Simulation Status

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CDF Week
Jul. 26, 2004

- News
- Summer MC Production
- 5.3.3 and Plus
- Future Simulation
- Summary

Simulation Quarterly

- People
  - MC=MP equality broken, Many thanks to Manfred Paulini
    1-1-1 → Two-top (Andreas/Soon) + the linker (Ashutosh)
  - Un-Ki ending his tenure as Top group MC coordinator
    Welcome Daniel Whiteson as new Top group MC coordinator
  - Rachid Mazini adding operational power to MC Production
  - Rick Tesarek retiring from EvtGen support, replacement is still open

- Era of Generation-5 Simulation
  - recommended version 5.3.3 released (July 1, 2004)
  - Summer MC Production is underway (Canadian Farms + DCAFs)
  - planning 5.3.4 = 5.3.3 + ToF for the B Group
    BMC Group (Saverio D'Auria) will coordinate B samples

mcProduction: Overview

- Man Power (Facility): Reda Tafirout, Rachid Mazini (BigMac), Bryan Caron (Thor/WestGRID), Rob Snihur (DACF-UCSD,Italy,Taiwan,Korea) Technical Support: Pasha and Dave for Multi-Run/Additional MinBias
- MC Production priorities set by physics group conveners on 6/25/2004 http://www-cdf.fnal.gov/internal/mcProduction/Priority_20040625_2.txt
- Total 98M events requested with the multiple run scheme (732 runs)
- Statistics on FARMS (as of 7/23): Total 36M events completed Toronto: 25M / Alberta: 7M / McGill: 4M (DCAFs)
- Backlog of ∼20M to be concatenated and put on tape (overhead due to concatenation/ data handling)
- Bug found in production machinery affecting last run-sections, lose about 10-15% of statistics by dropping the last run section
- The bug is fixed, next samples in production will not be affected

Production of Samples on the MC Farms

- 5.3.2 samples: (multiple runs / with 0 min. bias)

```
ttopti Herwig ttbar          1M  on tape
ttopui Pythia ttbar          1M  on tape
ztop0i Pythia Z->mumu        2M  on tape
ztop1i Pythia Z->tautau      1M  on tape
ztop2i Pythia Z->ee          2M  on tape
wtop1i Pythia W->enu         2M  on tape
wtop2i Pythia W->munu        2M  on tape
wtop3i Pythia W->taunu       2M  ~75\% completed @DCAFs
jqcd1f Pythia QCD ptmin18    5M  completed
jqcd2f Pythia QCD ptmin40    5M  completed
```

- 5.3.3 samples: (multiple runs / mostly with 0 min. bias)

```
wewkee W->ev PYTHIA          2M  completed (by EWK group)
jqcd1g Herwig QCD ptmin18    5M  ~50\% completed @Alberta
jqcd2g Herwig QCD ptmin40    5M  completed
btop4a Low Pt/b-tagging      2M  completed
```

Ready for production (1,2 MinBias) @Toronto

- +1 MinBias

```
ttop0v   ttbar HERWIG   .1M (on HOLD, QED/FSR fix/validation)
ttop1v   ttbar PYTHIA   .1M
wtop1v   W->ev PYTHIA   .2M
wtop2v   W->mv PYTHIA   .2M
wtop3v   W->tv PYTHIA   .2M
ztop1v   Z->ee PYTHIA   .2M
ztop2v   Z->mm PYTHIA   .2M
ztop3v   Z->tt PYTHIA   .1M
```

- +2 MinBias

```
ttop2v   ttbar HERWIG   .1M (on HOLD, QED/FSR fix/validation)
ttop3v   ttbar PYTHIA   .1M
wtop4v   W->ev PYTHIA   .2M
wtop5v   W->mv PYTHIA   .2M
wtop6v   W->tv PYTHIA   .2M
ztop4v   Z->ee PYTHIA   .2M
ztop5v   Z->mm PYTHIA   .2M
ztop6v   Z->tt PYTHIA   .1M
```

Changes to request for QCD samples

- Original request: QCD group dijet samples with 0 min bias

```
jqcd4e   PYTHIA DIJET PT=0    (5 M Events)
jqcd6e   PYTHIA DIJET PT=80   (5 M Events)
jqcd7e   PYTHIA DIJET PT=140  (5 M Events)
jqcd8e   HERWIG DIJET PT=3    (5 M Events)
jqcdae   HERWIG DIJET PT=80   (5 M Events)
jqcdbe   HERWiG DIJET PT=140  (5 M Events)
```

