Report from AIDA Annual meeting - WP2

Frank Gaede, DESY

KILC 2012

Daegu, Korea, Apr 23-27, 2012

The AIDA project

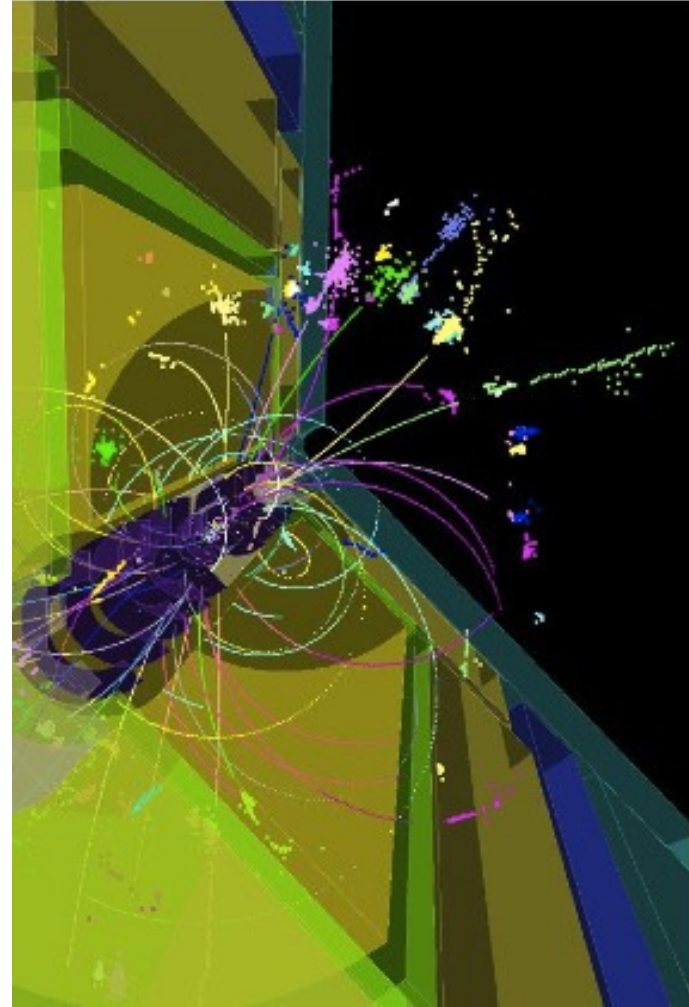http://aida.web.cern.ch/aida/index.html

- EU project
- duration of four years
- started Feb 2011
- sLHC, Linear Collider, neutrino,...
- WP2: common software

Summary talk given at
First Annual Meeting – DESY

Outline

- ## Introduction
  - organization of WP2
  - deliverables and milestones
- ## Status of tasks
  - geometry
  - tracking
  - particle flow
  - pile-up
  - alignment
- ## Summary

goal of WP2 – Common Software

- **develop core software tools that are useful for the HEP community at large**

- in particular for sLHC and Linear Collider (ILC/CLIC)

- strategy: develop tools in the context of the corresponding groups and frameworks, while having general application (re-use !) as a design criterion from the start

Task 2.2: Geometry toolkit for HEP
- Allow the description of complex geometrical shapes, materials an sensitive detectors
- Provide interfaces to full simulation programs (Geant4), fast simulations, visualization tools and reconstruction algorithms
- Allow for the misalignment of detector components
- Provide an interface to calibration constants and conditions data

Task 2.3: Reconstruction toolkit for HEP
- Tracking toolkit based on best practice tracking and pattern recognition algorithms
- Provide alignment tools
- Allow for pile up of hadronic events
- Calorimeter reconstruction toolkit for highly granular calorimeters based on Particle Flow algorithms

work package organization

TASK	PERSON
Coordination	Frank Gaede, DESY Pere Mato, CERN
Geometry	Gabriele Cosmo, CERN
Reconstruction	
Tracking	Steven Aplin, DESY
Particle Flow	Mark Thomson, UCam
Alignment	Chris Parkes, UMan
Tracking and Vertexing in Pile-Up	Lucia Silvestris, INFN

