18.10.2019

ILD DESIGN REPORT STATUS

The IDR

Comprehensive document to describe the state of ILD

- Description of the system and its “philosophy”
- Describe the development in particular of technology which has happened since our last document
  - Subdetectors
  - Simulation
  - reconstruction
- Describe the effort to optimise ILD: IDR-S and IDR-L
- Describe the science program we want to do with ILD
- Update the costing
- Update the ILD integration
- Update the site specific considerations

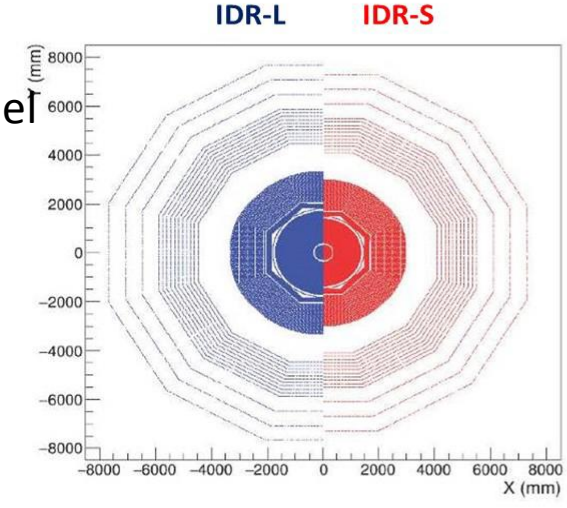
IDR-S and IDR-L

IDR-L:

- Nearly identical to DBD model
- “large”

