

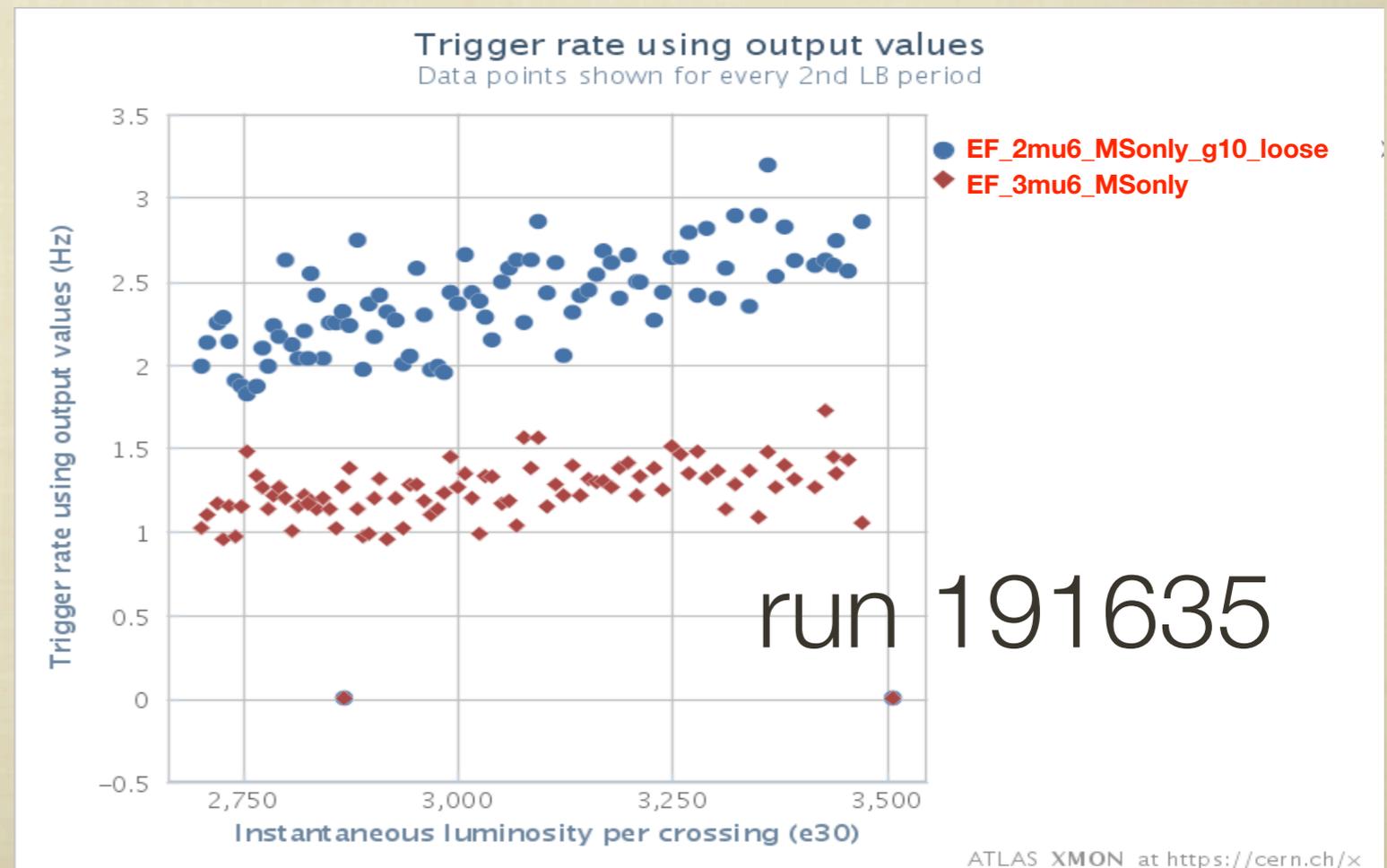
TRIGGERS FOR NON-PROMPT LEPTONJETS IN THE 2012 MENU

