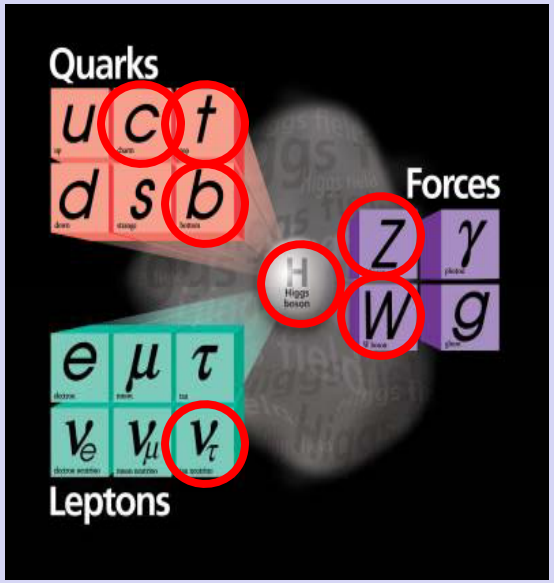
VLHC - Very Large Hadron Collider



- Progress in experimental particle physics was always driven by advances in experimental tools
  - Accelerators and detectors
- Over last ~40 years majority of discoveries have been made at the energy frontier hadron accelerators

- VLHC is an accelerator with center of mass energy for proton-proton collisions of 40-200 TeV. The only way to
  - Create particles with masses well above 10 TeV
  - Study distances below 10^{-20} cm
- We have a lot of expertise building hadron colliders while innovative ideas are needed to keep this path viable
  - Staged approach to ~100 TeV hadron collider
  - Based on a relatively long tunnel

Design Study for a Staged Very Large Hadron Collider

Report by the collaborators of
The VLHC Design Study Group:
Brookhaven National Laboratory
Fermi National Accelerator Laboratory
Laboratory of Nuclear Studies, Cornell University
Lawrence Berkeley National Laboratory
Stanford Linear Accelerator Center
Stanford University, Stanford, CA, 94309

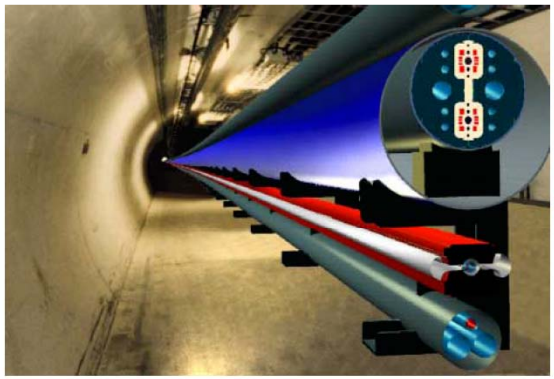
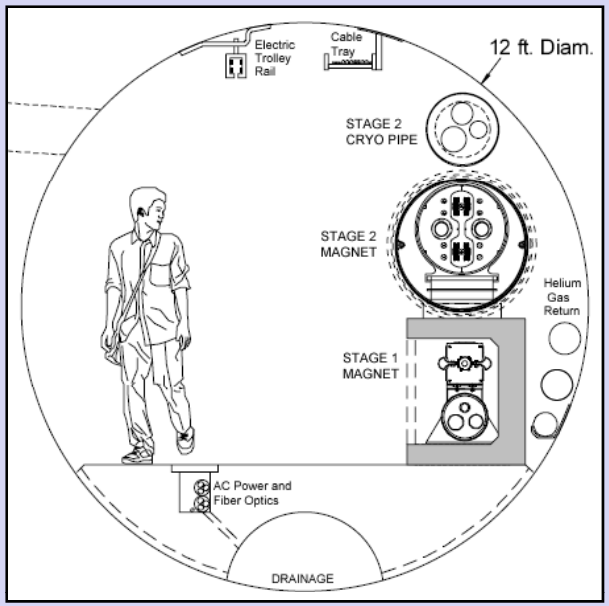


