Chamber Efficiency from commissioning cosmic data

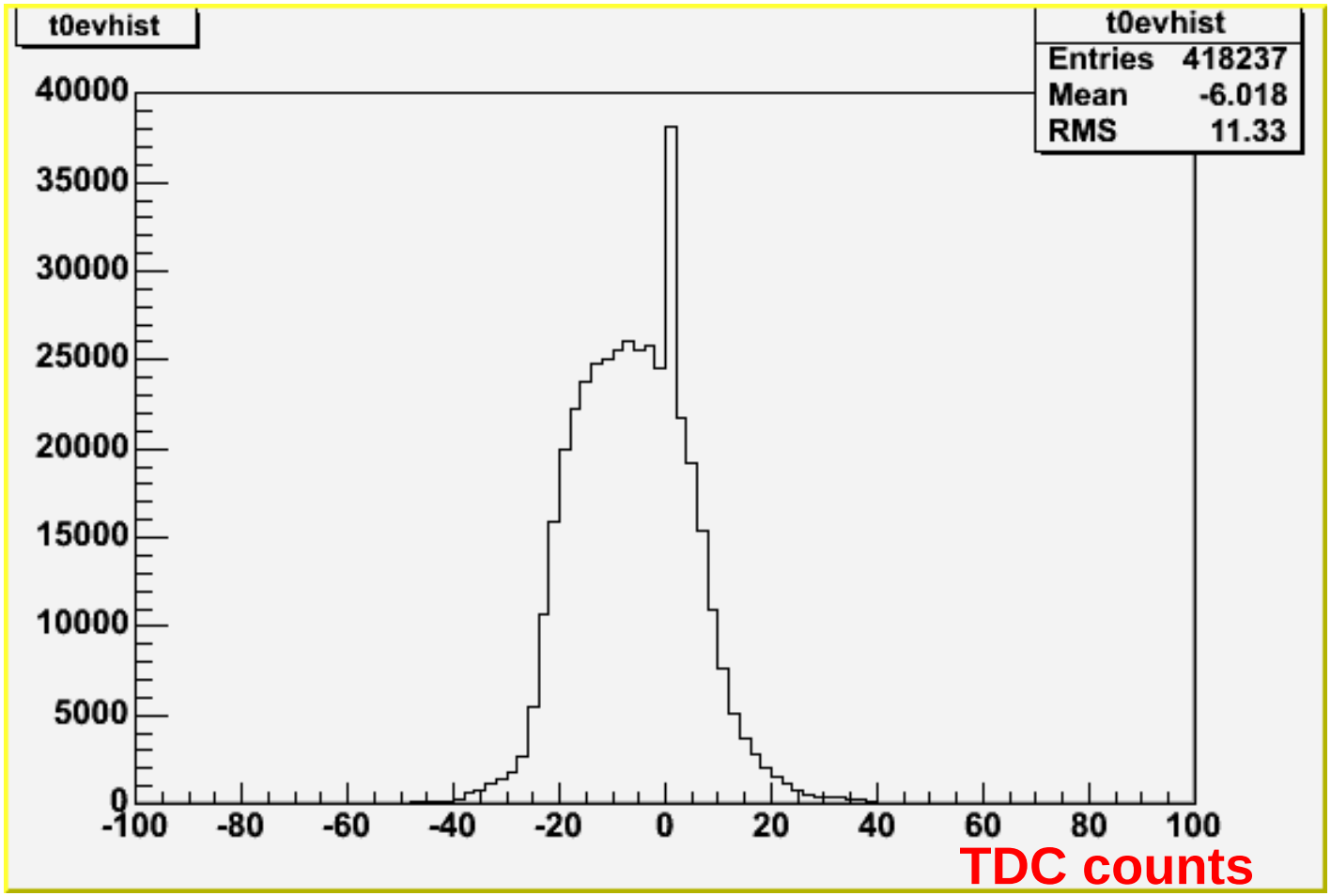
- Wheel 1 + Wheel 2
- Track reconstruction efficiency
- Local efficiency:
  - Cell efficiency
  - Layer efficiency
- Some runs are missing, some have problems, some local behaviours have to be better understood

Data used:

- Trigger: HAnyTheta, whenever available, for MB1, MB2, MB3; HHandHL or Default for MB4
- Local track reconstruction and tree production with ORCA_8_7_1 (P.Ronchese)
  - Constant v_{drift} (T_{max} = 492 TDC counts)
  - Constant error associated to each hit (300 μm)
- TP correction (compensation for delay found between the 2 TP lines: ~20% of the chambers) (A. Meneguzzo)
- t0 event by event determination (A. Meneguzzo)

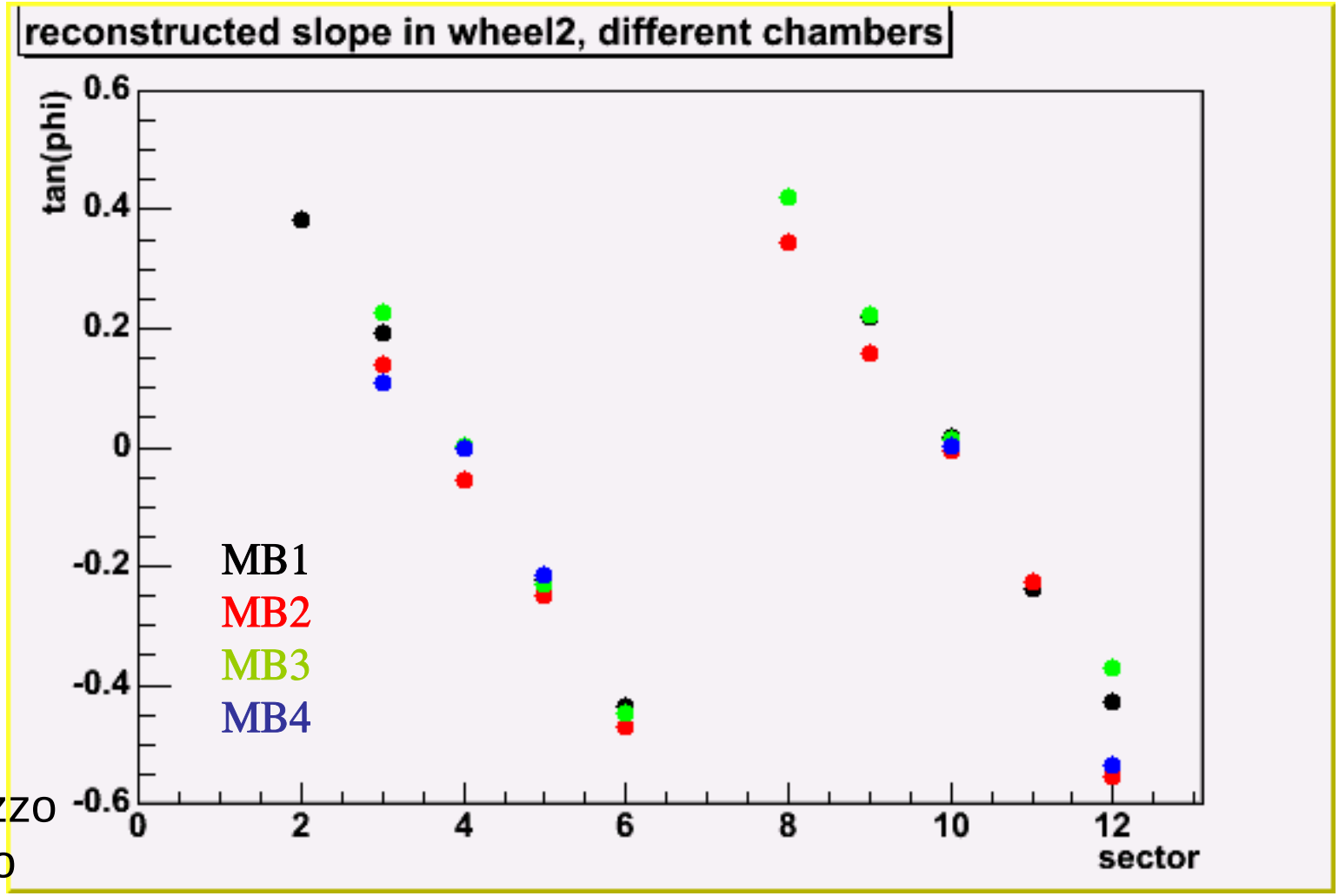
Example of t0 correction distribution

Anna Meneguzzo



Reconstructed track slope in Wheel 2

tan (Φ)



A. Meneguzzo
F.R. Cavallo

Reconstruction efficiency definition

$$\varepsilon_{Rn} = N_n/NEvent$$

where:

N_n = number of events with at least one track reconstructed in both Φ superlayers, with at least n points (n = 4, …,8)

NEvent = number of triggered events

Local efficiency definitions

- Cell efficiency:

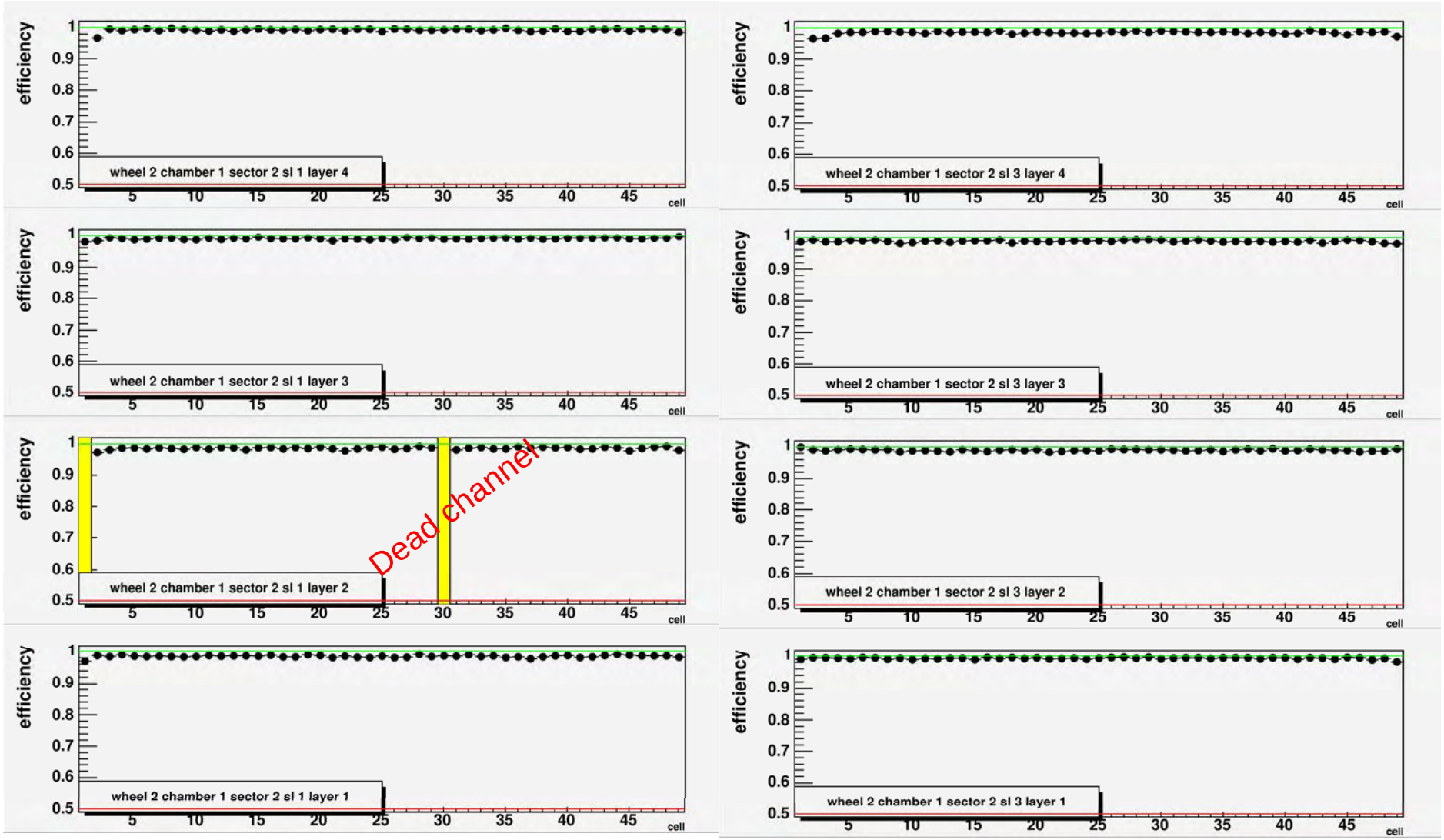
ε_c = Nh/Ntrack

where:

Ntrack = number of tracks reconstructed in both Φ superlayers, with at least 5 points (for Φ cells), or in Θ superlayer, with at least 3 points (for Θ cells), and traversing the considered cell.

