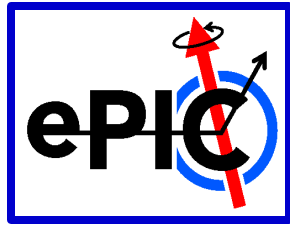




The roadmap towards ePIC TDR (general and detector)

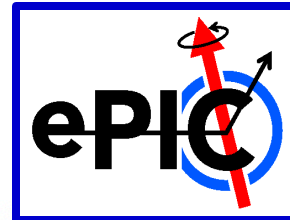
Silvia Dalla Torre

The TDR in the perspective of the DOE EIC PROJECT



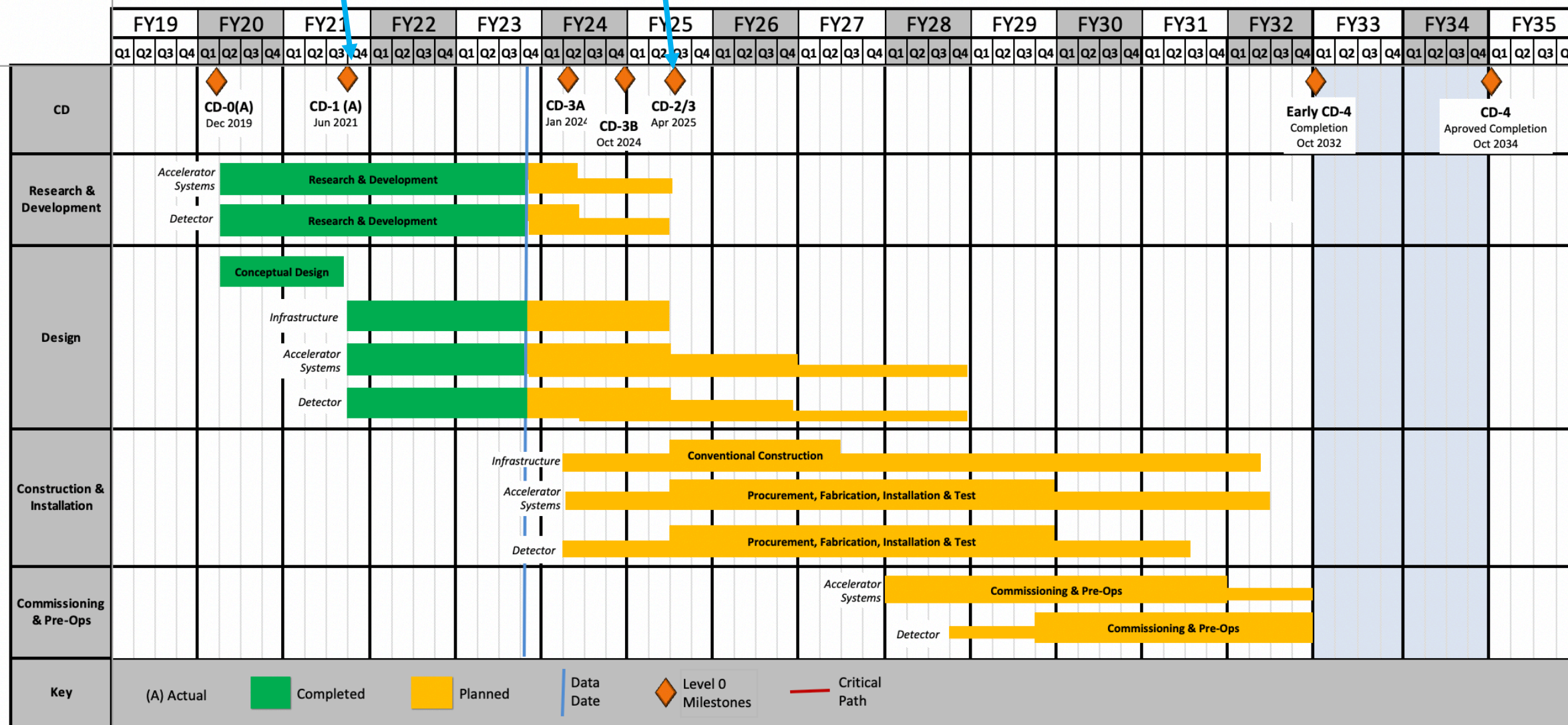
- **The EIC PROJECT includes:**
 - The **collider** (major concerning costs and technological challenges)
 - The **project detector**, namely our ePIC detector
- **Pre-TDR/TDR** are documents accompanying the critical project milestones
 - These documents include the whole project
 - Not the entire document is made public to protect proprietary accelerator technologies
- **RECALL:** it was the same when, in 2020, the **CDR** was submitted
 - At that time, we were busy with the Yellow Report and, in fact, YR material was used
- **An obvious comment: the success of the DOE project is fully in our ePIC interest!**