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Triggers in 2011 menu

- Two dedicated triggers for selecting non-prompt leptonjets, unrescaled in 2011 menu
 - **3mu6_MSonly**: selects decays to muonjets
 - “A SEARCH FOR LONG-LIVED LEPTONJETS FROM HIGGS DECAY IN THE ATLAS DETECTOR” (ATL-COM-PHYS-2011-1365, APPROVED BY EXOTICS, PRL DRAFT ALMOST IN THE FINAL VERSION FOR PUBLIC READING)
 - also used for prompt muonjets
 - **2mu6_MSonly_g10_loose**: for selection of displaced decays to leptonjets (electrons+muons)

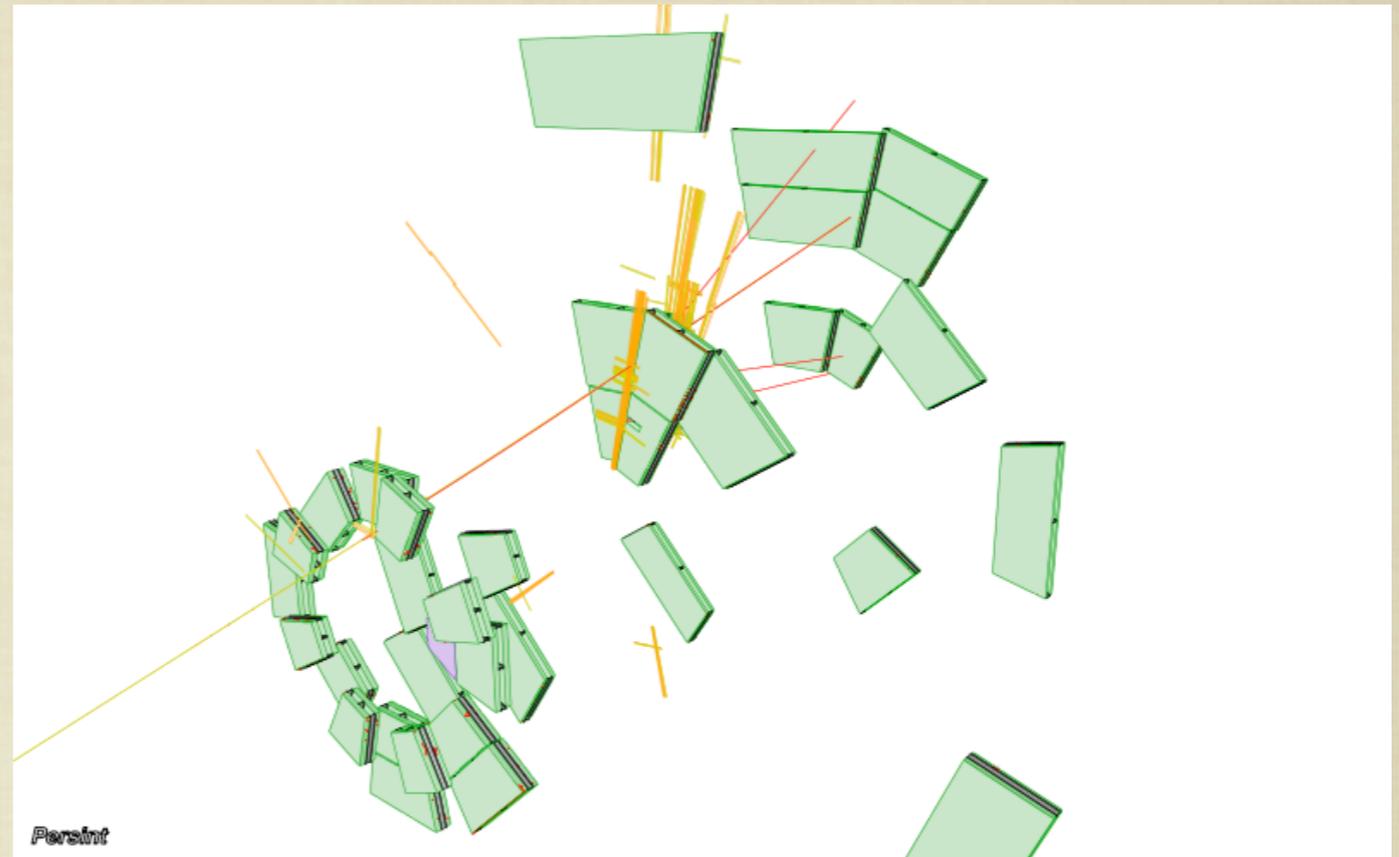
- ☑ We have found strategies to reduce rates
- ☑ muon overlap remover at EF