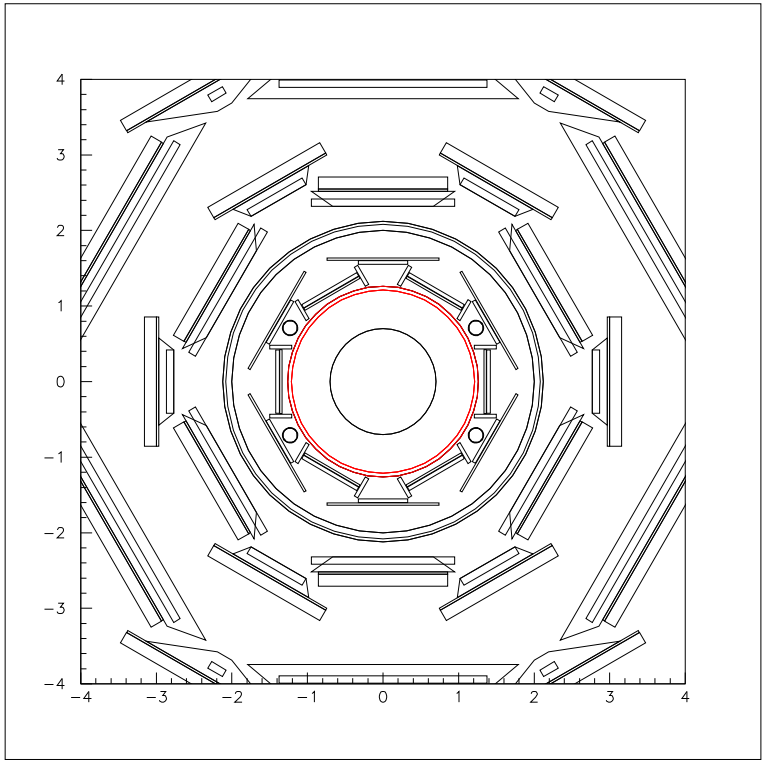
- Changed to 23-smaller samples)

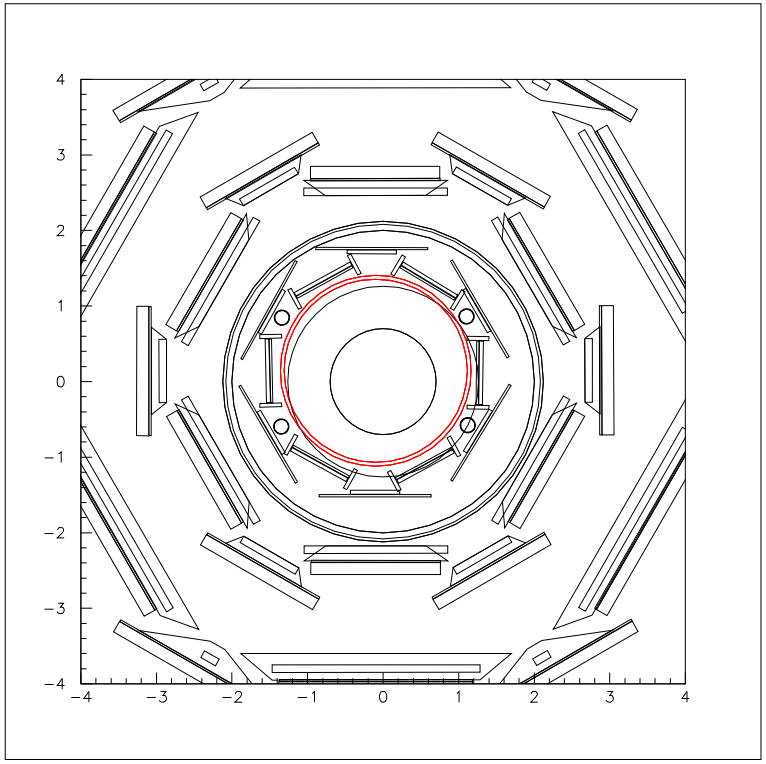
```
> Z Born Term (MSEL=11) PYTHIA Tune A CTEQ5L                    1M
> PYTHIA DIJET PT=0,10,60,200,300,400,500 each 1M = total   7M
> PYTHIA DIJET PT=90,120,150              each 2M = total   6M
> Alpgen+Pythia bbbar PT=20,70 (CDFSim ONLY)        0.5M,0.25M
> Alpgen+Pythia ccbar PT=20,70     "                0.5M,0.25M
> Alpgen+Pythia bbbar PT=8         "                       0.5M
> Alpgen+Herwig bbbar PT=8         "                       0.5M
> HERWIG DIJET PT=3,10,60,200,300,400,500  each 1M = total  7M
> HERWIG DIJET PT=90,120,150               each 2M = total  6M
```

