



Linear vs Ring

L. Evans, Lausanne, 8th April 2019
Slides courtesy F Zimmermann.

FCC-ee basic design choices

double ring e^+e^- collider ~ 100 km

follows footprint of FCC-hh, except around IPs

asymmetric IR layout & optics

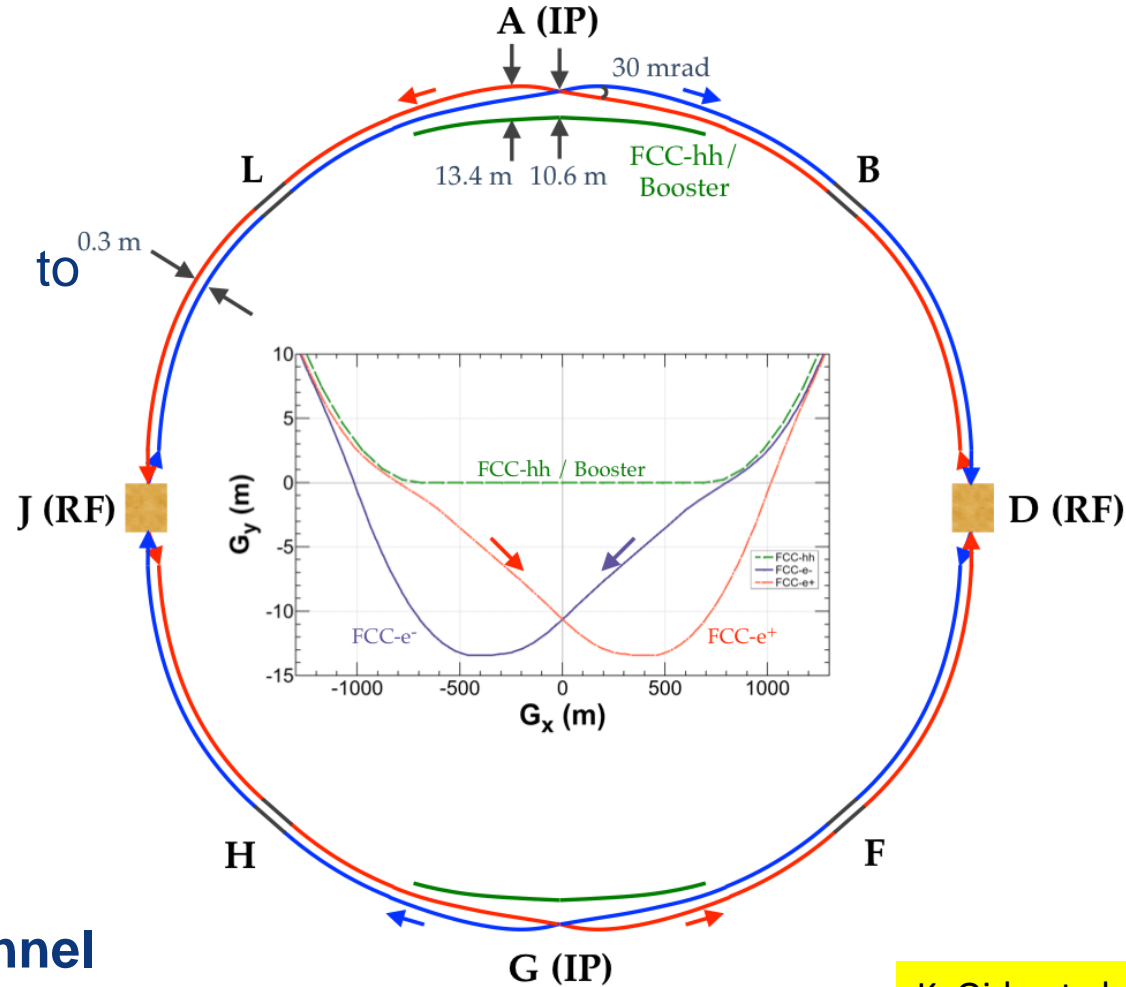
limit synchrotron radiation towards the detector

