

MATERIAL STATUS AND RECENT RATE STUDIES

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Penn Meeting Plenary 05/31/00

1. Material Status

2. Recent TRT Geometry Changes

3. Rate Studies

BARREL MATERIAL

Barrel Active Region:

Small decrease: 13.2% vs 13.4% X0 last year (13.6% TDR)

Small increases in straw and twister masses.

Decrease in mass from support cylinder design for which there are now reasonable drawings.

Estimate Reliable - items have actual weights available.

Barrel End Region:

Increased from ID TDR: 7.2% vs 8.5% X0.

Most of increase is from the space frame which is 2.4 cm thick now vs. 1.0 cm for the ID TDR (0.45% X0 to 1.27% X0). Space frame estimate is finally reliable thanks to good drawings and information from Luibov Klimkova.

Estimate Uncertain - The final mechanical design for the electronics and its cooling is not complete.

Barrel Gas/Cooling Manifolds and Cables:

Small reduction for manifolds from last year even with better drawings: 1.01% vs. 1.06% (manifolds were not in the TDR layout).

Adding the currently selected connector at PPB1 would make an additional 0.8% (if averaged over the barrel end).

Estimate Reliable (except cables) - drawings available but cabling probably should be rechecked with Zbyszek.

BARREL END TOTAL IS 9.5% X0 + cables (1.4%).

END-CAP MATERIAL

Wheel Inner Ring Region:

Need to update Francesco's spread sheet soon but little has changed. Currently the A&C wheels are estimated at 2.3% X0 (1.9% TDR) and B at 1.6% X0 (1.3%).

Estimate Reliable - Drawings exist.

Wheel Active Region:

The introduction of "tulle" fabric as a spacer increases the mass of the radiator stacks by at least 10%.

The type B wheel parts with 20 foils now have 34 foils which increases X0 by up to 2.5% in the affected volume.

Estimate Probably OK - Uncertainty remains until the final density of the radiator spacer material is set.

Wheel Outer Services:

Current estimates were made by Francesco in May, 1998 before drawings were near final. Type A: 11.8% X0 (10.2% TDR), Type B: 9.8% X0 (8.9%), and Type C: 10.8% (9.6%).

Hans has new drawings for me to revise these numbers.

Estimate should be Reliable - How final is design?

