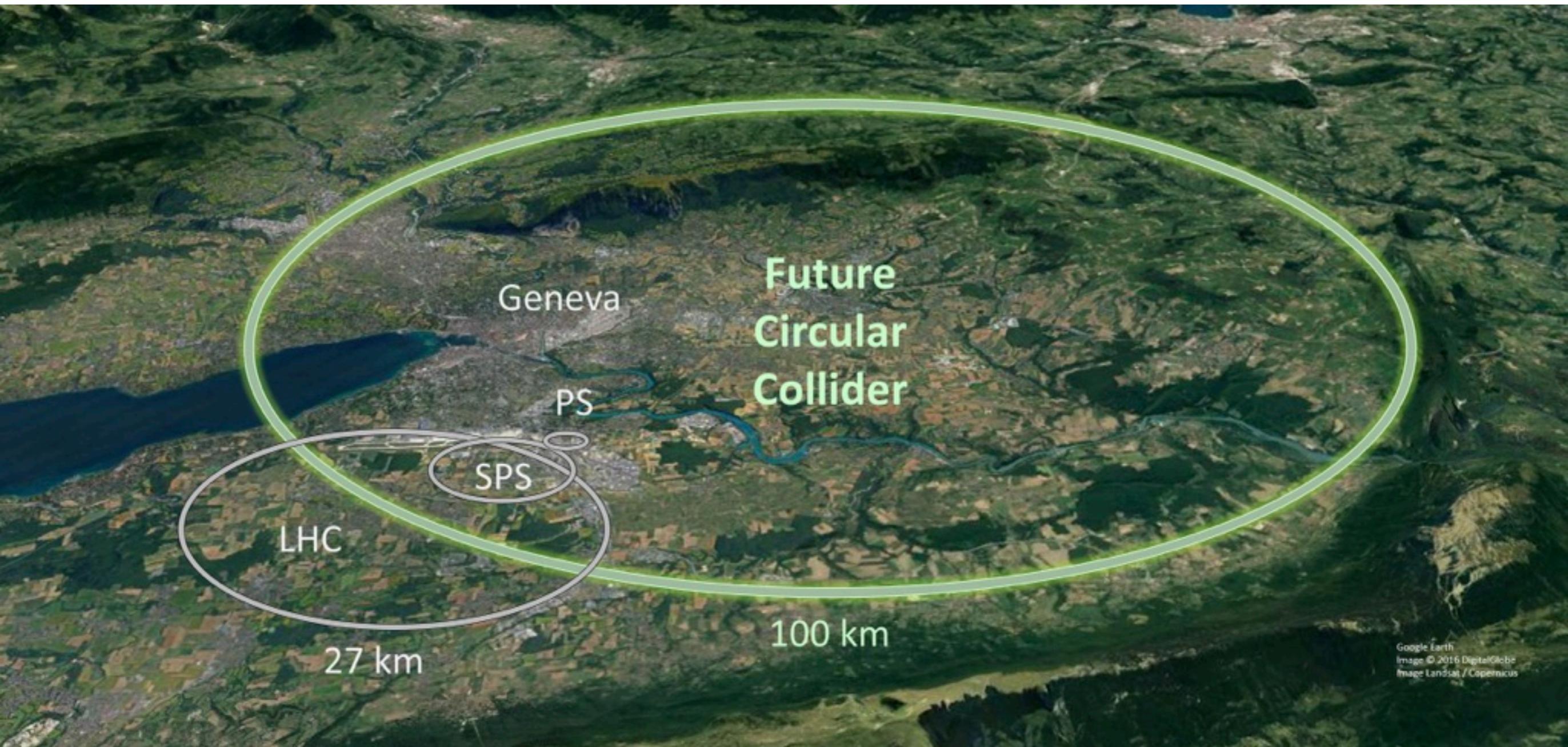


RD FA status



RDFA: R&D for future accelerator

Roma Tre group: 2020

B. Di Micco, M. Biglietti, A. Farilla, R. Di Nardo
3 year thesis student

Main activities:

physics studies on hh in FCC-hh ($hh \rightarrow WWbb$)
measurement of the ZH production cross section at FCC-ee

