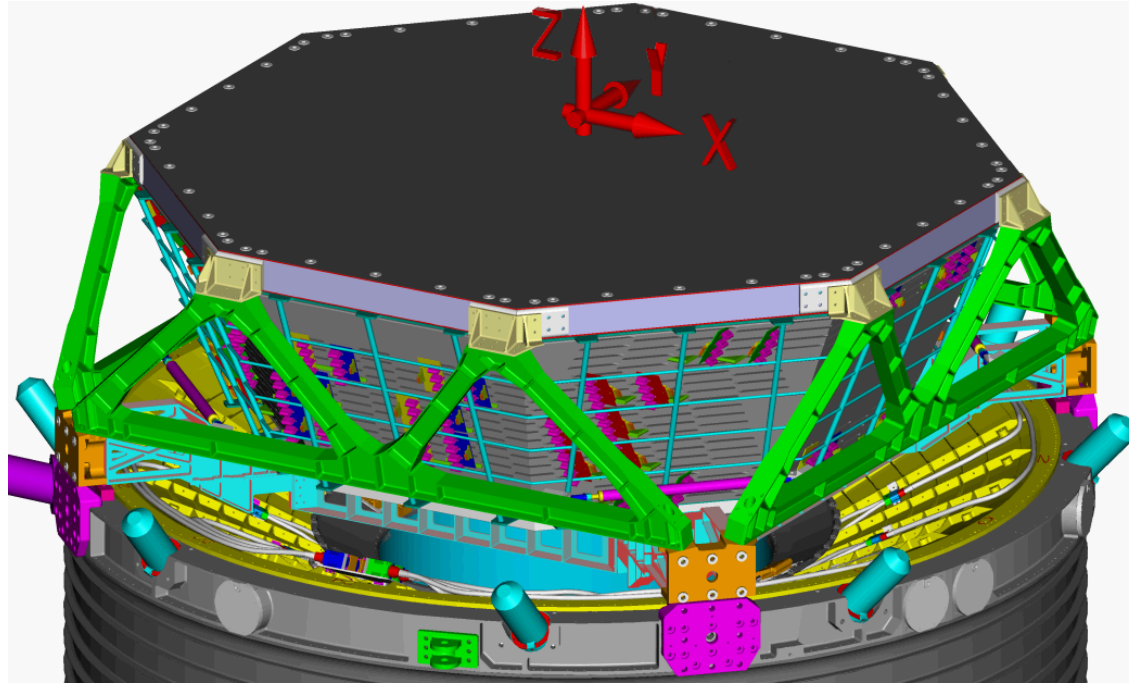


AMS TIM and General Meeting

TRD Progress Report / Aachen Activities



Th. Kirn

C.H. Chung, F. Dömmecke, S. Fopp, K. Lübelmeyer, W. Karpinski, S. Schael,
G. Schwering, Th. Siedenburger, A. Schultz von Dratzig, M. Wlochal

I. Phys. Institute B

RWTH
Physics AC-I

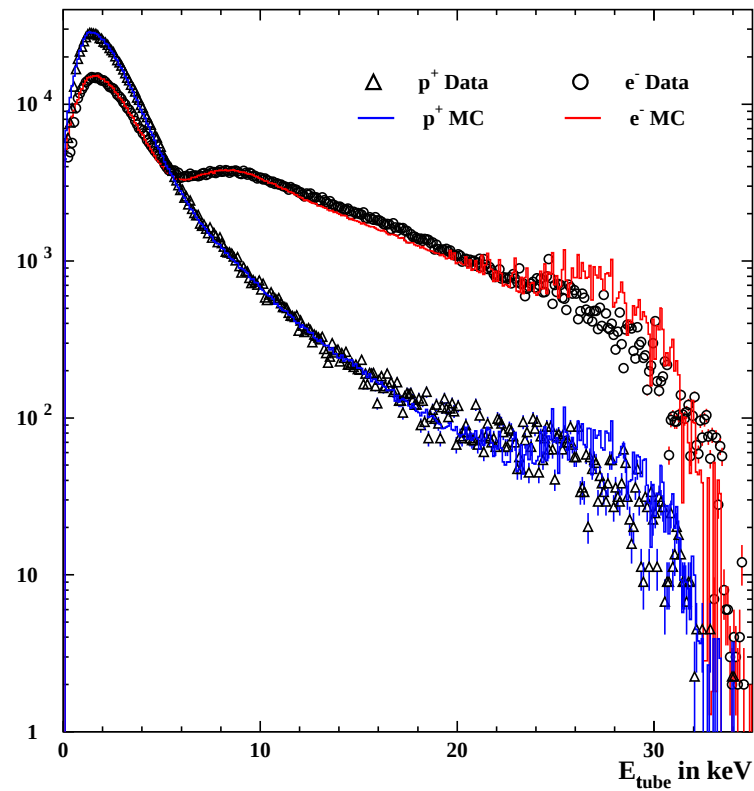
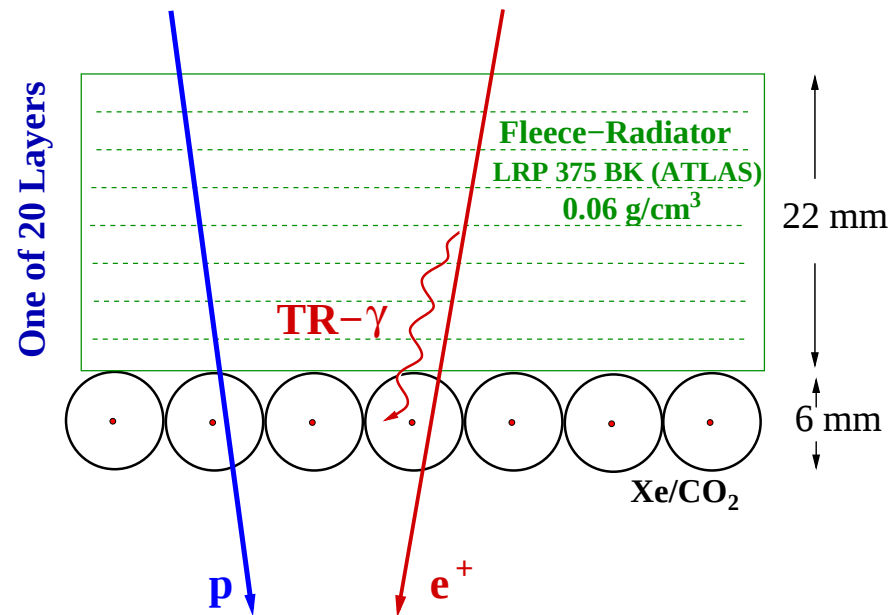
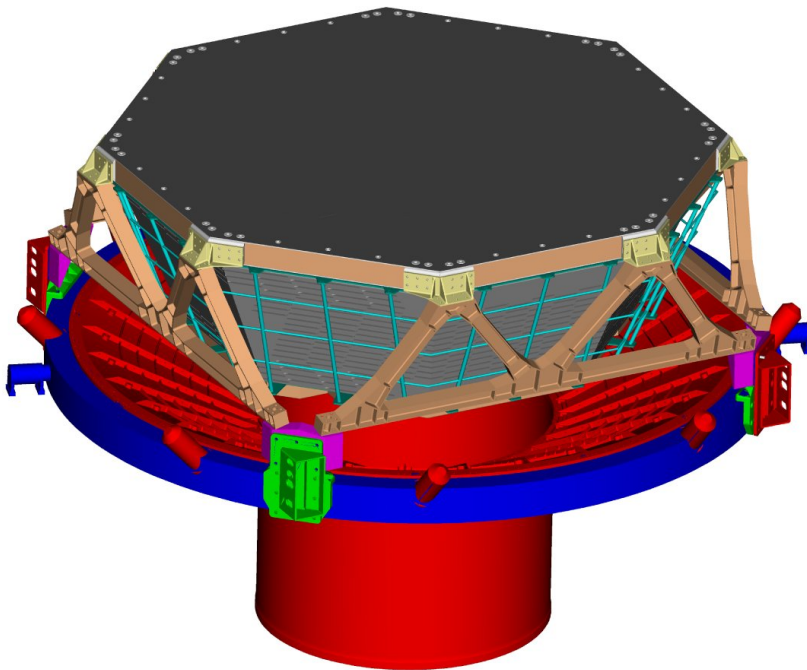
CERN, 20th July 2004

AMS-02 TRD

$$p^+ \text{-rejection} > 10^2 \text{ (10 - 300 GeV)}$$

Chosen Configuration for 60 cm height:
20 Layers each existing of

- 22 mm fleece
- $\varnothing$ 6 mm straw tubes (Xe/CO₂ (80/20))



Radiator Modules ✓



4000 pieces cut to individual shape



1000 modules of 22mm are sewn from 4 layers of 5.5mm

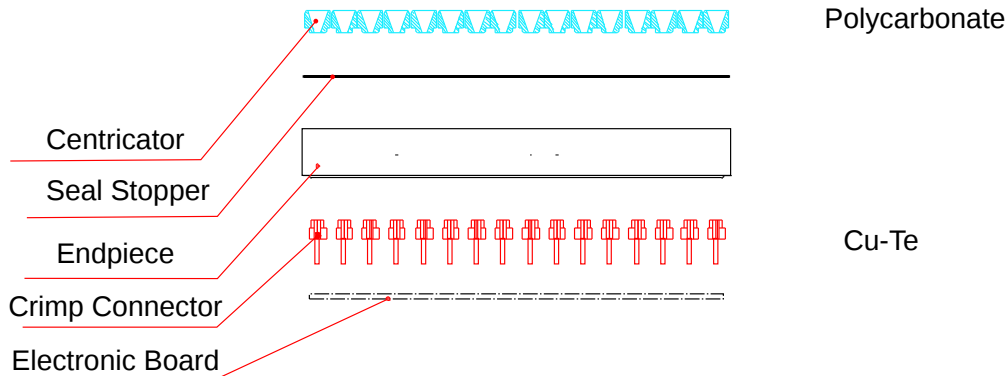
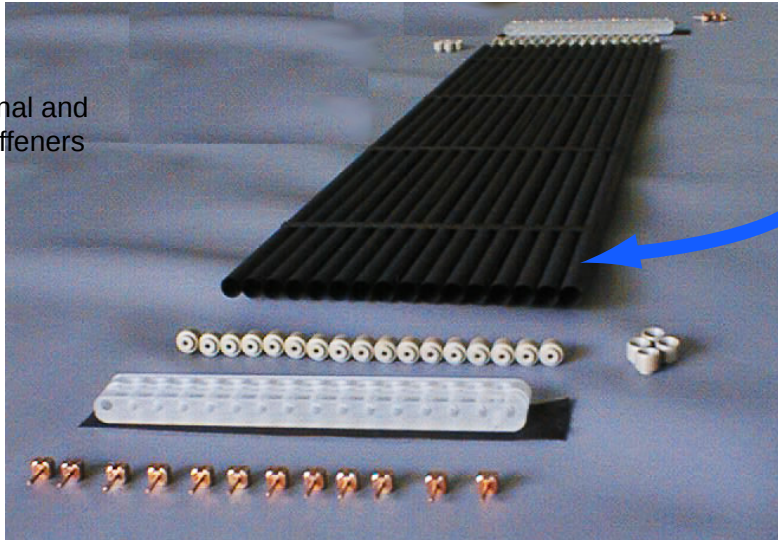


10 soxhlett extraction pipes (70cm) installed at RWTH Aachen Institute of Organic Chemistry

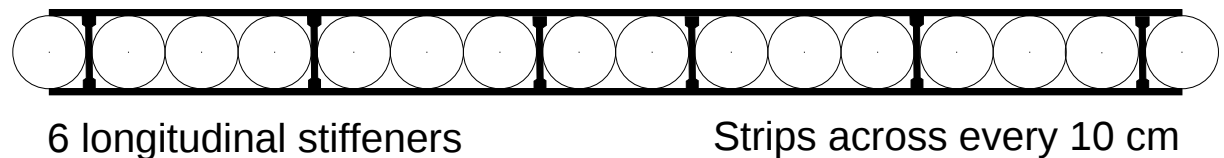
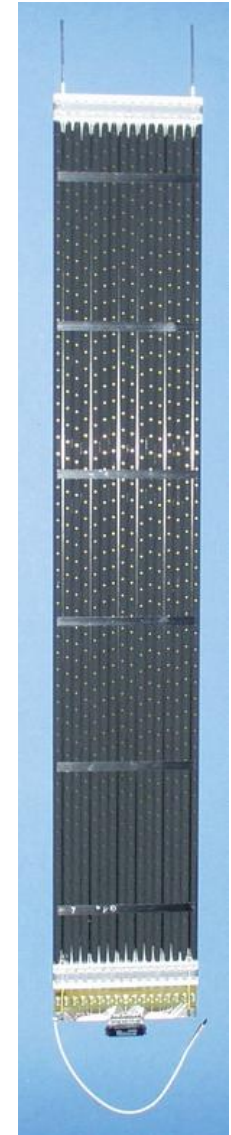
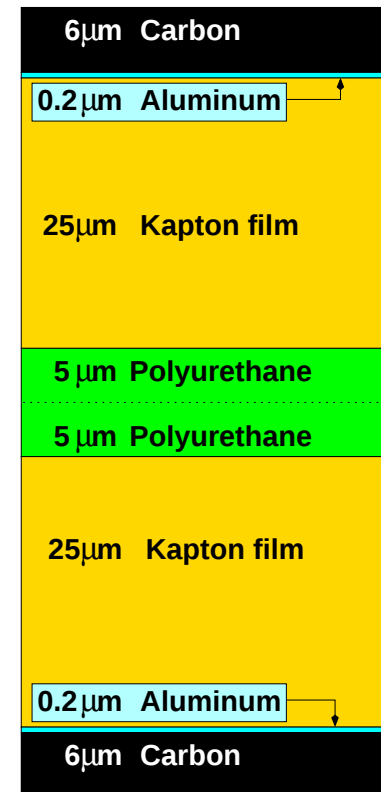
AMS-02 TRD Straw Modules: 16 straws at 6mm $\varnothing$ with 30 μm W-Au wire

