Calibrating the electronics response

Electronics response
- Pedestals, MIP peaks in ADC/ TOT counts
- Hardware thresholds in ADC counts
- Linearity between ranges in ACD, CAL
- Electronics Noise

Input from three sources
- Test charge injection (TCI)
- Pedestal running (random triggers)
- Response to selected particles (MIPs, CNOs)

Software requirements
- Analysis of TCI / pedestal data
- Selection of calibration events
- Generally simple and robust algorithms
Calibrating Efficiencies

- Single channel efficiency
  - Dead channel maps
  - Time-walk related inefficiency
  - Effects of zero-suppression

- Trigger efficiency
  - Efficiency for each “physics” condition in L1
    - TRK 3 in a ROW, CAL Lo, CAL Hi, AcdVeto
  - Efficiency for various Onboard Filter “lines”
    - Need better understanding of Onboard Filter
Alignments

- **Tracker**
  - Plane to plane
  - Tower to Tower
  - Checks on twists, shears & other systematic effects

- **Tracker - Cal**
  - Tower by Tower

- **Tracker - ACD**
  - Tile by Tile

- **Alignment Issues**
  - Require large, clean samples of tracks
  - Temperature dependent
Timing & Telemetry data

- Master Clock flutter
- Livetime
- Relative timing of events
- Position corrections
Environmental Calibrations

- Particles Background
  - Rates
  - Spectra & Orientation
  - Leakage into Photon Sample

- SAA characterization
Physics Level calibrations

- Tracker spatial resolution, PSF
- Cal energy resolution
- Efficiency Hypercube
  - Hopefully these are stable over long timescales, but this needs to be checked
What Do All These Have in Common

- Calibration defined by:
  - Input data “collection” (list of runs & events)
  - Version of reconstruction/calibration code
    - Calibration constants used in reconstruction/calibration

- Calibration has a validity period
  - Times and conditions under which a calibration should be used
    - Want to correlate validity periods with collection periods

- Calibration can be verified with a monitoring plot
  - Simple figure that shows visually how calibration was extracted
    - Want to overlay fit results as appropriate

- Calibration can be trended
  - Look from development over time

- Calibration can be grouped/correlated with others
# Web Based Interface, Top Level View

- **Acq Channel:** Pedestals, Mip Peaks, Search: History
- **Cal Channel:** Pedestals, LEX8 Gains, LEX1 Gains, Search: History
- **Tkr Channel:** Dead Strips, Search: History
- **Align Channel:** Layers, Search: History

- **Current:**
  - Pedestals
  - Mip Peaks
  - LEX8 Gains
  - LEX1 Gains
  - Dead Strips
  - Layers

- **Shortcut to most recent:**
  - History

- **Drill down to detailed pages**
  - With summary plots

- **Look for calibrations**
  - Which match validity criteria

- **Go to trending plots page**
Web Based Interface, summary level view

<table>
<thead>
<tr>
<th>AcdPedestals</th>
<th>Collection Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td>05/03/02 12:03:13 – Infinity</td>
</tr>
<tr>
<td><strong>Validity</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel</th>
<th>Value</th>
<th>Plot from which The calibration was extracted</th>
<th>Link to the trending Generation and validity History of this calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>000-0</td>
<td>241.5</td>
<td>plot</td>
<td>history</td>
</tr>
<tr>
<td>000-1</td>
<td>832.6</td>
<td>plot</td>
<td>history</td>
</tr>
<tr>
<td>001-0</td>
<td>396.1</td>
<td>plot</td>
<td>history</td>
</tr>
<tr>
<td>001-1</td>
<td>346.2</td>
<td>plot</td>
<td>history</td>
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<td>...</td>
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</tbody>
</table>
### Web Based Interface, history view

#### Strip history chart showing input data and validity times for this calibration

<table>
<thead>
<tr>
<th>AcdPedestals</th>
<th>Channel 0-000</th>
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</thead>
<tbody>
<tr>
<td>0x0000</td>
<td>plot input_coll_01 05/03/01 - 05/03/03</td>
</tr>
<tr>
<td>0x0001</td>
<td>plot input_coll_02 05/03/03 - 05/03/05</td>
</tr>
<tr>
<td>0x0002</td>
<td>plot input_coll_03 05/03/06 - 05/03/07</td>
</tr>
<tr>
<td>0x0003</td>
<td>plot input_coll_04 05/03/07 - 05/03/09</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

- **Calibration Key**: AcdPedestals
- **Value**: 241.5
- **Link to validation plots**: input_coll_01
- **Validity Data**: 05/03/01 - 05/03/03
- **Link to input data**: input_coll_02

...
Web Based Interface, search criteria

- **Channel**
  - Physical and electronics spaces
  - One or more channels
    - Example ( Cal, Tower 16, Layer 3, Log * )
    - Example ( Acd, GARC 0, GAFE 1 )

- **Time**
  - Date, time
  - Time stamp (seconds, nanosec since epoch start)

- **Run**
  - Which calibration will be used to process a run
    - Need to build from timestamps

- **LAT configuration**
  - Calibration depends on LAT configuration
Web Based Interface, single calibration view

**Calibration:** Top Level, Version v0r0, Key 0x0000
**Validity Range:** 05/03/01 - 05/03/03

<table>
<thead>
<tr>
<th>Acd</th>
<th>Channel:</th>
<th>Pedestals</th>
<th>GARC</th>
<th>GAFE</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mip Peaks</td>
<td>GARC</td>
<td>GAFE</td>
</tr>
<tr>
<td>Cal</td>
<td>Channel:</td>
<td>Pedestals</td>
<td>Tower</td>
<td>Layer</td>
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<tr>
<td></td>
<td></td>
<td>LEX8 Gains</td>
<td>Tower</td>
<td>Layer</td>
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<tr>
<td></td>
<td></td>
<td>LEX1 Gains</td>
<td>Tower</td>
<td>Layer</td>
</tr>
<tr>
<td>Tkr</td>
<td>Channel:</td>
<td>Dead Strips</td>
<td>Tower</td>
<td>LayerSide</td>
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<tr>
<td>Align</td>
<td>Channel:</td>
<td>Layers</td>
<td>Tower</td>
<td>LayerSide</td>
</tr>
</tbody>
</table>

**Calibration Name**

**Drill down to single channel calibrations**

**Search for a single channel by name**