the relevant e-mailing lists.

Mon	Tue	Wed	Thu	Fri
RPROM	PRS μ	PRS e/γ	DAQ*	Free
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SPROM	PRS b/τ	PRS J/M	CAFE	

*The DAQ meeting is on general DAQ issues. Whenever the online farm/framework is to be an item, this meeting slot will be used

Major dates in 2001– 2003

- DAQ TDR: end 2001; first draft: June 2001
  - This means all (analysis) results in by May – at the latest
- CoreSW/Comp TDR: end 2002
  - Have not discussed how much (if any of PRS) will also appear in this TDR as well
- Physics TDR: end 2003
  - Suggestion: two volumes, like ATLAS:
    - Vol I: physics objects (jets, e, etc) calibration, efficiency, detector response & parametrization
    - Vol II: physics analyses (tanβ vs M_A plots)
  - Intended organization:
    - Taskforces; Vol I is really our current system, with one additional horizontal bar called “TDR TF” (it’s finite term)
    - Vol II will need to wait until we evolve the organization to include the “physics” channels (e.g. Higgs, SUSY, etc)

DAQ TDR

- We currently have one chapter in the DAQ TDR (PS is the editor)
  - It should describe:
    - Amount of data per detector (occupancies, etc)
    - Readout scheme (zero-suppression, selective readout etc)
    - Basic raw data format (time samples)
    - Basic reconstruction
    - Lvl-2 algorithms
    - Lvl-3 algorithms
    - Performance of all object identification
    - Basic trigger table that includes all discovery channels
    - Basic rate plots. We MUST have a credible scenario to get to the O(100) Hz level

Muon-HLT activity & results

Mainly devoted to muon reconstruction for L2 + L3 trigger

This implied various activity on:

- digitization code from detectors
- validation/further development of existing L1 trigger simulation code, implementation of GMT
- muon reconstruction in the whole Muon System (Barrel, Endcap, overlap region)
- MC production and special simulation tools