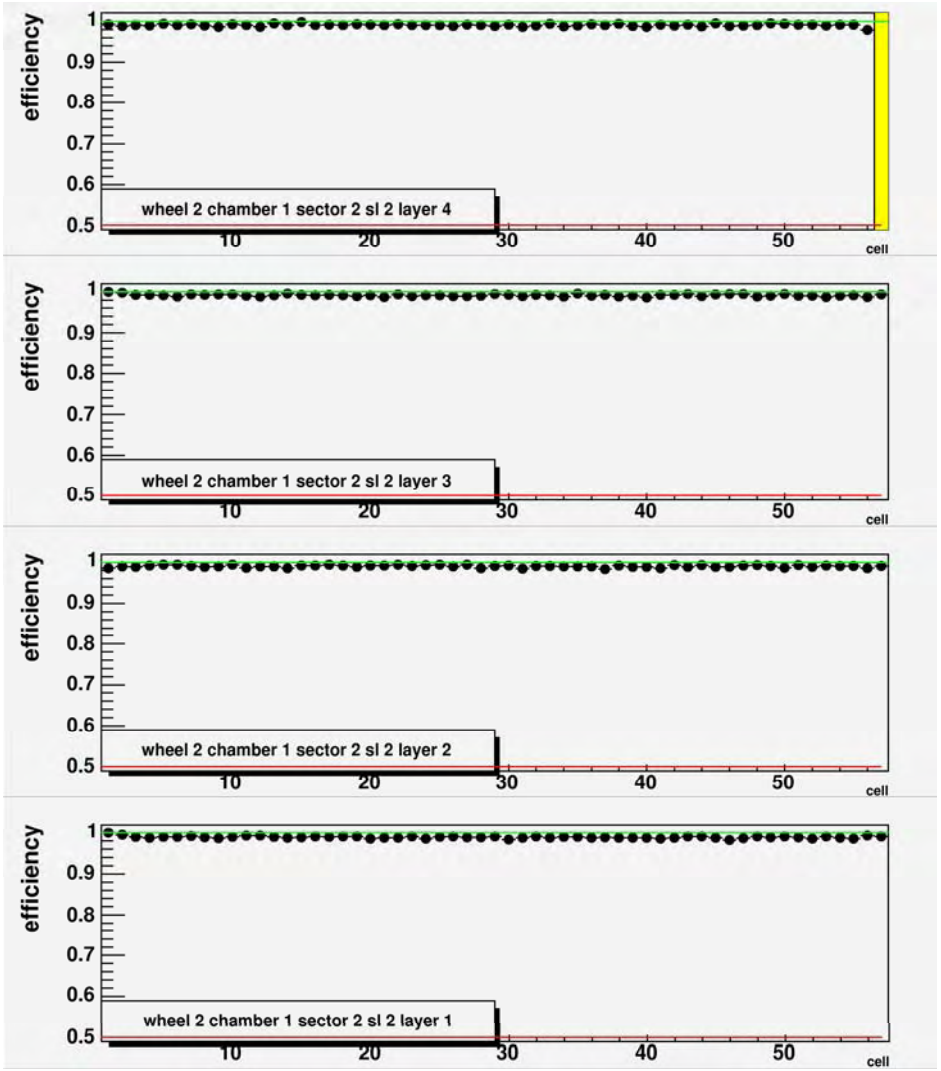
Nh = subset of Ntrack where hits are found within the considered cell or its 2 neighbours.

Example of cell efficiency (Φ sl)



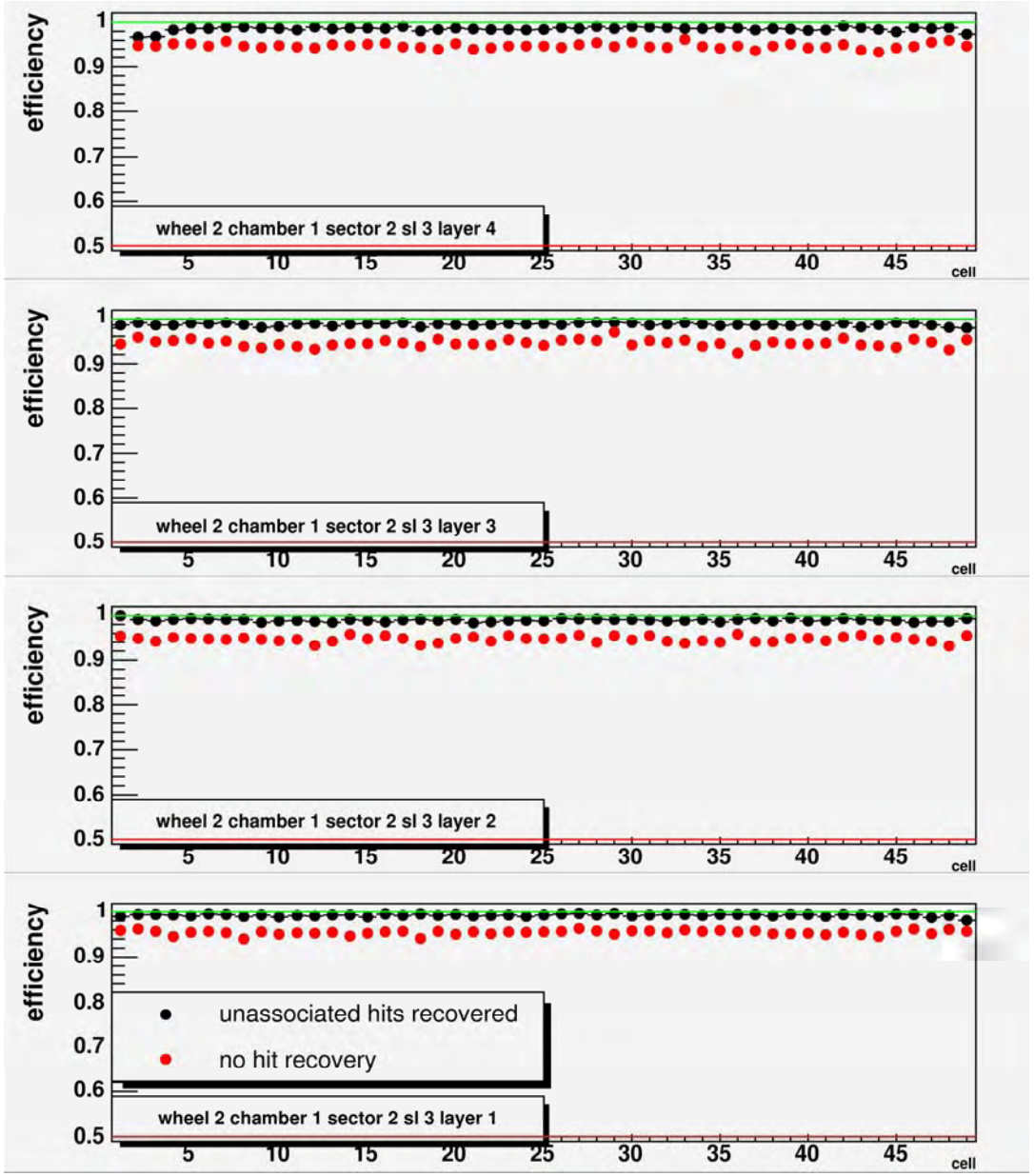
Example of cell efficiency (Θ sl)

Efficiency of good cells Is usually > ~ 99%



Effect of recovering unassociated hits

Unassociated hits whithin +- 1 cell contributes ~5% cell efficiency (mainly delta's)



Local efficiency definitions cont'd

- Layer efficiency:

ε_L = Nh/Ntrack

Efficiency of good layers is usually > ~98%

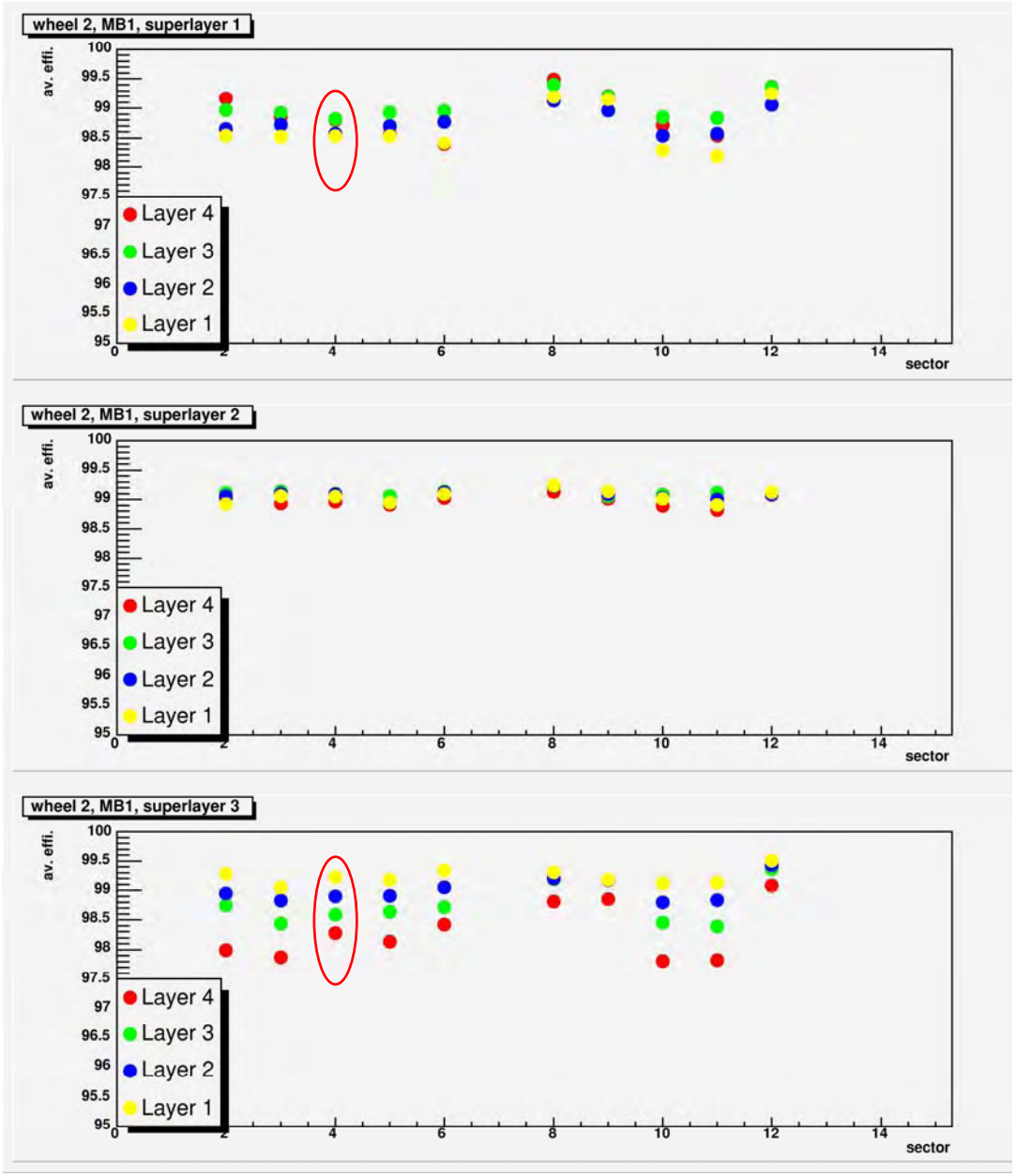
where:

Ntrack = number of tracks reconstructed as before (for Θ and Φ) and traversing the considered layer