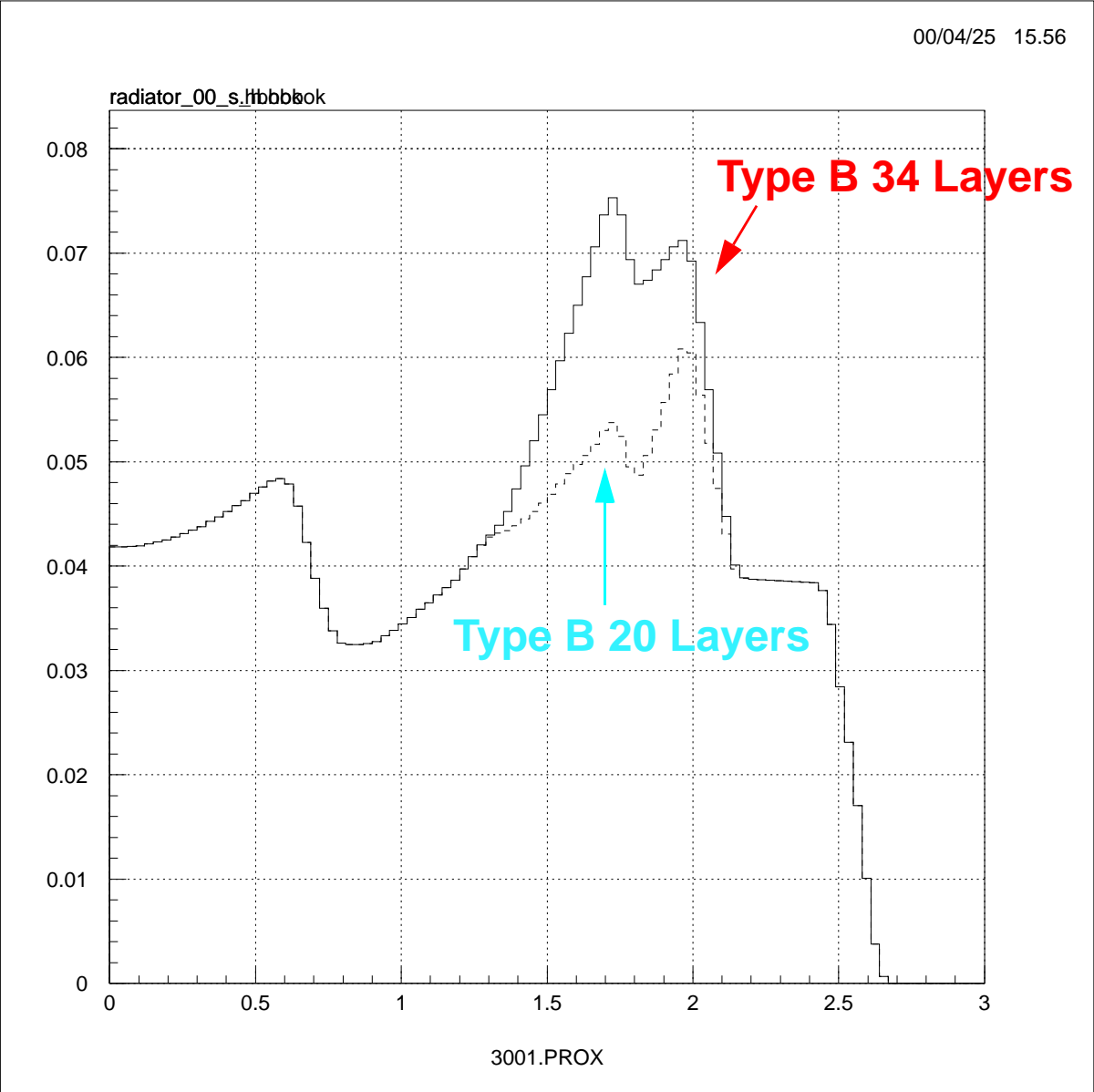
Cables/Services Outside Wheel:

The type C wheels were recently shortened to allow increased space for services just outside. The same stuff is supposed to be in the increased volume but...

Estimate will be Reliable? - How final is design?

