System Tests

- What for?
  - Comprehensive tests producing histograms & diagnostic statistics
  - A subset of the suite a subsystem would have for its own performance reviews
  - Multiple test configurations possible
  - Could be applicable to packages other than Gleam
    - eg CalDigi single crystal tests
  - Run on Gleam tags and releases (subtle distinction ☺)
  - Tracked in database with web plotting display capabilities
  - Comparison to standards (deemed 'correct' by package owners!)
  - Tests to be discovered and run automatically by the Release Manager
    - will capture results for the db
- Proposed Implementation Details
  - Basic idea: RM discovers system test in package cvs repo
    - Runs script that sets everything up
      - Gleam configured by jobOptions
      - Root macro to analyze output Root files and produces histos
    - Retrieves info; inserts into db
  - Add SysTest directory to cvs package structure
    - Subdirectory for each test holding files relevant to that test
      - Shell script, jobOptions, Root macro + fragments per subsystem
      - Use env variable to redirect file output
  - Root macro based on RootTreeAnalysis
    - Require standard fragments from contributors
      - Histo definitions
      - Filling histos
      - MC; Digi (TKR, CAL, ACD; Recon (ditto); Trigger

See **LAT-TD-00875** in Cyberdocs for Test Plan

What to Test?

- Expect to have a handful of test suites defined, based on source configuration:
  - Select from vertical, angled: muons, gammas, e's(?), p's, All_gamma, bkg-mix
  - Could envisage different test histograms tailored to the source.
    - eg look at hadron interaction length for protons as opposed to EM for gammas.
    - 'pencil' beams more diagnostic than 'survey' All_gamma, bkg-mix sources
- Should evolve as we learn which distributions are most telling to performance.
- Run test_Gleam (merit on 100 MeV gammas) as performance test.
  - Track PSF, Aeff in db.
  - Keep track of ChronoSvc output per package
  - etc

Concrete Example: CalDigi Single Xtal

- Example of a subsystem system test
  - Use xml to define a single CAL crystal: CsIElement
  - Single crystal centered at (0,0,0)
  - Use patch source to map out response along the length of the crystal
  - Look at resolution
- This example uses userAlg, but will use Gleam in future, configured by jobOptions

Example of shell script & running Root macro

```
noric10:richard> more systest_CALSingleCDEDigi
#!/bin/sh
cd $GLASTUSER/glastPackTest/userAlg
glastpack.pl login
cd $GLASTUSER/glastPackTest/test/SingleCDE-
      Electron
glastpack.pl run userAlg v2r1 userApp.exe
      $GLASTUSER/glastPackTest/test/SingleCDE-
      Electron/SingleCDEjobOptions.txt
root -b start.c RUN
mv Histograms.root SingleCDE-ElectronHistos.root

noric10:richard> more RUN
{
 gROOT->Reset();
 gROOT->LoadMacro("CALSingleCDEDigi.cxx");

 RootTreeAnalysis* m= new
      RootTreeAnalysis("digi.root","","mc.root");

 m->Go();
 m->histFile->Write();
}
```

