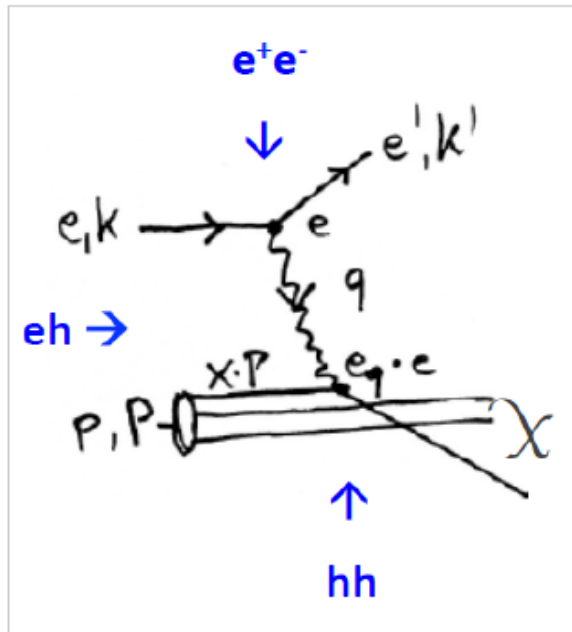
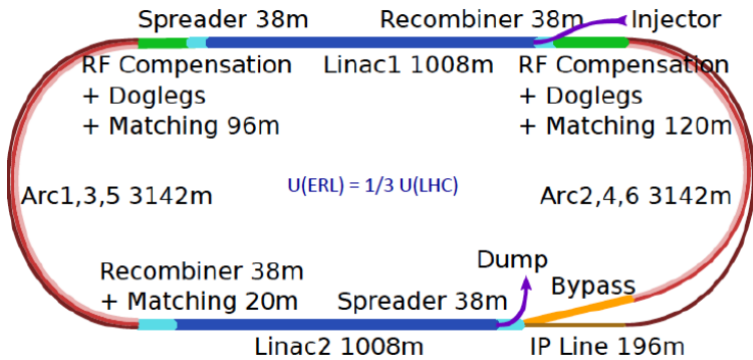


LHeC: Slides for Ian - PPAP



W Kandinsky, Circles in a Circle, 1923, Philadelphia Art Museum



Three Raisons d'être of the LHeC

Physics

- **Microscope:** World's Cleanest High Resolution
- **Empowerment** of the LHC Physics Programme
- **Creation** of a high precision, novel Higgs facility
- **Discovery** Beyond the Standard Model
- **Revolution** of Nuclear Particle Physics

Sustainability and Cost

LHC:

- see: SM, Higgs and no BSM
- use: Investment of O(5) BSF
- run: HL LHC until ~2040

LHeC [1206.2913, update 2/19]

- 1.2 TeV ep/A for O(1)BSF

→ Establish novel ep+pp

Twin Collider Facility at CERN:

sustains HL LHC and bridges to
CERN's long term future

For installation during LS4 (2030+)
and long term use (HE LHC, FCCeh)