Muon overlap removal at EF

- Focus e.g. on 3mu6_MSonly chain
 - observed ~ 1.2 Hz rate @ $3E33$
 - a lot of events is triggered because of duplicated EF tracks (see also extra slides for more examples)

```
Event = 725166 Run = 191517
////////////////////////////////////
L1 Thr = MU6 eta = 1.3829 phi = -1.42704
L1 Thr = MU6 eta = 1.10657 phi = 2.3456
L1 Thr = MU6 eta = 1.00039 phi = 2.29764
oooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo
Mu fast PT = 7169.63 eta = 1.43651 phi = -1.36123
Mu fast PT = 5341.22 eta = 1.09588 phi = 2.32752
Mu fast PT = 5257.72 eta = 0.993573 phi = 2.33377
=====
EF MSonly PT = 6515.45 eta = 1.42133 phi = -1.35951
EF MSonly PT = 3093.72 eta = 0.955898 phi = 2.32328
EF MSonly PT = 3093.72 eta = 0.955898 phi = 2.32328
+++++
MUIDSA MSonly PT = 6497.56 eta = 1.42111 phi = -1.35753
MUIDSA MSonly PT = 3099.19 eta = 0.955602 phi = 2.32368
```



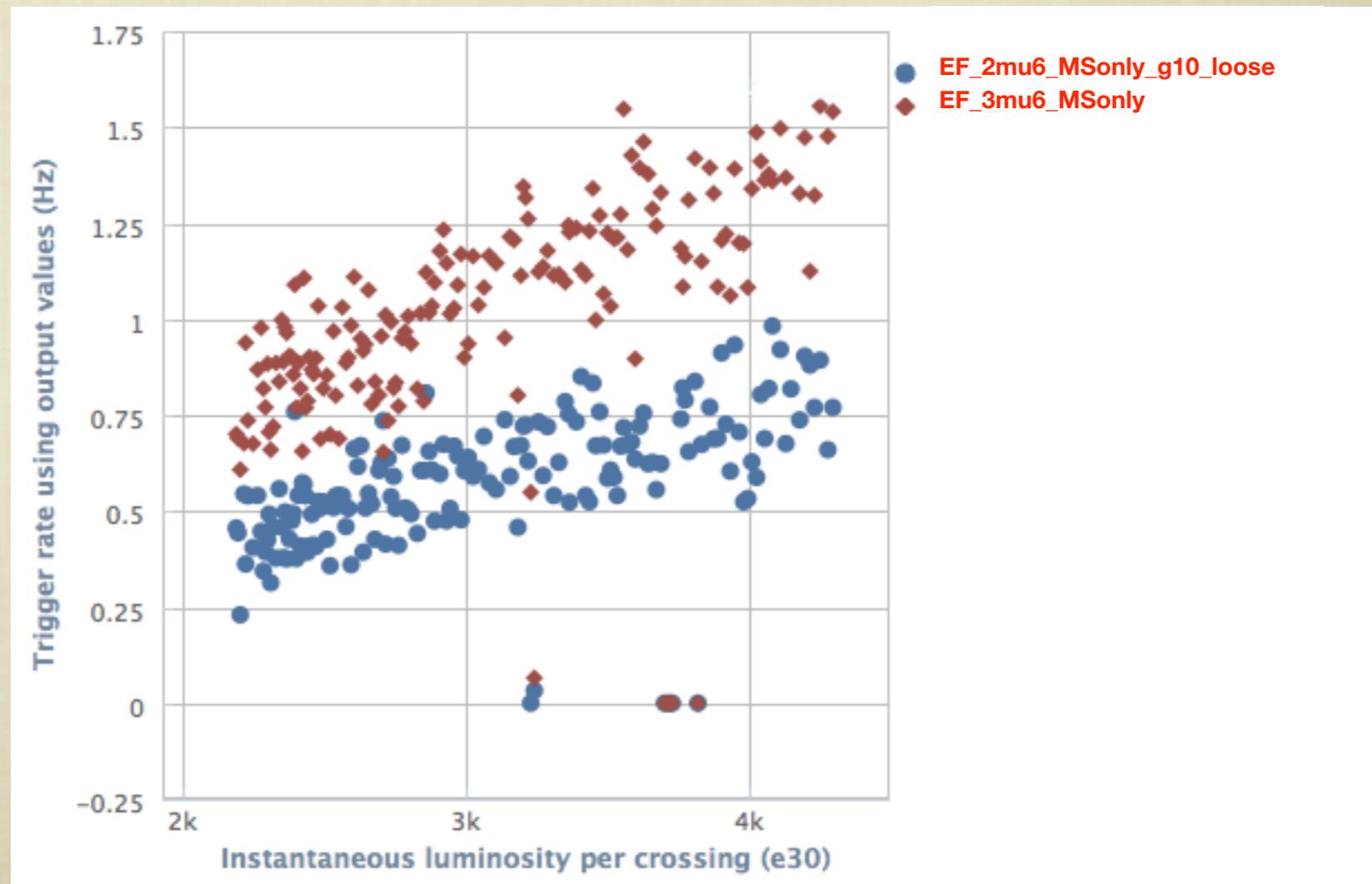
Want to reject this kind of events

- Duplicates are due to a muon crossing two independent trigger chambers (overlapping Rols)
 - mostly in the transition regions ($|\eta| \sim 1$) and in the endcap
 - remove those fake events results in a non negligible $\sim 40\%$ rate reduction
