Future Collider Activities at DESY: Detector Concepts / Software / Physics Performance

Jenny List (DESY) - with input from many people
Future Collider Forum Kickoff Meeting
16 April 2021

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

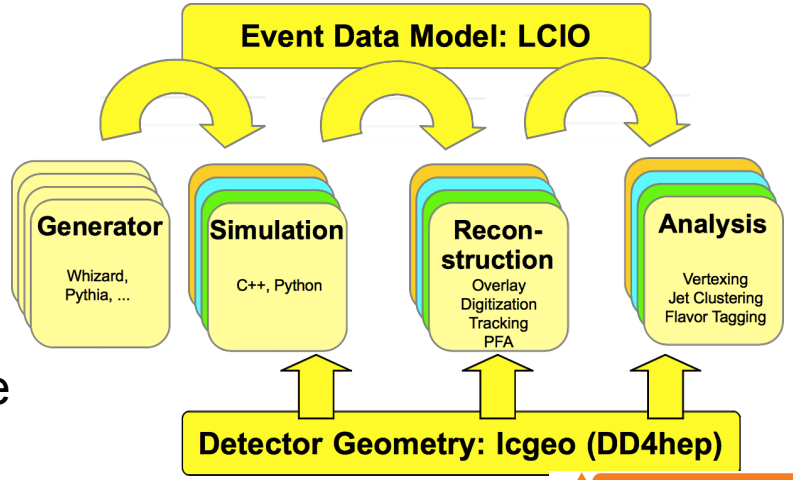
DESY.

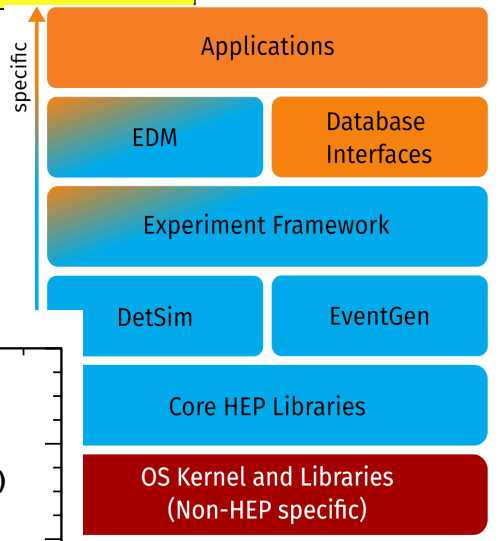
CLUSTER OF EXCELLENCE
QUANTUM UNIVERSE

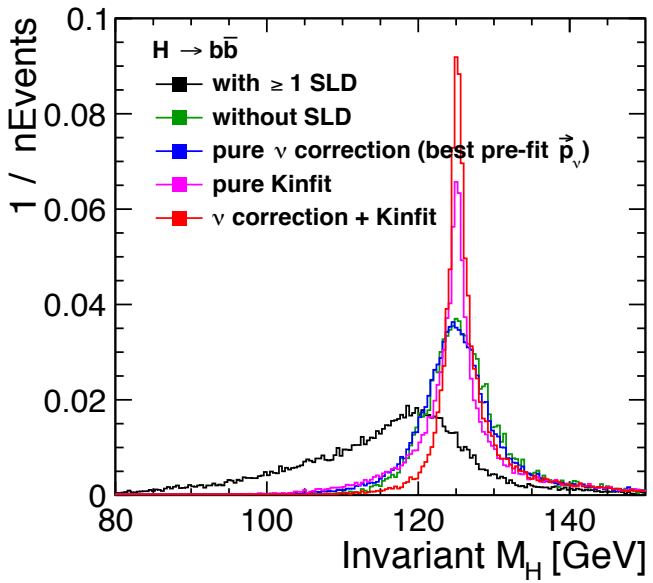
Software & Co

from iLCSoft to Key4HEP

- place of birth of iLCSoft, huge success of joint event data model and software framework for Calice, LCTPC, FCal, ILD, SiD and CLICdp, also used by CEPC, partially by FCCee
- **iLCSoft** still the most complete & advanced framework for future collider studies => needs to remain active as working horse
- exploring **machine learning**, both for reconstruction (flavour tag) and for fast shower simulation
- taking part in development effort of new software framework for all future colliders, **Key4HEP**:
  - EDM4HEP, Marlin wrapper -> profit from iLCSoft know-how
  - Delphes2EDM4HEP / Delphes2LCIO
- development of **detailed fast simulation SGV** (tracking from first principles, PFlow parametrized)
- development of various **reconstruction algorithms** - often using ILD as example, applicable to all e+e- detectors
  - tracking pattern recognition **- also for muon collider**
  - particle ID, tau reconstruction, flavour tag
  - semi-leptonic B-decays, kinematic fitting, …

