Summary of Testbeam, DAQ, and Simulation Session

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Hampton TRT Workshop Plenary Session

May 22, 2002

Talks

- Anatoli - Testbeam plans for this year.
- Paul - Plans for testbeam DAQ and DAQ-1
- Serkant - Effect of TR hits hits on resolution and efficiency
- Serge Sm. - Effect of straw drift-time increase on efficiency and occupancy
- FL - Status of TRT GEANT3 Simulation & Recent TRT Rate Studies
- Andrei/Yura - GEANT4 Work and Byte Stream
- FL - TRT Material Status

DAQ - Paul

- We decided to use the existing standalone TRT DAQ for this summer's testbeam.
- Paul will be in close contact with Elisabetta so that he can take over her work on DAQ-1 when she leaves.
  - Paul's first look at Elisabetta's work found that there were a number of technical issues but feels that none of them were show stoppers.
  - The current single board computer (SBC) selected by the DAQ does not support the 64-bit version of VME but probably will soon.
- Paul hopes to have a TRT implementation of DAQ-1 for the 2003 testbeam.

Effect of TR Hits - Serkant

HIT EFFICIENCIES:

ELECTRONS

all : 96.2%

only LL: 78.4%

HL : 17.8%

PIONS

all : 96.3%

only LL: 90.3%

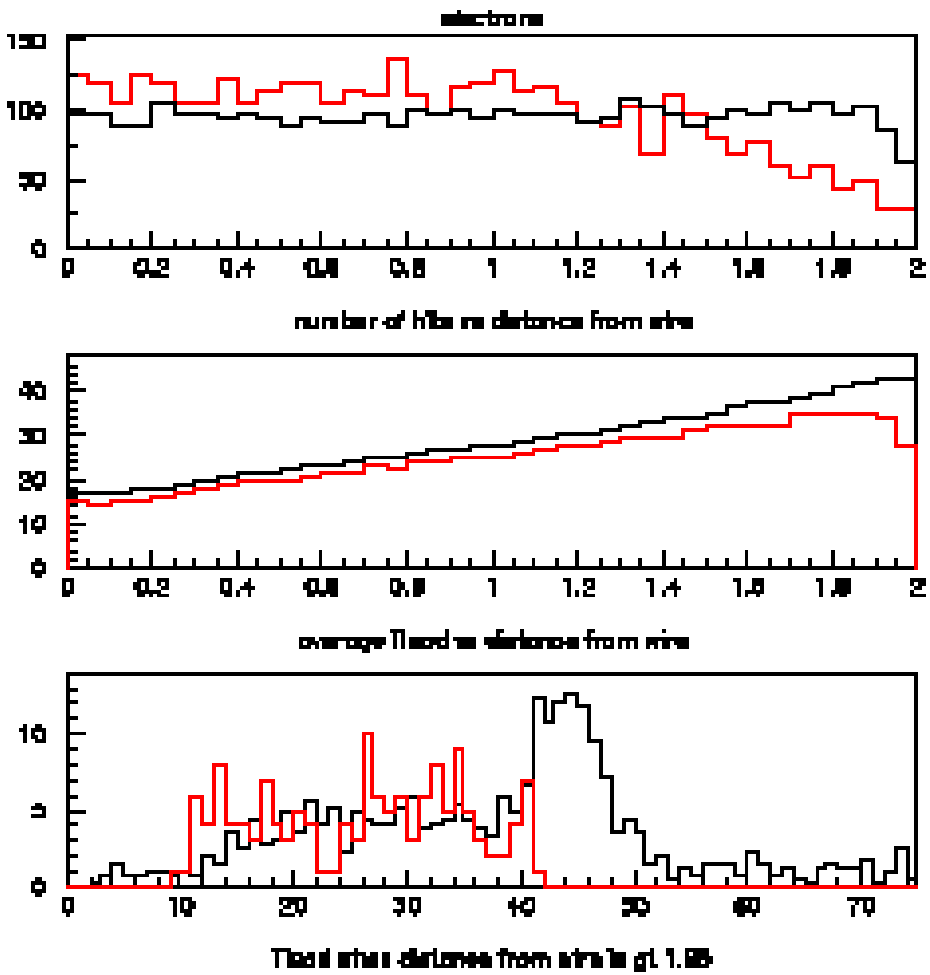
HL: 6.0%

	Electrons		*Pions*	
	1ns	3ns	**1ns**	3ns
LL + HL	**129**	150	**119**	146
LL	**120**	147	**117**	145
HL	**201**	179	**191**	162

- Why is the HL resolution so bad?
- LL resolution worsens in 3ns binning but HL resolution gets better.... ?

