# Software Overview

S. Margetis

Kent State University

# People (current)

- Kent, LBL, MIT, Prague, Purdue, (BNL)

# Software for CD0

- **Need for Simulations and detailed Detector Performance Evaluation**
  - We are capable of very good and detailed simulations, incl. pileup
  - We have several tools ('Quick'/'Full Chain' MC tools + Experience)

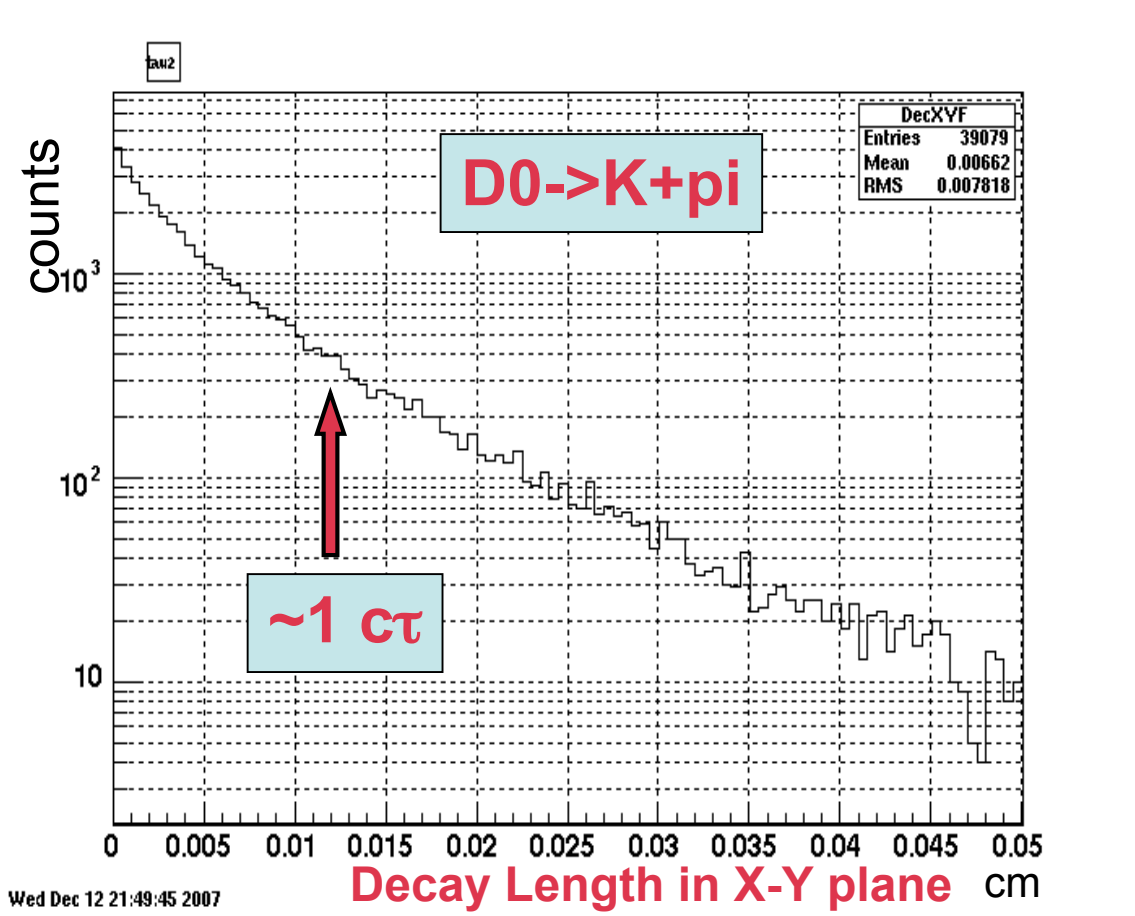
- **Realistic Simulations are very important**
  - We use them to validate the hardware design
  - Give feed back for optimization
  - Use and develop the software that will later be used for Physics Analysis

- **It is the best tool to optimize the system**
  - Beyond validation can trigger hardware revisions/restructuring
    - E.g. Tracking efficiency, backgrounds (received, generated) etc
  - Only caveat is that full simulations lag behind 'Quick' tools

