

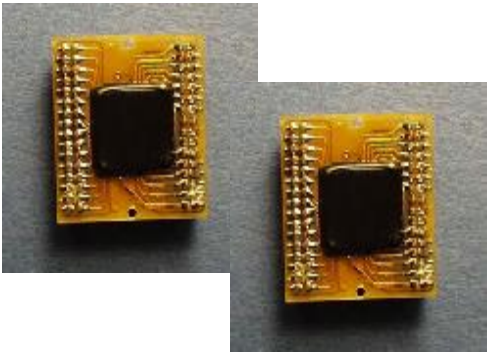
AMS-02: TRDTN3

Front End Electronics (82 FM + 19 FS)

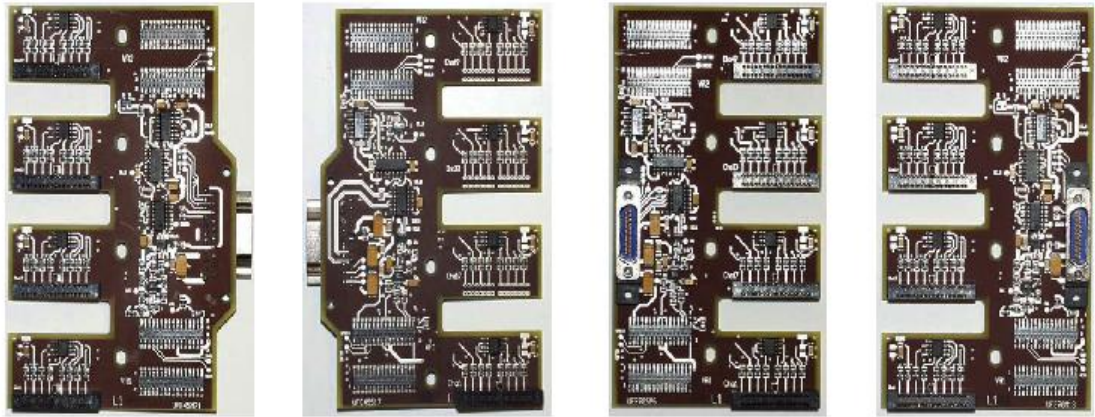
**Author: Th. Kirn, Ch. Chung, K. Lübelmeyer, A. Schultz v. Dratzig
I. Phys. Institute B, RWTH Aachen
Aachen, 13th January 2009**

Production, Space Qualification and
Quality Control of
Front End Electronics (82 FM + 19 FS)

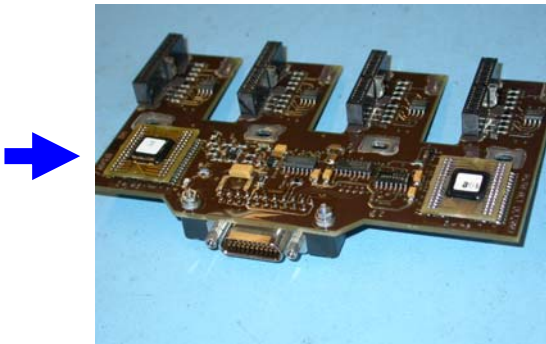
AMS-02 – TRD: Production of UFE-board (FM)



358 VA Chips Tests
Select 202 Chips



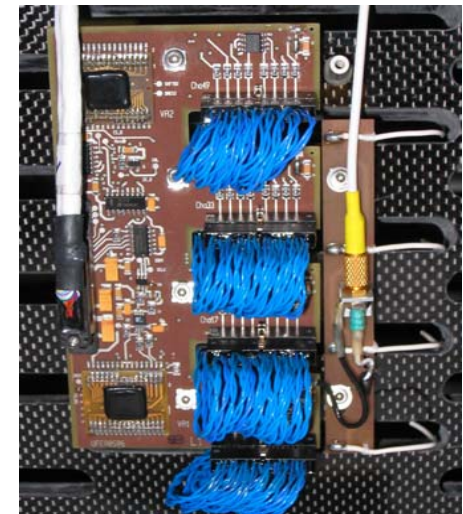
101 Production of 4 Types PCB



Functional Tests

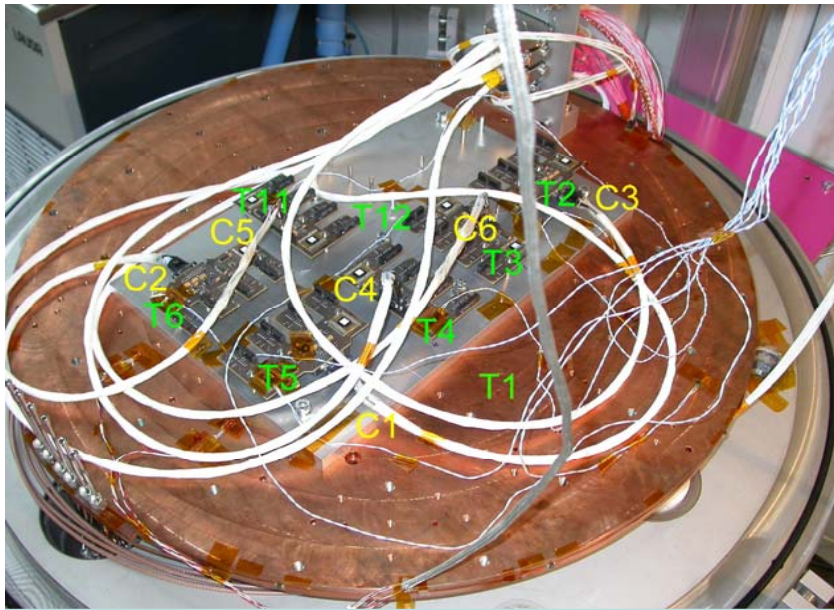


TVT → 3D Vibration
→ Coating → TVT



Integration

AMS-02 – TRD: Space Qualification Tests of UFE-board (FM)

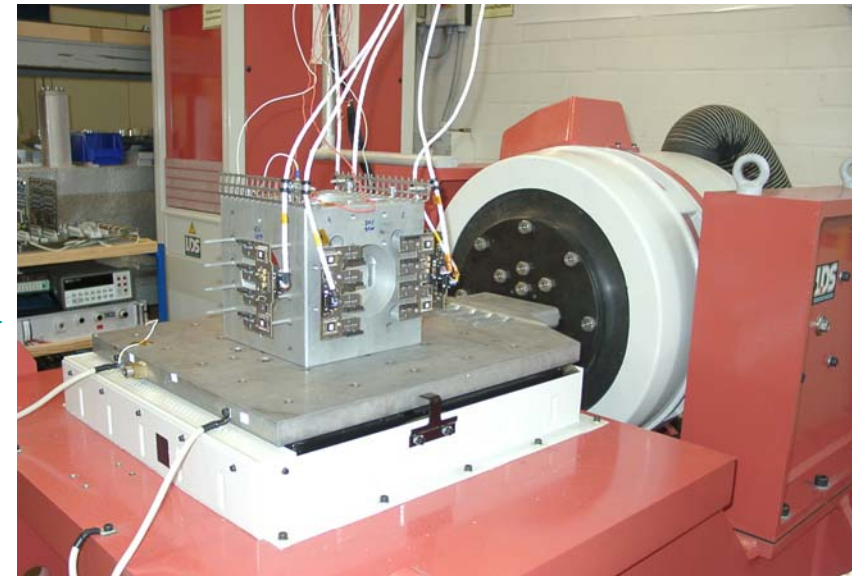


1st TVT

Temperature : -40°C ... +80°C
Pressure : 1×10^{-5} mbar
Functional test without failure

2nd TVT

Same as 1st TVT condition



Random Vibration

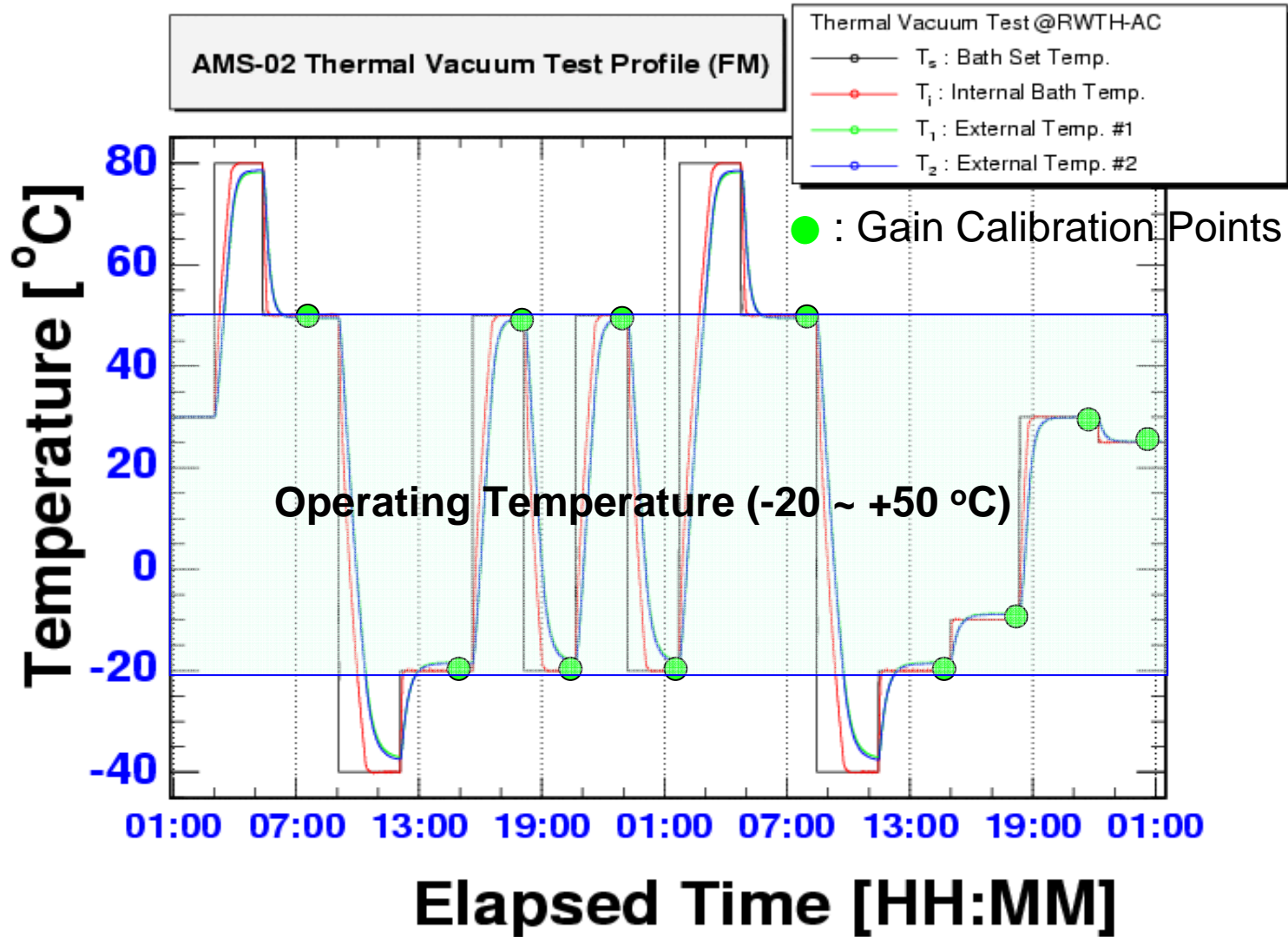
X,Y and Z-Direction
 $a_{\text{RMS}} = 6.8\text{g}$, 20-2000 Hz for 120 sec
Functional test without failure



