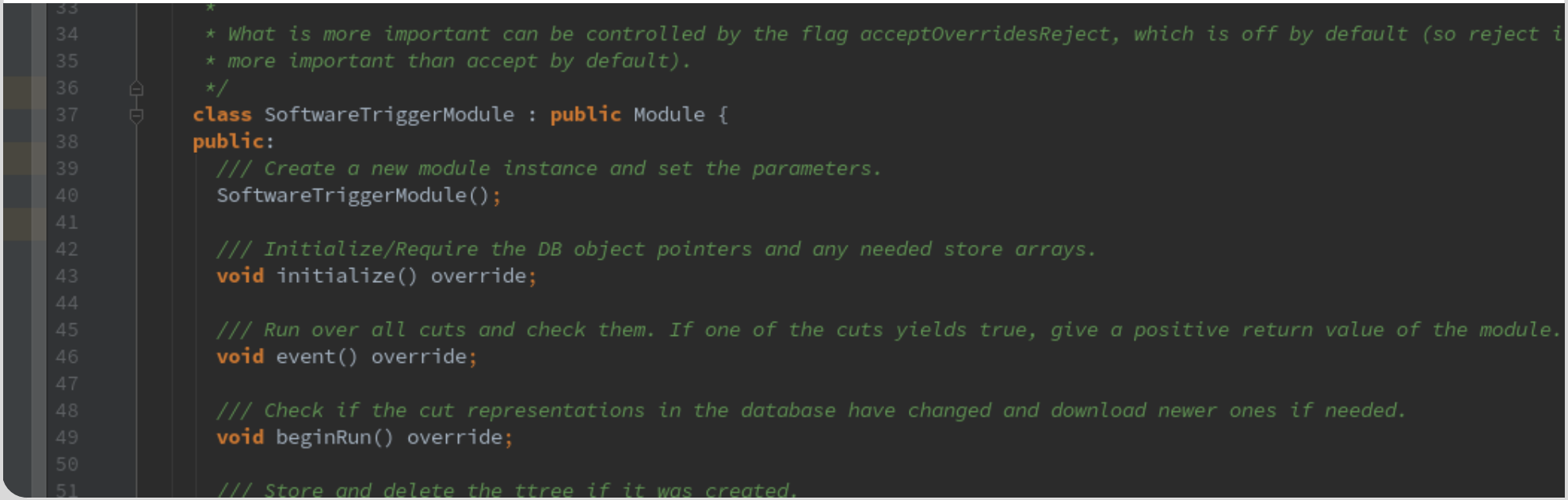
Karlsruher Institut für Technologie

HLT, FastReco and Performance

F2F Tracking Meeting Hamburg.

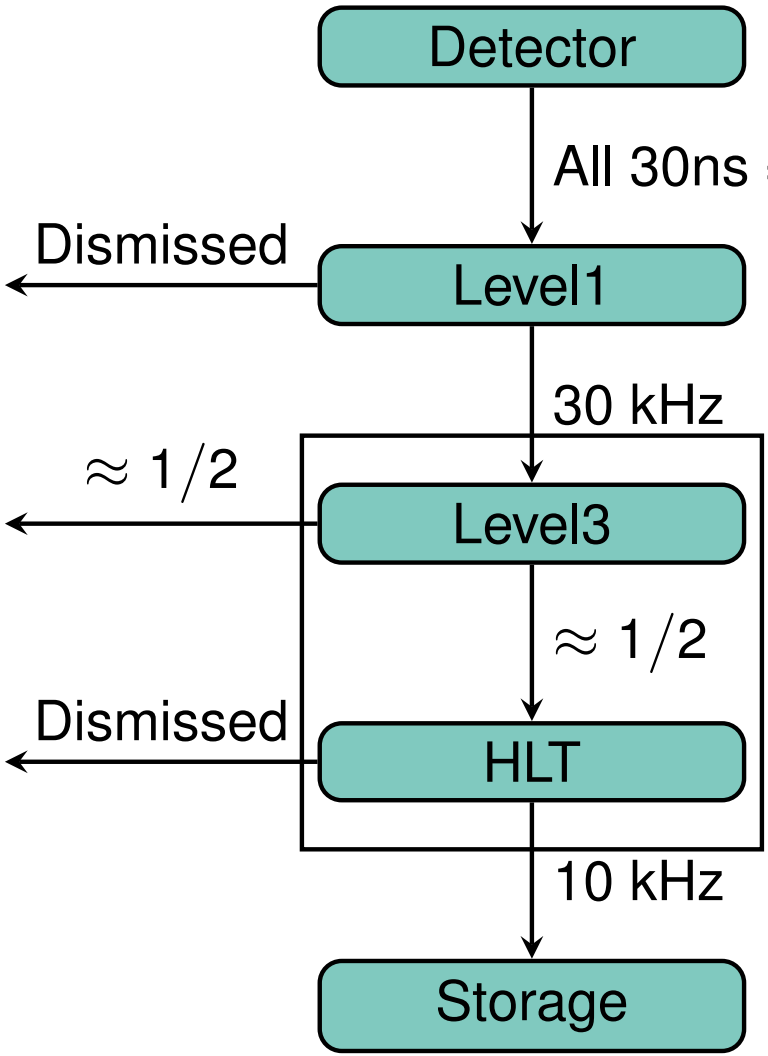
Nils Braun, Thomas Hauth | November 22, 2016

IEKP - KIT



```
 *
 * What is more important can be controlled by the flag acceptOverridesReject, which is off by default (so reject i
 * more important than accept by default).
 */
class SoftwareTriggerModule : public Module {
public:
  /// Create a new module instance and set the parameters.
  SoftwareTriggerModule();

  /// Initialize/Require the DB object pointers and any needed store arrays.
  void initialize() override;

  /// Run over all cuts and check them. If one of the cuts yields true, give a positive return value of the module.
  void event() override;

  /// Check if the cut representations in the database have changed and download newer ones if needed.
  void beginRun() override;

  /// Store and delete the ttree if it was created.
```

Organization of Triggers (how it was)



Hardware Trigger. Different trigger channels.

Independent fast reconstruction. “Simple” cuts without tags and classification.

Full reconstruction. Classification for different channels using global-event variables.

The shown numbers are design values.