- ☑ **TrigEFMuonOverlapRemover** has been developed for reducing rate of multi-muon MSonly based triggers
 - ☑ now running at P1 in the 2012 menu

Triggers in 2012 menu

- 3mu6_MSonly with TrigEFMuonOverlapRemover
- 2mu10_MSonly_g10_loose with TrigMuonEFOverlapRemover
- We use both triggers for the 2012 analysis
 - EMPTY and UNPAIRED_ISO items available
 - 2mu10_MSonly_g10_loose_EMPTY not available for the first $\sim 1\text{fb}^{-1}$

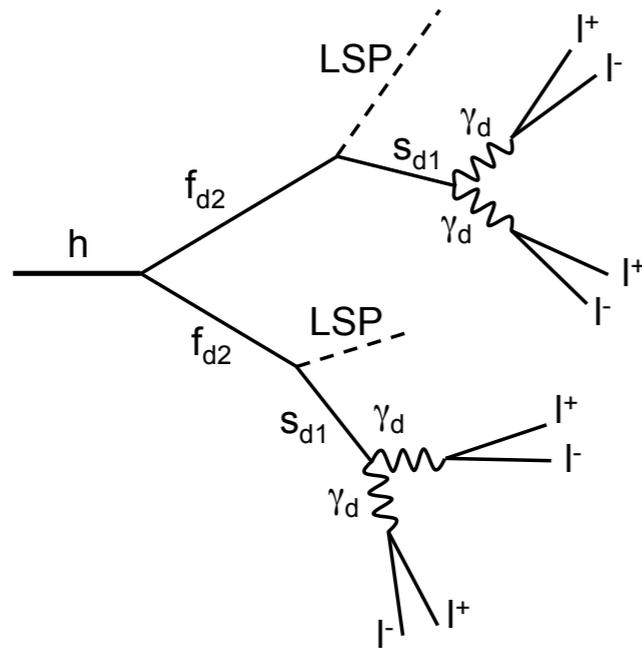
- ☑ **Observed rates are in agreement with expectation**
- ☑ **The two chains are running unrescaled in the 2012 menu**
- ☑ **Stay with this configuration up to higher luminosity**



TSample

- A 5k events TSample has been produced to check the performance of the new trigger configuration on MC signal

VALID1.115705.PYTHIAMADGRAPH_H100TOIJ_4ZD_MIXED_MET.MERGE.AOD.E873_s1372_s1370_R3459_R3460



MODEL PARAMETERS

- Standard Higgs production cross section
- $m_h = 100 \text{ GeV}$
- $m_{fd2} = 5 \text{ GeV}$
- $m_{sd1} = 2 \text{ GeV}$
- $m_{LSP} = 2 \text{ GeV}$
- $m_{\gamma_d} = 400 \text{ MeV}$
- $\text{BR}(\gamma_d \rightarrow ee) = 45\%$
- $\text{BR}(\gamma_d \rightarrow \mu\mu) = 45\%$
- $\text{BR}(\gamma_d \rightarrow \pi\pi) = 10\%$
- $c\tau(\gamma_d) = 78.8 \text{ mm}$

