LCWS 07

How to Get Involved in SiD

Richard Partridge
Brown / SLAC

Why Get Involved in SiD Now?

- During the next ~3 years, it is imperative for the ILC community to develop two optimized, complementary, and well understood detector designs that demonstrate the ability to carry out a compelling physics program
  - Hard to imagine the ILC can be approved without this
- SiD will be one of these two detectors
  - The precision, speed, and robustness of silicon detectors is unmatched by the competing technologies
- You can make a significant contribution in shaping the SiD detector design
  - The software tools needed for optimizing the detector design are either in place or well advanced, but the process of using these tools to optimize the detector design has barely started
  - An active detector R&D program is essential to make informed technical choices, develop detailed detector designs, and demonstrate the feasibility of these designs through simulations, prototypes, and test beam studies

How to Get Involved in SiD

A 3 step program for getting involved in SiD

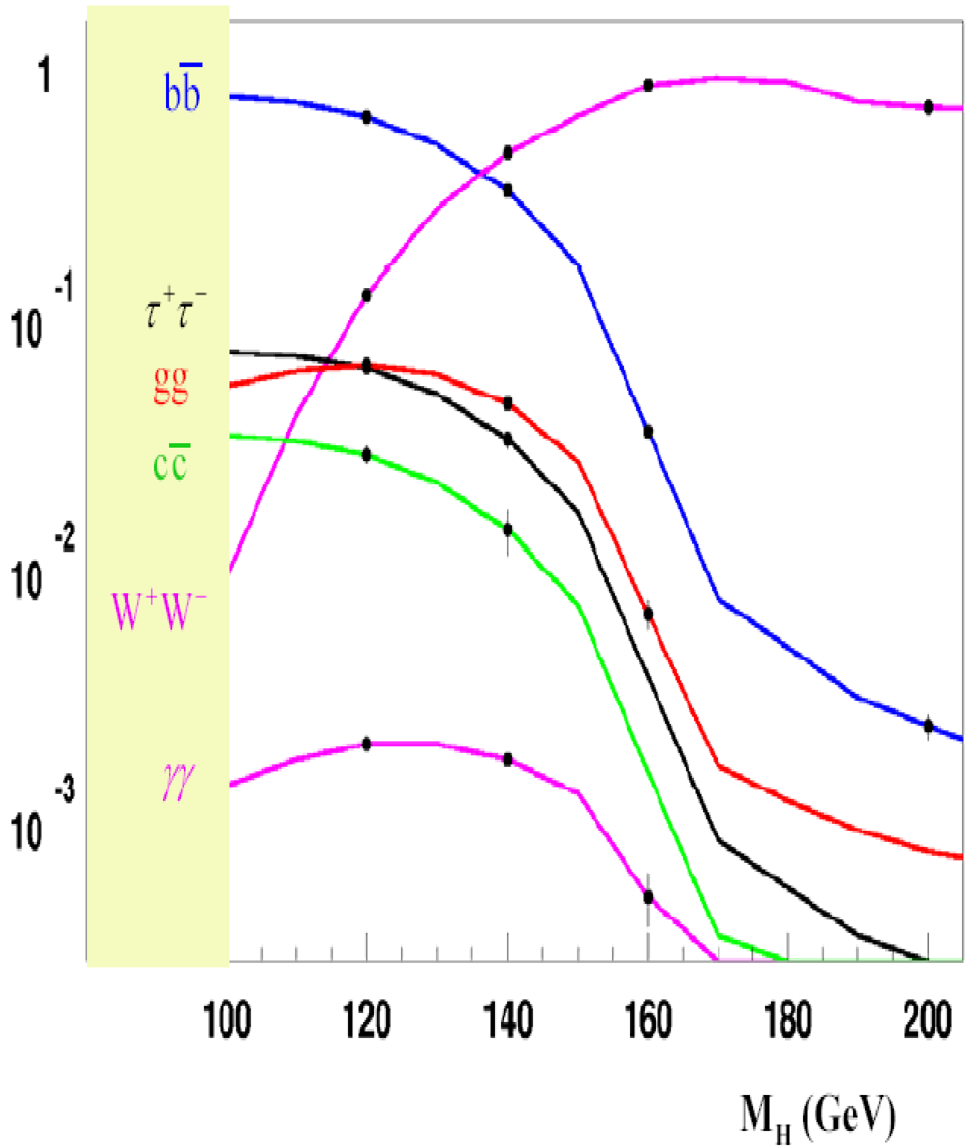
1. Identify an area in SiD where you would like to contribute
2. Talk with SiD leadership about your interests and our needs
3. Start attending meetings and begin contributing to SiD