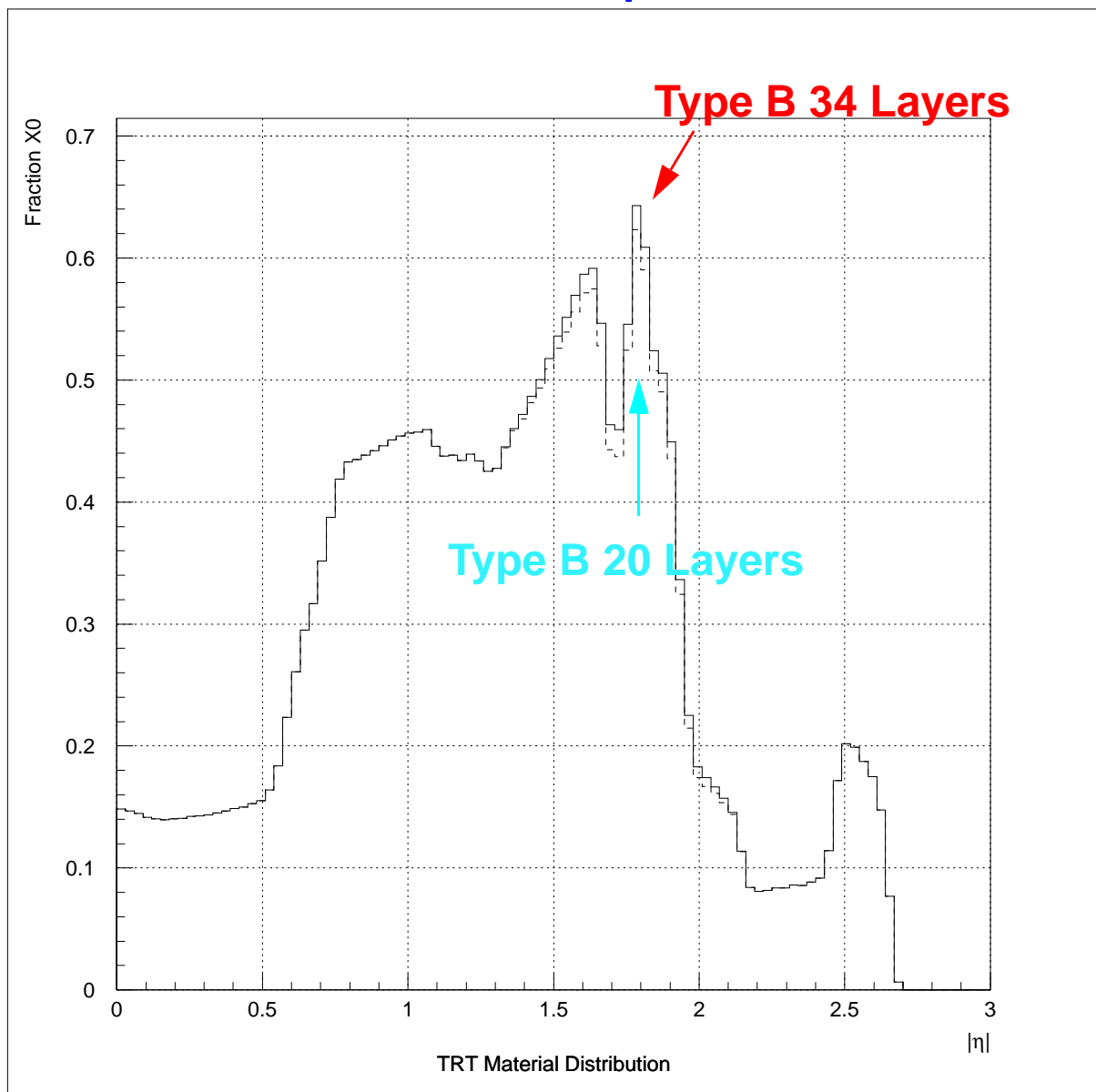
MATERIAL PLOTS

X0 for the radiator only:



MATERIAL DISTRIBUTION

The **PRELIMINARY** material plot:



Work remains especially for the end-cap TRT to get a final plot.

MATERIAL CONCLUSION

- 1.The lack of a final mechanical and cooling scheme for the barrel electronics leads to difficulty in estimating the mass. The spread sheet still uses an ASTRAL and a very thin PG plate as the default so some increase is inevitable.
- 2.There is a big increase in the barrel service region caused by the space frame and the stainless steel manifold.
- 3.The connectors for the active gas on the PPB1 are sub-optimal from a material point of view.
- 4.The current radiation length of the barrel has grown to 9.5% X0 (not including cables) while the original budget was 7.5% X0.
- 5.The use of a fabric spacer for the radiator stacks increases the mass in the end-cap region.
- 6.I need help understanding the outer edge of the wheels and the attached services (cables etc.).
- 7.The design of the end-cap seems to be stabilizing which should make it possible to make a better estimate of its mass.

An accurate accounting of the material is required for LHCC meeting in July.

GEOMETRY CHANGES

The main changes have been in the end-cap region where the straw active length keeps getting reduced:

The Incredible Shrinking Straws

	A,B TDR	A,B NOW	C ID TDR	C NOW
Outer Radius	1030.0 mm	1001.0 mm	1030.0 mm	968.0 mm
Inner Radius	640.0 mm	646.6 mm	480.0 mm	486.7 mm
Active Length	390.0 mm	354.4 mm	550.0 mm	481.3 mm

The Z position of the straws has been rearranged to accommodate the changing design of the support structures and services for the precision trackers:

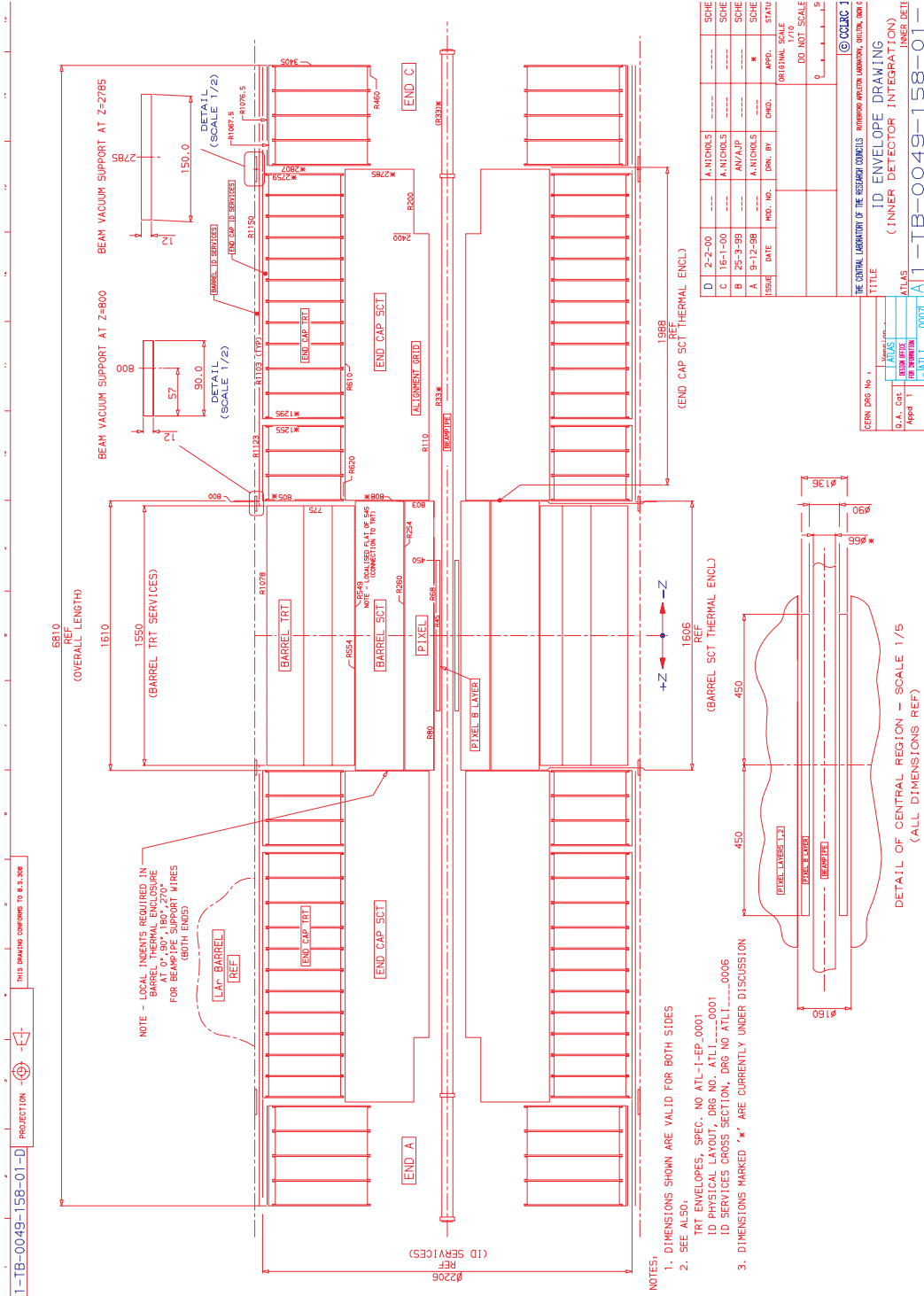
The SCT support that was in within the type A wheels has been moved to the barrel end-cap gap which has been widened back to its original ID TDR width of 110 mm. The gap may still need to be widened by up to another 10 mm.

The gap between the type B and C wheels is widened by 53.5 mm to 91.5 mm to fit the pixel and SCT services.

Consequently the Z positions of the TRT wheels have been redistributed for uniformity.