Workshop organisation:

FCC workshop Rome (2016)
CepC workshop EU-edition Roma Tre (2018)

Conference talks:

Future circular collider studies IFAE - 2017
Il programma di fisica di FCC-ee - 2019
Higgs measurements at the FCC-ee - EPS 2019

Write-ups:

FCC: Physics Opportunities: EPJC 79 pg. 474
FCC-ee: The Lepton Collider: EPJC 228 pg. 261
FCC-hh: The hadron collider (FCC-hh) (sub. to Eur. Phys. J. ST)
HE-LHC: The High-Energy LHC (sub. to Eur. Phys. J. St.)
CEPC CDR Vol II: Physics and Detector

RDFFA commitments

RDFFA had the commitment to contribute to the submission of inputs for the european strategy update, this has been done with the submission of inputs for:

- a circular e+e- collider of 100 km to be done at CERN working at the Z pole mass, and at the WW, ZH, and t-tbar threshold:
- a circular pp collider of 100 km to be done at CERN working at the energy of 100 TeV using 16 T NbSn dipole magnets;
- an option to replace all LHC magnets in the current LHC tunnel using 16 T NbSN technology to reach an energy of 27 TeV (High Energy LHC)
- an option to plug inside the LHC tunnel a muon collider working at 14 TeV or its high energy version of 27 TeV
- a CepC option (the chinese 100 km collider) working at the Z, ZH and WW thresholds

Evolution of CERN approach

CERN was not much in favour of an e^+e^- circular collider at the beginning

main concerns:

- it would not be a machine targeting for a discovery, prefer to have a pp option on a longer timescale that could span an higher energy range
- budget: it could not fit in the CERN flat budget considering the financial investment on HL-LHC

FCC-hh had the same budget concerns from CERN, but it was also a more far project and with a richer physics outcome, therefore the HE-LHC option was tried.

- physics study output: HE-LHC has strong limitation for the Higgs self-coupling and new physics measurement (self-coupling 10%-20%;
- the cost to replace all LHC magnets is not small, and it takes time to remove and re-insert;
- doesn't look that industrialization of NbSn magnets by 2035 is feasible

CERN director has then set as target of ES a decision between a 100 km circular and a linear $e^+ e^-$ collider as decision that needs to come out from the ES

RDFA change

given the new indication from CERN management RD-FA is going to change functioning

Focus on the following WPs

- 1 - Physics & Simulation (e+e-)
- 2 - MDI (Machine - Detector - Interface)
- 3 - Silicon detectors
- 5 - Drift Chamber
- 6 - Dual Readout calorimetry
- 7 - MPGD - Micro Pattern Gas Detector
- 8 - Muon Collider (include phys&Sim per mu+mu-)