The TDR in the perspective of the DOE EIC PROJECT

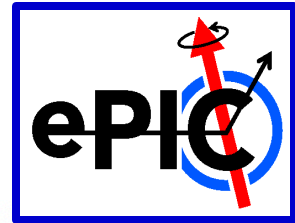


CDR needed

preTDR/TDR needed



The TDR in the perspective of the DOE EIC PROJECT



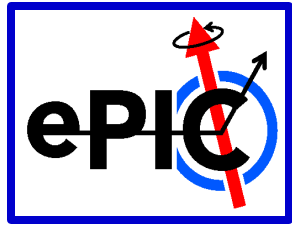
CDR needed

preTDR/TDR needed

	FY19				FY20				FY21				FY22				FY23				FY24				FY25				FY26				FY27				FY28				FY29				FY30				FY31				FY32				FY33				FY34				FY35			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4																
CD					◆				◆												◆	◆	◆																														◆															
					CD-0(A) Dec 2019				CD-1 (A) Jun 2021																																												CD-4 Approved Completion Oct 2034															
Research & Development																																																																				
Design																																																																				
Construction & Installation																																																																				
Commissioning & Pre-Ops																																																																				
Key																																																																				

IMPORTANT:
 (pre)TDR has to be accompanied by
 DOE OPA (*) reviews:
 the next one related to CD2
 is in January 2025 →
 Pre-TDR draft needed by the end of 2024
 (*) Office of Project Assessment

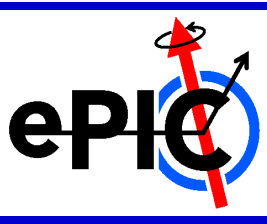
A very obvious question



- **What characterizes preTDR vs TDR (also CD2 vs CD3)?**
 - **CD2 and preTDR: 60% readiness level**
 - **Globally, some subsystem can be in more advanced status, other less advanced respect to the 60% readiness level**
 - **CD3 and TDR: 90% readiness level**

The Document structure

From Elke, ePIC meeting, July 2023, Warsaw



What Is Coming Up – TDR

We will start the process of writing a draft TDR later this year, and then this will continue towards a first version of a TDR in 2024.

Working model will be similar as we used to create the CDR, Elke/Rolf with engagement of ePIC leadership, and a mix of the project CAMs and EPIC WG representatives. At the late phases the editing rights will become more restricted. We plan to use where we can input from the CDR, YR, proposals, technical notes, etc.

Chapter 2: Physics Goals and Requirements (*should be short, < 50 pages*)

- 2.1 EIC Context and History (like CDR 2.2 or YR section 1)
- 2.2 The Science Goals of the EIC and the Machine Parameters (like CDR 2.3)
- 2.3 The EIC Science (follow YR structure)
- 2.4 Scientific Requirements

Chapter 3: Interaction Region 6 Overview (Elke/Rolf contributing)

Chapter 8: Experimental Systems (*can be long such that we can use as standalone detector TDR*)

- 8.1 Experimental Equipment Requirements Summary (like CDR 8.2)
- 8.2 General Detector Considerations and Operations Challenges (YR 10, CDR 8.3)
- 8.3 EIC Detector
- 8.4 Detector R&D Summary
- 8.5 Detector Integration
- 8.6 Detector Commissioning and Pre-Operations

Chapter 11: Commissioning (Elke/Rolf contributing)

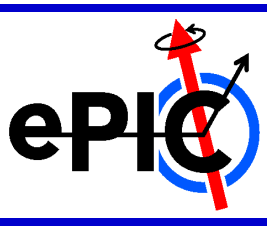
Appendix-B: Integration of a Second Experiment (mainly emphasizing feasibility, luminosity sharing, polarization with two experiments, and first-order checks of magnets/acceptance)

Where ePIC would like to play a major role ?

We should also contribute on physics

A standalone TDR would need a physics requirement section ...

