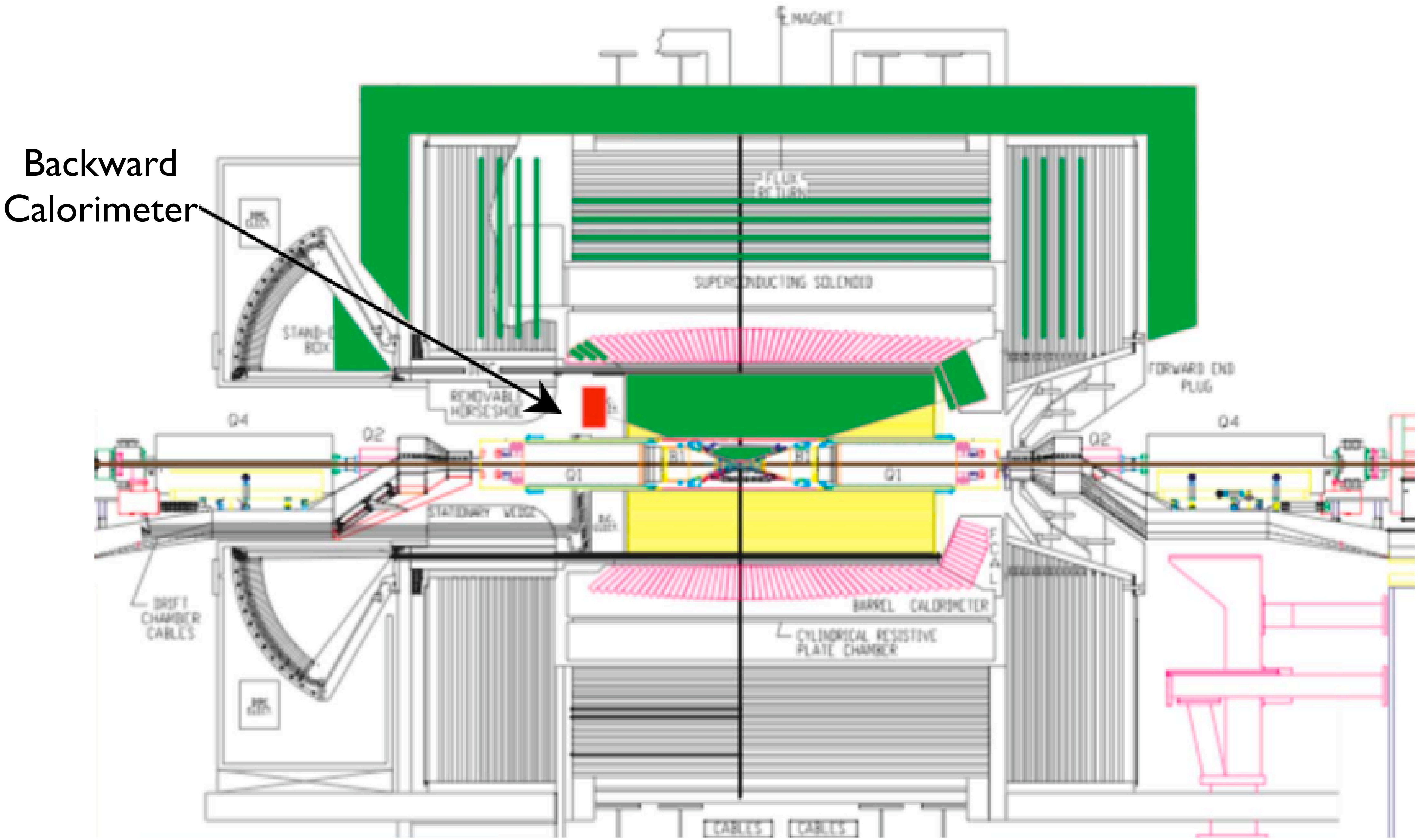
Plans of EMC Endcap Options Study

Chih-hsiang Cheng
Caltech

2009.02.16

SuperB Workshop, LAL Orsay, France

SuperB baseline design



