



ILD and **R&D** program

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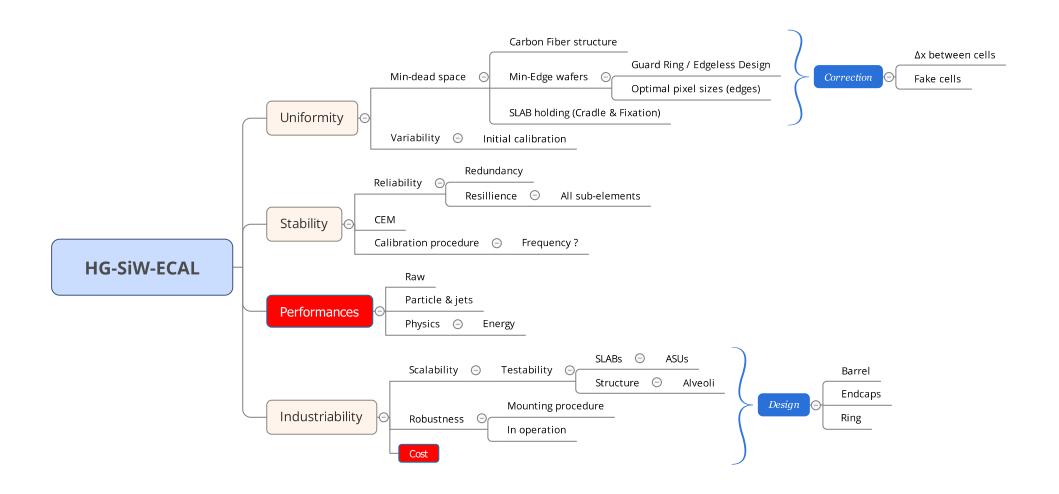
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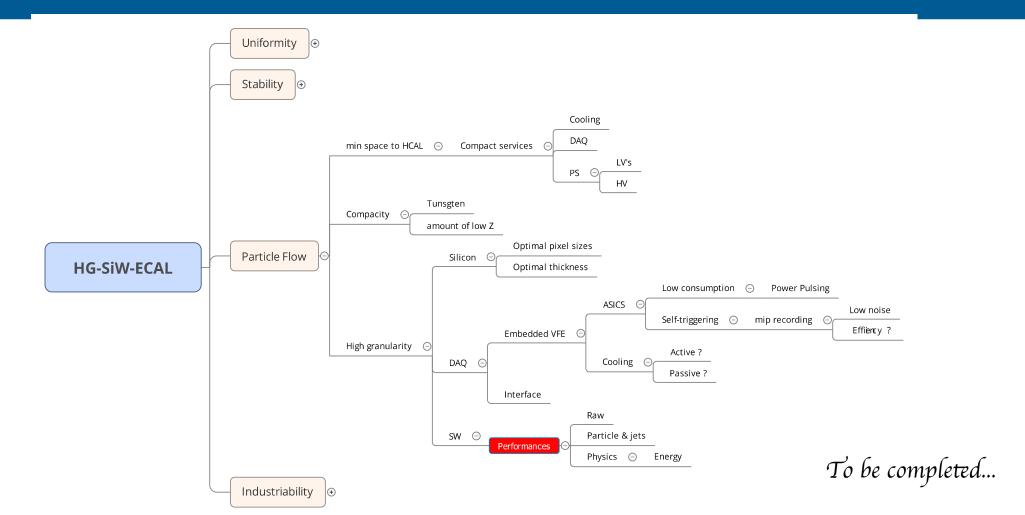
SiW-ECAL day LAL, Orsay, 21/03/2016



Silicon-ECAL: a complex project



PFA (HG) SiW-ECAL is even more complex



Critical / most relevant R&D in ILD?

On going inventory...

(i.e. don't feel offended if your favorite analysis/study is still missing)