An absolute must



The ePIC role for the pre-TDR / TDR effort

- **What the Project Management asks to us :**
 - Describe the detector in concise format (style: “executive summary-like”)

- **What ePIC managements has proposed to the Collaboration and decided upon after preliminary steps and an ample discussion at the Jan 2024 Collaboration meeting^(*) :**
 - Regard the (pre)TDR as the first priority
 - Prepare more extended material, which is the basis
 - not only for preTDR/TDR
 - but also for two scientific publications

(*)

Coordinator meeting, Oct. 27, 2023

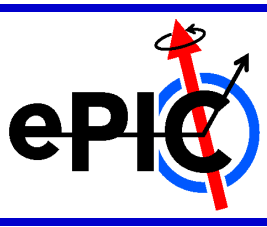
PM-SP office November 2023

EB, Nov. 17. 2023

first announcement at the collaboration at large: General Meeting, Dec. 1, 2023

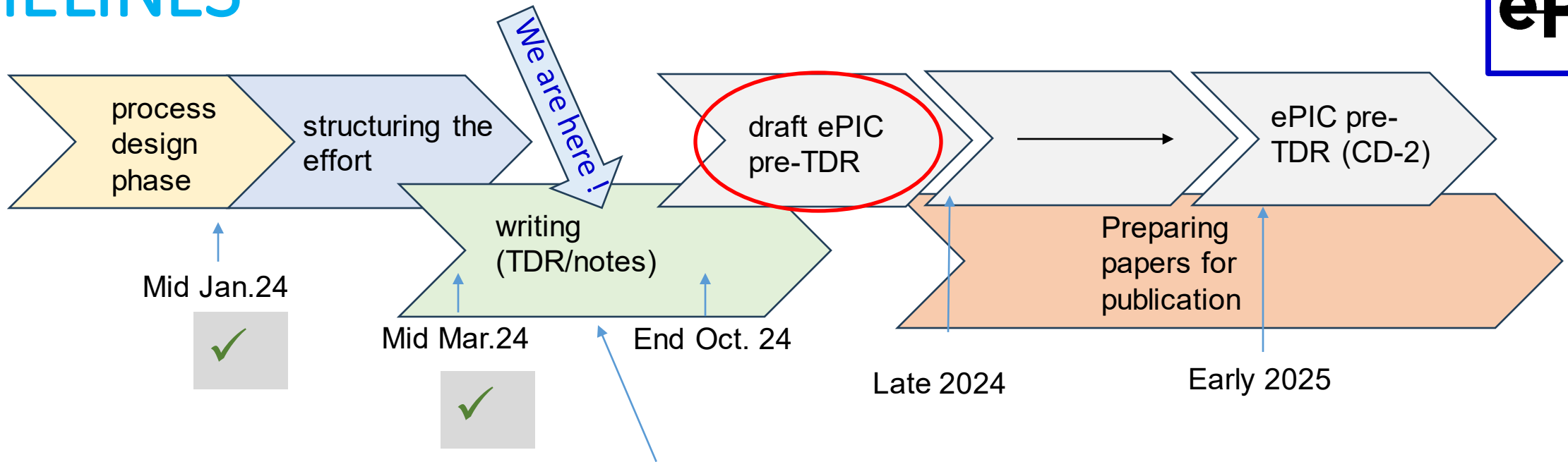
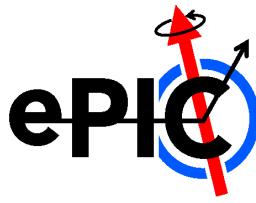
dedicated session at the ePIC meeting on January 2024

The ePIC goals in the (pre)TDR effort



- In late 2024:
 - The ePIC contributions to the preTDR draft (Chapters 2,8)
 - The EIC TDR is the top priority
 - Precise timescale driven by EIC project requirements
 - An extended version of the **ePIC detector** section from the EIC TDR with appropriate front matter, published in a scientific journal (such as NIMA, JINST, PRC)
 - Derived from TDR Chapter 8
 - An **ePIC Physics Performance** long paper published in a scientific journal (such as NIMA, JINST, PRC)
 - Derived and expanded from TDR Chapter 2 (Section 2.3)

TIMELINES



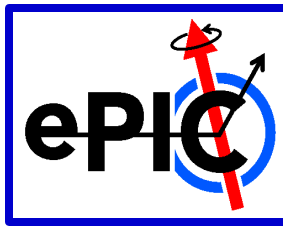
DSCs: writing includes all the preparatory activity: lab and testbeam studies, prototyping, simulations

Detector Subsystem Collaborations have prepared their TDR effort planning periodically reviewed at the Technical and Integration Council (periodicity: ~ 6-7 weeks)

Please, note that these timelines are somewhat different from those presented in January 2024:

The project timelines have been readjusted!