EMC geometry outline

- Solid angle coverage: forward ~6%, barrel ~84%, rear ~ 4%

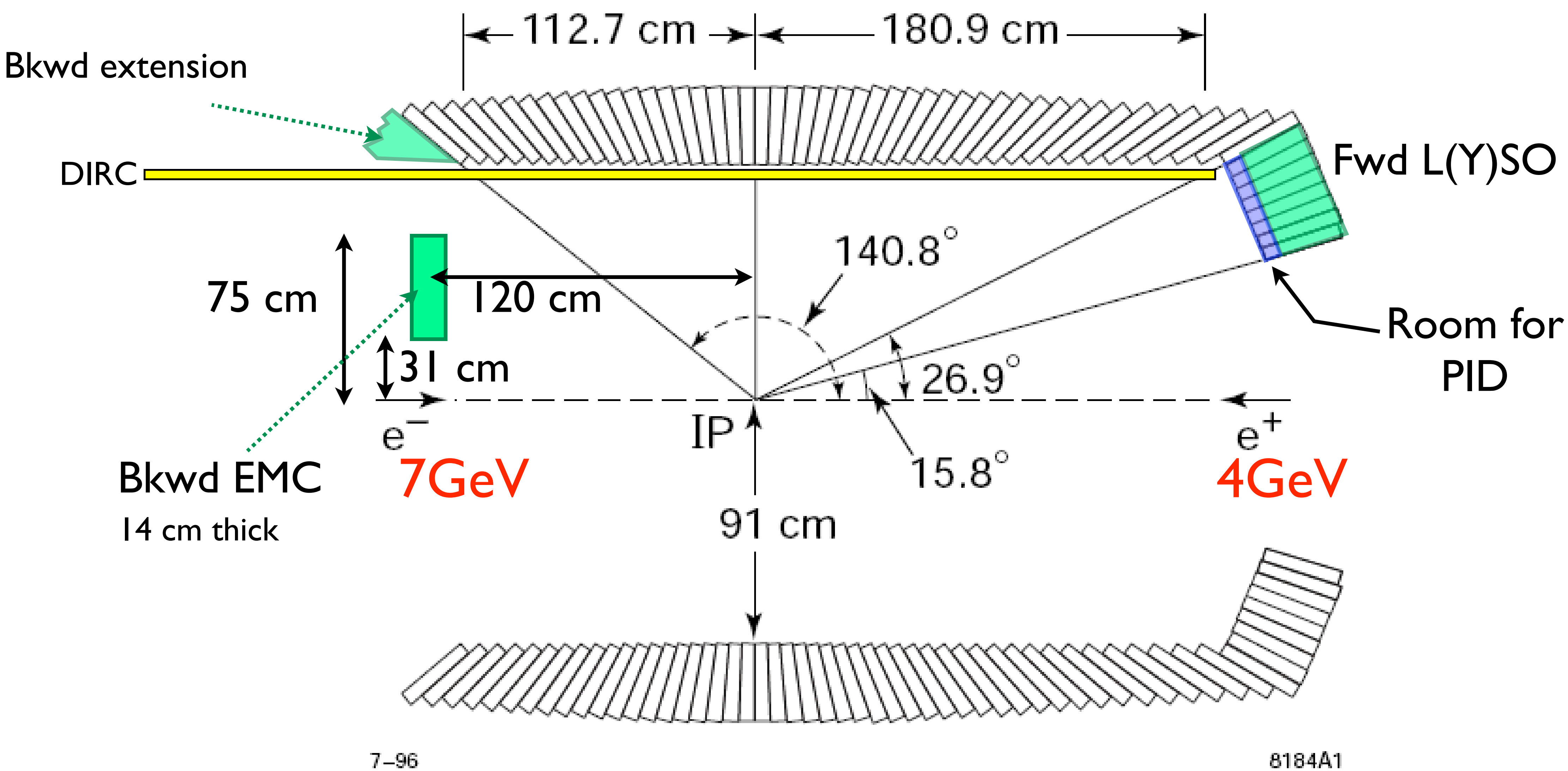
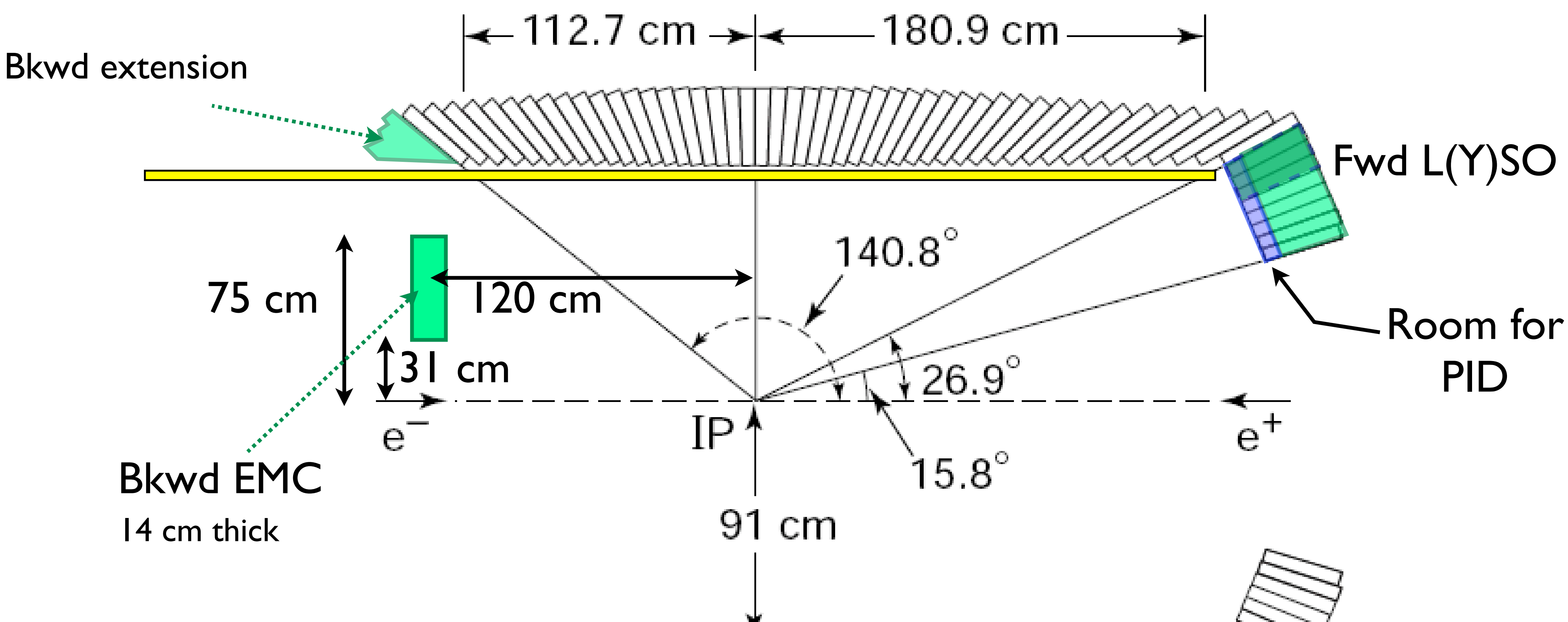