presently 2 IPs (alternative layouts with 3 or 4 IPs are under study),

large horizontal crossing angle 30 mrad, crab-waist optics

synchrotron radiation power 50 MW/beam at all beam energies

top-up injection scheme; requires booster synchrotron in collider tunnel





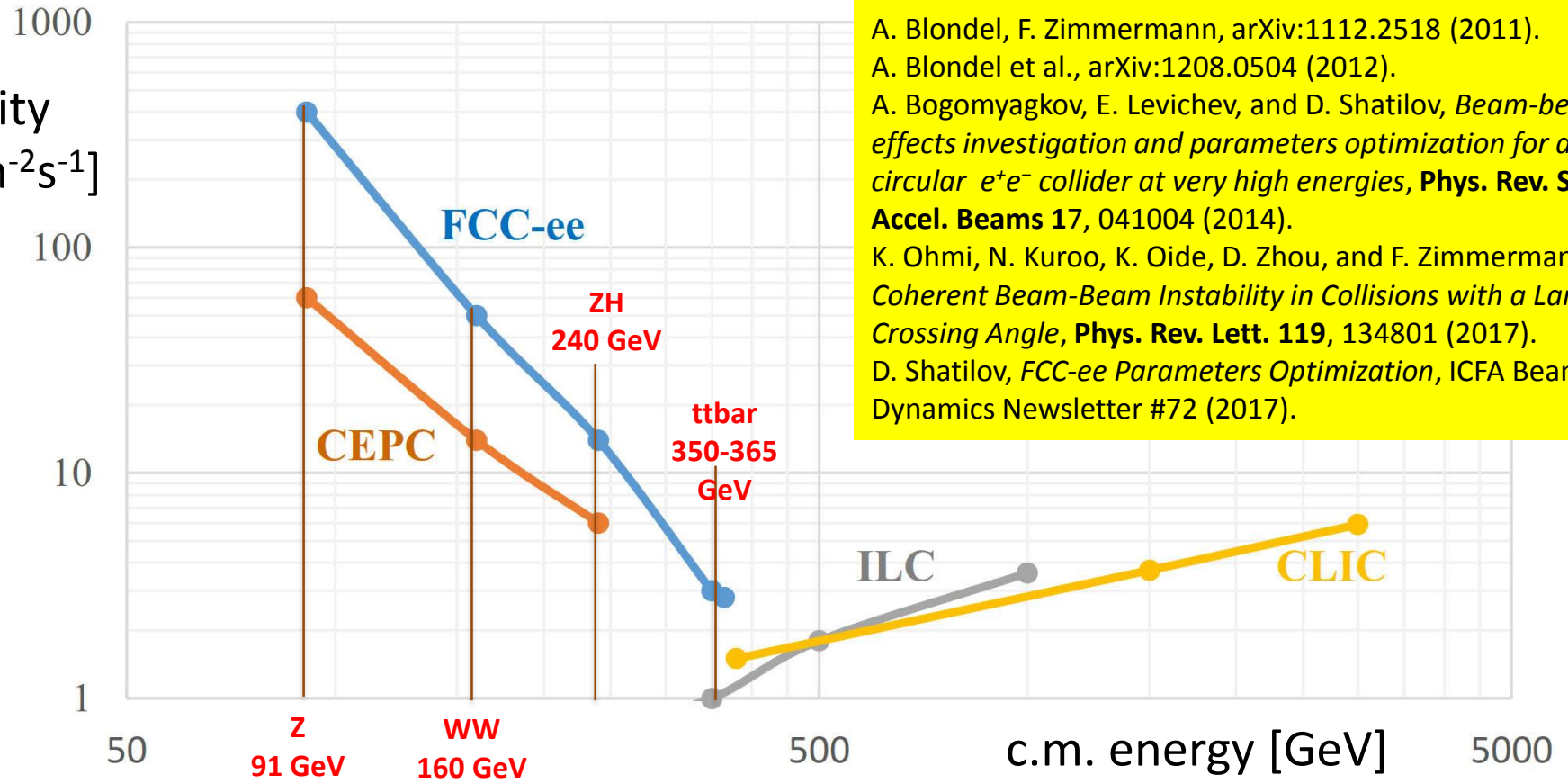
FCC-ee collider parameters

parameter	Z	WW	H (ZH)	ttbar
beam energy [GeV]	45	80	120	182.5
beam current [mA]	1390	147	29	5.4
no. bunches/beam	16640	2000	393	48
bunch intensity [10^{11}]	1.7	1.5	1.5	2.3
SR energy loss / turn [GeV]	0.036	0.34	1.72	9.21
total RF voltage [GV]	0.1	0.44	2.0	10.9
long. damping time [turns]	1281	235	70	20
horizontal beta* [m]	0.15	0.2	0.3	1
vertical beta* [mm]	0.8	1	1	1.6
horiz. geometric emittance [nm]	0.27	0.28	0.63	1.46
vert. geom. emittance [pm]	1.0	1.7	1.3	2.9
bunch length with SR / BS [mm]	3.5 / 12.1	3.0 / 6.0	3.3 / 5.3	2.0 / 2.5
luminosity per IP [$10^{34} \text{ cm}^{-2}\text{s}^{-1}$]	>200	>25	>7	>1.4
beam lifetime rad Bhabha / BS [min]	68 / >200	49 / >1000	38 / 18	40 / 18



FCC-ee luminosity versus energy

total
luminosity
[$10^{34} \text{ cm}^{-2} \text{ s}^{-1}$]



A. Blondel, F. Zimmermann, arXiv:1112.2518 (2011).
A. Blondel et al., arXiv:1208.0504 (2012).
A. Bogomyagkov, E. Levichev, and D. Shatilov, *Beam-beam effects investigation and parameters optimization for a circular e^+e^- collider at very high energies*, **Phys. Rev. ST Accel. Beams** **17**, 041004 (2014).
K. Ohmi, N. Kuroo, K. Oide, D. Zhou, and F. Zimmermann, *Coherent Beam-Beam Instability in Collisions with a Large Crossing Angle*, **Phys. Rev. Lett.** **119**, 134801 (2017).
D. Shatilov, *FCC-ee Parameters Optimization*, ICFA Beam Dynamics Newsletter #72 (2017).