Structuring the ePIC (pre)TDR effort: defining the engagement areas



CHAPTER 2

CHAPTER 8

2 Physics Goals and Requirements

2.1	EIC Context and History
2.2	The Science Goals of the EIC and the Machine Parameters.
2.3	Scientific Requirements
2.3.1	Systematic Uncertainties
2.3.2	Radiative Corrections
2.4	The EIC Science (ePIC performance for key observables)
2.4.1	Origin of Nucleon Mass
2.4.2	Origin of Nucleon Spin
2.4.3	Multi-Dimensional Imaging of the Nucleon
2.4.3.1	Imaging in Momentum Space
2.4.3.2	Imaging in Transverse Position Space
2.4.4	Properties of Nuclear Matter
2.4.4.1	Gluon Saturation
2.4.4.2	Nuclear Modifications of Parton Distribution Function
2.4.4.3	Passage of Color Charge Through Cold QCD Matter

8 Experimental Systems

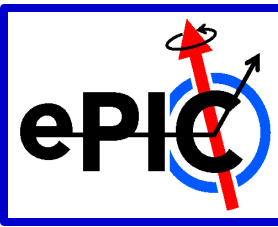
8.1	Experimental Equipment Requirements Summary
8.2	General Detector Considerations and Operations Challenges
8.2.1	General Design Considerations
8.2.2	Backgrounds and Rates
8.2.3	Radiation Level
8.3	The ePIC Detector
8.3.1	Introduction
8.3.2	Magnet
8.3.3	Tracking
8.3.4	Particle Identification
8.3.5	Electromagnetic Calorimetry
8.3.6	Hadron Calorimetry
8.3.7	Particle Identification
8.3.8	Far-Forward Detectors
8.3.9	Far-Backwards Detectors
8.3.10	Polarimetry
8.3.11	Readout Electronics and Data Acquisition
8.3.12	Software and Computing
8.4	Detector Integration
8.4.1	Installation and Maintenance
8.5	Detector Commissioning and Pre-Operations