Participant	Person-Months
CERN	60
OeAW	24
CNRS/LLR	61
DESY	71
NTUA	4.5
MTA-KFKI	17
INFN	38
UCAM	47
UNIGLA/UMAN	43

total: 397
~1/3 funded by EU

Deliverables for WP2

Deliverable Number [61]	Deliverable Title	Partners (lead beneficiary)	[62]	Dissemination level [63]	Delivery date [64]	
D2.1	Project web infrastructure to document software packages	CERN	5.00 O	PU	3	done
D2.2	Central code repositories and other infrastructure required for the software development	DESY	5.00 O	PP	4	done
D2.3	Software design for geometry toolkit including the interfaces for the reconstruction toolkits	CERN, DESY, LLR, UniGla, STFC		PU	12	ongoing
D2.4	Software design for tracking toolkit	DESY, CERN, OeAW, KFKI			12	ongoing
D2.5	Software design for PFA tools	Ucam, LLR, CERN,		PU	12	done
D2.6	Design for handling the pile-up in sLHC	INFN, NTU, KFKI		PU	17	next
D2.7	Software toolkit for detector geometry, materials and detection technologies	CERN, DESY, LLR, UniGla, STFC		PU	38	
D2.8	Software toolkit with tracking algorithms	DESY, CERN, OeAW, KFKI			38	
D2.9	Particle Flow software tools	Ucam, LLR, CERN,		PU	38	
D2.10	Alignment tools software tools	UniGla	30.00 O	PU	38	
D2.11	Trigger simulation software tool	STFC	20.00 O	PU	38	
	Total		350.00			

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WP2 – Milestones

| Milestone number [59]	Milestone name	Partners (lead beneficiary)		Comments	
MS10	Running first prototype of the particle flow algorithm.	Ucam,LLR,CERN	10	Application to LC detector (Task 2.3)	done
MS11	Running prototype of tracking toolkit including some algorithms	DESY	18	Application to ILD-TPC simulation (Task 2.2)	next
MS12	Running prototype of the geometry toolkit	CERN, DESY, LLR	26	Application to ILD detector simulation (Task 2.2)	
MS13	Running prototype of the tracking code for the pile-up	INFN, NTU, KFKI	26	Application to sLHC simulation (Task 2.3)	
MS14	Integration of tracking toolkit into LC software framework	DESY, CERN, OeAW	44	Validation of physics performance (Task 2.3)	
MS15	Application of PFA tools to sLHC detectors	Ucam, LLR	44	Demonstration of concept (Task 2.3)	
MS16	Application of alignment tools to sLHC	UniGla	44	Validation of performance (Task 2.3)	
MS17	Integration of pile-up tracking code in sLHC software frameworks	INFN, NTU, KFKI		Validation of tracking efficiency (Task 2.3)	

Deliverable 2.1 – WP2 Web site

- created web site for documentation of WP2 sub tasks and software projects

- based on Drupal system
  - http://aidasoft.web.cern.ch

- provides:
  - general documentation for software projects
  - link to code repositories
  - discussion forum

