Physics Comparisons & Generator Tunes

How to Improved MC Statistics at High PTmax

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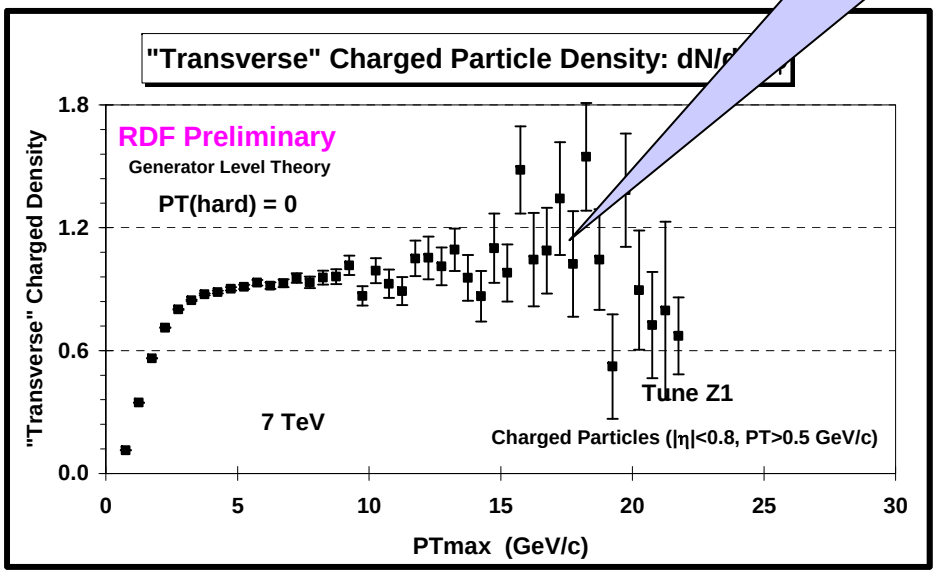
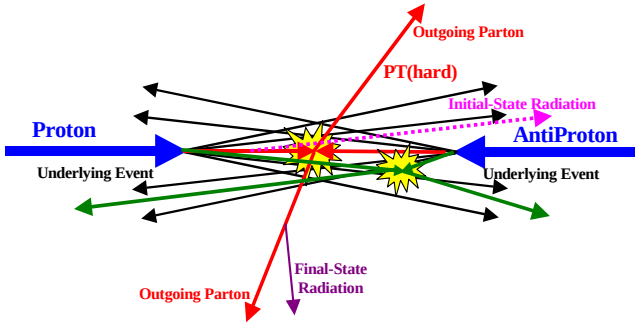
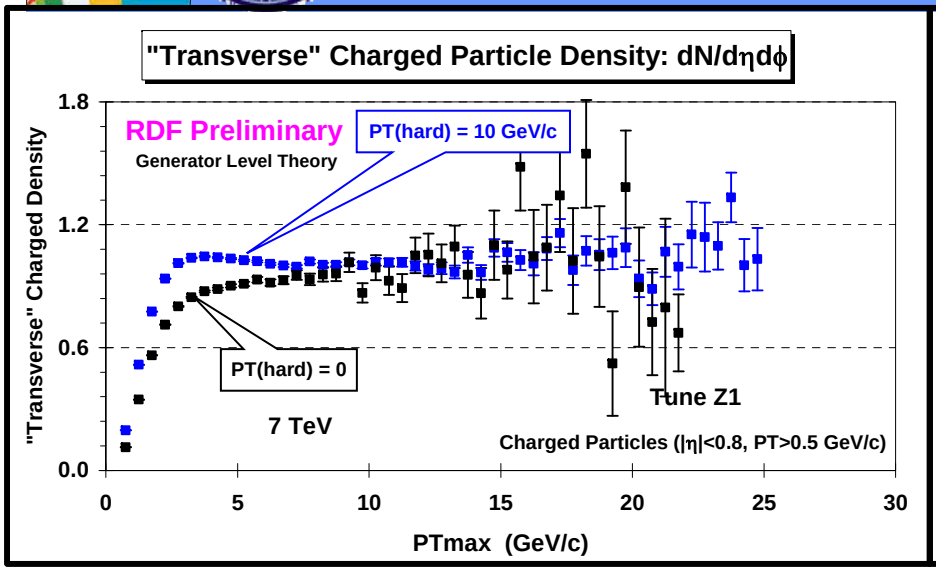
Poor statistics for PTmax > 10 GeV/c!