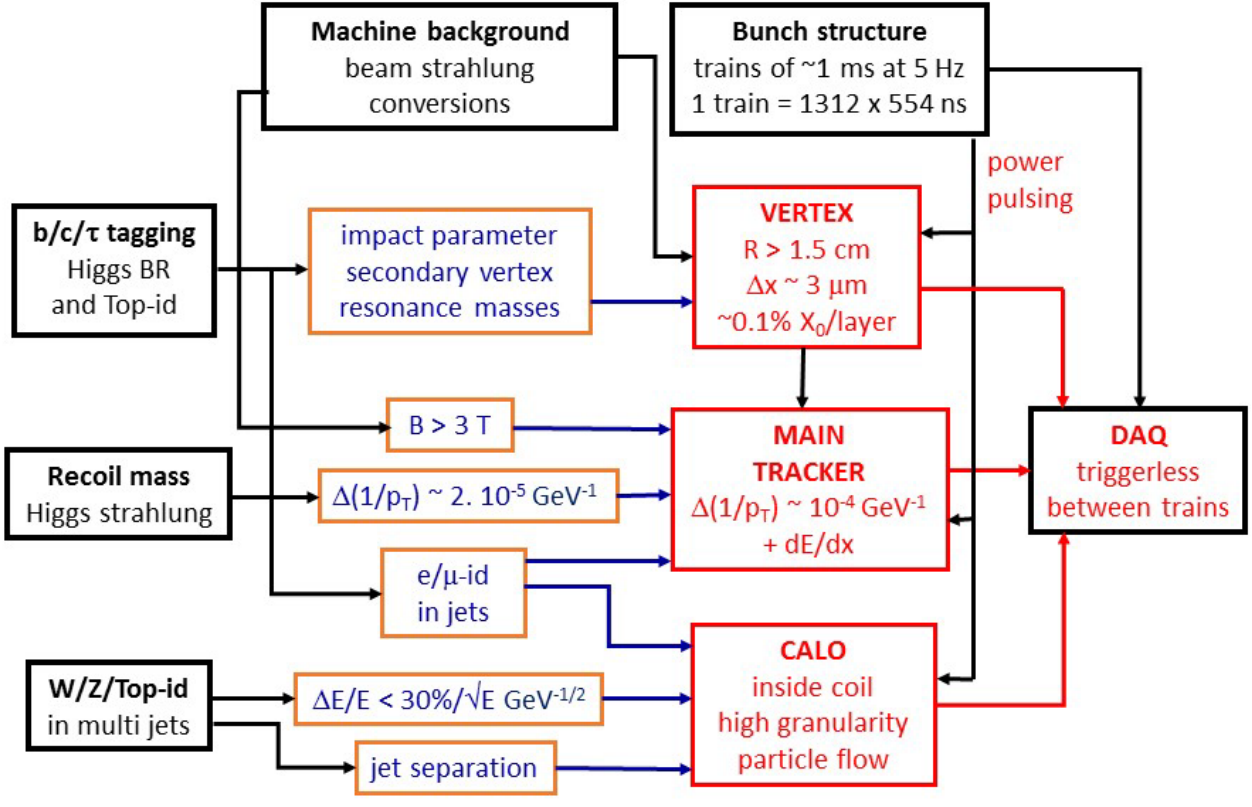
IDR-S

- Keep the length
- Reduce the radius

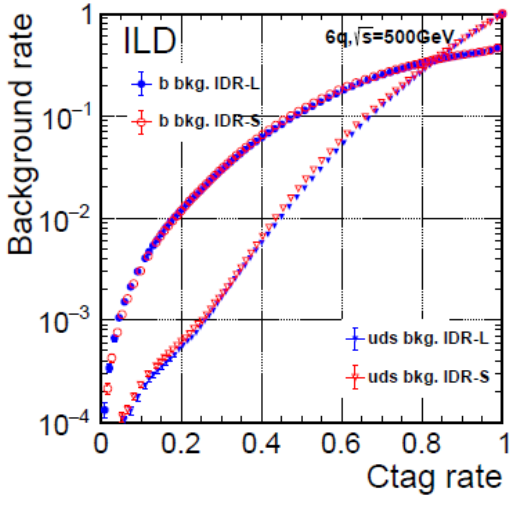


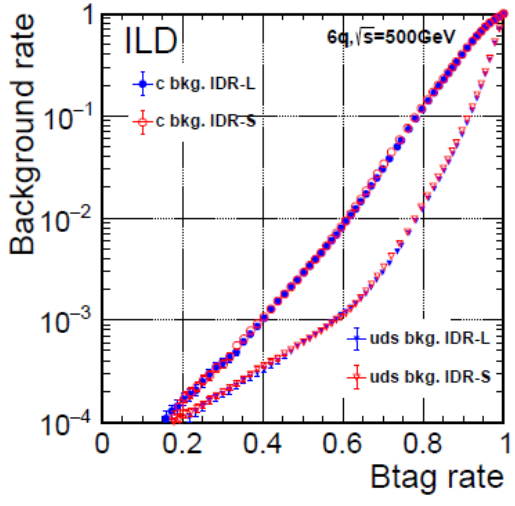
Detector	IDR-L	IDR-S
B-field	3.5 T	4 T
VTX inner radius	1.6 cm	1.6 cm
TPC inner radius	33 cm	33 cm
TPC outer radius	177 cm	143 cm
TPC length (z/2)	235 cm	235 cm
ECAL inner radius	180 cm	146 cm
ECAL outer radius	203 cm	169 cm
HCAL inner radius	206 cm	172 cm
HCAL outer radius	334 cm	300 cm
Coil inner radius	342 cm	308 cm

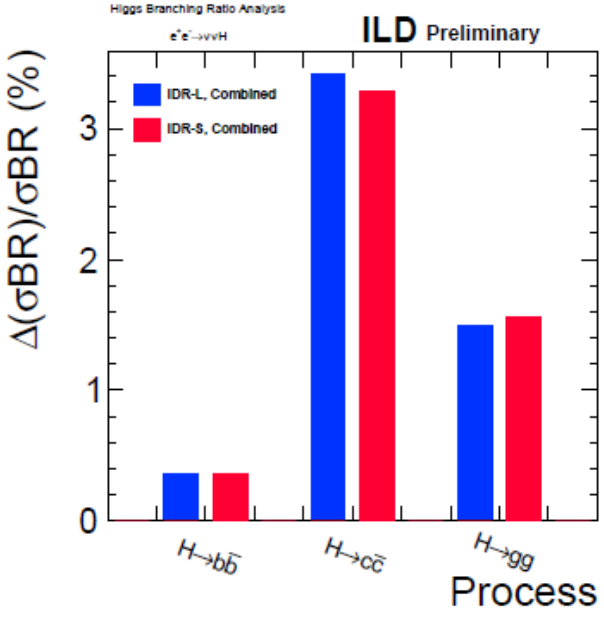
ILD specifications



Flavour tag performance



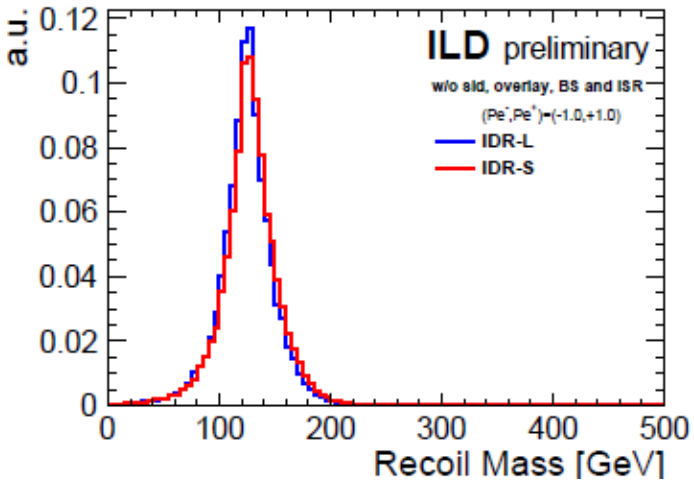


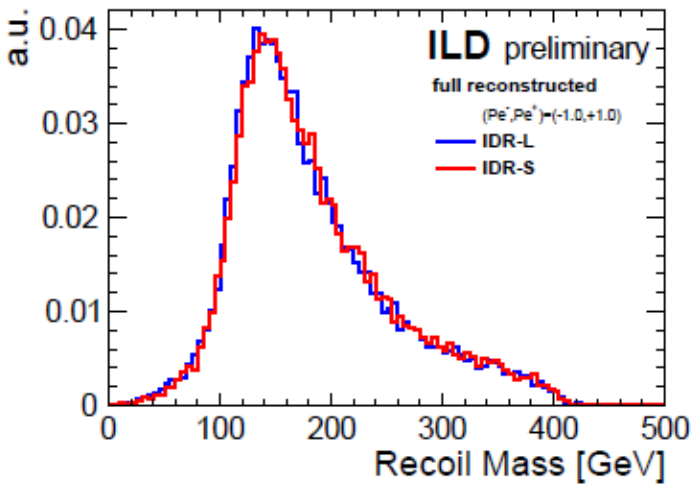


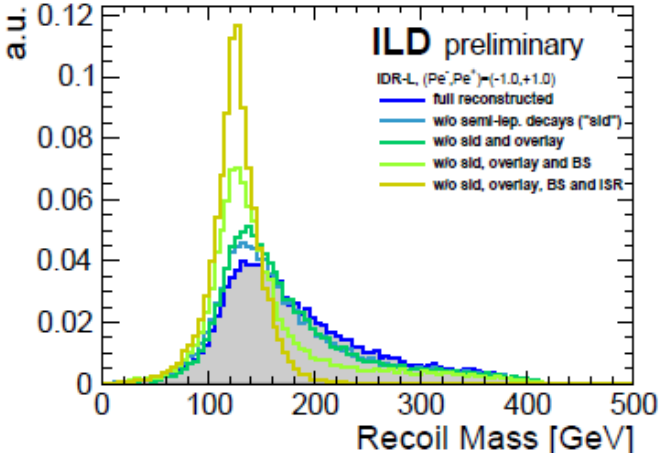
Impact on Higgs BR

- Hardly any difference for flavour tag performance for L and S model
- Not very surprising, given, that the VTX is identical (except B field)

