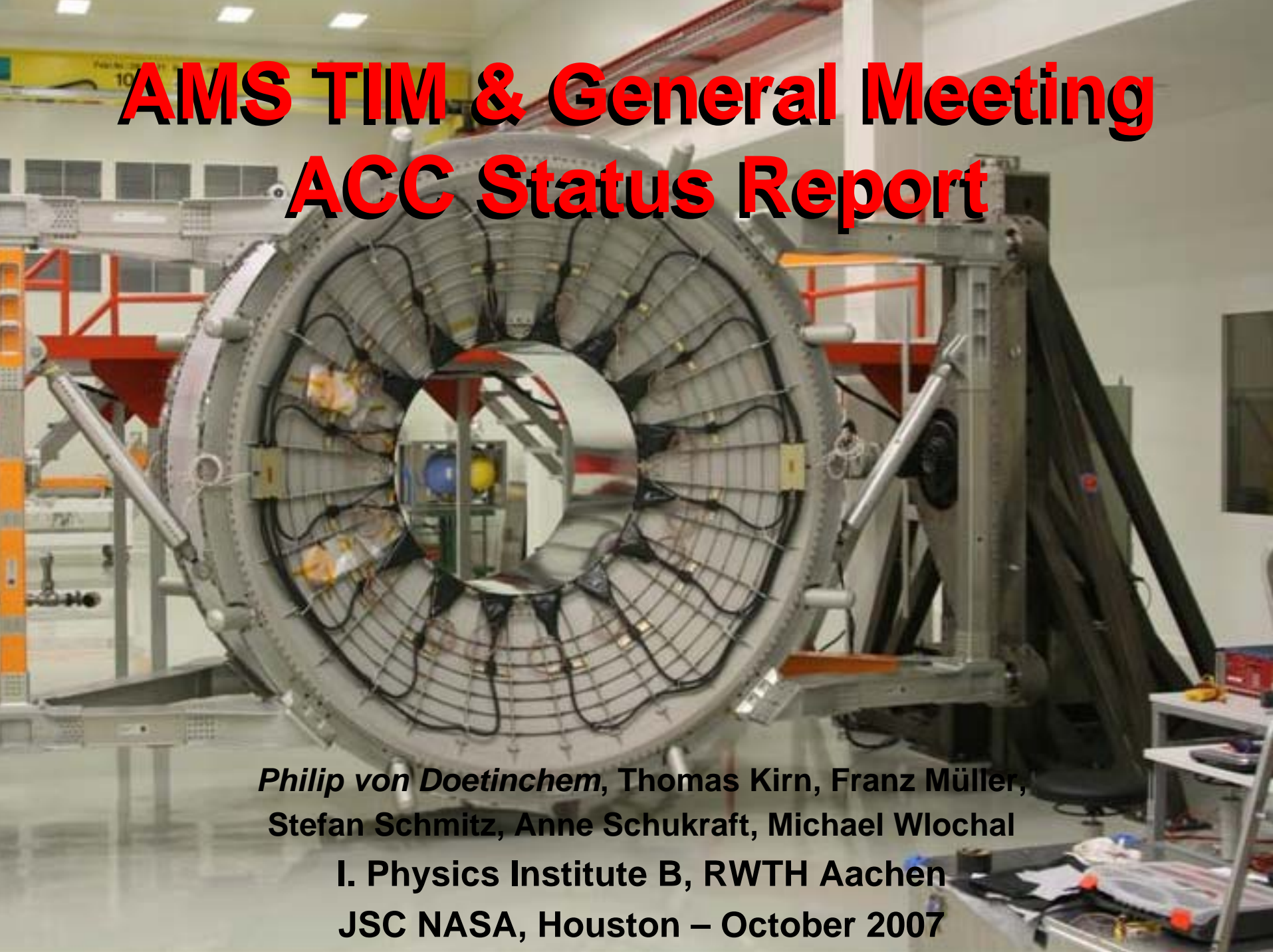


# **AMS TIM & General Meeting ACC Status Report**

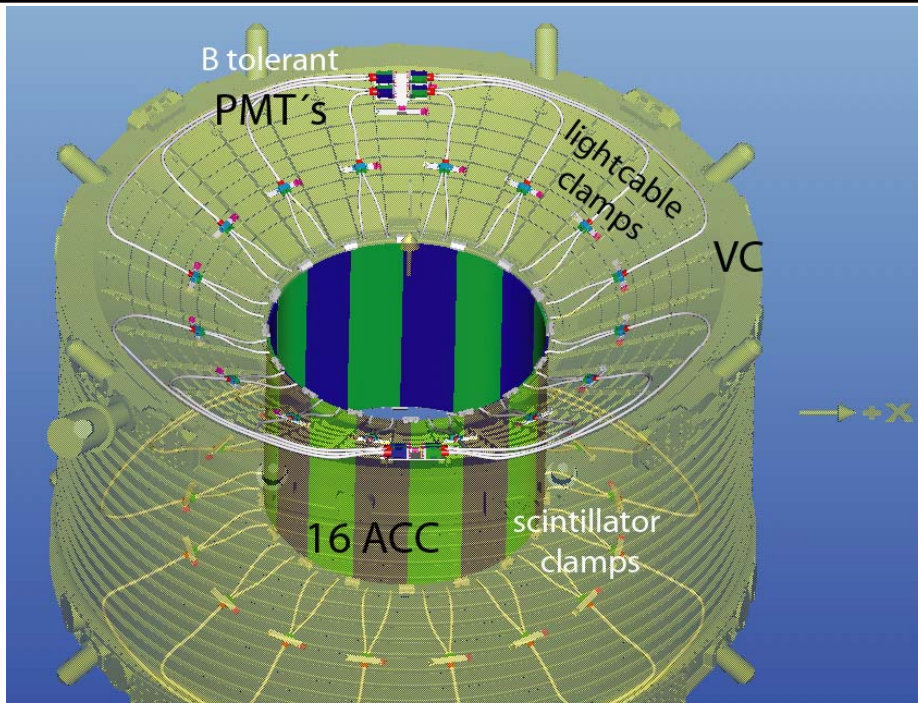


*Philip von Doetinchem, Thomas Kirn, Franz Müller,  
Stefan Schmitz, Anne Schukraft, Michael Wloch*

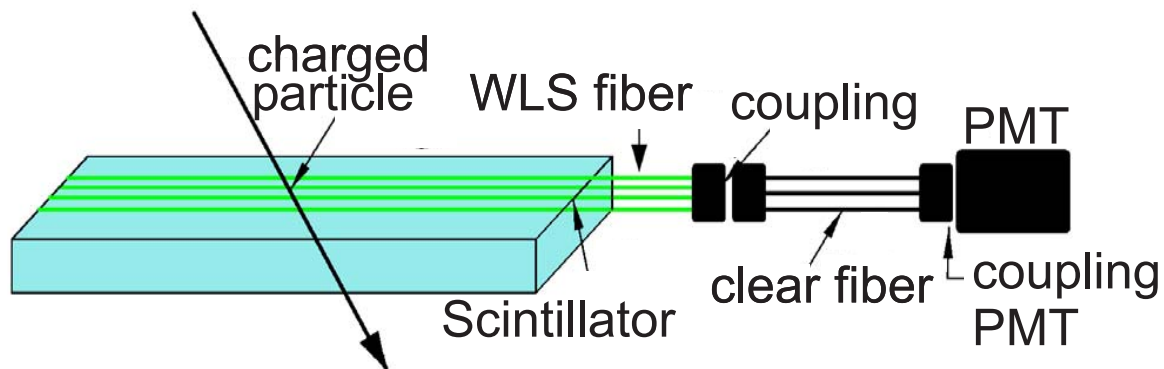
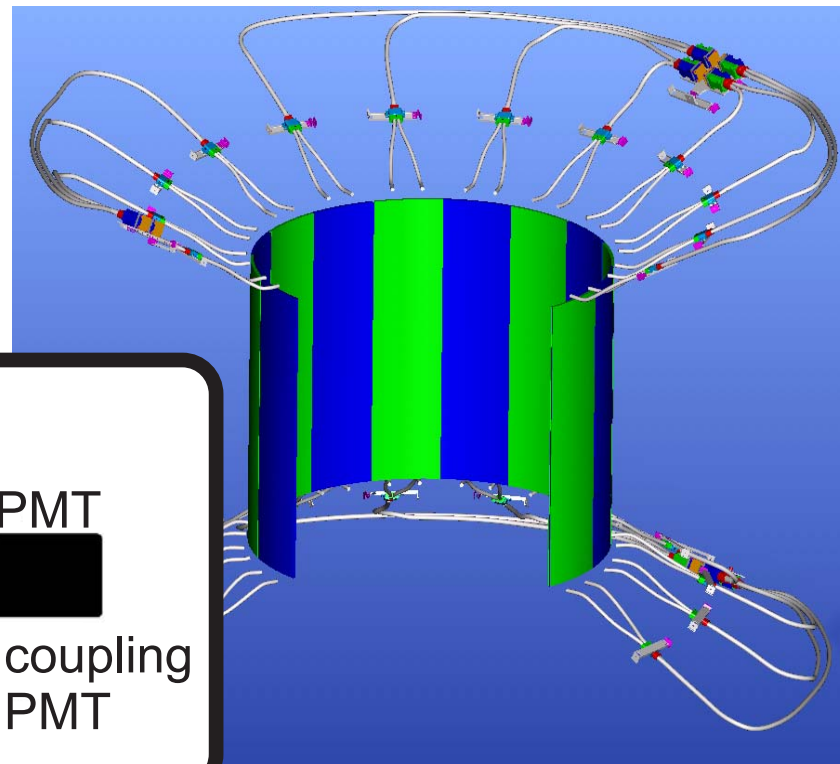
**I. Physics Institute B, RWTH Aachen**

**JSC NASA, Houston – October 2007**

# ACC System



**Panel:** Bicron BC414  
826.5mm x 230mm x 8mm  
**WLS:** Kuraray Y-11(200)M  
**CLF:** Toray PJU FB 1000  
**PMTs:** Hamamatsu R5946