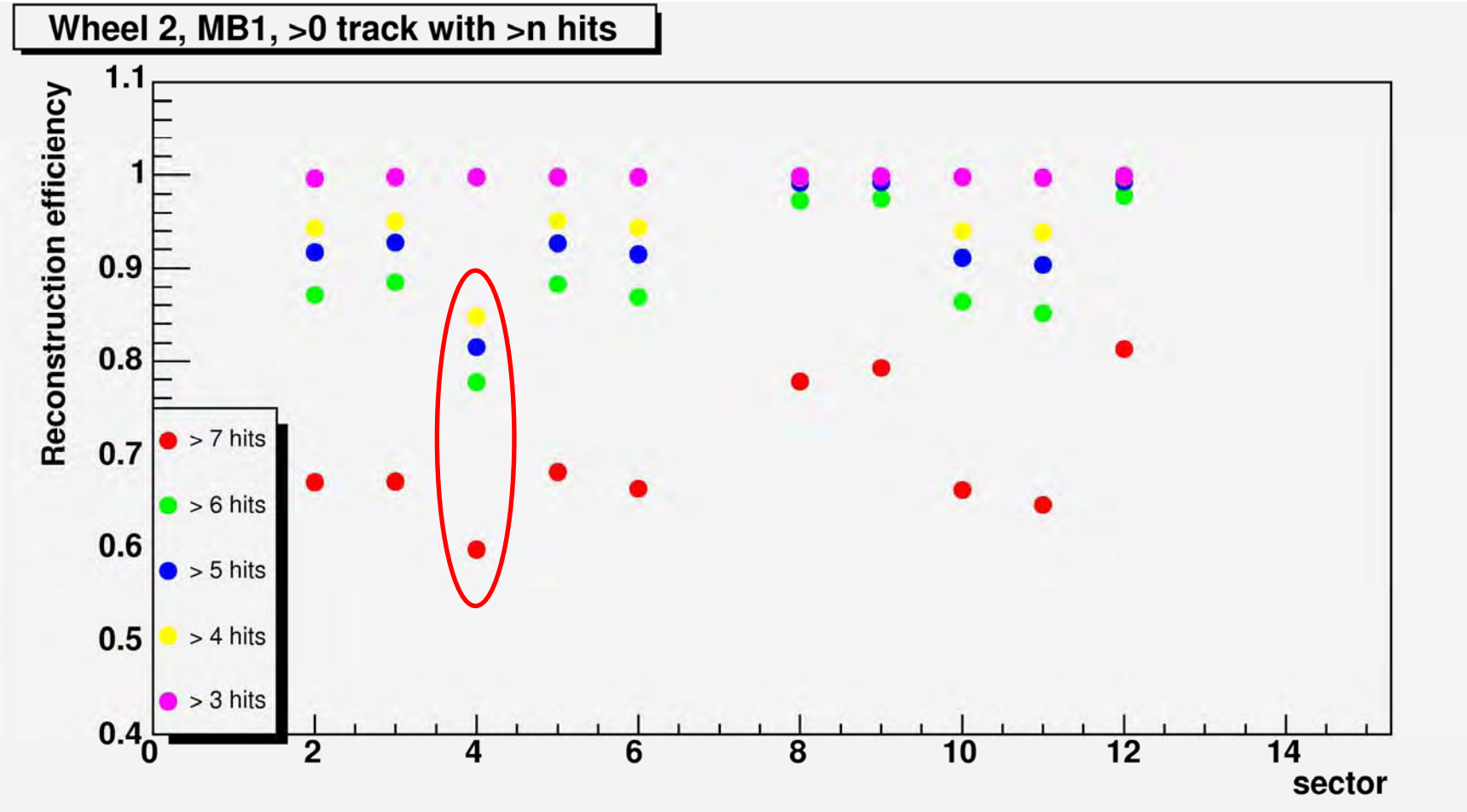
Nh = subset of Ntrack where hits are found in the considered layer, within the traversed cell or its 2 neighbours.

N.B cells with $\varepsilon_c < 0.5$ don't contribute to computation.

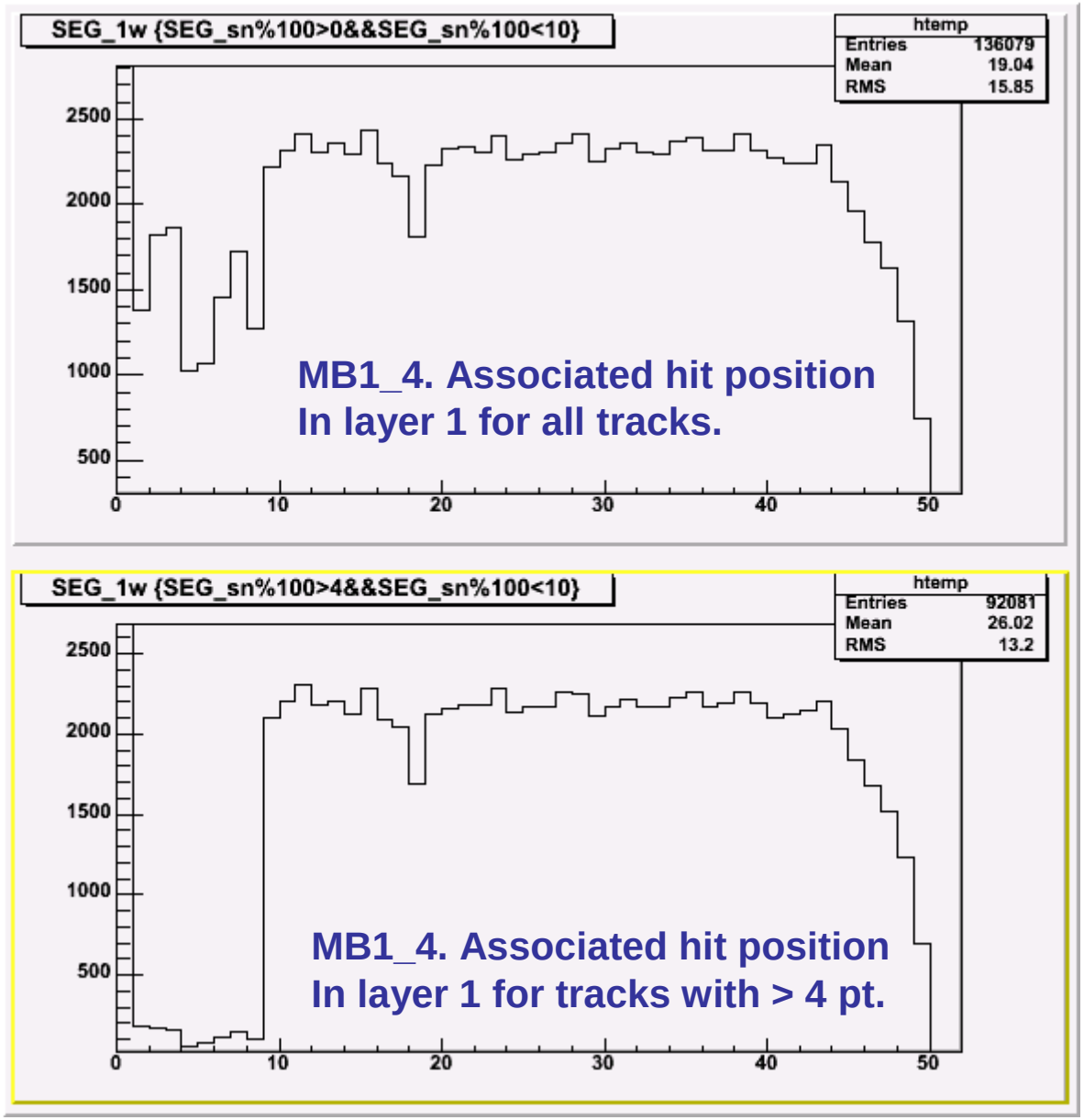
"Local" efficiency and "reconstruction" efficiency give different and complementary information.
e.g. MB1_4 has normal Loc. Eff. but poor Rec. Eff.
……



