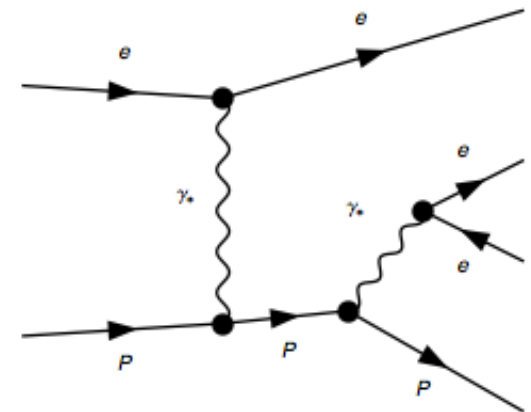
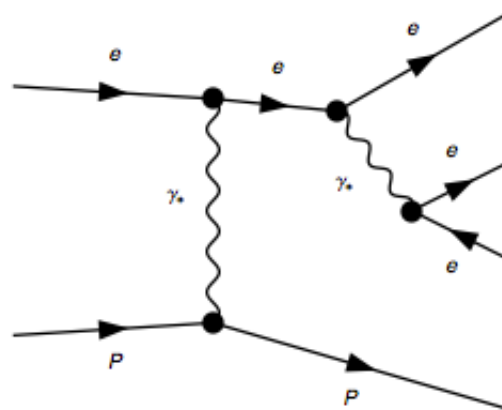
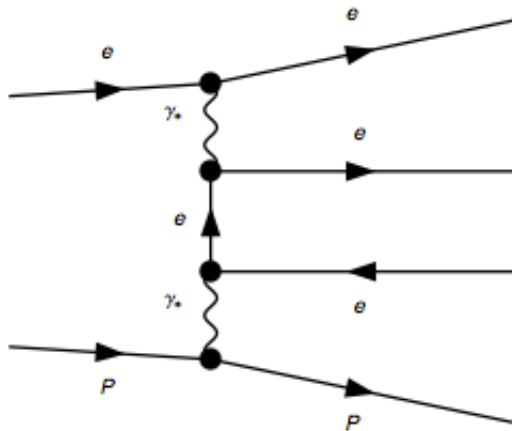


Using the CLAS12 Analysis Framework to Analyze CLAS6 Data

Timothy B. Hayward

DPWG Meeting, June 15

Looking for lepton-trident events ($e^- + p \rightarrow e^- + e^- + e^+ + p'$).



Why Trident Spin Asymmetries

- Double spin asymmetries are known in terms of the form factors for the elastic scattering region.
- As CLAS moves to 12 GeV, there is concern about rates of elastic scattering events.

Goals

- Be the first to use CLAS12 software to analyze CLAS6 data. (A learning process!)
- Use CLAS12 software to develop kinematic fitter based on previously developed cuts to pick out trident events from eg1-dvcs data.
- Write a Java class responsible for the analysis routine.

```

public static void main(String[] args) {

    HipoDataSource reader = new HipoDataSource();
    reader.open("/volatile/clas12/thayward/eg1dvcs_data/temp/hipo/run_58799_pass1.a00");
    GenericKinematicFitter fitter = new fitter_A(5.887);
    EventFilter filter = new EventFilter("11:2212");

    while(reader.hasEvent()==true){
        HipoDataEvent event = reader.getNextEvent();
        PhysicsEvent recEvent = fitter.getPhysicsEvent(event);

        if(filter.isValid(recEvent)==true){
            Particle mx = recEvent.getParticle("[b]+[t]-[11]-[2212]");
            System.out.println(mx.e());
        }
    }
}