- Comparison with previous trigger configuration (mc11 (200k events))

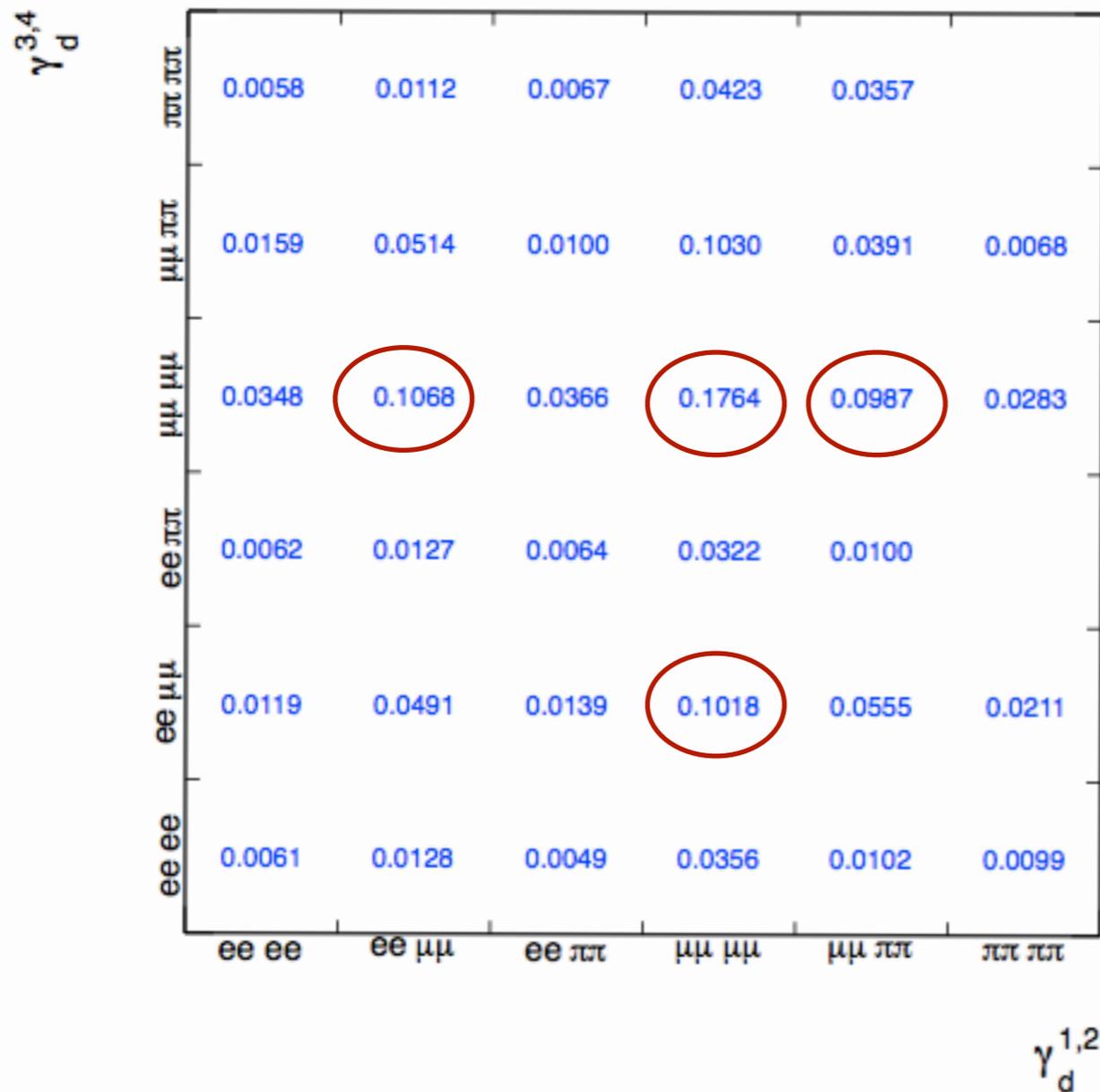
Total Trigger Efficiency (%)		
	2011 configuration	2012 configuration
2mu6_MOnly_g10_loose	2.07	1.28
3mu6_MOnly	4.90	4.40
Total w/o Overlap	6.61	5.40