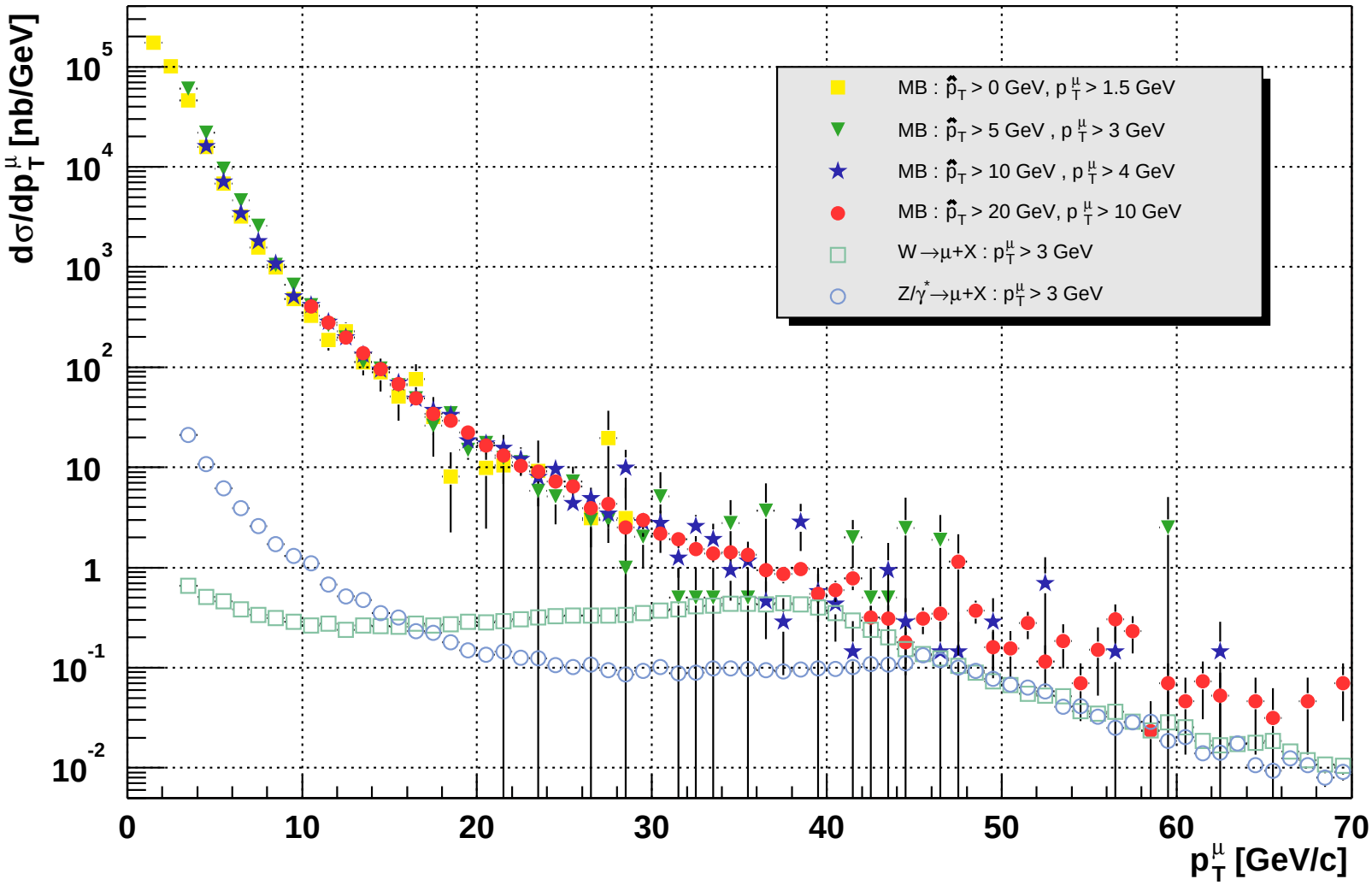
→ all this within the ORCA framework

Results presented at two HLT workshops :