Studied Channels

	Cross Section (nb)	Background
BB	1.1000	False
BB charged	0.5643	False
BB mixed	0.5357	False
$B \to J/\psi K_s ee$		False
$B \to \nu\nu$		False
$B \to \pi_0\pi_0$		False
$B \to \rho_0\gamma$		False
Continuum ($s\bar{s}$)	0.3800	False
Continuum ($d\bar{d}$)	0.4000	False
Continuum ($c\bar{c}$)	1.3000	False
Continuum ($u\bar{u}$)	1.6100	False

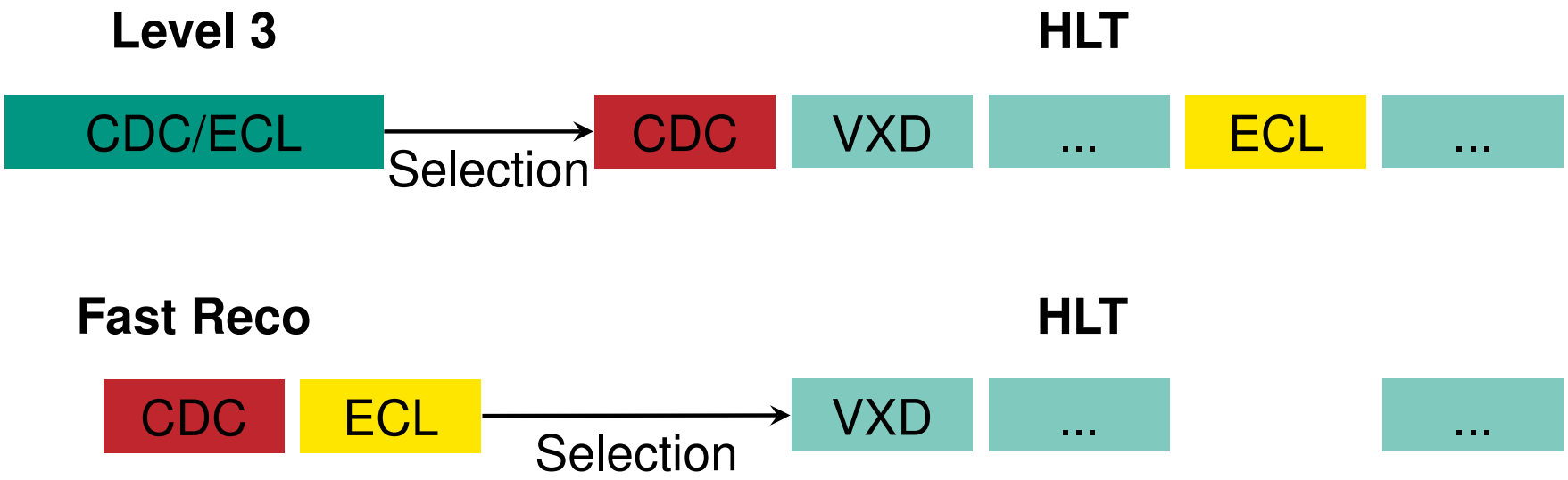
....

Studied Channels

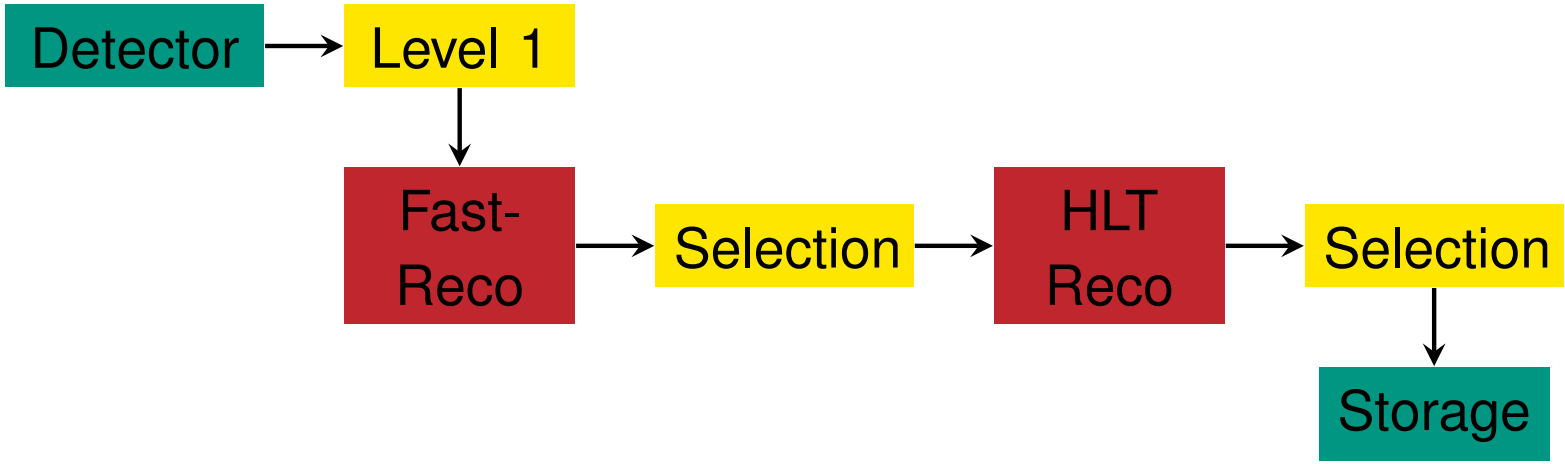
	Cross Section (nb)	Background
$ee \to ee$ (Bhabha)	74.4000	(False)
$ee \to eeee$	39.7000	True
$ee \to ee\mu\mu$	18.9000	True
$ee \to \gamma\gamma$	3.3000	False
$ee \to \mu\mu$	1.0730	False
$ee \to \pi\pi$		False
$ee \to \tau\tau$	0.9000	False
$\tau \to$ 1 prong 1 prong		False
$\tau \to e\gamma$		False

The numbers are taken from 'Overview of the Belle II Physics Generators' by P. Urquijo and T. Ferber.

