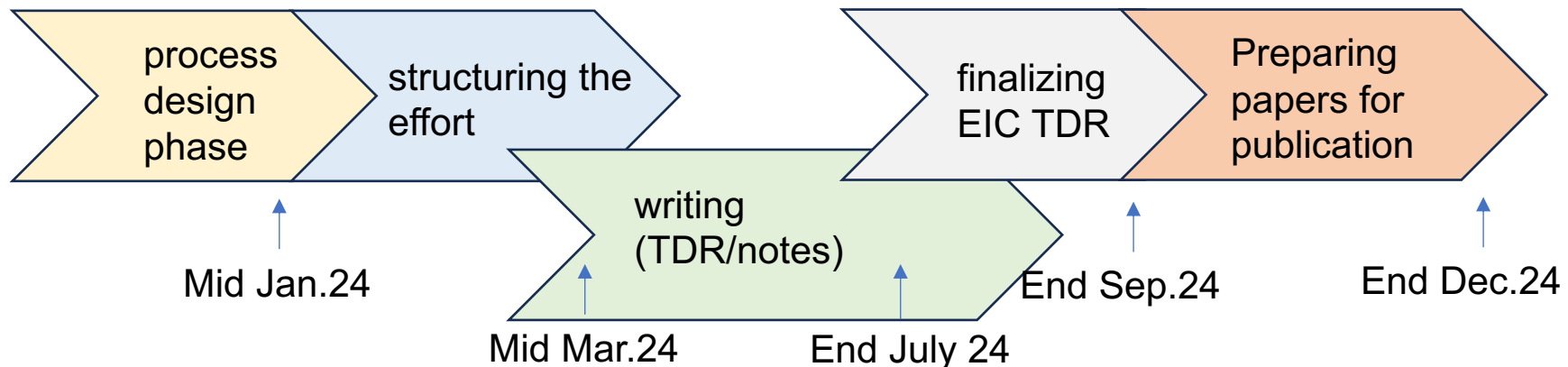# Analysis opportunities for the TDR

Salvatore Fazio (Calabria)

EIC_net General Meeting – 22 March 2023

Slide by John Lajoie
G.M.-March 8

- In 2024 the ePIC collaboration will produce:
  - The ePIC contributions to the EIC TDR
    - The EIC TDR is the top priority
      - Chapters on *Physics Goals and Requirements* and *Experimental Systems*
    - Not just the document, but the simulations and detector R&D that form the basis
    - Requires close cooperation between the collaboration and the project!
- An ePIC Detector Design paper:
  - Derived and expanded from the *Experimental Systems* TDR chapter
- An ePIC Physics Performance paper:
  - Derived and expanded from the *Physics Goals and Requirements* TDR chapter
- Both to be published in a scientific journal (such as NIMA, JINST, or PRC)
- These publications will serve as a focus in developing the ePIC Membership and Publication policies.

process design phase — Mid Jan.24

structuring the effort

writing (TDR/notes) — Mid Mar.24 — End July 24

finalizing EIC TDR — End Sep.24

Preparing papers for publication — End Dec.24

TDR structuring & companion papers

Slide by Silvia Dalla Torre

TDR

- PM Serves as the "managing editors" for the ePIC Contributions to the EIC TDR

- **TDR Chapter 2**
  - *Holistic detector performance* (short form)
    - The TC Office acts as "editor"
    - Organized/supervised by CC WG conveners
  - *Physics performance and science reach* (short form)
    - The ACs acting as "editors"
    - The Physics WGs as subgroups for text drafting

- **TDR Chapter 8**
  - *Detector description and basic performance*
    - Project CAMs/Collab. DSL's acting as "co-editors" for their sections
    - The DSCs provide studies, material, text, etc.
  - *Software, Analysis and Data Preservation*
    - Project CAMs and SCCs acting as "editors"
   - The electronics/DAQ CC WG and the software WGs

ePIC publications

- SP Office serves as the "managing editors" for the ePIC publications

- **ePIC Physics Performance Publication:**
  - *Holistic detector performance* (extended text)
    - The TC Office acts as "editor"
    - Organized/supervised by CC WG conveners
  - *Physics performance and science reach* (extended text)
    - The ACs acting as "editors"
    - The Physics WGs as subgroups for text drafting

- **ePIC Detector Publication**
  - *Detector description and basic performance*
    - DSL's acting as "editors" for their sections
    - The DSCs provide studies, material, text, etc.