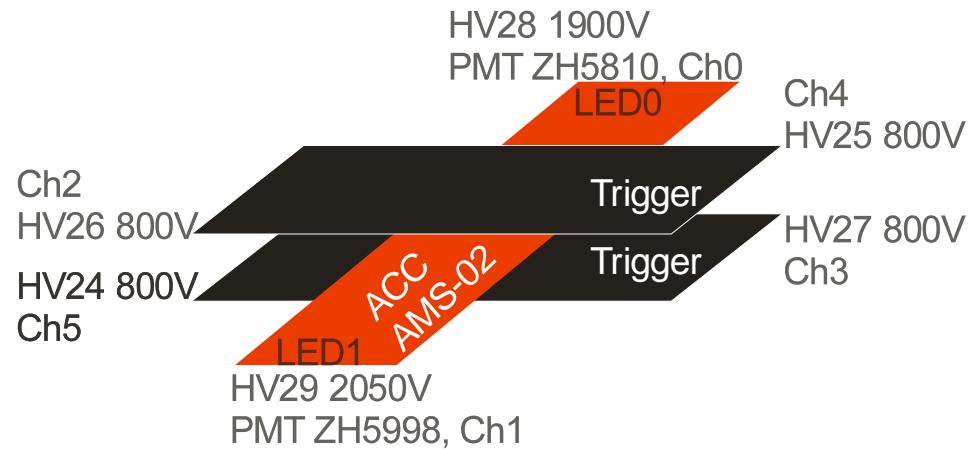


# Panel Test: Setup

test with atmospheric muons & LED

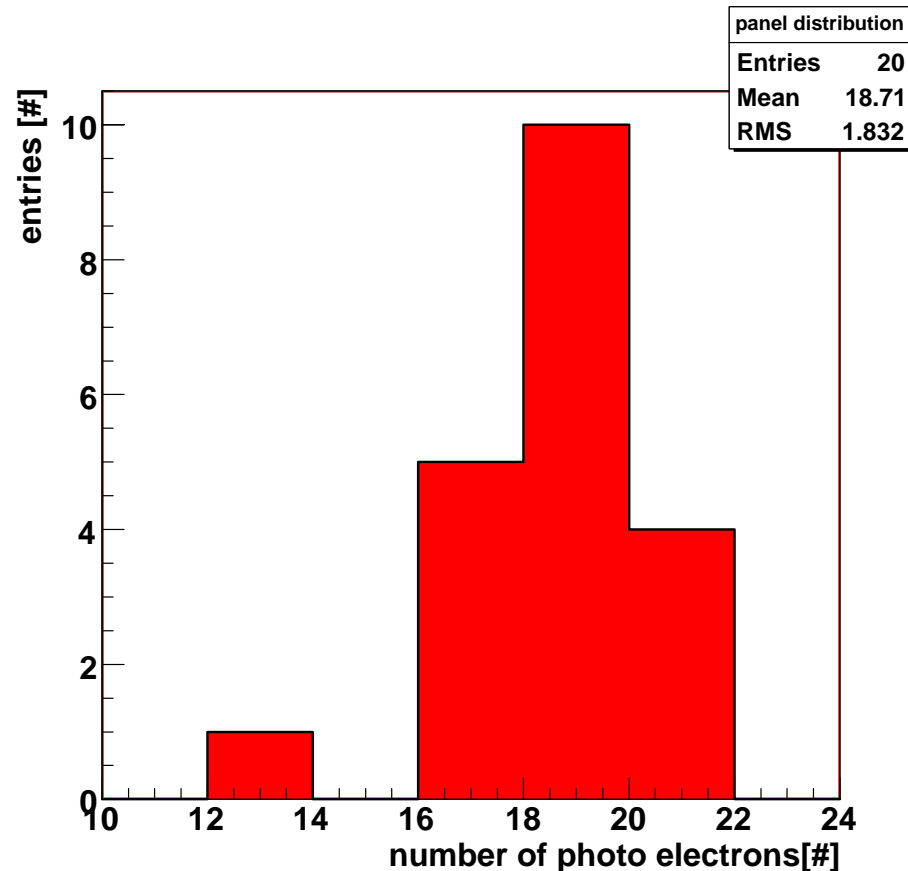
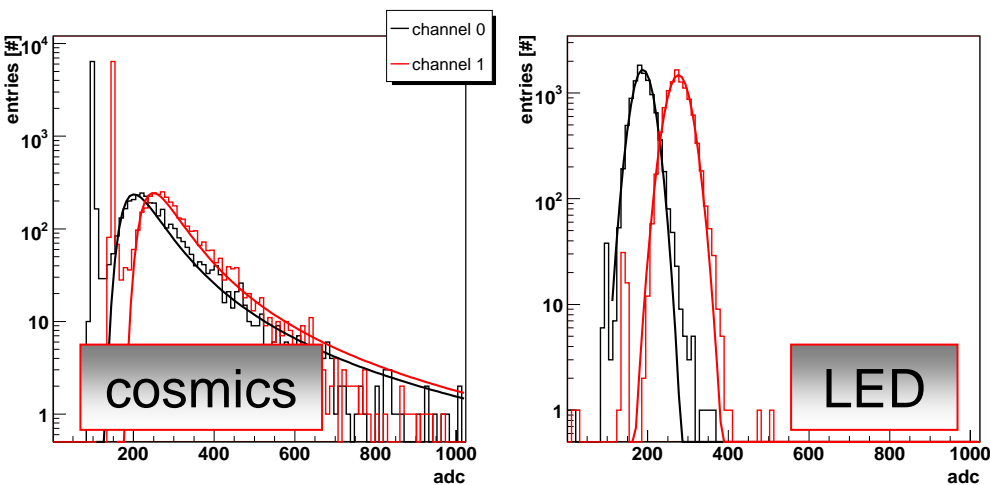
AMS02  
ACC

AMS01  
ACC trigger



All panels are tested with the same reference PMTs

# Calculation of Photo Electron Number

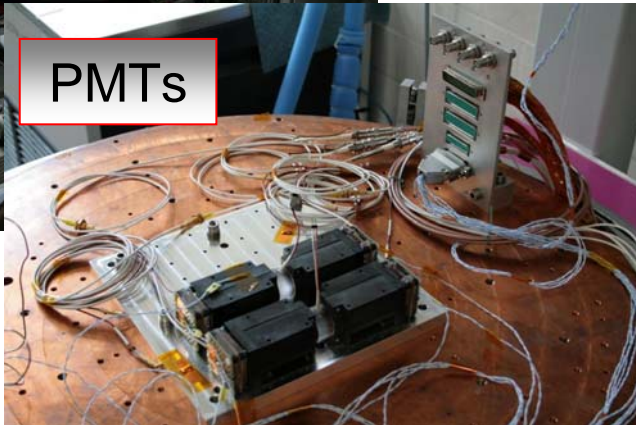
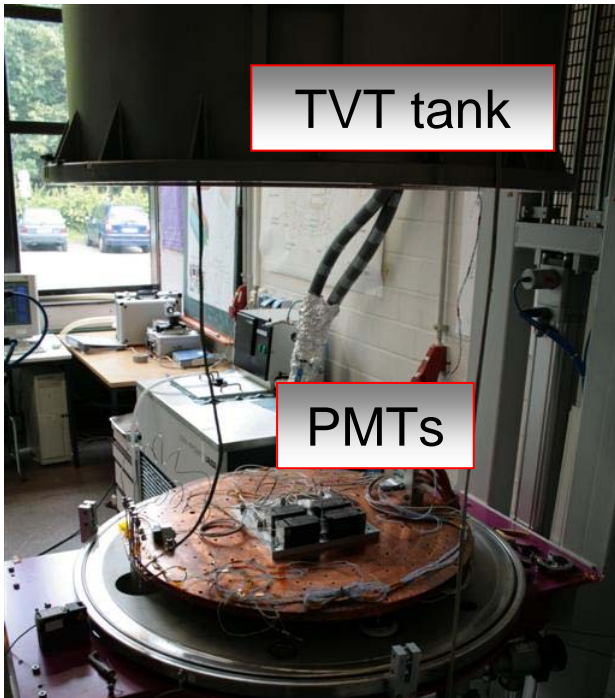


