Journées Collisionneur Linéaire
Paris, 23-24 Mars 2016

ILD TECHNICAL COORDINATION

- **Goals and means**
- **Technical organization**
- **Technical Coordinator view on detector optimization**

MAIN GOALS

Main goal is to bring the ILD consortium in situation to rapidly prepare a Technical Design Report of the detector in case the ILC proceeds in 2-3 years.

This includes:

- Updating the overall baseline design of the detector (size, mechanical structure) by performing a cost/performance optimization and resolving open global issues.
- Fostering construction of engineering prototypes of all subdetector technological options and summarizing for each of them the remaining critical issues *(nb: no selection of technologies on this time scale)*
- Defining the solutions to integrate each subdetector technological option within a global detector (services, etc…).
- Studying the solutions to build and integrate the detector in the context of the foreseen Japanese site.

The results should be documented into a new (light) document updating the previous DBD.
This document will be the main milestone focusing activities on a 2 year time scale.

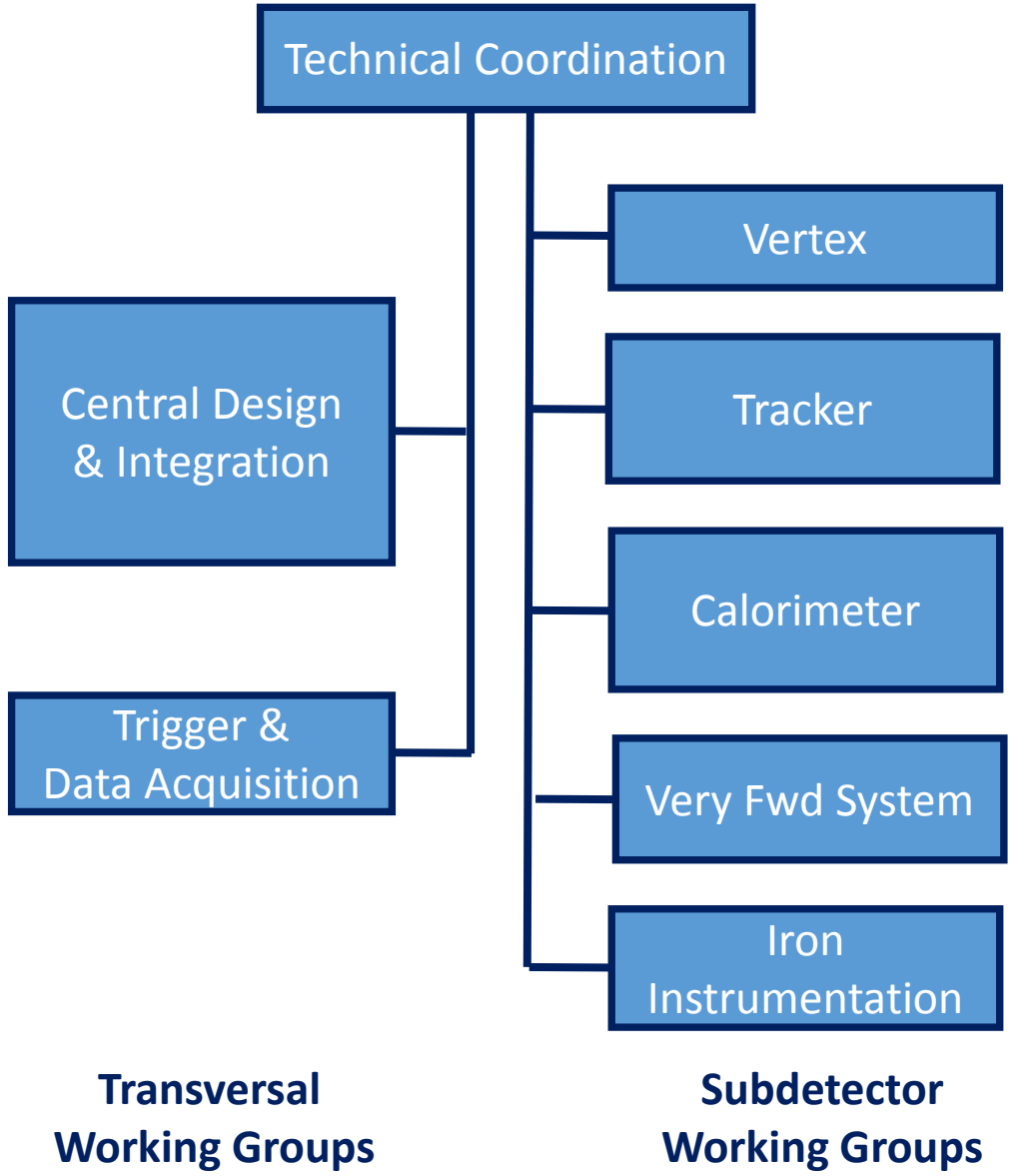
MEANS

- Internal physics benchmarks to perform the detector optimization.
- External focused reviews to help resolving global open issues.
- Common beam tests to favor sharing of hardware/software between subdetector groups.
- Follow up of technology implementations in external projects (LHC upgrades, BELLE II, etc…)
- Close cooperation with other consortia (SiD, CLICdp, etc..) to share/develop common tools and compare results.
- Regular interactions with the LCC PD group for light regular reviews of the progress and adaptation to the ILC project evolutions.

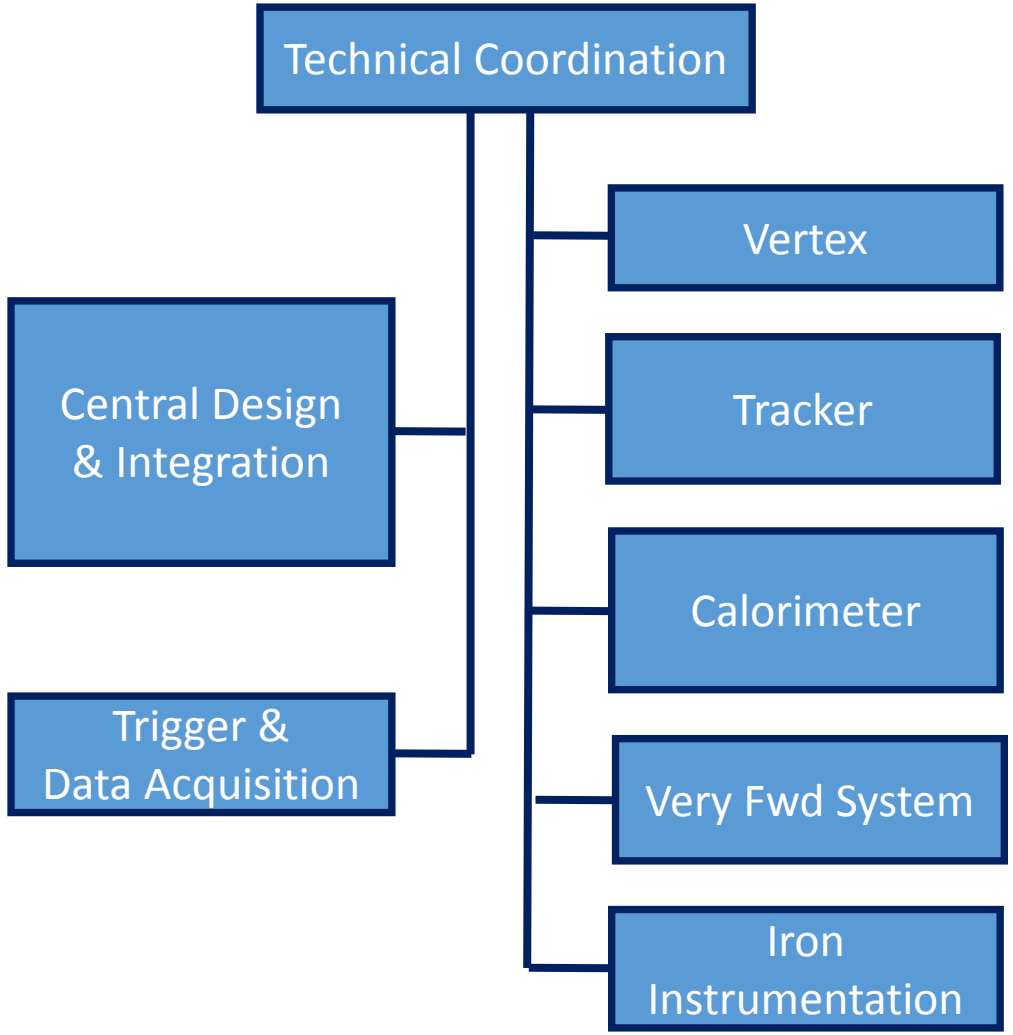
First priority: set up the ILD Technical Organization

