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# L1 jets pointing to L2 taus

- **L1 Taus with ORCA6 data**

  **energy scale**

  **Tau id efficiency**

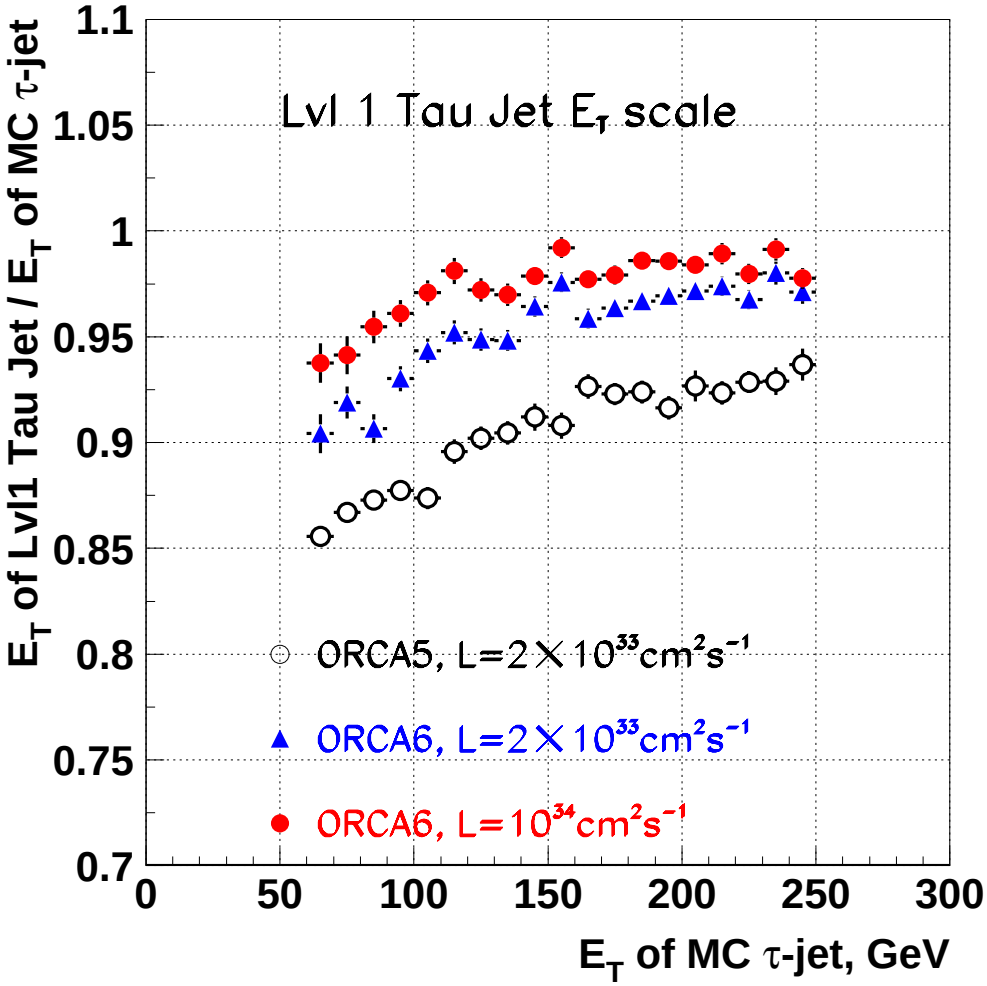
- **L1 jets pointing to L2 taus in**

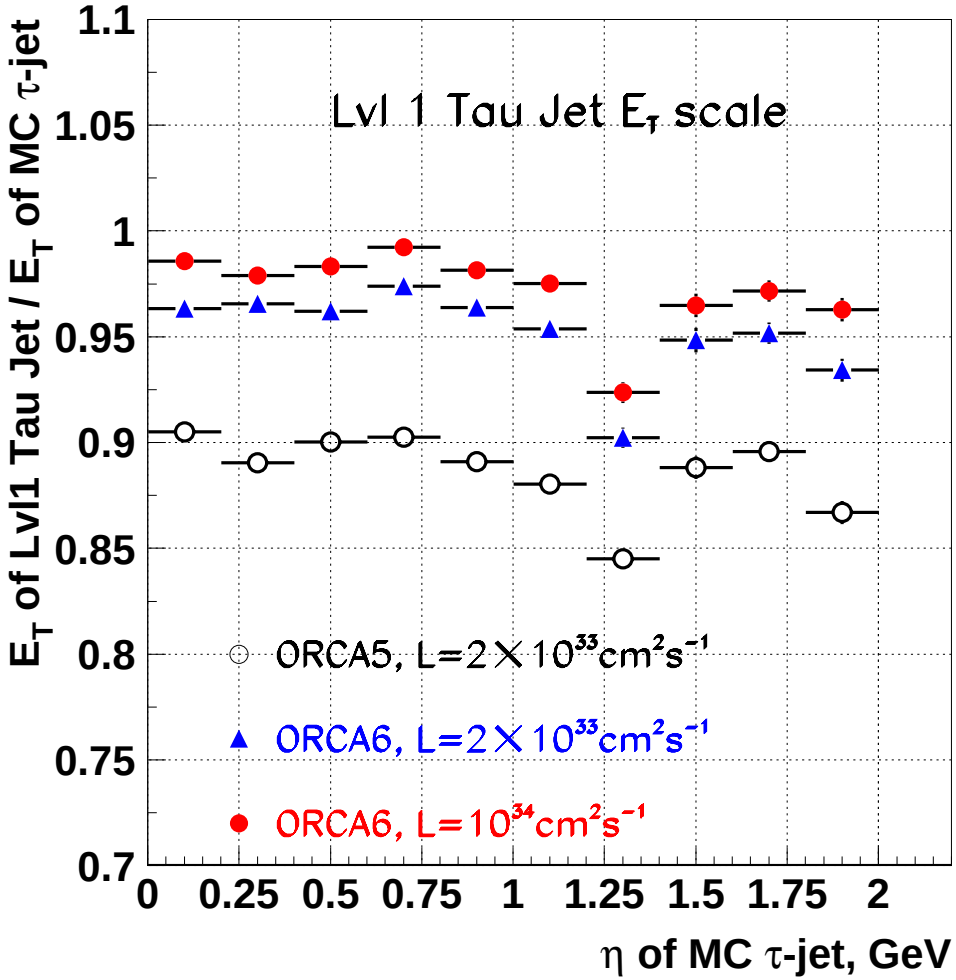
  **$A^o/H^o$ -> 2 $\tau$ -> 2 jets**

  **$A^o/H^o$ -> 2 $\tau$ -> e+jet & $\mu$ + jet**

  **$H^+$ -> $\tau\nu$ -> jet**

# L1 Tau Jet scale vs $E_T^{\tau\text{-jet}}$ and $\eta^{\tau\text{-jet}}$



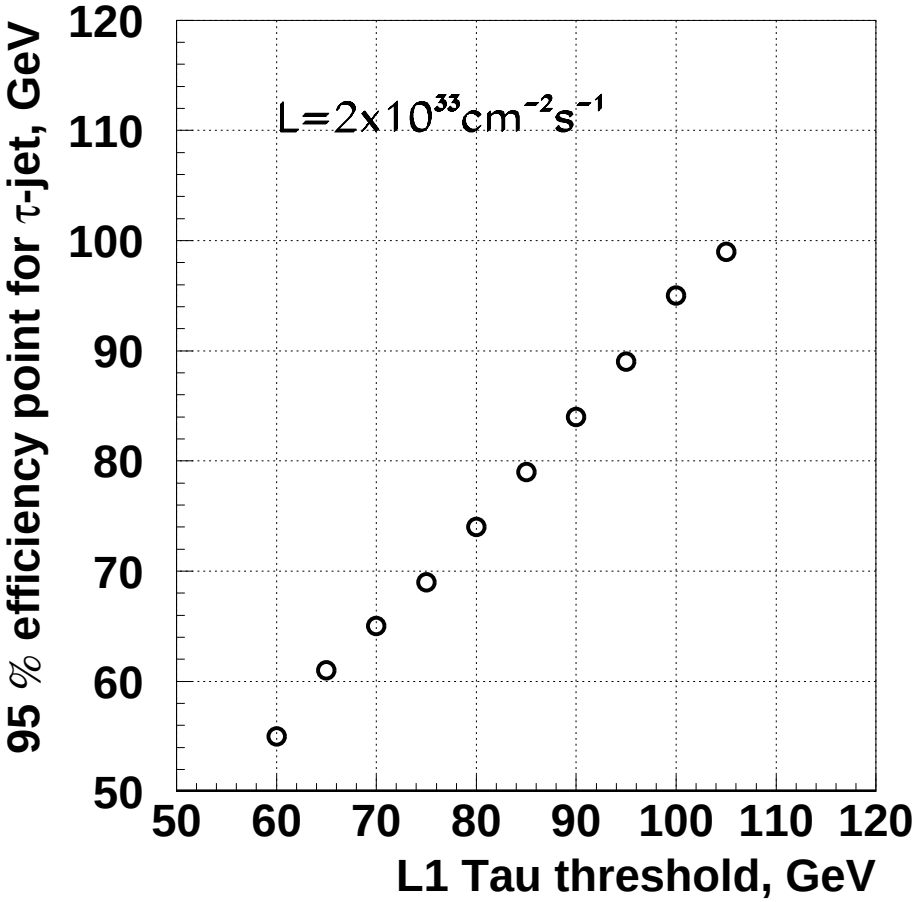

**Scale is changed by 5-10 %, anyway L1 uses qcd jet scale**

...

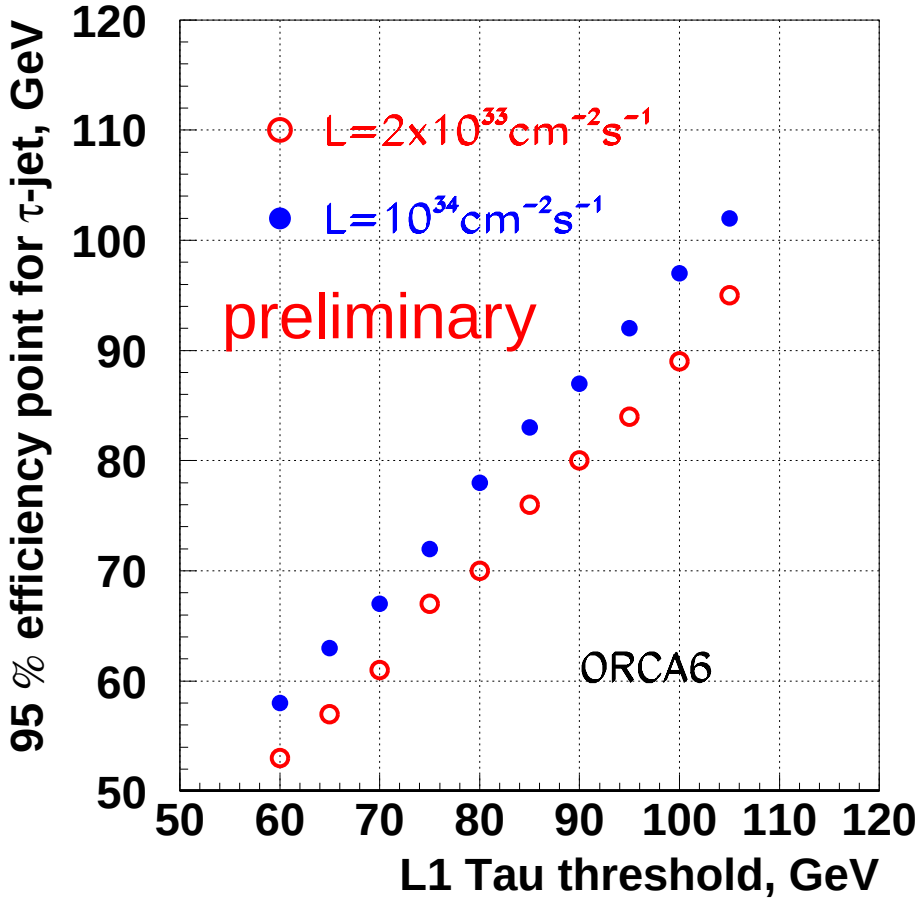
# reminder: L1 Taus use qcd jet energy corrections