What drivers 5.3.3? (compared to Gen4)

- Silicon CDM (tuned parametric model)
- COT Simulation
- Calorimeter Energy Scale (Wall/Plug)
- Electron/Muon Id Variables
- Passive Material
- Beamline/MisAlignment
- SiPassiveMaterial (L00/BulkHead/Screen)
- Run Dependent Configuration/Calibration/Simulation
- Capability of MinBias Overlay
- Complying with the Latest Production
- Thanks to MC developers/librarians and
  Production Task Force, Jet Calib/Sim Task Force

5.3.3 Geometry

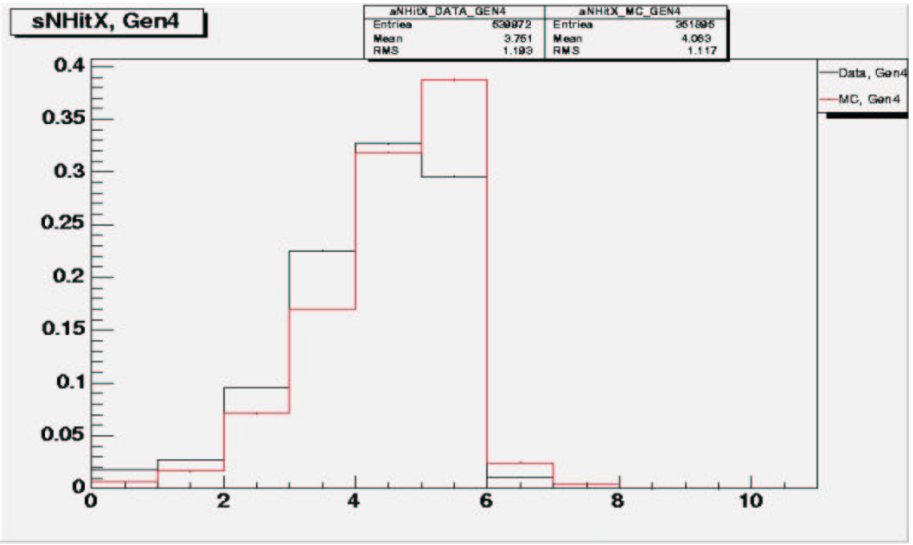


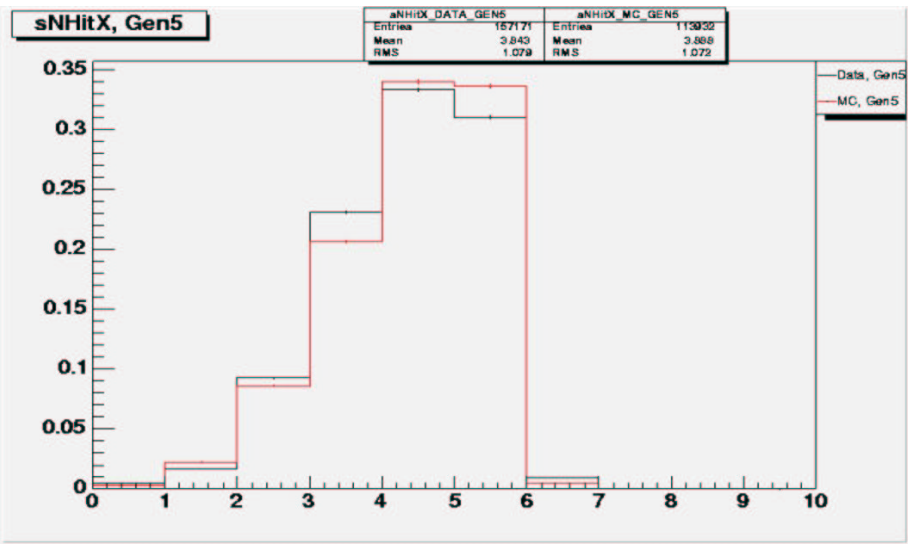


Nominal **MisAligned**

- BeamPipe/L00/Silicon Geometry overlap completely fixed (Matt Herndon)
- 5.3.1 → 5.3.3 (Beamline/BeamPipe/SiPassive) : Thanks to Chris N, Elena G, Joao G.d.C, Liz S.-K, Manfred P, Matt H, Reda T., Saverio d'A, Soon J, Stephen L, Thomas W, and Young-Kee K.

