TC-office Report

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ePIC General Meeting, May 17, 2024

OUTLOOK

- **TIC meetings news**
- **TC report at RRB on May6-7, 2024 in Rome**
- **TDR news**

Recent TIC meetings

TIC meetings after the previous General meeting (April 18)

13 May TIC meeting - TDR effort, progress (B0, el/r-o/DAQ); photosensors for Cherenkov PID

06 May TIC meeting - meeting cancelled (overlap with EIC RRB)

April 2024

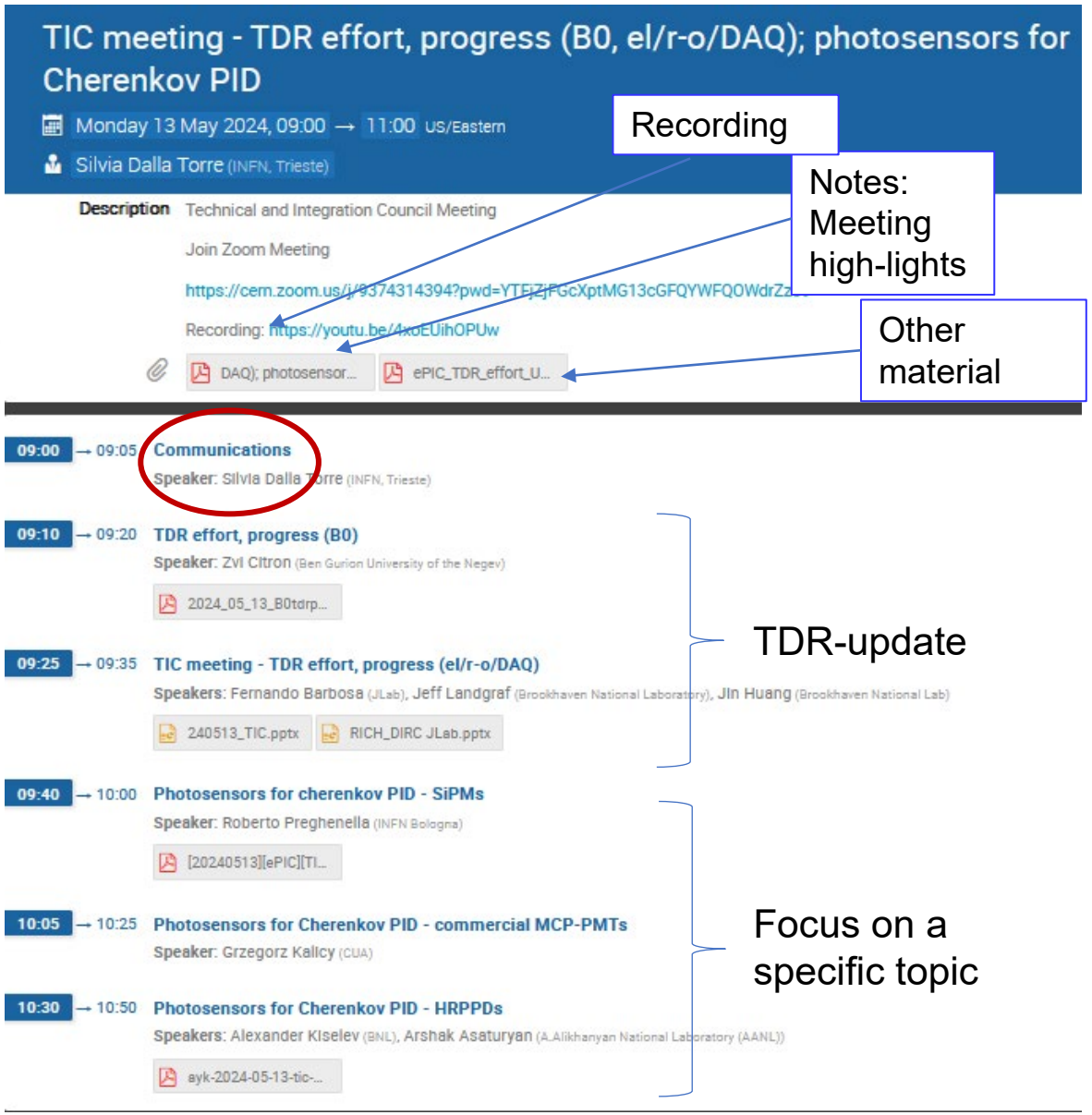
29 Apr TIC meeting - TC priorities for simulation studies; TDR effort, progress (far forward); detector DB requirements

