

# L0 Optimization for the TDR with Tagging Information: status

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## ■ L0 optimization ...

- using all interactions
- now with SPD/Pile-up veto cuts (obtained by Massi)
- using tagging information
- using only half of the available samples sizes
  - ( -> ability to cross-check results on an independent sample)

# Tagging Information

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- Tagging information available:

- muon tagging
- electron tagging
- opposite-side kaon tagging
- same-side kaon tagging (only relevant for  $B_s$  decays)

- "Usage" of kaon tagging:

- $B_d$  decays: use only opposite-side kaon tagging
- $B_s$  decays: correct kaon tag if and only if
  - ✓ opp.-side tagging is correct and no same-side tagging available,  
or vice-versa
  - ✓ if both opp.- and same-side tagging are correct

# Tagging Information (II)

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- General definitions:

- **tagging purity**

$$\text{purity} = (\# \text{ correctly tagged events}) / (\# \text{ tagged events})$$

- **tagging efficiency**

$$\text{efficiency} = (\# \text{ tagged events}) / (\# \text{ offline selected events})$$

- **tagging quality factor**

$$Q = \text{eff} \times (2 \times \text{pur} - 1)^2$$

# Tagging Information (III)

## Trigger-dependent definitions used in the LO optimization:

- tagging purity

$$\pi_{tag}^{ij} = \frac{\# i\text{-triggered and correctly } j\text{-tagged events}}{\# i\text{-triggered and } j\text{-tagged events}}$$

- efficiency

$$\epsilon_{trig}^i \times \epsilon_{tag}^{ij} = \frac{\# i\text{-triggered and } j\text{-tagged events}}{\# \text{selected and tagged events}}$$

- trigger power

$$P_{ij} = \sqrt{\epsilon_{trig}^i \times \epsilon_{tag}^{ij}} \times [2\pi_{tag}^{ij} - 1]$$

$$P = \sqrt{\sum_{i,j} P_{ij}^2}$$

( i = hadron, electron, ... triggers  
j = muon, electron, kaon tags )

# Tagging Information (IV)

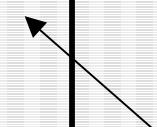
|   | Tag     | Tagging Efficiency     | Tagging Purity        | $\text{eff}*(2*\text{pur}-1)^2$ |
|---|---------|------------------------|-----------------------|---------------------------------|
| $B_d \rightarrow \pi\pi$                              | MuTag   | 6.12 % ( 105 / 1716 )  | 70.48 % ( 74 / 105 )  | 1.03 %                          |
|   | ElTag   | 1.98 % ( 34 / 1716 )   | 61.76 % ( 21 / 34 )   | 0.11 %                          |
|   | KTag    | 18.71 % ( 321 / 1716 ) | 64.80 % ( 208 / 321 ) | 1.64 %                          |
| % events with at least 1 tag = 24.59 % ( 422 / 1716 ) |         |                        |                       |                                 |
| $B_d \rightarrow J/\Psi(\mu\mu) K_s$                  | Tag     | Tagging Efficiency     | Tagging Purity        | $\text{eff}*(2*\text{pur}-1)^2$ |
|   | MuTag   | 6.99 % ( 45 / 644 )    | 66.67 % ( 30 / 45 )   | 0.78 %                          |
|   | ElTag   | 1.55 % ( 10 / 644 )    | 40.00 % ( 4 / 10 )    | 0.06 %                          |
| % events with at least 1 tag = 34.47 % ( 222 / 644 )  |         |                        |                       |                                 |
| $B_s \rightarrow D_s K$                               | Tagging | Tagging Efficiency     | Tagging Purity        | $\text{eff}*(2*\text{pur}-1)^2$ |
|   | MuTag   | 5.75 % ( 32 / 557 )    | 62.50 % ( 20 / 32 )   | 0.36 %                          |
|   | ElTag   | 2.69 % ( 15 / 557 )    | 60.00 % ( 9 / 15 )    | 0.11 %                          |
| % events with at least 1 tag = 38.60 % ( 215 / 557 )  |         |                        |                       |                                 |

# L0 optimisation - Channels

- Present scenario: some channels representative of each type of measurement

| Quantity measured <sup>(*)</sup> | Channels                                      | # off. sel. Events | # off. sel. events with at least 1 tag |
|----------------------------------|---|--------------------|--|
| $\beta$                          | $B_d \rightarrow J/\Psi(\mu\mu/e\bar{e}) K_s$ | 1295/236           | ~ 35 %                                 |
| $\gamma$                         | $B_d \rightarrow \pi\pi$                      | 3374               | ~ 25 %                                 |
|                                  | $B_s \rightarrow K\bar{K}$                    | 5553               | ~ 38 %                                 |
|                                  | $B_s \rightarrow D_s K$                       | 1059               | ~ 39 %                                 |
|                                  | $B_s \rightarrow D_s \pi$                     | 1354               | ~ 39 %                                 |
| $2\delta\gamma$                  | $B_s \rightarrow J/\Psi(\mu\mu) \Phi$         | 3863               | ~ 39 %                                 |
| Rare decays                      | $B_d \rightarrow K^* \gamma$                  | 817                | ---                                    |

Why lower than all others?



(\*) the "alpha" measurement is done with the  $B_d \rightarrow \pi\pi$ ; not included because of double counting

# L0 optimisation (II)

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- Give same "weight" to each type of measurement:

- each of the 4 groups described before is optimized separately
- optimization such that each group has the same loss in efficiency

... final numbers very soon (2 days max)