OO Conversion of the ALPHA BOS Bank Structure

/afs/cern.ch/aleph/project/database/cavanaug/PrototypeB/Applications

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December 6, 2000
ALPHA++ Meeting

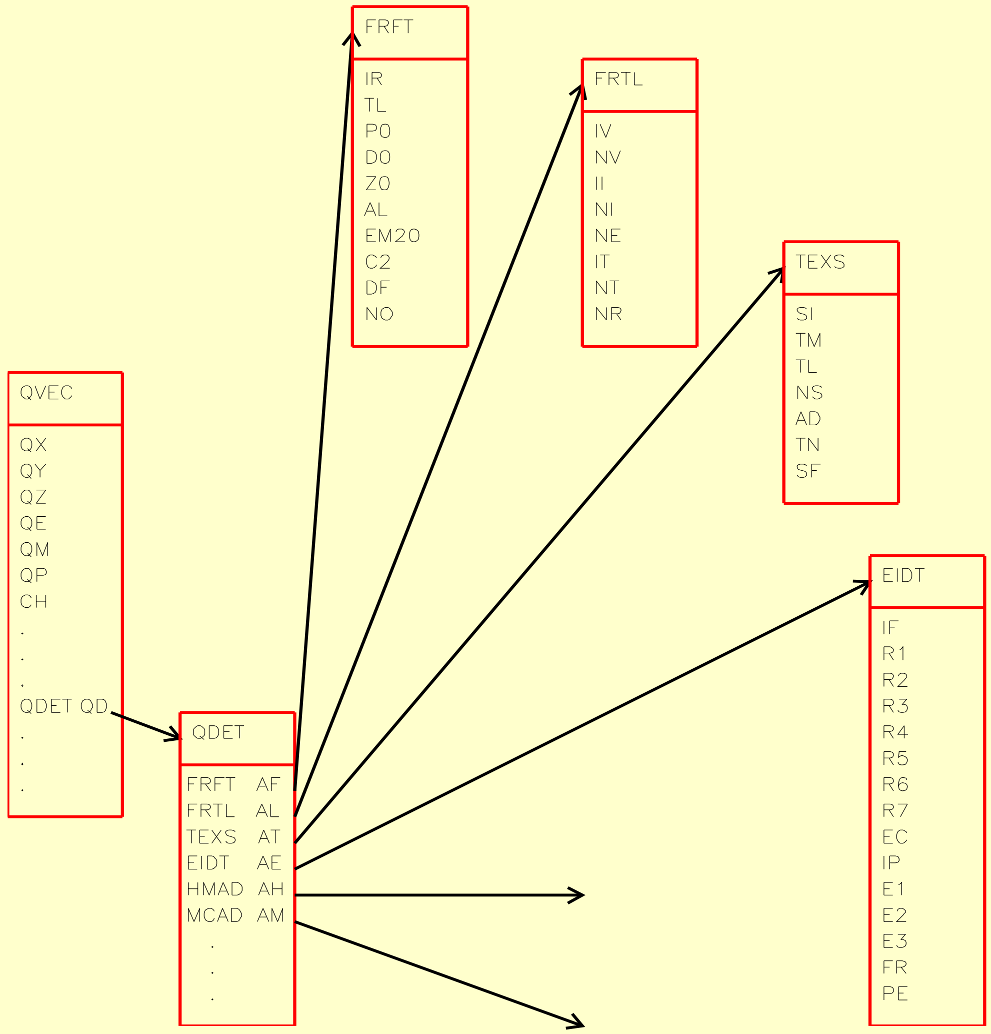
- New Tree-like Data Structure for QVEC
- New Monte Carlo Truth Class
- Conclusion

The ALPHA Data Structure Model

- The QVEC Bank is the fundamental "ALPHA track object"