- measurement of MOP with cosmics
- calibration with LEDs implemented in panels

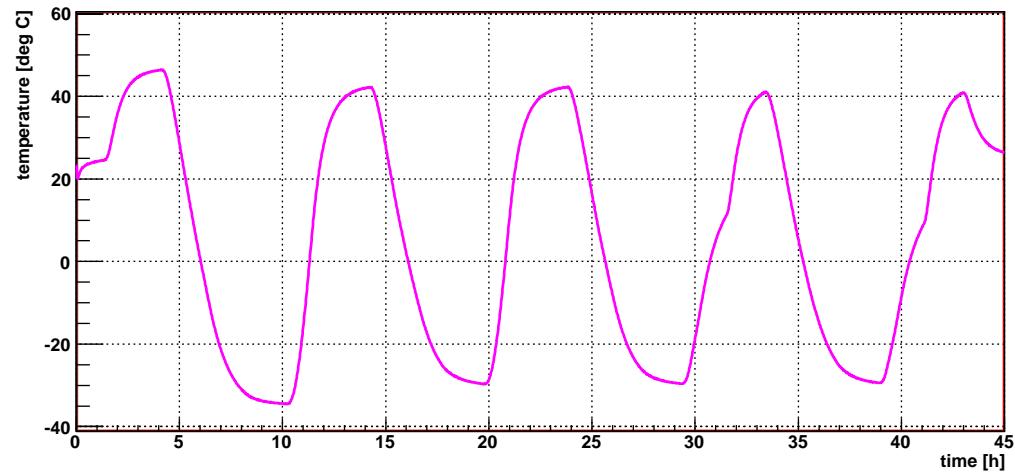
calculation of photo electron number

$$N_{pe} = \frac{Q_C Q_{LED}}{\sigma_{LED}^2}$$

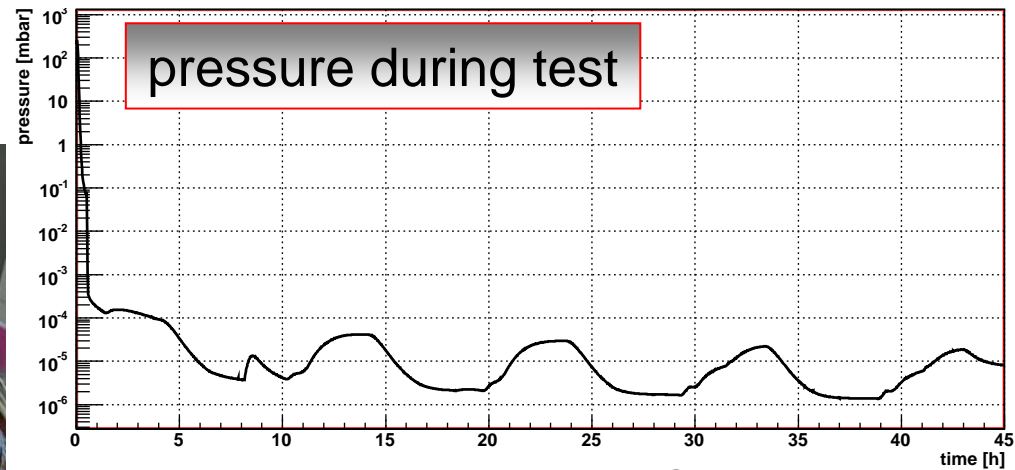
# PMT: Thermo Vacuum Test



Temperature on voltage divider



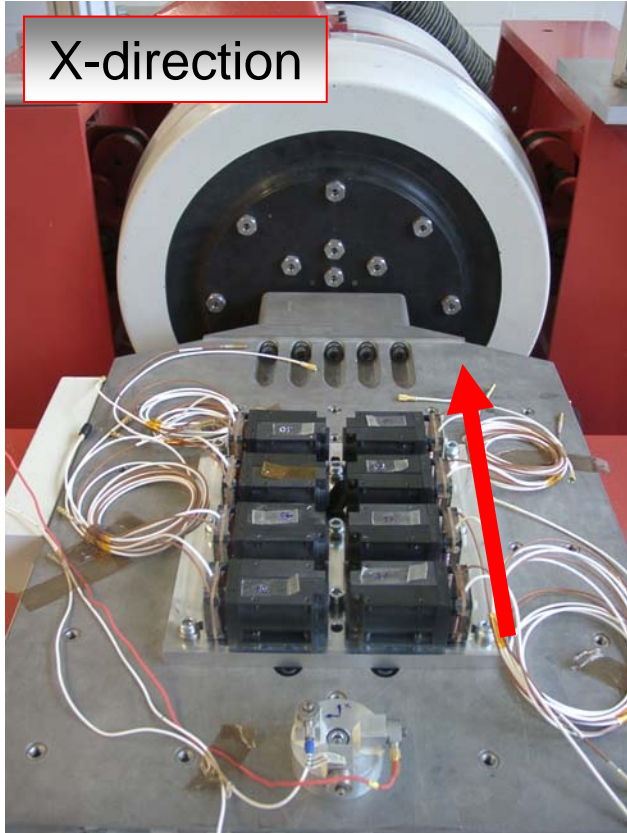
pressure during test



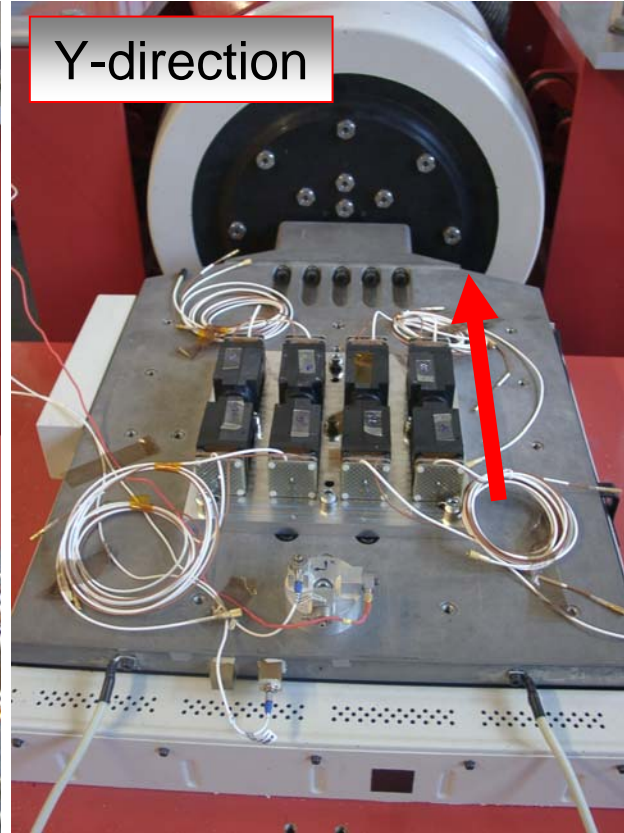
operative: -30 - +45 °C  
non-operative: -35 - +50 °C

# PMT: Vibration Test

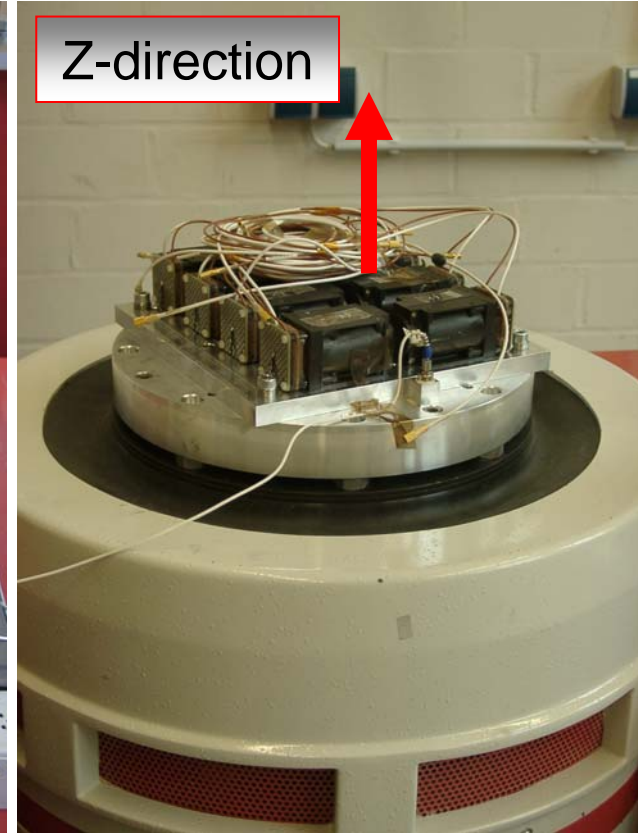
X-direction



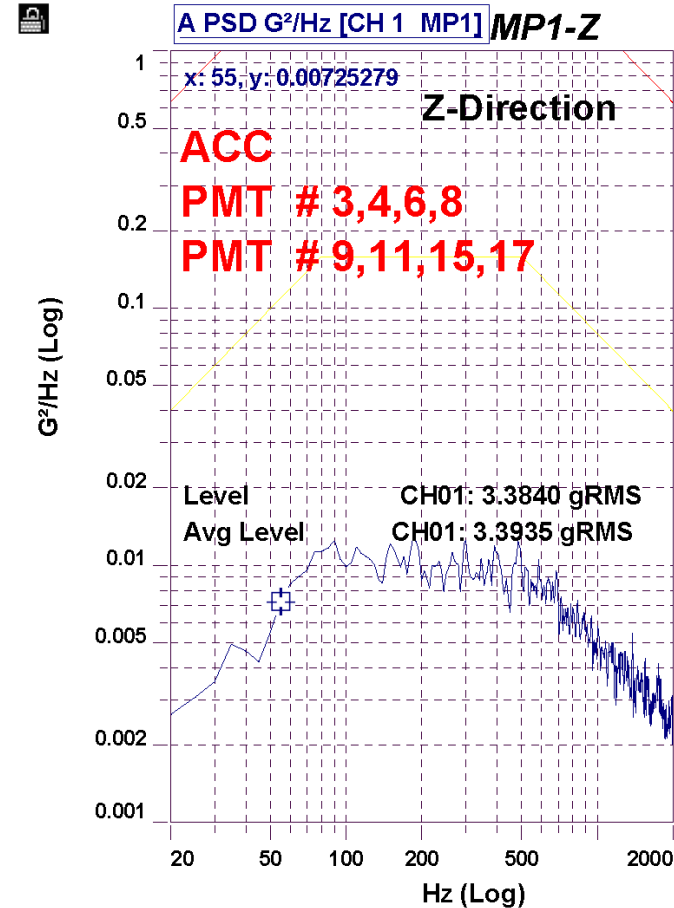
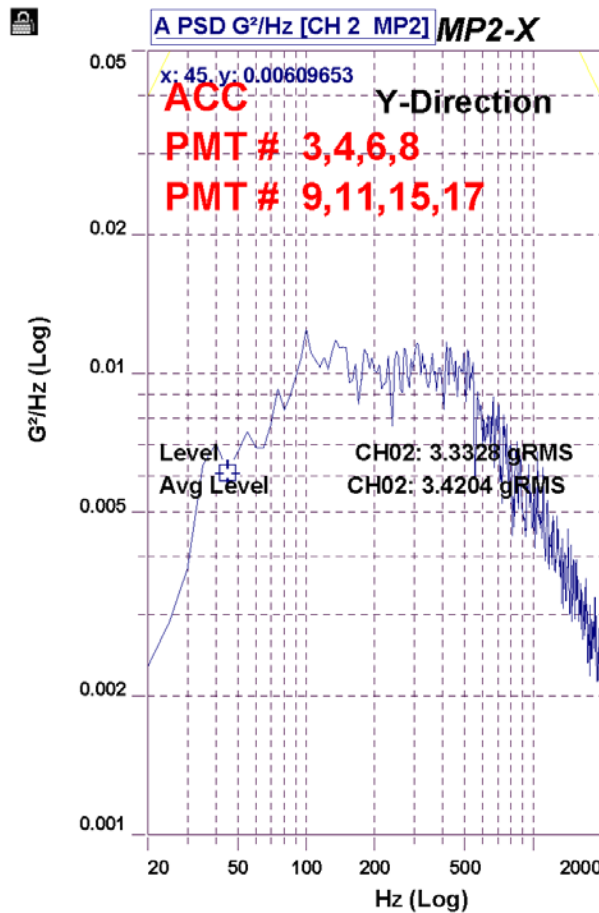
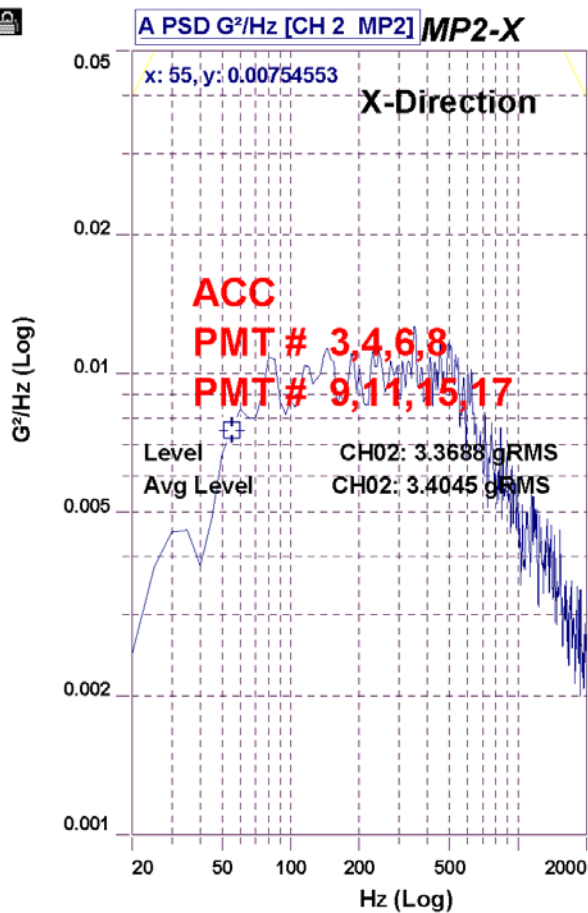
Y-direction