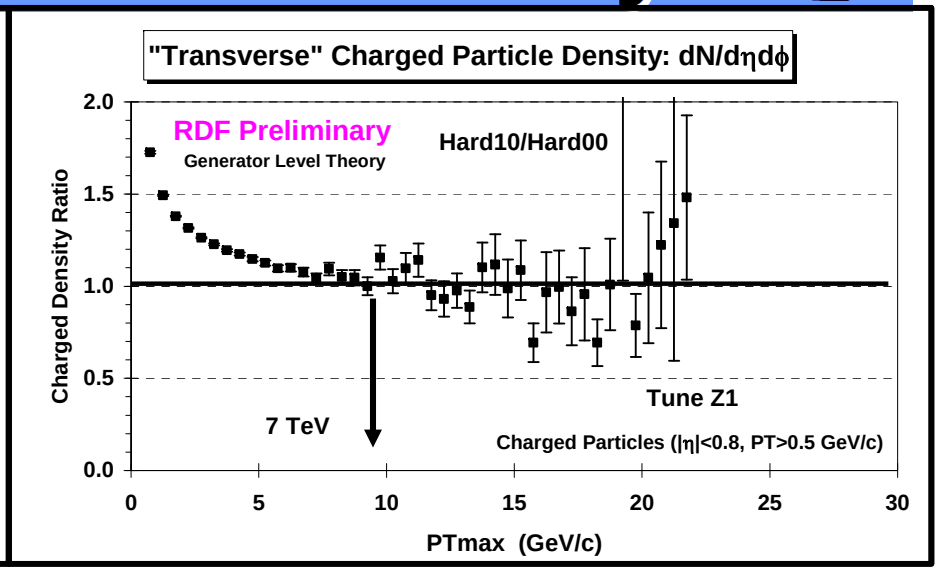




➡ **2 Million MB Events at 7 TeV: "Transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events).**

