

EpIC (ePic) generator - Update

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- EpIC (ePic): a generator for exclusive reactions
- EpIC is attached to the PARTONS framework: takes advantage of
 - multiple GPD models already exist
 - flexibility for adding new models
- Multiple channels: DVCS, TCS, DVMP
- Written in C++
- Why EpIC? Epicurus, EIC, epic, ...



- EpIC uses mini FOAM (mFOAM, a compact version of FOAM) to generate events randomly
- Input file: model, model parameters, number of events, kinematic limits, beam and target type, beam helicity, target polarization, beam and target energy
- Output file: 4-vectors of all particles

EpIC – Tests (VM)

the test.xml file under "home/partons/git/epic"

```
<!-- Experimental conditions -->
<experimental_conditions>
  <param name="lepton_energy" value="5.0" />
  <param name="lepton_type" value="e-" />
  <param name="lepton_helicity" value="1" />
  <param name="hadron_energy" value="41.0" />
  <param name="hadron_type" value="p" />
  <param name="hadron_polarisation" value="0.|0.|0." />
</experimental_conditions>

<!-- Computation scenario -->
<computation_configuration>

  <module type="DVCSProcessModule" name="DVCSProcessGV08">

    <module type="DVCSScalesModule" name="DVCSScalesQ2Multiplier">
      <param name="lambda" value="1." />
    </module>

    <module type="DVCSXiConverterModule" name="DVCSXiConverterXBToXi">
    </module>

    <module type="DVCSConvCoeffFunctionModule" name="DVCSFFConstant">

      <param name="qcd_order_type" value="L0" />

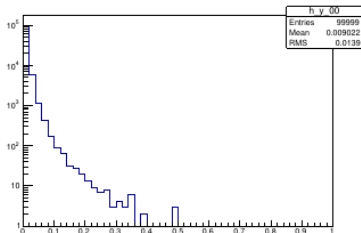
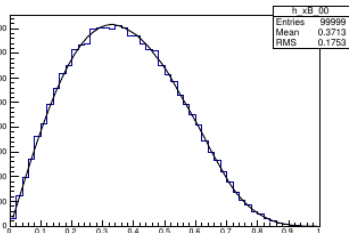
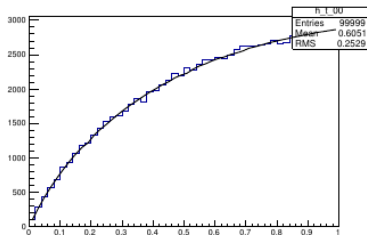
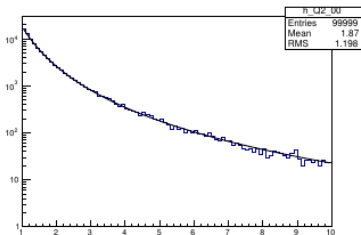
      <param name="cff_value_H_Re" value="3." />
      <param name="cff_value_H_Im" value="4." />
      <!-- param name="cff_value_E_Re" value="0." /-->
      <!-- param name="cff_value_E_Im" value="0." /-->
      <!-- param name="cff_value_Ht_Re" value="0.0" /-->
      <!-- param name="cff_value_Ht_Im" value="0.0" /-->
      <!-- param name="cff_value_Et_Re" value="0.0" /-->
      <!-- param name="cff_value_Et_Im" value="0.0" /-->

    </module>
  </module>
</computation_configuration>
```

- Compare generated events with theory expectation curves
- i.e. $\int_{\text{bin}} \frac{d\sigma}{dx_B} dx_B = \int_{\text{bin}} dx_B \int dQ^2 \int dt \int d\phi \int d\psi \frac{d^5\sigma}{dx_B dQ^2 dt d\phi d\psi}$

EpIC – Tests (VM)

Unpolarized target, $E_{\text{beam}} = 5 \text{ GeV}$, $E_{\text{target}} = 41 \text{ GeV}$



