IDEA Study Group Introduction

1st IDEA Study Group meeting
October, 15 2024

Paolo Giacomelli
INFN Bologna

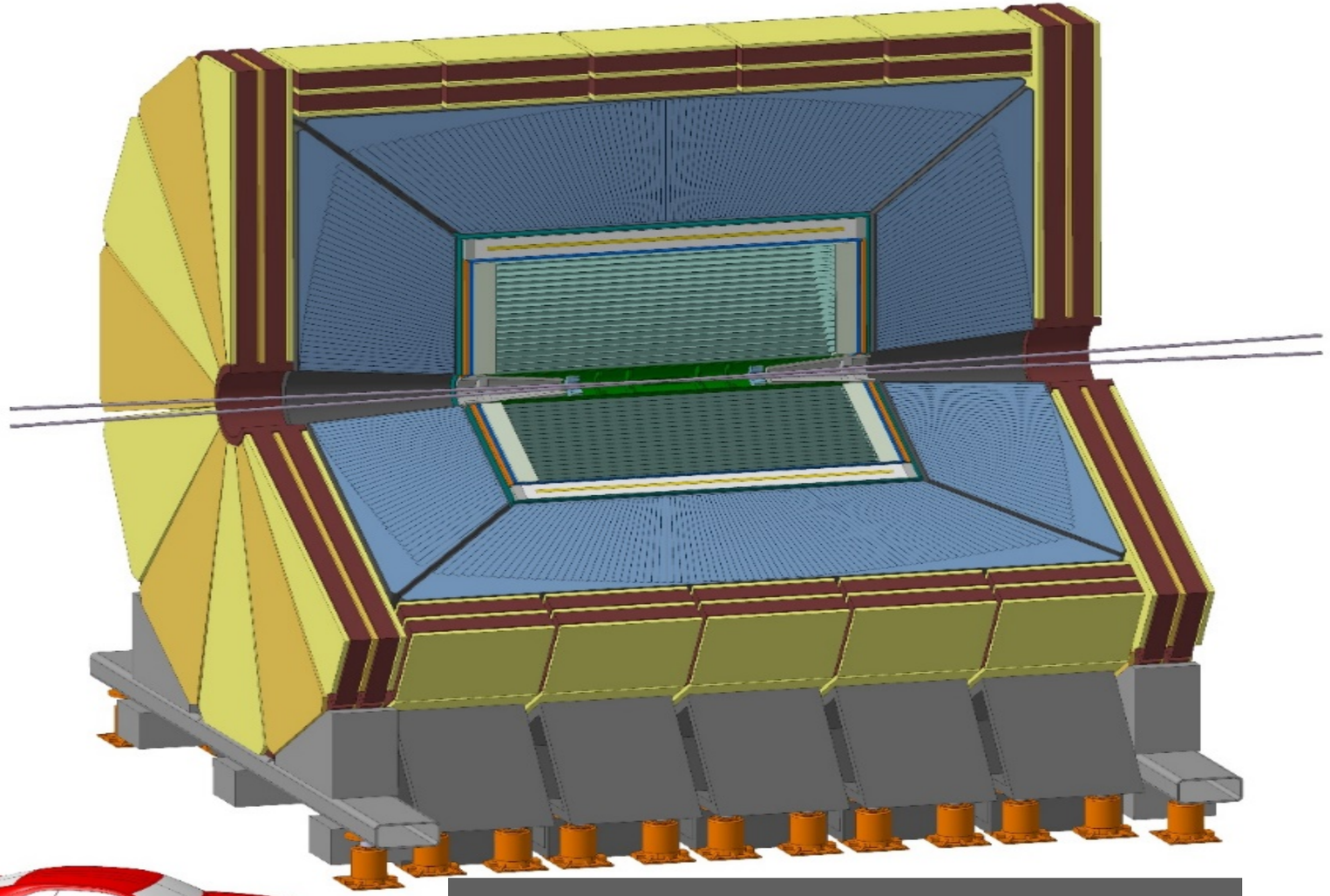
Introduction

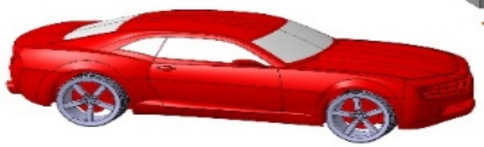
- The Innovative Detector for e^+e^- Accelerator (IDEA) was originally proposed by a few Italian groups
  - It has been conceived as a detector concept for a large circular e^+e^- collider
  - Since then many International collaborators (CERN, USA, UK, South Korea, Switzerland, France, Slovenia, etc.) have joined the R&D work
  - IDEA has to be a fully international enterprise
  - IDEA has been described in the FCC CDR (also in the CEPC CDR)
    - Will be described also in the FCC Feasibility Study final report

IDEA study group meetings

- IDEA has many activities as well as an extensive list of future plans
  - It becomes indispensable to have some regular meetings
  - Even more IMPORTANT to strengthen international collaborations
    - Invite
      - People who already collaborate with IDEA activities
      - People who expressed interest in collaborating with IDEA
      - Anybody who wants to be informed about IDEA activities and news
  - These meetings are complementary to detector concepts meetings
    - Will regularly report to detector concepts meetings and PED
    - Are not proto-collaboration meetings