Simulation

Physics analysis

Thermo-Mechanical

Structure & Cooling

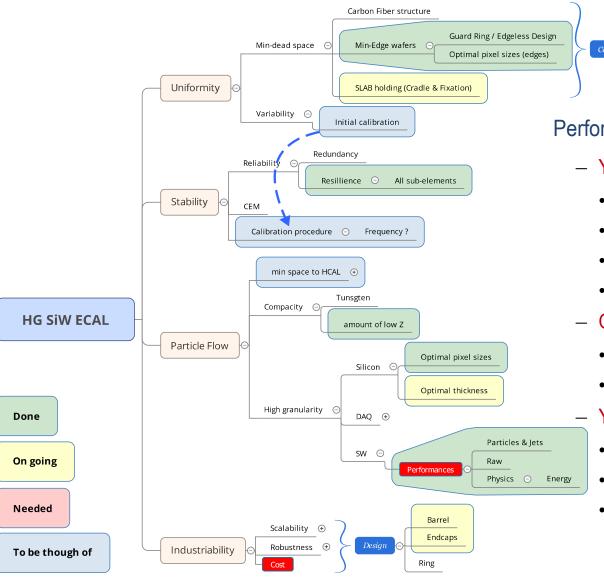
Electronics

- VFE (ASIC) \rightarrow DAQ

Instrumentation

beam tests, sensor studies

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Simulations

Performances:

- Years of tests ⇒ jets, tau's (lepton-ID), single parts
 - Granularity; Radius; Nb of Layers [Thompson, Hieu, ...]
 - Amount of low Z [Amjad]

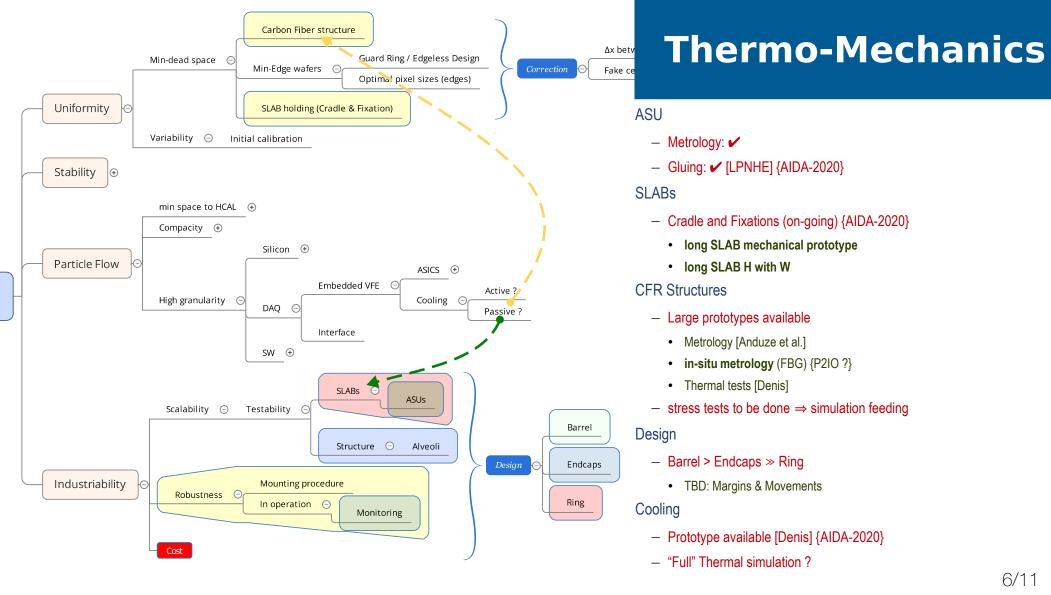
Δx between cells

Fake cells

- Gaps [Amjad], physics prototype (BT)
- Resilience to dead elements [Daniel]
- On-going (or soon)
 - new design: plugs [Daniel]
 - Wafer thickness []

Yet to be done:

- Gap ECAL/HCAL
- calibration studies [?]
- Gap corrections [Done by Daniel in Digi...?]



Min-dead space (+) Uniformity Variability Initial calibration Redundancy Reliability Resillience 🖯 All sub-elements Stability CEM 100M Channels ① Cooling DAQ min space to HCAL Compact services Compacity (+) Optimal pixel sizes Silicon 🖯 **HG SIW ECAL** Particle Flow Optimal thickness Low consumption Power Pulsing ASICS Done mip recording Embedded VFE High granularity "easy"? DAQ On going Cooling (Passive ? Gain? Interface Needed Raw SW 🖯 Physics (Energy To be though of SLABs ASUs Scalability (-) Testability Structure Alveoli Industriability Mounting procedure Robustness In operation

Electronics

VFE: SK2(a)with

- Many tests of SK2
 - COB/BGA/QFP, in sockets, on FEV8/11, in SLAB in beams, ... [Stéphane, Rémi, Jérôme, Thibault, Vladik, Taikan, ...]
 - Continuous, in PP mode
 - Direct readout (probe), with DAQ
 - still gaps in description
- SK2a on-going [Artur, Shriddha] ~ OK

ASU:

Low noise

Effiercy ?