EpIC – Tests (VM)

```
<!-- Experimental conditions -->
<experimental_conditions>
  <param name="lepton_energy" value="10.0" />
  <param name="lepton_type" value="e-" />
  <param name="lepton_helicity" value="1" />
  <param name="hadron_energy" value="1.0" />
  <param name="hadron_type" value="p" />
  <param name="hadron_polarisation" value="0.|0.|1." />
</experimental_conditions>

<!-- Computation scenario -->
<computation_configuration>

  <module type="DVCSProcessModule" name="DVCSProcessGV08">

    <module type="DVCSScalesModule" name="DVCSScalesQ2Multiplier">
      <param name="lambda" value="1." />
    </module>

    <module type="DVCSXiConverterModule" name="DVCSXiConverterXBToXi">
    </module>

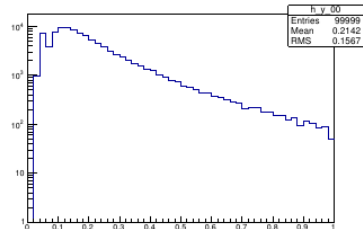
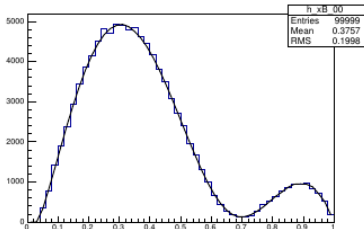
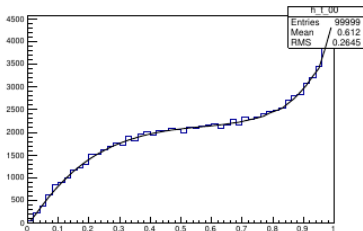
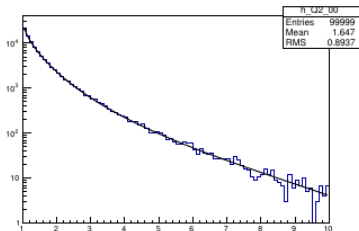
    <module type="DVCSConvolCoeffFunctionModule" name="DVCSFFConstant">
      <param name="qcd_order_type" value="L0" />

      <param name="cff_value H Re" value="1.0" />
      <param name="cff_value H Im" value="2.0" />
      <param name="cff_value E Re" value="3.0" />
      <param name="cff_value E Im" value="5.0" />
      <param name="cff_value Ht Re" value="8.0" />
      <param name="cff_value Ht Im" value="13.0" />
      <param name="cff_value Et Re" value="21.0" />
      <param name="cff_value Et Im" value="34.0" />

    </module>
  </module>
</computation_configuration>
```

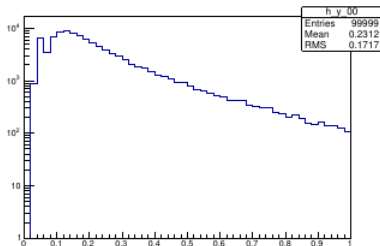
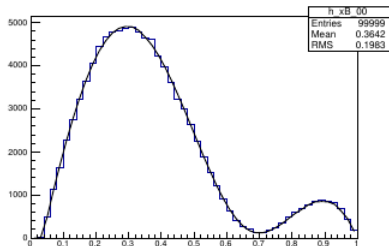
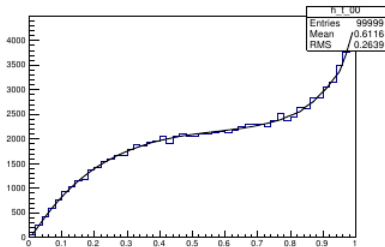
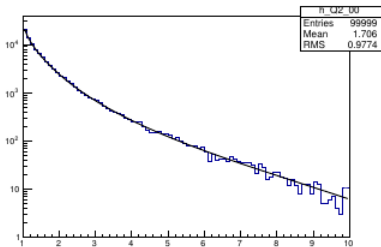
EpIC – Tests (VM)

Longitudinally polarized target, $E_{\text{beam}} = 10 \text{ GeV}$, $E_{\text{target}} = 1 \text{ GeV}$



EpIC – Tests (VM)

Transversely polarized target, $E_{\text{beam}} = 10 \text{ GeV}$, $E_{\text{target}} = 1 \text{ GeV}$