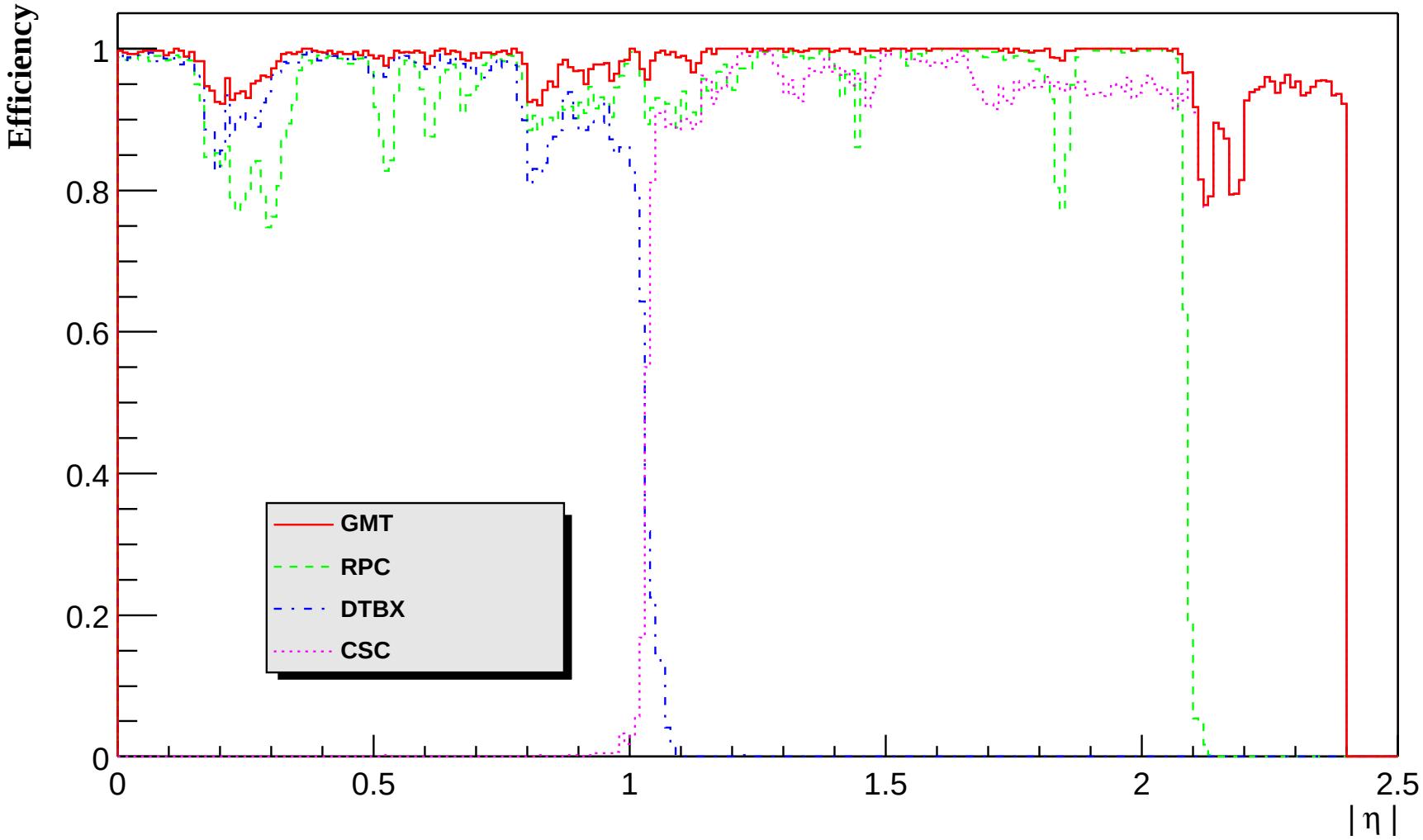
Nov.'99

July '00

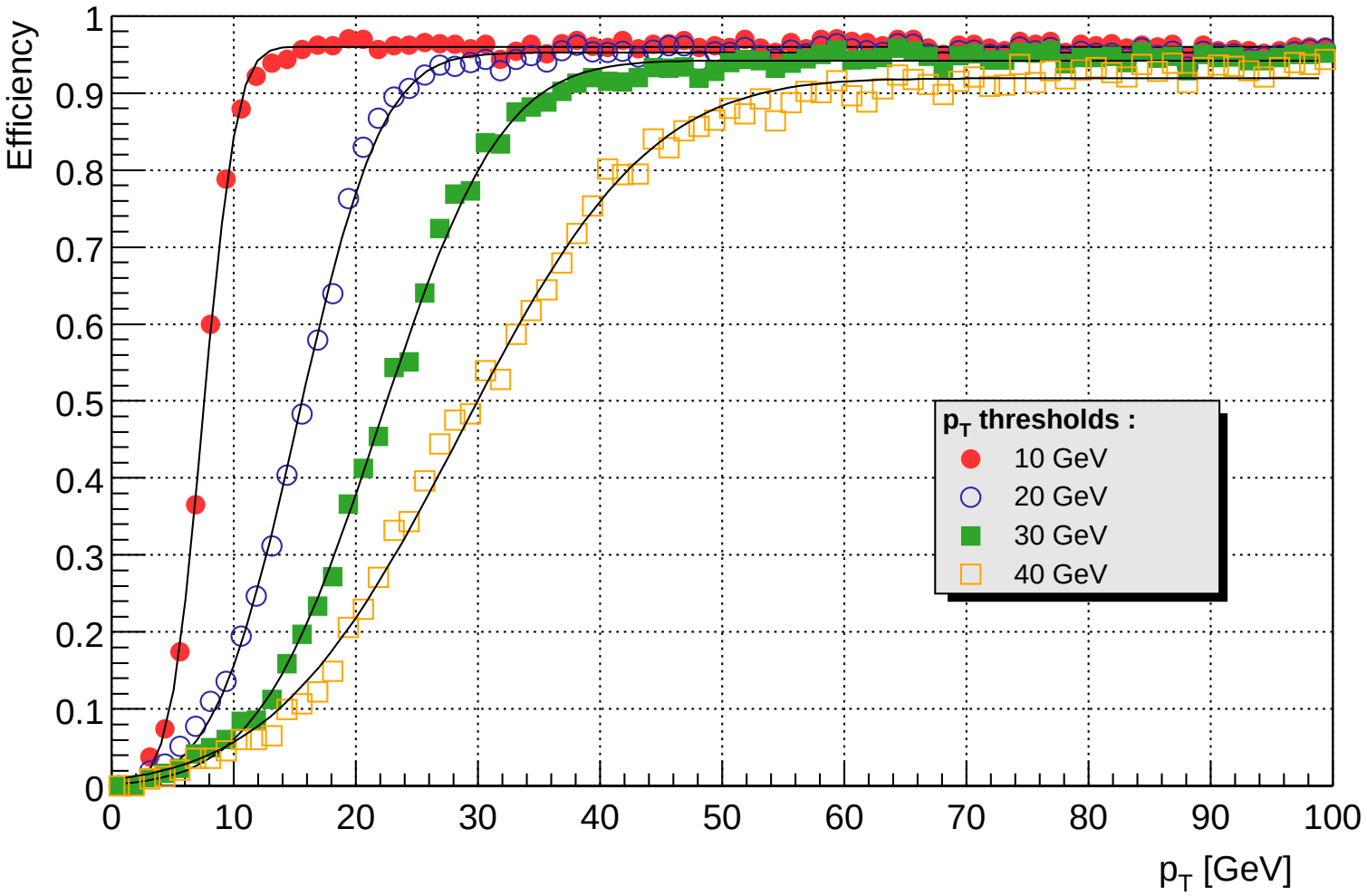
Generated data samples (10**6 ev)