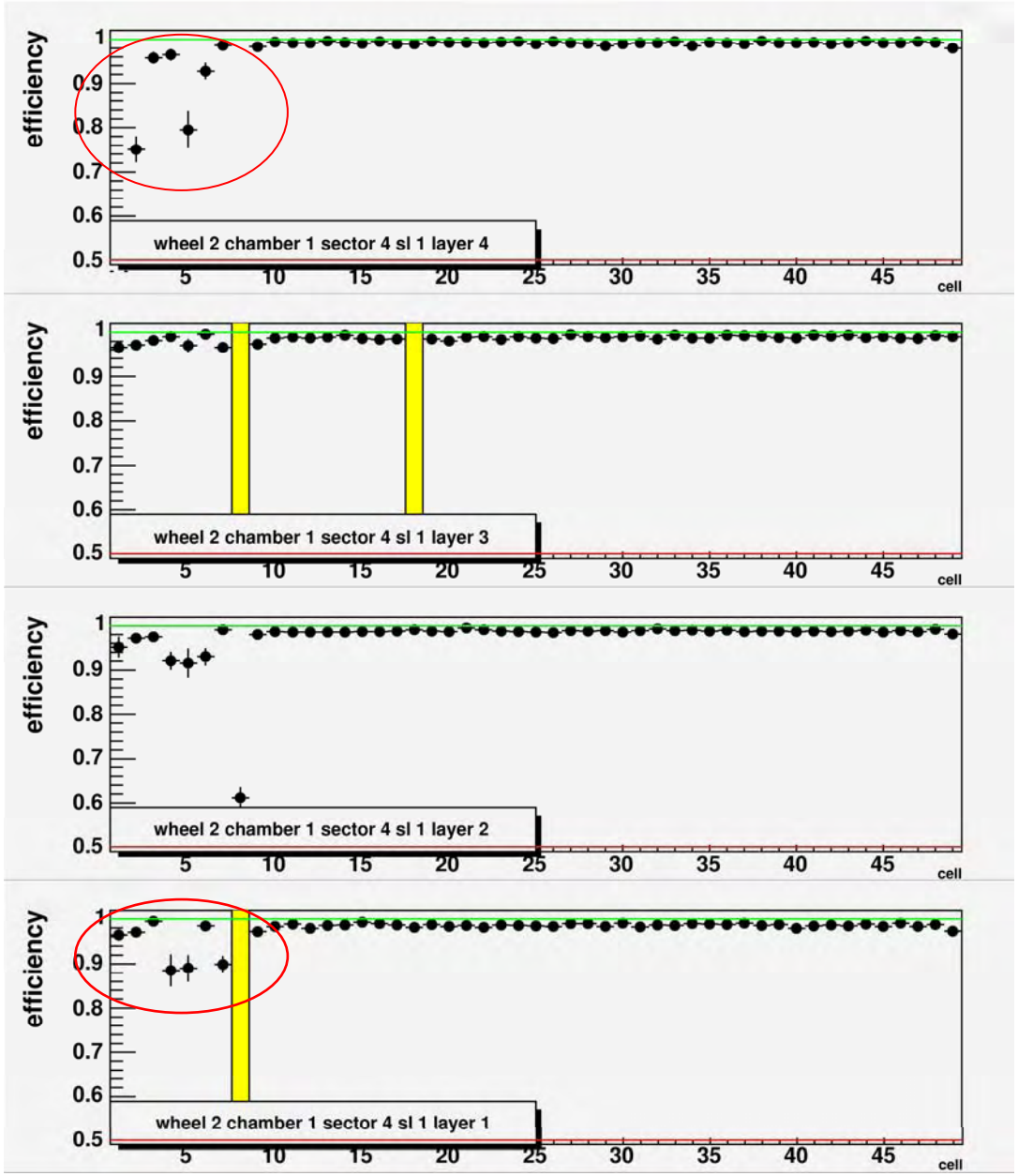
W2-MB1 Reconstruction efficiency



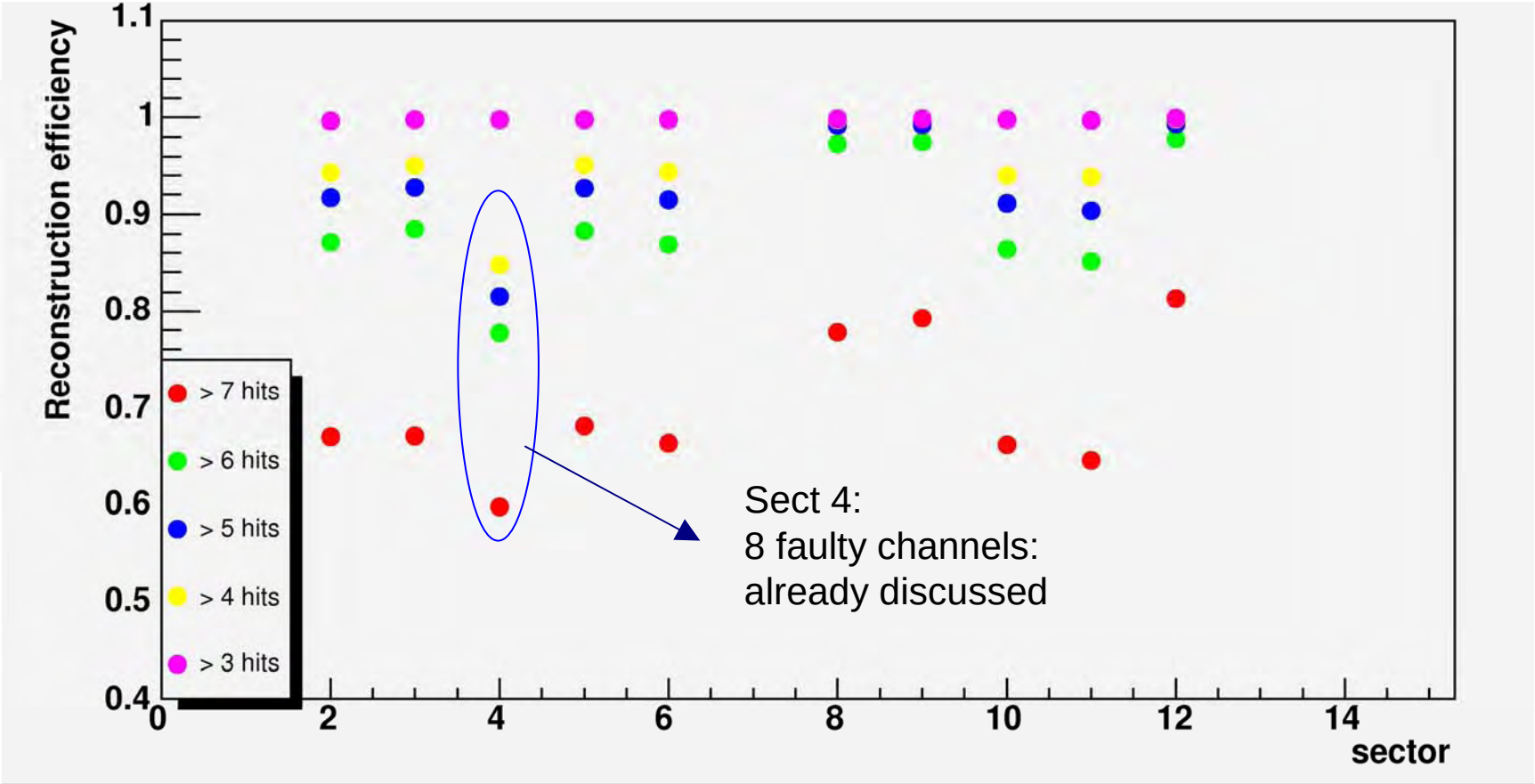
In fact, though raw hit occupancy looks *almost* “normal”, there is a lack of tracks in the first 8 channels of $\Phi 1$ (wrong hardware connections)
Poor statistics translates to larger errors but not necessariry to lower local efficiency!