High P_T b-tagging (Joao G.d.C)





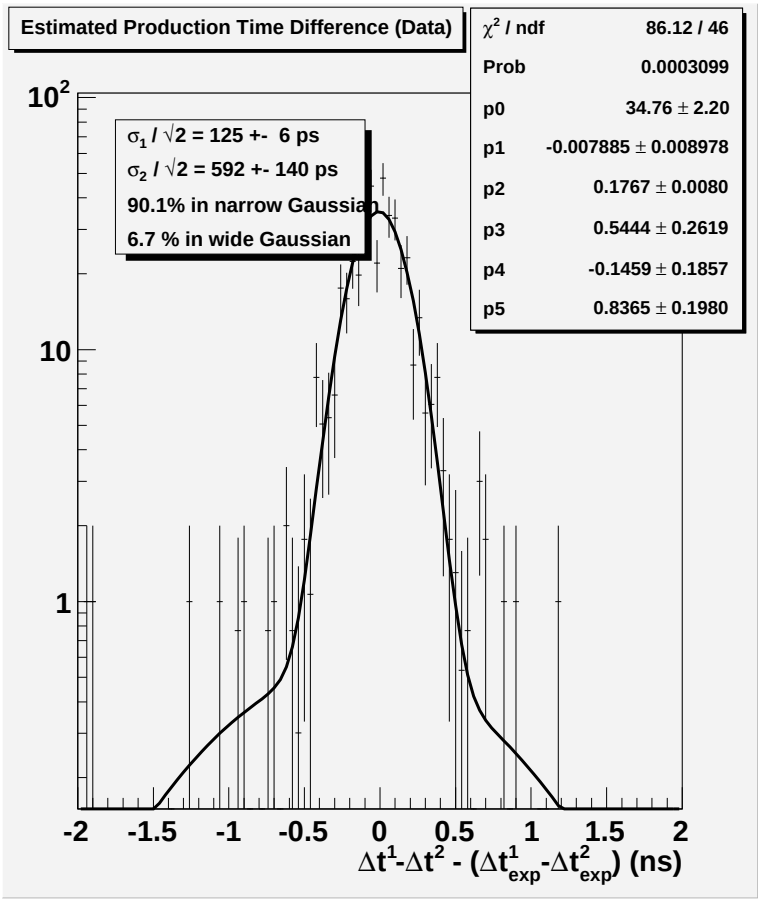
4.9 **5.2**

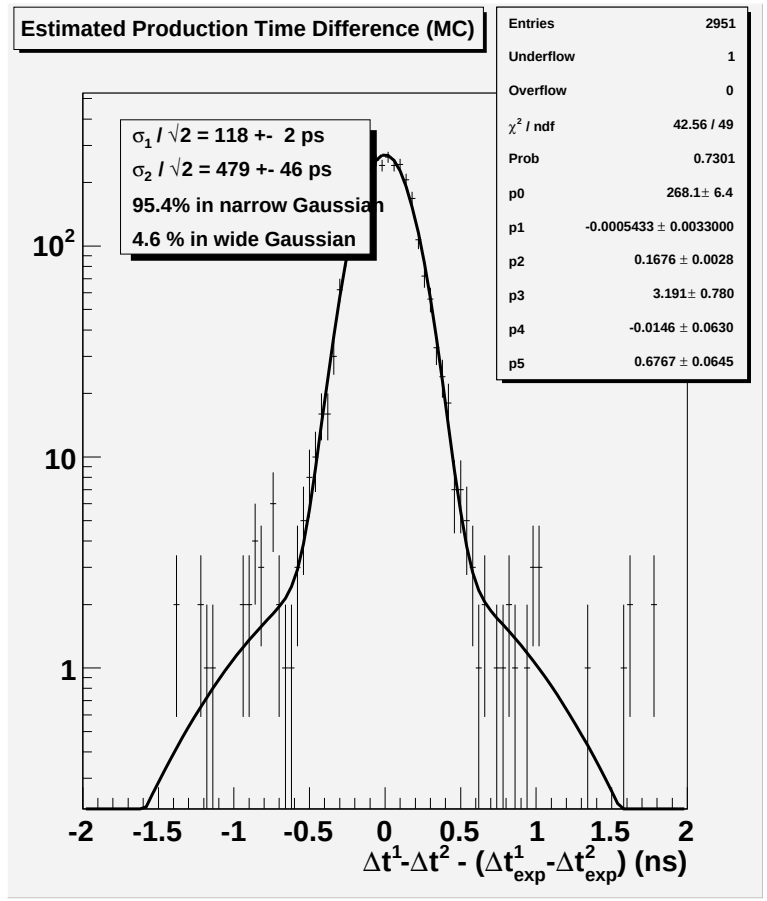
- jet50 MC (red) and jet50 data (black)
- The number of axial SVX hits in tracks used in SecVtx
- Data/MC scale factor for b-tagging closer to 1
- Validation: 5.3.1-Data/5.3.3-MC for tagging rates