deliverable report:
http://cdsweb.cern.ch/record/1379521

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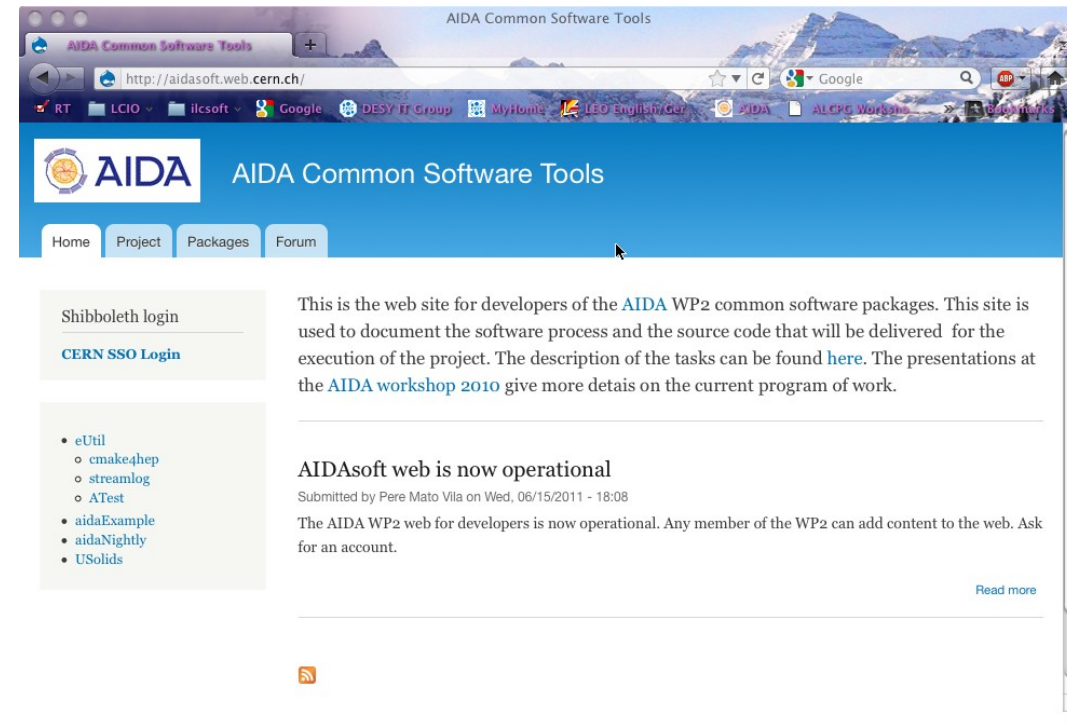
Deliverable 2.2 – WP2 Code repository

- created svn code repository for AIDA WP2
  - https://svnsrv.desy.de/viewvc/aidasoft/
- utilities for building HEP software packages with CMake
- logging library
- simple scripts for including software tests in project
- CDash server for dashboard with nightly test results
  - http://aidasoft.desy.de/CDash

deliverable report:
http://cdsweb.cern.ch/record/1383272

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Agenda of WP2 session

11:00	**Introduction**	MATO VILA, Pere et al.
	Sem 3, DESY	11:00 - 11:20
	Status of Geometry - USolids	GAYER, Marek
	Sem 3, DESY	11:20 - 11:40
	Status of Geometry: DD4Hep	MATO VILA, Pere
	Sem 3, DESY	11:40 - 12:00
12:00	**Status of Tracking Task**	APLIN, Steven
	Sem 3, DESY	12:00 - 12:20

14:00	**Status of Alignment Task**	PARKES, Chris
	Sem 4, DESY	14:00 - 14:20
	Timing of hadronic showers in geant4	RAMILLI, Marco
	Sem 4, DESY	14:20 - 14:40

- very interesting talks and fruitful discussions
- unfortunately not all beneficiaries could be present

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- implementation of geometrical 3D primitives for **Geant4** and **ROOT** including new '**union of many**' shape

  - phase 1 completed: design, first prototype and software tests

  - phase 2: box, orb, trd, union of many completed, performance tests (comparison geant4, ROOT, USolid)

Geometry – DD4Hep [Pere Mato]

- DD4Hep: Detector Description for High Energy Physics
  - design exists – based on C++ plugins/python scripts and TGeo implementation
  - first prototype implementation exists for simplified LC tracking detectors