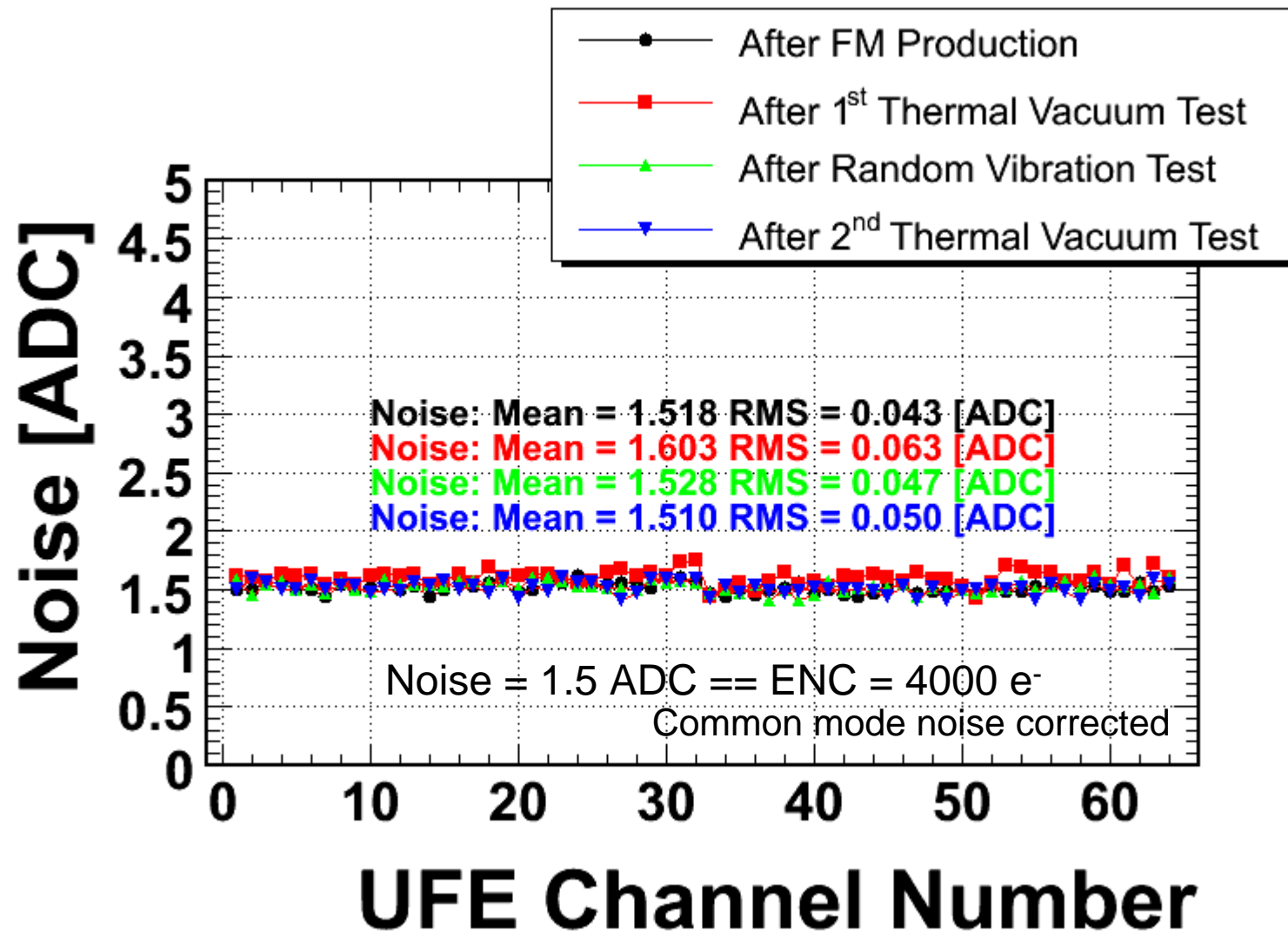
Conformal Coating



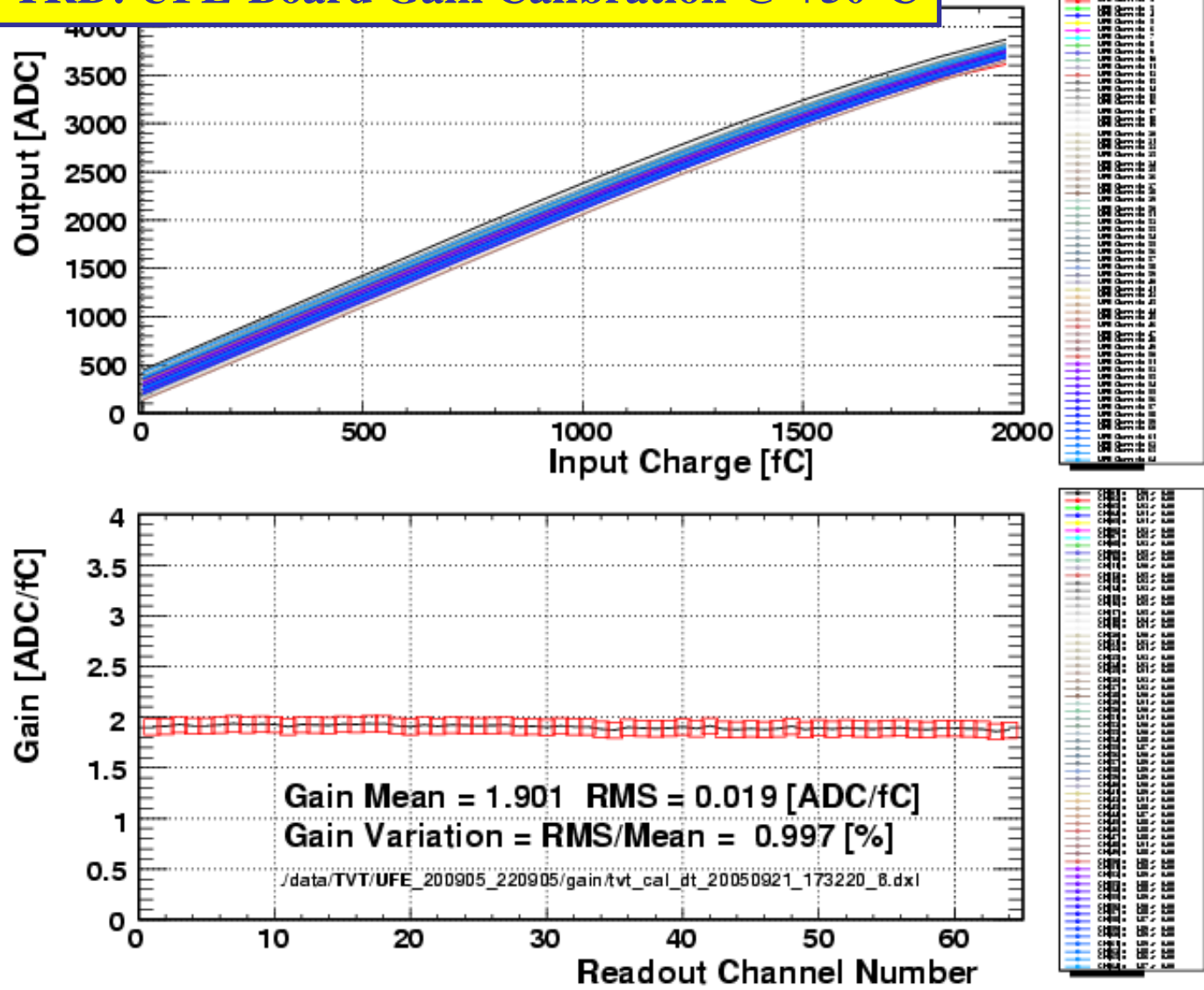
AMS-02 – TRD: Thermal Profile of TVT Test



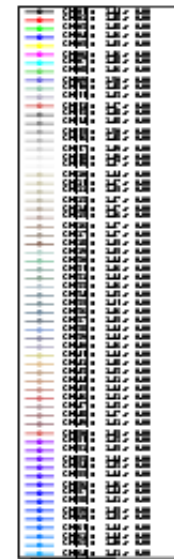
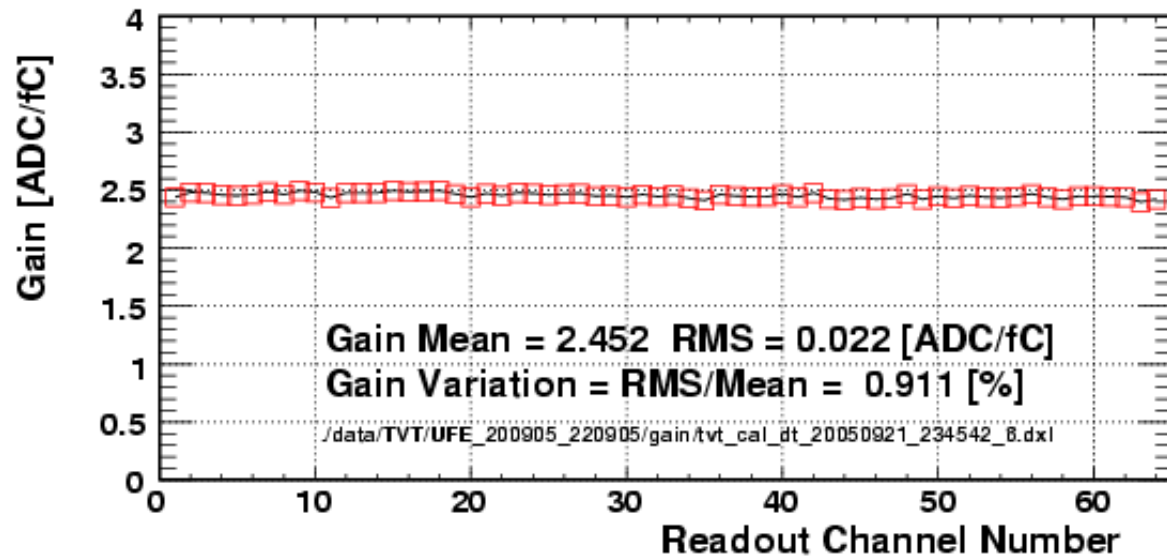
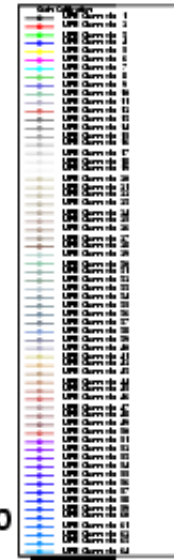
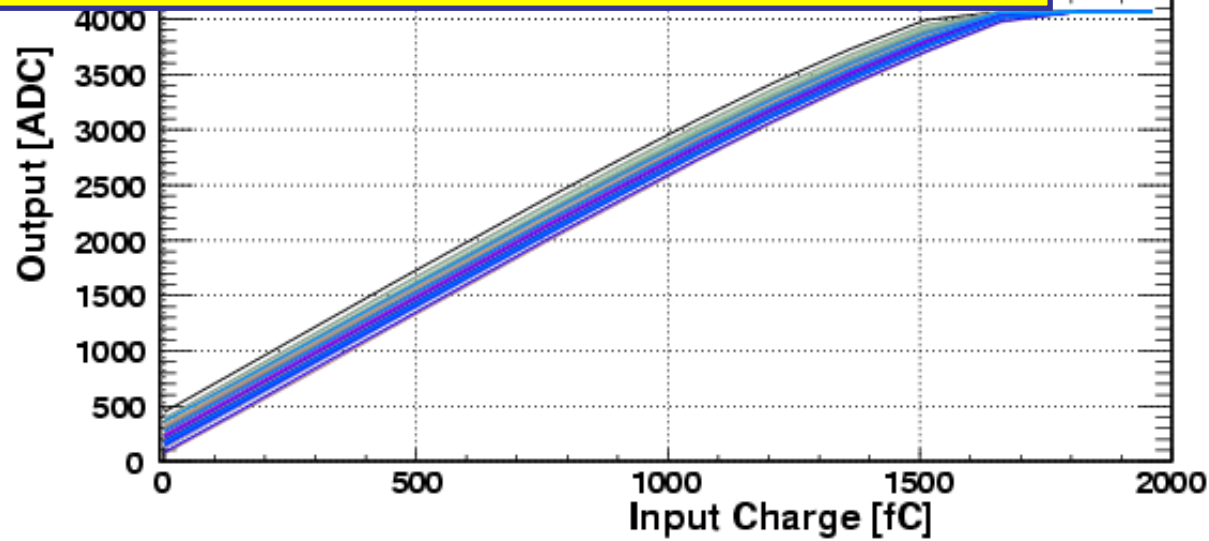
AMS-02 – TRD: UFE-Board Noise Measurement after TVT Test