Things on the Table

- New ToFSim
  - The ToF reconstruction Group:
    J. Beringer, A. Deisher, Ch. Doerr, M. Jones, E. Lipeles,
    S. Menzemer, M. Shapiro, R. Snider, D. Usynin
  - realistic ToF simulation (same calibration classes)
  - simulate the effect of multiple hits on a bar
  - many other updates/capabilities
- COT improvement (Chris Hays)
  - the beam t0 spread has been fixed and
    the COT hit resolution correspondingly adjusted
  - user-setable superlayer efficiencies and tuned hit width/resolution
    resulting in hit inefficiencies
  - The hit-width tuning results in better hits/SL agreement with data
- Validations with 5.3.3 MC

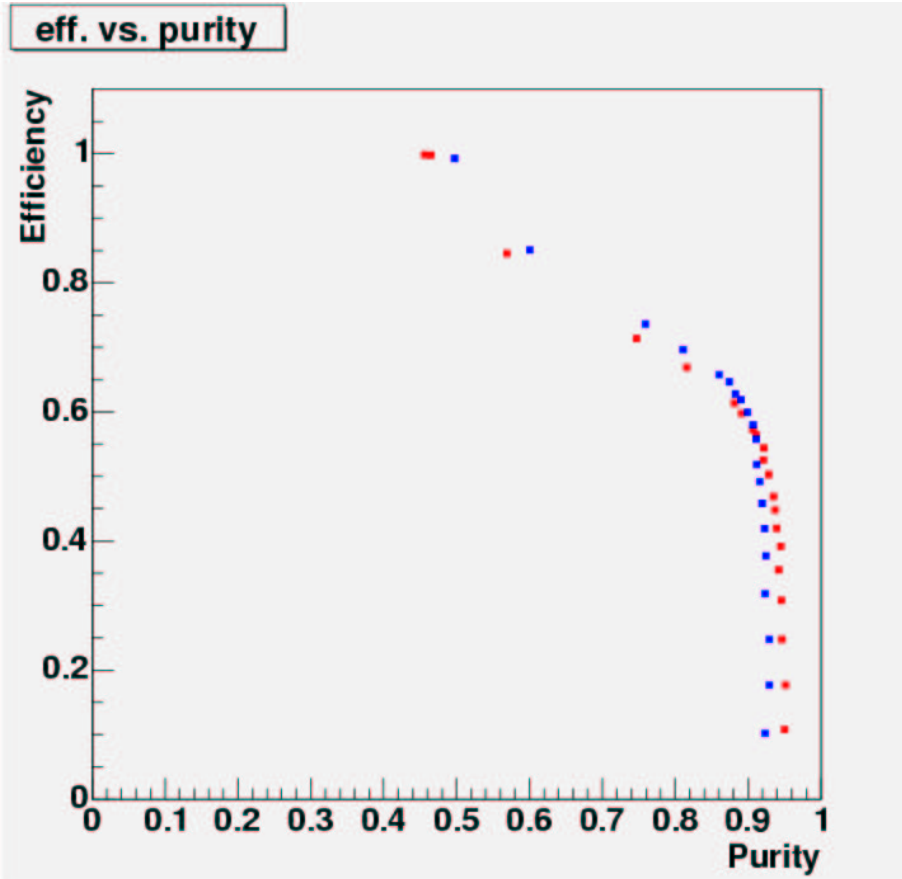
ToF Simulation

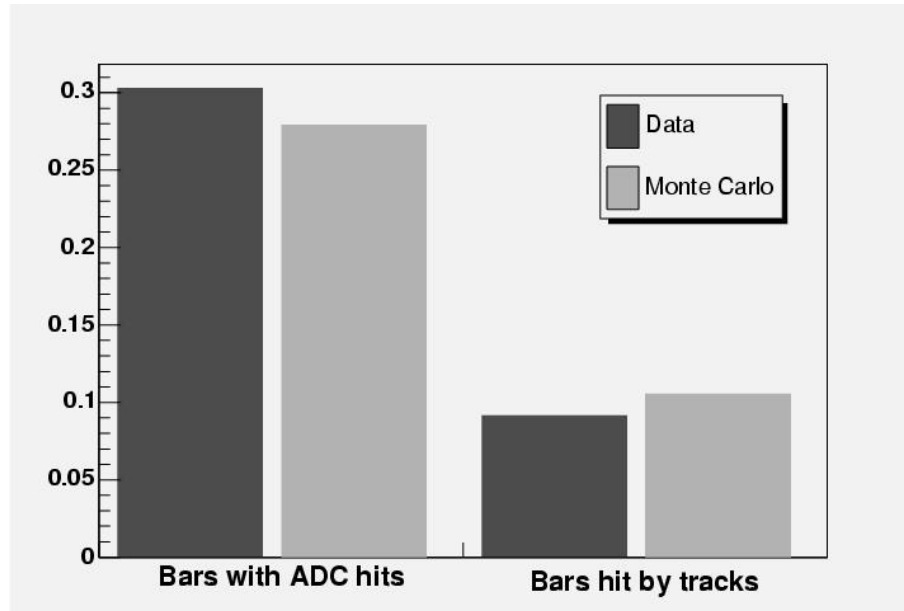




- Production Time difference for both muons of J/Ψ (independent of $t0$)
  - core $= \sqrt{2}\times$ the arrival-time resolution of the Tof
  - tail $=$ one of the both muons has a mis-measured tof arrival time.
- able to study the effects causing those tails

