

# alignment

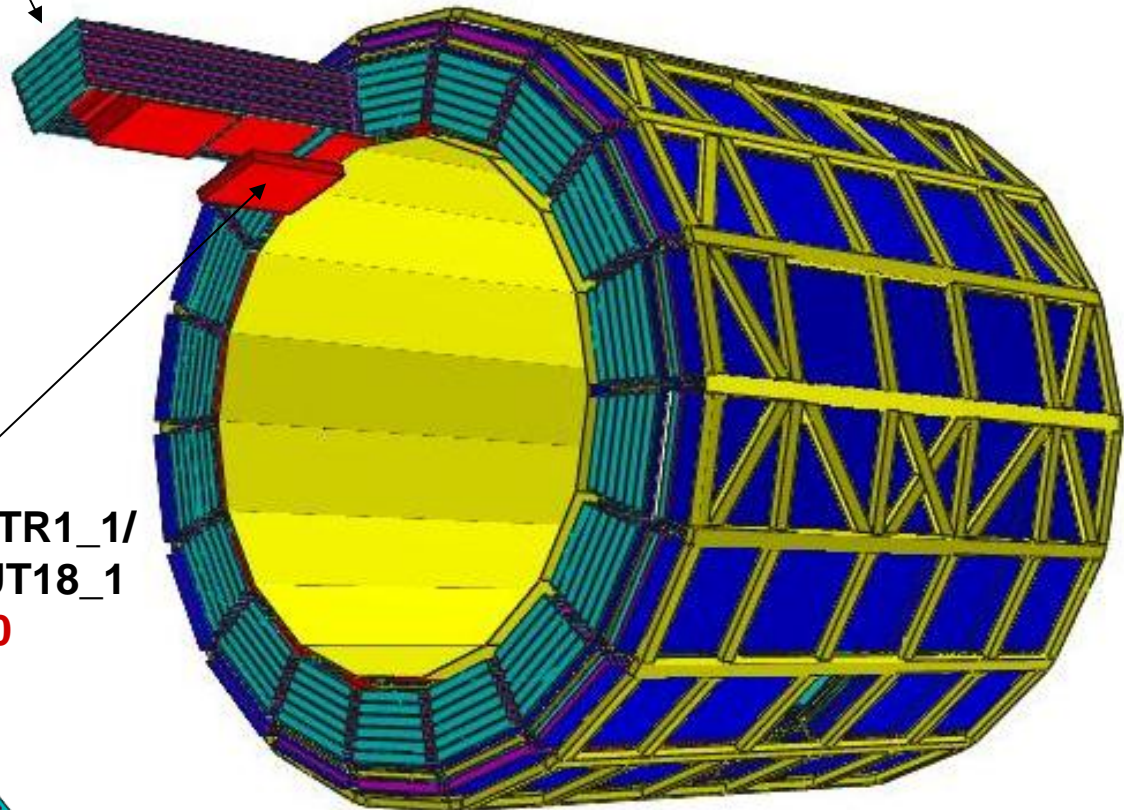
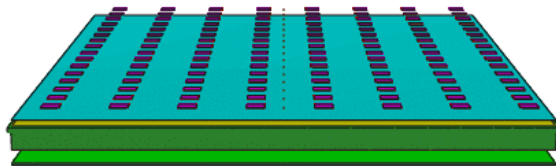
*... i.e. how to figure out where the detectors are,  
and how to use this knowledge in the reconstruction software*

- 📍 **introduction of symbolic names in the geometry**
- 📍 **measurement of chamber positions in SM08**
- 📍 **alignment with cosmics**
- 📍 **SM survey at CERN**

# alignable objects in TRD... and symbolic names

18 TRD supermodules  
like /ALIC\_1/B077\_1/B071\_6/BTR1\_1  
now called /TRD/sm03

540 TRD chambers  
like /ALIC\_1/B077\_1/B071\_6/BTR1\_1/  
UTR1\_1/UTS1\_1/UTI1\_1/UT18\_1  
now called /TRD/sm03/st3/pl0