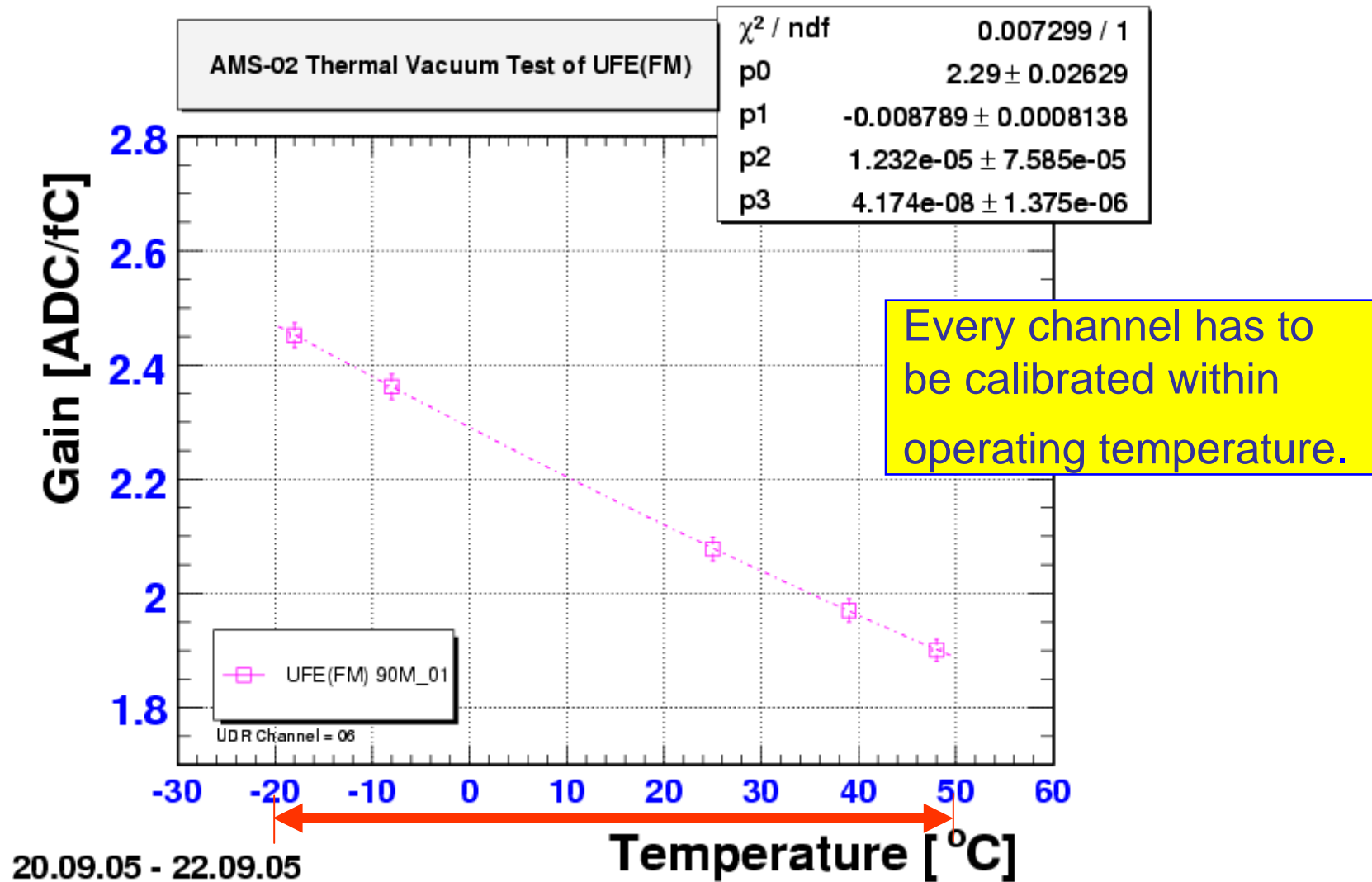
AMS-02 – TRD: UFE-Board Gain Calibration @ +50°C



AMS-02 – TRD: UFE-Board Gain Calibration @ -50°C

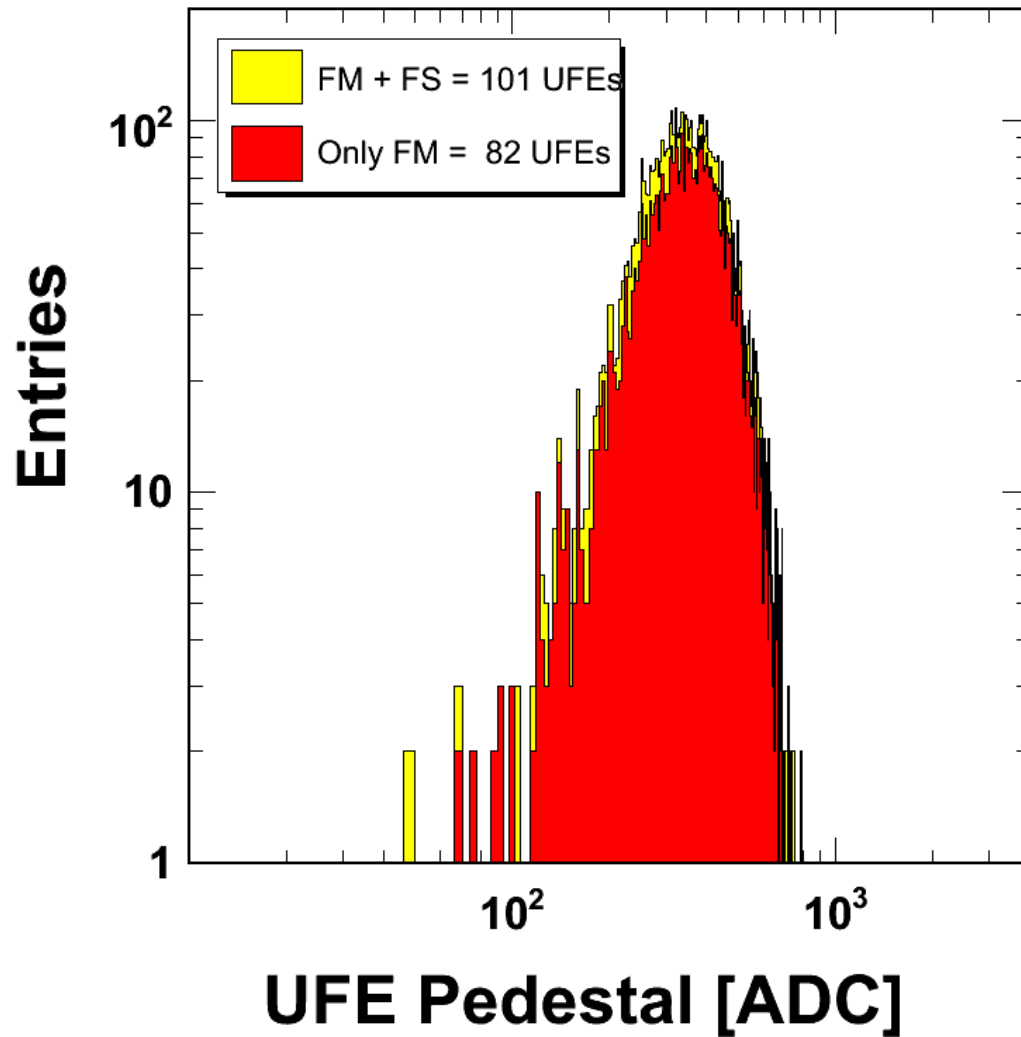


AMS-02 – TRD: UFE-Board Gain versus Temperature



AMS-02 – TRD: UFE-Board Pedestal Distribution

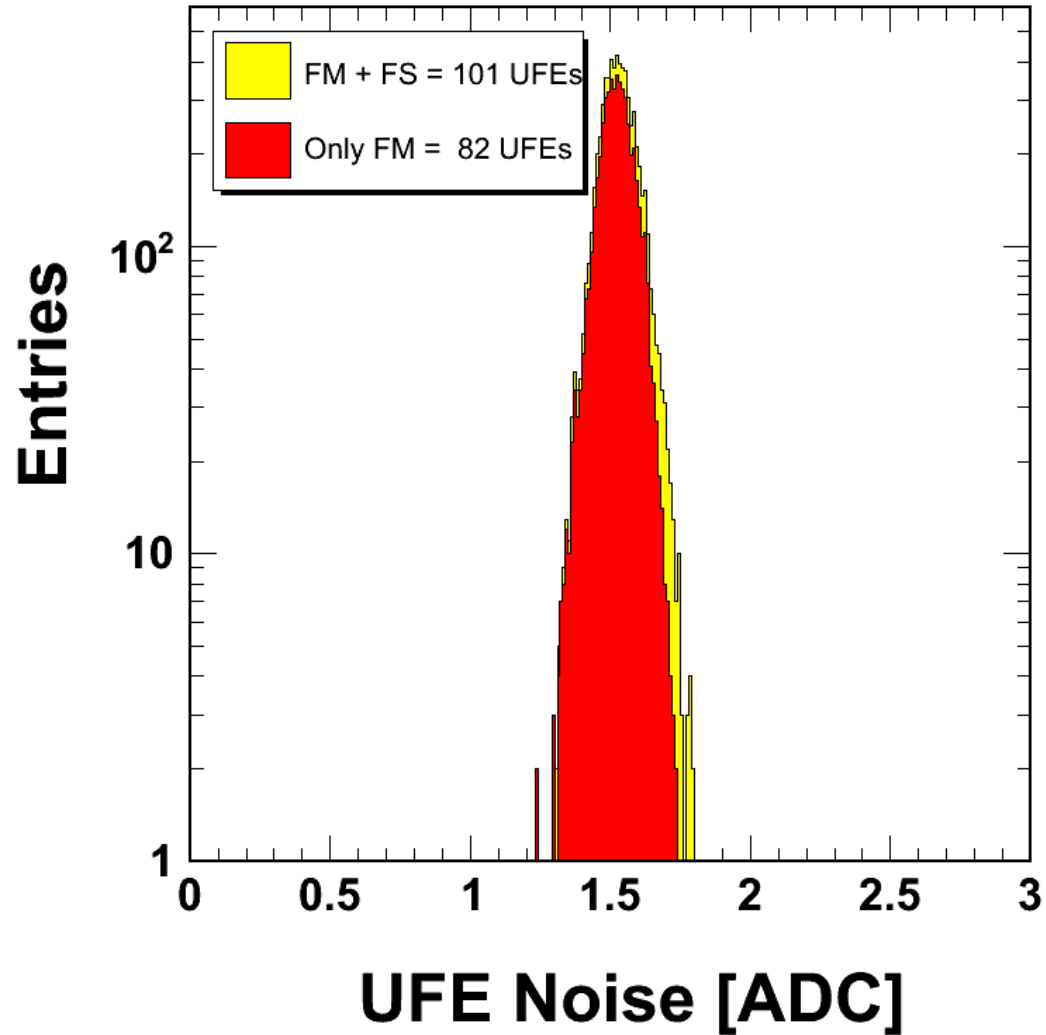
Mean/RMS = 372.21/106.66 [ADC]