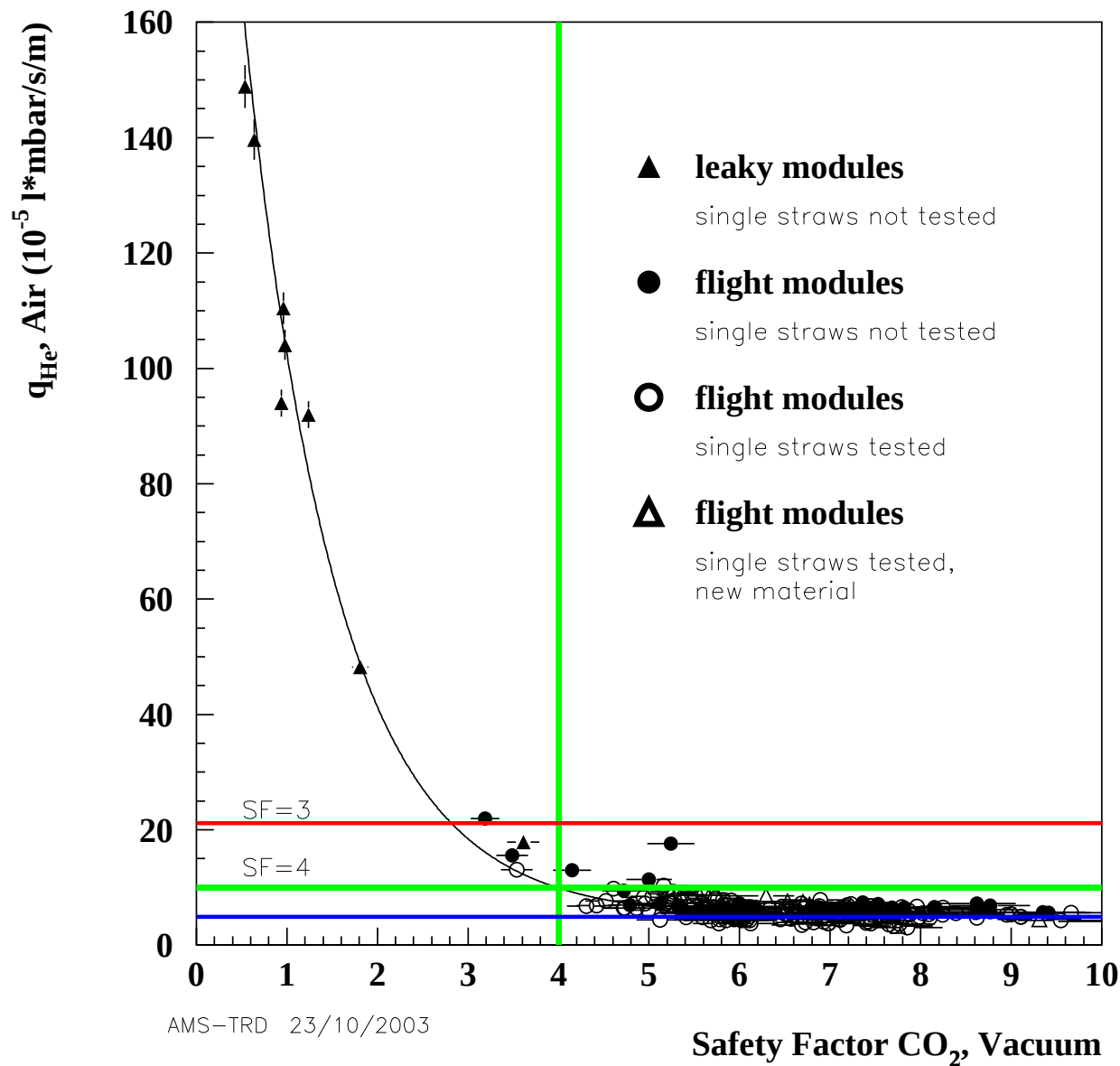
Multilayer Capton tubings

CFC longitudinal and transversal stiffeners



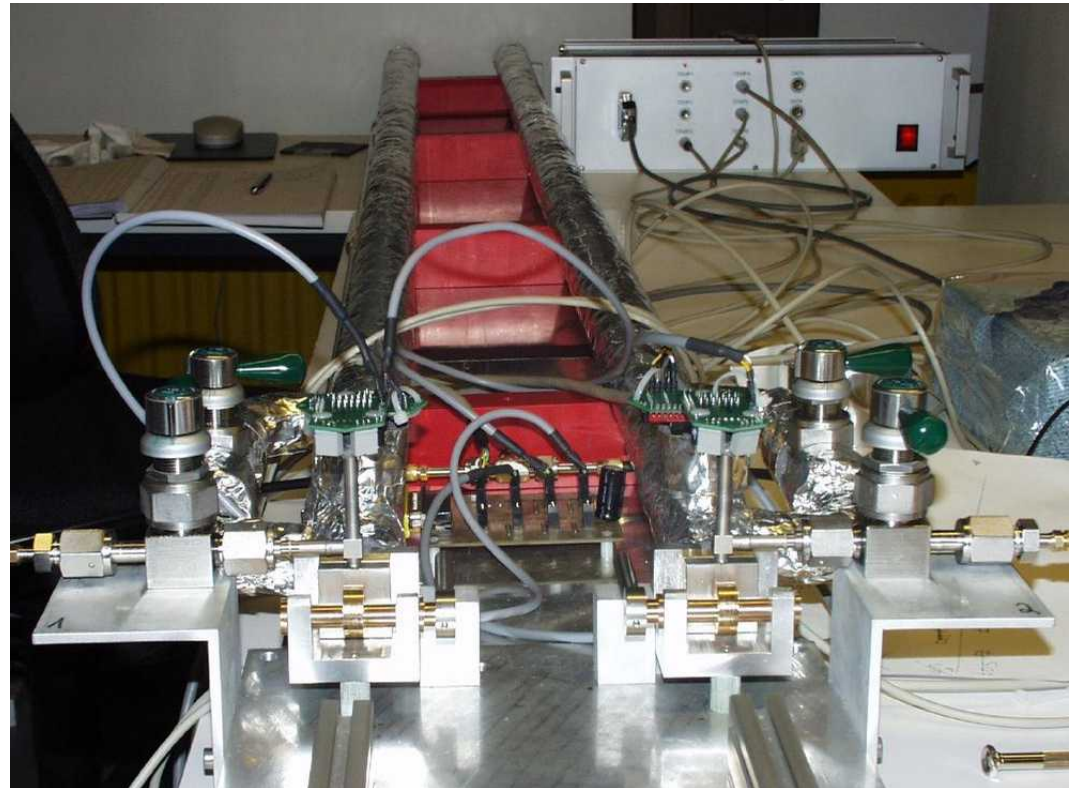
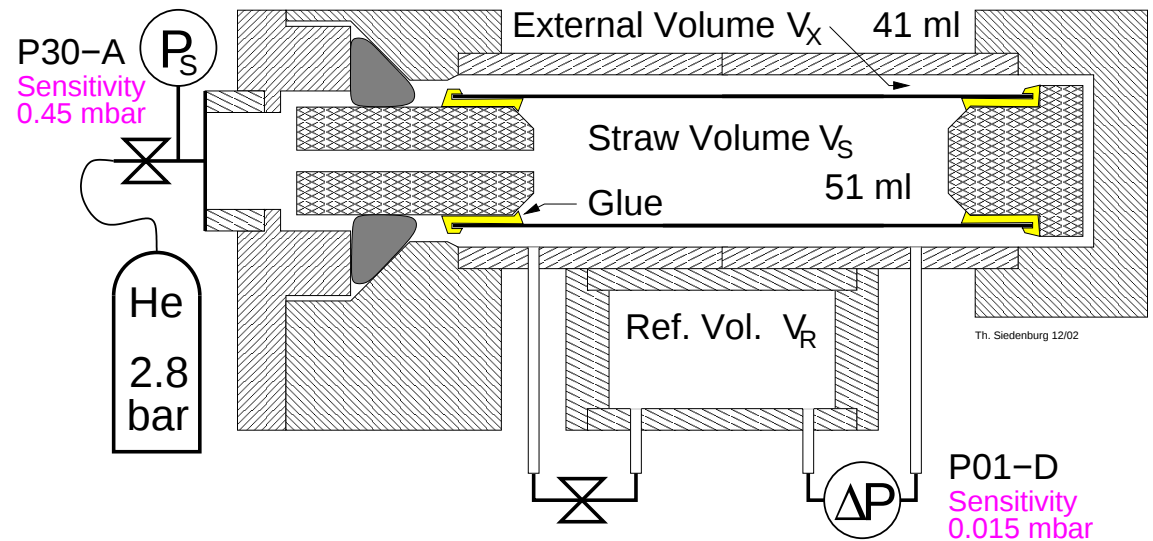
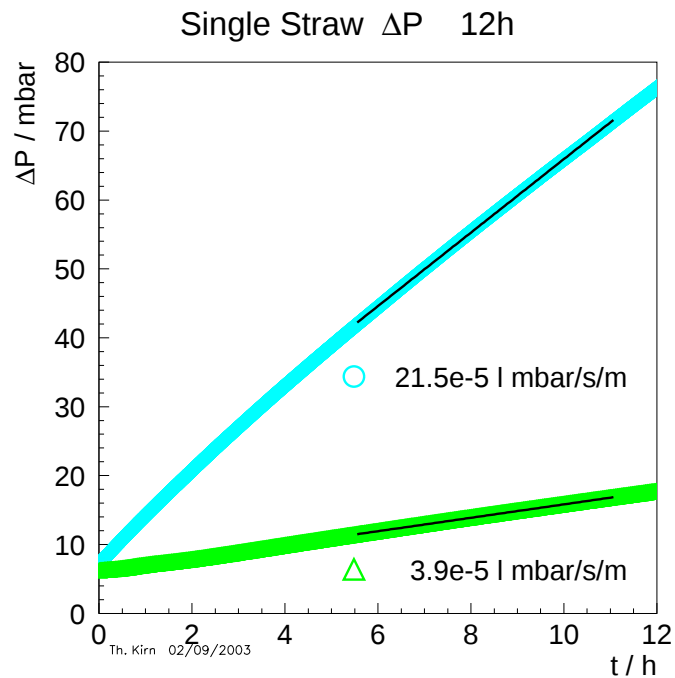
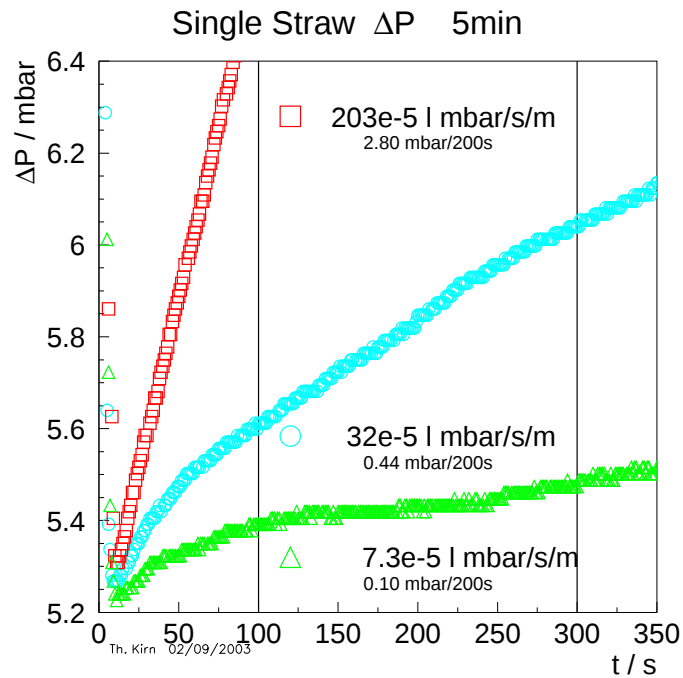
Capton wall



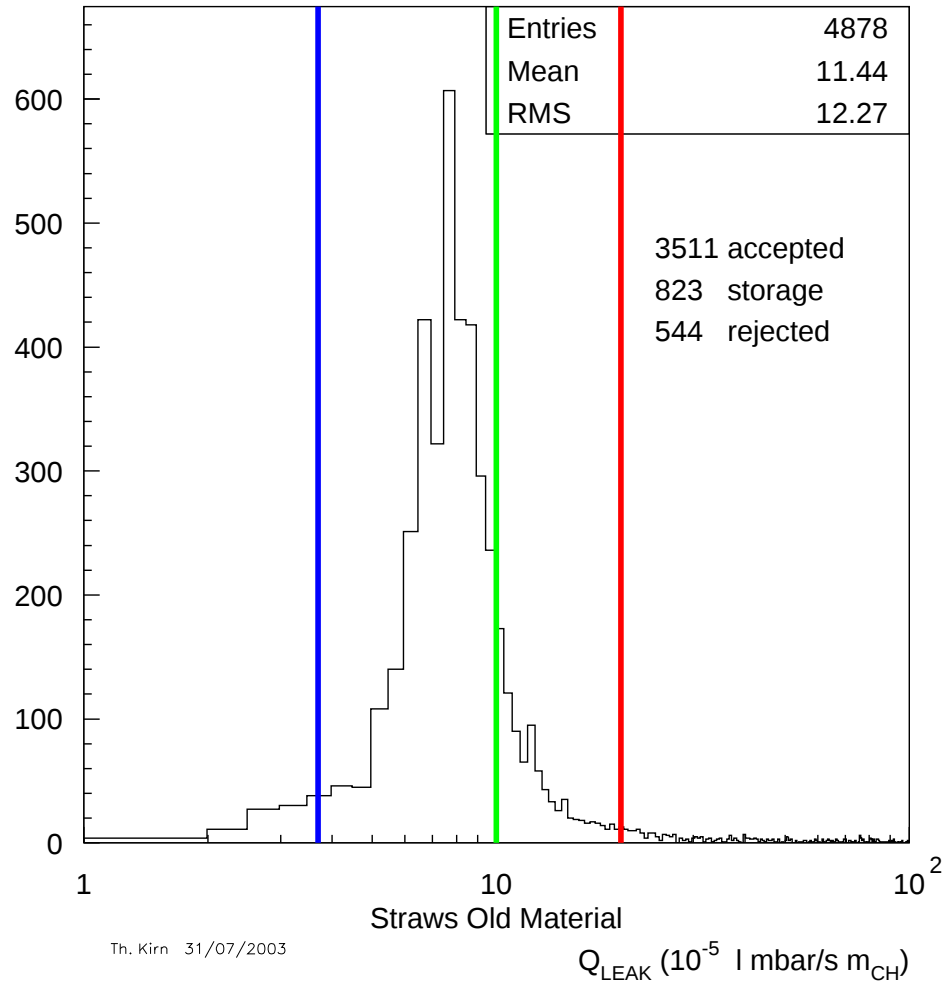
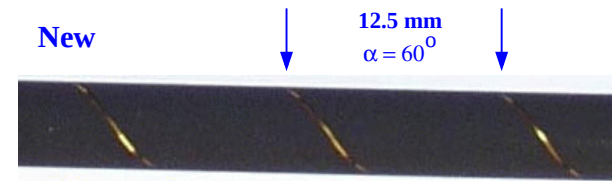
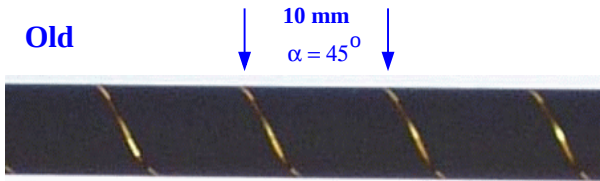