## 95 % efficiency point vs L1 threshold

### orca5. low lumi




### orca6



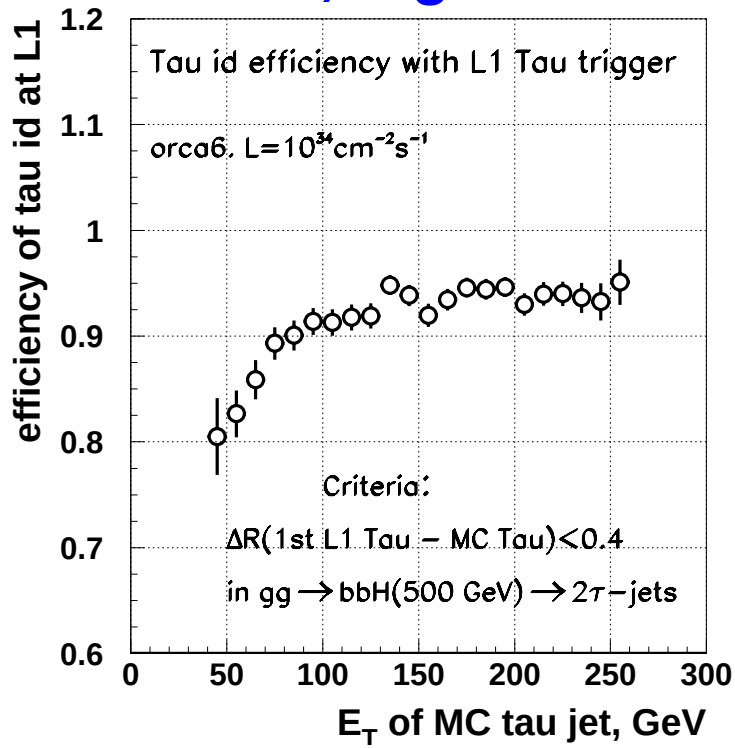
# L1 Tau id vs

$E_T^{\tau\text{-jet}}$

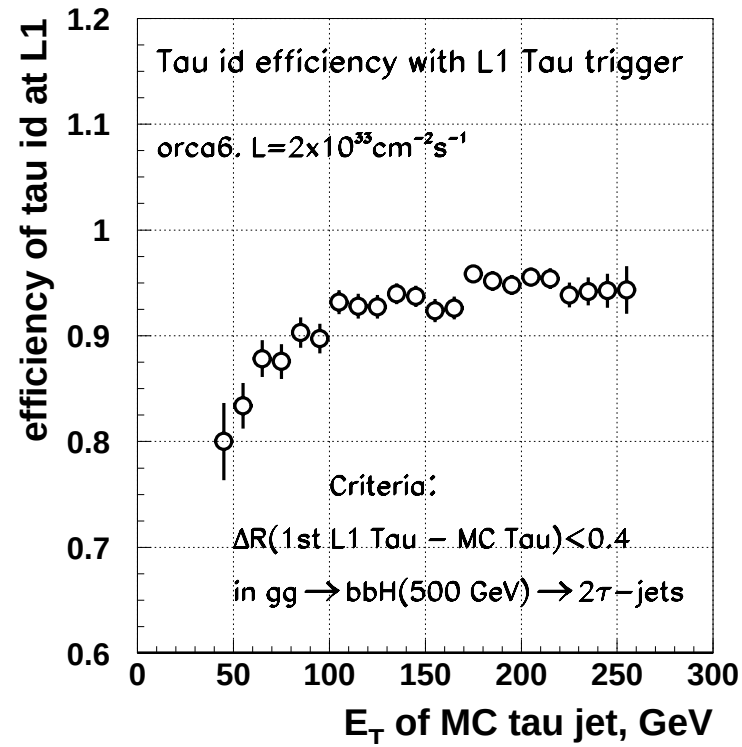
$\eta^{\tau\text{-jet}}$

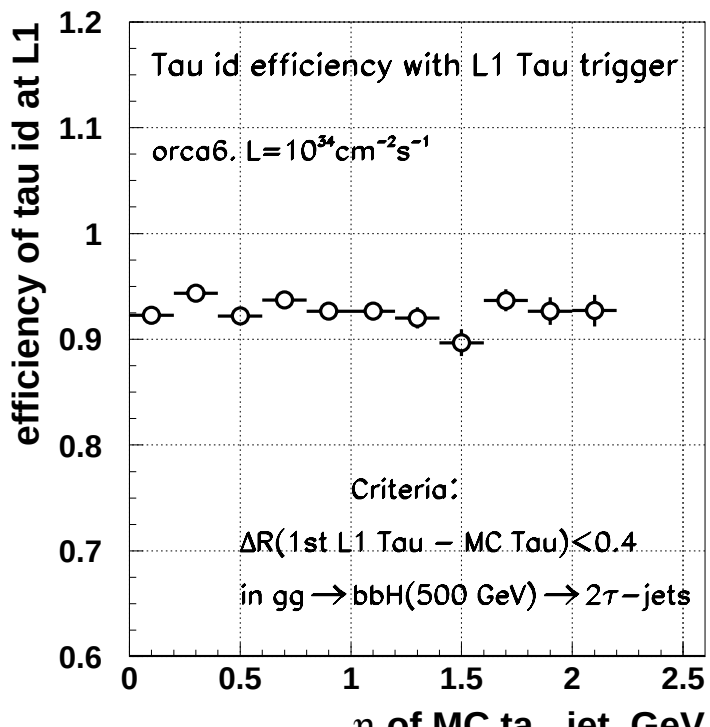