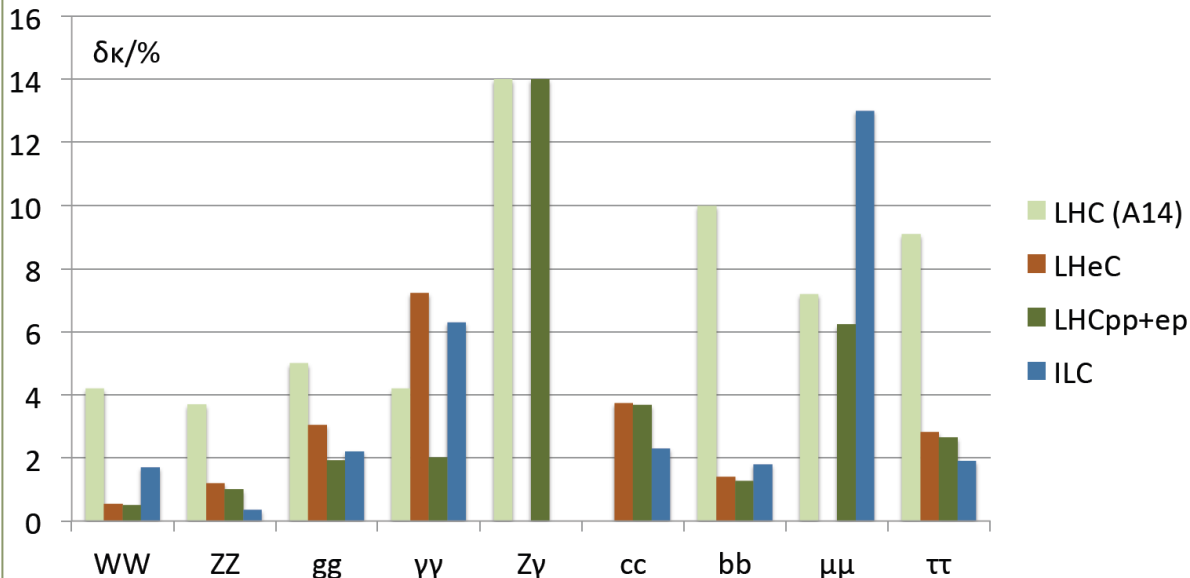
Technology

Accelerator: Novel SRF ERL, green power facility

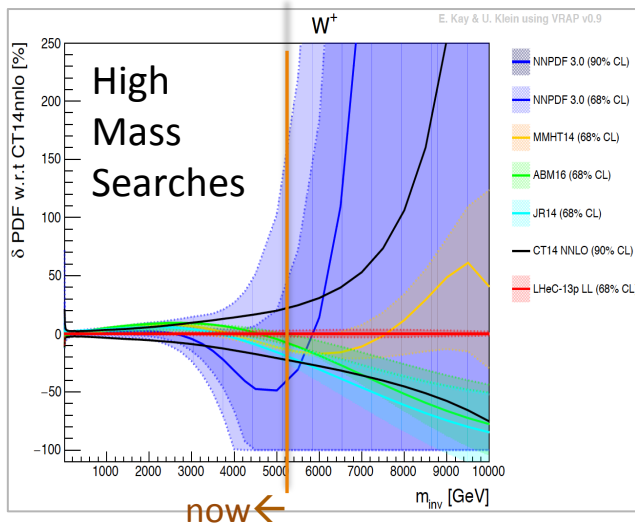
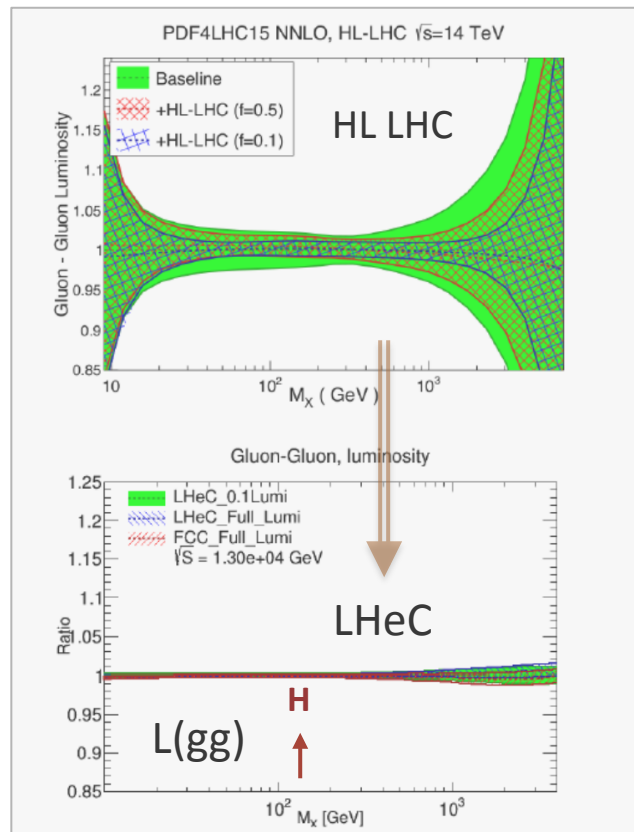
Detector: Novel high tech (CMOS..) apparatus

→ Keep accelerator and detector base uptodate
while preparing for colliders that cost O(10)BSF

