ILD performance optimization for ECAL

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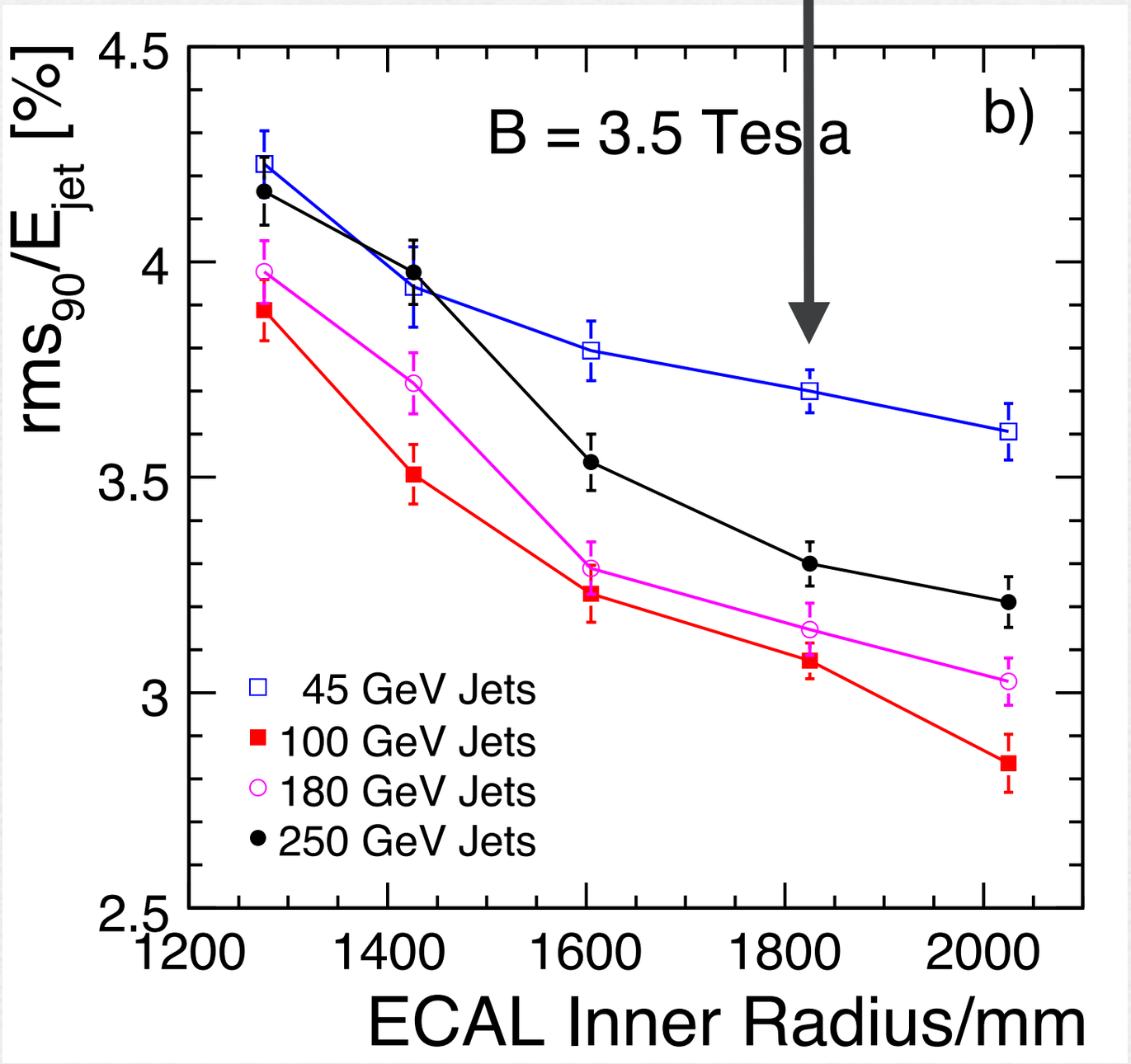
LOI, we have so far optimized the detector sizes
then DBD verified the performances
Now it is the time to revisit LOI phase
with the view point of cost