**We are in a good position mainly due to many years of dedicated effort**

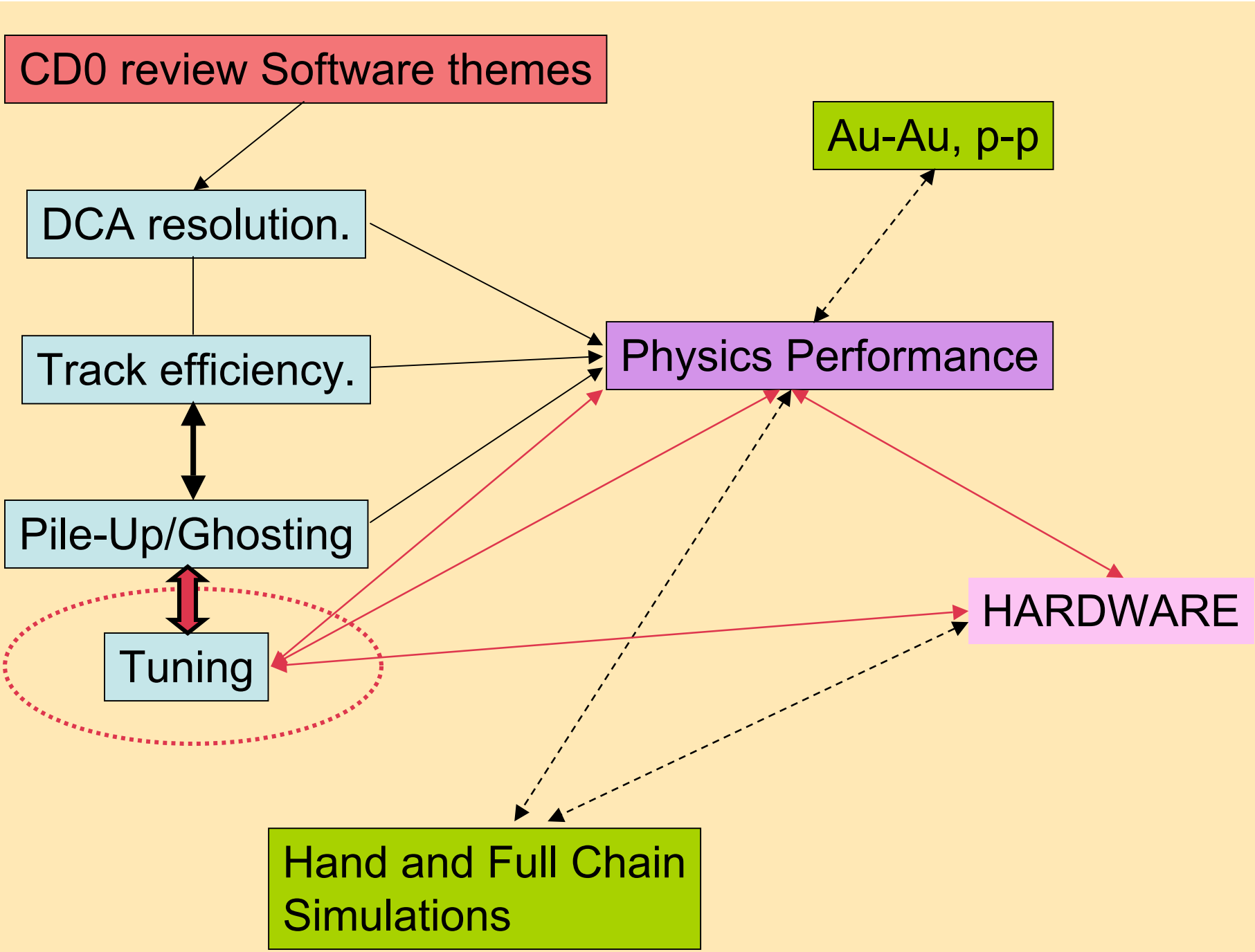
# D0 decays

- In mainstream Heavy Flavor the D0 decays are the hardest decays to reconstruct
  - They essentially drive the detector requirements on thickness and DCA accuracy




- Used <pt>~1GeV
- 1 GeV/ $\eta$=0 D0 has $\beta\gamma \sim 0.5$
  - Un-boost in Collider !
- We want to recover as much as possible

**That is why track pointing and alignment envelop are set to < 20 μm**


CD0 review Software themes
Au-Au, p-p
DCA resolution.
Track efficiency.
Physics Performance
Pile-Up/Ghosting
HARDWARE
Tuning
Hand and Full Chain Simulations