Recoil Mass Analysis

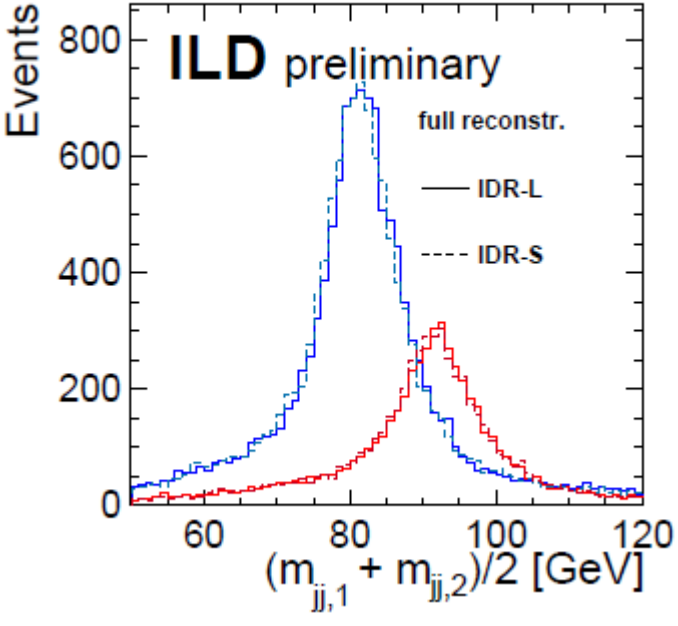




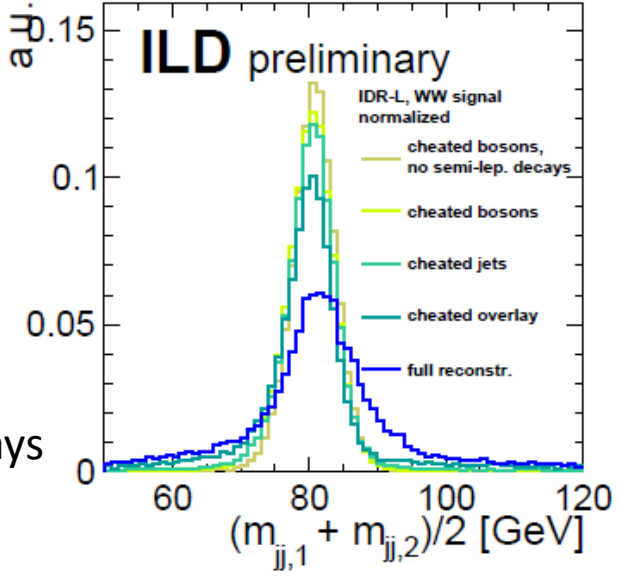


- Hardly any difference
- The performance is driven by other effects

WW/ ZZ reconstruction



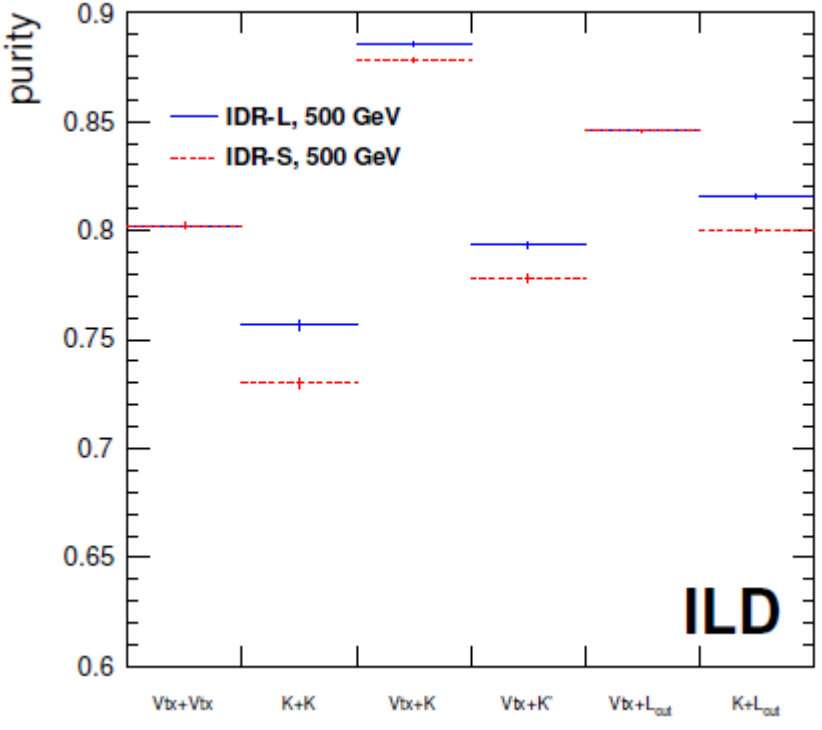
- Impact on dijet mass is small
- Strongly dominated by other effects:



- ➢ Overlay removal
- ➢ Jet clustering
- ➢ Semi-leptonic decays

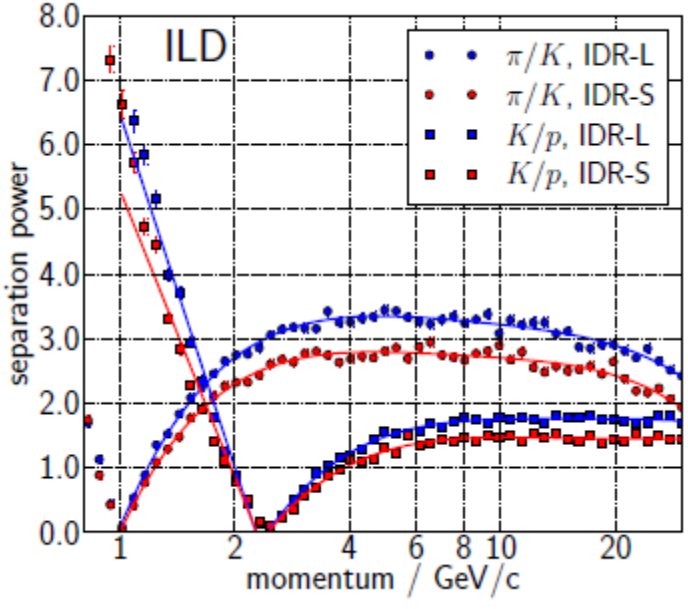
AFB from tt->bbqqlnu

- Vertex charge as a means to tag the charge of top/ anti-top
- Purity of the flavour tag via vtx charge and Kaon ID method
- Some advantage seen for the large detector

