The Road to D.C.

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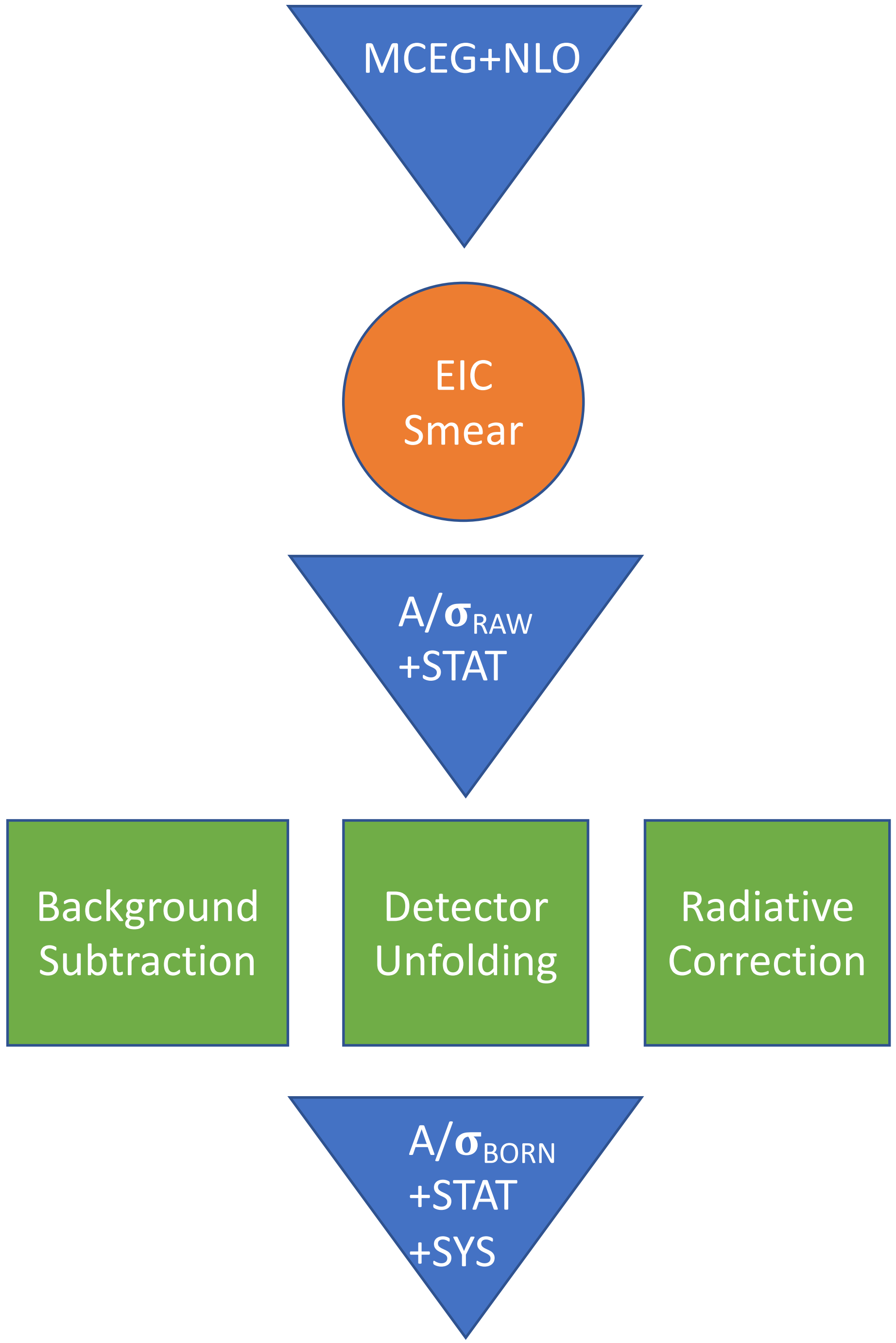
Goal: Impact plots for our golden channels