CHECK TIME INFORMATION !!

Effect of TR Hits - Serkant



RESOLUTION	*Electrons*	*Pions*
All	129μ	119μ
LL (E<5keV)	120μ	117μ
HL (E>5keV)	201μ	191μ

EFFICIENCY		*Electrons*	*Pions*
All	hit	96.2%	96.3%
	2.5σ	85.0%	84.6%
LL (E<5keV)	hit	78.4%	90.3%
	2.5σ	69.1%	79.2%
HL (E>5keV)	hit	17.8%	6.0%
	2.5σ	16.4%	5.2%

- If 2–3 ns early leading edge in HL is corrected:
  electrons : HL(156μ), ALL(124μ)
  pions : HL(150μ), ALL(119μ)
  The HL value is close to what one would get from individual HL r–t fit. (look at appendix)
- In our case (3.125ns binning), almost no difference in resolution. But close to straw–wall (0.3mm) r–t is lost.
- Hit efficiencies are almost the same for pions and electrons, but efficiency drops near straw–wall(0.5mm) for HL; hence if there had been no E>5keV deposition, efficiencies would have increased by 2.5% for electrons and 0.5% for pions.

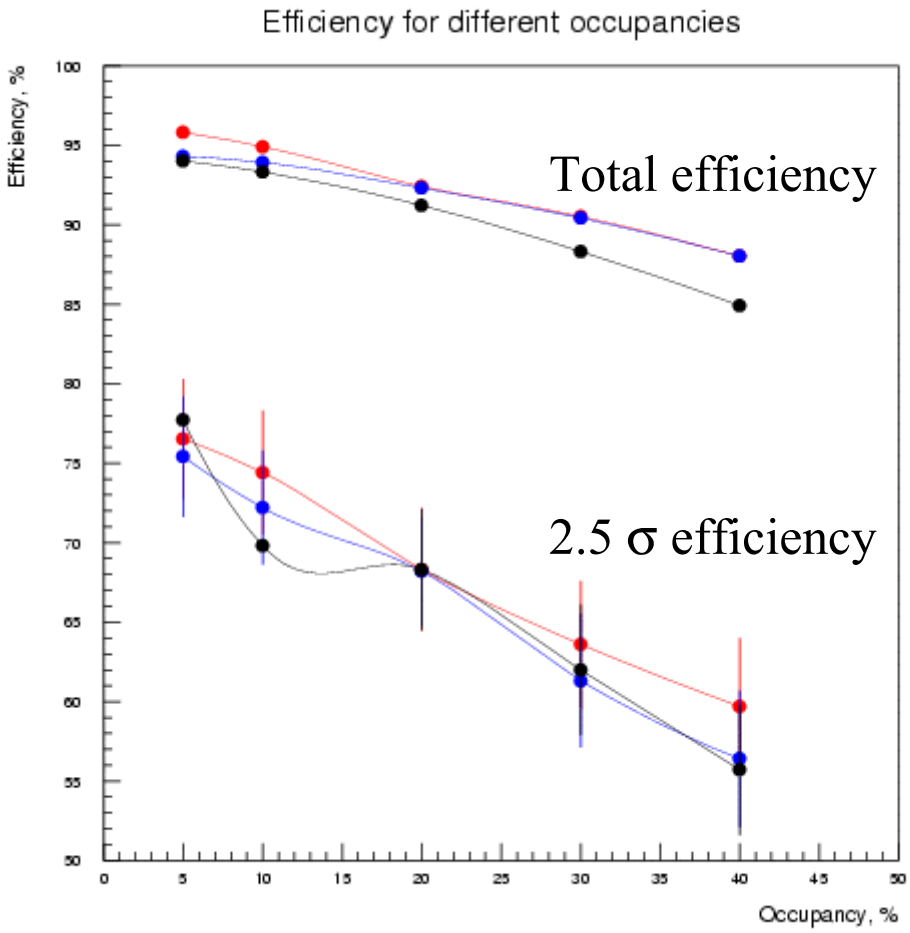
Drift Time Increase - Serge Sm.

