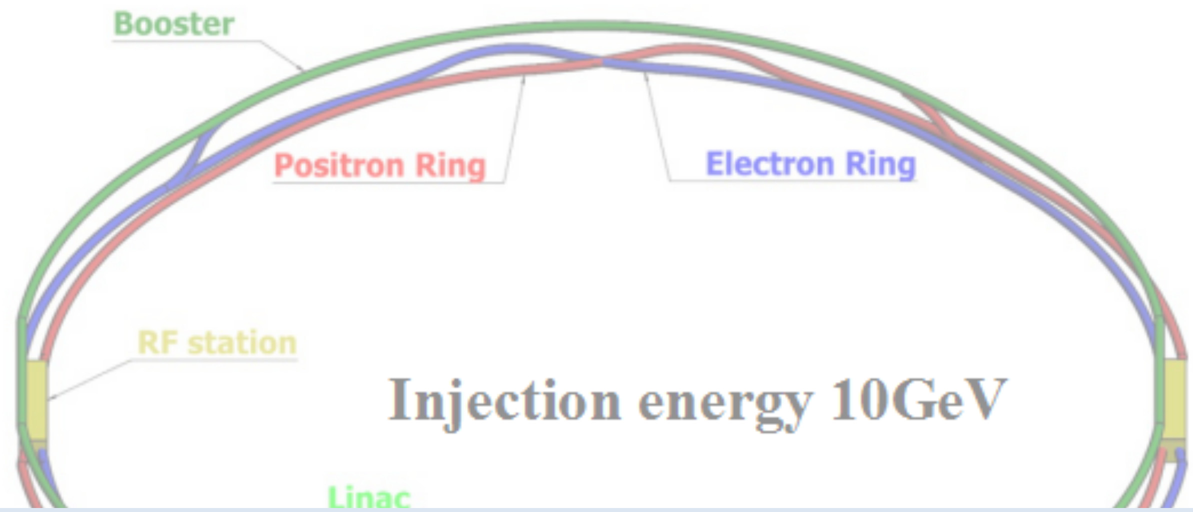
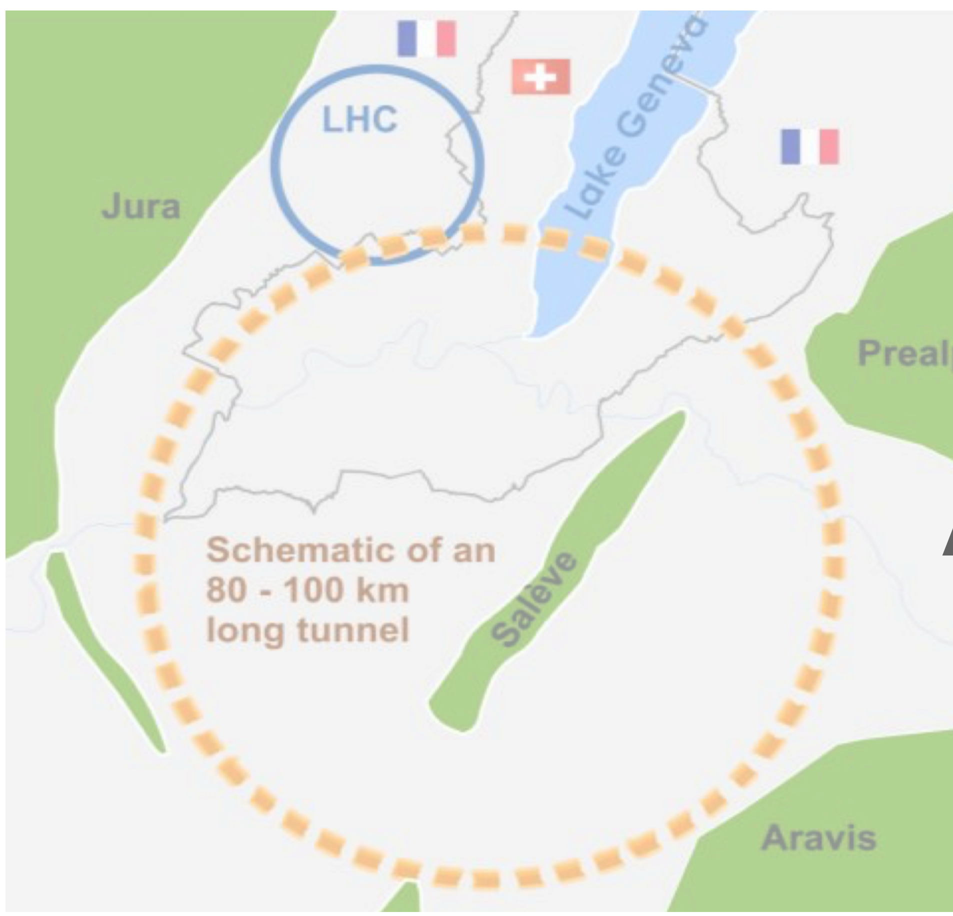


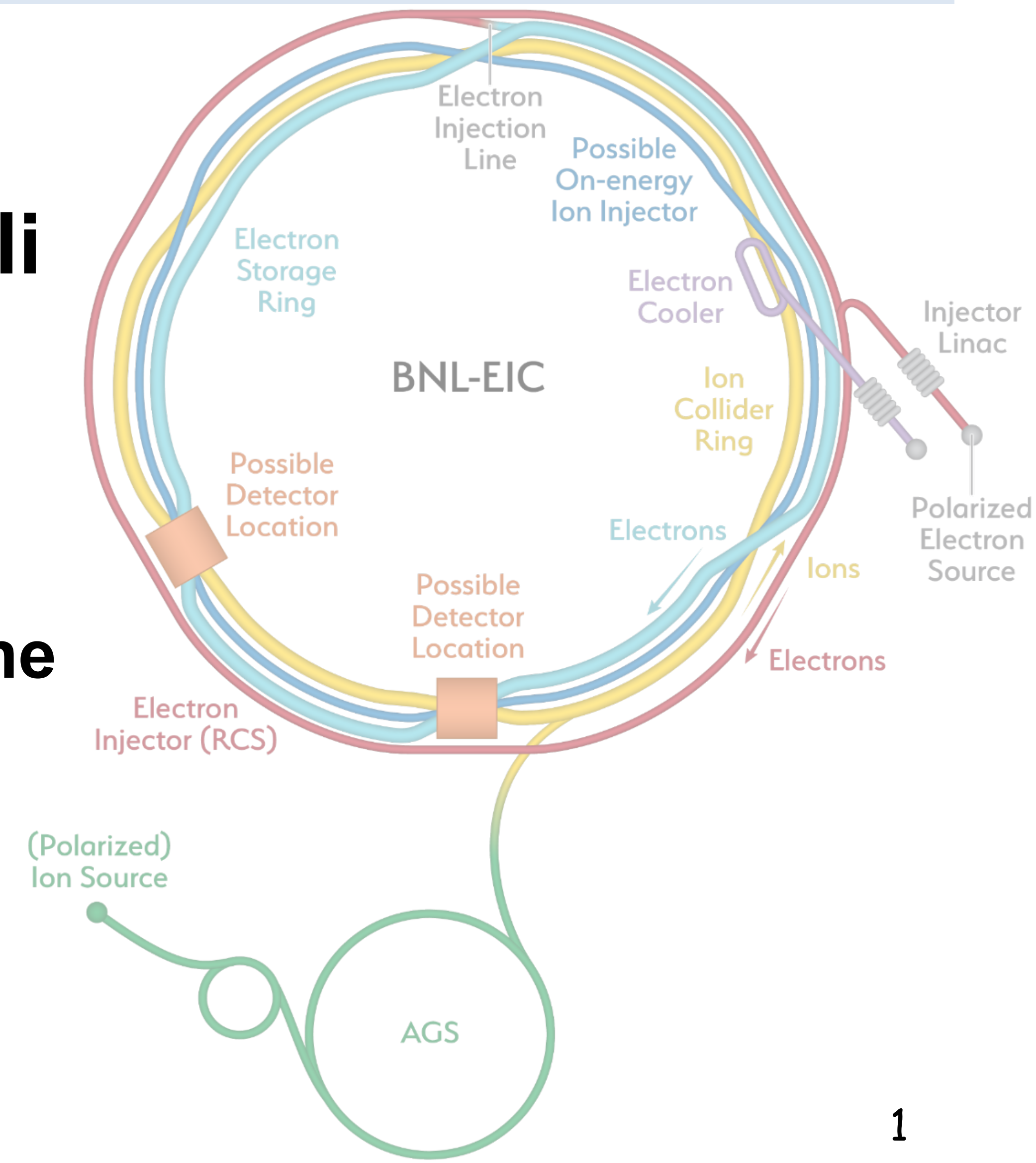
Bologna, 04/02/2021

Futuri acceleratori
(attività di Bologna)



Paolo Giacomelli
INFN Bologna

Assemblea di sezione



Outline

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- Future large circular leptonic colliders

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- Conclusions

e^+e^- circular collider options

Future leptonic Circular colliders

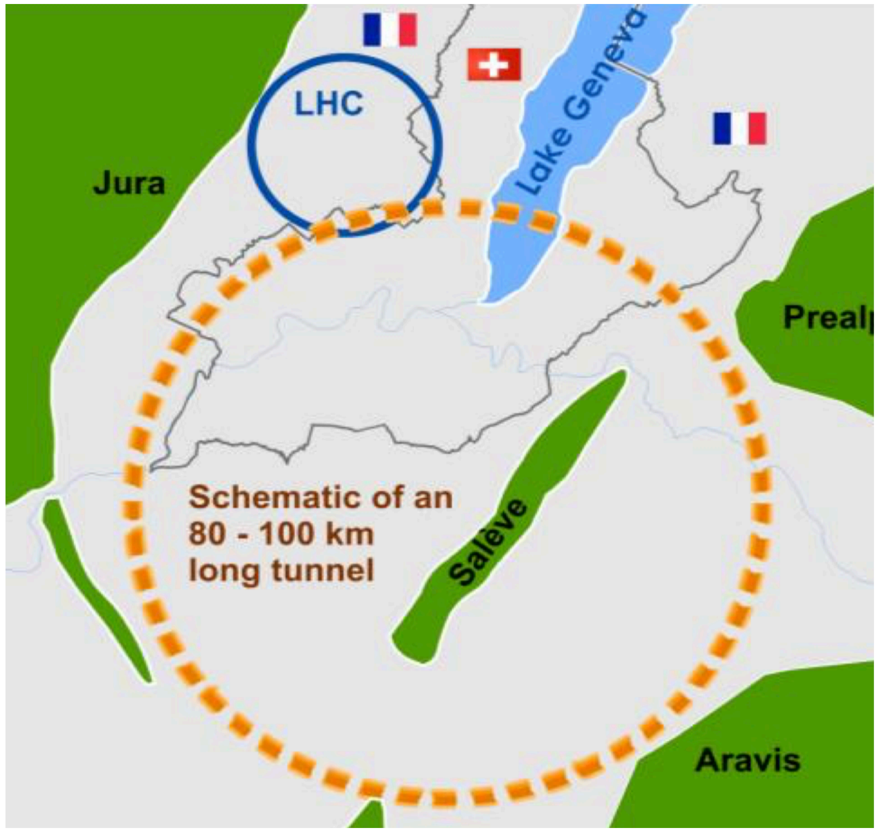
$\sqrt{s}$ = 90 – 240 GeV

e^+e^- circular collider options

Future leptonic Circular colliders

CERN

$\sqrt{s}$ = 90 – 375 GeV



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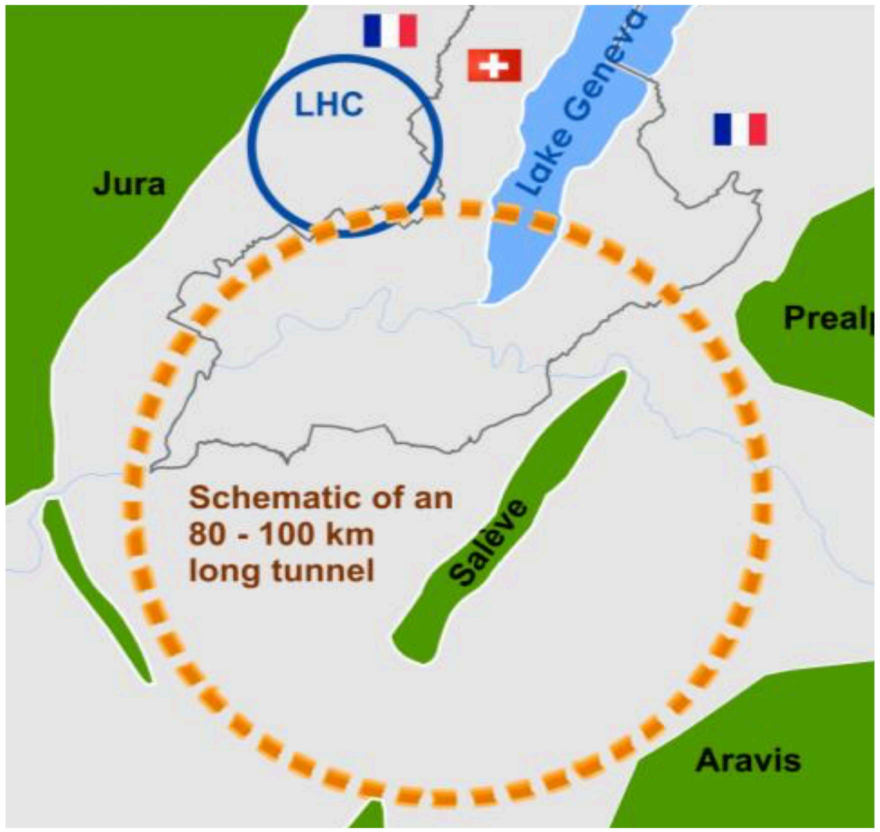
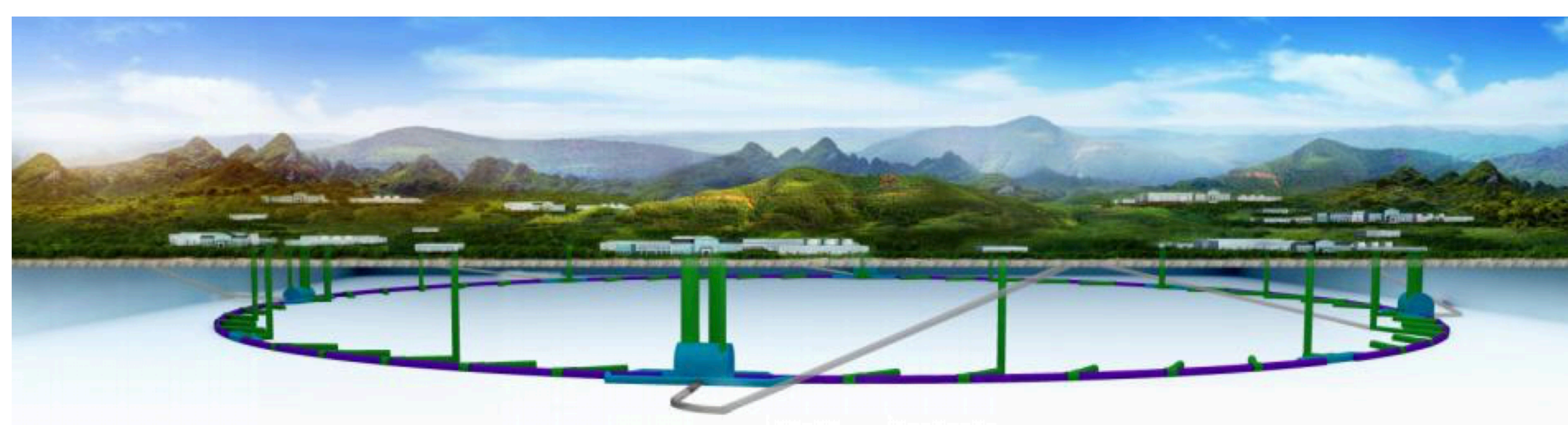


China

$\sqrt{s}$ = 90 – 240 GeV



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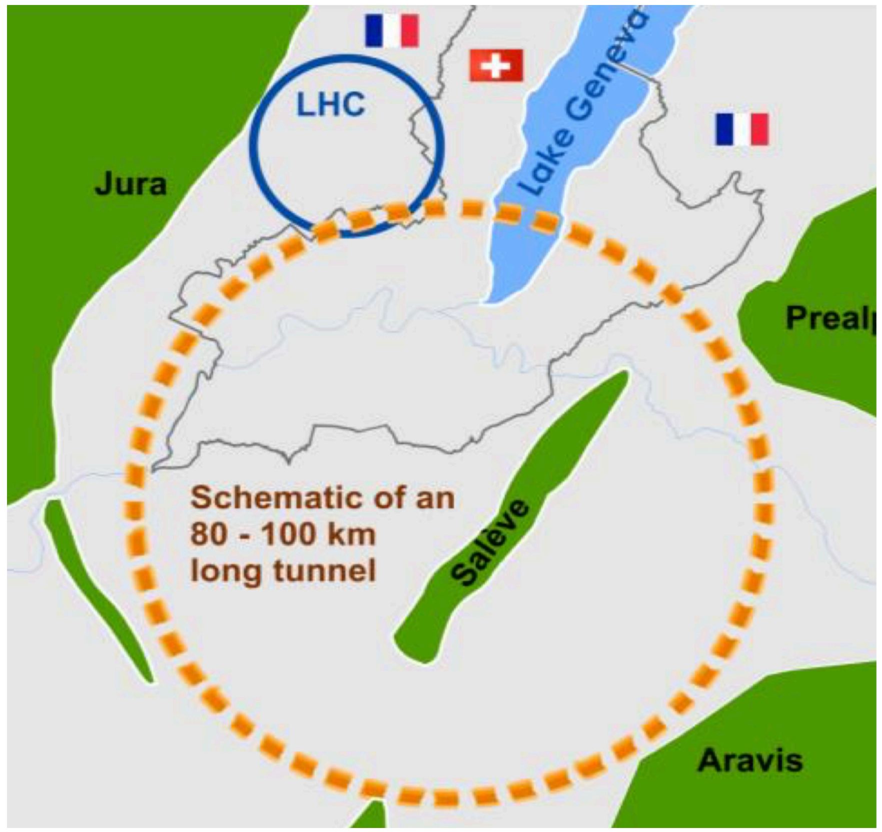

	FCC-ee	CEPC
$\sqrt{s}$	90–375 GeV	90–240 GeV
$\mathscr{L}_{max}$ @Z (10^{34} cm^{-2} s^{-1})	230	100
$\mathscr{L}_{max}$ @H (10^{34} cm^{-2} s^{-1})	7	3

China

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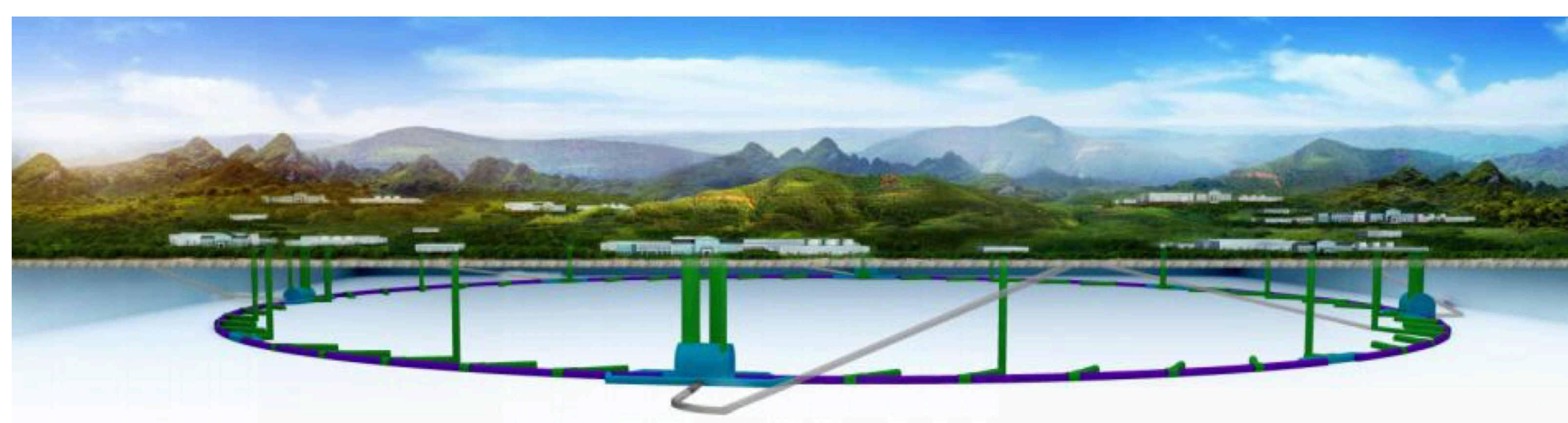

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Future leptonic Circular colliders

CERN

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√s	V
	3

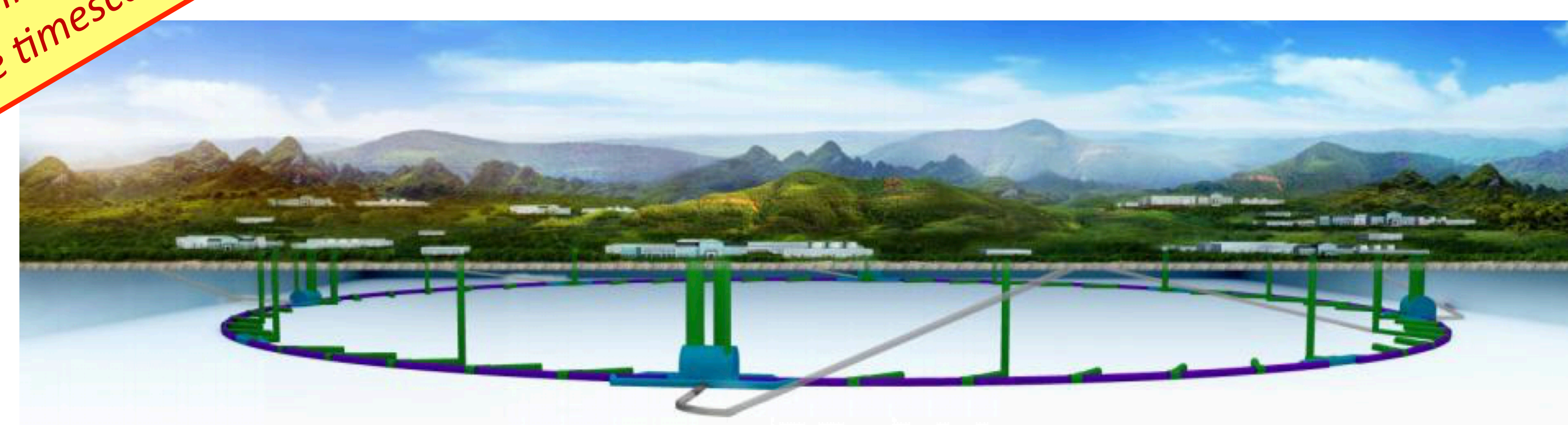
European Strategy Update: FCC-ee highest priority!

a) An electron-positron Higgs factory is the highest-priority next collider. For the longer term, the European particle physics community has the ambition to operate a proton-proton collider at the highest achievable energy. Accomplishing these compelling goals will require innovation and cutting-edge technology:

•*Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage. Such a feasibility study of the colliders and related infrastructure should be established as a global endeavour and be completed on the timescale of the next Strategy update.*

China

…40 GeV



Circular colliders: FCC-ee detectors

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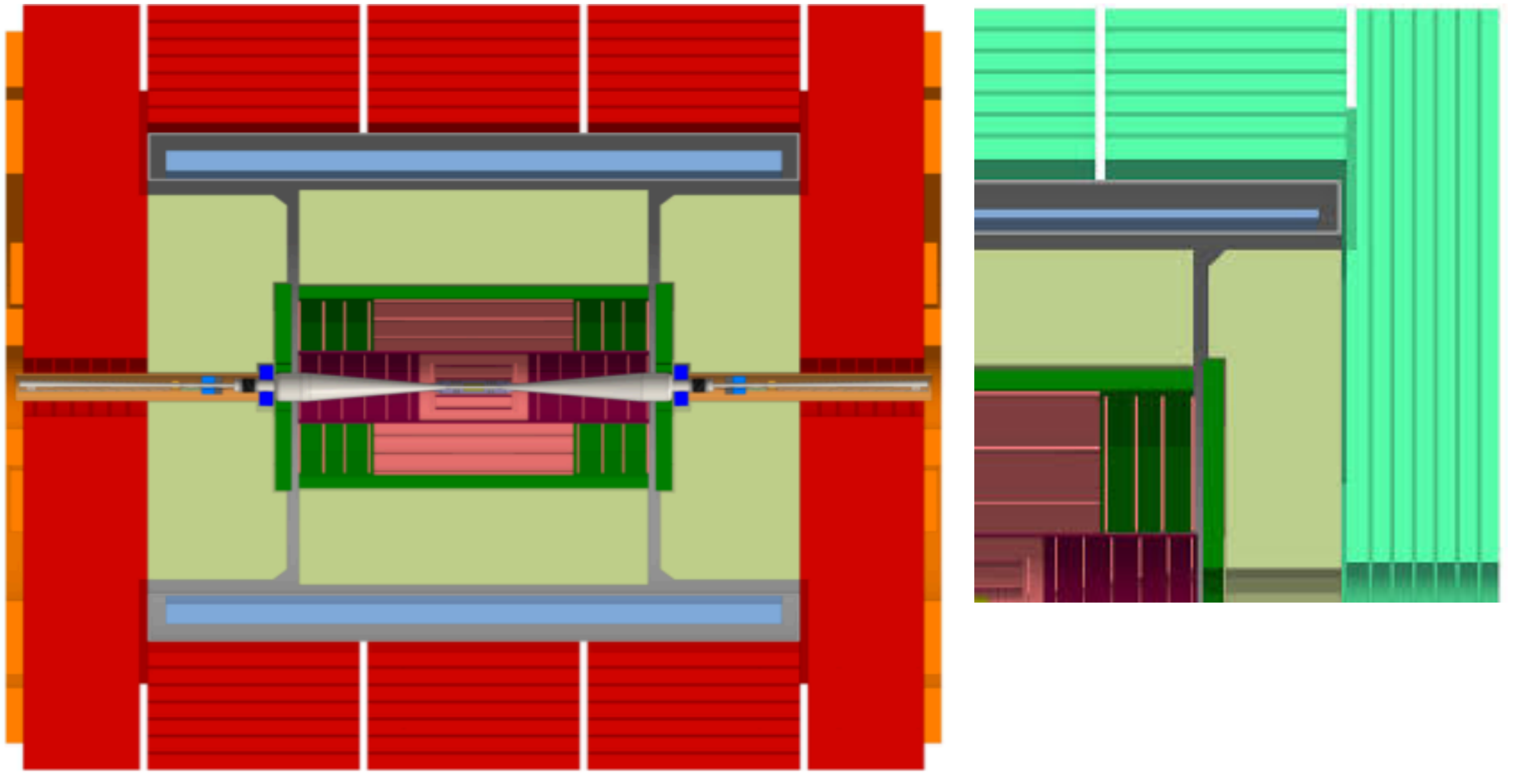
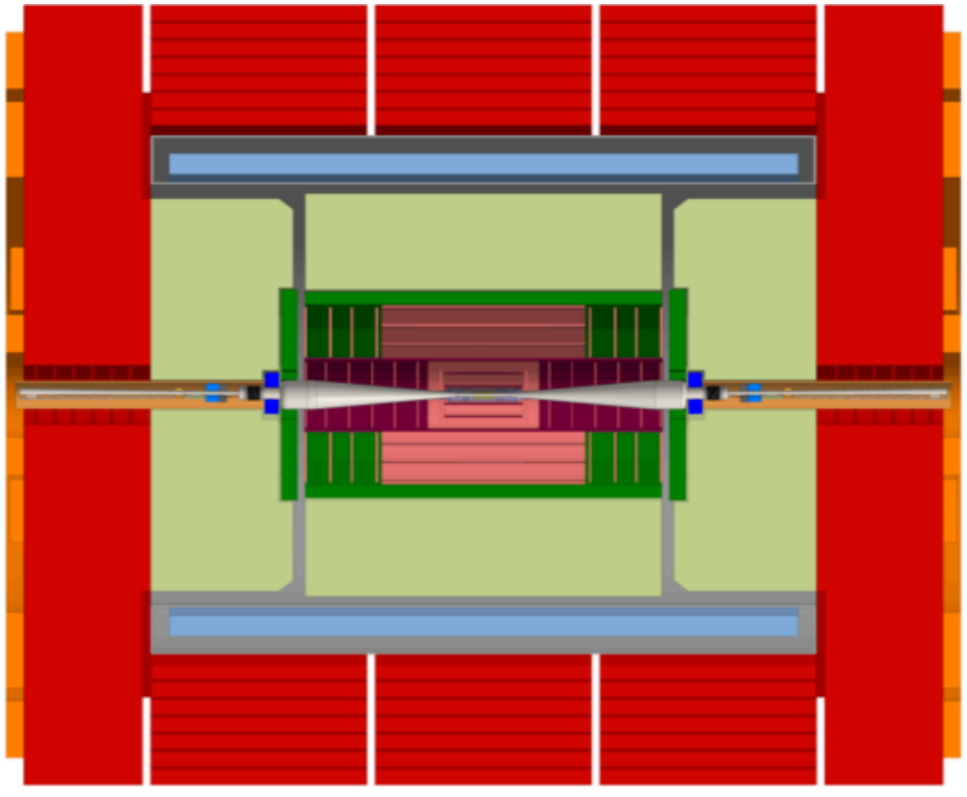
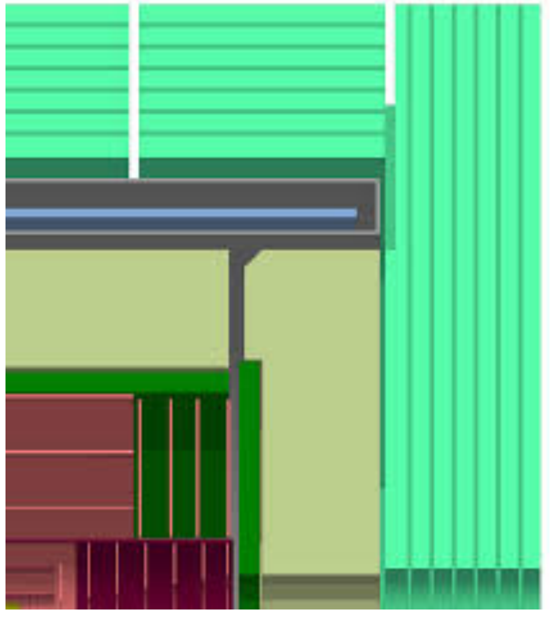


CLD

2 T solenoid
Full Si tracker
SiW HG EM calorimeter
Sci.-steel HG HCAL calorimeter
Muon detector with RPCs

Circular colliders: FCC-ee detectors





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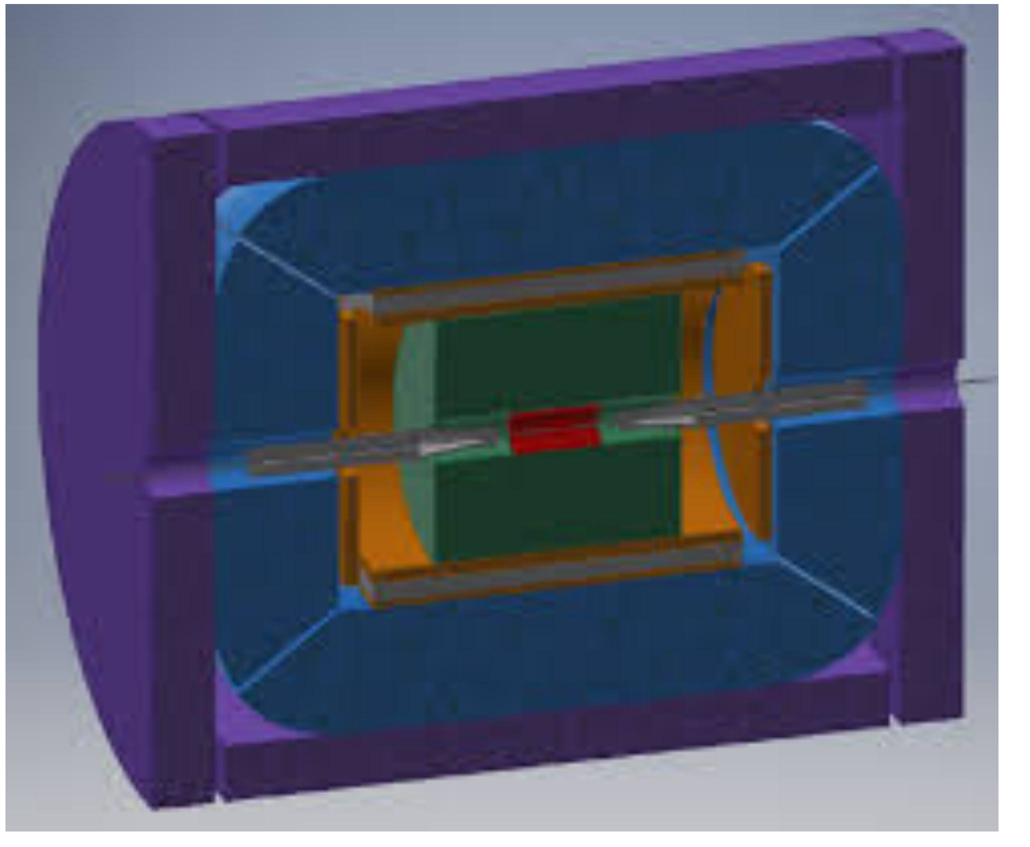

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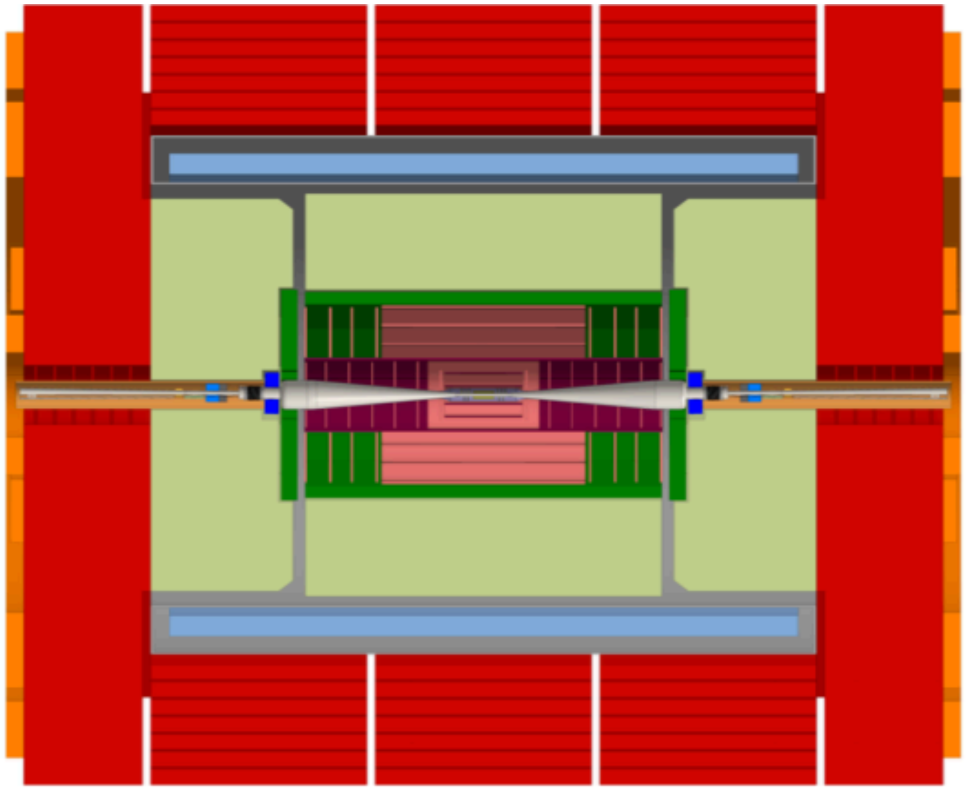