```

```
public static void main(String[] args) {
```

CLAS12 hipo files

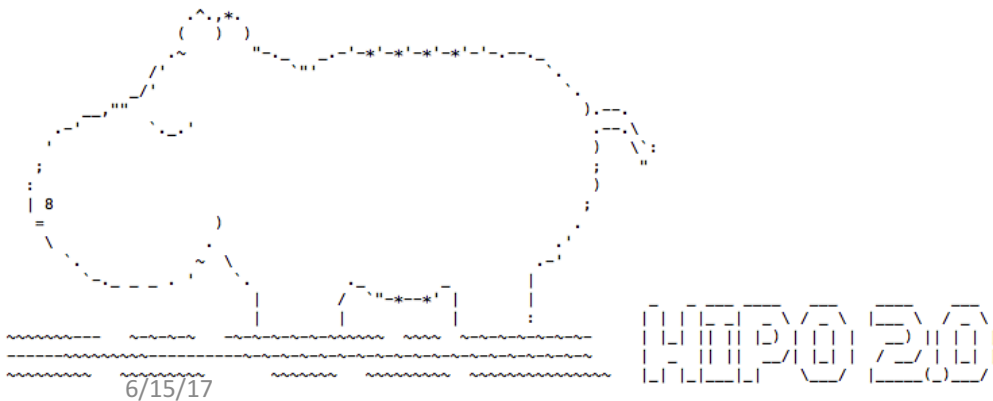


```
    HipoDataSource reader = new HipoDataSource();
    reader.open("/volatile/clas12/thayward/eg1dvcs_data/temp/hipo/run_58799_pass1.a00");
    GenericKinematicFitter fitter = new fitter_A(5.887);
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    while(reader.hasEvent()==true){
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        PhysicsEvent recEvent = fitter.getPhysicsEvent(event);


        if(filter.isValid(recEvent)==true){
            Particle mx = recEvent.getParticle("[b]+[t]-[11]-[2212]");
            System.out.println(mx.e());
        }
    }
}
```

- CLAS12 software uses new data compression .hipo files.
- Old CLAS6 .bos files are stored on tape and must be converted.



```
1 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a00
2 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a01
3 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a02
4 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a03
5 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a04
6 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a05
7 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a06
8 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a07
9 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a08
10 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a09
11 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a10
12 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a11
13 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a12
14 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a13
15 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a14
16 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a15
17 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a16
18 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a20
19 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a21
20 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a22
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23 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a25
24 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a26
25 /mss/clas/eg1dvcs/production/pass1/v3/data/main/run_58799_pass1.a27
```

```
public static void main(String[] args) {  
  
    HipoDataSource reader = new HipoDataSource();  
    reader.open("/volatile/clas12/thayward/eg1dvcs_data/temp/hipo/run_58799_pass1.a00");  
    GenericKinematicFitter fitter = new fitter_A(5.887);  
    EventFilter filter = new EventFilter("11:2212");  
  
    while(reader.hasEvent()==true){  
        HipoDataEvent event = reader.getNextEvent();  
        PhysicsEvent recEvent = fitter.getPhysicsEvent(event);  
  
        if(filter.isValid(recEvent)==true){  
            Particle mx = recEvent.getParticle("[b]+[t]-[11]-[2212]");  
            System.out.println(mx.e());  
        }  
    }  
}
```