The new setup

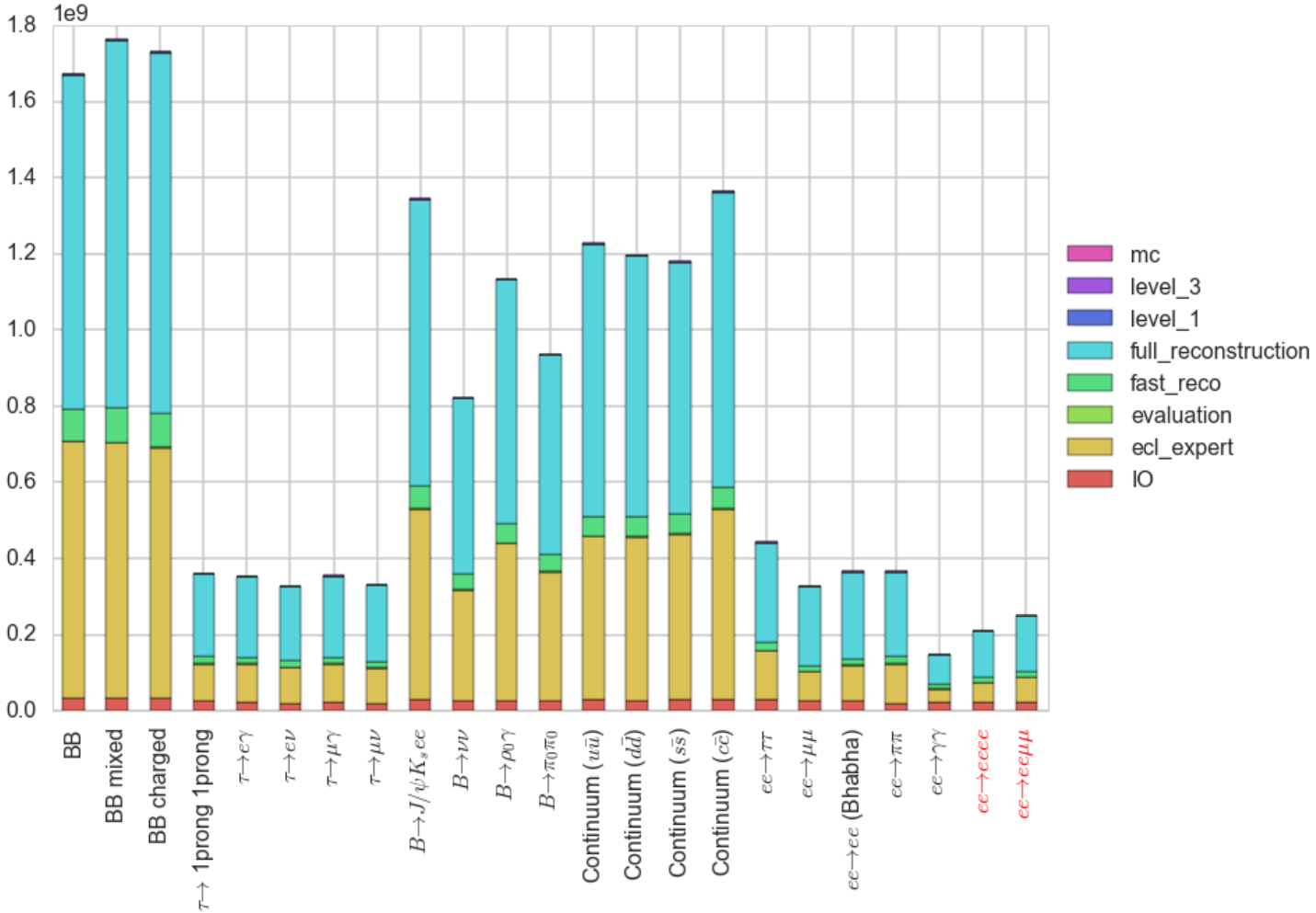


The HLT path using the `SoftwareTriggerModule`



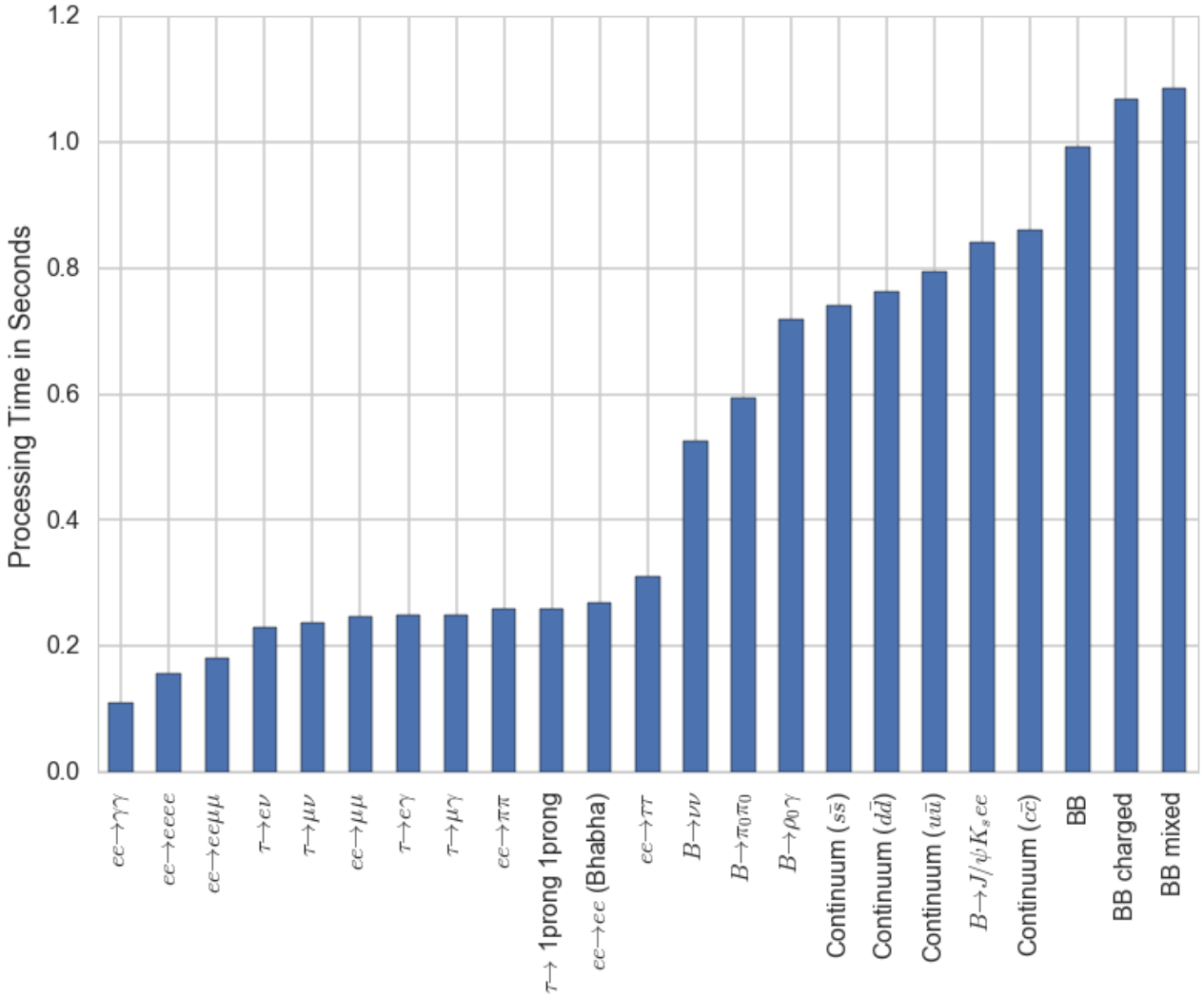
- FastReco includes CDC track finding (not fitting!) and ECL reconstruction
- The Selection is based on downloaded cuts from the database, which use basic variables (in case of FastReco) or advanced analysis variables (in case of HLT Reco).