- deliverable 2.3 "software design for geometry"
  slightly delayed by about 2 months
- institutes: CERN, (DESY, LLR)
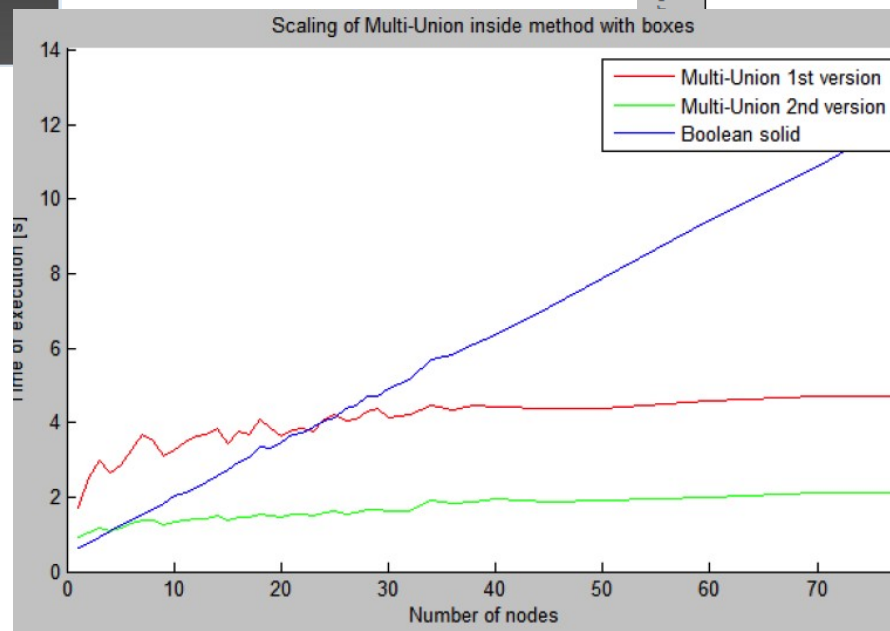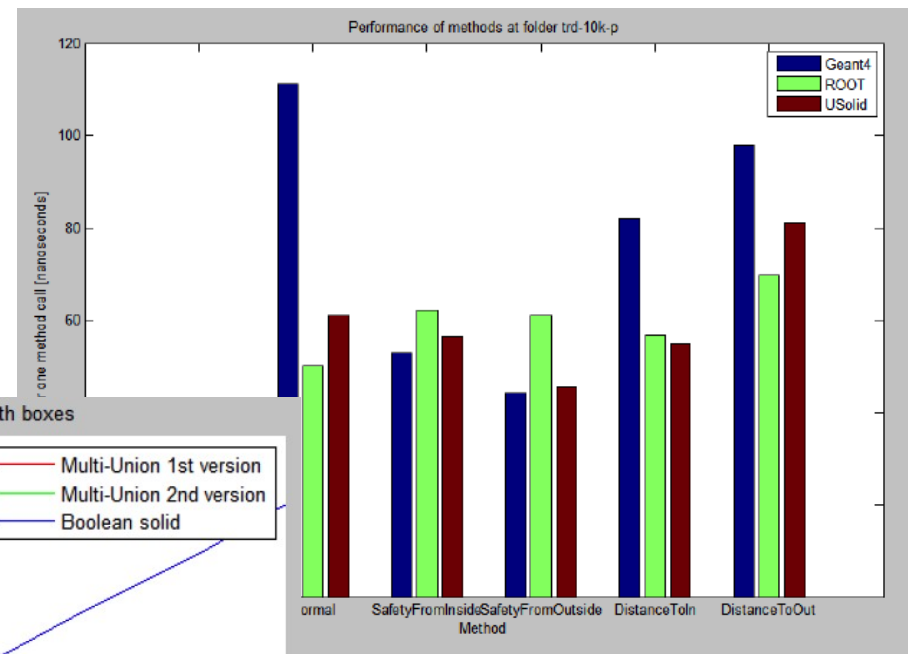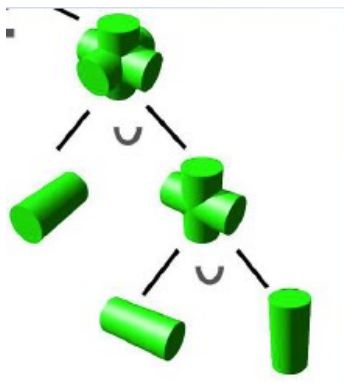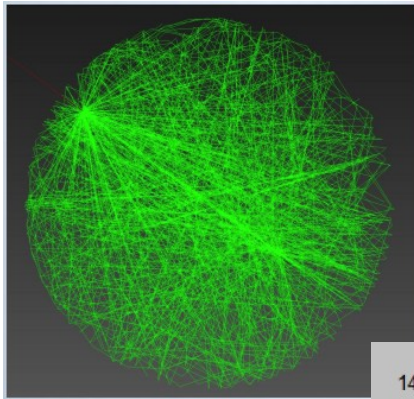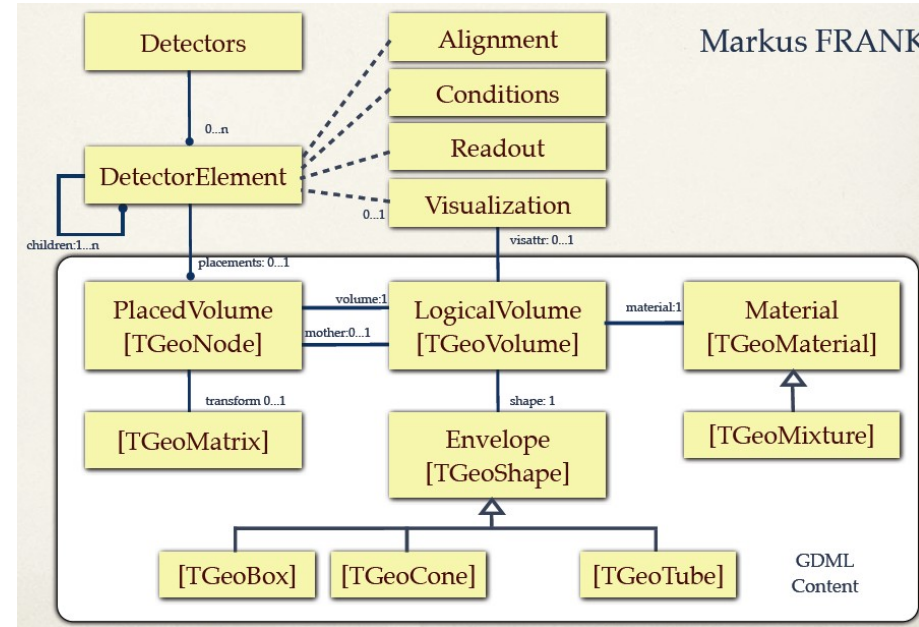
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Tracking