The experimental data were used to estimate the possible effects of straw drift time increase:

- Standard triple gas mixture with total drift time 40 ns (run 1854)
- Binary gas mixture with total drift time 46 ns (run 1744)
- Run with artificially increased (in the offline analysis) total drift time up to 53 ns

Pile-up is created by combining real experimental events with appropriate time offsets to simulate the bunch crossing structure.

Drift Time Increase - Serge Sm.



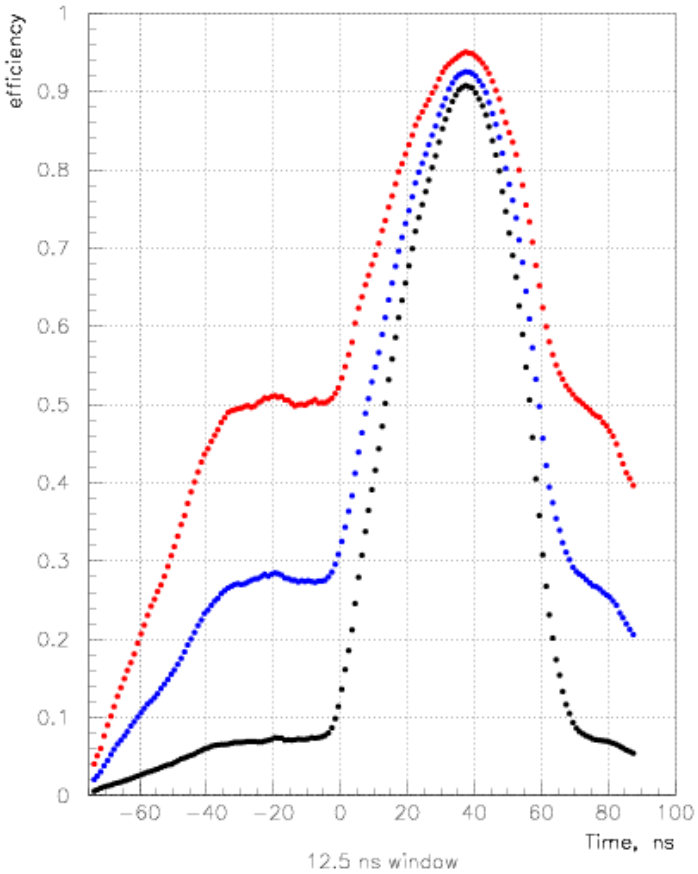
"Total efficiency" – the leading edge is found within 50 ns

Total drift times:

- 40 ns
- 46 ns
- 53 ns

"Occupancy" – probability to have a background hit in each BX

Drift Time Increase - Serge Sm.



