ILD Optimization Notes

- [ ] OPTIMIZE WHAT?: It would be best if we evolve the baseline design taking into account the ultimate reconstruction algorithms and detector capabilities.

  Examples:

  - [ ] Software compensation in AHCAL not yet used in standard PFA algorithm.
  - [ ] Inclusion of HCAL leakage corrections
  - [ ] More refined pileup mitigation including vertexing
  - [ ] Pi0 mass-constraint not used in reconstruction of EM component of jet energy
  - [ ] dE/dx not used in reconstruction
  - [ ] Calorimeter timing not used in reconstruction
  - [ ] Low pT track reconstruction optimization of inner tracking layout (rather than H->cc impact parameter).
  - [ ] Photon conversion reconstruction and V0s and kinks
  - [ ] Improvements to lepton ID

- [ ] MORE REALISTIC DESIGN : Include systematic issues in design evolution

  - [ ] Jet energy scale
  - [ ] Momentum scale
  - [ ] Neutral hadron scale
  - [ ] Alignment
  - [ ] Calibration
  - [ ] Magnetic field map
  - [ ] Beam-spot simulation
  - [ ] TPC field inhomogenieties.
  - [ ] In-situ estimation of accelerator parameters : L, E, P, etc.

- [ ] MORE RADICAL Forward looking DESIGN POSSIBILITIES

  We're talking about the design of a detector where the time-line is not short. It would be healthy to foster innovation.

  - [ ] Si ECAL

- MAPS based sensors ? for first layers
- Rectangular Si cells (eg 4*1 aspect ratio) to aid on photon position measurement

- SiD style vertex detector capabilities (timing).
- Pixellated inner tracking.
- Endcap precision timing detector (order 10 ps) using MCP PMTs

- COST SAVINGS
  - Octagonal ECAL -> more round. Eg. Dodecagonal ECAL. Reduces R_ECAL_MAX by 4.3%.
  - Aspect ratio. Shorter barrel is more cost effective.
  - HCAL depth -> most important for high energy.
    - Can identify hadronic interaction point - and flag particle as likely mis-measured and/or compensate for leakage.
  - Relax stray field requirement -> reduce size of yoke.
  - Remove ETD. Currently no clear case for it.
  - B-field reduction? Reduce cost of coil and yoke and reduce stray field.

- WHAT PHYSICS CHANNELS ? / OBSERVABLES
  - Typically very subjective.
  - Obviously need to include many of the standard Higgs analyses
  - Suggest we need to pay more attention to the detector hermeticity and the calorimetric design at forward angles.
  - Need to not neglect channels where kinematic fits may be very helpful.