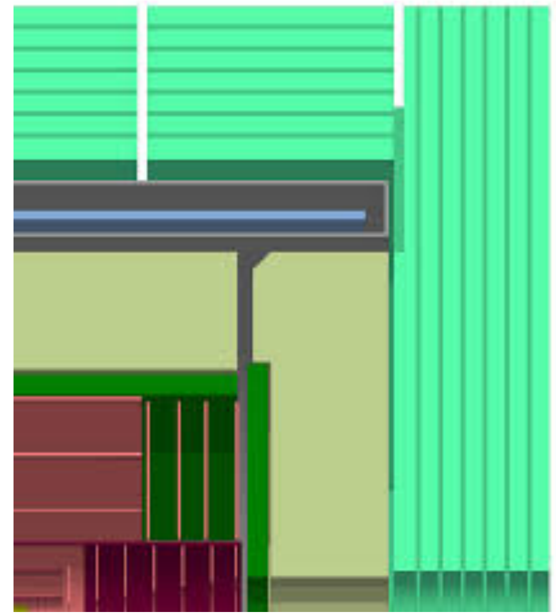

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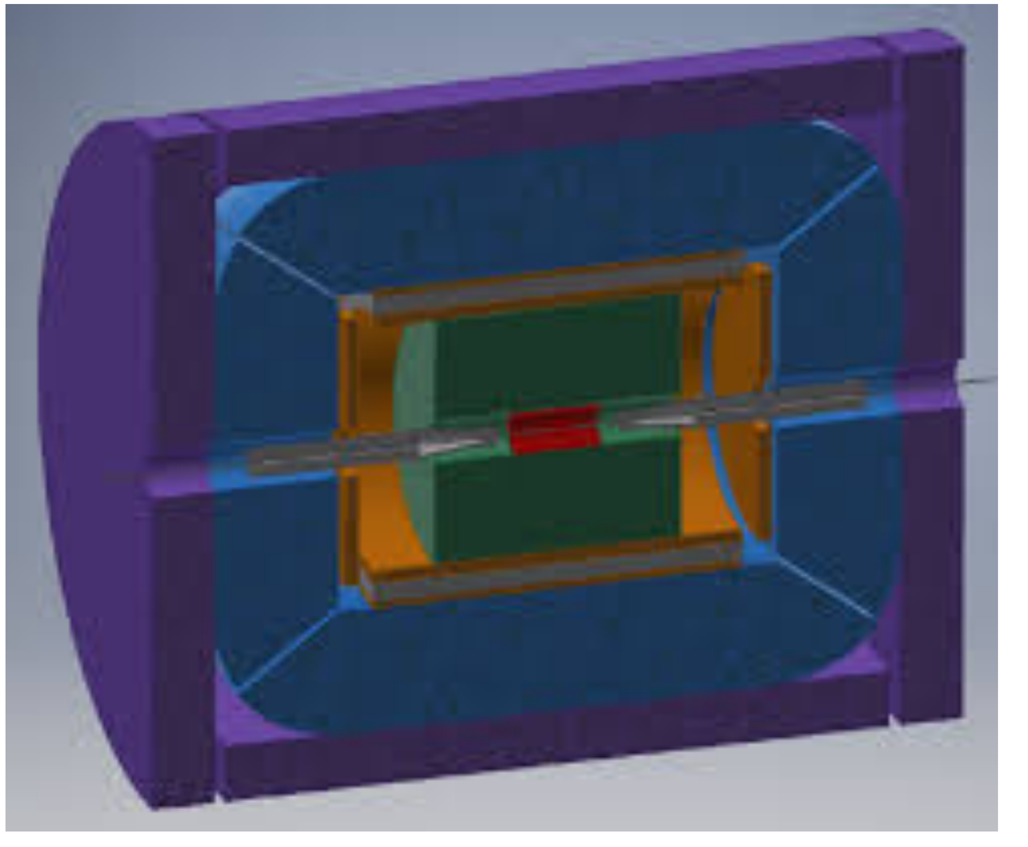

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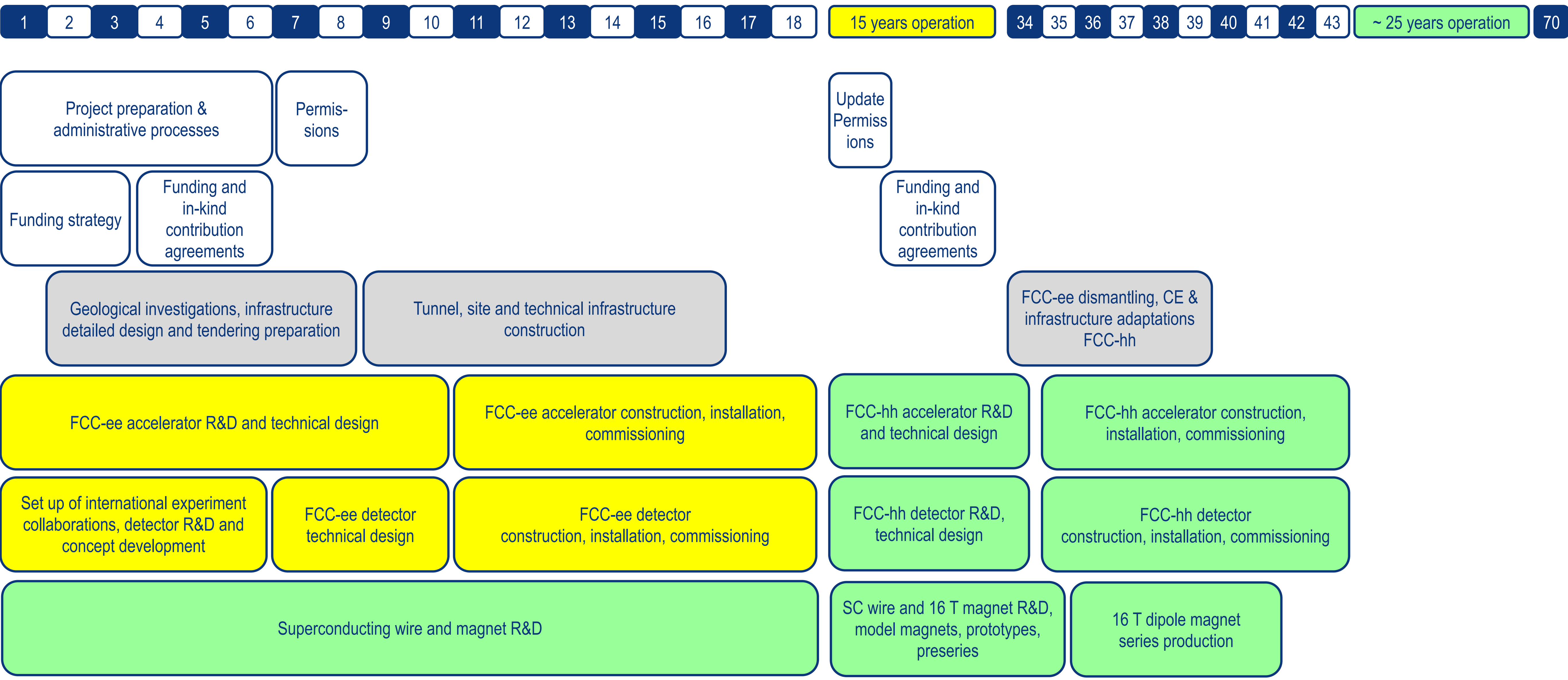
CDR published in January 2019

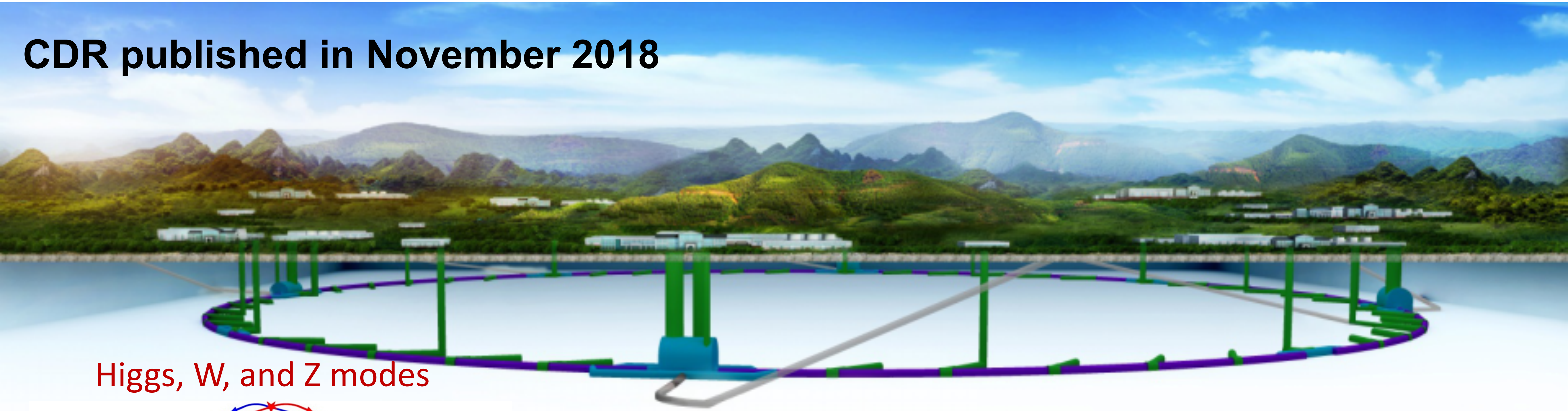
FCCs schedule



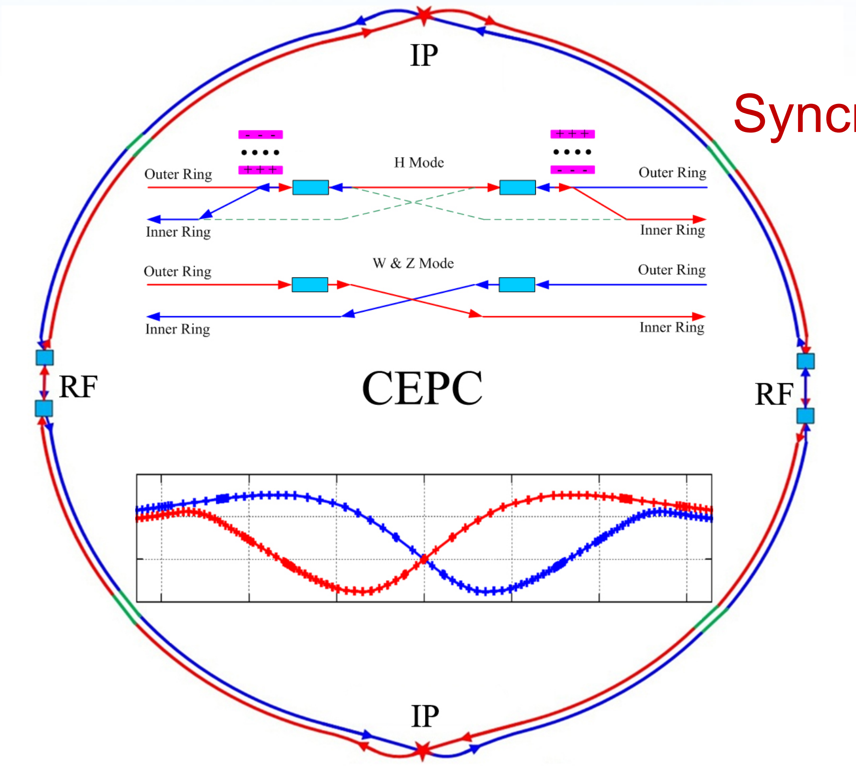
With CERN's new strategy:
FCC-ee first step (~**2040**)
FCC-hh would start around **2060**

Circular colliders: CEPC

CDR published in November 2018



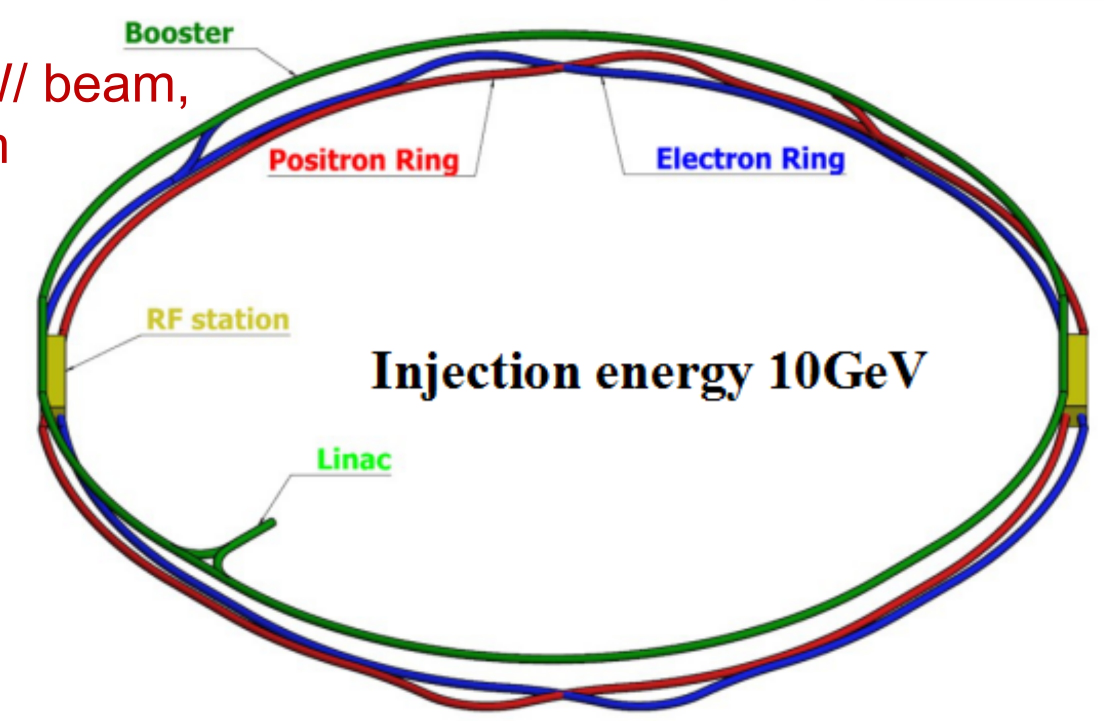
Higgs, W, and Z modes



CEPC collider ring (100km)

Syncrotron Radiation power 30MW/ beam, upgradable to 50MW/beam

CEPC could start operations in the early **2030s**



CEPC booster ring (100km)

Center of mass energy **91** - **240** GeV

Max. luminosity (√s=240 GeV) **3 x 10^{34}** cm^{-2}s^{-1}

Later install SPPC (pp collider) √**s** = **100-120** TeV

Circular colliders: CEPC detectors

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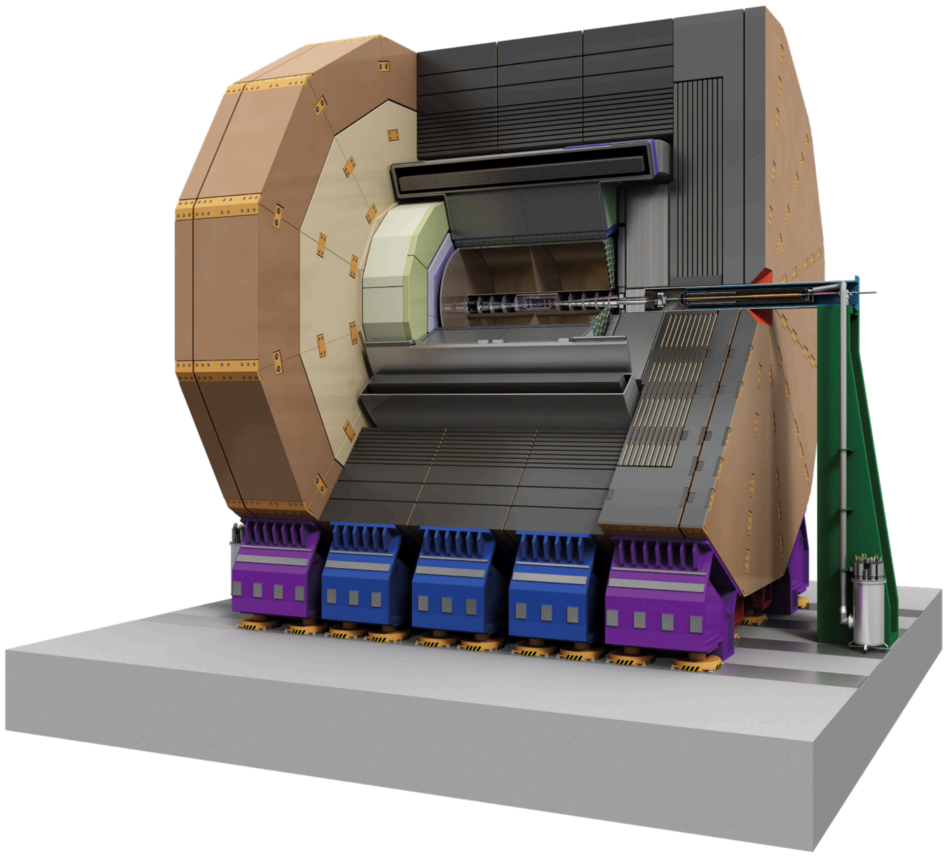

ILD-like

PFA oriented concept with high granularity calorimeter
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3 T solenoid

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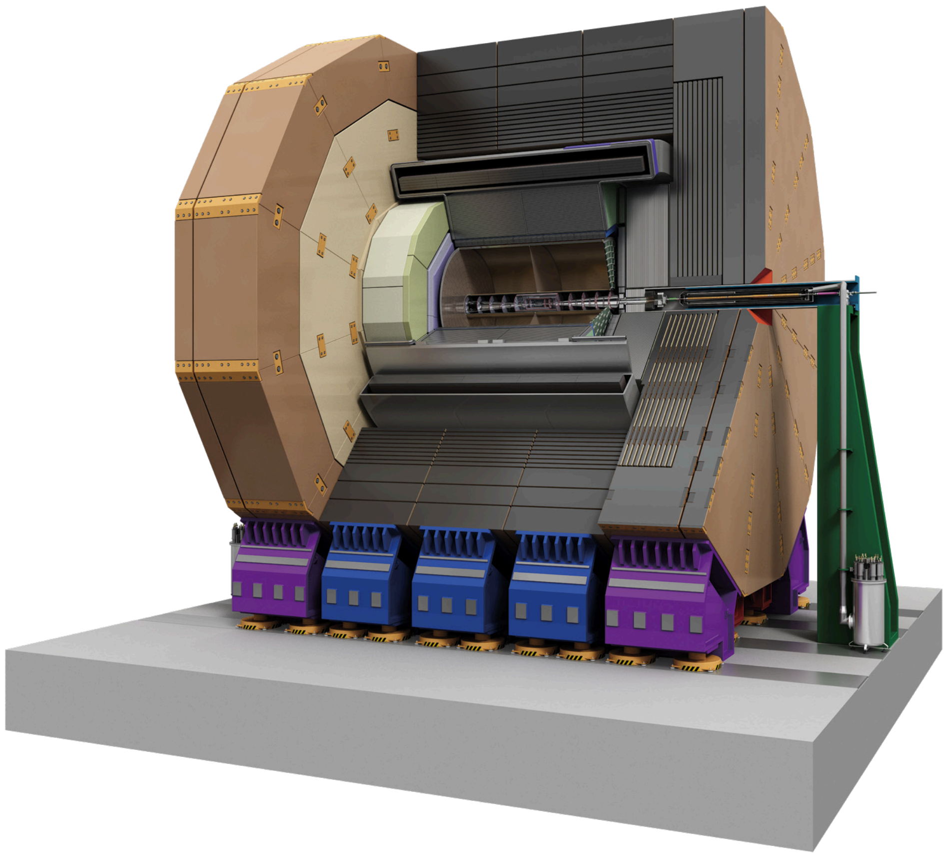

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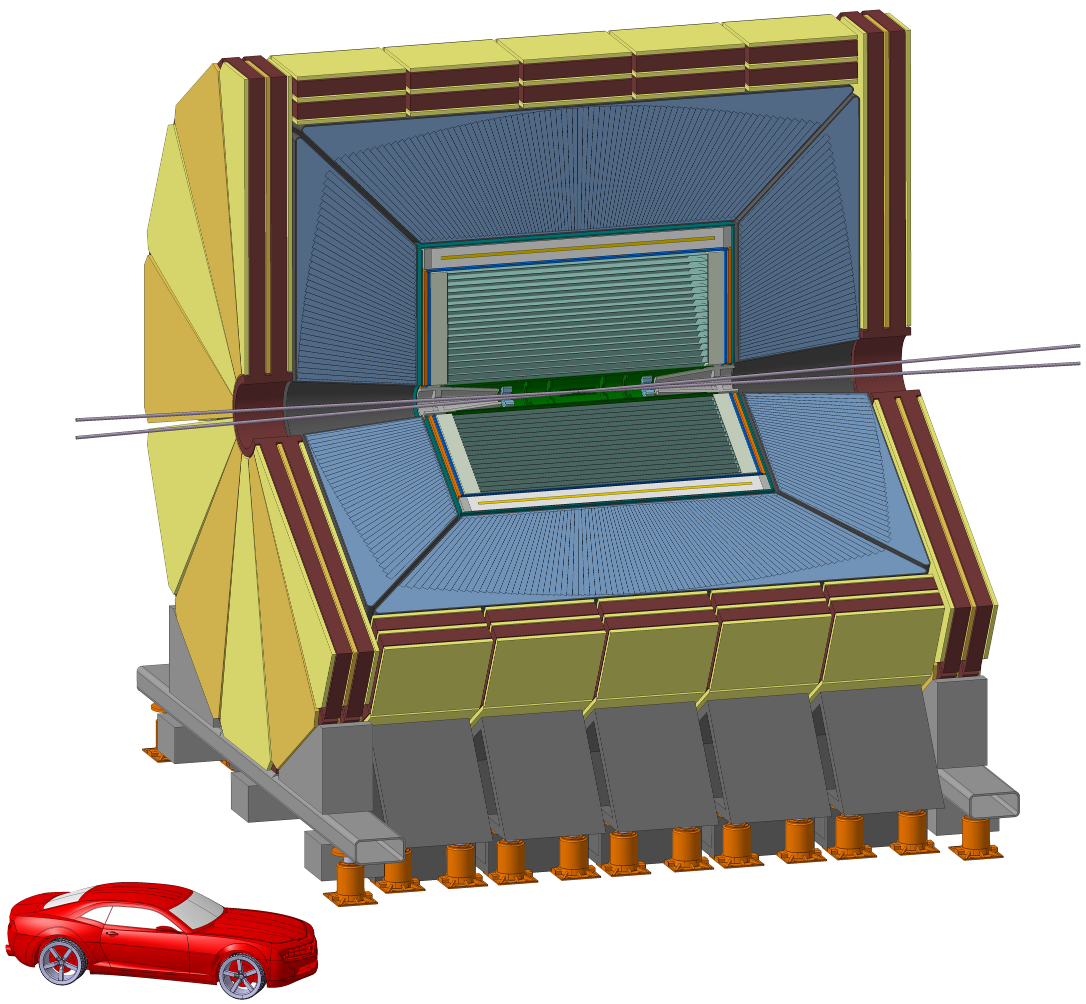

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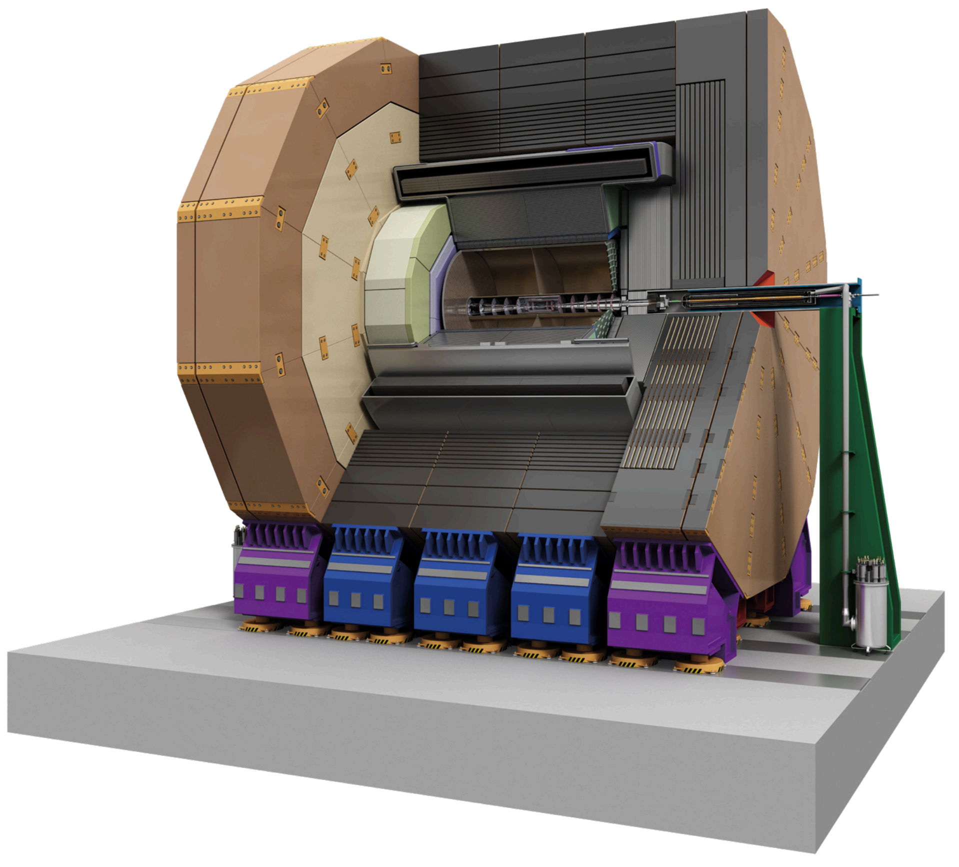

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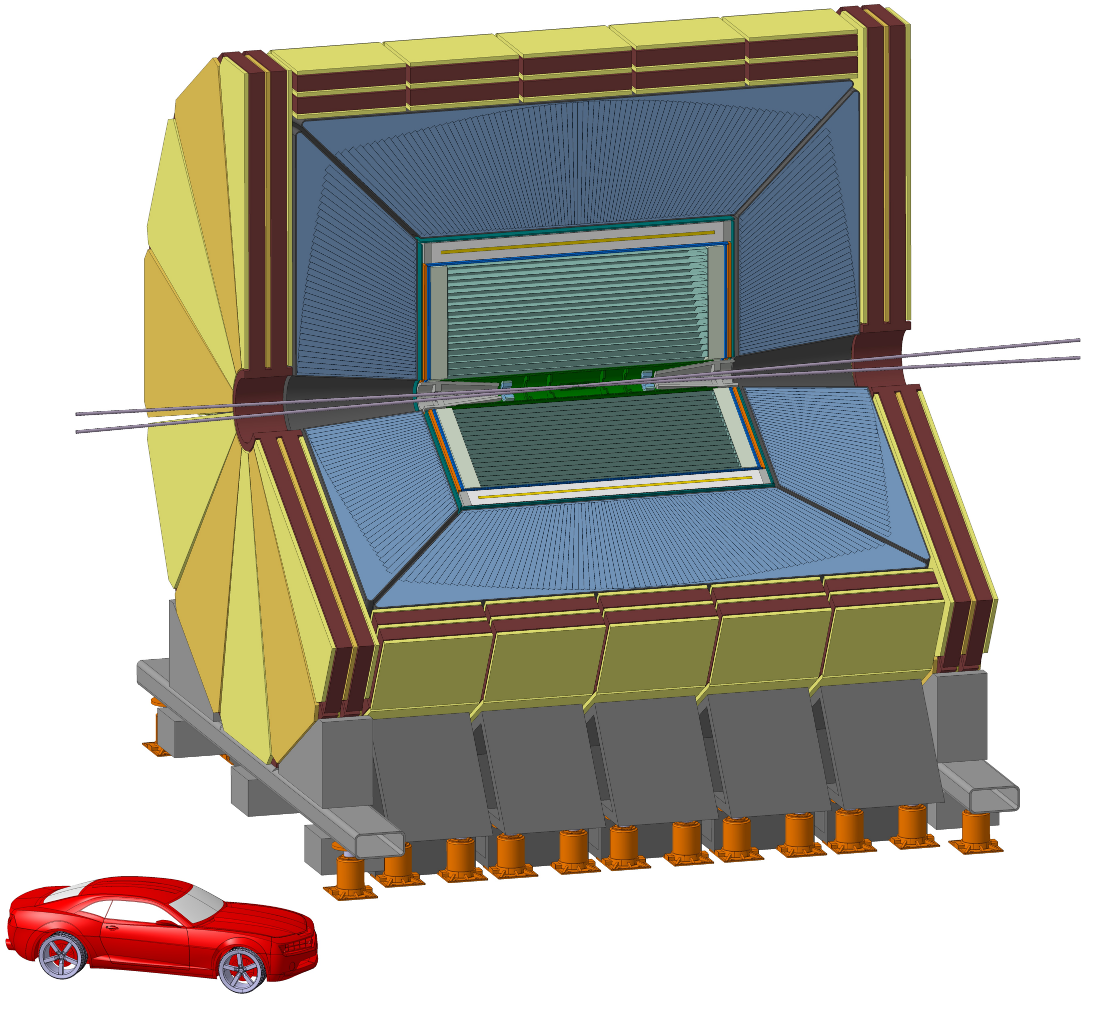

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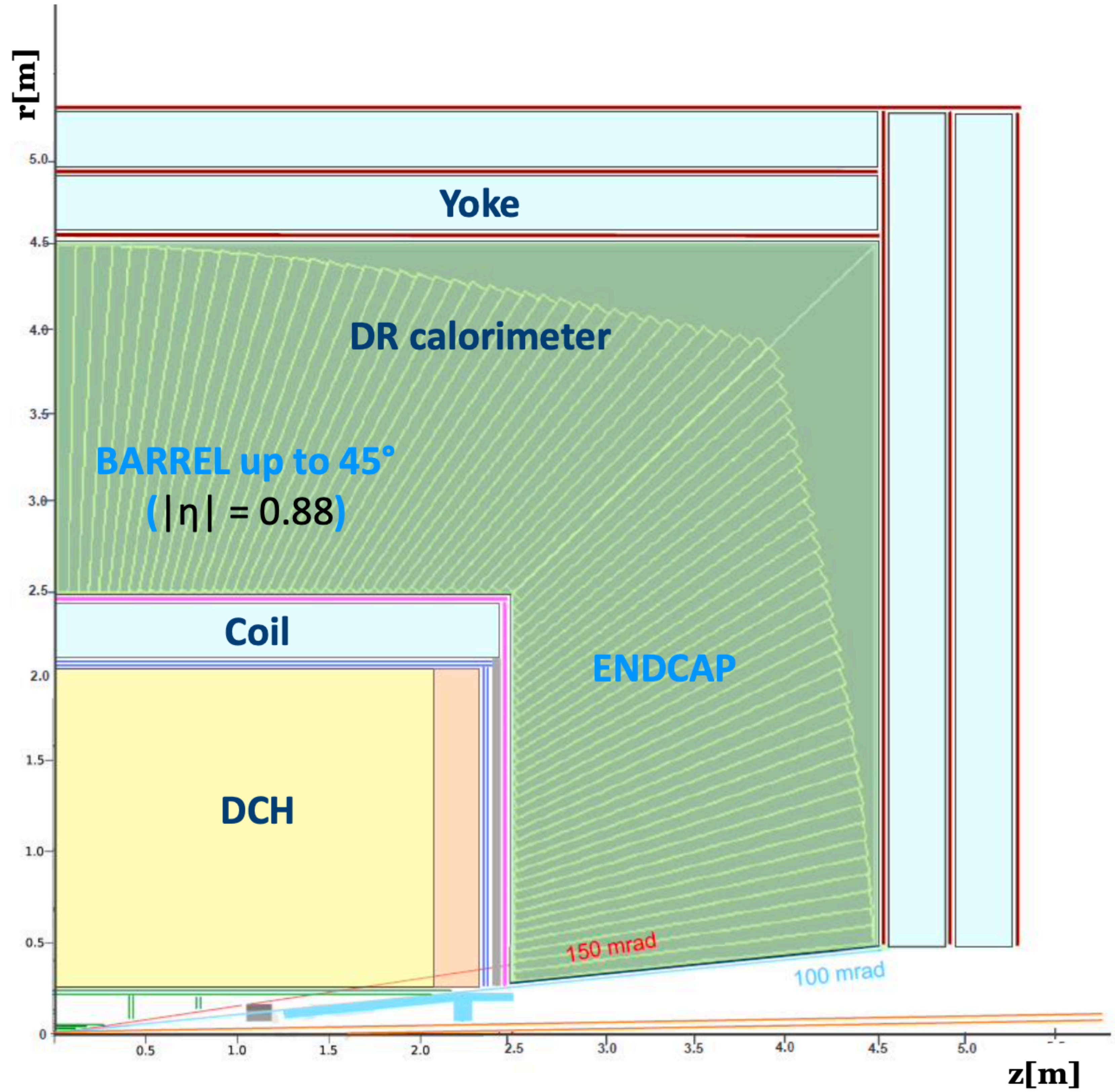

IDEA detector layout

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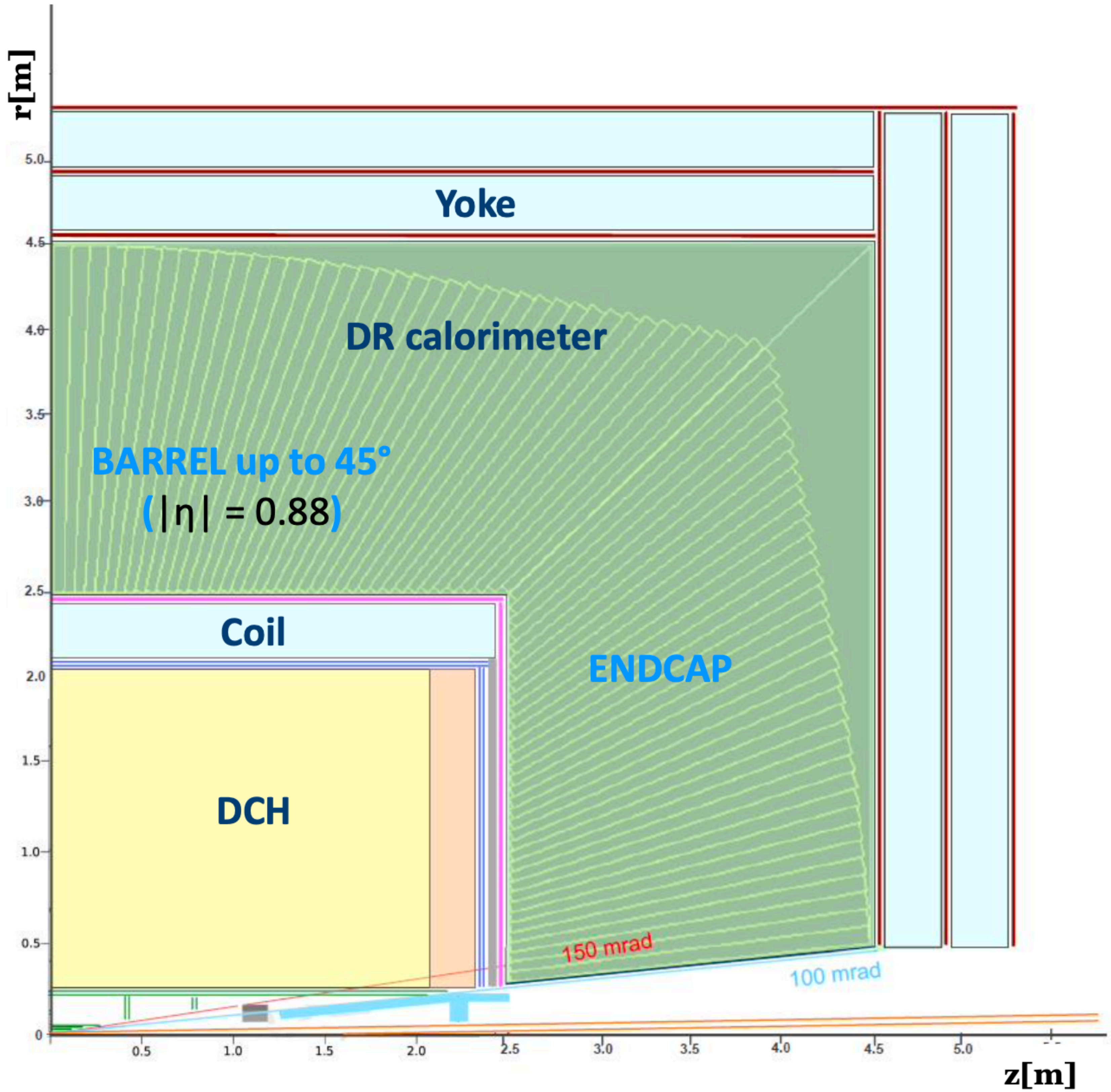