22 Apr TIC meeting - TDR effort, progress (PID); far backward detectors

Structure of the recent TIC meetings

- Quick communications
- ePIC TDR effort (for detector), updates
- Focus on specific topic(s)

An example



About communications/topics of general interest

TC priorities for simulation studies

An initial list

Part of the topics in this list can be addressed to Acs, other will require the direct engagement of DSCs

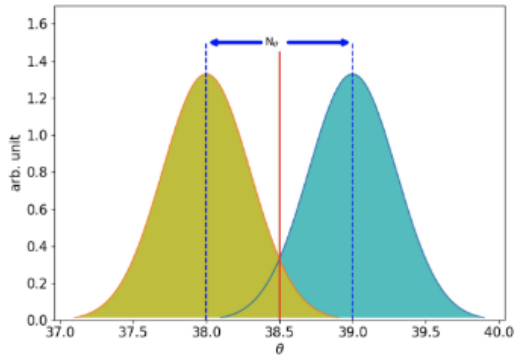
- To be included in standard simulation plots: the acceptance of the various detector to follow its evolution with layout modifications.

- This following list includes studies for subsystems where there are technical aspects still open:
  - simulations dedicated to soft gamma and to vector meson production in order to optimize the **ZDC configuration**;
  - motivation and requirements for the **backward HCal**;
  - needs in term of space resolution for the **outer MPGD**;
  - impact on physics of **dRICH with single vessel vs dRICH with split vessel**;
  - B0 calorimetry performance: **LYSO vs $PbWO_4$** .

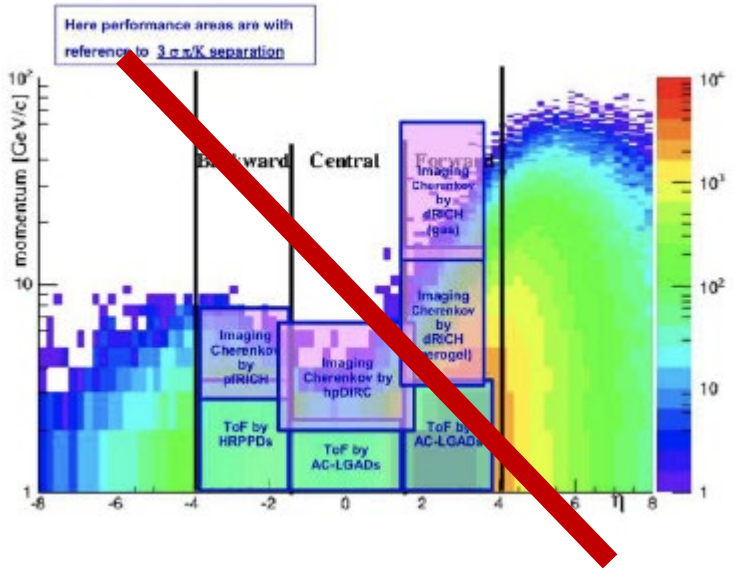
ePIC TDR effort, updates - April 22

PID:

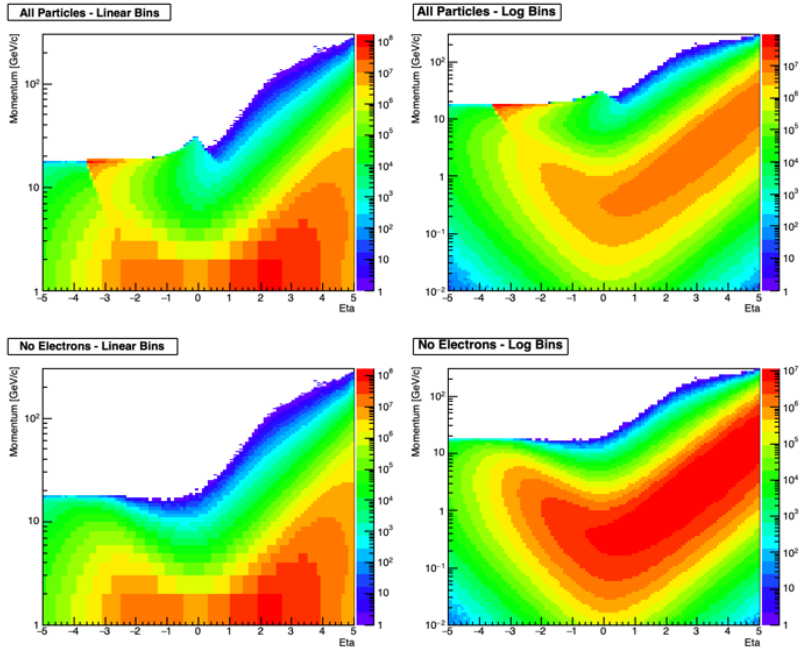
- An advanced set of key plots from the PID DSCs to be included in the (pre-)TDR is presented.
- Questions raised for common agreement:
  - Which definition when we quote n sigma's separation (f.i. π/K)
  - The need of a 2-D plot of event distribution frequency in the plane p vs eta that supports our PID subsystem choices : the currently used one is not fully adequate.



$$n\sigma = \frac{\theta_C^{\pi} - \theta_C^{K}}{(\sigma_\theta^{\pi} + \sigma_\theta^{K})/2}$$



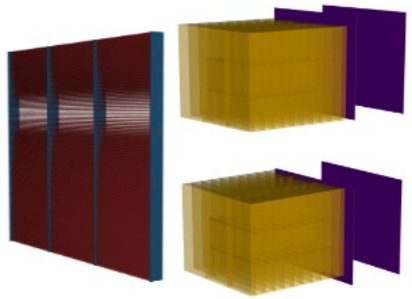
New options under consideration

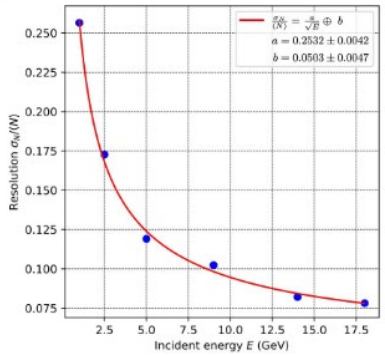


ePIC TDR effort, updates - April 22

Far backward, Lumy system

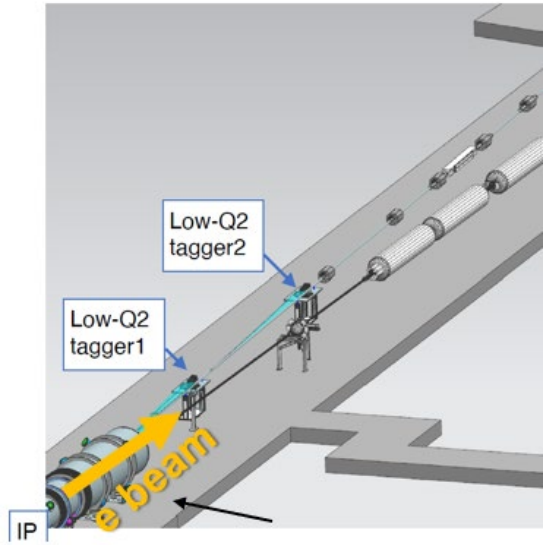
- Pair Spectrometer, critical items:
  - Services (cooling, gas system, sensor power supply, FEE power supply…)
  - ES&H aspects and QA planning
  - Collaborators and their roles, resources and workforce - Limited Workforce
  - Risk and mitigation strategy
- Direct photon, critical items:
  - Performance from available input (lab studies, test beam, prototyping)
  - resources needed for FEE development.