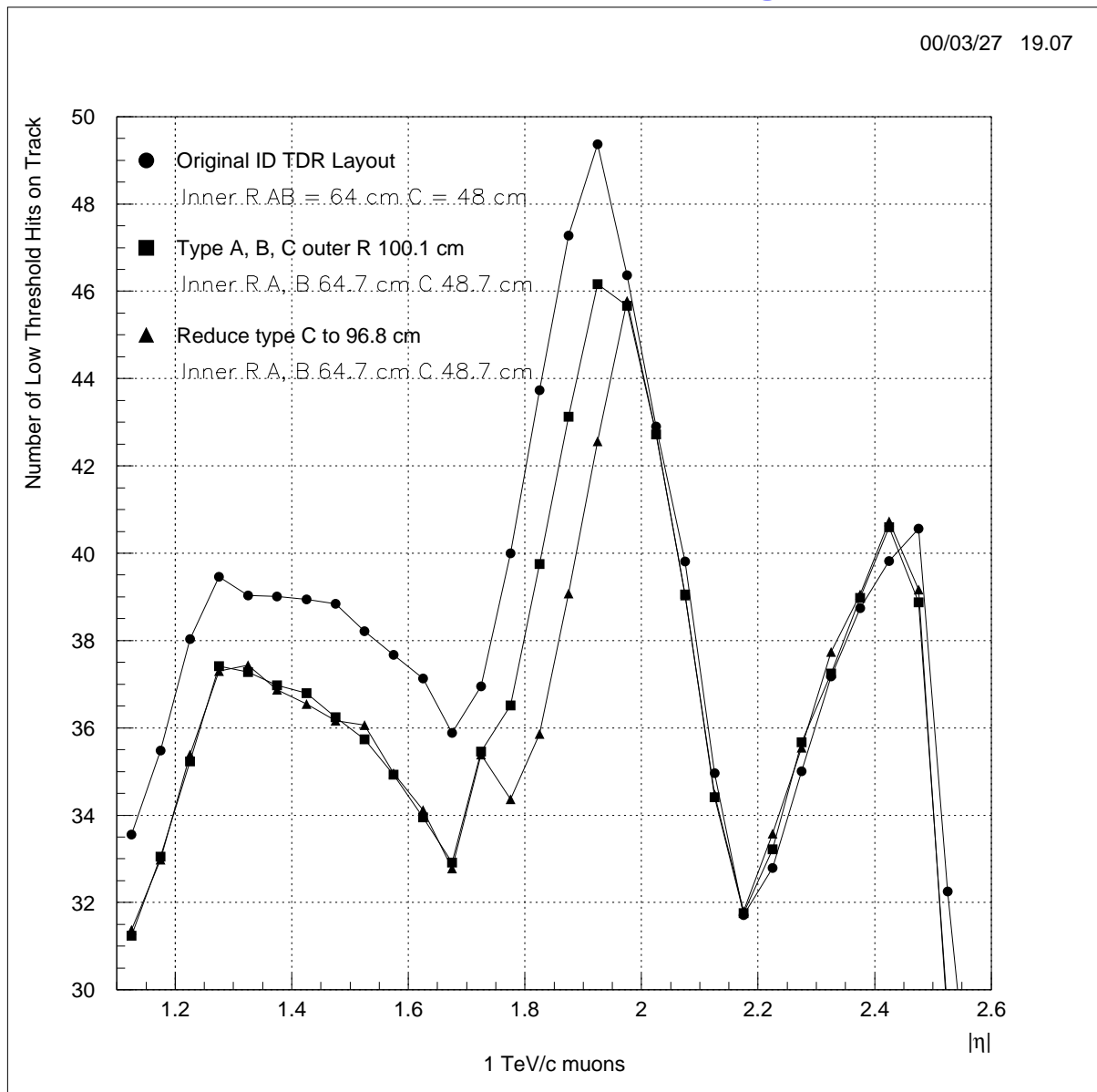
The Z positions of each layer within each wheel type are no longer uniform (as was the case for the ID TDR).

