

ITS Detector Alignment Status

Oct. 5 2005

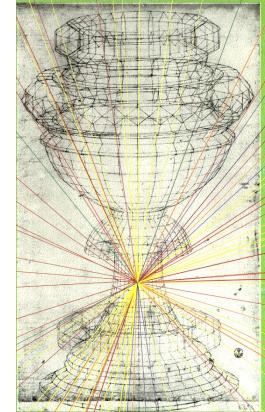
ALICE Offline Week

By: Bjørn S. Nilsen

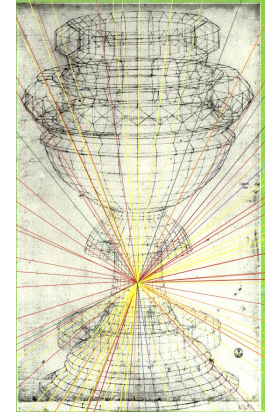




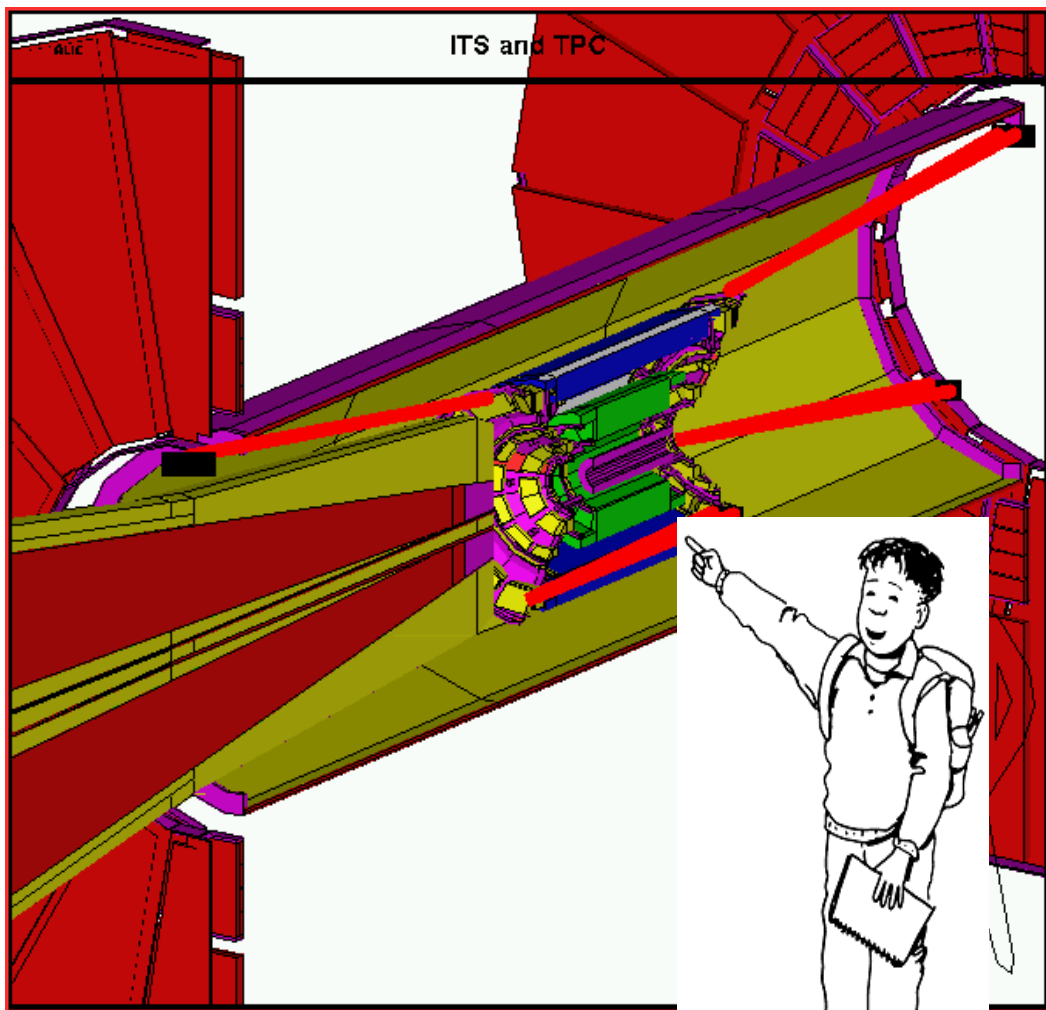
Outline



- Alienable Parts
- Effects on Hits, SDigits, Digits, RecPoints, Tracks
- Simulations with misaligned data
- Software realignment
- Other Stuff



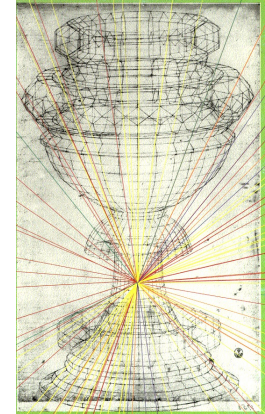
Alienable Parts



- 2198 Si detector wafers
 - 240 SPD wafers
 - 260 SDD wafers
 - 1698 SSD wafers
 - $\times 6 \text{ DoF} = 13188 \text{ DoF}$
- All of the other Radiation thick Materials of ITS.