Z-direction



# PMT: Vibration Test



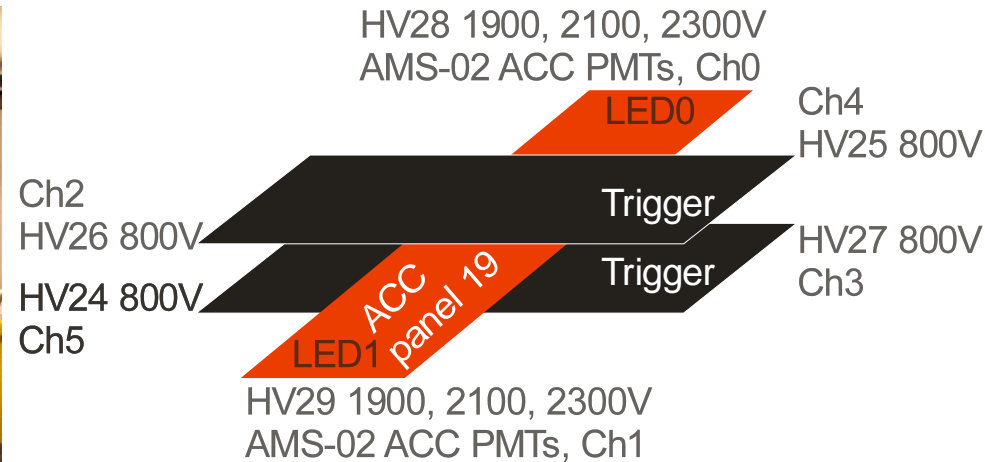
random spectrum with 3.3g

# PMT Test: Setup

test with atmospheric muons & LED

AMS02  
ACC

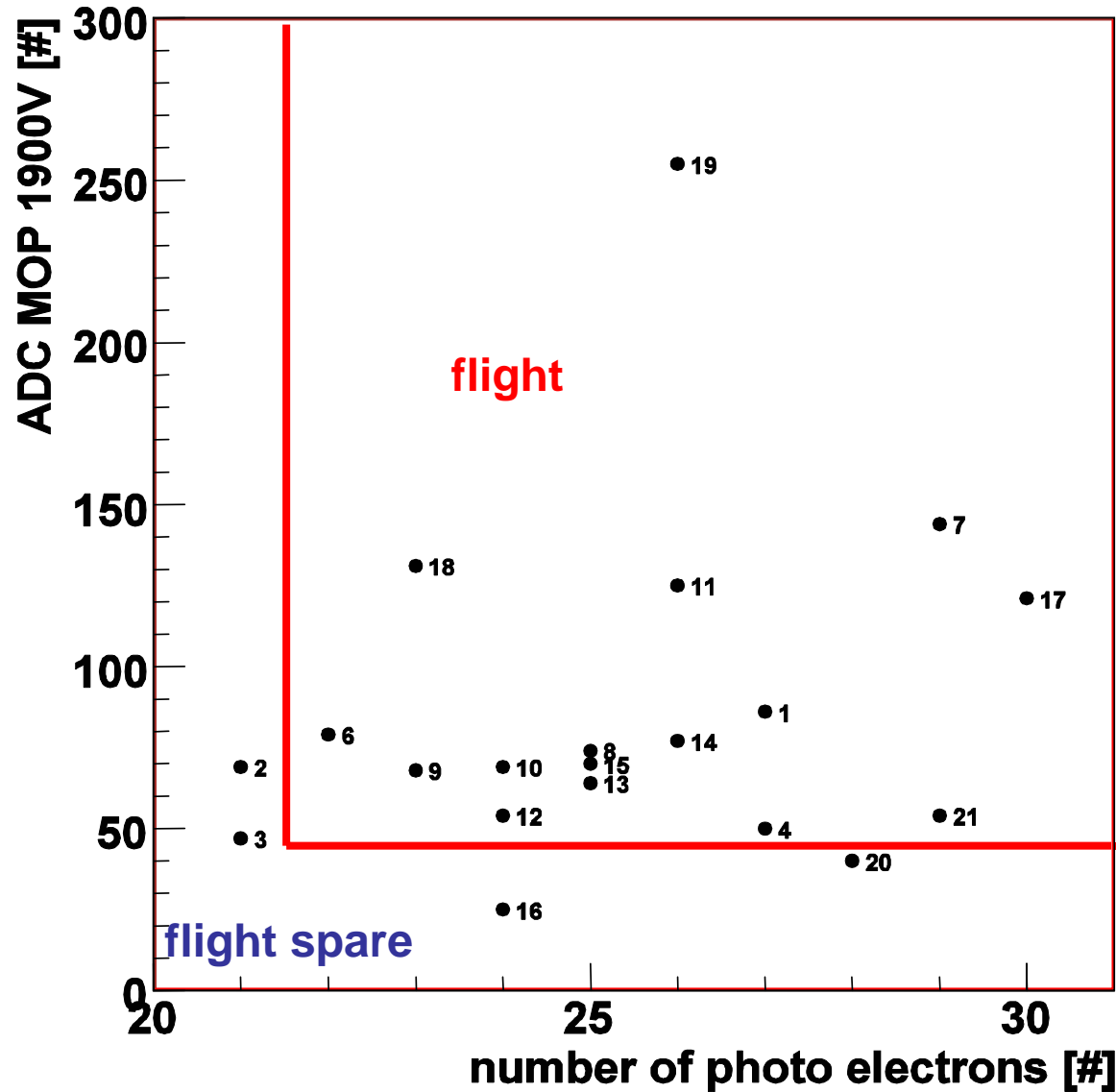
AMS01  
ACC trigger



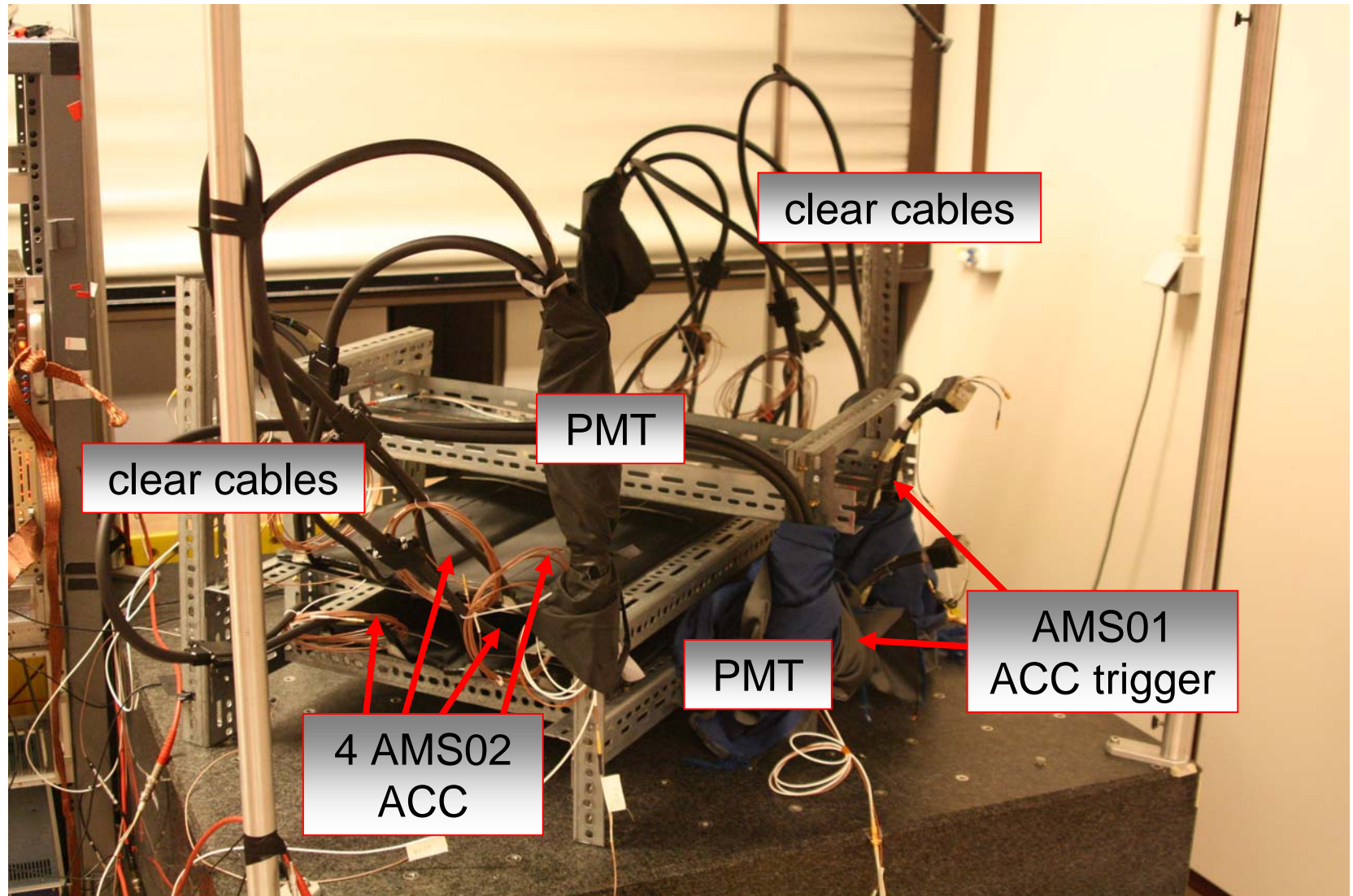
All panels are tested with the same reference panel.