Measurement	Main Detector Requirements	Anticipated Plot	Physics Topic/goal
inclusive $A_{\|\|}$ / $A_{\perp}$ for proton, deuterium, ^3He	Standard inclusive	$A_{\|\|}(x,y,Q^2)$,$A_{\perp}$ $g_1(x)$, $g_{2/T}(x)$ vs Q^2 $\Delta g(Q^2)$ vs x	Gluon & Quark Helicity $\Delta g(x,Q^2)$, Δu^+, Δd^+
inclusive A_{PV}	Standard inclusive	A_{PV} vs x for $W^{+/-}$ $g^W_5(x)$ vs Q^2 $\Delta s^+(Q^2)$, $s^+(Q^2)$ vs x	Strange Pol and Unpolarized $\Delta s^+(x,Q^2)$, $s^+(x,Q^2)$
$\sigma_{red}(x,Q^2)$, $\sigma^{c/b}_{red}(x,Q^2)$ $\rightarrow$ F_2, F_L, $F_2^{c/b}$	Standard inclusive + heavy quark tag	$\sigma_{red}(x,y)$ vs Q^2 $\sigma^{c/b}_{red}(x,y)$ vs Q^2 $g(Q^2)$ vs x	Proton PDFs $q(x,Q^2)$, $g(x, Q^2)$
$\sigma_{red}(x,Q^2)$, $\sigma^{c/b}_{red}(x,Q^2)$ $\rightarrow$ F_2, F_L, $F_2^{c/b}$	Standard inclusive + heavy quark tag	$\sigma_{red}(x,y)$ vs Q^2 $\sigma^{c/b}_{red}(x,y)$ vs Q^2 $F_L(Q^2)$ vs x $F^{c/b}_L(Q^2)$ vs x	Nuclear PDFs $q(x,Q^2)$, $g(x, Q^2)$
$\sigma_{red}(x,Q^2)$, $\sigma^{c/b}_{red}(x,Q^2)$ $\rightarrow$ F_2, F_L, $F_2^{c/b}$	Standard inclusive + heavy quark tag	$\sigma_{red}(x)$ vs Q^2 $\sigma^{c/b}_{red}(x)$ vs Q^2 $\Delta F_L/F_L$ vs x, Q^2	Non-linear QCD dynamics
EW inclusive A_{PV}	Standard inclusive	$A_{PV}(y)$ vs Q^2 $\sin^2\theta_w$ vs Q^2	BSM & Precision EW ($\sin^2\theta_w$)
$\frac{d\sigma^{NC}}{dx\,dy\,d\phi}$ Triply differential NC X-sec	Standard inclusive	Updated Fig.6 in ***PhysRevD.98.115018*** for CM energies smearing.	Lorentz and CPT Violating Effects

Full Analysis Chain

Originally we planned to implement a full "analysis" for each of these channels. Including:

- **Polarized MCEG production with radiative effects and NLO reweighting**
- **Detector effects** that allow for realistic **background subtraction**
- **Detector unfolding and radiative corrections.**
- Extracted Born-level observables are handed off to theorists for fitting and impact plots.



