IFR Fast Simulation

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**IFR geometry for the Super B**

- **SuperB IFR configuration is available in PacSim**
- **According to CDR:**
  - Number of active layers: 8
  - More # of Interaction lengths (6.5-7.5 instead of 5-6 we have now in BaBar)
- **Cylindrical geometry:**
  - N-agon will be available in the future
- **Outside the coil the magnetic field is modelled with a 0-Field**
  - Tracks in the IFR are straight lines

![Figure 4-41. Sketch of the longitudinal segmentation of the iron absorber (gray). Active detector positions are shown in white from the innermost (left) to the outermost (right) layers](image-url)
**IFR Fast Simulation: design**

Simple reconstruction: general design similar to the BaBar one

- **Digitization**
- **PacSimHit**
- **PacIfrHit**
- **Response of single scintillator \((x_0, y_0, z)\)**

**PacIfrResponse**

3D cluster (x track) made with the list of PacIfrHits associated with a track

- Final reco quantities associated to a track to fill IfrQual object:
  - last layer
  - layers active
  - average number of hits per layer
  - track chi2

**Reconstruction**

- **2D cluster (x layer) made with the IfrHits**

- **3D cluster (x track)**

- **No pattern recognition**
  - we known the PacIfrHits associated with a track

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Performances: muon selector

- *mu/π separation based on the # of traversed layers in the Iron: N>9 Layers*

Muons efficiency too optimistic, but the general features (shape of the efficiency versus theta and p) are in reasonable good agreement with the expectation

*Pions efficiency is too high! We need to better simulate the IfrResponse when a hadronic shower is produced*
Hadronic Showers

- When a hadron showers, PacSimHits are created within the IFR with some shower informations available:
  - Longitudinal development is parameterized (actual range is properly fluctuated)
  - For now, we do not take any other action for hadronic showers!

- Priority: better simulate the detector response to hadron showers and find the best shower parameters in segmented environment
  - A relevant aspect is the lateral development: some measurements (for \( E > 10 \text{GeV} \)) are available (Barreiro et al. DESY 89-171, 1989).
  - Generate (fluctuate) multiple PacIfrHit per layer, according to the transverse development
  - This will affect
    - the average size of the 2D cluster
    - the chi2 of the fit to the IFR tracks

- Use the Full Sim. for hadron showers
Next PacSim (V03) version

- Perform a fit to the 2D clusters simply with a straight line
  - Evaluate the matching between the fitted helix of the track and the track in the IFR at the coil
  - Fitter chi2 and the matching are crucial to properly discriminate between muons and pions

- Fill the IfrQual object with all the relevant quantity
  - Up to now only the number of penetrated layers is filled
  - Input to a simple cut based PID selctor (no NN or BDT!):
    - #penetrated layers (interaction length and expected interaction length in the muon hypothesis)
    - IFR track chi2
    - Matching chi2

- IFR response to hadronic showers: parameterize the shower development parameters

- Start to look at the $K_L$