The IDEA detector concept for FCC-ee



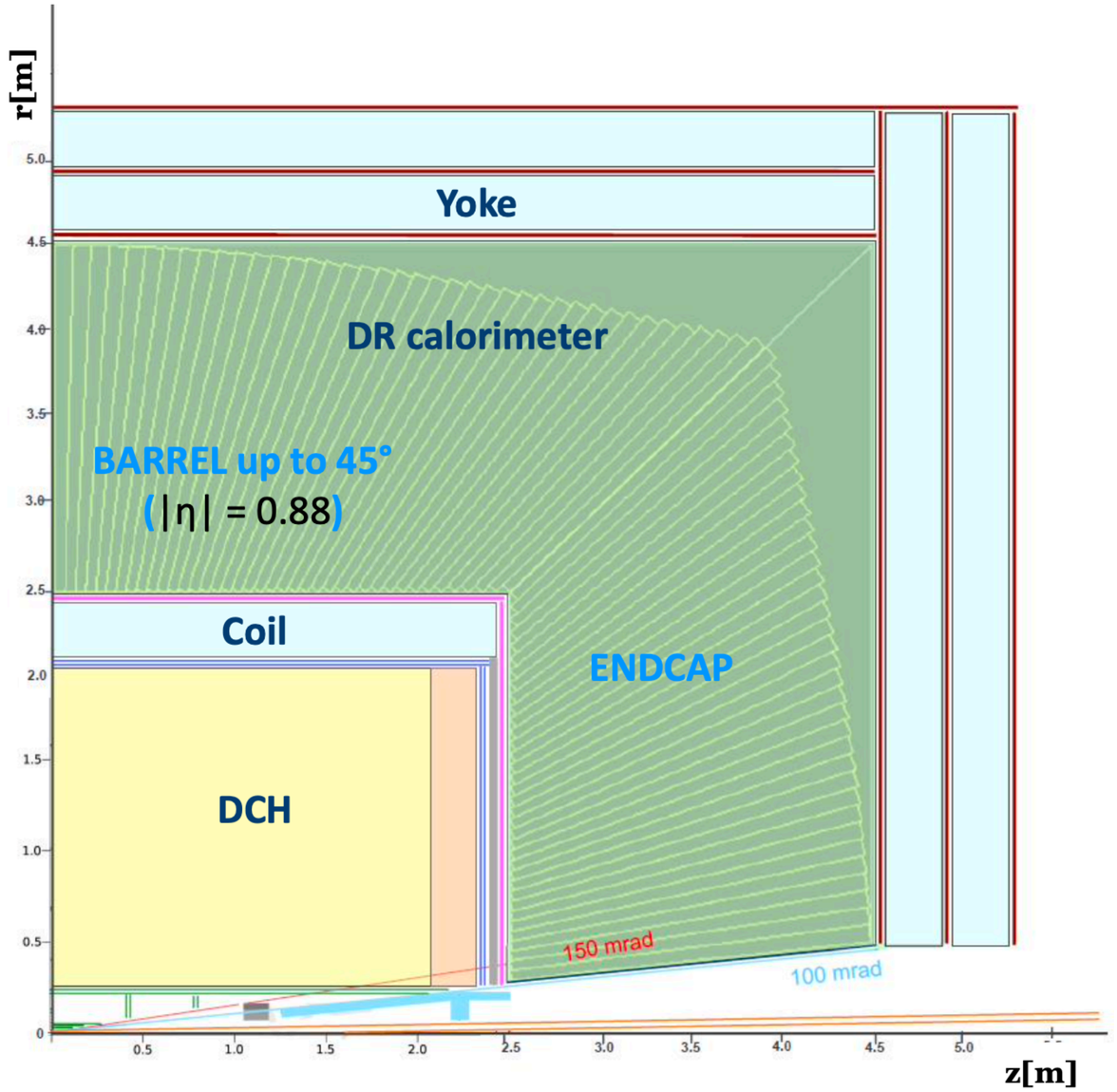


IDEA concept (proposed in FCC CDR)
Innovative Detector for e^+e^- Accelerator

- **New, innovative, possibly more cost-effective concept**
  - Silicon vertex detector
  - Short-drift, ultra-light wire chamber
  - Dual-readout calorimeter
  - Thin and light solenoid coil *inside* calorimeter system
    - Small magnet ⇒ small yoke
  - Muon system made of 3 layers of μ-RWELL detectors in the return yoke