**Similar to ORCA5 OK !**

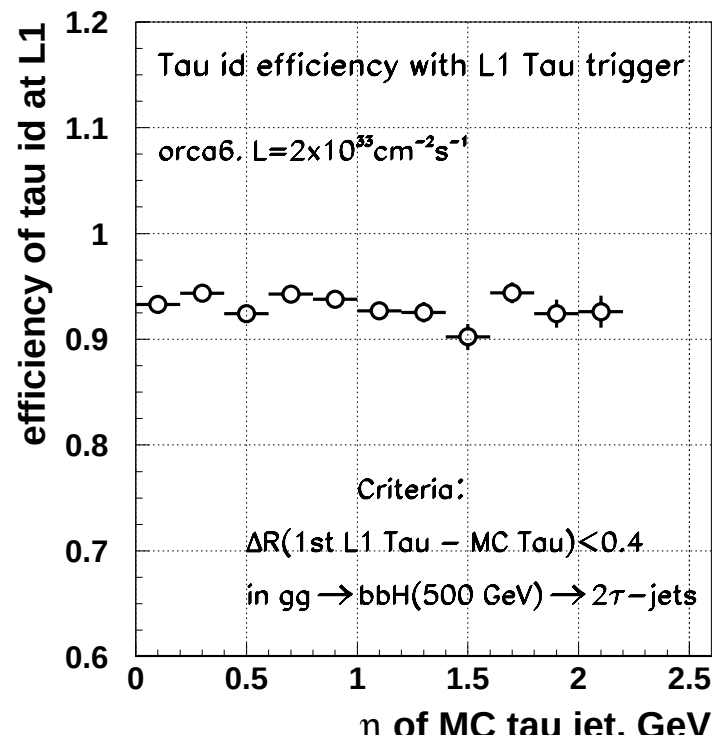
## orca6, high lumi




## orca6, low lumi

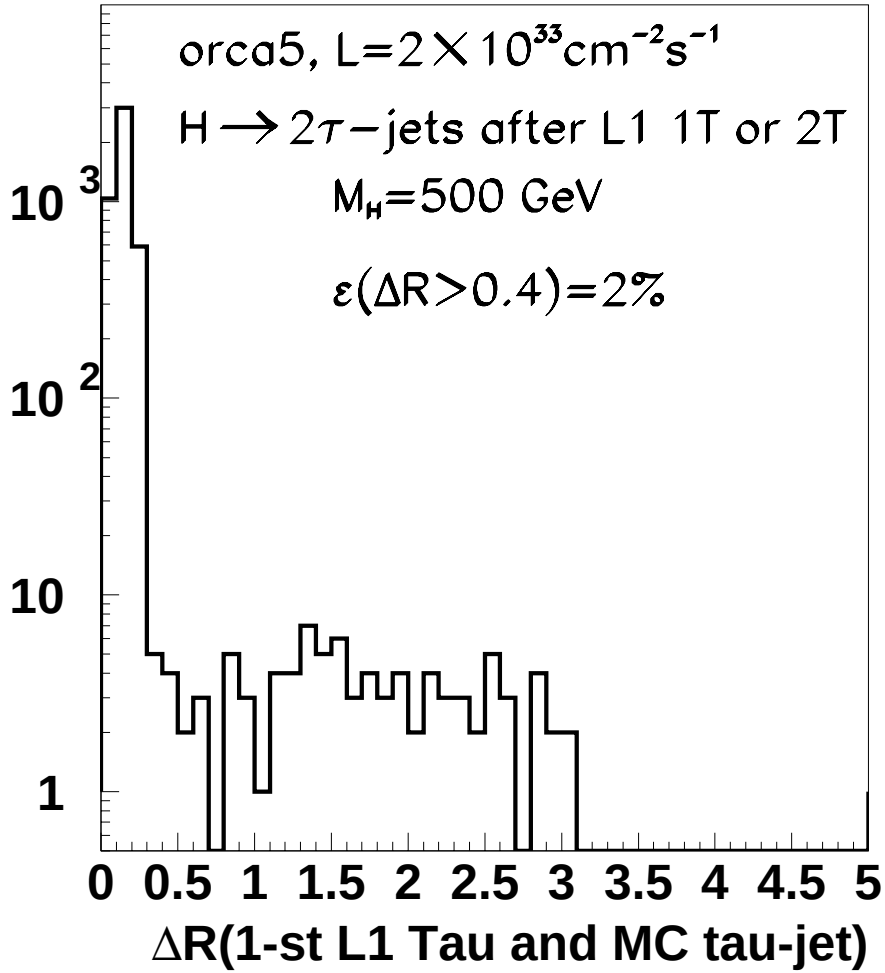


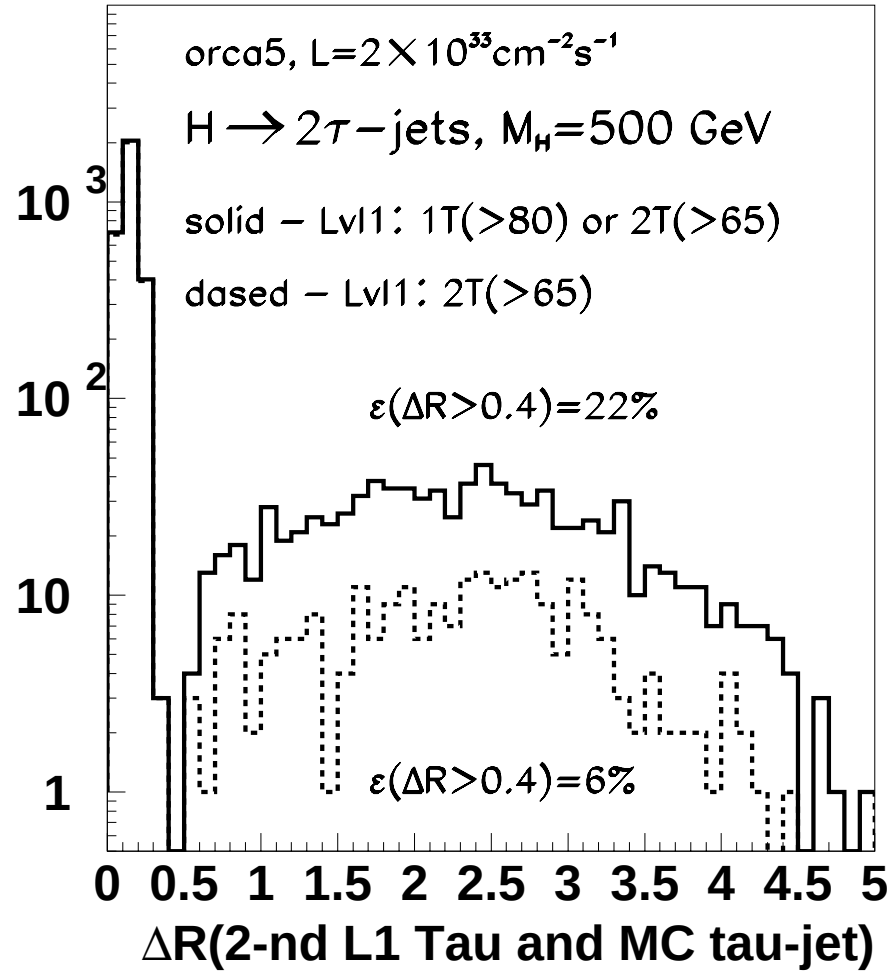
# Purity of Lvl-1 Tau Jets: $A^0/H^0 \to 2\tau \to 2$jet (I)