Prospects for Higgs Couplings: LHC, LHeC, ep+pp, ILC



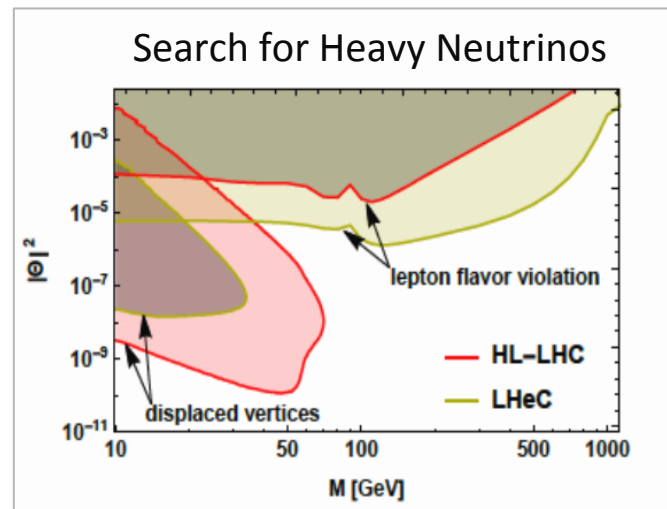
HL-LHC ATLAS2014. LHeC: $1ab^{-1}$, in progress ep+A14 ILC: $2ab^{-1}$: 1710.07621
 HL LHC WS to come, ep+pp: J de Blas, M+U Klein preliminary w/o LHC. e^+e^- provides Γ_{tot}



Physics

1802.04317

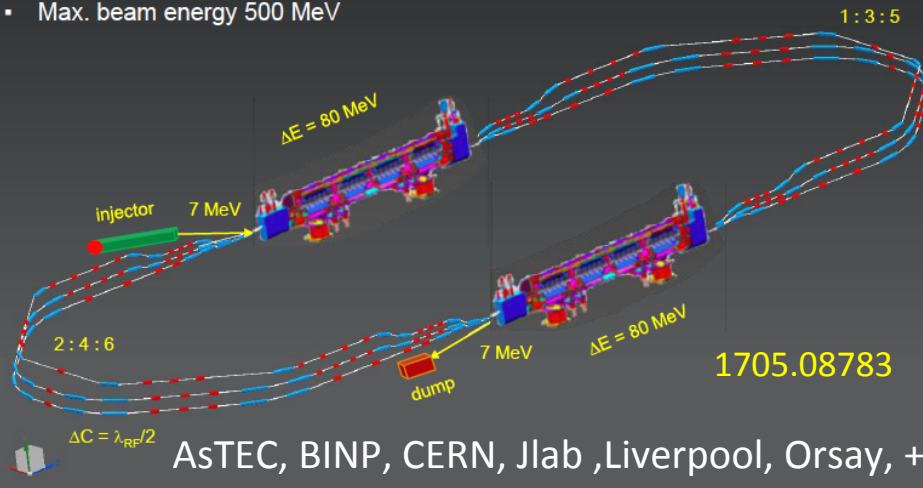
α_s to 0.1%
 V_{tb} to 1%...
 $\sin^2\theta_W$ better than LEP
 M_W [pp+ep]: 0.007%
 ...
 HIGH precision leads to Discovery BSM



Acc & Det Technology

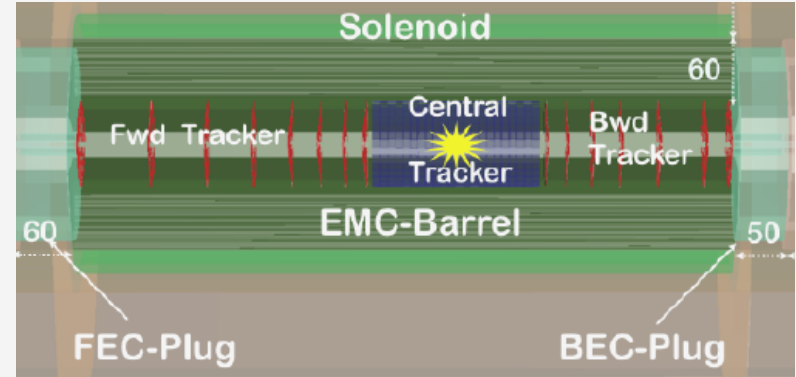
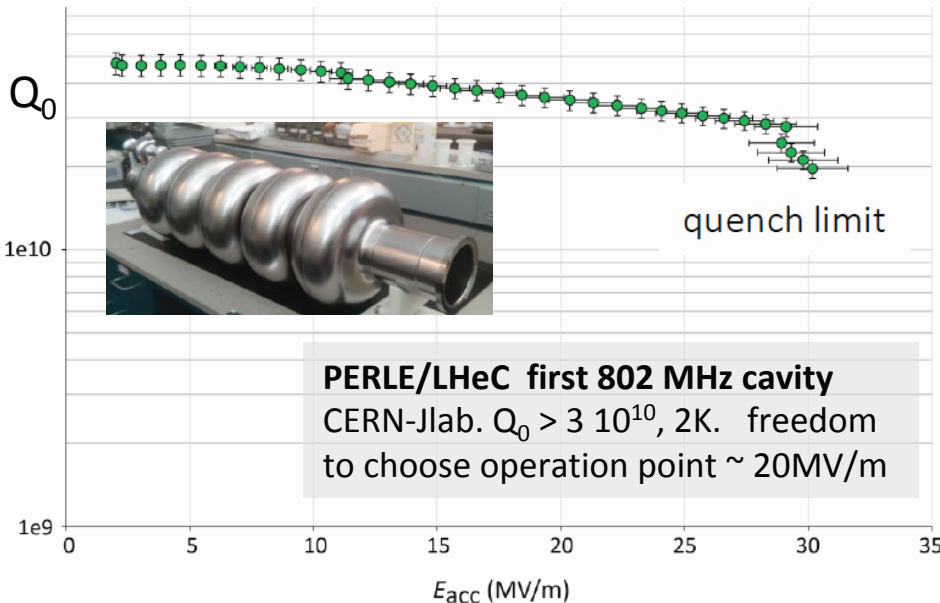
- 2 Linacs (Four 5-Cell 801.58 MHz SC cavities)
- 3 turns (160 MeV/turn)
- Max. beam energy 500 MeV