Effects on Hits, SDigits, Digits, RecPoints, and Tracks



- Simulation

Uses AliITSgeom

- Hits
- SDigits
- Digits

- AliITSgeom Must be Exactly from geometry at all times

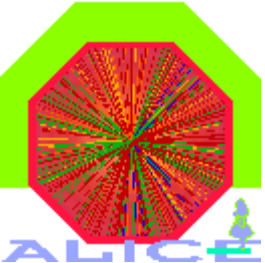
- Reconstruction

Uses AliITSgeom

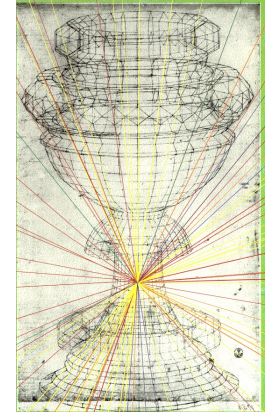
- RecPoints
- Tracks

- AliITSgeom should never be Exactly from geometry
- AliITSgeom can be modified before using in Reconstruction

Uses



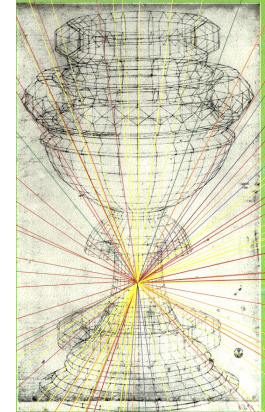
How to Reconstruct Unaligned data



- 1) Run Standard AliRoot (ITS) simulation through Digit creation.
AliITSgeom is filled from geometry (or file) and is exact.
- 2) Initialize reconstruction and load in the AliITSgeom data used during simulation.
- 3) `AliITSgeom dealignedGm,*exactGm = its->GetITSgeom();`
`dealignedGm = *exactGm; dealignedGm.RandomChange(σ_{trans} , σ_{rot});`
`its->SetITSgeom(&dealignedGm);`
- 4) Now Run reconstruction all the way through. Results will be using a de-aligned ITS.



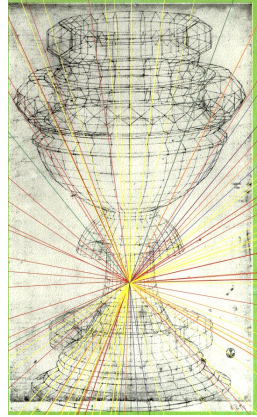
Simulations with Misaligned data



- Uses AliITSgeom.
 - Used in all ITS code from simulation to tracking.
 - Not tested with most recent uncommitted code. No reason why it should not work.
- Simulation was done using straight tracks.
- Simulation and Analysis was done during this last *Millennium*. See ITS TDR section 6.3



Software realignment

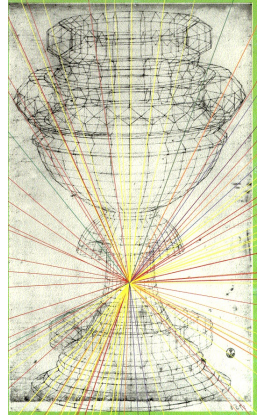


- **Waiting on ...**
- **Has not been done to date**
- **Expect a reasonable version based on TTask in about 6 months**
- Results of realignment will be reflected in a new ITS geometry
 - Specifically, will be in reconstruction version of AliITSgeom
 - Some misalignments break symmetries in such a way that the use of copies is excluded and cost too much in new volumes. Will only be reflected in



Software realignment

Outline



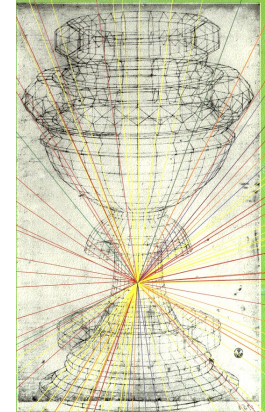
- Require primary tracks with unambiguous digits.
 - No hypothesis tree for digits/tracking.
 - Tracks come from a well defined point and must have digits in all 6 layers, preferably more (det. Overlaps).
 - Suggest better to use low multiplicity or even p-p data
- Prefer to use high P_t tracks.
 - Track model is better defined (material is clumped).
 - Fits to track shape are better, smaller χ^2 .

Since multiple scattering averages out, even low P_t tracks might be used.



Software realignment

Outline



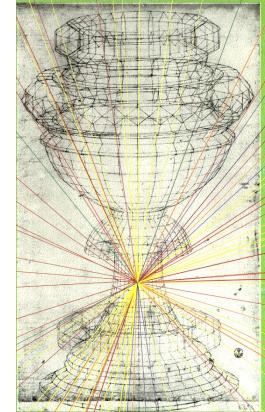
- Group detectors by ladder, layer, or individually.
- Perform fit of detector position to minimize separation between track and associated digit.
 - Note, average track-digit displacement gives new detector position to first order
 - Note, gradient in track-digit displacement gives rotation of detector to first order.