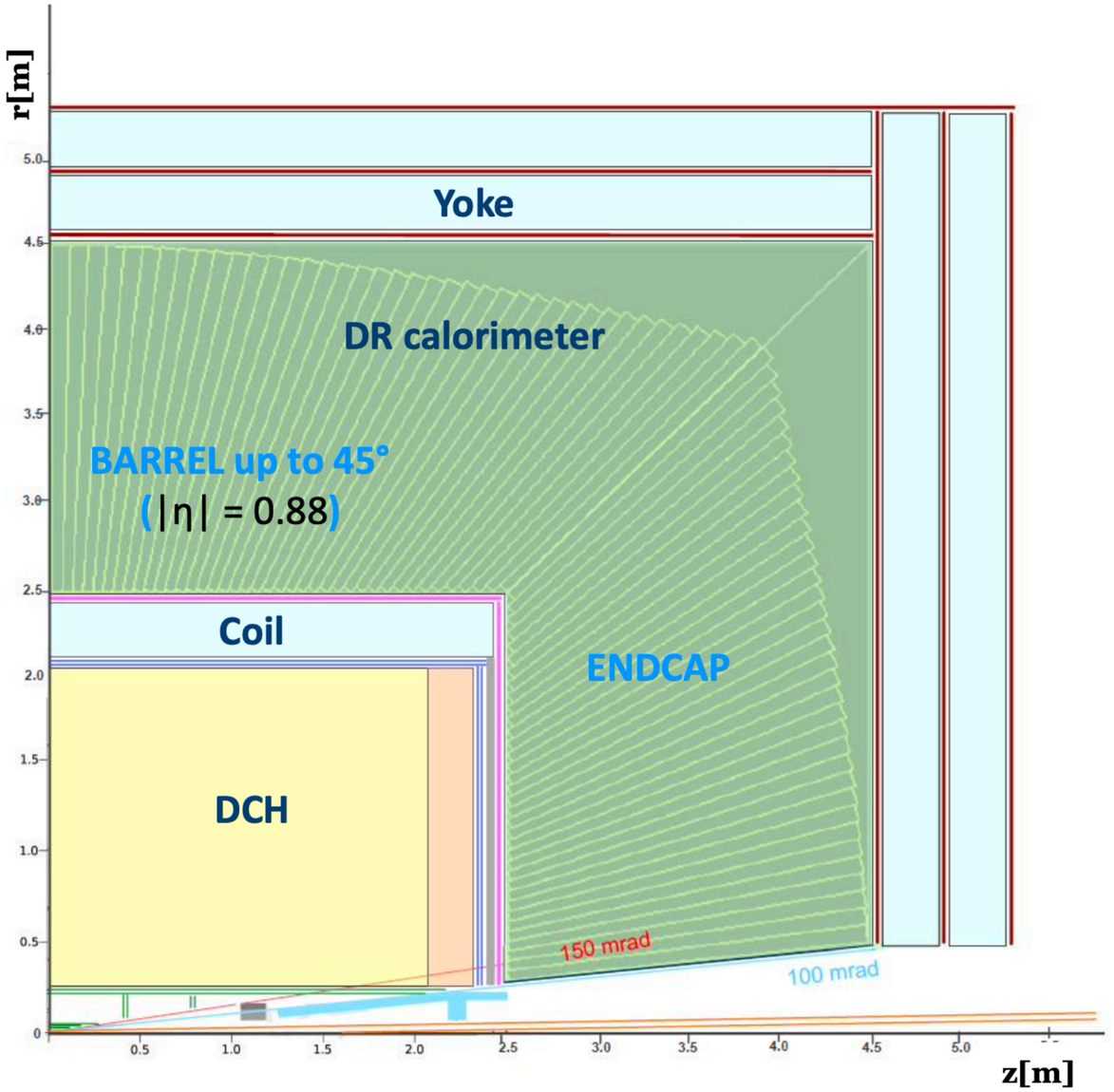
https://pos.sissa.it/390/

IDEA detector layout



IDEA detector layout

Beam pipe: R~1.0 cm



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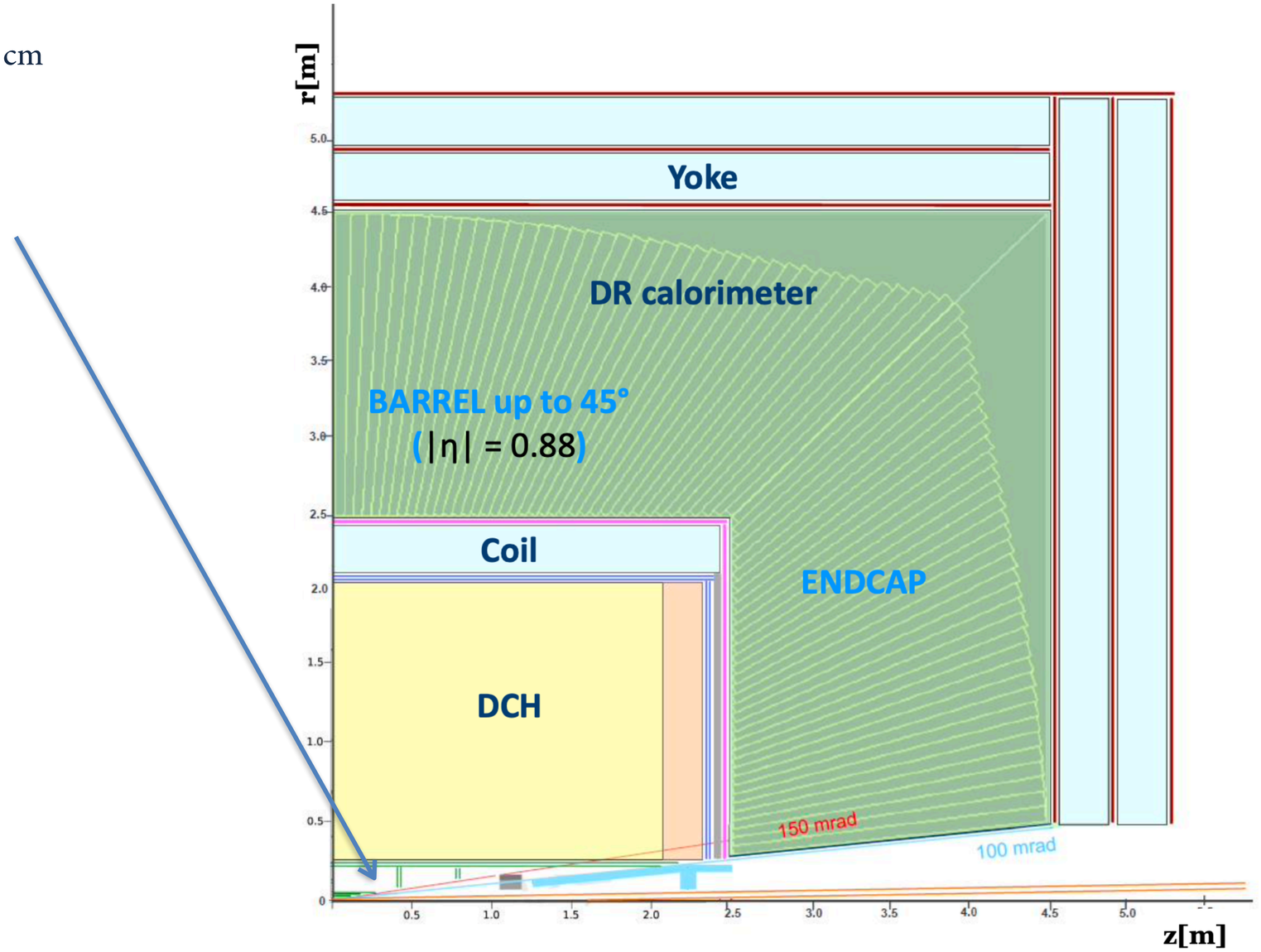
5 MAPS layers