ENVELOPES



WHEEL OUTER RADIUS

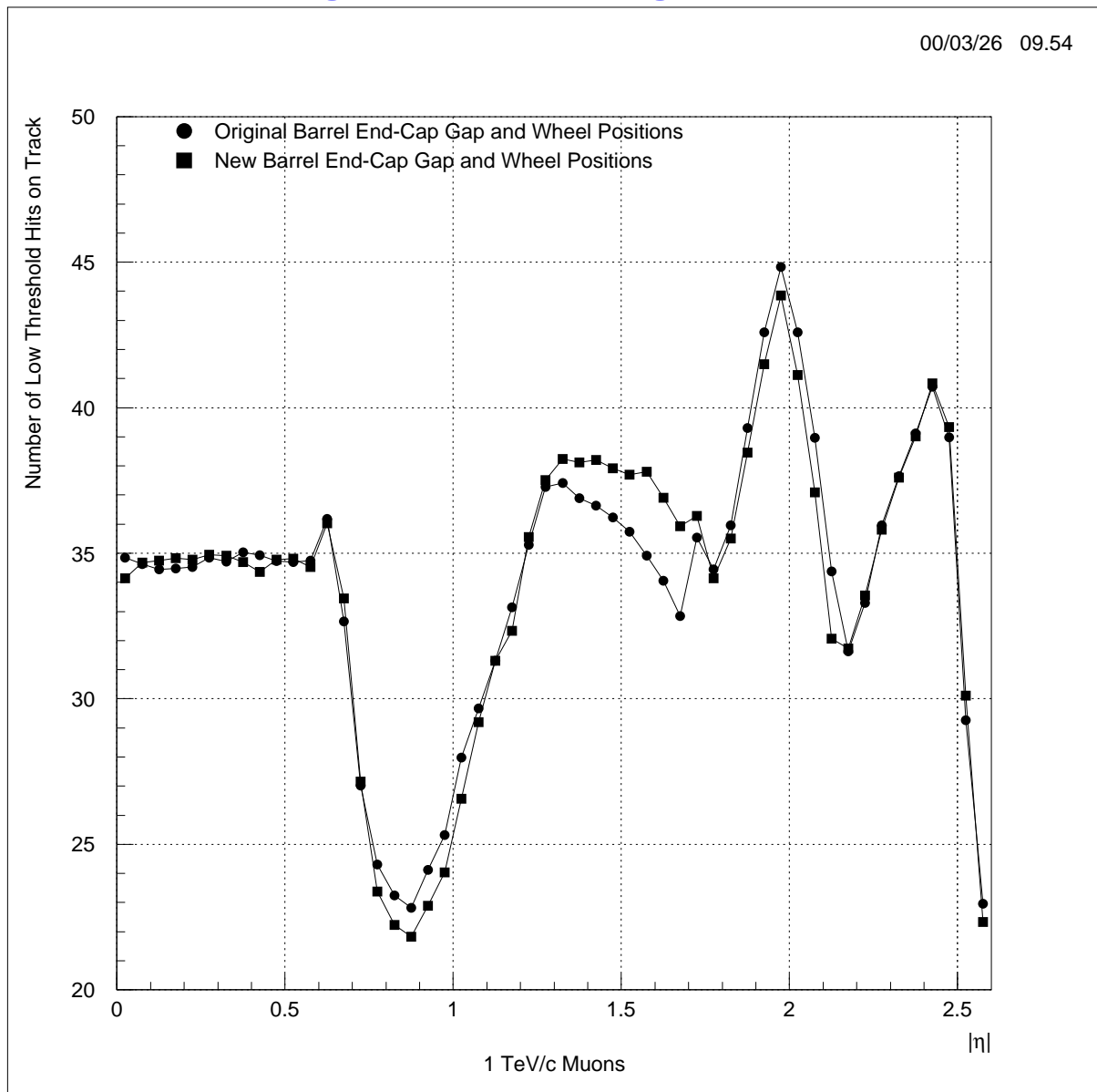
The stiff track hits falls as active length is reduced:



A reduction may be tolerable because of the large number of hits.

GAP WIDTHS

The number of hits on a stiff track crossing the barrel end-cap gap falls as the gap is widened:



Recall that the specification calls for 36+ hits...

BEAM PIPE DESIGN

Several proposed beam pipe designs were studied:

1. Simple Be pipe with OD 50 mm used in ID TDR.
2. Current design with aluminium getter pumps.
3. Current design with beryllium getter pumps.
4. Other designs with stainless steel getter pumps which thankfully were discarded.