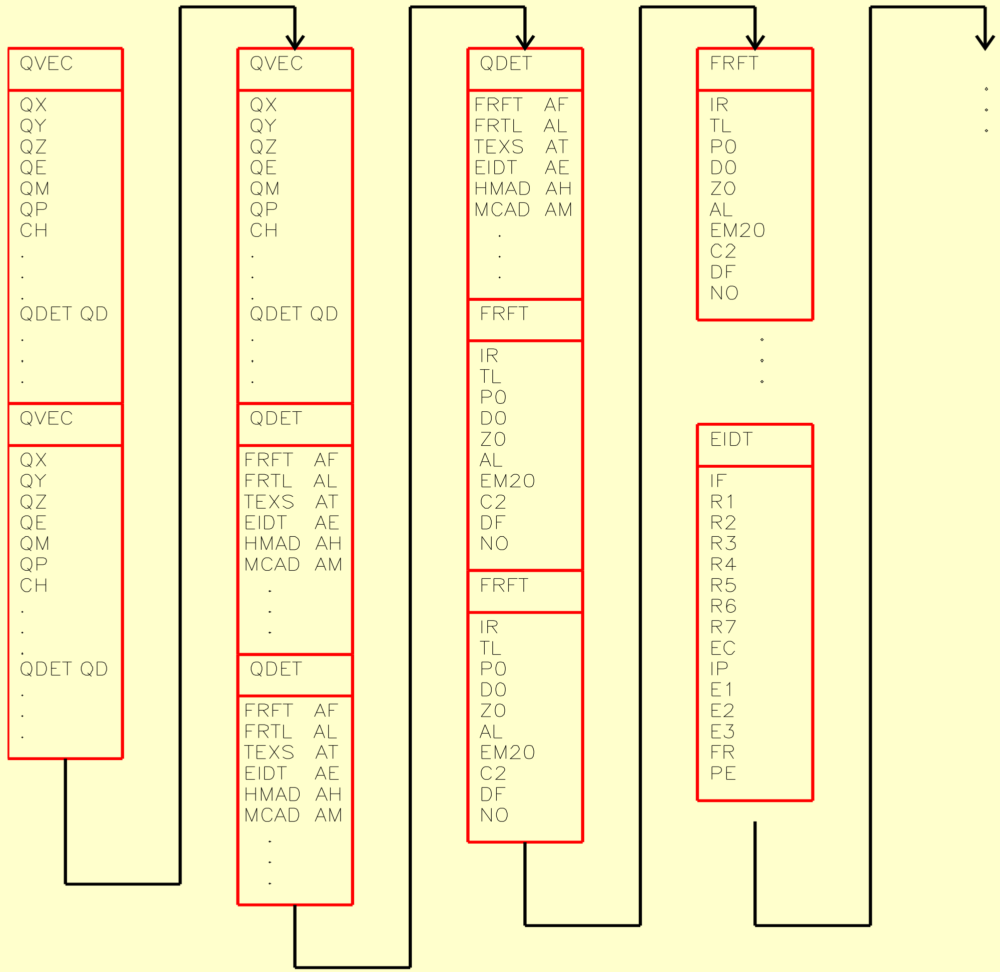
- Bank QVEC has a pointer to the detector information in Bank QDET and corresponds to a particular "track".

- Bank QDET then has pointers to other Banks: FRFT (Tracking), FRTL (Tracking), TEXS (dE/dx), etc.



BOS Implementation of the Model

- The BOS implementation of the model is essentially a linear "look-up" table.



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The ALPHA Data Structure Model

- **Conclusion:** FORTRAN ALPHA already has an OO like design, but a non-OO like implementation

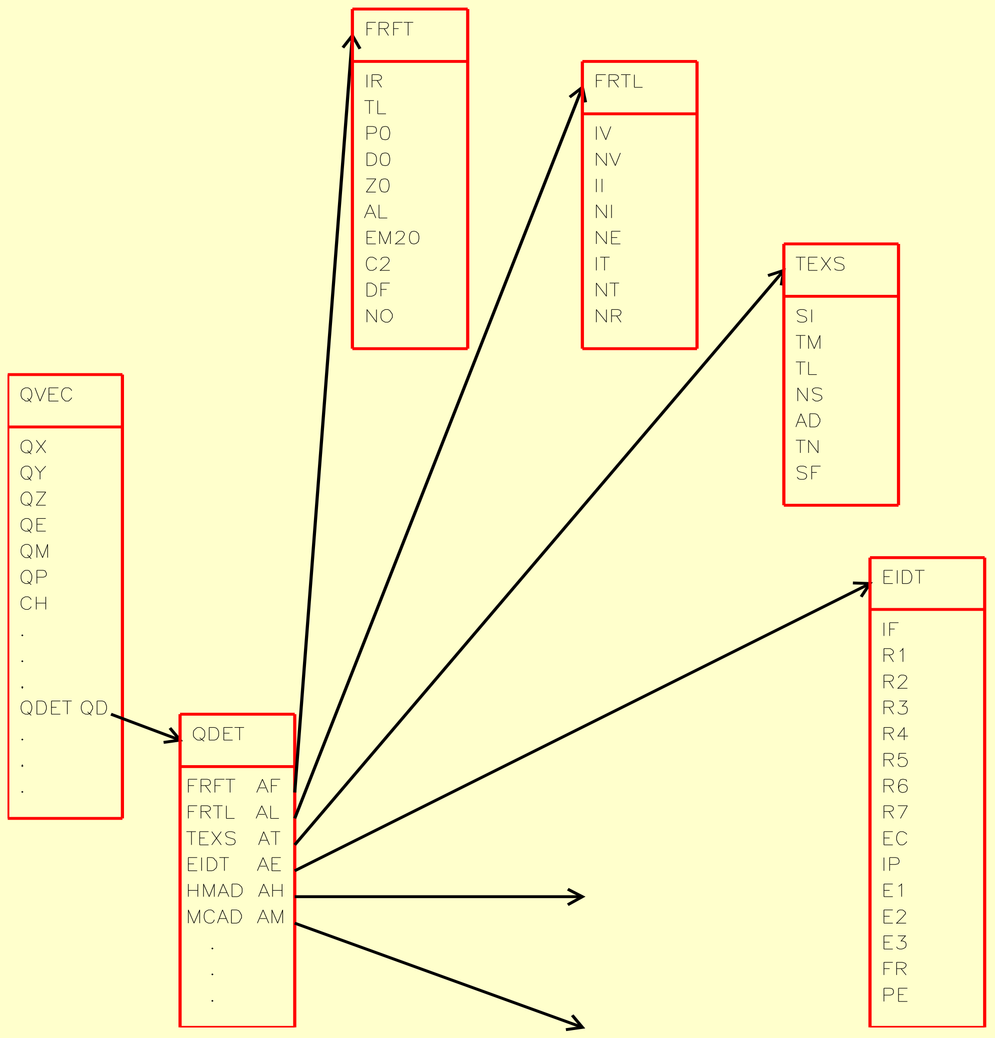
- **Idea:** Directly convert the ALPHA BOS Bank structure into a C++ tree-like data structure