R = 1.37-31.5 cm



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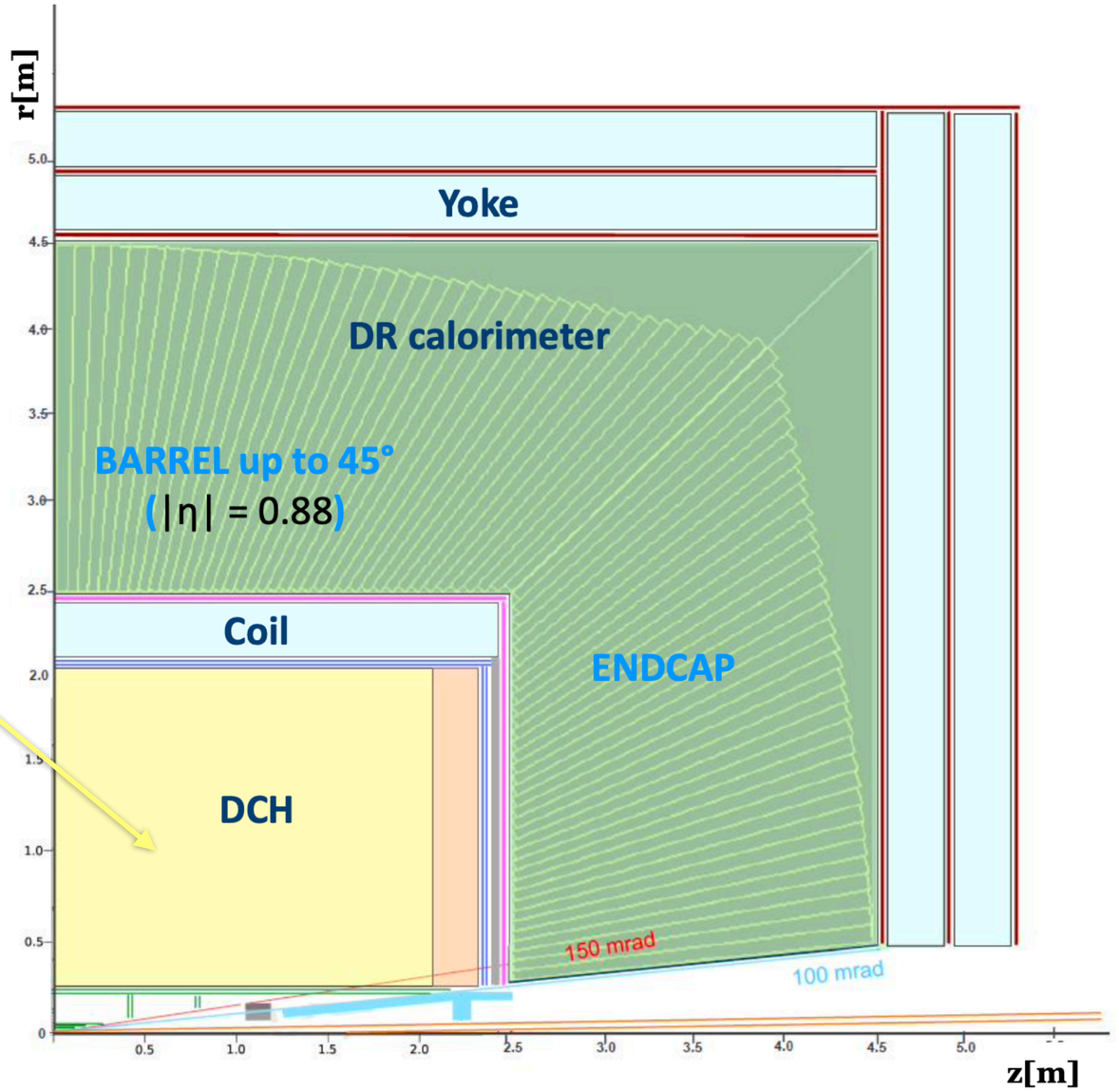
Drift Chamber: 112 layers

