**Restructuring**

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| *Current (2021-09-26)* | *Desired (Brigitte’s comments)* |
| **Chapter: Cosmics characterization and for alignmemnt studies**   * Canada construction process and chapter is about cosmic muon testing   *Collecting cosmic muon data:*   * Hodoscope * Hodoscope trigger * FEBs * ASIC * Record PDO above threshold * Decode to ROOT tree * Gas and gas system * HV, 2900V vs 3100V * 1 million triggers every for 2 hrs collection   *Rebuilding cosmic muon tracks for characterization*   * Need tracks for characterization * Get x and y from wires and strips * x coord: max wire PDO, uncertainty 10 mm * y coord from clustering * 60 um uncertainty on cluster mean * From x and y on layers, create tracks * Noise exists * Three methods used to characterize alignment (***remove***)   *Measuring local offsets in strip pattern using cosmics data*   * Misalignments are passive transformations * Define local offset in words an math * Don’t know d\_local or y\_nom so need a relative coordinate system * ***Be careful about using the word alignment*** * 2 fixed layers, residuals * Local mean of residuals causes systematic offsets -> see sample residual distributions * Residual distribution shape depends on tracking combination * Residual distribution bin size based on largest uncertainty in residuals for geometrically least favourable tracking combination * Gaussian fit > double gaussian fit * Area of region of interest * Bring home the point about relative local offsets   *Visualizing relative misalignments between layers*   * Show TH2Fs * Give potential misalignment model interpretation   *Systematic uncertainty in cosmic residual means*  **Chapter: The x-ray method**   * Work on characterizing relative misalignments is ongoing but we need absolute and to derive alignment parameters * X-ray gun attached to alignment platforms and strips record beam profile * Interaction type: photo effect * Distribution of cluster means is beam profile * Cut high mult clusters * Beam profile centroid is y, expected center is ynom, local offset if dlocal * Advantage of x-ray dataset is coordinate system * Systematic uncertainty of 120 um * Limited to alignment platforms | **Chapter: Using cosmic muons to measure relative strip position offsets**   * Cosmic muon testing at McGill and chapter is about DCP and relative local offsets   *Experimental setup*   * Quad in bench * Hodoscope * Trigger * Gas and gas system * HV   *DAQ*   * VMM ASIC on FEB * VMM amplifies signal and measures signal peak amplitude (***replace PDO***) * Thresholds tuned manually * Neighbour triggering * 1 million triggers every 2 hours   *Data preparation*   * GOAL: Rebuild tracks * Cutflow * Potential noise sources and how cutflow reduces (delta rays)   *Clustering*   * X coord max wire PDO, uncertainty 10 mm * Y coord from clustering * 60 uym uncertainty on cluster mean   *Tracking*   * DO IT * Assume straight * Lots of characterization metrics, but focus on residuals   *Relative local offsets in the strip pattern*   * Same as *Measuring local offsets in strip pattern using cosmics data*, but be careful about the word alignment * Could separate into definition, calculation, and visualization * Connect to strip position offsets * Show visualization * Give potential interpretation   *Systematic uncertainty in cosmic residual means*   * Same as before   **Chapter: Using x-rays to measure relative strip position offsets**   * Need x-rays to connect strip positions to alignment platforms * This chapter introduces the x-ray method in less detail than cosmics, referencing JINST paper   *Experimental setup*   * Wedge with alignment platforms at CERN horizontal on rotating post * X-ray gun attached to 1 of 5 positions on a given alignment platform * Gun positions chosen to avoid wire supports and VMM edges * Operated with CO2, HV, FEB * ***Check the operating conditions on the quads you showed…***   *DAQ*   * Interaction: photo effect * Random triggers * FEB board configuration   *Data preparation*   * Pedestal subtracted from hits * Clusters contiguous * Cut events with double clusters * Only use mult 3-5 clusters for analysis * ***ASK BRIGITTE: I don’t know all the cuts. They aren’t recorded anywhere. Plan: just reference JINST paper*** * List corrections in JINST   *Clustering*   * Same as before, Gaussian fit extract mean (footnote: now doing analysis using raw hits to find cluster centroid)   *Local offsets in the strip pattern*   * Distribution of cluster means is beam profile * Gaussian mean of beam profile is beam profile centroid |