Jet Energy Resolution

- one of the most important parameters to be optimized
- in ILD-LOI, the size was not optimized
-



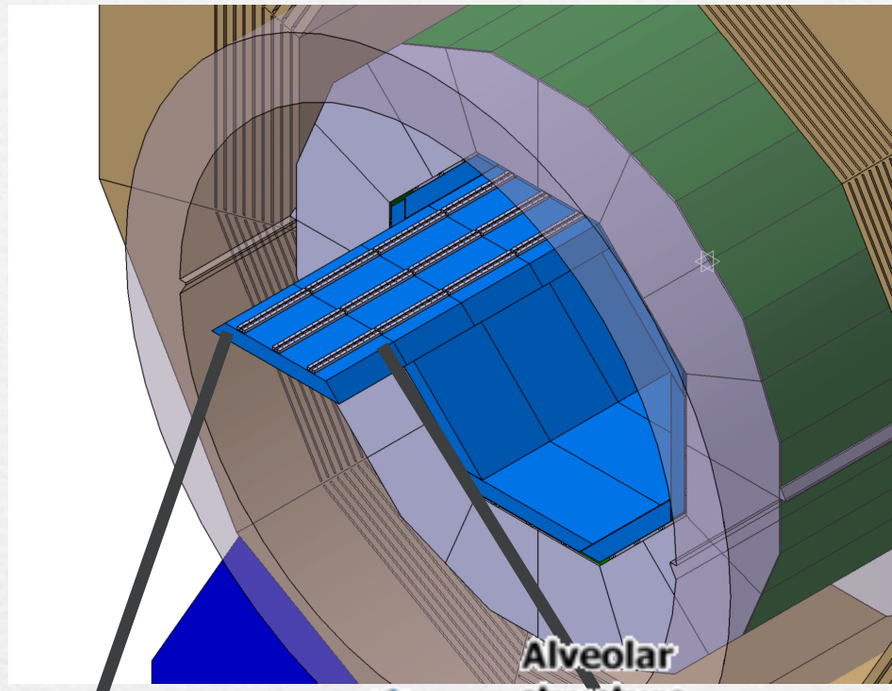
ILD-LOI(2009)
tab. 2.2-2

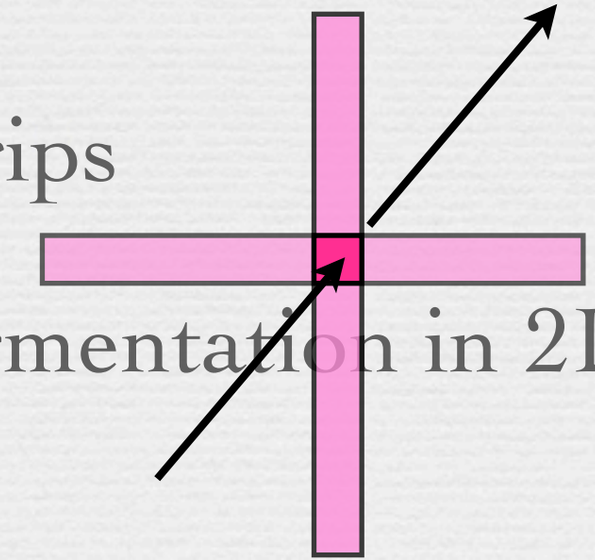
ECAL
$5x5mm^2$?