Figure 3-11. *The EMC layout: Side view showing dimensions (in mm) of the calorimeter barrel and forward endcap.*

Scenarios

1. Barrel (CsI(Tl)) only
2. Barrel + Forward Endcap (3 CsI(Tl) rings, 12 LYSO rings)
3. Barrel + Forward Endcap (~20 LYSO rings)
    1. with/without forward PID
4. Barrel + Forward Endcap (LYSO) + Backward Endcap
    1. with/without forward PID



Effects on basic quantities

- Photon energy and angular resolutions
  - materials in front, crystal sizes
- π^0 mass resolution, reconstruction efficiency.
  - energy/angular resolution, solid angle coverage.
- E/p
- Effects from background (machine and Bhabha)
  - How much of the forward endcap should be replaced by faster crystals, if not all.

- Main tool is fast simulation, with help from full simulation to tune parameters properly.
- Most of them can be done with single particle simulation.

Particle Identification

- EMC information used by BaBar PID (likehood, decision trees):
  - E, E/p, Lat, #crystals, Zernike moments (2,0) (4,2), s1/s9, s9/s25, second moment (θ,φ), shower depth.
    - E/p has the best discriminating power for electron ID.
    - FastSim doesn't know about shower depth.
- How elaborate should our PID be?

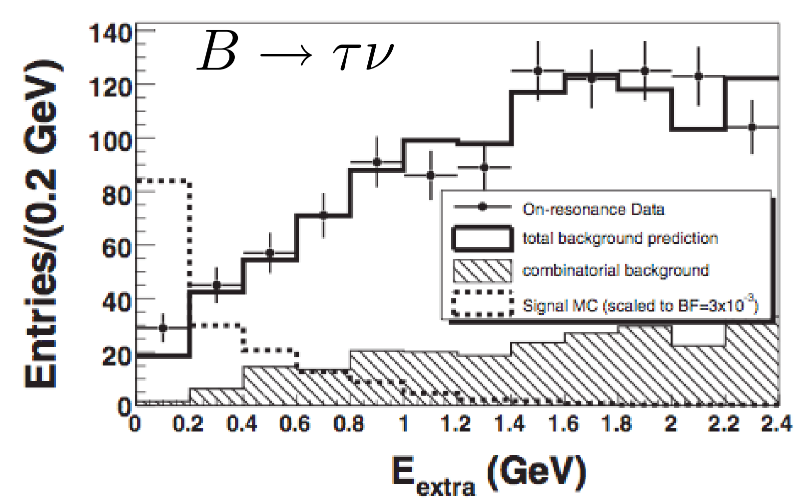
Physics channels

	H^+ high $\tan\beta$	Minimal FV	Non-Minimal FV (1-3)	Non-Minimal FV (2-3)	NP Z-penguins	Right-Handed currents
$\mathcal{B}(B \to X_s\gamma)$		X		O		O
$A_{CP}(B \to X_s\gamma)$				X		O
$\mathcal{B}(B \to \tau\nu)$	X-CKM					
$\mathcal{B}(B \to X_s l^+ l^-)$				O	O	O
$\mathcal{B}(B \to K\nu\overline{\nu})$				O	X	
$S(K_S\pi^0\gamma)$						X
β			X-CKM			O

$\tau \longrightarrow \mu\gamma$

- Many benefit from higher Breco efficiency.
- Good π^0/η veto essential for $B \to X_s\gamma$, $\tau \longrightarrow \mu\gamma$
- Tagging efficiency (time-dependent) study [coverage, e-ID,...]
- $B \to \tau\nu$ sensitive to coverage, background energy.

(More EMC specific)



Plans...

- Approach from both on detector resolution effects (use single particles, interplay with Geant4 simulation), and from on sensitivities to physics channels.
- Personally I will continue working on EMC fastsim (naturally, study the detector effects), and will start physics study with $B \to X_s\gamma$, and/or $B \to \tau\nu$.
  - There may be 1 postdoc and 1 gradstudent from Caltech joining the efforts.