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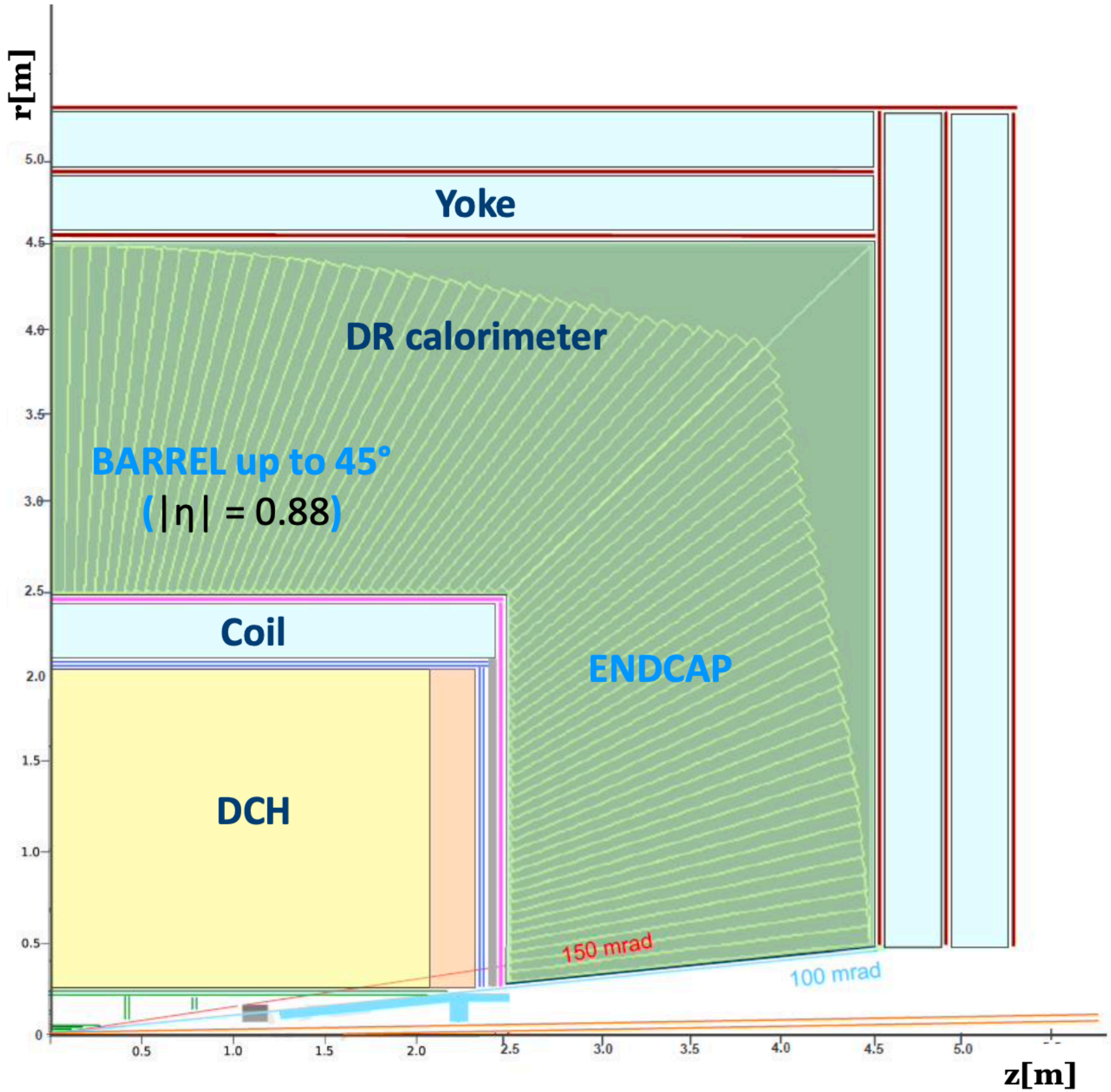

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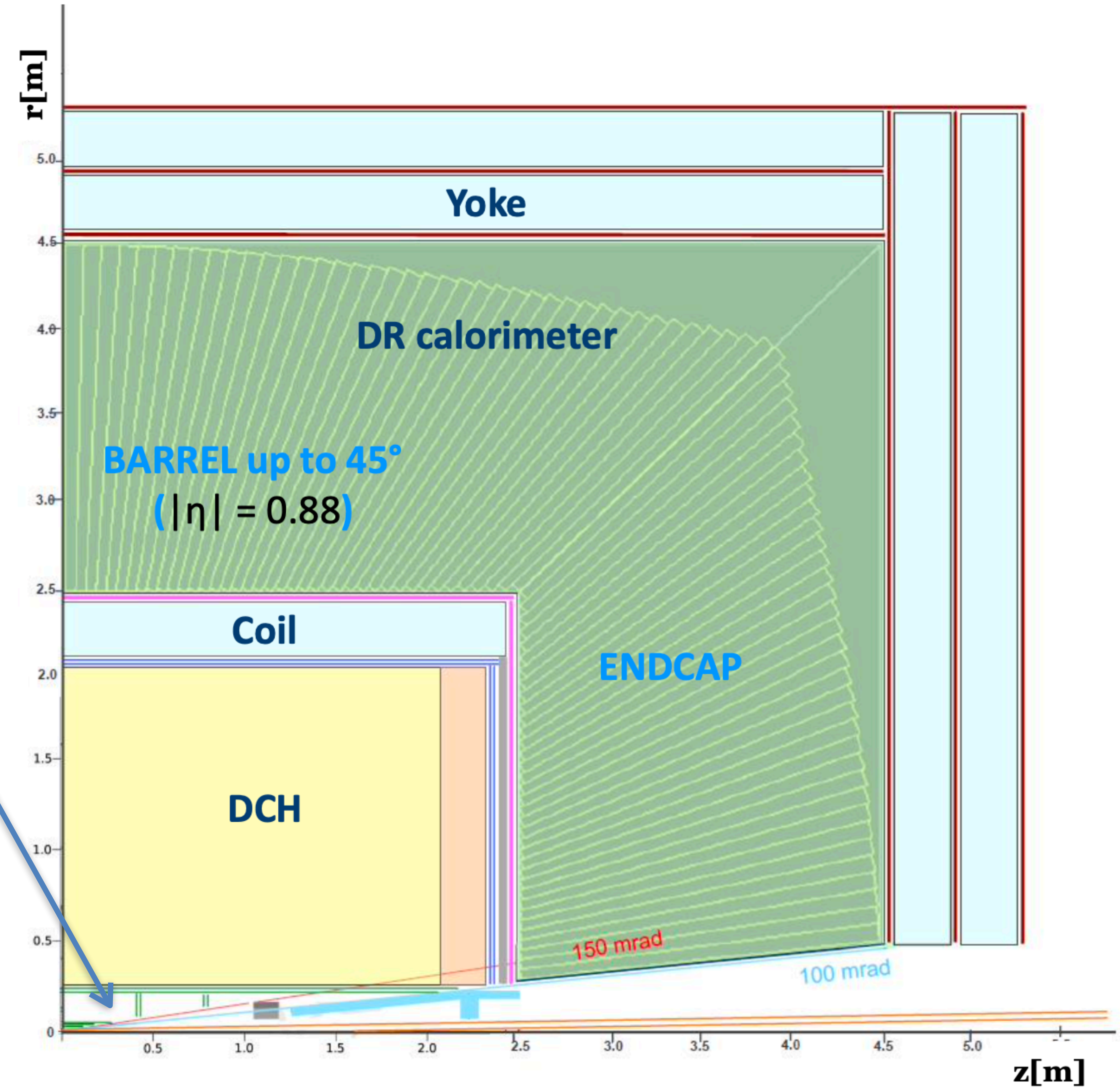

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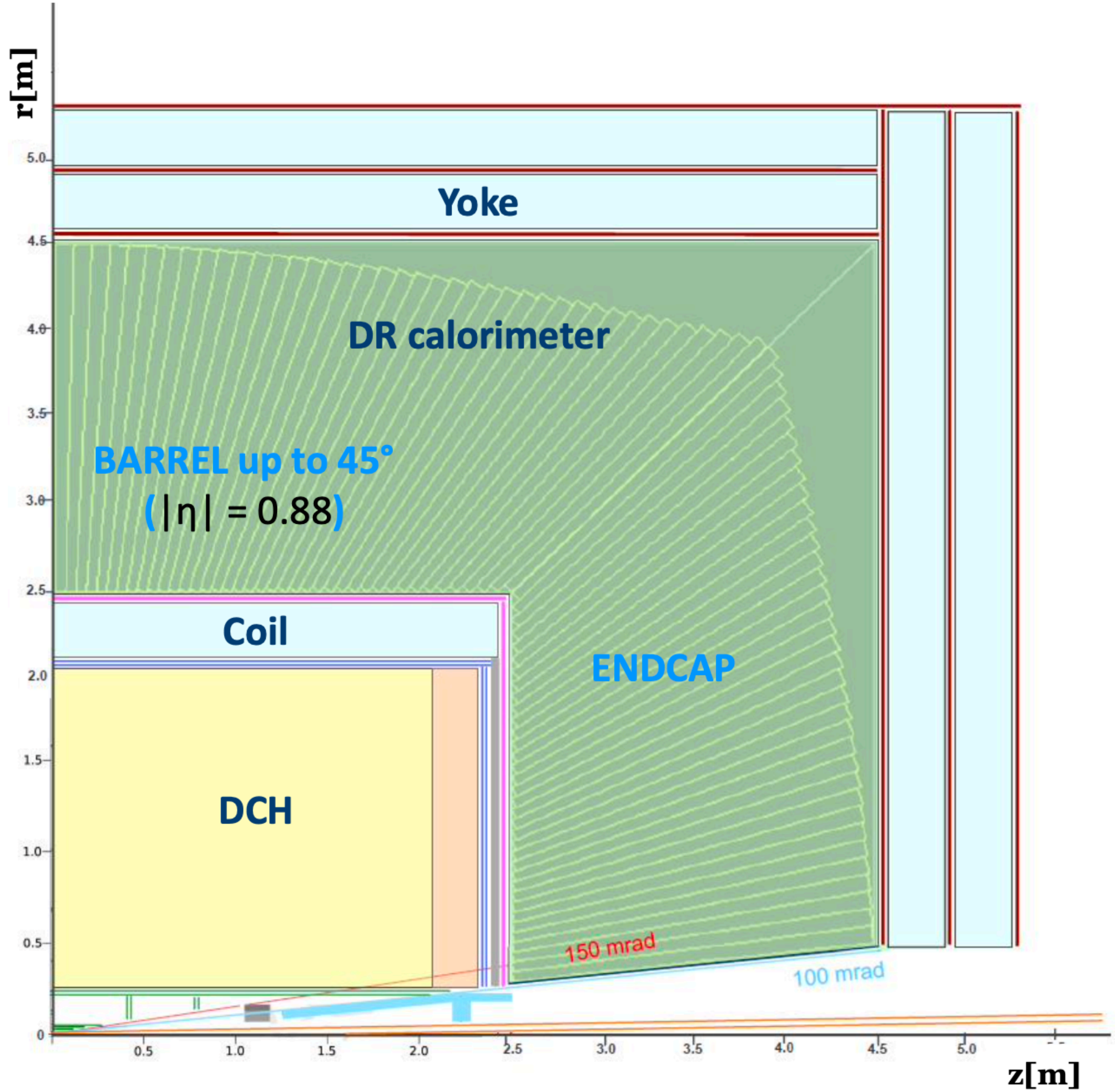

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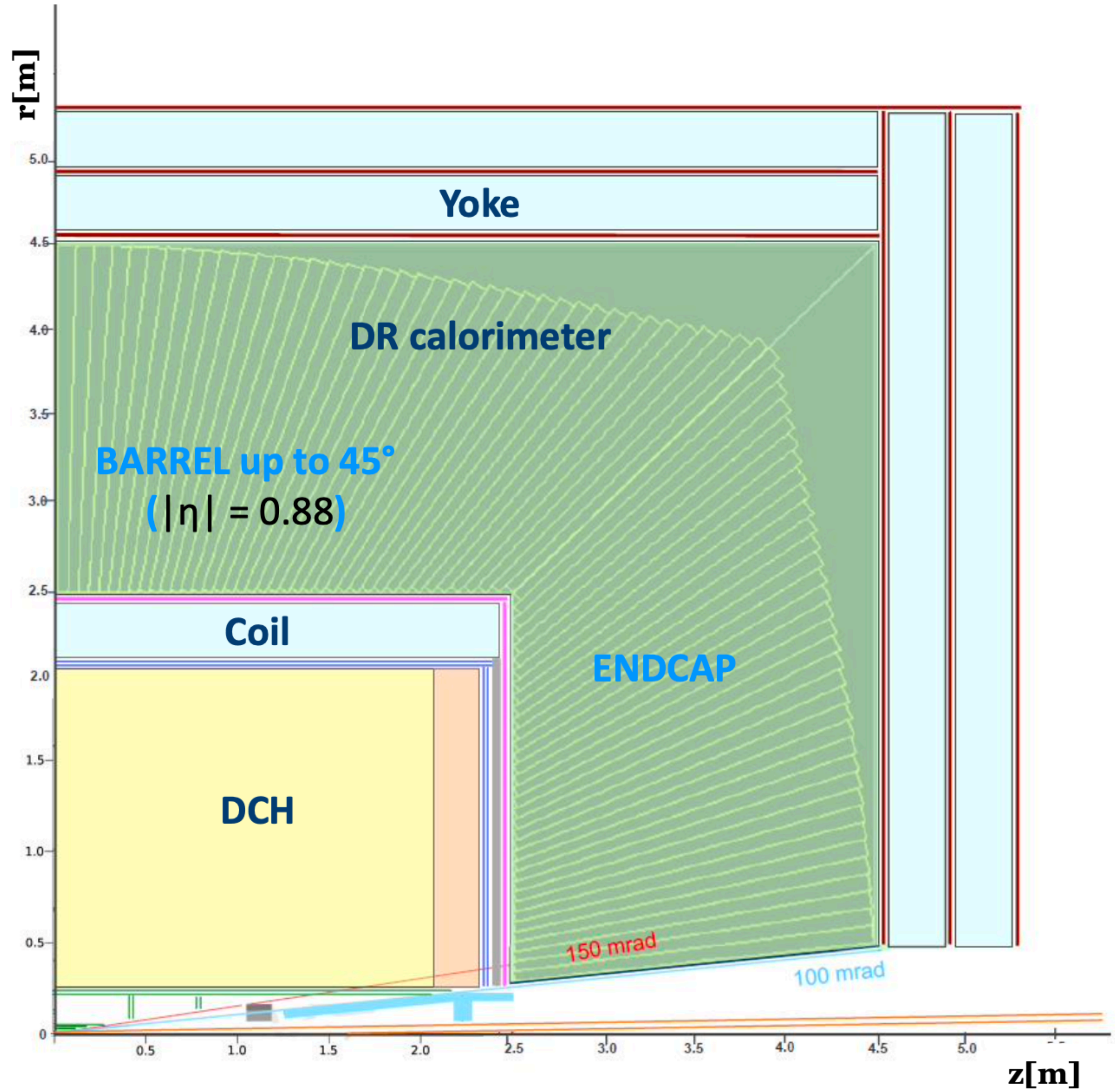
Drift Chamber*:* 112 layers

4 m long, R = 35-200 cm



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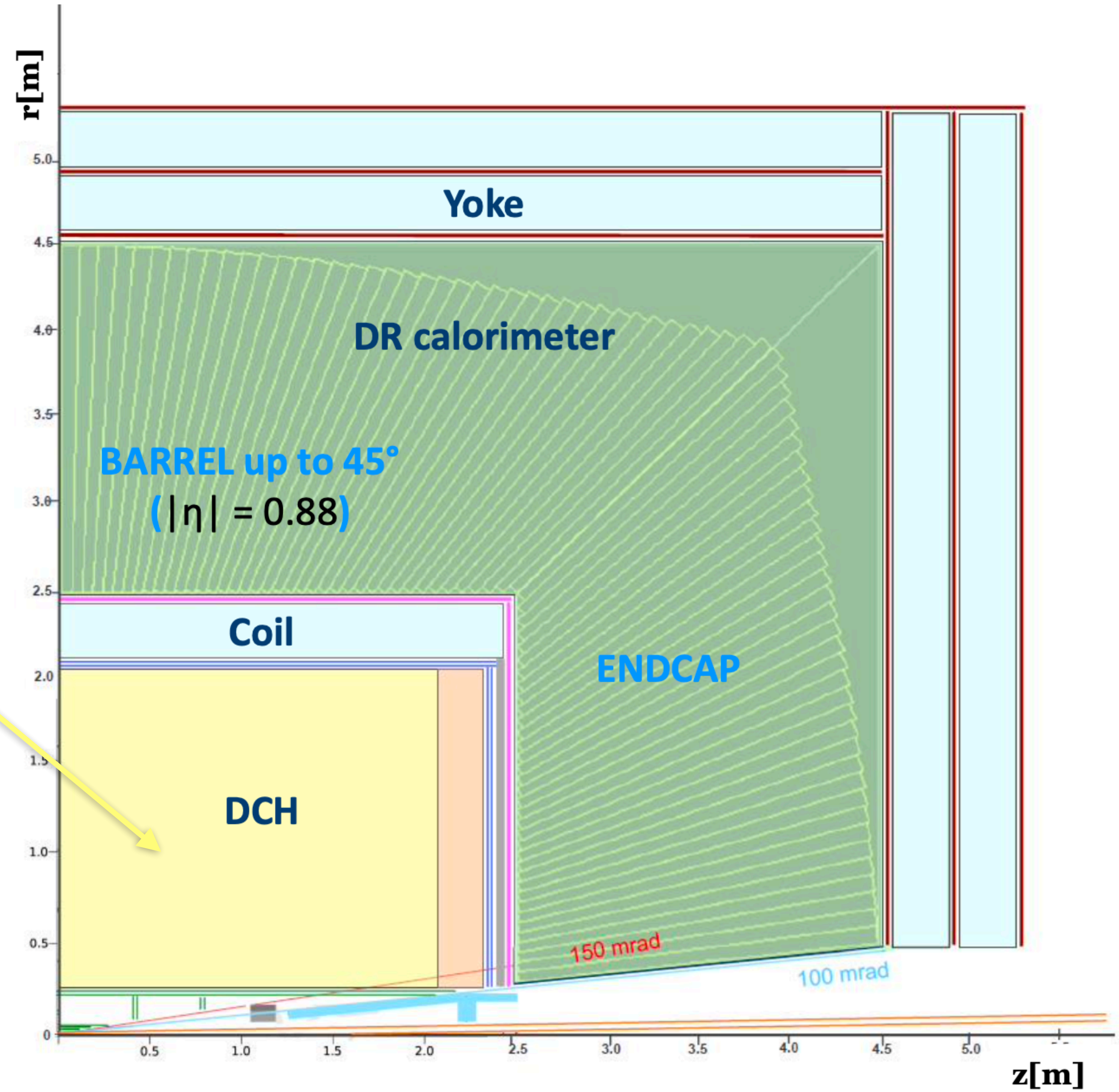

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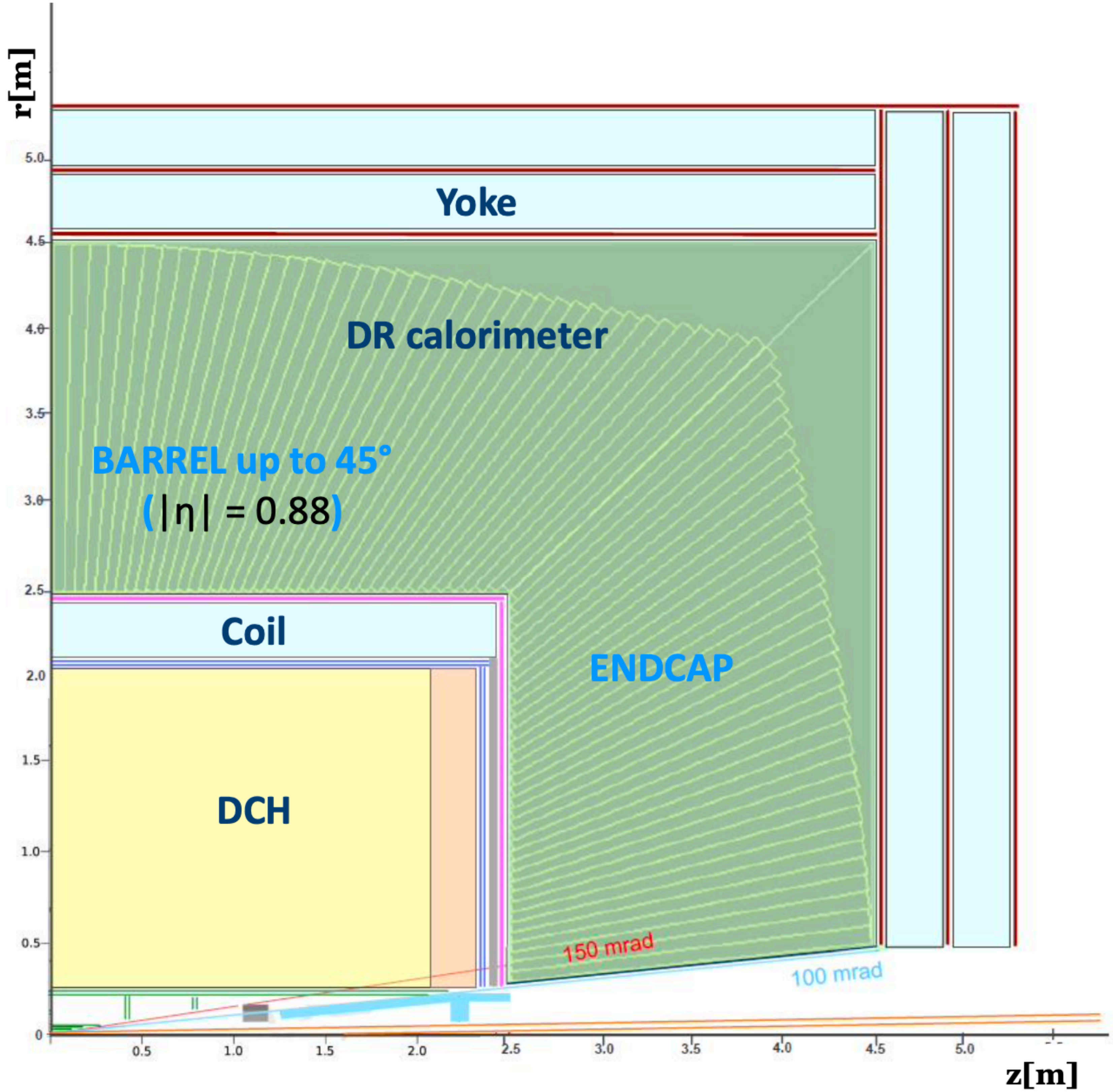

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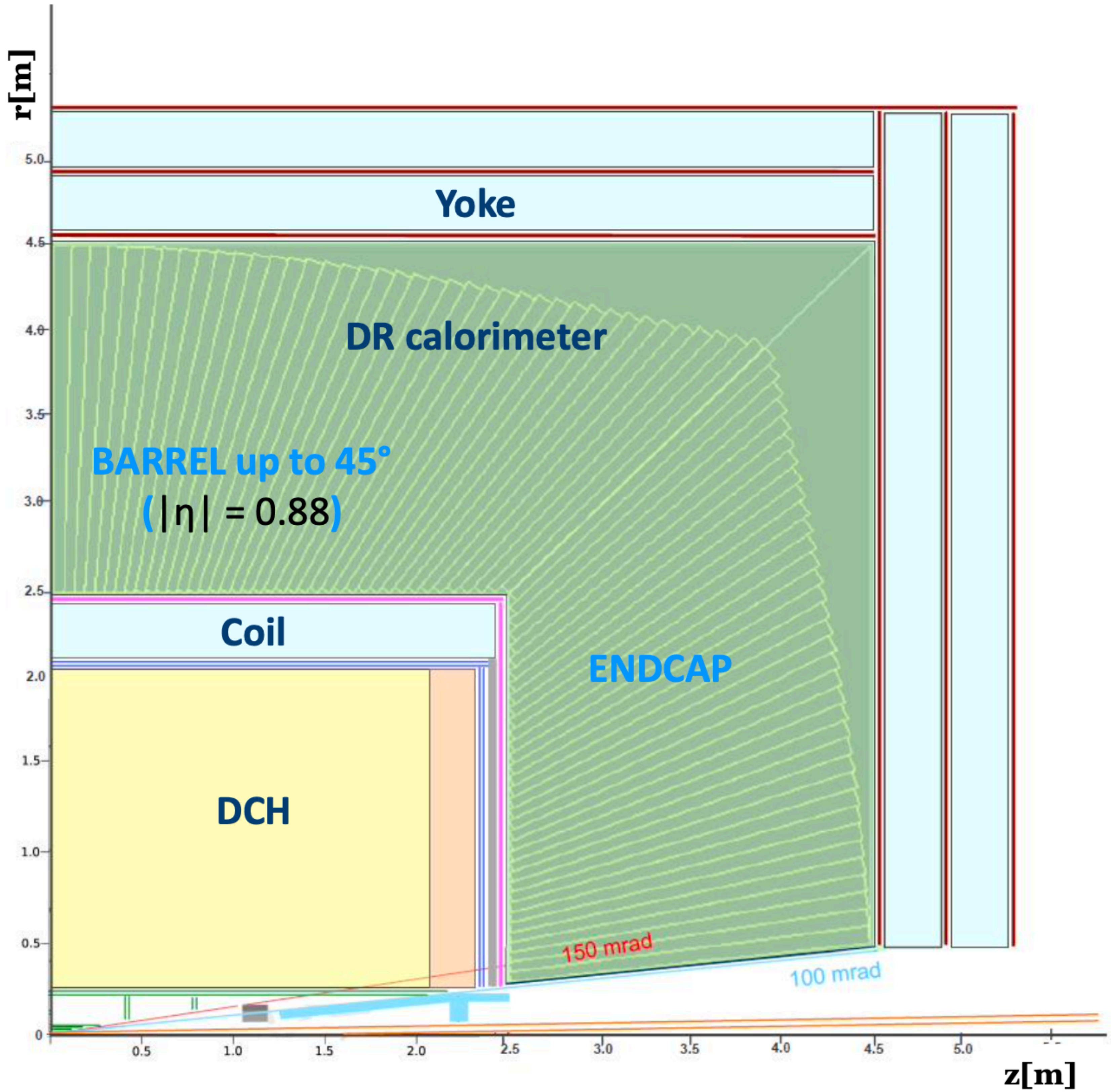

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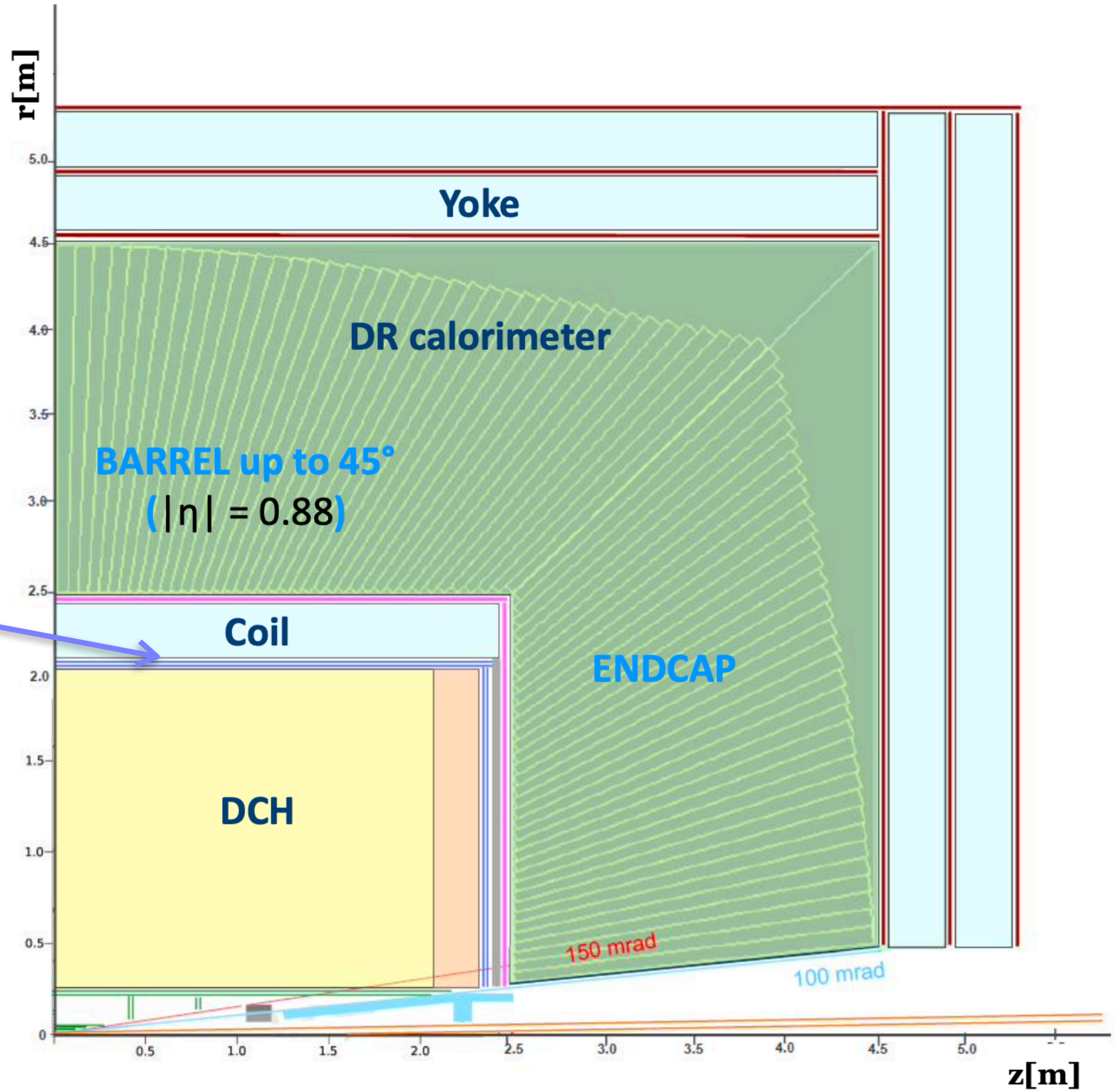

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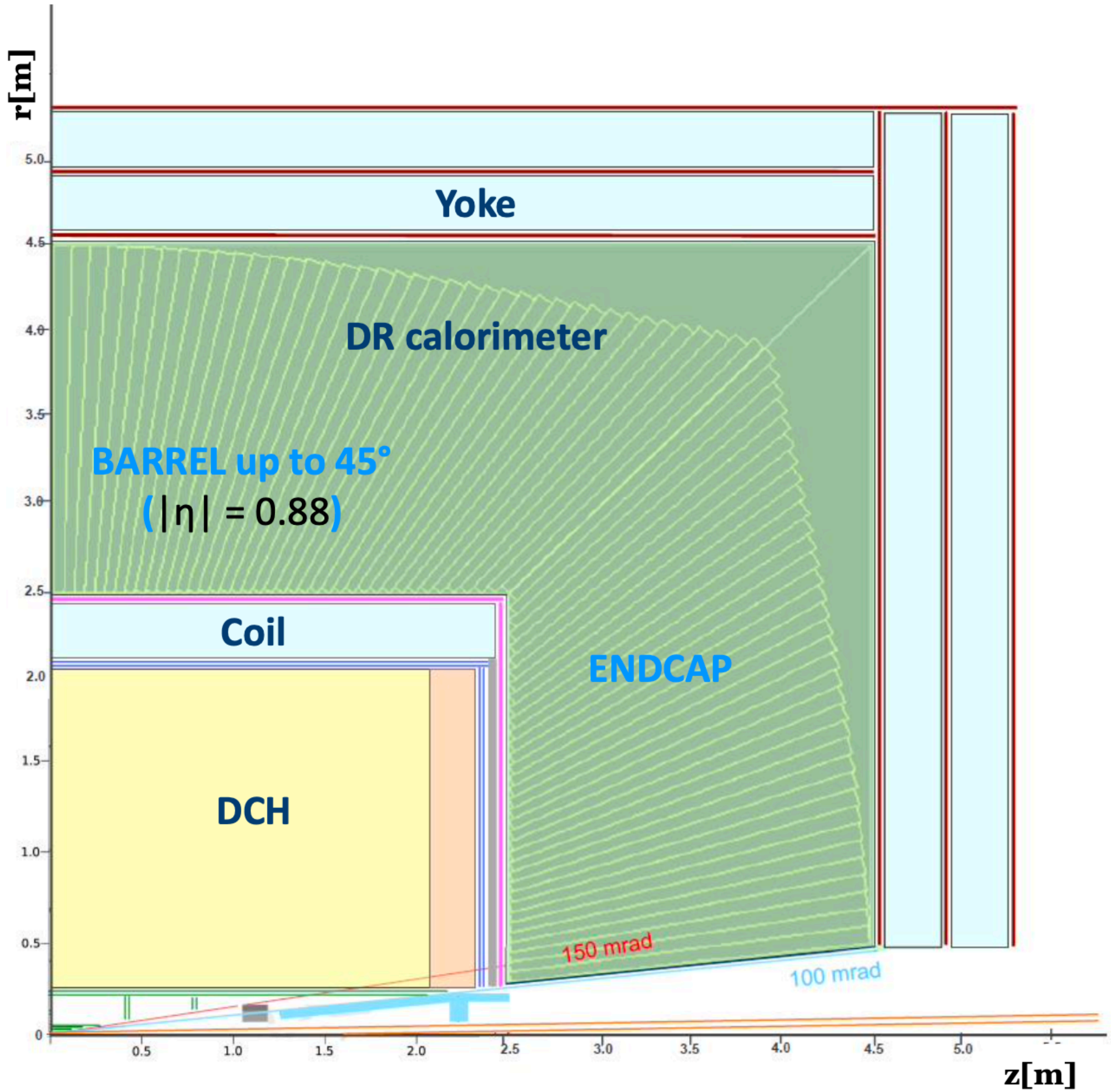