## new misalignment sets generated

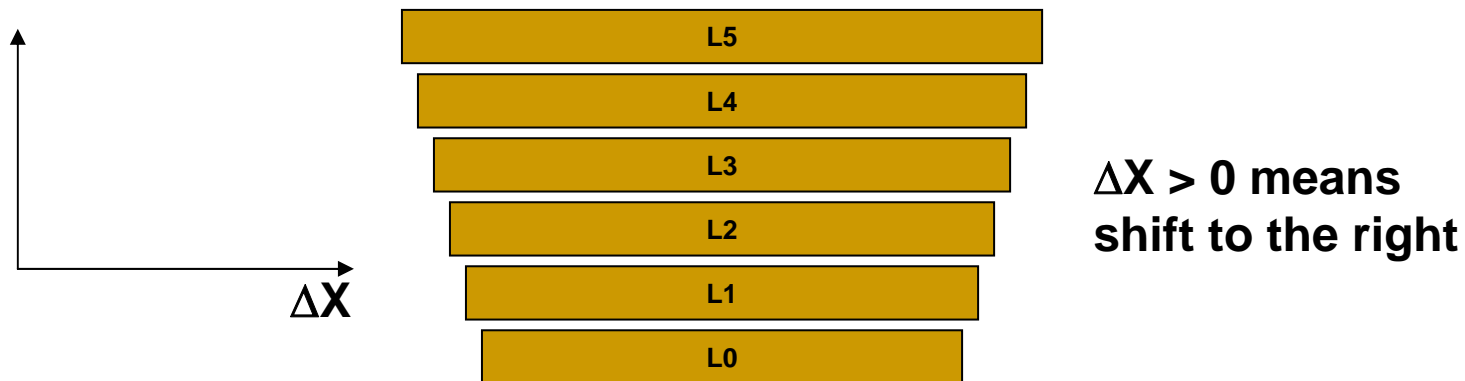
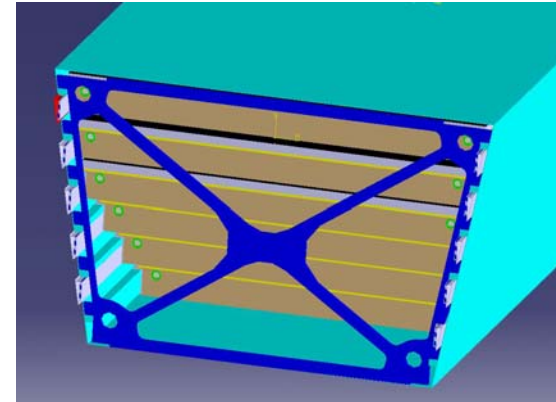
- 🌐 misalignment set using symbolic names generated
- 🌐 like for PDC2006, random Gaussian misalignments with following sigmas:

rdphi (mm)	dz (mm)	dr (mm)	rot phi (mr)	rot z (mr)	rot r (mr)	
3	3	3	0.4	2	0.4	supermodule initial
1	1	1	1	1	0.7	chamber initial
0.02	0.03	0.07	0.3	0.3	0.1	chamber residual

- 🌐 bug in the data sets submitted earlier to PDC discovered: shifts 10 times too large. Chambers displaced in phi by 200 instead of 20 microns (Gaussian sigma). All the PDC runs till last week produced with this misalignment.

# measurement of (some) chamber positions in the first supermodule in Heidelberg

- 🌀 crude caliper measurements
- 🌀 only phi
- 🌀 only first and last stack
- 🌀 only some of the chambers
- 🌀 trying not to damage the cables, light guides, hoses, etc.
- 🌀 5 methods: A,B,B',C,D



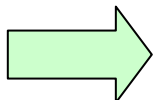
# measured chamber displacements $\Delta X$ in mm in phi

## opposite to muon-arm side

	A	B	B'	C	D
L5			$2.47 \pm 0.23$		
L4					$-3.0 \pm 2.2$
L3		$-2.93 \pm 0.71$		$-2.16 \pm 0.25$	$-3.0 \pm 1.4$
L2		$0.15 \pm 0.35$			$0.5 \pm 1.4$
L1		$2.10 \pm 0.21$		$1.76 \pm 0.52$	
L0		$-1.55 \pm 0.88$		$-2.33 \pm 0.35$	