[Steven Aplin]

- in 2011 complete re-write of of iLCSoft tracking software

  - topological TPC patrec

  - forward patrec w/ cellular automaton

  - definition of MarlinTrk interface

    - decouple tracking finding and fitting

- currently finalizing tracking package for massive DBD MC production

- serves as prototype for tracking toolkit in AIDA
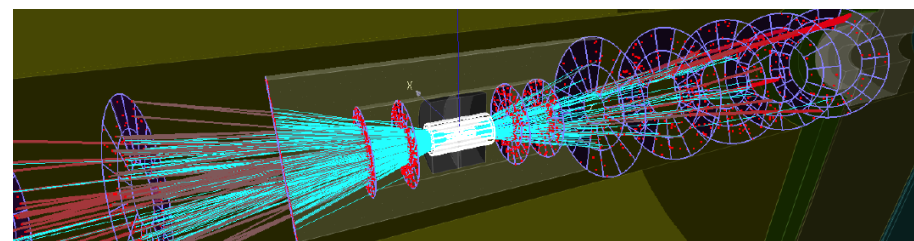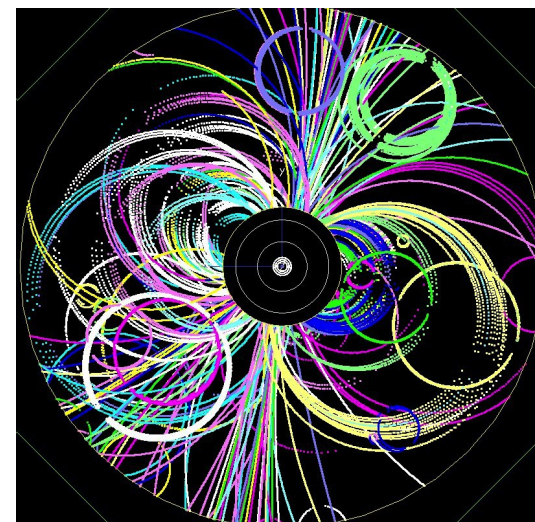
- deliverable D2.4 'software design for tracking toolkit' is slightly delayed by 2-3 months
  - reason is tight manpower situation and preparation for the ILC-DBD
- institutes: DESY, OEAW
- upcoming MS11: prototype for iLC tracking (M18)