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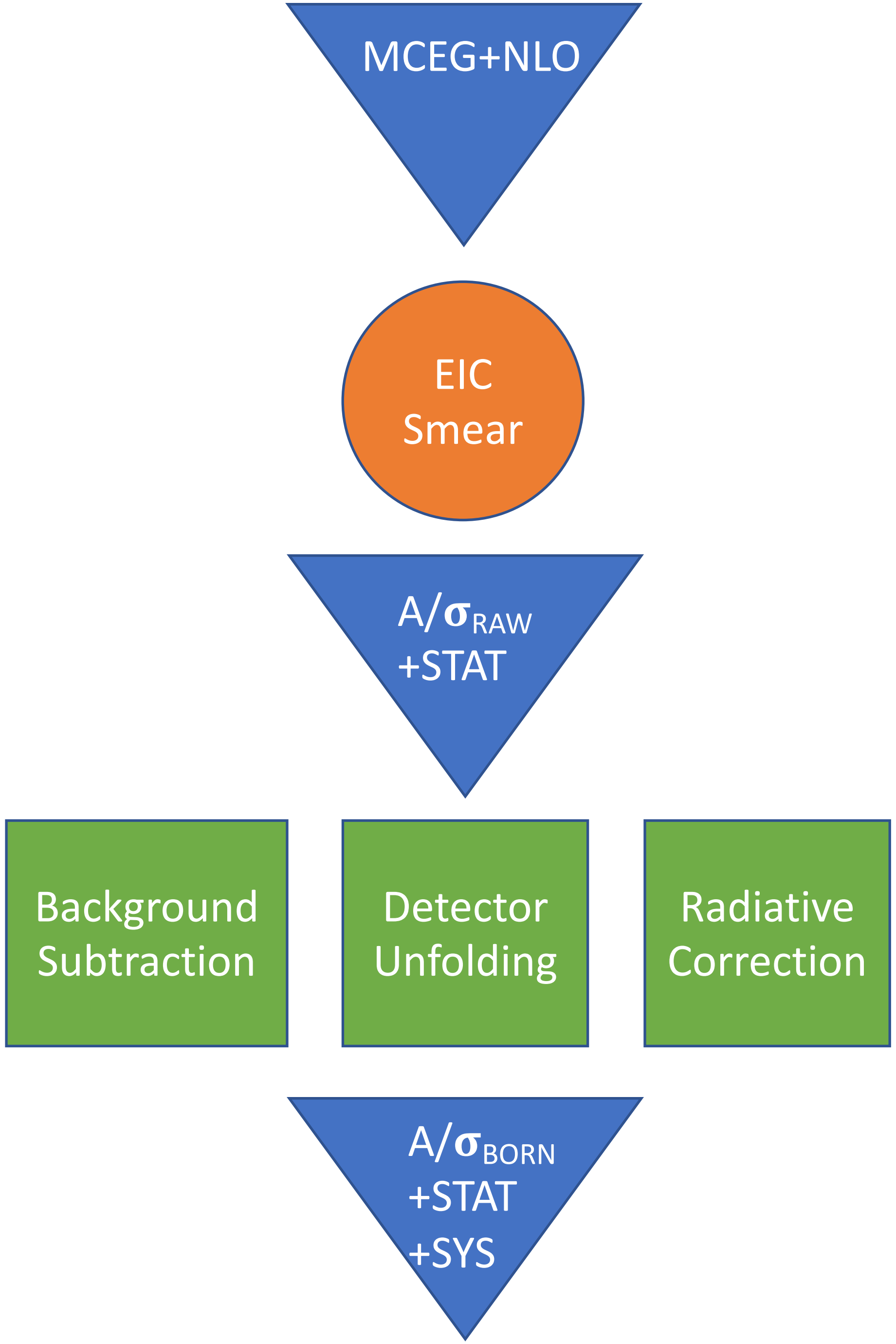
It seems we were a bit too ambitious.

- Very difficult to implement a realistic e-/h discrimination algorithm without GEANT.
- Impossible to simulate realistic e+/e- conversions without a realistic material budget. Also difficult to implement without GEANT.
- Tricky to reweight samples with QED effects because the σ_{Born} used to calculate radiative effects is not reweighted.