PERLE at Orsay

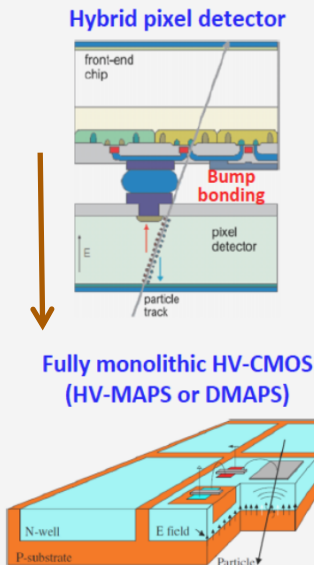


AsTEC, BINP, CERN, Jlab, Liverpool, Orsay, +

Challenge: demonstrate multi-turn ERL (cbeta, 2019)
Develop 802 MHz, LHeC Technology (PERLE > 2022)



Zoom LHeC detector [15.6 x 10.4m² HE LHC]



UK Institutes

Accelerator

AsTEC, Cockcroft (Lancaster, Manchester, Liverpool, Srathclyde), JAI (Oxford)

Detector+Physics

Birmingham, Liverpool, Manchester, Oxford, QMW

HERA+LHC have also Bristol, Glasgow, Imperial, Lancaster, RAL, UCL.

Detector: a new task post HL LHC design
Challenge for Acc+Det: 3 beam-IR design

Most up-to-date Information: <https://indico.cern.ch/event/698368/>

Workshop: LHeC/FCCeh and PERLE
Last week at Orsay near Paris



Electrons for the LHC

LHeC/FCCeh and PERLE Workshop

June 27-29, 2018
LAL-Orsay, France

Organising Committee:
Nestor Armesto (USC)
Oliver Brüning (CERN)
Walid Kaabi (LAL)
Uta Klein (Liverpool)
Zhiqing Zhang (LAL)

Advisory Committee:
Sergio Bertolucci (Bologna)
Nicola Bianchi (INFN)
Frederick Bondur (CERN)
Oliver Brüning (CERN)
Stanley Brodsky (SLAC)
Heping Chen (IHEP Beijing)
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Sidiq Fera (Milano)
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Max Klein (Liverpool)
Peter Kostka (Liverpool)

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Giovanni Igo (CERN)
Ella Krieger (CERN)
Gergely Ágoston Horváth (DESY)
Paul Newman (Birmingham)
Sergio Bertolucci (Bologna)
Zhiqing Zhang (LAL-Orsay)
Gergely Ágoston Horváth (DESY)
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New and Updates on
Physics: PDFs, QCD, H, t, BSM, eA + Relation eh-hh..
Accelerator: IR, Optics, Lattice, Cost-Energy, CE..
Detector: the GPD and its fwd and bwd detectors
PERLE: Source, Injector, Cavity, Cryomodule,.. Physics
Project Development towards the ES2020:
LHeC + FCCeh+ PERLE input 12/18. **PERLE TDR in 2019.**

<http://lhec.web.cern.ch>