

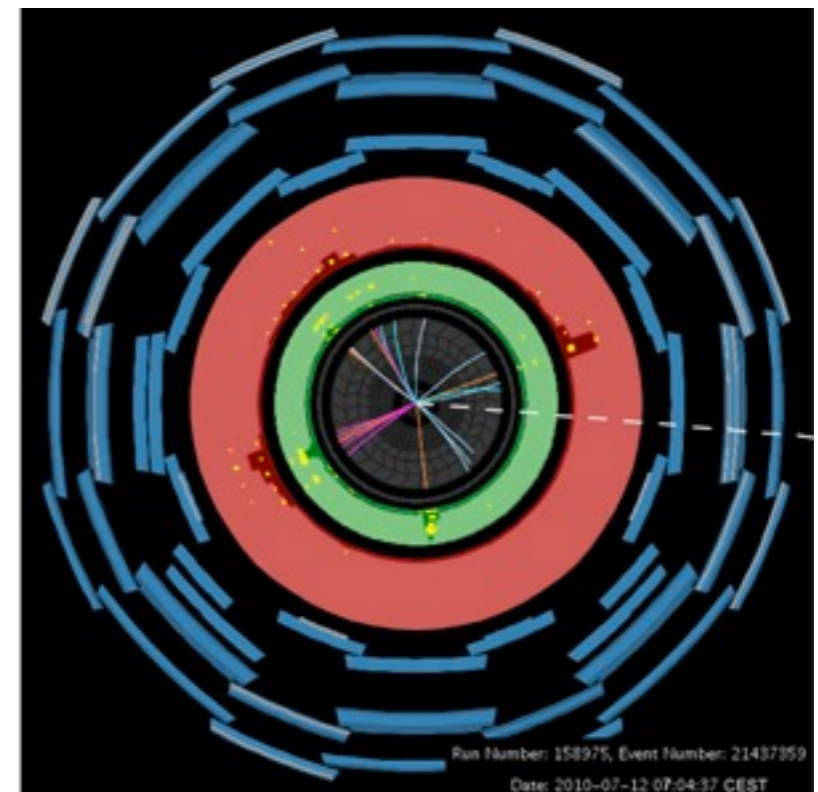
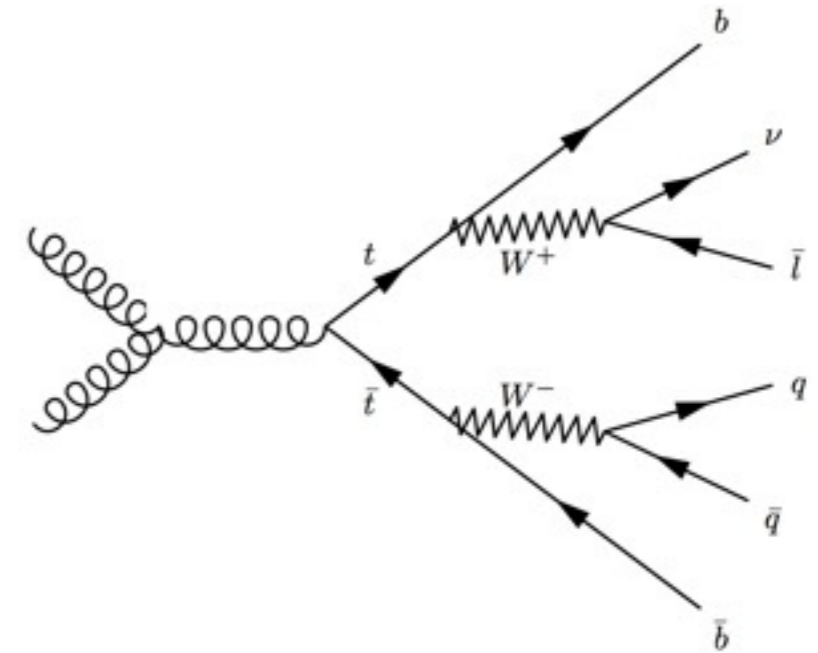
Fake electron estimates for top physics at ATLAS

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Motivation

- LHC is a top factory: about 80 million top quark pairs produced per year, and 34 million single tops (at design luminosity).
- Top-Antitop event with semi-leptonic decay (2 b-jets, $W \rightarrow \ell \nu$, $W \rightarrow qq$).
- Important background: QCD multi-jet events where one jet is misidentified as an electron.
- Difficult to describe with MC \rightarrow use a data-driven approach.



Anti-Electron method and event selection

- Obtain **model for QCD background** by modifying the electron selection → “Anti-Electrons”
 - Apply **nominal $t\bar{t}$ → e+jets** selection, but with anti-electrons:
 - Event-level cuts: GRL, sub-detector quality flags, 1 good primary vertex.
 - Trigger: One loose electron, energy threshold is period-dependent.
 - Exactly 1 anti-electron, no other “good” lepton ($p_T > 25$ GeV).
 - At least 4 good jets ($p_T > 25$ GeV), at least 1-btag (MV1 tagger, 70% WP).
 - Missing transverse energy (MET) > 30 GeV.
 - Transverse W mass (from MET and lepton) > 30 GeV.
- ➔ **Anti-Electron selection**, providing QCD model.

Modification of electron selection

Bitmask	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	ClusterFtaRange	ConversionMatch	ClusterHadronicLeakage	ClusterMiddleEnergy	ClusterMiddleFratio37	ClusterMiddleFratio33	ClusterMiddleWidth	ClusterStripsFratio	ClusterStripsDeltaFmax2	ClusterStripsDeltaF	ClusterStripsWtot	ClusterStripsFracm	ClusterStripsWeta1c	TrackBlayer	TrackPixel	TrackSi	TrackA0	TrackMatchFta	TrackMatchPhi	TrackMatchFoverP	TrackTRThits	TrackTRRatio	TrackTRatio90	TrackA0Tight	Isolation	ClusterIsolation	TrackIsolation					
ElectronLoose	x		x	x	x																											
ElectronLoosePP	x		x	x	x																											
ElectronMedium	x		x	x	x																											
ElectronMediumPP	x		x	x	x																											
ElectronTight	x	x	x	x	x																											
ElectronTightPP	x	x	x	x	x																											

Highlighted: difference between Tight++ and Loose++.

- “isEM” bitset: Each bit describes one quality check an electron has to pass.
- Few checks for loose electrons, several for tight electrons.
- Nominal $t\bar{t} \rightarrow e + \text{jets}$ selection requires tight electrons.
- **Idea:** Revert some of the bits required for tight electrons, but do not move outside of loose definition.

Some results...

1. Confirm **validity** of QCD model with **data/MC comparison** control plots.
 2. Confirm **usefulness** of QCD model by applying Anti-Electron selection to MC samples (**ttbar**, **W/Z+jets**, **singletop**) to see how many **real electrons** are reported as fake electrons.
- Try many possible bit-reversals, bit-combinations, also play with isolation.
 - No perfect solution so far, keep trying ☺