TRD-UFE (FM)
Pedestal Distribution :
~ 10% of full range

AMS-02 – TRD: UFE-Board Noise Distribution

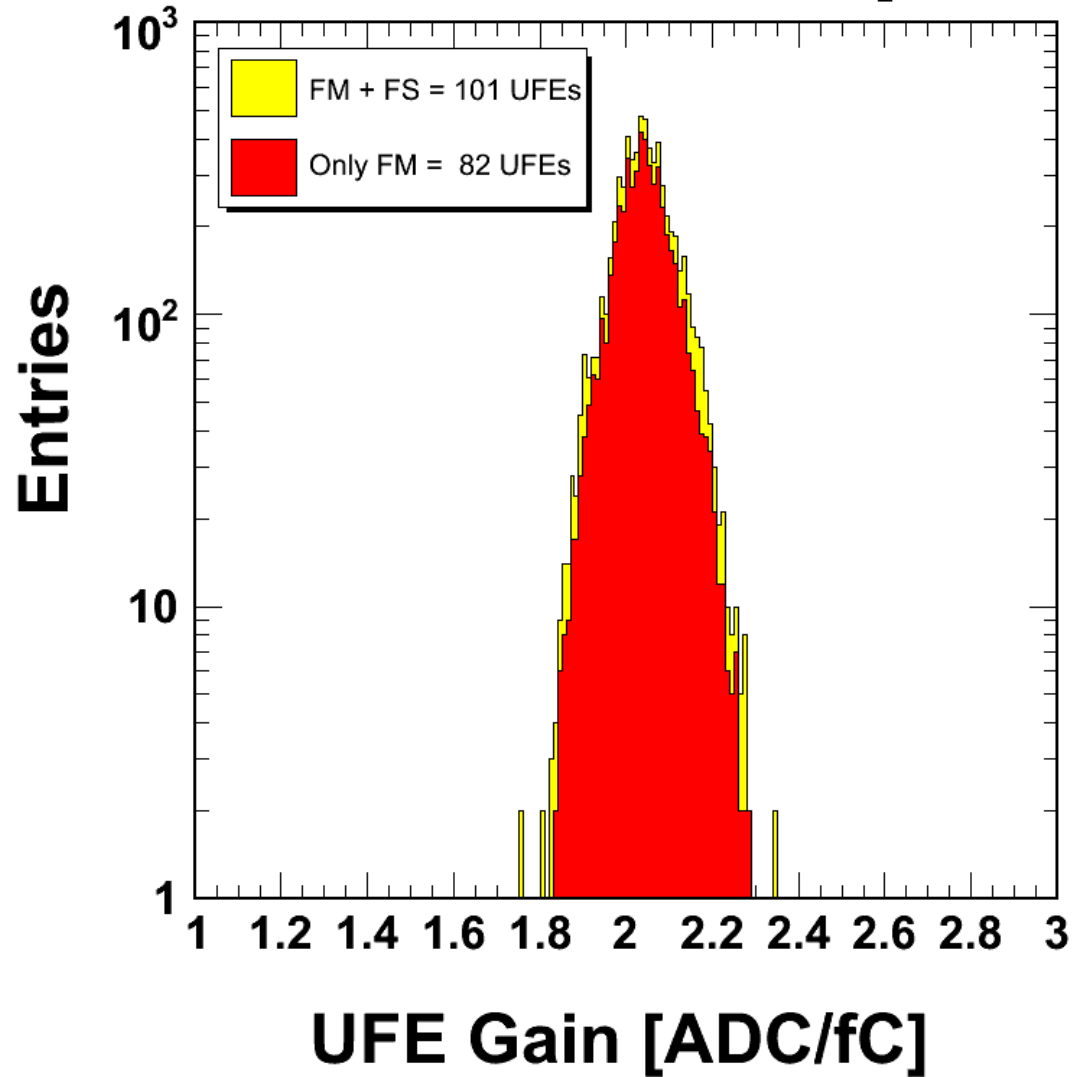
Mean/RMS = 1.52/ 0.06 [ADC]



TRD-UFE (FM)
Noise RMS Spread :
~ 4%

AMS-02 – TRD: UFE-Board Gain Distribution

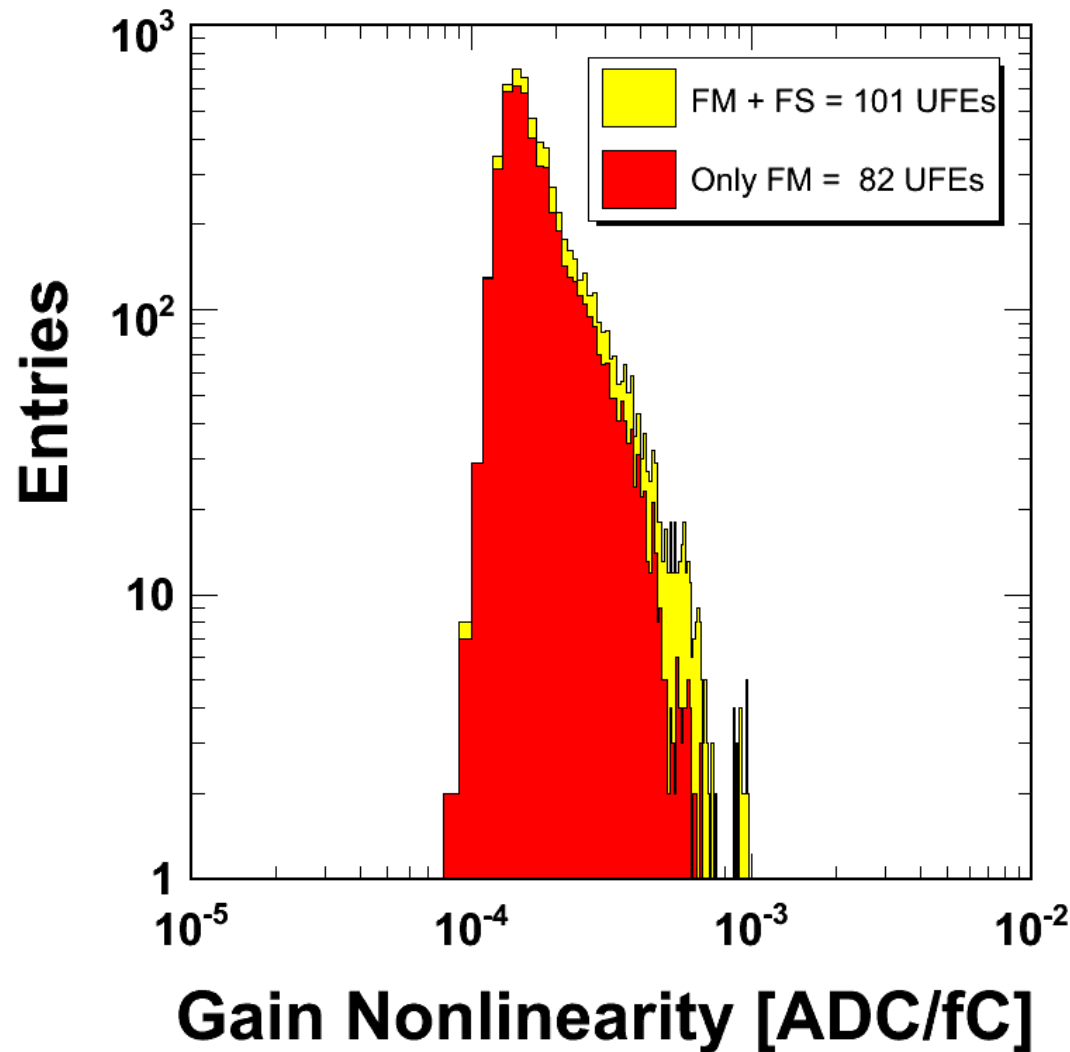
Mean/RMS = 2.04/ 0.07 [ADC/fC]



TRD-UFE (FM)
Gain RMS Spread :
~ 3%

AMS-02 – TRD: UFE-Board Non-Linearity Distribution

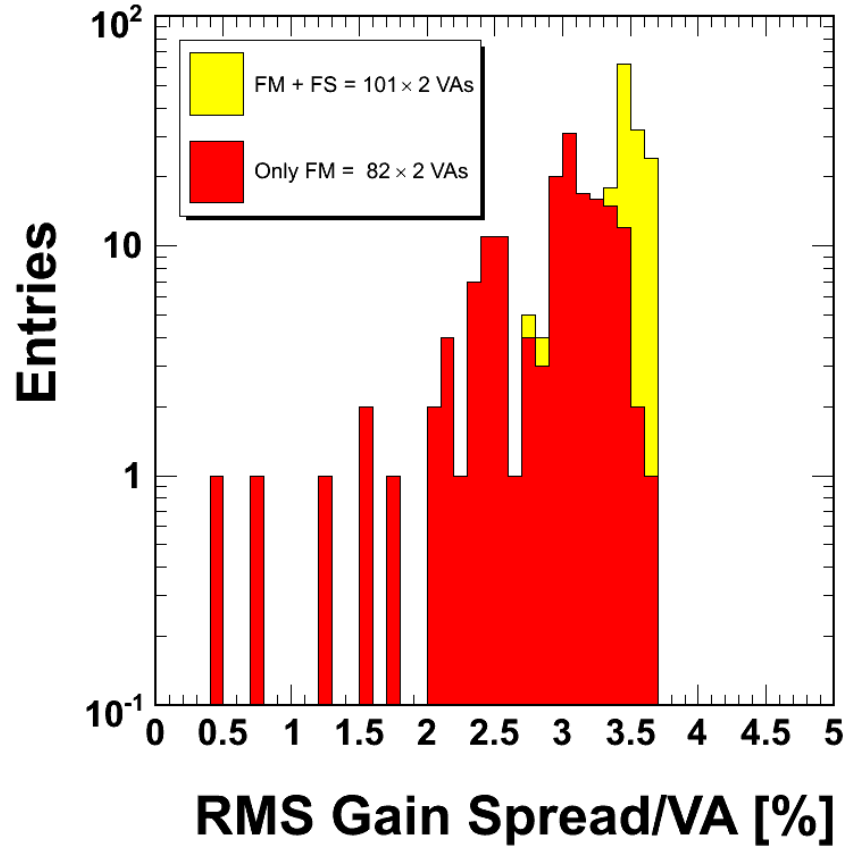
Mean/RMS = $1.99\text{E-}04/8.34\text{E-}05$ [ADC/fC]