4 m long, R = 35-200 cm



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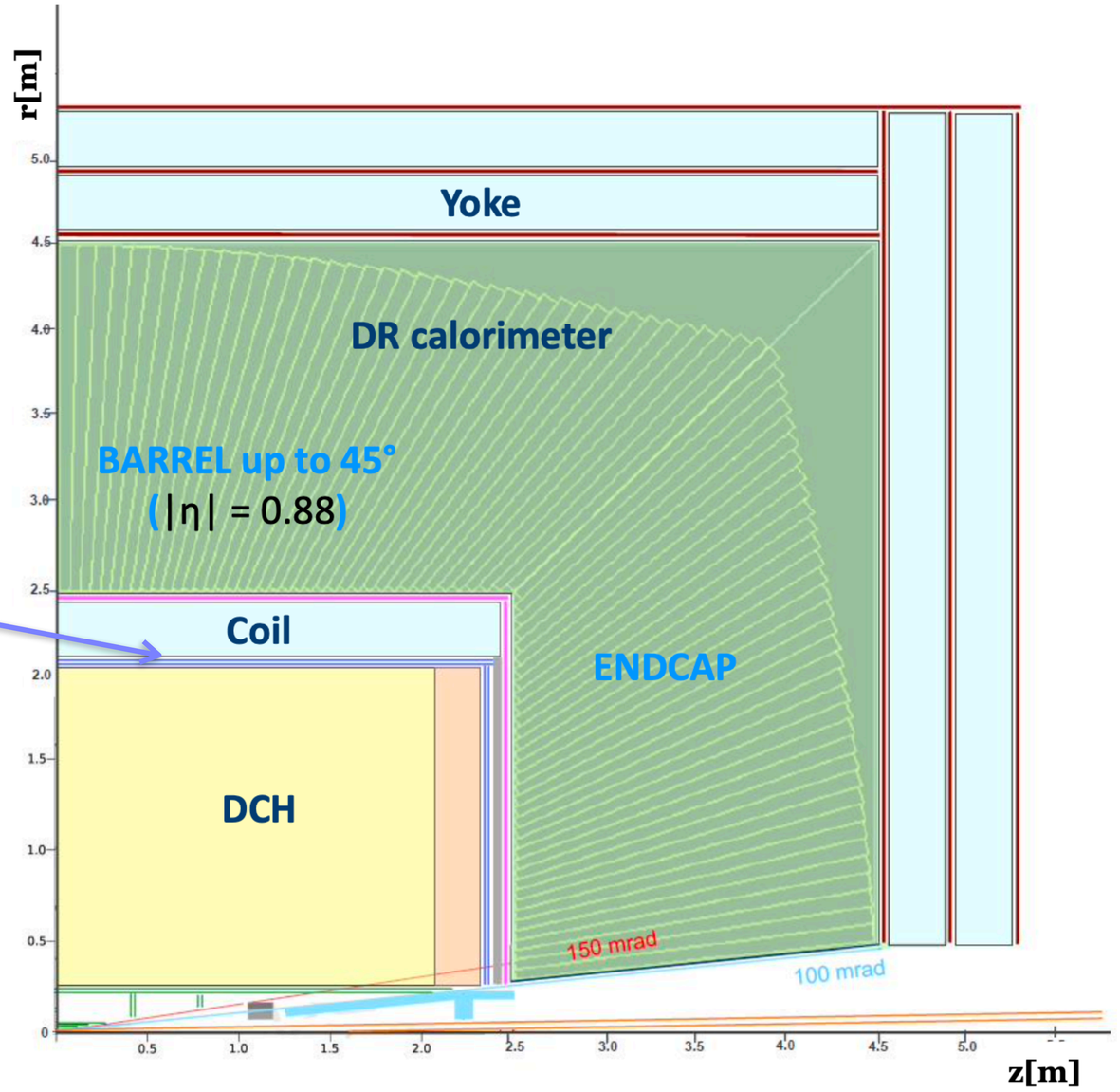
Si strips



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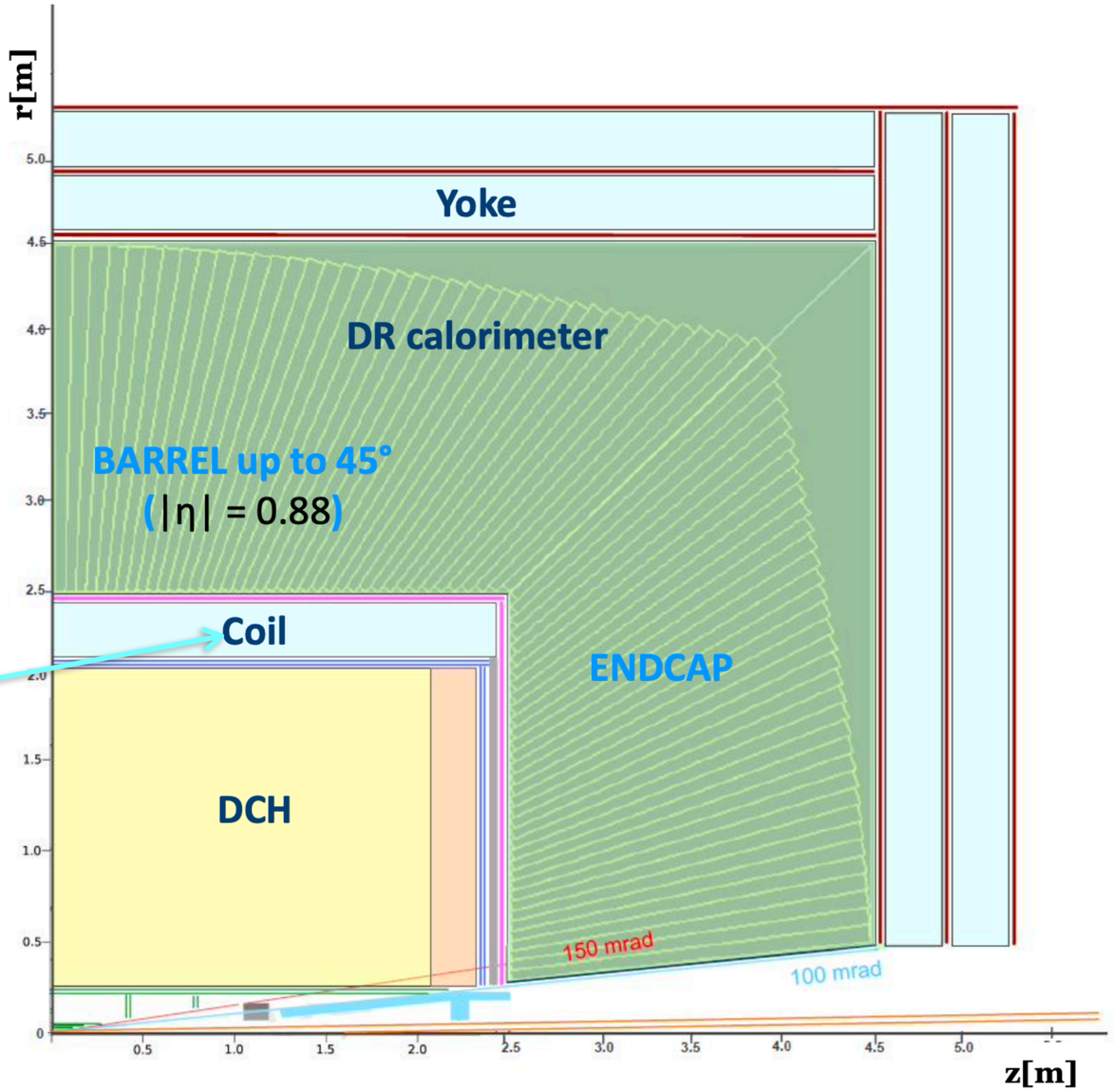
2 T, R ~ 2.1-2.4 m

