

# ILC : experiment and IN2P3 activities

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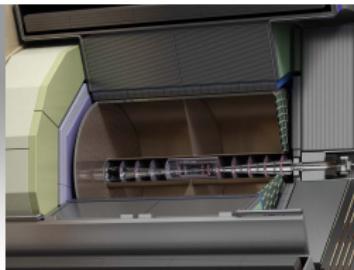
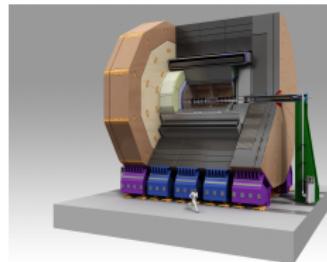
# ILC

$e_{L,R}^+ e_{L,R}^-$ , 2 ab<sup>-1</sup> at 250 GeV,  $\mathcal{L}_{\text{LEP}}$  every 2 days,  $E_{CM}$  up to 1 TeV.

$e_{L,R}^+ e_{L,R}^- \rightarrow h^0 (\rightarrow X) Z^0 (\rightarrow \mu^+ \mu^-)$ ;  $h^0 \rightarrow b\bar{b}, \tau^+ \tau^-, c\bar{c}, \mu^+ \mu^-$ , ...  
 $e_{L,R}^+ e_{L,R}^- \rightarrow W^\pm W^\mp, Z^0 Z^0$ ;  $Z, W \rightarrow q\bar{q}$  mass separation.

$$\frac{\sigma(E_{jet})}{E_{jet}} < \frac{0.3}{\sqrt{E_{jet}(\text{GeV})}}, \sigma\left(\frac{1}{p_{track}}\right) < \frac{5 \cdot 10^{-5}}{\text{GeV}}, \sigma(d0) < \left(5 \oplus \frac{10}{p_{track}(\text{GeV}) \sin^{frac{32}}}\right) \mu\text{m}$$

Push-pull of 2 detectors : SiD and ILD, most of IN2P3 in ILD.



Particle Flow Detectors  
 ⇒ Highly granular calorimeters

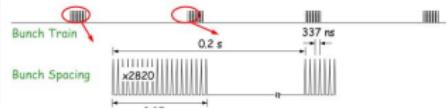
Tracker : TPC (Irfu) and Vertex  
 (lighter and granularity ×10)

Better than LHC ⇒ ILC R&D ⇒ HL-LHC

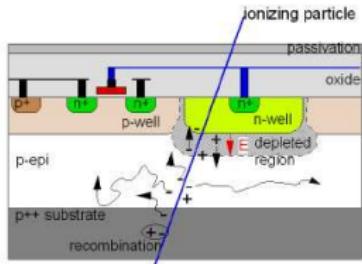
# Vertex Detector

## ILC requirements

$\sigma_{\text{single point}} < 3\mu\text{m}$   
 $< 0.15\%X_0$  per layer  
 $< 1\%X_0$  total  $\sim 900\mu\text{m}$  Si  
 100 krad/year  
 Power Consumption  $< 50\text{mW/cm}^2$



Under development, Fine Pixel CCD,  
Silicon On Insulator, DEPFET,  
CMOS Pixel Sensor @ IPHC



## PLUME double sided layers

MIMOSIS for CBM  
 $0.5\%X_0$  / layer  
 $\sigma = 5\mu\text{m} \& 5\mu\text{s}$

## PSIRA proposal for ILC

$0.15 - 0.20\%X_0$  / layer  
 $\sigma = 4\mu\text{m} \& 1\mu\text{s}$   
 Power pulsing  
 $(< 50\text{mW/cm}^2)$  in high B field

# ECAL



ILD Sc-W ECAL Scintillator strips  $45 \times 5\text{mm}^2$ , SiPM,  $\Omega$

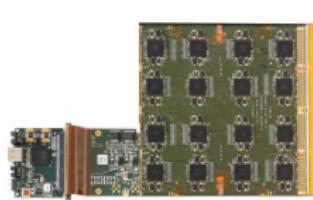
ILD SiW ECAL Si sensor  $5.5 \times 5.5\text{mm}^2$ , 12 bit ADC per pixel, LLR/LPNHE/LPSC/LAL/ $\Omega$



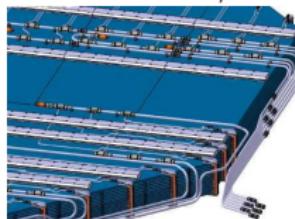
Technological prototype

Embedded readout, Power pulsing, mass production, Omega SKIROC2a chip

NB :  $\Omega$  Omega provides chips for almost all CALICE ECAL/HCAL prototypes.



space for 12 ASU



Thermo-mechanical simulations

Goal : reaching ILD requirement until construction time

# HCAL



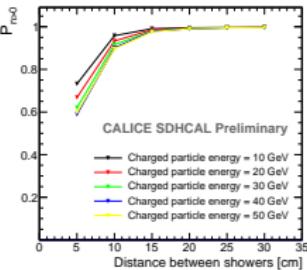
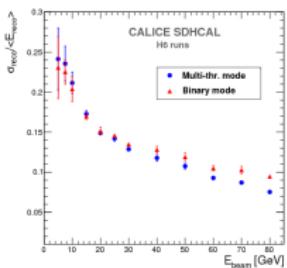
**ILD AHCAL** Scintillator+PM (DESY),  $3 \times 3\text{cm}^2$ ,  $\Omega$

**SiD DHCAL** GRPC (Argonne), Micromegas (LAPP),  $1\text{cm}^2$

**ILD SDHCAL** GRPC (**IPNL**/LAPP/LLR/LPC/ $\Omega$ ),  $1\text{cm}^2$

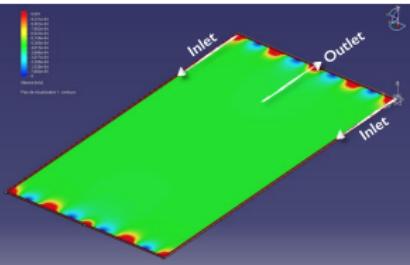
## SDHCAL

First technological prototype :  
embedded readout,  
power pulsing.

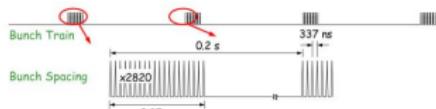


## Development

HR3 chip, I2C link,  
 $1 \times 3\text{m}^2$  chamber,  
eco-gas,  
GBT-link DAQ,  
reconstruction  
software



# R&D evolution



CMOS : thinner and faster double sided ladders.  
Calo base design : time resolution < interbunch time.

## Sub-ns timing under way

CMS-HGCAL

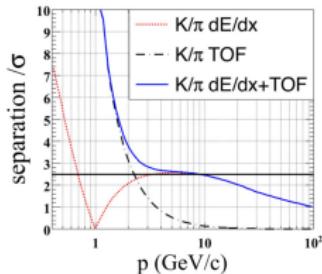
ATLAS-HGTD

CMS-muon RPC with OMEGA

PETIROC



Fast-timing price = power consumption.



## Jets

Fine granularity Calo + PFA + eventual 4D tracking and calorimetry  $\Rightarrow$  jets algorithm limitations, Lorentz Invariant QCD final state.