A Tour of SiD for Higgs Bosons

- A comprehensive program of precision measurements of Higgs Boson properties is a key reason for building the ILC
- Since Higgs Bosons are known to be a demanding lot, they place many requirements on detector performance
- Focus on 3 Higgs Boson measurements to illustrate how our physics goals impact detector design and provide opportunities for you to contribute to SiD
  - Branching ratios
  - Search for invisible Higgs decays
  - Triple Higgs coupling

Higgs Branching Ratio

- The Standard Model (and many beyond the Standard Models) account for particle masses through couplings to one or more Higgs Bosons
  - Couplings are proportional to m^2
- We can test this hypothesis by measuring the branching ratios of the Higgs to all accessible final states
- Particularly challenging to separate $b\bar{b}$, $c\bar{c}$, and gg decay modes – requires excellent vertex detector performance



Vertex Detector Projects

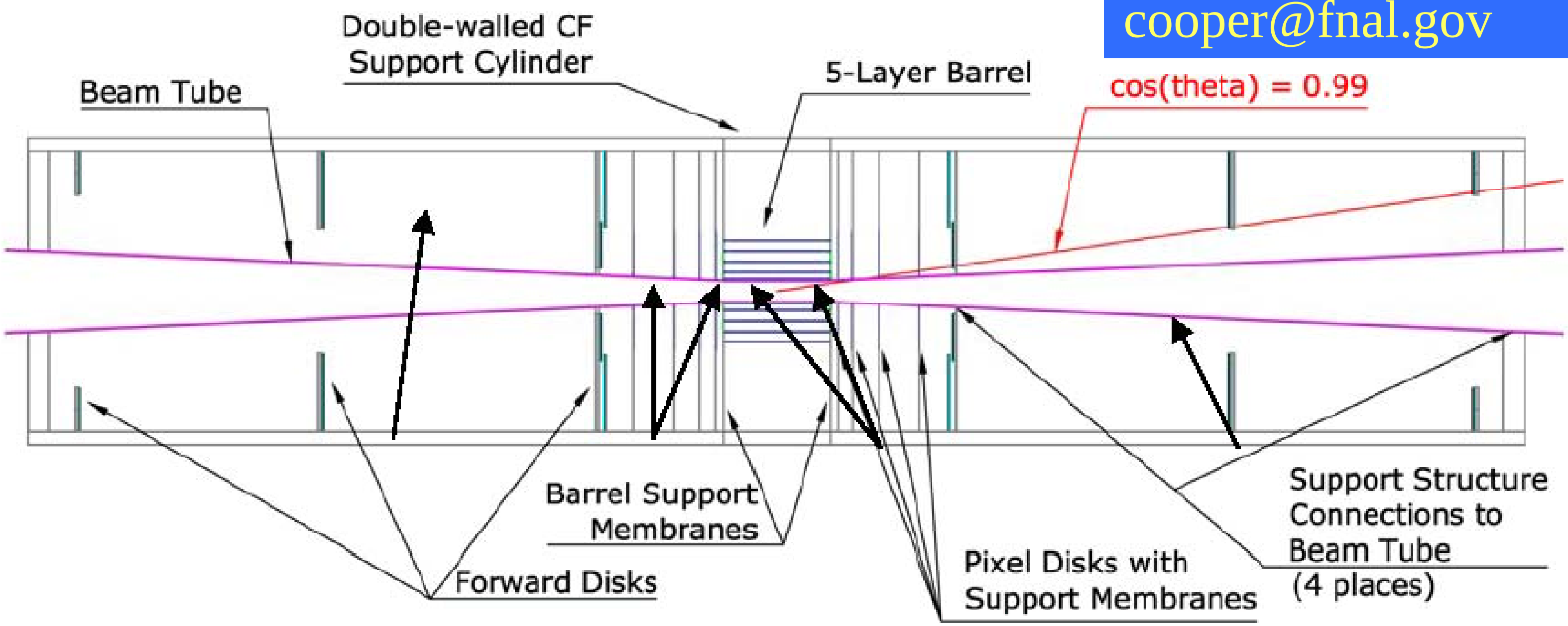
- Pixel sensor development and testing
- Mechanical design and testing
- Power delivery and signal transmission
- Vertex and flavor tagging algorithms
- Test beam program

