ALICE First Alignment Plans
(Use of Survey Data)

2nd LHC Detector Alignment Workshop

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What will ALICE detectors use for first alignment?

- Survey of the active elements

- Survey of the final detector positions

- Survey of supporting structures

- Geometry monitoring systems:
  - Spaceframe (BCAMS based)
  - MUON - GMS (see talk by R. Tieulent)
  - ITS (see talk by R. Tieulent)

Sources of Survey Data

- **TS/SU - CERN Survey Team:**
  - Survey during assembly / alignment
    - Ex: ROC in TPC, Crystals in PHOS
  - Survey in the final position
    - Ex: TPC, TRD, PHOS, HMPID, VZERO
  - Supporting structures
    - Ex: Rails for ITS, Spaceframe
- **Survey during construction / assembly:**
  - Individual detector components
    - Ex: ITS - SDD, FMD
- **Precisions (TS/SU):**
  - Photogrammetry - typical < 0.5 mm w.r.t. ALICE rs
  - Theodolite - mm range
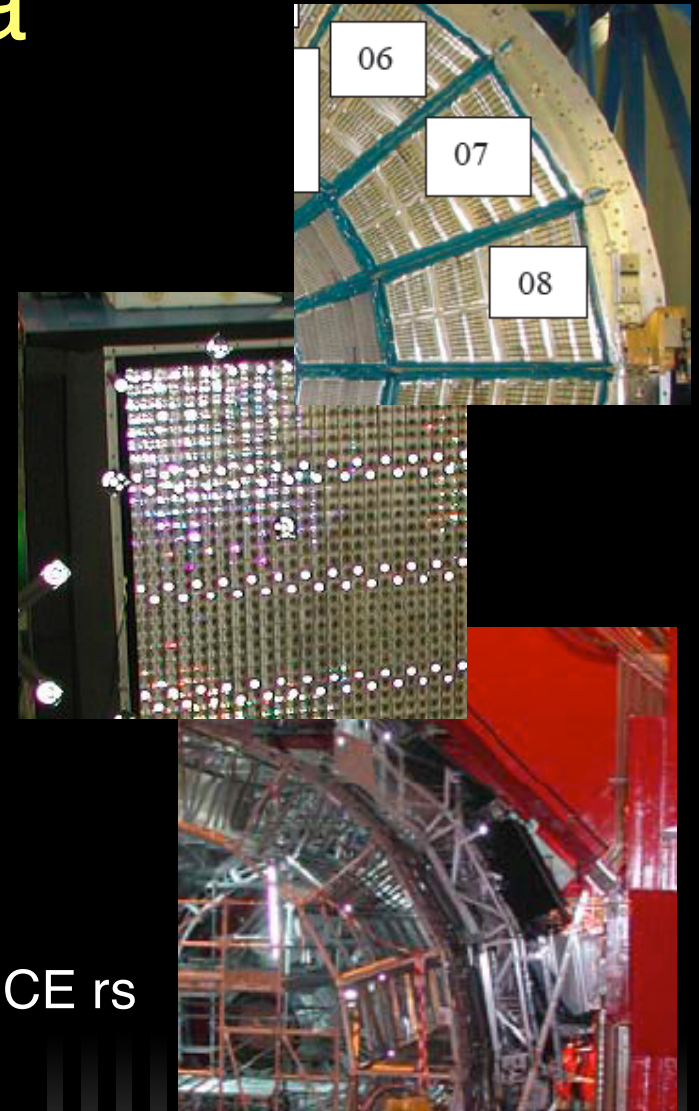
Format of survey data: Problem

- TS/SU produced data is available in EDMS as a PDF report
- Data produced internally by the detectors is available as Excel files or text files
- Unpractical for use in alignment procedures
- Initially detectors used "copy-paste", unsafe!

ALICE-TPC Readout chambers

2.3.2 Coordinates:

The global accuracy with respect to the EDMS 526340) is 0.2 mm (one sigma). Relative (one sigma).