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2 T, R ~ 2.1-2.4 m

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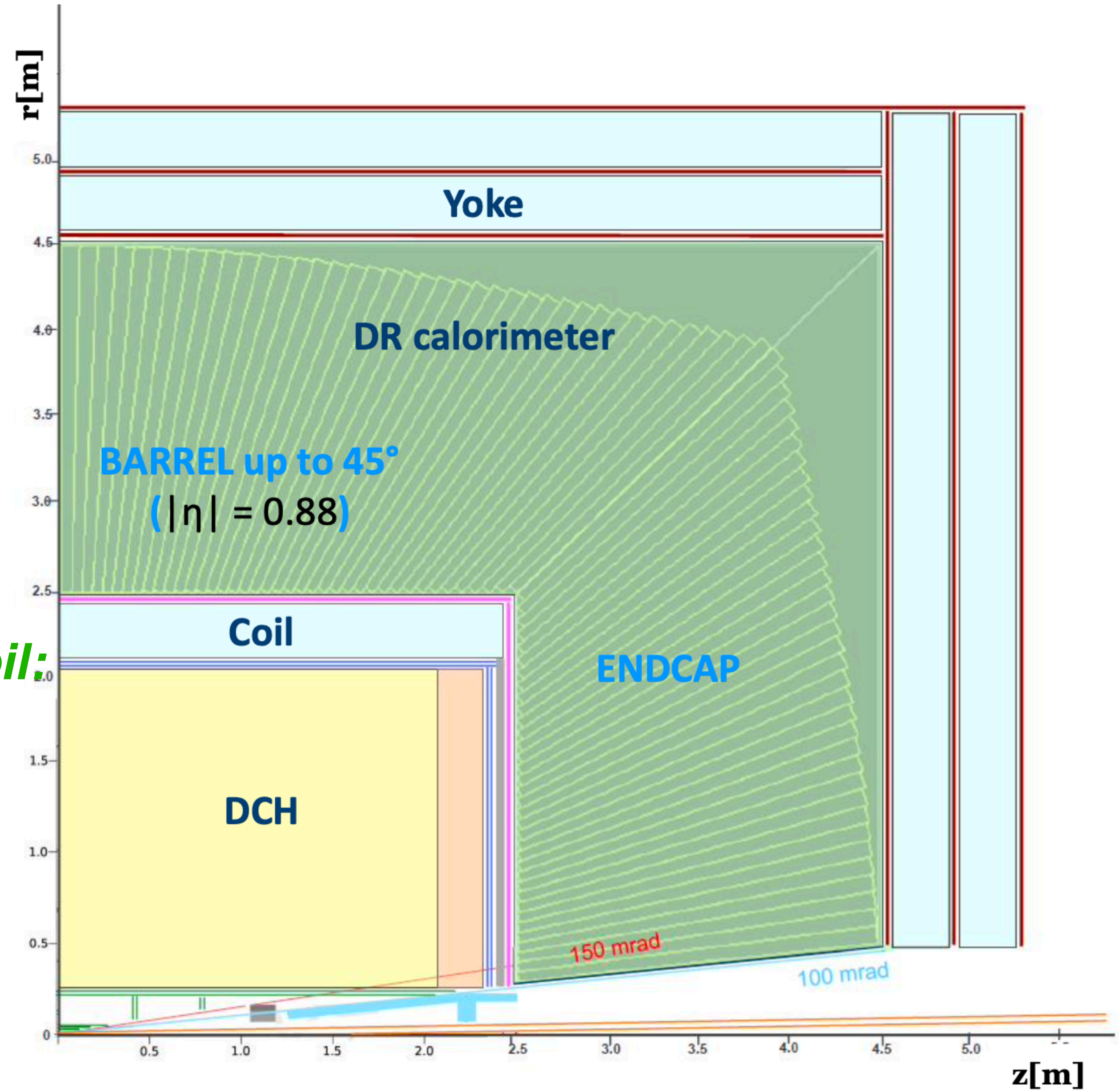

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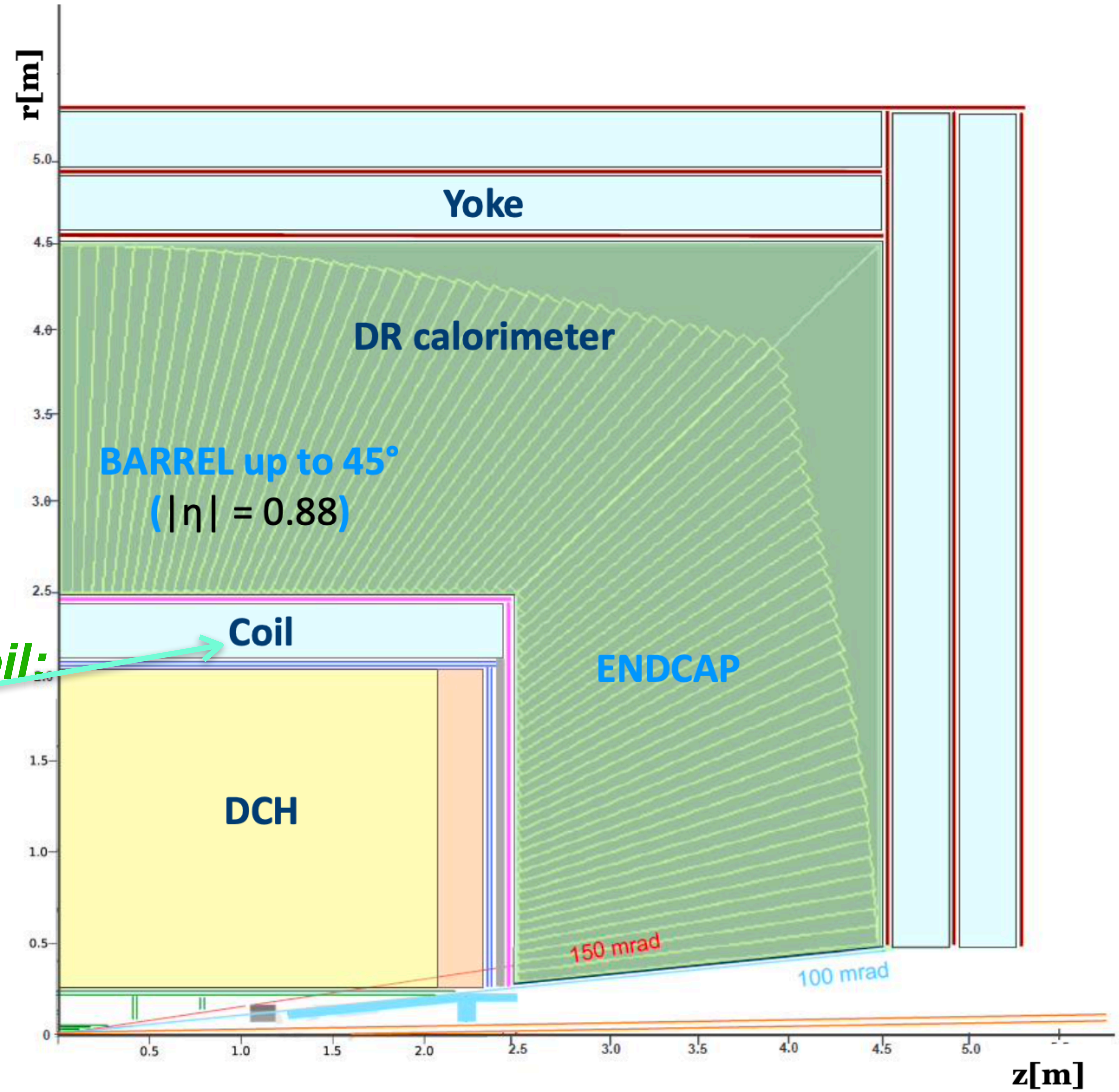

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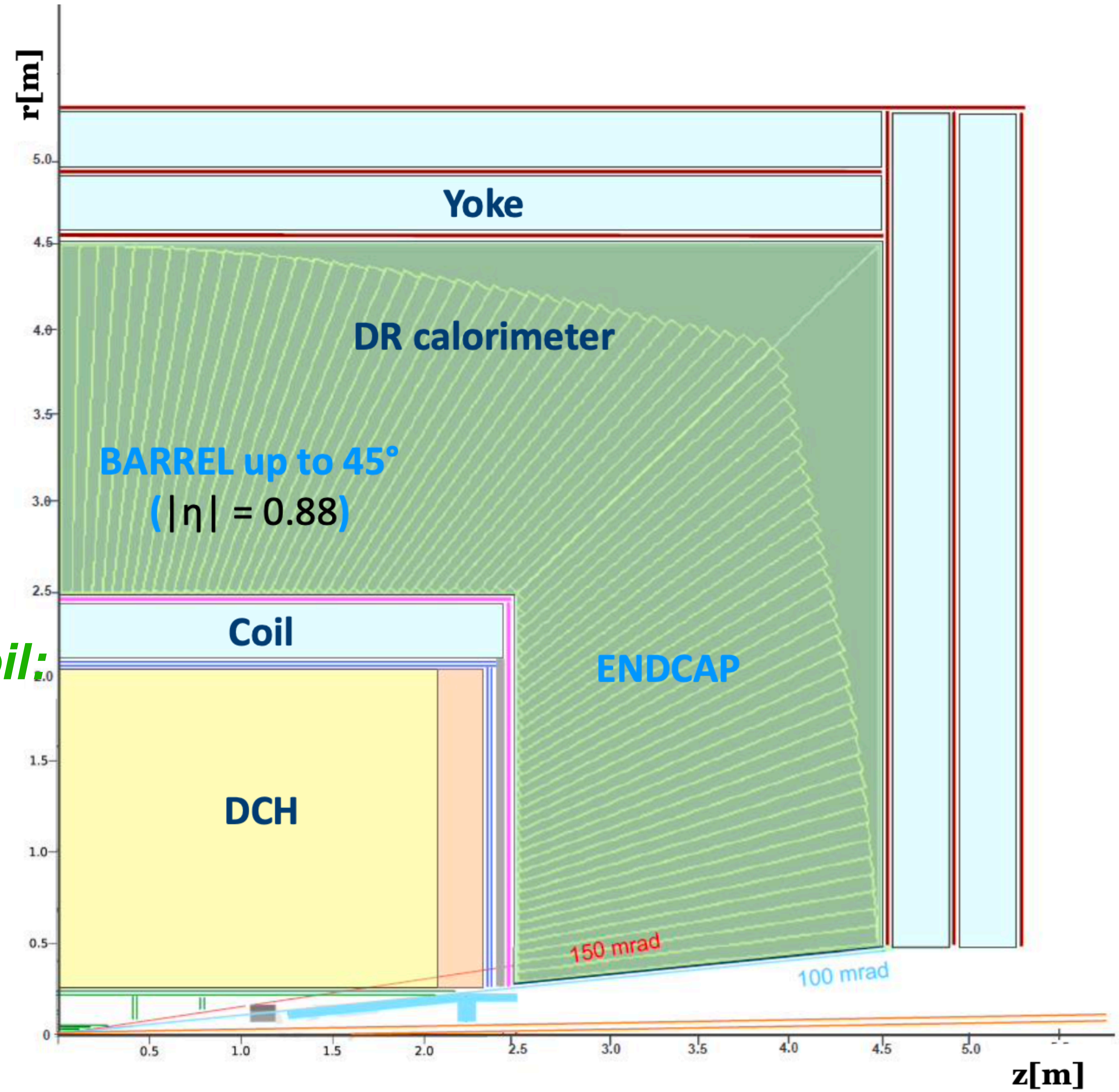

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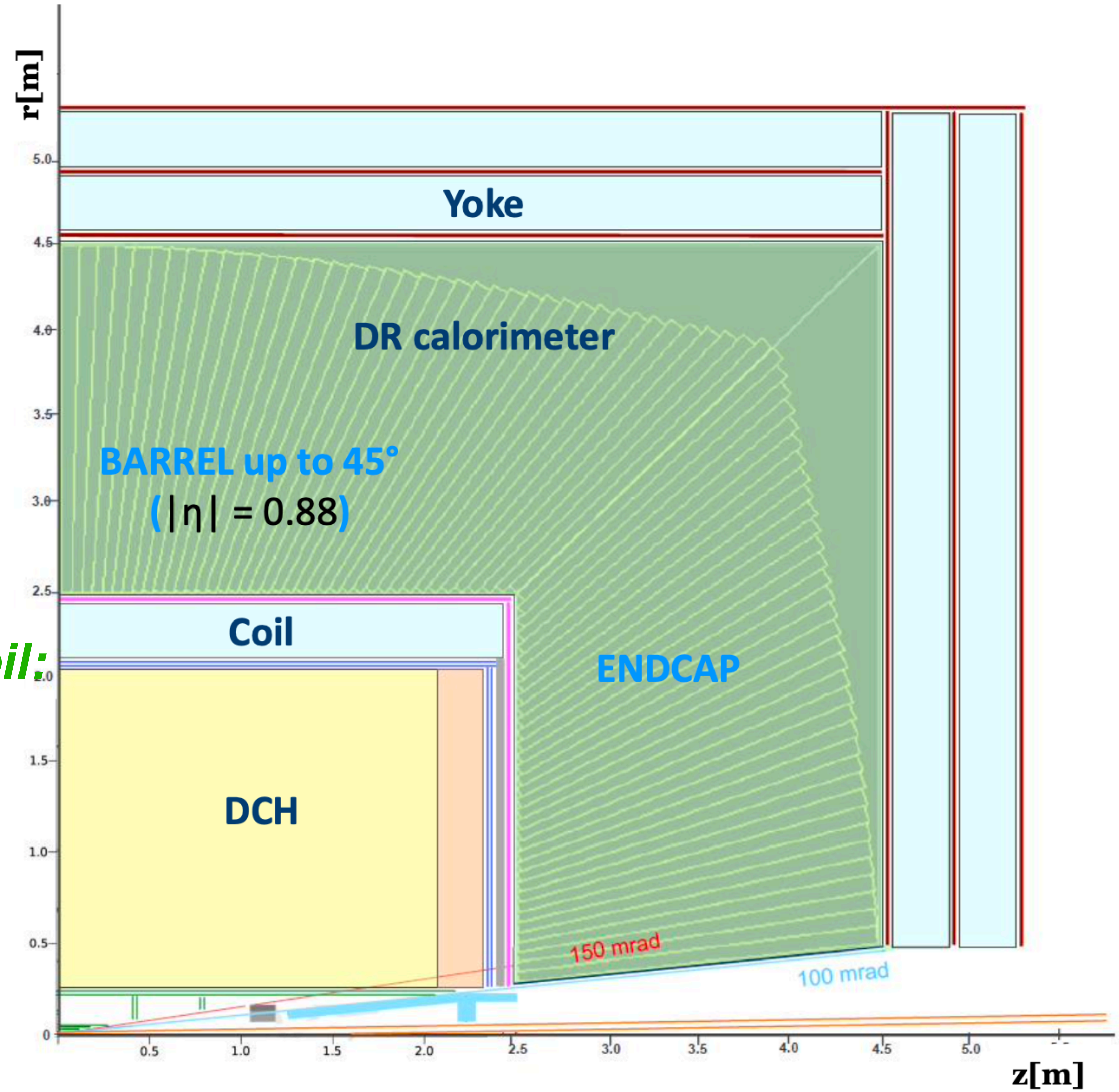

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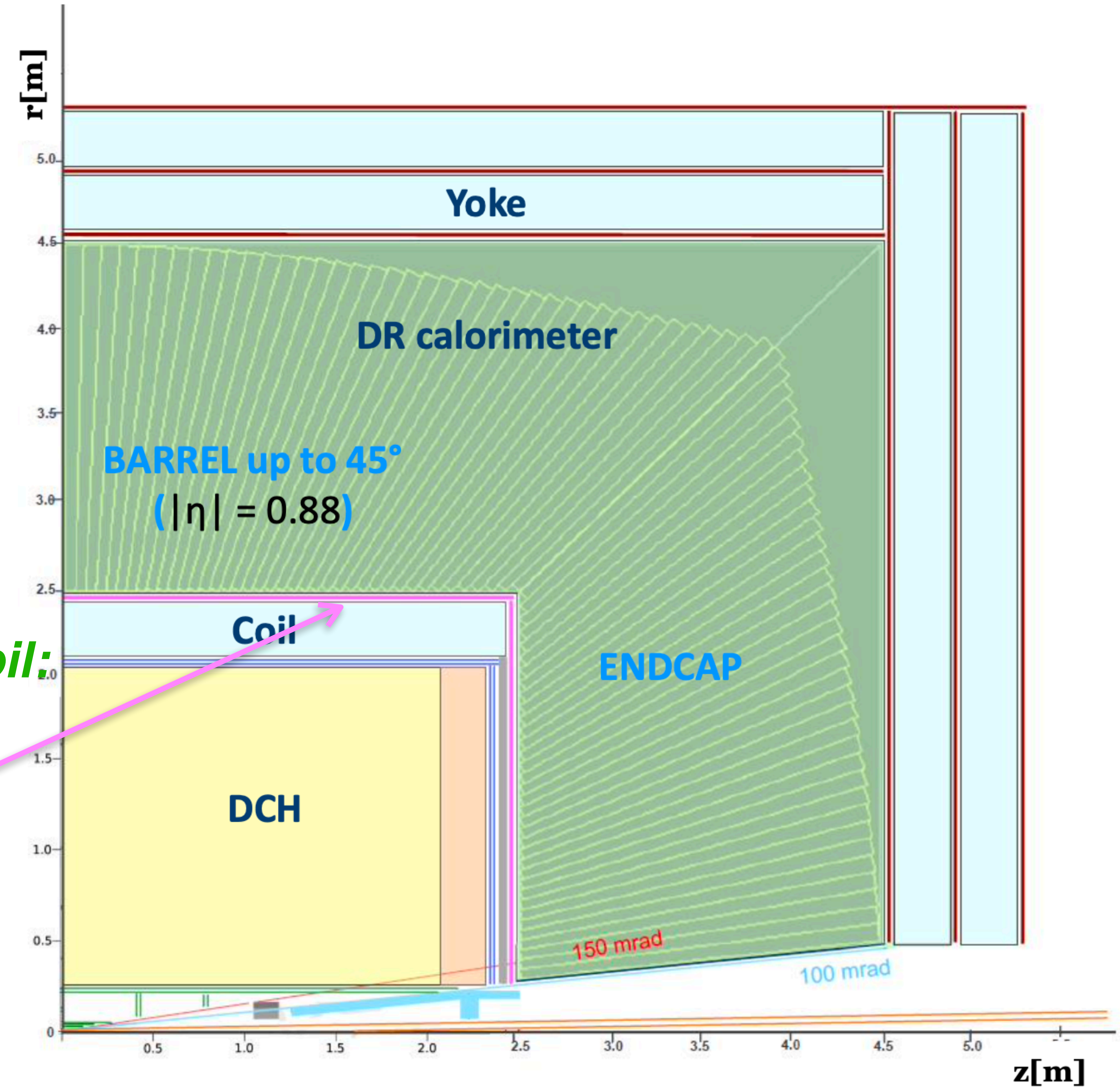

IDEA detector layout

Beam pipe: R~1.5 cm

Vertex:
5 MAPS layers
R = 1.7-34 cm

Drift Chamber: 112 layers
4 m long, R = 35-200 cm

Outer Silicon wrapper:
Si strips

Superconducting solenoid coil:
2 T, R ~ 2.1-2.4 m
0.74 X_0, 0.16 λ @ 90°

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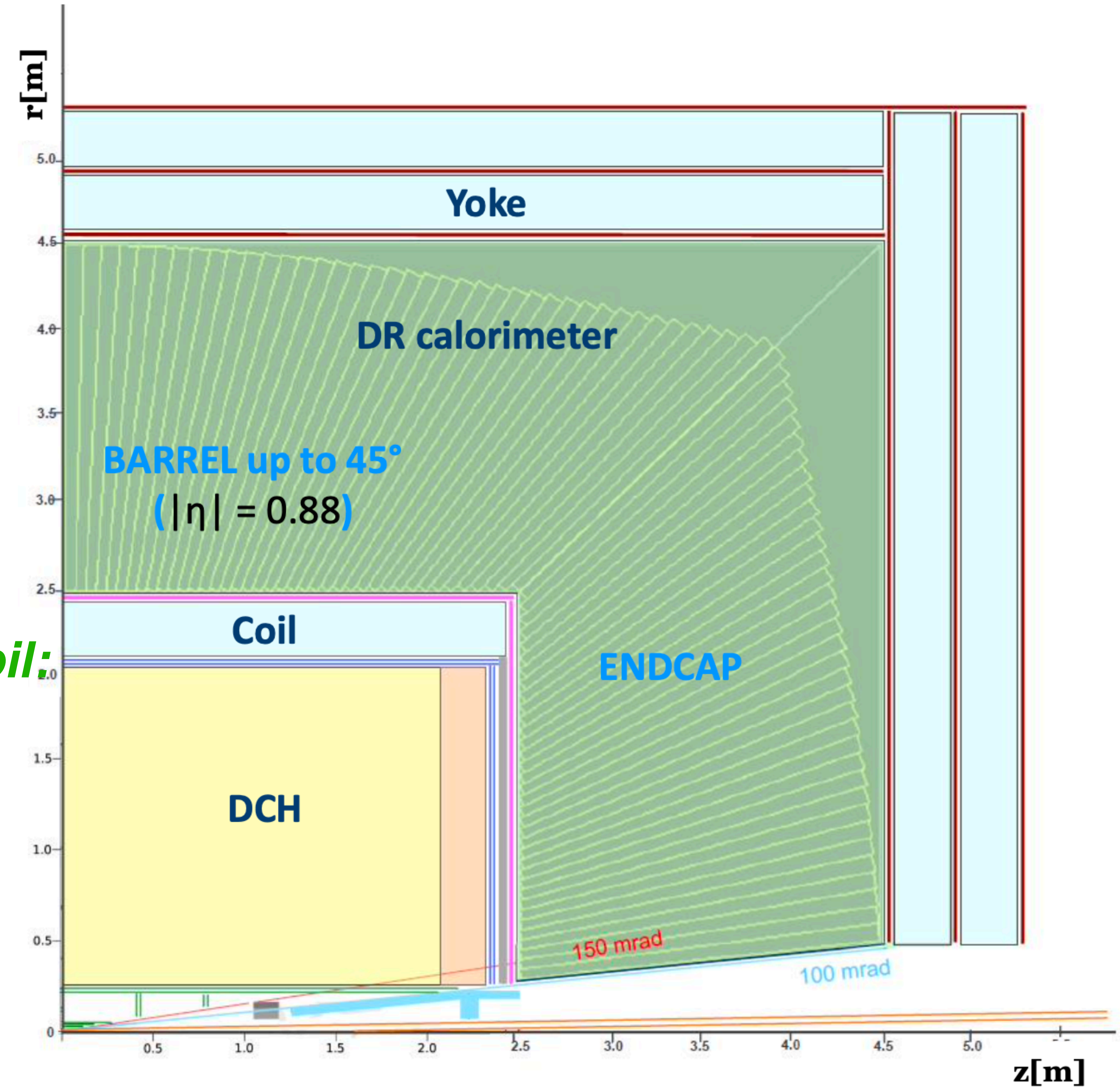

IDEA detector layout

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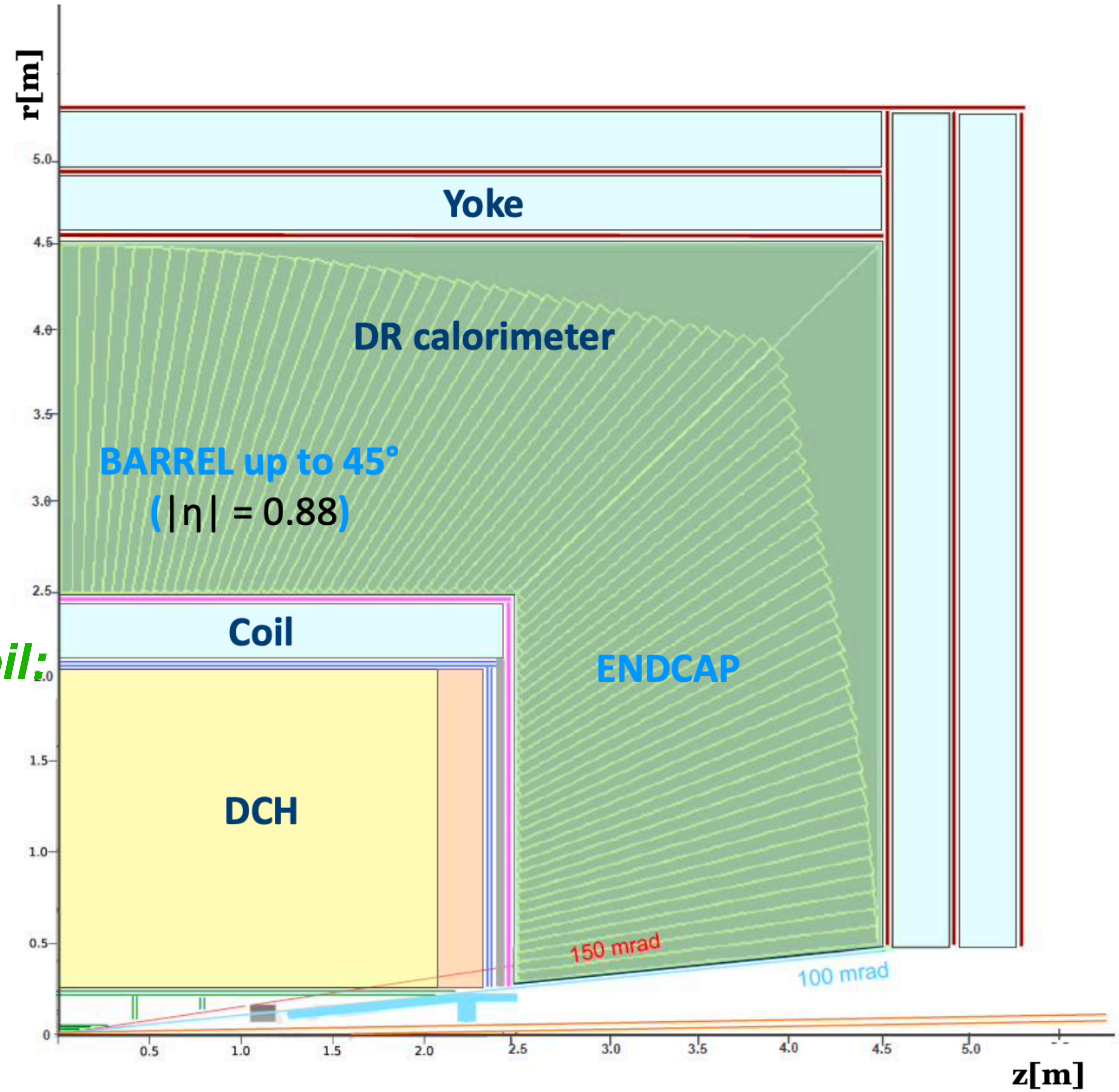
Dual-Readout Calorimeter*:*

2m / 7 λ_{int}



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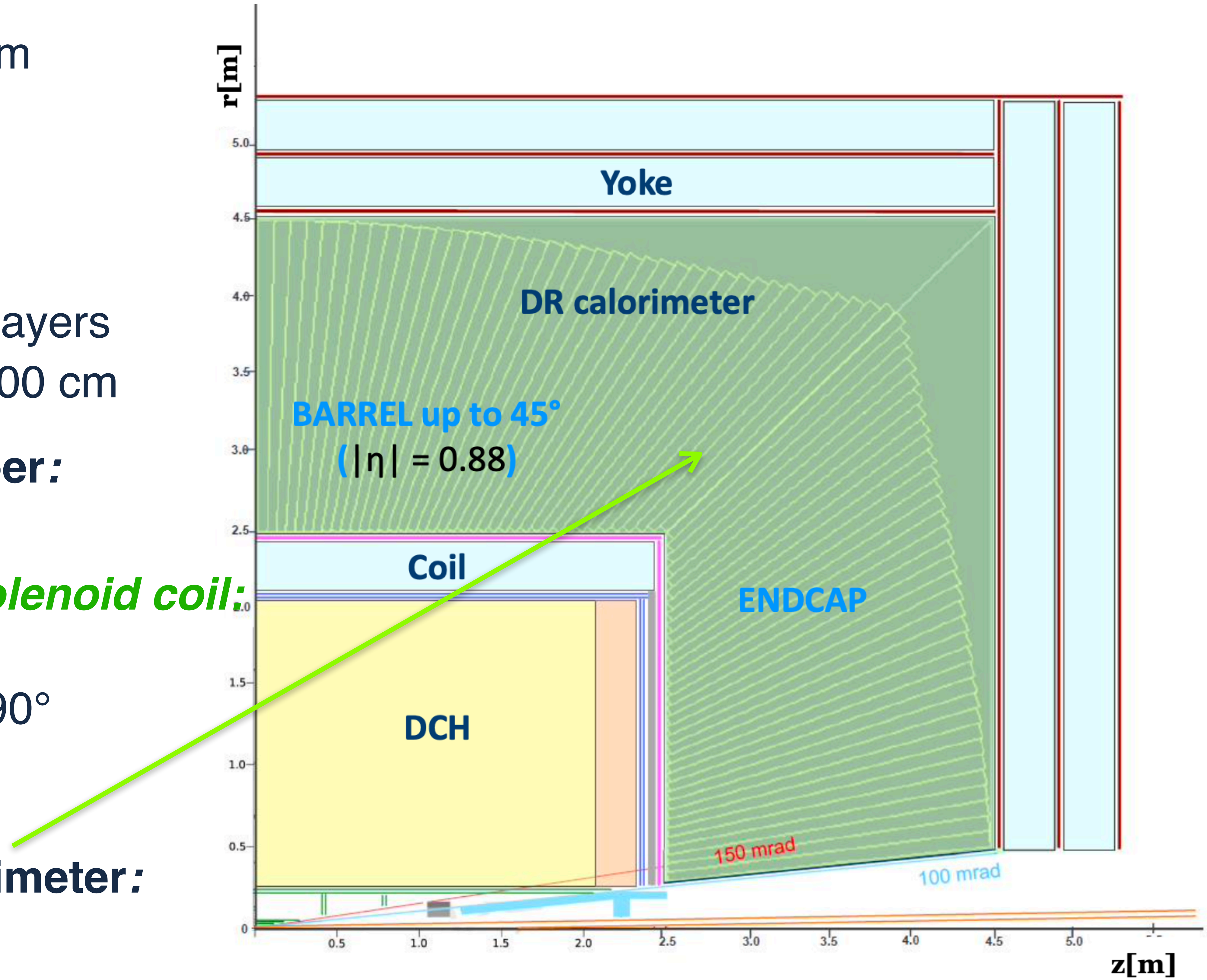

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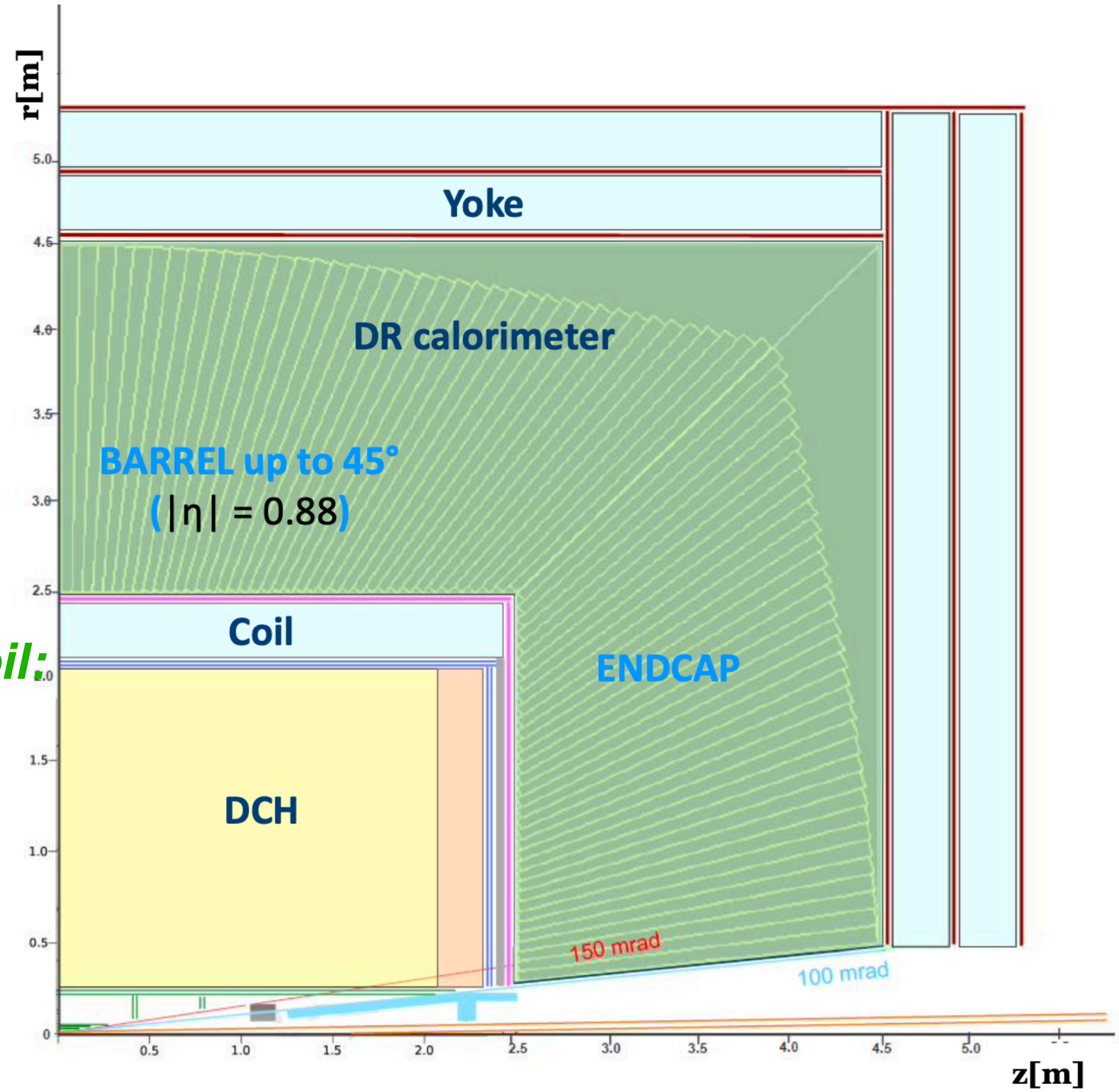

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- 5 MAPS layers
- R = 1.7-34 cm

Drift Chamber*:* 112 layers
- 4 m long, R = 35-200 cm

Outer Silicon wrapper*:*
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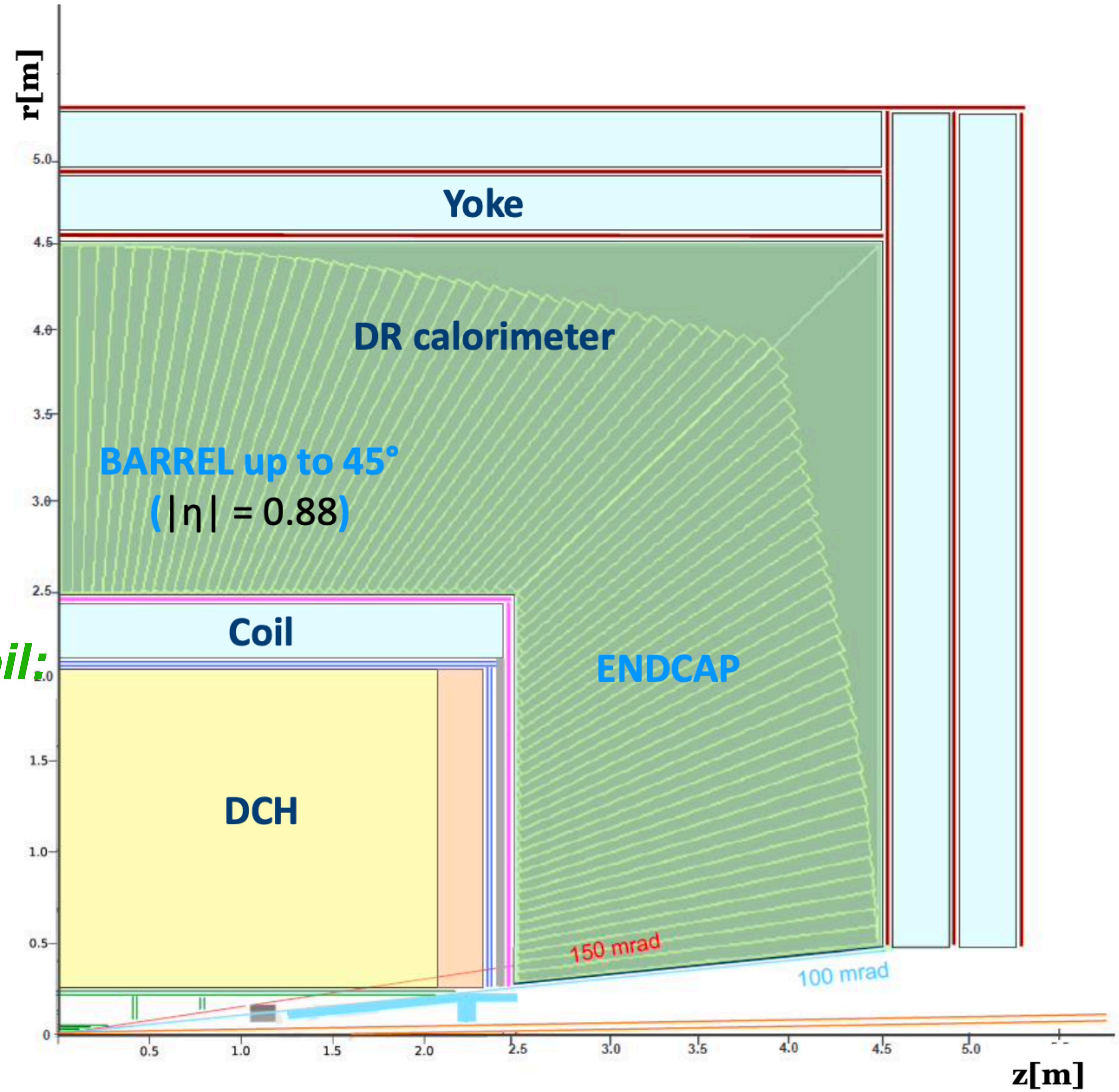
Superconducting solenoid coil:
- ***2 T***, R ~ 2.1-2.4 m
- ***$0.74\ X_0$, $0.16\ \lambda$*** @ 90°

