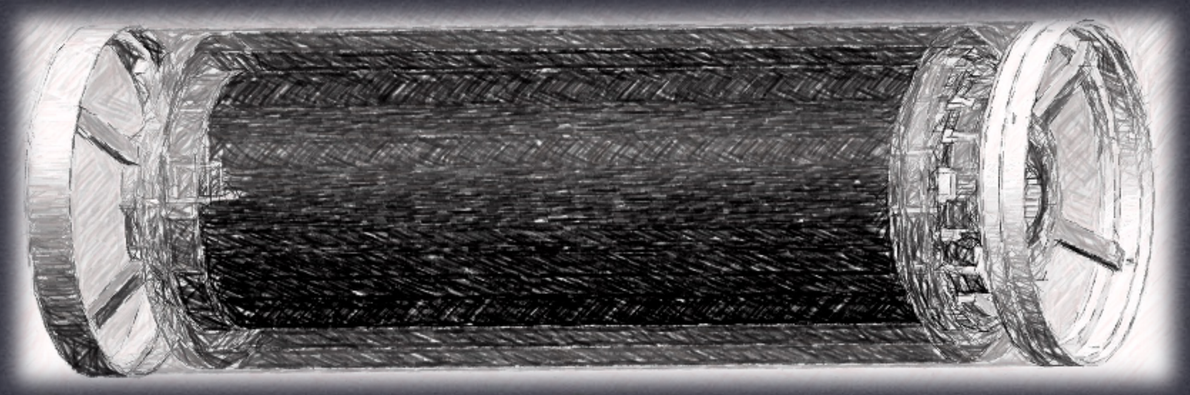


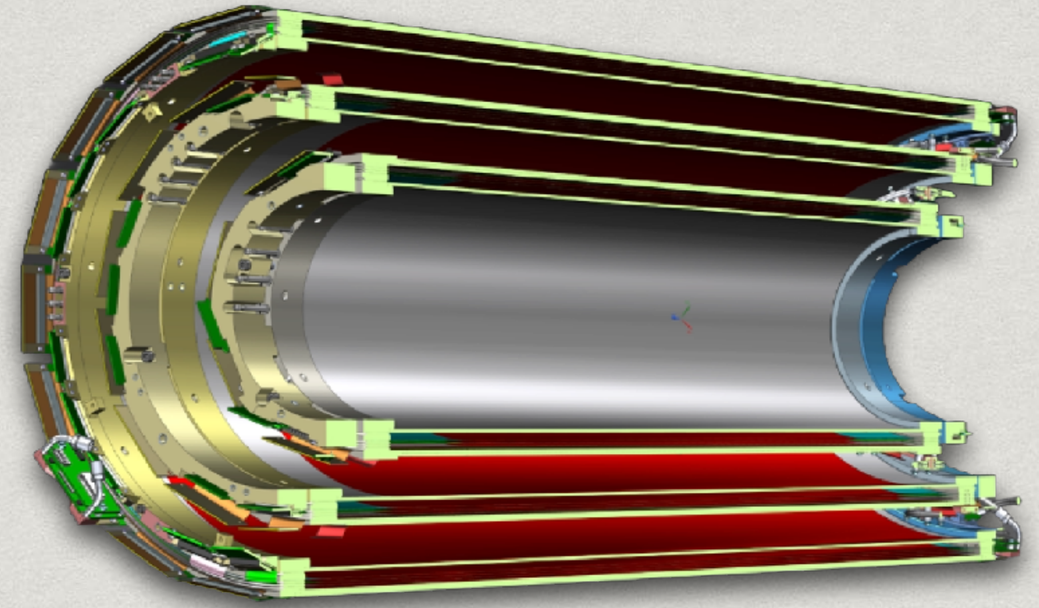
CGEM-IT: OVERALL STATUS AND SCHEDULE OF THE PROJECT