0.74 X_0, 0.16 λ @ 90°



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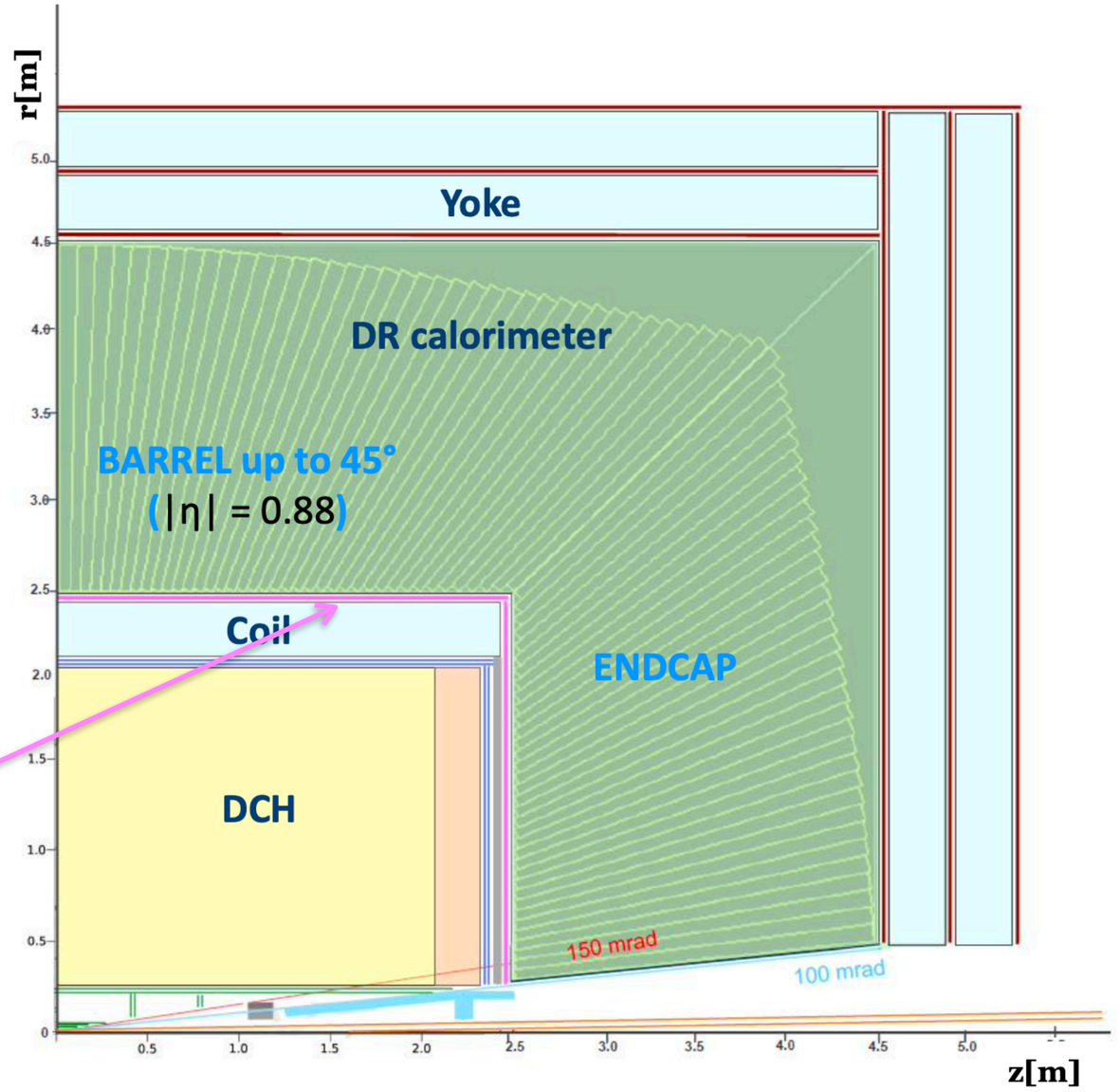