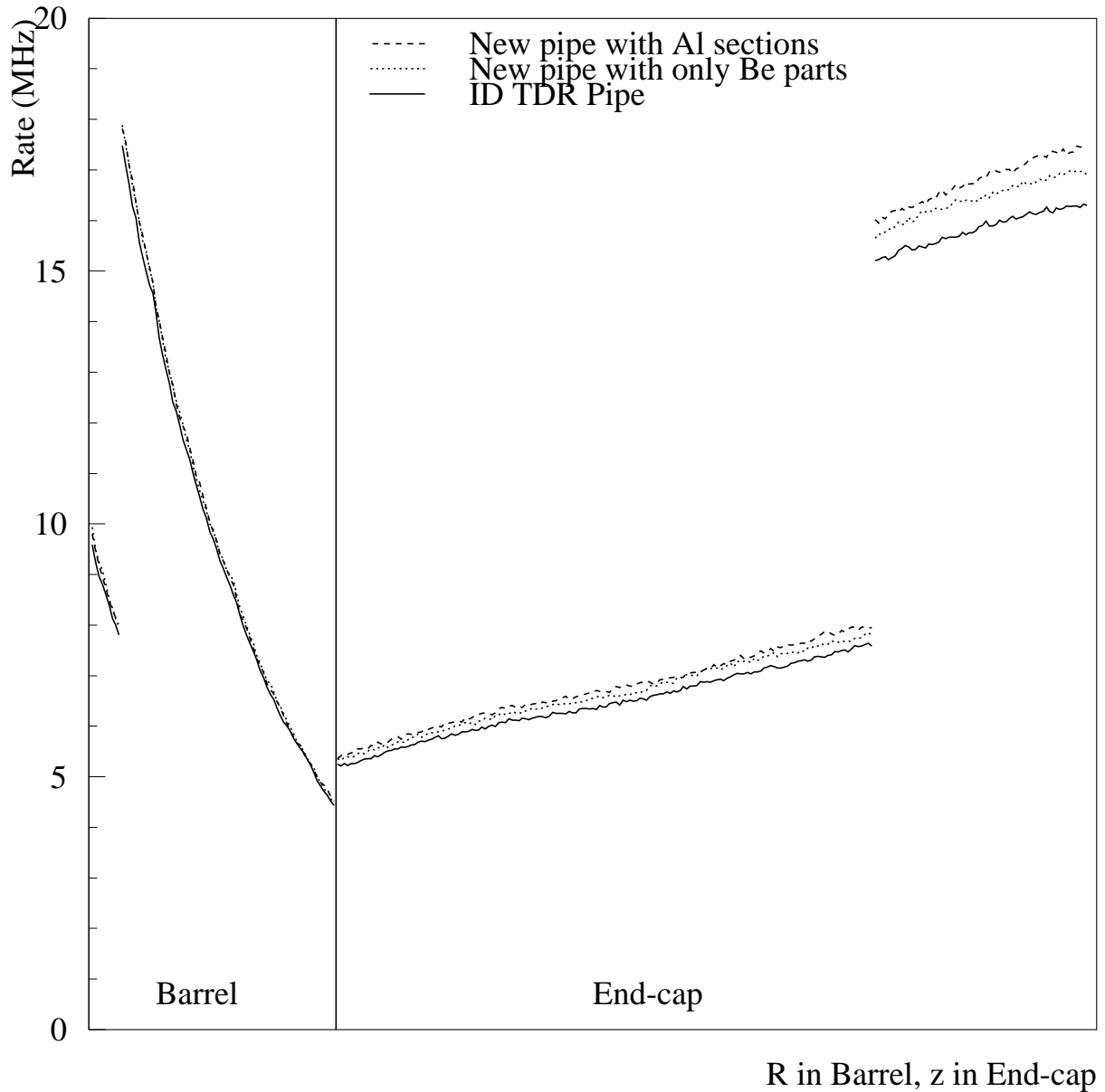
Simulation Parameters of Various Beam Pipes

Name	Material	Wall (mm)	OD (mm)	Z Location (mm)
Original	Be	1.0	50.0	$ Z < 3650$
Al Getter	Be	0.8	59.6	$ Z < 2750$
	Be	0.8	67.6	$ Z < 2750$
	Al	1.1	60.2	$2750 < Z < 3650$
	Al	1.1	68.2	$2750 < Z < 3650$
Be Getter	Be	0.8	61.2	$ Z < 3650$
	Be	0.8	67.6	$ Z < 3650$

The 1.6 mm total thickness of Be walls models the 1.0 mm beam pipe wall and an Al foil supported on ceramics provides as a vacuum jacket for thermal insulation to protect the B-layer during bake-out.