Preshower*:* ~1 X_0

Dual-Readout Calorimeter*:*
- 2m / 7 λ_{int}

Yoke + Muon chambers



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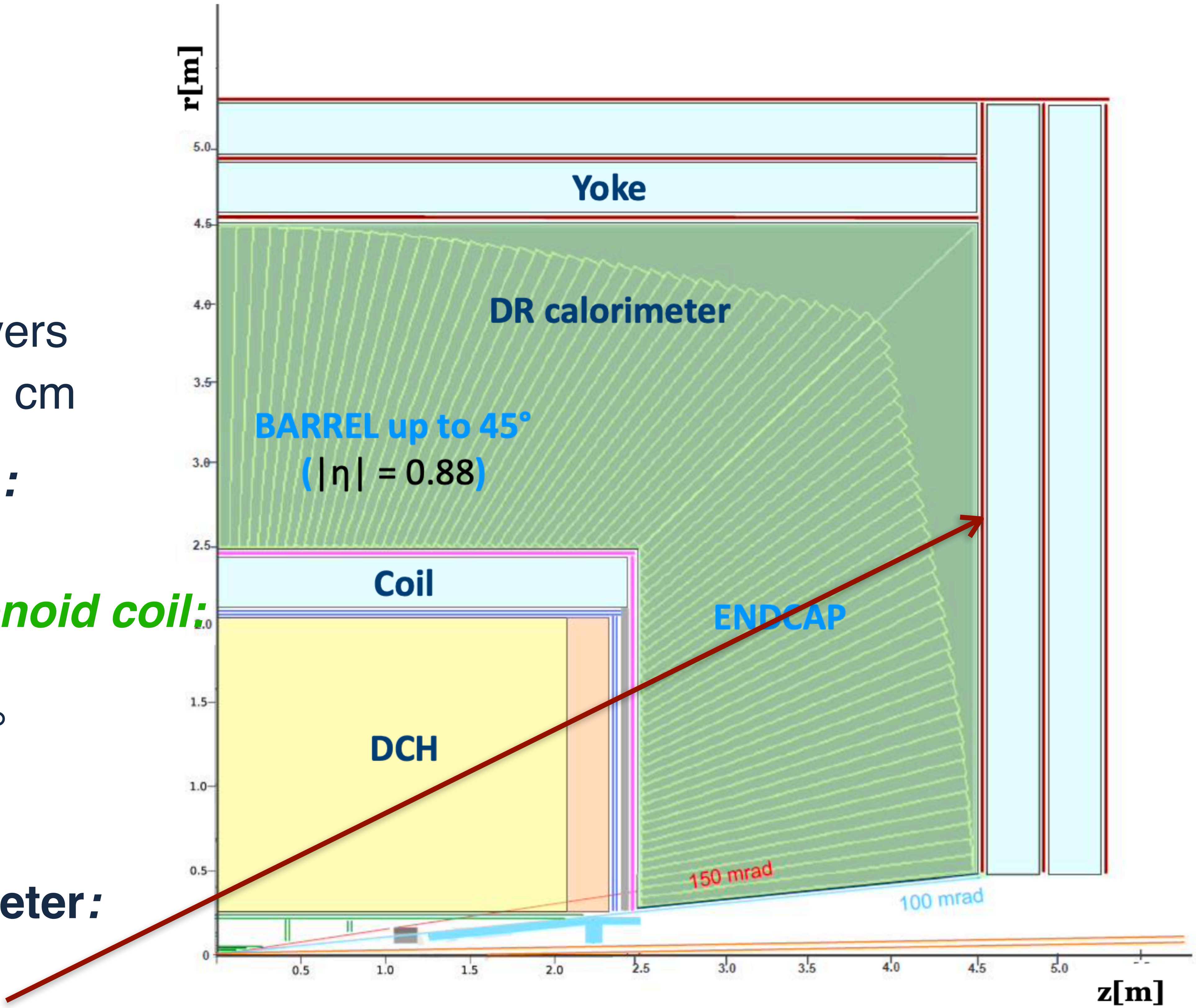

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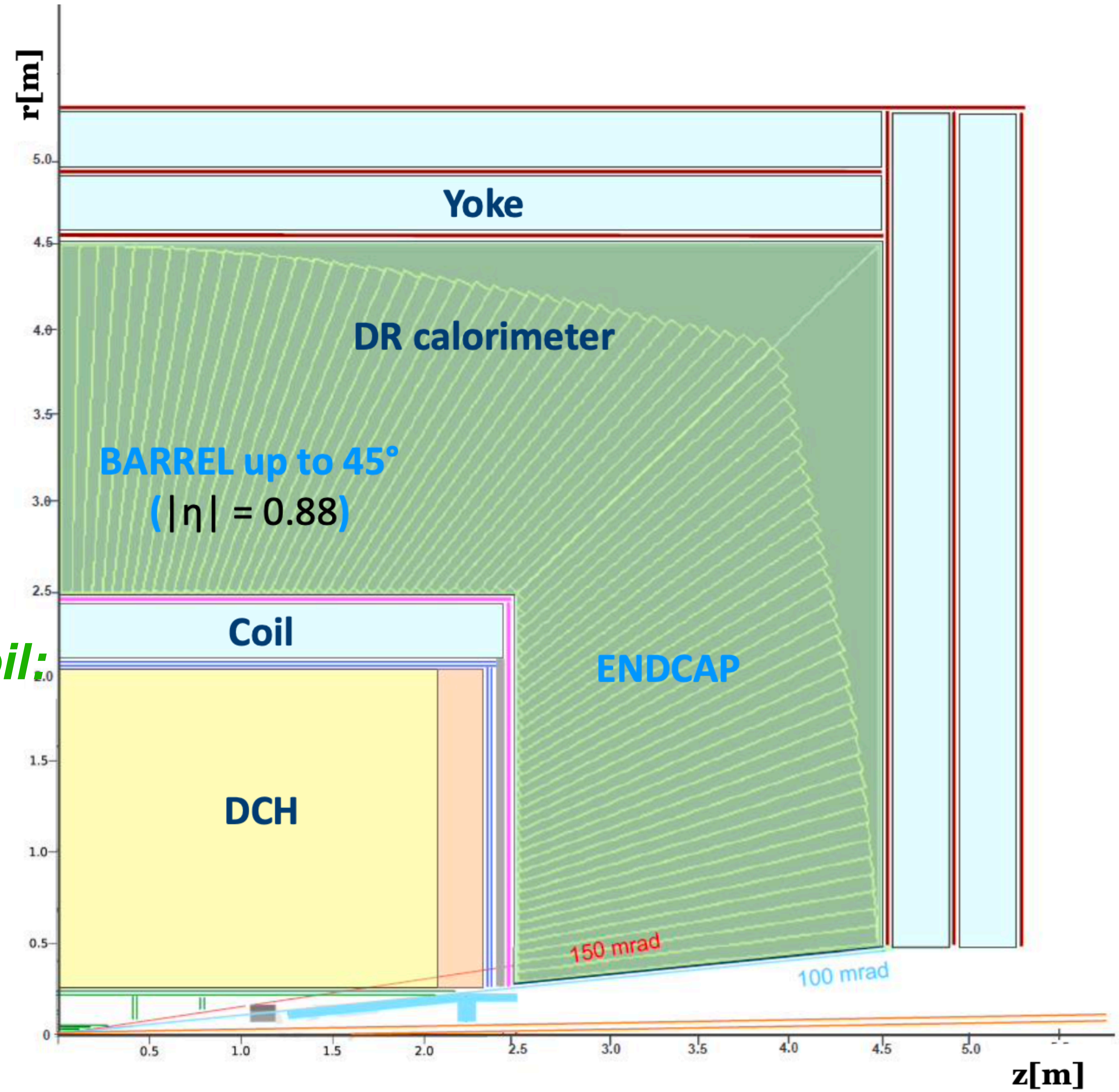
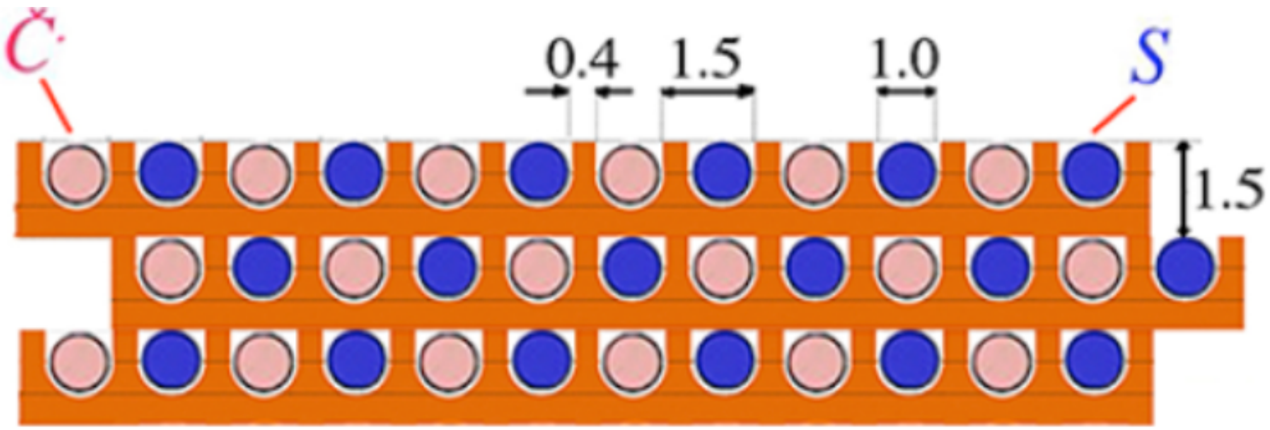
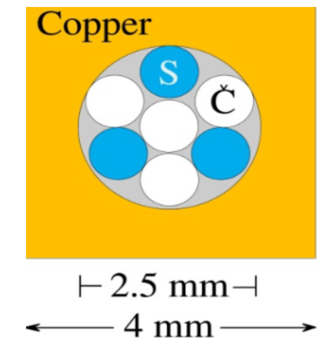


IDEA Dual Readout calorimeter



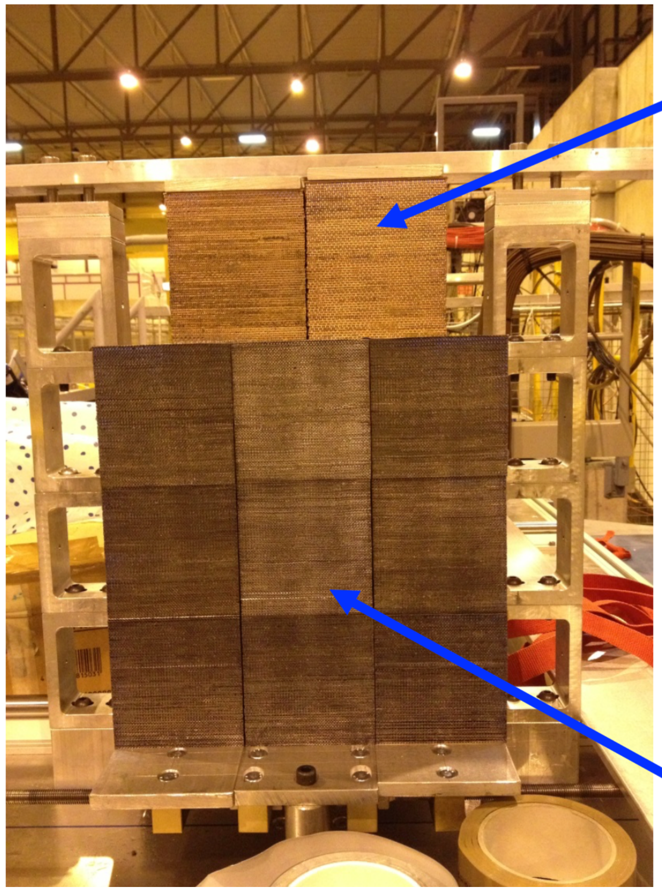
Alternate
Cherenkov fibers
Scintillating fibers

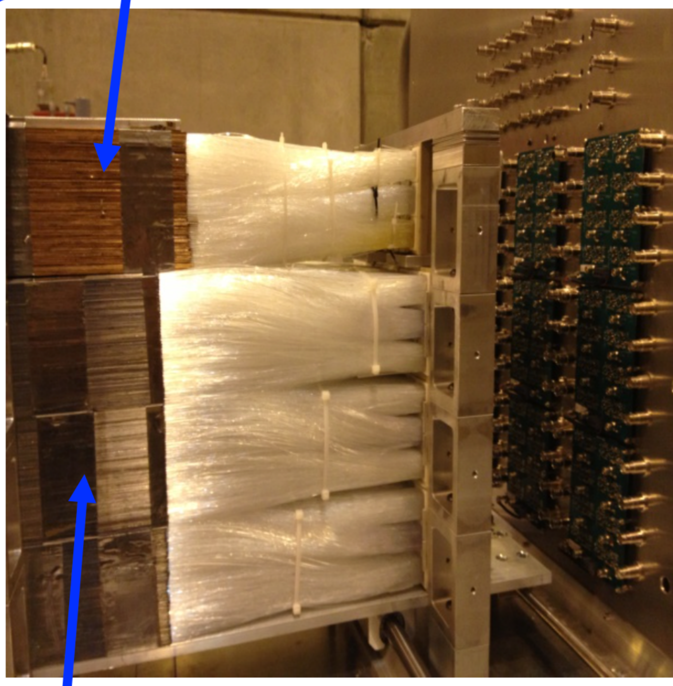


"Building block" of the DREAM calorimeter

2m long (10 λ_{int}) [5130 blocks, ≈ 16 cm radius]
$R_{Molière}$ = 20.4 mm

A Dual Readout calorimeter prototype (looks like a spaghetti calorimeter)





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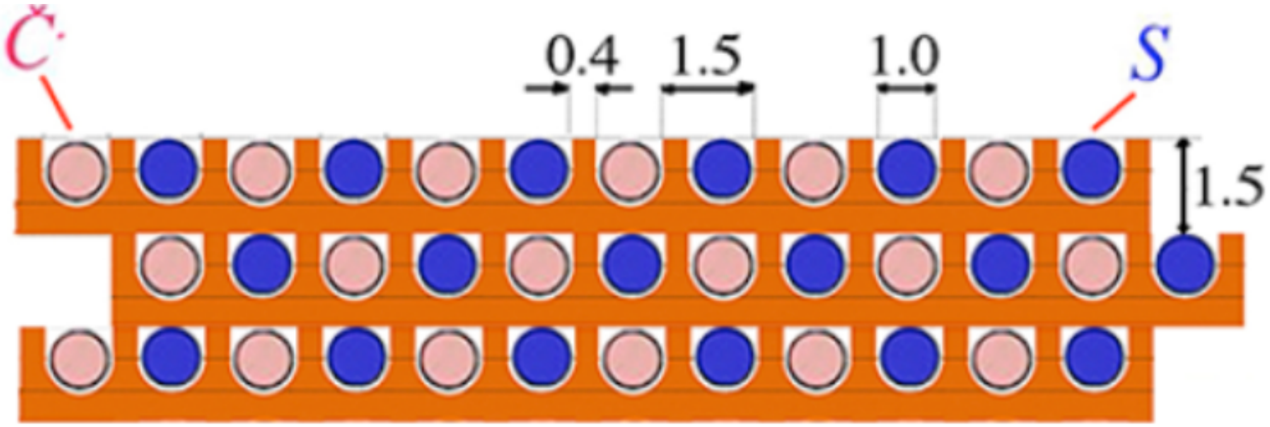

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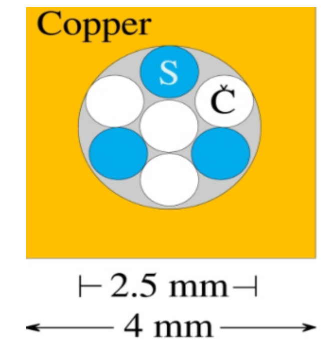

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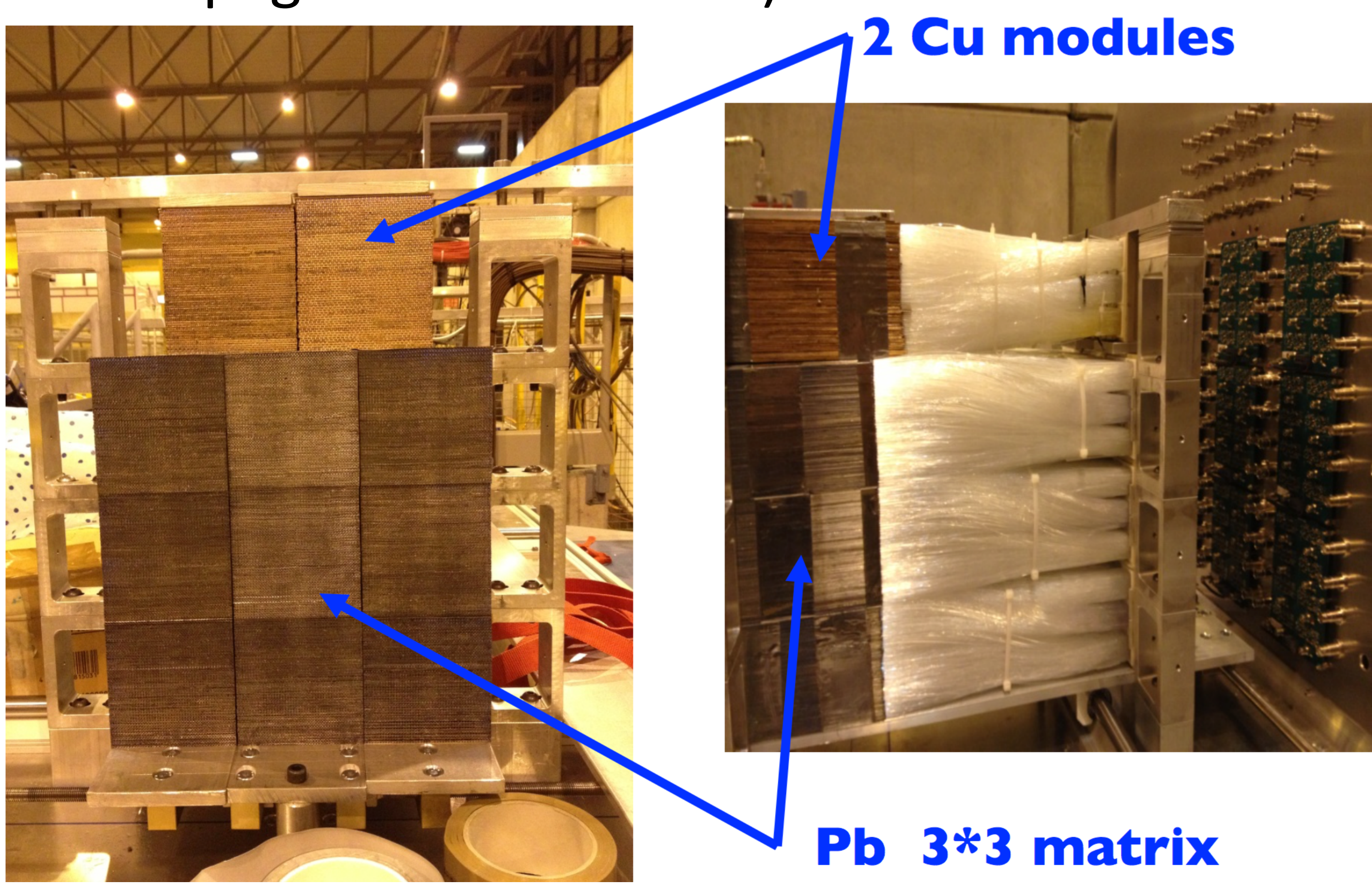

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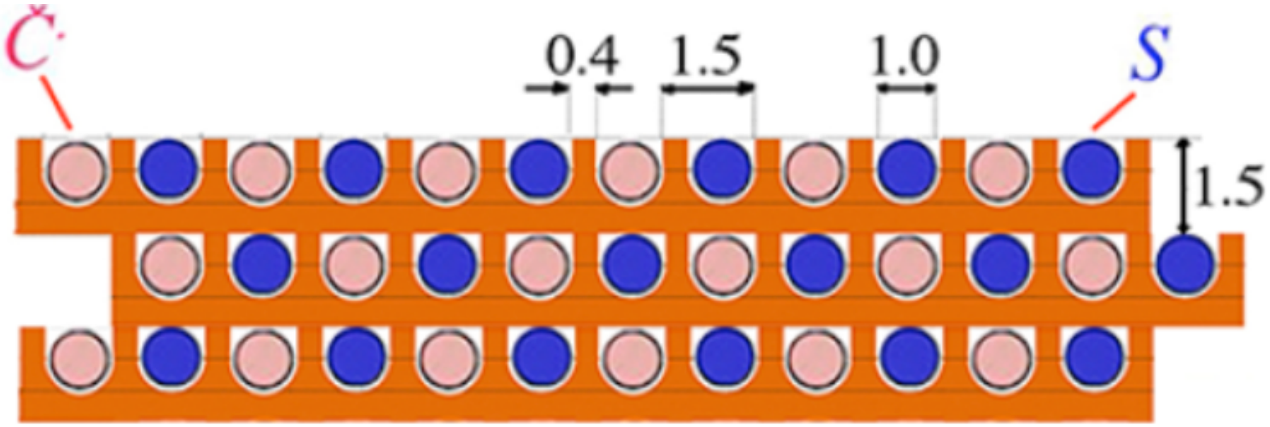

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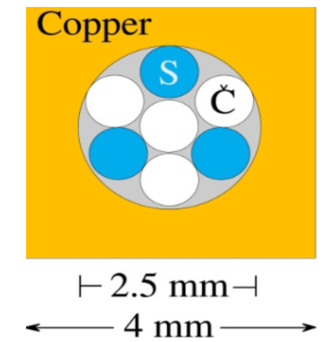

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- Calibrate both signals with e⁻

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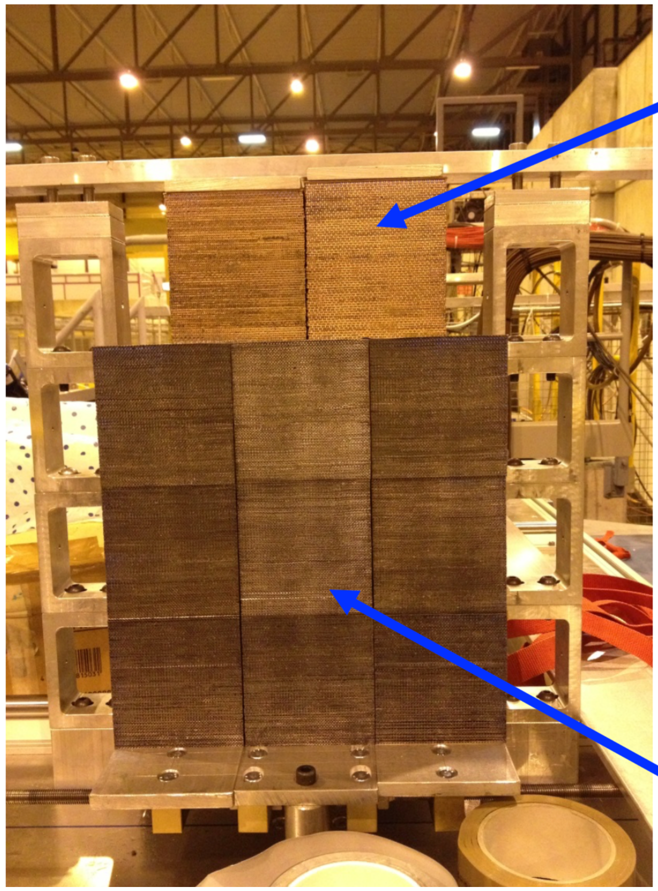
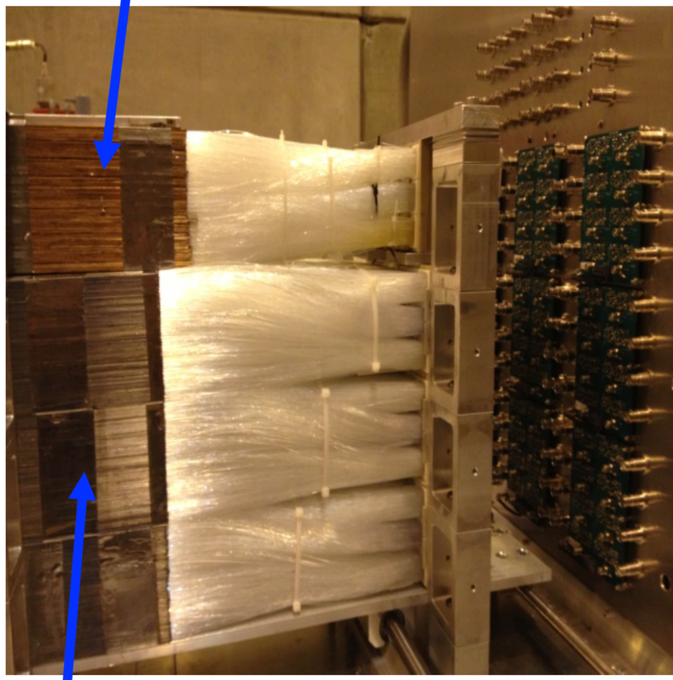
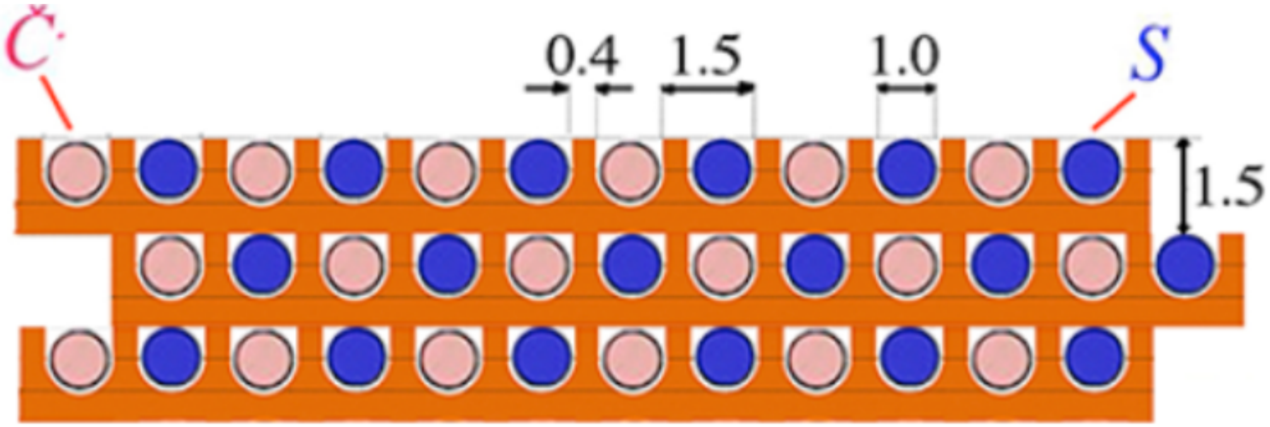




2 Cu modules

Pb 3*3 matrix

IDEA Dual Readout calorimeter



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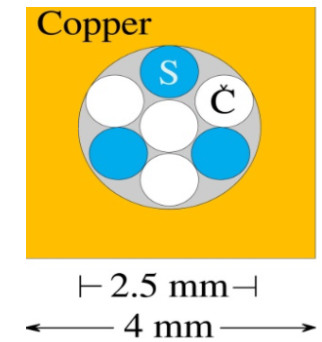

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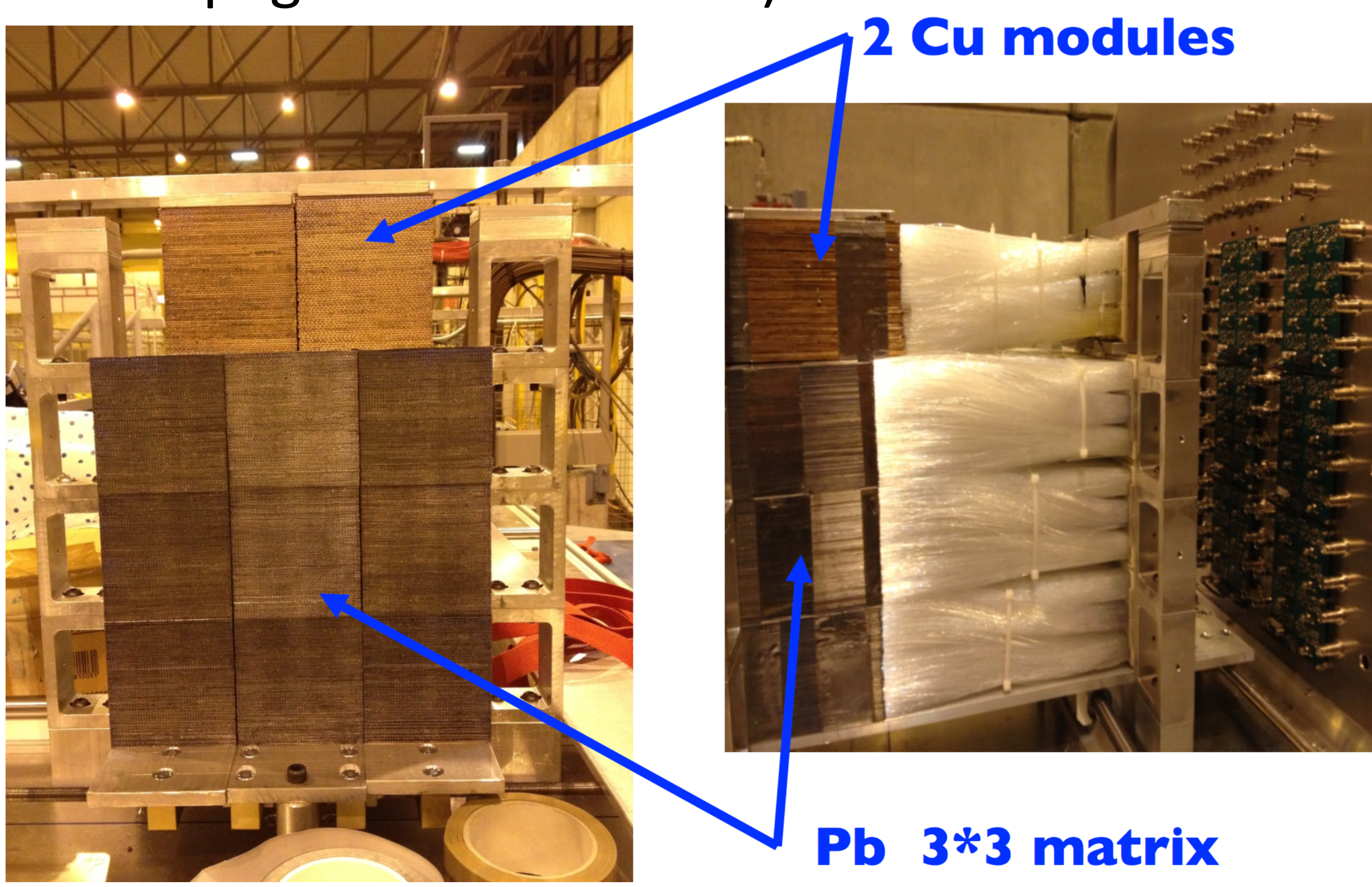
- Unfold event by event f_{em} to obtain corrected energy

A Dual Readout calorimeter prototype (looks like a spaghetti calorimeter)



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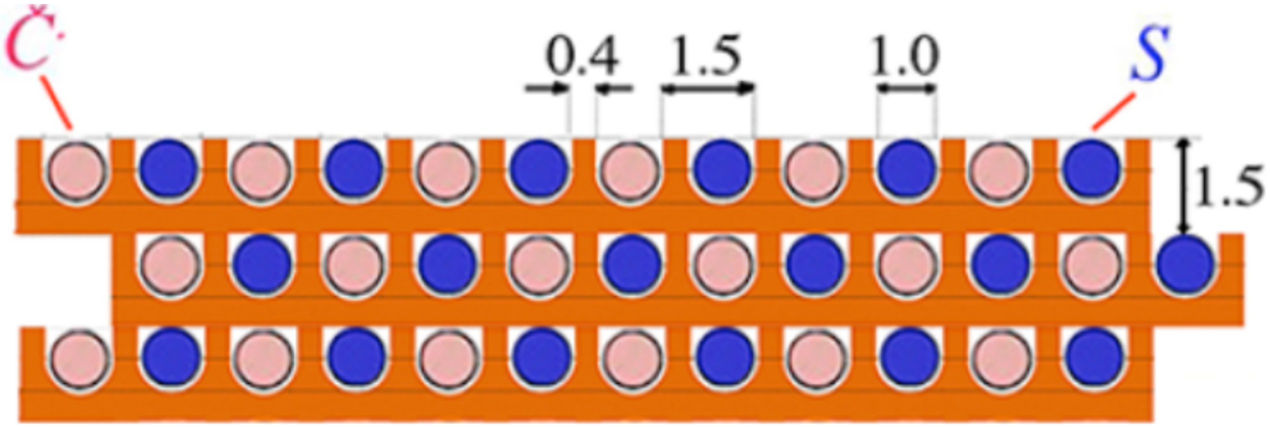

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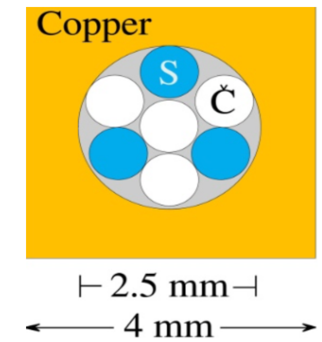

