What follows an historic discovery?

- LHC Run 1 a success
- Runs 2-3 and the HL-LHC at 13-14 TeV will extend the search
  - This is the energy frontier for the foreseeable future
    - Fully exploit it
      - A huge potential could go untapped if it is undercut
  - The US is by now a well established collaborator
- Most of all, important physics is guaranteed
There are reasons to believe it will not be the last at the LHC
- We have really just begun the searches
- A lot of parameter space yet to be accessed ...
  - E.g. see EPS plenary talk of O. Buchmueller
- And many yet-to-be models will go untested without an active broad-band hadron collider

Investment is critical
- More powerful detectors, triggers, computing.. will bring a sustained period of important results
- Also in accelerator R&D that could be a big part of US national labs program

The LHC can also do precision and rare physics, looking for particles beyond its direct production reach
- A superb intensity frontier machine

It’s the only Higgs, (top, Z, W...) factory on the planet for many years to come!
Unprecedented challenges

Raw $\Sigma E_T \sim 2 \text{ TeV}$

14 jets with $E_T > 40 \text{ GeV}$

Estimated PU $\sim 50$
Unprecedented impact

17,000 news articles in 108 countries in 2 days

> 1 billion people saw TV footage
1,034 TV stations
5,016 Broadcasts
The super-exploitation of the CERN complex: Injectors, LEP/LHC tunnel, infrastructures

- 1985: LEP Physics
- 1990: LEP Upgr
- 1995: LHC Design, R&D
- 2000: LHC Proto
- 2010: LHC Physics
- 2015: HL-LHC Design, R&D
- 2025: HL-LHC Physics
- 2030: HE-LHC Design, R&D
- 2035: HE-LHC Proto

2000 large magnets of 15-20 T
1500 tons of HEP grade Nb3Sn
500 tons of HTS for magnets
100 tons of SC for Sc links

Courtesy L. Rossi
ATLAS & CMS > 500 Run 1 publications so far.

~all break new ground in one way or another.
The LHC

A global and US success story
And yet the view persists that the LHC is not a US program!
- Out of scores of countries, the US has made some of the largest contributions to the detectors

- ~25% of CMS+ATLAS
  - Most of what you see here was made in the USA
  - Also contributed a smaller amount to ALICE

- Key contributions to LHC accelerator complex
  - And vital R&D with LARP

- THANKS to DOE and NSF
  - and so many US labs & Universities for their support!
US involvement at CERN is not only a major opportunity, it is the continuation of a transatlantic partnership that has spanned generations and has blossomed into a demonstration of peaceful cooperation on an unprecedented global scale.

Science is now global
Particle physics provides an example of how a global community of talent and dedication can face and overcome daunting challenges.
CERN welcomes strong US participation

- In accelerators and detectors, the US involvement is extremely important.

The US research community benefits tremendously

- Retaining the ability to do cutting edge detector systems development and data analysis

CERN understands the importance of the US LBNE project to the US and to overall global balance

- A willingness to reciprocate
Host laboratories bear the lion’s share of the infrastructure costs

Leading regions need to share this burden
- An example of a program of new initiatives for next N years:
  - EU: HL-LHC ++
  - US: LBNE ++
  - Japan: ILC ++
- All 3 regions would support all 3 projects and encourage/support participation of all other regions
  - The “Big 3” projects should not however preclude smaller projects that target important physics at relatively small cost.

The US should remain a strong player
- Now is not the time for the US to walk away from nearly century-long partnerships that have yielded part of the greatest scientific legacy in human history
A magnificent century (and counting...)  

- From early radiation and cosmic ray experiments to accelerator-based, space-based and deep underground experiments...  
  - Particle physics has advanced human understanding of the universe - it’s underlying code, structure and evolution – by an incredible amount.
- The ‘Standard Models’ are among man’s greatest achievements ... ever ... and will forever be part of our greatest legacy
  - And the story is not over.
From early radiation and cosmic ray experiments to accelerator-based, space-based and deep underground experiments...

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- And the story is not over.
  - In fact it’s 95% incomplete.
Additional slides
• ATLAS
  • 38 Countries
  • 176 Institutions
  • 3000 Authors total
  • 900 Graduate Students
A small fraction of those who made CMS possible

CMS has ~4300 Scientists (including 800 PhD students), Engineers and technicians from 41 Countries and 190 institutes
44 Institutions
600 Scientific Authors
170 Graduate Students

48 institutions
650 Scientific Authors
200 Graduate students
16 T ⇒ 100 TeV in 100 km
20 T ⇒ 100 TeV in 80 km

even better 100 km?
Where do we stand now?

The Higgs:
so simple yet so unnatural

Guido Altarelli

Presentations/discussions (*Nobel Symposium, May 12-17 Uppsala*)

Talk by G. Altarelli*

A malicious choice! $m_H = 125.6 \pm 0.4$ GeV

*G. Altarelli: https://indico.cern.ch/conferenceDisplay.py?confId=239571