**matching of MC tau with 1-st L1 Tau Jet**



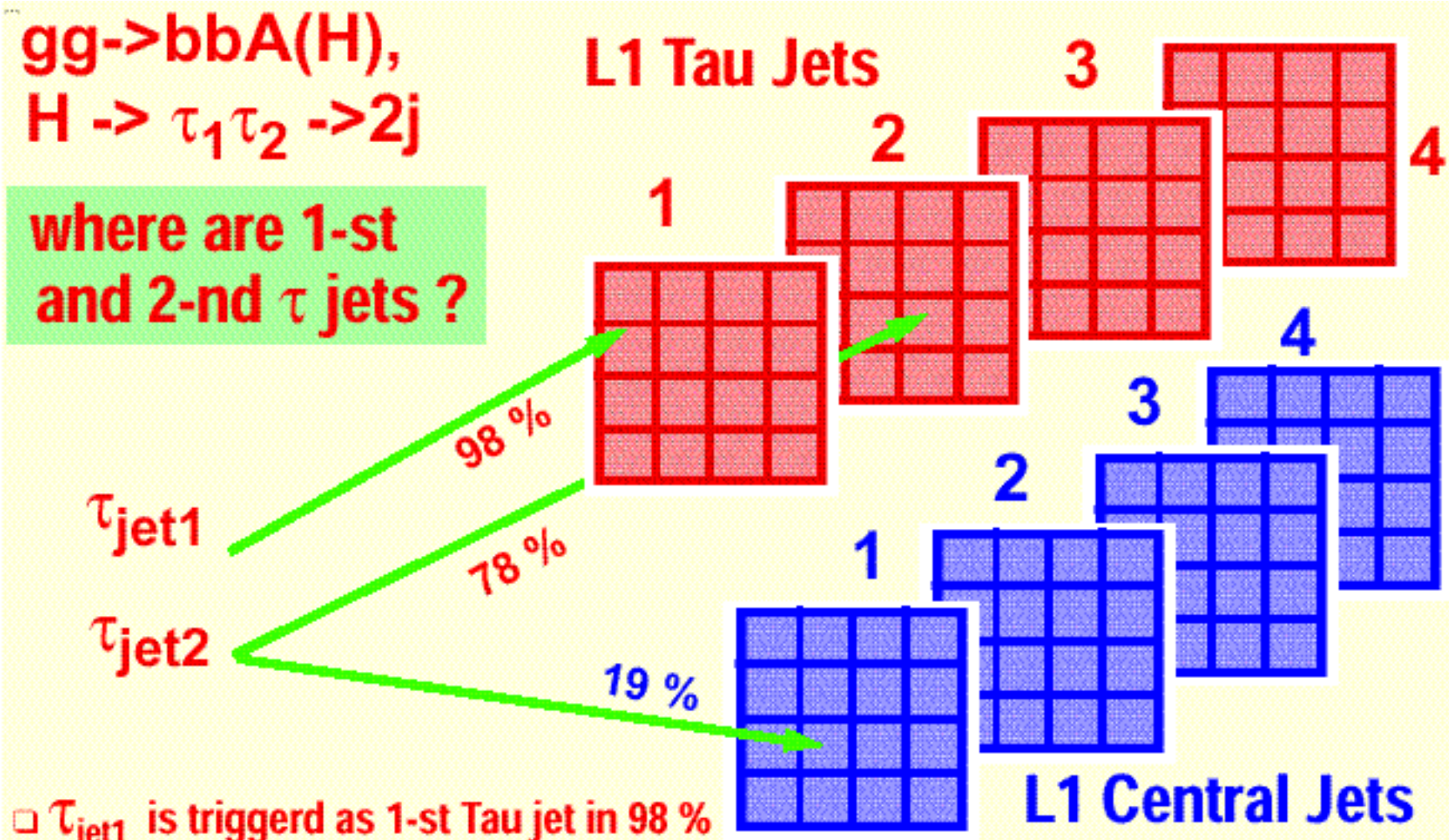

**good matching !**

**matching of MC tau with 2-nd L1 Tau Jet**




**bad matching. it spoiles efficiency at Lvl-2 Pxl**
**How to search for 2-nd tau ?**

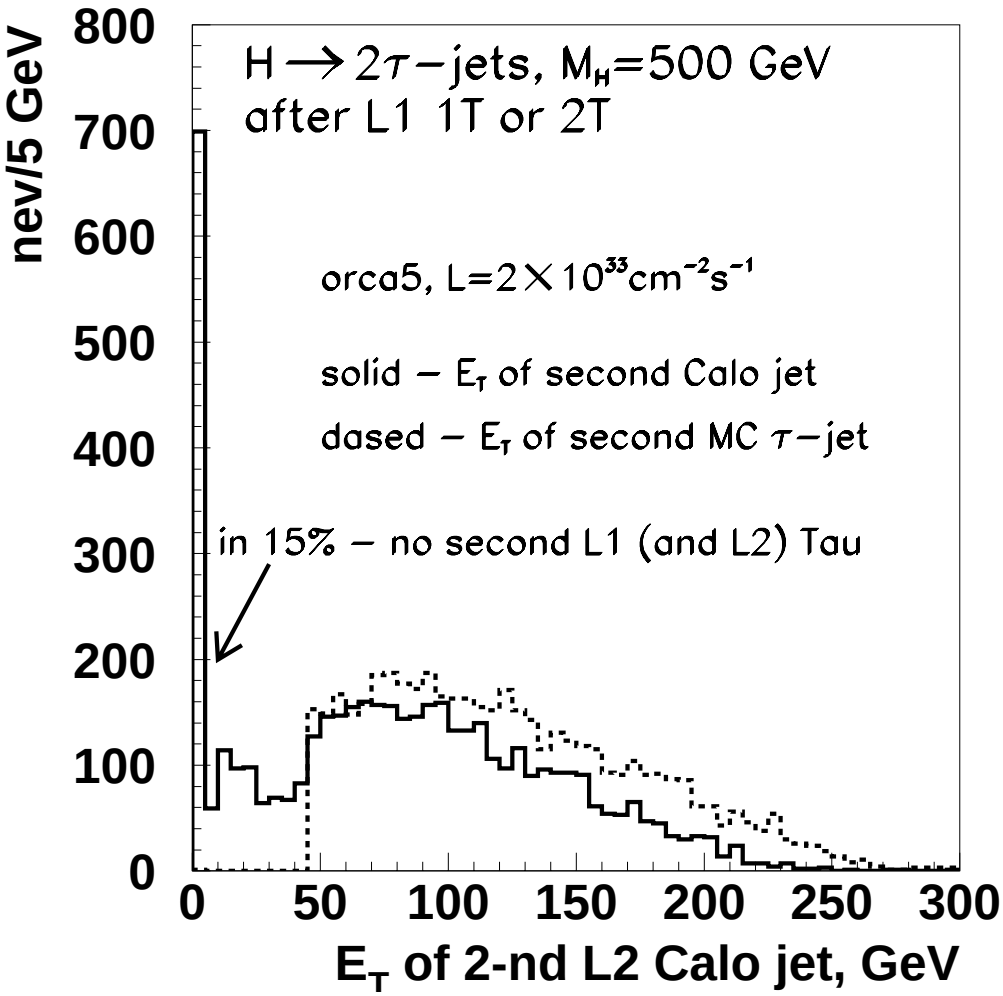
# Purity of Lvl-1 Tau Jets: $A^0/H^0 \to 2\tau \to 2jet$ (II)