General rationale :

- Few “large” subdetector groups in order to foster exchange of information between technology options and favor internal optimization of main subdetectors.
- Working Group boundaries defined by ILD functionality rather than by technology.



Working Group boundaries



Global design including coil and yoke.
Integration with ILC and SiD.
Internal integration of subdetectors.
Costing.

Common hardware and software subdetector components.
Central trigger and data acquisition.

Vertex reconstruction and flavor tagging.

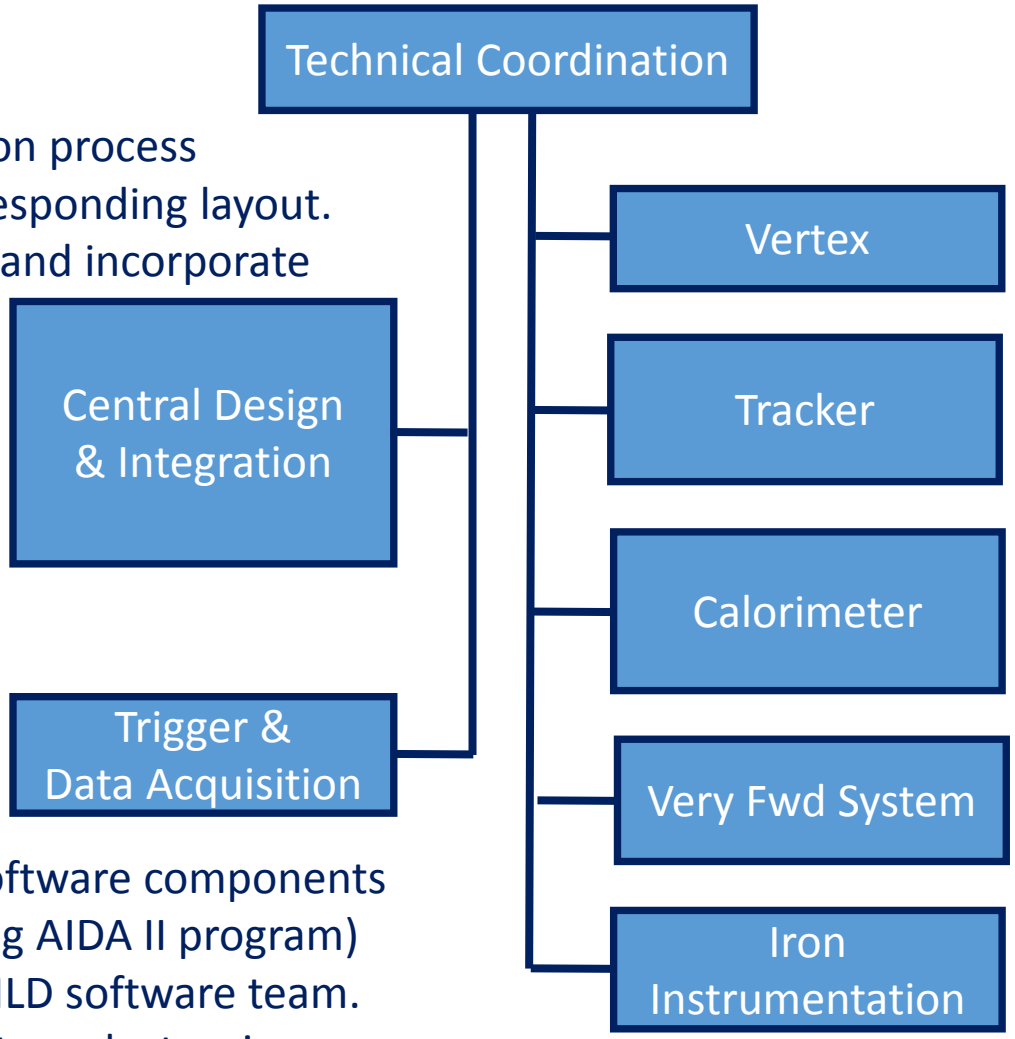
Charged track momentum measurement and identification.