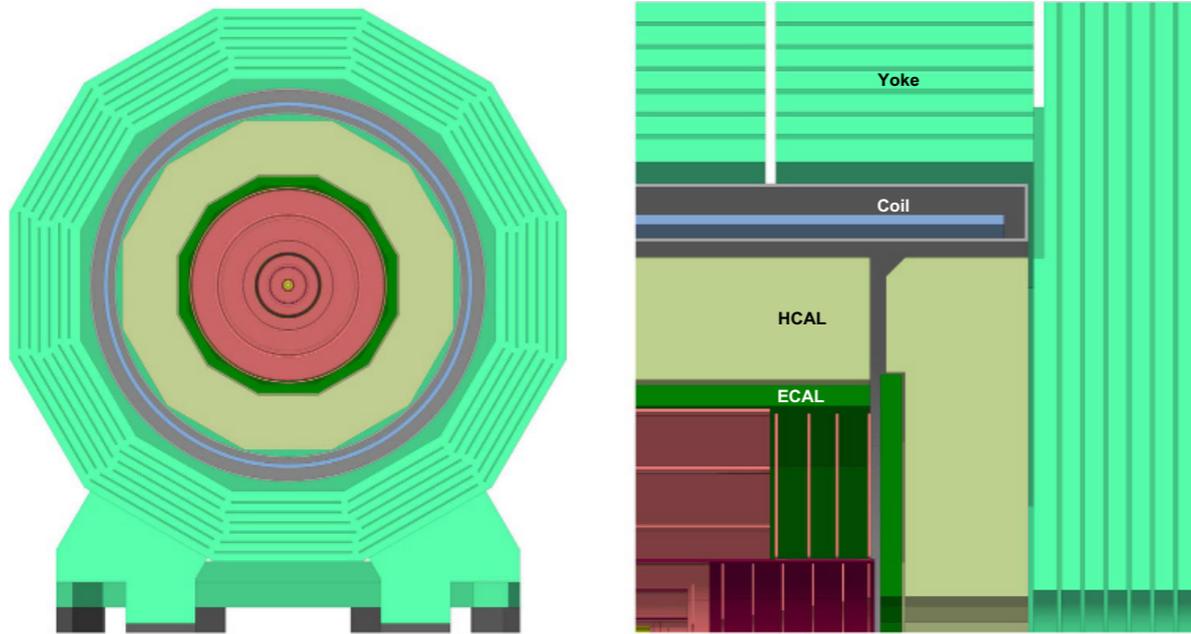
8. will be probably decoupled from RDFA later in 2019, people interested should join now RDFA; there is some interest in physics studies and muon production but the situation is still evolving

At the moment we have 0.6 FTE on RDFA for 2020, all in WP1

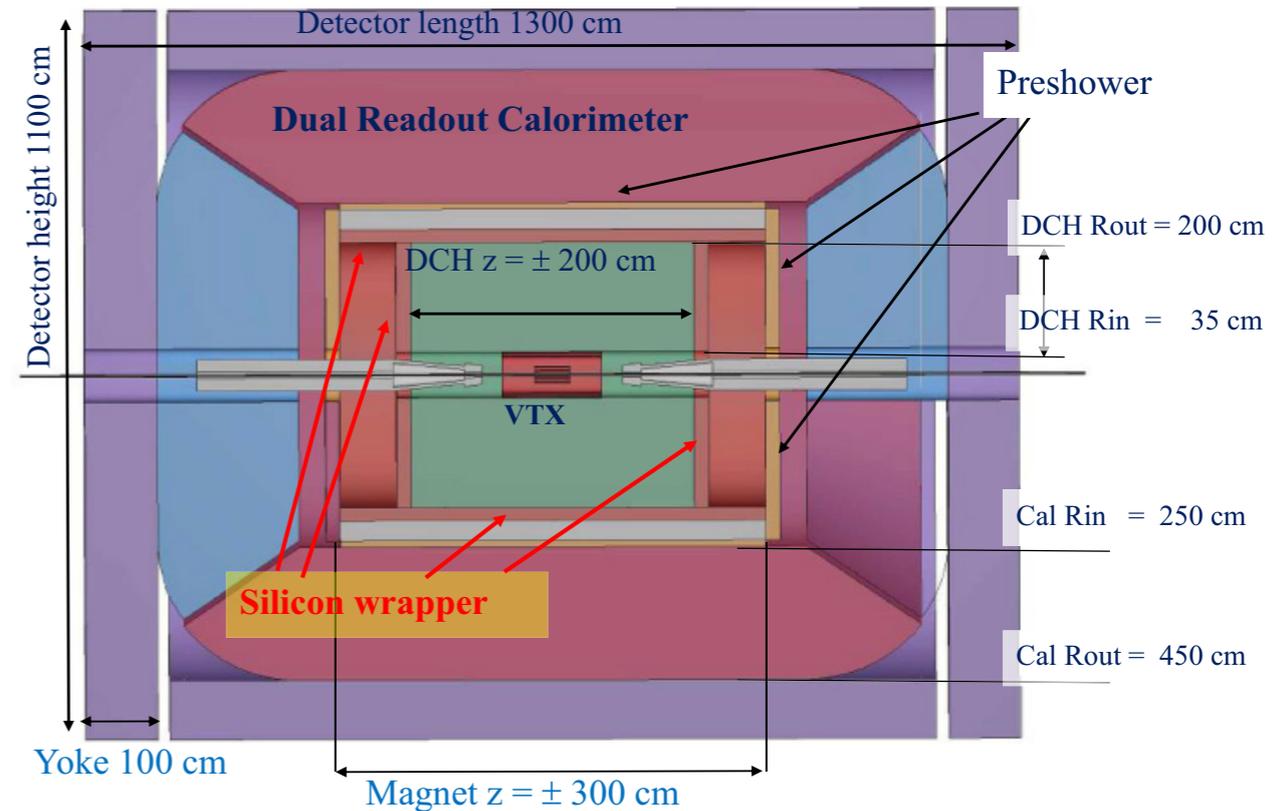
Item 5, 6 and 7 are developed in the framework of the IDEA detector, proposed for FCC-ee and CepC and present in their CDR