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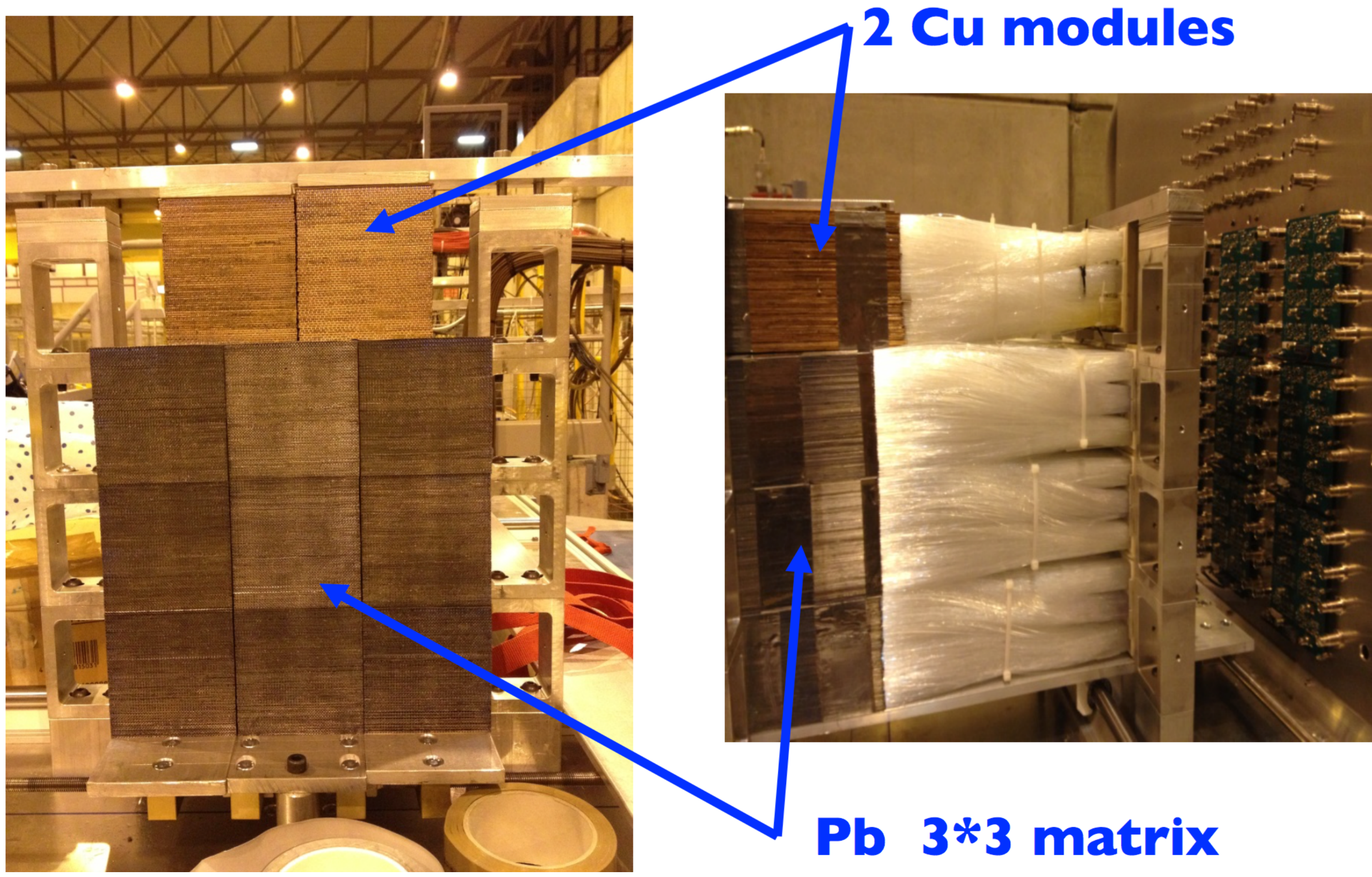
- Calibrate both signals with e^-
- Unfold event by event f_{em} to obtain corrected energy

$$S = E\left[f_{em} + (h/e)_S(1 - f_{em})\right]$$

$$C = E\left[f_{em} + (h/e)_C(1 - f_{em})\right]$$

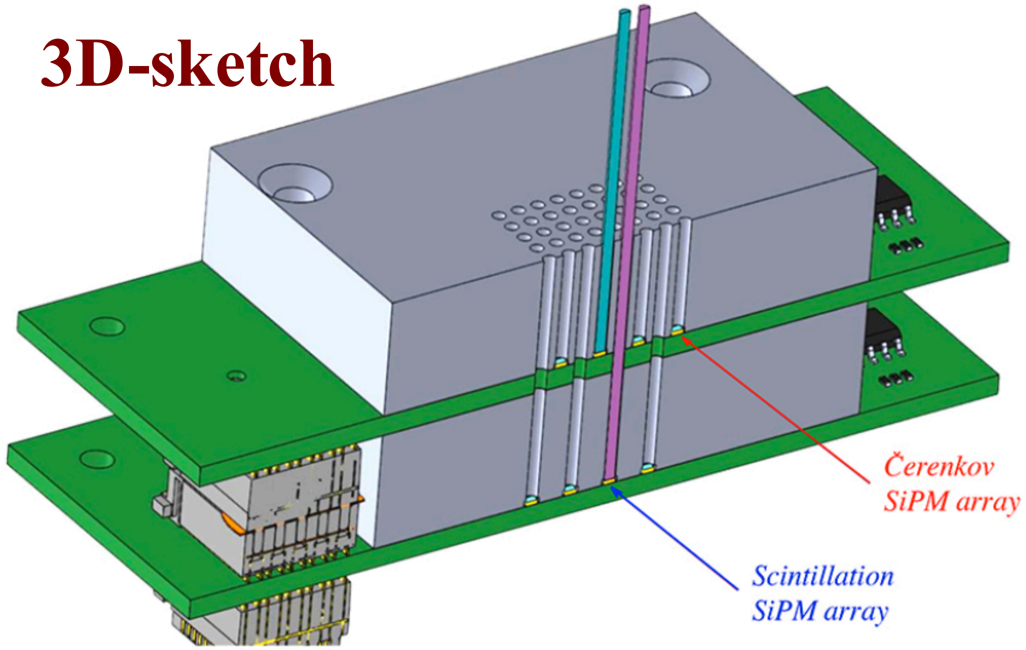
$$E = \frac{S - \chi C}{1 - \chi} \quad \text{with: } \chi = \frac{1 - (h/e)_S}{1 - (h/e)_C}$$

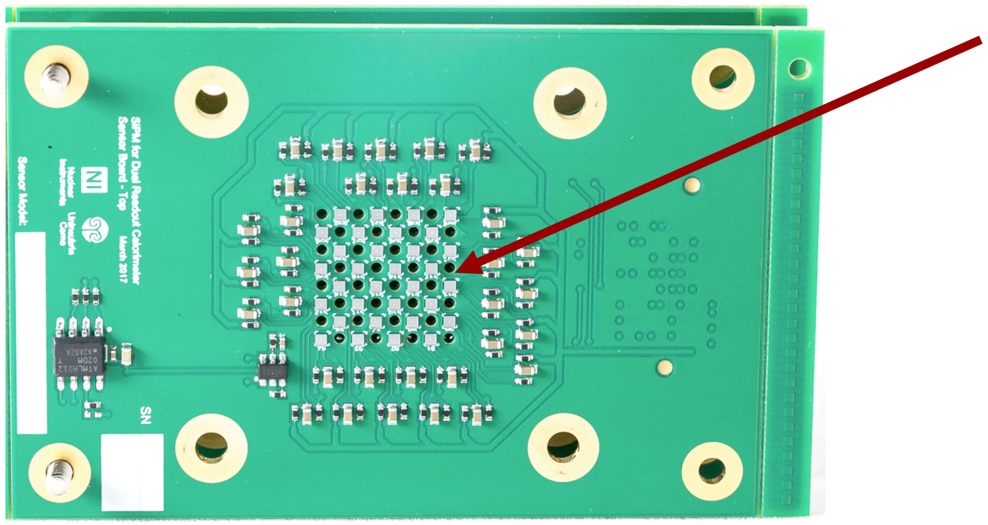
A Dual Readout calorimeter prototype (looks like a spaghetti calorimeter)

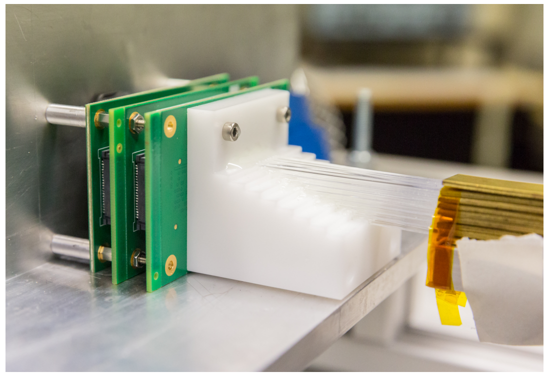


IDEA Dual Readout calorimeter

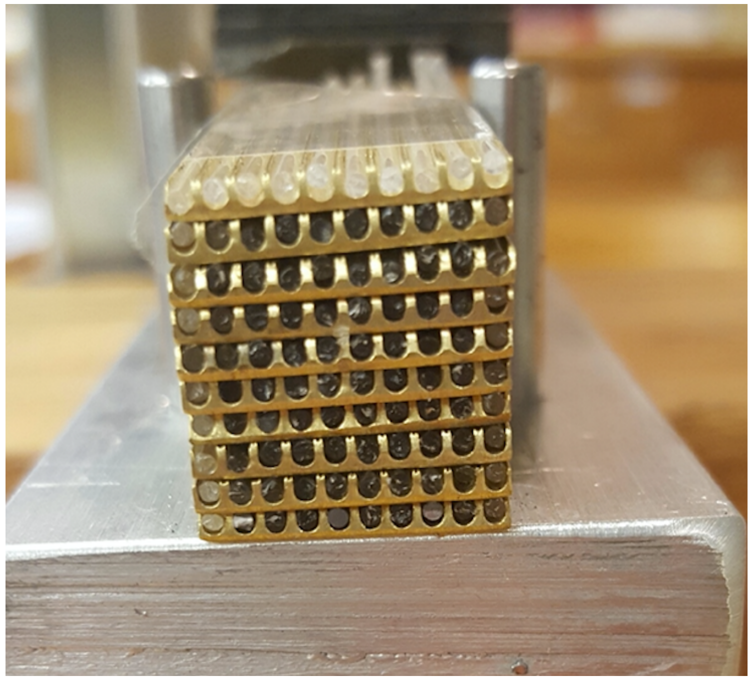
3D-sketch



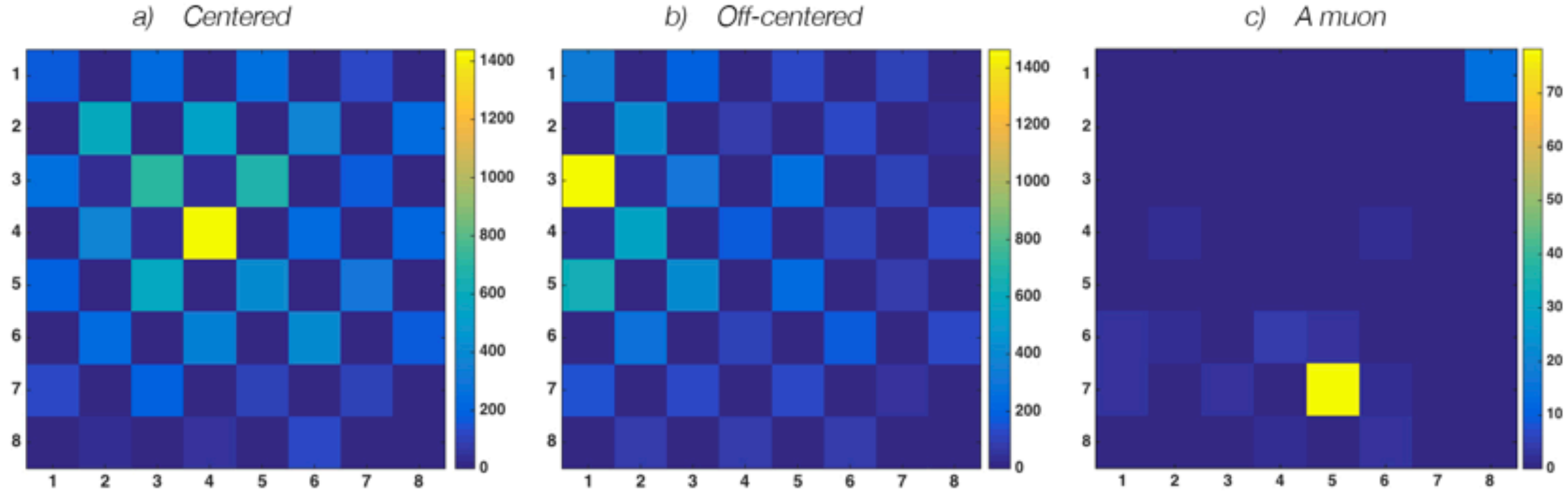




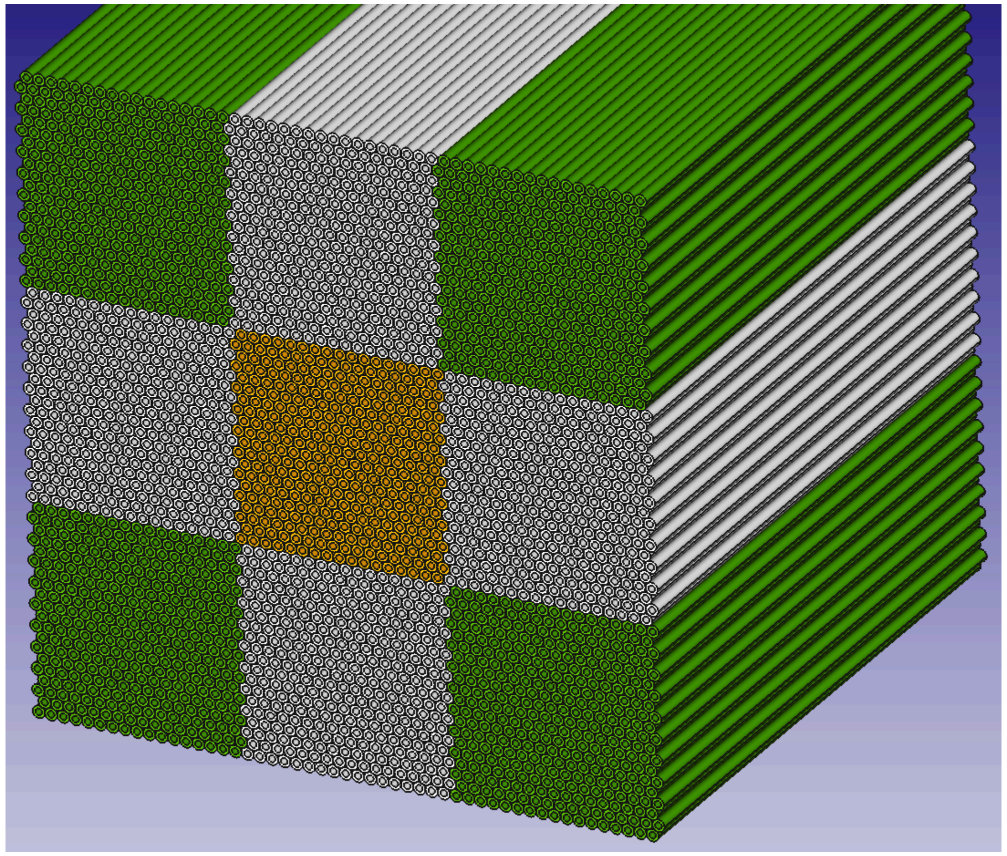
10x10 fibers

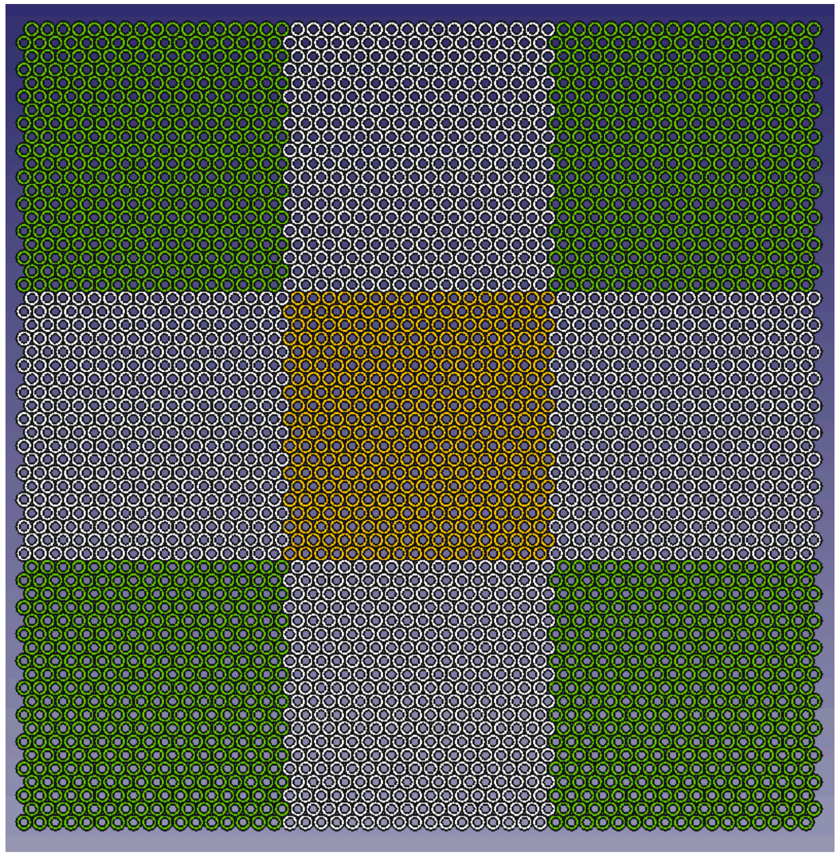


Event Display



IDEA Dual Readout calorimeter





Tubelets

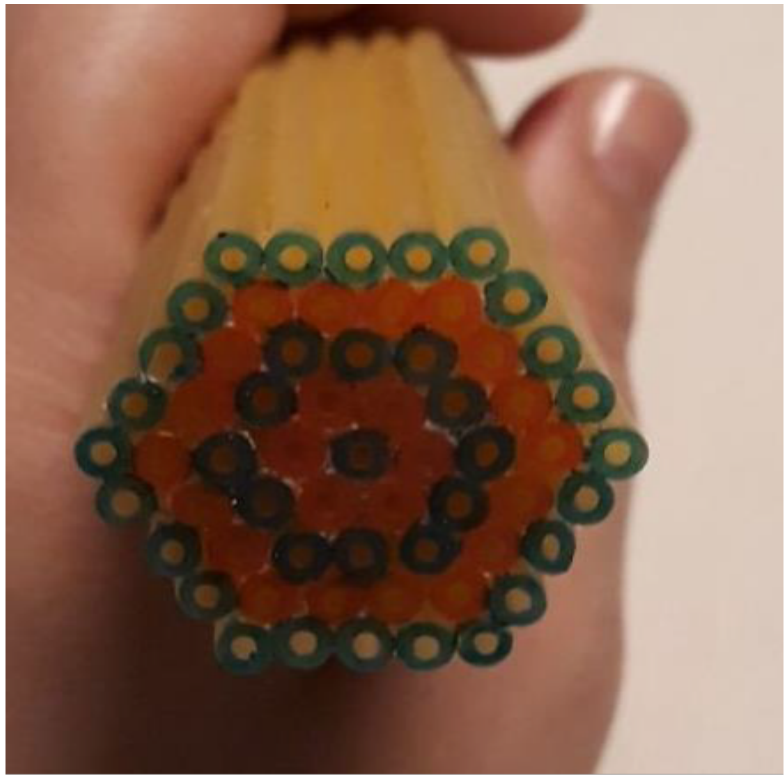
2.0 mm OD, 1.1 mm ID and 1000 mm Length

ID tolerance: + 0.1 mm and - 0.0 mm

Material: CuZn37, 170 VPN Hardness

New “housing” of the Cherenkov and scintillating fibers

The “bucatini calorimeter” is born!



RBI Zagreb : select, test and assembly tubelets study fibre insertion
INFN Pavia : mechanics for fibre gathering and distribution, fibre insertion
U. of Sussex : select S and Č fibres, light yield, numerical aperture
INFN Milano (Insubria) : SiPM selection and readout chain
INFN Bologna : SiPM readout chain

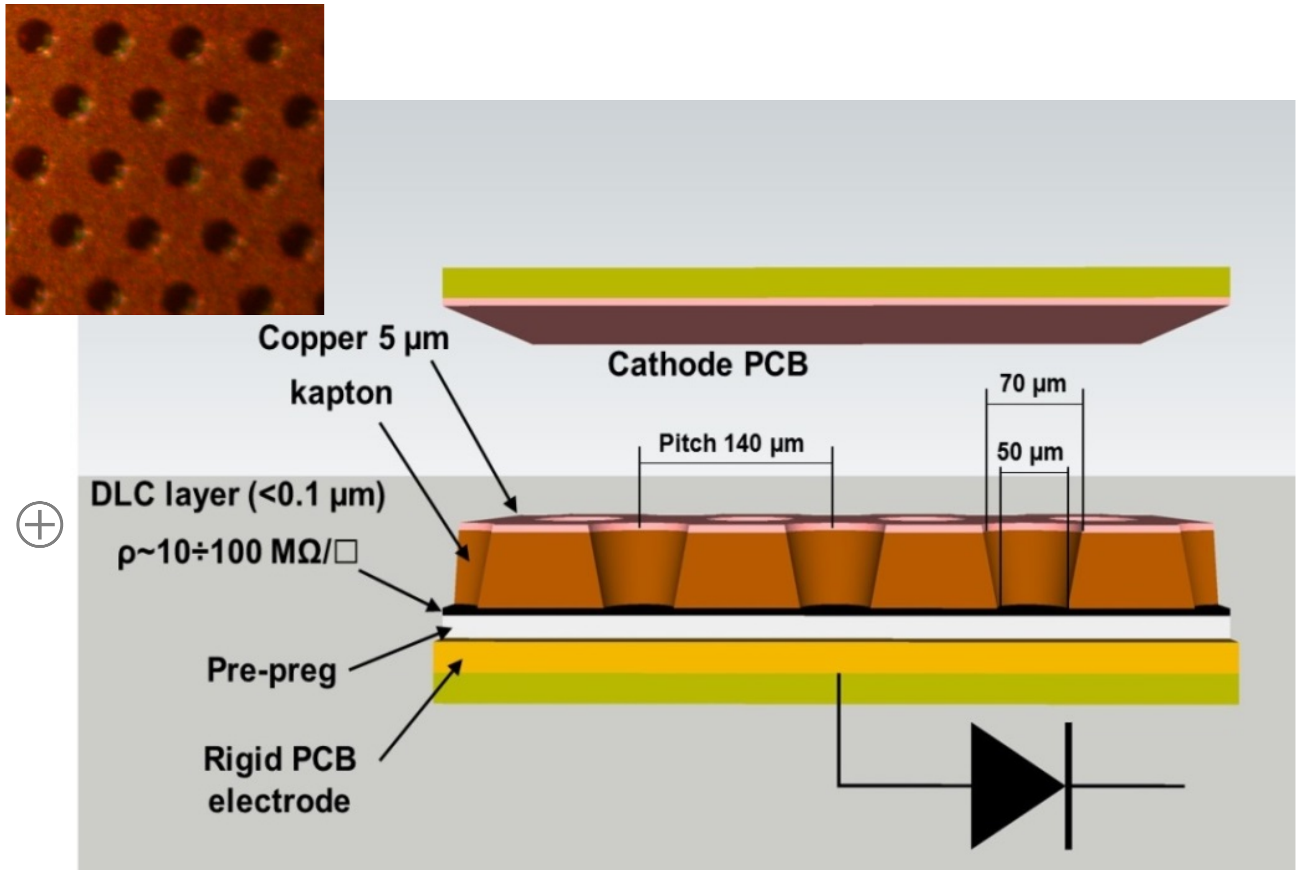
IDEA preshower and muon detector

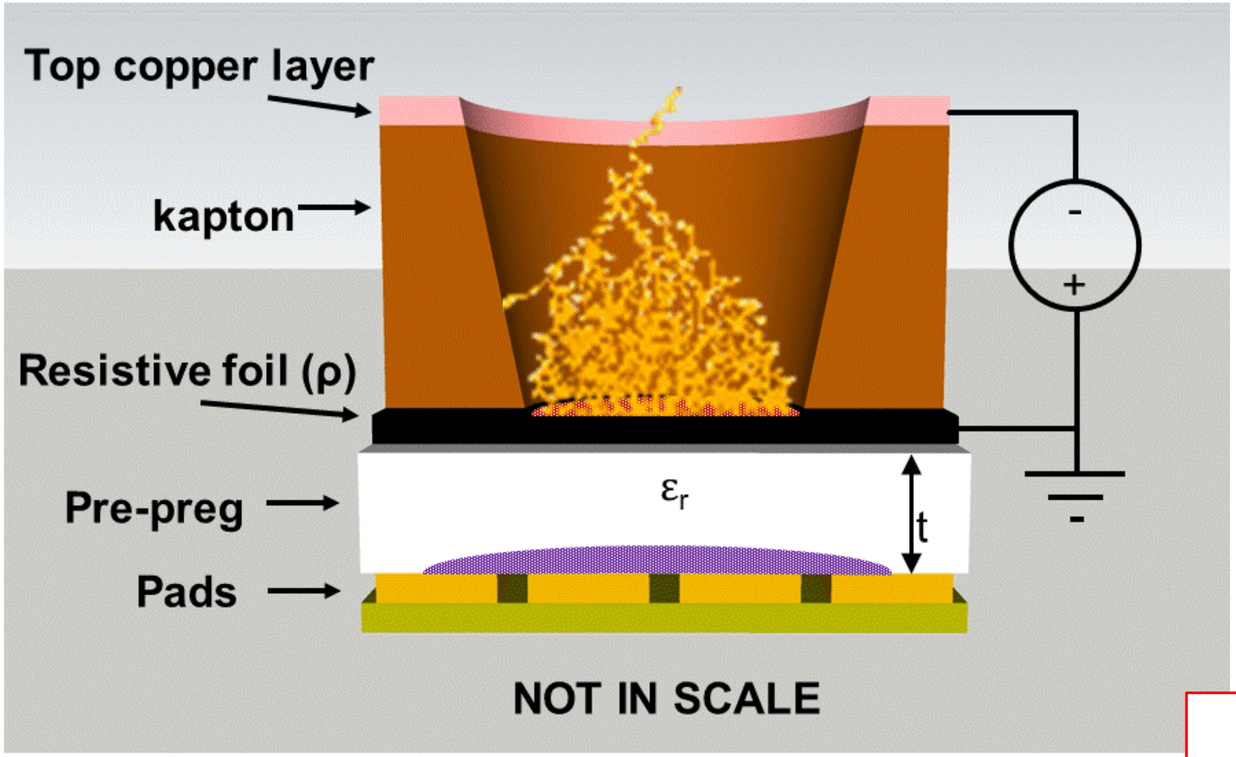
Detector technology: μ-RWELL

The μ-RWELL is composed of only two elements:

- μ-RWELL_PCB
- drift/cathode PCB defining the gas gap

μ-RWELL_PCB = amplification-stage ⊕ resistive stage ⊕ readout PCB



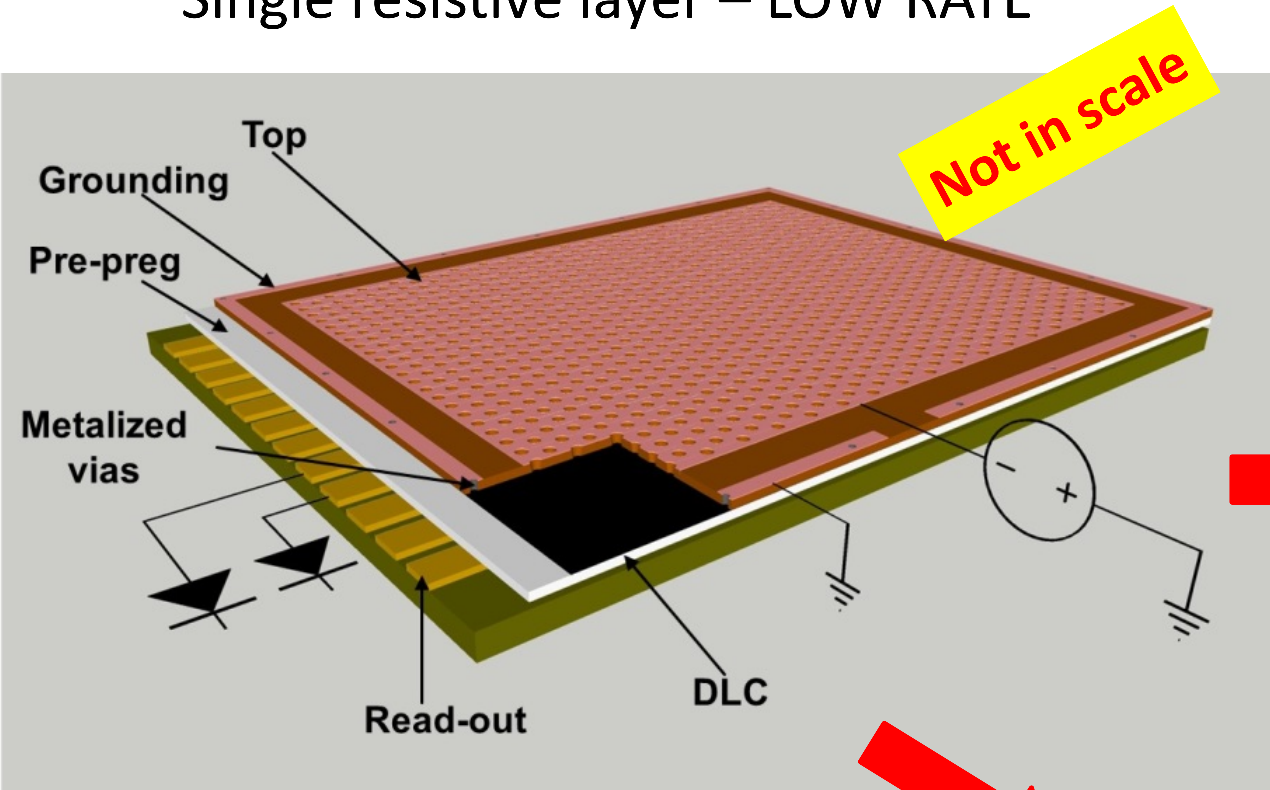


- The "WELL" acts as a multiplication channel for the ionization produced in the gas of the drift gap
- The charge induced on the resistive layer is spread with a time constant, $\tau \sim \rho \times C$

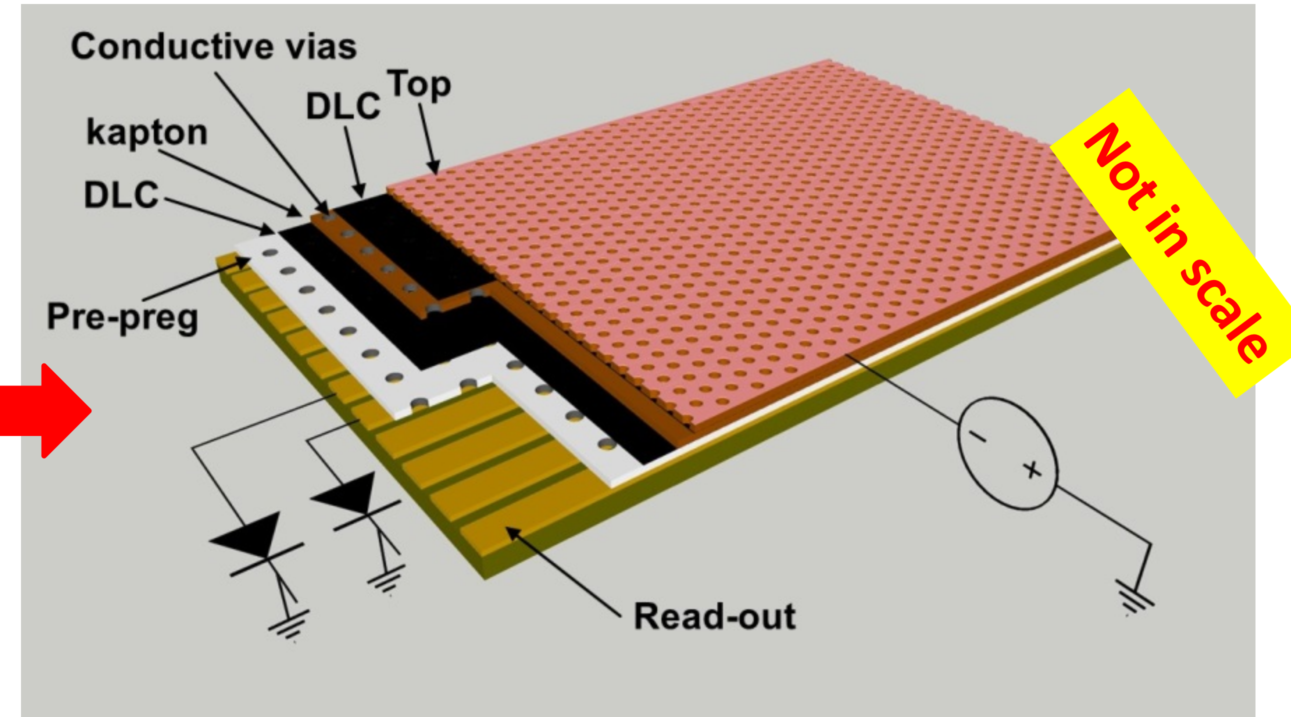
$$C = \varepsilon_0 \times \varepsilon_r \times \frac{S}{t} \cong 50\ pF/m$$ (pitch-width 0,4 mm)