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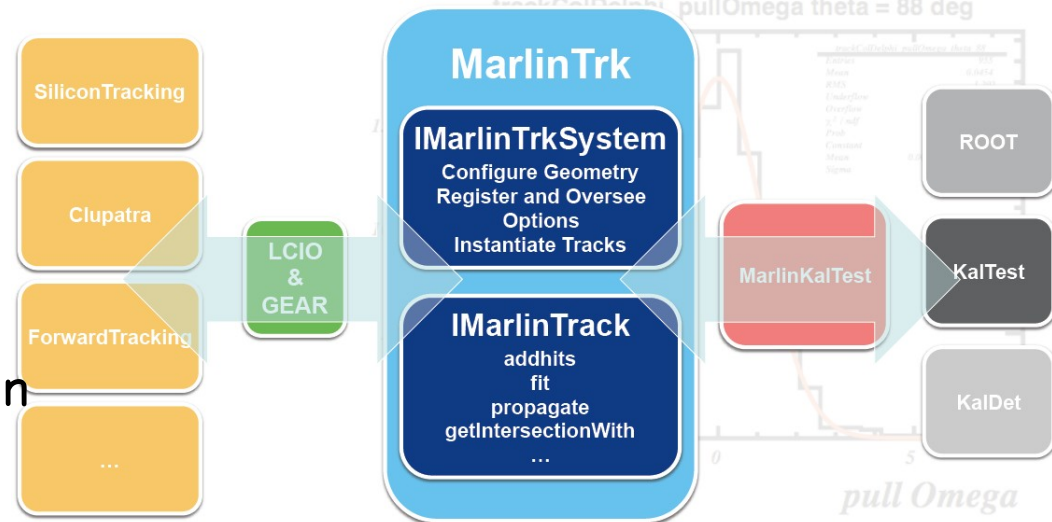
Particle Flow

- *Calorimeter reconstruction toolkit for highly granular calorimeters based on Particle Flow algorithms*

- good progress has been made with the Particle Flow tools work package with all institutes making significant contributions

  - design for a powerful new particle flow reconstruction framework designed with generic applications in mind

  - re-implemented existing LC PFA in new PandoraPFA framework

  - successful application to 3TeV events at CLIC in context of CDR

  - development of reconstruction algorithms for digitial and semi-digital highly granular calorimeters

- milestone M10: "Application of PFA to Linear Collider" reached
- deliverable D2.5 'design of Particle Flow software tools' submitted on time

AIDA-D2.5

AIDA

Advanced European Infrastructures for Detectors at Accelerators

Deliverable Report

SOFTWARE DESIGN FOR PFA TOOLS

Thomson, M. (UCAM)

13 March 2012
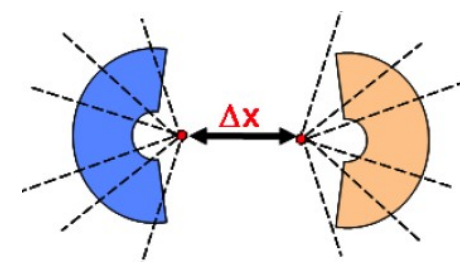
AIDA

Tracking and Vertexing w. Pile Up

- *provide tracking and vertexing tools for high multiplicity hadronic events with pile up*