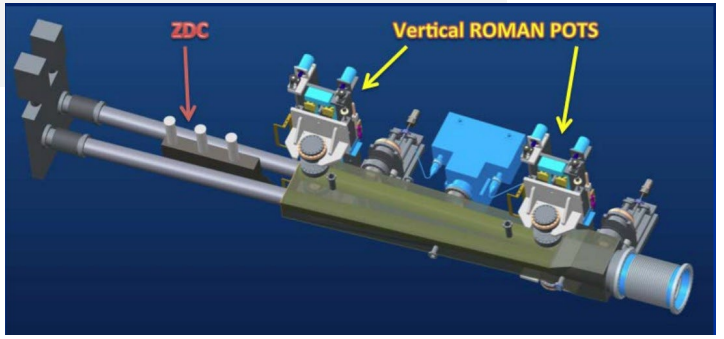


Far backward, low-Q^2 taggers

- careful and detailed planning presented, including the timeline over 2024 for all the different activities

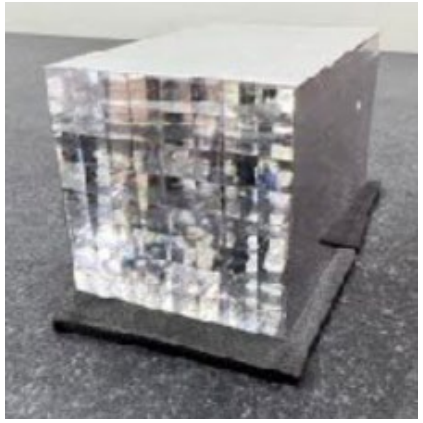


ePIC TDR effort, updates - April 29



RPs and OMDs:

- FEE ASIC - EICROC0 several limitations preventing performance evaluation;
  - the new version EICROC0A/1 is expected in Fall;
  - Performance vs T and radiation dose?
- Reconstruction software: working on global solution to handle beam effects and crossing angle, particularly relevant in FF
  - the integration of machine learning methods into EICrecon (ODFs !) progressing
- integration: progress for vacuum system, detector moving stages and cooling systems

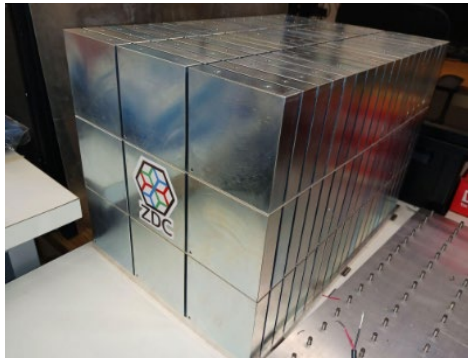


ZDC, crystals:

- the comparison LYSO vs PWO requires dedicated simulations;
- the choice of photosensors (APD vs SiPM) includes irradiation studies foreseen at RIKEN/RANS;
- ongoing simulation efforts: Lambda identification by Alex, Low-E photon by Miguel; plans in Asian groups (Sejong Univ. group, Academia Sinica): Lambda, pi/K structure function by Sullivan process for pi/K DIS, Mass/GPD by pi/K DVCS/DVMP

ZDC, SiPM on tile:

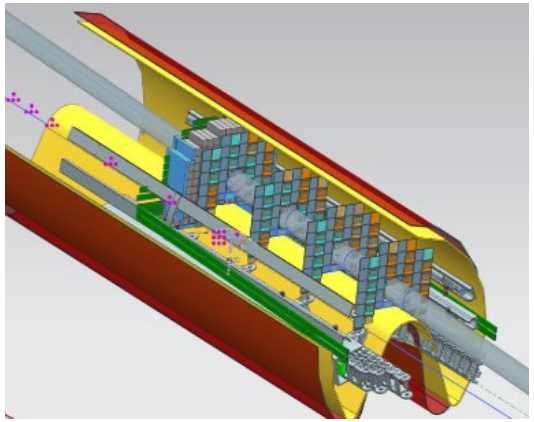
- relevant improvements in energy and space resolution with GNN-based reconstr. algorithms;
- multiple neutron response is satisfactory and highly linear;
- a prototype is under test at STAR, a 30 x 30 cm^2 calorimeter will be tested in Fall 24 at JLab;
- physics studies coupling the hadronic section with 7 cm long LYSO crystals ongoing using standard physics benchmarks (A^0, vector mesons);
- <u>new:</u> the capability to detect down to the first line of U238 (45 keV), which shows up at ~10 MeV in the lab frame (separation of coherent/quasi-coherent scattering)



ePIC TDR effort, updates - May 13

B0 detectors

- On the TDR time scale, no dedicated laboratory/testbeam/prototyping studies are possible
  - Support will come from the studies of AC-LGAD from RP/OMD program and crystal calorimetry with ZDC
- Relevance of using charge sharing in AC-LGDS to obtained the require space resolution
- About the ECal, the need of long (~ 20 cm) crystal to cope with high energy gammas
  - Baseline is $PbWO_4$ crystals (soft photon performance challenges)
  - LYSO crystals can offer mate and, therefore are still considered, if with reasonable size and cost
- Installation and integration remain key issues for the B0 detectors