Average Event Processing Time (in ns)

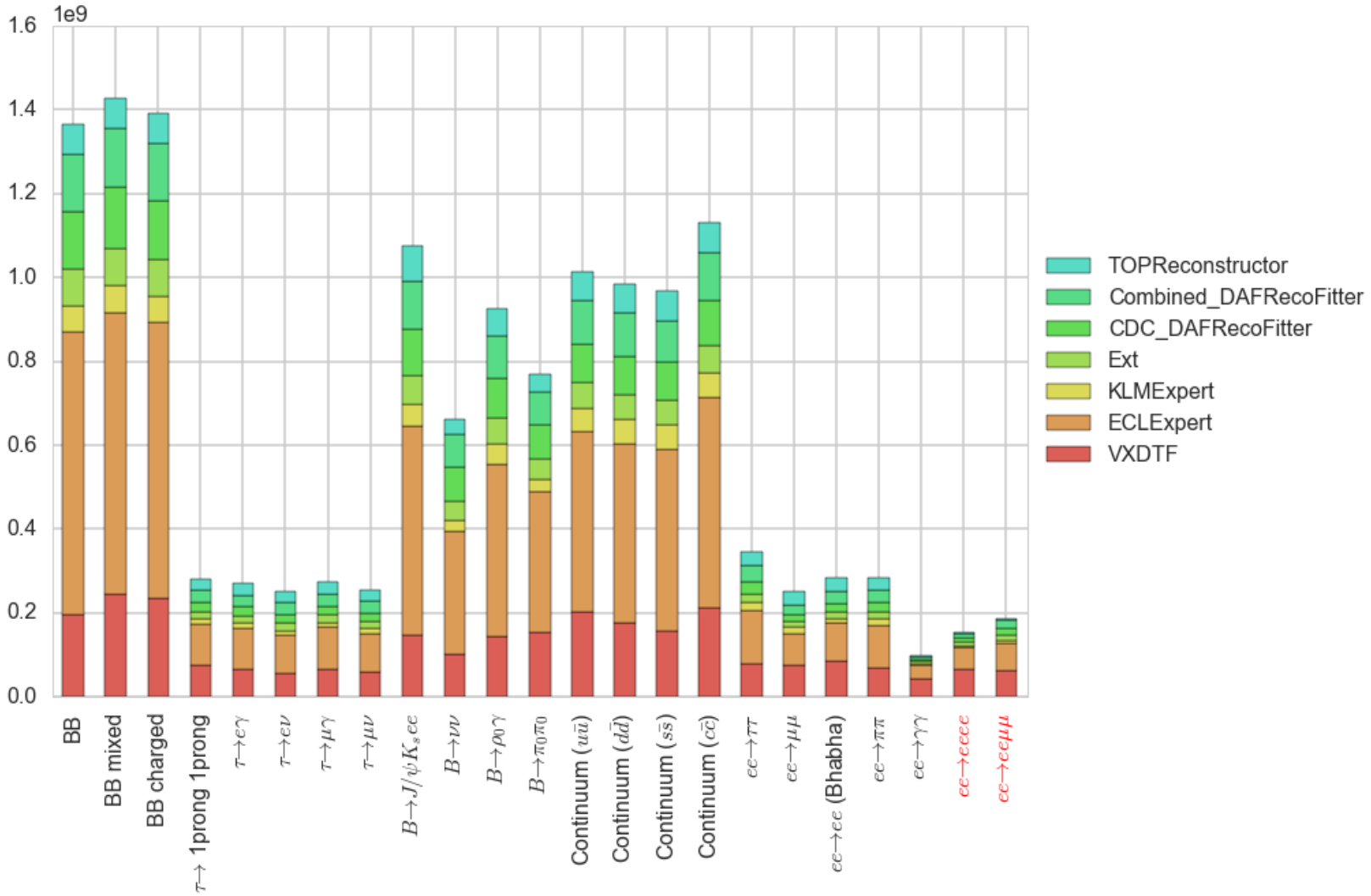


This test was done on a single core on the HLT workernodes.