- **Advantages:**
  - Minimises FORTRAN: Cut FORTRAN out at the level of copying the FORTRAN BOS Banks to the C++ Object Tree
  - Natural: All data used by ALPHA is available to ALPHA++ in a transparent way.

- **Example:** Implementation of Monte Carlo Truth information becomes almost trivial.

C++ Data Structure Model and Implementation

- QVEC is the fundamental *class*
- QVEC has a pointer to the detector information *class*: QDET
- The *class* QDET then has pointers to *classes*: FRFT (Tracking), FRTL (Tracking), TEXS (dE/dx), etc.
- AlphaBanks fills everything into an STL vector of QVEC objects



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Accessing information in the Object Tree

Stick to the naming convention of ALPHA (well documented).

For example, to access the number of VDET hits for a charged track

- `qvec` is of type `QVEC`
- `QVEC` has a data member `QD` of type `QDET`
- `QDET` has a data member `AL` of type `FRTL`
- `FRTL` has a data member `NV` of type `int`
- Thus,

```
Num_VDET_hits = qvec -> QD -> AL -> NV;
```

What has changed?

Slightly Modified:

- `AlObject.h`

- `AlTrack.h,   AlEflw.h,   AlGamp.h`
- `AlTrack.cpp, AlEflw.cpp, AlGamp.cpp`

- `QvecBase.h`
- `QvecBase.cpp`

Completely changed:

- `AlphaBanks.h` –simplier and more concise
- `AlphaBanks.cpp` –fills the Object Tree and the other objects

New:

- `BankClasses.h` –Class definitions for nodes in the Tree
- `BankClasses.cpp` –fills and attaches nodes in the Object Tree

- `BankPatterns.h` –Patterns which overlay the BOS memory structure

Important OO considerations

WORK COMPLETED:

Just as in the earlier ALPHA++ versions, the `qvec` object tree is only accessable through objects derived from QvecBase:

- AlTrack
- AlEflw
- AlGamp
- etc.

This forces the user to access all information only through designated objects and prevents the user from having direct access to `qvec`.

WORK IN PROGRESS:

write protect `qvec` against accidental modification...this is not yet implemented...suggestions are welcome!