## muon-arm side (the one with thick gas pipes, optic fibers)

	A	B	B'	C	D
L5			$-4.22 \pm 0.12$		



- 🚫 somewhat worse than the expected  $\Delta X=1$  mm
- 🚫 parallel shift of a whole layer rather than rotation

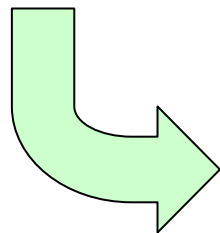
# alignment with cosmics

## running standard alignment procedure

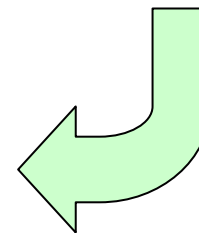
- 🌐 understand TPC alignment done by Marian (volume-to-volume)
- 🌐 TPC volume to TRD volume
- 🌐 TRD volume to TRD volume

## looking at cosmic events

- 🌐 translated to digits by Minjung
- 🌐 clusterizing works
- 🌐 standalone TRD tracking
- 🌐 ESD files



**TRD volume to volume  
on cosmic events**



# survey of the supermodules at CERN

- 🕒 this year: survey A-side of the first supermodule
- 🕒 procedure survey data → software
- 🕒 after the second TRD installation slot:  
survey all existing supermodules
- 🕒 then, alignment strategy: align supermodules based  
on the survey, align chambers based on tracks

**now I would like to ask them to go and do it**

- 🕒 with whom to discuss details?
- 🕒 position of our target holes?

# Calibration and alignment variables, part 1

parameter	source	sim	rec	nr	size	total MB	update freq.
- position of supermodule (cm,deg)	survey	OK	OK	18x6	float	0.0004	year
- position of chamber (cm,deg)	analysis of 1e5 pp events	OK	OK	540x6	float	0.012	hour
- pad drift velocity factor	analysis of 1e8 pp events	OK	OK	1.2e6	ushort	2.3	year
- pad T0 (timebin)	analysis of 1e8 pp events	OK	OK	1.2e6	ushort	2.3	year
- pad gain factor	analysis of 1e8 pp events	OK	OK	1.2e6	ushort	2.3	year
- pad resp. funct. width (pad)	analysis of 1e8 pp events	OK	?	1.2e6	ushort	2.3	year
- chamber drift vel. (cm/timebin)	analysis of 1e5 pp events	OK	OK	540	float	0.0021	hour
- chamber drift T0 (timebin)	analysis of 1e5 pp events	OK	OK	540	float	0.0021	hour
- chamber gain	analysis of 1e5 pp events	OK	OK	540	float	0.0021	hour
- dedx histogram	offline analysis or sim.	--	OK	55	hist	0.052	year
- max timebin histograms	offline analysis or sim.	--	OK	55	hist	0.052	year
- clock frequency (MHz)	readout config	OK	OK	1	float	0	run
- number of timebins	readout config	OK	OK	1	int	0	run
- status byte of superm.	readout config	con	--	18	char	0	run
- status byte of chamber	readout config	OK	?	540	char	0.00051	run
- status byte of MCM	readout config	OK	?	6.7e4	char	0.064	run
- status byte of pad	readout config	OK	?	1.2e6	char	1.1	run
- FEE gain correction	readout config	--	--	1.2e6	ushort	2.3	run
- ADC thresholds	readout config	--	--	6.7e4	char	0.064	run
- pretrigger information	DCS Archive DB	--	--	1024	char	0.001	run



