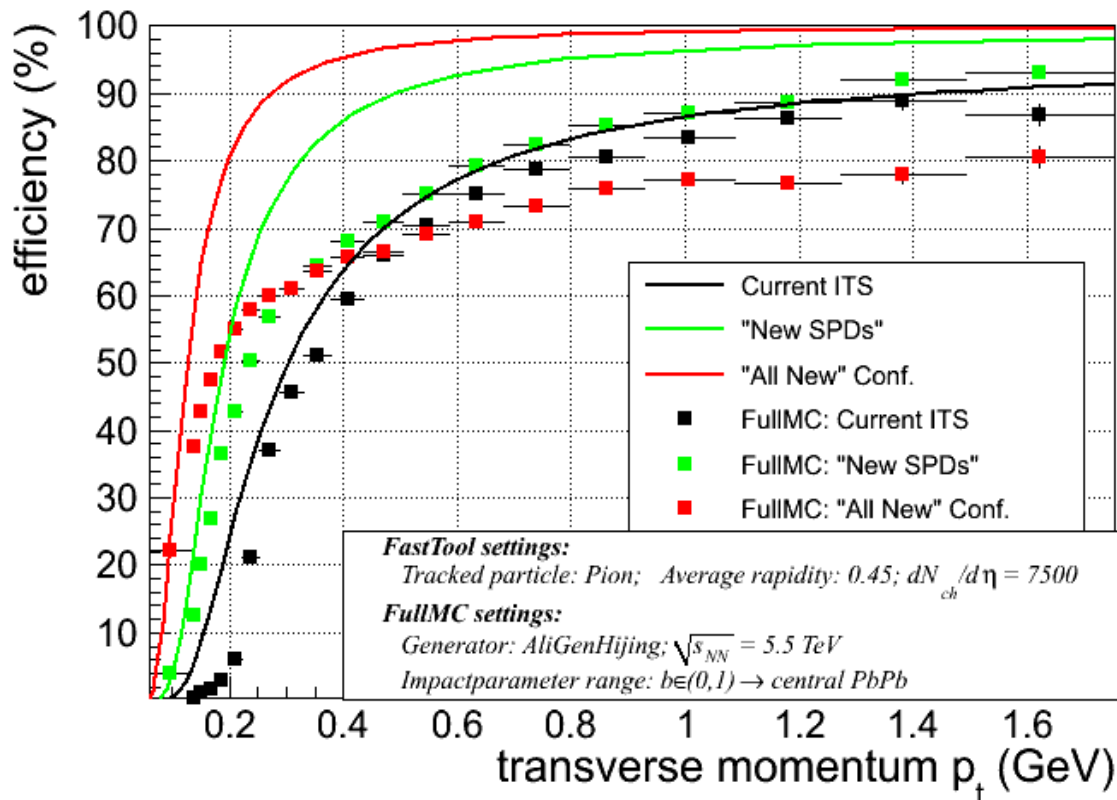


Tracking efficiency studies

12th of September, 2011



The scenarios:

- New SPDs (exchange only Pixels)
- All New (build a completely new detector)

The tools:

- Fast (semi-analytical) Tool
- ITSupgrade code in AliRoot

The problem:

- The tools do not agree ...