All coordinates are given in the center of t offset of the targets with respect to the contact sur

After transformation, the coordinates o following table-2.2:

Name	X (mm)	Y (mm)	Z (mm)		N
R01	2999.62	-797.52	2527.47		
R02	2999.68	-2587.84	573.11		
R03	2999.50	-1791.22	-1954.21		
R04	2999.67	797.15	-2528.06		
R05	2999.72	2587.46	-573.92		

Format of survey data: The (ALICE) Solution

- Defined an ALICE-wide structured text file format (raw survey files)

- Used a basic set of rules to build the files

- In cooperation with TS/SU, biggest survey data producer for ALICE

- Production of this file is now part of TS/SU normal procedure (for relevant measurements)

- EDMS Number and Version still used to identify each report, eliminates completely any ambiguity

Raw Survey file

- Stores basic survey report description:
  - EDMS Report number, version
  - Date
  - Short description
  - Coordinate system
- For each point:
  - Point name
  - Coordinates
  - Precision
  - Target used (Yes/No)
  - Type of point (Measured/Transformed)
- Flexible

```
> Title:
PHOS MODULE # 2 - CALIBRATION and DEFORMATIO
PHOTOGRAMMETRY
> Date:
11/09/2006
> Subdetector:
PHOS
> Report URL:
https://edms.cern.ch/document/772860
> Version:
1
> General Observations:
Measurement of the 08/09/2006 is with prefix
Measurement of the 11/09/2006 is with prefix
Point Types: M(easured),T(ransformed), R(efe
> Coordinate System:
LOCAL
> Units:
mm
> Nr Columns:
7
> Column Names:
Point Name,XLOCAL,YLOCAL,ZLOCAL,Point Type,
> Data:
T1_5000,-14.02,155.69,-41.19,R,Y,0.08
T1_5001,1436.54,154.47,-44.59,R,Y,0.08
T1_5002,1435.6,155.42,1292.74,R,Y,0.08
```

Dataflow overview
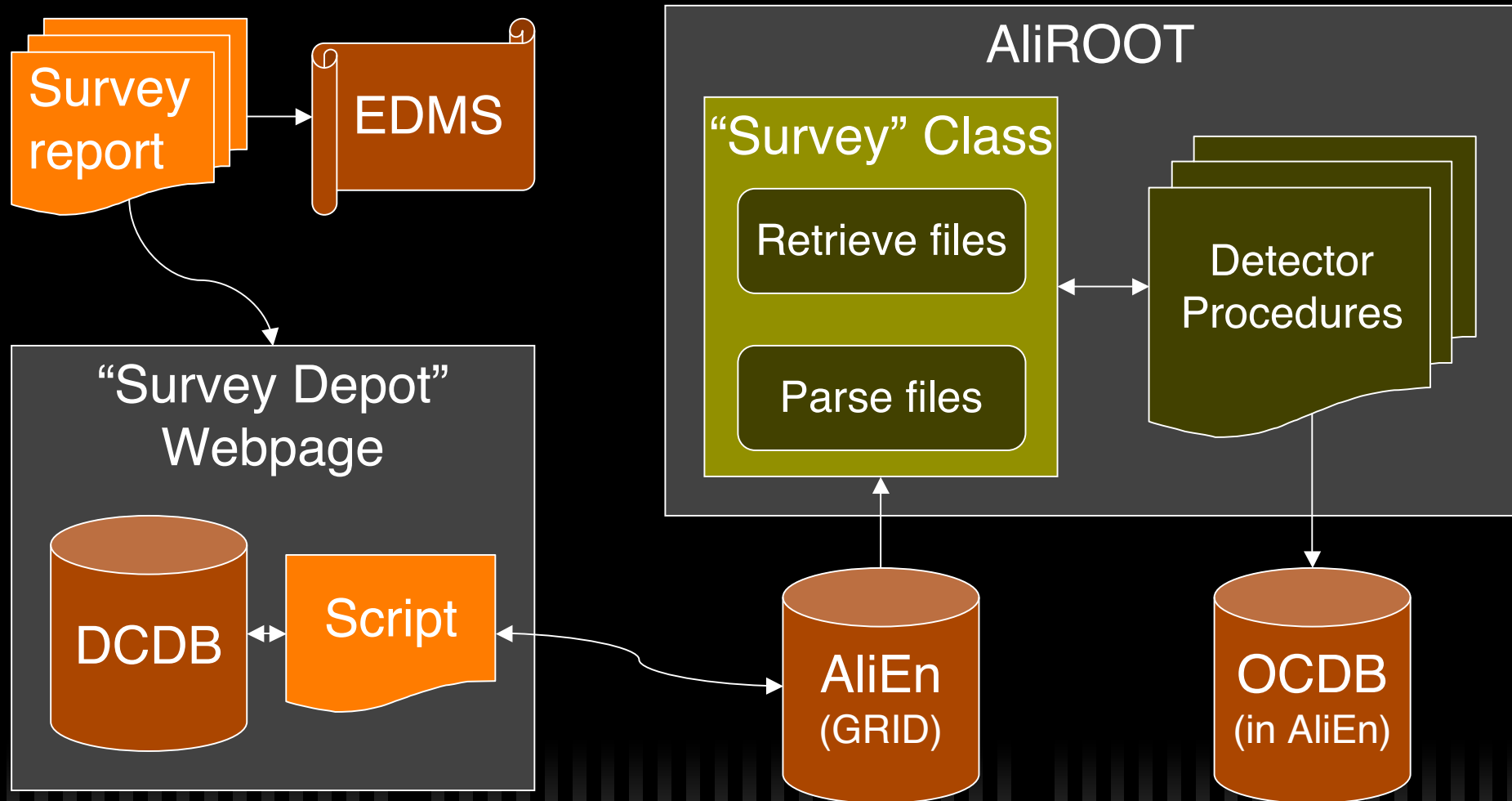
ALICE Survey Data Depot (DCDB)