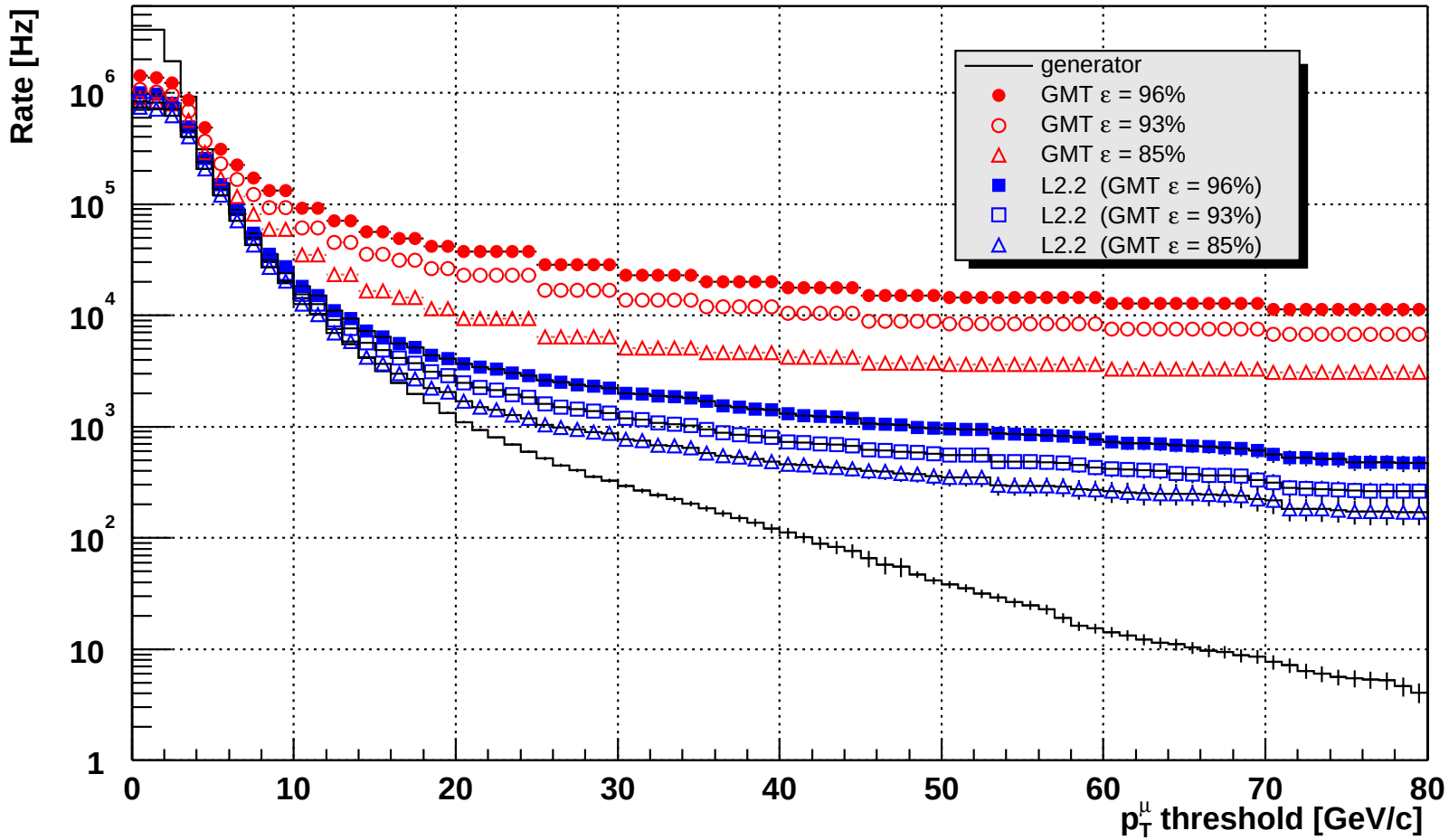
GMT 1



Global Muon Trigger



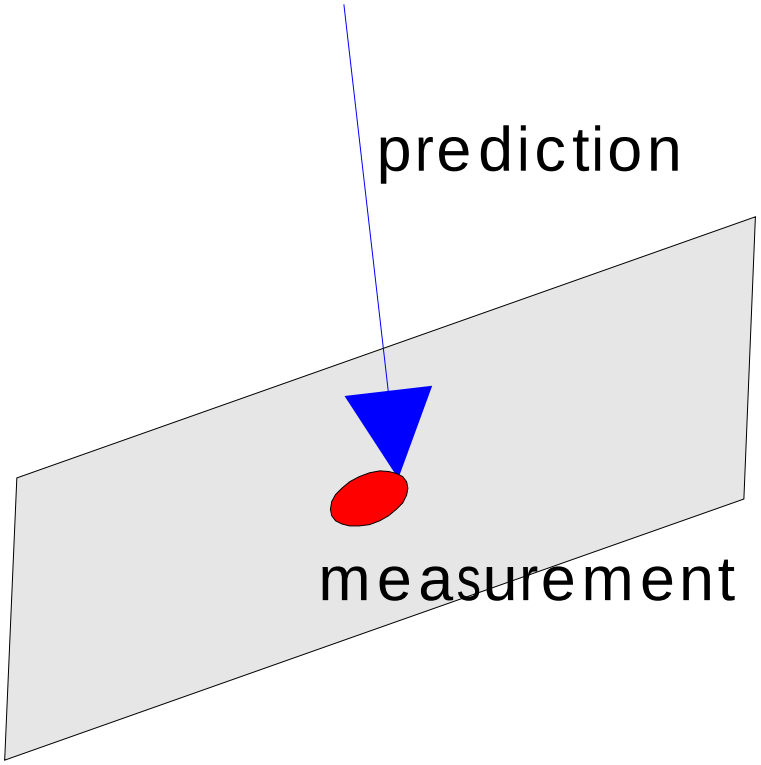
L2 rates


Rate [Hz]
10^6
10^5
10^4
10^3
10^2
10
1
0
10
20
30
40
50
60
70
80
p_T^μ threshold [GeV/c]
generator
GMT ε = 96%
GMT ε = 93%
GMT ε = 85%
L2.2 (GMT ε = 96%)
L2.2 (GMT ε = 93%)
L2.2 (GMT ε = 85%)