- Note: for 140GeV Higgs mass, the trigger efficiency doubles!
- The increased muon threshold penalize the signal trigger efficiency

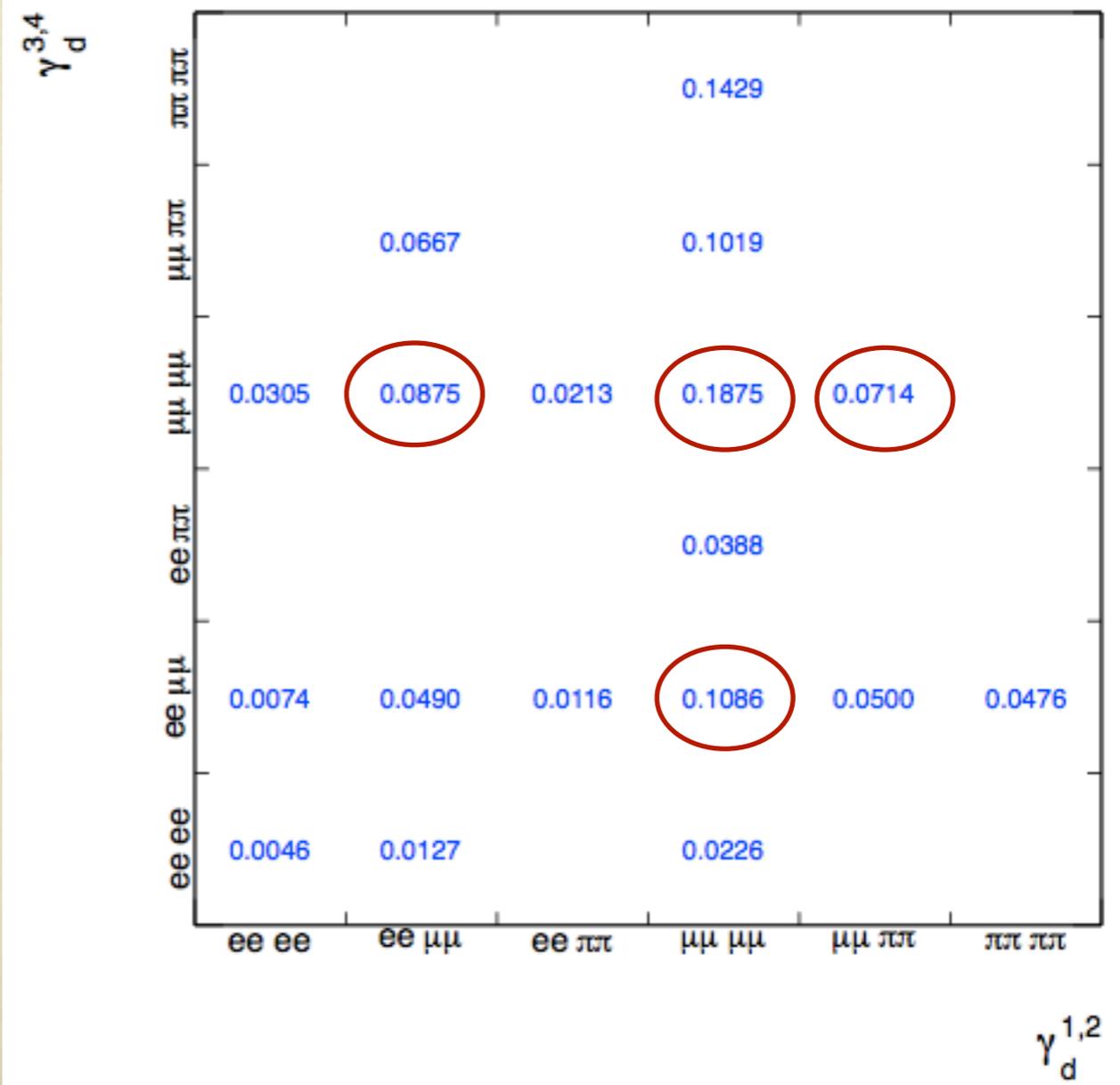
Signal efficiency: 3mu6_MSonly

- Fraction of decay modes selected by 3mu6_MSonly
- Very good efficiency in selecting non-prompt muonjets also after overlap remover