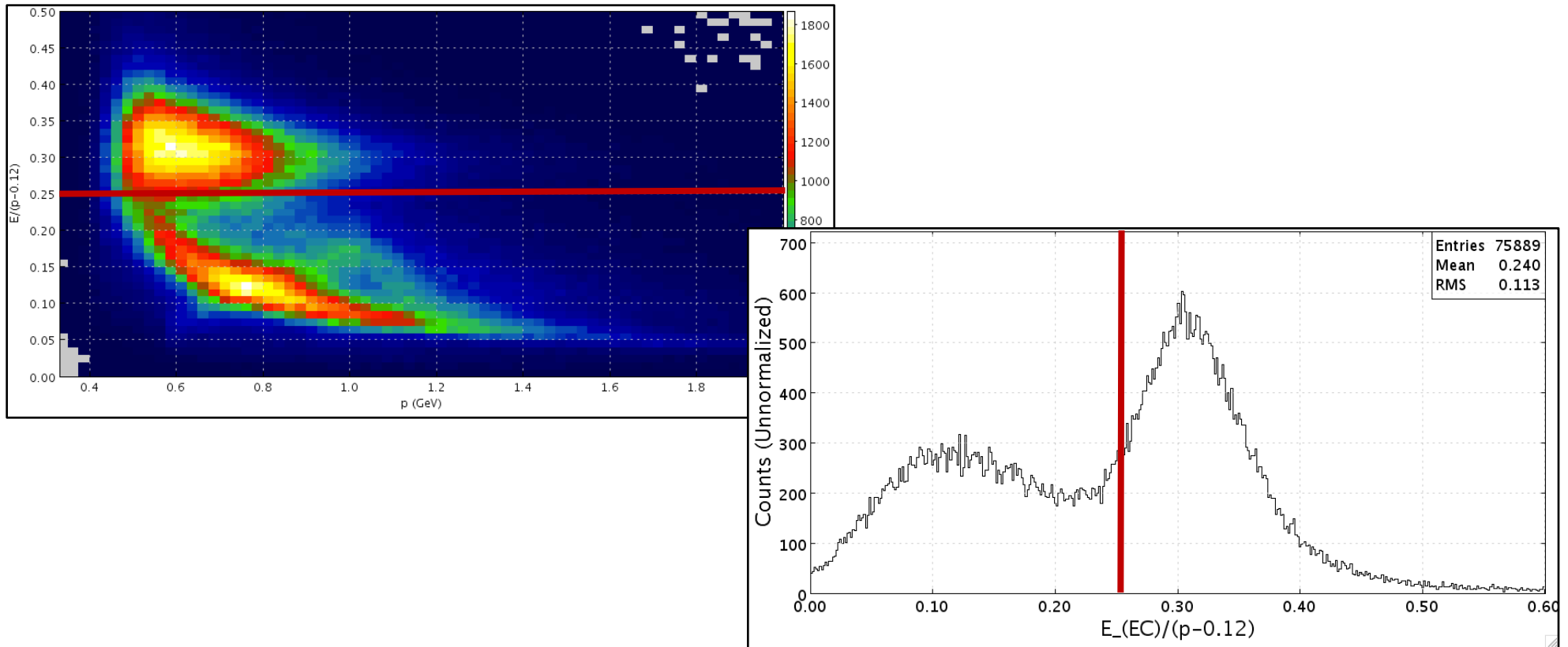


Where the work gets done!

- With the latest build, all relevant CLAS6 detector information is available for perusal with the CLAS12 software.
- Each analysis group can develop their own Kinematic Fitter.

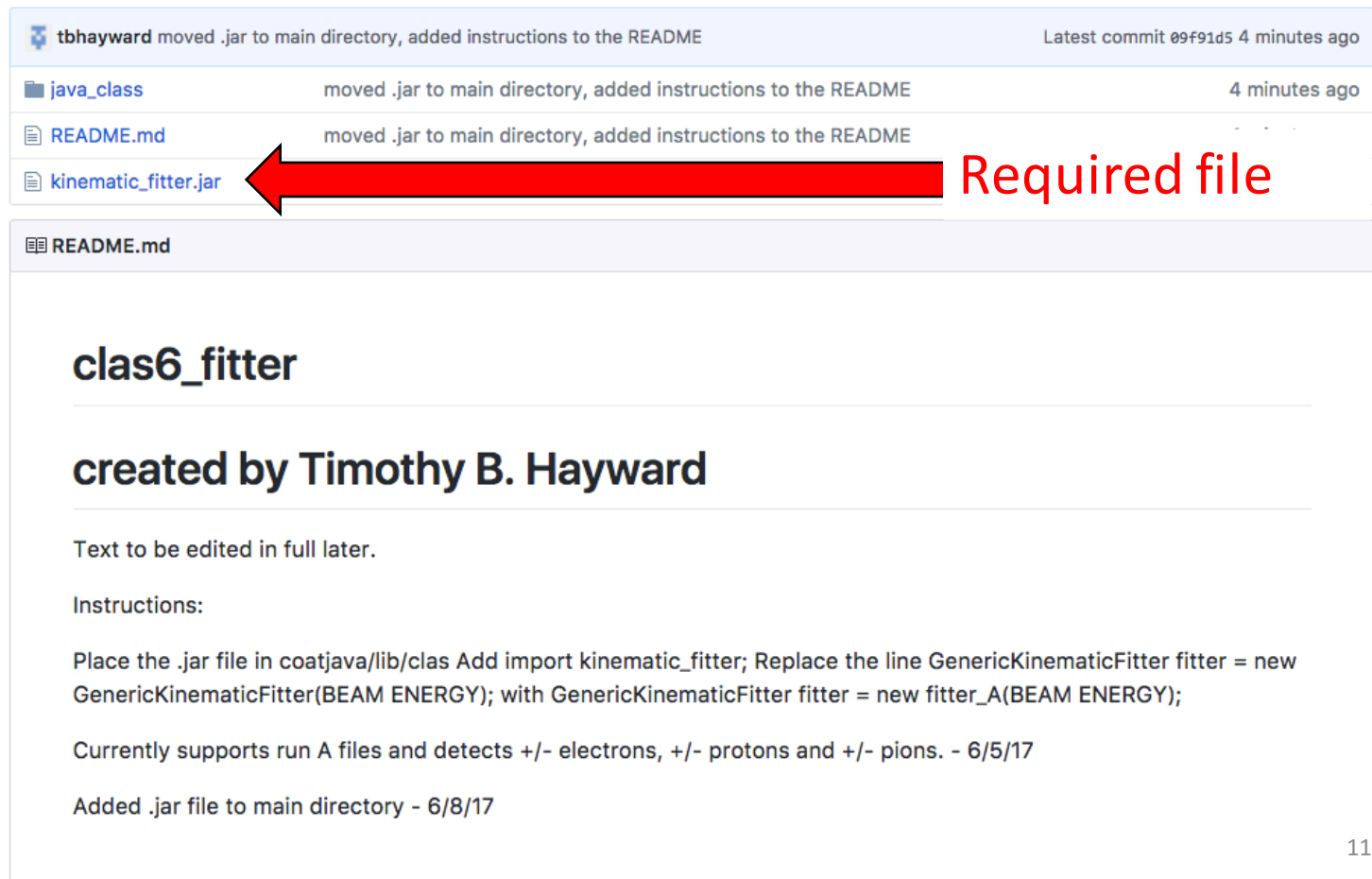
```
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  <section name="ecpb" tag="23001" info="EC detector bank">
    <column name="sector" type="int8" num="1" info="hit sector"/>
    <column name="etot" type="float32" num="2" info="total energy of the hit"/>
    <column name="ein" type="float32" num="3" info="inner energy of the hit"/>
    <column name="eout" type="float32" num="4" info="outter energy of the hit"/>
    <column name="time" type="float32" num="5" info="time of the hit"/>
    <column name="path" type="float32" num="6" info="path of the hit"/>
    <column name="x" type="float32" num="7" info="x coordinate of the hit"/>
    <column name="y" type="float32" num="8" info="y coordinate of the hit"/>
    <column name="z" type="float32" num="9" info="z coordinate of the hit"/>
  </section>
```