The Track Fitting

based on a Kalman Filter

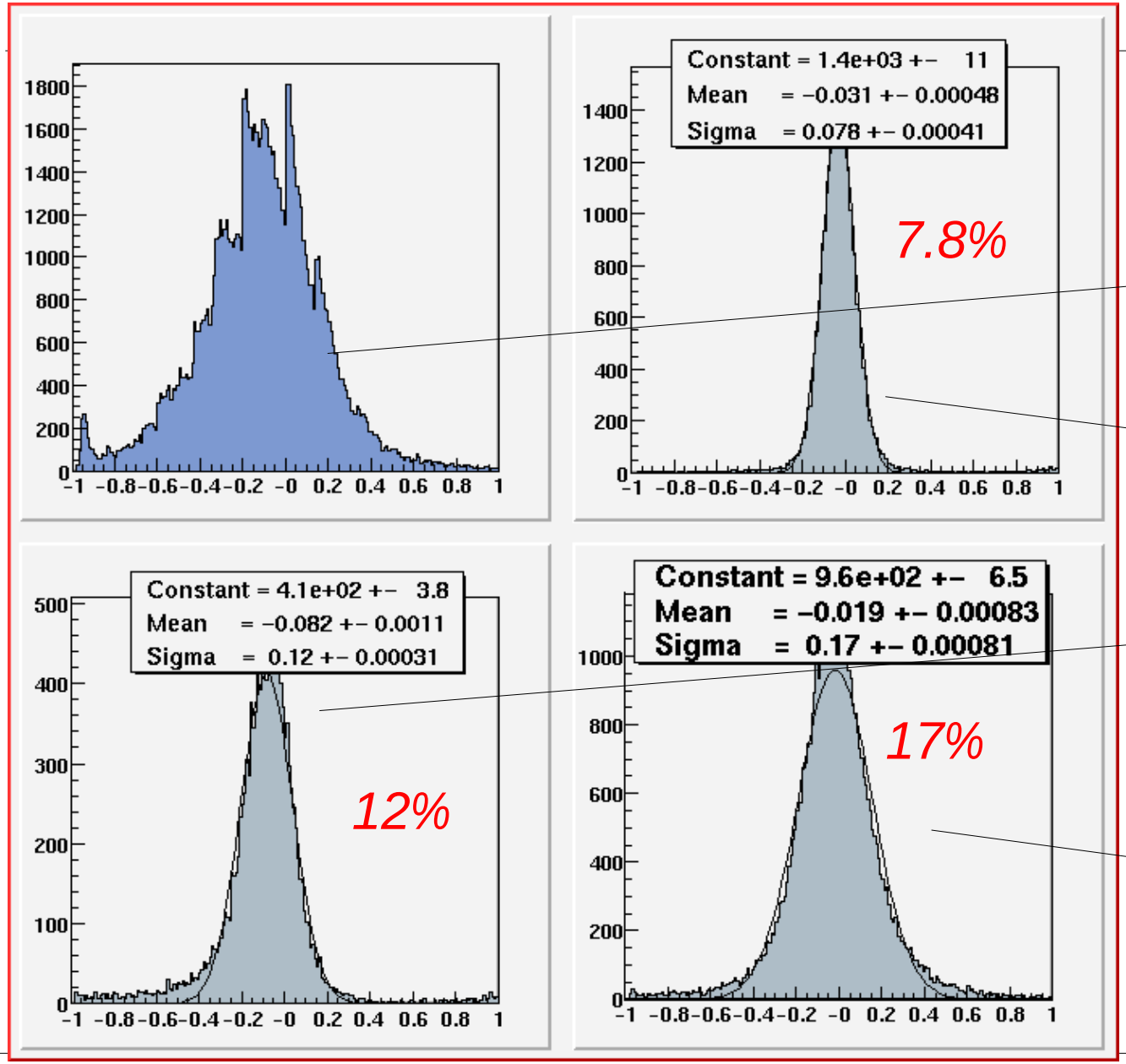
- measurements are:
  - 3D points in the endcap
  - 3D segments in the barrel



NOTE:
in both the cases the track segment is used at level of the track finding to reduce the combinatory

L2.2 Resolution1/pt (II)