Barrel+Endcap electromagnetic and hadronic calorimeters.

Very forward calorimeters and beam monitors.

Yoke instrumentation for muon tracking and calorimetry tail catching.

Working Group mandate



- Interact with physics optimization process to design the best possible corresponding layout.
- Design overall services strategy and incorporate subdetectors services.
- Update detector costing.
- Interact with ILC and SiD for beam&hall integration and assembly procedures.

- Foster use of common hard/software components in combined test beams (along AIDA II program) in close cooperation with the ILD software team.
- Ensure that evolving subdetectors electronics complies with ILC specifications.

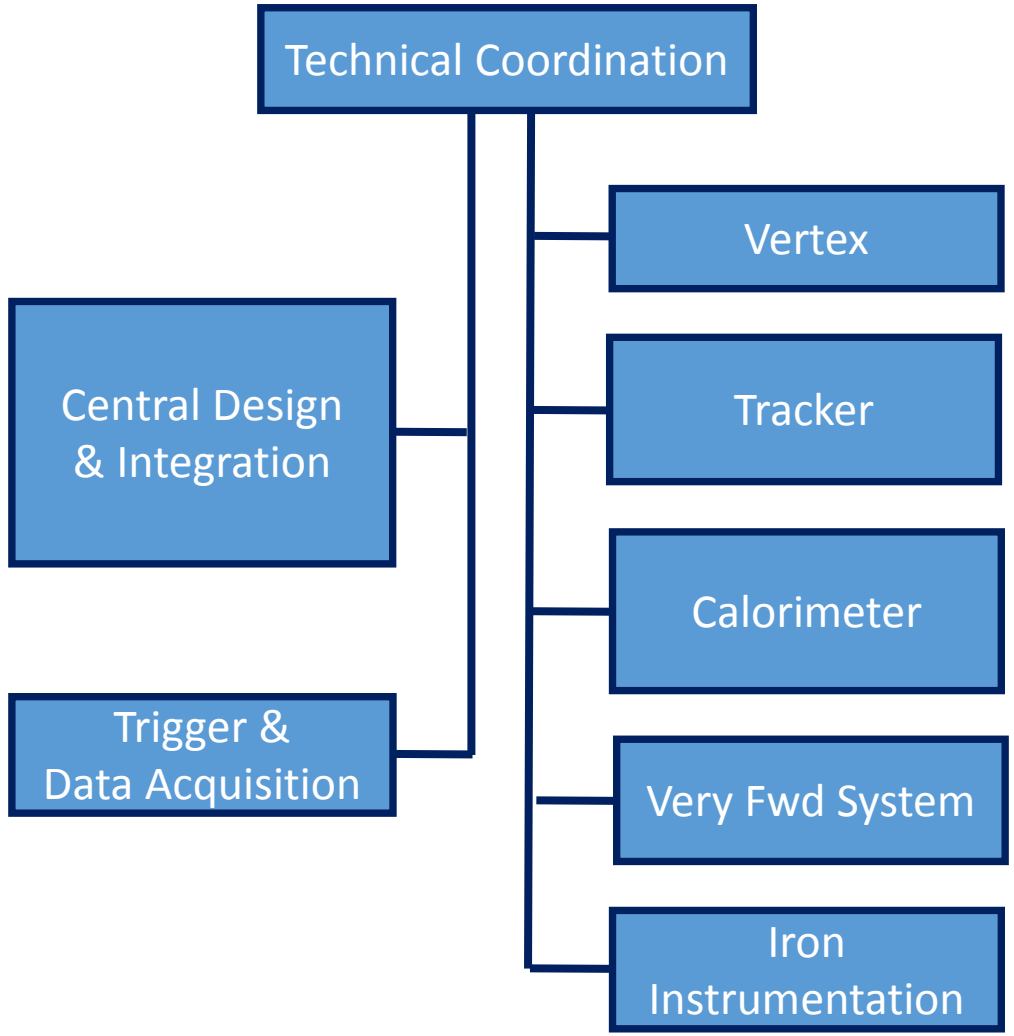
<u>For each subdetector</u> :