MB1_4
Cell efficiency

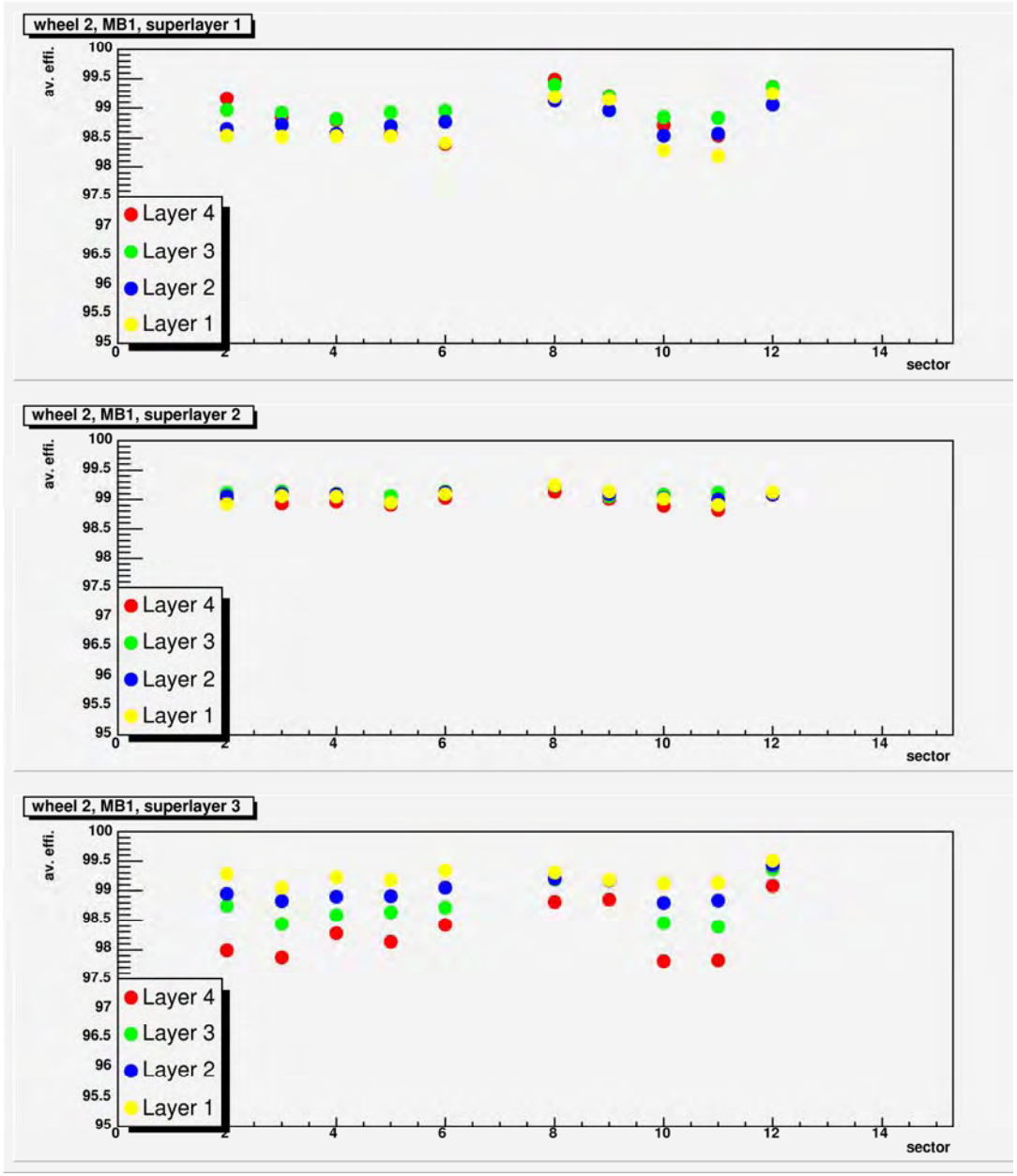


Wheel 2 summary:
MB1 reconstruction efficiency



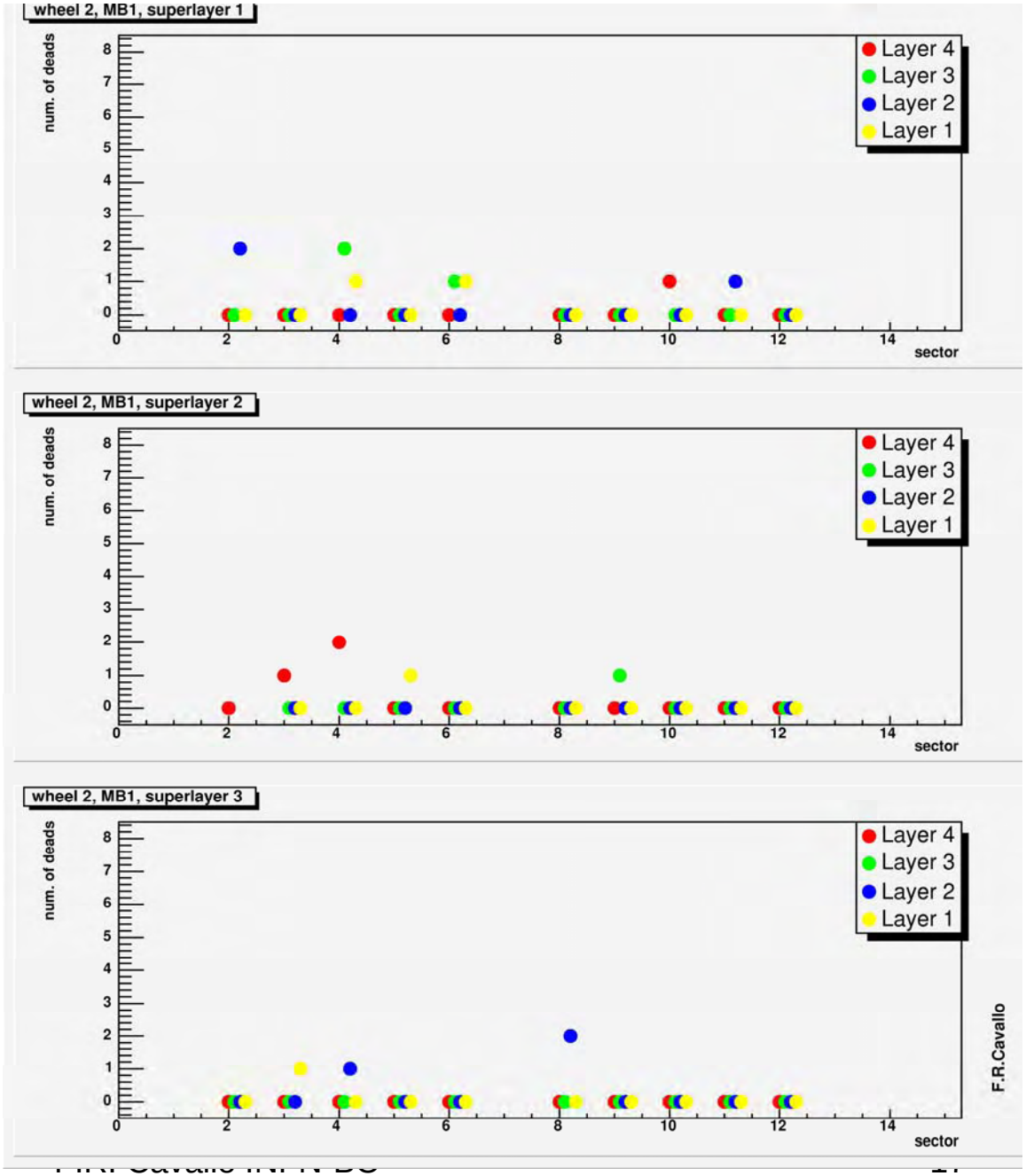
Wheel 2 summary

MB1 layer efficiencies

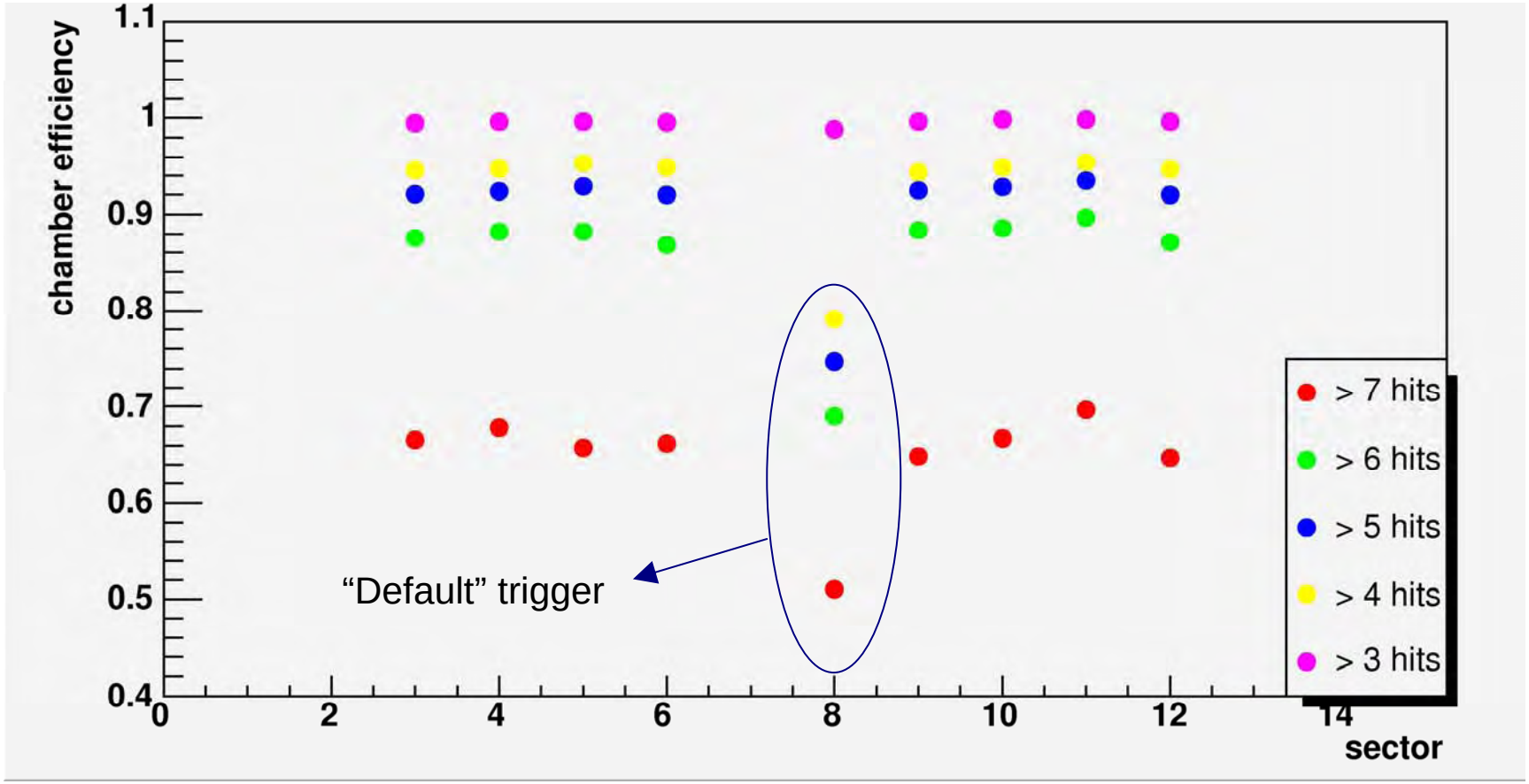


Wheel 2 summary

MB1 number of dead channels

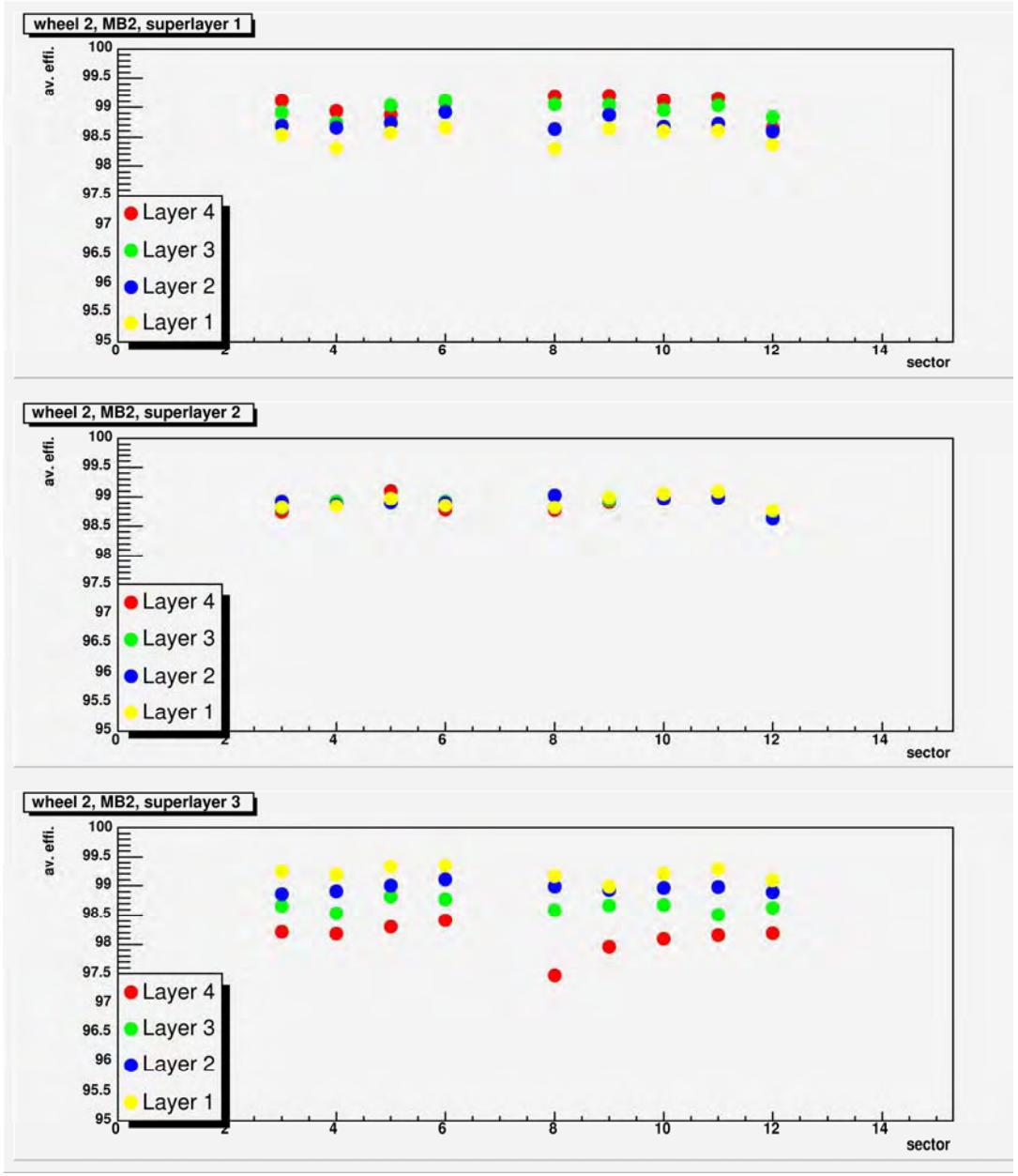


Wheel 2 summary:
MB2 reconstruction efficiency

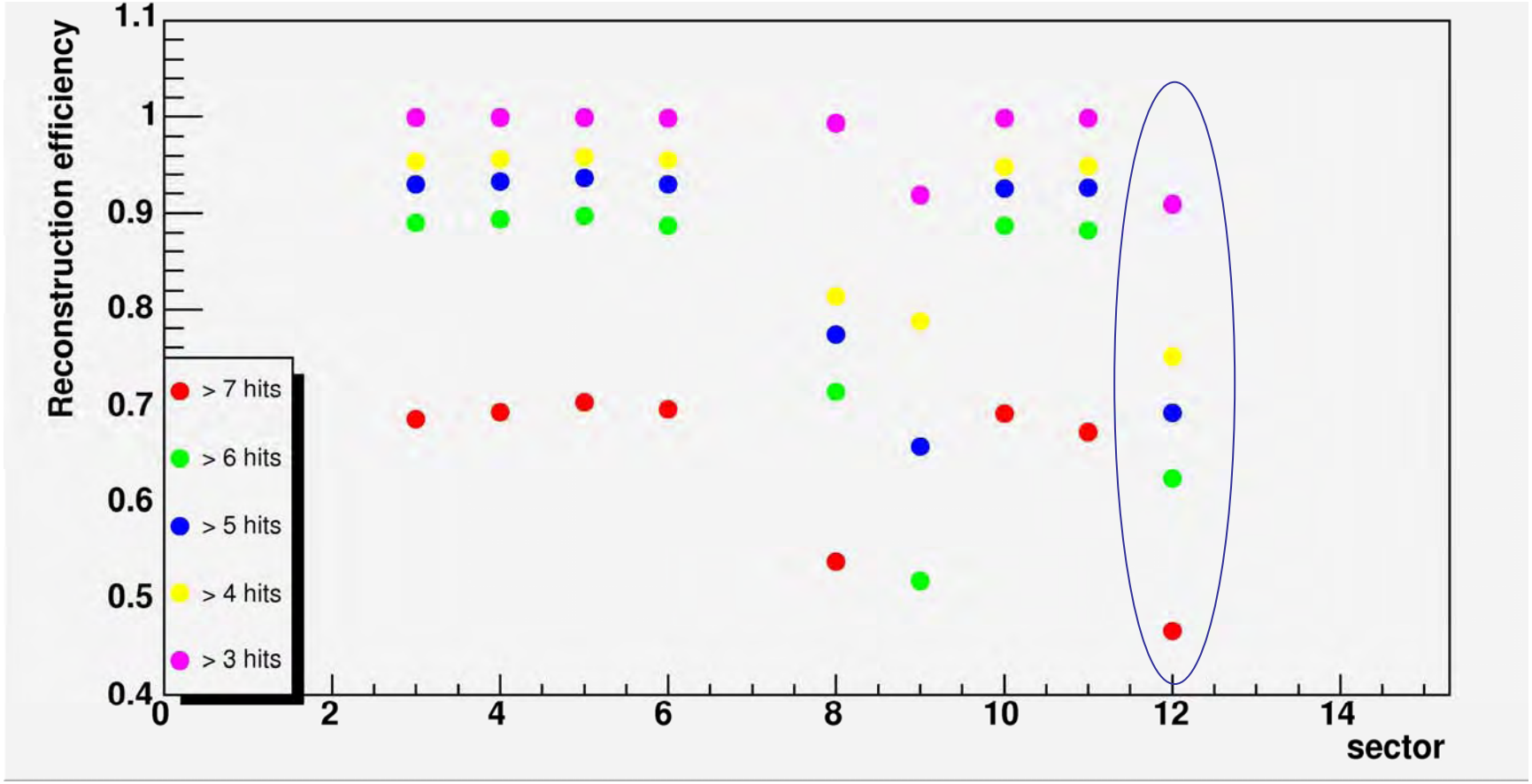


Wheel 2 summary

MB2 layer efficiencies



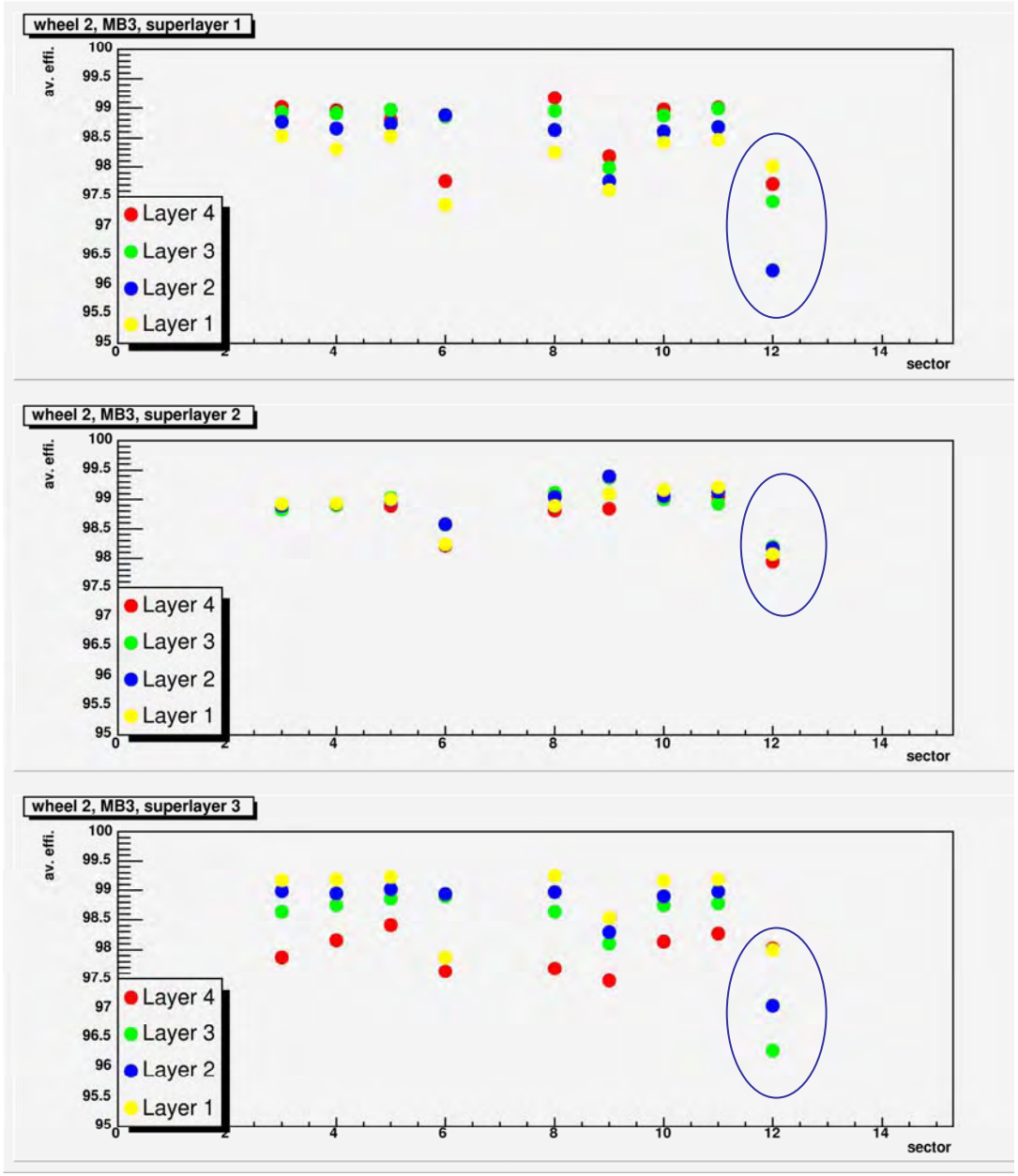
Wheel 2 summary:
MB3 reconstruction efficiency