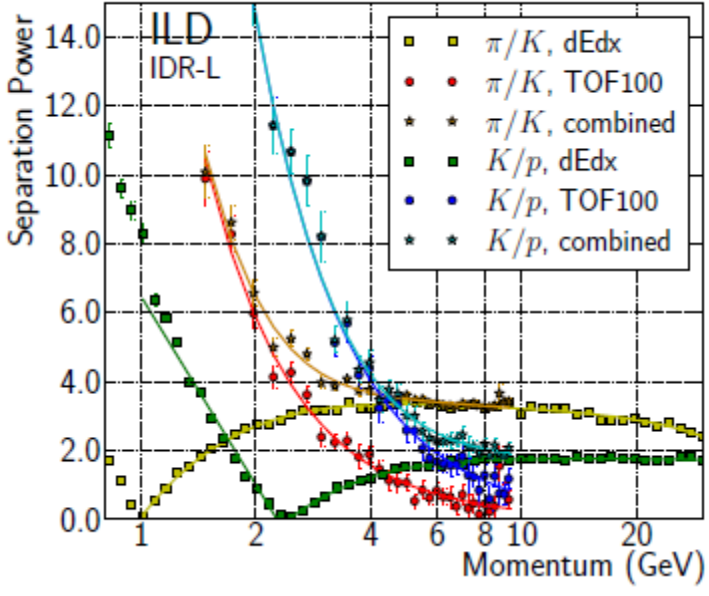


Particle ID

dE/dx

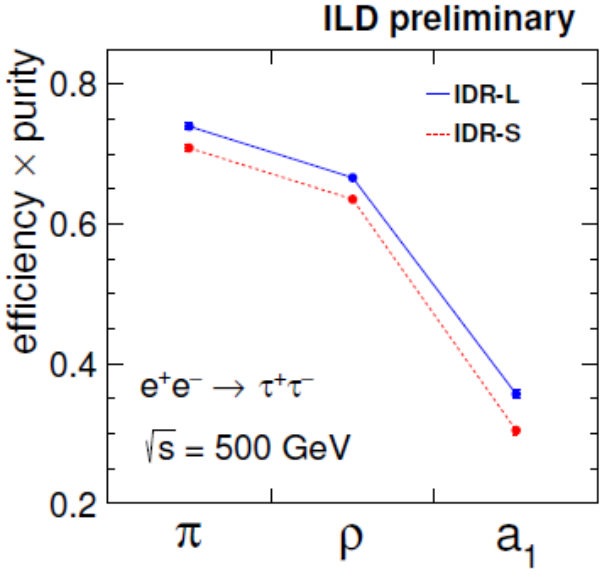


dE/dx and timing for IDR-L



- Particle ID via dE/dx
- Impact of smaller detector / smaller TPC is visible

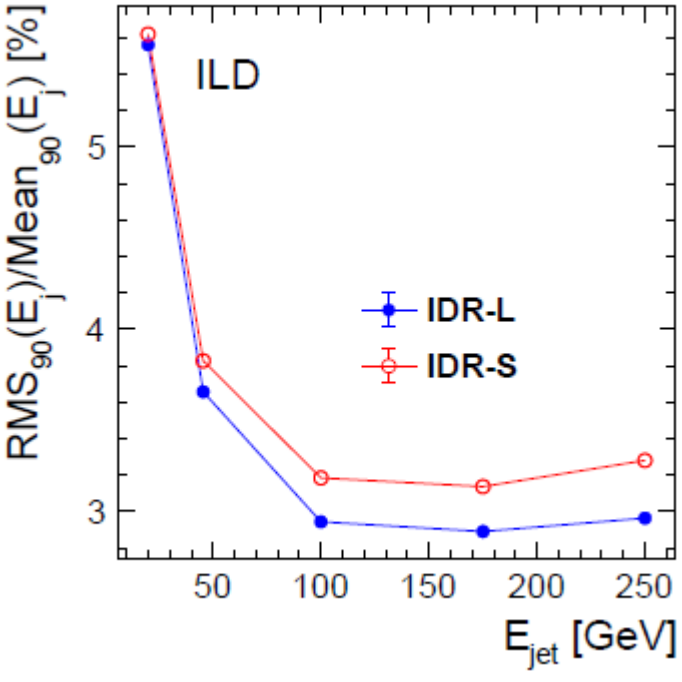
Hadron ID



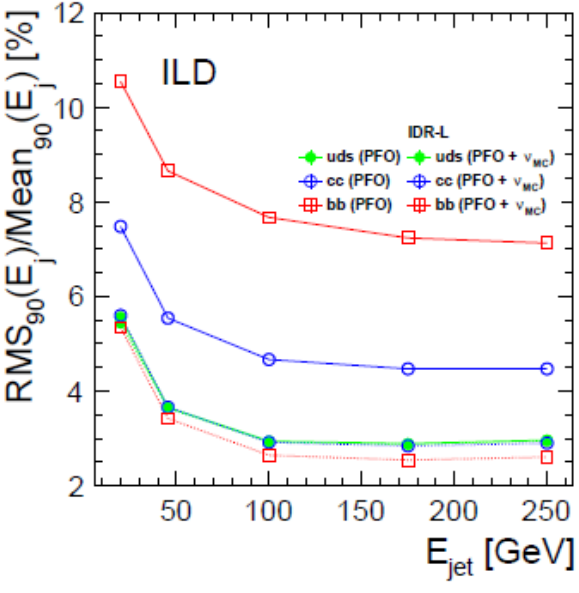
Tau identification in ILD

- Slight improvement for the large detector

Particle Flow

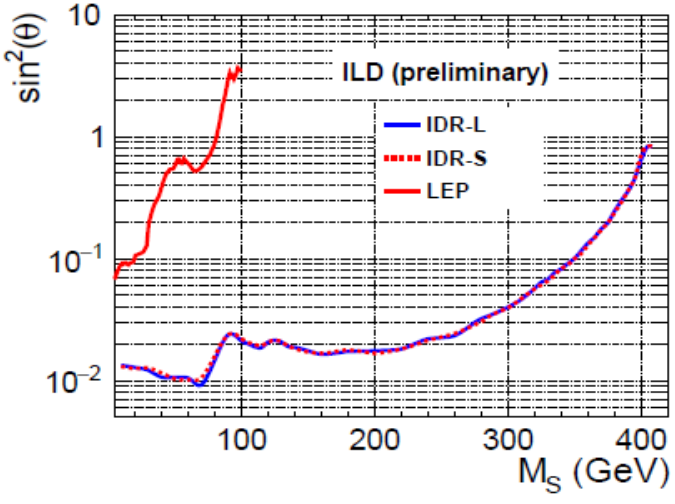


- The larger detector does better
- The improvement grows with energy



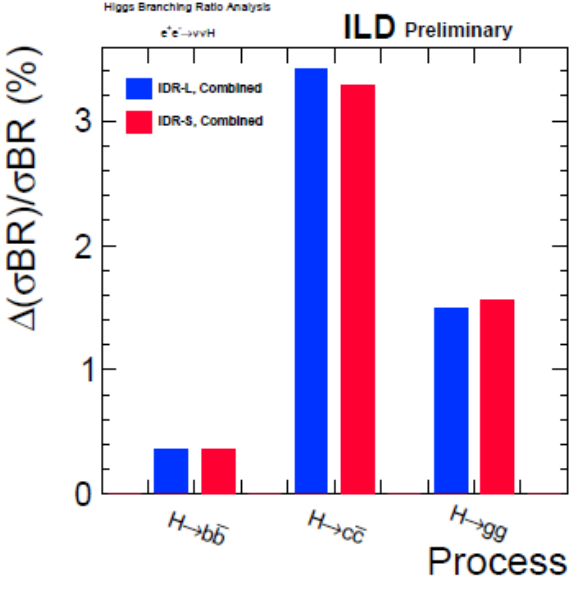
Intrinsic differences due to flavour are much larger

Science impact