- For current technology options, follow progress on engineering prototypes developed by the R&D Collaborations or implemented in future projects like LHC upgrades.
- Follow also emergence of possibly new promising technologies.
- For each technology option, gather information on services, infrastructure etc… relevant for its integration in the global ILD detector.
- For each technology option provide realistic and validated simulation and digitization code within the overall ILD software environment.

Working Group convening

Guidelines :

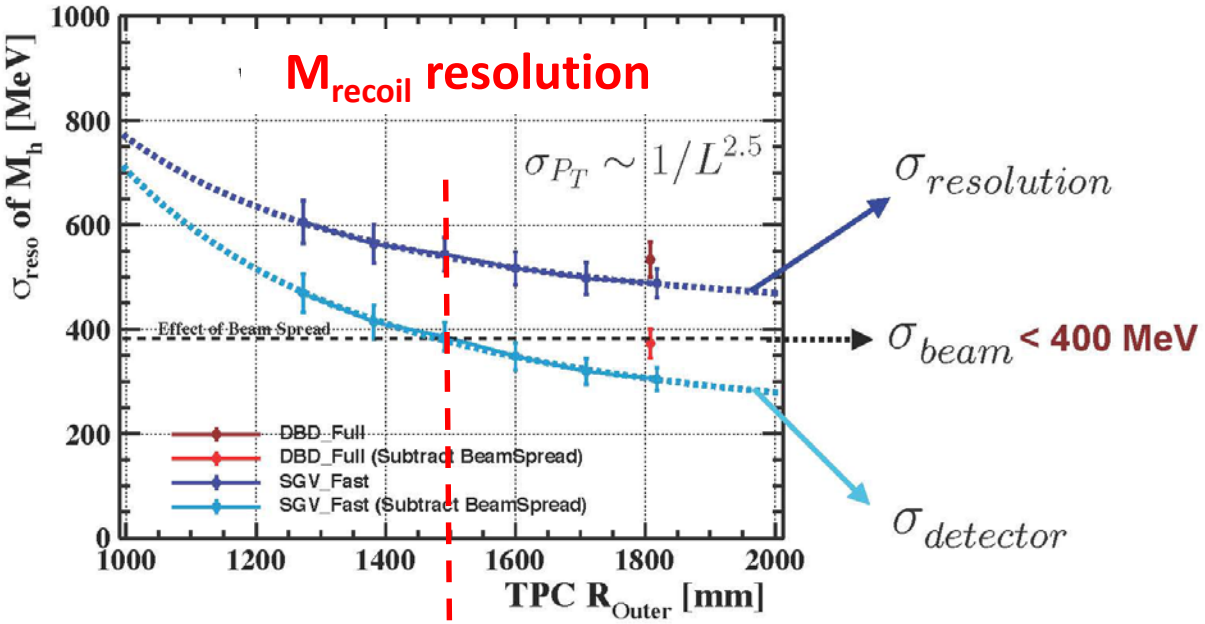
- Between 2 and 4 co-convenors / Working Group, depending on the volume of WG activities, nominated for 2 years (extendable/renewable).
- Institutional origin of convenors should match the corresponding share of contributions in the WG.
- Each major technological option should be represented in the subdetector WG convening.
- Subdetector convenors should be active and well recognized in the corresponding R&D collaborations, but not currently have a central responsibility in these Collaborations in order to avoid conflicts of interest.
- The team of convenors will meet regularly by phone conference or face-to-face to monitor the progress, in particular in fields of common interest to the ILD detector.

