SuperB Detector R&D Workshop
SLAC 14-16 Feb 2008

Planning for SuperIFR simulation

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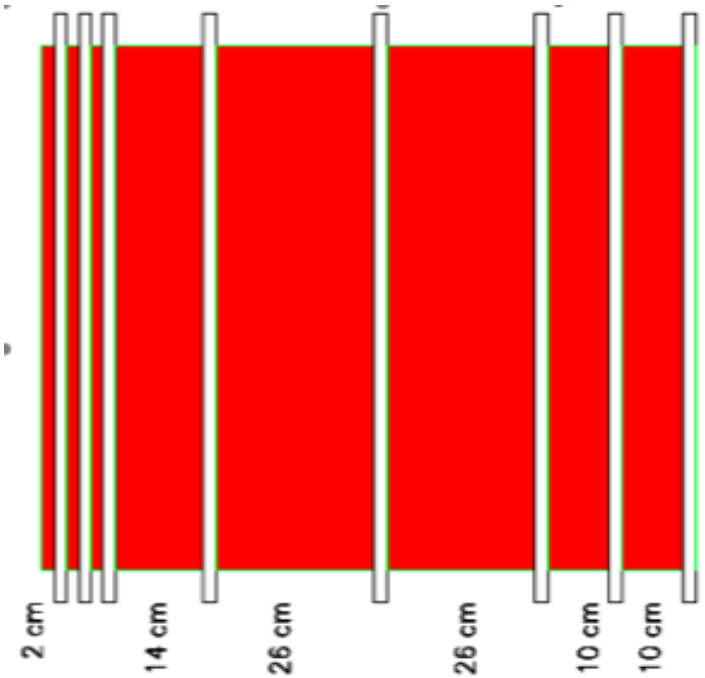
SuperIFR simulation

- *People involved:*
  - *Andreotti, Cibinetto, Munerato, Negrini (Ferrara)*
  - *Rotondo (Padova)*
- *Contact people: Andreotti, Rotondo*
- *Ongoing activities: just started*
  - *Optimization of the detector geometry*
  - *Interact with the background experts*
    - *upgrade the present IFR geometry*
  - *Fast simulation*
- *Start to think about a full simulation*

Detector Optimization

Baseline

- Add iron to BaBar stack to improve μ ID.
  - ➔ 7-8 detection layers.
- Re-use BaBar steel (still to be fully assessed)
- Keep longitudinal segmentation in front of stack to retain K_L ID capability.
- Backgrounds are problematic for gas detectors.
  - ➔ Use Minos style scintillation bars.



- ***Studies on the simulation and background evaluation need to be performed soon:***
  - *Time resolution and spatial segmentation (ϕ-z segmentation)*
  - *Configuration of active layers and absorbers (transverse segmentation)*

Detector Optimization

*For these studies it is **desirable to use a full simulation** in order to have a detailed simulation of the hadronic showers*

Use the BaBar framework gives many advantages:

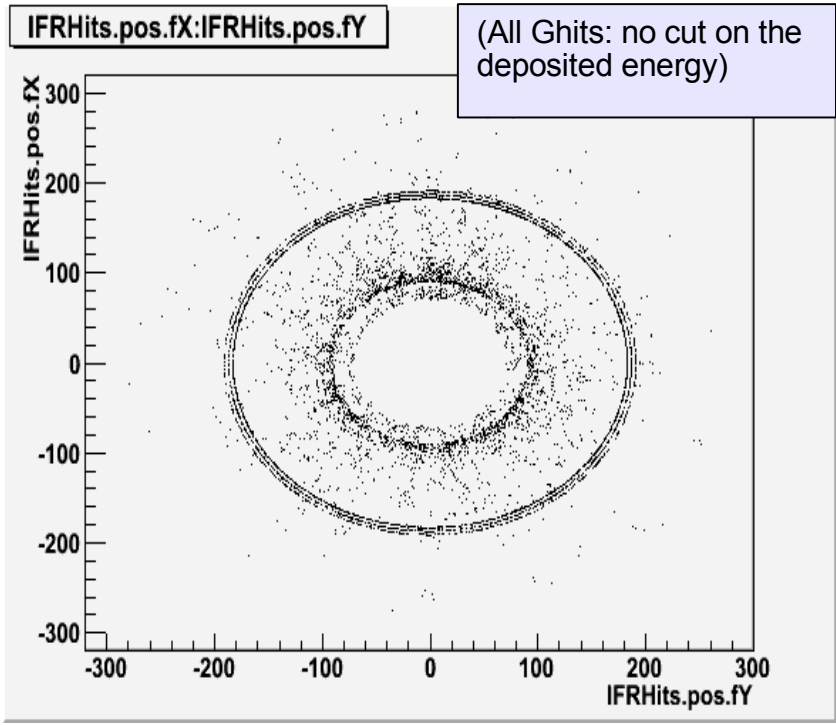
➔ *we need reconstructed information from other detectors: for ex. swimmer from DCH*