Vertex Contacts:

Su Dong
sudong@slac.stanford.edu

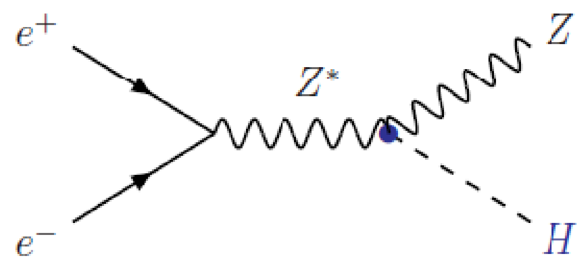
Ron Lipton
lipton@fnal.gov

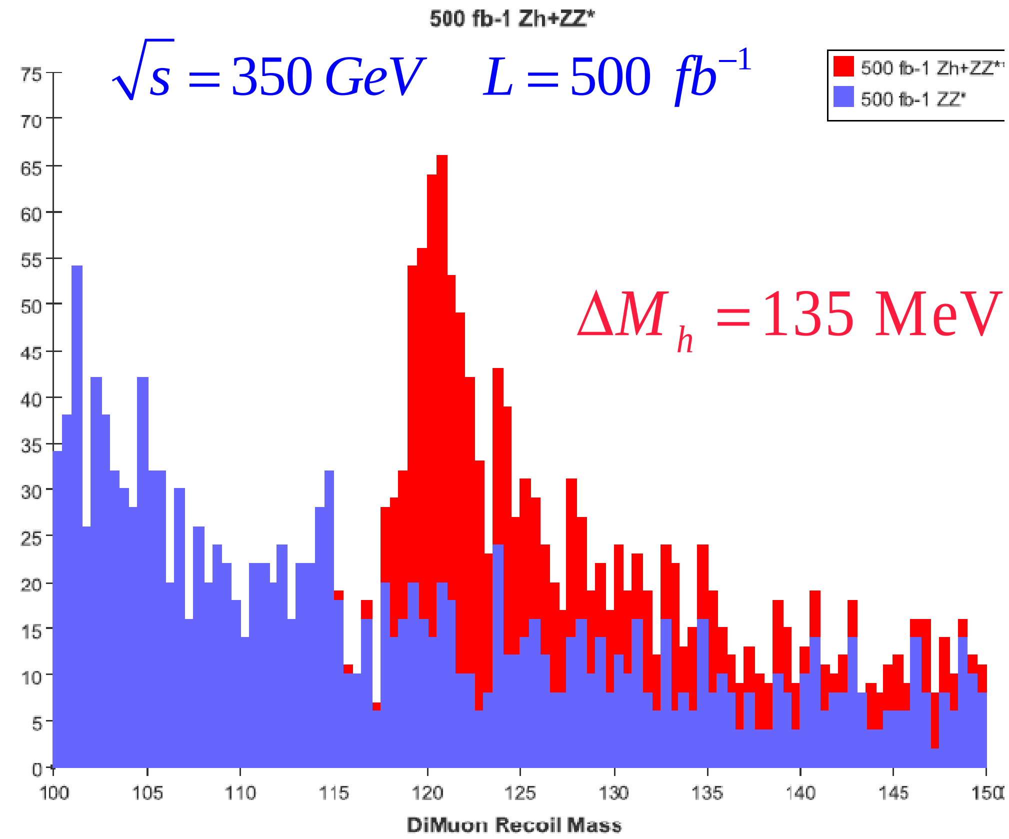
Bill Cooper (mechanics)
cooper@fnal.gov



Search for Invisible Higgs Decays

- Look at ZH production with $Z \rightarrow \mu^+\mu^-$
- Higgs events can be identified in the Z recoil mass
- Measurement makes no assumptions about Higgs decay, so sensitive to invisible and non-SM decays
- Sharpness of the recoil mass peak depends on tracker momentum resolution