G. CIBINETTO on behalf of the CGEM-IT group

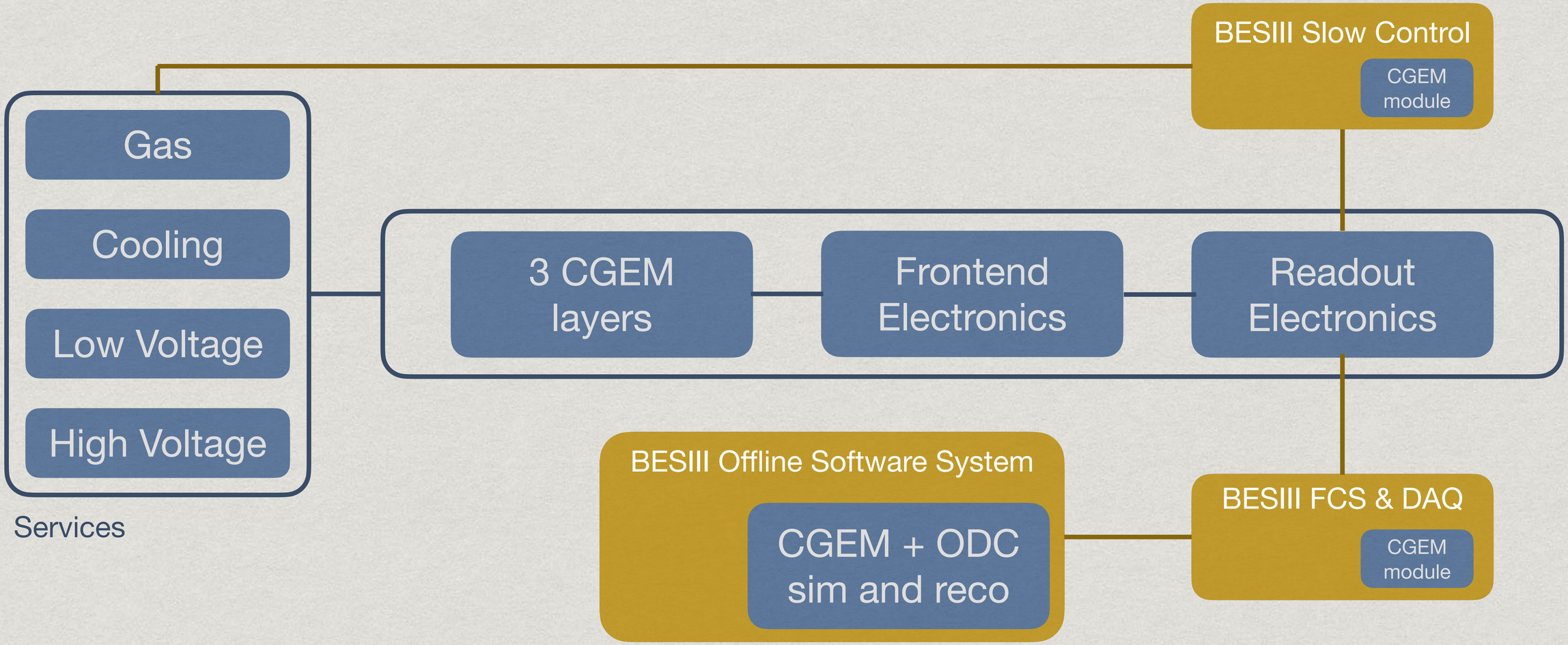
BESIII ITALY MEETING - FERRARA, NOV 6-7 2023

