

## Metrology DESY testbeam

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## **Measuring chip position**

- Use the alignment microscope with LabVIEW controlled XY stage
  - Stage range 100 x 100 mm => we have to do it in two steps with a number of points in overlap
- Use LabVIEW program to move to all measuring points
  - XY by manual fine adjustment, automatic coordinate recording
  - Z by autofocusing of microscope => coordinate recording by hand!
  - Also measurement of guard height





#### Metrology on testbox

- All chips characterized by 3 points in XYZ
- = => 96 points + 12 guards
- Measurement accuracy few μm
- Quad 4 has been recently investigated with the laser





#### Metrology on testbox

- 2 measurement files have been joined
  - Using 8 overlap points
  - Rotation and translation in XY plane
  - Rotation in YZ plane and translation in Z
- Resulting joined file has been tilted in the XZ plane to correct for the thickness variation of cooling plate

#### Chips metrology in 8-quad testbox

Measurements of 18-4-2019 Meas 1 and 2 joined on 12-9-2019 Meas 2 aligned to meas 1 using the 8 overlap points of quad 5 and 6 Afterwards linear tilt correction in X applied



#### Metrology on testbox

- Remaining Z errors partly due to unflatness of cooling plate
- Guards have more deviation at some points
- Resulting joined measurement file can be found on \\Beuk\lepcol\users\fredh\Testbox metrology\testbox position file 4-18-2019 full rot.txt

#### Chips metrology in 8-quad testbox

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# **DESY testbeam**

 In 1T magnet of ILC-TPC magnet in TB24/1

## => non-magnetic components needed

Stages

Actuators

- Which period?
  - Dec 9 16??

#### **DESY testbeam**



#### DESY Test Beam Schedule 2019 - Version 8 02/08/2019



Ralf Diener, Norbert Meyners, Marcel Stanitzki - DESY Test Beam Coordinators

	Week		TB21		TB22		TB24/1		ТВ24		
				DATURA		DURANTA	PCMAG	Telescope in PCMAG		AZALEA	
2-Sep-19	36		CMS-Pixel-Phase2		Setup Time						
9-Sep-19	37		CMS-Pixel-Phase2	х	ATLAS-ITk-Strips	х			CEPC-STCF	х	
16-Sep-19	38		AFP-TOF	х	Mu3e	x			CEPC-STCF	х	
23-Sep-19	39		CLIC PIXEL	х	ATLAS-ITk-Pixel	x	ТРЕХ		ΤΟΤΕΜ	х	
30-Sep-19	40		X-Ray-Crystal-Rad	х	ATLAS-ITk-Pixel	х	ТРЕХ				Ż
7-Oct-19	41										Q
14-Oct-19	42		BL4S	Х	SHiP-SplitCAL				ATLAS-ITk-TJCMOS		
21-Oct-19	43		BL4S	х	SHiP-SciFi						
28-Oct-19	44		CMS-Pixel-Phase2	х	SHiP-SciFi				SHiP-Emulsion+Ship-SBT		
4-Nov-19	45		CMS-Pixel-Phase2	х	ATLAS-HGTD	x			LHCb-ECAL	х	
11-Nov-19	46		FCAL	х	ATLAS-HGTD	х			LHCb-ECAL	х	
18-Nov-19	47				Setup Time						
25-Nov-19	48		CMS Outer Tracker	х	ATLAS-ITk-Strips	х			ATLAS-ITk-Pixel	х	
2-Dec-19	49		CMS Outer Tracker	х	ATLAS-ITk-Strips	х			ATLAS-ITk-Pixel	х	
9-Dec-19	50		ELIOT		CMS-Pixel-Phase2	х			Mu3e	х	
16-Dec-19	51	Beam till 20/12 0800	ELIOT		CMS-Pixel-Phase2	х			CLIC PIXEL	х	
23-Dec-19	52		Shutdown								
30-Dec-19	1		Silutiowi								

#### **DESY testbeam Hall 2**



#### **Time structure DESY II testbeams**

- From http://inspirehep.net/record/1683824/plots
- ~1 MHz structure (not relevant for us)
- 12.5 Hz, 40 45% duty cycle





## Solenoid magnet in TB24/1

- Remotely movable vertically and sideward (X and Z)
- Super conducting
  - => no running power needed
  - But how much time does it take to cool it down?
- 1T magnetic field horizontally
- Radiation length magnet wall: 20%
- Inner diameter: 85 cm



#### Floorplan DESY testbeam TB24/1

- Leak tray with all services on wooden table
- DCS PC Levaard also on that table
- Cable length between leak tray and testbox: ~ 8 m
- We cannot lay our own cables between the hut and our area
  - Only possible when all beams are off
  - We have to use available cables/tubing





# Mounting the testbox in the magnet

- Our setup will be mounted on a frame on rails
- Detector has to be installed at ~
  60 cm from the magnet entrance