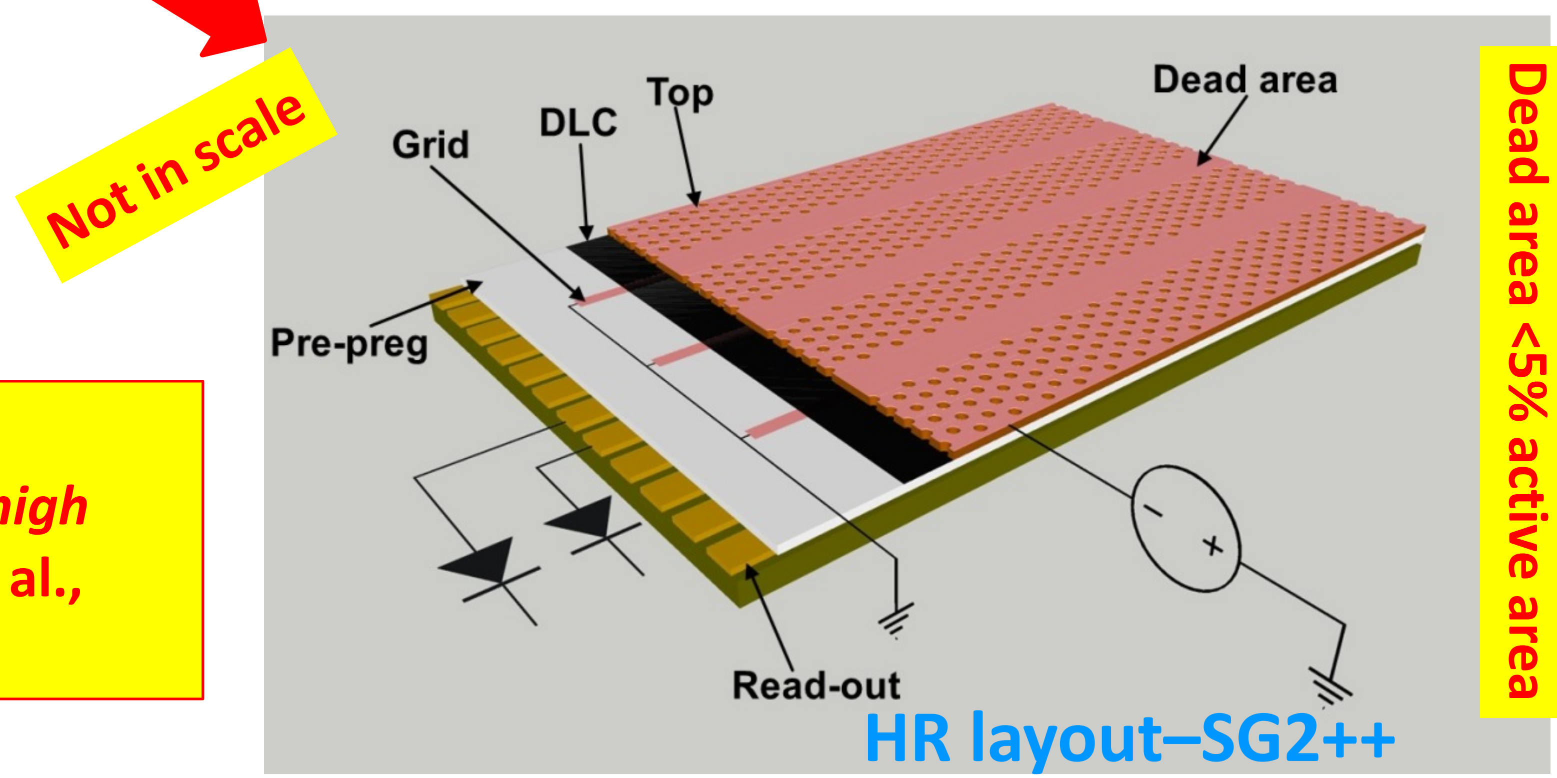
IDEA preshower and muon detector

Single resistive layer – LOW RATE



Double resistive layer – HIGH RATE

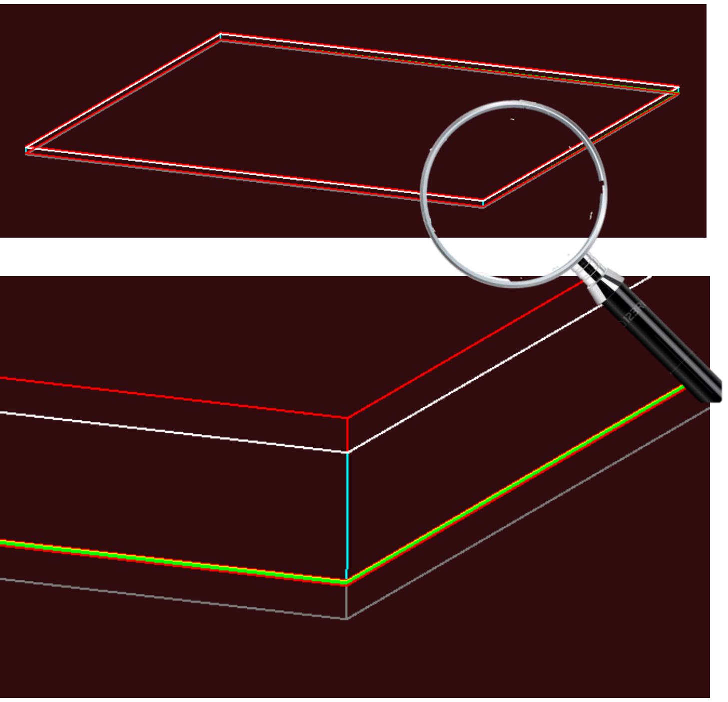


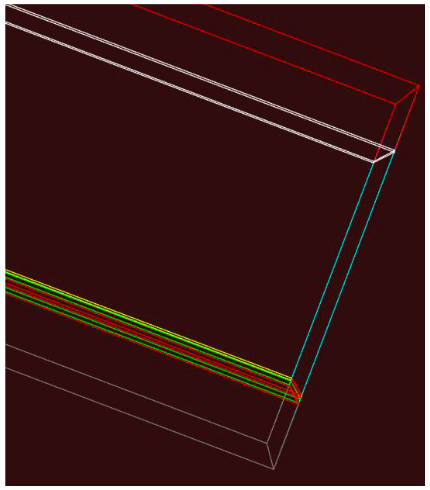


Single resistive layer with dense grid grounding – SIMPLIFIED HIGH RATE

Detailed description in:
***The micro-RWELL layouts for high particle rate*, G. Bencivenni et al., 2019_JINST_14_P05014.**

IDEA full simulation of preshower



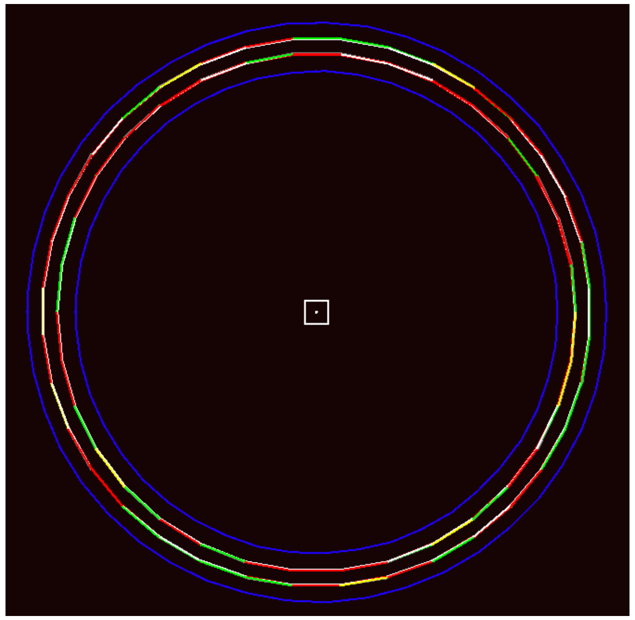


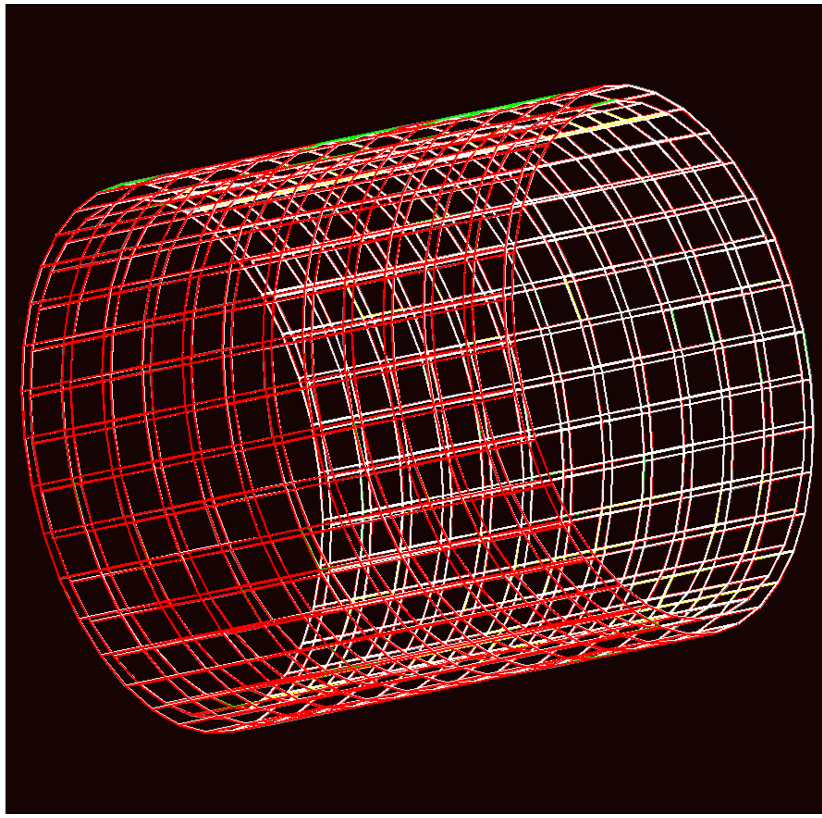
Chamber thickness: 9.4601mm

- **Cathode thickness: 1.635mm**
- **Driftgap: 6mm**
- **μ-RWELL+readout thickness: 1.8251mm**

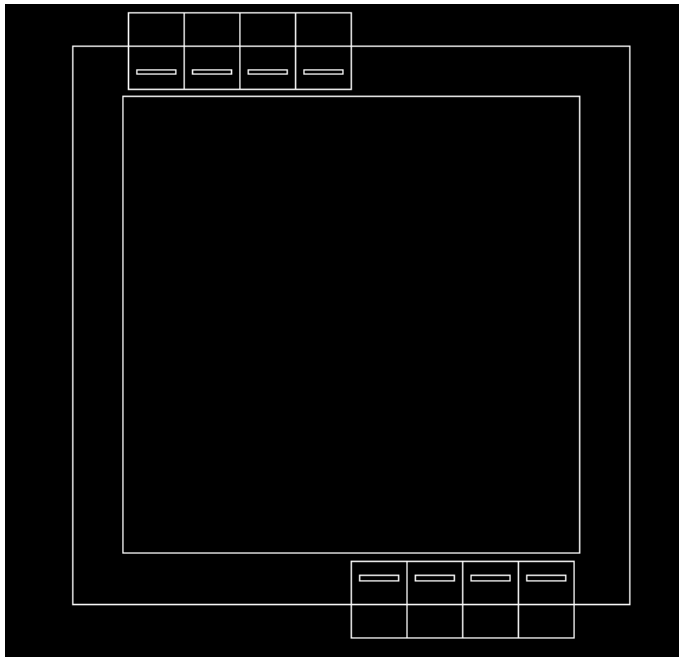
All the materials and dimensions of a HR μ-RWELL HR-SG2++ have been considered

Barrel preshower





First considered chamber size:
500 mm x 500 mm



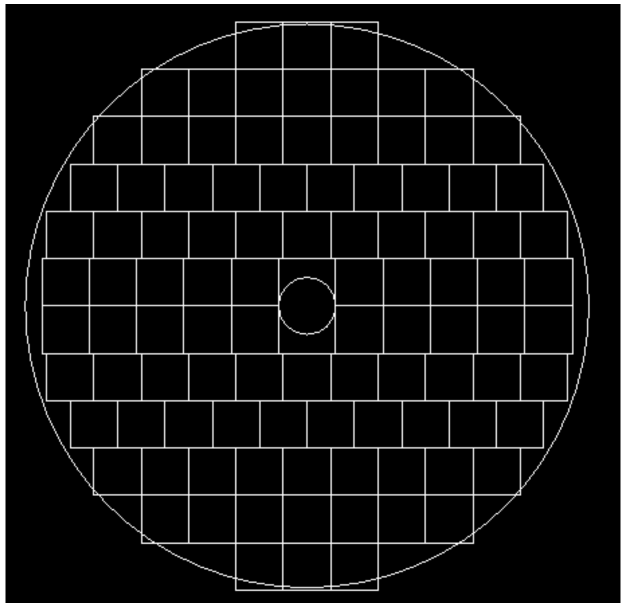
Need to evaluate the realistic ACTIVE AREA of the detector:

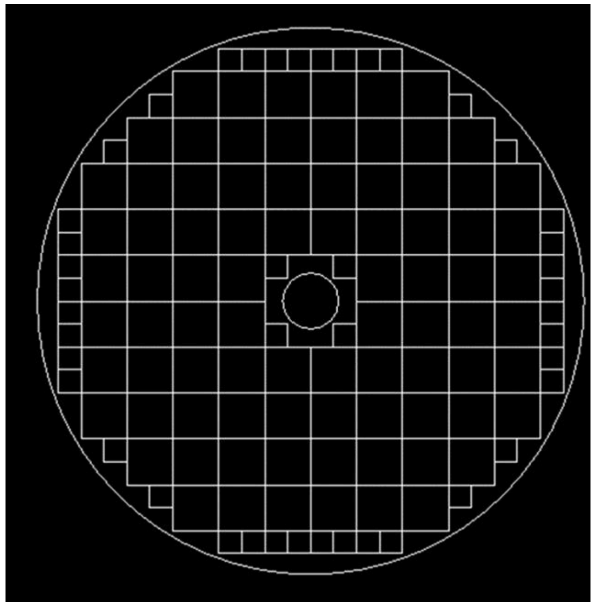
- HV cables
- 8 APV25 (128 channels):
  50 mm x 68 mm x 1.6 mm
- Panasonic connectors (perpendicular to strips):
  35 mm x 4.2 mm x 7mm

ACTIVE AREA = 410 mm x 410 mm

Pitch: 400 μm=> 1025 strip (they will be reduced to 1024, so that they can be read by 8 APV25 (128 channels)

Several options studied for the end-caps





Description of a μ-RWELL (**HR layout–SG2++**) detector implemented

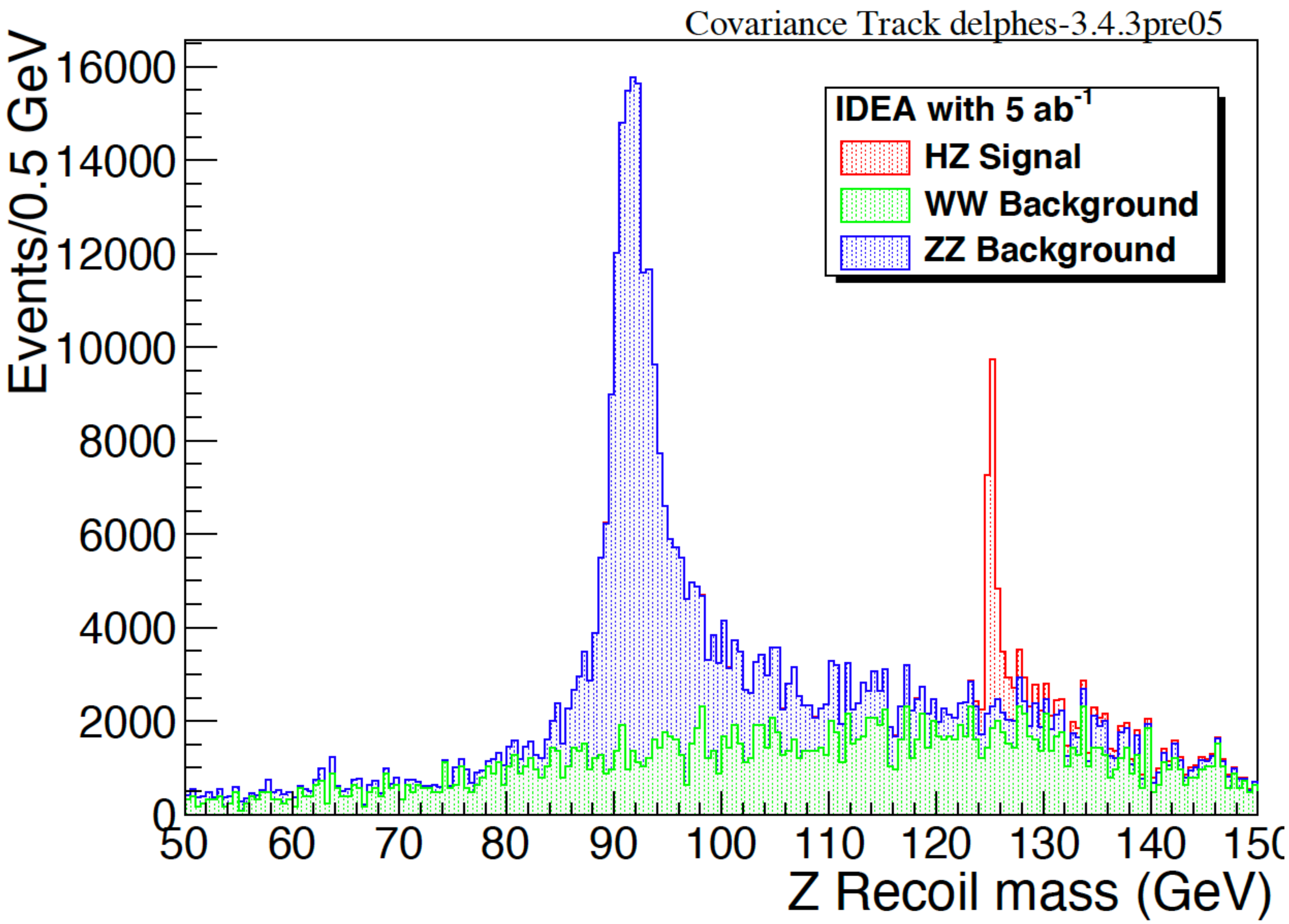
Physics studies

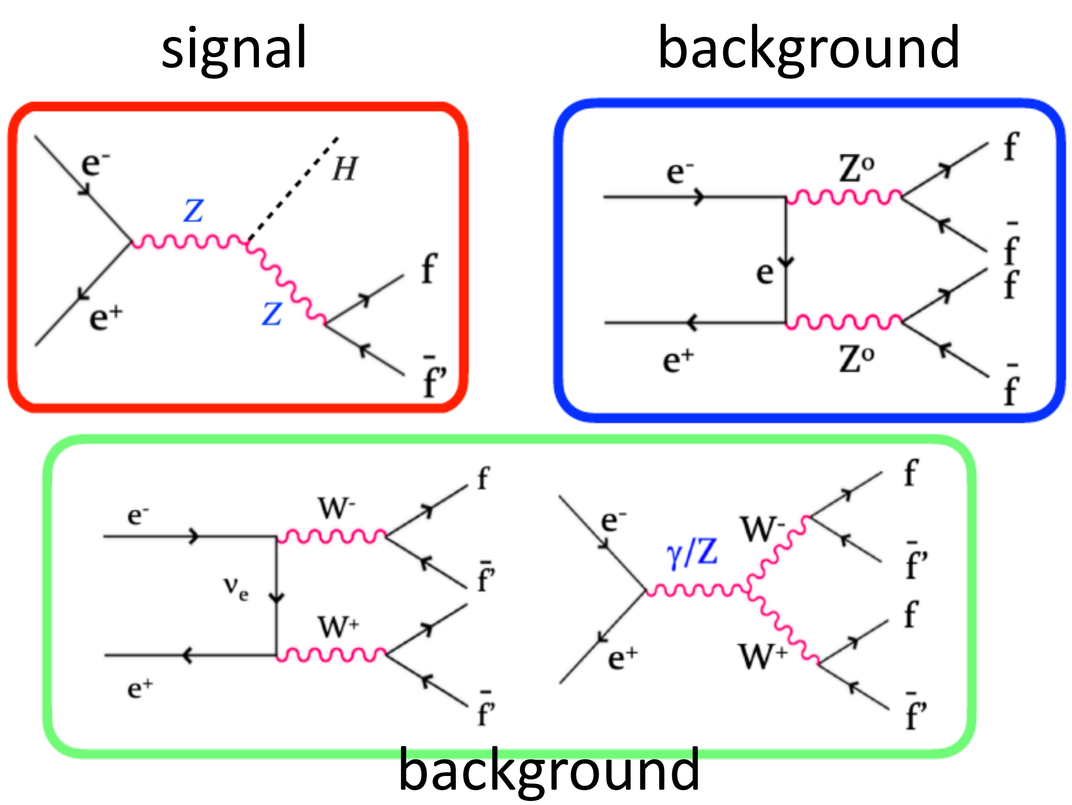
Higgstrahlung process

S. Braibant coordinates the RD-FCC physics studies group

$e^+e^- \to ZH$ **where**
$Z \to \mu^+\mu^-$ **and** $H \to$ **anything**

$\sqrt{s} = 240$ GeV with $\mathscr{L} = 5\ ab^{-1}$





The selection criteria are:

- two muons of opposite charge with $p_T > 1$ GeV
- $|\eta| < 2.4$
- $|m_{\mu\mu} - m_Z| < 20$ GeV
- Mass range 124-126 GeV

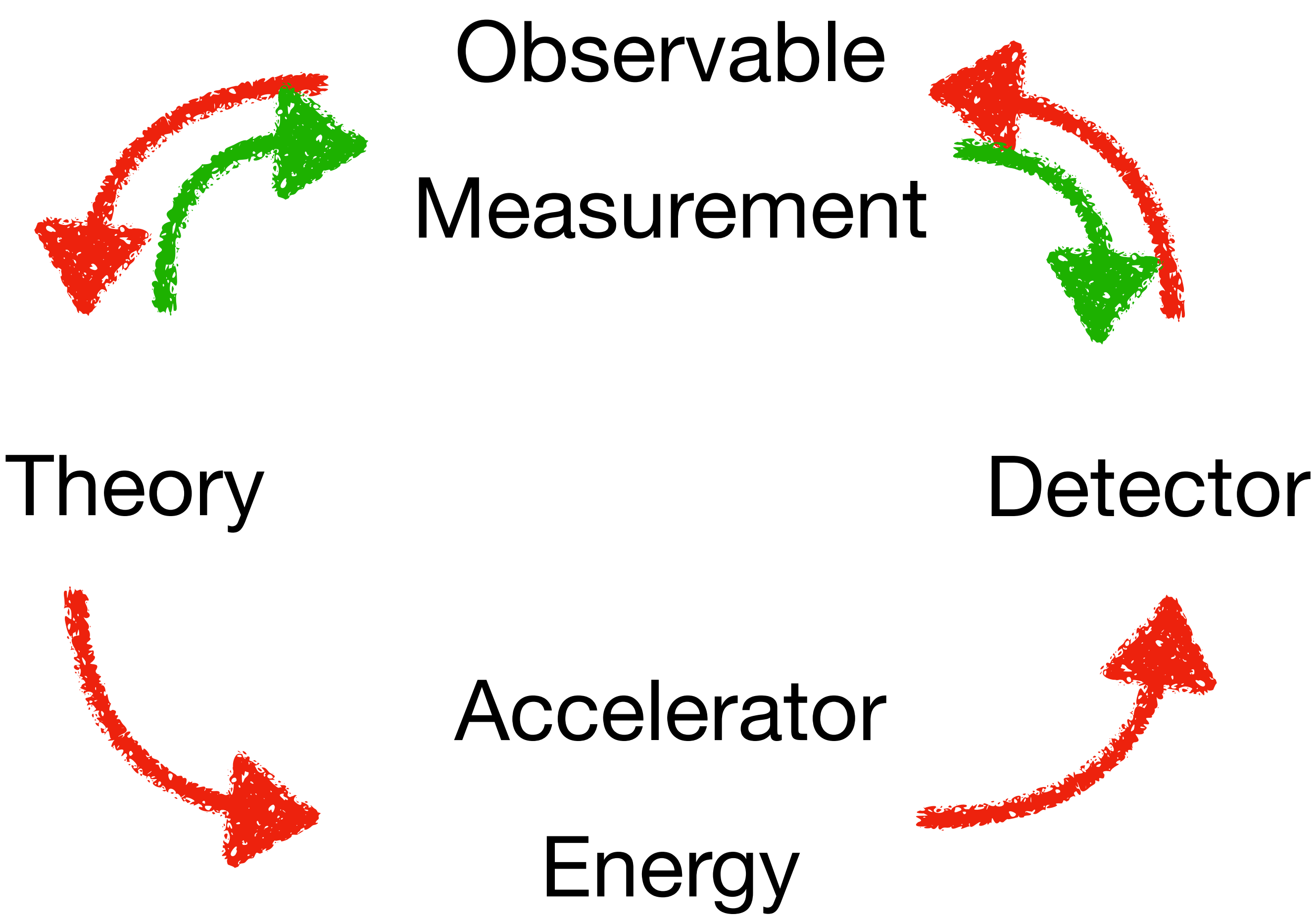
V. Diolaiti recently presented the IDEA fast simulation studies at the IAS conference 2021

RD-FCC Bologna

- People in the group: L. Bellagamba, D. Boscherini, S. Braibant, A. Carbone, V. Diolaiti, E. Fontanesi, F. Ferrari, P. Giacomelli, L. Guiducci, F. Maltoni, A. Polini, V. Vagnoni
- Activities:
  - IDEA Preshower and muon detector design since a few years, working on the μRWELL technology R&D since 2016
  - Recently joined also the Dual Readout R&D and will contribute to the SiPM readout chain development and testing
  - Leading the physics studies group of IDEA
  - Working in close collaboration with the FCC-ee and CEPC management
    - Important roles in FCC-ee and CEPC committees
- Together with the rest of RD-FCC extremely successful in European calls:
  - FEST (Grant Agreement 872901)
  - URANIA (Grant Agreement 777222)
  - AIDAinnova (starting on 01/04/2021)

Muon collider physics @ BO

Antonio Costantini (TH), Marco Dallavalle (EXP), Fabio Maltoni (TH), Antonio Sidoti (EXP)
Università di Bologna/INFN Bologna



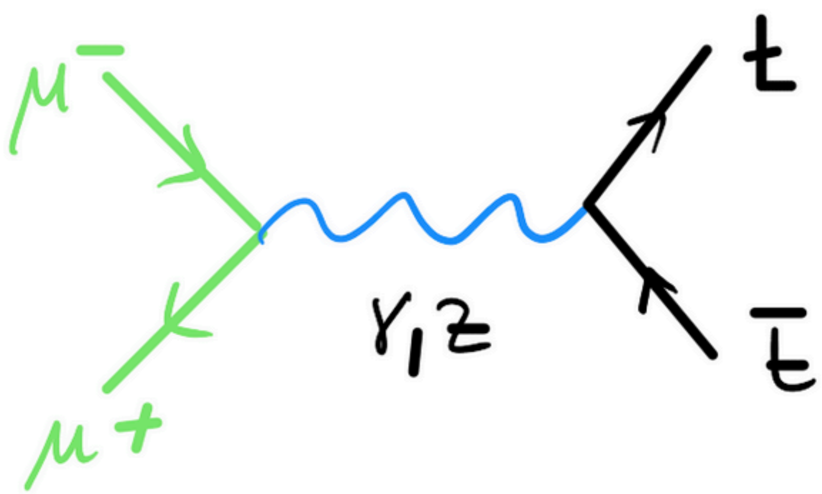
The group is involved in a number of TH/EXP activities on the feasibility and exploration of the physics potential of a multi-TeV muon collider.

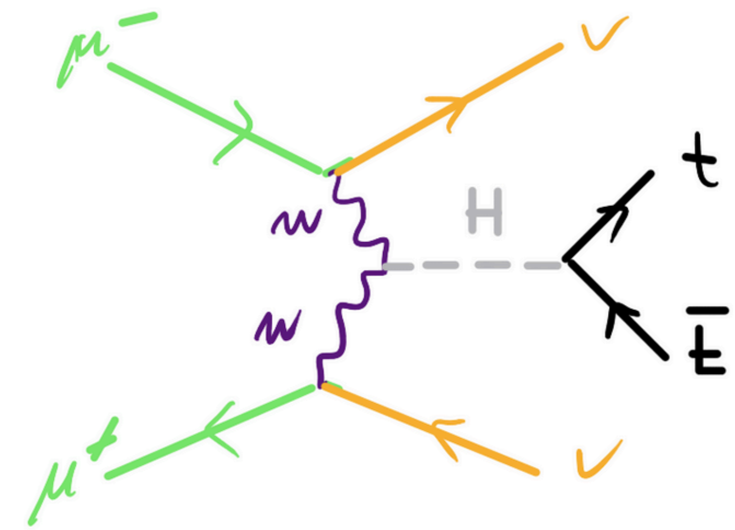
We contribute to the setting up of the Muon Collider Collaboration at CERN.

We contribute to the on-going activities of the Snowmass 2021(2) process in the US (F. Maltoni è convener del Collider Phenomenology Topical group in TF e TH convener of the Muon Collider Forum inter-TF)

Muon collider production mechanisms

Annihilation vs scattering





- Annihilation processes (s or t-channel or both) are the way we normally think about physics at e^+e^- colliders.
- QFT technology has been developed since the LEP times to perform accurate predictions for the main production processes.
- A lot of progress made over the LHC times (e.g. NLO automation, two loop,… PS matching/merging) is available, yet it has not been yet applied extensively.

- Vector boson fusion starts at $2 \to 3$. Dominates at high energy. Its new physics potential up to 3 TeV has been studied in the context of CLIC [De Blas et al. 1812.02093] .
- Possibly complicated as it mixes with annihilation channels, even though at high energy it is de facto separable. Simulations of multiparticle final states, including "jets", can be time consuming already at tree-level. NLO EW computations for simple final states are in principle possible.
- Considerable simplifications and possible improvements via the EWA.

LoI to Snowmass process

Letter of Interest: Tau-neutrino Production at a multi-TeV Lepton Collider

GaetanoMarco Dallavalle, Fabio Maltoni, Silvia Pascoli, Antonio Sidoti

to be submitted to

the Accelerator Frontier (AF04), Energy Frontier (EF03), and Neutrino Frontier (NF06)

TeV-neutrino interactions in the laboratory are uncharted physics [1]: muon neutrinos have been studied up to about 350 GeV, electron neutrino measurements only exist at lower energies,

Experiments being planned at LHC have the potential to fill in the energy gap between 350 GeV and a few TeV, and test different neutrino flavours [7–9]. Their detectors will intercept the flux of neutrinos from b and c decays, and those from pion and kaon decays. However the sample of observed tau-neutrino interactions in the LHC Run 3 (2022-2024) is expected to be marginal for precision measurements. Extension of those experiments in the High Luminosity LHC era beyond 2028 is unlikely, because the LHC environmental background will become prohibitive, ten times worse than at the LHC.

We would like to propose a Snowmass activity on the opportunities for neutrino tau flavour studies at present and future colliders. More specifically, here we express our interest in investigating tau neutrino production in the process W^+W^- at future high-energy lepton colliders, such as a muon collider.

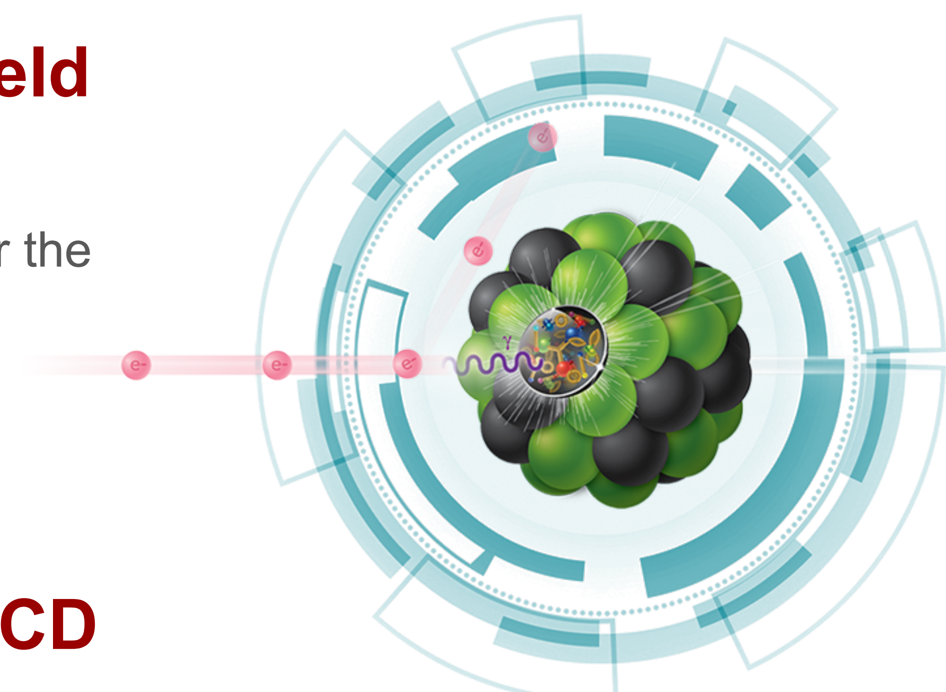
SNOWMASS21-

The Electron-Ion Collider

a machine that will unlock the secrets of the strongest force in Nature

is a future electron-proton and electron-ion collider to be constructed
in the United States in this decade and foreseen to start operation in 2030

- **EIC constitutes the major US project in the field of nuclear physics**
  - and will surely be one of the most important scientific facilities for the future of nuclear and subnuclear physics
- **EIC will be the world’s first collider for**
  - polarised electron-proton (and light ions)
  - electron-nucleus collisions
- **EIC will allow one to explore the secrets of QCD**
  - understand the origin of mass and spin of the nucleons
  - provide extraordinary 3D images of the nuclear structure



www.bnl.gov/eic

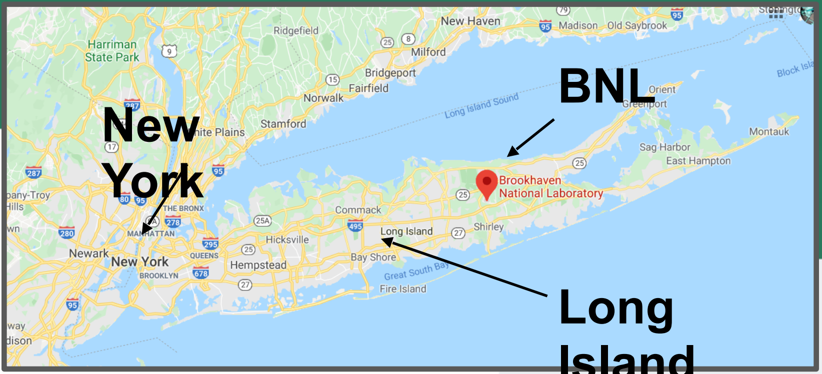
The Electron-Ion Collider

The EIC collider project is formally approved!

Department of Energy

U.S. Department of Energy Selects Brookhaven National Laboratory to Host Major New Nuclear Physics Facility

JANUARY 9, 2020



Home » U.S. Department of Energy Selects Brookhaven National Laboratory to Host Major New Nuclear Physics

WASHINGTON, D.C. – Today, the **U.S. Department of Energy (DOE)** announced the selection of Brookhaven National Laboratory in Upton, NY, as the site for a planned major new nuclear physics research facility.

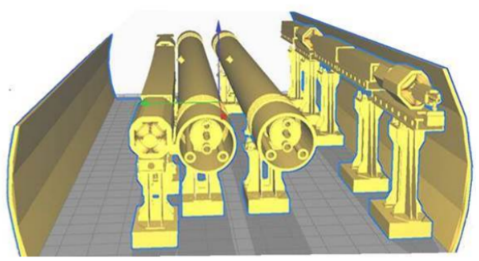
The Electron Ion Collider (EIC), to be designed and constructed over ten years at an estimated cost between $1.6 and $2.6 billion, will smash electrons into protons and heavier atomic nuclei in an effort to penetrate the mysteries of the "strong force" that binds the atomic nucleus together.

"The EIC promises to keep America in the forefront of nuclear physics research and particle accelerator technology, critical components of overall U.S. leadership in science," said **U.S.**

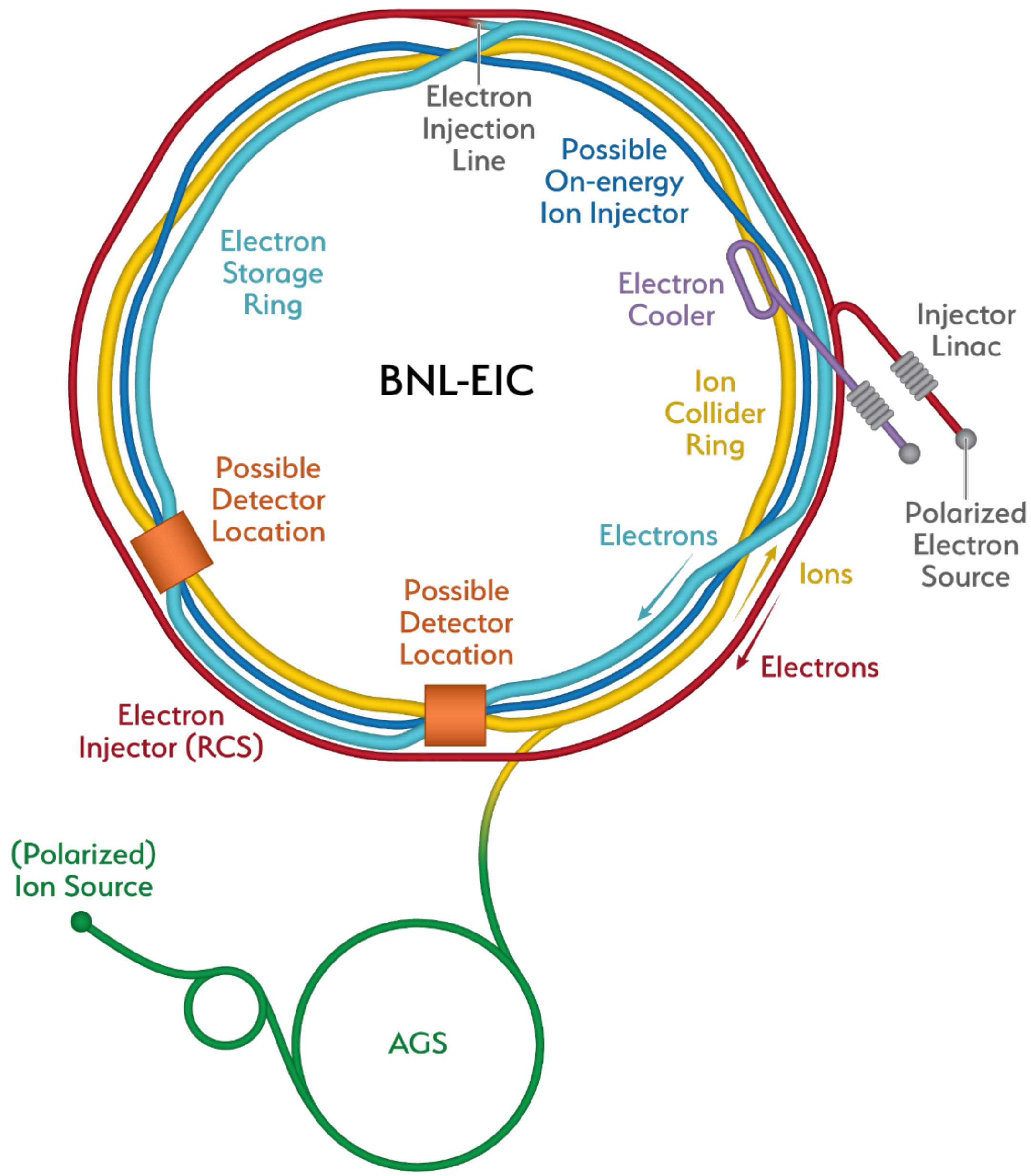
Secretary Brouillette approved Critical Decision-0, "Approve Mission Need," for the EIC on December 19, 2019.