Outline

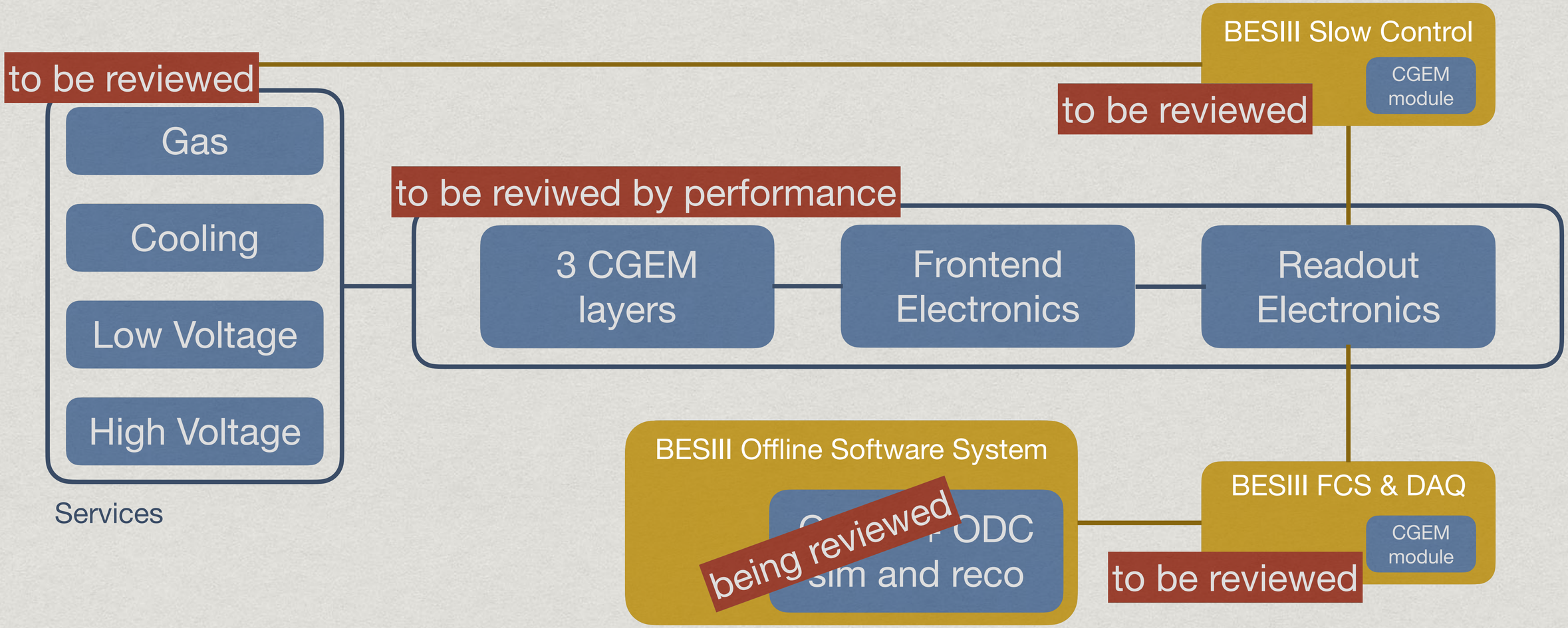
- Project scope
- Overview of the CGEM system
- Present status and schedule
- Summary, outlook and bibliography



The CGEM-IT system



The CGEM-IT system under review

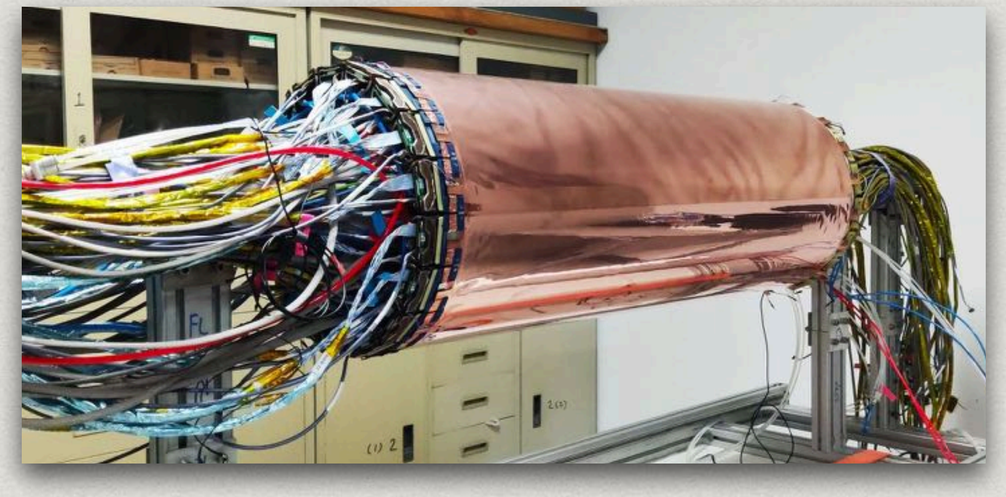


Hardware

- Detector —> 3 layers assembled into the final CGEM-IT

  —> all 720 high voltage sectors connected

- Frontend electronics —> 80 FEB mounted onto the detector
- Readout electronics —> 22 GEMROC ready
- Data concentrator —> to be tested
- Final HV/LV system —> ready
- Final cables —> ready



