

# Digitization Using the SiSim Package

- ◆ Most of this code was originally developed for SiD by Tim and Jeremy
- ◆ Matt Graham and RP have been working to make this code work for ATLAS upgrade
- ◆ Allows rectangular planar detectors in barrel
  - Flexible geometry allows pinwheel or castellated designs with azimuthal and/or z overlaps
  - Can have multiple sensors in a module (i.e., 2 single sided sensors to form a stereo pair) and/or double sided sensors
- ◆ Two different endcap packages
  - Division of a plane into wedges by specifying #rings, max sensor size
  - Equally spaced (in azimuth) isosceles trapezoid shaped sensors

# RP and MG Changes

- ◆ Extended SiSensorElectrodes class to form SiPixel class
  - Tim had already done most of the infrastructure
  - Rather minimal differences relative to existing SiStrip class
- ◆ Developed a generic readout chip
  - Existing KPix readout chip was a very detailed, specific implementation
  - Generic readout chip is much simpler, easier to debug
- ◆ Rewrote clustering code
  - Introduced ClusteringAlgorithm interface to allow the use of different clustering algorithms
  - New implementation of a nearest neighbor clustering algorithm that scales linearly with number of hits, doesn't go into infinite loop
  - Works with either strips or pixels
- ◆ Eliminated many hard-coded constants / parameters
- ◆ Successfully adapted code for ATLAS upgrade

# Breaking News

- ◆ Originally, the code that constructs strip electrodes was contained in the class that created the sensors
- ◆ Sensor geometry is specified in the compact.xml file
- ◆ Strip/pixel electrode geometry is implemented in code
  - This is where you implement the details of the sensor design beyond the geometrical boundaries, so need flexibility
  - May be easiest to leave as user code rather than try to figure out all “interesting” cases
- ◆ Yesterday, Jeremy pulled the code that constructs the electrodes out of GeomConverter and put it into a driver
  - Major step forward
  - We can now develop more than one detector without resorting to private versions of barrel / endcap GeomConverter classes

# Still Some Missing Pieces

- ◆ sATLAS and SiDloi versions of the electrode driver code
- ◆ Would like to be able to handle polygonal sensors
  - Currently limited to Isoceles Trapezoids
  - Current sATLAS design has non-trapezoid sensors in endcap
  - Other geometries might be of interest (hexagons, wedges with cut corners, etc.)
- ◆ Still a number of hard-coded parameters
  - Example: ChargeCarrier enum has 8 hard coded mobility parameters
  - ChargeCarrier is widely used to distinguish carrier type
  - Move mobility parameters to a dedicated, user settable mobility class?
- ◆ Radial Strips?
  - Current SATLAS design, probably not too difficult to implement
- ◆ Short Strips?
  - sATLAS has strips divided into 2-4 electrically separate short strips
  - Treat as long pixels with no z clustering?

# Tracking with Digitization

- ◆ Have sATLAS tracking with full digitization working
  - Have been using/improving code for several months
  - Need to update to use electrode drivers
  - Detector geometry clearly visible by looking at origin of secondaries

