



Energy Frontier Capabilities



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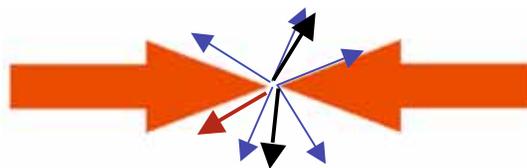
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Lepton Conveners:

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(MIT/USPAS)



Tentative charge: Energy-frontier hadron colliders



- ✱ Questions concerning the LHC
 - How high a luminosity is possible for the LHC?
 - What integrated luminosity is possible w/o compromising experiments?
 - What design choices affect detector survival?
 - How high an energy is possible in the LHC tunnel?
 - What technologies are needed for an LHC energy upgrade?
 - Where are the break-points for each technology?
 - What are luminosity limits for LHC energy upgrades
 - How does LHC evolution affect rationale for lepton colliders
- ✱ What energy & luminosity values are practical for VLHC?

What is R&D path to maximize hadron collider potential?



Tentative charge: Energy-frontier lepton & photon colliders

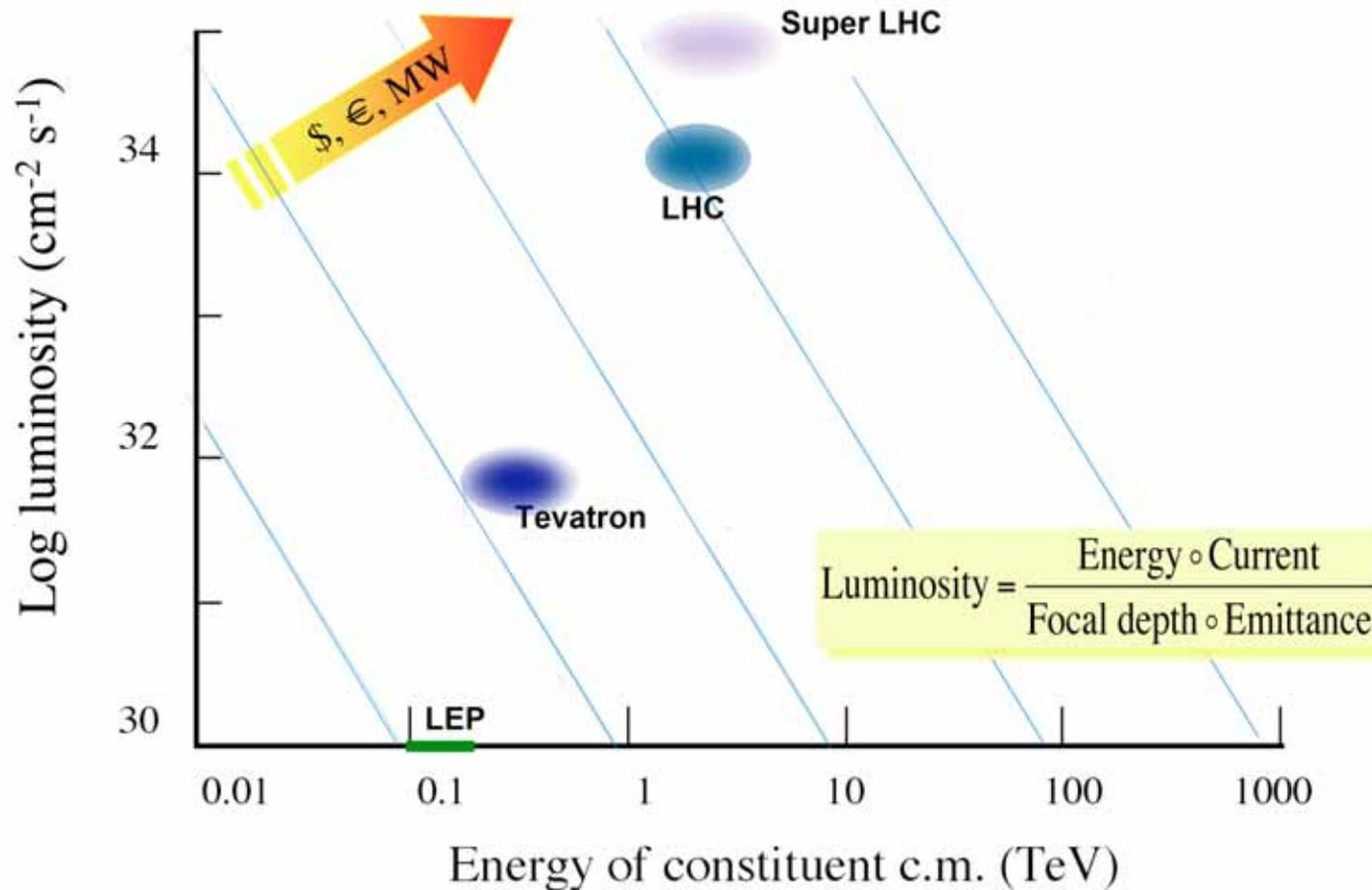


