BigBite Tracking Software Progress

Transversity Collaboration Meeting
09 July 2007

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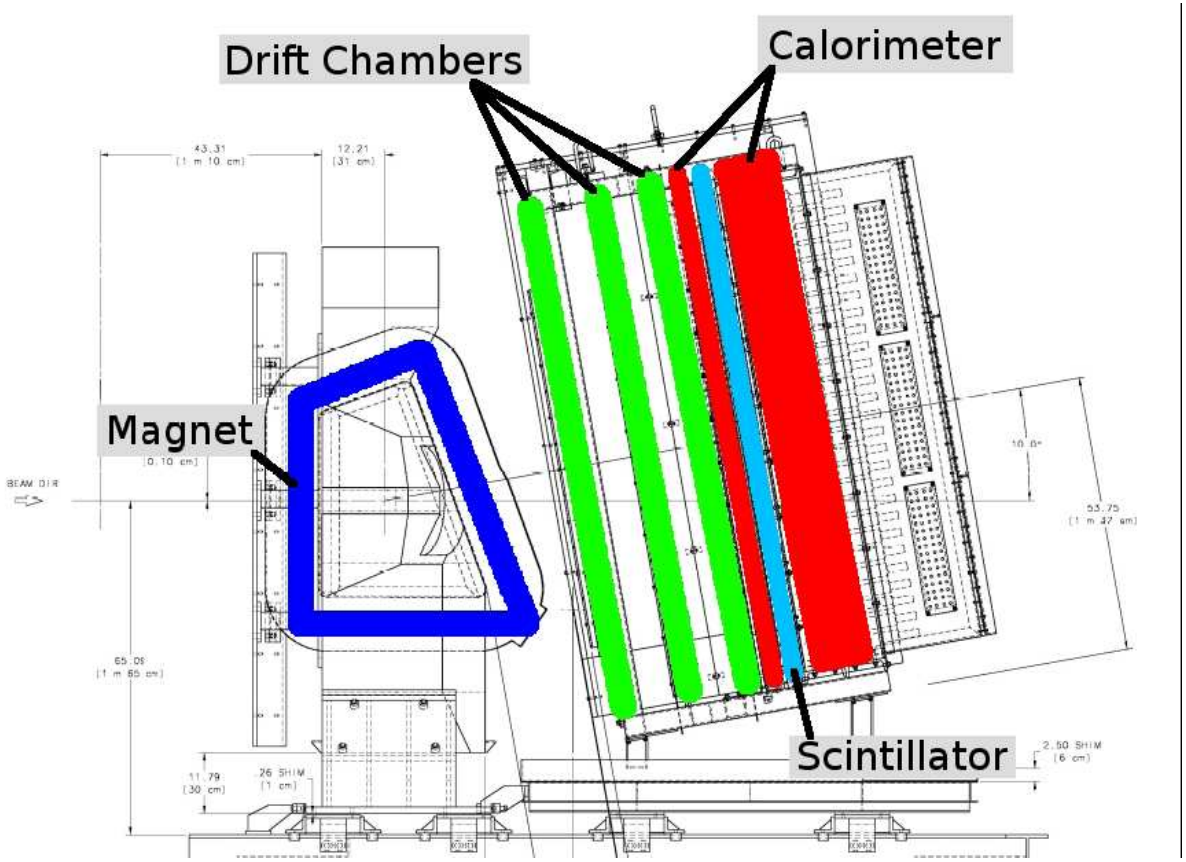
BigBite Spectrometer