**PMTs passed Space Qualification successfully!**  
**PMTs did not change within a range of about 5%!**

# PMT: Results after TVT & Vib.



# System Test: Setup (4 panels, 4 PMTs, 4 cables)



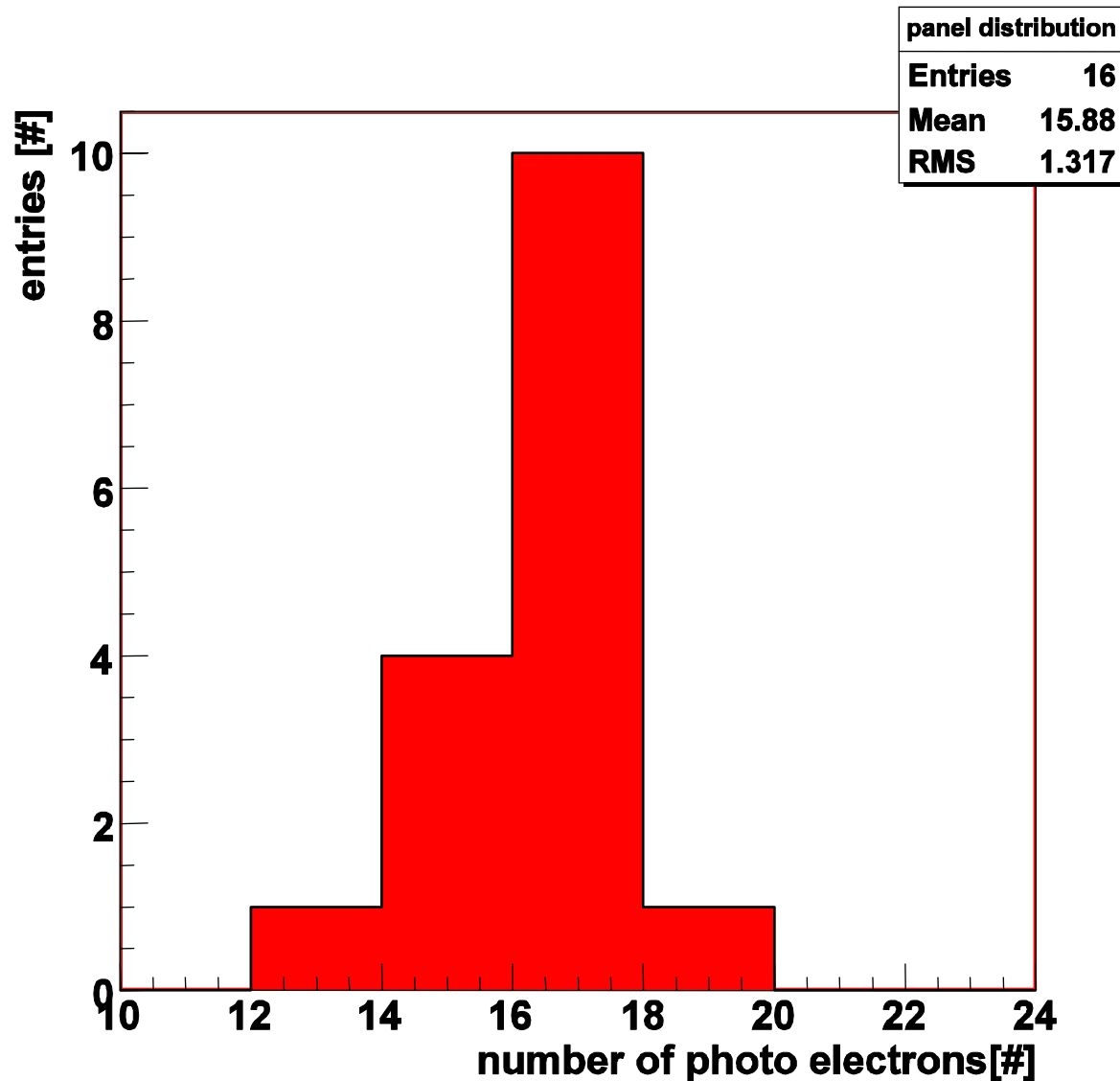
# System Test: Results

Panel	Cable A	PMT A	MOP A 1900V (adc counts)	number of photo electrons A	Cable B	PMT B	MOP B 1900V (adc counts)	number of photo electrons B
13 12	18 short 18 long	19	127	15	7 short 7 long	7	70	13
19 16	2 short 2 long	18	76	14	11 short 11 long	11	60	16
5 4	1 short 1 long	1	46	17	17 short 17 long	17	69	18
9 7	8 short 8 long	8	44	16	6 short 6 long	6	53	14
11 14	15 short 15 long	15	44	16	3 short 3 long	14	45	16
10 6	10 short 10 long	10	44	16	9 short 9 long	9	41	15
8 15	13 short 13 long	13	43	17	14 short 14 long	21	33	17
18 20	12 short 12 long	12	37	17	4 short 4 long	4	36	17
3 17	19 short 19 long	2	41	14	21 short 21 long	3	40	16

red: flight; blue: flight spare

average coupling efficiency WLS to clear fiber:  $61 \pm 4\%$  ( $2.1 \pm 0.3\text{dB}$ )

# System Test: Results

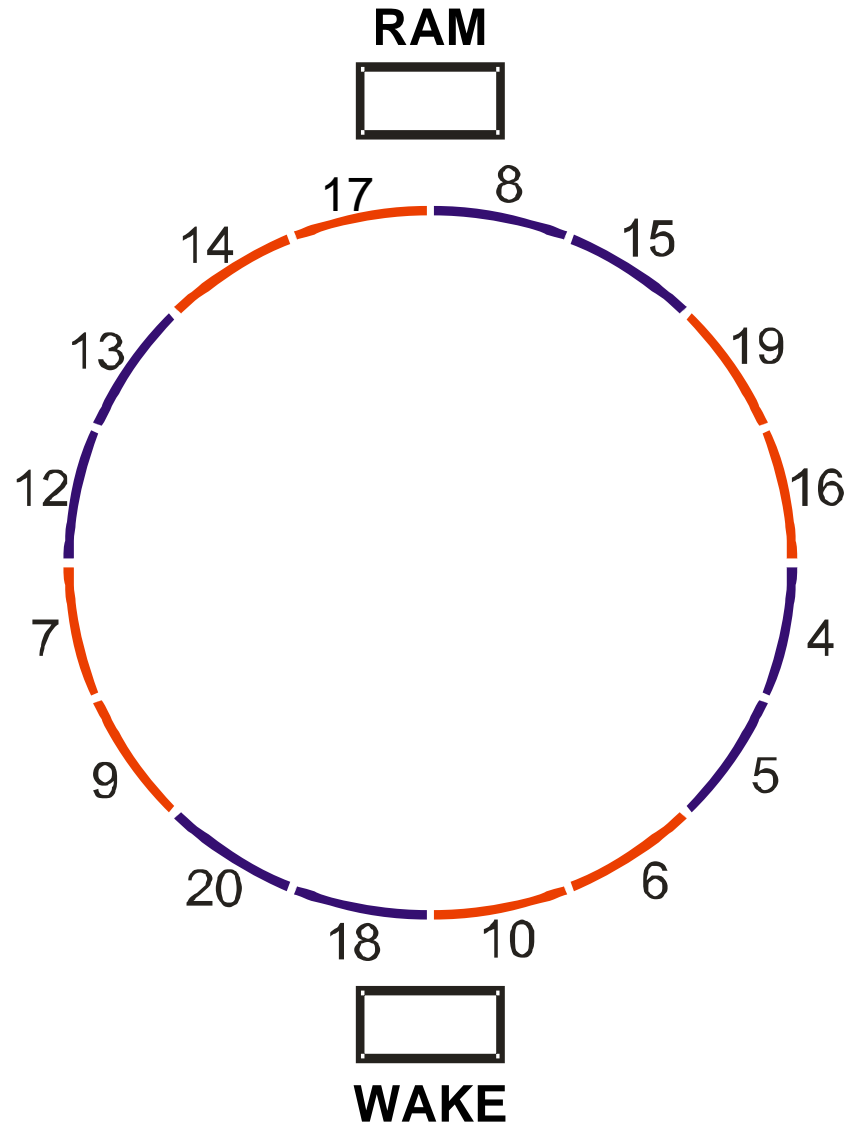


# Final Voltages for Flight PMTs

PMT	MOP position 50 Voltage [V]	MOP position 75 Voltage [V]	MOP position 100 Voltage [V]	MOP position 125 Voltage [V]	MOP position 150 Voltage [V]
1	1916	2014	<b>2108</b>	2174	2239
4	1980	2114	<b>2198</b>	2283	2368
6	1888	1986	<b>2084</b>	2147	2202
7	1851	1912	<b>1974</b>	2036	2098
8	1927	2038	<b>2124</b>	2180	2236
9	1943	2062	<b>2143</b>	2205	2268
10	1929	2048	<b>2135</b>	2196	2258
11	1871	1943	<b>2014</b>	2086	2127
12	1972	2106	<b>2187</b>	2268	2348
13	1937	2068	<b>2154</b>	2226	2297
14	1920	2018	<b>2113</b>	2197	2280
15	1929	2051	<b>2139</b>	2204	2269
17	1850	1916	<b>1982</b>	2047	2113
18	1845	1898	<b>1951</b>	2004	2057
19	1804	1835	<b>1865</b>	1896	1927
21	2013	2143	<b>2241</b>	2339	2437