- Aim: Safety Factor of $> 4 \Leftrightarrow > 12$ years on ISS $\rightarrow$ He: $10 \cdot 10^{-5} \text{ l} \cdot \text{mbar/s/m}$
 $\Rightarrow$ Need to test each of 5248 straws

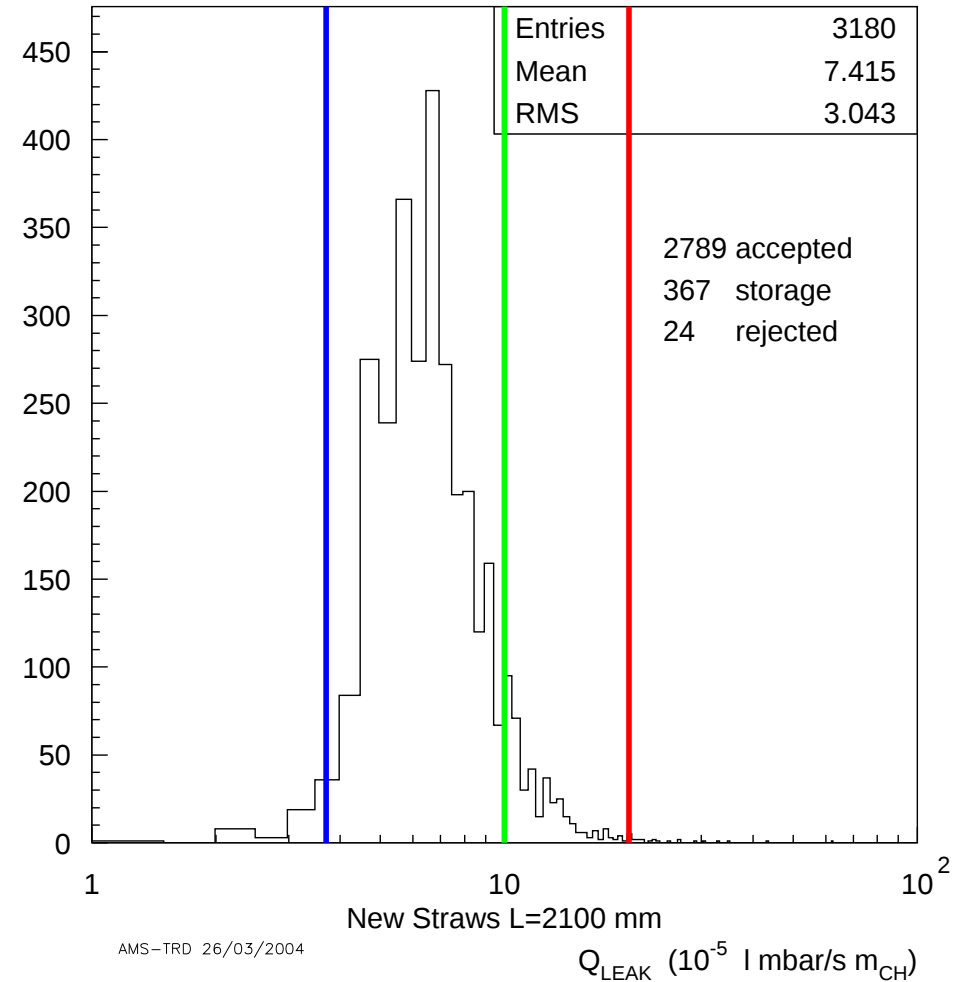
Single Straw Test



Single Straw Test: 16 Straws/Module $\times$ 328 Modules = 5248 Straws $\checkmark$



He-Leakrate

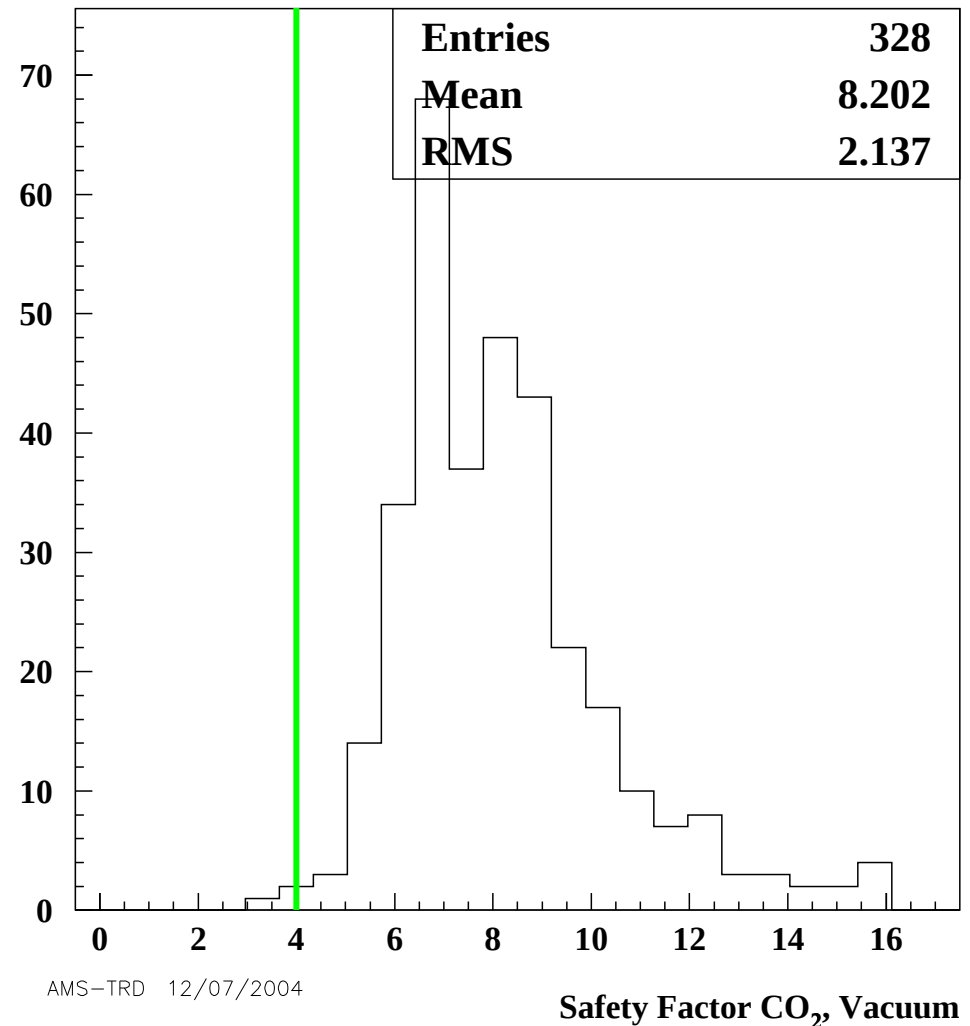


He-Leakrate

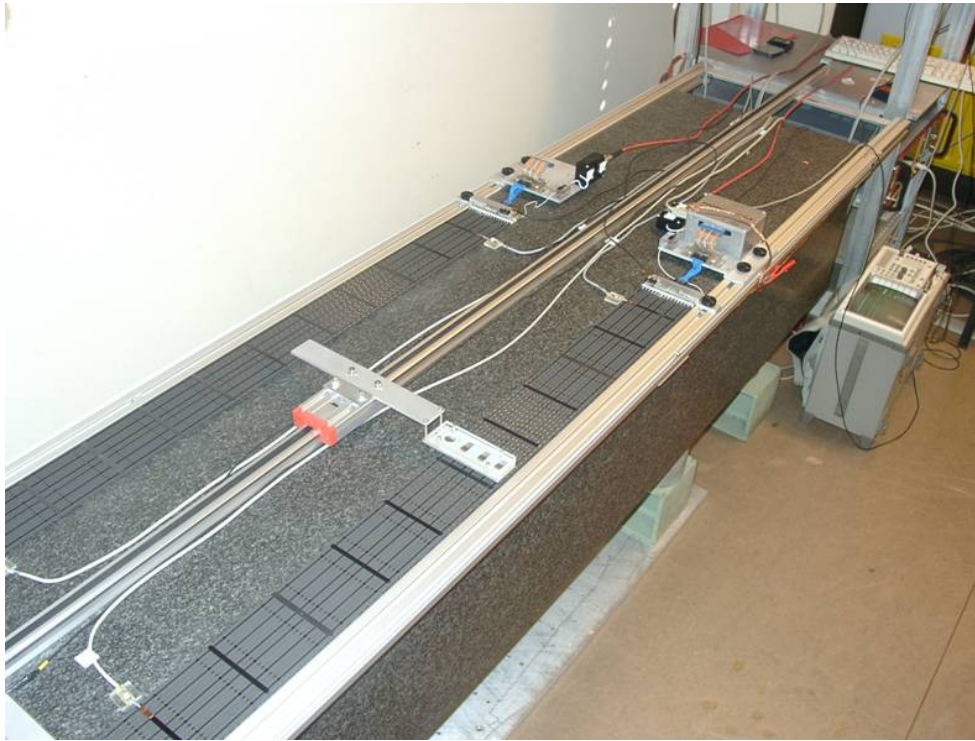
Straw Module Production: Gastightness



328 Straw Modules:
Safety Factor for TRD: ~ 8
 $8 \times 3y \sim 24$ years operation on ISS

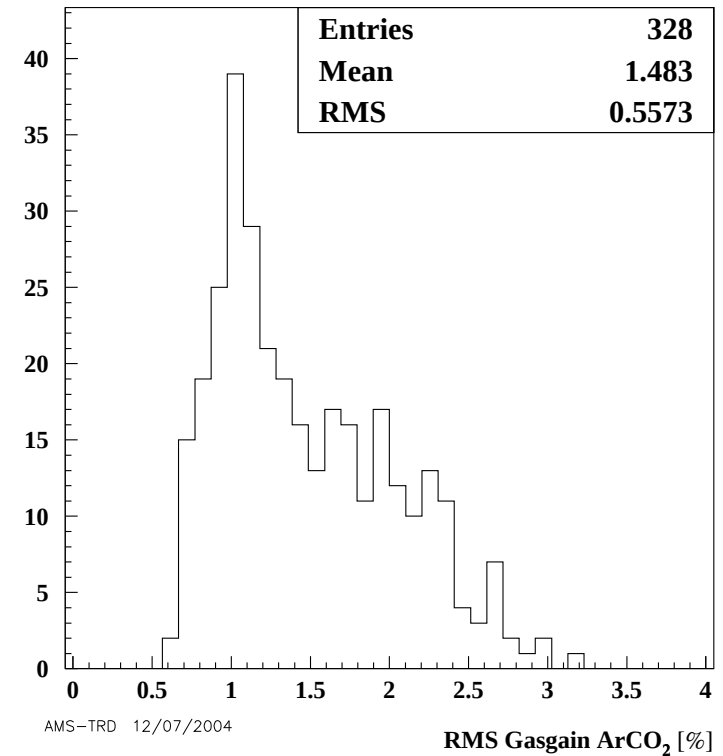
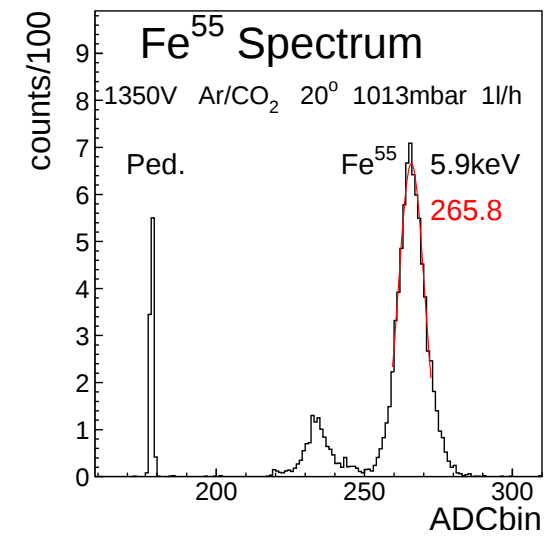