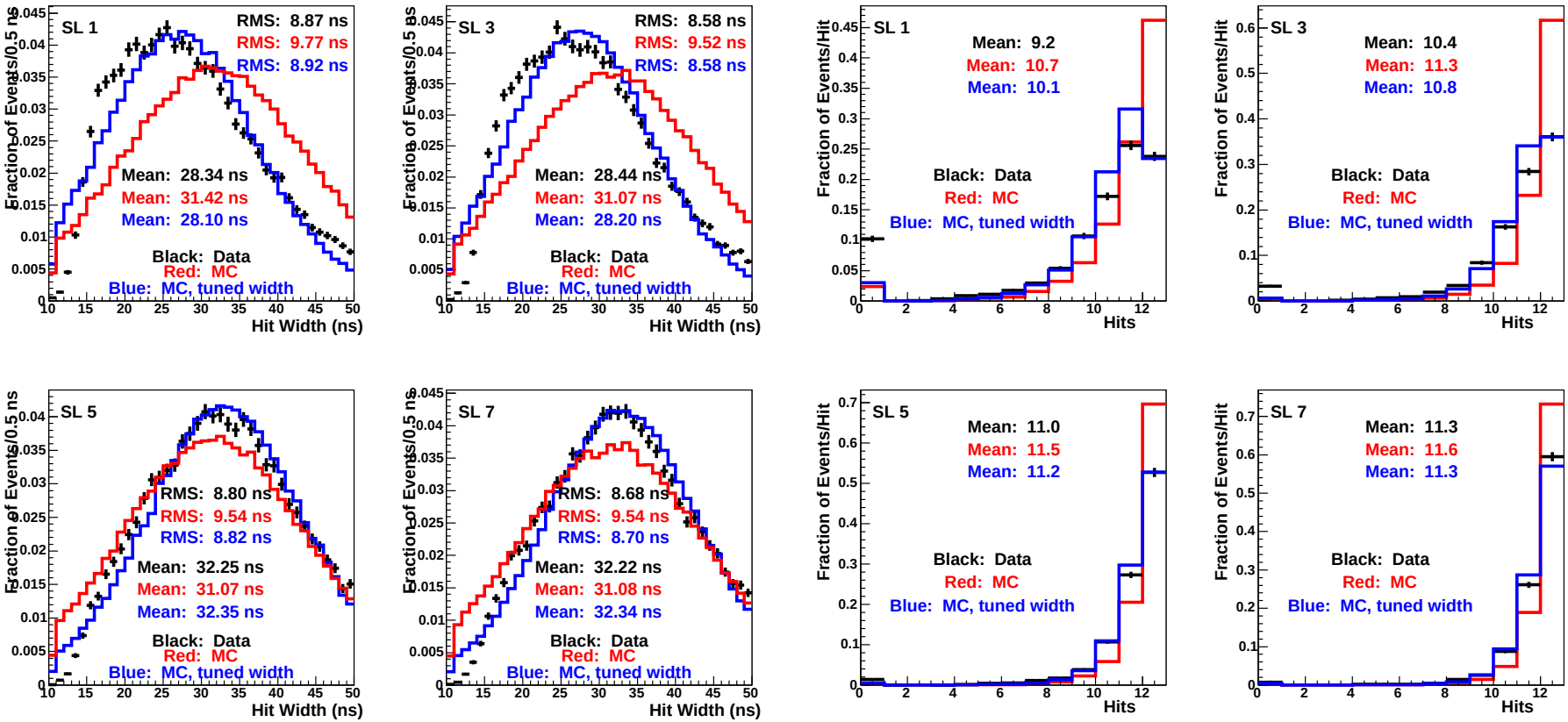
ToF Simulation





- Efficiency vs. Purity
  - Efficiency = both muons from the J/Psi matched to a tof-measurement
  - Purity = fraction of events end up in the core of δ(production-time)
- how many tof-bars see a signal and how many of tof-bars are hit by a track

COT Simulation



Hit Width **N Hits**

- Better match Data/MC with tuned widths
- Similar agreement in Axial Super Layers

Simulation Performance

- CPU (per event in sec)

Process	Generator	cdfSim	ProductionExe
$t\bar{t}$	Herwig+EvtGen	10.8	2.2
$t\bar{t}$	Herwig+QQ	11.5	2.6
$Z \to \mu\mu$	Herwig	6.2	0.8
$W \to \mu\nu$ + UE	Herwig	9.5	1.0
$W \to e\nu$ + MBR	Herwig	12.1	1.3
$Z \to \mu\mu$ + UE	Pythia	6.5	0.8
$Z \to ee$ + UE	Pythia	7.3	0.9
$W \to \mu\nu$ + UE	Pythia	6.5	0.7
$W \to e\nu$ + UE	Pythia	6.8	0.8
Dijet+UE	Pythia	8.6	1.1
Jet50+UE	Pythia	9.7	1.5
$b\bar{b}$	Pythia	7.3	0.9
$J/\Psi \to \mu\mu$	Pythia	3.2	0.4
$B \to J/\Psi K_s$	BGen	0.8	0.3

Table 1: Each 1K events with Intel(R) Pentium(R) 4 CPU 2.00GHz

- SimulationControlMod: 98% (possible improvement with maxopt?)

Future Developments

- MP's Wish List:
  http://www-cdf.fnal.gov/cdfsim/development/MP_wish_list.html

- MC Survey: (so far from Saverio and Pasha)
  http://www-cdf.fnal.gov/cdfsim/development/survey_july2004.html

- Big apples and Small potatoes
  - Operational: max-opt, RN, SVT beamline parameters into DB
  - Silicon: reorganize SiGeometry, L00 CDM, bow corrections
  - COT: hit efficiencies/merging, tuning of dE/dx response in MC
  - Calorimeter: 2nd-Phase Tuning, Realistic MC, CES/CPR/PES
  - Muon: chamber configurations from DB,
    hit in-efficiencies in CMP, energetic muons
  - Materials: re-tune PhantomLayer, check volume overlaps/hierarchy
  - Validation/Visualization
  - SAM-mcProduction: SAM-CAF, SAM-DCAF
  - Many others in Generators/QuickSim/Small Issues here and there

Conclusion

- Generation-5 MC ready to comply with $400pb^{-1}$ physics analysis
- Various MC-Farms are on very productive modes
- Critical improvements are coming for ToF simulation
- Gearing up for future improvements/maintenance
- Your wish list for $4(8)fb^{-1}$ analysis are still welcome

Have you run cdfSim lately?