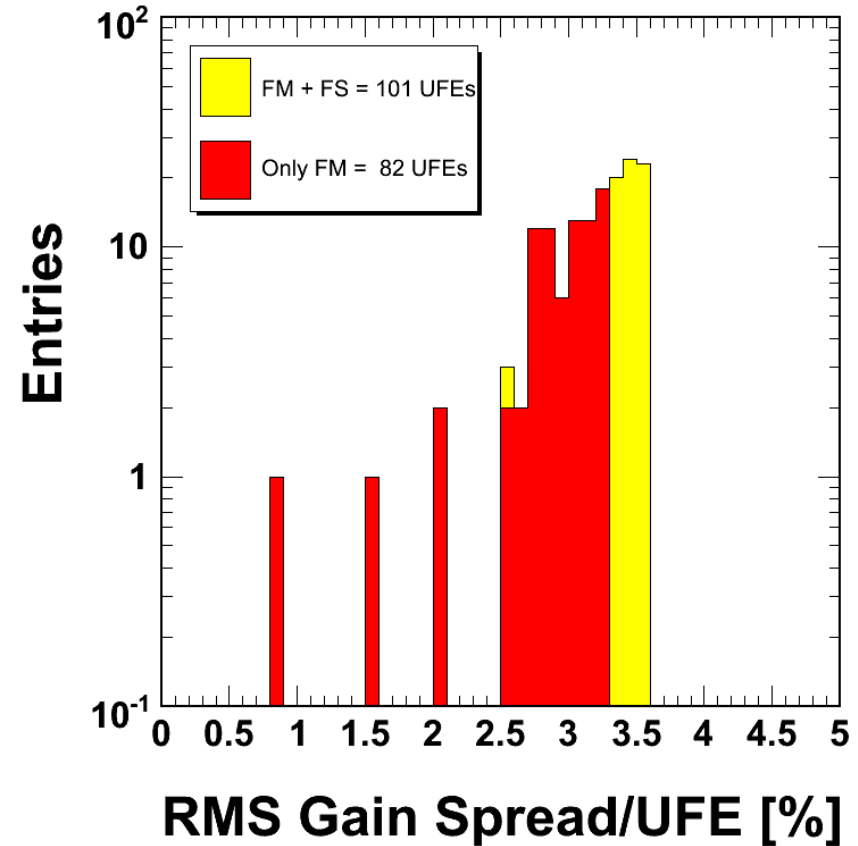
TRD-UFE (FM)
Nonlinearity
 $\sim 2\text{E-}04$ [ADC/fC]

AMS-02 – TRD: UFE-Board Combination of 2 VAs

RMS Gain/VA = 2.91/ 0.49 [%]



RMS Gain/UFE = 2.94/ 0.37 [%]



AMS-02 – TRD: Front End Electronic UFE-Board Summary

UFE(FM) Production : Finished (Jul. 2005)

Total = **101** UFEs (FM = 82, FS = 19)

Functional Tests : Finished (20.07.05)

UFE Space Qualification Tests (Mar.05 ~ Mar. 06)

1st Thermal Vacuum Test = **101** (Done w/o failure)

Random Vibration Test = **101** (Done w/o failure)

Conformal Coating = **101** (Done w/o failure)

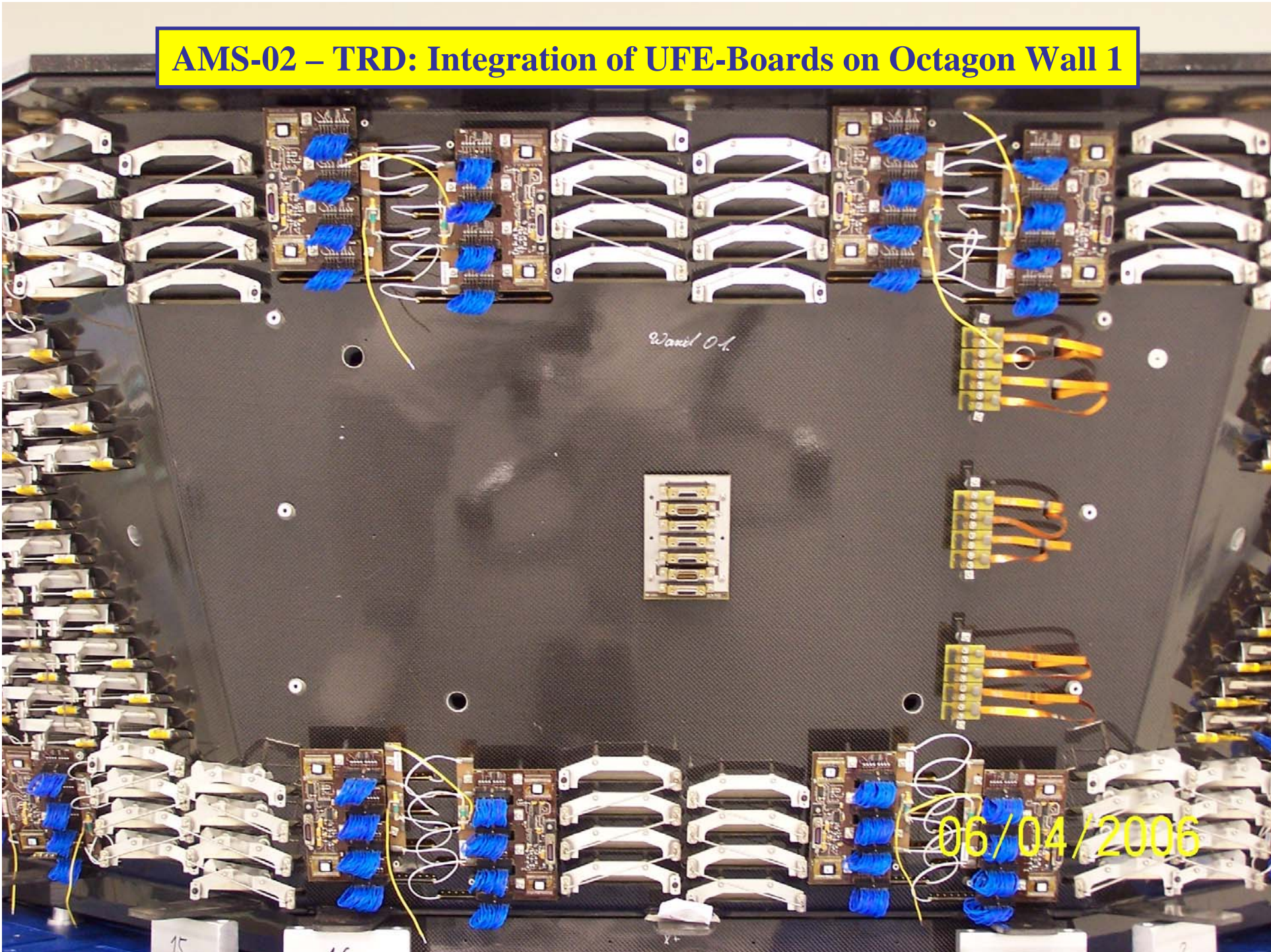
2nd Thermal Vacuum Test = **101** (Done w/o failure)

⇒ **Best 82 FM selected (Mar. 2006)**

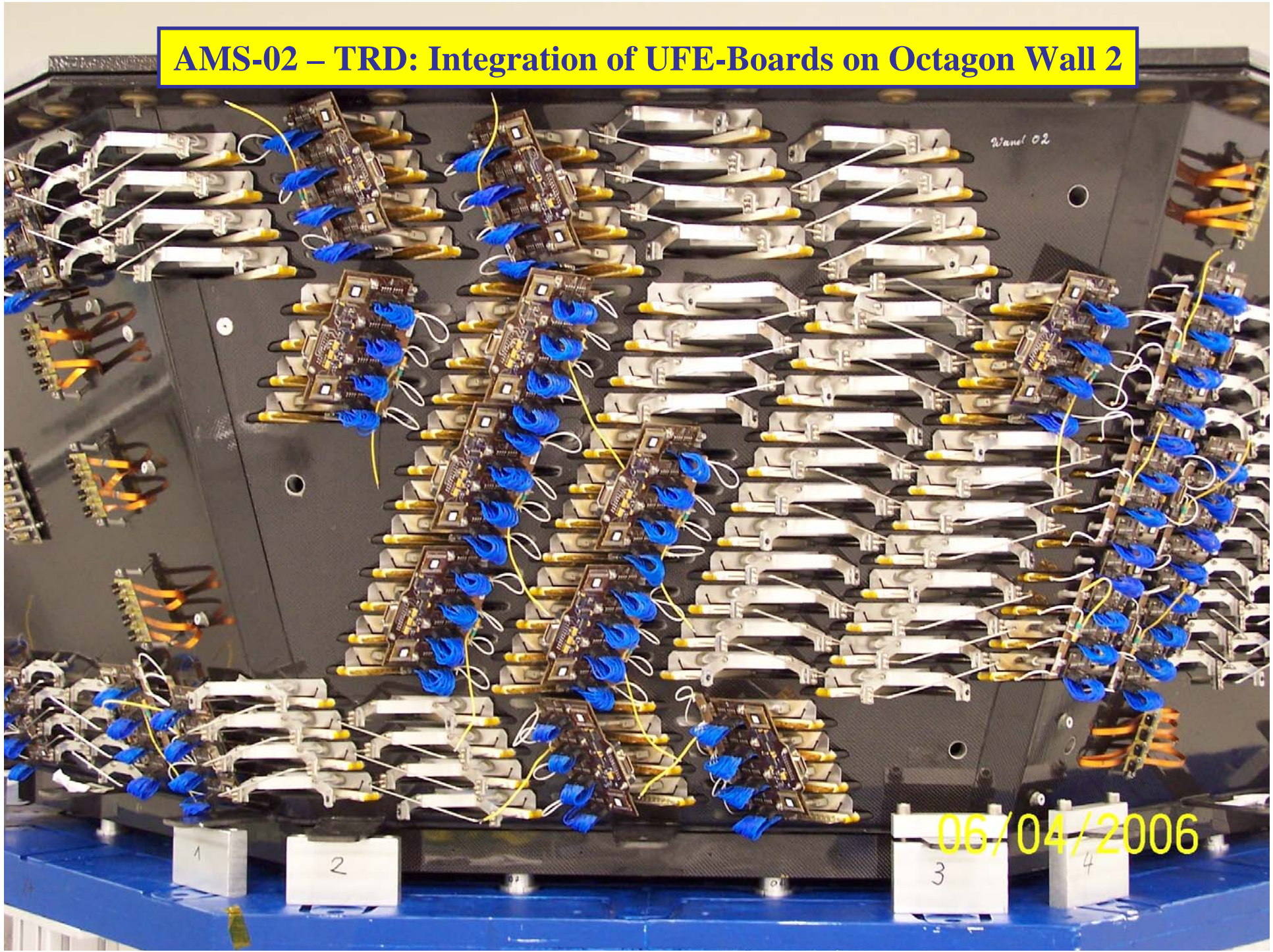
UFE Integration : Finished (Apr. 2006)