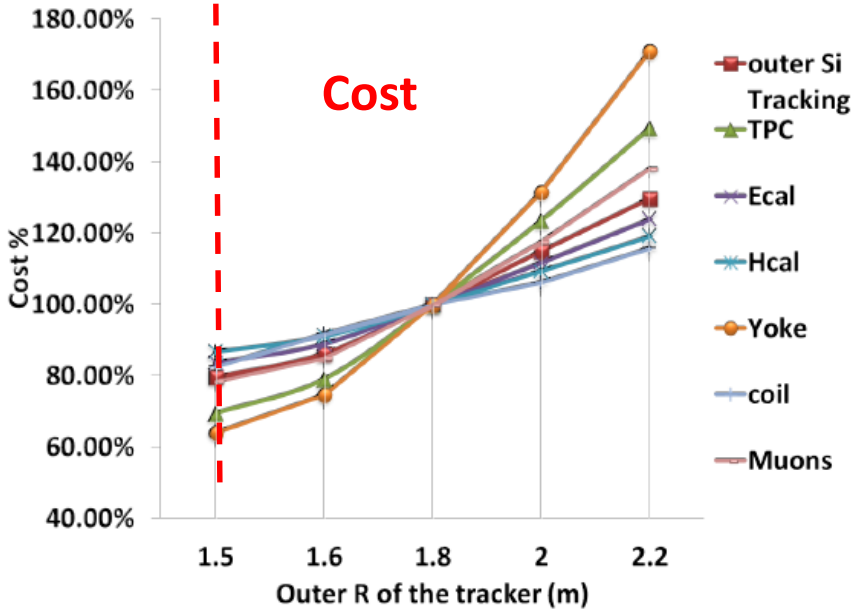


TECHNICAL COORDINATOR VIEW ON DETECTOR OPTIMIZATION

General principles:

- Factorize intrinsic constraints (physics, etc…) from external contingent constraints (push pull, etc…) to keep benefit of studies in case the context evolves.
- Factorize global parameters (sizes, B field, structure, etc…), which have priority, from internal detector parameters (technology, granularity, etc…) which can be defined later.
- Include “reality” parameters (services, integration, cost, etc…) into optimization criteria.
- Work in close cooperation with other consortia (CLICdp, SiD) to avoid duplication of efforts and allow cross-checks / comparison of results.





GLOBAL PARAMETERS : Size

- Already existing indications that a reasonable detector radius option might be around 1.5 m.
- Suggest to have at most 2 detector size options for the comprehensive physics benchmark simulations, far enough from each other to see significant differences in the performance and get the derivative.

GLOBAL PARAMETERS : Size cont'd
Comparison CLICdet-2015 to ILD-DBD

Concept\Key param.	ILD (DBD)	CLICdet_2015 (3 TeV)
Tracker	TPC	Silicon
Solenoid Field [T]	3.5	4
Solenoid Free Bore [m]	3.3	3.4
Solenoid Length [m]	8	8.3
VTX Inner Radius [mm]	16	31*
ECAL Inner Radius [m]	1.8	1.5
ECAL ΔR [mm]	172	159
HCAL Absorber B / E	Fe	Fe
HCAL λ_I	5.5	7.55
Overall Height [m]	14	12.8
Overall Length [m]	13.2	11.4