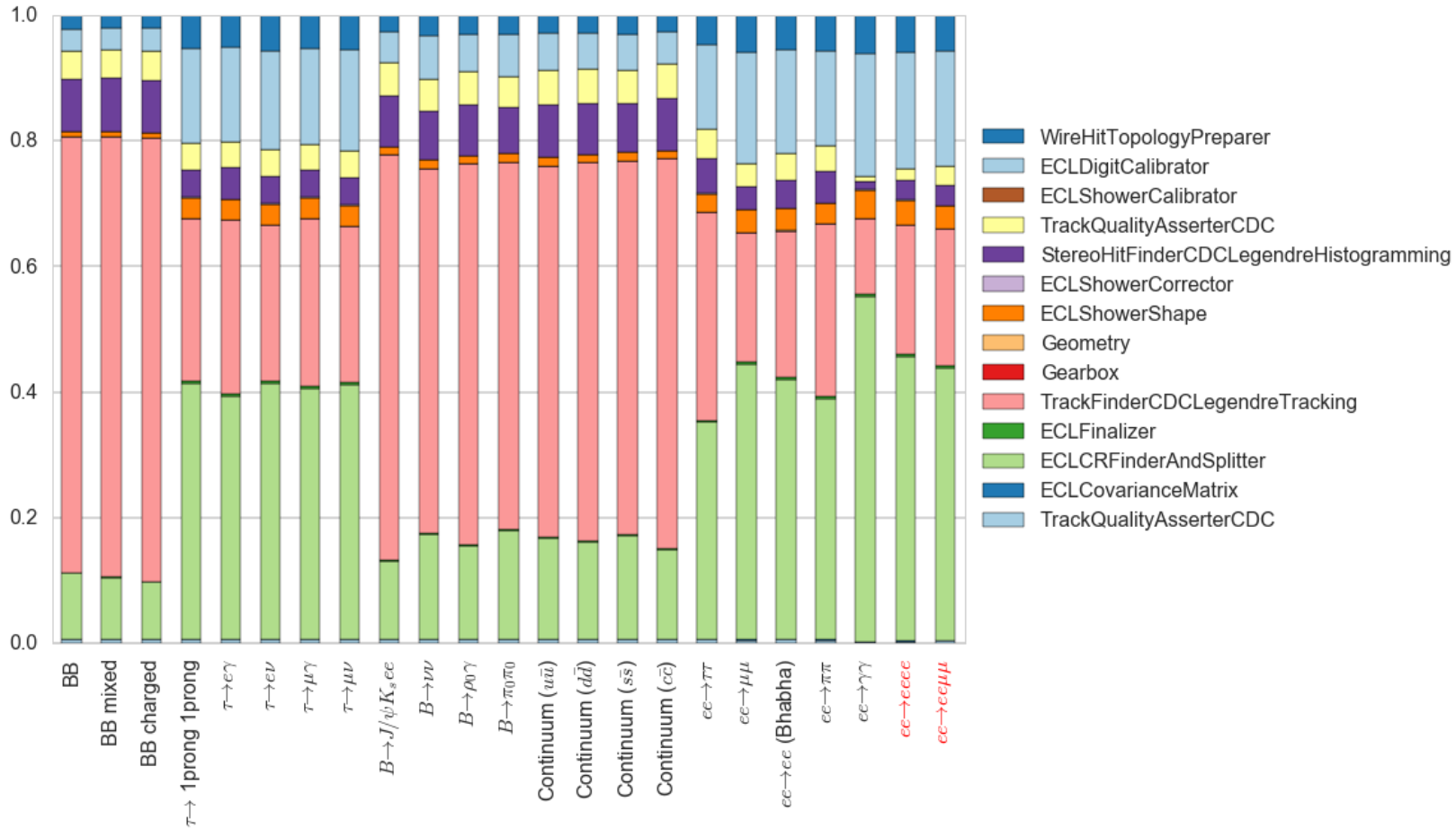
Average Processing Time for the relevant Modules



