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

- **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)

- General definitions:
  - tagging purity

    purity = (# correctly tagged events) / (# tagged events)
  - tagging efficiency

    efficiency = (# tagged events) / (# offline selected events)
  - tagging quality factor

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

Tagging Information (III)

- **Trigger-dependent definitions used in the L0 optimization:**
  - tagging purity

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

  - efficiency

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

  - trigger power

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

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

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

Tagging Information (IV)

$B_d \to \pi\pi$

Tag	Tagging Efficiency	Tagging Purity	eff*(2*pur-1)^2
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)

$B_d \to J/\Psi(\mu\mu)\ K_s$

Tag	Tagging Efficiency	Tagging Purity	eff*(2*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 %
KTag	28.88 % (186 / 644)	59.68 % (111 / 186)	1.08 %

% events with at least 1 tag = 34.47 % (222 / 644)

$B_s \to D_s\ K$

Tagging	Tagging Efficiency	Tagging Purity	eff*(2*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 %
KTag	33.75 % (188 / 557)	65.96 % (124 / 188)	3.44 %

% 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(*)	Channels	# off. sel. Events	# off. sel. events with at least 1 tag
β	B_d -> $J/\Psi(\mu\mu/ee)$ K_s	1295/236	~ 35 %
γ	B_d -> $\pi\pi$ B_s -> KK B_s -> D_s K B_s -> D_s π	3374 5553 1059 1354	~ 25 % ~ 38 % ~ 39 % ~ 39 %
$2\delta\gamma$	B_s -> $J/\Psi(\mu\mu)$ Φ	3863	~ 39 %
Rare decays	B_d -> K^* γ	817	---

Why lower that all others?

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

L0 optimisation (II)

- **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)