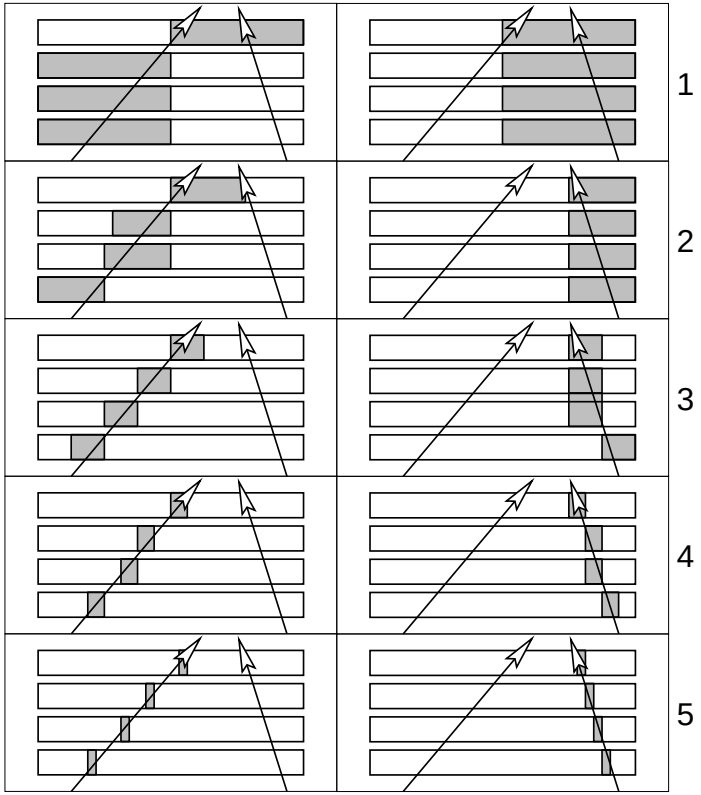
BigBite Tracking System Properties

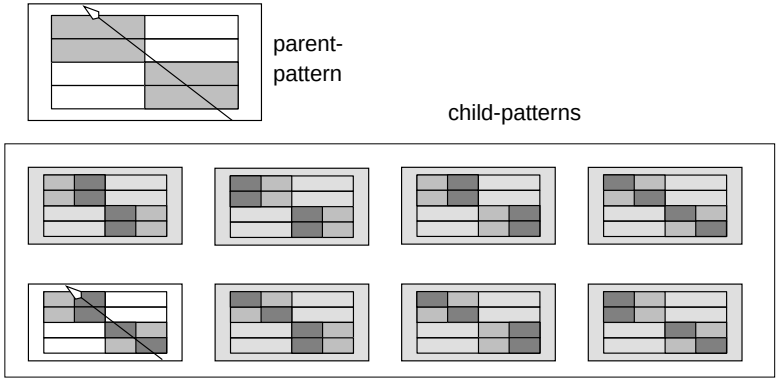
	Front	Center	Back
z position (mm)	0	50–350	710
Active height (mm)	1400	2000	2000
Active width (mm)	350	500	500
Wire spacing (mm)	10	10	10
# of Planes	6	3 or 6	6
Plane order	UU'XX'VV'	UXV or UU'XX'VV'	UU'XX'VV'
# of Wires (X)	142	202	202
# of Wires (U/V)	141	200	200

- U/V axes at $\mp 30^\circ$, X axis at 0° w.r.t. vertical
- Primed planes have staggered wires (offset by 1/2 wire spacing)
- 3256 channels total when fully instrumented

Tree Search Algorithm

Recursive method for finding straight lines in a hit pattern

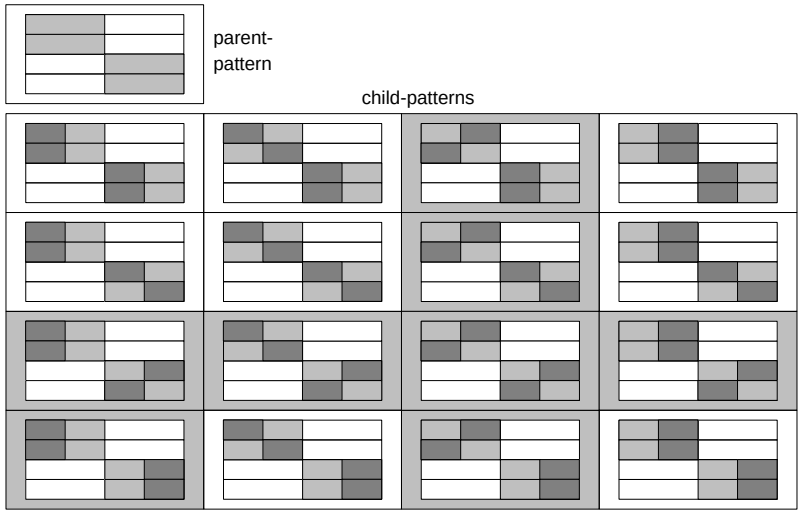


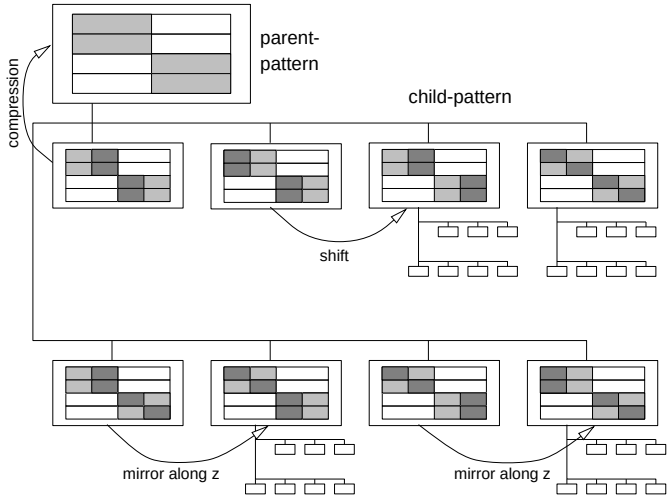


Pattern Database (PDB)