2011 CONFIGURATION



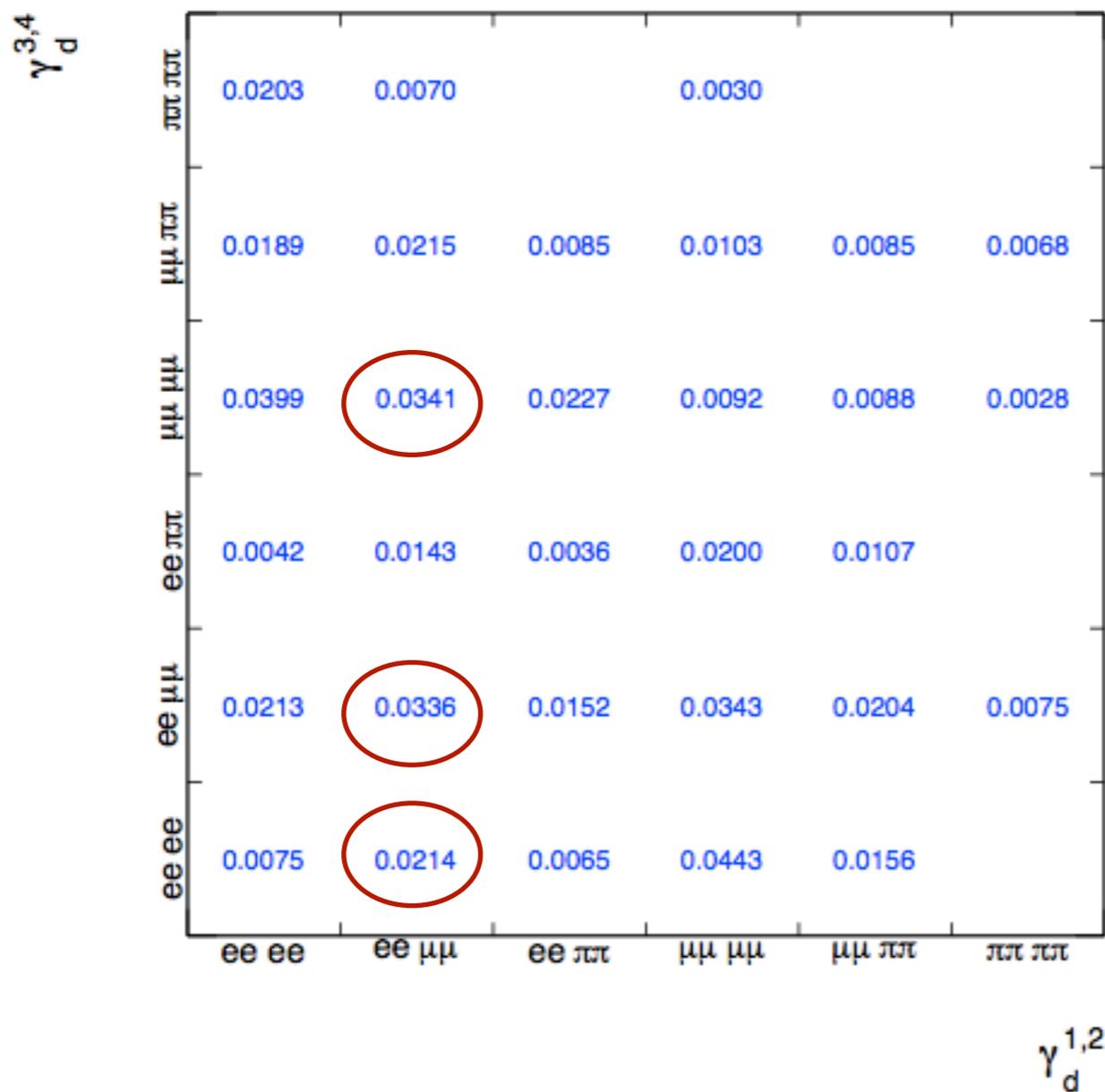
2012 CONFIGURATION



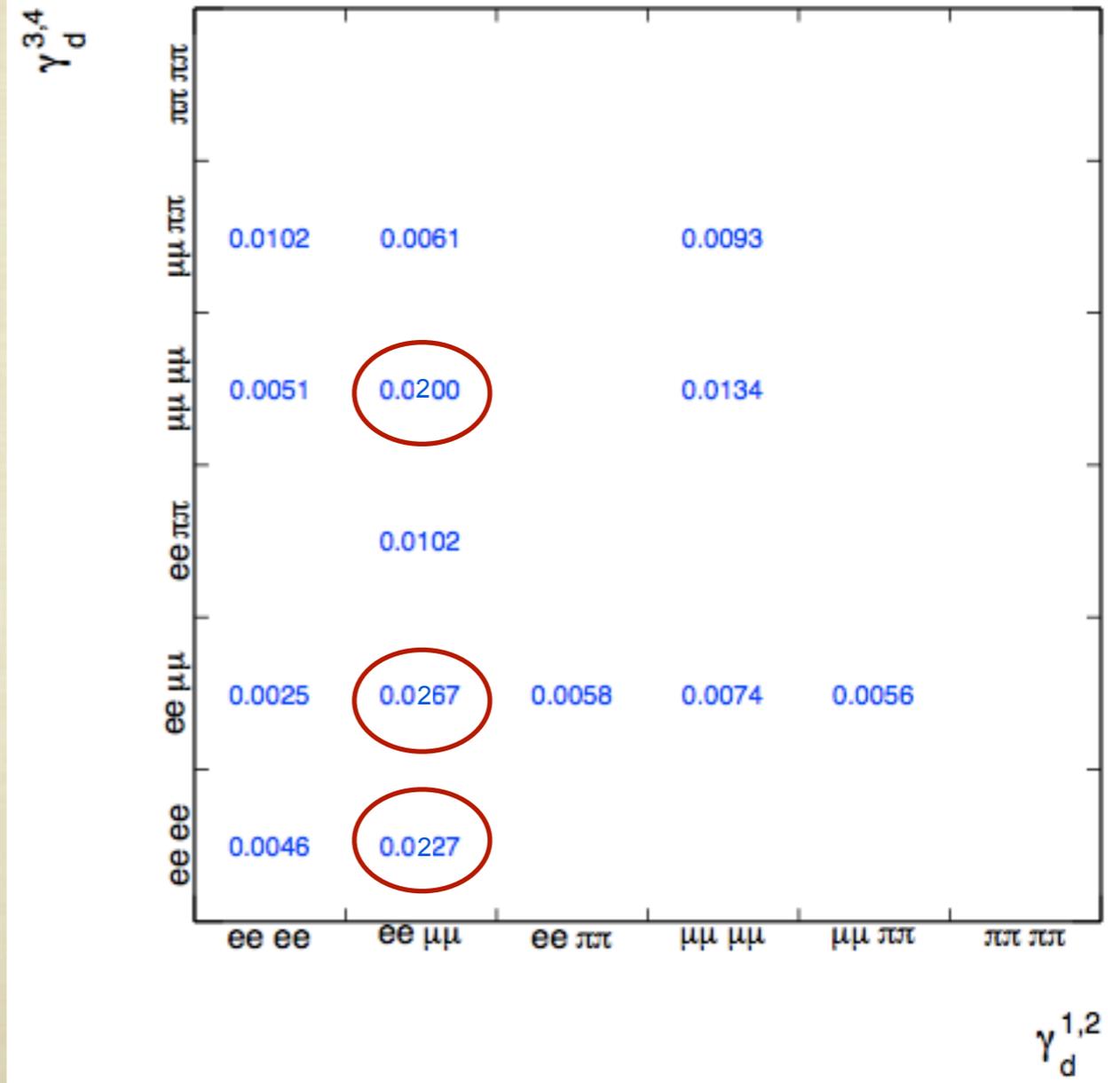
Signal efficiency: 2mu10_MSonly_g10_loose

- Fraction of decay modes selected by 2mu10_MSonly_g10_loose
- Select a bunch of events with mixed e/ μ final states
- The increased muon threshold penalizes the signal trigger efficiency

2011 CONFIGURATION



2012 CONFIGURATION



Summary

- Strategies to reduce rates enough to stay in 2012 menu have been found and we have the two triggers running at P1
- The EF muon overlap remover is now part of the standard muon trigger software (and I have gained some class 3 FPE :))
- Rates look reasonably low and very likely no further changes will be needed to stay unrescaled up to higher luminosity
- The TSample shows that we still have good signal efficiency
- wait for MC12 production with complete statistics to have the final estimate