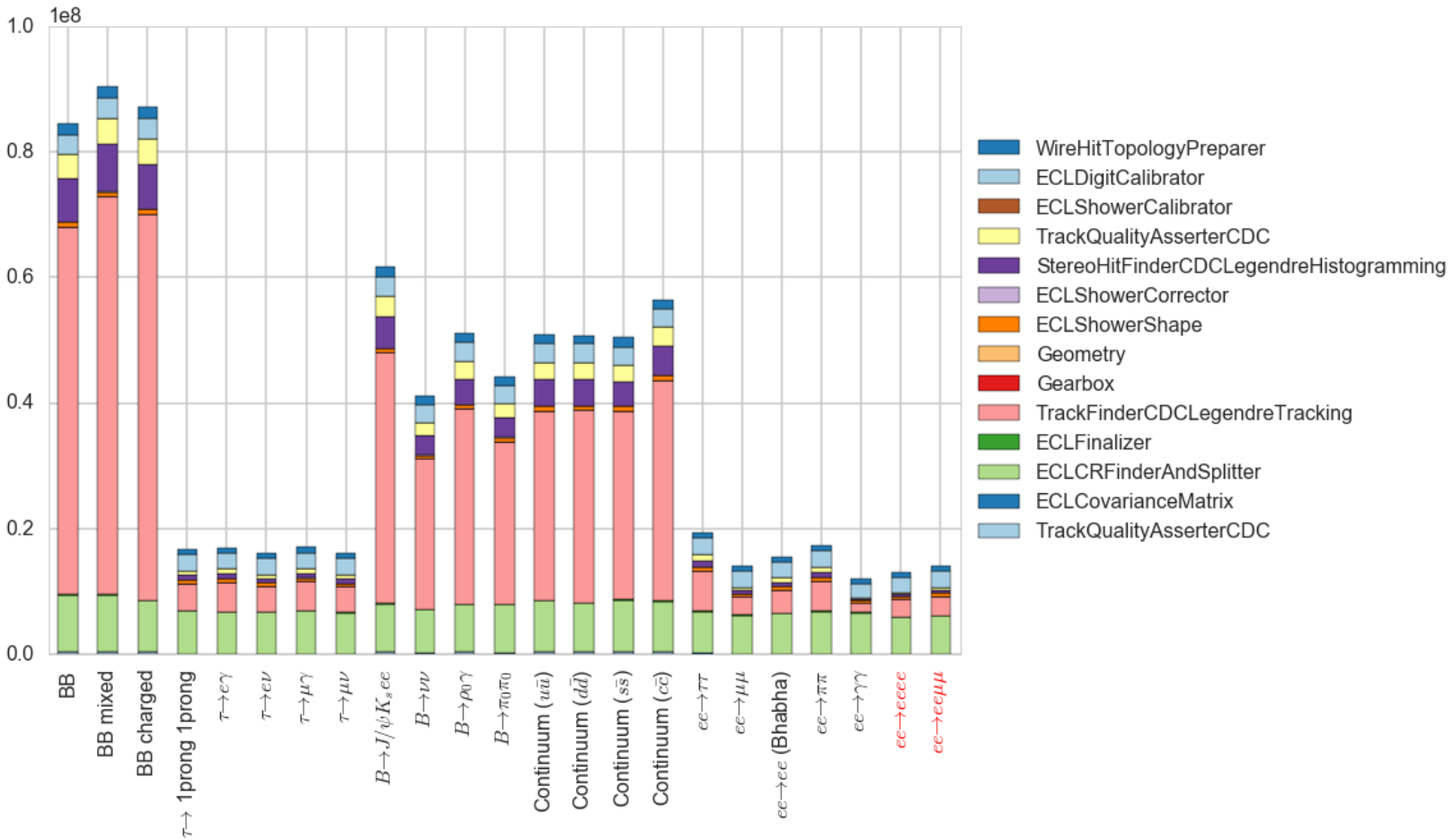
Top Time Consumers



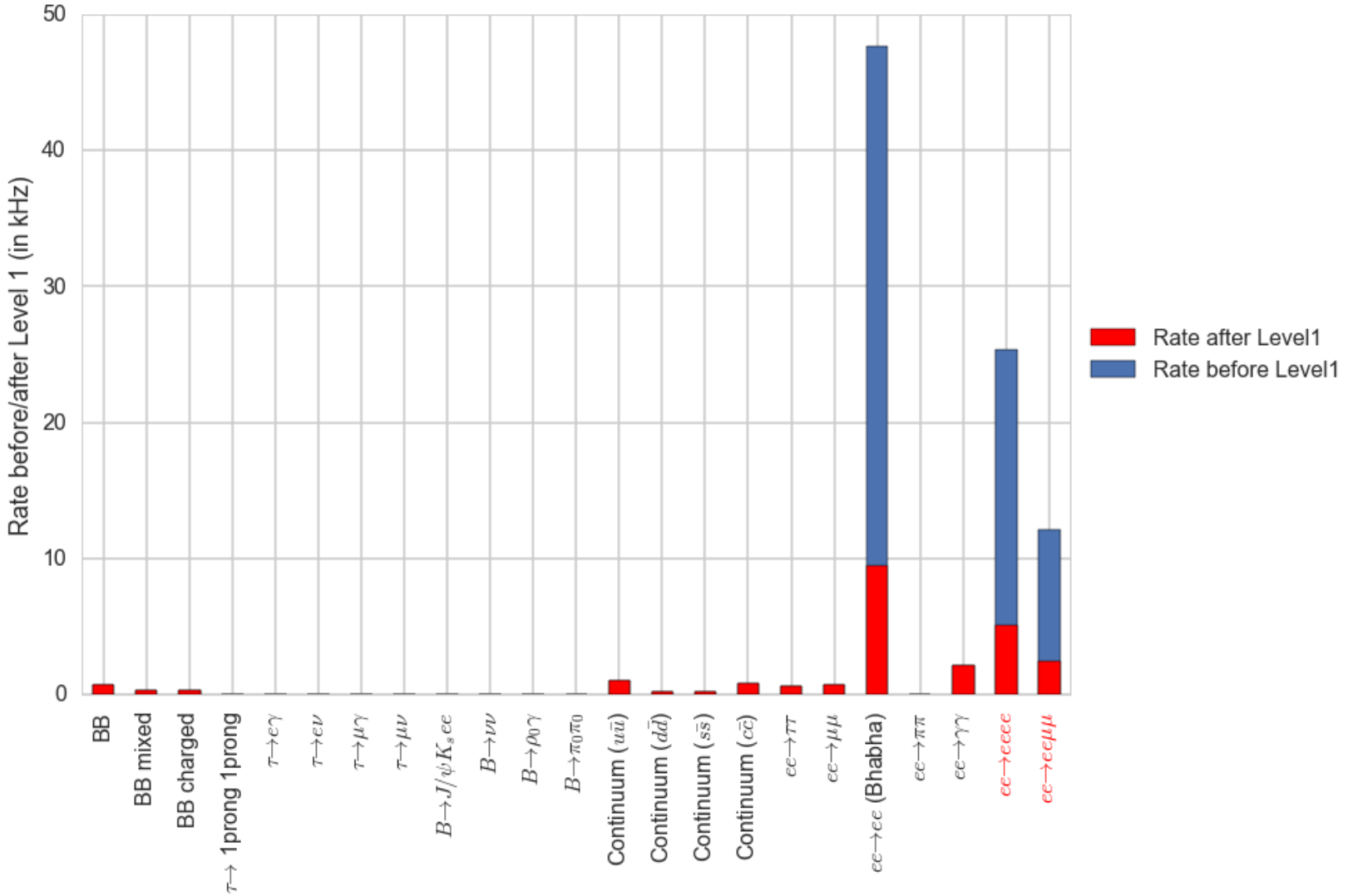
Average Ratio of different FastReco Modules