### Our setup

- Testbox setup mounted on the ILC-TPC moving frame
- Testbox is movable in X and Z wrt telescope frames
- Using non-magnetic stages and pneumatic cylinders
- For each stage we can use 2 + N stable positions
  - N is the number of intermediate stops
  - Minimum distance between stops: 13 mm or 6.5 mm if we stagger the stop cylinders
  - Reproducibility estimated at 30 µm
- Pneumatic operation will be done remotely under LabVIEW control







#### Non-magnetic stages and pneumatics

- Compatible with 1T magnetic field
- 2 stages 152 mm long, 100 mm stroke ordered
  - Expected week 41 (Oct 7 12)
- Actuation pneumatically
  - Double acting cylinder
    - Gently moving
  - 100 mm stroke
  - $\blacksquare$  => 2 stable positions
  - Cylinders have arrived
    - Slightly magnetic
- Use small cylinders for additional stops









#### How many intermediate stops do we need?

- Mimosa26 telescope
  - Pixel size 18.4 x 18.4 um
  - 1152 columns
  - **576** rows
  - => acceptance 21.2 x 10.6 mm (X x Z)
- So with 3 positions in X we cover the full two quad width of 57 mm
  - => 1 intermediate stop
  - Within each position we have to set 7 different positions of the magnet to cover the full area of the quads with the 3 mm wide beam
- In Z we might want 4 positions to cover the full 40 mm drift range
  - $\blacksquare$  => 2 intermediate stops



#### Gas management

- We will use the existing T2K gas bottle from ILC-TPC
  - Located in TB24
  - Full 501 bottle contains ~ 70 bar
  - We use maximum 3 l/h => one bottle is sufficient for 1.5 month
- We use the ILC-TPC gas regulation system
  - Probably too high flow => we put our own regulation system in series to the existing gas tubing
  - Both for inlet and exhaust





Gas inlet and exhaust Flexible tubing near magnet



Nikhef/Bonn LepCol meeting, September 23, 2019

#### ILC-TPC gas regulation



Bottle cabinet

#### **Running the testbeam experiment**

- We can easily have access if needed (own shutter)
  - But we depend on the TB24 experiment which beam or if there is a beam at all
  - In December ~ 3 GeV
- 2 stage systems each in X and Z
- Magnet + telescope + testbox
  - 6 7 positions of 3 mm apart in X
  - ~3 positions of 3 mm apart in Z
    - Positions NOT logged, but can be deduced from data
- Pneumatic system moving the testbox alone
  - 3 positions of ~ 20 mm apart in X
  - ~ 4 positions of ~ 10 mm apart in Z
  - Pneumatic positions can be logged
- For a full scan across the width of the testbox at a single drift distance (Z) we have to move the magnet about 20 x and the pneumatically driven stage 2 x
- We need a rapid feedback (event display) of the telescope position in the beam

Note that the X of the magnet stage is the Z of our testbox

#### Organization

- Hut is very crowded
- => hard to find a place for remote desktop DCS PC and DAQ PC (Arawana)
  - 2 x screen, keyboard, mouse
- Blue sea container as additional sitting room
  - But that may be crowded as well







- Transport of equipment by (rented) car
- Everybody needs to attend a safety training
  - Only given on Monday morning
  - We probably have to send our credentials (name, address, sofi nr, ....) in advance

**Organization** (cntd)

- Pass needed to enter the experimental hall
  - Given after the safety training
- Who will attend the testbeam? 7 potential candidates:
  - Peter
  - Fred
  - Jan
  - Kees
  - Harry?
  - Gerhard?
  - Naomi?
  - We will use a lot of DESY / ILC-TPC /Bonn services that we have not tested before
    - > we have to schedule a second day for installation
    - Can we install our equipment when the magnet is cooled down?

#### **Critical issues: Using DESY / ILC-TPC services**

- Optical fibre is said to be compatible with the one we use
  - Type LC
  - Multimode
  - To be verified: are there **two** optical fibre harnesses available?
- One Ethernet cable exists for remote control DCS PC
- Using ILC-TPC gas flow control
  - Will our couplings fit?
  - Too high backpressure, pollution, problems with operation?
  - Will there be a sufficiently filled gas bottle ( $P \ge 20$  bar)?
- Will the remote control of the magnet operate properly?
- Which Mimosa planes will we use?
  - Bonn?
  - DESY?
  - Problems when getting it operational and synchronizing the data?



#### **Critical issues: Nikhef equipment**

- Making our own non-magnetic setup
  - Time scale looks good
  - Mechanical parts expected to be ready end of October
- Services
  - 8 m long HV cables, LV cables, sensor cables, gas tubing, pneumatic tubing, cooling tubing
  - There is sufficient time to finish it all
- Will the concentrators be really operating or do we have to run with one or two quads only?
  Until now the time scale is permanently slipping
- Will the new board for the non-magnetic LV supplies ready in time?

## Reference