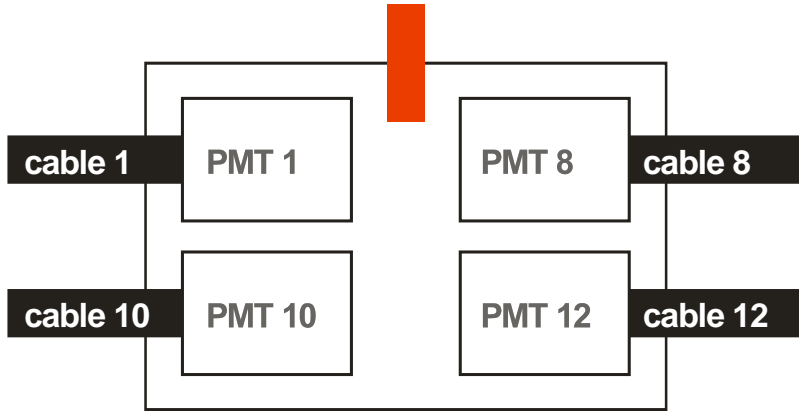
average high voltage for PMTs: 2088V (range: 1865 – 2241V)

# Order of Panels

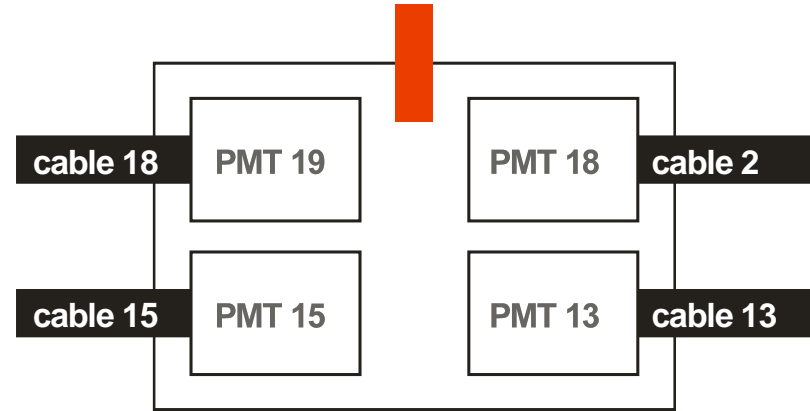


# Order of PMT Boxes

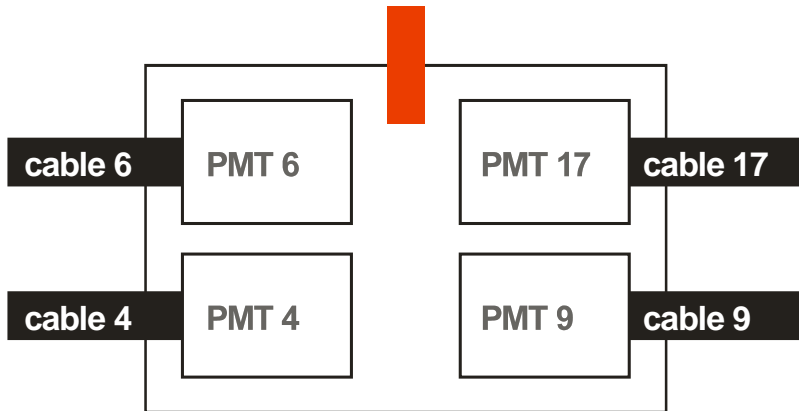
WAKE A TOP



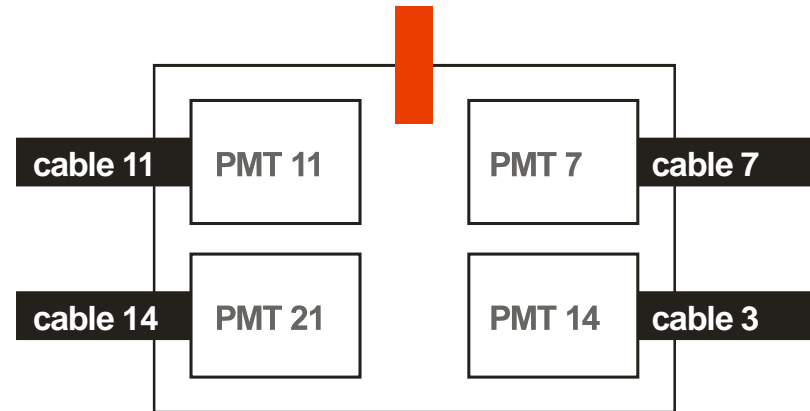
RAM A TOP



WAKE B BOTTOM



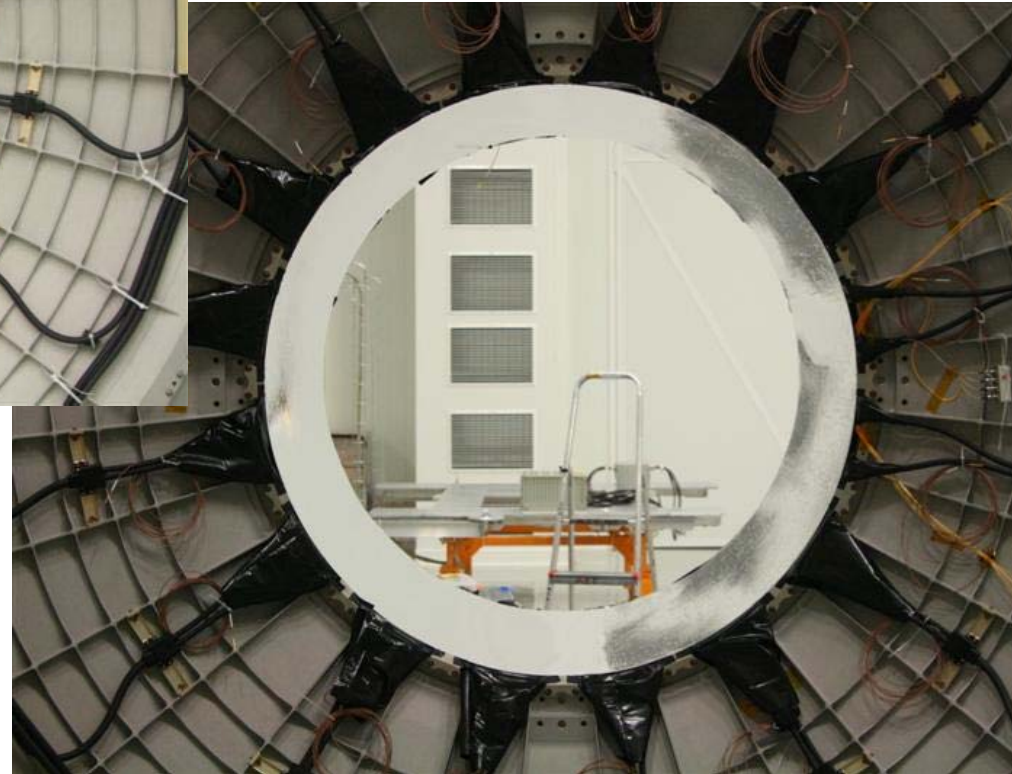
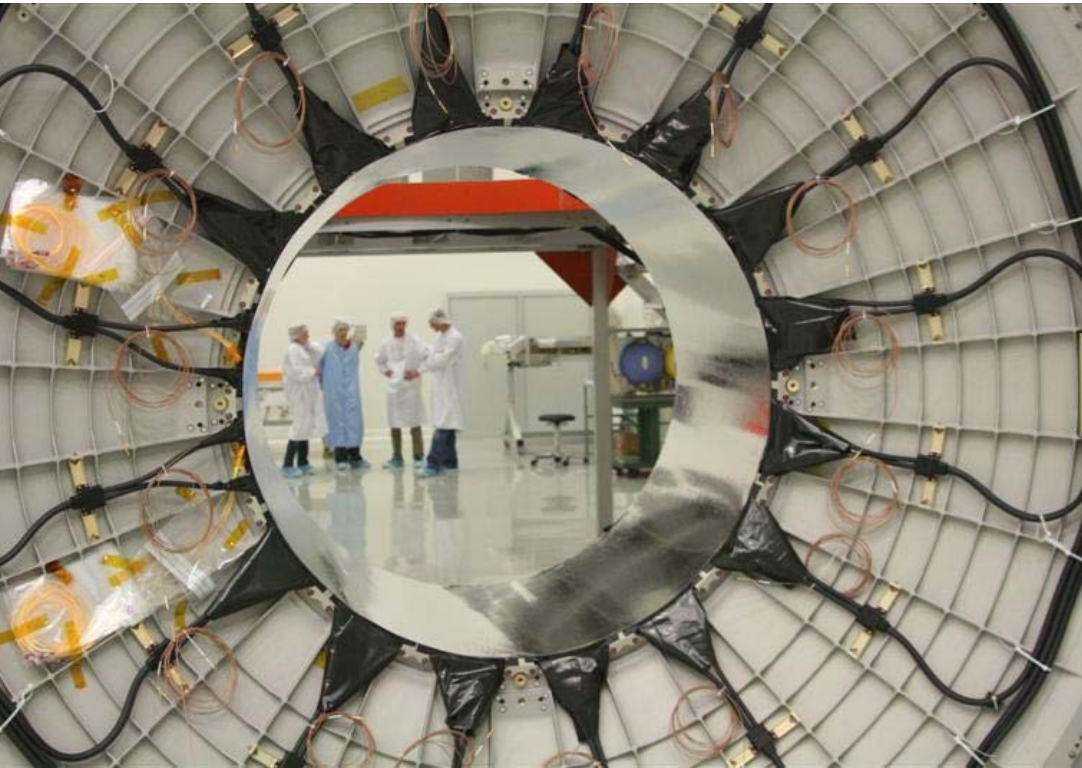
RAM B BOTTOM