Electronics/Read-out/DAQ

- The Electronics and DAQ PDR #2 is scheduled on June 10-11.
  - Included: final design review for lPGbt /vtrx+, LLP items for CD3-B
- Progress in determining the data volume, with some remaining open issues:
  - RICH detectors; Far For/Backward; Synchrotron Radiation; Noise (needed thresholds > 4-5 sigma), thresholds increase with radiation damage.
  - FEE for MCP-PMT-like sensors (FCFD vs EICROCx) remains an open point
    - in both cases, space requirement below 10
    - the OMEGA group will be contacted about the possibility of developing 3 ASICs (CALOROC, EICROC and EICROCx) in accordance with the project timelines
- Six RDO boards have been fabricated by the end of April, as expected (ppRDO).
- A compilation of detector slow control requirements has been started.

Specific topics: DETECTOR DB

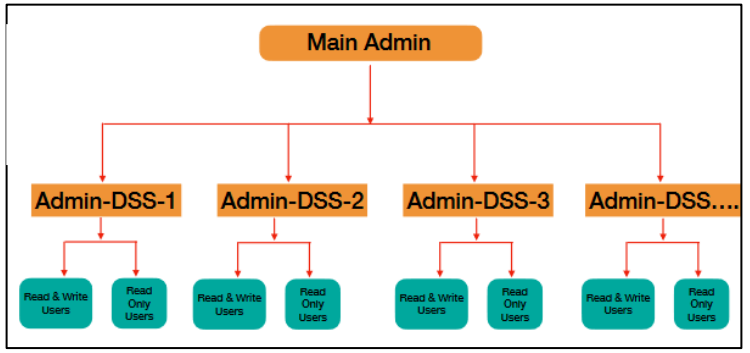
A substantially mature draft presented:

https://docs.google.com/document/d/1ow1nfy8dsrI1CfTBkG6kUJ0Oy2MZONhAktLy-zevJ1E/edit

Further comments/suggestion collected with deadline May 12 → the document is now FINAL

High-lights:

- **Landing Page**
  - A "Real Database Page" for live data.
  - A "Test Database Page" for practice and familiarization.
- **Administration hierarchy**
- Also included:
  - **Backup and Contact info**
  - **Numbered and Unnumbered items**
  - **Data upload and Plotting**
  - **Query, Inventory and shipping**
  - **Stage of Preparation with Time**

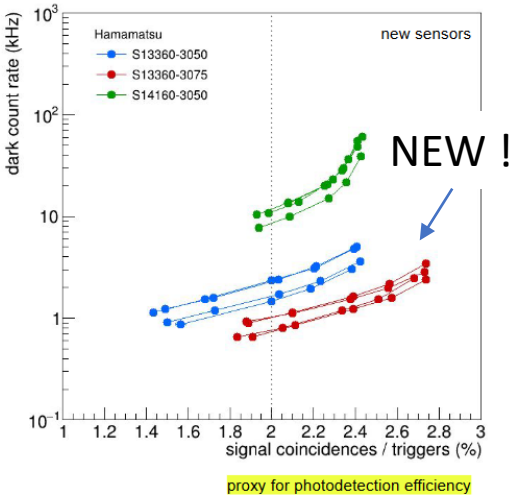


NEXT STEP: selection of the technical tool for this implementation

Specific topics: photosensors for Cherenkov PID

SiPMs for dRICH

- Abundant further studies ongoing. Highlights here:
- From recent rate studies: a factor of 2 increase of neutron fluence in the dRICH SiPM
  - revisited strategies to preserve SiPMs with tolerable dark count rates
- The SiPM window (Si resin) looses transparency when heated in situ at 175 degrees (not in oven)
  - Environmental effect? How when in pure N_2 atmosphere?
  - Heating at max 150 degree with no transparency loss should be equally effective
  - Further studies ongoing.
- New SiPMs from Hamamatsu (not yet commercialized) under test
  - lower dark count noise for the same PDE;
  - the effective spectrum moved towards UV (quartz window)