EpIC – Tests (Farms)

```
<kinematics type="DVCSObservableKinematic">
  <param name="xB" value="0." />
  <param name="t" value="0." />
  <param name="Q2" value="0." />
  <param name="E" value="436.916" />
  <param name="phi" value="0." />
</kinematics>

<computation_configuration>

  <module type="DVCSObservableModule" name="DVCSCrossSectionTotal">
    <param name="DVCSCrossSectionTotal_rangeXb" value="0.0|1." />
    <param name="DVCSCrossSectionTotal_rangeT" value="-1.|-0.0" />
    <param name="DVCSCrossSectionTotal_rangeQ2" value="1.0|10." />
    <param name="DVCSCrossSectionTotal_rangePhi" value="0.0|6.2831853" />
    <param name="DVCSCrossSectionTotal_rangeY" value="0.0|1." />

    <param name="DVCSCrossSectionTotal_beamHelicity" value="1." />
    <param name="DVCSCrossSectionTotal_beamCharge" value="-1." />
    <param name="DVCSCrossSectionTotal_targetPolarization" value="0.0|1." />

    <param name="DVCSCrossSectionTotal_subprocessesTypes" value="DVCS" />

    <param name="DVCSCrossSectionTotal_rangeN0" value="5000" />
    <param name="DVCSCrossSectionTotal_rangeN1" value="1" />

    <param name="DVCSCrossSectionTotal_xB_over_y" value="0" />
  </module type="DVCSProcessModule" name="DVCSProcessGV08">

    <module type="DVCSScalesModule" name="DVCSScalesQ2Multiplier">
      <param name="lambda" value="1." />
    </module>

    <module type="DVCSXiConverterModule" name="DVCSXiConverterXBToXi">
    </module>

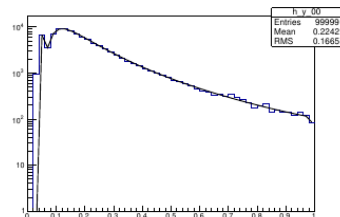
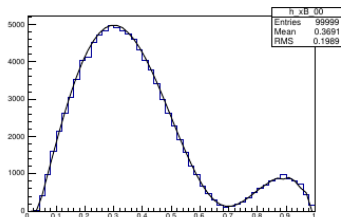
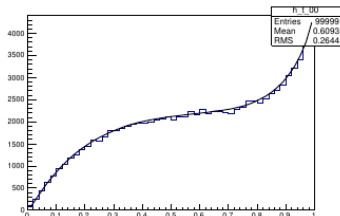
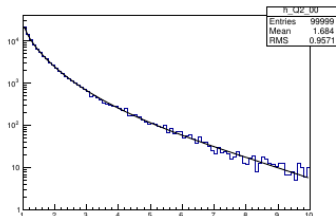
    <module type="DVCSConvCoefFunctionModule" name="DVCSFFConstant">

      <param name="qcd_order_type" value="LO" />

      <param name="cff_value_H_Re" value="1." />
      <param name="cff_value_H_Im" value="2." />
      <param name="cff_value_E_Re" value="3." />
      <param name="cff_value_E_Im" value="5." />
      <param name="cff_value_Ht_Re" value="8." />
      <param name="cff_value_Ht_Im" value="13." />
      <param name="cff_value_Et_Re" value="21." />
      <param name="cff_value_Et_Im" value="34." />
    </module>
  </computation_configuration>
```

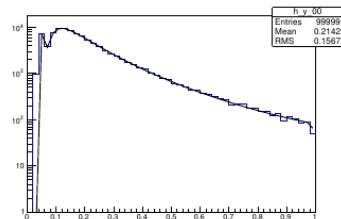
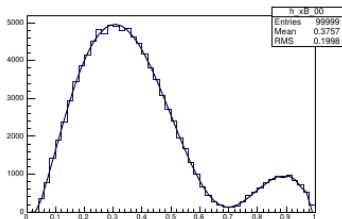
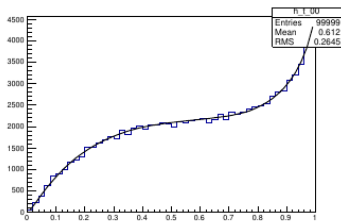
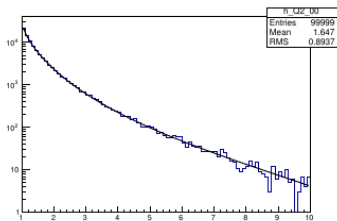
EpIC – Tests (Farms)

Unpolarized target, $E_{\text{beam}} = 10 \text{ GeV}$, $E_{\text{target}} = 1 \text{ GeV}$