- ✱ Explore scenarios for future e^+e^- , $\mu^+\mu^-$, & $\gamma\text{-}\gamma$ colliders
 - Can ILC & CLIC designs be improved using new technologies?
 - Can they be constructed in stages? What is a staging plan? Cost profile?
 - What would be the parameters of a Higgs factory as a first stage of ILC or CLIC?
 - Higgs factories
 - Could a Higgs factory be constructed in the LHC tunnel? Near KEK?
 - What are parameter limits
 - What would be parameters of a $\gamma\text{-}\gamma$ collider Higgs factory
 - What technologies are needed?
 - Could one build a $\mu^+\mu^-$ collider as a Higgs factory?
 - How might one design a multi-TeV energy $\mu^+\mu^-$ collider?
 - What new technologies are needed? Is beam polarization practical?
 - Can we suppress backgrounds from beamsstrahlung & muon decay?
 - What are staging scenarios with physics at each step?

What is the essential R&D path?



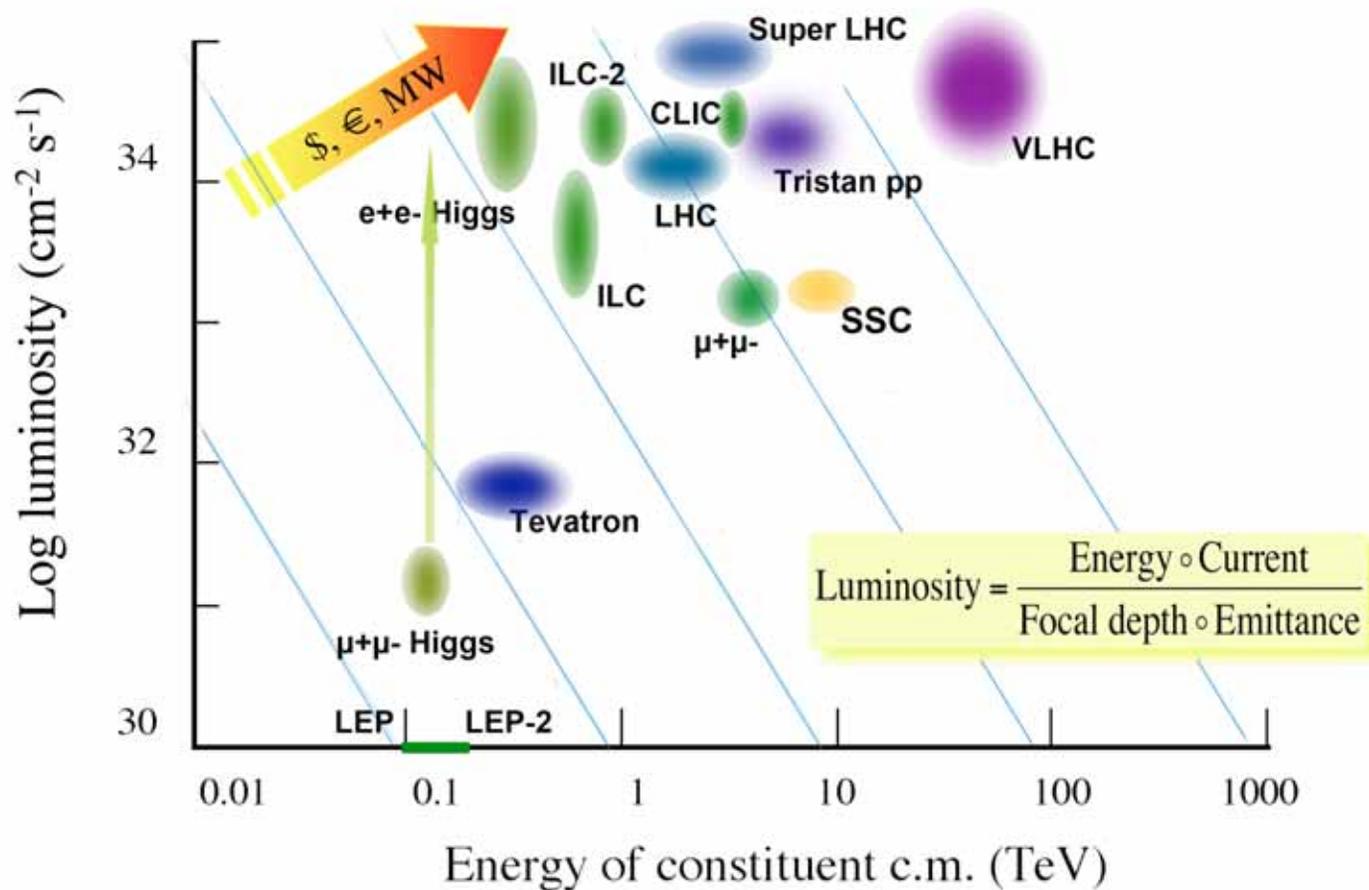
Discovery space & contours for existing Energy Frontier Facilities