Measurement of Gas Gain with Fe^{55} source



Mean: 5720.69 RMS: 63.90
c:\ggdata\progs\027_3S.pas

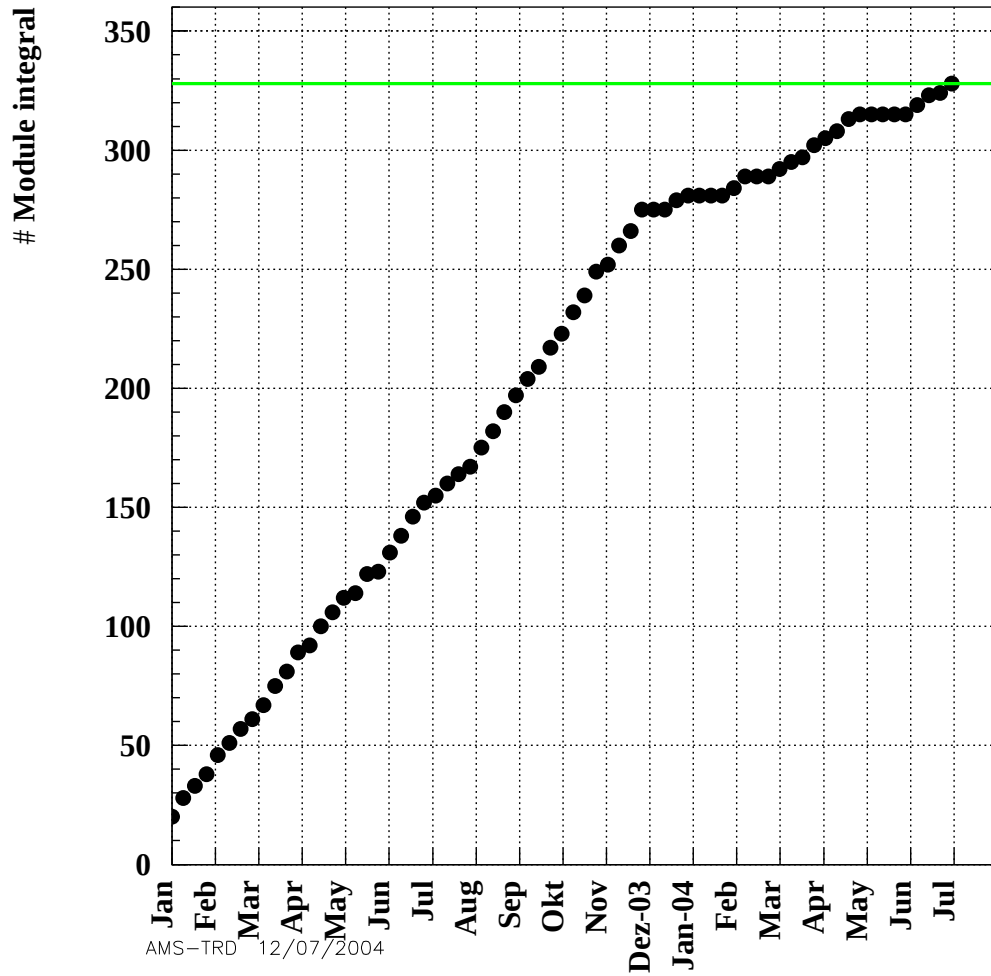
Straw	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	2.1	1.6	-2.1	1.0	1.4	1.9	-0.3	0.5	1.6	0.5						
2	-0.8	1.2	0.0	-0.7	1.2	1.0	1.7	-0.2	1.9	1.3						
3	-0.4	-0.5	0.8	-1.3	-0.3	1.6	2.4	0.7	2.9	2.4						
4	-0.4	-1.0	-0.7	-0.5	-1.6	-1.2	0.4	0.5	0.4	0.7						
5	-0.3	0.2	-1.4	0.2	0.3	0.1	0.5	0.8	1.5	0.1						
6	-0.4	0.7	-1.7	-0.1	0.4	-1.3	-0.2	1.4	-0.8	-1.2						
7	-1.1	0.9	-1.9	-1.1	0.3	-0.3	-1.1	1.4	0.6	-0.0						
8	-0.4	-0.1	-1.2	-0.8	-0.0	-2.0	0.4	1.4	-1.4	-1.2						
9	-0.1	-0.3	-0.2	-0.7	-0.8	-1.4	0.2	1.4	-1.2	-0.2						
10	-0.1	0.6	-2.5	-0.3	1.0	0.0	-0.5	0.6	1.2	-1.3						
11	-1.7	-0.6	-1.1	-2.3	0.3	0.1	-0.6	-0.3	0.6	0.3						
12	0.2	-0.9	-2.8	-0.7	-0.9	-0.5	-1.0	-0.5	-0.4	-1.3						
13	-0.3	0.6	-2.3	-0.3	1.4	-0.5	-2.0	0.2	0.5	-1.1						
14	-0.2	0.4	-0.3	0.2	0.3	0.6	-0.1	1.1	0.8	1.4						
15	-2.2	-0.8	0.1	-0.6	-1.0	0.5	0.9	-0.8	2.0	1.9						
16	0.8	1.3	-1.1	2.1	2.4	0.6	0.2	1.7	1.0	-1.2						



Average variation of gas gain: 1.48%

Straw Module Production Status

Flight Module Production 03+04



Module Production completed ✓

Straw Module Production Status

	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6	+7	+8	+9	
260		268		276		284		292		300		308		316		324			20
	264		272		280		288		296		304		312		320		328		
259		267		275		283		291		299		307		315		323		327	19
	263		271		279		287		295		303		311		319		322		
258		266		274		282		290		298		306		314		322		326	18
	262		270		278		286		294		302		310		318		325		
257		265		273		281		289		297		305		313		321		325	17
	261		269		277		285		293		301		309		317		325		
188		196		204		212		220		228		236		244		252		256	16
	192		200		208		216		224		232		240		248		256		
187		195		203		211		219		227		235		243		251		255	15
	191		199		207		215		223		231		239		247		255		
186		194		202		210		218		226		234		242		250		254	14
	190		198		206		214		222		230		238		246		254		
185		193		201		209		217		225		233		241		249		253	13
	189		197		205		213		221		229		237		245		253		
	128		136		144		152		160		168		176		184				12
	124		132		140		148		156		164		172		180		183		
	127		135		143		151		159		167		175		183				11
	123		131		139		147		155		163		171		179		182		
	126		134		142		150		158		166		174		182				10
	122		130		138		146		154		162		170		178		181		
	125		133		141		149		157		165		173		181				9
	121		129		137		145		153		161		169		177		120		
	064		072		080		088		096		104		112		120				8
	060		068		076		084		092		100		108		116		119		
	063		071		079		087		095		103		111		115		118		7
	059		067		075		083		091		099		107		115		117		
	062		070		078		086		094		102		110		118				6
	058		066		074		082		090		098		106		114		117		
	061		069		077		085		093		101		109		117				5
	057		065		073		081		089		097		105		113				
	004		012		020		028		036		044		052		056				4
	008		016		024		032		040		048		056						
	003		011		019		027		035		043		051		055				3
	007		015		023		031		039		047		055						
	002		010		018		026		034		042		050		054				2
	006		014		022		030		038		046		054						
	001		009		017		025		033		041		049		053				1
	005		013		021		029		037		045		053						

BODY

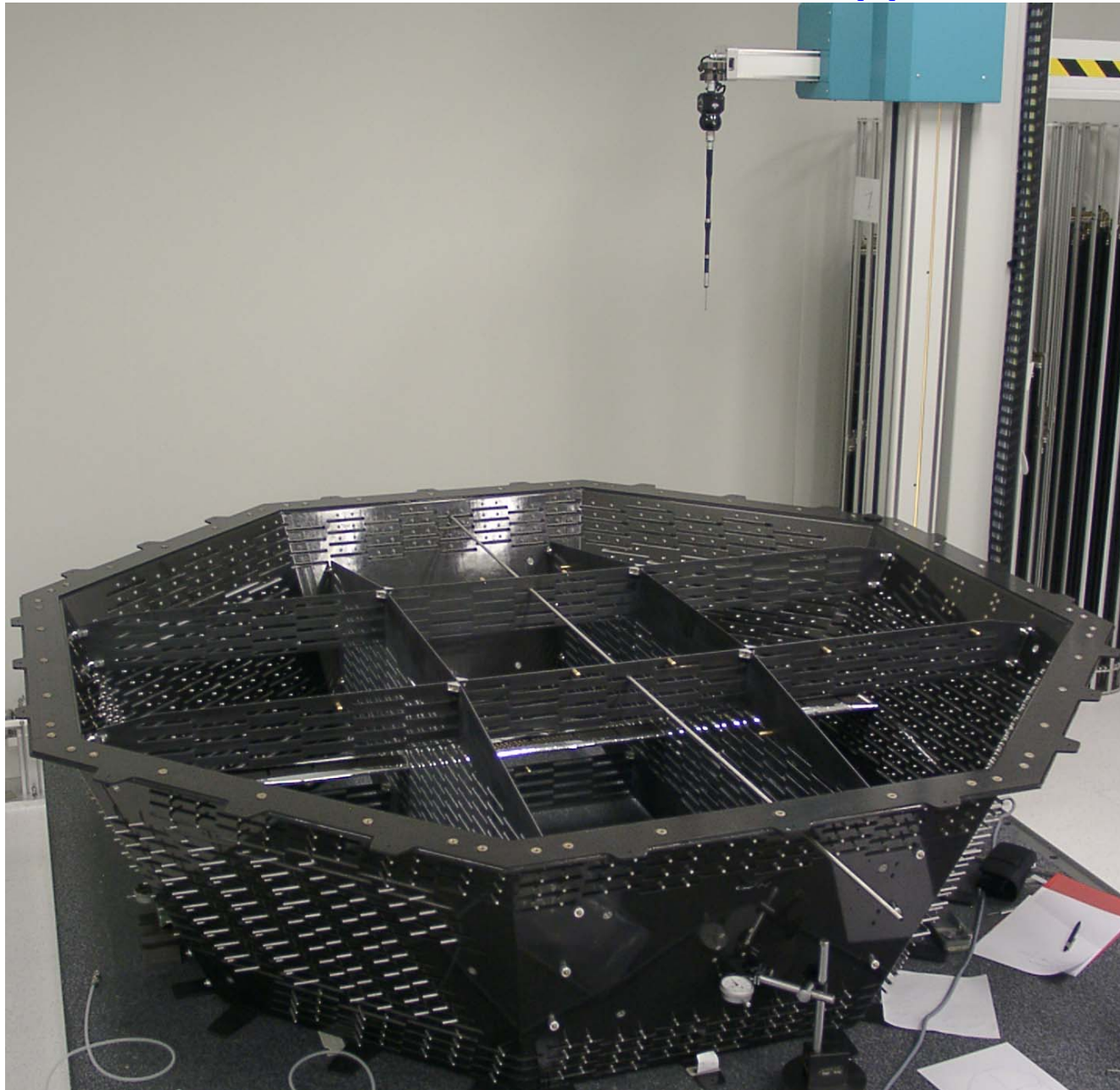
produced

MODULE

under test

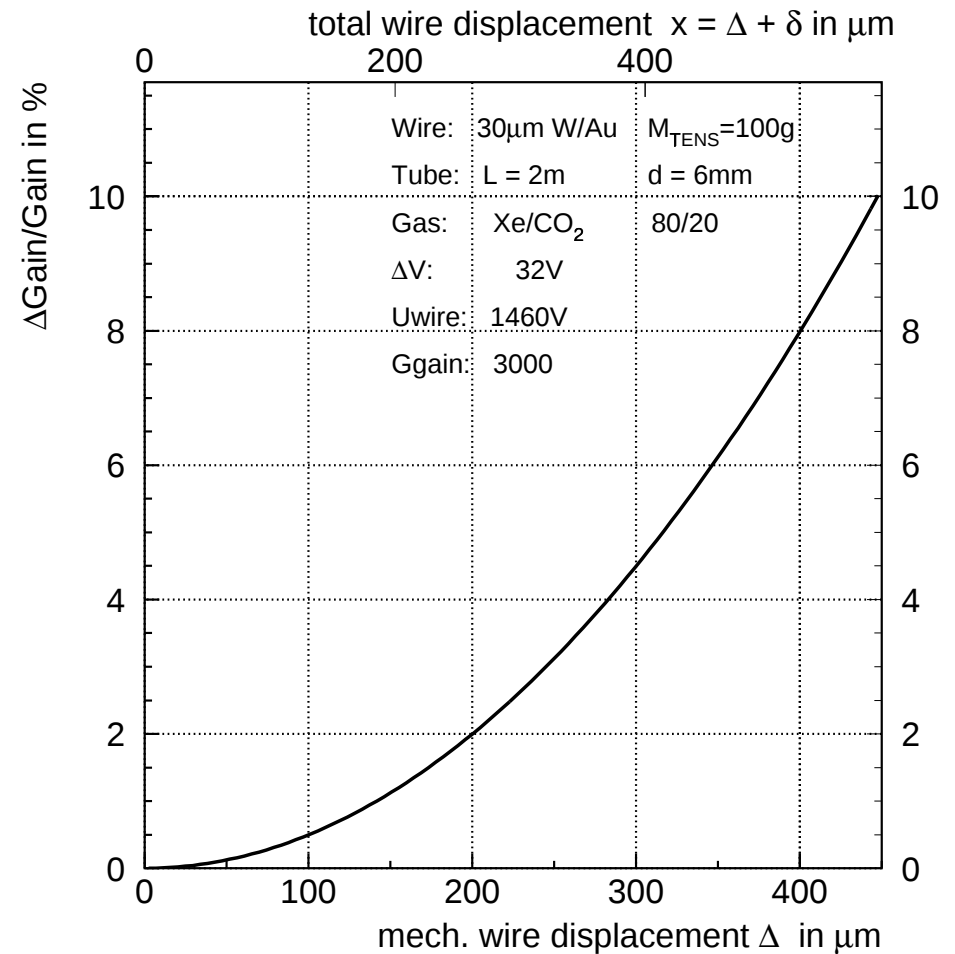
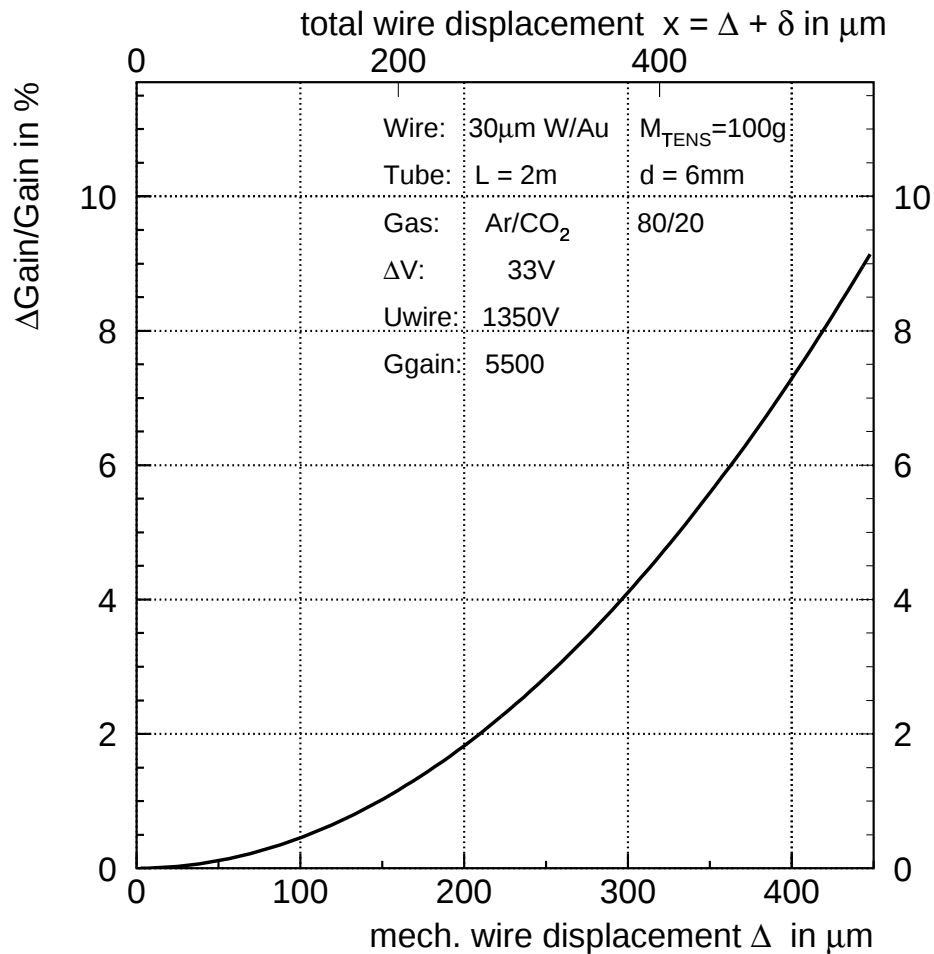
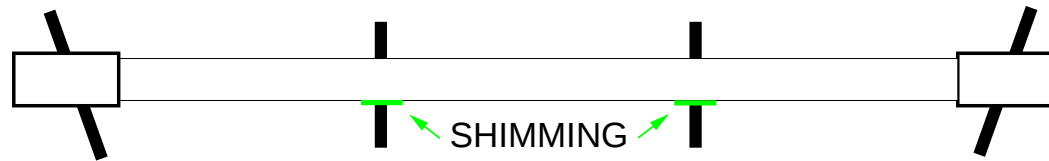
ok