Average Ratio of different FastReco Modules

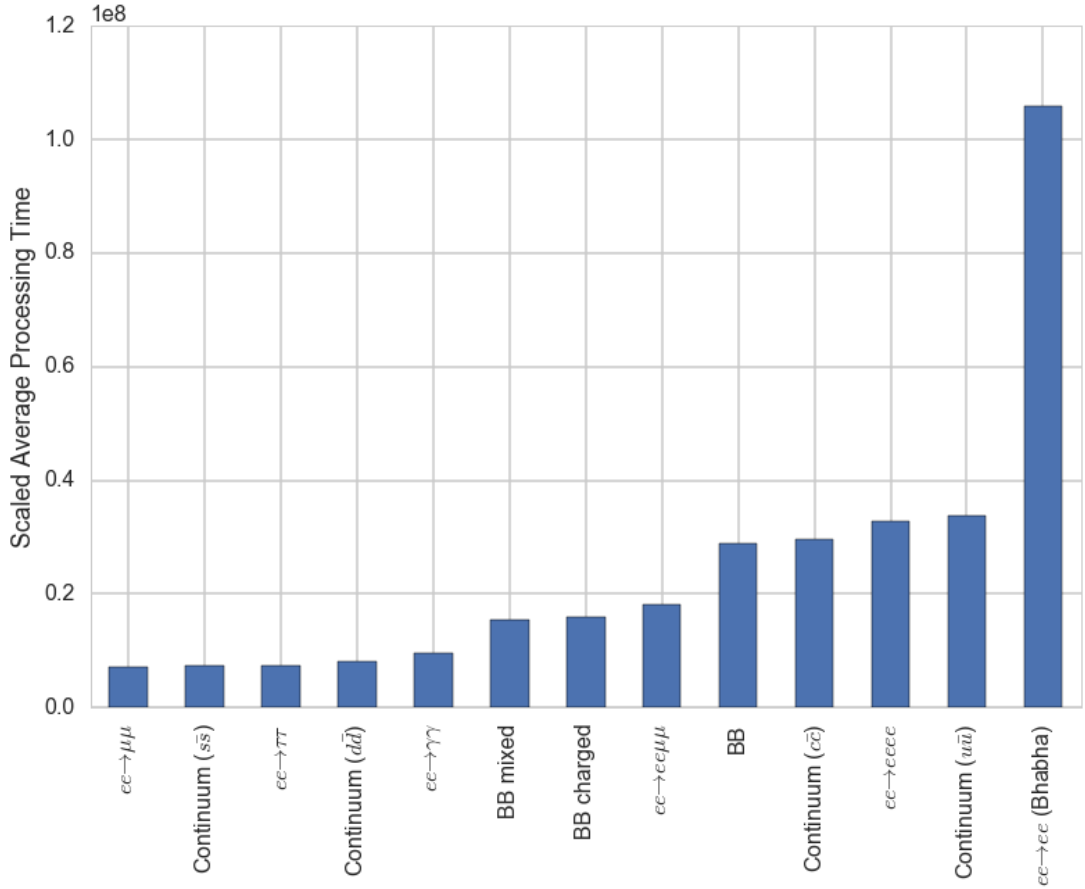


Assumed Cross Section after Level 1



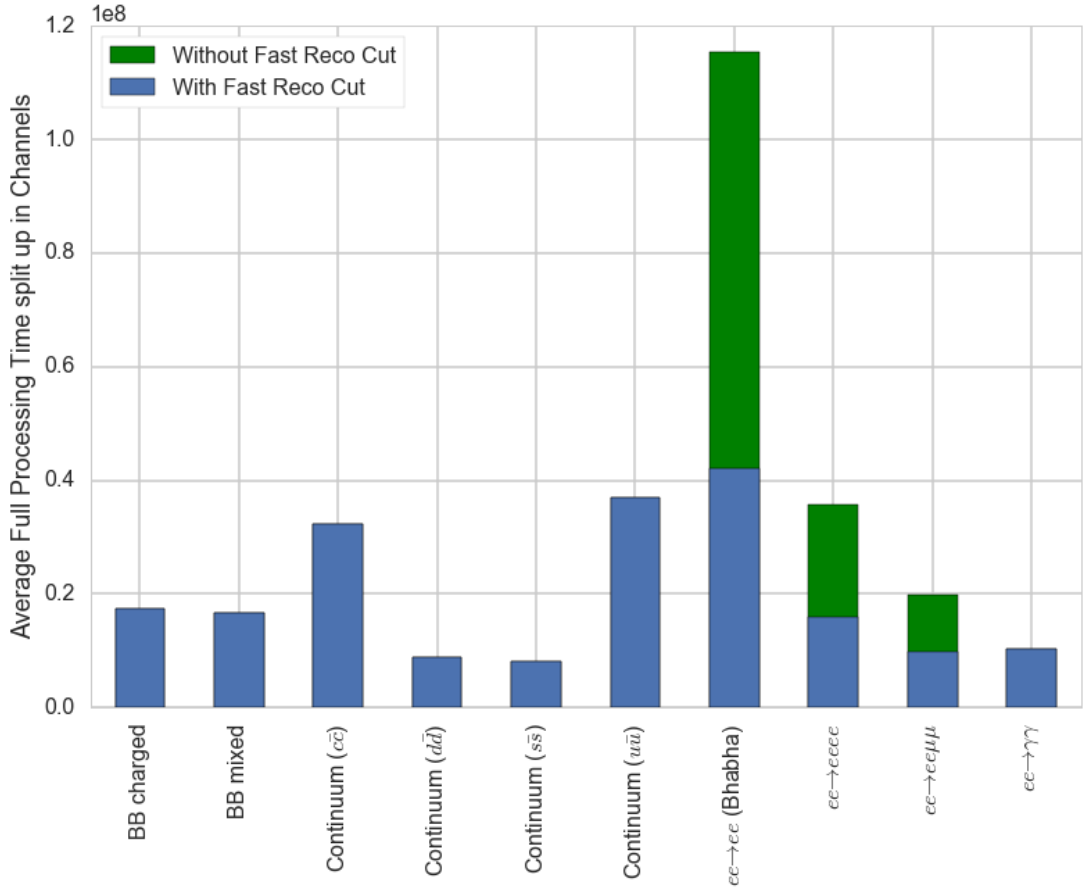
These numbers are just references as there is no complete L1 simulation available.

