TRT barrel acceptance tests

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- Description of acceptance tests
- Status

The task

107 modules to be tested

- 32 modules each of type 1, 2 and 3 needed for the detector
- +2 modules of each type for test beam
- +2 spares for type 1 and 3
- +1 spare module for type 2

More than 117 000 wires to checks

The goal

- Ensure that all TRT barrel modules are properly functioning and will remain so for at least 10 years
- Identify problematic wires; replace when possible, remove otherwise
- Make sure that all anomalies are detected and fixed
- Improve module quality
- Aim for less than 1% dead channels

The time frame

- Lab preparation started in Sept 2002
- First modules arrived in May 03
- 3 modules ready for test beam in June 03
- Reached production level in September 03
- First module of type 1 delivered for assembly on 12 March 04
- All 107 modules to be delivered by Oct 04

The crew

<u>All acceptance tests</u>

- 1 physicist – since Sept 02
- 1 engineer – since March 03
- 1 post-doc – since Jan 04
- 1 part-time student in 2004

<u>Gain mapping - Hampton U.</u>
(since Jan 04)

- 1 operator/data manager
- 1 part-time technician
- 1 physicist in Hampton

Acceptance tests and required time

Unpacking, inspection and dimension tests	1 hour per module
Tension test Data analysis	2-4 hours/module 1 hour/module
HV checks	3-7 days per module

Replace problematic wires identified during tension test, HV checks and gain mapping prior to shipment; do all other needed repairs

Acceptance tests (cont.)

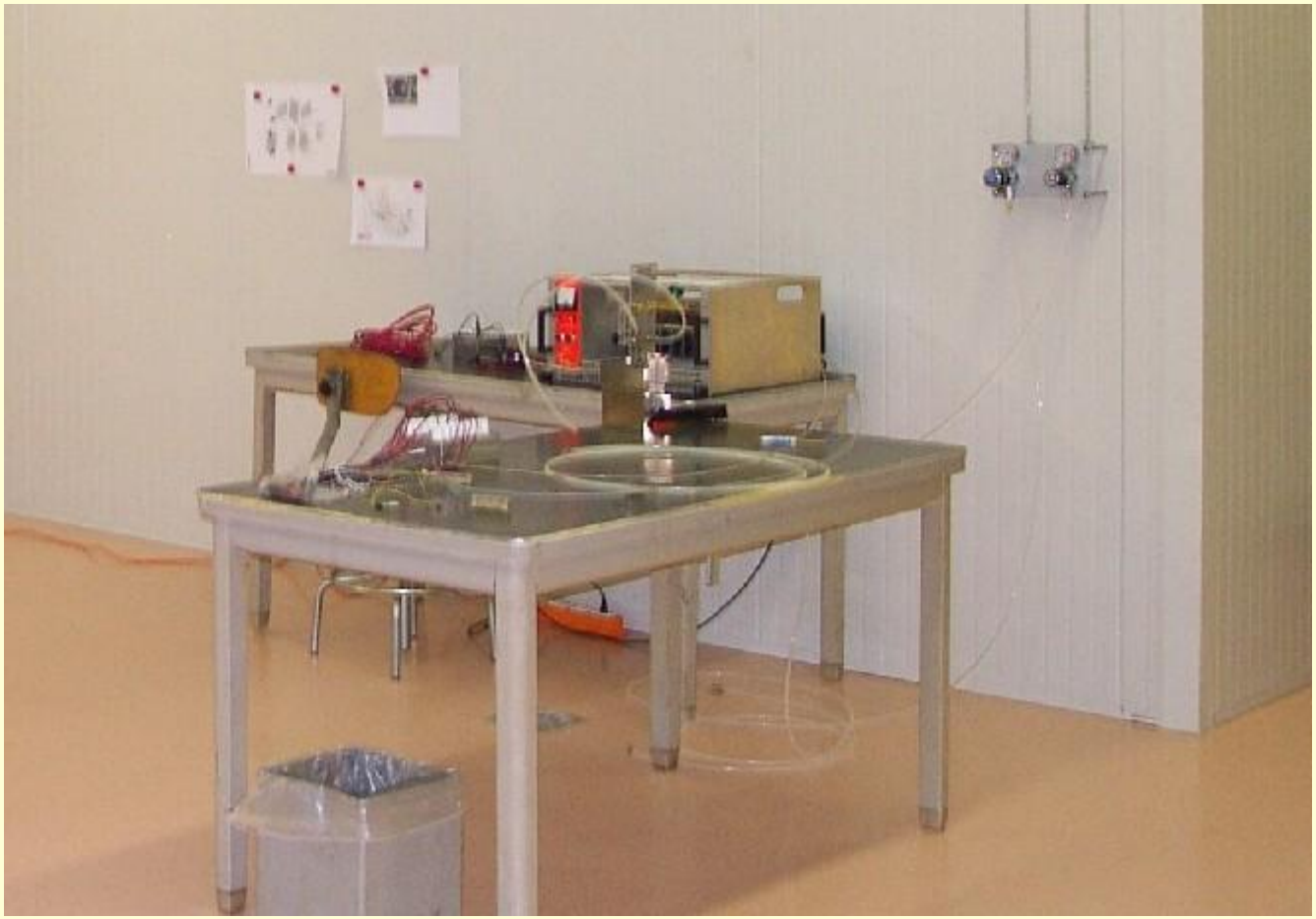
Rework	3-12 hours/module
HV final checks	3-7 days
Gain mapping	1-2 day/module
Long-term HV test	1-2 hours/day (18 modules)
Active gas leak test	1 hour for setup + analysis; test overnight