TRD-Octagon with Bulkheads - 3D-Measurement Initial ΔZ Measurements - Module-Support Shimming

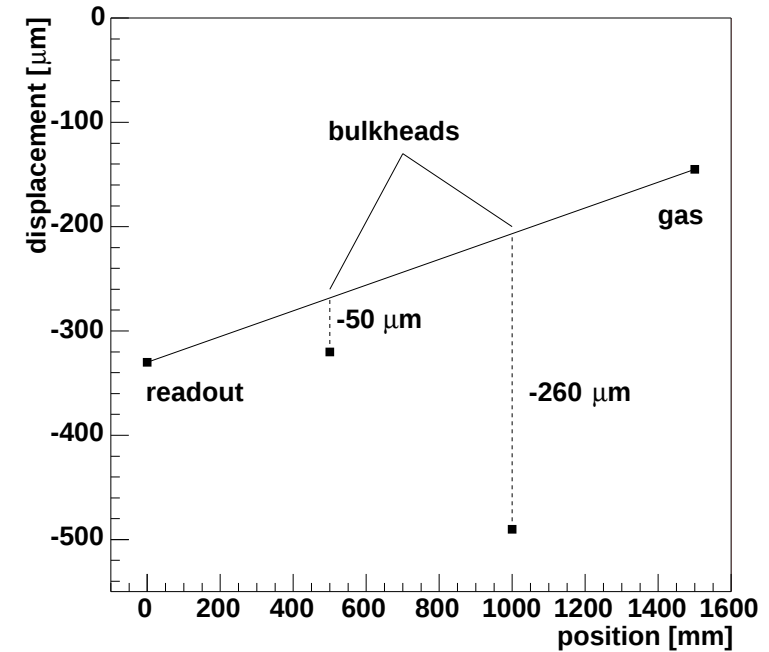
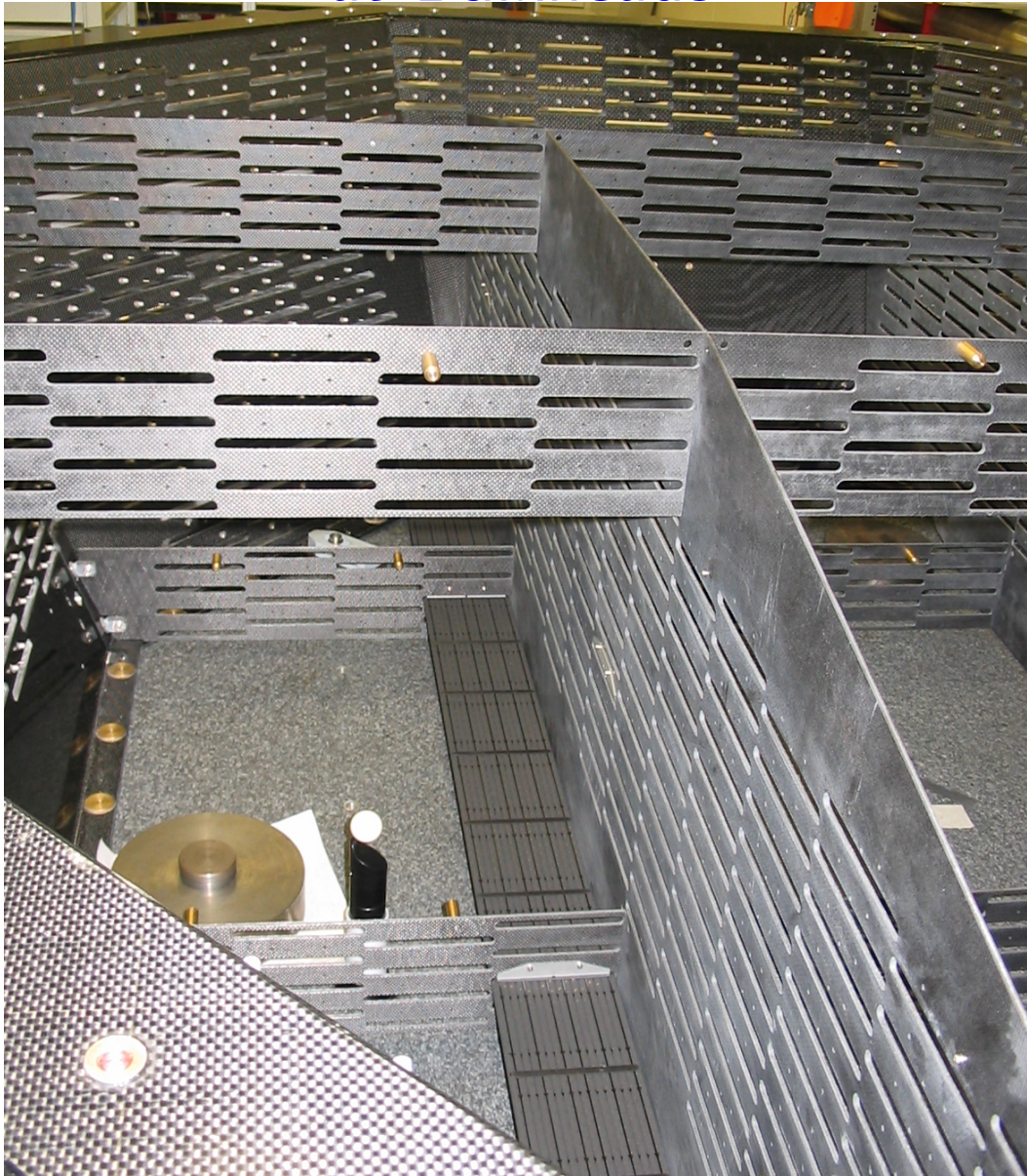


TRD-Octagon with Bulkheads - 3D-Measurement

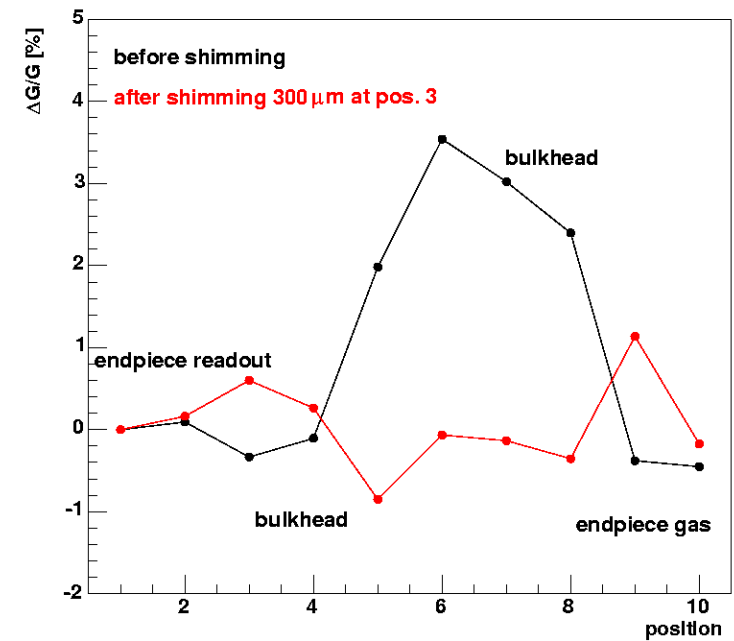
Initial ΔZ Measurements - Module-Support Shimming



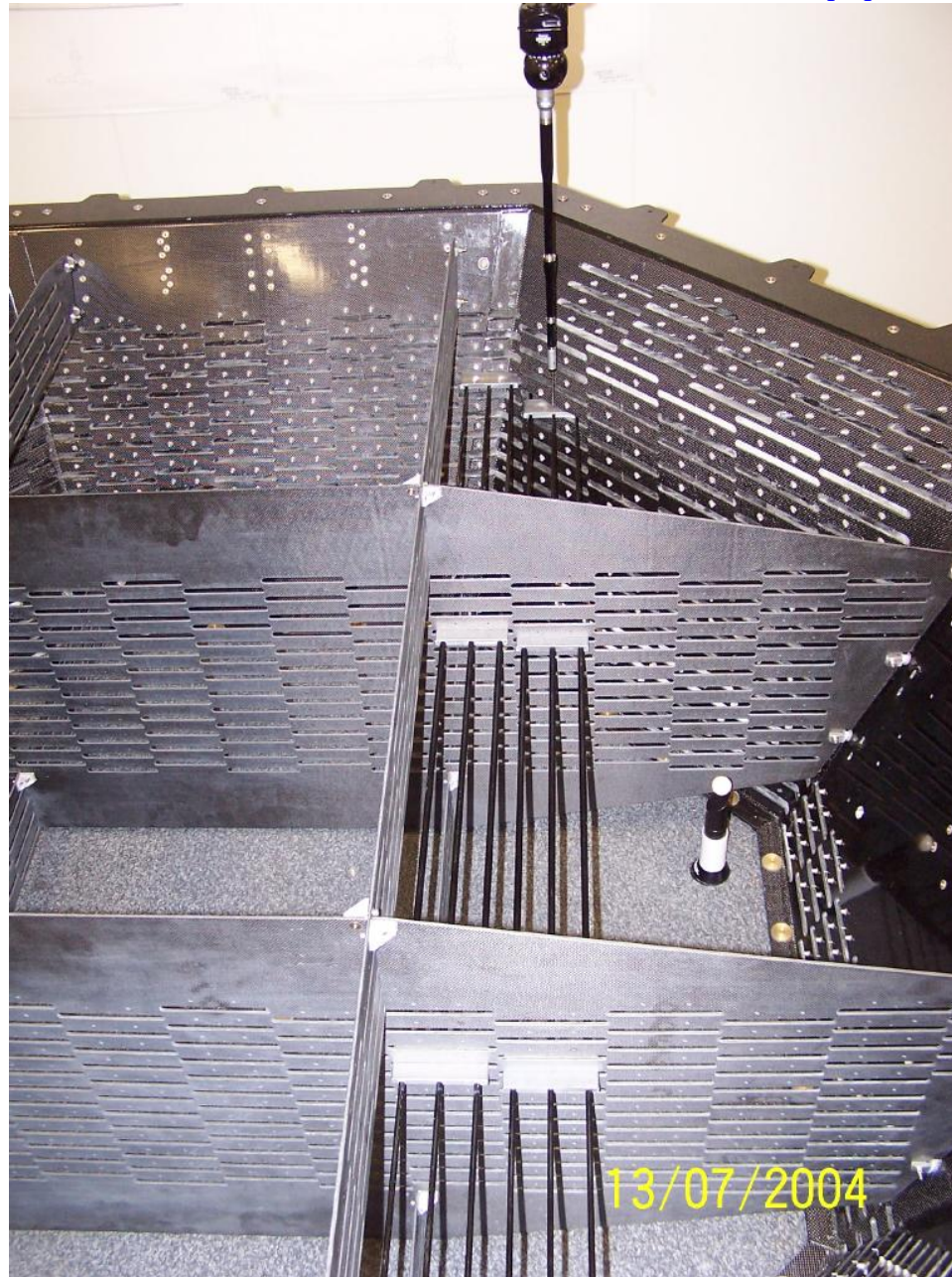
Initial ΔZ Measurements Module-Support Shimming at Bulkheads