# Checking for Light Leaks



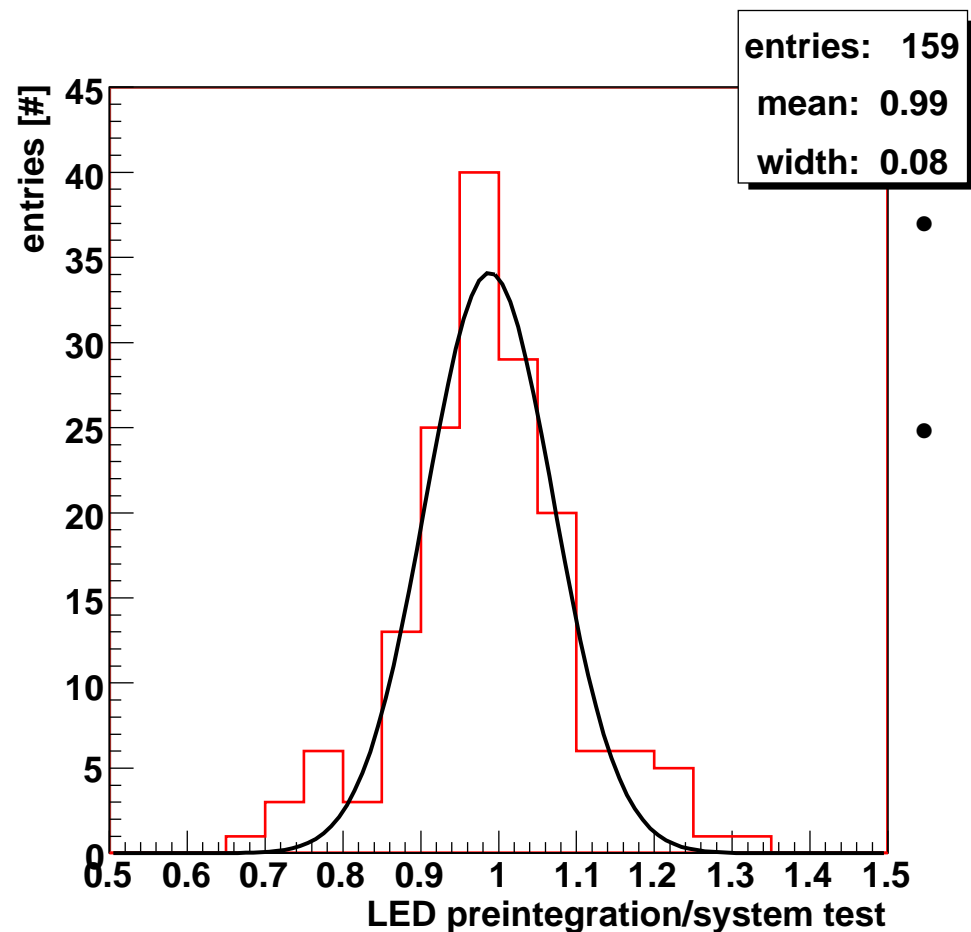
# Light Leaks covered



# Data Taking



# Comparison: Preintegration/System Test

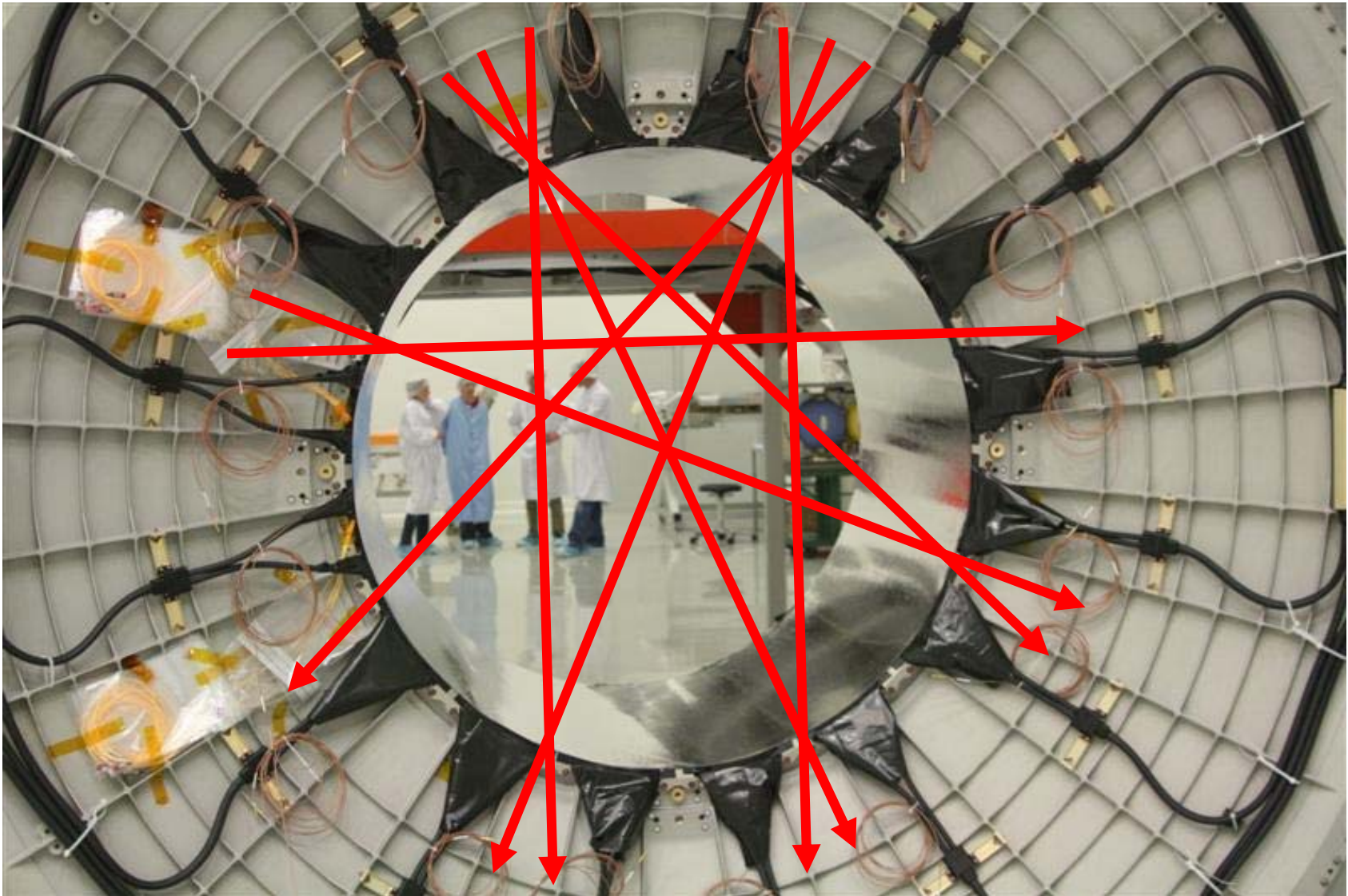


- after preintegration: test of complete ACC with calibrated LEDs from system test in Aachen
- average fraction of PMT signal heights preintegration/system test:

**$99 \pm 8 \%$**

**Successful preintegration!**

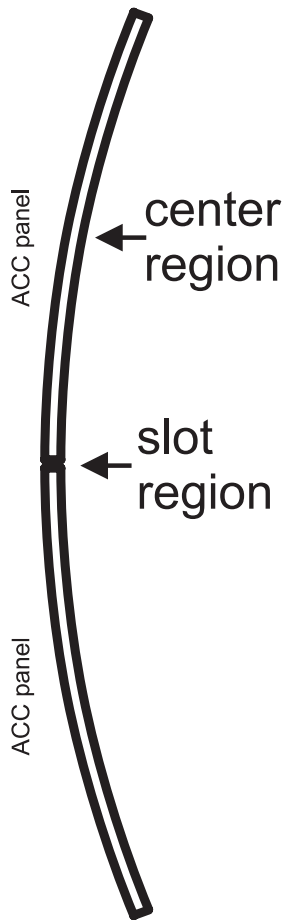
# First Tracks in AMS-02



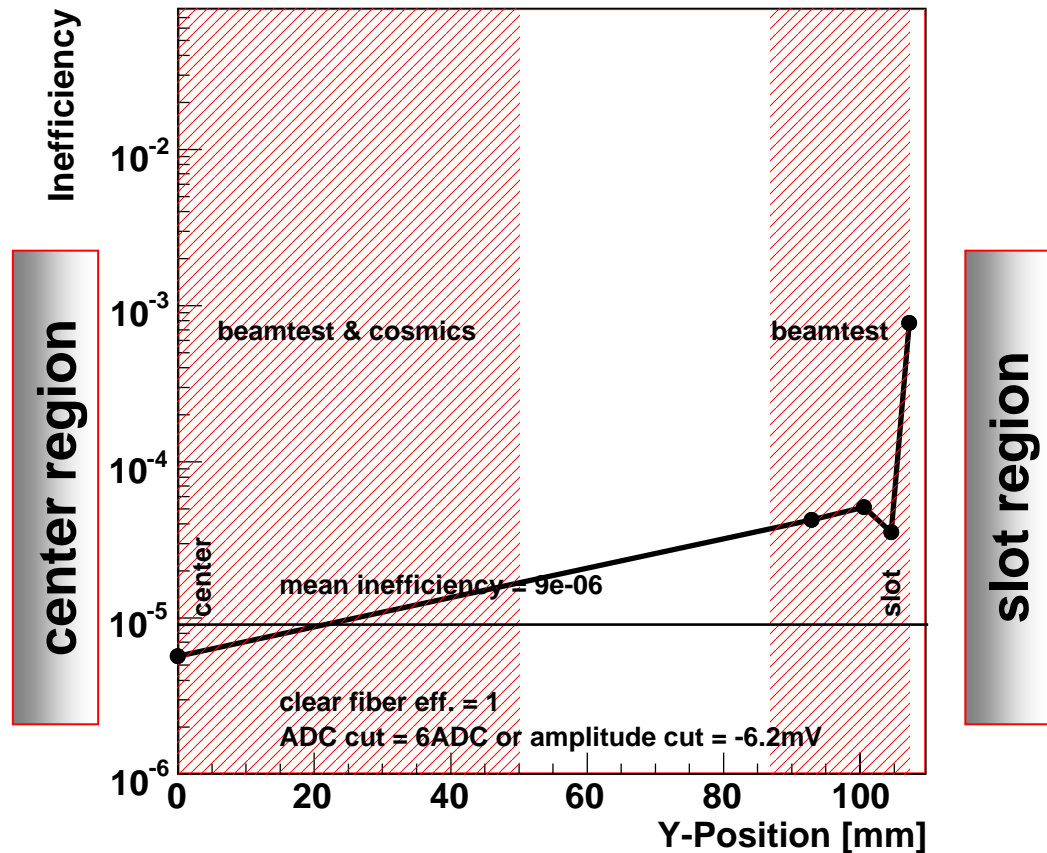
# Rotation back to vertical Position



# Efficiency of ACC



Upper Limit Inefficiency  $1\sigma$



Estimated upper limit ( $1\sigma$ ) inefficiency: **one complete ACC panel**

- data of **complete system test** and **beamtest** with lab electronics
- assumption of **isotropic particle distribution**