Acceptance lab at CERN

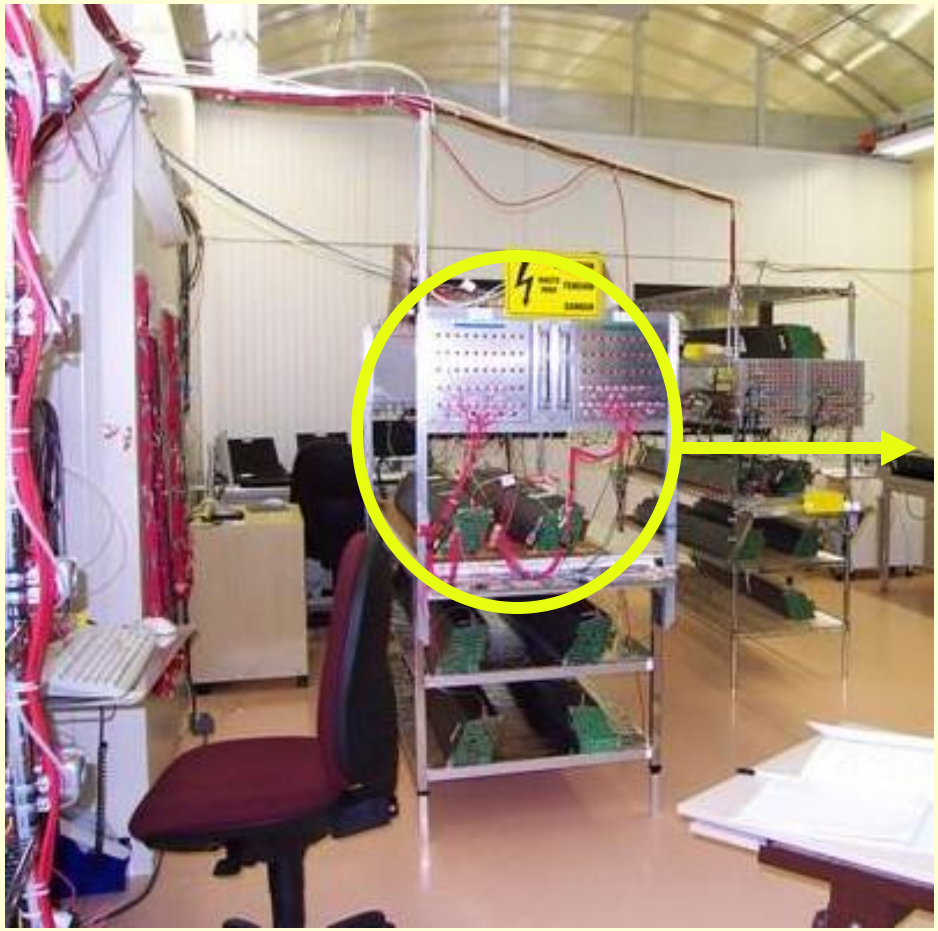
The way it looked in September 02

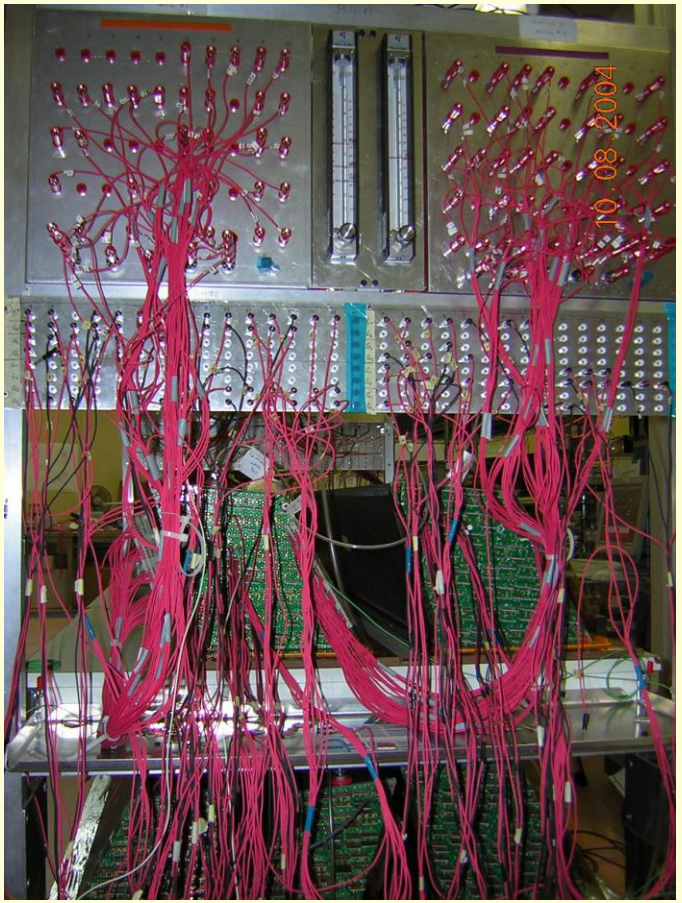
Acceptance test facility now

HV test station in Fall 2002

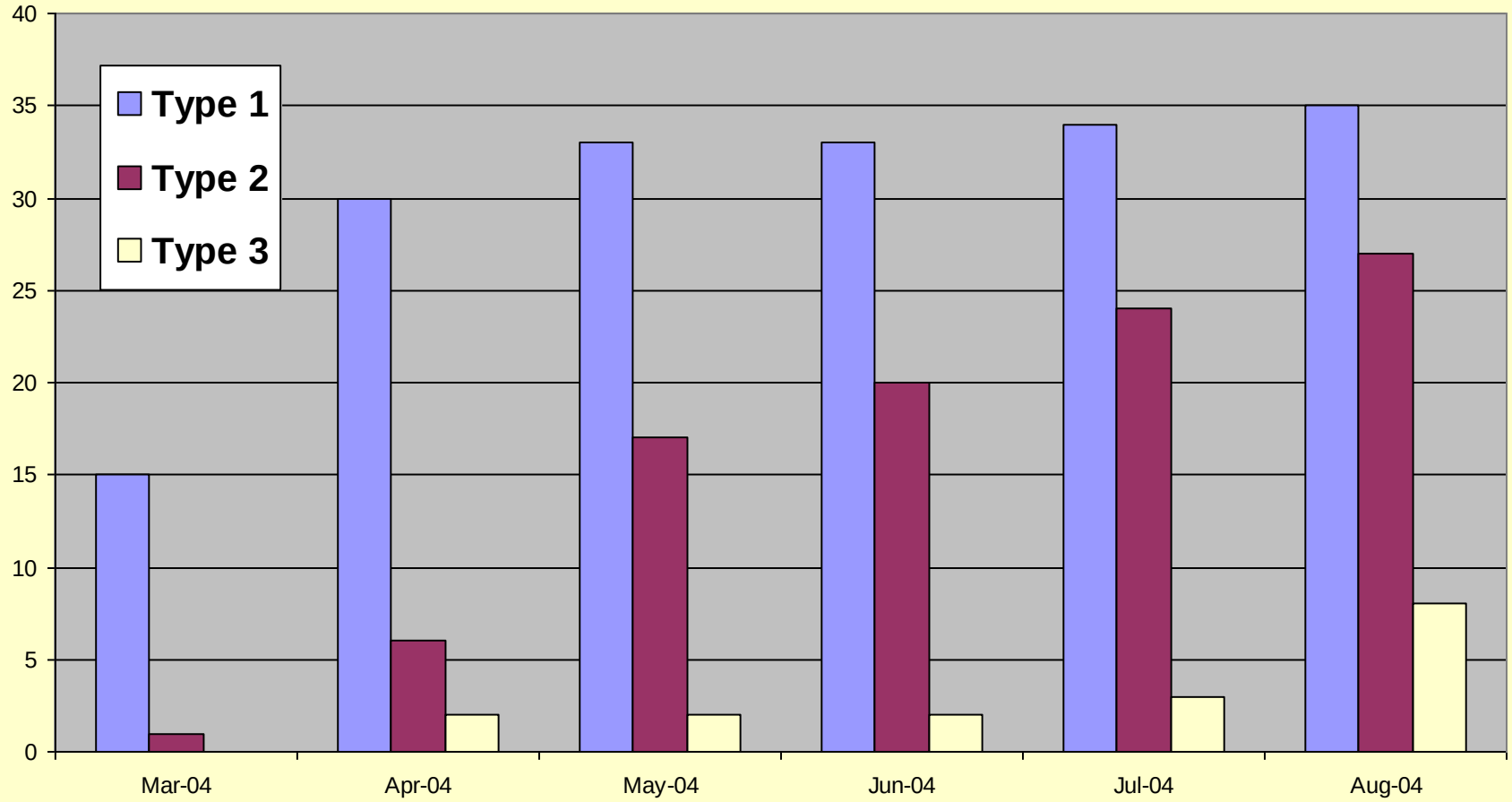


HV test stations now

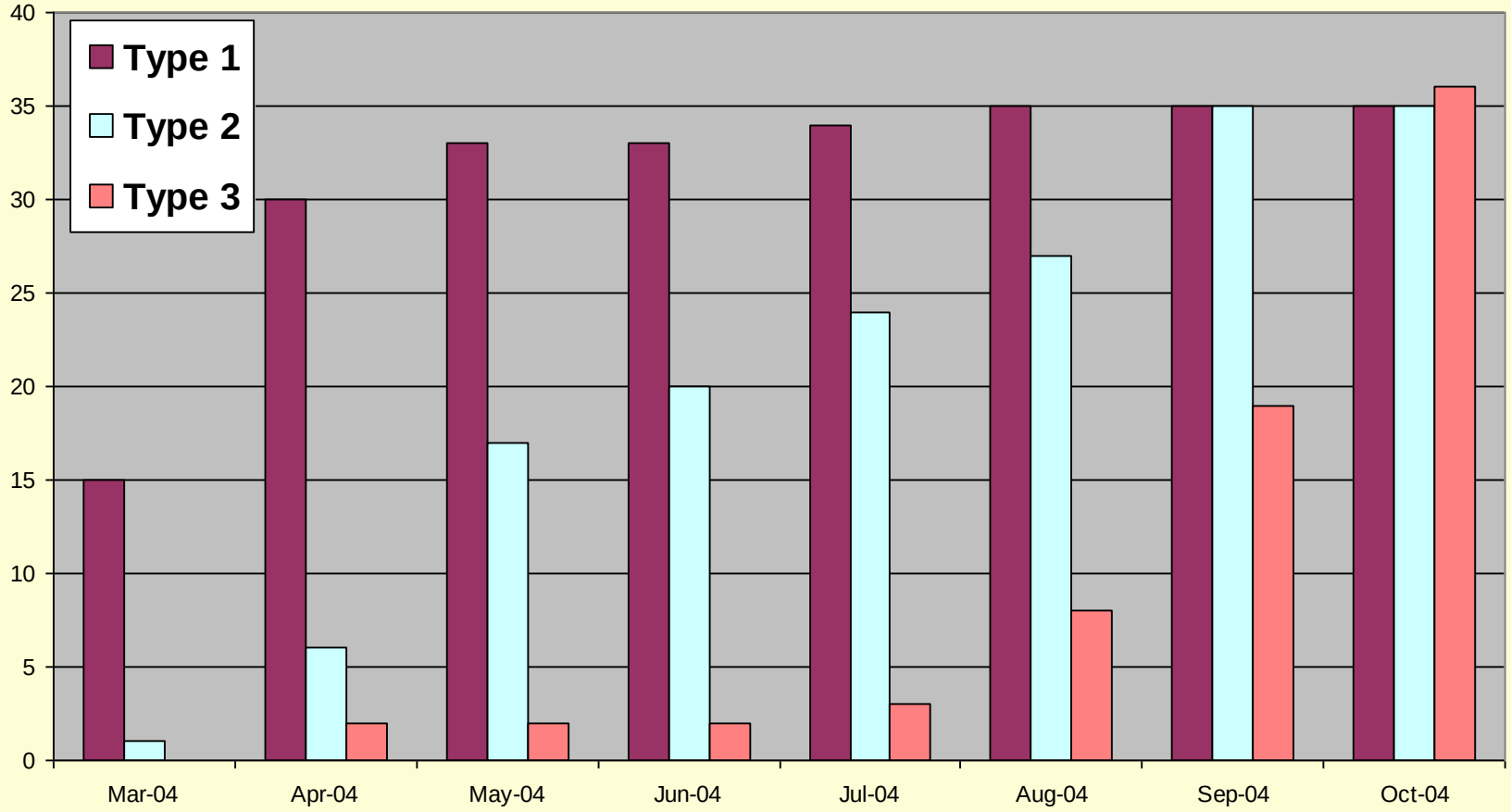




Delivered modules: 61 so far



Projected module delivery

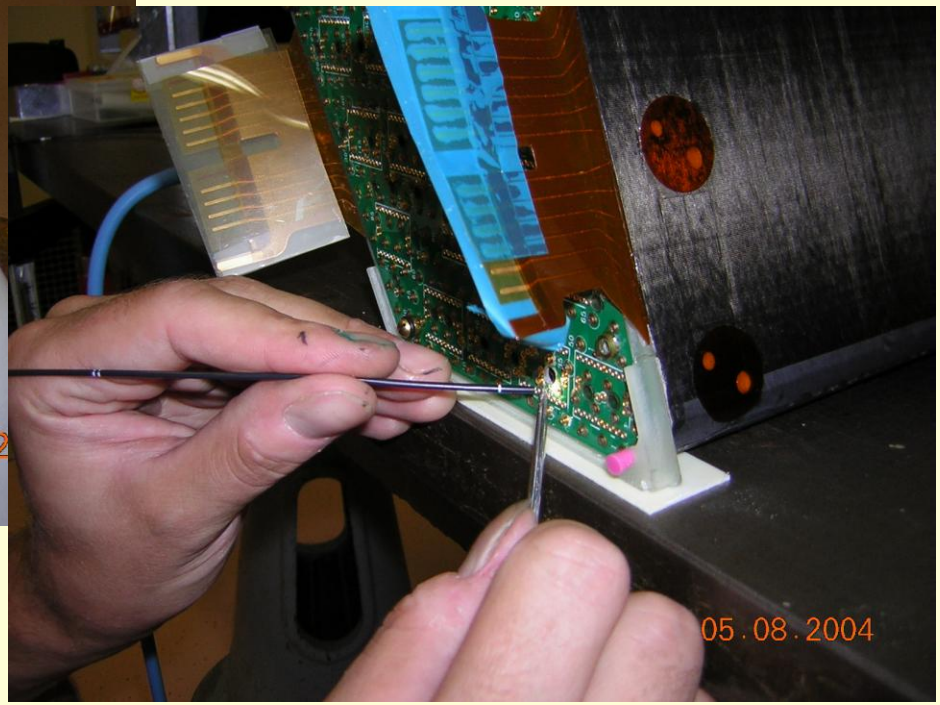


Improved quality: replaced wires

gain mapping in US	297	35.7%
HV problems	233	28.0%
dead at production site	180	21.6%
tension	122	14.7%
total	832	100.0%

Special repairs: lost pieces of wire between HV and tension plates

5 modules so far



Dead channels per modules

completed modules	% dead channels	best modules	worse modules
32 type 1	1.23%	1.21: none	1.26, 1.37: 11 dead each
35 type 2	0.56%	2.07, 2.36: none	2.14: 7.5 dead

Not enough type 3 completed to be meaningful

Expected number of dead channels

module type and fraction of wires	dead	modules completed
Type 1 (20%)	1.23%	100 %
Type 2 (32%)	0.56%	78%
Type 3 (48%)	~3.0%	8%
Combined	~1.9 %	65%

Documentation

- All information on dead channels, anomalies, repairs, tension data and gain mapping data summarized in a "module passport"
- Accessible on the web (Oracle database)
- Also allows anybody to get general statistics, global information etc.

Summary

- Modules quality has greatly improved
- All modules will have been tested for long-term HV stability
- Many problems undetected at production sites have been found and fixed
- Quality and state of the modules better known and documented
- Modules delivered in time for installation despite modules late arrival