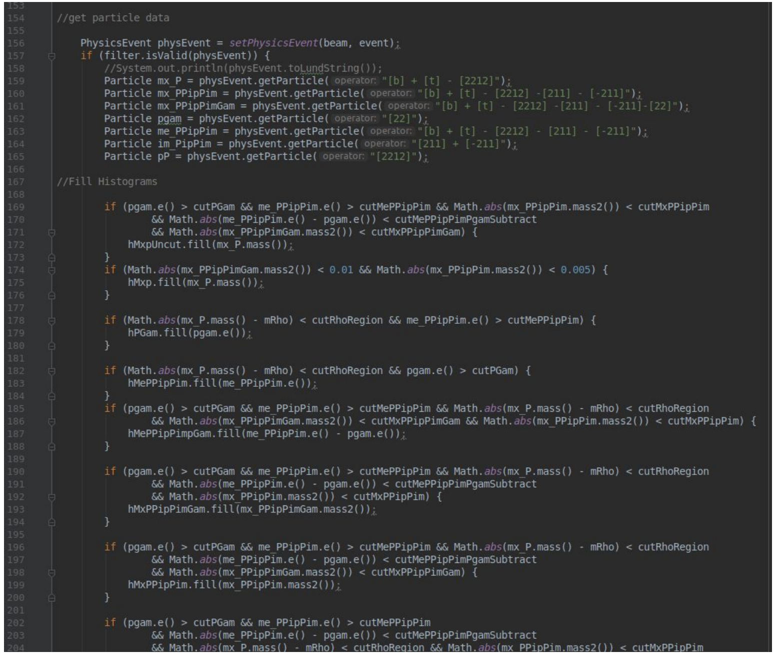
Preliminary analysis of LMD in RGA

Finding light mesons and the code that does it



```
//get particle data

    PhysicsEvent physEvent = setPhysicsEvent(beam, event);
    if (filter.isValid(physEvent)) {
        //System.out.println(physEvent.toLundString());
        Particle mx_P = physEvent.getParticle( operator: "[b] + [t] - [2212]");
        Particle mx_PPipPim = physEvent.getParticle( operator: "[b] + [t] - [2212] -[211] - [-211]");
        Particle mx_PPipPimGam = physEvent.getParticle( operator: "[b] + [t] - [2212] -[211] - [-211]-[22]");
        Particle pgam = physEvent.getParticle( operator: "[22]");
        Particle me_PPipPim = physEvent.getParticle( operator: "[b] + [t] - [2212] - [211] - [-211]");
        Particle im_PipPim = physEvent.getParticle( operator: "[211] + [-211]");
        Particle pP = physEvent.getParticle( operator: "[2212]");

//Fill Histograms

        if (pgam.e() > cutPGam && me_PPipPim.e() > cutMePPipPim && Math.abs(mx_PPipPim.mass2()) < cutMxPPipPim
                && Math.abs(me_PPipPim.e() - pgam.e()) < cutMePPipPimPgamSubtract
                && Math.abs(mx_PPipPimGam.mass2()) < cutMxPPipPimGam) {
            hMxpUncut.fill(mx_P.mass());
        }
        if (Math.abs(mx_PPipPimGam.mass2()) < 0.01 && Math.abs(mx_PPipPim.mass2()) < 0.005) {
            hMxp.fill(mx_P.mass());
        }

        if (Math.abs(mx_P.mass() - mRho) < cutRhoRegion && me_PPipPim.e() > cutMePPipPim) {
            hPGam.fill(pgam.e());
        }

        if (Math.abs(mx_P.mass() - mRho) < cutRhoRegion && pgam.e() > cutPGam) {
            hMePPipPim.fill(me_PPipPim.e());
        }
        if (pgam.e() > cutPGam && me_PPipPim.e() > cutMePPipPim && Math.abs(mx_P.mass() - mRho) < cutRhoRegion
                && Math.abs(mx_PPipPimGam.mass2()) < cutMxPPipPimGam && Math.abs(mx_PPipPim.mass2()) < cutMxPPipPim) {
            hMePPipPimpGam.fill(me_PPipPim.e() - pgam.e());
        }

        if (pgam.e() > cutPGam && me_PPipPim.e() > cutMePPipPim && Math.abs(mx_P.mass() - mRho) < cutRhoRegion
                && Math.abs(me_PPipPim.e() - pgam.e()) < cutMePPipPimPgamSubtract
                && Math.abs(mx_PPipPim.mass2()) < cutMxPPipPim) {
            hMxPPipPimGam.fill(mx_PPipPimGam.mass2());
        }

        if (pgam.e() > cutPGam && me_PPipPim.e() > cutMePPipPim && Math.abs(mx_P.mass() - mRho) < cutRhoRegion
                && Math.abs(me_PPipPim.e() - pgam.e()) < cutMePPipPimPgamSubtract
                && Math.abs(mx_PPipPimGam.mass2()) < cutMxPPipPimGam) {
            hMxPPipPim.fill(mx_PPipPim.mass2());
        }

        if (pgam.e() > cutPGam && me_PPipPim.e() > cutMePPipPim
                && Math.abs(me_PPipPim.e() - pgam.e()) < cutMePPipPimPgamSubtract
                && Math.abs(mx_P.mass() - mRho) < cutRhoRegion && Math.abs(mx_PPipPim.mass2()) < cutMxPPipPim
```