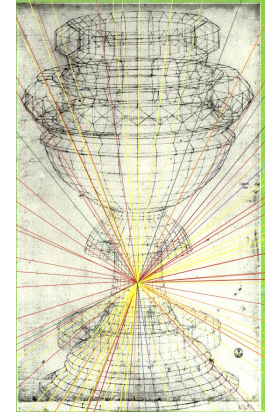
There are out of alignment modes which can not be found/corrected with tracks.



Conclusion Alignment

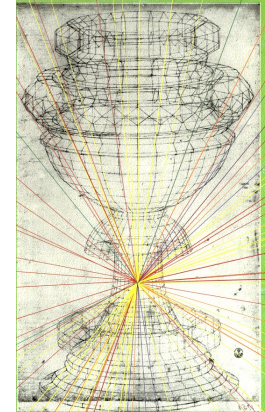


- Alienable Parts
 - 2198 Si Wafers
 - All other central elements of the ITS
- No effects on Hits, Sdigits, and Digits. Effects on RecPoints, and Tracks
- Simulations with misaligned data - Done
- Software realignment – To be done

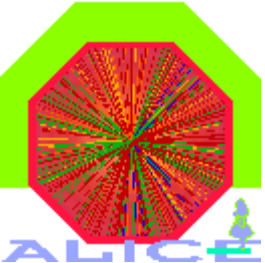




Information still to get SPD Configuration Data

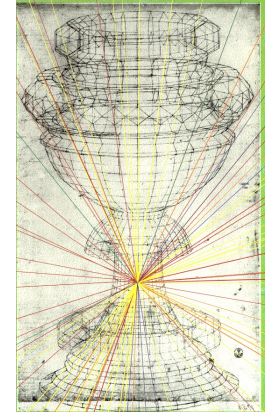


- 4 bit Threshold/cell (computed based on noise [DCS-fecf])
- Dead cell index (constDB and data analysis [ConstDB,?])
- Noise cell index (no data noise run [DCS-fecf])
- Multi-event buffer mode switch (by det chip [DCS])?
- Voltage setting and current (1/power supply [DCS])?
- Det chip on/off (indicated by $V=0$? [DCS])?
- Detector chip index map [constDB]



Information still to get

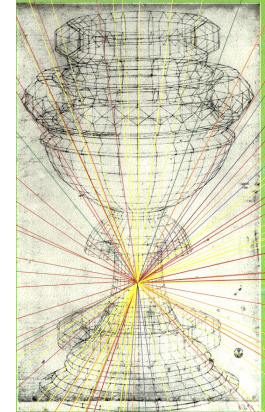
SDD Configuration Data



- Drift time residues (450/Det? [constDB])
- Drift/Anode correction maps (2/cell [constDB])
- Charge collection Efficiency (between 1/det to 1/cell, from data analysis [?])
- Injectors/Thermal map (special trigger data [?])
- Noise (no data noise run, zero unsuppressed [dcs-fecf])
- 2 Thresholds/anode (no data noise run/trigger, zero unsuppressed [dcs-fecf])
- 1 Baseline/anode (no data noise run/trigger, zero unsuppressed [dcs-fecf])
- PreAmp gain (? [dcs-fecf])
- High voltage/current (1/power supply [dcs])
- Low voltage/current (1/power supply [dcs])
- 10 bit/8 bit data mode switch (2/det? [dcs-fecf])
- Zero suppressed data switch (2/det? [dcs-fecf])
- Sampling doubling switch (2/det? [dcs-fecf])
- Clock frequency (2/ladder [dcs])
- CARLOS Compression switch (2/ladder? [dcs-fecf])
- CARLOS multi-event buffer switch (2/ladder? [dcs-fecf])



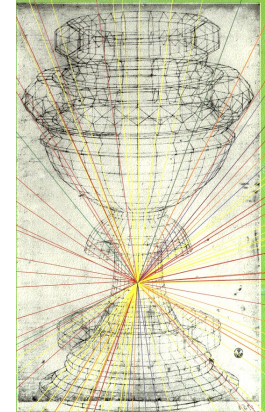
Information still to get SSD Configuration Data



- Anode/Cathode index map [constDB]
- Detector index map [constDB]
- PreAmp gain (from noise run [dcs-fecf])
- Baseline (from noise run [dcf-fecf])
- Noise (from noise run [?])
- Threshold (from noise run [dcf-fecf])
- Detector voltage/current (1/power supply [dcf])



Information still to get Geometry Configuration Data



- Base Geometry (constDB, survey, alignment [?])
- AliITSgeom (alignment + Base Geometry [?])
- AliITSAMS hardware alignment system alarm (1 type time? [dcs?])
- AliITSAMS setup info (??? [?])
- AliITSAMS voltage/current (1 [dcs?])