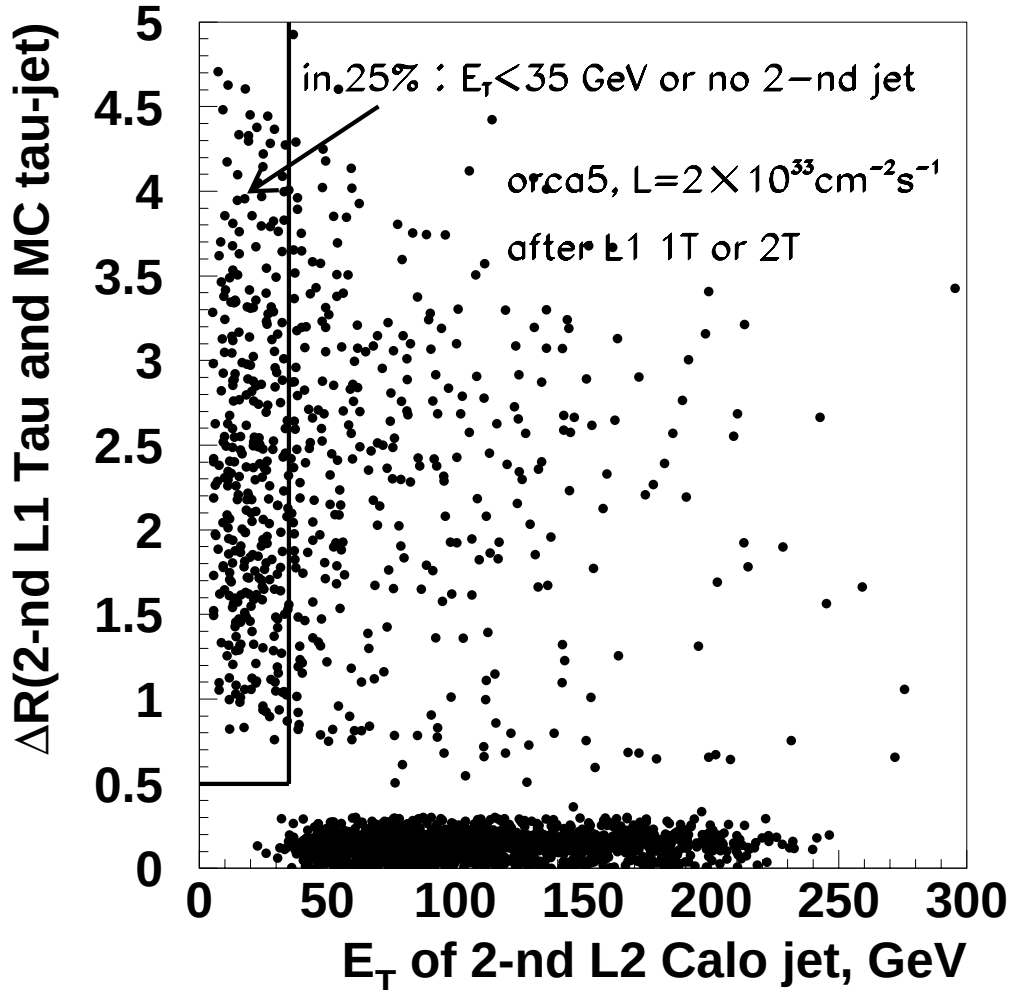



- $\tau_{jet1}$ is triggerd as 1-st Tau jet in 98 %
- 2-nd L1 Tau exists in 85 %, $\tau_{jet2}$ is triggerd as 1-st L1 Tau Jet in 78 %
  $\tau_{jet2}$ is triggerd as 1-st L1 Central Jet in 19 %
- 2-nd L1 Tau doesn't exist in 15 %, $\tau_{jet2}$ is triggerd as 1-st Central Jet in 94 %

how to search for the second Tau at Lvl-2 ?

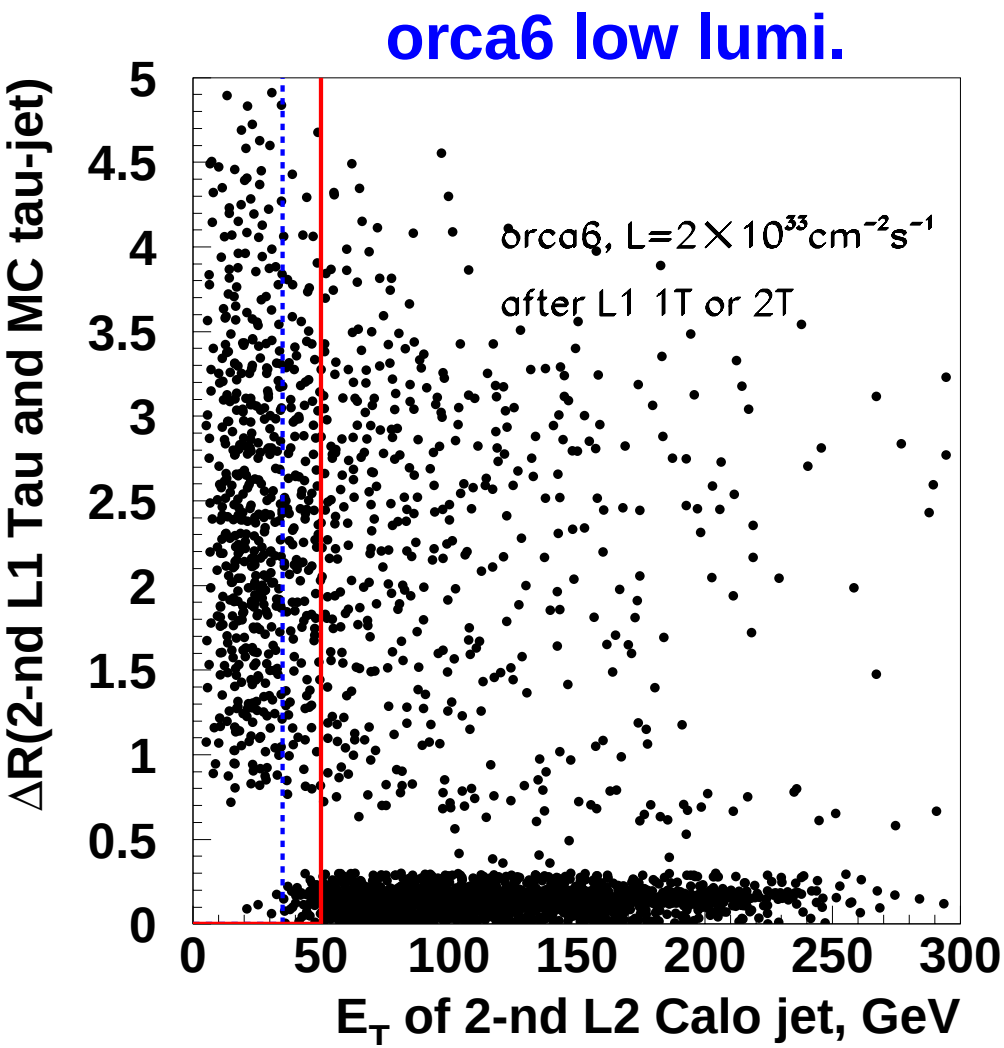
# Purity of Lvl-1 Tau Jets: $A^0/H^0$ ->2τ->2jet (III)