ECAL option

- two sensor options for ILD-ECAL
- within the same alveola structure
- embedded FE electronics
- silicon-pad of pin diode 10^8 ch.
  - square cells
- scintillator strip with PPD 10^7 ch
  - perpendicular strips
    $5x45mm^2$ strip
  - effective fine segmentation in 2D

Recal=1850

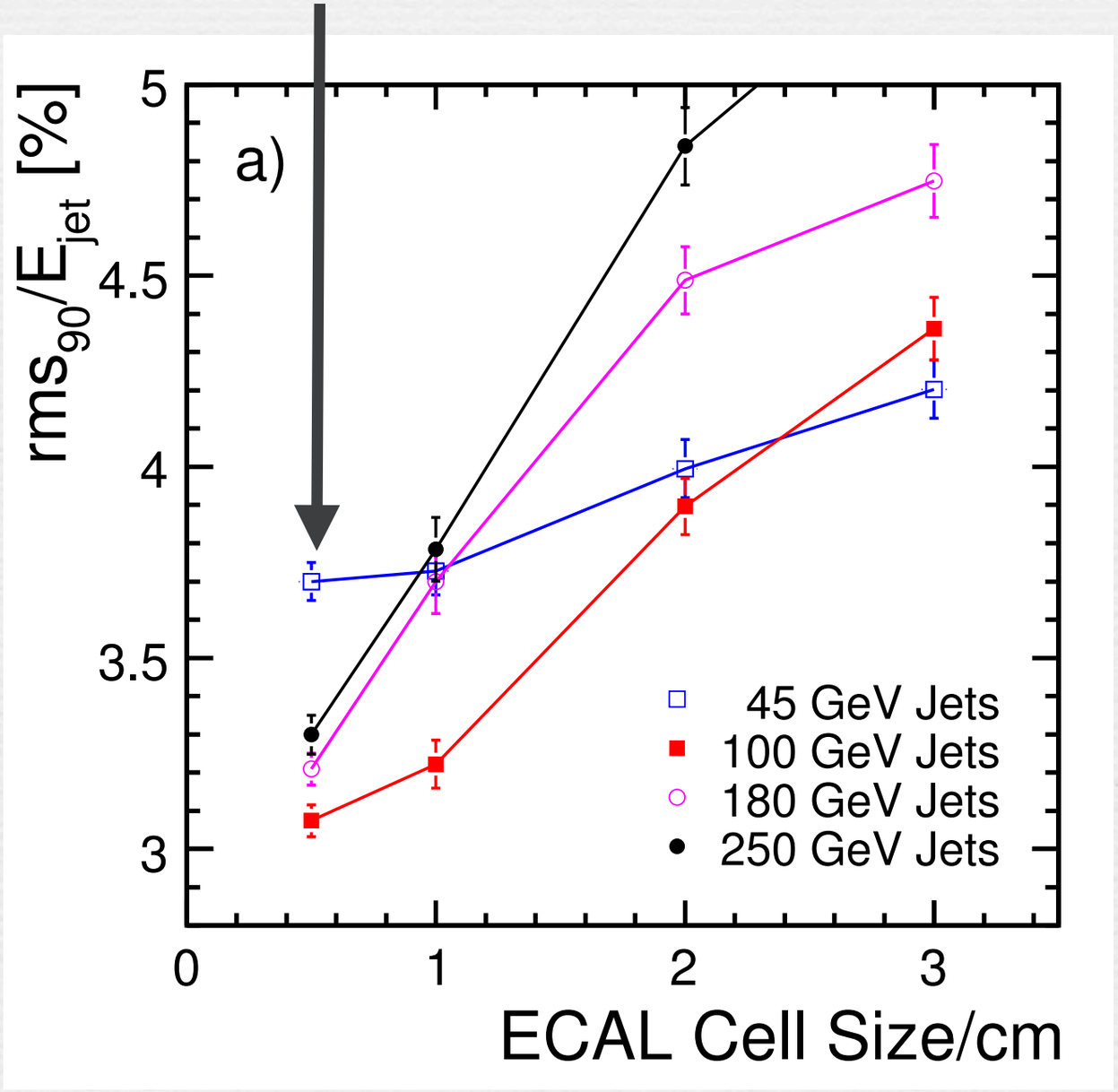




segmentation

- PFA requires fine segmentation in both
- lateral and longitudinal directions of particles
- we have chosen 5x5 mm^2 for ECAL

JER



ILD-LOI(2009)