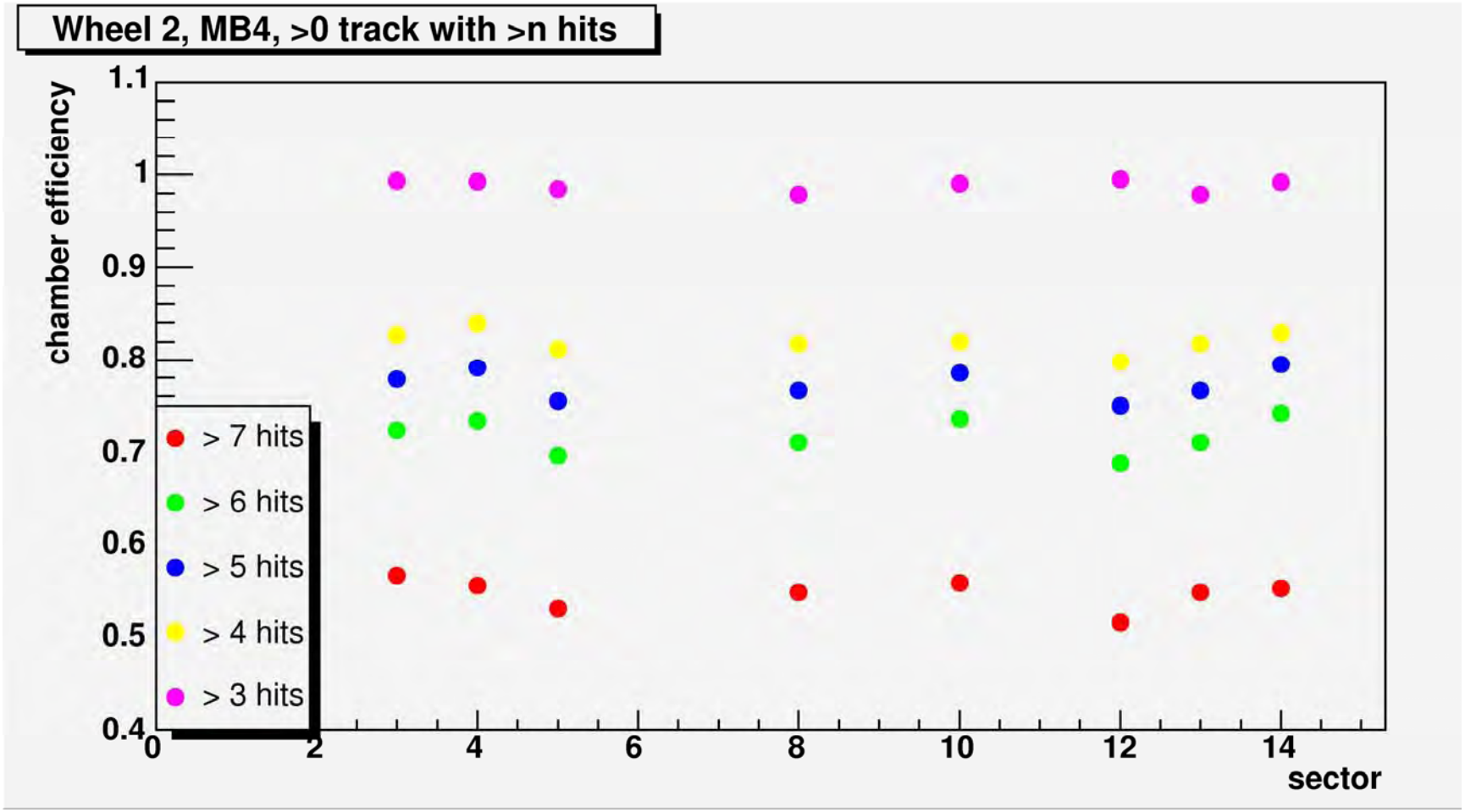
Wheel 2 summary

MB3 layer efficiencies

Sector 12 has a bad HAnyTheta run and must be investigated



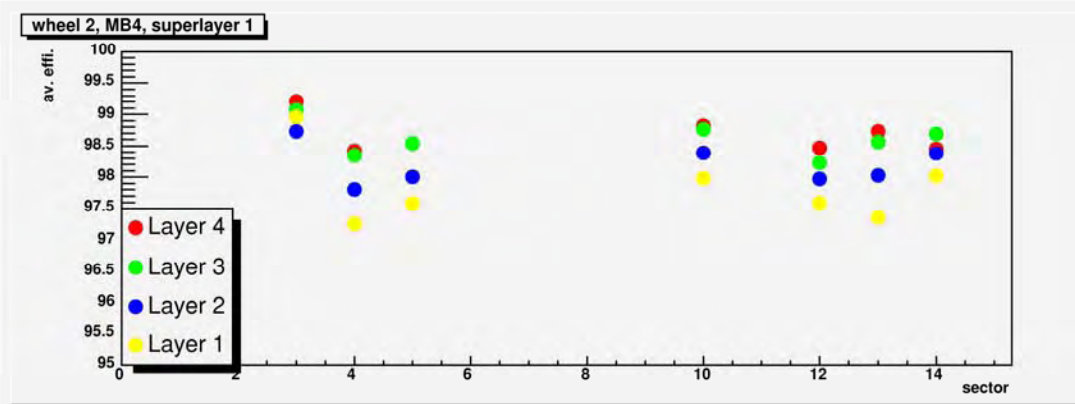
Wheel 2 summary: MB4 reconstruction efficiency

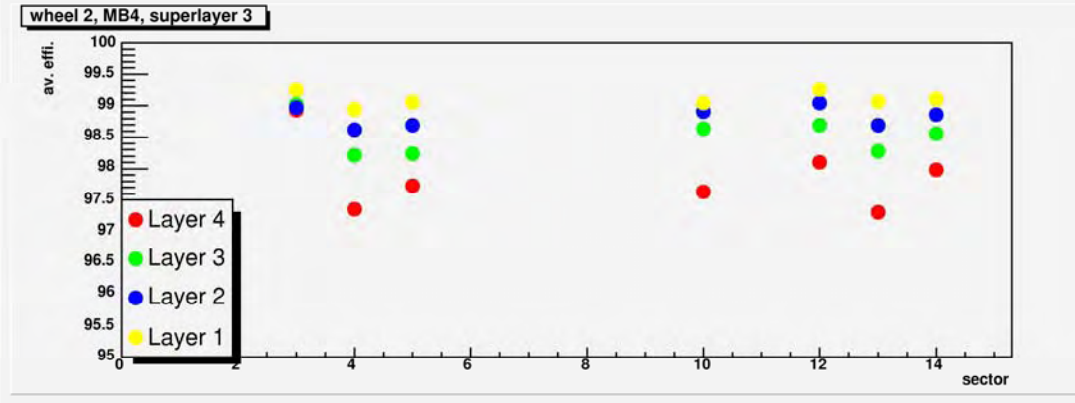


Wheel 2 summary

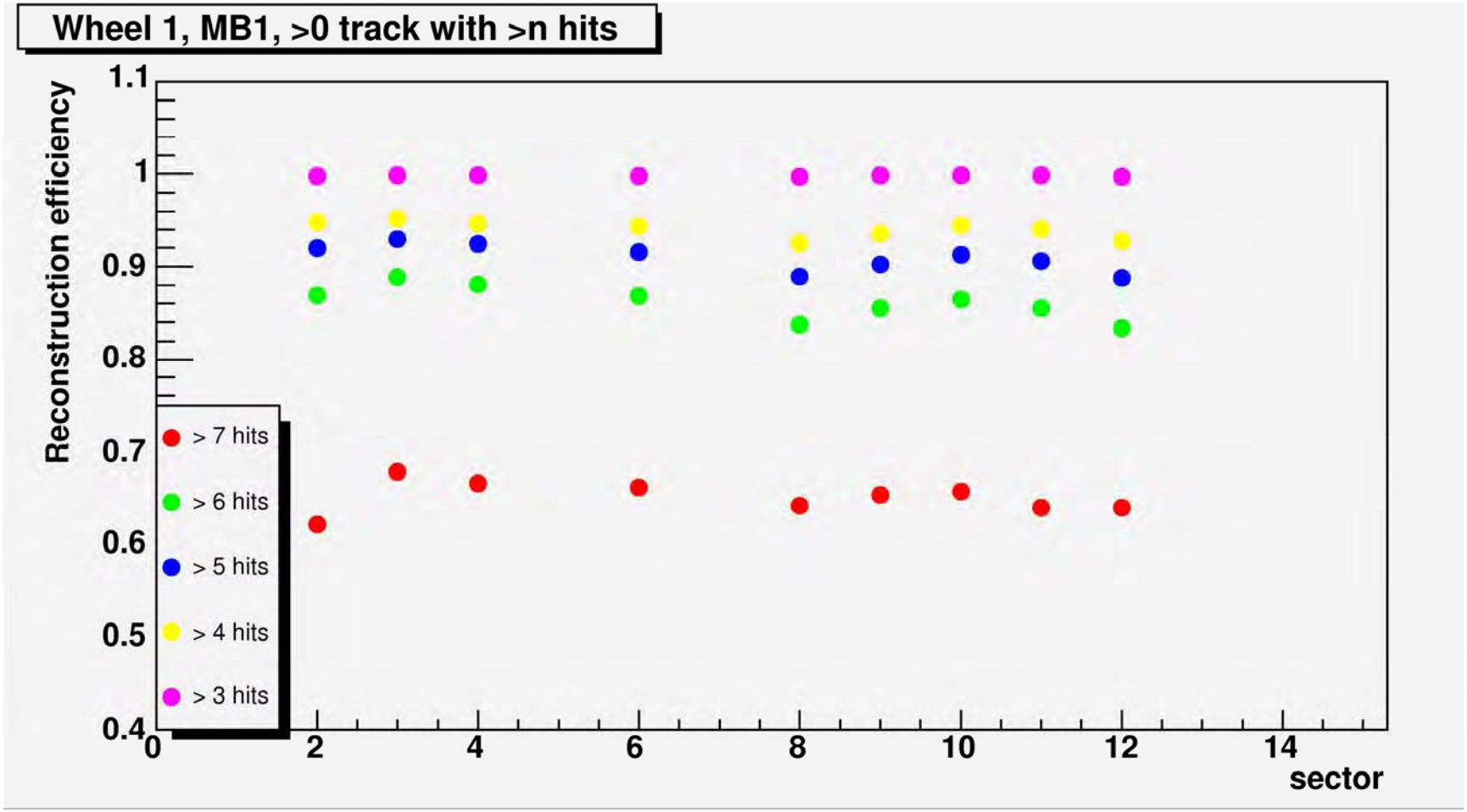
MB4 layer efficiencies

(a few runs missing)