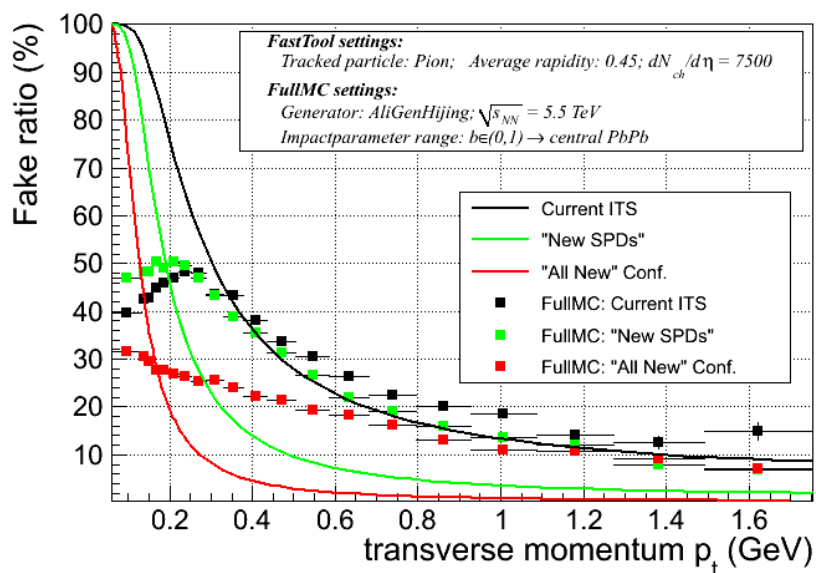
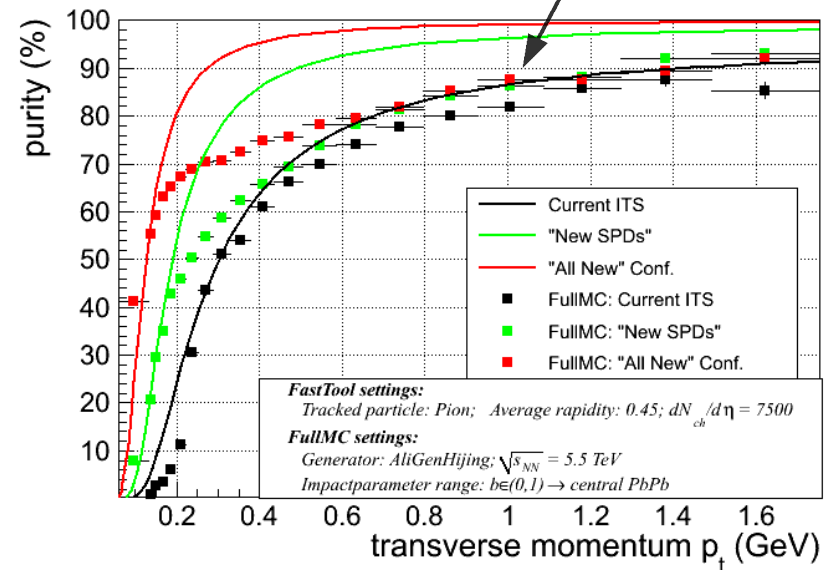
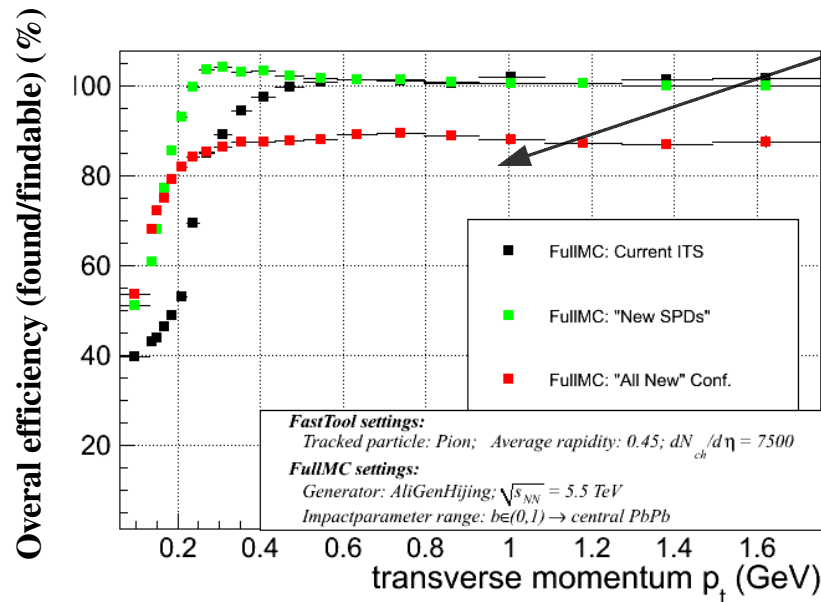
Ongoing discussion ...

Due to “Tool-imperfections”:

- The Fast-tool does not account for “seeding & track-finding problems” in ITS standalone mode
- The Full-MC code in AliRoot (tracking code) cannot be easily optimized for the Upgrade Scenarios (this might take months)
- The Fast-tool does not account for the layer-correlation during the track-fitting
 - Ruben currently develops an “intermediate” tool (Semi-MC) which should help to understand the discrepancy ...
 - layers close to each other (double layers) might be a cure for the real reconstruction to work better?
- Ongoing studies if “many more layers” (e.g. Double-sided) could improve the overall situation

Closer look into purity and fake rate ...