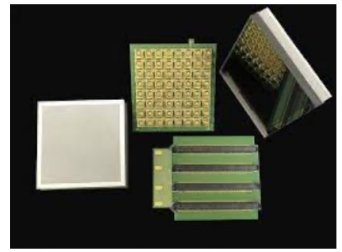


proxy for photodetection efficiency

Commercial MCP-PMTs (baseline for hpDIRC)

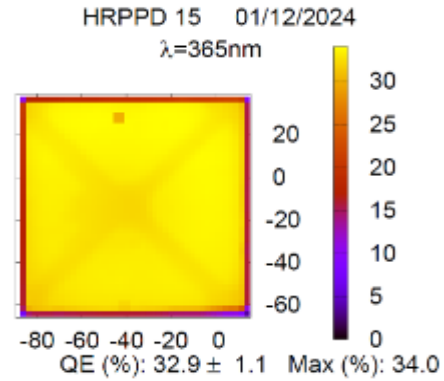
- The panorama is restricted to Photek devices (HRPPDs are still an alternative option).
- Preparatory work to have them characterized in Edinburgh is ongoing.

Photek MAPMT 253



HRPPDs for pfRICH

- Six HRPPDs have been delivered and basic quality assessment started (a seventh coming soon).
- Globally , good performance (QE, gain, time resolution).
- QE setups are organized/ are being organized at Jlab, BNL and Yale.
- Other planned studies : comparative tests in Edinburgh, ageing at INFN.
- Engineering issues persisting (HV contacts, mechanics, photocathode coating).
- Important progress, but robust characteristics suitable for mass industrial production are still far.



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- **TDR news**

OUTLOOK

- ePIC as project detector and as ePIC Collaboration effort
- Technologies, expertise and institutions in ePIC
- The finalization of the ePIC detector design and the path to the TDR

See next item in today report

OUTLOOK

- ePIC as project detector and as ePIC Collaboration effort

The community (Project and Collaboration) has turned the challenge arising from this dual nature of the ePIC detector into the opportunity for a highly coherent and effective effort.

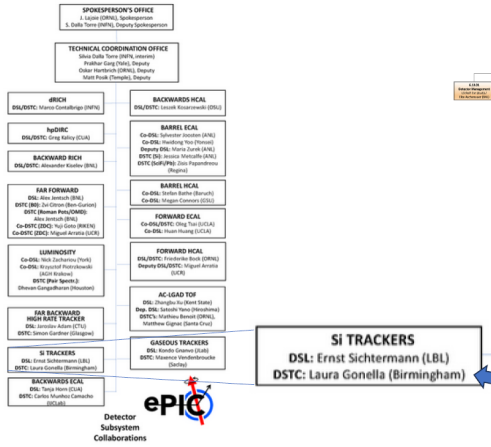
There are **specific missions**:

- Project: ensure that all aspects related to the EIC project realization and completion are satisfied;
- Collaboration: optimize the physics reach of the detector and manage the Collaboration to make it functional, effectively operative and a professionally sound environment

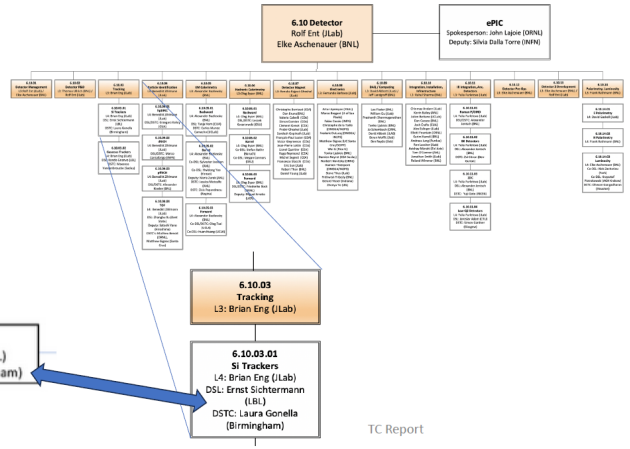
Beyond these specificities, **Project and Collaboration are synergistically cooperating** across the two missions towards the common goal: **a detector matching the overall EIC physics scope.**

