Fast and reliable Tracking for the High-Level-Trigger at Belle II

CTD 2017.

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```
33      *
34      * What is more important can be controlled by the flag acceptOverridesReject, which is off by default (so reject i
35      * more important than accept by default).
36      */
37     class SoftwareTriggerModule : public Module {
38     public:
39       /// Create a new module instance and set the parameters.
40       SoftwareTriggerModule();
41
42       /// Initialize/Require the DB object pointers and any needed store arrays.
43       void initialize() override;
44
45       /// Run over all cuts and check them. If one of the cuts yields true, give a positive return value of the module.
46       void event() override;
47
48       /// Check if the cut representations in the database have changed and download newer ones if needed.
49       void beginRun() override;
50
51       /// Store and delete the ttree if it was created.
```
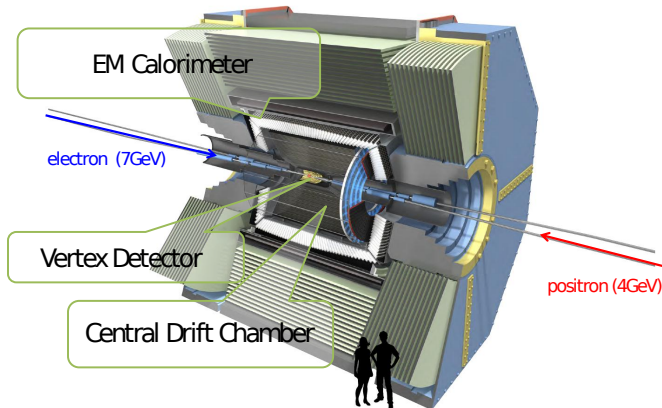
Why do we need (another) trigger?
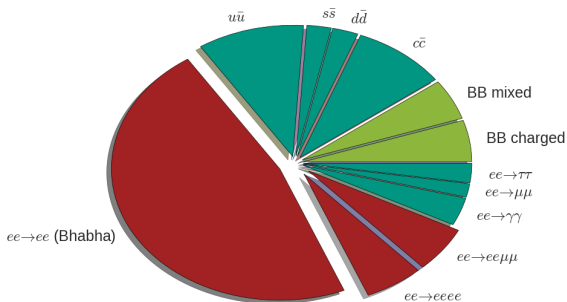
$$= 0.298\,\text{s}$$

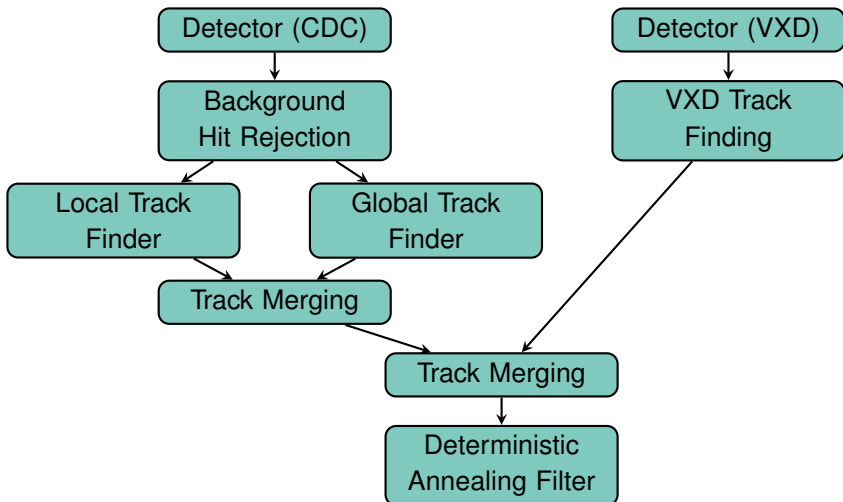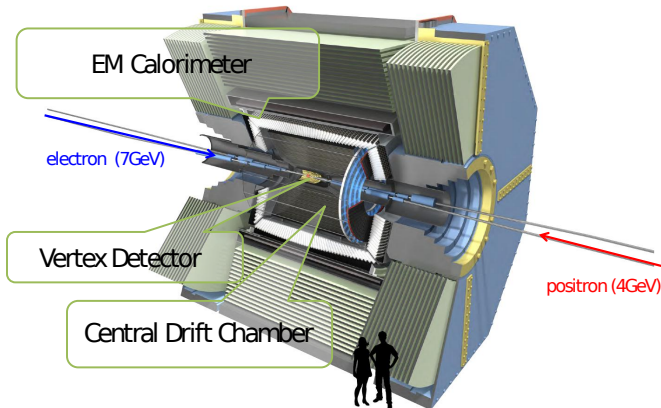6400 Cores / 30 kHz $= 0.213\,\text{s}$

The Belle II Experiment

Luminosity: $8 \cdot 10^{35}\,\mathrm{cm^{-2}s^{-1}}$ Collision approx.   Deadtime free
($40\times$ Belle)   every $2\,\mathrm{ns} = 500\,\mathrm{MHz}$ continuous trigger

Tracking at Belle II

The Belle II Experiment

EM Calorimeter

electron (7GeV)

Vertex Detector

Central Drift Chamber

positron (4GeV)

Luminosity: $8 \cdot 10^{35} \, \mathrm{cm}^{-2}\mathrm{s}^{-1}$ Collision approx.   Deadtime free

($40\times$ Belle)   every $2 \, \mathrm{ns} = 500 \, \mathrm{MHz}$ continuous trigger

Data flow
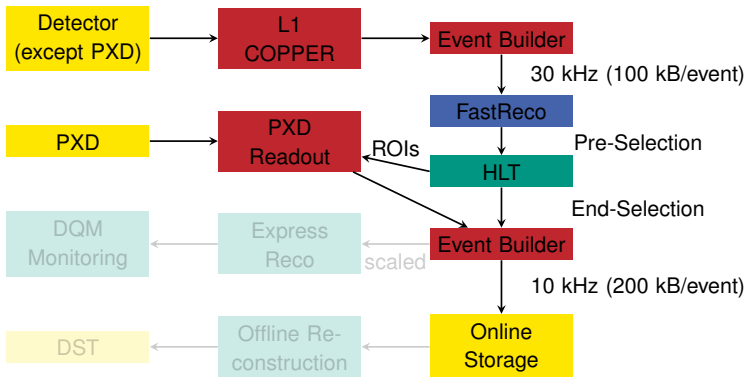
For more on ROIs, please see next talk!

FastReco Principle
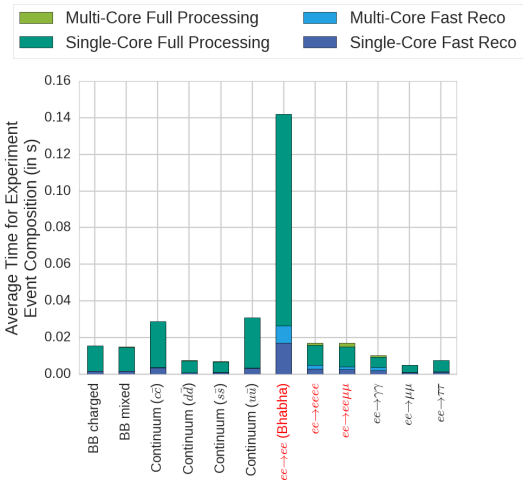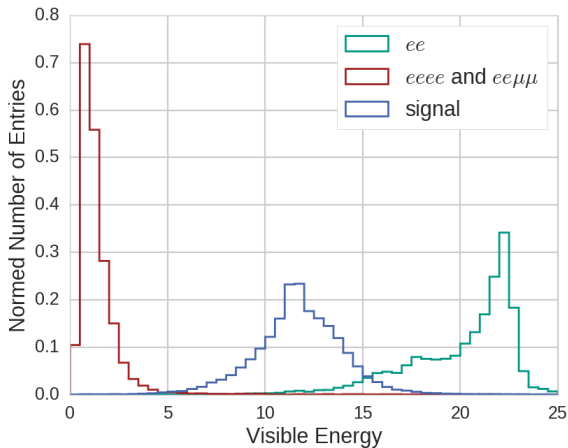
Selection