... when one tries to compare Fast vs. Slow tool, it's probably better to use "Purity" instead of "efficiency" since the fast tool does not include Track-Finding ...



ITSupgrade code in Aliroot (SA tracker)

is optimized for the **Current ITS** geometry

→ **Agreement in Efficiency, Purity and even Fakes ...**

But it still does not work as expected for the

Upgrade scenarios → Too many fakes

Interesting fact, number of reconstructable pions:

Curr.ITS ~ 15000; NewSPD ~ 18000; AllNew ~ 20000

Ongoing efforts

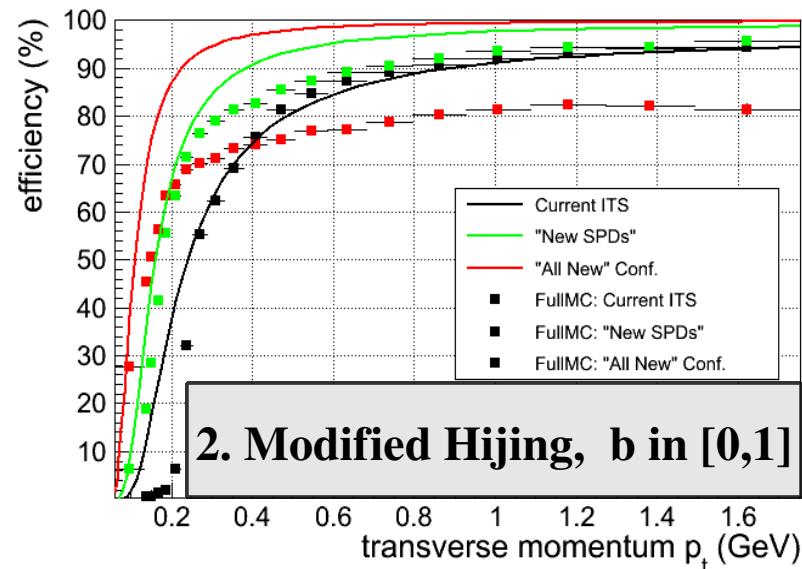
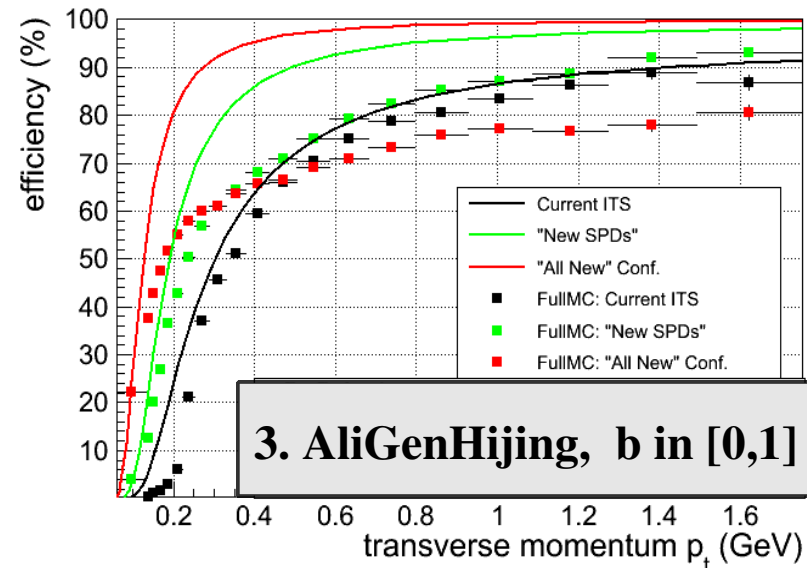
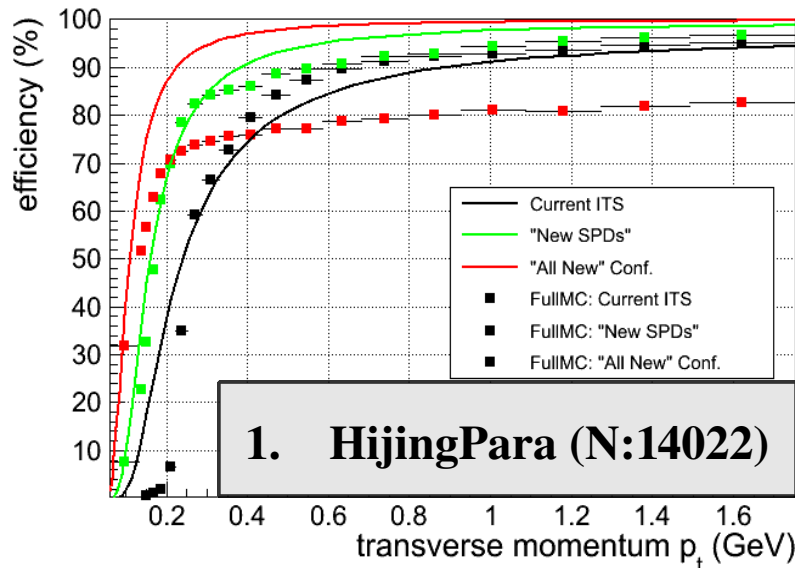
- Ruben: His Semi-MC tool already reproduces the impact-parameter resolutions, he is currently implementing the “efficiency calculation”
- Francesco, will provide a “efficiency plot” of the current ITS with “all its imperfections”
→ this will be the one we should compare the upgrade to ...
- Sergui, looks into the possibility on how “double-layers” could improve the situation (within the MC code) ...
- Annalisa, Christina: Look into the possibility of “optimizing” the MC code for the upgrade scenarios