EIC RRB meeting, May 6-7, 2024

Within ePIC, each subsystem is realized by a Detector Subsystem Collaboration, DSC (15 DSCs, in total) guided by a Leader assisted by Technical Contacts



In the Project organization, subsystems are under the responsibilty of CAMs and L4 managers – DSCs are co-responsible at L4 level



OUTLOOK

- ePIC as project detector and as ePIC Collaboration effort
- Technologies, expertise and institutions in ePIC
- The finalization

The detector subsystems have been analyzed in term of the experience required by the different technologies, and Institutions matching these needs

EIC RRB meeting, May 6-7, 2024

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(pre-)TRD : the ePIC engagement

CHAPTER 2

2 Physics Goals and Requirements

CHAPTER 8

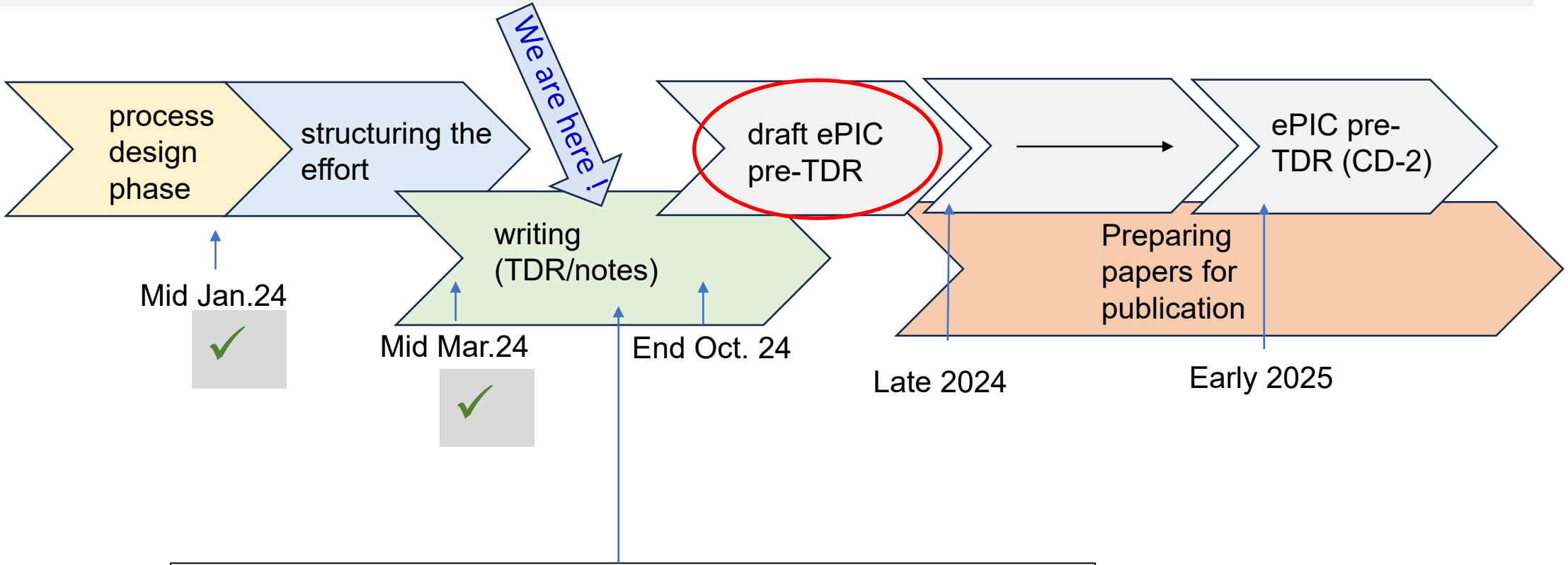
8 Experimental Systems

ePIC responsibility

Joint responsibility

Project responsibility

pre-TDR and TDR – the timelines



For the detector subsystems 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 weeks)