- Backed by the DCDB

- Easy to create a simple interface

- Includes an authentication mechanism

- Only surveyors can create and edit the reports

- http://dcdb.cern.ch/surveydepot-production/

ALICE Survey Data Depot

Storage of raw survey (AliEn)

- AliEn is only an intermediate storage for the raw survey files

- Selected because of the existing mechanisms to access remote files from within AiiROOT

- Data is stored outside the normal OCDB data location in a separate Reference data folder

- Schema to store the raw survey data using AliEn:

Base Folder: `/alice/data/Reference/`

Specific Folders: `<Detector>/RawSurvey/<RepYear>/`

Filename: `<RepNumber>_v<RepVersion>.txt`

**Example:** `/alice/data/Reference/HMPID/RawSurvey/2005/598379_v1.txt`

Getting the data in the ALICE Framework (AliROOT)

- Two classes were created which represent a measured point and a complete survey report:
    - "Report class" (AliSurveyObj) has a parser for raw survey files
    - Both local and remote files can be parsed
    - Remote files are opened specifying only the detector and report number
    - Users get the data were they need it without any particular effort, using familiar mechanisms
- Existing mechanisms to access AliEn are used

Detector procedures

- Created by each detector, basically compare the measured and ideal positions of the fiducial marks

- The 3 Euler angles and 3 rotations are determined for each alignable volume

- An alignment object (AliAlignObj) is created and stored in the OCDB

- This procedures uses the tools made available by the ALICE Offline Alignment Framework
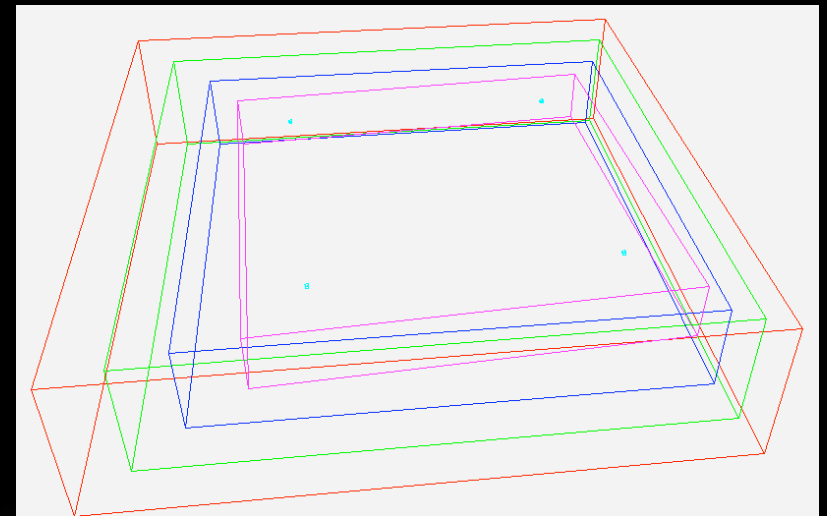
Long term perspective

- More survey data will be produced in the future, data has to be available for a long time

- Framework was designed with long term operation in mind

- Keep it simple and flexible are key objectives

- Minimal maintenance: DCDB interface, synchronization script and AliROOT class

What has been done so far?