Tyler Viducic

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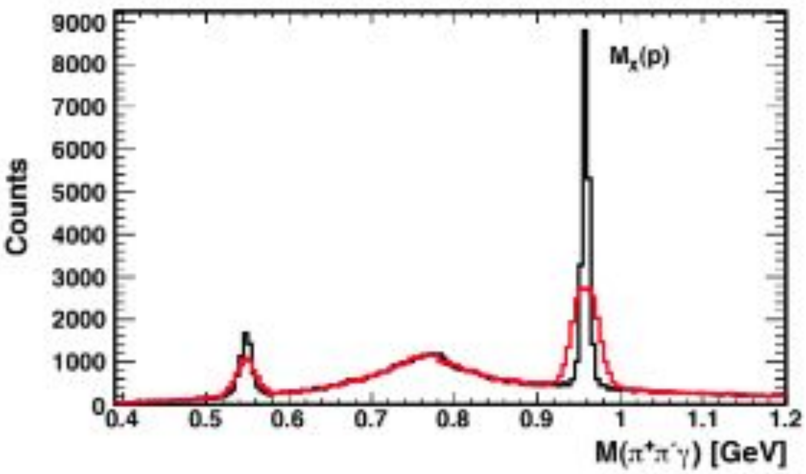
Goals of physics analysis

-Extract physics events with final state $ep\pi^+\pi^-\gamma$

-Identify events where parent particle for the $\pi^+\pi^-\gamma$ is a light unflavored meson (η, ρ, η')

-Pictured at right is what we hope to see



A look at the code

-Code written using Groovy and JAVA analysis tools

-An example of how to do physics analysis using the JAVA analysis framework

-Please feel free to ask questions about the script as we go

A look at the code

-First step:

-Filter code for desired final state

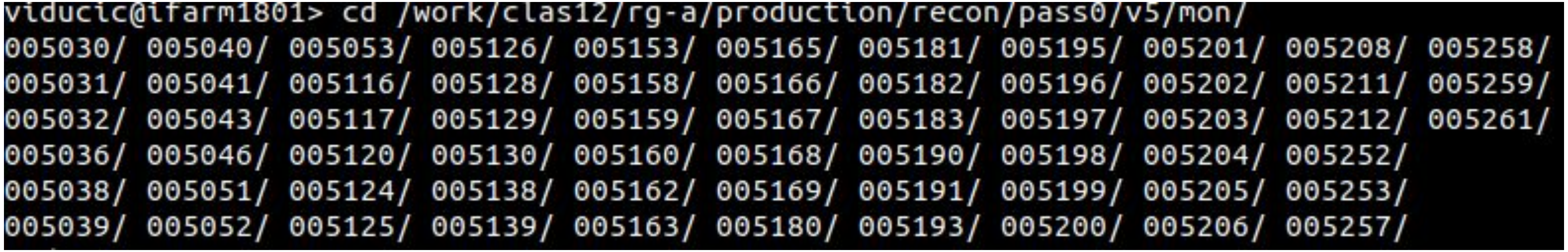
-Attempted with exclusive final state of $ep\pi^+\pi^-\gamma$