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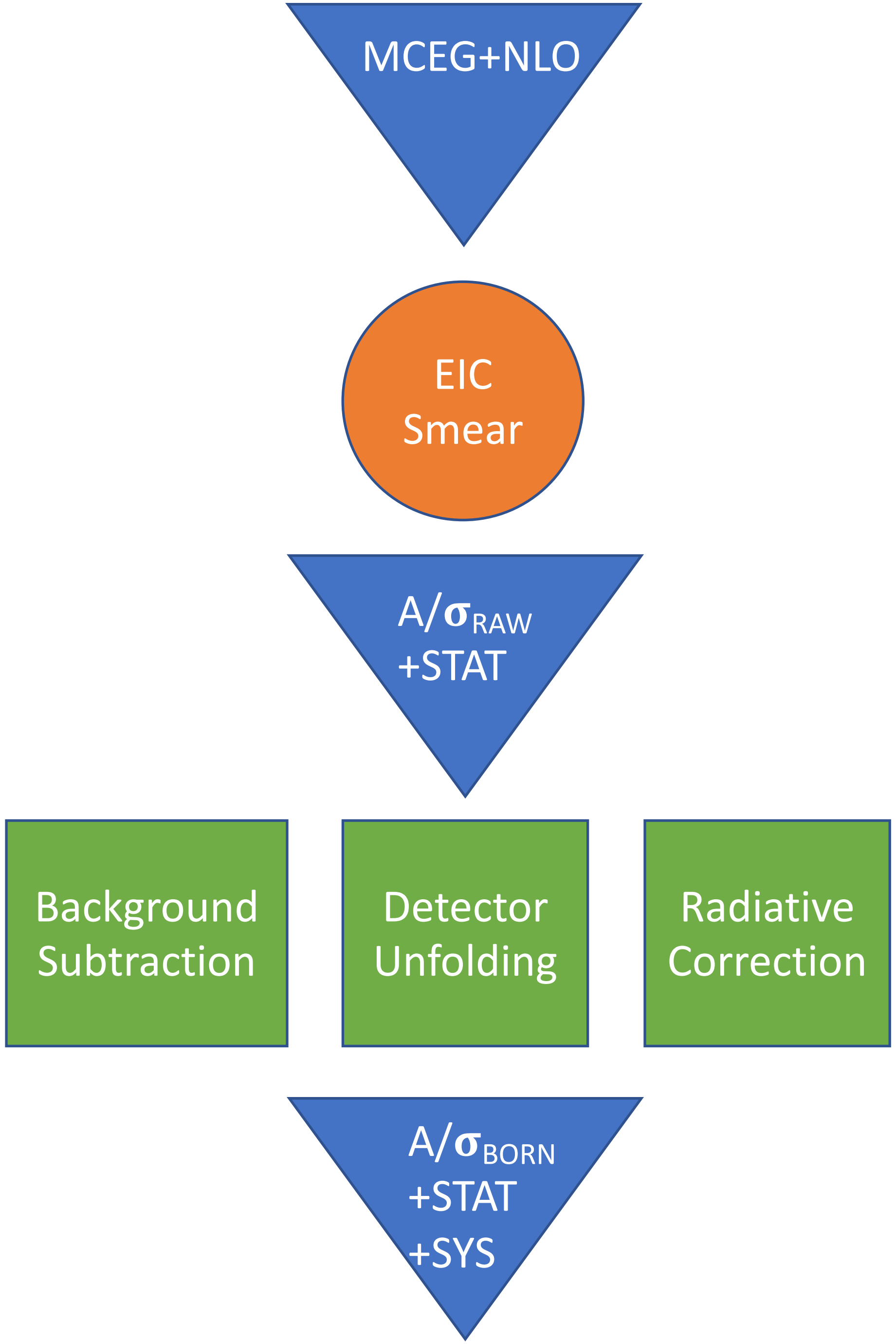
You may be thinking … how accurate do we need to be for this exercise? And the answer is very accurate because the IRG has the largest set of existing data so constraints are driven by systematic error estimates.



Revised Plan

I. Produce central values and statistical error one of two ways:
   A. Django + perfect detector + realistic acceptance + B-field without QED radiative effects. NLO reweighting at the vertex level.
   B. Theoretical codes with acceptance and thresholds implemented.

II. Estimate systematic errors for each kinematic bin, either by focused MCEG or GEANT studies.
   A. Electron/hadron background (see Sasha's talk today)
   B. e+/e- backgrounds
   C. Radiative corrections
   D. Unfolding
   E. Luminosity
   F. Polarization

III. As a starting point use systematic errors from HERA with 10-100 fb^{-1} and put limits on how small the systematic errors have to be in order to make an impact.

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First crticial step for experimentalists is to determine the optimal binning, which are based on purity maps that may change with EICSmear detector configuration. (See Xiaoxuan's talk today)