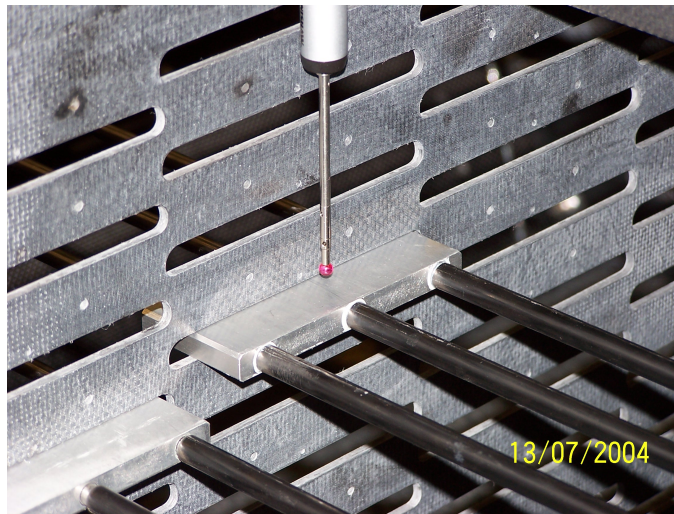
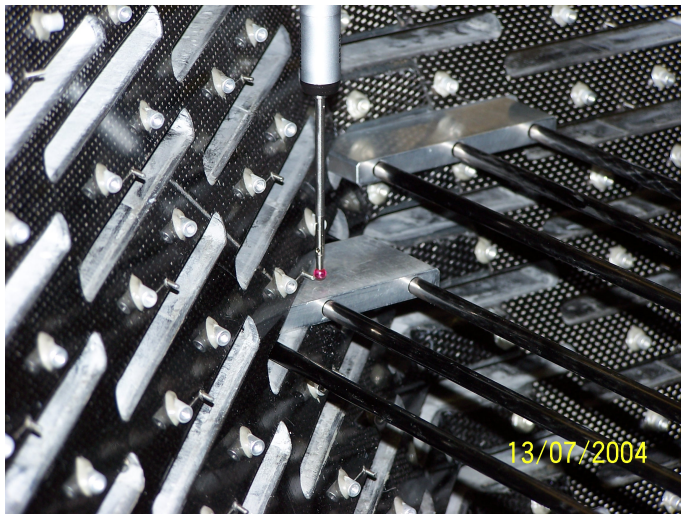
testchamber 108 in octagon



TRD-Octagon with Bulkheads - 3D-Measurement Initial ΔZ Measurements - Module-Support Shimming

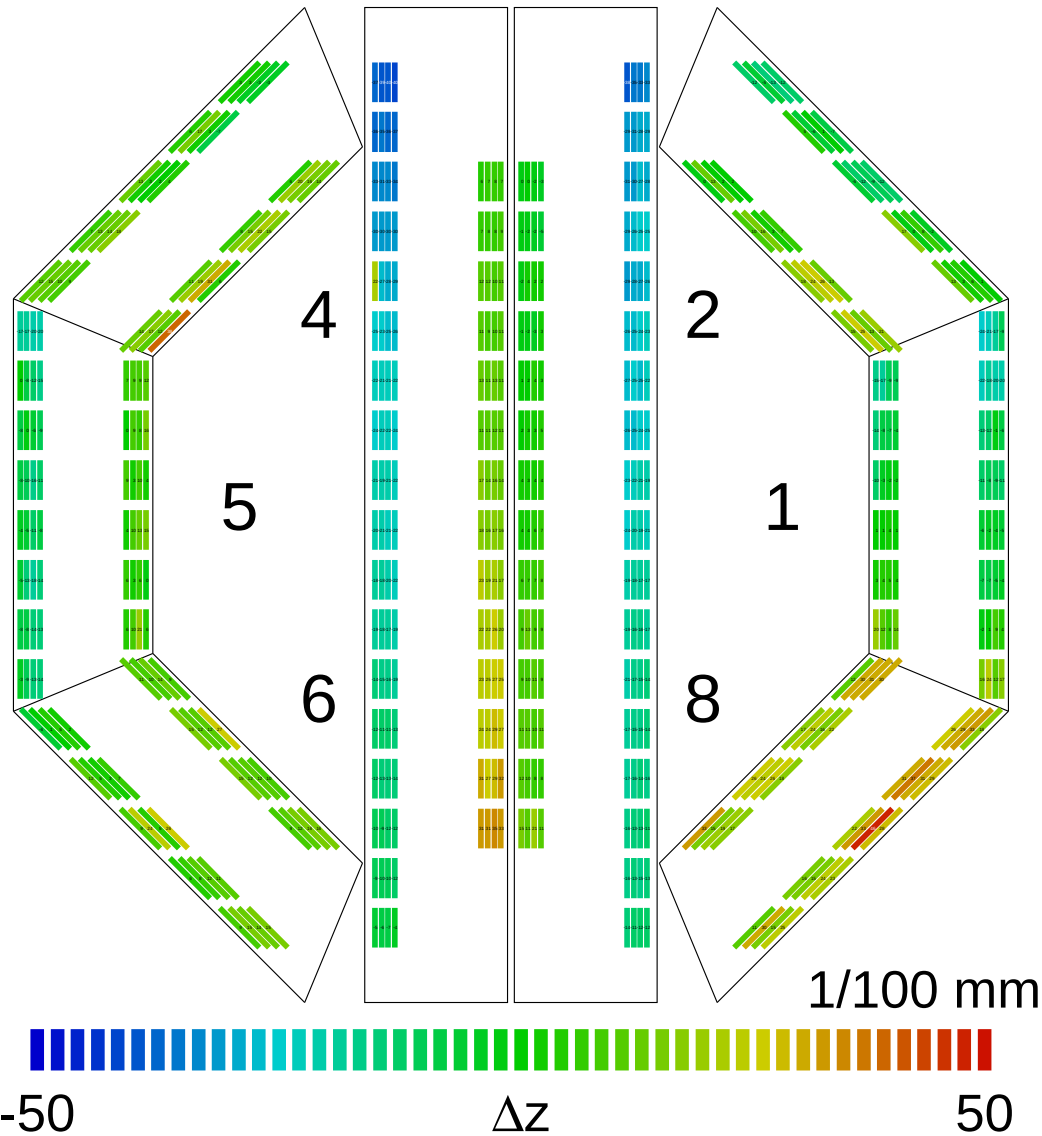


TRD-Octagon with Bulkheads - 3D-Measurement Initial ΔZ Measurements - Module-Support Shimming

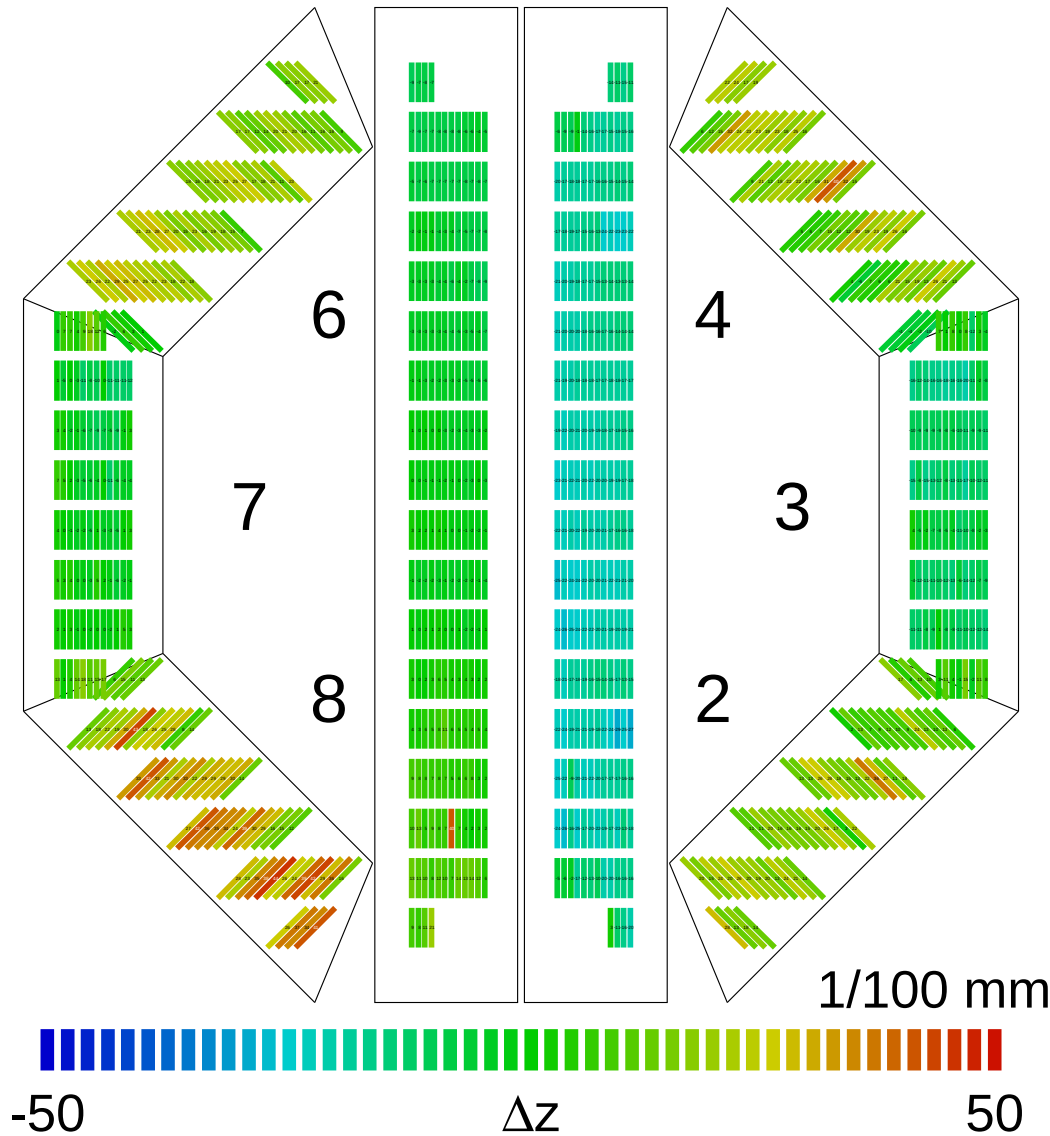


TRD-Octagon with Bulkheads - Initial ΔZ Measurements

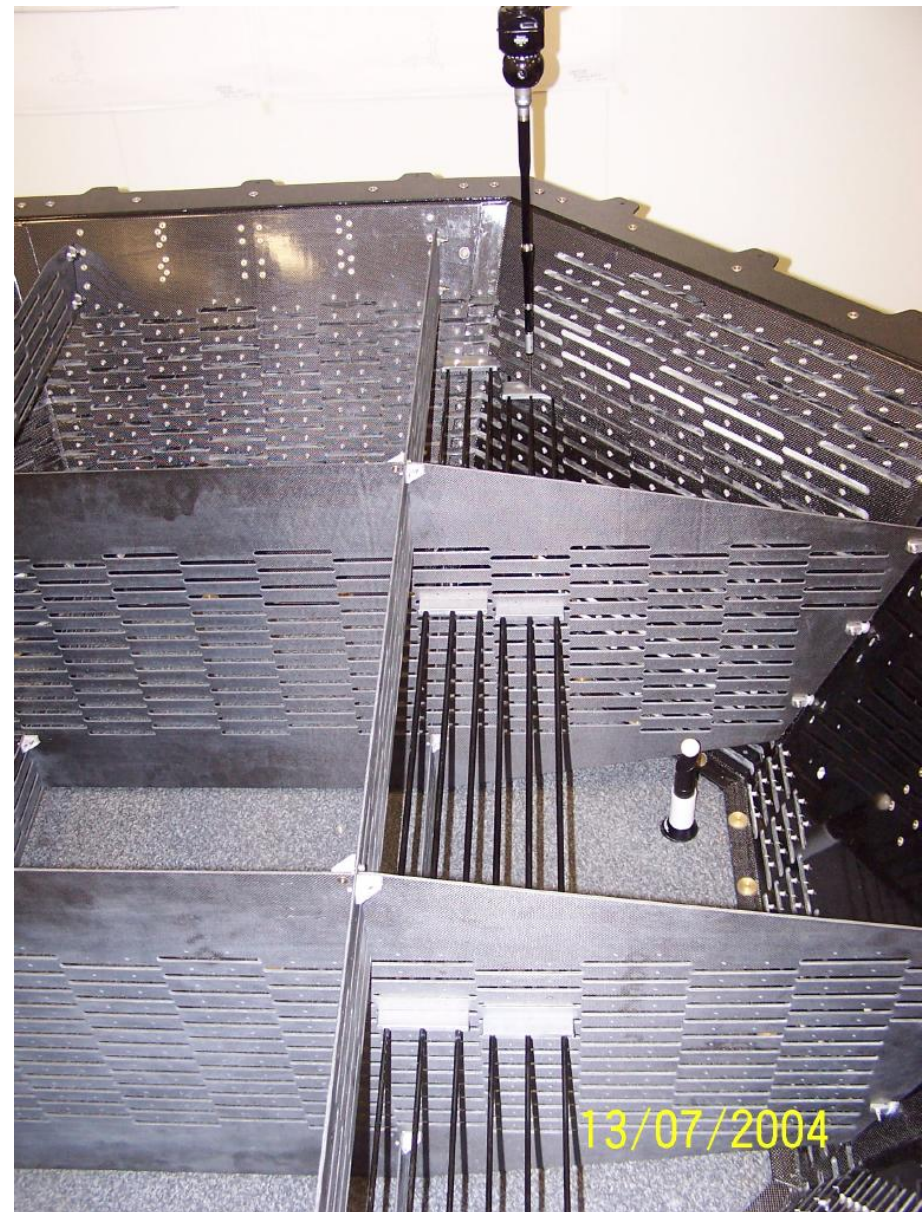
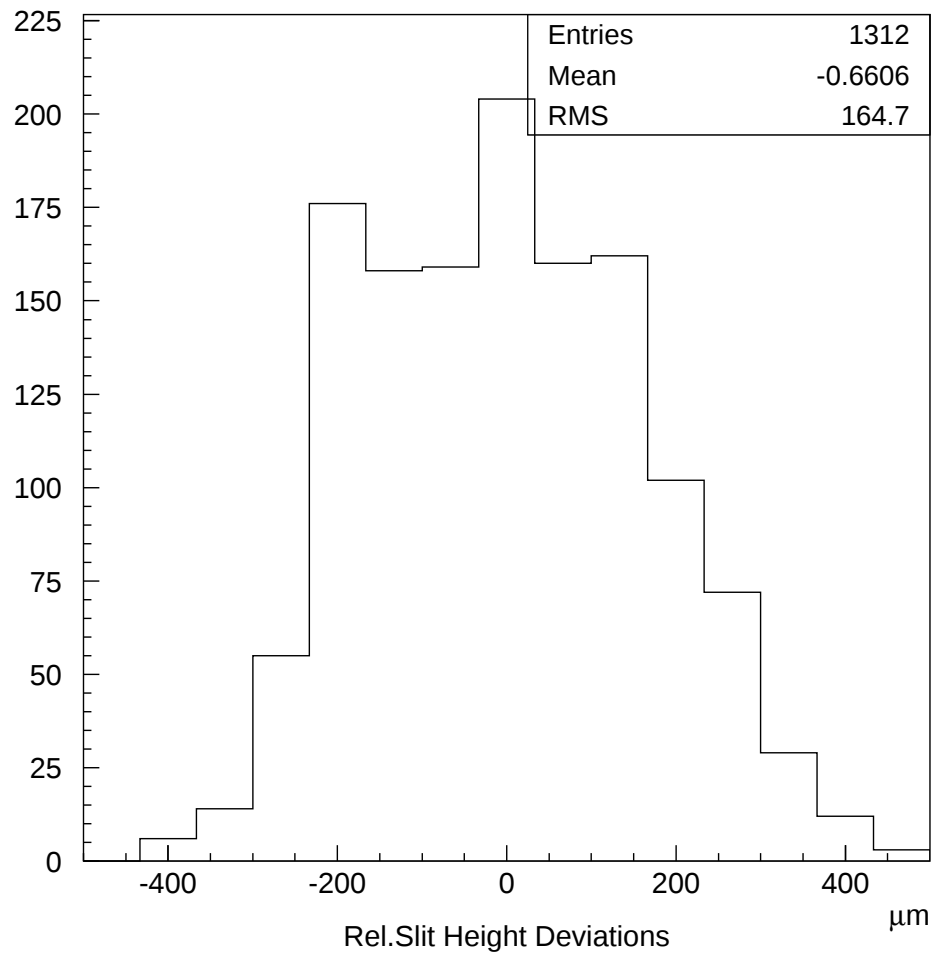
Rel. slit heights for x modules