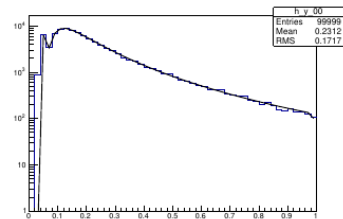
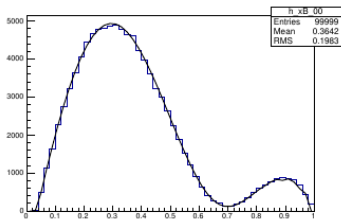
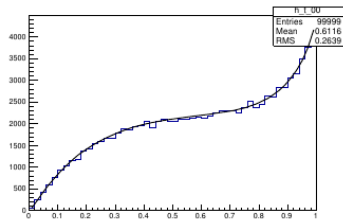
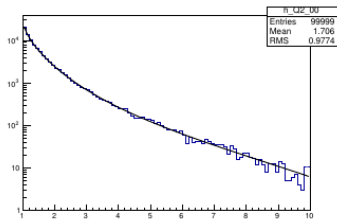
EpIC – Tests (Farms)

Longitudinally polarized target, $E_{\text{beam}} = 10 \text{ GeV}$, $E_{\text{target}} = 1 \text{ GeV}$



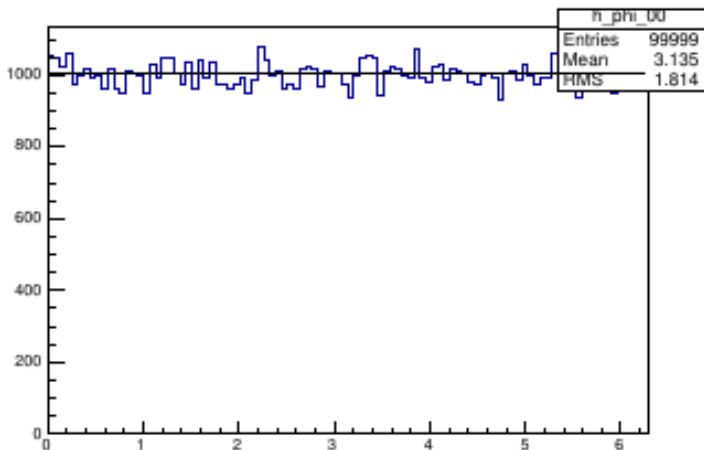
EpIC – Tests (Farms)

Transversely polarized target, $E_{\text{beam}} = 10 \text{ GeV}$, $E_{\text{target}} = 1 \text{ GeV}$



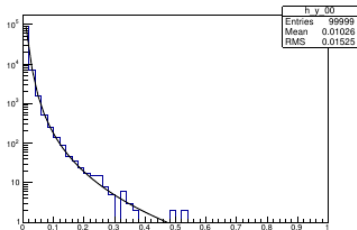
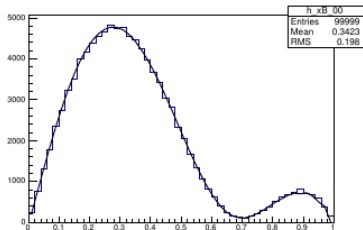
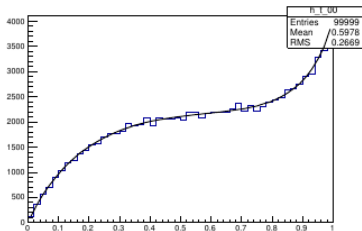
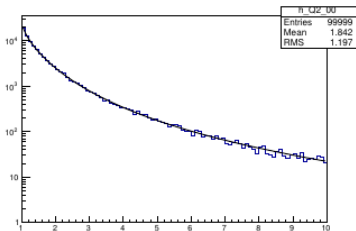
EpIC – Tests (Farms)

Transversely polarized target, $E_{\text{beam}} = 10 \text{ GeV}$, $E_{\text{target}} = 1 \text{ GeV}$



EpIC – Tests (Farms)

Longitudinally polarized target, $E_{\text{beam}} = 5 \text{ GeV}$, $E_{\text{target}} = 41 \text{ GeV}$



- Pure DVCS seems to be working
- BH process involves singularities
- Radiative corrections