SANE Analysis beakdown

Goals:

- DIS spin structure functions g_1, g_2, moments, matrix elements
- Elastic form factors ratios
- Spin asymmetries in the resonances

Stages:

- Charge normalized, dead time (and pion, e+/e- pairs corrected for spin structure) electron yields for each helicity: $Y^+ = N^+/Q^+$, $Y^- = N^-/Q^-$
  - BETA events
    - Detector energy and position calibrations
      - BigCal for spin structure and form factors:
        - cluster identification, position, timing
      - Cherenkov, Lucite and Tracker for spin structure
        - timing alignments, *x* position (Lucite)
    - Tracking from BigCal to target through target field
    - pair background identification with Tracker for spin structure
    - Quality control:
      - run list database, run selection (online run sheets, hclog, channel archive)
      - beam position studies (raster cuts for 80° data if time cuts, tracking to target does not clean up background, ...)
      - charge corrected yields
      - kinematics binning
  - HMS events
    - reconstruction with target field
      - parallel
      - 80°

- Raw count or yield asymmetries $A_{raw} = (Y^- - Y^+)/(Y^- + Y^+)$

- Measured asymmetries A_{para}, $A_{80} = A_{raw}/[f(pf) P_b P_t]$; $A_{elastic}$
  - Off-line beam polarization by run periods – Moller and status of half-wave plate
  - Off-line target polarizations run by run
  - Packing fractions *pf* and dilution factors *f* by target cup – only for spin structure
    - HMS C, C+He target runs, helicity independent NH_3 data
    - comparison with mc_hms_single montecarlo
  - Combine single arm 4.7 GeV 80° and 5.9 GeV 80°, same for parallel

- Background asymmetries

- e+/e- dilution and contamination
- radiative corrections

- Physics asymmetries
  - A_1, A_2(A_{para}, A_{80})
    - BETA DIS data:
      - combine measured asymmetries, including out-of-plane angle factors, R unpolarized structure function
      - fit and extrapolate to $x = 1$
    - HMS resonances data: fit A_1, A_2 with resonant shapes, compare to *RSS*
  - $A_{elastic}$: extract form factor ratio at two momentum transfers

- Spin structure functions g_1, g_2
  - Combine with F_1 unpolarized s.f.
    - BETA
      - g_1, g_2 (x) at constant Q^2: Nachtmann moments, matrix elements, models, pQCD
      - g_1, g_2 (Q^2) at fixed W or x: evolution, global fits
    - HMS DIS data: extend *RSS* DIS range to lower x; improve extrapolation errors

Underlined: potential thesis topics