

Tests of Drift Tube Chambers at CERN

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Drift Tube Chambers Tests at ISR and SX5

Ingredients for ISR Tests:

- **DTCs:** tested at production sites and equipped with Front End electronics and HV boards
NO minicrates until 2003 !!
- **HV:** Power supplies, cables and monitoring programs. Plan to convert to final hardware (even prototypes) as soon as possible:
1 MF(SY1527), (1 Primary Channel(A876) + 12 MacroChannels(A877) + 1 Junction Box)/Chamber
- **LV:** supplies and cables;
- **Electronics:** TDCs +.....;
- **DAQ:** stand alone system with monitoring program;
- **Trigger:** scintillators for coarse cosmic ray trigger;
- **Gas System;**
- **Operators.**

Before the DTC can be installed in the wheels we need:

- Alignment survey;
- RPCs equipped with on board electronics.

According to our sliding schedule we should have 98 DTCs by the end of next year, champagne is on order for 60 DTCs and Chianti for 40. At any rate we should have chambers ready for testing at the ISR in 2001.

⇒ Get ready the hardware for the test station

DTC Tests at the ISR:

In the absence of the minicrates (i.e. standard electronics on board the DTCs) it is not feasible to make a full test of more than one chamber at a time.

⇒ 800 TDC channels for MB3

However it would make the testing more efficient to have at least two DTCs under HV at the same time.

The following is a possible list of tests to be done at the ISR, not necessarily in this order:

- Gas tightness of each SM;
- Pulser test;
- Noise test with HV Off at several thresholds;
- Noise test with HV On " " " ;
- Monitor and store current drawn by HV channels;
- Cosmic ray with ϕ and θ scintillator trigger.
This can be done in many varieties depending on the time and resources available:
 - full chamber coverage with scintillators,
 - fixed scintillator strips at:
HV side, middle and FE side,
 - movable scintillator strip,

In all case the trigger should be made by a coincidence of counters above and below the DTC under test.

⇒ Impact on stacking system foreseen for the DTCs

⇒ keep the scintillator array simple and easy to move.

To make this exercise useful

it is necessary to analyze the data.

With any reasonable CR trigger it should be possible to test one chamber in one day including switching the read-out cables.

Assuming that two DTCs are under HV at the same time one chamber would be under HV for a day before the CR test.

Drift Tube Chambers Tests in SX5

In my preferred scenario the DTCs and the RPCs should be transported separately from the ISR to SX5 and should be coupled there using the mounting jig foreseen for chamber installation.

This requires a fair size assembly room with two DTCs in their mounting jigs at all times during installation.

Pre-Installation Tests:

Gas tightness test:

this might be required or not depending on the failure rates found at the ISR.

pulser test:

HV test: to check for broken wires.

The feasibility of this scenario rests on the availability of several mounting jigs for the DTCs which would decouple the testing of the DTCs (and the coupling with the RPCs) from the actual installation of the chambers in the iron pockets.

After the installation of a few chambers it will become more evident which tests are really needed but we should have a conservative scenario where these tests are needed and we should ask for an adequate space at SX5 to prepare the chambers for installation.

If the tests are not needed, the availability of several mounting jigs and a reserved area would help in speeding up the installation procedure.

Tests on Installed Drift Tube Chambers in SX5

Some of the wheels will be equipped with DTCs and RPCs for a long time before they are installed in UX5

⇒ Opportunity to make a **System** test of the DTCs.

Goals :

- rough chamber alignment,
- map of noisy channels (if any),
- check trigger electronics,
- develop algorithms for DTC monitoring/debugging with cosmic rays, during LHC shutdowns.
- develop/debug Slow Control system.

Constraints:

- minimize construction/development of special purpose hardware,
- minimize manpower requirements,
DTC installation is top priority,
- smooth transition to canonical CMS DAQ.

⇒ Two Sectors in working conditions

Requirements:

- gas (premixed battery), HV,LV (for sectors under test),
- cooling,
- minimal scintillator trigger (inside wheel),
- stand alone DAQ, Slow Control, interlocks.

The feasibility of this scenario rests on the availability of “fully” equipped wheels:

- **Minicrates,**
- **HV Junction boxes.**

⇒ Develop scenario for priority of available minicrates
For instance:

- **Burn in:** where is it done, how long it takes,
- **Installation:** chamber construction sites will be in full production before the minicrates are available.
All QC tests already done without minicrates:
⇒ install minicrates at CERN
- **Priority:** install minicrates in new chambers before insertion in wheels or in already installed chambers?

⇒ Depending on schedule of minicrates delivery and/or of LHC start-up, not much time might be available for system tests in SX5!!

⇒ Scintillator trigger for wheels probably not high priority

⇒ Use self triggering mode of DTC with cosmic rays. This is in principle possible but it should be tested at the ISR where the cosmic trigger will be available.

This requires additional hardware to be built.

According to Martinelli there is an option to make coincidences of DTCs self triggers. This should be implemented since it would allow to trigger across a sector, or even sector to sector.