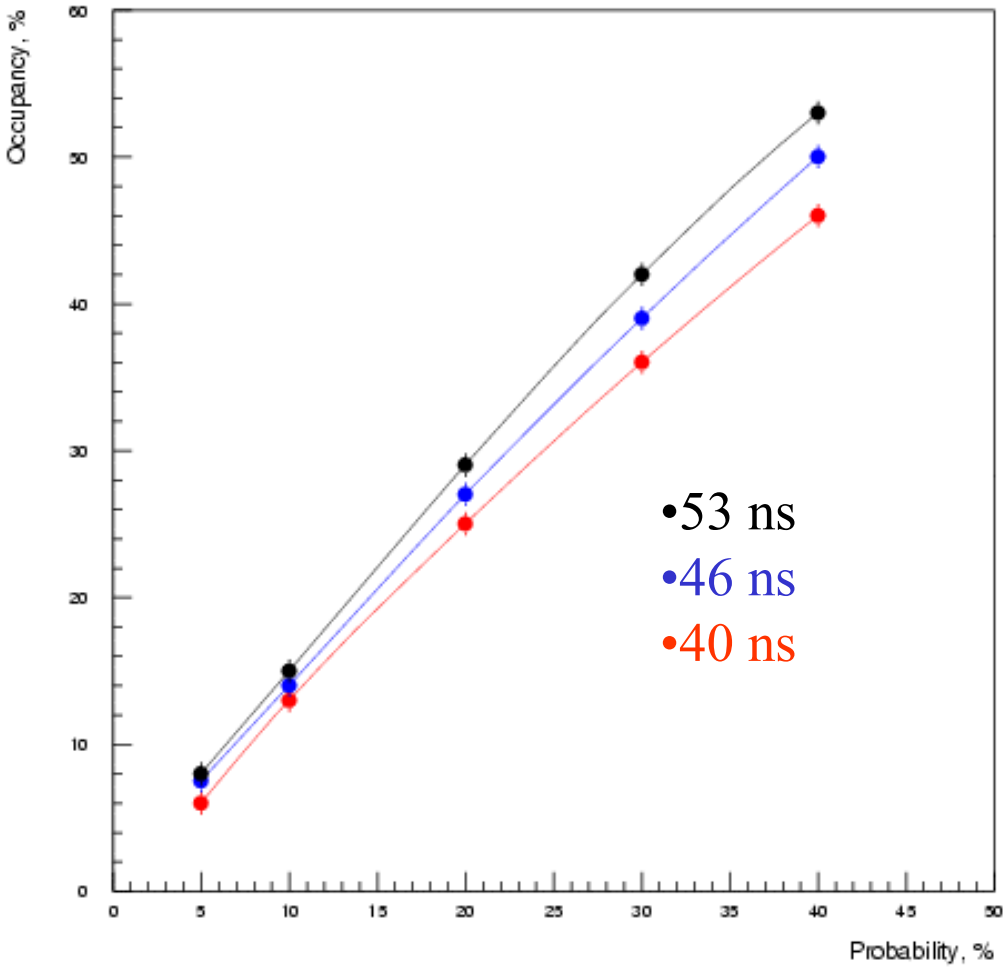
Probability to have a valid hit within the 12.5 ns window

Total drift time: 46 ns

Simulated occupancies:

- 40 %
- 20 %
- 5 %

Drift Time Increase - Serge Sm.



"Measured" occupancy as a function of probability to have a background hit in each bunch crossing