# Some important details

- **Geometry (in GEANT)**

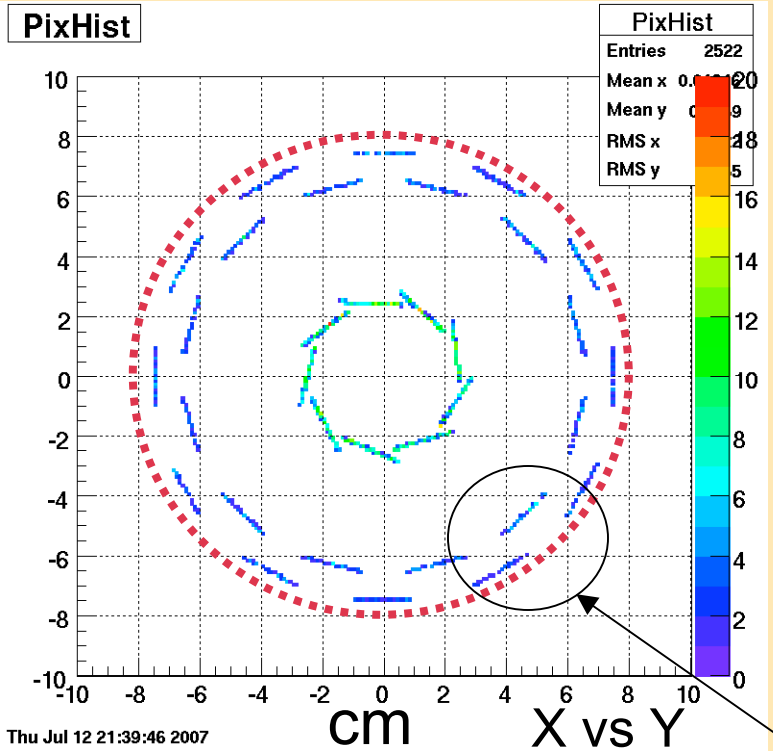
  • Extra material in active areas is present and accounted for but we do not have a full implementation of support structures for new detectors right now

  • The rest of STAR is as detailed as of today!

  • A few variations of the proposal geometry were tagged (for evaluation purposes)

  • It takes a couple of months to implement a new geometry in the system, with GEANT expert help from BNL core group

# Geometry (details)

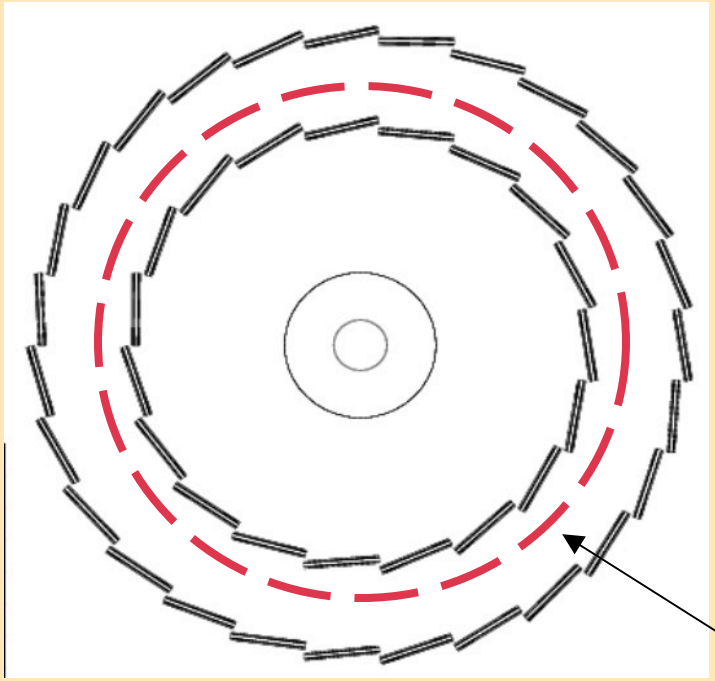



**PIXEL**

- This is how the Pixel part looks like in the proposal geometry

- Latest design moved outer layer slightly outwards (to 8 cm). This slightly improves the overall efficiency. Also the inner-barrel number of ladders increased from 9 -> 10

# Geometry (details)



## IST

- The proposal design had three single-sided strip detectors arranged in two layers.

- Current thinking involves a single one-side layer at ~14 cm with much shorter strips.

Eg. Instead of 60 um x 2 (4) cm
500 um x ~1 cm

# Some important details (cont.)

- **Simulators**
  - Realistic response simulation of readout and resolutions
  - TPC in proposal has latest dead RDOs
  - Pile-Up hits in Pixel (pileup events, UPC-e, Background) were estimated and included in simulations (for various RHIC-II luminosity scenarios)
- **Tracking**
  - Standard STAR framework, minor tweaks in effective hit errors to bring singe track efficiency to anticipated levels.
- **Analysis**
  - Standard methods with some ‘CD0-short cuts’ for convenience

# Software in the near future

- **Need for fine tuning the design**
  - Interact with Engineers
  - We have the tools
- **Calibrations**
  - Stringent requirements require slightly different methods than ones used so far but we have valuable experience
- **Precise evaluation/optimization of physics performance**
  - Anticipate reality
  - Software tools should explore every possible cut variable

This will probably be the most thin/precise vertex detector ever built

# Summary

- Software and Simulations are mature and realistic
- We have a good understanding of the demanding environment and of what is needed for successful operation of the device
- We have started (and will continue) building the analysis framework to be used on real data