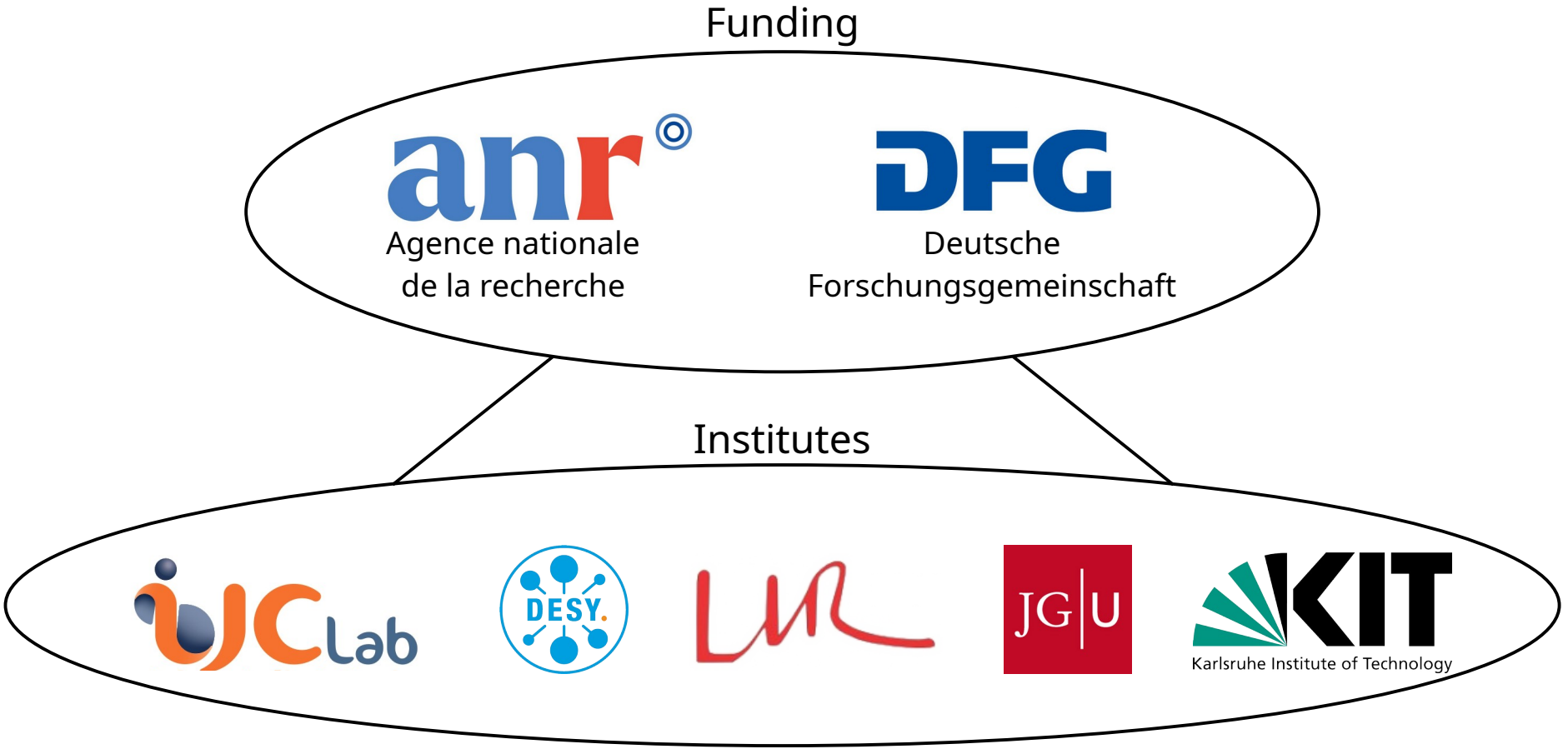
CALO5D: Introduction and Plans

Bohdan Dudar
on behalf of the CALO5D project

DRD6 AHCAL "Marzipan" Meeting
11.12.2024

Funded by
DFG Deutsche Forschungsgemeinschaft
German Research Foundation

CALO5D is a Joint French-German Project

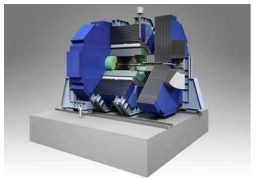


3-years project

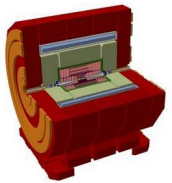
Official Start March 1st 2024

Our Goal is to Push Calorimetry at Higgs Factory Experiments Beyond Its Current Limits