Pt4 sample



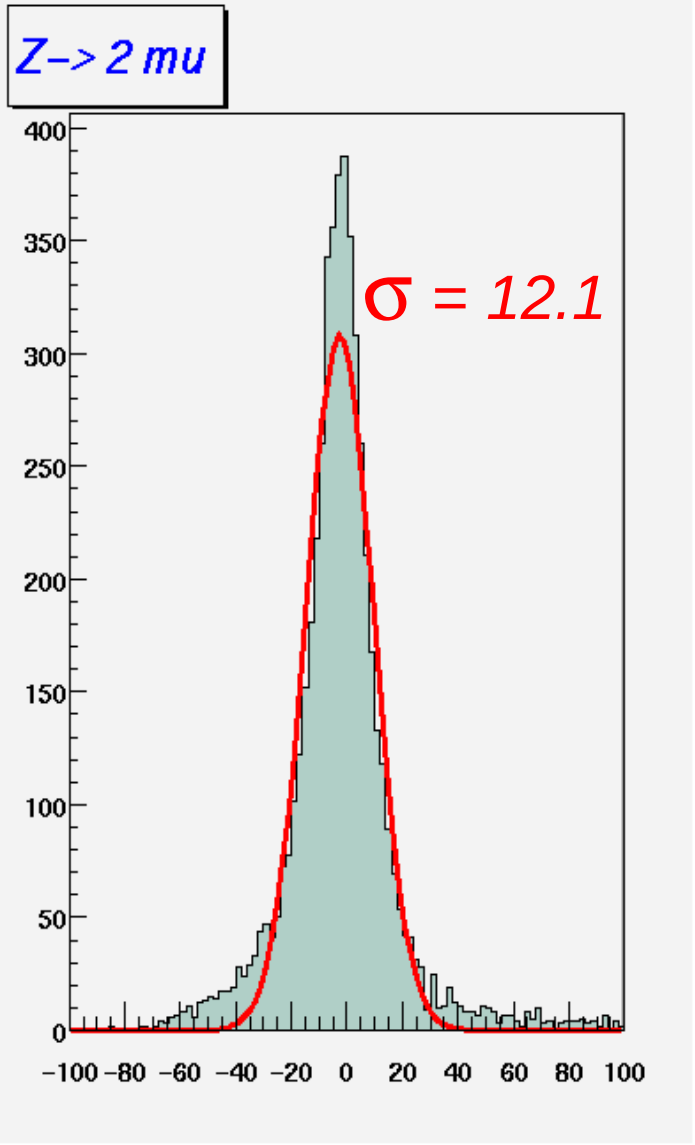
L1

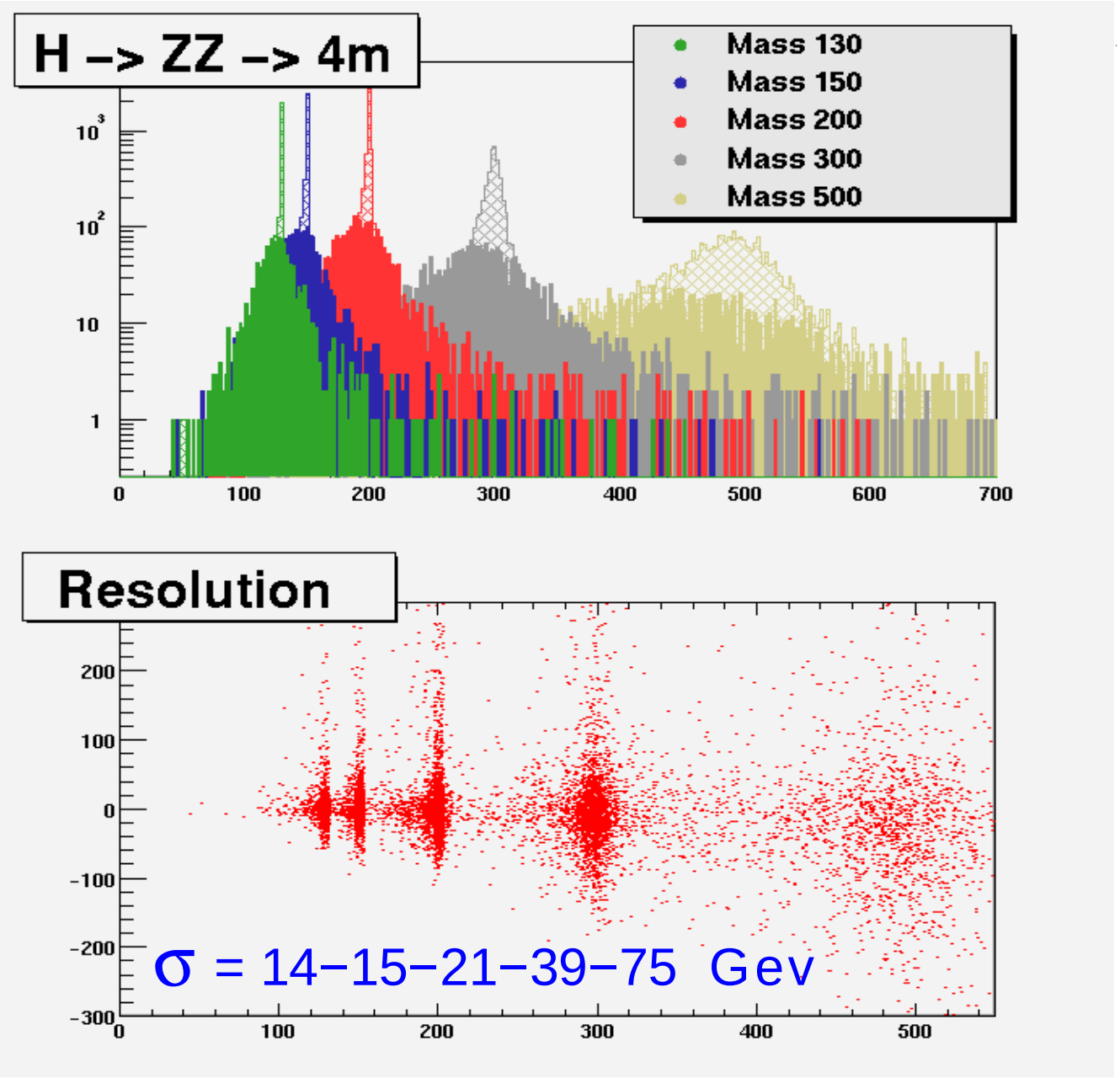
Barrel

Overlap

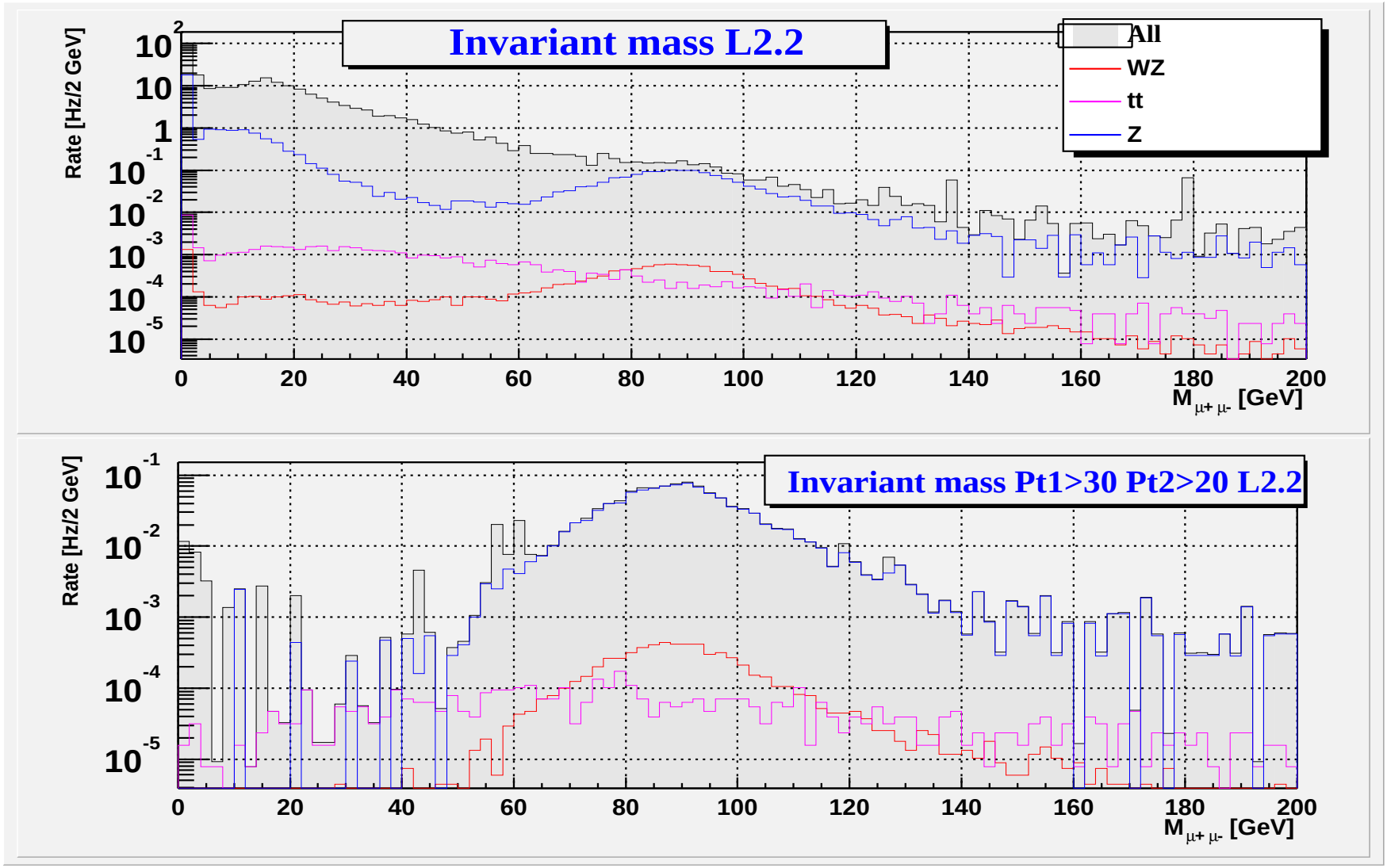
Endcap

Invariant mass



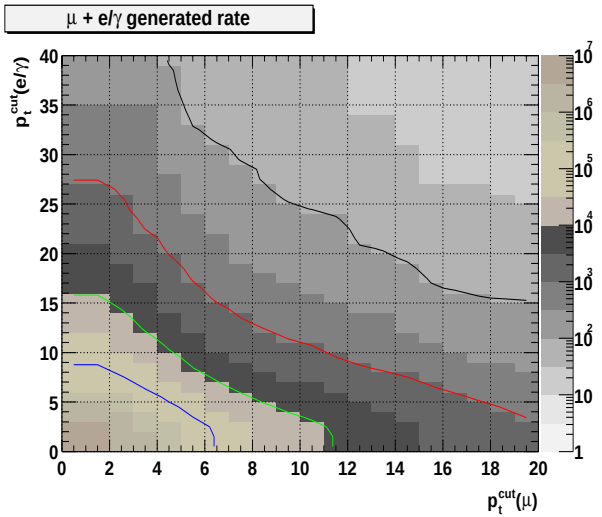


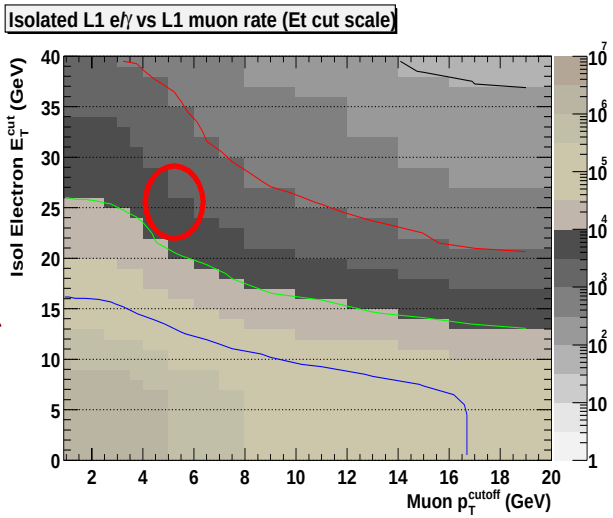
$H \rightarrow WW \rightarrow 2\mu$ selection



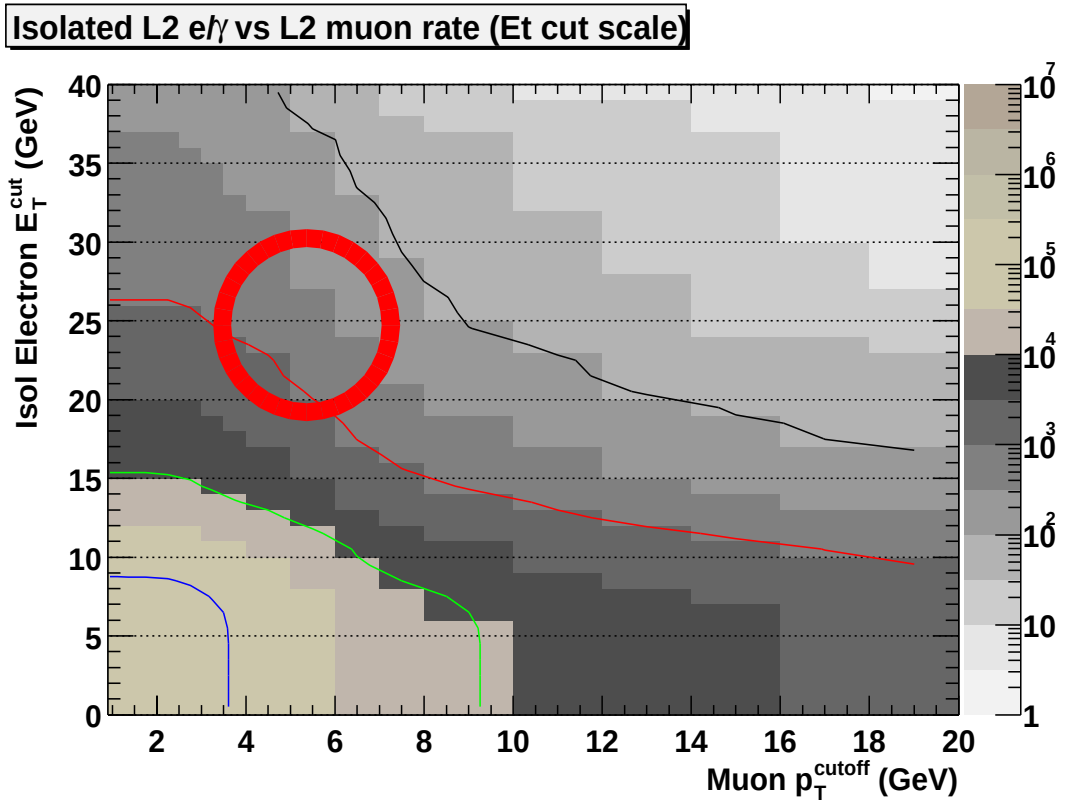
L2 e/γ × L2 μ

L1 calo + L1 muon





L2 μ (A.Vitelli)



L2 e/γ (E.Meschi)

People

ORCA muon code developers:

A.Vitelli (TO)	Muon-barrel package coordinator (*)
T.Cox (UCDavis)	Muon-EndCap " "
C.Grandi (BO)	DT-L1 trigger
B.Tannenbaum (UCLA),D.Acosta (UFl)	CSC L1, Endcap TrackFinder
M.Konecki (Cracow),G.Bruno (Pv)	RPC L1
N.Neumeister , M.Fierro (Cern)	Barrel TrackFinder, GMT
R.Wilkinson(UCLA)	CSC digi
P.Ronchese (Pd)	DT digi
S.Lacaprara (Pd) ,A.Fanfani(Bo)	HLT-L2

Needed MC production and analysis activity carried out by the same persons (more or less).

(*) on leave from CMS

Future: missing issues

OSCAR (Geant4) <=> ORCA interface

Alignement/Calibration software

Validation from Test Beam analysis

Muon + Tracker reconstruction in ORCA (just starting)

Physics analysis