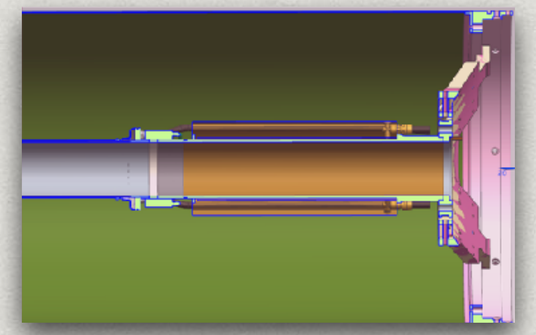
Spares, for system maintenance and operation, have been or will be procured

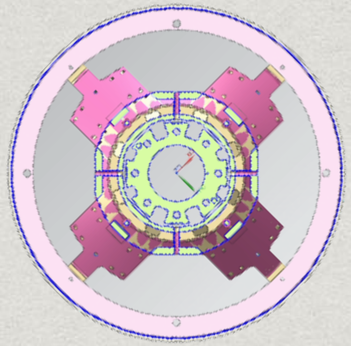
L1 and L2 tested remotely during the pandemic —> data used for detector integration, digitization tuning, time calibration…

The full system will be qualified in its final configuration with cosmics starting from December

Integration (I): mechanics

- Mechanical integration has started at the very beginning of the project with the detector design
- Common (Chinese and Italian) design of envelopes, connections, flanges, installation tooling…
- Studies and tests for inner MDC extraction performed by the MDC group
- Space for services and cables routing addressed pre and post pandemic
- A simulation of the installation procedure with full size mockup will be performed to study the procedure and for risks analysis





Integration (II): DAQ and SC

- CGEM detector and electronics integration: despite the pandemic, activities have been carried out in Italy or remotely —> we have a good understanding of L1 and L2 noise and features
    - Detector and electronics are quite new to each other —> we expect to learn more by the upcoming cosmic data taking
    - Situation will be more clear after end-of-November integration week
- Integration with BESIII DAQ also resumed after pandemic (intense interaction between Italian and Chinese groups is needed —> experts on the task)
    - Plan to test run mode on a small scale and then move to the CGEM-IT
    - Need to work on a schedule
- Integration with BESIII Slow Control —> same as for the DAQ
- Do we need an interlock system?

Integration (III): services

- Cooling system: assigned
- Gas system: IHEP responsibility, no one from our side
- Dry air system: task not assigned

Offline software (p)review

Geometry

Implementation of the definitive design of the complete CGEM detector

Estimation of the radiation length, and of possible effects on the EMC

Digitization

Complete description of the MC signal modelling, from ionization to the electronics readout response

Comparison of simulation with real data from 2-layer cosmics data (run 17)

Global Tracking

Complete reconstruction of charged tracks using outer MDCs and CGEM

Characterization of tracking performances (resolution, efficiency) with particle gun, comparison with standard MDC

