

What's the object(ive) of tracking?

- some things:
 - hits, wires, clusters, track segments, tracks, trajectories, outer detector matching hits,
- some actions:
 - find clusters of hit wires in one superlayer, find possible track segments within a cluster, link segments from different superlayers into a track candidate, “swim” a trajectory through CLAS, find all hits which are “close” to a candidate trajectory, decide the “left-right” for each hit, calculate the doca between track and wire, calculate the doca from the wire hit alone, correcting for local angle, B-field, coordinate along the wire and beta

Order of actions ...

- identify clusters of hits in superlayers
- find paired clusters in neighboring superlayers
- link clusters to find track candidates
- trim linked clusters to viable segments
- convert time \rightarrow distance for hits in segments
- do local l-r ambiguity \rightarrow space hits
- fit space hits to a track

What objects (and methods) are best suited to the problem?

- from the track-finder's point of view
 - finds suitable clusters of hits consistent with a track
- from the track's point of view-
 - a track has methods which finds nearby hits using a calculated trajectory, and calculates the residuals between the trajectory and the hit positions. A final method is to minimize chi-squared by a combination of discarding bad hits and iterating the trajectory
- from the hit's point of view-
 - a hit has methods to transform itself from a TDC value to a 3-d space point, using information from the track trajectory

What are the Objects?

- Signal object
 - has a
 - type (ADC, TDC, other?)
 - electronic location (crate, slot, channel)
 - value (integer)
 - Purpose: returns an integer value
 - Requires: a valid entry on a signal list
 - Promises: a meaningful integer

more objects

- WireHit object
 - has a
 - geometric location (a wire id. number)
 - a pointer (?) to a Signal object
 - Purpose: returns a wire id. number
 - Requires: that the wire has a valid Signal, and also a signal channel to wire number map
 - Promises: to return a valid wire identification (sector, layer, wire) for any valid signal identification (crate, slot, channel)
 - Comment: used in “hit-based” tracking

more objects

- TimeHit object
 - has a
 - a pointer (?) to a WireHit object
 - value (in ns); with event-independent corrections done
 - Purpose: returns a time value in ns
 - Requires: that the wire has a valid WireHit
 - Promises: to return a time in a useful range for conversion to distance

... and more

- TrackTimeHit object
 - has a
 - is in a one-to-many relation with a TimeHit
 - a track-dependent (flight path, beta-dependent time walk, signal propagation time along wire) time correction
 - Purpose: return a track-dependent corrected time
 - Requires: that the wire has a valid TimeHit and that the TimeHit be included in a TrackHitList.
 - Promises: a legitimate time useful for converting to a calculated distance-of-closest-approach

... and more

- TrackSpaceHit object
 - has a
 - is in a one-to-one relation with a TrackTimeHit
 - a track-dependent (local angle, B-field) time to distance conversion
 - geometric location (a 3-d point-of-closest approach)
 - a “left-right” resolution choice (-1,0,+1)
 - Purpose: return a 3-d space point
 - Requires: that the wire has a valid TrackTimeHit
 - Promises: a legitimate 3-d space point

..... it continues

- TrackSegment object
 - has a
 - TrackSegmentHitList (a list of wires with valid WireHit objects)
 - Trajectory (a list of 5Vectors defined at various DetectorPlanes)
 - Chisquared (a match of the Trajectory with the TrackSpaceHits on the TrackHitList)
 - Purpose: provide a hit list within a superlayer that might be part of a Track
 - Requires: a valid ClusterHitList
 - Promises: a valid value for 5Vectors, Chisquared and TrackSegmentHitList

..... it continues

- Track object
 - has a
 - TrackHitList (a list of wires with valid WireHit objects)
 - Trajectory (a list of 5Vectors defined at various DetectorPlanes)
 - Chisquared (a match of the Trajectory with the TrackSpaceHits on the TrackHitList)
 - TOFHitList (a list of TOF paddles with valid TOFTimeHits and a match with the trajectory)
 - Purpose: provide valid 5Vectors at various planes
 - Requires: a valid TrackHitList and a valid Trajectory
 - Promises: a valid value for 5Vectors and Chisquared

..... it continues

- Track object
 - member functions
 - findHits
 - Purpose: for each plane; queries the “left wire” and “right wire” for a valid TimeHit and assigns a +, -, or 0 value to each TimeHit for conversion to a TrackTimeHit and then to a TrackSpaceHit
 - Requires: a valid Trajectory
 - Promises: a TrackHitList with 0 to 2*nplanes members

..... it continues

- Track object
 - member functions
 - generateTrajectory
 - Purpose: produce a 5-vector at each detector plane if the projected trajectory is within a fiducial volume
 - Requires: a starting 5-vector within the CLAS12 fiducial volume
 - Promises: a FiveVectorList with 0 to nplanes members

... two CRC cards

class, responsibilities, collaboration

TimeHit

Responsibilities

- identify wire (sec, lay, wire)
- transform TDC signal \Rightarrow time
- correct time for fixed delays

Collaborators

- signal \Leftrightarrow wire map
- table of cable delays

TrackHit

Responsibilities

- do trk-dependent time corrections
- do trk-dependent time \Rightarrow distance
- return a 3-d space point

Collaborators

- trajectory (defines y as well as local angle, B-field, path length)
- TOF time (defines beta)
- event start-time