Light blue lines: a factor of 2 in energy is worth 10x in luminosity



EF Capabilities we'd like to have



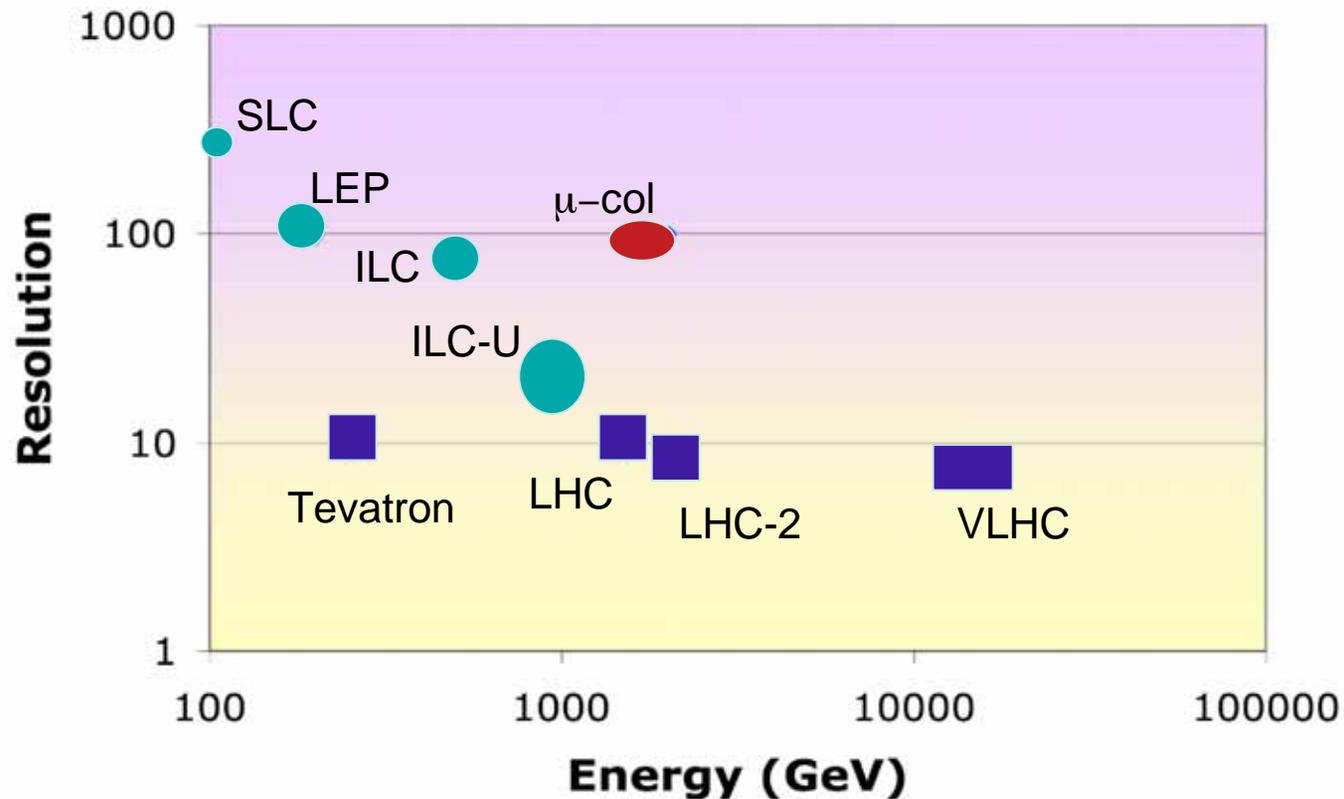
*Different Higgs factory concepts lay within the ellipse
Machine design does not change much within the ellipse*