Scheme of subsystem information in the (pre-)TDR

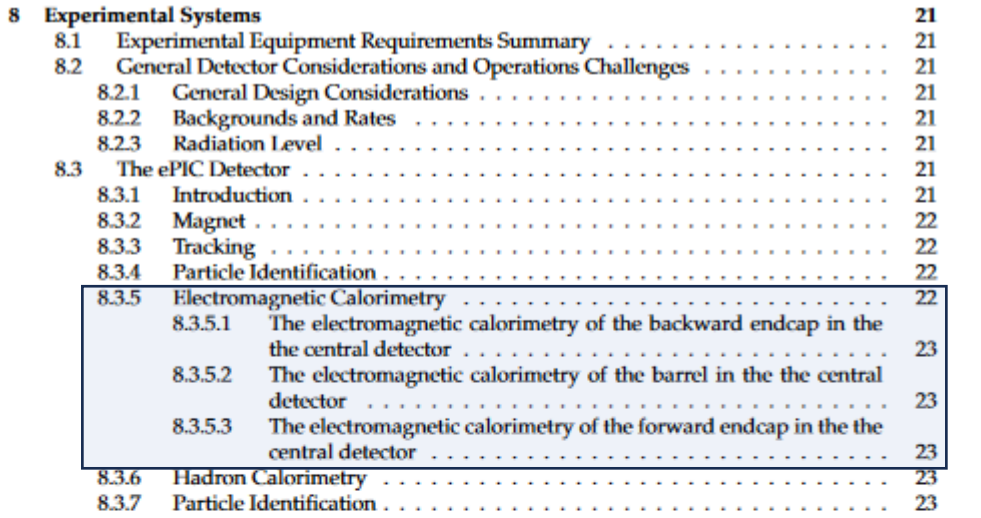
- Requirements
  - The requirements from physics
  - Radiation hardness requirements
  - Expected data rates

- Justification
  - The device concept and the justification for the technological choice
  - Subsystem description
    - General device description
    - Sensors
    - FEE
    - Other components
  - Subsystem performance

- Implementation
  - Services
  - Subsystem mechanics and integration
  - Calibration, alignment and monitoring
  - Status and remaining design effort
    - R&D effort
    - E&D status and outlook
    - Other activity needed for the design completion
    - Status of maturity of the subsystem
  - Environmental, Safety and Health (ES&H) aspects and Quality Assessment (QA) planning
  - Construction and assembly planning
  - Collaborators and their role, resources and workforce
  - Risks and mitigation strategy

Approved at TIC after 2 passes (March 11, April 22)

(pre-)TDR in overleaf



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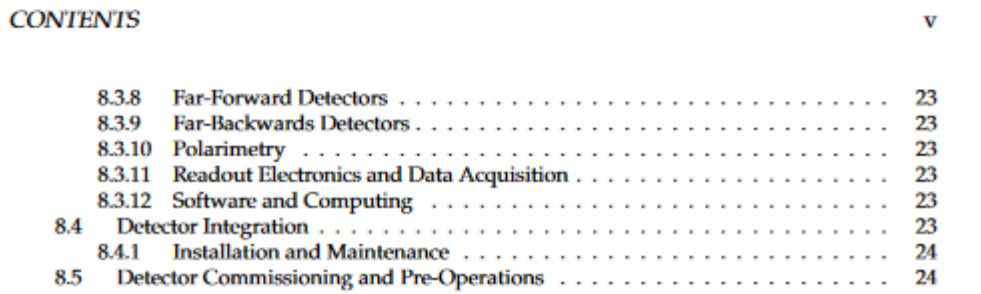

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NEXT steps (coming soon)

- Subdividing "category" subsection to host all subsystems
  - As in the example about electromagnetic calorimetry
- Implement the detector text scheme for each subsystem
- Provide editing privileges to DSLs and DSTCs

Reports including more information

- Access to overleaf for stand-alone documents will be provided according to needs/requirements
- All your documents can be catalogued
  - *See the report "*Recommendations from the Ad-Hoc Committee on Collaborative Tools"
  - When you would like that a report is approved as an official ePIC Technical Report (eTR), contact the TC-office: the document will be signed off as eTR after appropriate reviewing