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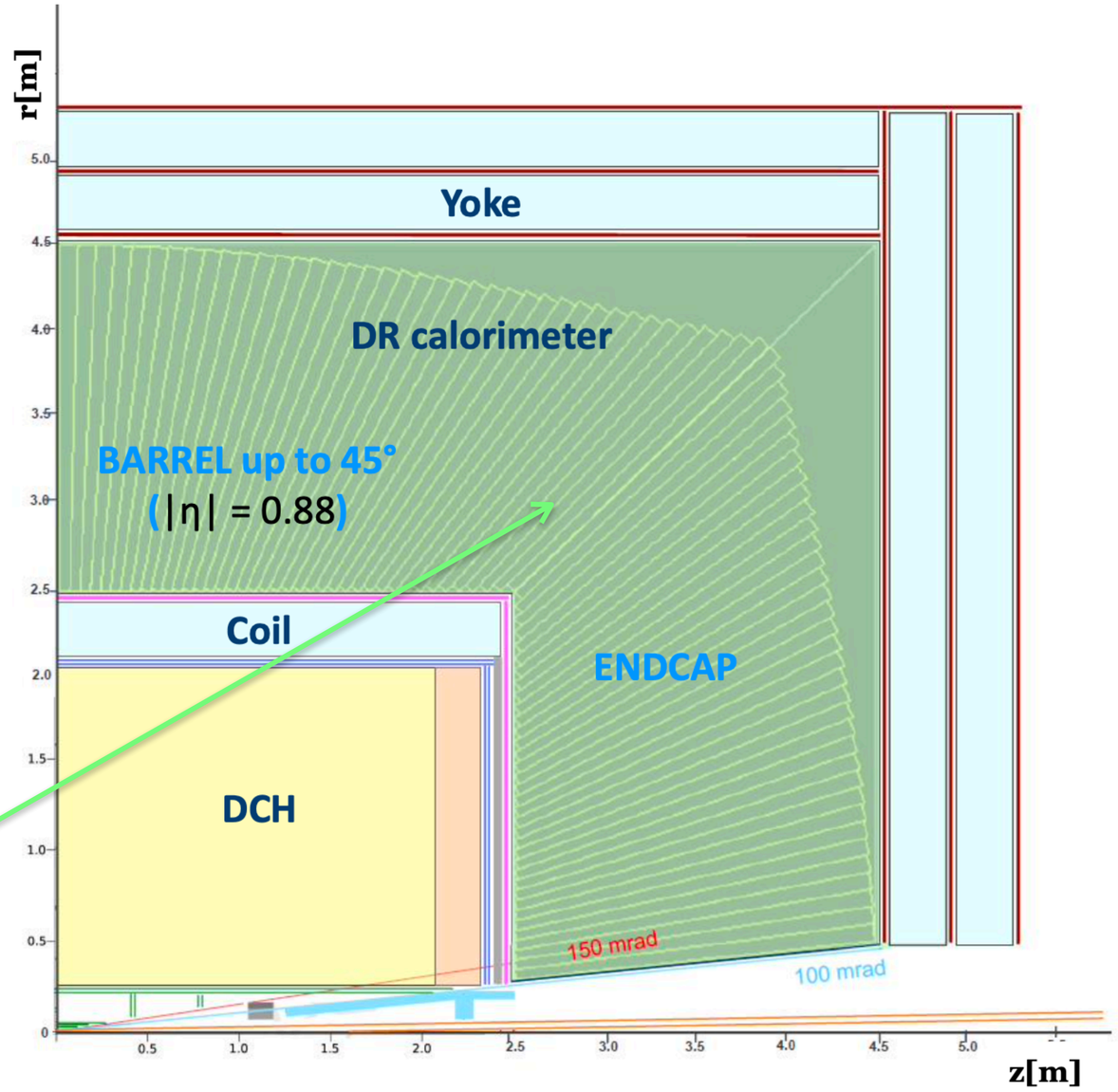
2m / 7 λ_{int}