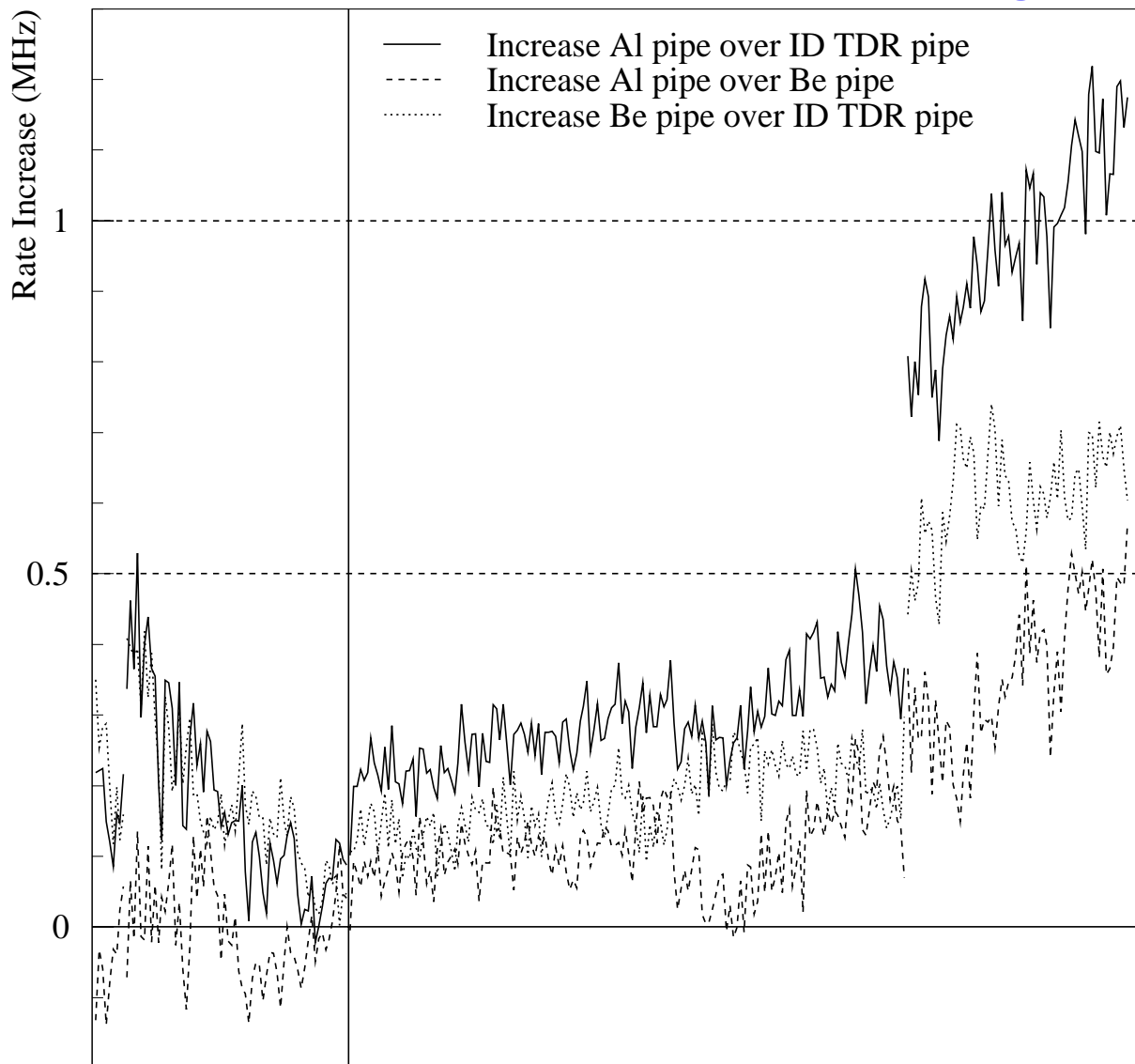
BEAM PIPE RESULTS

The rates of TRT hits by charged particles with $E > 100$ keV for the three beam pipe scenarios are:



BEAM PIPE RESULTS

The rate increase for each new beam pipe design:



R in Barrel, z in End-cap

The increase is probably OK for the Be designs but the Al pumps reduce the type C wheel performance.