"Transverse" Density

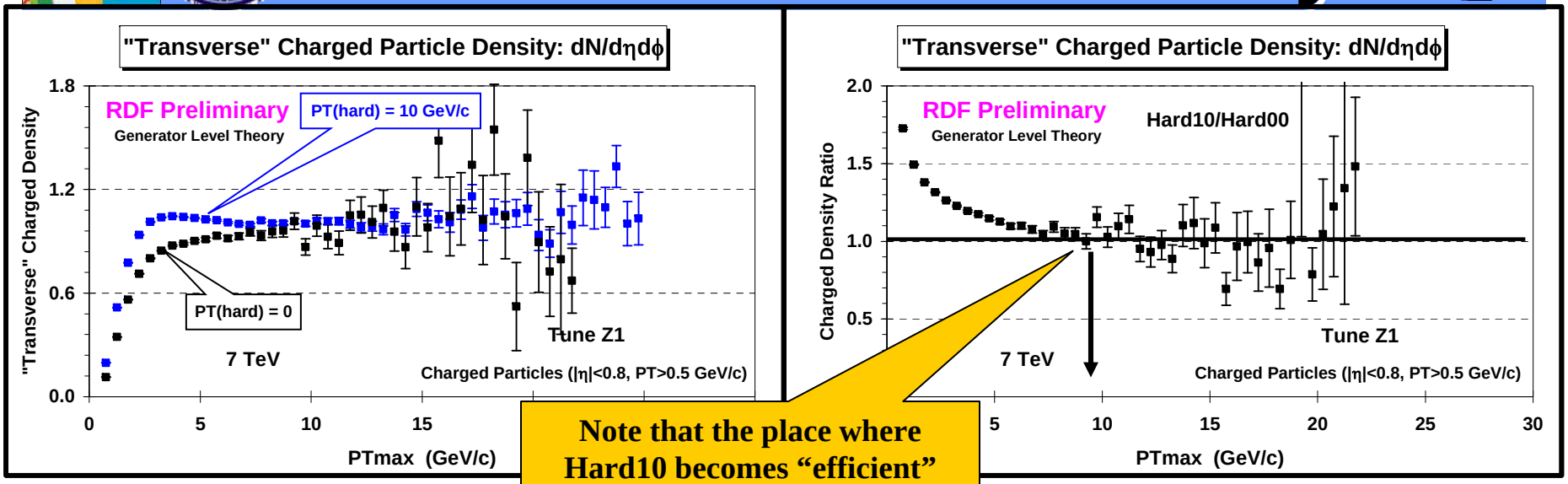




- **"Transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events) and with PT(hard-min) = 10 GeV/c.**
- **Ratio of the "transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events) with PT(hard-min) = 10 GeV/c.**

We see that Hard10 is biased at low PTmax values and becomes "efficient" around PTmax = 10 GeV/c.

"Transverse" Density



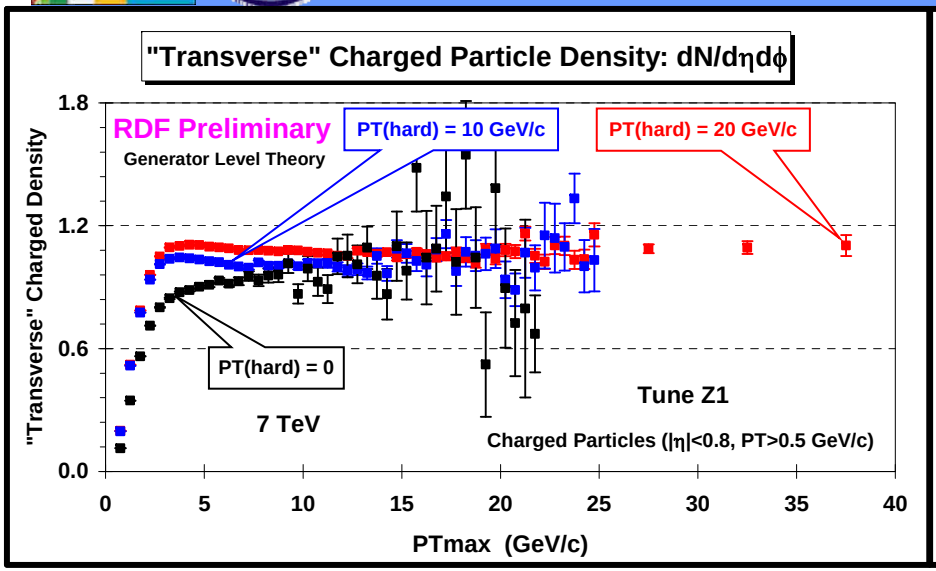
Note that the place where Hard10 becomes "efficient" depends on the observable and the center-of-mass energy!

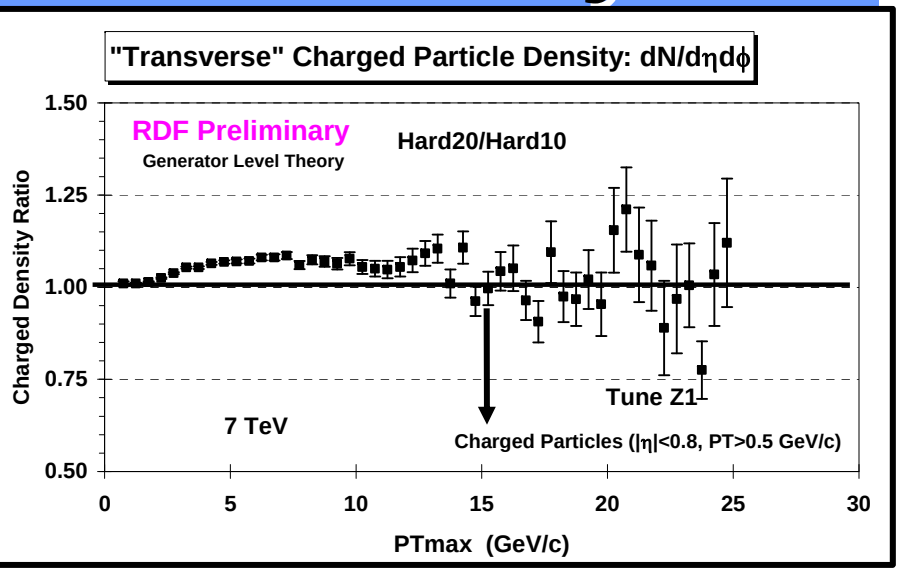
- **"Transverse" charged particl… PYTHIA Tune Z1 with PT(ha… (*i.e.* MB events) and with PT(hard-min) = 10 GeV/c.**