Collider Figure of Merit: Resolution ($\mathcal{R} = \text{Energy}/\Delta\text{Energy}$)



- ✱ Intertwined with detector & experiment design
 - In hadron colliders: production change, parton energy distribution
 - In lepton colliders: energy spread of beams (synchrotron radiation)

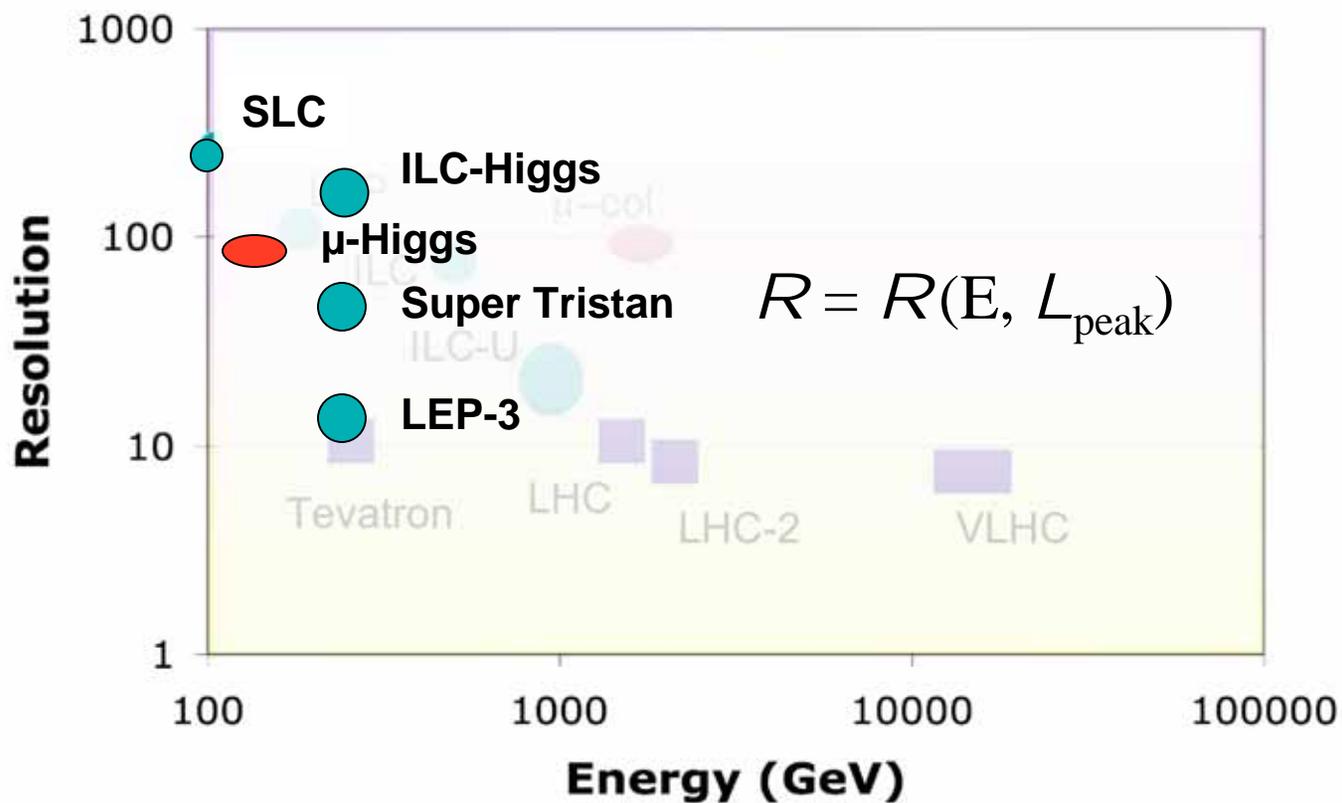




Collider resolution for Higgs factory



- ✱ Impact of machine design on Higgs physics studies
 - Energy spread driven by machine topology, beamsstrahlung