-Not enough statistics yet

-Tried semi-inclusive $ep\pi^+\pi^- X_n$

-Much better statistics

-Runs used (10 files/run)



```
viducic@ifarm1801> cd /work/clas12/rg-a/production/recon/pass0/v5/mon/
005030/ 005040/ 005053/ 005126/ 005153/ 005165/ 005181/ 005195/ 005201/ 005208/ 005258/
005031/ 005041/ 005116/ 005128/ 005158/ 005166/ 005182/ 005196/ 005202/ 005211/ 005259/
005032/ 005043/ 005117/ 005129/ 005159/ 005167/ 005183/ 005197/ 005203/ 005212/ 005261/
005036/ 005046/ 005120/ 005130/ 005160/ 005168/ 005190/ 005198/ 005204/ 005252/
005038/ 005051/ 005124/ 005138/ 005162/ 005169/ 005191/ 005199/ 005205/ 005253/
005039/ 005052/ 005125/ 005139/ 005163/ 005180/ 005193/ 005200/ 005206/ 005257/
```

A look at the code

-Second step:

    -Filter file for wanted banks (REC::Particle, REC::Event)
    -This dramatically speeds up read time

-How-to:

    -On farm:

```
-/home/viducic/jaw-0.9/bin/hipoutils.sh -filter -b REC::Particle,REC::Event -o output_file_name.hipo input_file_name.hipo
```

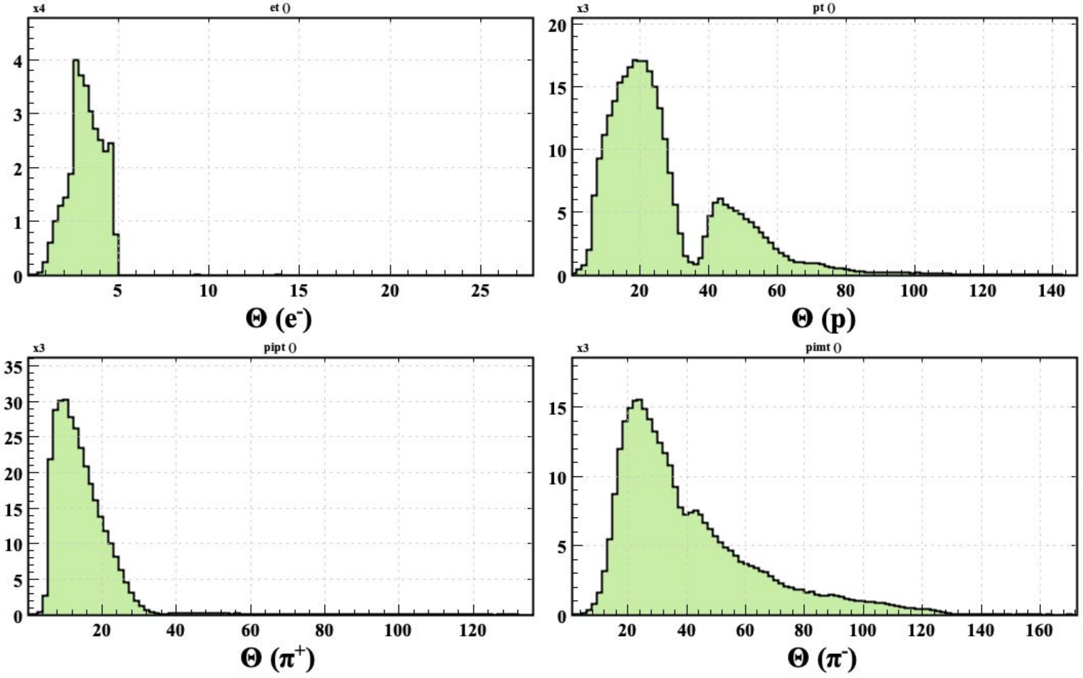
Time for physics

-First a look at the code:

Time for physics

-Cut selection

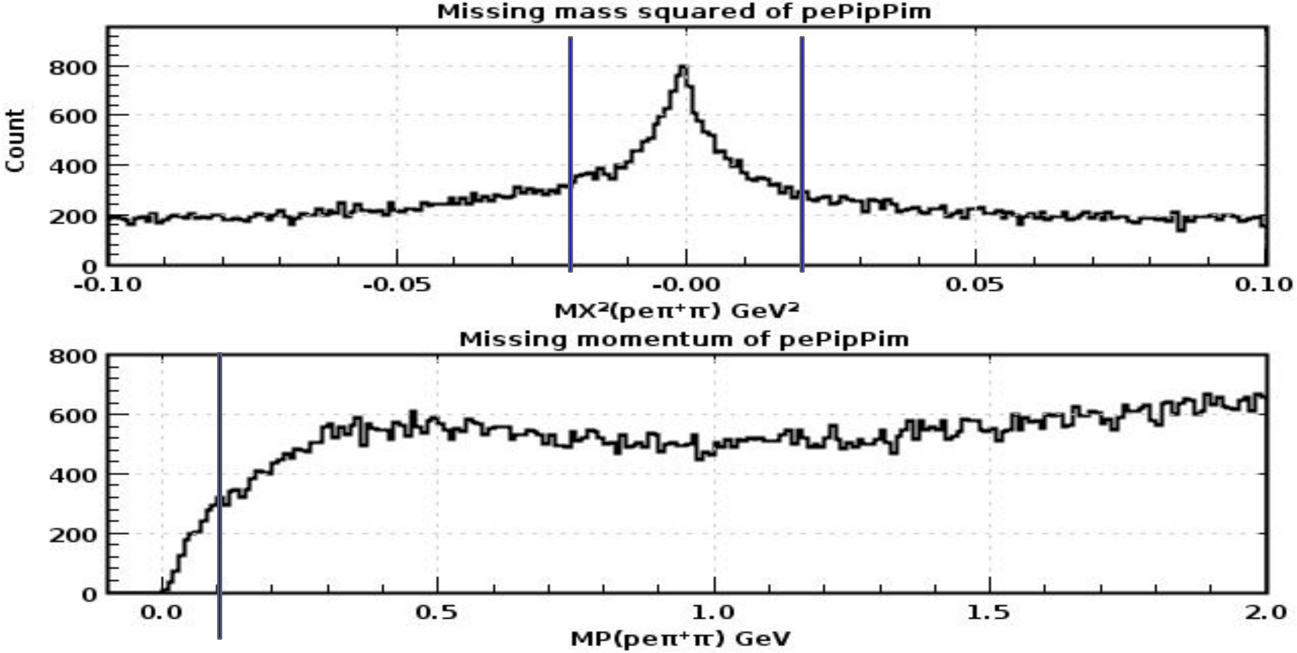
  -Electron in FT -> decay particles in FD



Time for physics

-Cut selection

-$|\mathrm{MX}^2(pe\pi^+\pi^-)|$ < 0.02 GeV^2 && $\mathrm{MP}(pe\pi^+\pi^-)$ > 0.1 GeV



Jefferson Lab

Time for physics

-And now a look at the results.

-How to open saved histograms:

-/home/gavalian/coatjava/bin/browser my_file.hipo

What’s Next

-In conclusion: Not great!

-Need more statistics and better calibration

-Evaluate viability of analysis with FastMonteCarlo

  -FastMC gives acceptance within minutes to single digit%

  -Cuts down on need to fully simulate with GEMC

```
if(seminar.hasQuestions()){
	String question = seminar.ask();
	tyler.answer(question);
}else{return;}
```