Alignment data streams for the ATLAS Inner Detector

A Toroidal LHC ApparatuS (ATLAS/CERN)

B. Pinto, A. Amorim, P. Pereira (SIM and *University of Lisbon, Portugal*); M. Elsing, R. Hawkings (*CERN/ATLAS, Geneva 23, Switzerland*); J. Schieck (Max-Planck Institut für Physik, Munich, Germany); S. Garcia (Instituto de Física Corpuscular, València, Spain); R.D. Schaffer (LAL, Orsay, France); Hong Ma (*Brookhaven National Laboratory, Upton, USA*); J. Baines (*Rutherford Appleton Laboratory, Didcot, England*); A. Anjos (*University of Wisconsin,Madison, USA*);

The ATLAS Computing Model

Input parameters:
- Collision rate = $L \cdot \sigma = 10^9$ Hz p-p collisions at design luminosity.
- Trigger rate = 200 Hz independent of the luminosity.

High-level Trigger (HLT) CPU Requirements: Simulation model with 100 kHz level-1 trigger **(LVL1)** accept rate and assuming 8GHz **CPUs**.
- **Level-2 trigger (LVL2):** 500 dual-**CPU** machines with an accept rate of ~3.2kHz.
- **Event Filter (EF):** 1500 dual-**CPU** machines providing an output of ~200Hz and ~ 320MB/s.

Grid concept implies a high degree of decentralization with a Tier-0 facility at CERN that will be responsible for:
- Archival and distribution of primary RAW data received from the **EF**.
- Providing:
  - the prompt reconstruction of the calibration and express streams;
  - first-pass processing of the primary event stream;
- Distribute the derived datasets to the Tier-1 facilities.

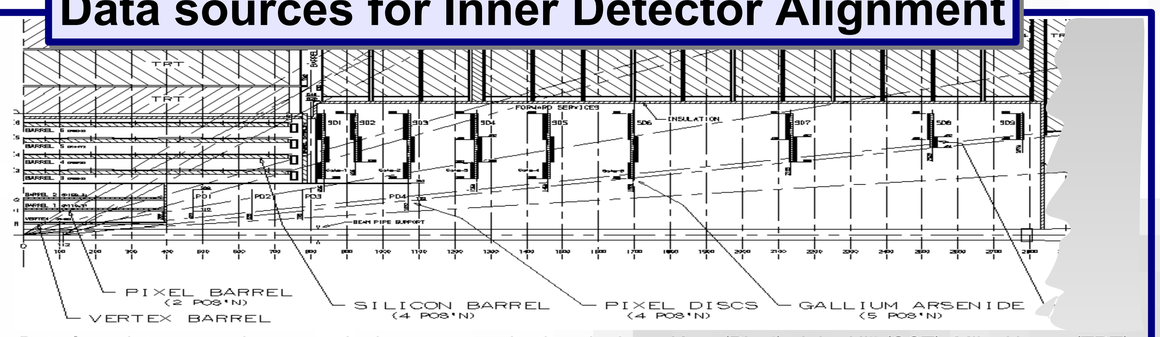
EF->Tier-0 streaming baseline model:
- Primary physics stream containing all physics events;
- An express stream containing a subset of events (~5% of the full data);
- The calibration stream;
- The diagnostic stream.

Calibration Stream: Produce calibrations of sufficient quality to allow a useful first-pass processing of the main stream with minimum latency.

Latency: At 1.6 MB per event, each Sub-Farm Output (**SFO**) at 4Hz fill a 2 GB file with ~1250 events every 5 minutes.

Working target (remains to be shown achievable):
- Express and calibration streams reconstructed within 8hours;
- Primary data stream reconstruction beginning in 24hours.