Sensitivity for a new scalar particle, as a function of its mass and of the mixing angle with the SM Higgs boson.

Expected precision reachable for H BR measuremnets, for large and small ILD detector version.



Summary ILD size study

- The particle flow performance of the IDR-L is slightly better than IDR-S
- Most other performance criteria are very similar (nearly by design)
- The impact on the science is small, at least up to energies of 500 GeV.

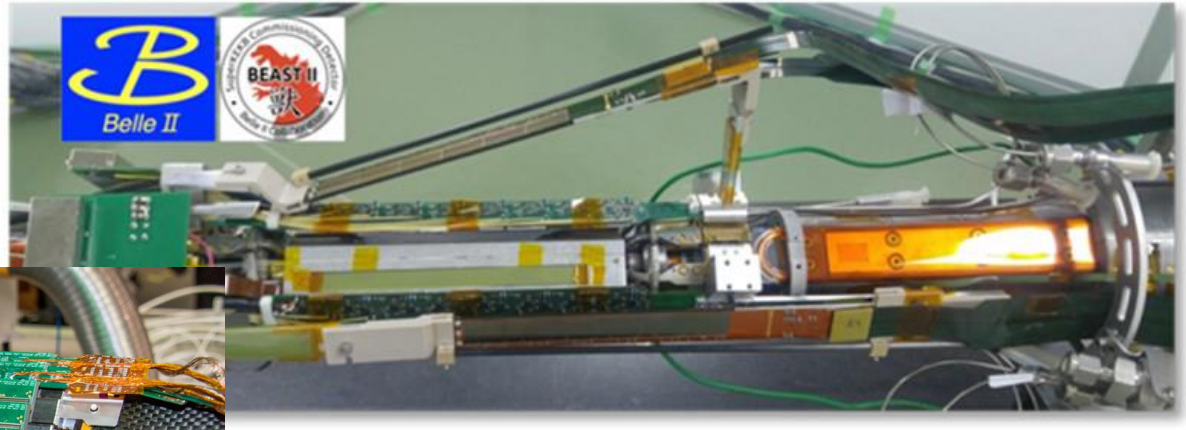
ILD subdetectors

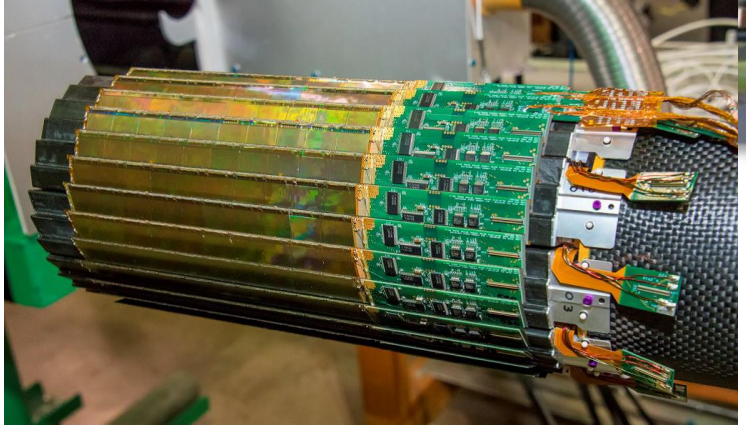
- The fundamental design ideas from the DBD have not changed
- Many experiments and studies have confirmed and validated the anticipated performance.