Detectors under study

CLD



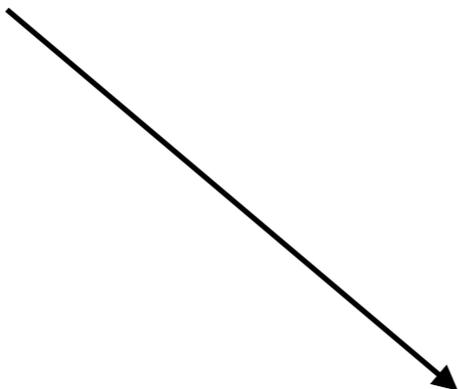
IDEA



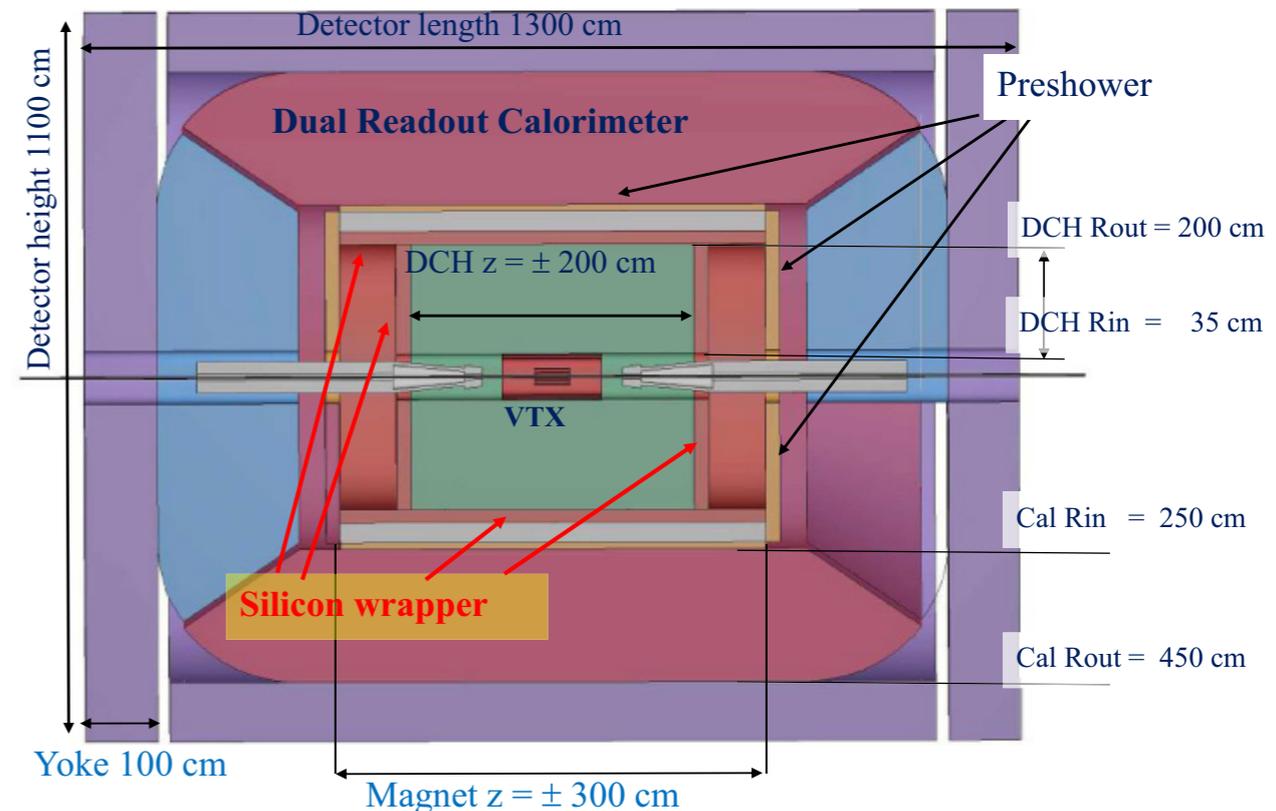
- conceptually extended from the CLIC detector design
 - full silicon tracker
 - 2T magnetic field
 - high granular silicon-tungsten ECAL
 - high granular scintillator-steel HCAL
 - instrumented steel-yoke with RPC for muon detection