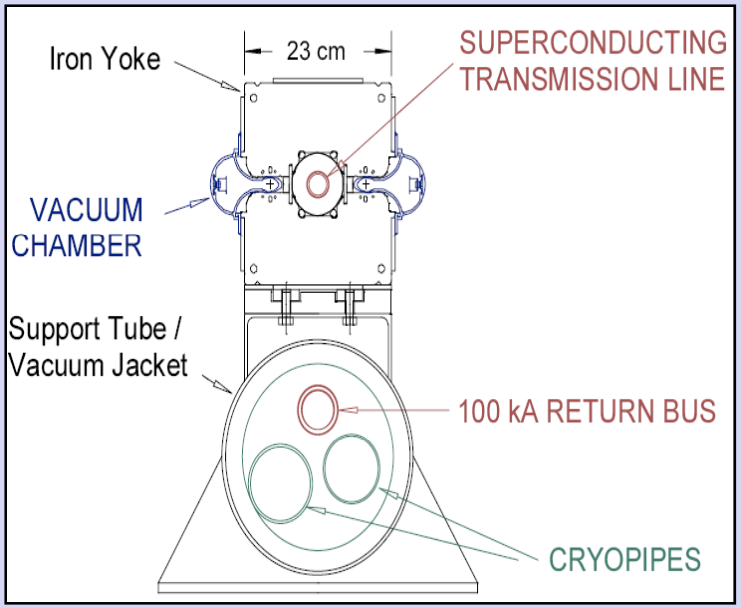
Table 1.1. The high-level parameters of both stages of the VLHC.

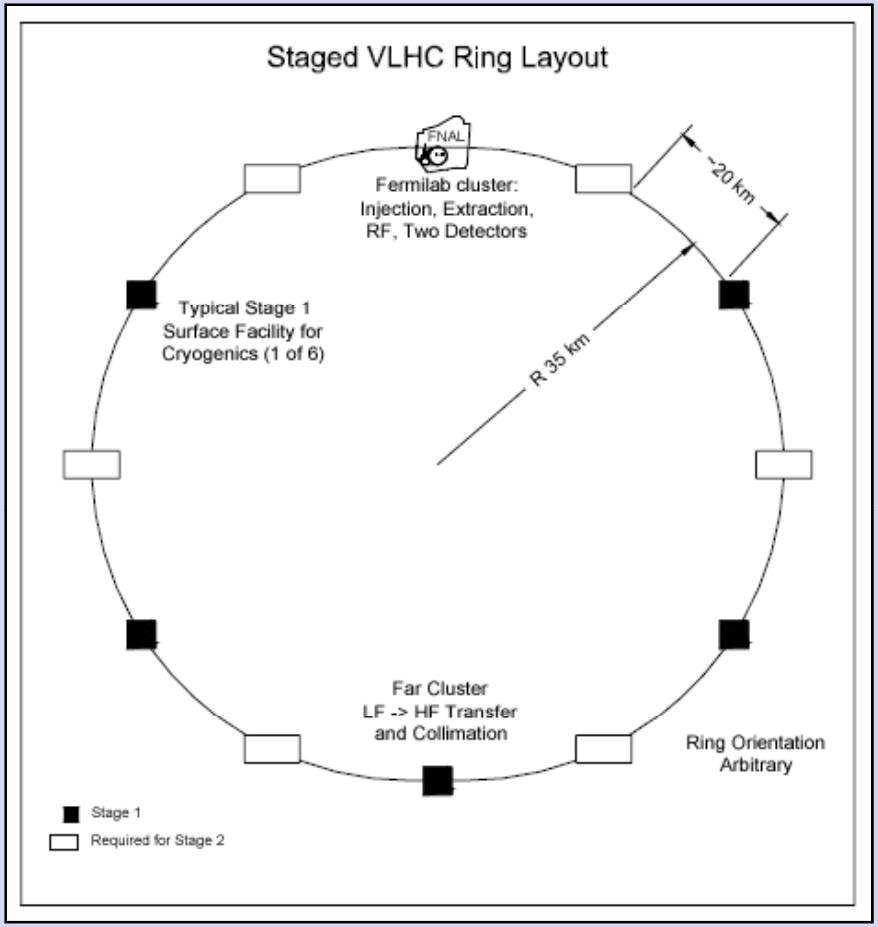
	Stage 1	Stage 2
Total Circumference (km)	233	233
Center-of-Mass Energy (TeV)	40	175
Number of interaction regions	2	2
Peak luminosity ($cm^{-2}s^{-1}$)	1×10^{34}	2.0×10^{34}
Luminosity lifetime (hrs)	24	8
Injection energy (TeV)	0.9	10.0
Dipole field at collision energy (T)	2	9.8