Tracker Projects

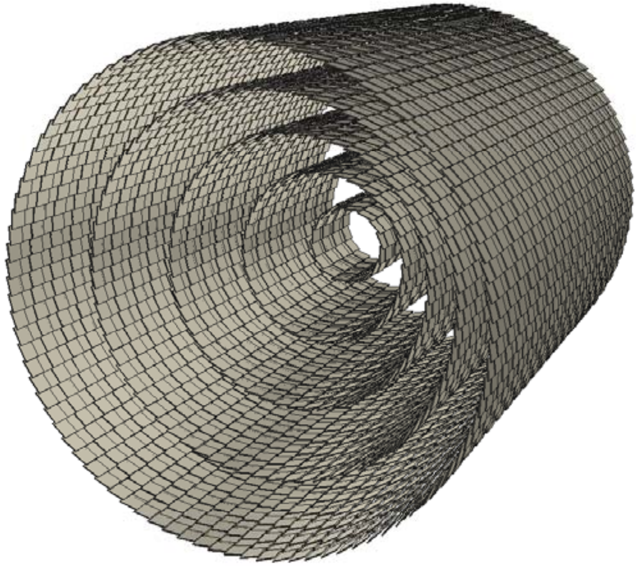
- Module design and testing
- Mechanical design and testing
- Alignment and vibration measurement
- Forward tracker design
- Tracking algorithms and optimization
- Test beam program

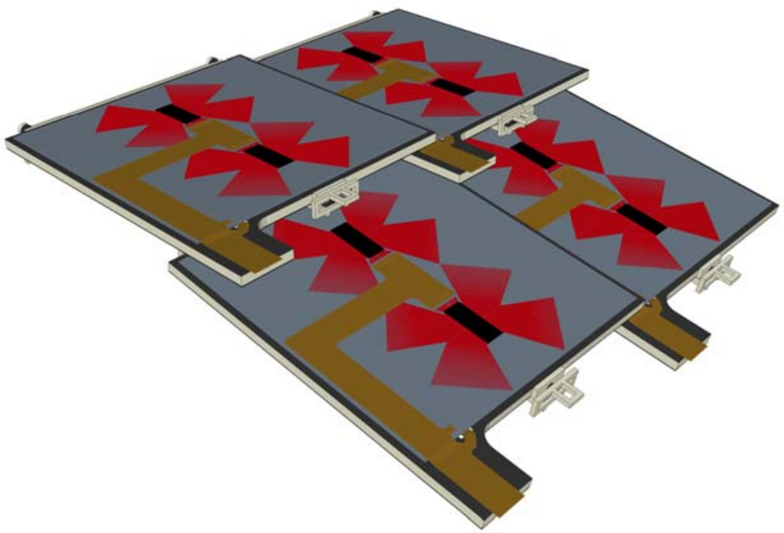
Tracker Contacts:

Marcel Demarteau
demarteau@fnal.gov

Rich Partridge
partridge@hep.brown.edu

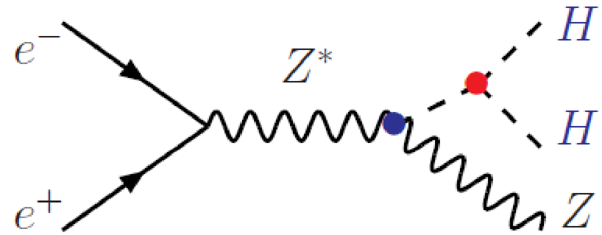
Bill Cooper (mechanics)
cooper@fnal.gov

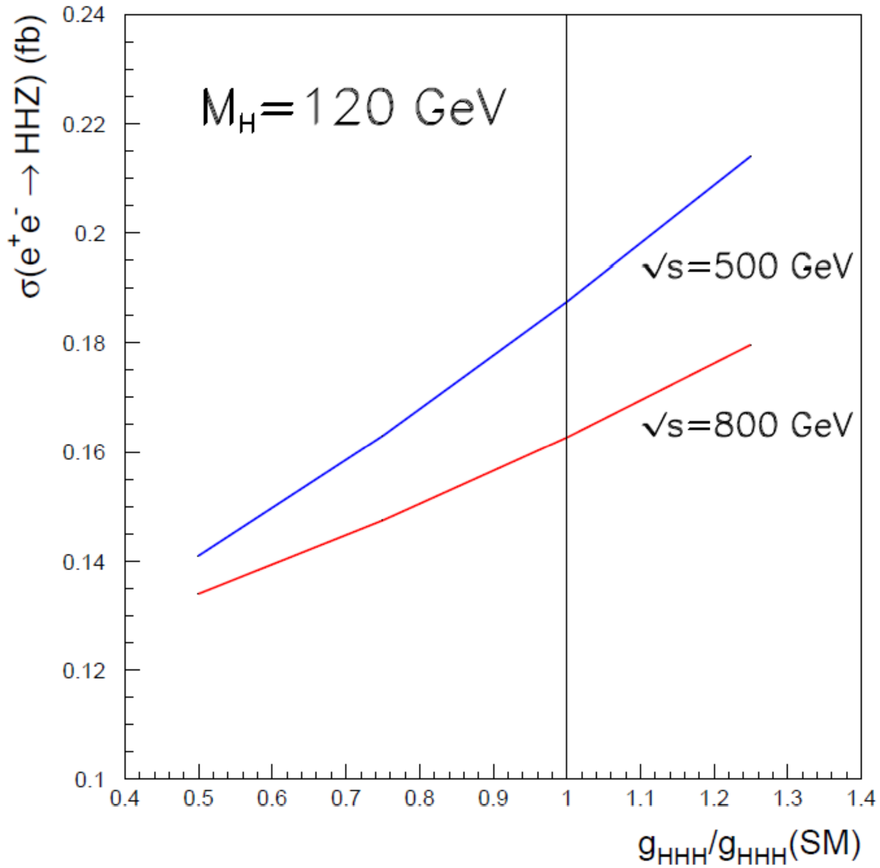




Triple Higgs Coupling

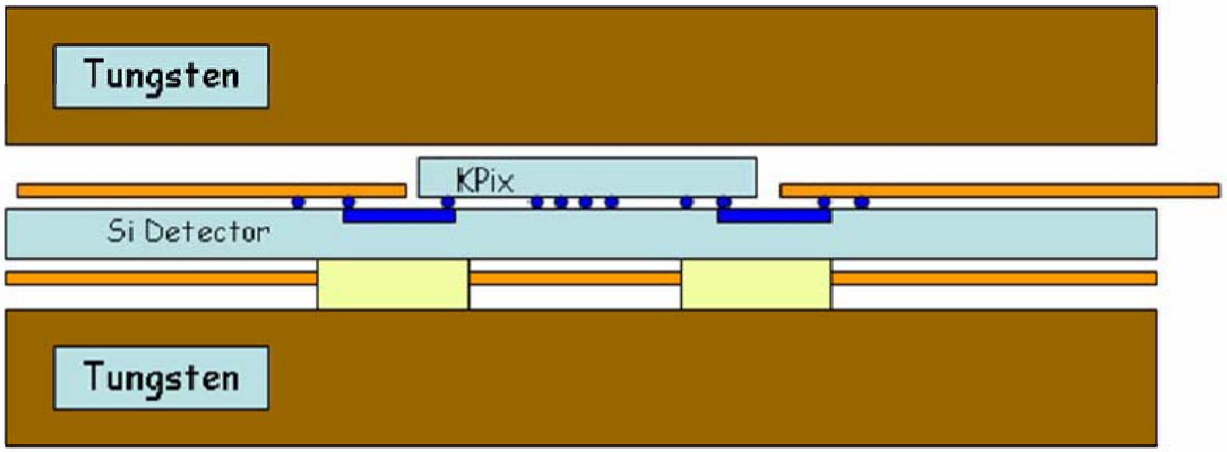
- Triple Higgs coupling is a consequence of the ϕ^4 term in the Higgs potential
- SM makes a precise prediction for this coupling
- SiD can measure the triple Higgs coupling in the ZHH channel
- Small cross section – will need to use multijet final states like qqbbbb
- Need good calorimeter performance to identify Higgs mass peaks





Calorimeter Projects

- ECal design and testing
- HCal design and testing
- Mechanical Design
- PFA development and studies
- Other Simulation studies: τ, π^0, #λ, etc.
- Test beam program



Calorimeter Contacts:

Ray Frey (ECal)
rayfrey@cosmic.uoregon.edu

David Strom (ECal)
strom@physics.uoregon.edu

Jerry Blazey (HCal)
gblazey@nicadd.niu.edu

Harry Weerts (HCal)
weerts@anl.gov

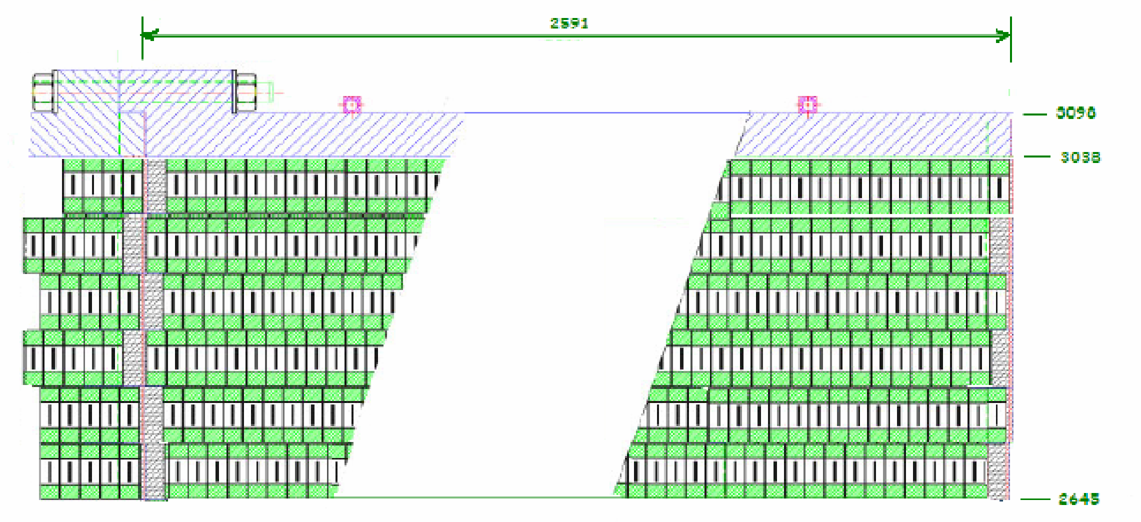
Norman Graf (PFA)
ngraf@slac.stanford.edu

Steve Magill (PFA)
srm@anl.gov

Muon and Solenoid Projects

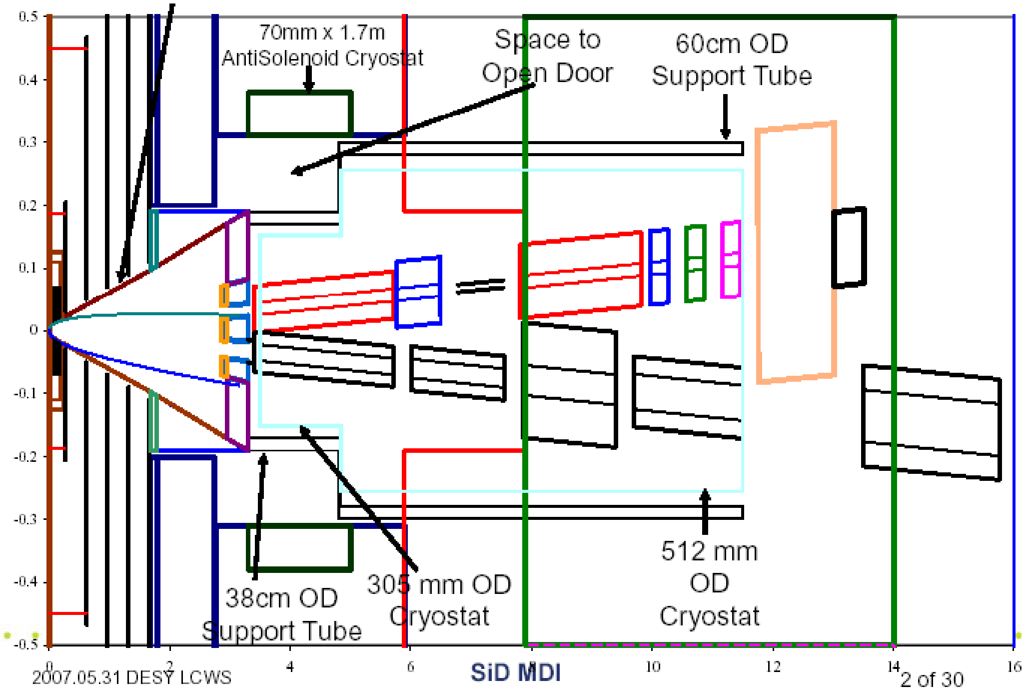
- Muon system design
- Muon tracking algorithms and studies
- Punch-through, background studies
- Test beam program
- Solenoid design

Muon/Solenoid Contacts:
Henry Band (muon)
hrb@slac.stanford.edu
Gene Fisk (muon)
hefisk@fnal.gov
Paul Karchin (muon)
karchin@physics.wayne.edu
Kurt Krempetz (solenoid)
krempetz@fnal.gov



Forward Detector and MDI Projects

- LumCal, BeamCal, GamCal design
- MDI design
- Energy, polarimeter design
- Beam pipe design



