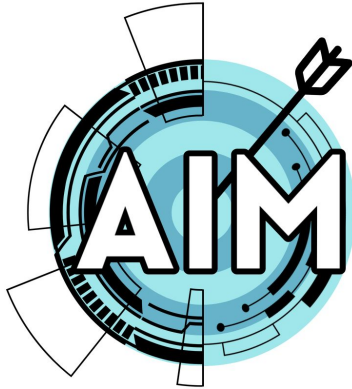


# Integrated Detector Concepts

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US HFCC Detector Workshop: AIM Parallel

[19 Dec 2024](#)

# Integrated Detector Concepts (IDC)

*Goal: whole-detector optimization & feed into international efforts*

- **Physics studies:** strategy, software framework, execution, etc.
- **Design and optimization** of whole-detector concepts
  - AI-based detector design/optimization – coordinate with AIM AI/ML
- Whole-detector data **simulation/reconstruction** (e.g. for TDAQ bandwidth studies) - coordinate with S&C
- **Integration** of subsystem capabilities (e.g. fast timing) - coordinate with detector groups
  - Study performance/physics reach

# US HFCC Charge - where are we?

## Charge (Physics, Experiments & Detectors), 5/28/2024

1. **Physics and technical feasibility studies**, including any associated design and R&D efforts, to **advance various experiment detector concepts** at a future Higgs factory;
2. **Prioritization and stewardship** of the national R&D efforts should funds be identified by DOE and/or NSF;
3. **Development of the pre-project detector R&D scope** that will be required prior to DOE and/or NSF initiating any detector project at a future e+e- collider;
4. Conceptualization of the **software and computing framework** that will be needed to advance physics studies and R&D efforts; and to collect, store, and analyze the large volumes of physics data at future collider experiments;
5. In consultation with DOE and NSF program managers, **develop various funding models** that will be required to support the R&D efforts described in items (3) and (4) above; and
6. **Ensure collaborations** by the U.S. with our partners are cost-effectively carried out to advance the future Higgs factory initiatives. (CPAD, ECFA, DRD, others).
  - Prepare the groundwork to respond to the P5 Recommendation 6a: “[Convene a targeted panel to review] the level and nature of US contribution in a specific Higgs factory including an evaluation of the associated schedule, budget, and risks once crucial information becomes available”

“Integrated Detector Concepts” L3 area will coordinate closely with:

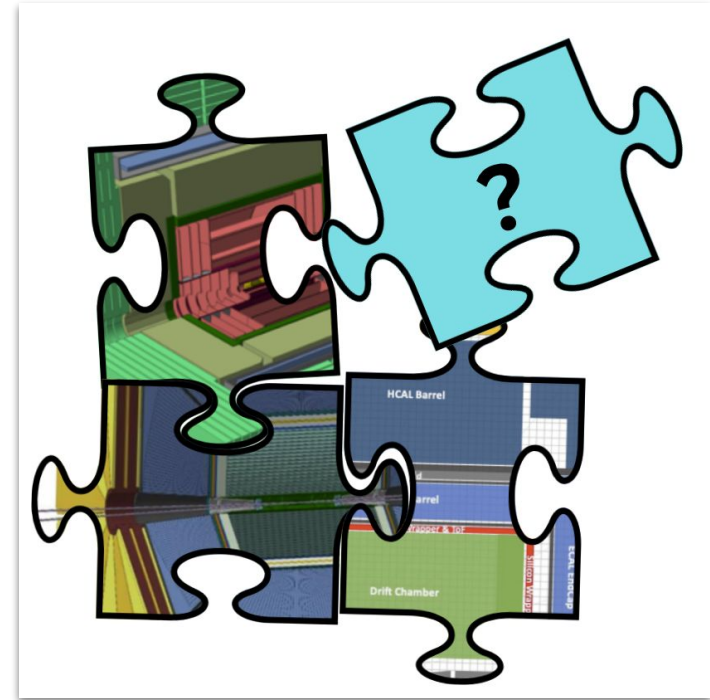
- HFCC Detector Groups
- HFCC S&C
- ongoing work by / with HFCC partners

“US Plans” talk at 2024 FCC Week

# Community Detector Design/Optimization “Challenge”

## Physics studies for full-detector concepts

- **Goals:**
  - Inspire the US community to contribute to **international efforts** for Integrated Detector physics studies
  - Lower the barrier to entry for new groups
  - Inspire new optimization and design ideas, both of which are key deliverables for AIM and US HFCC-PED.



# Community Detector Design/Optimization “Challenge”

- **Needs:**

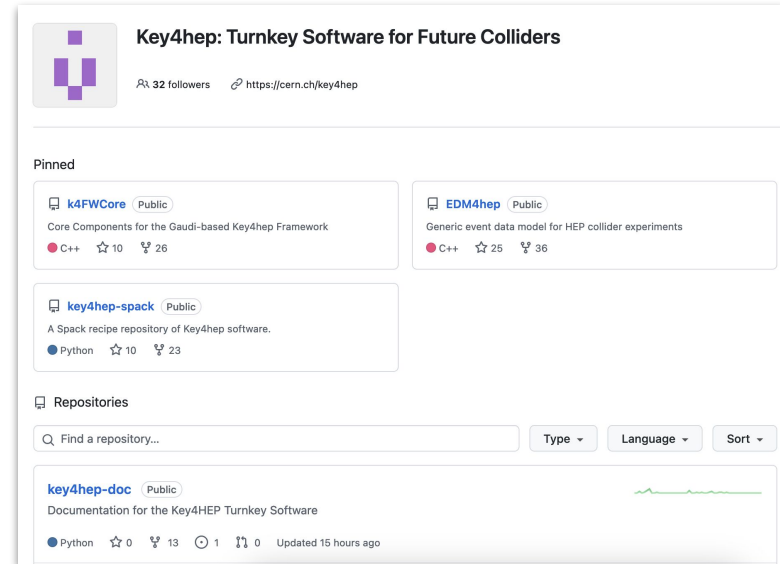
- Common physics benchmarks
- Common signal and background samples
- Code frameworks

- **Synergies:**

- HFCC Software & Computing
- FY24 funding (Key4HEP @ Princeton) →
- International efforts for detector design


- **Existing Work / US Expertise:**

- Leadership of FCC PED studies for physics benchmarks (BNL, Brown, Maryland, MIT, SLAC, others)



The screenshot shows the GitHub profile for Key4hep, a public repository with 32 followers and a website link to https://cern.ch/key4hep. The profile features a pinned section with three repositories: k4FWCore (C++, 10 stars, 26 forks), EDM4hep (C++, 25 stars, 36 forks), and key4hep-spark (Python, 10 stars, 23 forks). Below the pinned section is a 'Repositories' section with a search bar and filters for Type, Language, and Sort. The first repository listed is key4hep-doc (Python, 0 stars, 13 forks, 1 watch, 0 issues, updated 15 hours ago).

# Near-term IDC Goals / Plans / Needs

- **Communication**: As we have seen, the scope of the IDC group has connections to every other HFCC area
  - Natural “forum” for future discussions in the vein of the cross-cutting session at this workshop
- **Community**: Let us know if you are interested in starting to get involved - we can make connections
  - Easier to make an impact (given small current funding / FTE available) if we work together 
- **Challenge**: Community Detector Design “Challenge” - kickoff early next year?
- **Creativity**: New ideas? We’d love to hear from you!