Analysis of benchmark channels

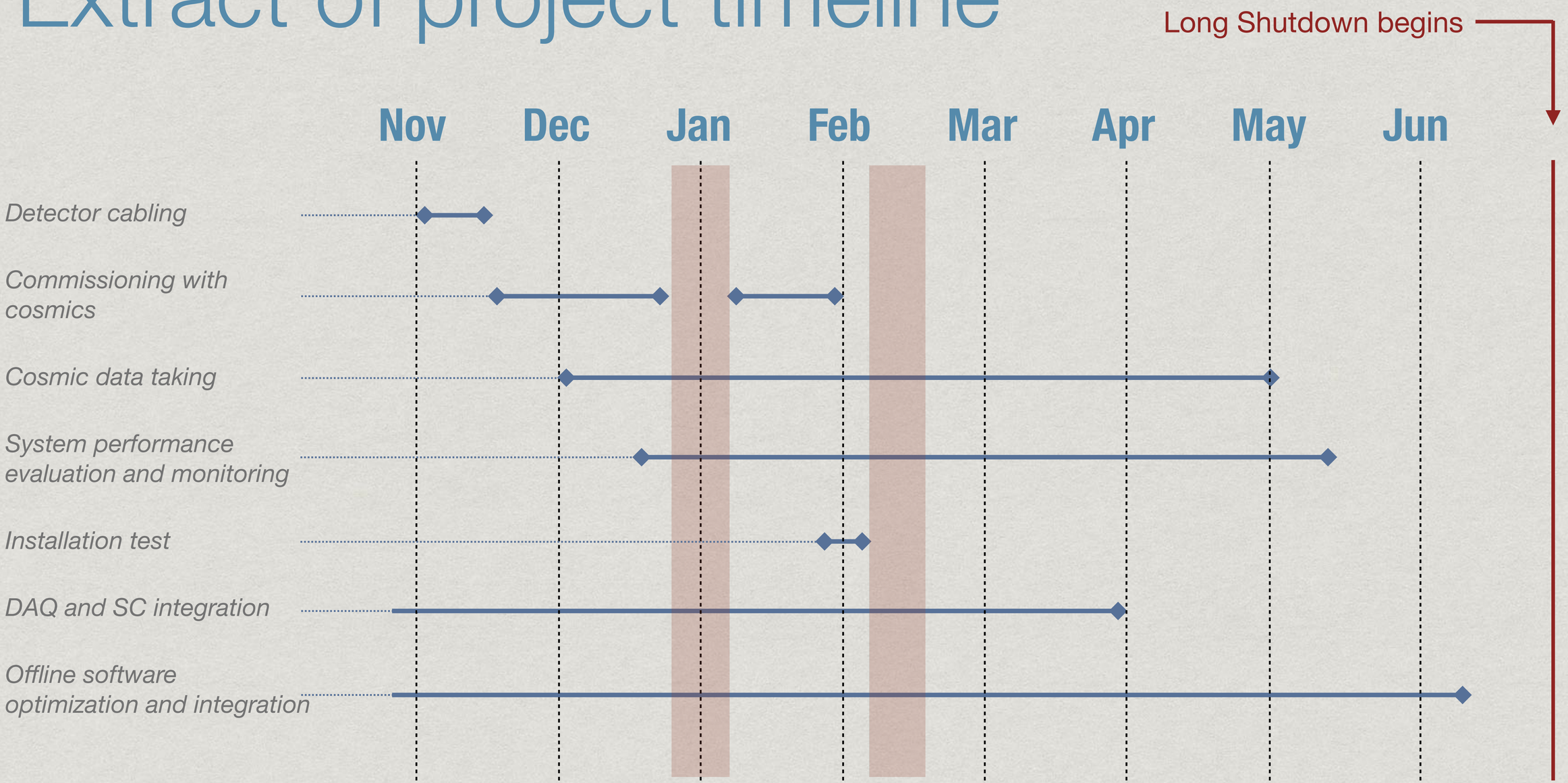
Performance (reconstruction efficiency, invariant mass resolution, vertex resolution) compared to standard MDC tracking

- → phase space events with n-prong pions
- → low multiplicity events (such as $e^+e^- \to p\bar{p}$)
- → standard charmonium decays $\psi(2S) \to J/\psi\pi^+\pi^-$
- → higher multiplicity events (i.e. over DD threshold)
- → hyperon production (to study displaced vertices)

Performance review

- Highest priority
    - We cannot afford to waste one week
- CGEM shift for cosmic runs
    - Experts, shifters, data production and QC
- Italian task force
    - Kickoff meeting within one or two weeks
    - Tasks shared
    - Will report to CGEM software
- Not pleasant but rewarding

Extract of project timeline



Summary and outlook

- The CGEM-IT is a complex detector capable of improving the reliability of the BESIII inner tracking system
- It represents the state-of-the-art of cylindrical MPGDs
- It is also a brand new system we recently started to play with: the more we use it the better we operate it
- The next four months will be crucial for the success of the project, thanks in advance for your contribution

THANKS FOR YOUR ATTENTION