

# Frontier Capabilities

## - Accelerator Capabilities -

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**U.S. High Energy Physics  
Community Planning Meeting 2012**  
*Organized by the Division of Particles and Fields of the American Physical Society*

**October 11-13** Fermilab, Batavia, Illinois  
[indico.fnal.gov/event/CPM2012](http://indico.fnal.gov/event/CPM2012)

*CPM2012 is a first step toward Community Summer Study 2013, a long-term planning exercise for the U.S. High Energy Physics community within a global context. CPM2012 will help define the issues to be emphasized within the Summer Study by engaging the community and funding agencies in interactive presentations and discussions.*

**Working Groups**  
Energy Frontier  
Intensity Frontier  
Cosmic Frontier  
Frontier Facilities  
Instrumentation Frontier  
Computing Frontier  
Education & Outreach

**Local Organizing Committee**  
David Asner, Chicago, USA  
Henry Cheng, Fermilab  
Brenda Fischer, Fermilab  
André de Gouvêa, Northwestern  
Kevon Heggen, UW, Paducah  
Steve Hahn, Fermilab  
Dale Hopper, Fermilab  
Andreas Kroll, Fermilab  
Rafael Kolda, Fermilab  
Rishi Mishra, SLAC  
Piero Ranieri, FNAL  
Cynthia Scaife, Fermilab  
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Community Planning Meeting 2012, FNAL, 13 October 2012

# Themes, Questions and Organisation

## Six Accelerator Capabilities Areas

### Energy-frontier hadron colliders

M Battaglia (UCSC) & M Klute (MIT), L Rossi (CERN), S Prestemon (LBNL)

### Energy-frontier lepton & photon colliders

M Klute (MIT) & M Battaglia (UCSC), K Yokoya (KEK), M Palmer (FNAL)

### High intensity proton beams

J Galambos (ORNL), S Nageitsev (FNAL), M Bai (BNL)

### High intensity electron and photon beams

G Varner (UH), T Flanagan (KEK), J Byrd (LBNL)

### Nucleons & Nuclei (mainly Electron-ion colliders),

R Ent (JLab), T Roser (BNL), O Brüning (CERN)

### Accelerator Technology test-beds & test beams

G Hoffstaetter (Cornell), M Hogan (SLAC), W Gai (ANL), V Shiltsev (FNAL)

## Themes, Questions and Organisation

WG will not compare/evaluate accelerator projects but rather address the scaling of collider capabilities with basic parameters and define templates of performance to be populated with data from the various projects;

Given the advanced status of some designs and the need for intense R&D for others, WG will try to act as point of contact between different designs and technologies and address new questions emerging in the projects (new accelerator technologies for energy upgrade paths, review of energies of interest, ...);

Address aspiration of the community to bring a high energy machine back on US soil in the timescale after the LHC;

Goals on many decades are useful to community but less so for interaction with funding agencies: define road-map with well-defined short- to mid-term milestones will help whatever the long-term ambitions are; intermediate steps may target applications outside HEP;

Focus attention on accelerator capabilities reachable within  $\sim$  a decade and motivate R&D for those spanning a longer development cycle.

Define useful variables in the matrix [accelerator parameters, physics reach]

Scaling of Beam Energy Resolution now driven by narrow Higgs state

Consider power as important as cost and adopt Integrated Luminosity Cost parameter;

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Look at technologies which can improve efficiency and cut component costs (more efficient machines, component less expensive to manufacture)

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Articulate R&D needs in support to accelerator needs

## Interaction with community and reporting

Charge to SGs still being refined, welcome suggestions from community + other WGs;

Plan to issue call for technical inputs from community in the form of white papers;

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SGs to summarise results of study in documents containing enough new analysis to be submitted for publication on referred journals;

Describe physics-driven accelerator capabilities and define road-maps for required R&D;

Avoid the appearance of advocacy for projects and their prioritization;

## Interaction with other WGs in this study

Intend to consider generic parameter space (beam particle species, energy, luminosity, energy spread, beam structure and timing, induced bkg rates, ...) and assess usefulness to specific physics goals, related R&D requirements and instrumentation challenges;

Projection of physics capabilities on specific accelerator parameters to understand thresholds of interest and optimisation;

Define collaboration with Physics SGs, HEF Technical Advisors, Instrumentation Liasons, *et cetera*

Provide detailed guidance and data sets for physics studies but put also specific questions to guide our work:

*“Which are the (energy,luminosity) parameters for a study of the Higgs profile ?”*

*“How do detectors limit useable luminosity at hadron colliders ?”*

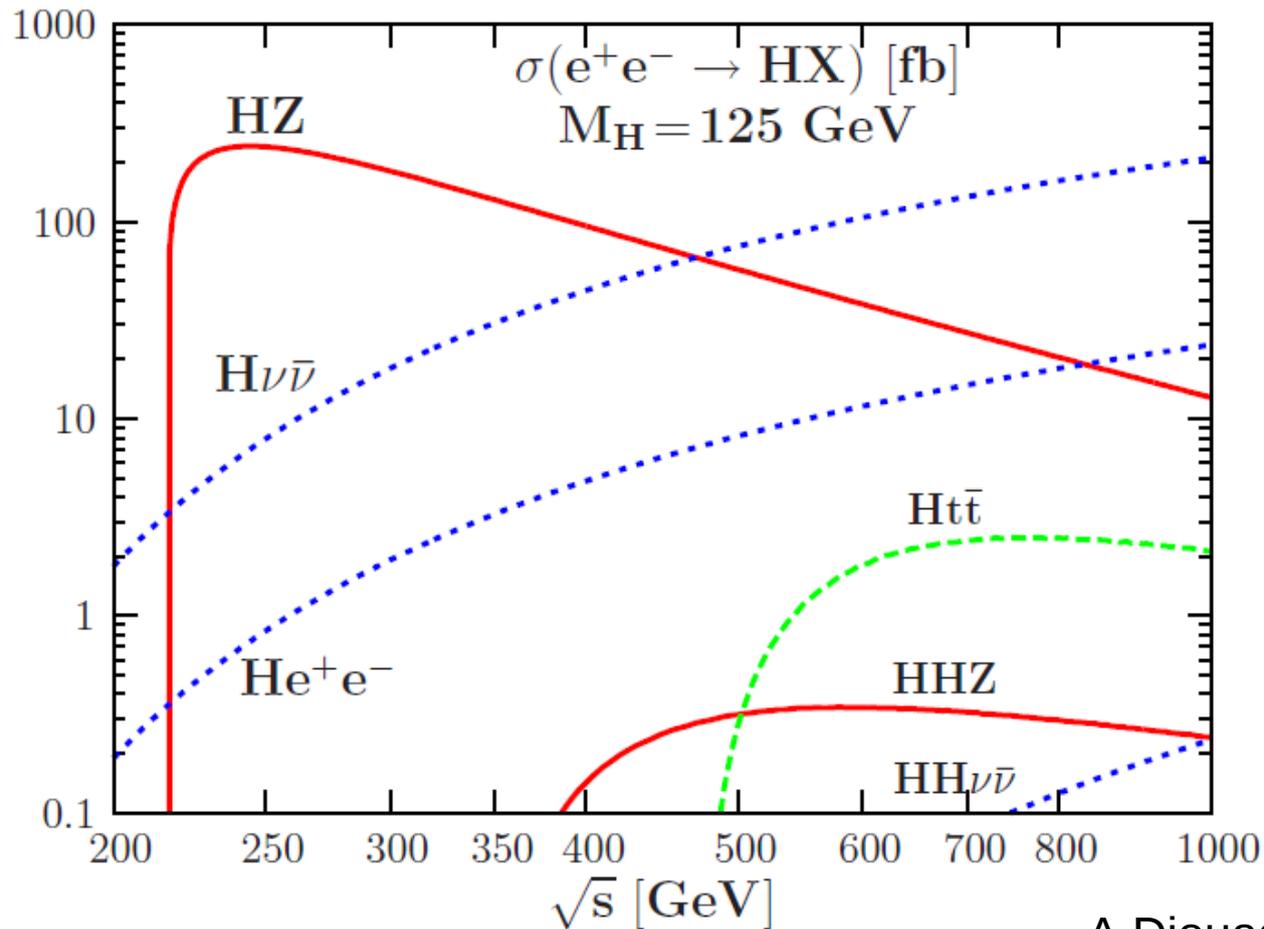
*“How do advances in beam instrumentation and diagnostics improve accelerators capabilities ?”*

# Accelerator Capabilities and Higgs Factory

What characteristics are required for a Higgs factory with capabilities beyond the LHC ?