Data sources for Inner Detector Alignment



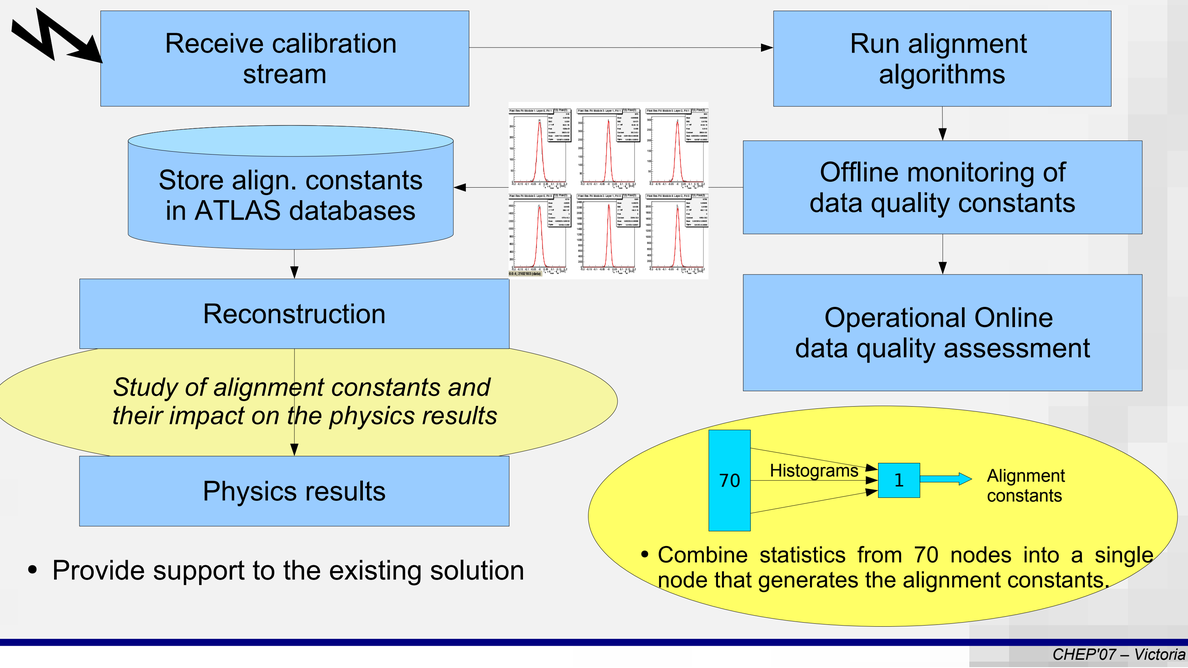
Data from detectors web page and private communication: Andreas Korn (Pixel), John Hill (SCT), Mike Hance (TRT).

		Module or straws per ROD*	RODs	ROBs
Pixel	B-Layer	6 / 7	44	132
	Layer-1/Disk	12/13	38/24	
	Layer-2	26	26	
SCT	Barrel	48	44	90
	Endcap	Sparsely populated	46	
TRT (1/32)	Barrel (A or C)	1642	2	6
	Endcap (A or C)	3840	4	

* Readout drivers.

Future Plans

Full processing of the ID calibration stream



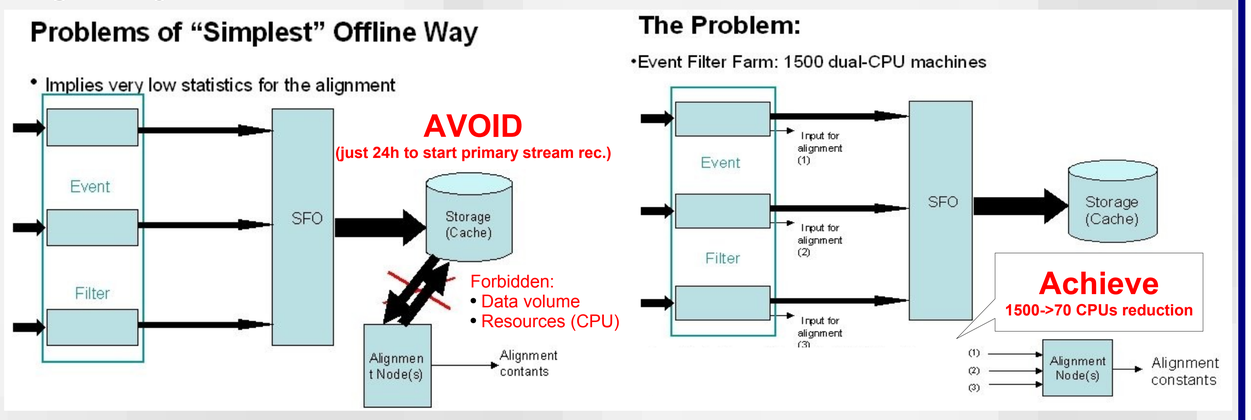
- Provide support to the existing solution
- Combine statistics from 70 nodes into a single node that generates the alignment constants.

ID Alignment Stream

Composition: Trackfit and hit data of generic reconstructed tracks (with p_T > 2GeV) processed in the **EF**: 4 MB/s.

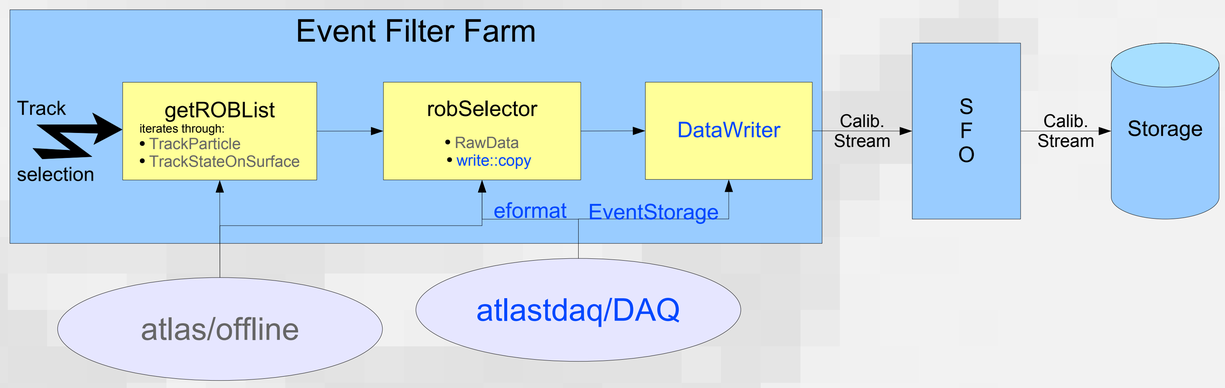
Purpose: derive and update a set of calibration and alignment constants, after every fill, processing the stream to accumulate residuals and other histogram quantities before prompt reconstruction.
- Processing requirements:
  - Pixel and SCT: 50 KSI2k for derivation of silicon alignment constants;
  - TRT: 20? KSI2k for derivation of TRT alignment constants;
- The constants are then verified by re-reconstruction on an independent part of the calibration stream within 12 hours.