- subtask has made considerable progress in the context of LHC experiments:
  - code development of new phase I geometry for CMS Pixel system integrated in CMSSW framework
  - study to improve the CPU performance of the CMS tracking finding
  - development of a Legendre transform based track finding for ATLAS
  - development of a detector independent vertexing package for high pile up at colliders
  - development of rapid tracking detector simulation for triggers

– no milestones or deliverables in subtask so far

– upcoming D2.6 : design for handling the pile-up in sLHC (M17)

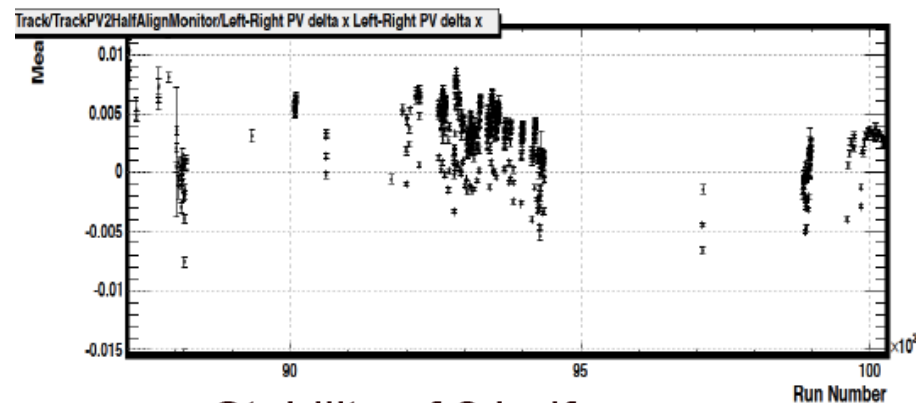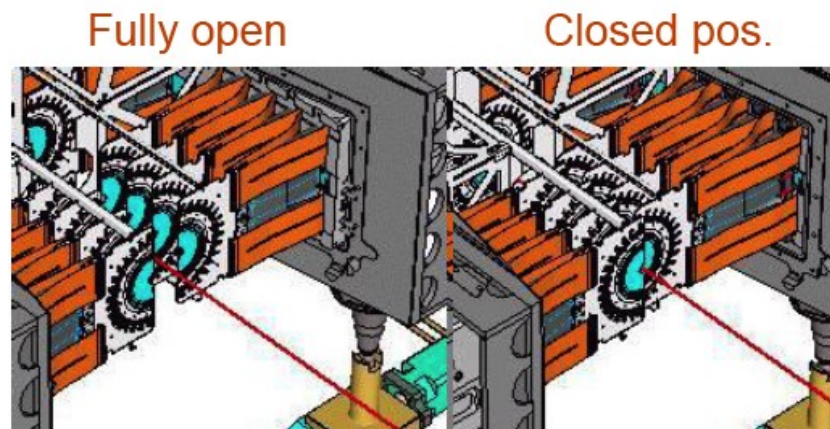– institutes: INFN, KFKI, MTUA, STFC

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Alignment [Chris Parkes]

- *development of generic alignment tools*

- work has focused on the development of alignment for the LHCb silicon vertex locator (VELO)

- study of **weak modes in alignment** for LHCb performed.

- **alignment monitoring** package for LHCb developed

- plan to apply alignment techniques and DD4Hep to WP9 medipix telescope
- → nice synergy between AIDA WPs

2011 data

Fully open   Closed pos.

Track/TrackPV2HalfAlignMonitor/Left-Right PV delta x Left-Right PV delta x

- institute: University of Manchester (transferred from Glasgow)

■ Stability of 2 half alignment by PV method:
  ■ within ± 5 μm for Tx

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Summary

- in WP2 we develop core software tools that are useful for the HEP community at large

- develop tools in context of existing experiments/frameworks but eventually have experiment independent tools

- work organized in sub tasks

  - geometry
  - tracking
  - particle flow
  - pile-up
  - alignment

- in first year we have made good progress towards our goals and objectives:

  - one milestone achieved on time

  - three deliverables on time

  - currently working on two deliverables that are slightly delayed