Can muons colliders have a role as a Higgs factory on a 10-15 year horizon?

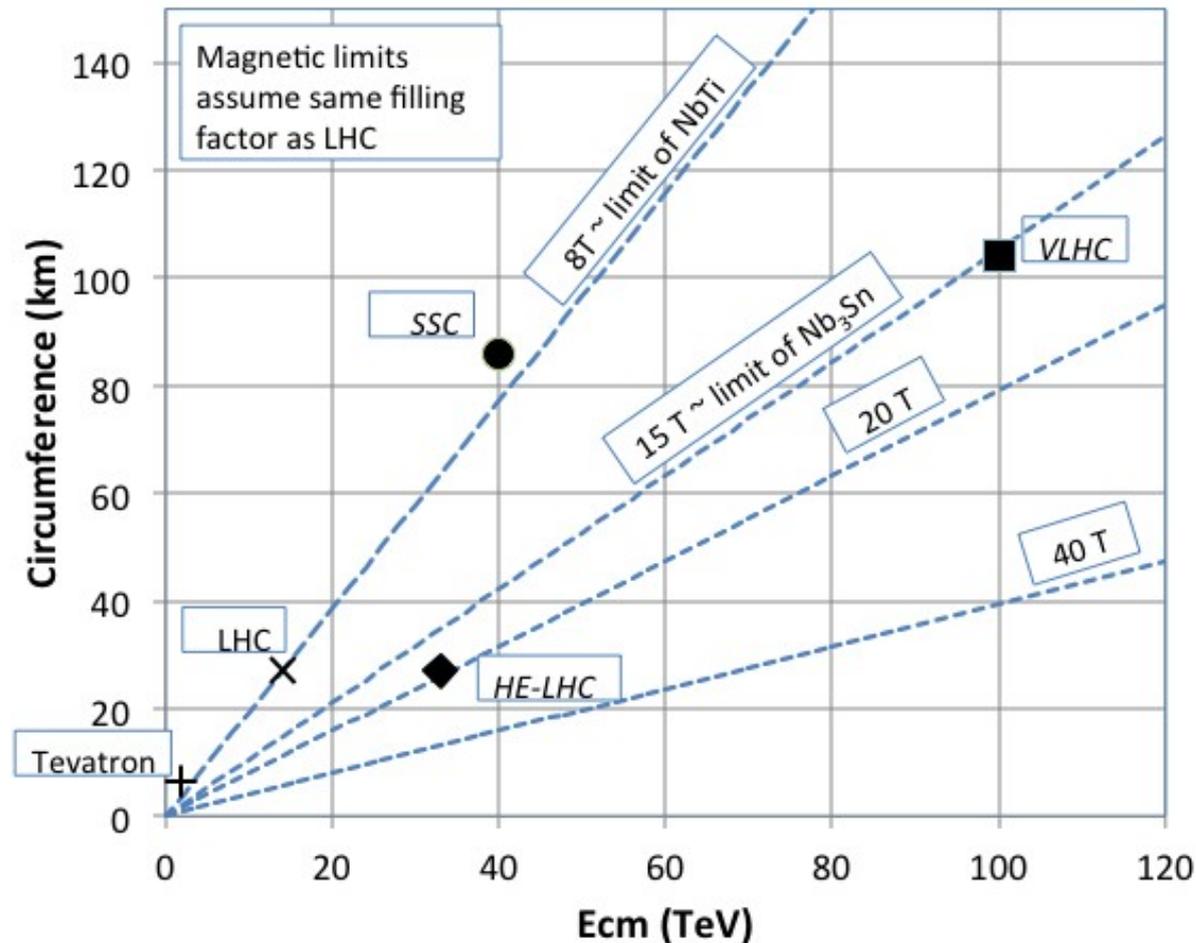
What would be the characteristics and technical challenges of a  $\gamma\gamma$  Higgs factory?



A Djouadi

# Accelerator Capabilities and Hadron Colliders beyond LHC

Understand how interest of energy reach depends on magnet technology and define magnet technology challenges



Subgroups refine charges for their areas: solicit input from Labs, established programs, WGs and all participants to this study;

Assemble core groups of participants;

Encourage groups interested in specific proposals or scientific topics to submit white papers on their subjects;

Subgroups to hold topical meetings to develop & refine ideas and do bulk of quantitative original work;

Aim at generating reports to be published on refereed journals.