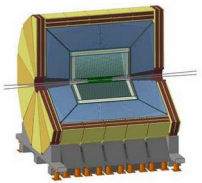
SiD



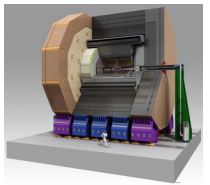
CLICdet



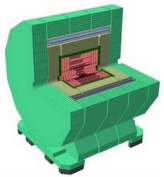
IDEA



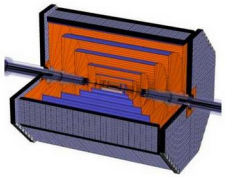
ILD



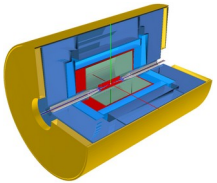
CLD



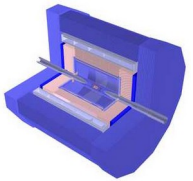
FST

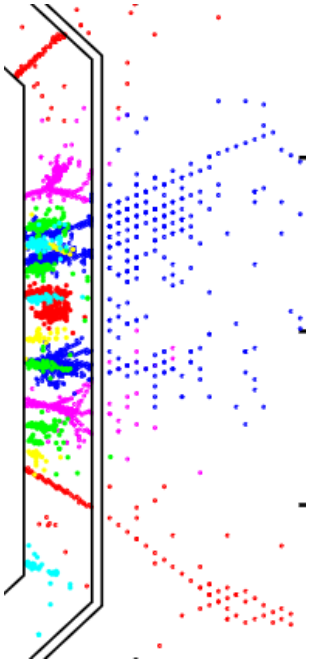


ALLEGRO



CEPC Baseline





Potential benefits

- Particle flow with time
- Software compensation

Potential challenges

- Power consumption
- Increased noise

CALO5D will address these questions in a consistent way
Calorimetry has to make up its mind

We Are a Team Uniting Simulation and Hardware Expertise

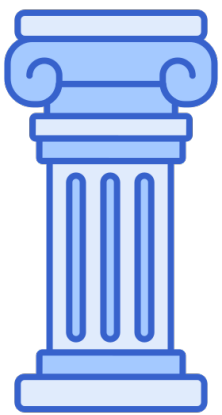
ECAL expertise – French institutes
HCAL expertise – German institutes

Project Coordination
Lucia Masetti (JGU), Roman Pöschl (IJCLab)

Steering Committee
Vincent Boudry (LLR), Katja Krüger (DESY), Frank Simon (KIT), Lucia Masetti (JGU), Roman Pöschl (IJCLab)

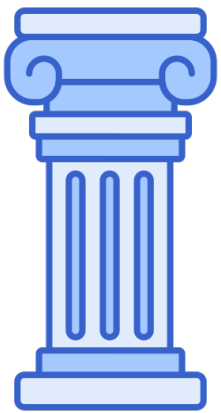
Working Packages

- **Implementation of Timing in Calorimeter Simulation**
- **Particle Flow with Timing**
- **Impact on Key Physics Processes**
- **Implications for Detector Design**



People

M. Akbiyik (KIT), M. Balzer (KIT), V. Boudry (LLR), J.C. Brient (LLR),
M. Caselle (KIT), S. Chlingaryan (KIT), B. Dudar (JGU), U. Einhaus (KIT),
F. Hummer (KIT), K. Krüger (DESY), L. Masetti (JGU), R. Pöschl (IJCLab),
F. Richard (IJCLab), D. Rousseau (IJCLab), F. Sefkow (DESY), F. Simon (KIT),
H. Videau (LLR), X. Xia (IJCLab), D. Zerwas (IJCLab), 2 PD TBA (IJCLab, LLR)