**$< 9 \cdot 10^{-6}$**

# Weight

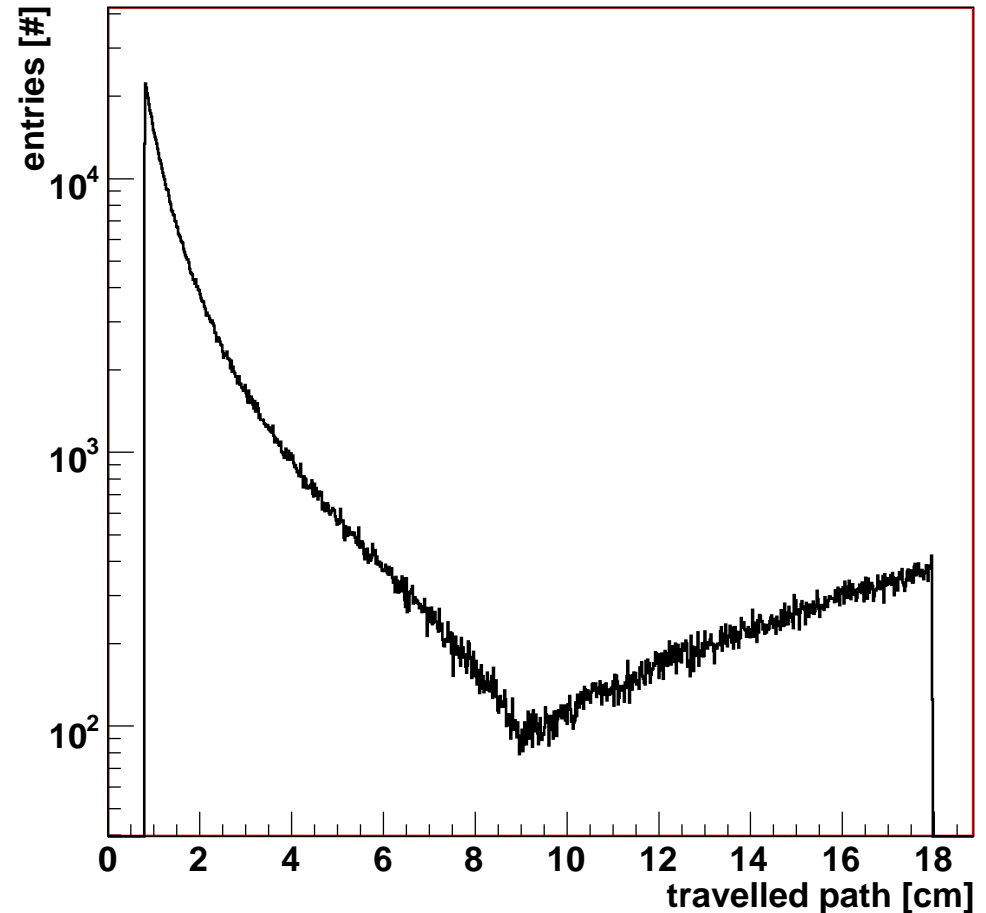
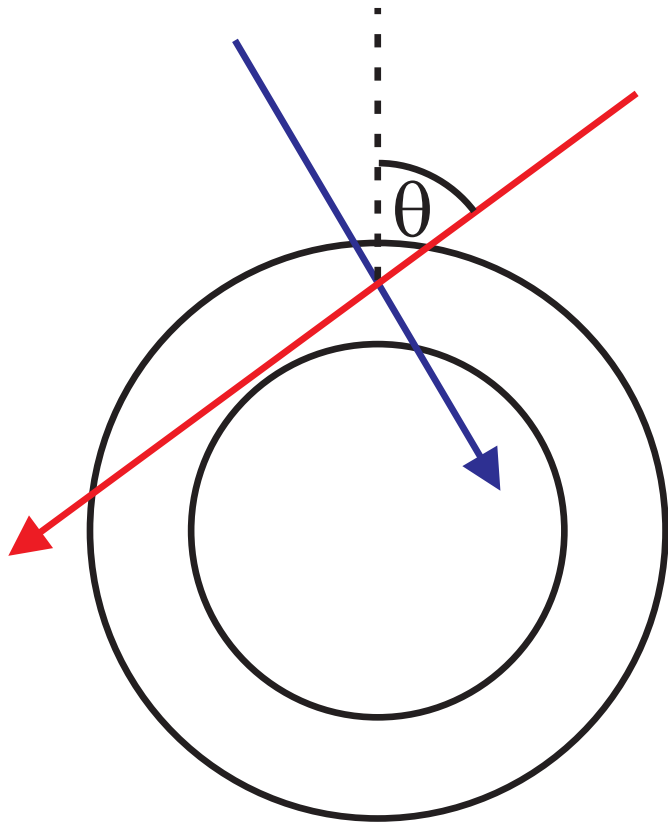
Component	kg
Scintillator with WLS fibers	29.2
Clamps & Bolts	2.8
CFC-Cylinder	5.2
Connector Support	1.8
Threaded Rod	0.2
PMT boxes with clear fibers, signal/HV cables, fixations	14.4
Fiber Fixation to VC	0.1

**Total: 53.7kg**

# Conclusion & Outlook

- Space qualification of ACC was successfully completed.
- Complete system test was performed in Aachen.
- Preintegration was performed.
- Solution for light leaks found (detailed tests ongoing)
- Tests show a good behaviour of the ACC.
- Inefficiency with lab electronics is  $< 9 \cdot 10^{-6}$ .
- Need investigation on and with flight electronics!

# Isotropic Particle Distribution in Panels

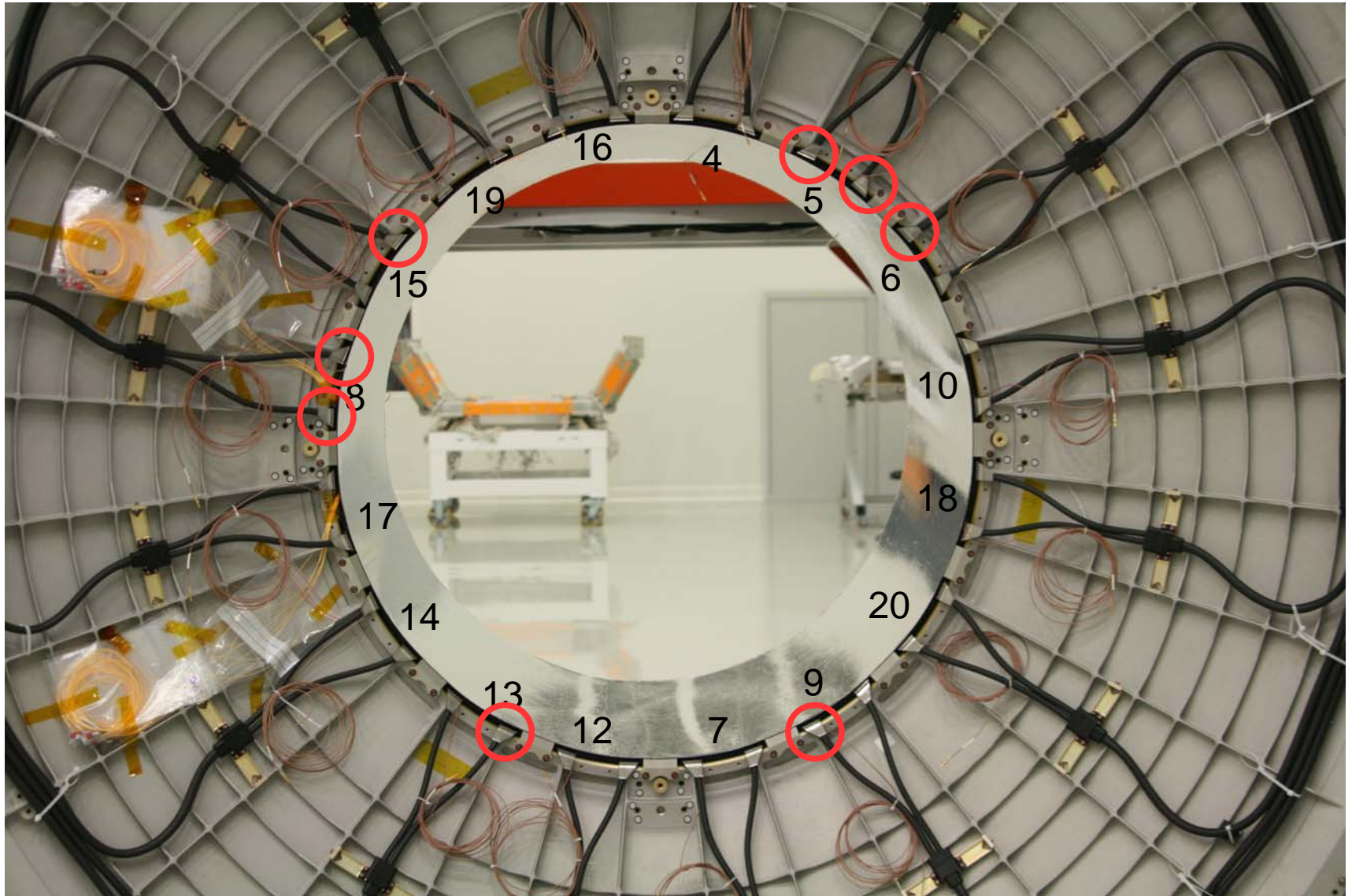


- **beamtest**: straight infall to panel

- **space**: isotropic particle distribution leads to a **longer** path length in scinitillator

⇒ **random factor** on measured charge according to the folding of the isotropic particle distribution and the distribution of travelled path lengths

# Light leaks top +Z



# Light leaks bottom -Z