➔ *In terms of interaction length, all detectors inside the BaBar IFR are not so different from the CDR SuperB configuration*

Need to include the effect of the bacgkround, how?

Effect of the background

Simulated machine background available from a Geant4 standalone simulation (Calderini, Marchiori)
We have root files with hit information

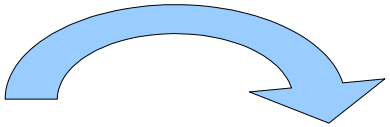


Extract the spatial distribution of the rates due to the background

The parameterized rate will be inserted like a noise in the BaBar MC reconstruction

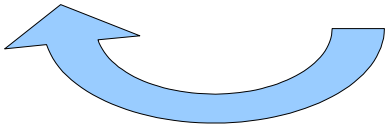
Evaluation of background effects in terms of inefficiency in the
- swimming of tracks from DCH
- clusters reconstruction

Background <-> Simulation



- ***Bacgkround simulation side***
  - *Improve the IFR geometry description: now simple G4Tubes*
  - *Try different geometries (segmentation)*
    - *Many advantages moving to a description based on GDML*

- ***BaBar simulation of SuperB side***
  - *Detector optimization*
  - *Effect of different geometries/resolutions*



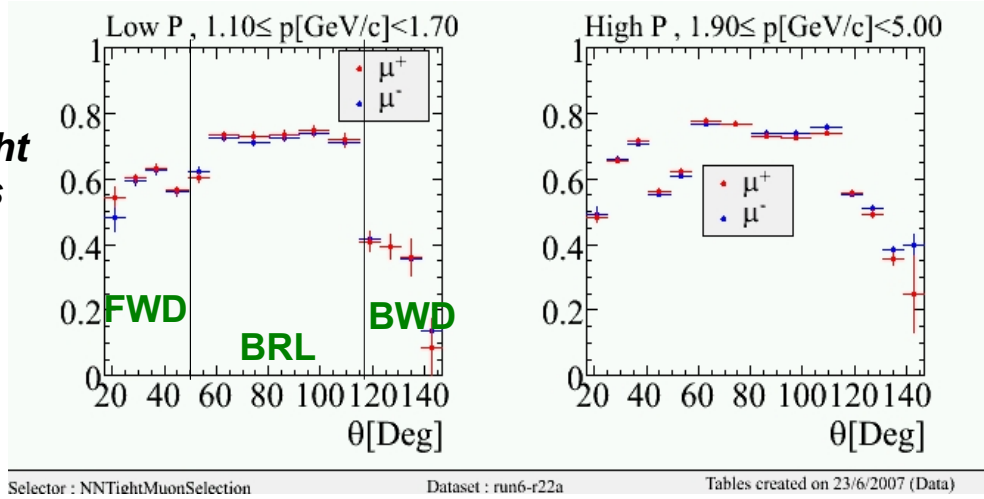
Many iterations between IFR people and Background people could be needed

Fast Simulation

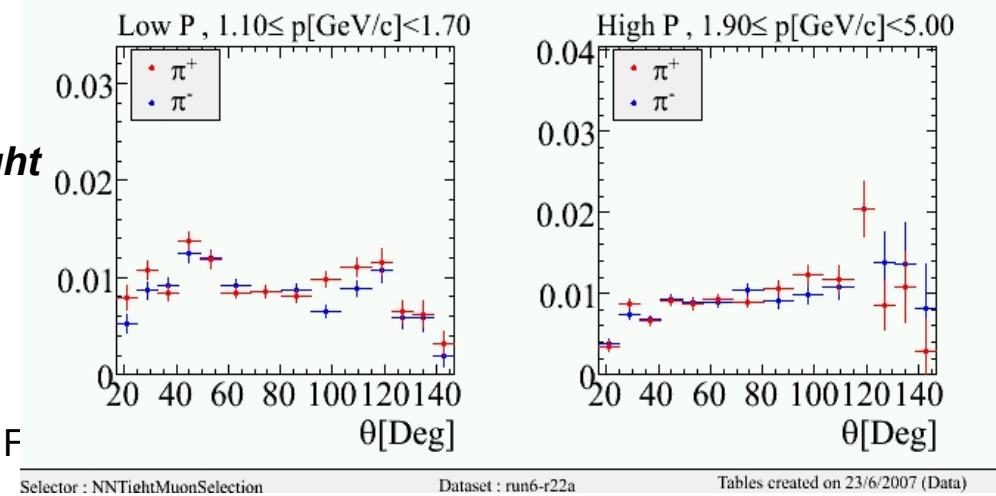
- *PravdaMC: the DIRC and the IFR are not described*
- *At present: the overall PID efficiency/mis-ID is given using the BaBar PID tables (ASCII files)*