- Stores precomputed hit patterns for physically allowed tracks at all levels of bin resolution
- Coarse acceptance cuts (positions, apertures, angles) may be applied at generation time by omitting outlying patterns
- Compression important for managable size (memory!). Eliminates redundant entries by exploiting symmetry (translational, rotational, mirror)
- Challenge: Accomodate different chamber arrangements called for by experiments (different symmetries)

Pattern Database Generation

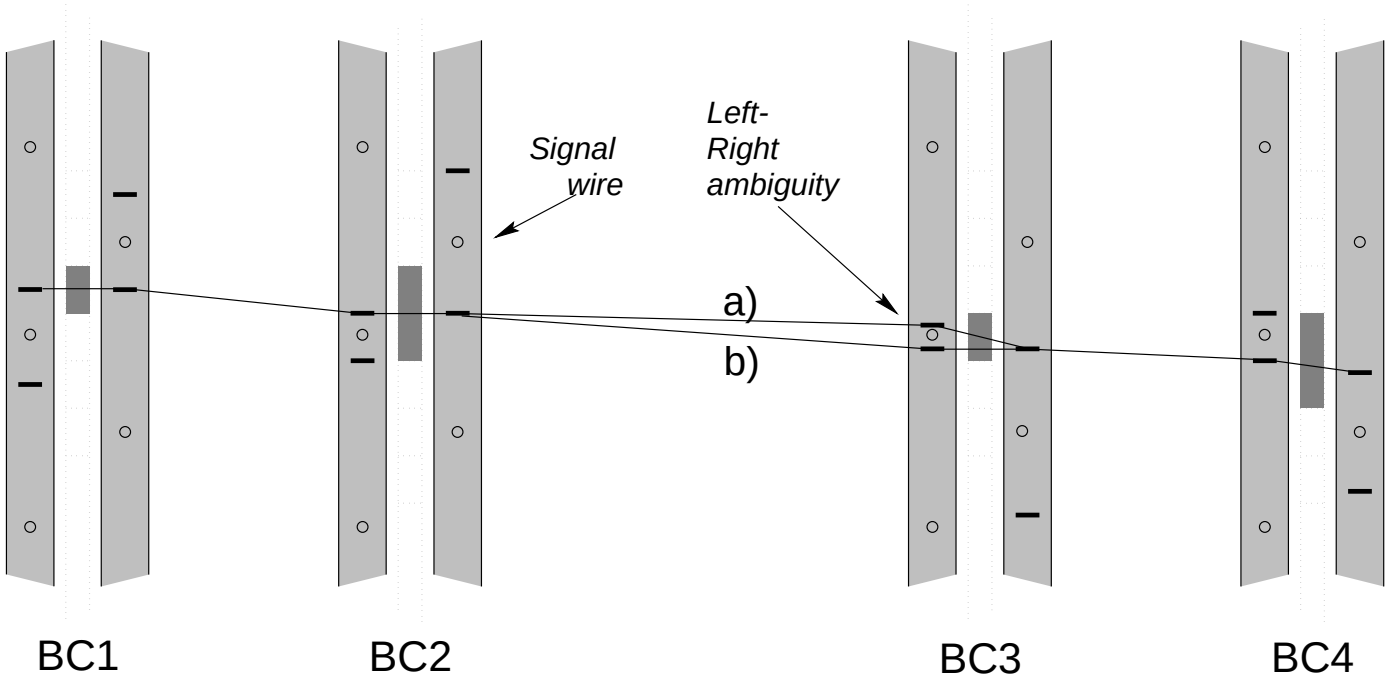




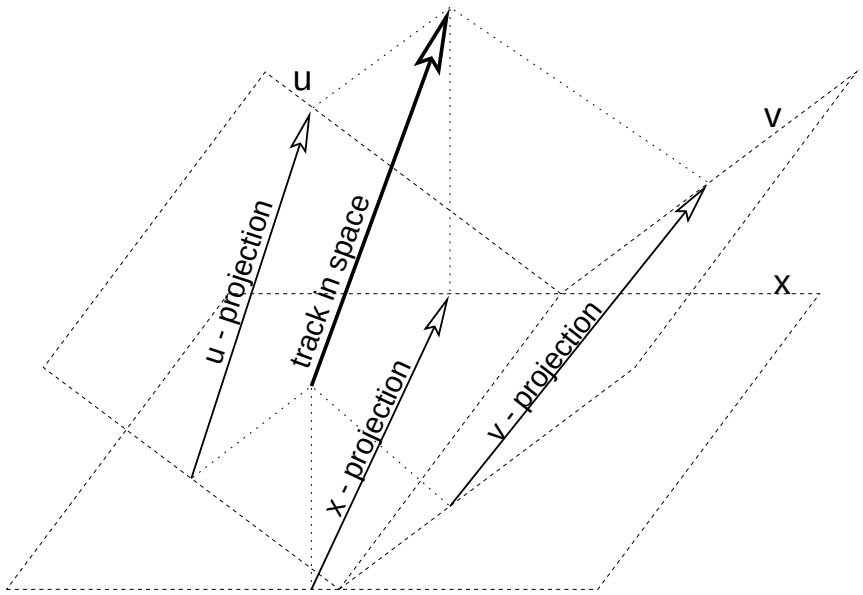
Tree Search Algorithm Detail

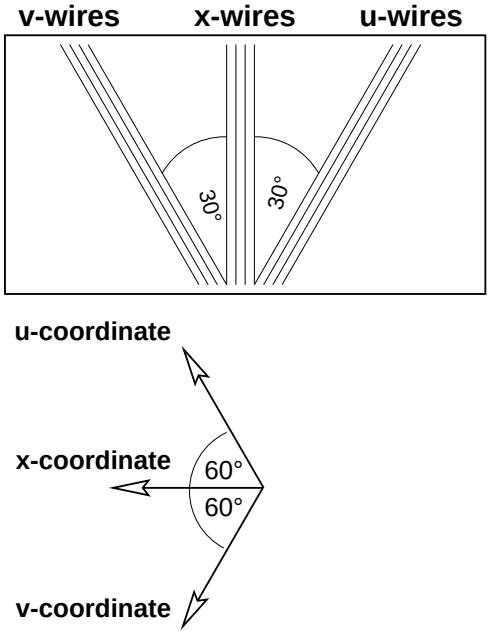
- For u-, v-, x-coordinates separately:
  - Convert drift times to distances
  - Make hit pattern
    - Use staggered planes to resolve most LR-uncertainties
    - Set adjacent bins if necessary to account for detector resolution
    - Allow for missing hits
  - Match hits to precomputed patterns recursively $\longrightarrow$ "roads"
  - Do linear fit of hits within each road $\longrightarrow$ "projected tracks" (resolves remaining LR-unertainties)
- Combine fitted $u/v/x$ track projections in 3D $\longrightarrow$ "tracks"
- (optional) match tracks to other detector hits (*e.g.* shower clusters)
- Reconstruct tracks to target

Track Fitting Within A Road



Combination of Projected Tracks in 3D





NB: BigBite coordinates rotated by 90° counter-clockwise w.r.t. above

Status

Working:

- PDB generator. (Compression partly implemented)
- Pattern matching (PM) code
- Simple Monte Carlo for 2D hit patterns (still buggy)
- C++ analyzer interface, database reader, CVS repository

Progressing:

- Decoder
- Generation of hit patterns from data