- DCDB interface in production, synchronization with AliEn ready, ALICE framework code ready

- Several detectors have already implemented procedures to create the initial alignment objects from survey data:
  - HMPID, PHOS, TOF, TRD, VZERO

- One of the detectors with externally produced survey has already adopted our standard procedure:
  - ITS-SDD

Thank you!
Questions?

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Backup

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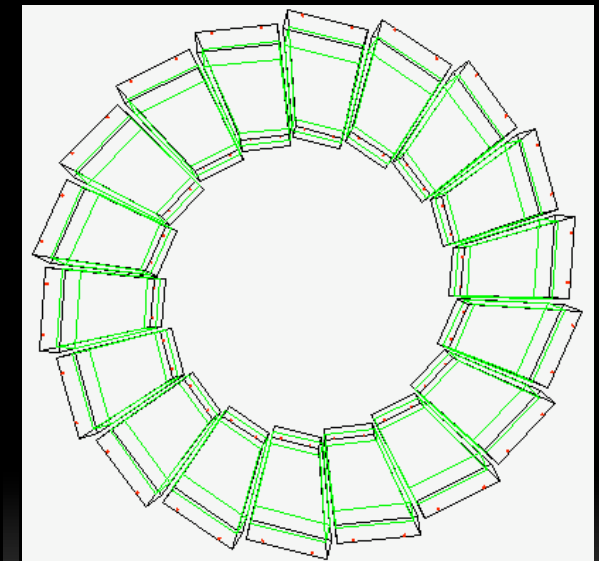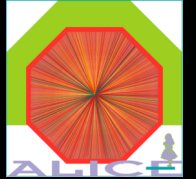
Glossary

- **AliROOT** - ALICE Off-line framework for simulation, reconstruction and analysis. It uses the ROOT system as a foundation on which the framework and all applications are built.

- **AliEn** - lightweight Grid framework. It is being developed by the ALICE collaboration as a production environment for the simulation, reconstruction and analysis of physics data.

- **DCDB** - Detector Construction Database, ORACLE backed.