Vertex Detector

- Real life demonstrations in real experiments:

Belle VTX test installation based on ILC technologies

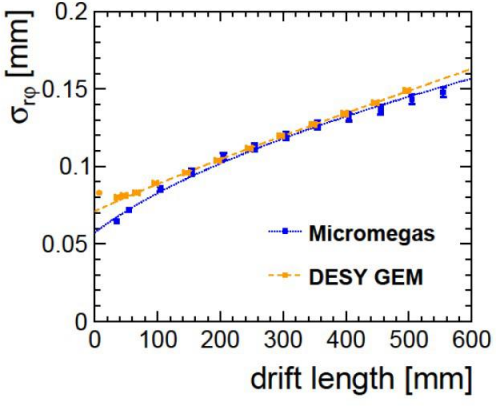


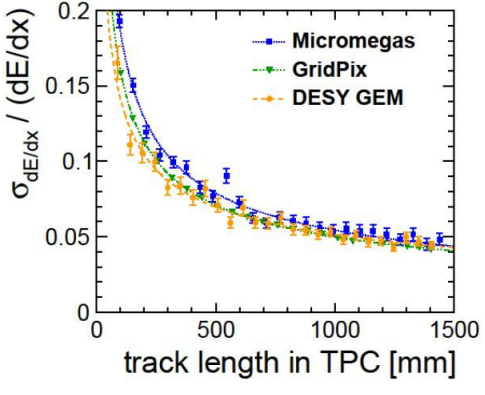


Star vertex detextor, based on the ILC developed CMOS technology

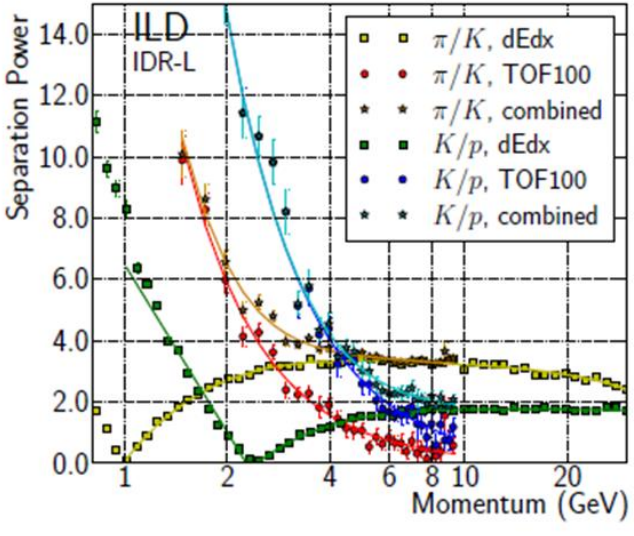
Tracking in ILD

- Fundamental concept remains unchanged
- Timing comes in as an additional component
  - Faster readout, less pileup
  - Active use for particle ID