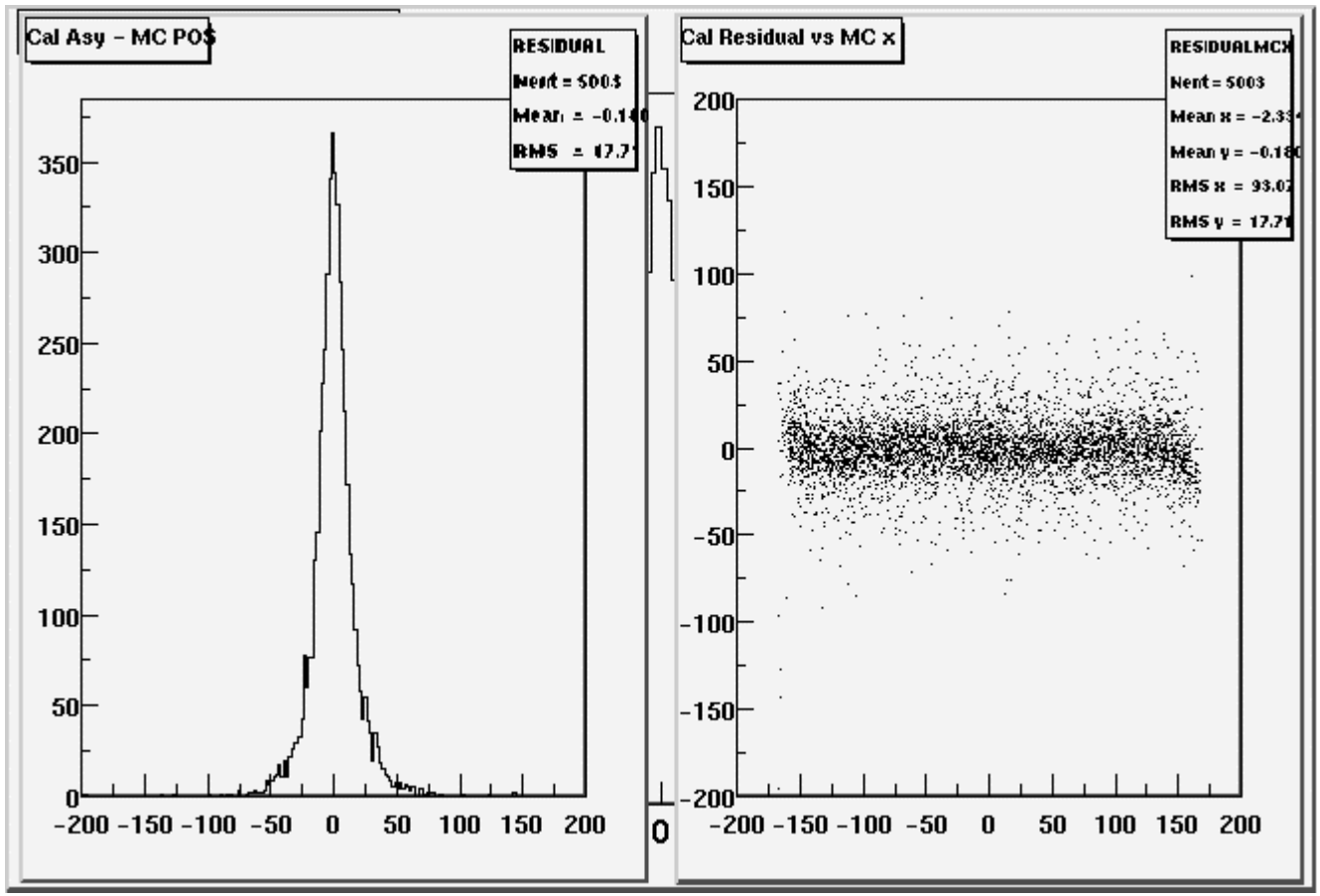
start.c loads libs.