- **OCDB** - Online Conditions Database implemented as a set of folders in AliEn (GRID), has metadata capabilities and relies on existing structures to ensure availability
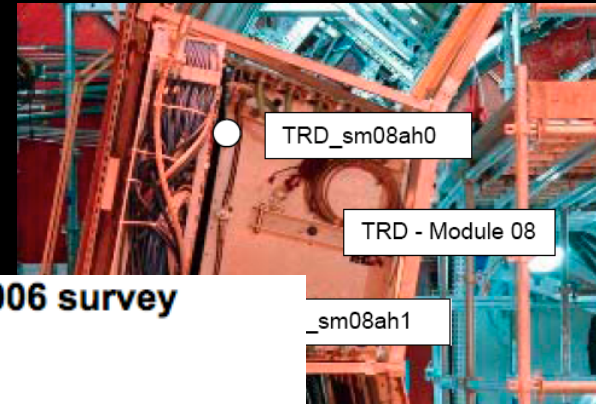
TOF
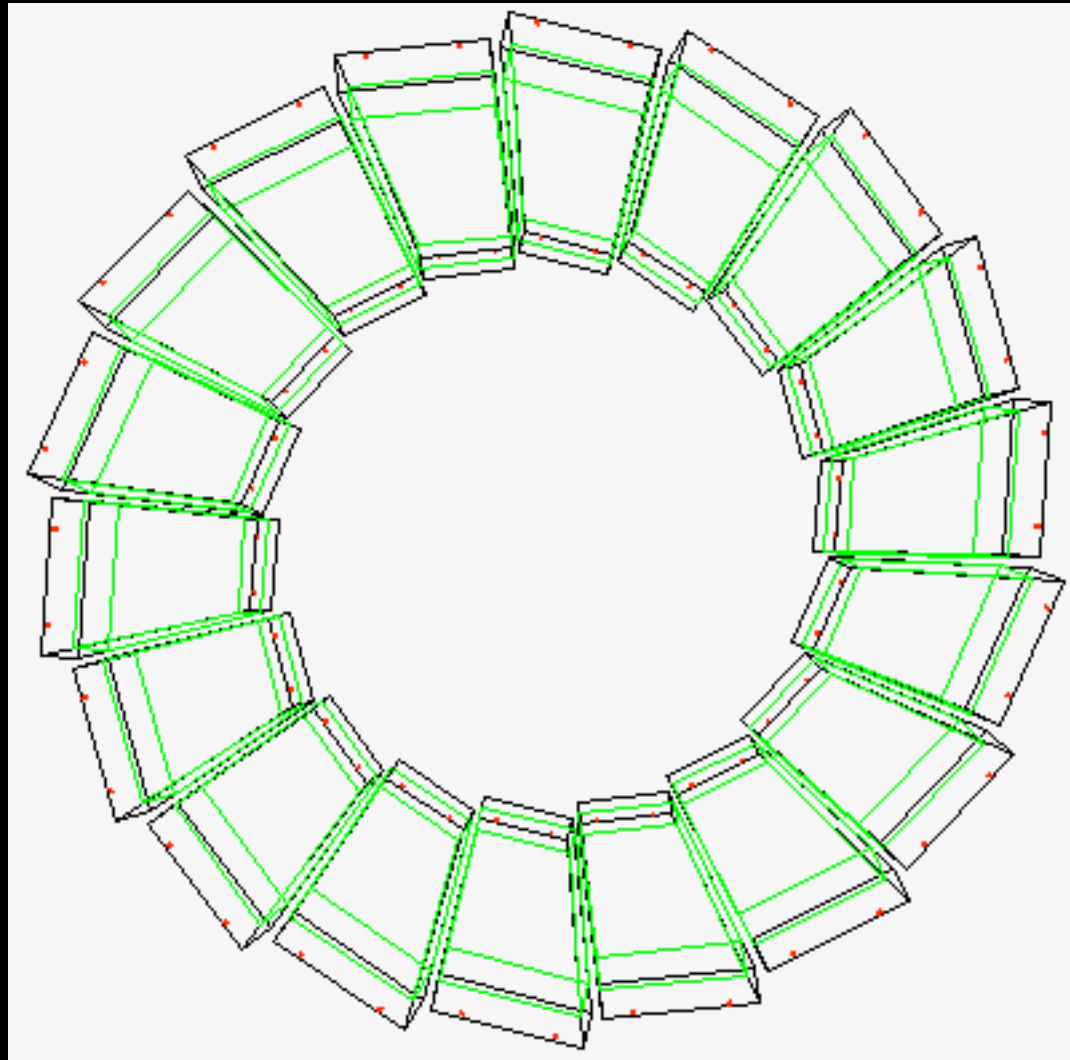
- Even without real survey data yet

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TRD

alignment params of supermodule 08 deduced from Dec-2006 survey

phi-shift	z-shift	r-shift	phi-rot	z-rot	r-rot
0.279	2.085	-2.224	0.000	0.000	0.000
±0.300	± 0.300	±0.300	±0.000	±0.000	±0.000

(only translations)

0.295	2.085	-2.224	0.000	-0.025	0.000
±0.477	±0.300	±0.300	±0.000	±(	

(transl

4. RESULTS

The precision of the measured coordinates is 1.0mm in X-, Y- a
one sigma level.

The coordinates are given in the center of the survey target.

Remark: The survey target did not touch the contact surface of t
hole.

Point Name	Xph (m)	Yph (m)	Z(ph)
TRD_sm08ah1	-3.6504	0.3337	3.5311
TRD_sm08ah0	-3.5451	0.9294	3.5306

TRD_sm08ah0

TRD - Module 08

_sm08ah1

- Before AliSurveyObj was available, but already used the standard text format.

Precision of Survey Data (TS/SU)

- **Photogrammetry measurements**
  - typical < 0.5 mm relative to Global ALICE coordinate system
  - "0.4 to 0.8 mm r.m.s. for any fiducial mark with respect to 'machine geometry'" C.Lasseur (2001)
- **Theodolite - mm range**