# Calibration and alignment variables, part 2

parameter	source	sim rec	nr	size	total MB	update freq.
- goofy: HV	DCS Archive DB	-- --	1	float	0	minute
- goofy: peak1 pos	DCS Archive DB	-- --	1	float	0	minute
- goofy: peak2 pos	DCS Archive DB	-- --	1	float	0	minute
- goofy: peak1 area	DCS Archive DB	-- --	1	float	0	minute
- goofy: peak2 area	DCS Archive DB	-- --	1	float	0	minute
- goofy: temp1	DCS Archive DB	-- --	1	float	0	minute
- goofy: temp2	DCS Archive DB	-- --	1	float	0	minute
- goofy: pressure	DCS Archive DB	-- --	1	float	0	minute
- goofy: velocity	DCS Archive DB	-- ?	1	float	0	minute
- goofy: gain1	DCS Archive DB	-- --	1	float	0	minute
- goofy: gain2	DCS Archive DB	-- --	1	float	0	minute
- goofy: CO2	DCS Archive DB	-- --	1	float	0	minute
- goofy: N2	DCS Archive DB	-- --	1	float	0	minute
- O2 content in gas	DCS Archive DB	-- --	1	float	0	minute
- chamber gas overpressure	DCS Archive DB	-- --	1	float	0	minute
- environment temperature	DCS Archive DB	-- --	18x4	float	0.00027	minute
- HV chamber anode currents	DCS Archive DB	-- --	540	float	0.0021	minute
- HV chamber drift currents	DCS Archive DB	-- --	540	float	0.0021	minute
- HV chamber anode voltages	DCS Archive DB	-- --	540	float	0.0021	minute
- HV chamber drift voltages	DCS Archive DB	-- --	540	float	0.0021	minute
- low voltage power distr. box	DCS Archive DB	-- --	18	float	0.0001	minute
- DCS boards voltage	DCS Archive DB	-- --	18	float	0.0001	minute
- low voltage D18	DCS Archive DB	-- --	108	float	0.0004	minute
- low voltage A18	DCS Archive DB	-- --	108	float	0.0004	minute
- low voltage D33	DCS Archive DB	-- --	108	float	0.0004	minute
- low voltage A33	DCS Archive DB	-- --	108	float	0.0004	minute
- low voltage current	DCS Archive DB	-- --	90	float	0.0004	minute

# Calibration and alignment variables, part 3

parameter	source	sim rec	nr	size	total MB	update freq.
- MCM chip temperature	DCS Archive DB		6.7e4	float	0.26	minute
- dcs-board temperature	DCS Archive DB		2160	float	0.082	minute
- low voltage power-bus bar pdb	DCS Archive DB		216	float	0.0008	minute
- low voltage power-bus bar DCS volt	DCS Archive DB	-- --	216	float	0.0008	minute
- low voltage power-bus bar D18	DCS Archive DB		216	float	0.0008	minute
- low voltage power-bus bar A18	DCS Archive DB		216	float	0.0008	minute
- low voltage power-bus bar D33	DCS Archive DB		216	float	0.0008	minute
- low voltage power-bus bar A33	DCS Archive DB		216	float	0.0008	minute
- ADC clock phase in respect to TTC	DCS Archive DB		1	float	0	run
- cooling plant setPoint temperature	DCS Archive DB		1	float	0	minute
- cooling plant readBack temperature	DCS Archive DB		1	float	0	minute
- cooling plant setPoint pressure	DCS Archive DB		1	float	0	minute
- cooling plant readBack pressure	DCS Archive DB		1	float	0	minute
- cooling plant tank pressure	DCS Archive DB		1	float	0	minute
- cooling plant tank level	DCS Archive DB		1	float	0	minute
- cooling plant pump pressure	DCS Archive DB		1	float	0	minute
- cooling plant conductivity	DCS Archive DB		1	float	0	minute
- cooling plant mixed water flowing	DCS Archive DB		1	float	0	minute
- cooling SM setPoint temperature	DCS Archive DB		18	float	0	minute
- cooling SM plant readBack temp	DCS Archive DB		18	float	0	minute
- cooling SM plant setPoint pressure	DCS Archive DB		18	float	0	minute
- cooling SM plant readBack pressure	DCS Archive DB		18	float	0	minute
common alice stuff:						
- atmospheric pressure	DCS Archive DB	-- --	1	float	0	minute
- luminosity	DCS Archive DB	-- --	1	float	0	minute
- magnetic field	DCS Archive DB	con con	1	float	0	minute