Ongoing FCC activities

- List of titles for internal FCC notes on detectors that was suggested to serve as reference for the forthcoming FCC mid-term report (first draft due by mid-June)
  - **IDEA dual-readout calorimetry**
  - Beam test results with dual-readout calorimeter prototypes
  - **Dual-readout calorimetry performance on single particles and jets**
  - Performance of the IDEA dual-readout calorimetry in the identification and reconstruction of complex final states with DNN
  - Exploiting timing measurements for the 3D reconstruction of hadronic showers with the IDEA dual-readout fibre calorimeter
  - **Preliminary estimate of the IDEA dual-readout calorimetry costing**

Volunteering as editor?

- Mogens Dam and Felix Sefkow charged of collecting cost estimates for the various sub-detector proposals for FCC (Franco Bedeschi contact person for IDEA)

Note on *“Preliminary estimate of the IDEA dual-readout calorimetry costing”*

- Minimize efforts by collecting all information directly in the FCC cost estimate note:
  - Link to overleaf
  - Use as basis the cost estimate from the Calvision proposal
  - Let me know if there is any update you would like to include

- Proposed outline/approach:
  - Brief description of detector design
  - Breakout of cost drivers
    - Crystals, SiPMs, filters, electronics, cooling, mechanics
  - Discussion of cost-performance optimization possibilities
  - Keep the total cost below 100M$ and show how the fiber calo cost could be reduced in case of a crystal EM section (coarser readout granularity, larger brass tubes, shorter fibers)

Additional material

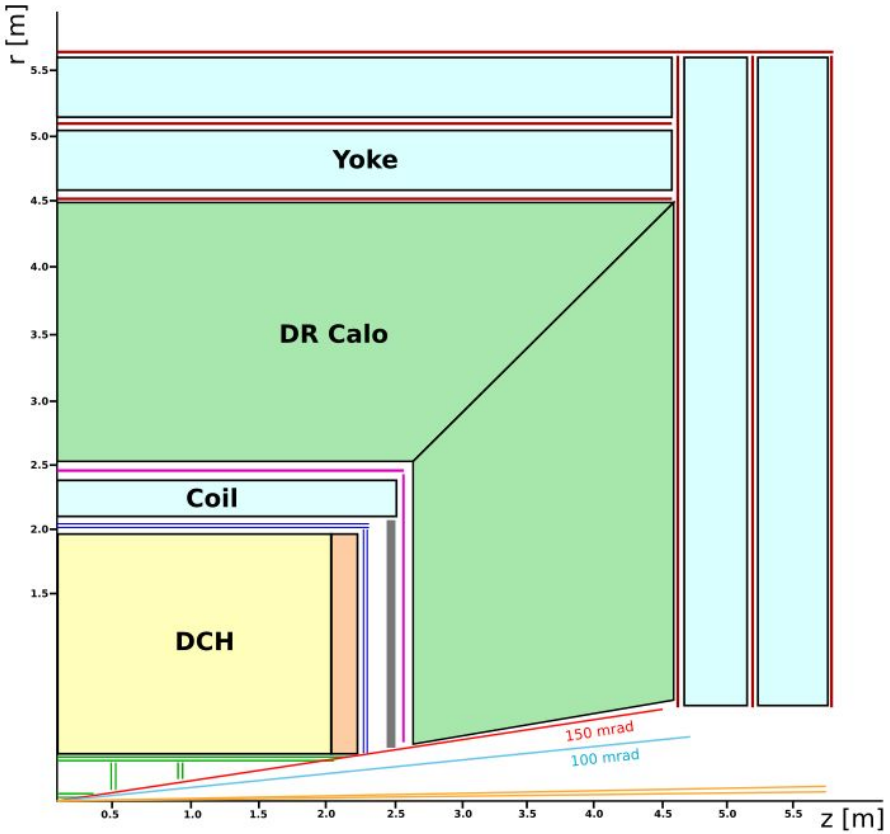
Cost estimate uncertainty level

Cost Estimate Classification	Primary Characteristics		Secondary Characteristic	
	Level of Definition (% of Complete Definition)	Typical Estimating Technique of the Cost	Typical purpose of estimate	Expected accuracy range - Variation in low and high ranges
Class 5, Concept Screening	0% to 2%	Capacity factored, Stochastic, most Parametric models, judgement or analogy	Concept screening	L: -20% to -50% H: +30% to +100%
Class 4, Study or Feasibility	1% to 15%	Equipment factored, more Parametric models	Study or feasibility	L: -15% to -30% H: +20% to +50%
Class 3, Preliminary, Budget Authorization	10% to 40%	Semi-detailed unit costs with assembly level line items, cost estimating technique includes the combinations of various techniques (detailed, unit-cost, or activity-based; parametric; specific analogy; expert opinion; trend analysis)	Budget authorization or control	L: -10% to -20% H: +10% to +30%
Class 2, Control or Bid/Tender	30% to 70%	Detailed unit cost, cost estimating technique includes the combinations of various techniques (detailed, unit-cost, or activity-based; expert opinion; learning curve)	Control or bid/tender	L: -5% to -15% H: +5% to +20%
Class 1, Check Estimate or Bid/Tender	50% to 100%	Deterministic, most definitive cost estimation	Check estimate or bid/tender	L: -3% to -10% H: +3% to +15%

The target for the mid-term Feasibility Study is Class 4.