- explicitly designed for FCC-ee/CepC
 - silicon vertex
 - low X_0 drift chamber
 - drift-chamber silicon wrapper
 - MPGD/magnet coil/lead preshower
 - dual-readout calorimeter: lead-scintillating/cerenkov fibers
 - μ Rwell for muon detection

for the ATLAS Phase-II upgrade, we have experience in Micromega buildings, it could be used to start some activity in this sector



IDEA

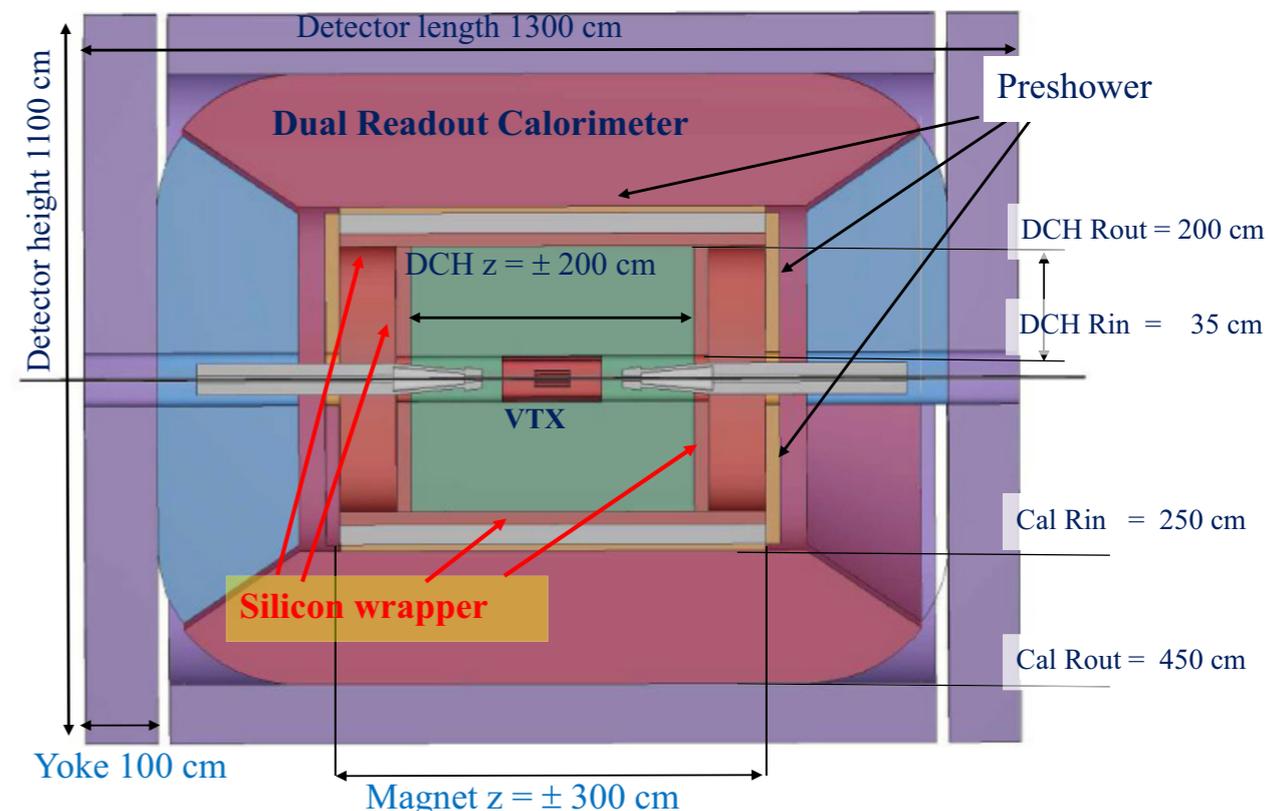


- explicitly designed for FCC-ee/CepC
- silicon vertex
- low X_0 drift chamber
- drift chamber silicon wrapper
- **MPGD/magnet coil/lead preshower**
- dual-readout calorimeter: lead-scintillating/cerenkov fibers
- μ Rwell for muon detection

both the DC and the calorimeter have much in common with the KLOE DCH (stereo-wire) and calorimeter, they are a good opportunity to start an hardware activity with the experience we have from KLOE

photo detectors will be Silicon PM, it could be another activity we could start in collaboration with other developments in group 2

IDEA



- explicitly designed for FCC-ee/CepC
- silicon vertex
- low X_0 drift chamber
- drift-chamber silicon wrapper
- MPGD/magnet coil/lead preshower
- dual-readout calorimeter: lead-scintillating/ cerenkhov fibers
- μ Rwell for muon detection

Planned activity of RDFA

There was a call for EU funding in the AIDA++ project, it is dedicated to future colliders R&D

Several Express Of Interest are going to be presented as R&D for IDEA

- Calorimetri DR

3 Eol's:

- 1) Meccanica