…he "transverse" charged particle …rom PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events) with PT(hard-min) = 10 GeV/c.

We see that Hard10 is biased at low PTmax values and becomes "efficient" around PTmax = 10 GeV/c.

"Transverse" Density

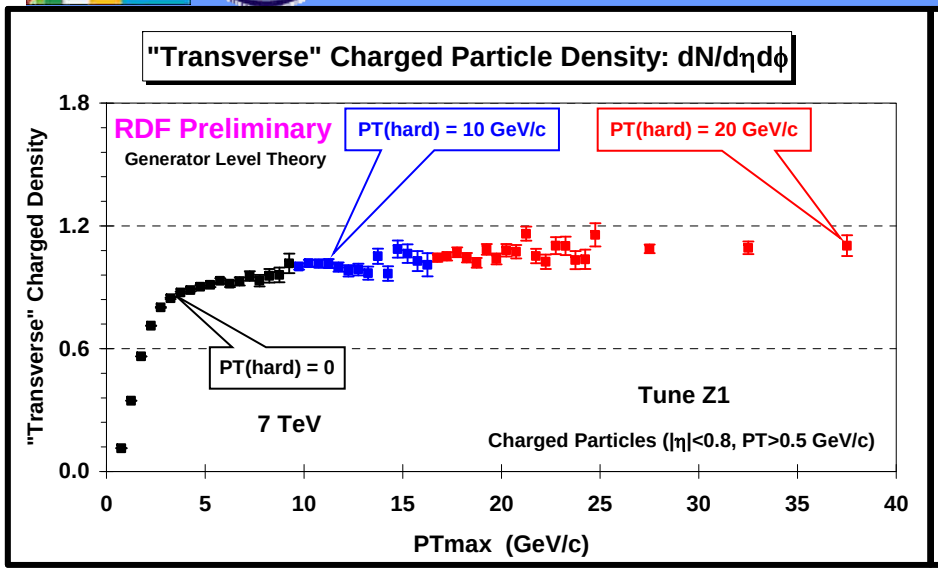


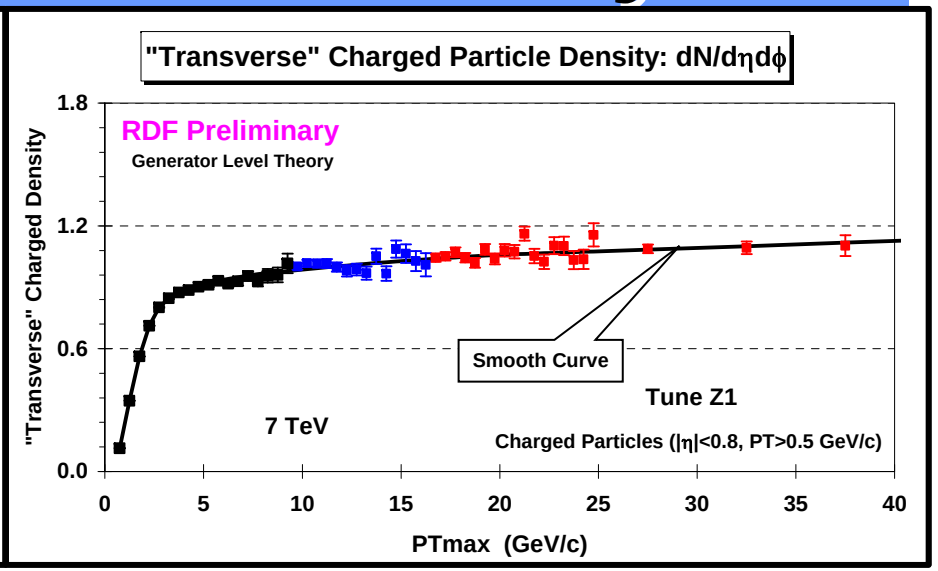


- **"Transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events), PT(hard-min) = 10 GeV/c, and PT(hard-min) = 20 GeV/c.**
- **Ratio of the "transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 10 GeV/c with PT(hard-min) = 20 GeV/c.**