Baseline IDEA radial envelopes

- Silicon pixel vertex detector (MAPS):
  - R = 1.7 - 34 cm
- Drift chamber:
  - R = 35 - 200 cm
- Si wrapper (micro-strip layer)
  - R = 200 - 210 cm
- Thin Solenoid (2T, 0.7X0)
  - R = 210 - 240 cm
- Pre-shower (μRwell behind absorber)
  - R = 240 - 250 cm
- Dual readout calorimeter
  - R = 250 - 450 cm
- Muon chambers (μRwell)
  - R = 450 - 560 cm

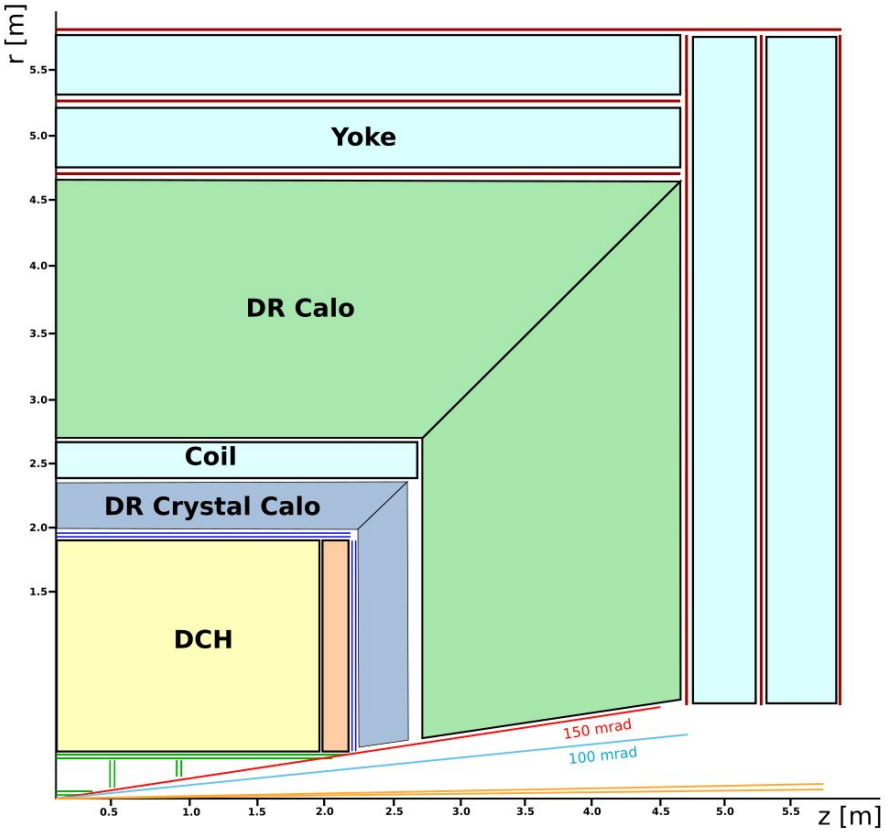


EM crystal calo radial envelopes: baseline?

- Silicon pixel vertex detector (MAPS):
  - R = 1.7 - 34 cm
- Drift chamber:
  - R = 35 - **190** cm
- Si wrapper (micro-strip layer)
  - R = **190 - 200** cm
- **Crystal Calorimeter**
  - **200 - 230 cm**
- Thin Solenoid (2T, 0.7X0)
  - R = **230 - 260** cm
- ~~Pre-shower (μRwell behind absorber~~
  - ~~R = 240 - 250 cm~~
- Dual readout calorimeter
  - R = 260 - 460 cm
- Muon chambers (μRwell)
  - R = 460 - 570 cm

-10 cm

+10 cm



Overview

It’s a global cost-performance optimization of the full detector

Option	DC outer radius [cm]	Crystal inner radius [cm]	Solenoid inner radius [cm]	Fiber calo inner radius [cm]	Approx crystal volume* [m³]
No crystals	**200**	**-**	**210**	**250**	**-**
Previous sim	175	185	220	250	14.0
New baseline	190	200	230	260	17.2

Note: crystal calo is about $1\lambda_I$ so we could reduce the length of the fiber calo
** Crystal calo cost is 80% driven by crystal volume, volume ~ $R^{1.65}$*