

Input to the LCC detector R&D questionnaire

CERN LCD project, participation in CLIC vertex detector R&D

To achieve the physics goals of flavour tagging at CLIC, a vertex pixel detector with high spatial precision (3 μm single-point resolution), 10 ns time stamping and ultra-low mass (0.2% X_0 per detection layer) will be required.

Participating institution:

CERN LCD project for this questionnaire page

Ongoing R&D efforts at CERN-LCD for the CLIC vertex detector include:

- Development of the CLICpix hybrid pixel readout ASIC with 25 μm pitch, analog readout, time stamping, and power-pulsing functionality, implemented in 65 nm CMOS technology
- Development of ultra-thin (50 μm) planar pixel sensors, as well as active sensors with capacitive coupling
- Low-mass fine-pitch interconnects between sensor and ASIC
- Through-silicon via technology for powering, configuration and readout of the ASIC
- Low-mass powering infrastructure, including power-pulsing with local energy storage
- Low-mass carbon-fibre supports
- Detector cooling based on forced air-flow
- Concepts for mechanical integration and detector assembly
- Detector layout optimisation studies

Documentation:

Vertex-Detector R&D for CLIC [2014 JINST 9 C03026](#).

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CERN LCD project, participation in CALICE

CALICE: [general CALICE web page](#)

The CERN LCD participation in CALICE concerns 3 activities:

1. Beam tests with a scintillator-SiPM HCAL (AHCAL) with tungsten absorber plates => W-AHCAL beam tests in 2010-2011
2. Beam tests with a glass RPC HCAL (DHCAL) with tungsten absorber plates => W-DHCAL beam tests in 2012
3. Laboratory tests of small scintillator tiles with SiPM read-out

Participating institution:

CERN LCD project for this questionnaire page

1. Beam tests with a scintillator-SiPM HCAL (AHCAL) with tungsten absorber plates => W-AHCAL beam tests in 2010-2011

Beam tests are completed. Test beam analysis is partially published and partially on-going

Documentation:

- Description of the beam tests: [LCD-Note-2012-002](#)
- Published results 1-10 GeV: [2014 JINST 9 P01004](#)
- CAN-044 preliminary result 10-100 GeV: [CAN-044](#)

Future plans:

No plans for a follow-up activity yet.

2. Beam tests with a glass RPC HCAL (DHCAL) with tungsten absorber plates => W-DHCAL beam tests in 2012

Beam tests are completed. Test beam analysis is on-going

Documentation:

- CALICE CAN-043 preliminary result: [CAN-043](#)

Future plans:

No plans for a follow-up activity yet.

3. Laboratory tests of small scintillator tiles with SiPM read-out

These are on-going laboratory studies.

Motivation:

- Acquire experience with small scintillator tiles read out by SiPM. Understand instrumental effects and calibration issues. Test different types of SiPM. Study possibility of using small scintillator tile sizes.
- Study possibility of using scintillator tiles in ECAL (for a cost-effective ECAL)
- Gain experience in applying scintillator+SiPM for HCAL
- Use this R&D as a vehicle to develop and test calorimeter readout electronics suited for CLIC background conditions

Documentation:

This activity was started recently. No documentation yet

Future plans:

See motivation above. No targeted plans.

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CERN LCD project, participation in FCAL

FCAL [general FCAL web page](#)

Participating institution:

CERN LCD project for this questionnaire page

Activity

The CERN participation in the FCAL hardware R&D concerns:

- Construction of an precision absorber structure with tungsten plates for FCAL beam tests

More input about FCAL has been provided through the [FCAL input to LCC detector R&D questionnaire](#)

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CERN LCD project, participation in Superconducting detector solenoid R&D

The activity concerns engineering calculations and designs as well as an extrusion test of a reinforced conductor based on Nb-Ti superconductor cable surrounded by a Al-Ni stabilisation.

Participating institution:

CERN LCD project for this questionnaire page

Documentation

- Recent work in CLICdp on novel superconductors for large magnet systems [IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 23, NO. 3, JUNE 2013](#)
- Work done between ILD concept group and CLICdp on the ILD detector magnet system [LC-DET-2012-081](#)
- Detailed work on a 5T large bore solenoid for a future Linear Collider Detector (MT22 conference, Marseille, 2011) [MT22 paper](#)

Future plans:

There are no well-defined plans for the continuation of this activity. It will depend on the availability of CERN engineers, which is currently quite limited.