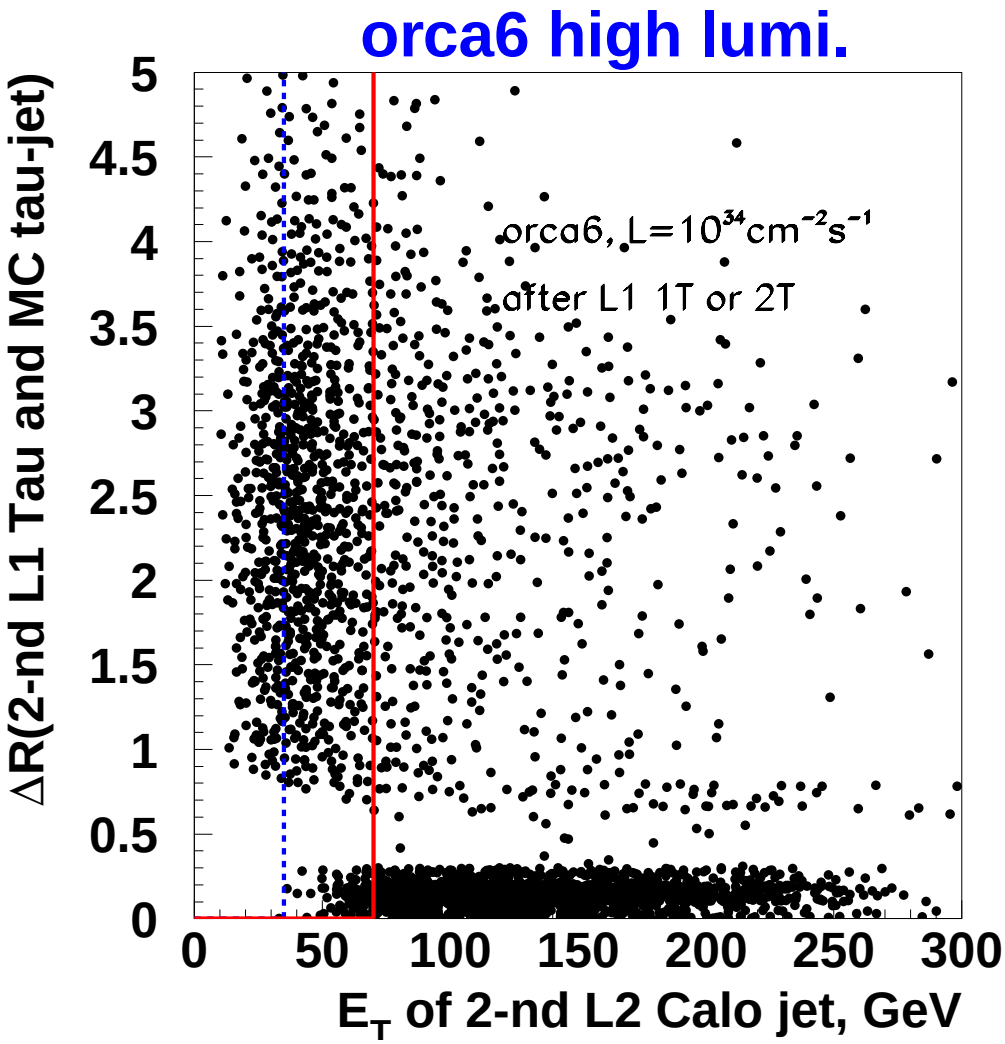



**Recipy used : if $E_T$ of 2-nd Lvl-2 Calo Jet < 35 GeV (orca5) or jet doesn't exists take a jet matched with 1-st Lvl-1 Central Jet**

# Purity of Lvl-1 Tau Jets: $A^0/H^0 \to 2\tau \to 2jet$ (IV)




$E_T^{cut}$ on Lvl-2 Calo Jet should be higher for orca6 data since jet scale is changed.

# Search for two Lvl-2 Tau Jet candidates with L1 output in gg->bbH, H->2τ-jet events passed Lvl-1 T or 2T trigger

| search for Lvl-2 Tau jets with Lvl-1 output | ORCA5 $L=2x10^{33}cm^{-2}s^{-1}$ | ORCA6 $L=2x10^{33}cm^{-2}s^{-1}$ | ORCA6 $L=10^{34}cm^{-2}s^{-1}$ |
|---|---|---|---|
| matching with 1-st Lvl-1 Tau Jet | 0.98 | 0.98 | 0.98 |
| no 2-nd Tau Jet in the Lvl-1 Tau jet list | 0.15 | 0.16 | 0.07 |
| matching with 2-nd Lvl-1 Tau Jet | 0.78 | 0.74 | 0.65 |
| matching with 2-nd Lvl-1 Tau Candidate | 0.90 | 0.88 (0.89)* | 0.75 (0.87)* |

## How to find Lvl-2 Tau jet candidates :

## 1-st L2 Tau Jet Candidate - L2 jet matched with 1-st L1 Tau Jet

## 2-nd L2 Tau jet candidate -

a) if $E_T$ of 2-nd L2 Calo Jet > $E_T^{cut}$ - take this jet

b) if $E_T$ of 2-nd L2 Calo Jet < $E_T^{cut}$ - take L2 jet matched with 1-st L1 Central Jet

$E_T^{cut}$ = 35 GeV used for orca5 and for orca6

definition of L2 Calo Jet : 1-st / 2-nd L2 Calo Jet is L2 jet matched with 1-st / 2-nd L1 Tau Jet

* $E_T^{cut}$ = 50 GeV for ORCA6 low lumi, 70 GeV for ORCA6 high lumi.

# Purity of Lvl-1 Tau Jets: $A^0/H^0 \to 2\tau \to e+jet$ (I)

$gg \to bbA(H)$, $H \to \tau_1\tau_2 \to e + j$ Olivier van der Aa

where is $\tau$ jet in events passed e&T trigger ?