Octagon Integration of Front End Electronics (82 FM + 19 FS)

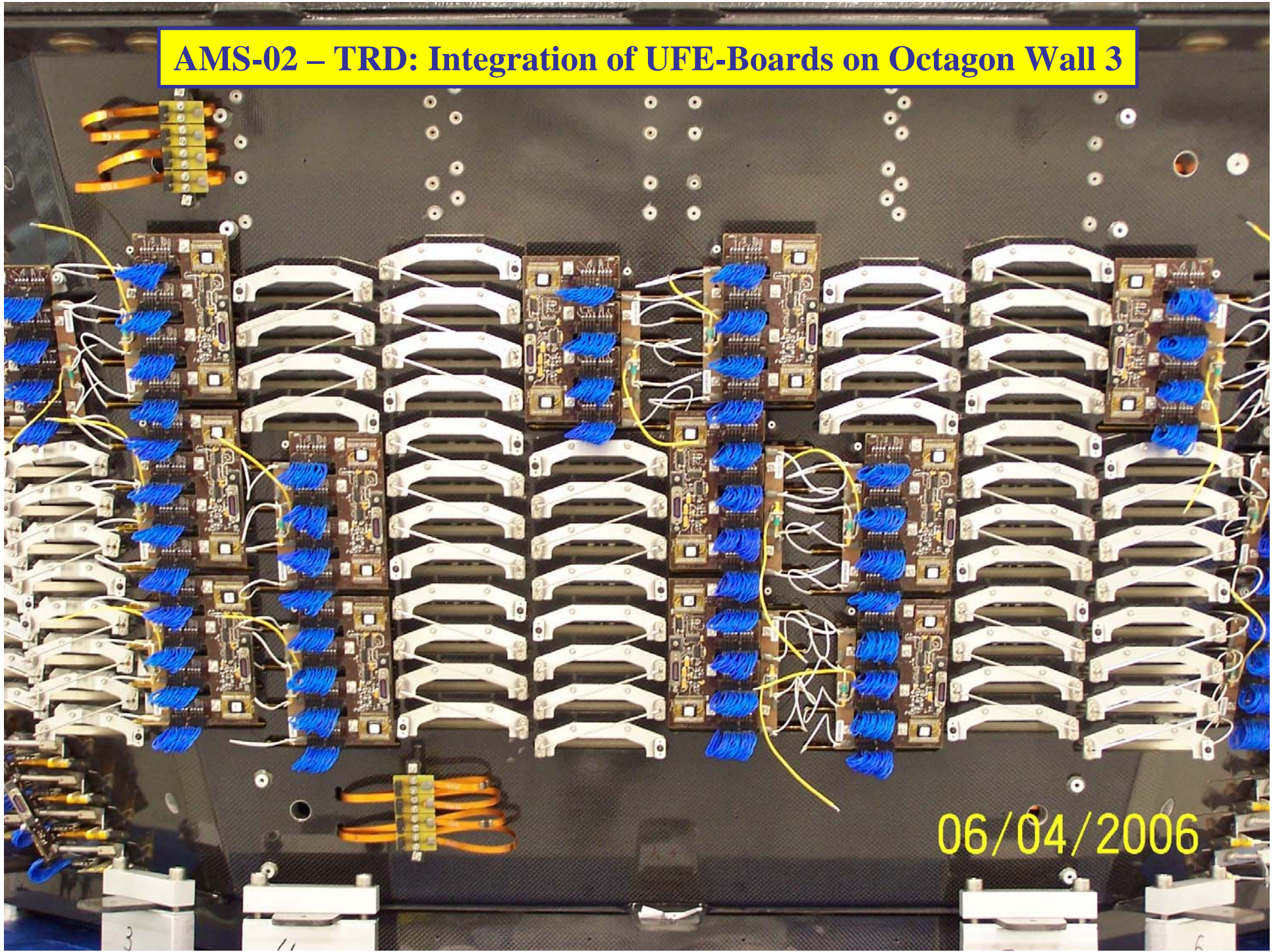
AMS-02 – TRD: Integration of UFE-Boards on Octagon Wall 1



