# Thoughts on Fast Simulation for SVT Optimization

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# What are the goals?

- Detector optimization
  - radii of the 6 layers
  - material of Layer0
  - angular coverage
  - measure of charge deposition (for dE/dx)
  - etc.
- Detector performance estimation
  - track parameter resolutions
  - hit, track efficiencies
  - fake track rate
  - etc.

These are two distinct use cases. Optimization is less demanding on simulation than performance estimation.

# SVT Optimization

- Layer0
  - radius
  - intrinsic resolution
  - material budget

  } Impact on L0 technology
- Acceptance – angular coverage
  - heavily constrained by the machine
- Outer layers
  - radius
    - no support tube (as in Babar)
  - geometry
    - smaller boost ($\beta\gamma$=0.28 instead of 0.56)
    - bending in outer layers
  - dE/dx capability → decision on readout electronics

Note: sometimes optimal design choices are trivial (e.g. layer0 material should be as small as possible), and technology, cost or geometrical constraints will drive the design. This is true for many of Layer0 parameters.

# Questions

Matteo asked us to answer 2 questions:

1. Is a fast simulation still useful to do optimization studies of SVT? If so, what is needed that Pravda cannot do?
2. Is there the need of having machine background events in the fast simulation to optimize the detector? Or instead do you need different tools, like a full simulation with Geant4?

# Answers I

1. Is a fast simulation still useful to do optimization studies of SVT? If so, what is needed that Pravda cannot do?

- Yes, a fast simulation will be important for SVT optimization. Some things that **Pravda cannot do**:
  1. Pattern recognition – tracks are made from known hits, I.e. perfect pat rec is assumed
  2. No Kalman fit – Billior technique is used for track errors → underestimate in some cases
  3. Perfect helix parameters – energy loss not accounted for
  4. Ks decays not handled correctly
- Do we need these features for optimization? Probably not. For performance estimation, we probably need to have 1) and 4), at least.

# Answers II

- Is there the need of having machine background events in the fast simulation to optimize the detector? Or instead do you need different tools, like a full simulation with Geant4?

- The answer to this question is similar to the answer to the previous one: for optimization, no; for performance estimation, probably. Of course, when estimating performance, the tools you need will depend on how good you need the estimate to be.

Of course, we already know a lot about SVT from our BaBar experience. Perhaps a combination of fast sim plus practical experience with BaBar can give us what we need, without resorting to a full GEANT simulation.

# Last time: BABAR TDR

- BaBar TDR came out in April 1995, some four years before the start of first data taking.
  - A fair amount of preliminary work had already been performed for the Letter of Intent, which appeared a year earlier.
- Most (all?) of the detector optimization was done with TRKERR, which is the main component of PRAVDA.
- Much of performance estimation was done with TRKERR, although some aspects, such as pat rec and fake rates were studied with the full simulation (which already existed in 1995).

Again, it may be feasible to use BaBar to study any PRAVDA/GEANT differences and apply them to the SuperB case, if not enough resources are available to develop a full simulation on the required time scale.

# Summary

- Detector optimization of SVT can be performed with PRAVDA and perhaps some judicious extrapolations from BaBar.
- If we want accurate performance estimates of the proposed SVT, we will probably have to augment PRAVDA with something more detailed.