Quick & Dirty Results

(from Brandon Belew, RPI, SULI summer student)

```
Enter rows, bins, tracks: 3 64 3
ev has 7 levels, 64 bins
. . . . . X . . . . . X . . . . . X . . . . . .
. . . . . X . X . . . . . X . . . . . .
. . . . X . . . . . X . . . . . . . . . . . . X . . . . . .
Pattern DB initialized for 3 rows and max of 64 bins
thaDB contains 13399 nodes and 10112 leaves
3 matches found
match 0:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .

match 1:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . X . . . . . .

match 2:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .
```

Results II

```
Enter rows, bins, tracks: 3 64 3
ev has 7 levels, 64 bins
. . . . . X . . . . . X X . . . . . .
. . . . . X . . . . . X . . . . . .
. . . . . X . . . . . X X . . . . . .
Pattern DB initialized for 3 rows and max of 64 bins
thaDB contains 13399 nodes and 10112 leaves
7 matches found
match 0:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .

match 1:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .

match 2:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .

match 3:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .
```

Results II (cont.)

```
match 4:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .

match 5:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .

match 6:

. . . . . X . . . . . .
. . . . . X . . . . . .
. . . . . X . . . . . .
```

To Do

- Careful testing of pattern matching code using simple MC (this month)
- Integration of prototype code into class framework
- Track fitting within roads
- Combination of projected tracks in 3D
- Re-testing using advanced MC input
- Target reconstruction
- (optional) Event Display

ETA $\approx$ 4 months