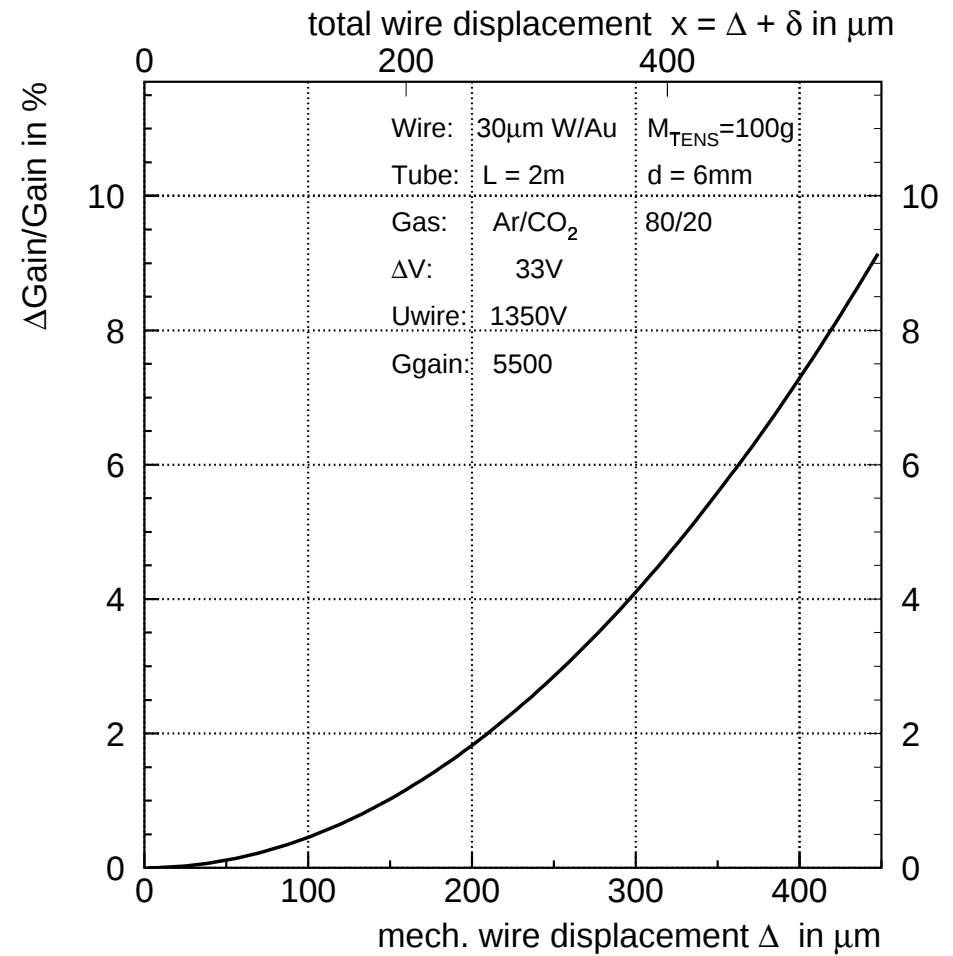
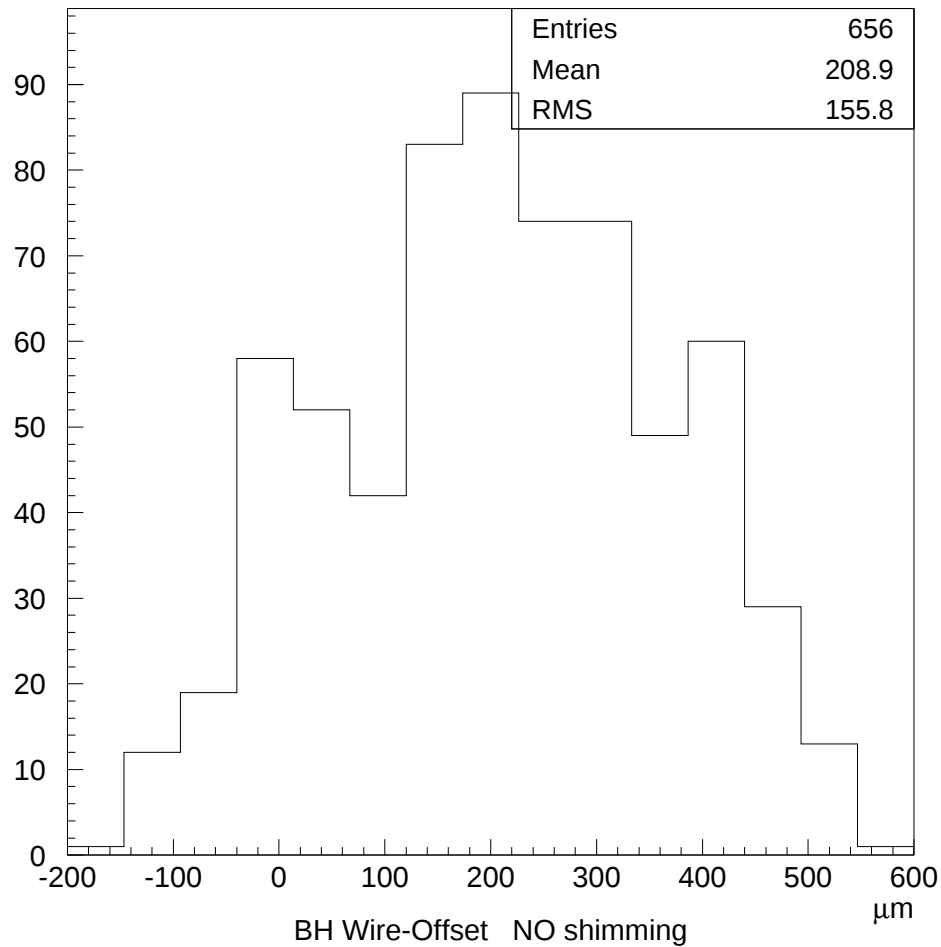
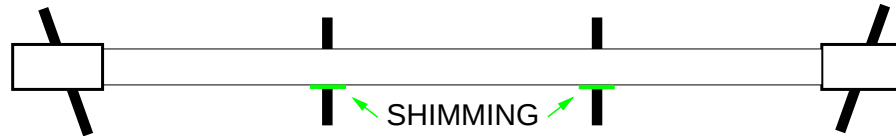
Rel. slit heights for y modules