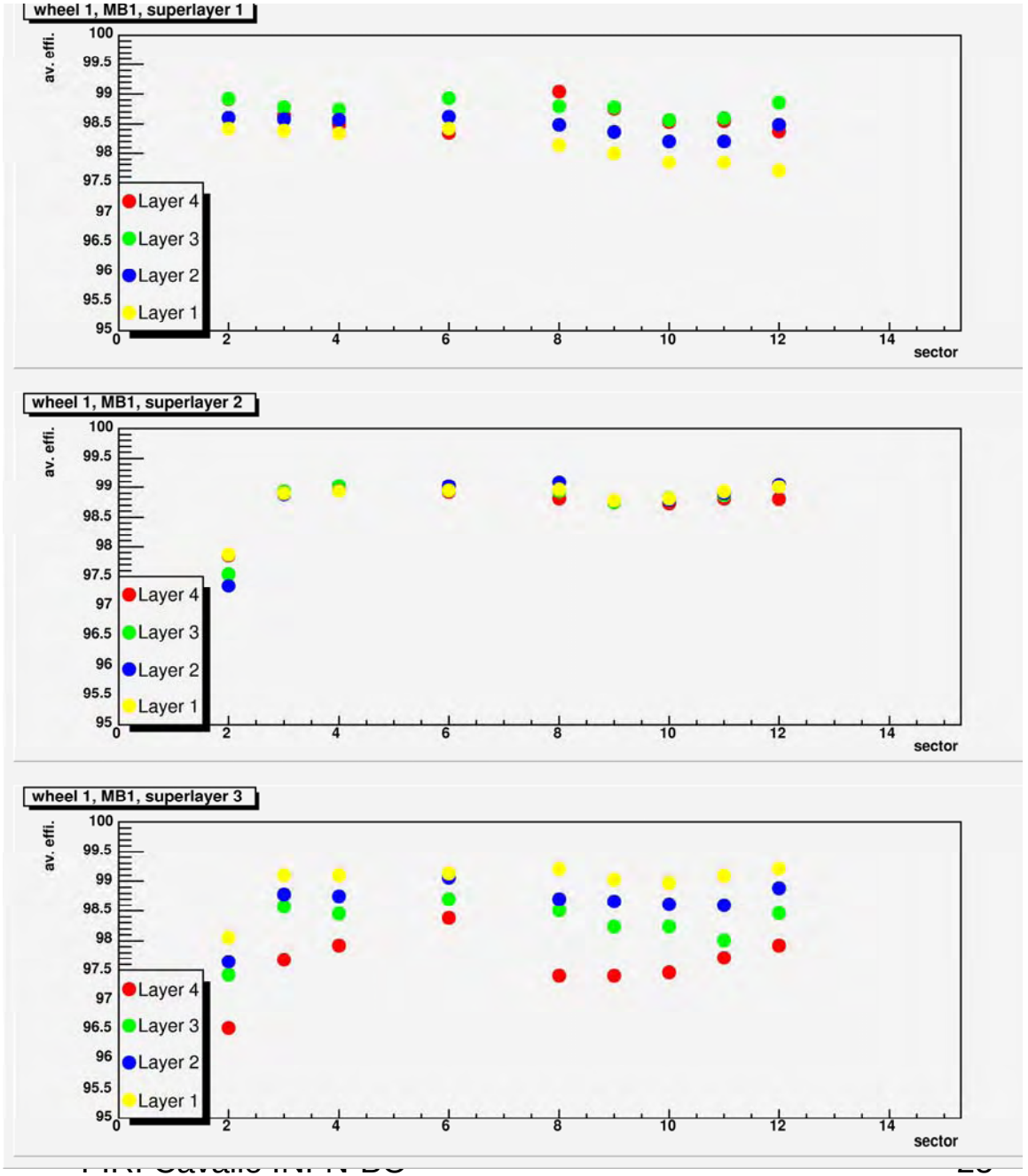


Wheel 1 summary:
MB1 reconstruction efficiency

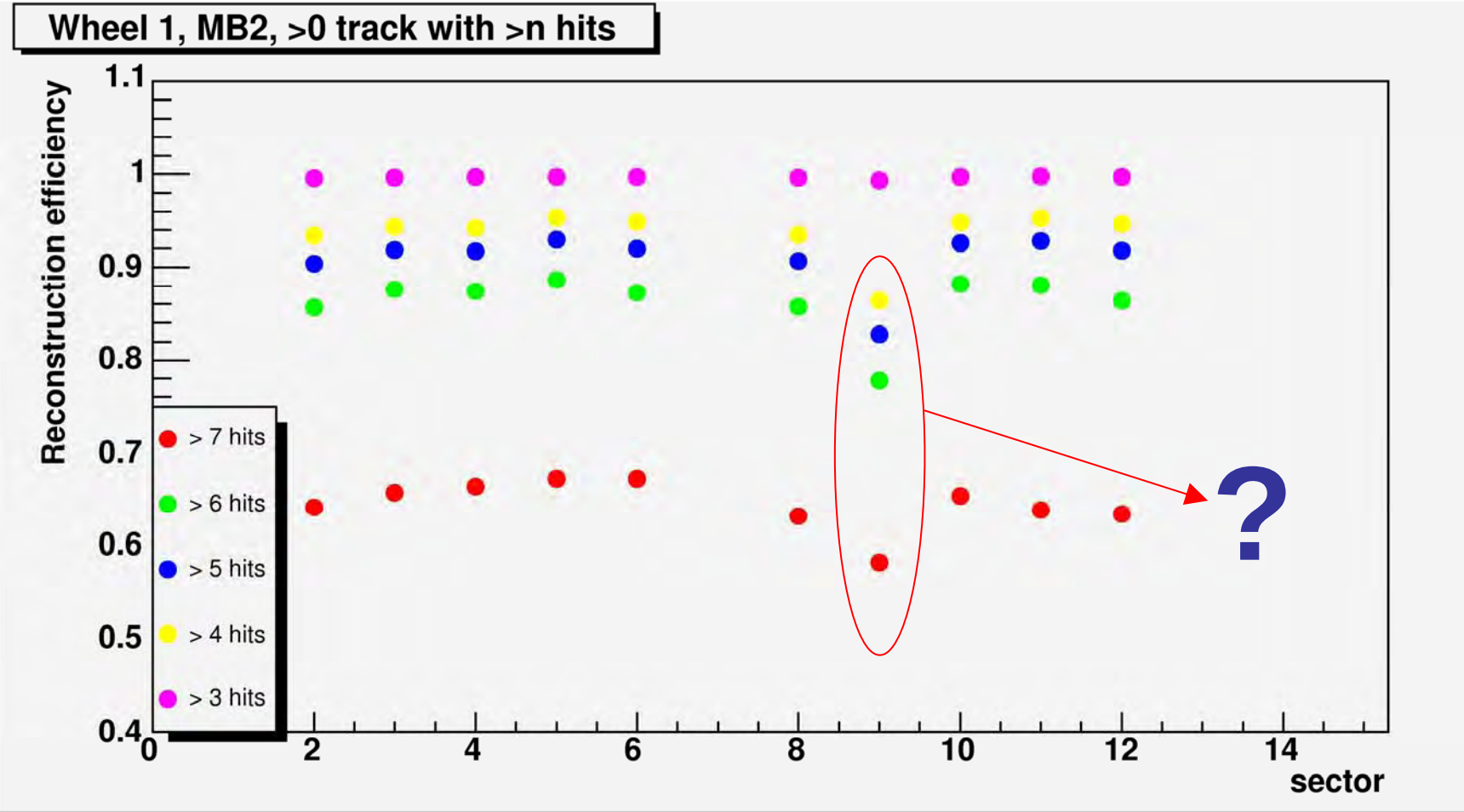


Wheel 1 summary

MB1 layer efficiencies

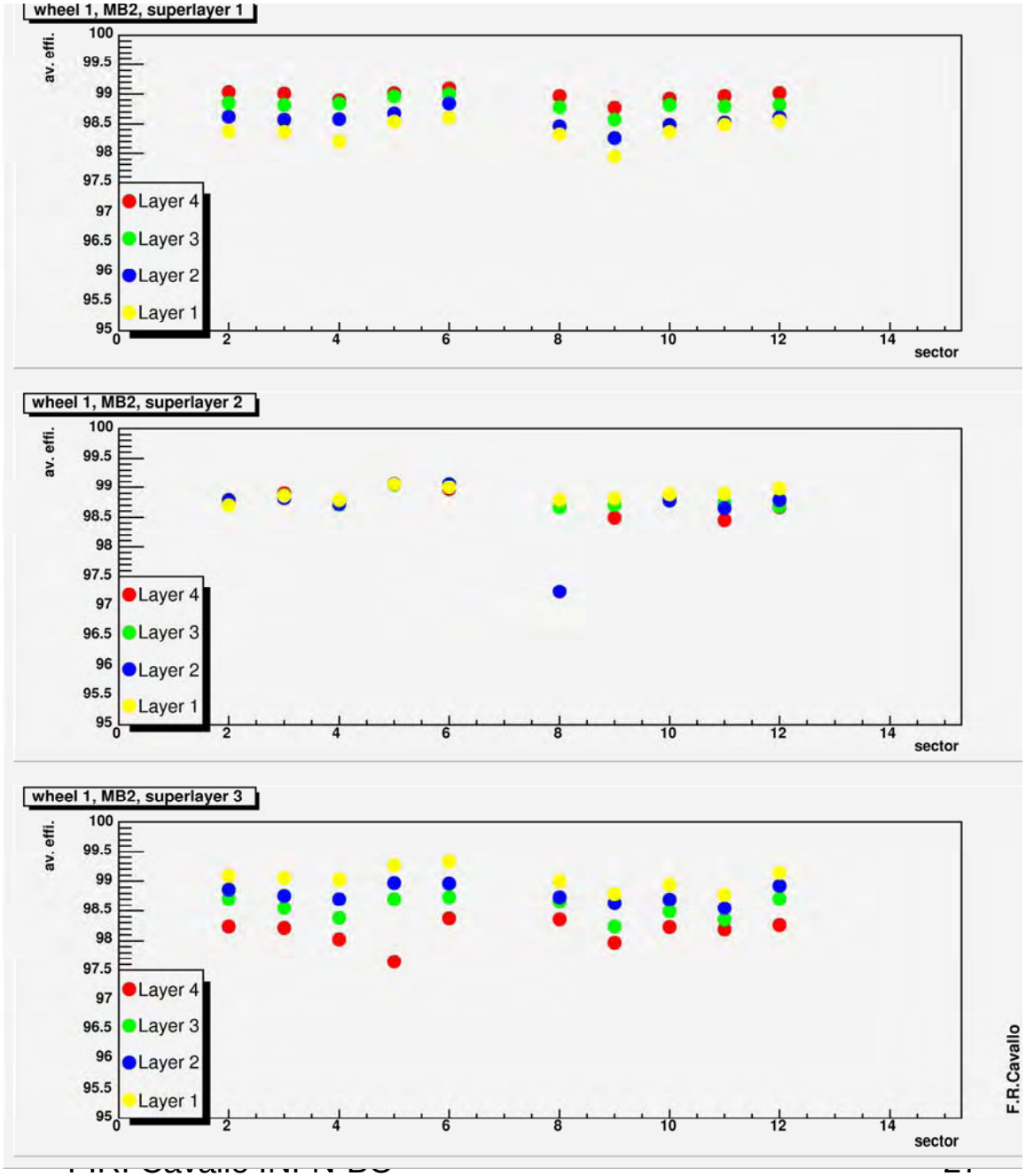


Wheel 1 summary:
MB2 reconstruction efficiency

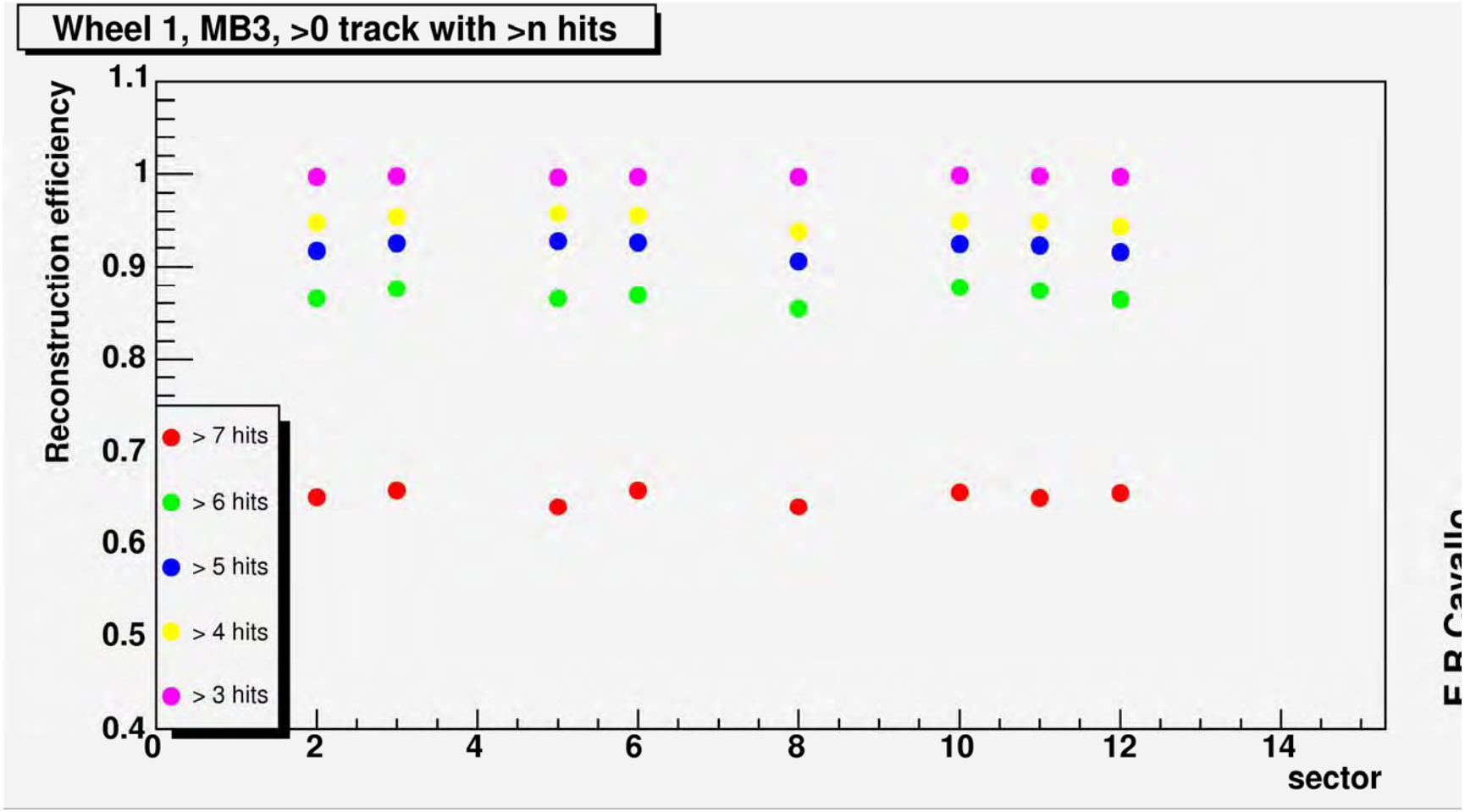


Wheel 1 summary

MB2 layer efficiencies

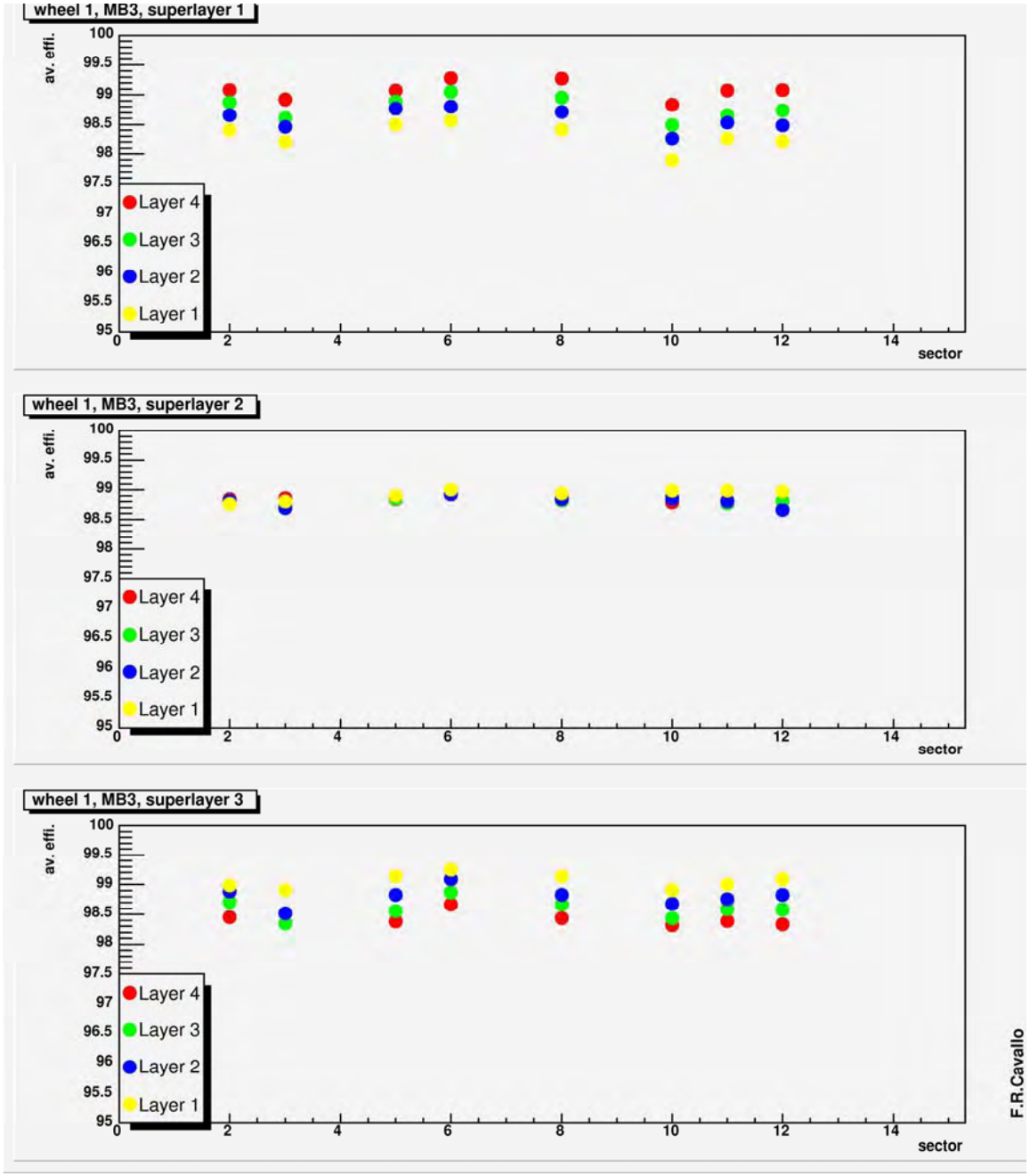


Wheel 1 summary:
MB3 reconstruction efficiency

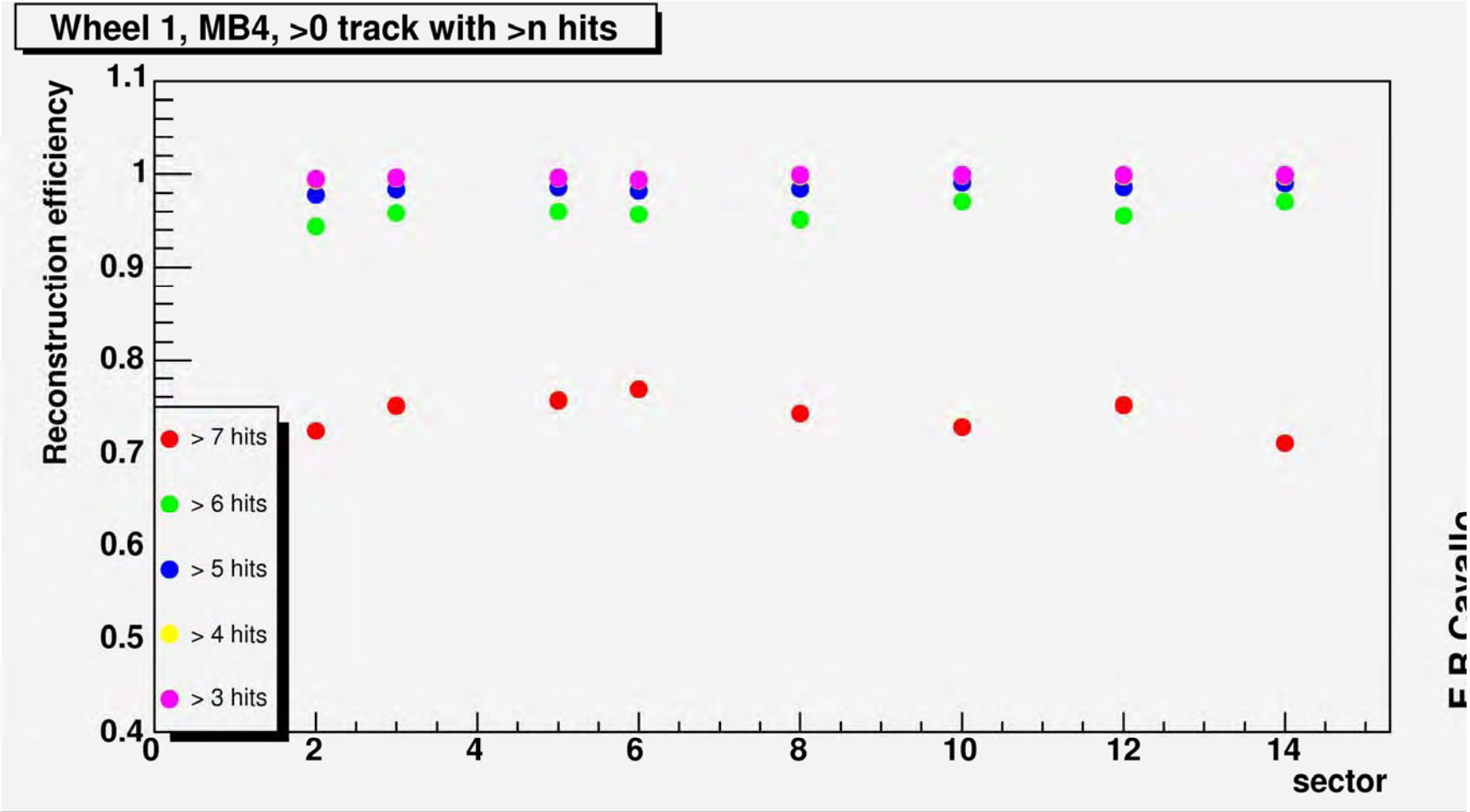


Wheel 1 summary

MB3 layer efficienciency



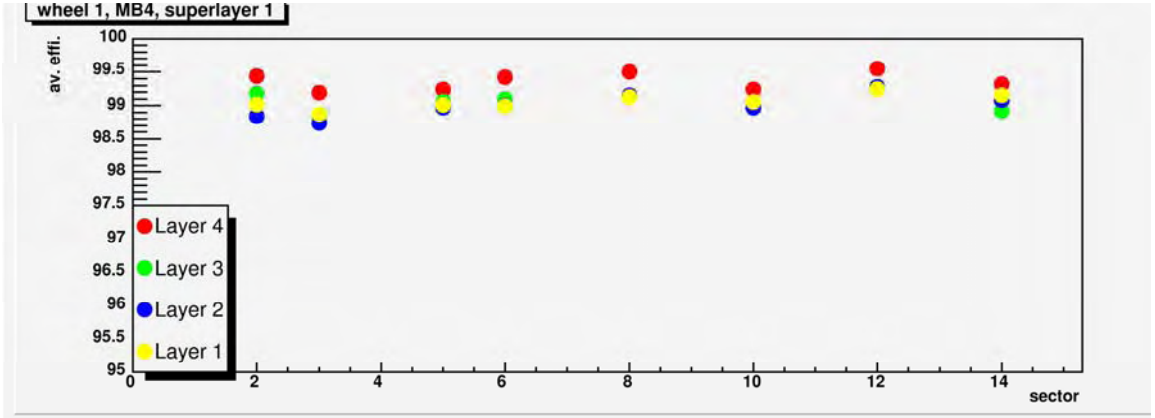
Wheel 1 summary: MB4 reconstruction efficiency

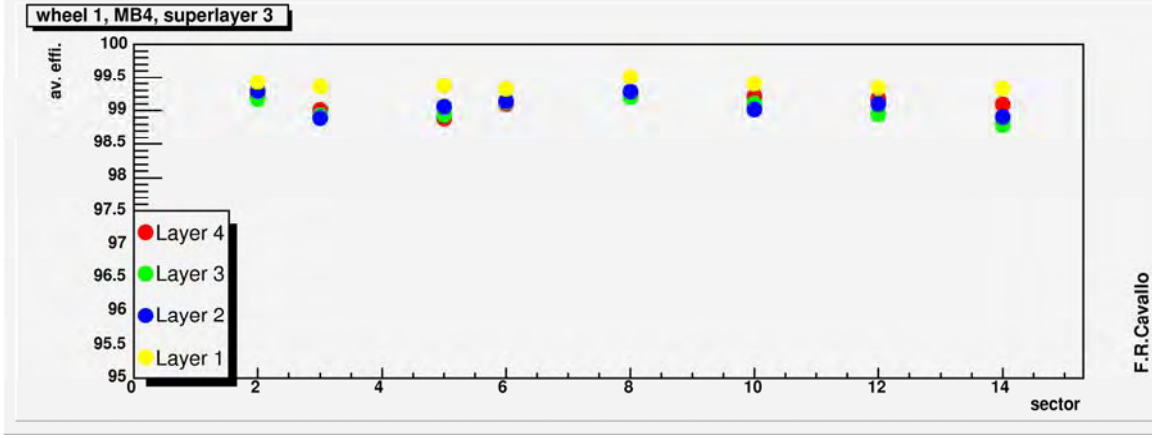


Wheel 1 summary

MB4 layer efficiencies

(a few runs missing)





Ongoing:

- A few chambers haven't been analysed yet.
  (Some runs were missing from runlist and just recovered - thanks Kerstin - from paper logbook)
- For a few chambers only a "default" trigger run exists: they need a special treatment in order to suppress the fake triggers and the apparent loss of Reconstruction Efficiency
- The results could be included in the commissioning web pages and made available to everybody

Ongoing cont'd

- Compute local efficiency of a SL, using tracks reconstructed in the other one (make SL's independent of each other)
- Compute Θ efficiency using no Θ trigger runs (e.g. HHand HL)
- Fine study of efficiency vs drift distance and vs track inclination within each run.
- …..

Conclusions

- Local (cell and layer) efficiencies and track reconstruction efficiencies have been computed for (most of) the chambers installed in W2 and W1
- The results are consistent with the trigger logic applied (high with HAnyTheta, higher with HHandHL, lower with uncorrelated trigger) and independent of track inclination (sector)
- We shall be able to evaluate trigger efficiency using cosmic Monte Carlo and our well tested trigger emulator