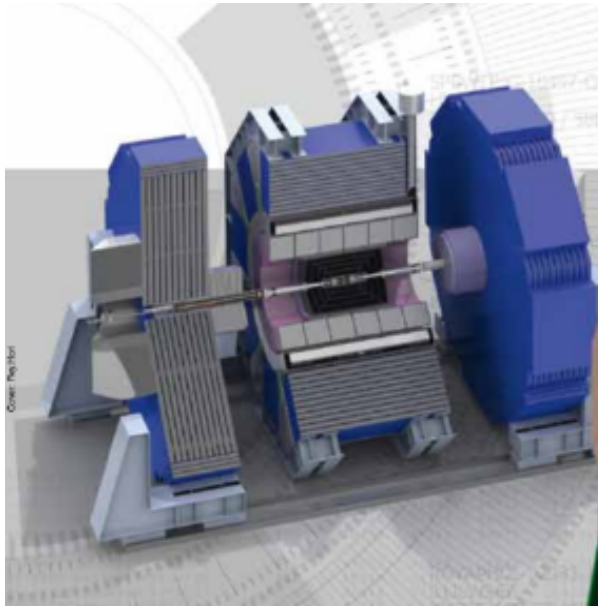






Detector Concepts

mainly ILD, some SiD, some muon collider

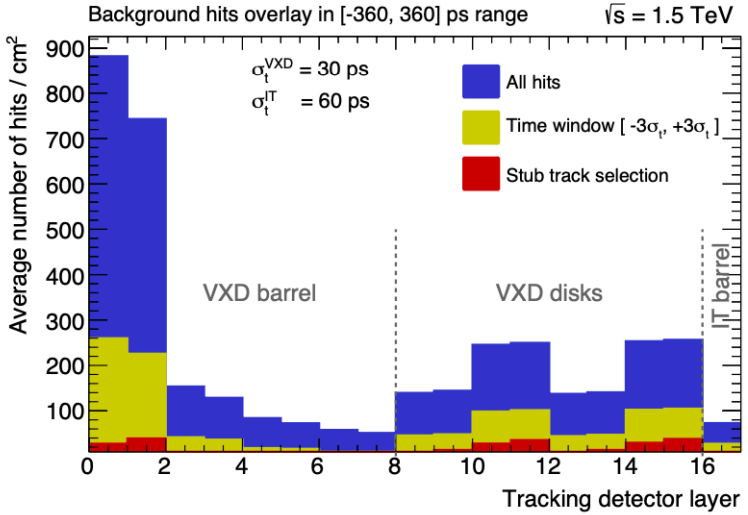


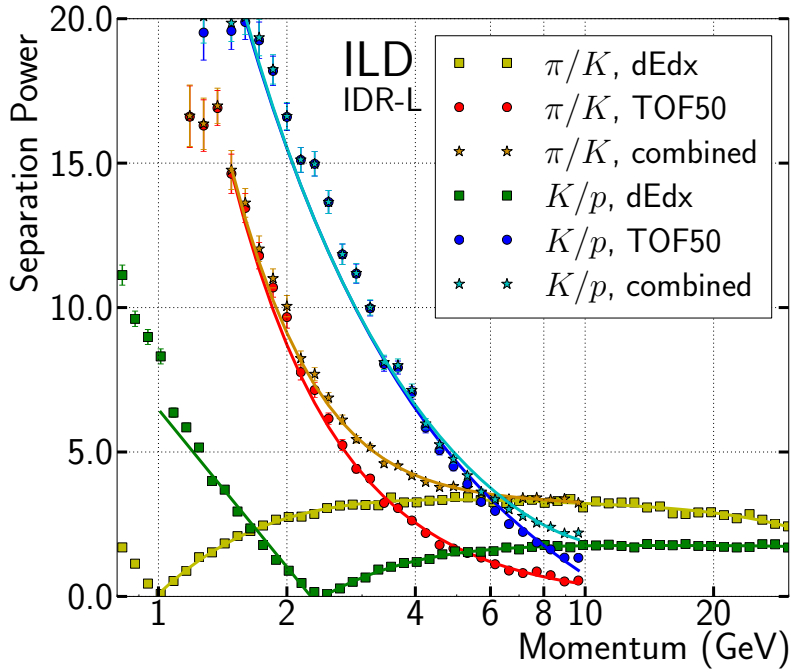
long tradition in shaping the detector concepts for the ILC

- optimised for particle flow reconstruction, served as starting point for
  - CLICdp
  - FCCee/CEPC detector concepts
- leading roles in **ILD & SiD** concept groups (NEW: light-weight guest membership for easy access to full simulation data sets!)
- active in e.g.:
  - performance-driven detector optimisation
  - detector integration, assembly, earth quake safety, MDI …
  - if and (if yes) how to integrate fast timing

muon collider detector:

- tracker optimisation
- beam-induced backgrounds
- co-organise det. WS in June

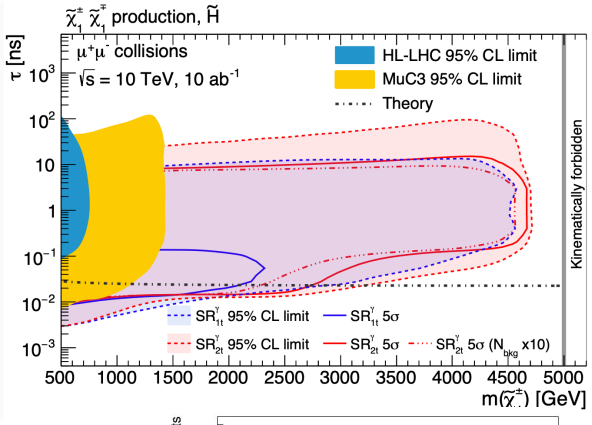


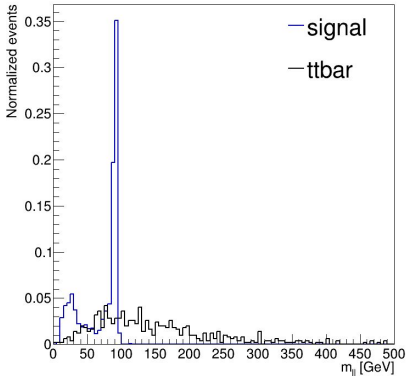


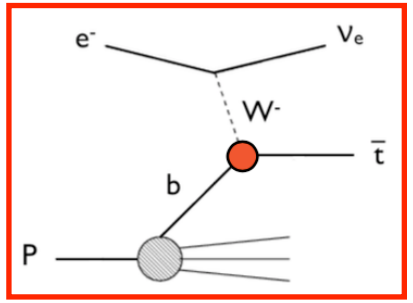
Physics Performance

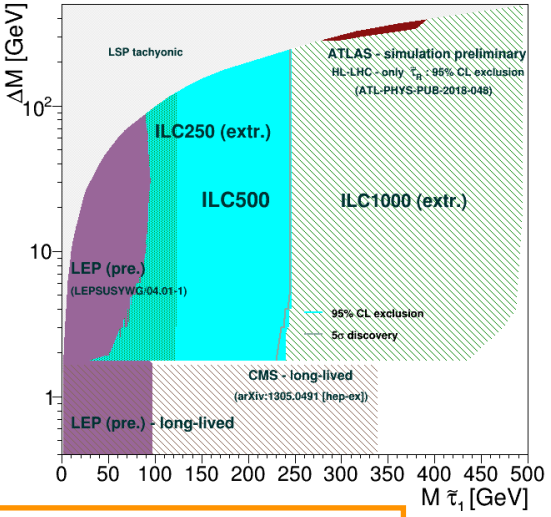
SM & BSM @ FCC, ILC, CLIC, muon collider

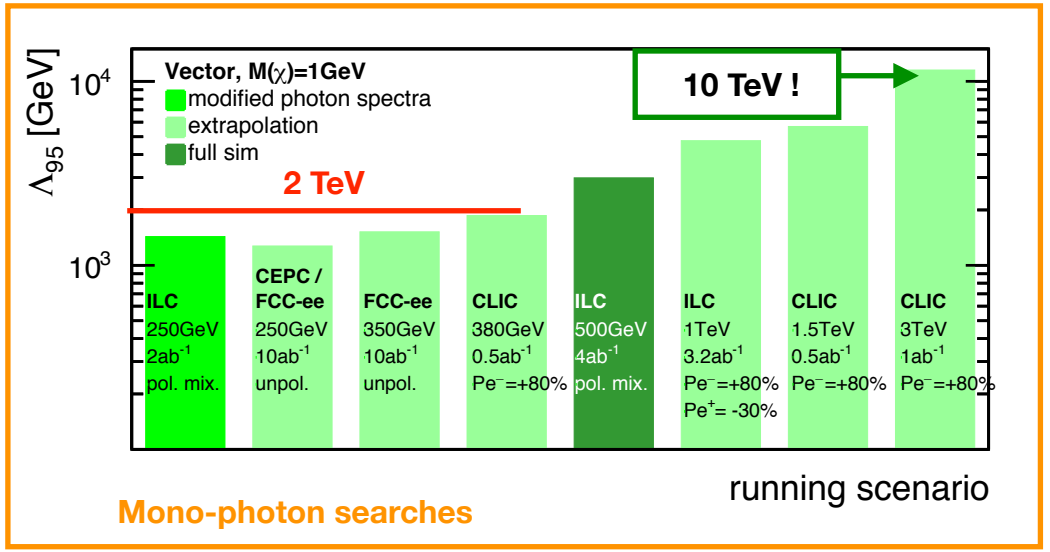
- Muon collider: long lived particles
- FCCeh/LHCeh: eg measurement of Vtb
- FCChh: Delphes study of Higgs self-coupling prospects in HH→bbZZ→bbllvv
- FCCee:
  - used to co-convene Higgs WG, bachelor theses
  - no current activity due to lack of person power, engage again if interested Fellow or Master student…
- ILC:
  - leading roles in International Development Team
  - BSM reach, eg sleptons, charginos, dark matter, …
  - Higgs: decays, self-coupling, …
- e^+e^- generic:
  - global fits (SM and MSSM)
  - physics impact of top-level machine parameters (luminosity, energy, polarisation, …)
  - role of experimental systematic uncertainties











Thank you!

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