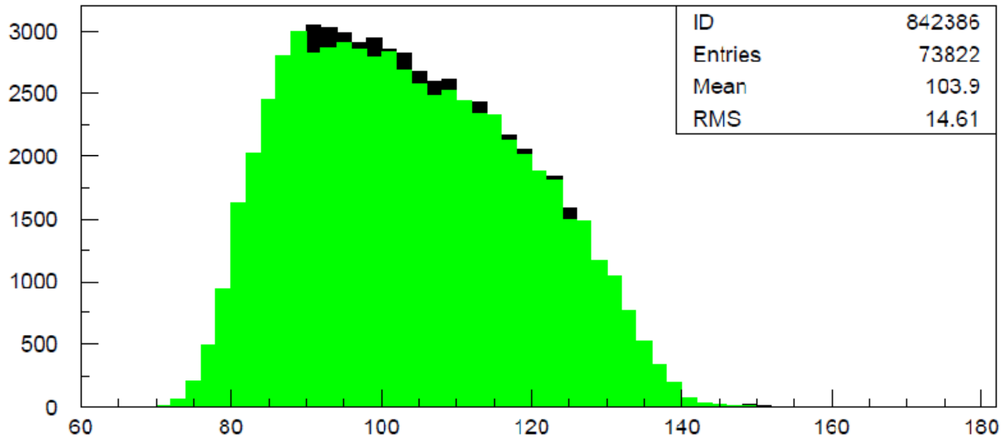
Forward Det. Contacts:

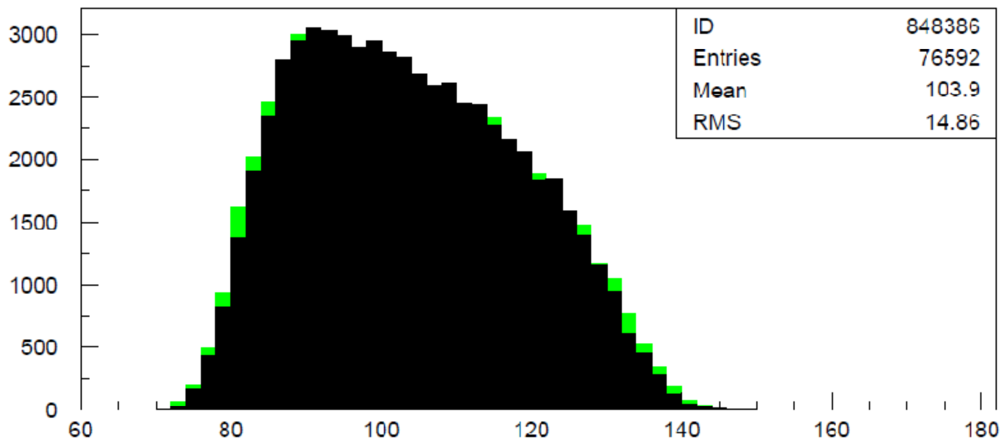
Bill Morse (Forward)
morse@bnl.gov
Phil Burrows (MDI)
p.burrows@qmul.ac.uk
Tom Markiewicz (MDI)
twmark@slac.stanford.edu
Tauchi Toshiaki (MDI)
toshiaki.tauchi@kek.jp

Benchmarking Projects

- Physics performance studies

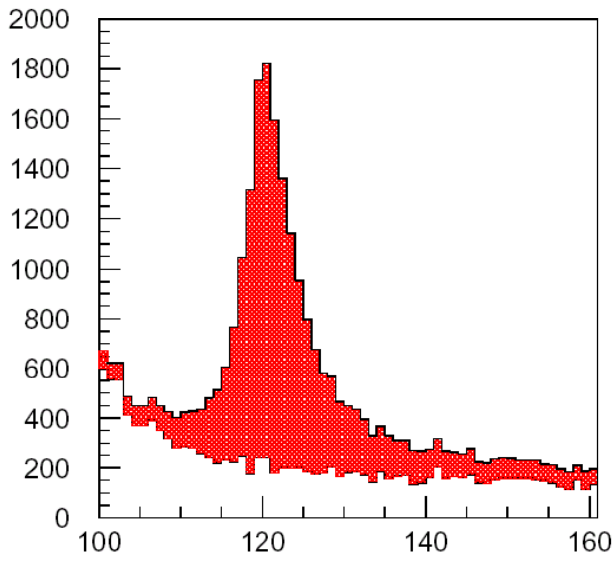
$$e^+e^- \rightarrow \tilde{\chi}_1^+\tilde{\chi}_1^- \rightarrow \tilde{\chi}_1^0\tilde{\chi}_1^0 W^+W^- \rightarrow \tilde{\chi}_1^0\tilde{\chi}_1^0 qqqq$$