VLHC – Design Options



Low cost underground construction
New magnets technologies

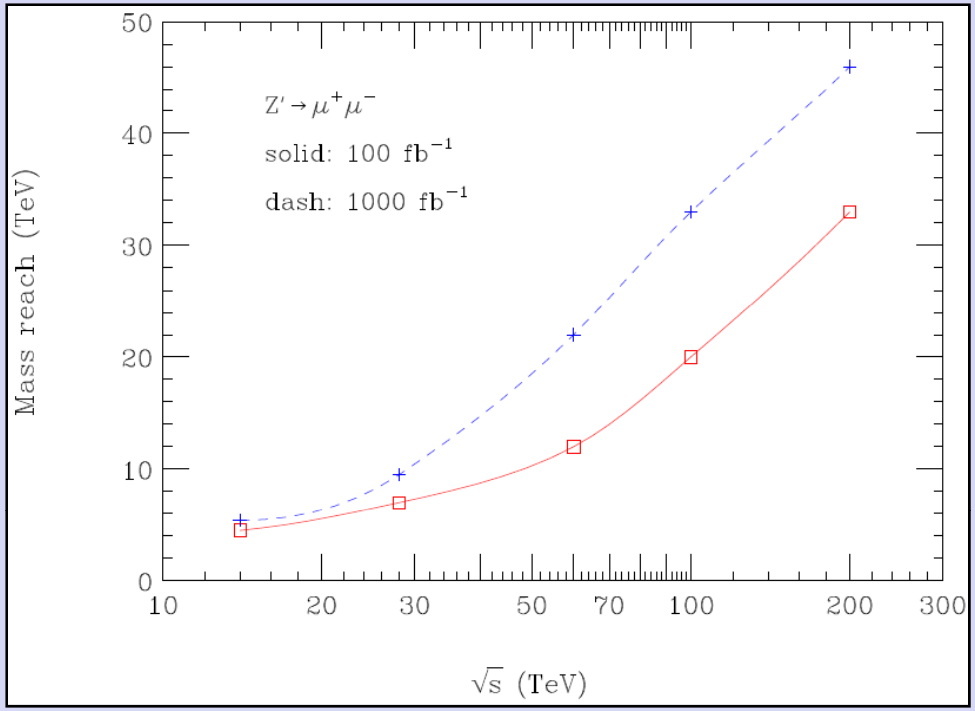




- **VLHC could be built based on reasonable extrapolation of today's expertise**
- **Developments and technological advances would benefit the project and develop new technologies**

Denisov, Town Hall Meeting

Very Large Hadron Collider



- **VLHC is an experimental tool to advance our understanding of sub-atomic world by over an order of magnitude**
  - **Smaller distances probed**
  - **Higher mass objects created**
- **The option is viable and with continuing technological advances could become even more affordable**

channel particle	LHC 100 fb^{-1}	LHC 1 ab^{-1}	28 TeV 100 fb^{-1}	40 TeV 100 fb^{-1}	200 TeV 100 fb^{-1}
$\tilde{q}, \tilde{g}$	2	2.5	4	5.5	> 10
W' Z'	4.5	5.4	7	8.5	33
q^*	7	8	10	13	50
Λ comp.	33	50	60	75	130
M_D $(\delta = 2)$	9	12	15	20	75