AMS-02 – TRD: Integration of UFE-Boards on Octagon Wall 2

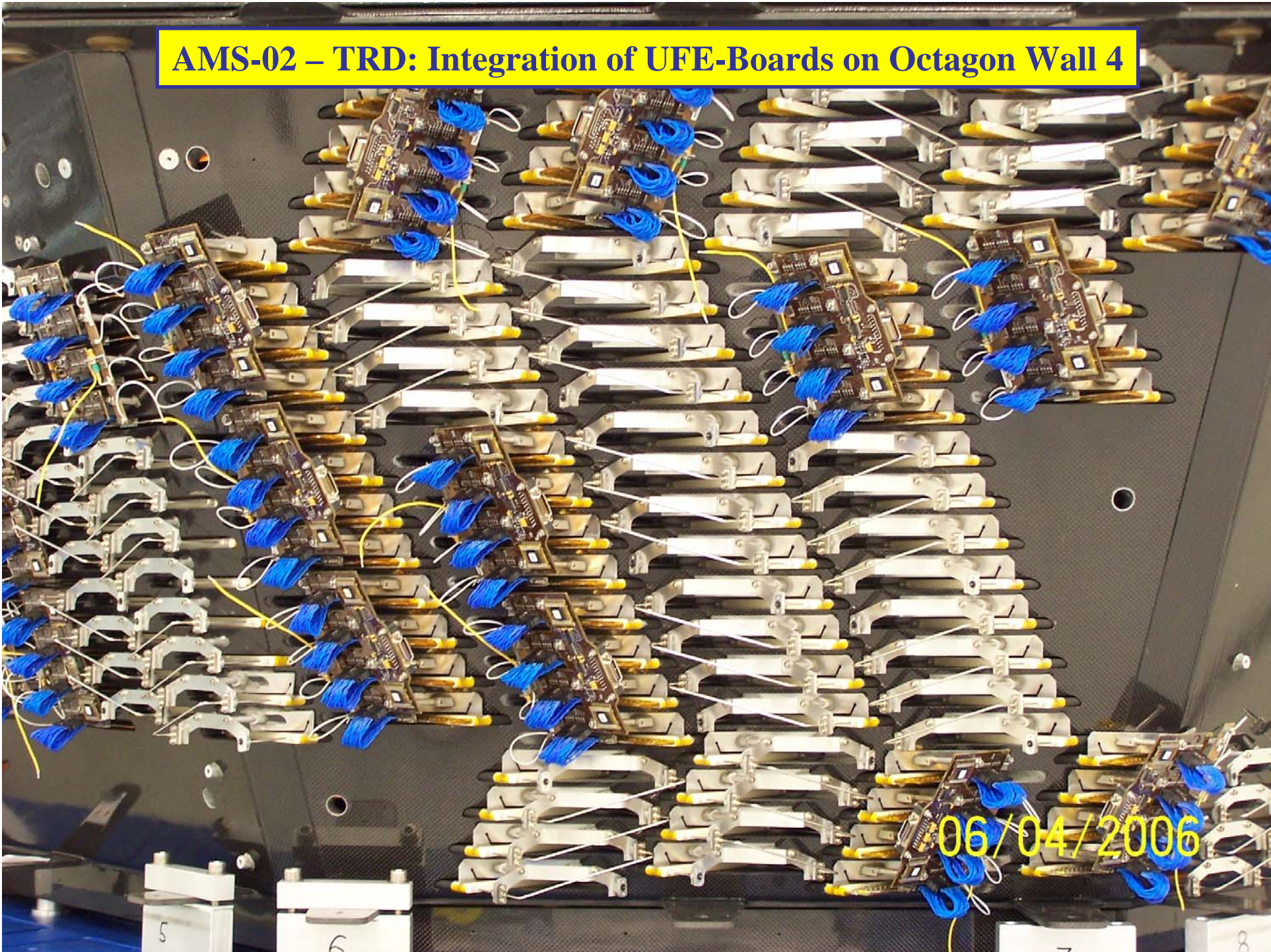


AMS-02 – TRD: Integration of UFE-Boards on Octagon Wall 3

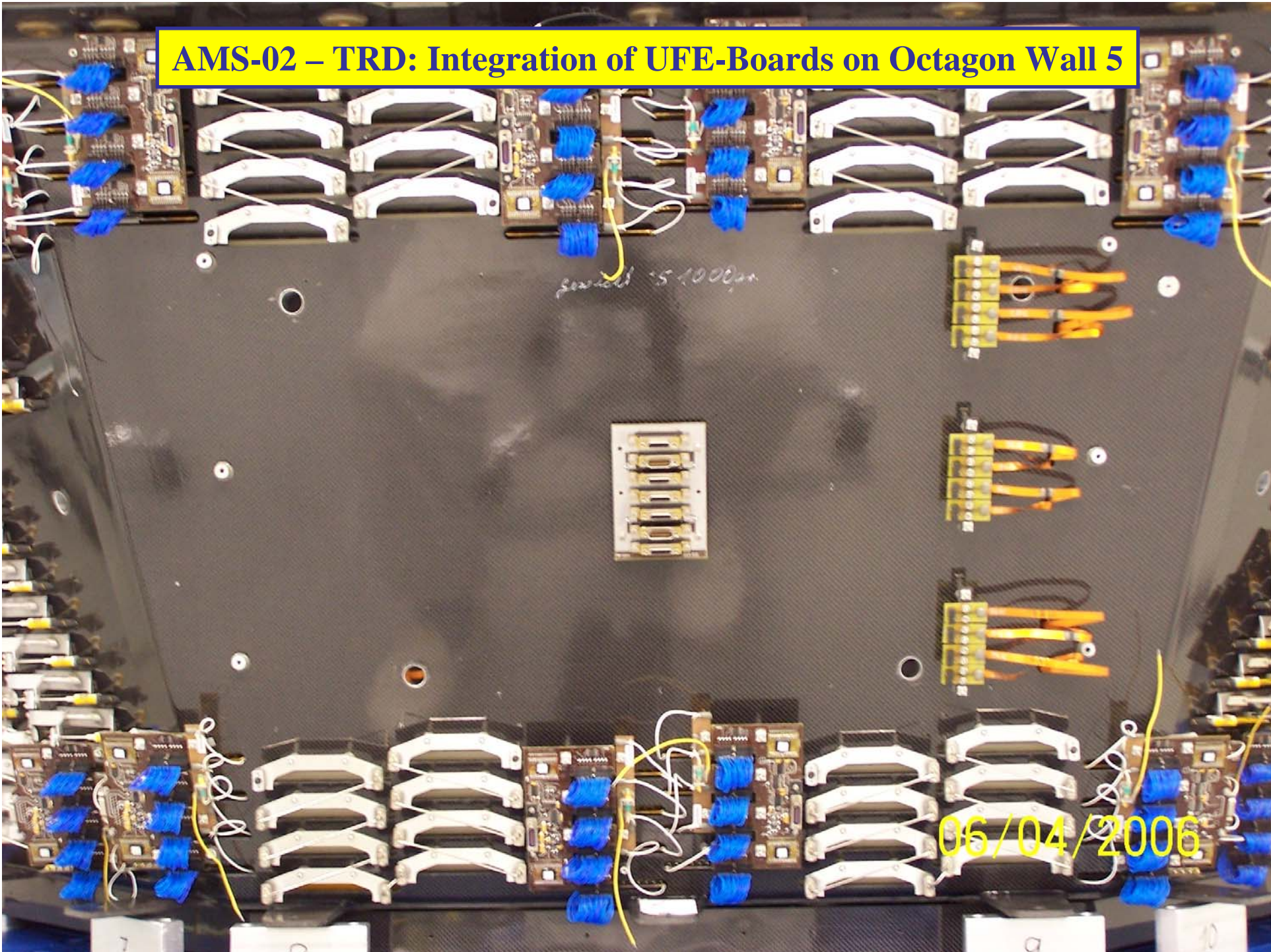


06/04/2006

AMS-02 – TRD: Integration of UFE-Boards on Octagon Wall 4

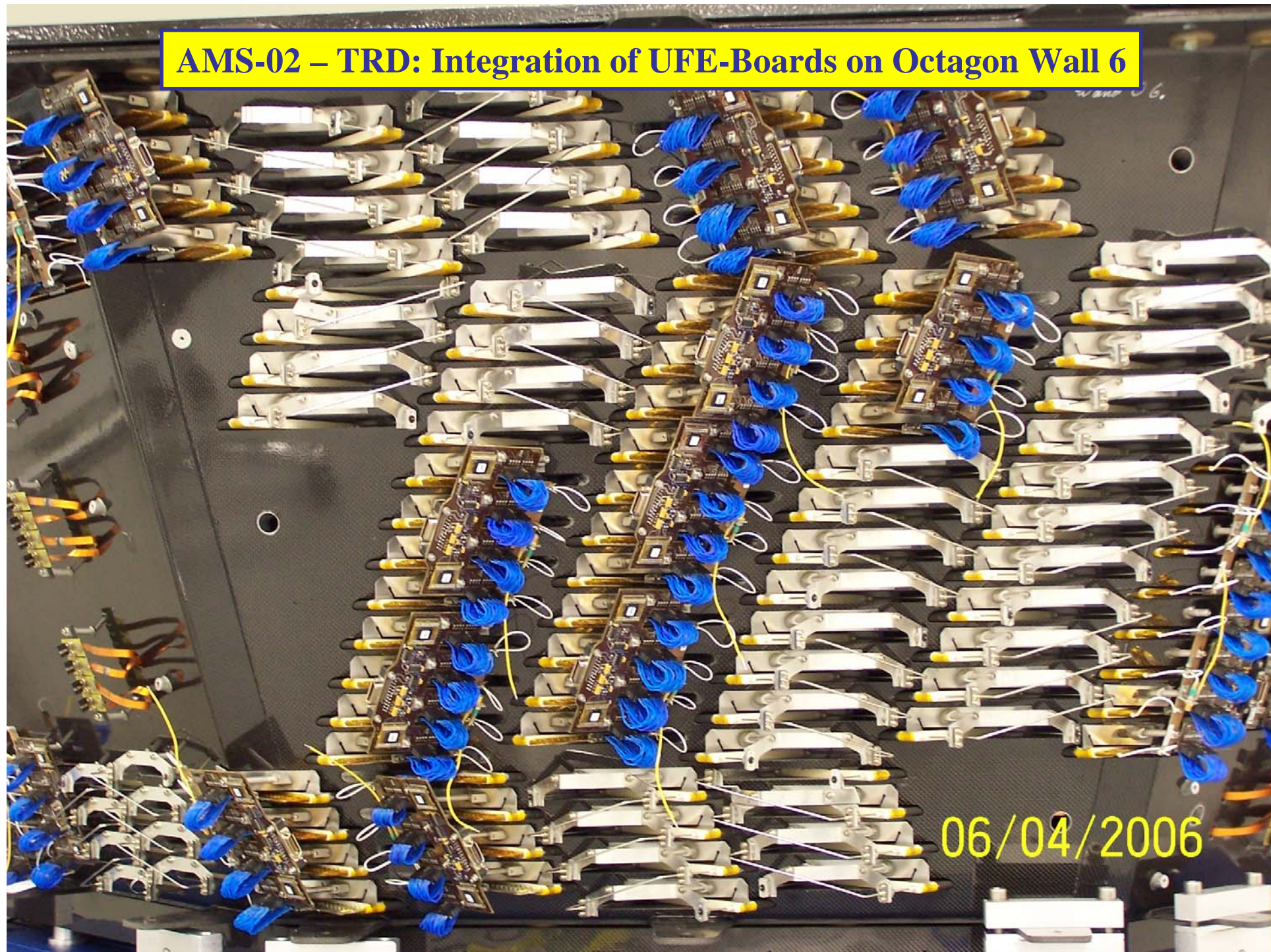


AMS-02 – TRD: Integration of UFE-Boards on Octagon Wall 5

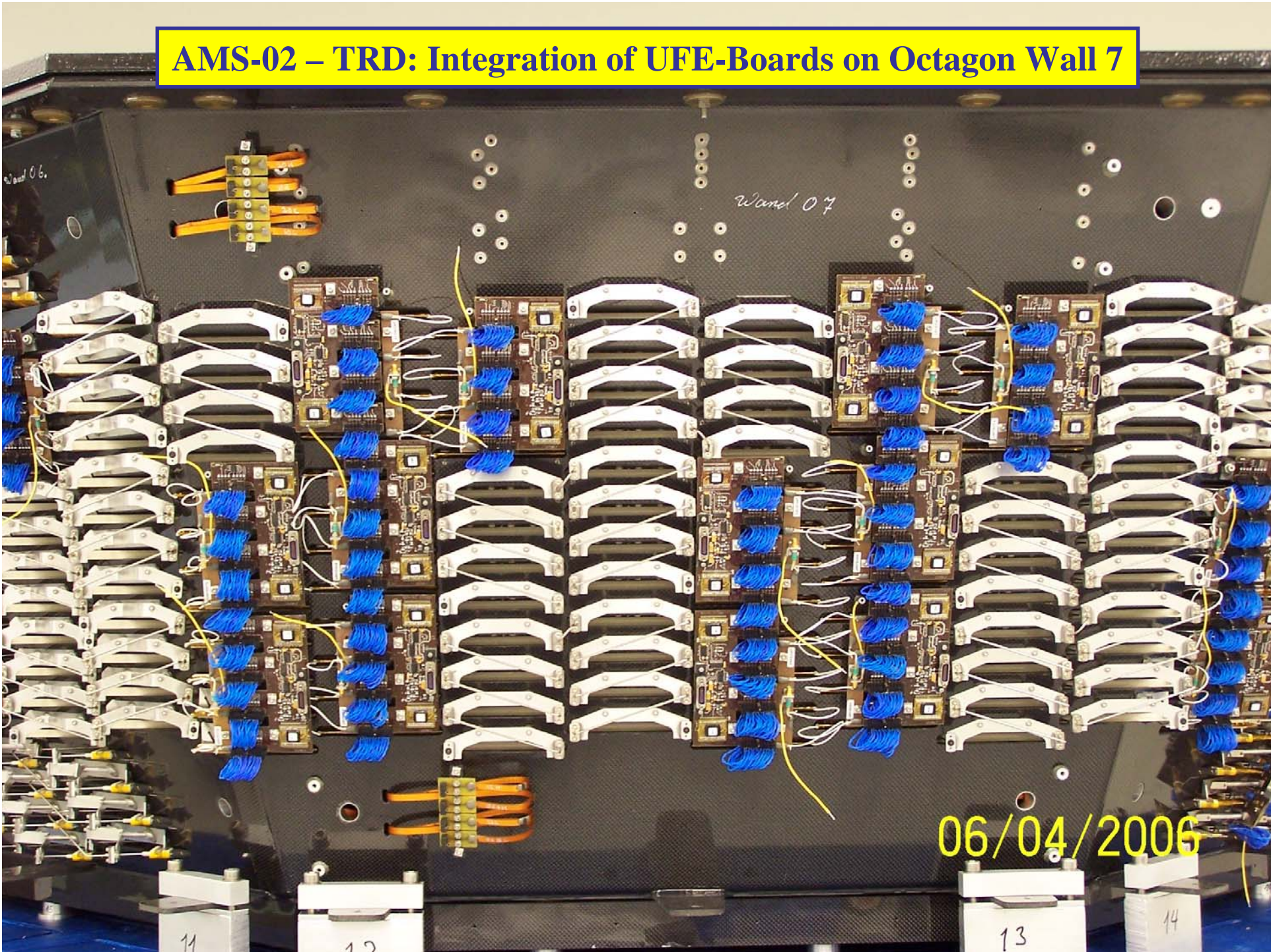


06/04/2006

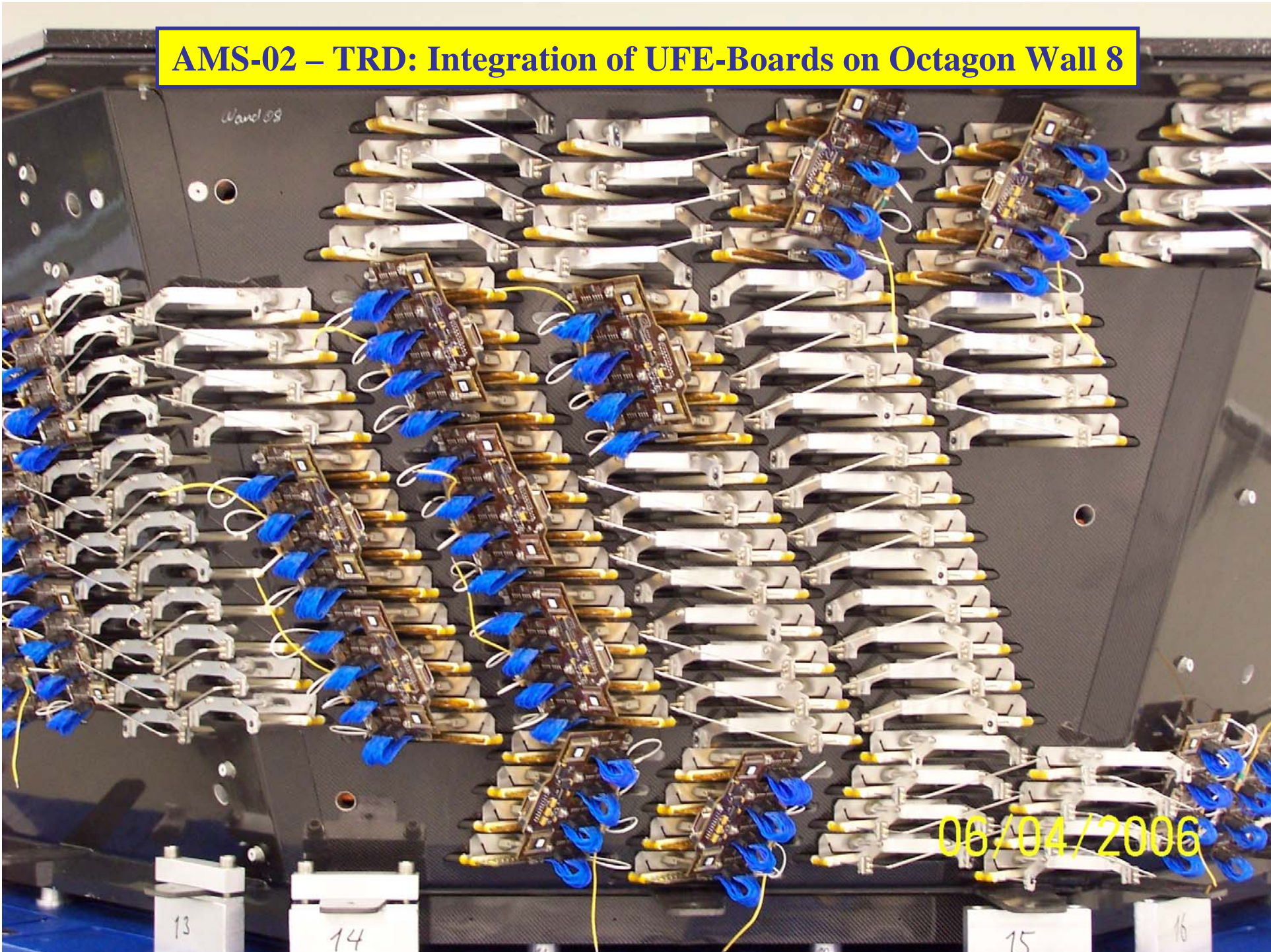
AMS-02 – TRD: Integration of UFE-Boards on Octagon Wall 6