- ***Order 0:***
  - *Redo the tables with reasonable guess on the mis-ID and efficiency*
  - *Use the estimated inefficiency (parameterized in P,θ,ϕ) obtained from the detector optimization studies*
  - *(equalize the FWD and the BWD parts)*

NNTight muons

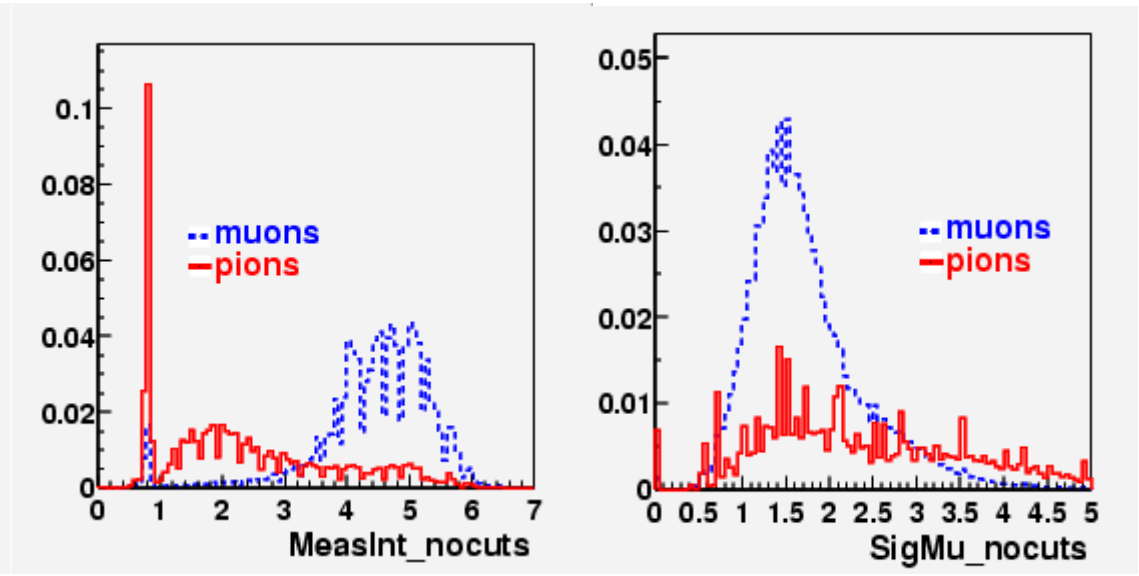


NNTight pions



Fast Simulation

- ***Order 1:***
  - *A parameterized output can be easily provided in Pravda, using the existing reconstructed output from BaBar IFR reconstuction, for example:*
    - *N-Interaction lenghts*
    - *hit multiplicity x layer*
  - *Run the (almost)standard muon selector on these quantity*



- Advantages: *implicitly these PDFs parameterize the hadron showers;*
- These PDFs need to be changed according to the full simulation or using reasonable guesses;
- The effect of the background can be propagated to these PDFs according to the detector optimization studies

Preliminary conclusions

- *For the detector optimization and the evaluation of the background effects we will take advatage of the existing BaBar full simulation*
- *To implement a reliable Fast Simulation a detailed parameterization of the hadronic showers and the inefficiency due to the background is :*
  - *important for μ/π separation, and crucial for the K_L identification*
- *The inefficiency due to the bkg, parameterized as a function of (P,θ,ϕ), can be used in a Fast Simulation (PravdaMC Stile)*
- *The IFR fast simulation with Pravda can be done at different level of details*