

# US HFCC: AIM, TDAQ, S&C Parallel

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HFCC Detector Workshop: Parallels  
[19 Dec 2024](#)

# Agenda

## **Cross-Cutting Topic: Detector Design/Optimization Challenge**

*53/4-4002 - Toluca, SLAC*

14:00 - 14:50

## **Cross-Cutting Topic: AI for HF**

*53/4-4002 - Toluca, SLAC*

14:50 - 15:20

## **Miscellaneous/AOB**

*53/4-4002 - Toluca, SLAC*

15:20 - 15:30

# 1. Detector Design/Optimization Challenge: Overview

1. Select set of key **physics** processes (eg. di-Higgs, BSM Higgs decay, etc.) and provide Madgraph generation info
2. Provide detector simulations:
  - a. Full detector (to adapt relative subsystem sizes, mix and match) → Delphes?
  - b. By subsystem (to study data formats/rate, low-level granularity)
3. Simple analysis scripts to determine **performance metrics** (eg. search sensitivity, object resolution)

→ Single website/git repo with all information compiled and easy to access!

# 1. Detector Design/Optimization Challenge: Physics

- Benchmark **physics** processes (configs/Madgraph processes)
- “Rules”/Final deliverables for “**judging**” (simple analysis scripts, eg. displaced vertex reconstruction, di-Higgs sensitivity, etc.)

# 1. Detector Design/Optimization Challenge: Simulations

- **Simulations, full detector-level:**
  - Need set of baseline Delphes cards
  - What sub-detector improvements should be included in Delphes cards?
  - Do existing Delphes cards need updating to reflect latest (most accurate) GEANT-evaluated performance?
  - Plan for estimating **data rates** from integrated detector (Trk/Calo/Muon → TDAQ): are Delphes simulations adequate or do we need separate (full-sim) samples?
  - Machine induced backgrounds
- **Simulations, specific subsystem** (eg. module data readout)
  - Which existing sub-detector GEANT simulations are available for general use?
  - Electronics noise level of each detector to understand the zero suppression levels
  - Ask subsystems for preliminary buffer size (data format is subdetector dependent)

# 1. Detector Design/Optimization Challenge: Next Steps

- Establish organizing committee
- Where to host information (HFCC websites, git?)
- Can we identify specific people (students, physicists) to take on physics steps (Madgraph for processes, simple analysis scripts for deliverables)?
- Timeline:
  - Launch competition by end of FY24
  - Deadline at US HFCC/FCC workshop in ~spring 2026

## 2. AI for Higgs Factory

- Front-end (eFPGAs, neuromorphic, other electronics, etc.)
- Trigger (FPGAs)
- Reconstruction (simulation)
  
- Discussion:
  - What do we want to do?
  - What resources are needed?
    - Datasets
    - SW frameworks/tools
    - Computing facilities

# Conclusions & AOB

- Other funding opportunities to supplement any HFCC funding?
- How to connect to FCC EOIs?
  - FCC Physics Week satellite meeting Jan 17
- EPPSU input: any cross-cutting topics to submit?