Benchmarking Contacts:

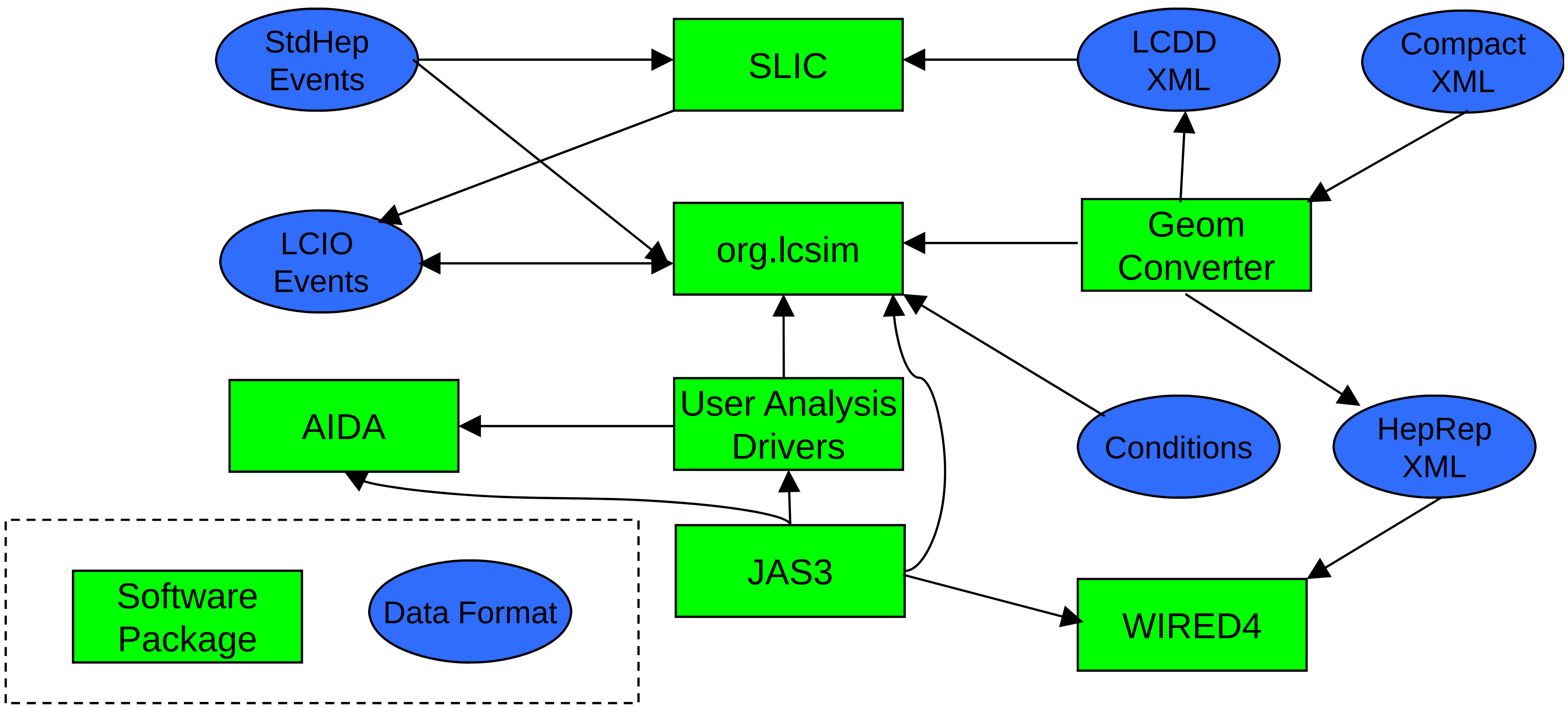
Tim Barklow
timb@slac.stanford.edu
Aurelio Juste
juste@fnal.gov



Simulation Projects

- Detailed detector simulation
- Algorithm development and detector optimization through simulation

Simulation Contact:
Norman Graf
ngraf@slac.stanford.edu



Summary

- It is a great time to get involved in SiD
- Many interesting projects that need your help
- More information can be found in the SiD talks in LCWS
- Getting started is easy:

1. Identify an area in SiD where you would like to contribute
2. Talk with SiD leadership about your interests and our needs
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See the SiD web page for links to further information:

http://www-sid.slac.stanford.edu