Processing Time Scaled with Cross Section



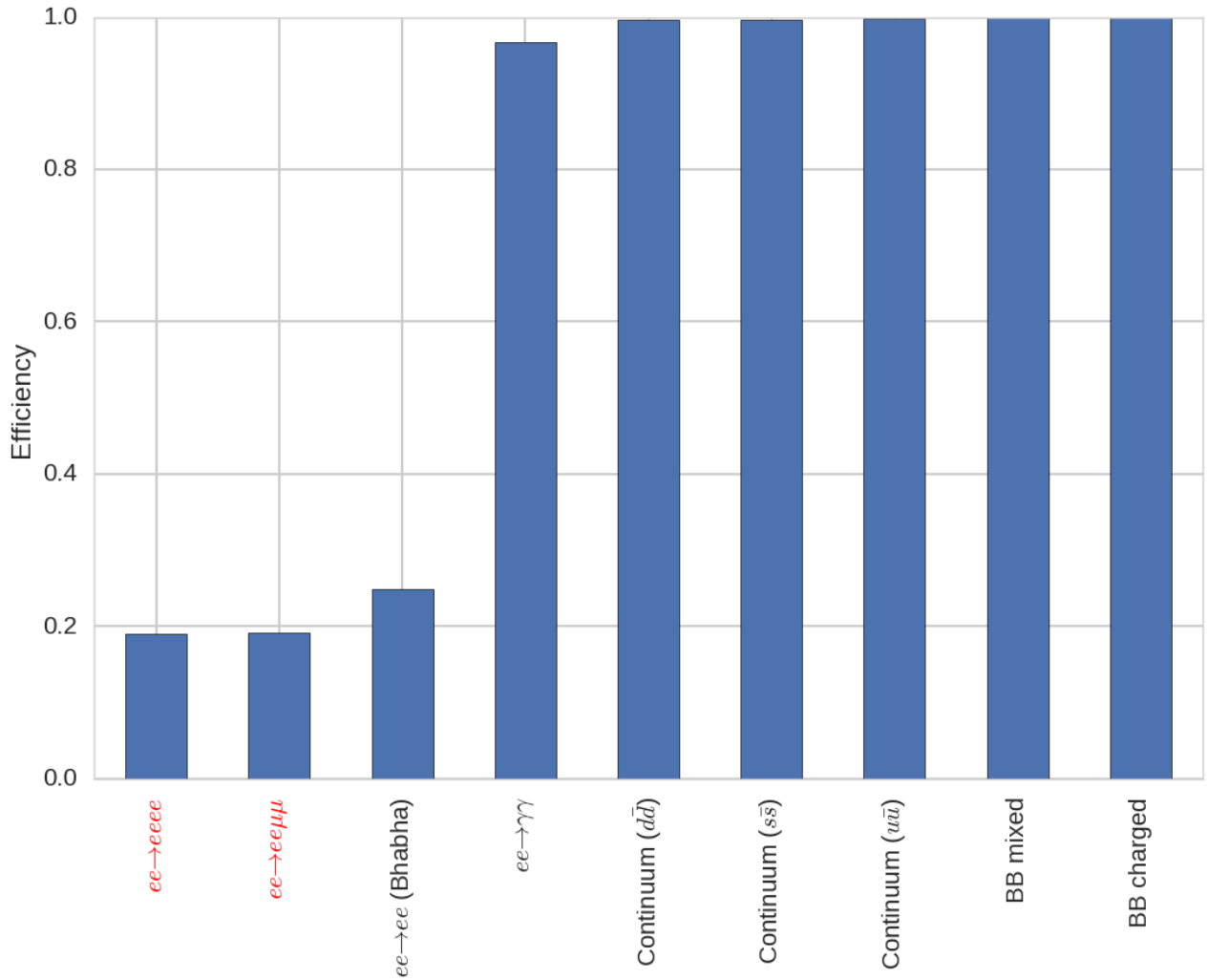
Average Processing Time: 0.30 s. Allowed time to reach rate goal: 0.30 s.

Processing Time after cuts



Average Processing Time with cuts: 0.198 s

Efficiency after FastReco and HLT



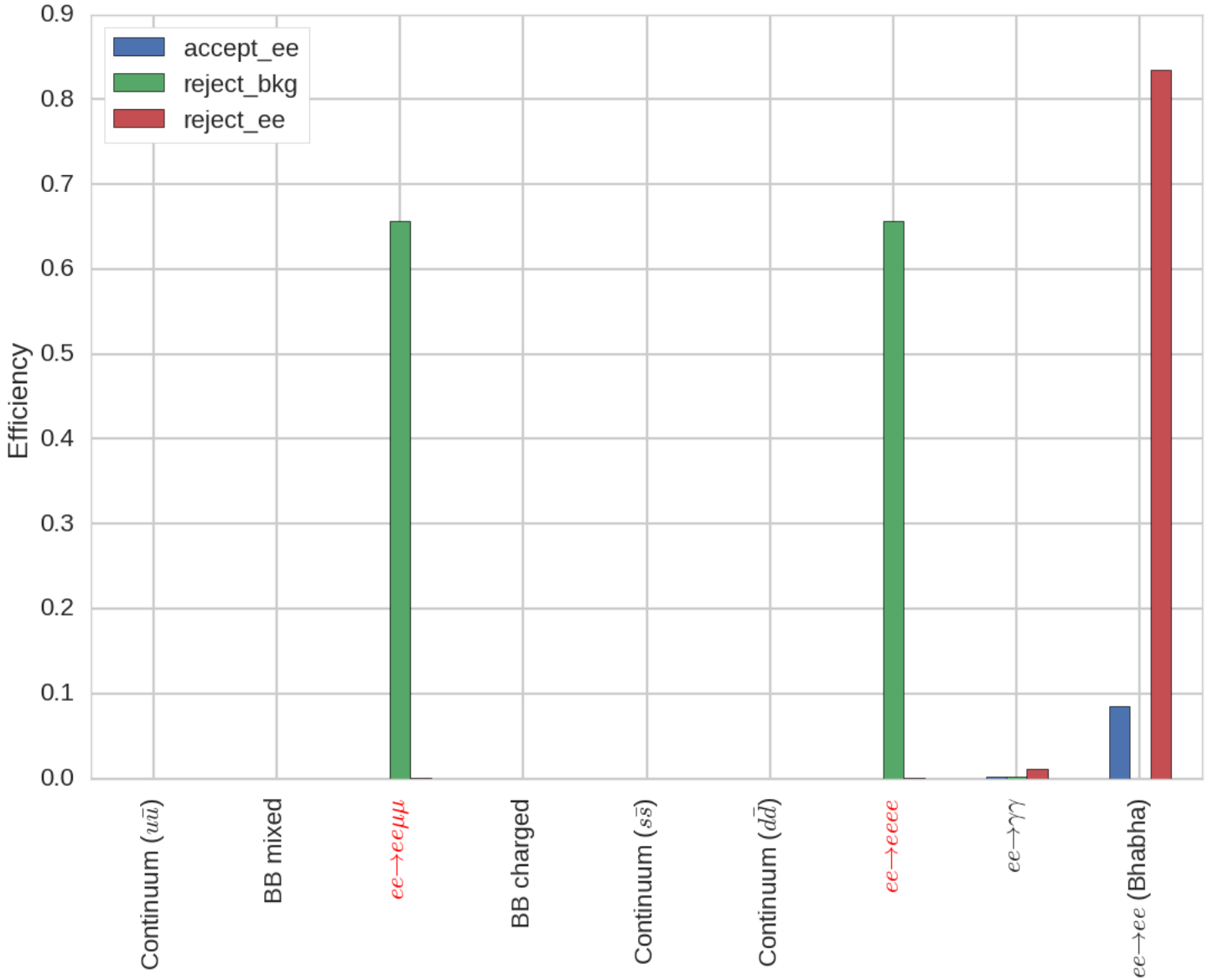
Cuts just based on FastReco and HLT information (work still ongoing).

Summary

- HLT software trigger stack is now fully implemented.
- Tracking plays an important role here - in giving important cuts and as a top time consumer.
- The time performance goal can be reached using FastReco precuts.
- Studies on multiprocessing showed: scaling is good enough to keep the performance goal.

Backup

Efficiency of the different FastReco cuts



Efficiency of the different HLT cuts