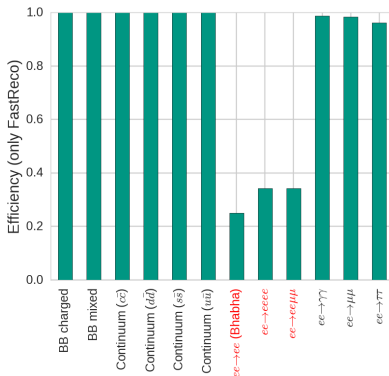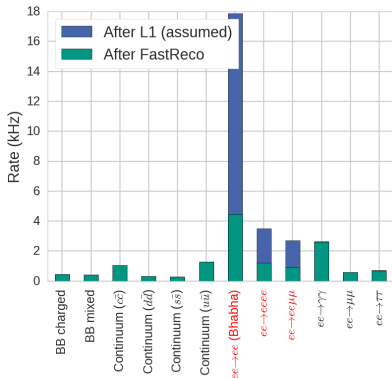

visible_energy, highest_[2,3]_ecl, max_pt, mean_abs_theta

Trigger Efficiency

A selection based on FastReco can reduce the rate from $30\,\mathrm{kHz}$ up to $\approx 14\,\mathrm{kHz}$ - without affecting the signal channels.

Runtime Performance

$$6400 \text{ Cores } / 30 \text{ kHz} \qquad = 0.213 \text{ s}$$

$$= 0.298 \text{ s}$$
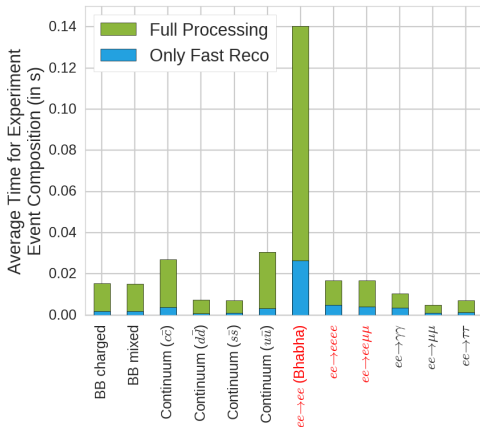
Runtime Performance

$$6400 \text{ Cores} / 30 \text{ kHz} \qquad = 0.213 \text{ s}$$

$$= 0.197 \text{ s}$$

Summary
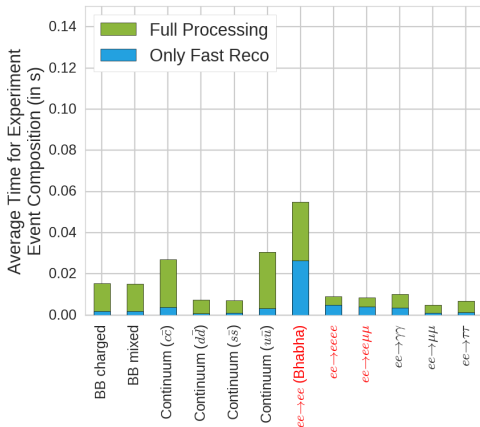
- HLT reconstruction on all events coming from level 1 trigger is too slow.
- With FastReco, the time performance and efficiency requirements for a stable operation of Belle II are reached.
- Reusing fast-running parts of the offline reconstruction leads to a large code reduction.
- Procedure is currently tested on first cosmics data and a large MC campaign.

Backup

FastReco runtime by task