→ **B field increased to 4 T** because of smaller tracker radius

→ Vertex detector radius strongly machine BG dependent

→ **ECAL inner radius reduced to 1.5 m**
and #layers reduced to 25

→ **Large HCAL depth for containment at 3 TeV**

NB: Similar tracker length as ILD-DBD

GLOBAL PARAMETERS : Size cont'd

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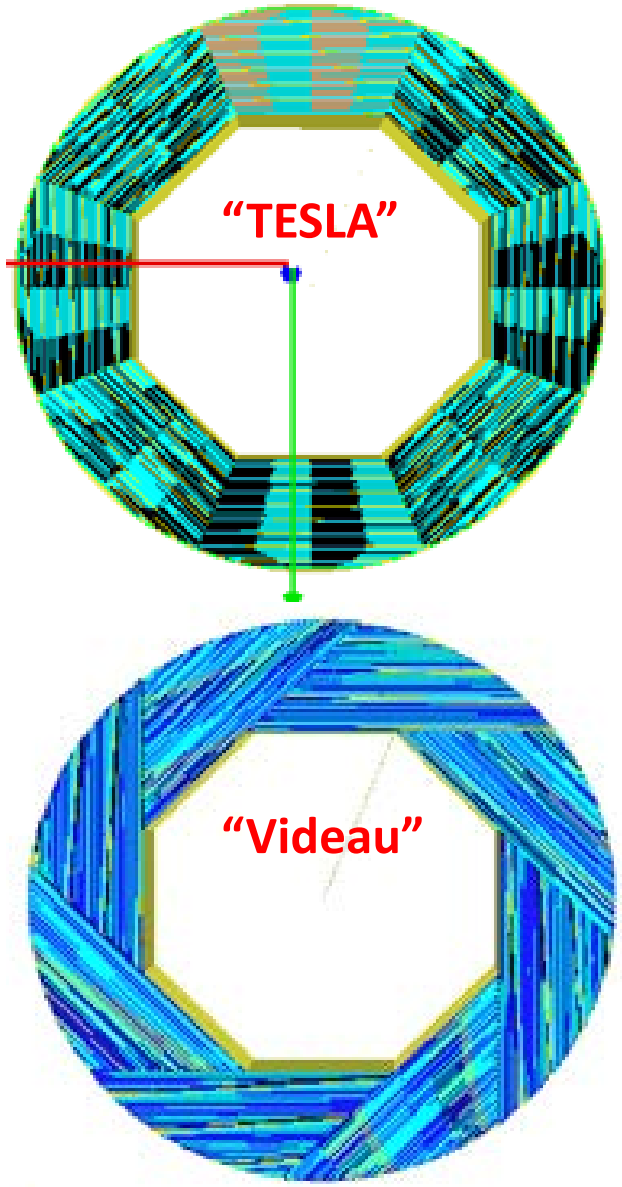
Suggest to take for the 2 sizes of the benchmark MC the DBD configuration and an "ILC-oriented CLICdet":

- ECAL inner radius reduced to 1.5 m
- ECAL #layers reduced to 25
- Magnetic field increased to 4 T
- HCAL depth same as DBD
  (hence smaller coil as CLICdet)
- Tracker length same as DBD

Advantages :

- Keep DBD configuration as reference to quantify improvement of methods/components
- Allow comparison/cross checks with CLICdp
- Allow comparison between TPC and Si tracker options
- Allow comparison of costings of a "1TeV" and a "3TeV" detector.



GLOBAL PARAMETERS : other points to be fixed before comprehensive physics benchmarks simulations

- Baseline calorimeters mechanical structure (TESLA ↔ "Videau")
- Need for anti DID (→ field map)

Reviews with external experts to be organized soon

Stray fields (→ yoke size) need also better understanding

SUBDETECTORS

Comprehensive physics benchmark samples should (ideally) :

- allow further tuning of granularities (#layers, cell sizes) and comparisons of technologies
- Include realistic 1st order description of detector services, dead zones, etc…

Subdetector working groups will be asked to :

- contribute to the validation of their simulation software within the global ILD simulation framework (simulation contact person to be nominated in each working group)
- provide interface documents with information on their external boundaries and services