

Benchmark measurements / processes for PPG Groups

1. Electroweak physics, incl. Higgs

- Higgs (mH, single-Higgs couplings via SMEFT and kappas)
- HH and Higgs potential (Higgs self-coupling)
- Precision EW (mW, Z width, sin²thetaW; EW couplings via SMEFT)
- Longitudinal scattering
- Top benchmarks: top mass and SMEFT

Co-convener: Jorge de Blas, Monica Dunford

2. Strong Interactions

- Precision QCD
 - Precision and accuracy on alpha_s;
- Inner structure of protons and nuclei
 - Precision on (longitudinal) PDF(x,Q²);
 - Precision on nuclear PDF(x,Q²);
- Hot and dense QCD
 - Heavy-flavour hadron production (rare states, kinematic coverage); QGP transport coefficients (heavy quarks, jets);
 - QGP thermal radiation / temperature;
- QCD connections with hadronic, nuclear and astro(particle) physics
 - Constraints on nature of exotic hadrons from spectroscopy and h-h correlations;
 - Precision on anti-nuclei production and absorption relevant for cosmic-ray physics;

Co-convener: Andrea Dainese, Cristinel Diaconu

3. Flavour physics

$B \rightarrow K^{(*)} \tau\tau$

$B \rightarrow K^{(*)} \nu\nu$

$B_d \rightarrow \mu\mu$

$\tau \rightarrow 3\mu$

τ lifetime and $B(\tau \rightarrow \mu\nu\nu)$ (τ universality tests)

CP violation in neutral D-meson mixing

Co-convener: Gino Isidori, Marie H el ene Schune

4. BSM physics

- New gauge forces (Z' , W' ...)
- Compositeness (indirectly from EFT fits)
- Extension of the minimal real scalar sector giving 1st order EW phase transition and possibly stability.
- Minimal dark matter (WIMP) global
- High-energy aspects of flavour, e.g. exotic top decays
- SUSY (direct only collider)
- Portals (dark photon, dark higgs, HNLs, axions, ALPs)

Co-convener: Fabio Maltoni, Rebeca Gonzales Suarez

5. Dark matter and dark sector

Ultralight DM: ALPs, Z' .

Light DM: ALPs, Z' , Freeze-In

Heavy DM: Wino & Higgsino, Simplified Models, ALPs, Z' , Dark Showers

Note: Cannot compare benchmark processes across collider/direct/indirect detection. Only models.

Co-convener: Mathew McCullough, Jocelyn Monroe

6. Detector instrumentation

In general, scalability, time scales, Technology Readiness Levels (TRLs) of the proposed technologies and a discussion on existing/missing coverage in ECFA/CERN DRD collaborations is requested.

For collider experiments, in addition, requirements on:

- Vertex: Impact parameter resolution, single hit resolution on detector plane, material budget limits, power consumption, cooling
- Tracking: Momentum resolution, timing requirements (4D tracking), material budget, occupancy
- Calorimeter: energy resolution, granularity for FPA, dual readout
- PID: required particle separation capabilities over p range
- DAQ: data rate, latency, is a hardware trigger required?
- MDI: integration aspects, especially on last focussing magnet inside experiment volume

Co-convener: Thomas Bergauer, Ulrich Husemann