TRD-Octagon with Bulkheads - Initial ΔZ Measurements

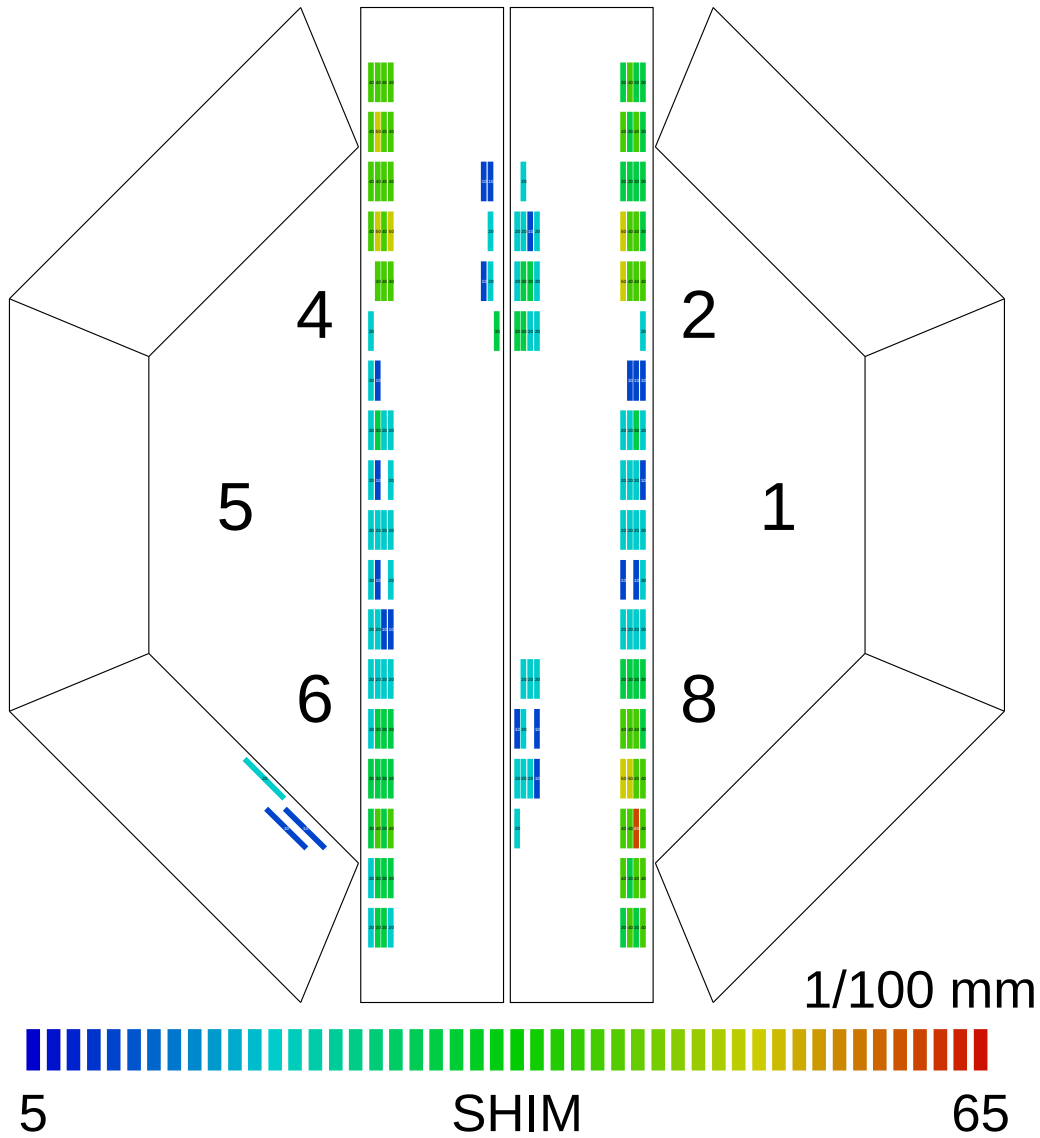


Module-Support Shimming

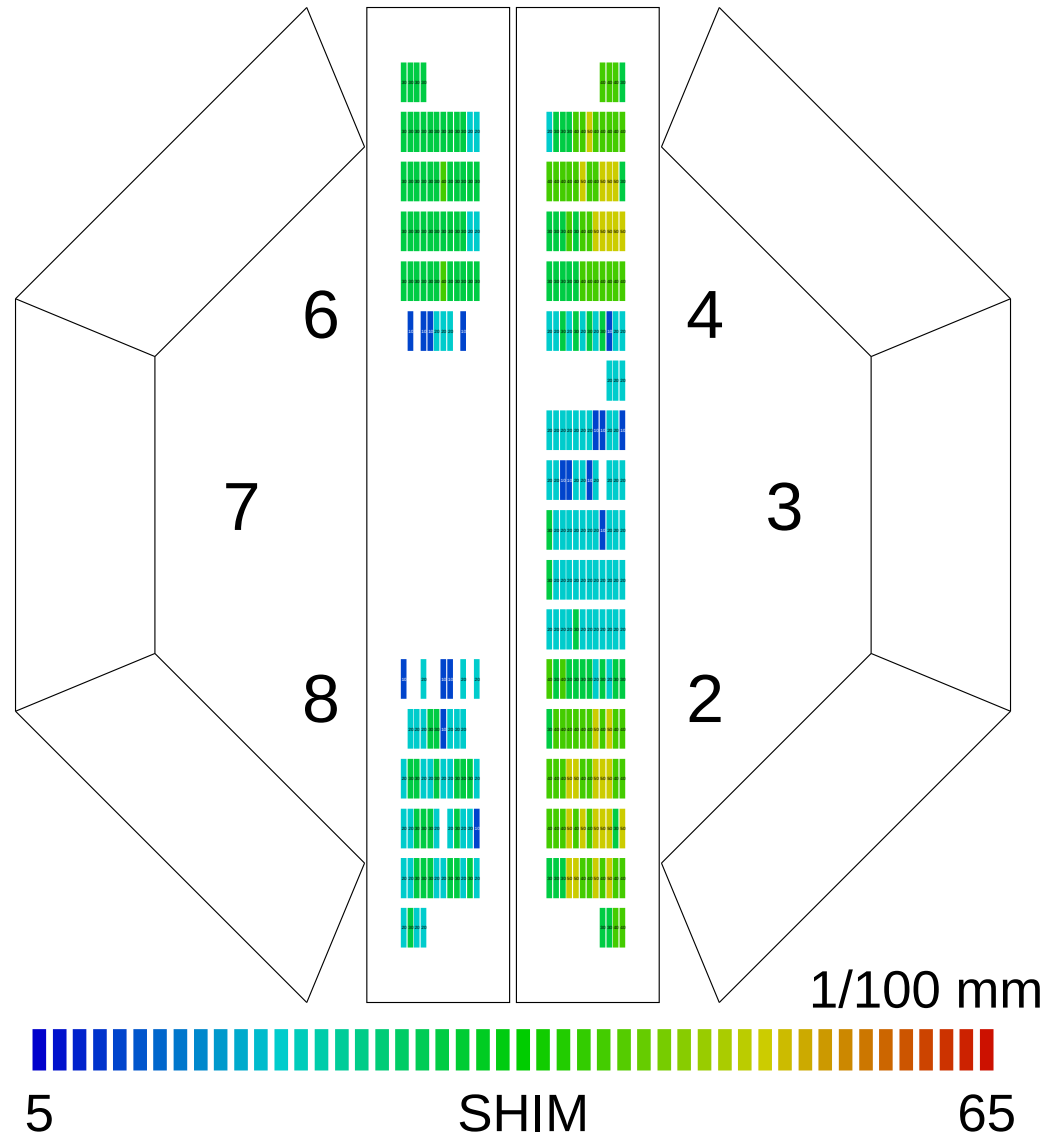


Module-Support Shimming at Bulkheads

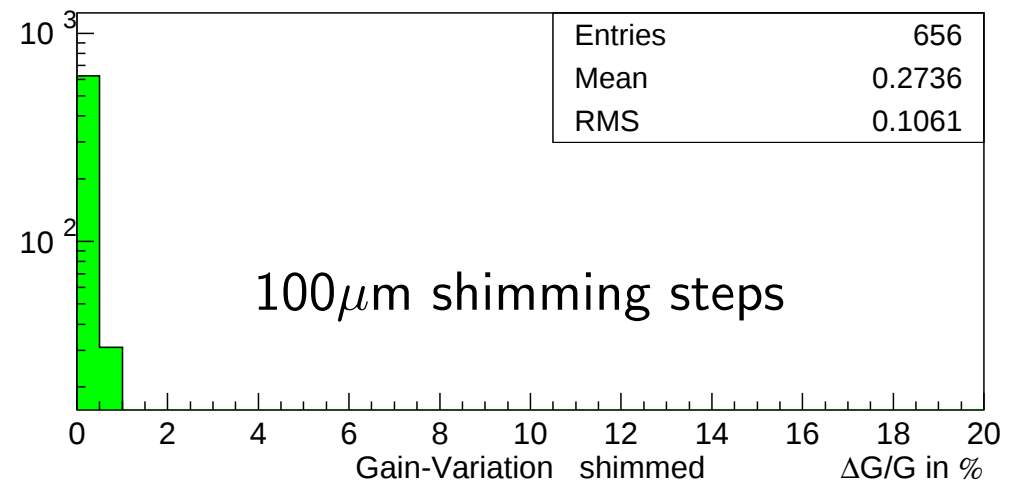
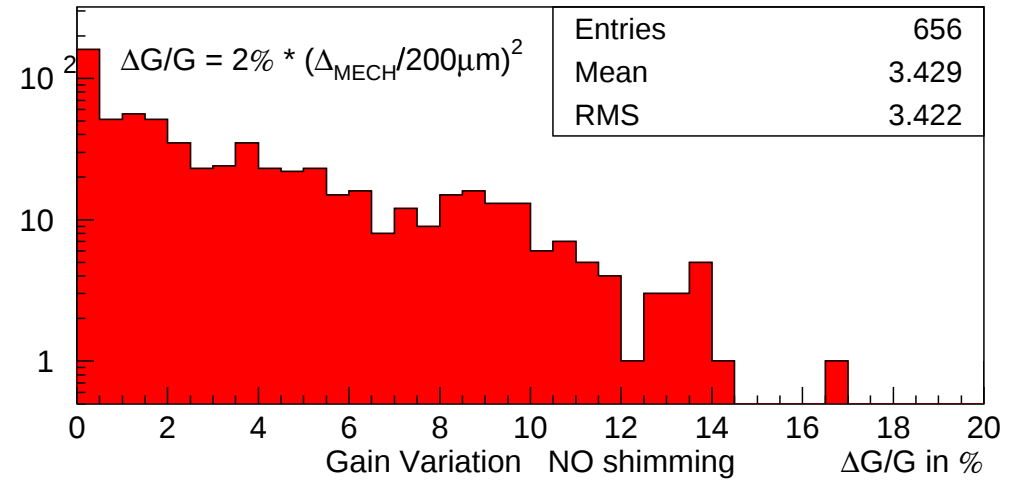
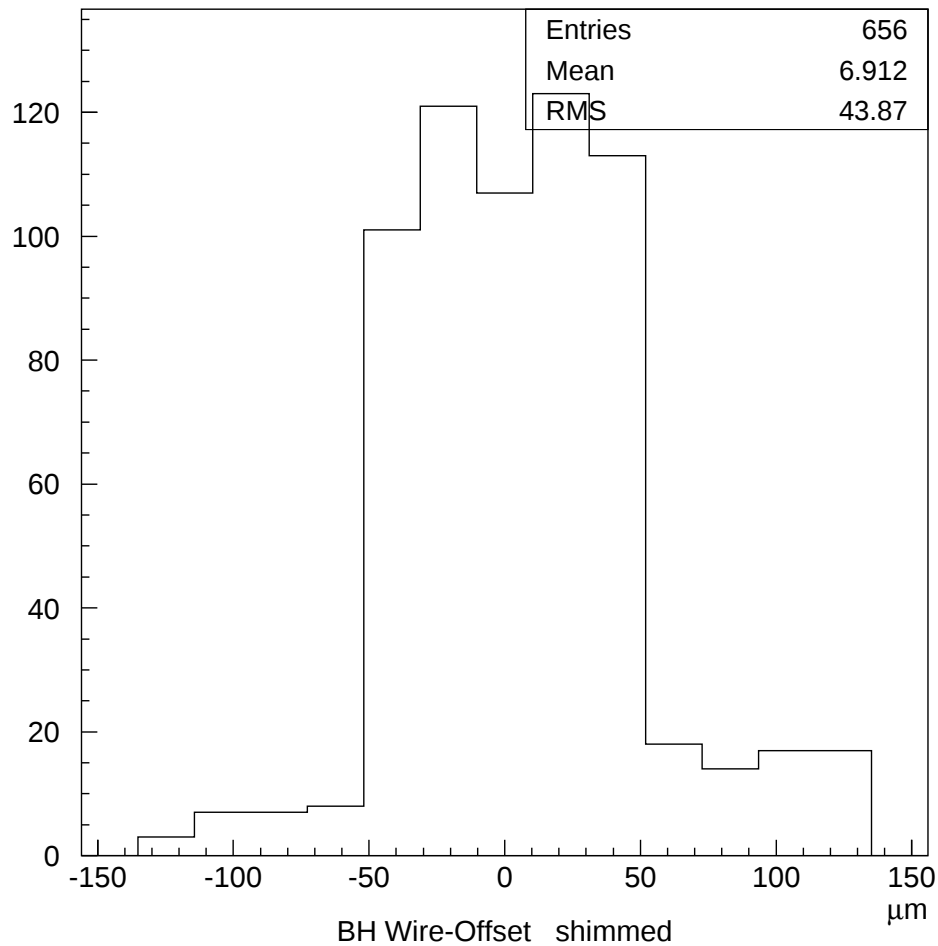
Allowed tolerance 130 μm (EPcs 50 μKapton)



Allowed tolerance 130 μm (EPcs 50 μKapton)



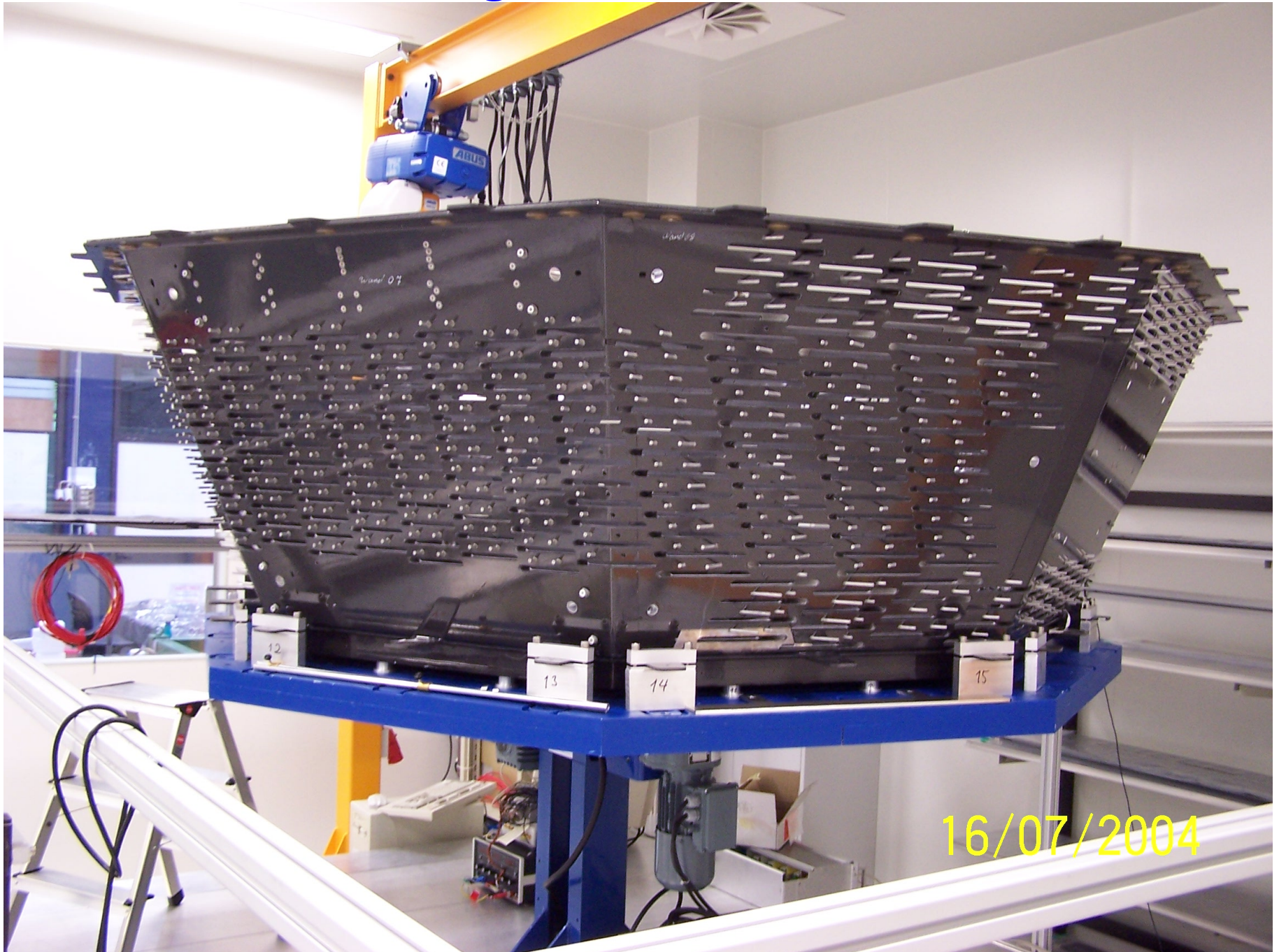
Module-Support Shimming at Bulkheads



TRD Octagon - Lower Honeycomb Mounting

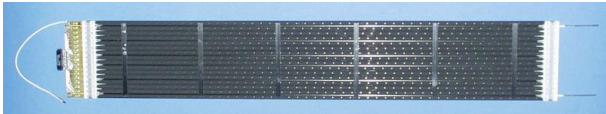
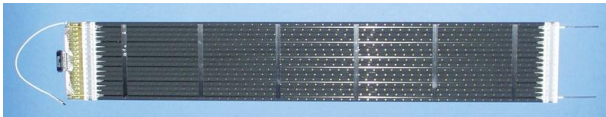
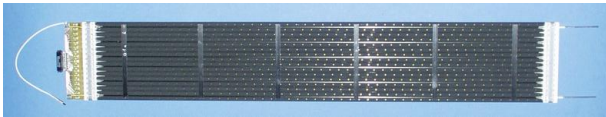
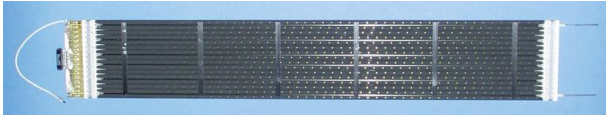


TRD Octagon on Cosmic Teststand



Outlook

Flight Module Installation:



4 Modules/day

→ August 2004 till February 2005

4-Layer Systemtest in October 2004



Conclusion

Radiator:

- 328 Straw Modules $\times$ 3 = 984 Modules ✓

Single Straws:

- 328 Modules $\times$ 16 Straws = 5248 Straws ✓

Flight Modules:

- 328 Modules ✓

Octagon: ✓

⇒ Ready for
Flight Module Installation