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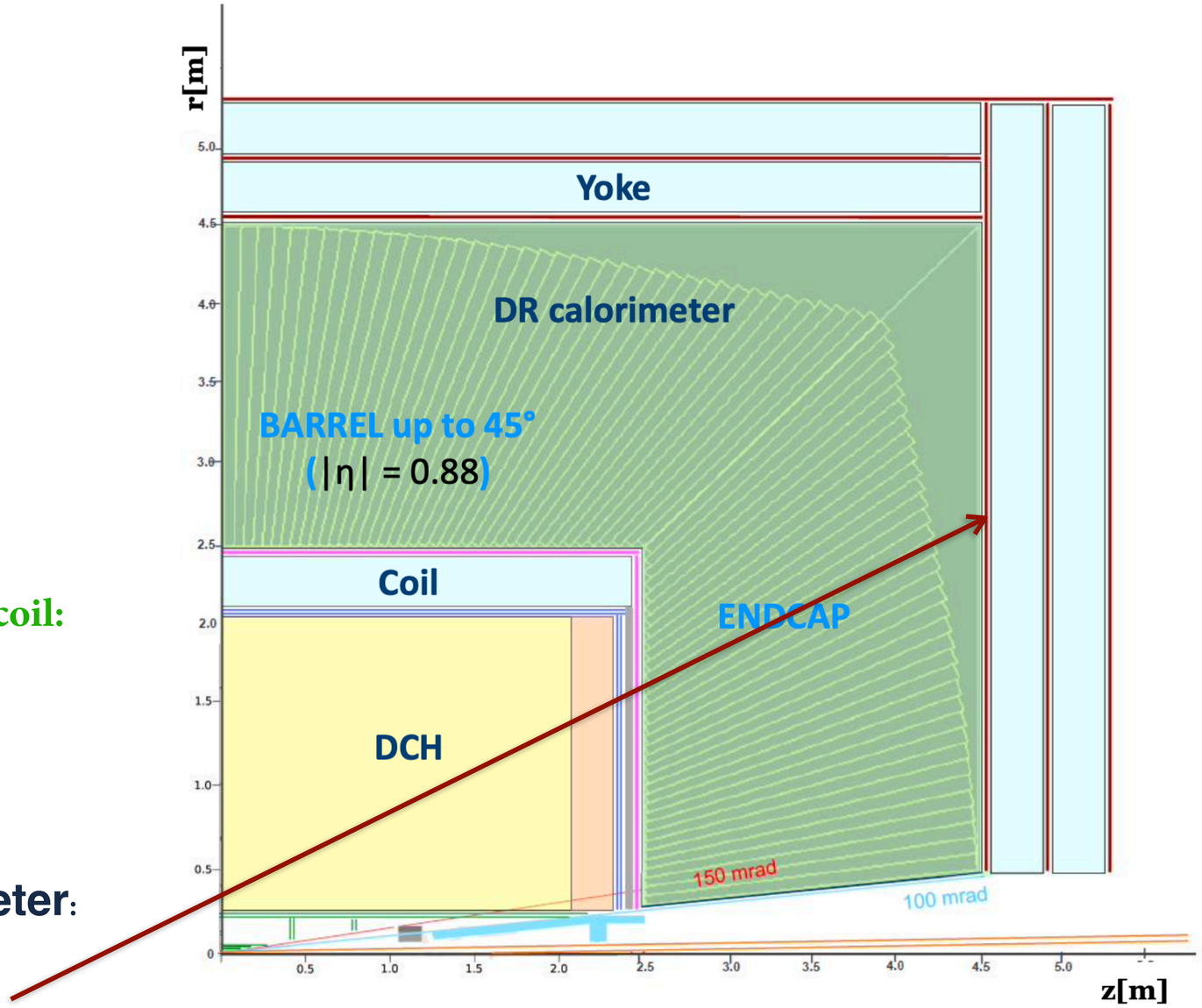
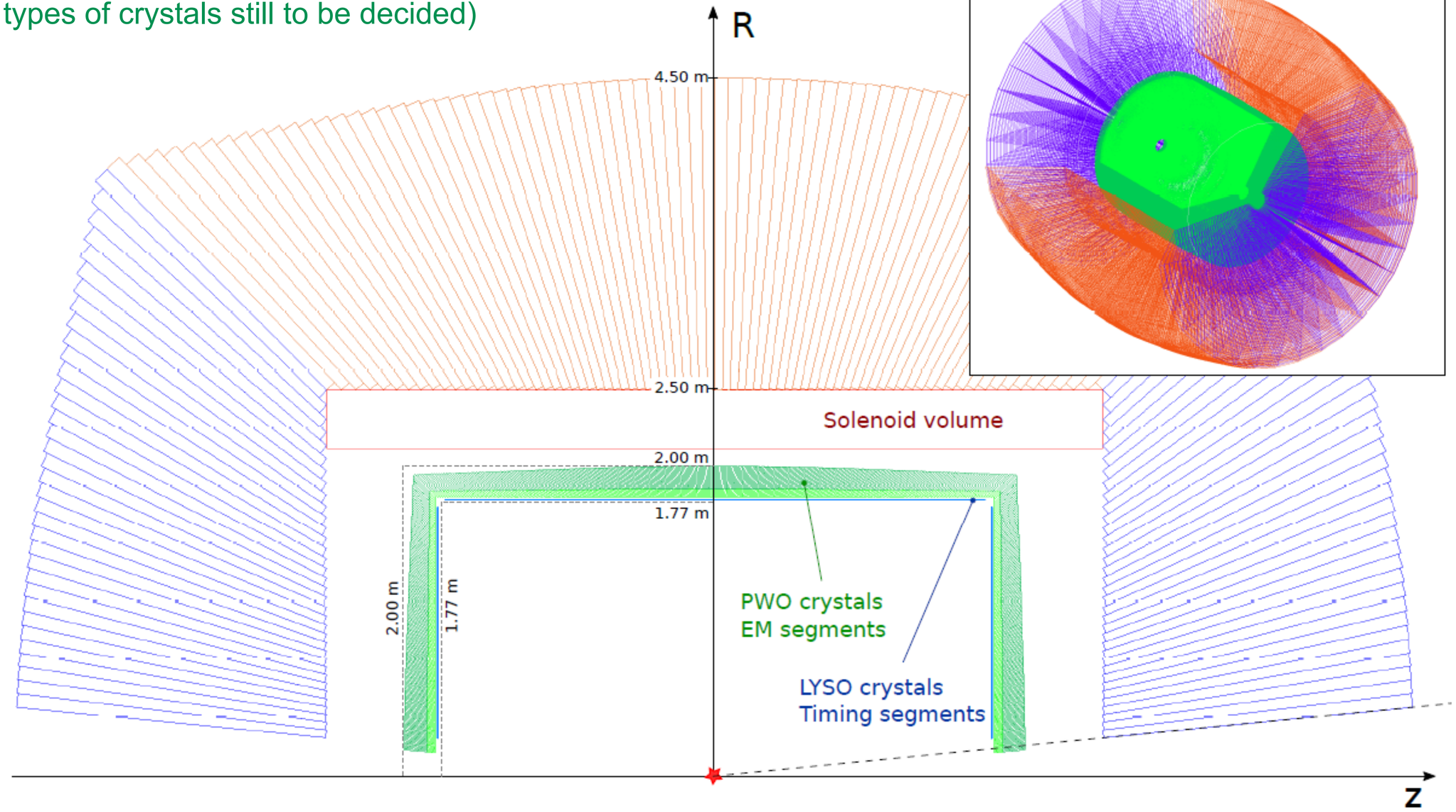
Yoke + Muon chambers



Crystal ECAL option

New baseline solution for em calorimetry
(choice of types of crystals still to be decided)



New design of IDEA's solenoid

- Had a very positive meeting in June with L. Rossi and his LASA collaborators
  - LASA people will propose a new solution for IDEA's solenoid
    - They will take into account the inclusion of the crystal calo
      - Inner radius considered 2.3 m
      - Relax constraints on solenoid's material in terms of X_0
    - The solenoid will be designed to reach 3 Tesla and operate at 2 Tesla at the Z peak

Some considerations

- Today we have a short presentation on each sub-detector
  - MDI and software/analysis are the only topics missing today
- Today most speakers are Italian
  - From the next meeting, we look forward to have many International speakers
- We have a time window of 4-5 years for doing R&D for IDEA
  - None of the solutions that you will see today are cast in stone
  - Need to improve/modify/change the design of every component
    - Huge space for new collaborators to make an impact!

Collaborations with other projects

- All ongoing IDEA activities are also present in the various DRDs
- We collaborate also with some large EU projects
  - AIDAinnova
  - EURO-LABS
- We encourage collaborations with the other FCC detector concepts
  - Vertex detectors look alike in all proposed detector concepts
  - ALLEGRO's tracking system is extremely similar to IDEA's
    - Already discussed with them a possible collaboration on the drift chamber

FCC's Expressions of Interest

- Most of you have probably seen F. Sefkow's recent e-mail on the FCC EoIs
  - Detector technologies (sub-detectors)
  - Detector concepts
  - These will be used as inputs for the European Strategy Update
- Have to be presented by the end of January 2025
- We aim at writing an EoI for each of IDEA's sub-detector and also on the detector concept
  - These EoIs should be signed by all the collaborators

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  - Next meeting on **Tuesday November 19th, 2025** at **16:00 (GVA time)**
- **Lots of possibilities for many colleagues to join FCC-ee and IDEA and contribute to all these developments!!**