Sample Code

```
void RootTreeAnalysis::DigiHistDefineCAL() {

   histFile->cd();

   TH1F *CALDIGICOUNT = new TH1F("CALDIGICOUNT", "Cal Digi multiplicity",
      50, 0, 50);

   TH1F *CALADC = new TH1F("CALADC", "Cal Digi ADC - both faces",
      200, 0, 1000);
   TH1F *CALADCN = new TH1F("CALADCN", "Cal Digi ADC - NEG",
      200, 0, 1000);
   TH1F *CALADCP = new TH1F("CALADCP", "Cal Digi ADC - POS",
      200, 0, 1000);

   TH2F *CALADCNMCX = new TH2F("CALADCNMCX", "Cal Digi ADC - NEG vs
MC x",
      50,-200,200,200, 0, 1000);
   TH2F *CALADCPMCX = new TH2F("CALADCPMCX", "Cal Digi ADC - POS vs
MC x",
      50,-200,200,200, 0, 1000);

   TH1F *RESIDUAL = new TH1F("RESIDUAL", "Cal Asy - MC POS",
      200, -200, 200);
   TH2F *RESIDUALMCX = new TH2F("RESIDUALMCX", "Cal Residual vs MC x",
      50,-200,200,50, -200, 200);
   TH2F *CALASYMCX = new TH2F("CALASYMCX", "Cal Light asy vs MC x",
      50,-200,200,200, -0.4, 0.4);

   TH1F *CALRANGE = new TH1F("CALRANGE", "Cal Digi Range - both faces",
      10, 0, 10);
   TH1F *CALEAVE = new TH1F("CALEAVE", "Cal Digi Energy - faces/2",
      200, 0, 1000);

   TH1F *CALEAVETOTAL = new TH1F("CALEAVETOTAL", "Cal Digi Energy -
faces/2 summed",
      200, 0, 10000);

   TH1F *CALLAYER = new TH1F("CALLAYER", "Cal Digi Layer",
      15, 0, 15);
   TH1F *CALTOWER = new TH1F("CALTOWER", "Cal Digi Tower",
      20, 0, 20);
   TH1F *CALCOLUMN = new TH1F("CALCOLUMN", "Cal Digi Column",
      20, 0, 20);
};
```

```
void RootTreeAnalysis::DigiCal() {

  TObjArray* cL = evt->getCalDigiCol();
   int nCalDigi = cL->GetEntries();
   ((TH1F*)GetObjectPtr("CALDIGICOUNT"))->Fill((Float_t)nCalDigi);

   int nLayer[8]={0,0,0,0,0,0,0,0};
   float eLayer[8]={0.,0.,0.,0.,0.,0.,0.,0.};
   float eTotal = 0.;

   for (int ic=0; ic < nCalDigi; ic++) {
    CalDigi* c=(CalDigi*)cL->At(ic);
    CalXtalId id = c->getPackedId();
    int layer = id->getLayer();

   CalXtalReadout* cRo=c->getXtalReadout(0);
    float adcN = cRo->getAdc(0);
    float adcP = cRo->getAdc(1);
    float asy = (adcP-adcN)/(adcP+adcN - 200.);
    //      float resid = 1099.*asy - mcX;      // muons
    float resid = 1446.*asy - mcX;       // electrons
    ((TH1F*)GetObjectPtr("RESIDUAL"))->Fill(resid);
    ((TH2F*)GetObjectPtr("RESIDUALMCX"))->Fill(mcX,resid);
    float eAve = (adcN+adcP)/2.;
    ((TH1F*)GetObjectPtr("CALEAVE"))->Fill(eAve);
    ((TH1F*)GetObjectPtr("CALADC"))->Fill(adcN);
    ((TH1F*)GetObjectPtr("CALADC"))->Fill(adcP);
    ((TH1F*)GetObjectPtr("CALADCN"))->Fill(adcN);
    ((TH2F*)GetObjectPtr("CALADCNMCX"))->Fill(mcX,adcN);
    ((TH1F*)GetObjectPtr("CALADCP"))->Fill(adcP);
    ((TH2F*)GetObjectPtr("CALADCPMCX"))->Fill(mcX,adcP);
    ((TH2F*)GetObjectPtr("CALASYMCX"))->Fill(mcX,asy);
    ((TH1F*)GetObjectPtr("CALRANGE"))->Fill(cRo->getRange(0));
    ((TH1F*)GetObjectPtr("CALRANGE"))->Fill(cRo->getRange(1));
    int tower = id->getTower();
    int column = id->getColumn();
    ((TH1F*)GetObjectPtr("CALLAYER"))->Fill(layer);
    ((TH1F*)GetObjectPtr("CALTOWER"))->Fill(tower);
    ((TH1F*)GetObjectPtr("CALCOLUMN"))->Fill(column);

    nLayer[layer] += 1;
    eLayer[layer] += eAve;
    eTotal += eAve;
   }
        ((TH1F*)GetObjectPtr("CALEAVETOTAL"))->Fill(eTotal);
};
```

Sample Output



We'll see what happens when comparing scatterplots!

Misc

- We'll need to properly document the Root macros and describe the histograms

- We're setting up Carrot/Root/Apache to access Root histos over the web
  - Plus ability to plot/histogram quantities from the database
    - eg plot of memory usage for Gleam vs version
  - May run into hitch with SCS security folk for Carrot
    - run server outside SLAC firewall
    - fallback is JAS/Tomcat à la I&T/Eddy
    - So far, server is blocked at the firewall

Status

- CalDigi single crystal is working prototype of test
- Defining shell of Root macro now for contributors
  - Tracy/Michael set to contribute; Richard for CAL
- Test database is defined and implemented
  - Under test with Carrot
- Have demonstrated all needed display capability with Carrot
- Release Manager
  - must learn to find and submit tests
  - gather up output
  - how to deal with individual statistics (rather than histograms) which may be test specific in meaning and method of obtaining (eg a Landau fit to crystal energy deposit).