- 2) Elettronica
- 3) Software

- Drift Chamber

2 Eol's:

- 1) Meccanica
- 2) Elettronica

-

Software

1 Eol:

Machine Learning technique for Particle Flow in jets and Heavy Flavour for Dual Readout calorimeters

RM3: M. Biglietti, B. Di Micco, R. Di Nardo, A. Farilla
National groups: LNF, Padova, Pavia, Milano, Roma1
International groups: CERN, Sussex

MPGD Detectors

5 Eol's:

- 1) ML for tracking in MPGD -
- 2) Engineering of high rate mRwell -
- 3) Electronics for pixellated mRwell
- 4) RPC with high time and spacial resolution
- 5) Neutron gas detectors with imaging

- Silicon detectors

4 Eol's:

- 1) ARCADIA DMAPS
- 2) DMAPS qualification (Pernagger)
- 3) Passive CMOS -
- 4) Cooling of FPGA -

if you are interested to join any of these please let us know!!

It would be nice to start an hardware activity in RDFA at Roma Tre

Planned activity only software (if you want to join let us know)
needs computational resources with GPU (we have)
needs dedicated manpower

Conclusions

- paper work for future colliders done
- next step is a Technical Design Report for CepC, FCC-ee
- need to go from physics-only work to more software and hardware R&D
- hopefully things will grow up in the next years, the outcome of the European Strategy will be important
- present requests are limited to request for traveling (computing resources should be enough for the moment)
- if you would like to join any activity or start a new one in RDFA, please just join !!