CALO5D Gets Up To Speed

Preliminary timeline plan

	Year 1	Year 2	Year 3	ANR-DFG
WP 1	Management			
WP 2	Implementation of Timing into Calorimeter Simulation			
Task 2.1				IJCLab-PD
Task 2.2				
WP 3	Particle Flow with Timing			
Task 3.1				LLR-PD, KIT-PD, JGU-PhD, IJCLab-PhD
Task 3.2				
WP 4	Impact on Physics Processes			
Task 4.1				IJCLab-PhD, KIT-PD, LLR-PD, JGU-PhD
Task 4.2				
WP 5	Implications for Detector Design			
				IJCLab-PD

01.03.2024 – 01.09.2024:

- Recruiting phase
- Regular weekly meetings since
- Webpage is launched

02-03.12.2024

First face-to-face CALO5D meeting

- Brainstorming ideas
- Identifying areas of priority
- Selecting benchmarks

Building Up on Existing Achievements

Literature on Applications of Timing in HCAL

Manqi Ruan et al	2024	arXiv:2411.06939
Imad Laktineh	2024	TSDHCAL talk (DRD6 WP1 colab. m.)
Jack Rolph	2023	PhD thesis & arxiv:2407.00178
C. Graf and F. Simon	2022	JINST 17 P08027
N. Akchurin et al	2021	JINST 16 P12036

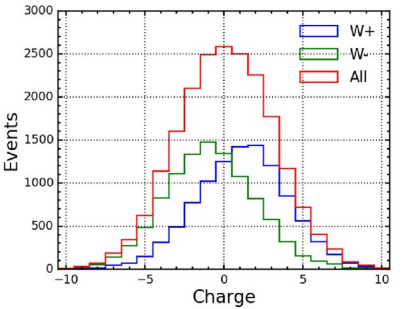
Advancing Existing Studies With More Realism

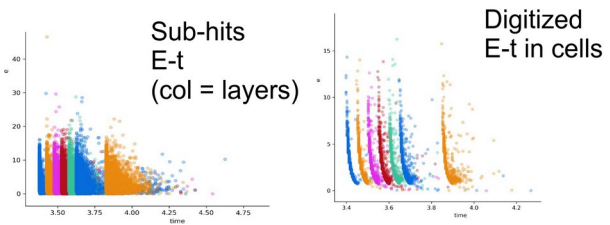
- ECAL + HCAL
- Time Digitisation
- Physics applications
- Detector design (cooling, etc.)

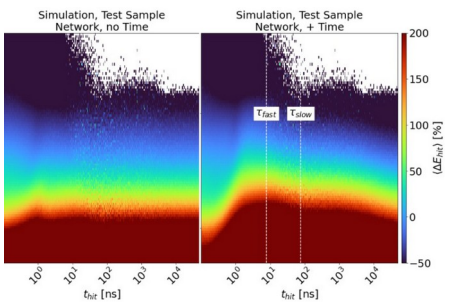
Next Steps Identified and a Lot of Interesting Work Ahead

Identified preliminary work directions:

Xin	WW analysis / W charge measurement physics benchmarks
Vincent+Melike	Realistic time digitisation
Bohdan	Software compensation with ML in a realistic calorimeter (ECAL + HCAL)
Uli	Timing for pattern recognition in PandoraPFA







Jack Rolph PhD Thesis

Summary

- CALO5D is a Joint French-German Project
  between five institutes: IJCLab, DESY, LLR, JGU, KIT funded by ANR and DFG

- Main goal of the project: is to understand the benefits of timing in calorimeters
  at future Higgs factory experiments building up on existing studies

- The project will integrate into international collaborations
  e.g. DRD Calo and Higgs Factory studies

- Official project start 01.03.2024
  Work started 01.09.2024
  The project is ramping up and active hands-on work is starting