EIC accelerator overview

BNL-EIC satisfies the requirements
to fulfill a rich physics programme

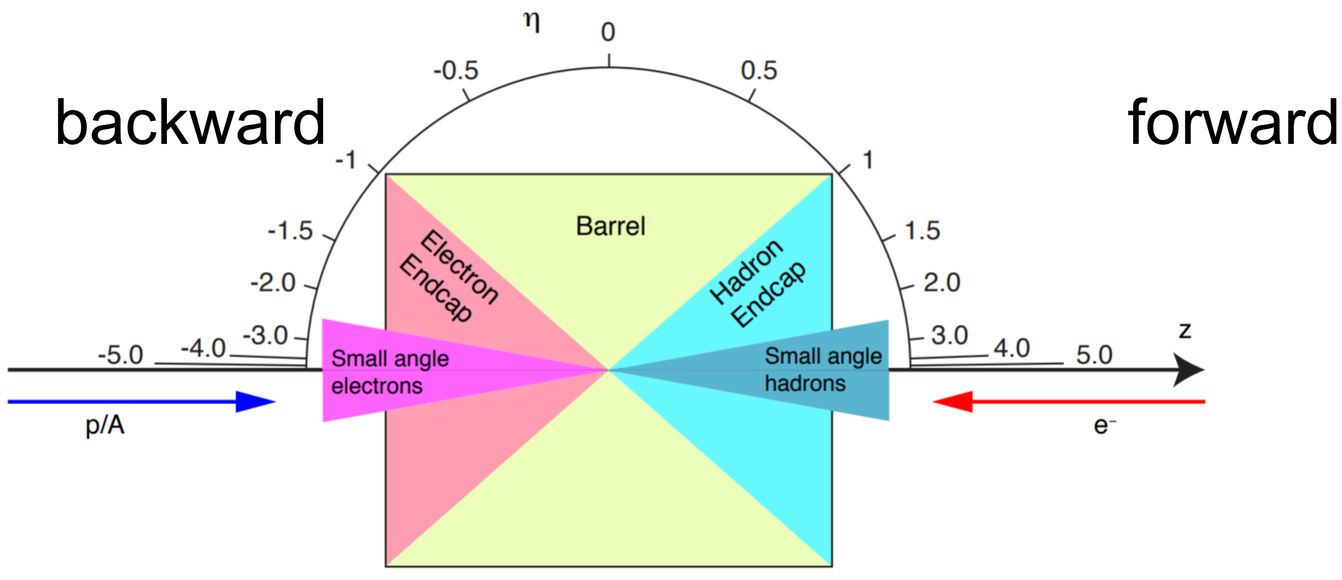


$\sqrt{s}$	20 – 141 GeV
$\mathscr{L}_{max}$	10^{34} cm^{-2} s^{-1}
P(e⁻)	80%
P(h)	80%
A	p – U



- **design using much of the RICH facility**
  - three accelerator rings
    - existing RHIC ring (275 GeV)
    - new Rapid Cycling Electron Synchrotron (18 GeV)
    - new Electron Storage Ring (18 GeV)
  - two injector complexes
    - existing Hadron Injectors
    - new Electron Injectors
  - two detector halls
  - hadron cooling facility

Detector requirements



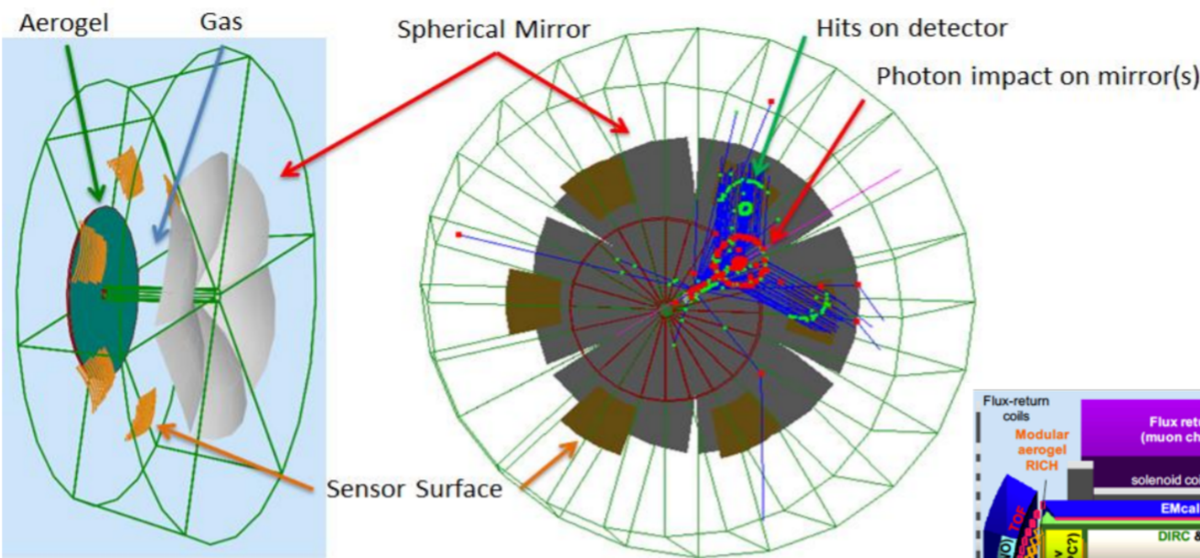
main challenges
forward PID
(included in INFN EoI)

- **hermetic detector**
  - with low-mass inner tracker
  - moderate radiation hardness
- **good momentum resolution**
  - central: $\sigma_p/p = 0.05 \oplus 0.5$ %
  - forward: $\sigma_p/p = 0.1 \oplus 0.5$ %
- **and impact parameter resolution**
  - $\sigma = 5 \oplus 15 / p \sin^{3/2}$ μm
- **electron and jets**
  - $-4 < \eta < 4$

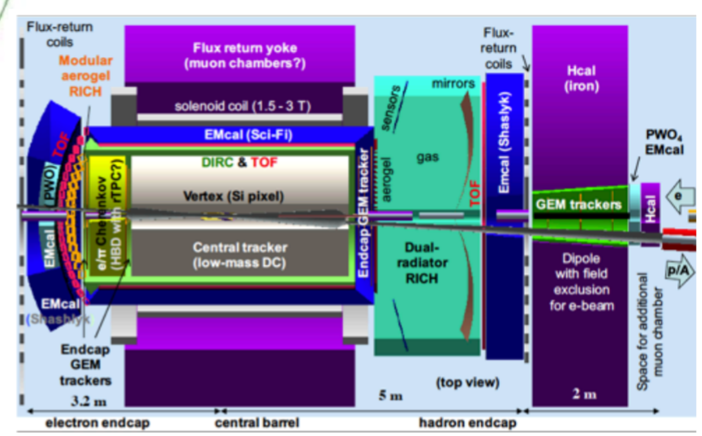
- **excellent EM resolution**
  - central: $\sigma_E/E = 10 / \sqrt{E}$ %
  - backward: $\sigma_E/E < 2 / \sqrt{E}$ %
- **good hadronic energy resolution**
  - forward: $\sigma_E/E \approx 10 / \sqrt{E}$ %
- **excellent PID for π, K, p**
  - forward: up to 50 GeV/c
  - central: up to 8 GeV/c
  - backward: up to 7 GeV/c

dRICH proposal for forward PID

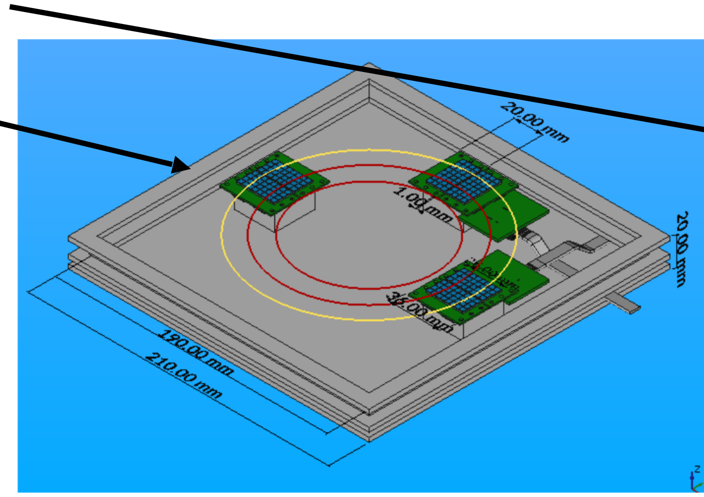
BO, CT, FE, LNF, RM1, TO

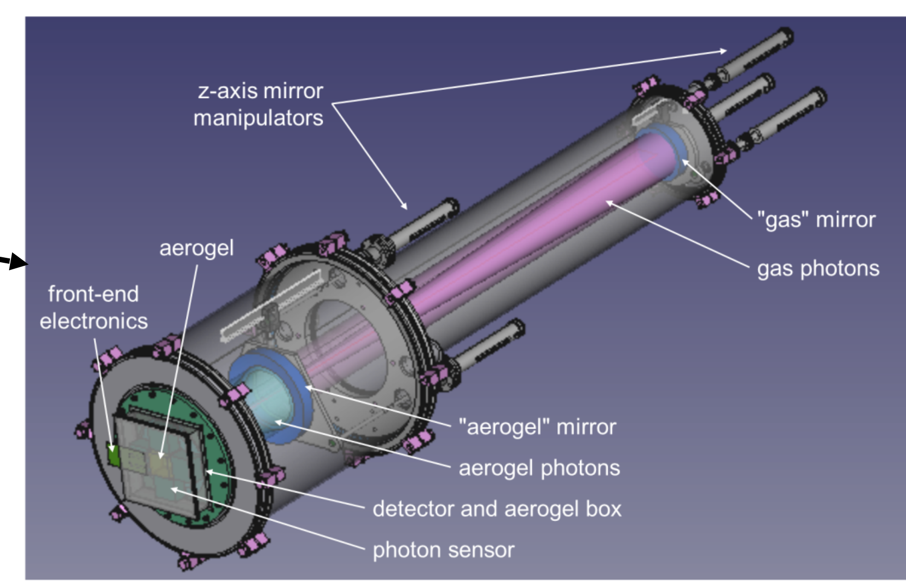


- **dual-radiator RICH (dRICH)**
  - aerogel (n ~ 1.02) + gas (n ~ 1.0008)
  - for PID in the hadronic endcap
    - 3 < *p* < 50 GeV/c
    - 1.5 < η < 3.5
  - 6 sectors x 0.5 m²/sector photosensors
    - ~ 1 T magnetic field
    - sensors out of acceptance
- **explore SiPM readout option**



- **realisation of dRICH prototype, test beam in 2021**
  - design of SiPM boards **(BO)**
  - SiPM studies **(BO)**
    - irradiation tests (@ Trento)
    - annealing at high T ~ 170°
    - operation at low T ~ −40°
  - DAQ for front-end readout **(BO)**
    - front-end based on ALCOR





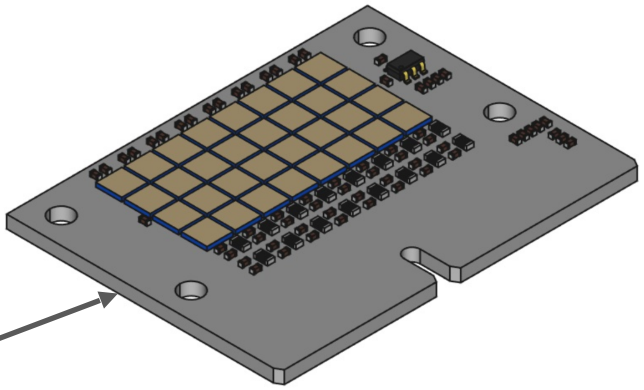
SiPM R&D program

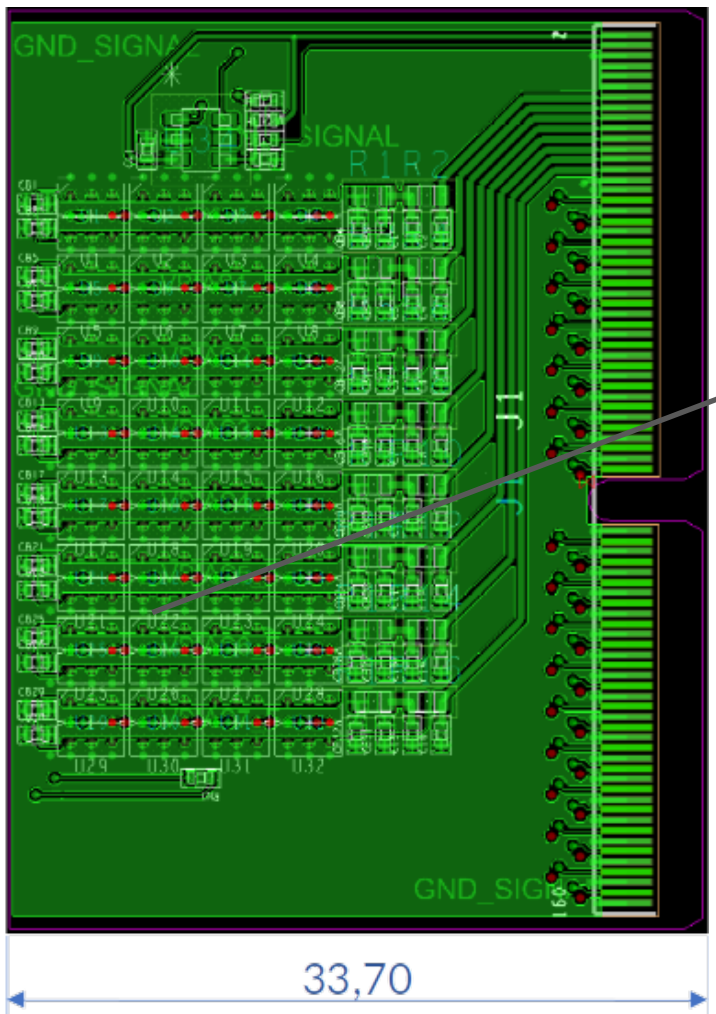
BO, FE, TO

- **born within the forward RICH proposal for EIC**
  - proof of feasibility of SiPM for Cherenkov application at colliders, this requires
    - single-photon counting capabilities (SiPM can do it)
    - reasonable dark-count rates (low-temperature operation, time resolution)
    - radiation tolerance (small SPAD cells, high-temperature annealing)
  - SiPM readout with dedicated readout electronics
    - ALCOR front-end ASIC (Torino)
    - streaming (aka continuous) readout DAQ
- **foreseen two main phases in 2021**
  - characterisation of the sensors before and after irradiation
  - use of the sensors (with/without irradiation) in dRICH prototype at test beam
- **if successful can have direct applications in multiple cases, i.e.**
  - other EIC detectors looking for B-tolerant photon counters
  - the Aerogel-RICH proposal for ALICE3
  - ...

Recent hardware developments @ BO

PCB of the SiPM **carrier board**
fully designed in Bologna (big work by Casimiro Baldanza)
edge connector for high-temperature annealing
hosts 4x8 matrix of SiPM, temperature sensors

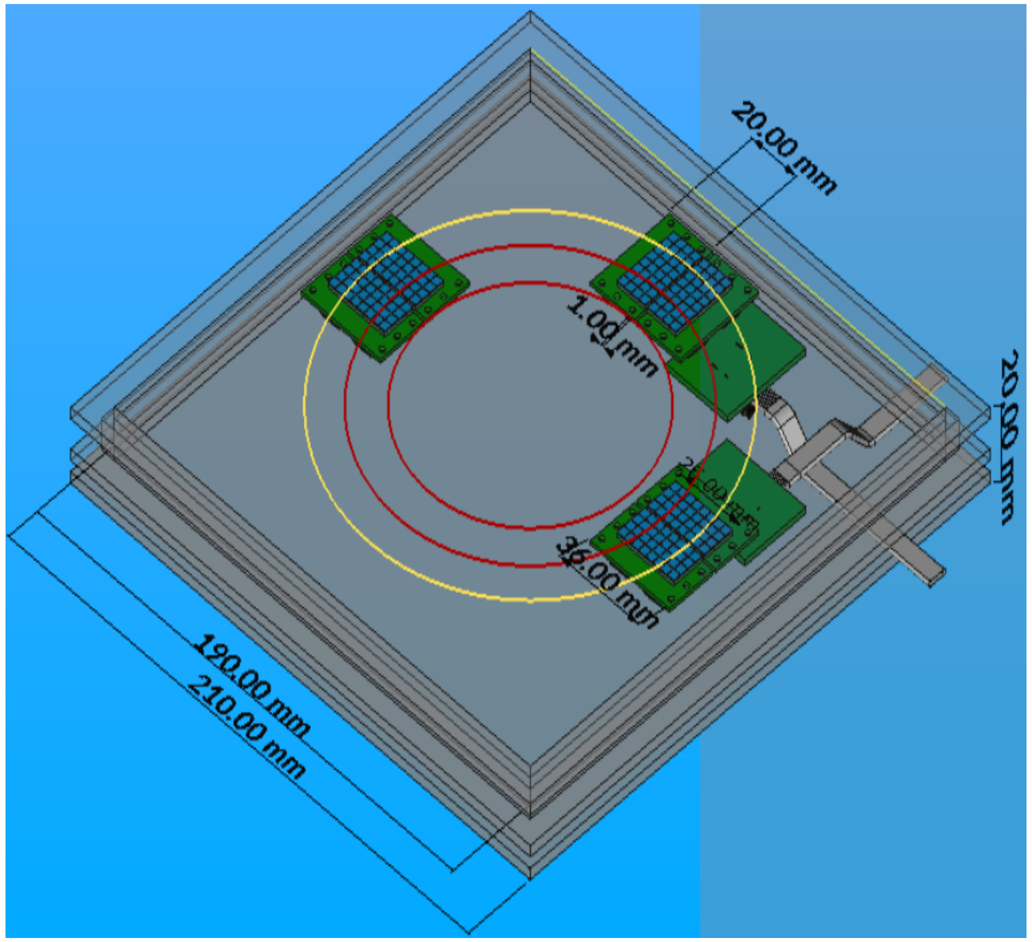




5 different versions designed
- SENSL
- Broadcom
- Hamamatsu-1
- Hamamatsu-2
- FBK

orders have been placed!
(responsibility of Bologna)

- SiPM characterisation
  → February/March
- SiPM irradiation at Centro di Protonterapia (Trento/TIFPA) → April
- SiPM used in dRICH test-beam (CERN)
  → October/November



the boards in the readout box of the dRICH prototype

AIDAinnova structure

Largest European HEP detector R&D grant

- 13 Work Packages (WPs)
  - 2 Administration WPs
  - 10 Scientific WPs
  - 1 "Blue-sky" WP
- 2 coordinators/WP
  - 4 Italian coordinators

- WP1: Project management and coordination
- WP2: Communication, Education and Innovation
- WP3: Test beam and infrastructure
- WP4: Upgrade of Irradiation and Characterization Facilities
- WP5: Depleted Monolithic Active Pixel Sensors
- WP6: Hybrid pixels sensors for 4D Tracking and Interconnection Technologies
- WP7: Gaseous detectors for frontier science
- WP8: Calorimeters and Particle Identification detectors
- WP9: Cryogenic neutrino detectors
- WP10: Advanced mechanics for tracking and vertex detectors
- WP11: Microelectronics
- WP12: Software
- WP13: Prospective and Technology-driven Detector R&D

AIDAinnova Topics

- **Advanced R&D and infrastructure** for detectors at future colliders
  - Leptonic colliders
    - Circular
    - Linear
  - Hadronic colliders
- **Novel detector technologies** for large-scale particle physics experiments
- **Innovative software** solutions (ML, etc.) for future detectors
  - Triggering
  - Tracking
  - Calorimetry
- Extended neutrino WP with also short baseline neutrino detectors
- **Joint R&D** programmes with **industrial beneficiaries**
- "Blue sky" R&D (competitive allocation after start of project) higher risk projects

Attività bolognesi

- Task 5.2.1: DMAPS High granularity design
  - A. Gabrielli
- Task 7.2.1: MRPCs for fast timing (30 keuro)
  - O. Pinazza, D. Hatzifotiadou, A. Margotti, P. Antonioli, D. Falchieri
- Task 7.3.2: Industrial engineering of µRWELL detectors
  - S. Braibant, V. Diolaiti, P. Giacomelli
- Task 7.5.1: Photon detector for hadron particle identification at high momenta (25 keuro)
  - R. Preghenella, F. Noferini, N. Agrawal
- Task 8.3.2: Large area scintillator detectors (20 keuro)
  - A. Montanari, N. Tosi
- Task 8.4.2: Dual readout calorimetry for future particle physics experiments
  - D. Falchieri, A. Gabrielli, P. Giacomelli

Attività bolognesi

- Task 11.3: Networking & ASICs for other WPs (80 keuro)
  - L. Bellagamba, D. Boscherini, D. Falchieri, A. Gabrielli, P. Giacomelli, A. Perrotta, A. Polini
- Task 12.2.1: Turnkey Stack
  - P. Giacomelli
- Task 12.4.2: MPGD Simulation
  - S. Braibant, V. Diolaiti, P. Giacomelli

- La sezione di Bologna riceverà da AIDAinnova 155 keuro

Conclusions

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  - RD-FCC: BO one the main proponents of IDEA

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    - Contributing to the Preshower, Muon and DR calorimeter detectors, and leading the physics studies

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Istituto Nazionale di Fisica Nucleare

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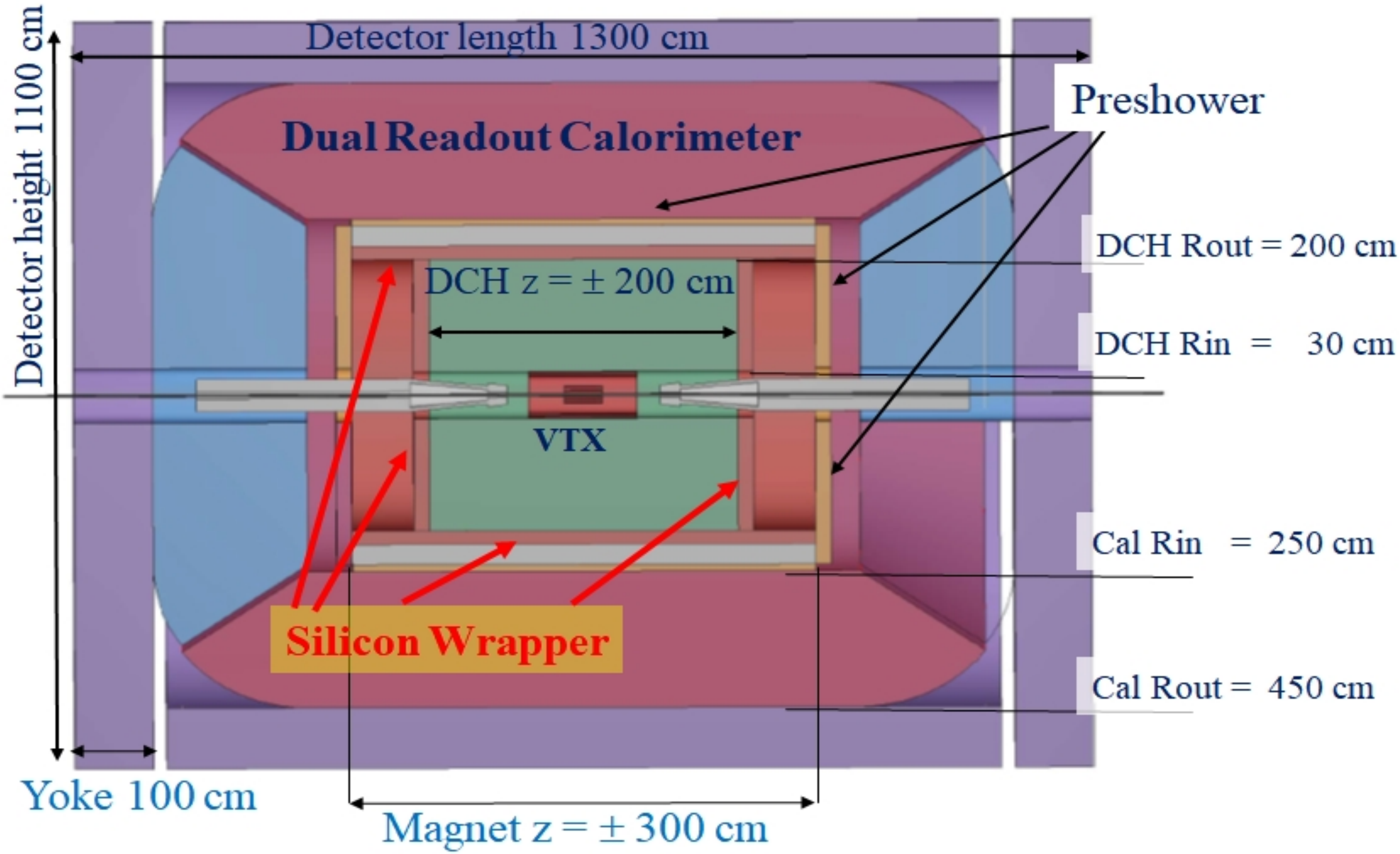
- Activities trasversal to all the sezione!
  - Plenty of possibilities to join in many challenging activities, spanning from detector design and testing, to electronics design, to software development and physics studies!

Backup

RD-FCC: IDEA detector layout

RD-FCC: IDEA detector layout

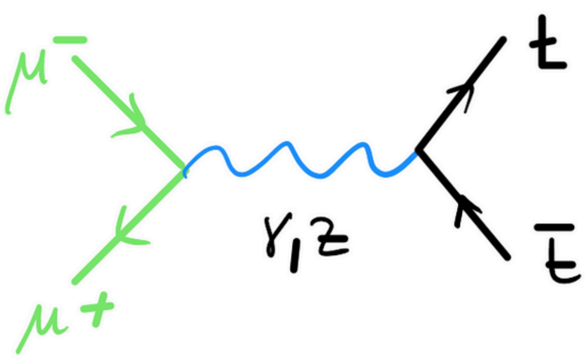


Detector for circular lepton collider

Mun collider production mechanisms

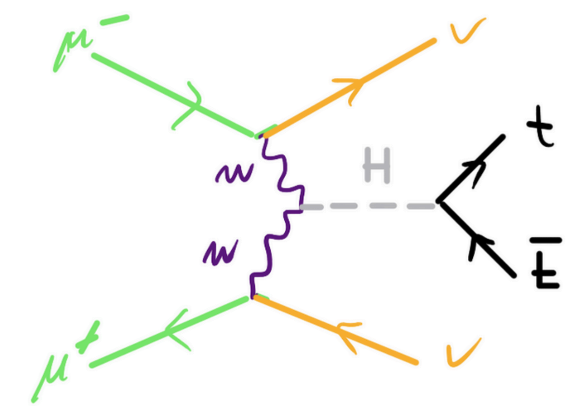
Annihilation vs scattering

$\sqrt{s} \lesssim$ 1-5 TeV



$$\sigma_s \sim \frac{1}{s} \quad \Longleftrightarrow \quad \sigma_s \sim \frac{1}{M^2} \log^n \frac{s}{M}$$

$\sqrt{s} \gtrsim$ 1-5 TeV



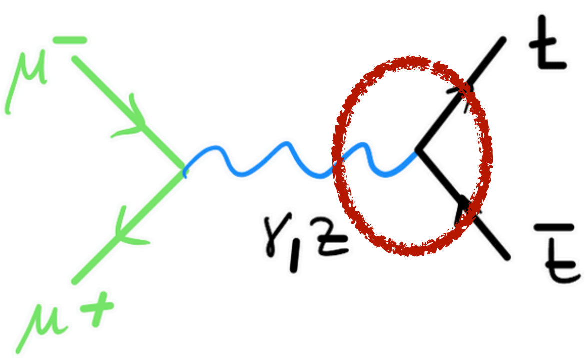
A completely new regime opening for a multi-TeV muon collider

Different physics being probed in the two channels

Mun collider production mechanisms

Annihilation vs scattering

$\sqrt{s} \lesssim 1\text{-}5\,\mathrm{TeV}$



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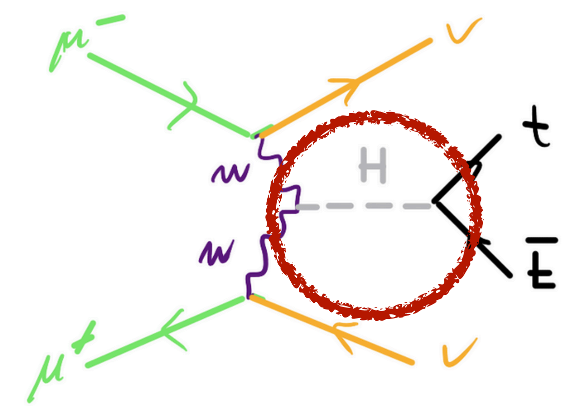


A completely new regime opening for a multi-TeV muon collider

Different physics being probed in the two channels

INFN Istituto Nazionale di Fisica Nucleare

LoI to Snowmass process

Letter of Interest: Muon Collider Physics Potential

D. Buttazzo, R. Capedevilla, M. Chiesa, A. Costantini, D. Curtin, R. Franceschini, T. Han, B. Heinemann, C. Helsens, Y. Kahn, G. Krnjaic, I. Low, Z. Liu, F. Maltoni, B. Mele, F. Meloni, M. Moretti, G. Ortona, F. Piccinini, M. Pierini, R. Rattazzi, M. Selvaggi, M. Vos, L.T. Wang, **A. Wulzer ***, M. Zanetti, J. Zurita

On behalf of the forming muon collider international collaboration [1]. * **wulzer@cern.ch**

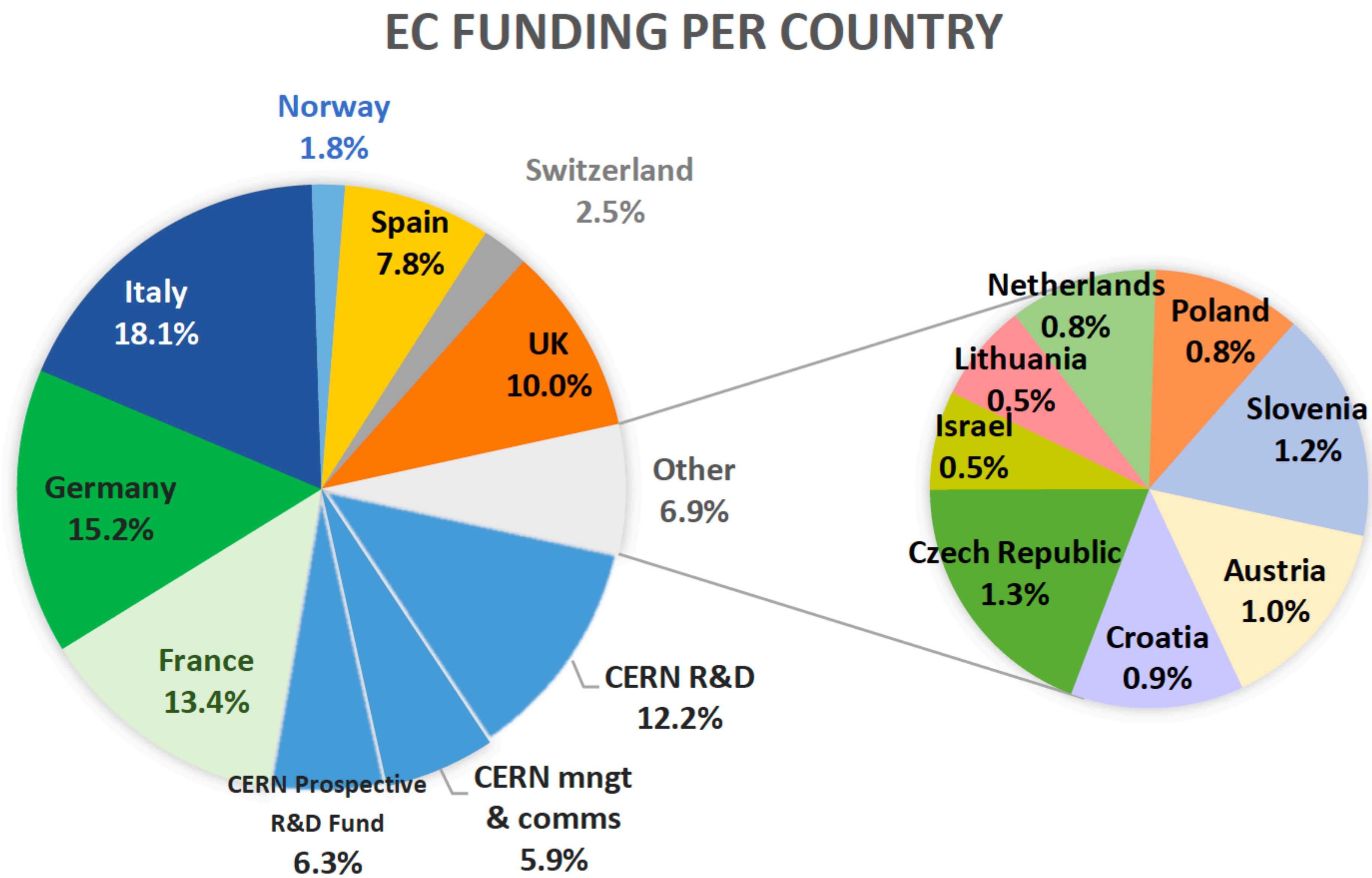
We describe the plan for muon collider physics studies in order to provide inputs to the Snowmass process. The goal is a first assessment of the muon collider physics potential. The target accelerator design center of mass energies are 3 and 10 TeV or more [2]. Our study will consider energies $E_{\rm CM} = 3, 10, 14$, and the more speculative $E_{\rm CM} = 30$ TeV, with reference integrated luminosities $\mathcal{L} = (E_{\rm CM}/10 \text{ TeV})^2 \times 10\,\text{ab}^{-1}$ [3]. Variations around the reference values are encouraged, aiming at an assessment of the required luminosity of the project based on physics performances. Recently, the physics potentials of several future collider options have been studied systematically [4], which provide reference points for comparison for our studies.

Submitted by Andrea Wulzer

Resources

Full costs budget AIDAinnova = **~ 30 M€**

EC contribution = **10 M€**



Italy is the largest beneficiary!