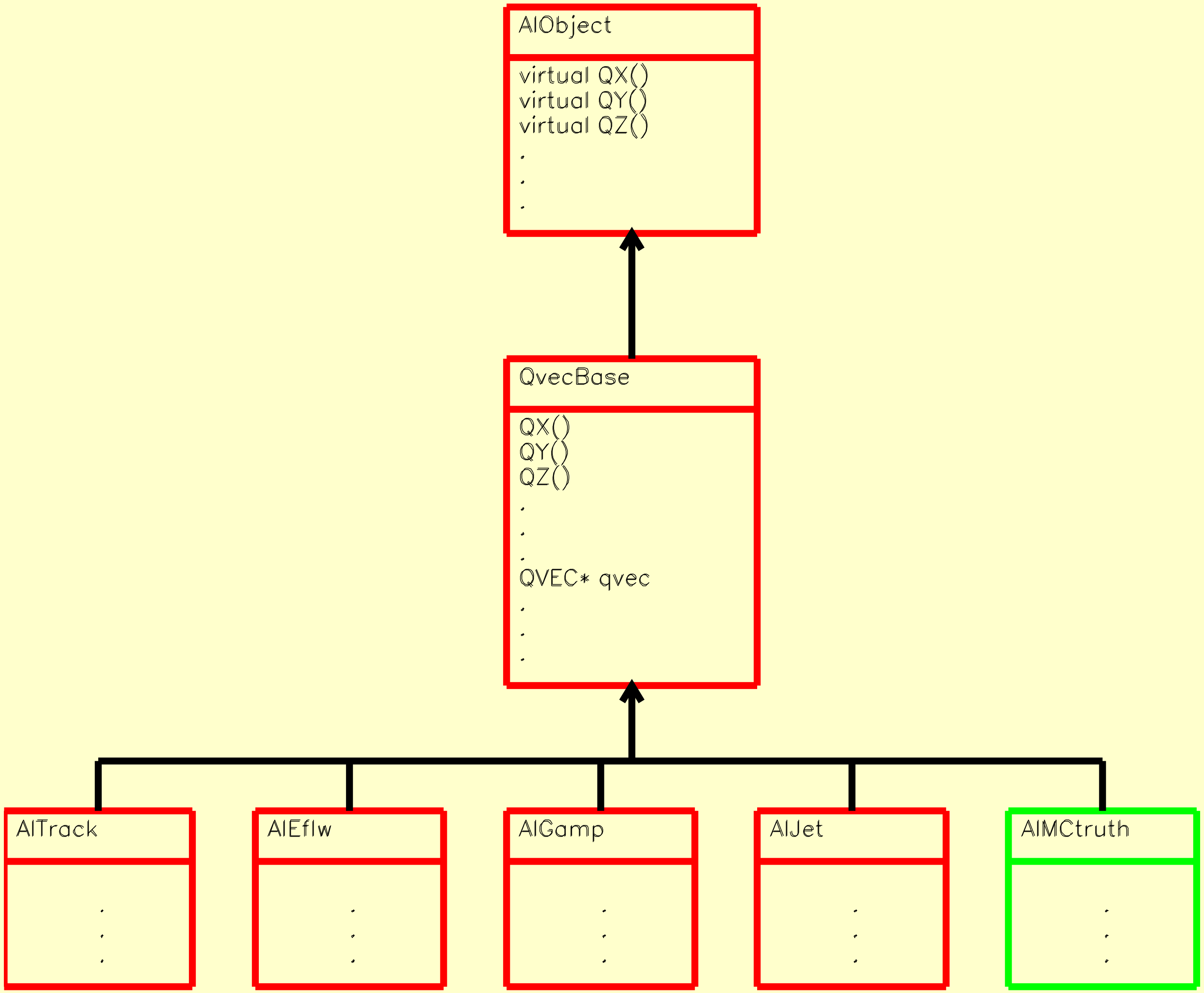
Monte Carlo Truth Implementation

Add a class which inherits from QvecBase called AlMCtruth which:

- has an AlephVector of pointers to Mother(s)
- has an AlephVector of pointers to Daughters
- privides its Monte Carlo Particle Identification Code

```
class AlMCtruth : public QvecBase
{
public:
   AlMCtruth();                                        // constructor
   AlMCtruth(const AlMCtruth&);                        // copy constructor
   AlMCtruth& operator= (const AlMCtruth& OldM);       // assignment operator
  ~AlMCtruth();                                        // destructor
   ALEPHTYPE TYPE(){return MCTRUTH;}                   // get the object type
   void setMotherVector(   AlephVector<AlMCtruth*> );// set mothers
   void setDaughterVector( AlephVector<AlMCtruth*> );// set daughters
   AlephVector<AlMCtruth*> getMotherVector();          // get mothers
   AlephVector<AlMCtruth*> getDaughterVector();        // get daughters
   int PA() { return qvec -> PA; }                     // MC particle code
   int NO() { return qvec -> NO; }                     // number of Mothers
   int ND() { return qvec -> ND; }                     // number of Daughters
   char* name();                                       // name of particle
private:
   AlephVector<AlMCtruth*> Mother;                     // vector of pointers to mother(s)
   AlephVector<AlMCtruth*> Daughter;                   // vector of pointers to daughters
};
```

Monte Carlo Truth Implementation



Conclusion

- The ALPHA BOS Banks have been converted into a **C++ tree-like data structure**.

- This **defines a border**, beyond which ALPHA++ is independent of FORTRAN.

- **Backward compatibility** has almost been achieved:
  - The implementation is transparent to the user
  - AlTrack, AlEflw, AlGamp, etc., need to be slightly modified

- A new **Monte Carlo Truth class** has been developed using the new tree-like data structure.

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Future

- Implement a C++ tree-like data structure for QVRT
- Provide additional protection against modifying `qvec` and `qvrt`
- Di-fermion physics analysis already under development...