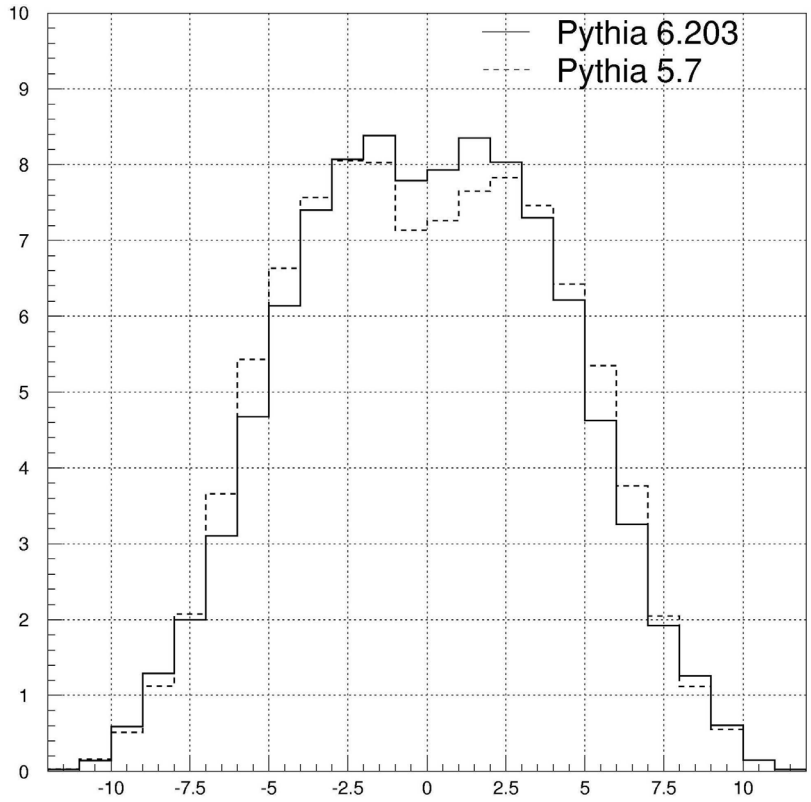
GEANT3 Status - FL

- These changes are planned for implementation in phase 2 of data challenge 1:
  - Update (i.e. increase) the amount of material in the representation of the service material.
  - Add volumes for the Al heat exchangers in the end-cap.
  - Fix minor bug in setting high threshold bit in the xtrtdig.
  - Restore the full encoding digits in xtrtdig because they are probably needed for the high level trigger TDR.
    - Currently the TRT digits reflect the compressed, high luminosity form of the TRT readout.
  - Possibly adding byte stream code to the simulation.
  - Inafgeo needs to be changed because there has been a substantial savings in the weight of the squirrel cage.
- These changes should all be made at the same time.

GEANT3 Mass Calculation - FL

- All of the TRT services are built as carbon blocks.
  - The block density is modified to generate the correct radiation length in the thickness of the volume.
- This modified density technique causes problems.
- Take as an example the TRT barrel services:
  - This volume contains ~50 different items (metals, plastics, CF, etc.) but it is simulated as a single carbon volume with a density adjusted to produce ~14% X0 at normal incidence.
  - This volume weighs 457 kg if made of hydrogen, 318 kg if made of carbon, 103 kg if made of iron, 96 kg if made of copper and actually weighs ~150 kg based on a detailed spread sheet calculation. Thus the simulation cannot be used to check the weight of the detector.
  - The nuclear interaction length is almost certainly incorrect.

New Pythia Version - FL



- For |η| > ~2.5 the number of tracks is less for the new version of Pythia (6.203).

Rate Study Conclusions - FL

- The latest minimum bias tuning for Pythia gives similar results to what has been used for years but:
  - Slightly more charged tracks for $|\eta| < 2.0$
  - Slightly less charged tracks for $|\eta| > 2.5$
- The affect of using a magnetic field map is to decrease the number of hits in the forward region where the field strength is low.
- The increase in rates caused by changing to a beampipe made partially of Al is small.
- There is apparently a low-level problem that causes GEANT3 to skip small volumes some part of the time. Pavel is looking into this.

Recent Material Work - FL

- The barrel service calculation has had the Faraday cage material added to it.
- A detailed calculation of the services at the outside of the end-cap has been started but work continues on:
  - The electronics cooling system.
  - The manifolds.
  - Structural elements attached to the wheels.
  - The CO_2 ventilation system.
- The mass on the barrel material spread sheets has been compared to the mass calculated by Andrea.

Barrel Material - FL

- The only change in the material of the active region is to add the Faraday cage to the support cylinders:
  - Al layers of 0.34% X0 at both R = ~56 cm and ~107 cm.
- The material for the services at the end of the barrel has increased from 13.8% X0 to 15.0% X0.
  - Increase is mostly from including the Faraday cage.
  - Small increase from better estimates of adhesives.
  - Small decrease from changes to one kind of connector.
- The biggest uncertainties are:
  - The mechanical structure of the electronics.
    - Currently using chip on board.
    - Will change to FBGA?
  - The electronics cooling.

End-cap Material - FL

- There are no changes to the spread sheet for the inner ring services:
  - The masses that Andrea gave me for the inner rings will slightly reduce the amount of material
  - Currently 2.98% X0 A, 2.10% X0 B, and 2.98% X0 C.
- The active region has not been changed on my spread sheets but:
  - The simulation has been revised to have a better representation of the radiators.
- Both the simulation and my spread sheets are missing the heat exchangers for the ventilation gas and the membranes sealing the front and back of the wheels.

End-Cap Material - FL

- The detailed calculation of the outer ring region is 75% done for the type A wheels:
  - The intermediate result is ~15% X0 with some portions of the material not included.
  - Previously had 11.78% X0 type A, 9.76% X0 type B, and 10.80% X0 type C.
- I believe that I have identified most of the items that need to be included.
- I have not yet looked at the cables and other items running outside the end-cap wheels but I believe that Claude Menot has a calculation of them.