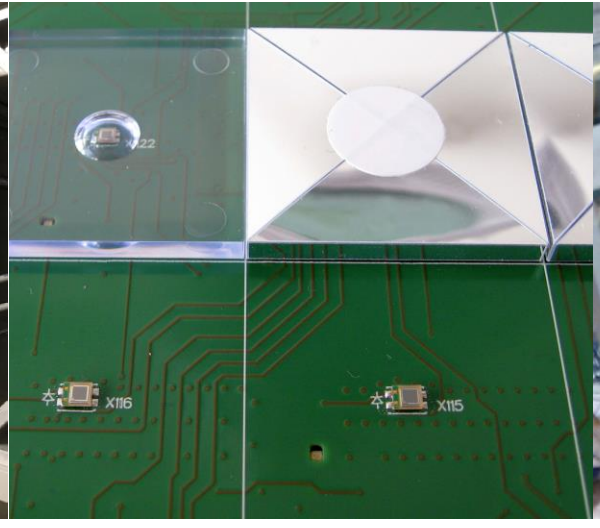


Fast timing as a tool for particle ID in ILD

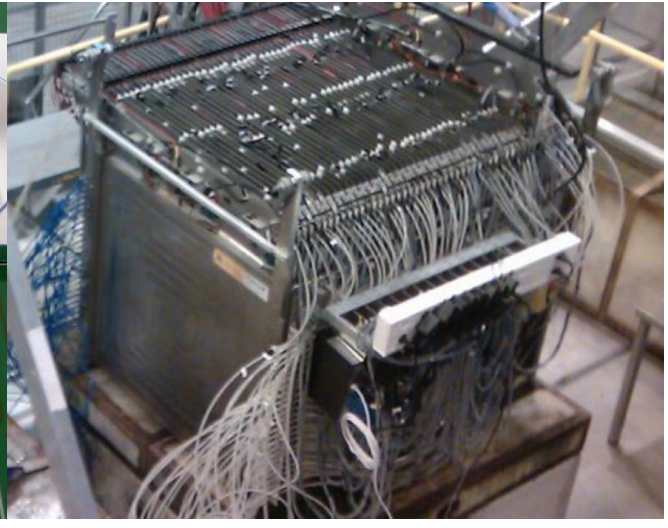


Calorimetry

ECAL: long slab prototype



AHCAL: integrated readout plane prototype

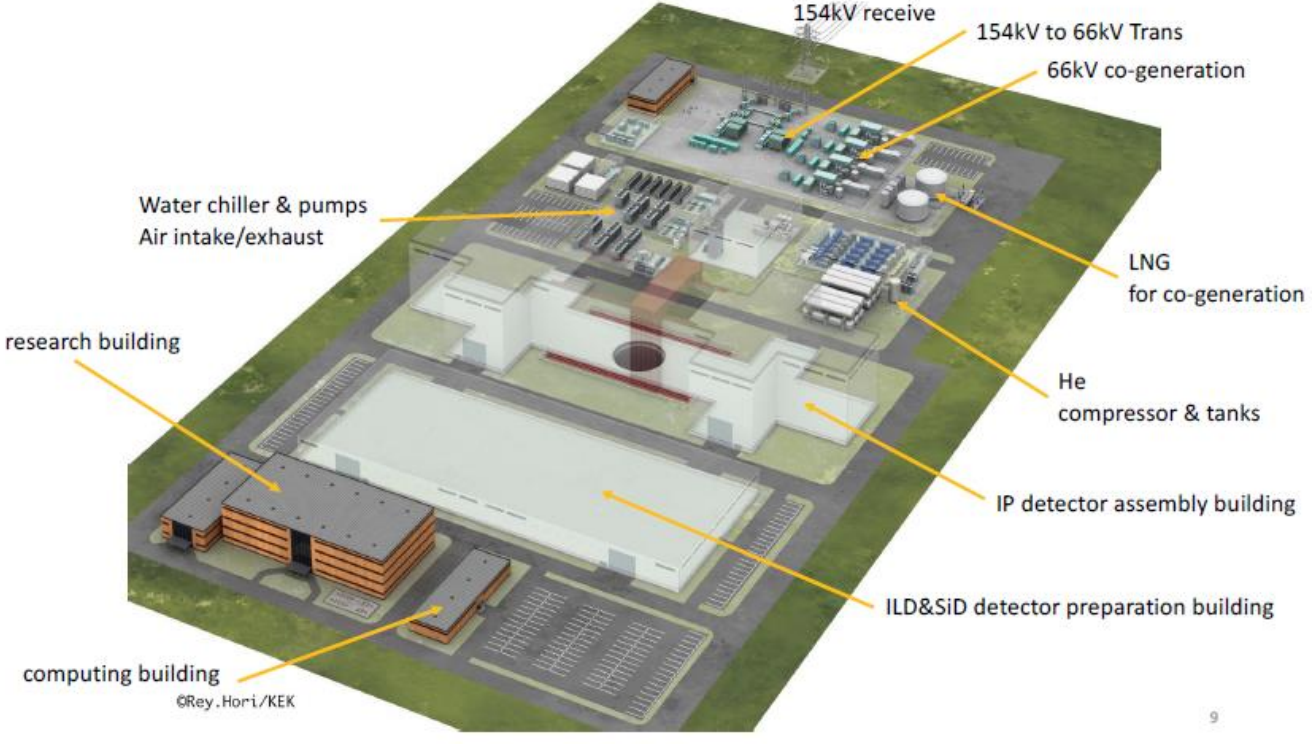


HCAL: large voluem system tests for both AHCAL and SDHCAL

Comprehensive demonstration of the feasibility of highly granular calorimetry for particle flow.