AMS-02 – TRD: Integration of UFE-Boards on Octagon Wall 7



AMS-02 – TRD: Integration of UFE-Boards on Octagon Wall 8



AMS-02 – TRD: Integration of UFE-Boards on Octagon

Documentation TRD UFE-Board Installation				RWTH Physics AC-I
From Module	To Module	Position	Layer-Sceme	UFE-Board-Nr.
1	4	Y-7	L1-4	45 S # 10
5	8	Y-6	L1-4	45 S # 05
9	12	Y-5	L1-4	45 M # 01
13	16	Y-4	L1-4	45 M # 02
17	20	Y-3	L1-4	90 S # 10
21	24	Y-2	L1-4	90 M # 19
25	28	Y-1	L1-4	90 M # 24
29	32	Y+1	L1-4	90 S # 22
33	36	Y+2	L1-4	90 S # 03
37	40	Y+3	L1-4	90 M # 21
41	44	Y+4	L1-4	45 S # 16
45	48	Y+5	L1-4	45 S # 17
49	52	Y+6	L1-4	45 M # 09
53	56	Y+7	L1-4	45 M # 13

AMS-02 – TRD: Integration of UFE-Boards on Octagon

Documentation TRD UFE-Board Installation				RWTH Physics AC-I
From Module	To Module	Position	Layer-Sceme	UFE-Board-Nr.
57	60	X-8	L5-8	45 S # 19
61	64	X-7	L5-8	45 S # 18
65	68	X-6	L5-8	45 M # 14
69	72	X-5	L5-8	45 M # 12
73	76	X-4	L5-8	90 M # 01
77	80	X-3	L5-8	90 M # 03
81	84	X-2	L5-8	90 M # 13
85	88	X-1	L5-8	90 S # 06
89	92	X+1	L5-8	90 S # 18
93	96	X+2	L5-8	90 M # 27
97	100	X+3	L5-8	90 M # 02
101	104	X+4	L5-8	90 M # 04
105	108	X+5	L5-8	45 M # 18
109	112	X+6	L5-8	45 M # 17
113	116	X+7	L5-8	45 S # 06
117	120	X+8	L5-8	45 S # 09

AMS-02 – TRD: Integration of UFE-Boards on Octagon

Documentation TRD UFE-Board Installation				RWTH Physics AC-I
From Module	To Module	Position	Layer-Sceme	UFE-Board-Nr.
121	124	X-8	L9-12	45 S # 20
125	128	X-7	L9-12	45 S # 13
129	132	X-6	L9-12	45 M # 19
133	136	X-5	L9-12	45 M # 07
137	140	X-4	L9-12	90 M # 26
141	144	X-3	L9-12	90 M # 25
145	148	X-2	L9-12	90 M # 15
149	152	X-1	L9-12	90 S # 07
153	156	X+1	L9-12	90 S # 14
157	160	X+2	L9-12	90 M # 16
161	164	X+3	L9-12	90 M # 07
165	168	X+4	L9-12	90 M # 08
169	172	X+5	L9-12	45 M # 26
173	176	X+6	L9-12	45 M # 20
177	180	X+7	L9-12	45 S # 12
181	184	X+8	L9-12	45 S # 08

AMS-02 – TRD: Integration of UFE-Boards on Octagon

Documentation TRD UFE-Board Installation				RWTH Physics AC-I
From Module	To Module	Position	Layer-Sceme	UFE-Board-Nr.
185	188	X-9	L13-16	45 M # 03
189	192	X-8	L13-16	45 M # 11
193	196	X-7	L13-16	45 S # 25
197	200	X-6	L13-16	45 S # 23
201	204	X-5	L13-16	45 M # 08
205	208	X-4	L13-16	90 S # 05
209	212	X-3	L13-16	90 S # 12
213	216	X-2	L13-16	90 M # 10
217	220	X-1	L13-16	90 M # 11
221	224	X+1	L13-16	90 S # 02
225	228	X+2	L13-16	90 S # 17
229	232	X+3	L13-16	90 M # 12
233	236	X+4	L13-16	90 M # 06
237	240	X+5	L13-16	45 S # 04
241	244	X+6	L13-16	45 M # 25
245	248	X+7	L13-16	45 M # 23
249	252	X+8	L13-16	45 S # 07
253	256	X+9	L13-16	45 S # 11

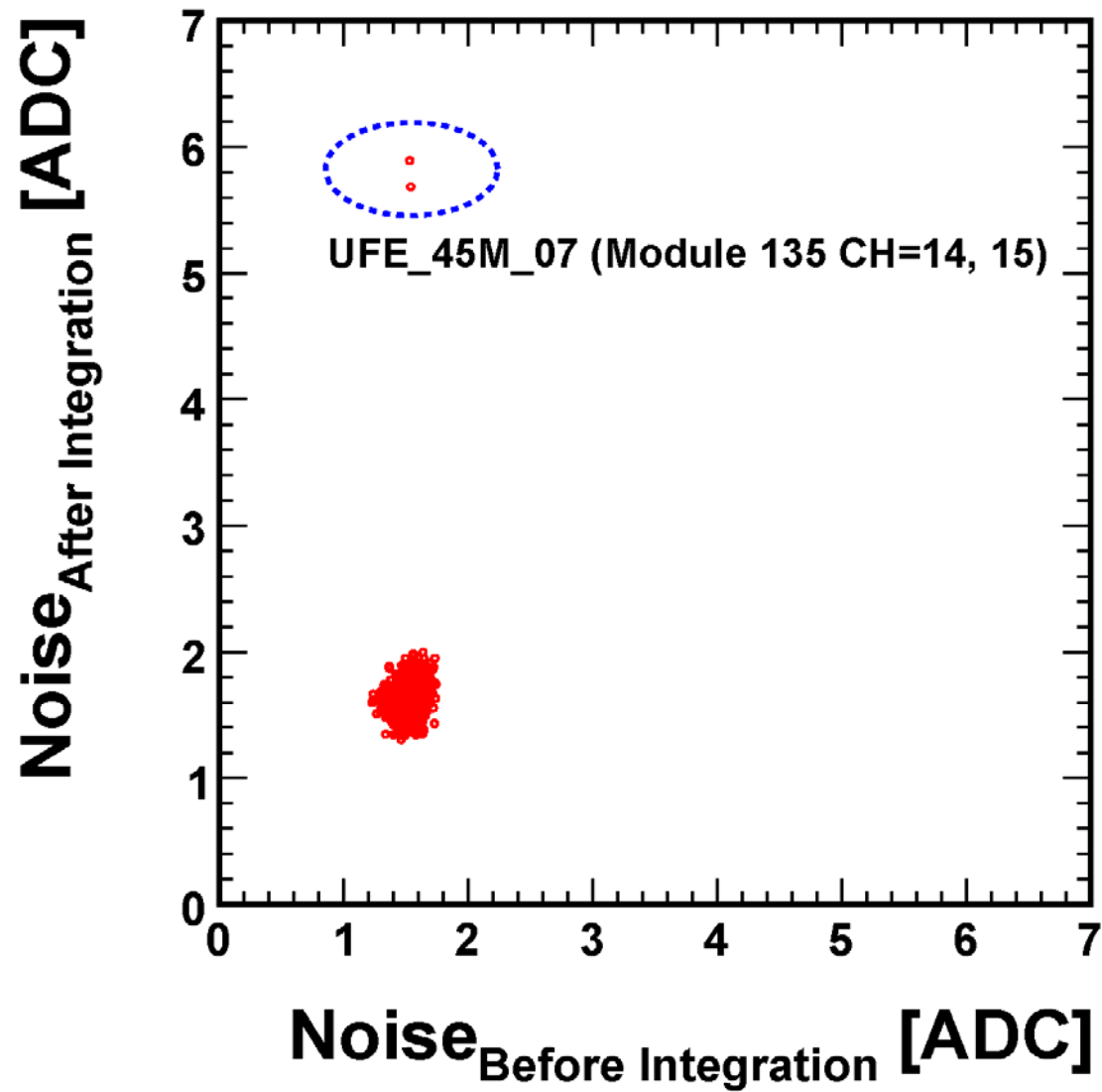
AMS-02 – TRD: Integration of UFE-Boards on Octagon

Documentation TRD UFE-Board Installation				RWTH Physics AC-I
From Module	To Module	Position	Layer-Sceme	UFE-Board-Nr.
257	260	Y-9	L17-20	45 M # 22
261	264	Y-8	L17-20	45 M # 21
265	268	Y-7	L17-20	45 S # 03
269	272	Y-6	L17-20	45 S # 02
273	276	Y-5	L17-20	45 M # 24
277	280	Y-4	L17-20	90 S # 11
281	284	Y-3	L17-20	90 S # 09
285	288	Y-2	L17-20	90 M # 18
289	292	Y-1	L17-20	90 M # 23
293	296	Y+1	L17-20	90 S # 15
297	300	Y+2	L17-20	90 S # 08
301	304	Y+3	L17-20	90 M # 17
305	308	Y+4	L17-20	90 M # 22
309	312	Y+5	L17-20	45 S # 24
313	316	Y+6	L17-20	45 M # 15
317	320	Y+7	L17-20	45 M # 16
321	324	Y+8	L17-20	45 S # 21
325	328	Y+9	L17-20	45 S # 01

Replaced by
UFE 45 M # 10



AMS-02 – TRD: Integration of UFE-Boards on Octagon



AMS-02 – TRD: Integration of UFE-Boards on Octagon