ePIC responsibility

Joint responsibility

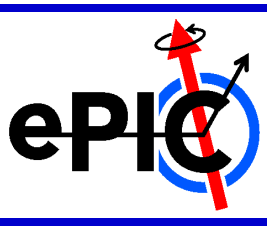
Project responsibility

Structuring the ePIC (pre)TDR effort: building the editorial tool

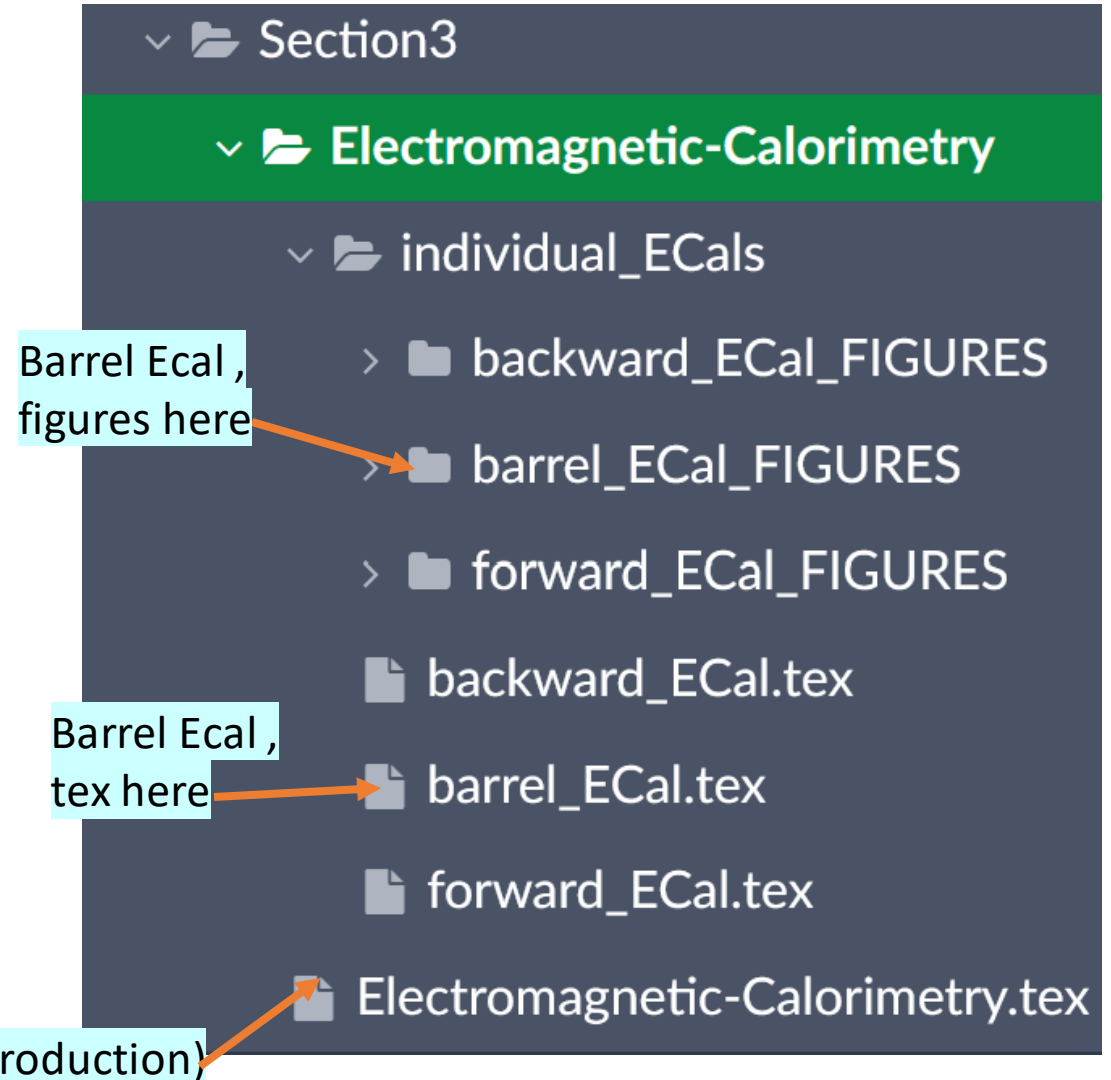


- On overleaf project: **“ePIC Preliminary Design Report”**
- Owner and creator of the overall Frame
Douglas Higinbotham (now also supported by his collaborator Anil Panta)
- Technical aspects:
 - Same structure as the one adopted for the collider (easier merging, later)
 - The project is structured so that, while progressing in your editing, you do not need to recompile the whole of it at each step: recompiling a subsection is enough (large saving on editors' time !)
 - The above document has 3 chapters
 - Chapter 0: format and latex instructions
 - Chapter 2: Physics performance
 - Chapter 8: Detector dedicated

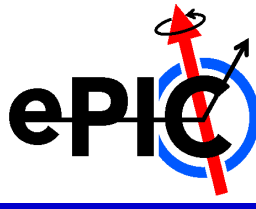
Structuring the ePIC (pre)TDR effort: building the editorial tool



- Who can edit:
- SP-office
- ACs, SCCs, TC-office
- **CC WG conveners**
- **DSLs and DSTCs**
- **Let's understand this with an example**



Structuring the ePIC (pre)TDR effort: frame in place



The structure discussed at 2 TIC meetings and finally approved is in: please, preserve it!

8.3.5.2 The barrel electromagnetic calorimeter

Requirements

Requirements from physics: Add text here.

Requirements from Radiation Hardness: Add text here.

Requirements from Data Rates: Add text here.

Justification

Device concept and technological choice: Add text here.

Subsystem description:

General device description: Add text here.

Sensors: Add text here.

FEE: Add text here.

Other components: Add text here.

Requirements from Data Rates: Add text here.

Implementation

Services: Add text here.

Subsystem mechanics and integration: Add text here.

Calibration, alignment and monitoring: Add text here.

Status and remaining design effort:

R&D effort: Add text here.

E&D status and outlook: Add text here.

Other activity needed for the design completion: Add text here.

Status of maturity of the subsystem: Add text here.

Environmental, Safety and Health (ES&H) aspects and Quality Assessment (QA planning): Add text here.

Construction and assembly planning: Add text here.

Collaborators and their role, resources and workforce: Add text here.

Risks and mitigation strategy: Add text here.

Additional Material Add text here.

How many pages?

- **The length of each DSC subsection (excluding Additional Material) is expected to be within 10-15 pages; this length is related to the subsystem complexity and to its readiness. → a kind of Executive summary**
- Use these limits with a grain of salt.
- **IMPORTANT, about Additional Material:**
 - Please insert here all the extra material exceeding the compact format of the pre-TDR document.
 - At a later time, this extra material, which can be abundant, will be moved in appropriate **Appendices**.

- **Plots:**

- the plot format (a uniform one to be used all over our text) is being elaborated and communications will follow;
- the procedure by which each plot is related to the information used to obtain the plot itself (which simulation sample, which events selection and which cuts applied, ...) is being elaborated and, again, communications will follow.

→ **Therefore:**

- In case, while start editing, you need to make use of preliminary/temporary plots, please consider that, later, they have to be replaced with plot-figures according to the prescriptions mentioned here above.

- preTDR/TDR : needed for the Project and for ePIC
- A great opportunity for the ePIC Collaboration to cooperate internally following the model of an effective Collaboration
- The effort will also result in ePIC published papers!
- The (pre)TDR structuring initial phases :
 - Designing the process
 - Structuring the process
- are now completed and we are running in the writing phase!