What we need from the EF study

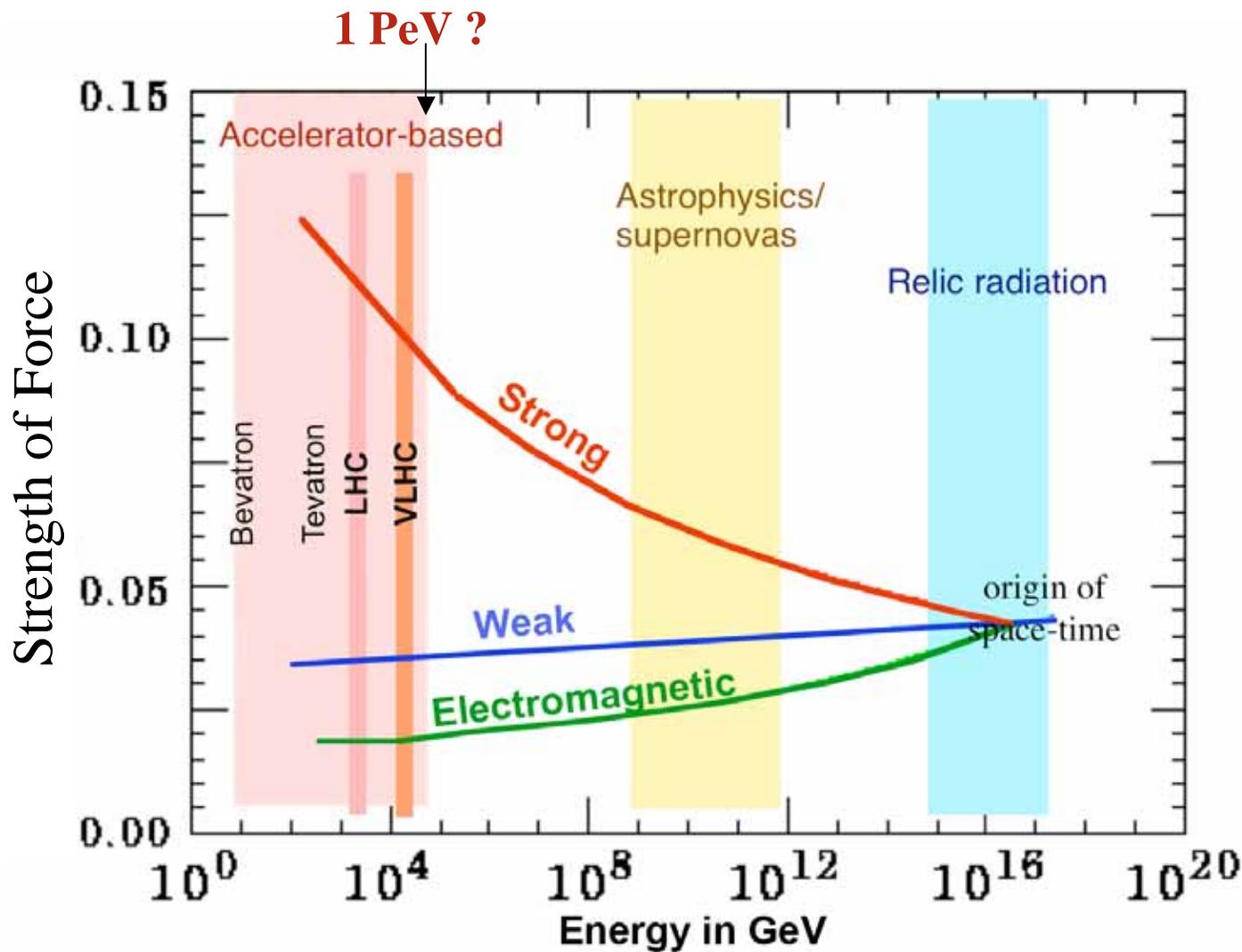


✱ From Marco and Markus

Backups



How far can we go with this approach?





How much do these things cost?