*a) 43 % collinear events: 1-st L1 e/$\gamma$ = 1-st L1 Tau*

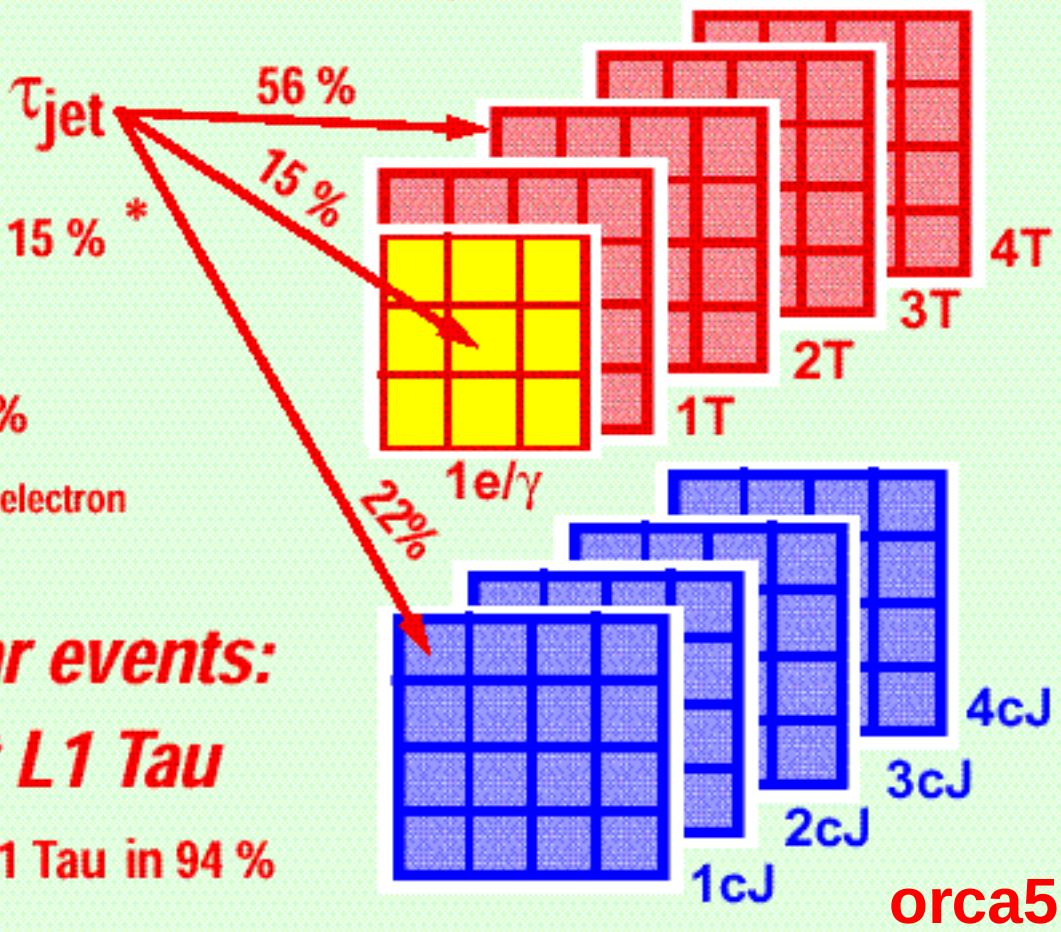
$\tau_{jet}$ is triggered by :

1-st L1 isolated e / $\gamma$ in 15 % *

2-nd L1 Tau in 56 %

1-st L1 centr. Jet in 22 %

* in 83 % 1-st L1 isol. e/$\gamma$ takes electron




*b) 56 % not collinear events:*

*1-st L1 e/$\gamma$ != 1-st L1 Tau*

$\tau_{jet}$ is triggered by 1-st L1 Tau in 94 %

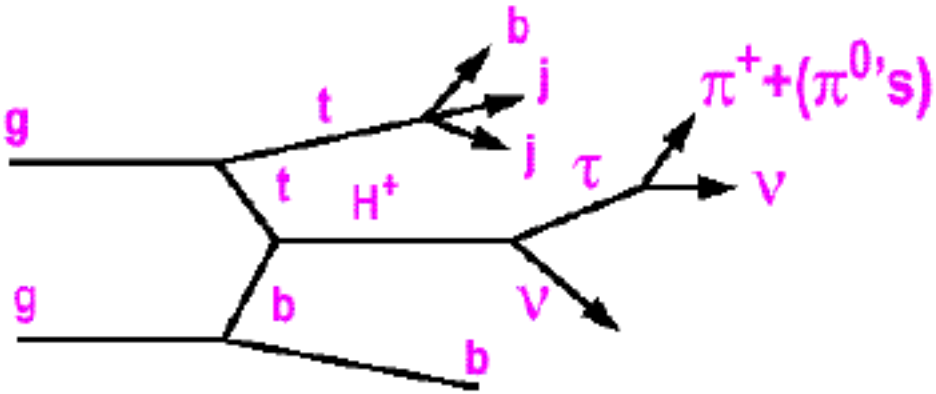
What jet should be taken as Tau at Lvl-2 ? the best Lvl-2 Calo Tau jet ?

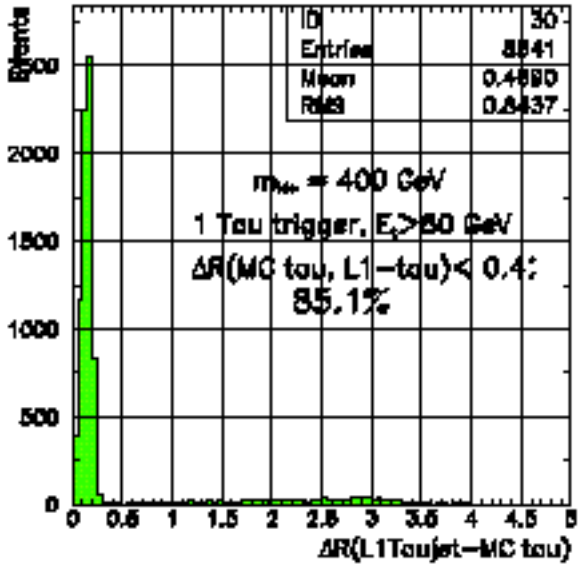
# Purity of Lvl-1 Tau Jets: $H^+ \to \tau\nu \to$ jet, $A^0/H^0 \to 2\tau \to \mu$+jet

R. Kinnunen

**in $H^+ \to \tau\nu$ $\tau$-jet is triggered by 1-st L1 Tau in 85 %**

$gg \to H^+tb$, $H^+ \to \tau\nu$, $t \to bqq$




M. Konecki

**in $H \to \tau\tau \to \mu$+j, $\tau$-jet is triggered by 1-st L1 Tau in 93 %**

## instead of conclusion :

***it looks like each channel should find its own way to search for tau at Lvl-2***