Main question:

- Is there a basic design difference between a detector in ITS+TPC and ITS standalone mode?
- In standalone, seeding layers close to each other would certainly reduce the “track-possibilities” and therefore the used reconstruction time ...

Multiplicity considerations ...

Obviously, the efficiency depends on the multiplicity. But is the one we are using the one we want to use?



Ongoing discussion, which setting should be used for "benchmarks"

Result with isPhysicalPrimary
(incl e.g. D0)

- 1. $\rightarrow dN/dy \sim 2050$
- 2. $\rightarrow dN/dy \sim 2800$
- 3. $\rightarrow dN/dy \sim 5400$

Result with isPrimary

- 1. $\rightarrow dN/dy \sim 2040$
- 2. $\rightarrow dN/dy \sim 1100$
- 3. $\rightarrow dN/dy \sim 2300$

Other points for discussion

- Currently, we used three different “Central” scenarios:
 - which “generator” (&settings) delivers the best estimates for 5.5 TeV PbPb collisions?
- Are overlapping modules (sensitive region) essential for the alignment or just “helpfull”?
 - how “essential” are they really?

Final question to be answered:

- Do we need a basic change of the detector-arrangement to reach a high ITS standalone reconstruction efficiency?

Backup

Multiplicity and tracking

Reminder on the ITS SA tracking phases :

- The algorithm searches for candidate clusters within $\Delta\phi/\eta\Delta$ windows layer by layer
- All the combinations of such clusters are considered and a list of tracks is built
- The track having the lowest χ^2 is stored

The tracking efficiency depends on the event topology

Increasing the event multiplicity reduces the tracking efficiency

Available event generators (define the event topology):

- Particle boxes : They do not reproduce the exponential shape => Not good for efficiency studies
- Hijing param : HI parametrization which is very fast very useful!), the event topology could not be the same as in central HI events (e.g. : mini jets).
- Hijing generator : the default multiplicity is around 5000 charged particles at midrapidity (->to be reduced)

Backup

Possible Multiplicity scenario

Best estimate is the extrapolation from $\sqrt{s_{NN}} = 2.76 \rightarrow$ to 5.5

Figure 3 in the ALICE paper : <http://prl.aps.org/pdf/PRL/v105/i25/e252301>

\rightarrow $dN/d\eta$ per participant at midrapidity is proportional to $s^{0.15}$.

If we assume :

- N_{part} constant going from 2.76 to 5.5
- Primary charged particles at midrapidity is 1584

$$\Rightarrow dN/d\eta (\text{midrapidity}) = (5.5^2/2.76^2)^{0.15} * 1584 = 1948 \approx 2000$$

Hijing can be tuned to obtain a lower multiplicity.

Preliminary test Full Hijing (reduced multiplicity):

- $dN/d\eta \mid |\eta| < 0,5 = 2700$ (bit worse)
- 8 Layers containing 3 very close outermost layers

\Rightarrow efficiency $\approx 80\%$ at 200 MeV/c