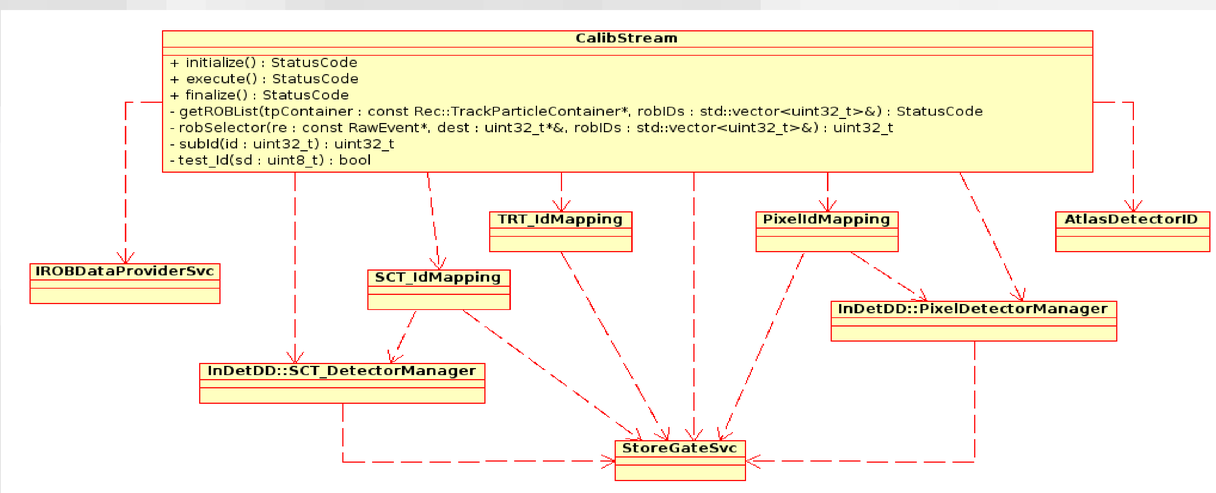
Origin: originated at each **SFO** and the files transferred to Tier-0.



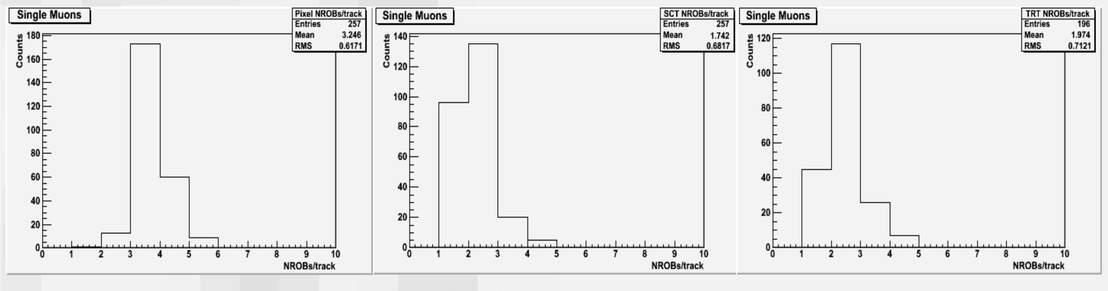
Solution: InDetCalibStream

Per event, make a list of Read Out Buffers (**ROBs**) with hit information of each selected track and use it to eliminate ROBFragment's from the EventFragment. The remaining data will be written to bytestream files.





Software test: running reconstruction with ATHENA version 12.0.3.
- Number of used **ROBs** per track.
  Input file of 300 generated events of single Muons with pT=50GeV and Eta<3.0.



Each track uses on average 7 **ROBs** (≈ 2%).

- Use of simulation file with 200 minimum bias events:

File	Size (MB/evt)	Rec. time (KSI2K-sec)	Time/evt (KSI2K-sec)	**Track Selection**	Nº CPU (KSI2K)
EF Reconstruction	0.2	1696	8	-	1500
Calib. Stream	0.04	718	4	"1/10"	75*

*Assuming scaling with number of tracks.

Less 80% size file and half the time to run it.