- design ~OK BT2015 [Vladik]
- COB tests [Roman, SKKU] {P2IO}:

Min-dead space (+) Uniformity Variability Initial calibration Redundancy Reliability Resillience 😑 All sub-elements Stability CEM 100M Channels ① Cooling DAQ min space to HCAL (Compact services Compacity (+) Optimal pixel sizes Silicon 🖯 **HG SIW ECAL** Particle Flow Optimal thickness Low consumption Power Pulsing ASICS Done Embedded VFE High granularity "easy"? DAQ On going Cooling (Passive ? Gain? Interface Needed Raw SW 🖯 Physics 😑 Energy To be though of SLABs ASUs Scalability (-) Testability Structure Alveoli Industriability Mounting procedure Robustness In operation

Electronics

SLABs

- Noise [BT June 2016]
 - ⇒ services? better decoupling?
 - SK2A short SLABs {AIDA-202, P2IO}
- Long SLAB 10 ASU on bench {P2IO}
- Industrialisation
 - step 0: Quality {AIDA-2020}, Assembly {P2IO}
 - step 1: Re-evaluate solution with industrial partner

Services:

Low noise

Effiercy ?

mip recording

- DAQ (redundancy, rates)
- Power Supplies, Interface (P2IO)
- CEM design

Carbon Fiber structure Δx between cells Guard Ring / Edgeless Design Min-dead space Min-Edge wafers (-) Fake cells Optimal pixel sizes (edges) Uniformity SLAB holding (Cradle & Fixation) Initial calibration Variability Θ Redundancy Reliability (-) Physics prototype Resillience CEM Stability Calibration procedure (-) Frequency? 100M Channels Silicon min space to HCAL ④ **HG SIW ECAL** Compacity ① Optimal pixel sizes Particle Flow Silicon 🕞 Optimal thickness Done High granularity (DAQ ① SW (+) On going SLABs ASUs Testability \bigcirc Scalability 😑 Barrel Structure 😑 Alveoli Needed Endcaps Design Industriability Mounting procedure Ring Robustness In operation To be though of "easy" Timing

Instrumentation

Wafers

- Characterisation [Jacques] {AIDA-2020}
- Irradiation [Daniel, Lacour]
- Guard Ring solutions
 - Laser tests [Rémi, Vladik, Taikan]
- Dead space:
 - ⇒ beam tests μ's [TBD], physics proto
 - ⇒ pencil beams (a la PHIL)
- Wafer size: 8"
 - waiting for LFoundry (paid)...

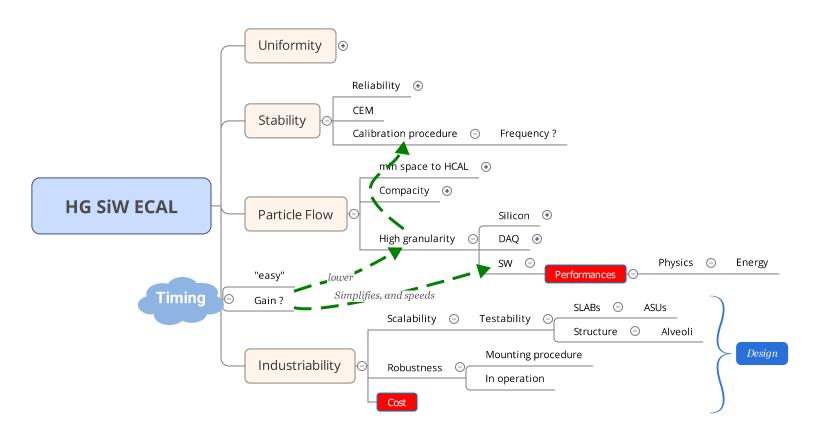
ASU

- testing → bench @ LPNHE & LAL
- Timing testing: SK2a ASU

Beam test analyses

- Photon direction
- HE showers in tech. prototype

What would bring Timing?



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Conclusions

Probably missed some items

- To be completed!
 - structured list of task and studies for possible new comers

Which priorities for 2017?

CALICE

- Short SLAB and Prototype: noise / running modes
 - SK2 / SK2a
 - improved PS, ASUs?
- Long SLAB: assess
 - Assess electronics
 - Mechanics feasibility

ILD

- New models
 - Finalisation of simulation models
 - Dimensions
 - Validate models
 - Review of analyses
 - Get organised by tasks...⇒ responsibilities ?
- Constraints from services ?
 - ⇒ interfaces
 - PS scheme
 - DAQ Scheme
 - ..