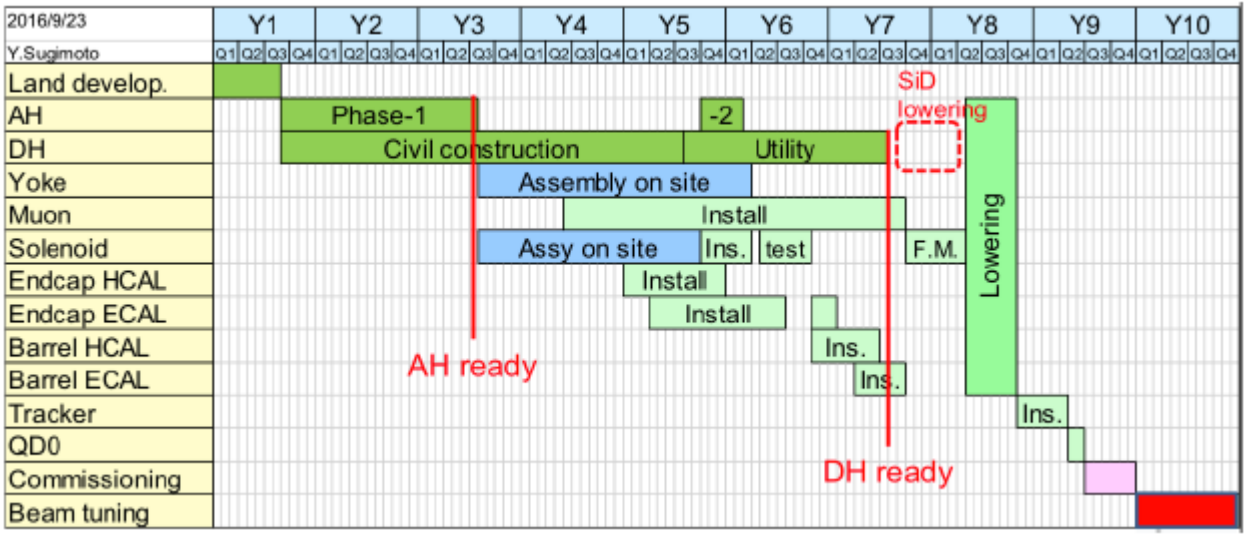
ILD integration

Campus and infrastructure planning

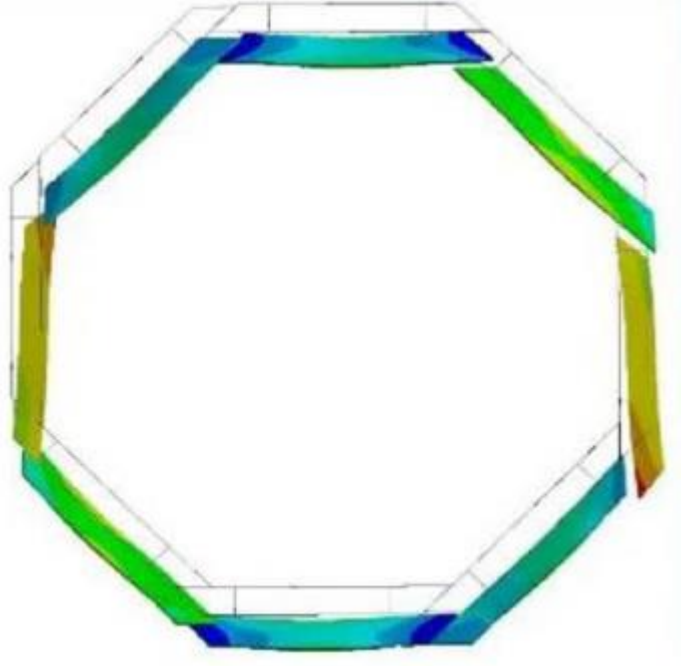


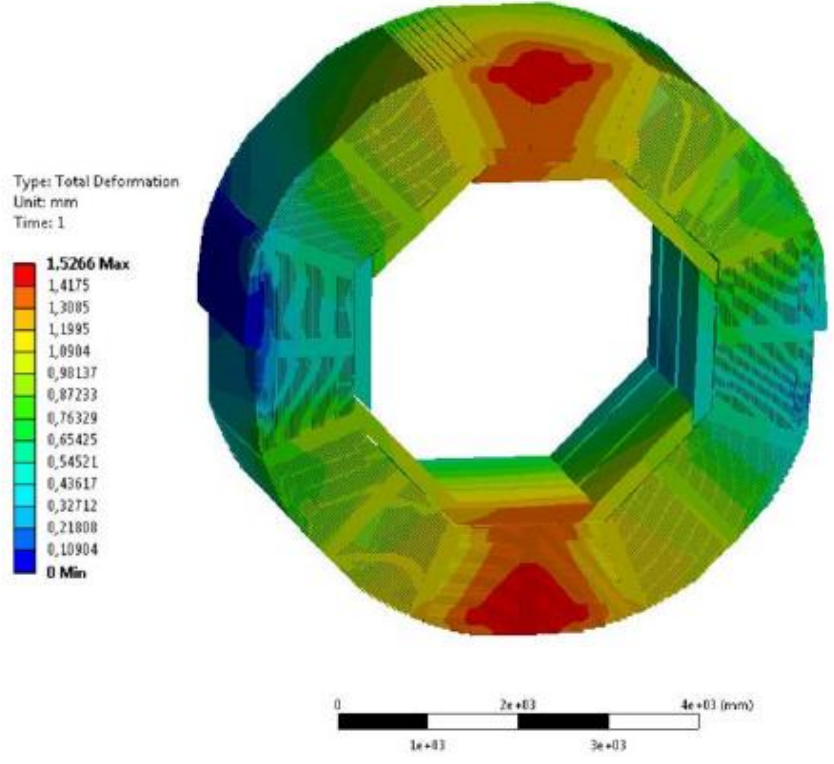
ILD planning

Example plan for the detector assembly on-site



Integration studies

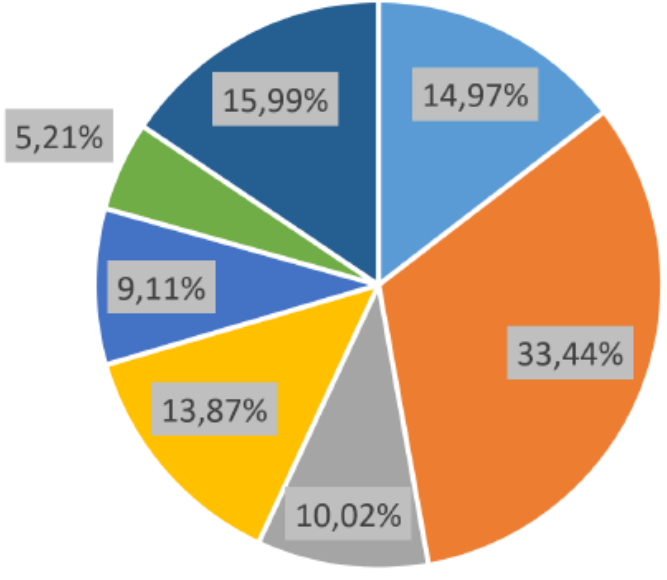




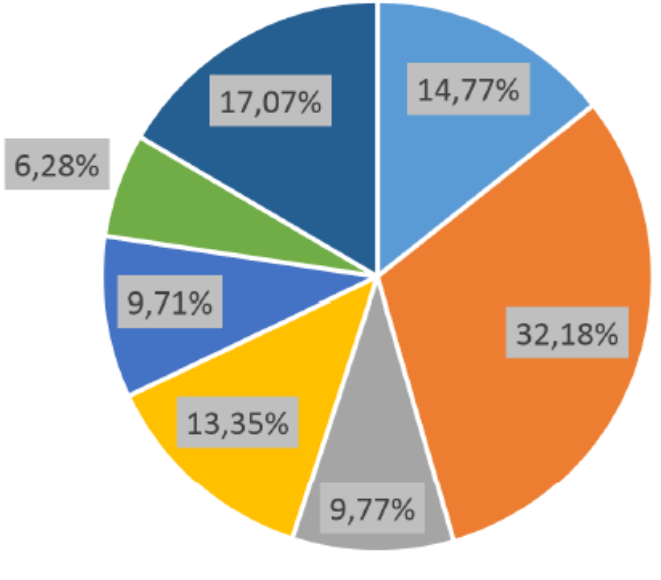
Significant progress in understanding the mechanical side of ILD

Costing: a snapshot

ECAL cost: 35% of total cost in large model



ECAL: 29% of total cost in small model



tungsten silicon PCB ASICs others tooling operations

IDR Status/ Plans

- 1. Circulation to the collaboration: July 6
- Circulation to internal reviewers: August 2019
- Submission to group of external reviewers: October 3, 2019
  - Paul Grannis
  - Lucie Linssen
  - Katsuo Tokushuku

- 2. circulation to ILD: October 25, 2019
- Discussion in ILC meeting: November 1, 2019
- Final editing: November 28/ 29, 2019

Summary

The ILD IDR is getting there

- Significant document, significant new information compared to the DBD
- Excellent progress on many fronts

The optimization did not result in very surprising results, but we understand the scalings much better

The process led to much improved software and models, with much improved reliability for scientific results: significant impact on EUP