Positron Cuts – EC Energy



Energy deposited in EC divided by momentum with 0.12 GeV offset to account for energy loss by positron throughout detectors. Good positrons required to have $E_{(EC)}/(p-0.12) > 0.25$.

- Compiled fitter jar file available at github.com/tbhayward/klas6_fitter



tbhayward moved .jar to main directory, added instructions to the README Latest commit 09f91d5 4 minutes ago

java_class	moved .jar to main directory, added instructions to the README	4 minutes ago
README.md	moved .jar to main directory, added instructions to the README	
kinematic_fitter.jar		

Required file

klas6_fitter

created by Timothy B. Hayward

Text to be edited in full later.


Instructions:

Place the .jar file in coatjava/lib/klas Add import kinematic_fitter; Replace the line GenericKinematicFitter fitter = new GenericKinematicFitter(BEAM ENERGY); with GenericKinematicFitter fitter = new fitter_A(BEAM ENERGY);

Currently supports run A files and detects +/- electrons, +/- protons and +/- pions. - 6/5/17

Added .jar file to main directory - 6/8/17

```
public static void main(String[] args) {  
  
    HipoDataSource reader = new HipoDataSource();  
    reader.open("/volatile/clas12/thayward/eg1dvcs_data/temp/hipo/run_58799_pass1.a00");  
    GenericKinematicFitter fitter = new fitter_A(5.887);  
    EventFilter filter = new EventFilter("11:2212");  
  
    while(reader.hasEvent()==true){  
        HipoDataEvent event = reader.getNextEvent();  
        PhysicsEvent recEvent = fitter.getPhysicsEvent(event);  
  
        if(filter.isValid(recEvent)==true){  
            Particle mx = recEvent.getParticle("[b]+[t]-[11]-[2212]");  
            System.out.println(mx.e());  
        }  
    }  
}
```

 Filter by event type.

```
public static void main(String[] args) {  
  
    HipoDataSource reader = new HipoDataSource();  
    reader.open("/volatile/clas12/thayward/eg1dvcs_data/temp/hipo/run_58799_pass1.a00");  
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        HipoDataEvent event = reader.getNextEvent();  
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        if(filter.isValid(recEvent)==true){  
            Particle mx = recEvent.getParticle("[b]+[t]-[11]-[2212]");  
            System.out.println(mx.e());  
        }  
    }  
}
```

Create missing mass.



Summary

- All relevant CLAS6 banks and event information included in the bos2hipo converter.
- Now possible to analyze CLAS6 data using the new CLAS12 Java framework.
- Contact: tbhayward@email.wm.edu