We see that Hard20 is biased at low PTmax values and becomes "efficient" around PTmax = 15 GeV/c.

"Transverse" Density



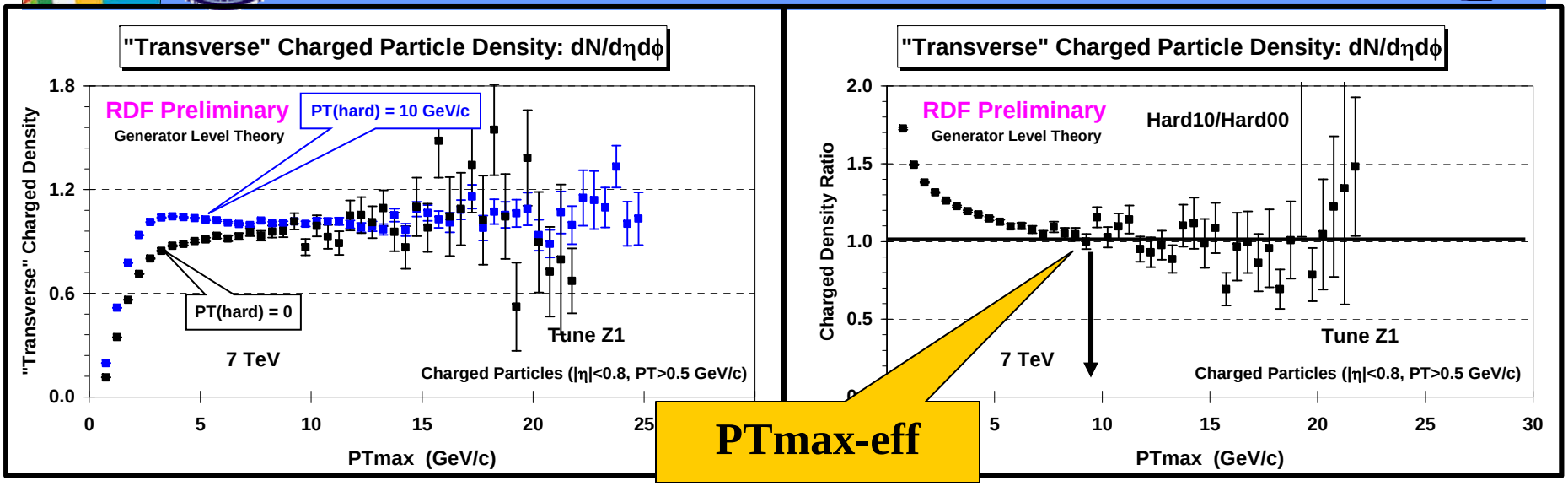


- **"Transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events), PT(hard-min) = 10 GeV/c, and PT(hard-min) = 20 GeV/c.**

- **"Transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events), PT(hard-min) = 10 GeV/c, and PT(hard-min) = 20 GeV/c.**

The theoretical prediction (*i.e.* theory curve) is suppose to be the result with infinite statistics.

Recommendation



- "Transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events) and with PT(hard-min) = 10 GeV/c.
- Ratio of the "transverse" charged particle density from PYTHIA Tune Z1 with PT(hard-min) = 0 (*i.e.* MB events) with PT(hard-min) = 10 GeV/c.

I suggest we run Hard00 (*i.e.* MB) and Hard10 at each energy and determine PTmax-eff for each observable. Then we use Hard00 for PTmax < PTmax-eff and we use Hard10 for PTmax > PTmax-eff.
Maybe we can do this with the "professor" when doing a new tune??