  - *Software, Analysis and Data Preservation*
    - SCCs acting as "editors"
    - The electronics/DAQ CC WG and the software WGs for text drafting

What's new in the TDR timeline

Salvatore Fazio (Calabria)

○ New TDR timeline

- Presented by John at the General Meeting on March 8
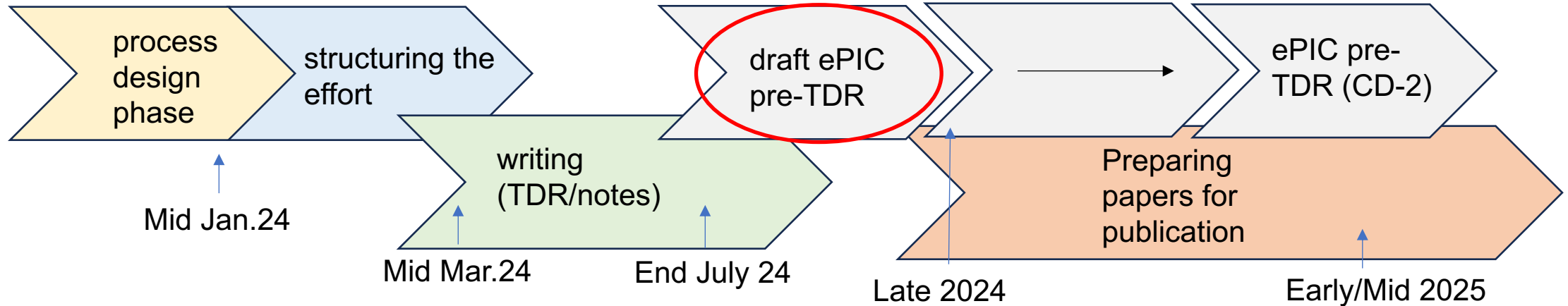
- "pre-TDR" (~60% design completion) comes first [CD-2]

- Final TDR (~90% design completion) delayed [CD-3]

- The Physics paper will be most probably aligned with the final TDR

- Consequence: priority goes to performance plots for TDR (we need them first)

- Each PWG: **Identify TDR plots**. Next: common PWGs+DSTs meeting

What we need to succeed

- o Performance plots
  - Analysis of simulated events to show detector capability of measuring a certain process and observable
  - Landing page with **Analysis tutorials**: https://eic.github.io/documentation/landingpage.html

- o Analysis tools
  - Many reconstruction tools still not ready
    - Electron finder – a first version close to release
    - Particle ID – no full reconstruction available in EICrecon, we will use Look-Up Tables first
    - Vertexing – still to be finalized. Reconstruction of secondary vertices to be implemented

- o Work force is crucial!
  - Opportunity for new/emerging Universities with students/postdocs available
    - impact on TDR (current ePIC's topmost priority) and on a large scientific publication

How can we help?

o Opportunity for **M.Sc.** and Ph.D. **students** -> make plots out of reconstructed root trees

o Opportunity for **more experienced Ph.D.s** and **postdocs**

- Help with reconstruction (by working with S&C group – strong coding skills required)
- Impact studies for the extended physics paper

o Italy has some potential to exploit (and help with the TDR cause):

- Observables related to TMDs
- Observables related to GPDs
- c- and b-tagging using displaced vertices and PIS
- Diffractive PDFs for studying the transition into saturation
- Computing -> via OSC

o New Workforce being gathered (focus on Universities outside US)

- We are matching Institutions (and each of their students) to proposed tasks

Example of available tasks

Inclusive PWG

- Neutral-current reduced cross sections - Correction to raw yield, Projected statistics, Estimated systematics

- Charged-current reduced cross sections - NC background, Estimated systematics

- F_L extraction - Correlated vs uncorrelated systematics, Structure function separation fit

Exclusive+Diffraction+tagging PWG

- Time-like Compton Scattering (TCS) analysis, using EpIC generator

- Generic Vector Meson studies, using eSTARlight generator

- Diffractive PDFs in ep (...and eA for saturation studies)

- Development of generic reconstruction/analysis code templates and organisation on github (for on-boarding new analyses in future and making certain reconstructions consistent in the group)

SiDIS PWG

- Particle identification (PID) studies. Investigate the need for PID in the different kinematic regions. Compare the foreseen newly available PID information with the truth PID, and study the need for improvements in PID, vs different kinematic variables

- Study of radiative effects and corrections. Using the DJANGOH generator, study the impact of radiative effects on the reconstruction of the kinematic variables and potentially asymmetries, by comparing the reconstructed variables for events with and without radiative effects included

- c- and b-tagging for nPDFs via displaced vertices and PID

Example of available tasks

Jets+HF PWG

- HF reco developments: Exist: basic D0 inv mass reco in reco and gen with visible signals in filtered files
  - **Task:** Start eA performance studies

BSM+EW PWG

- Performance in tagging and reconstructing muons - muon ID

Software Reconstruction Tasks (more suited for experienced postdocs)

- **Full PID reconstruction** in EICrecon – porting and optimizing standalone codes from different PID subsystems
- **Vertexing** – including reconstruction of secondary vertices