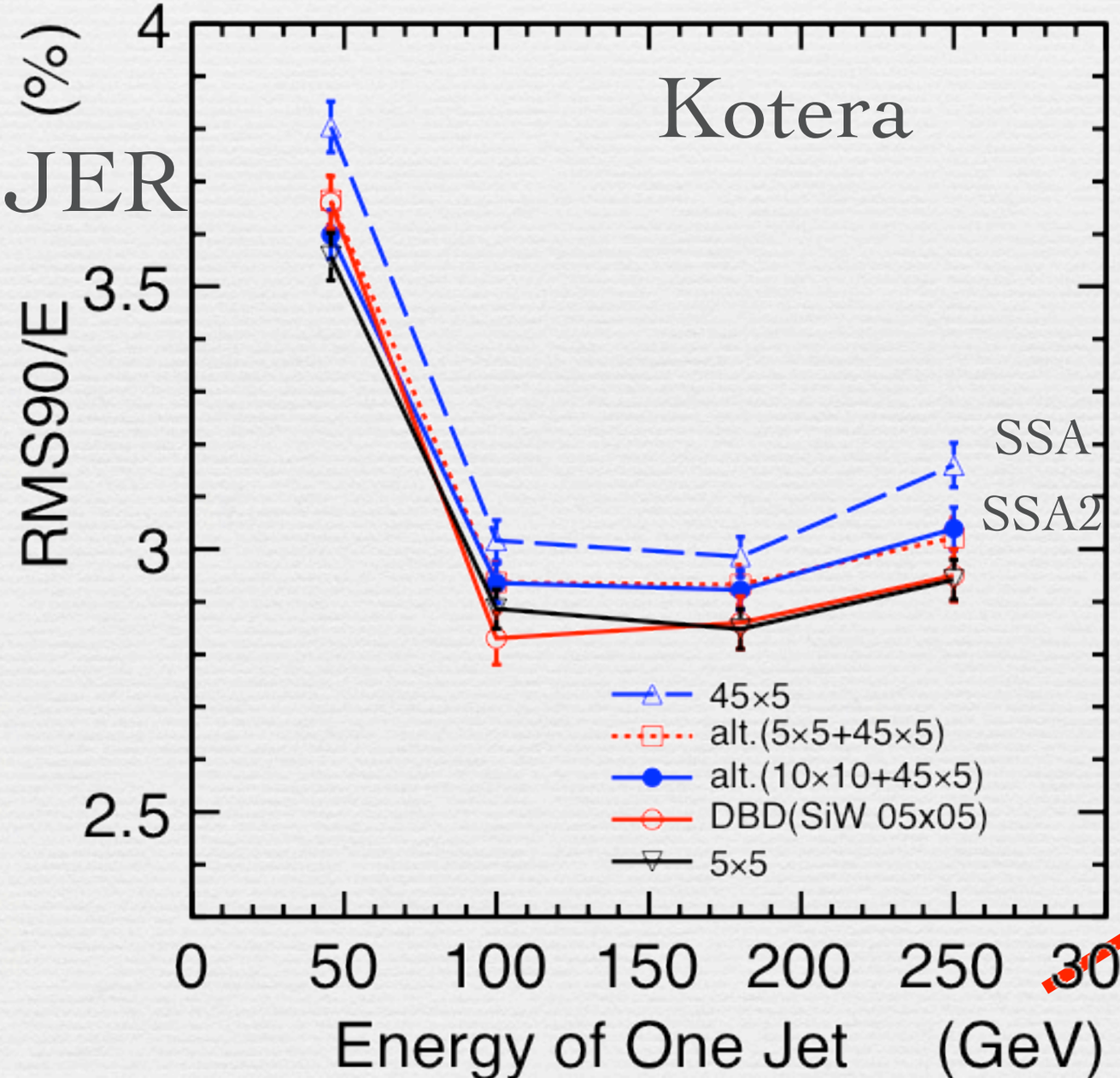
tab. 2.2-4

Recal=1850

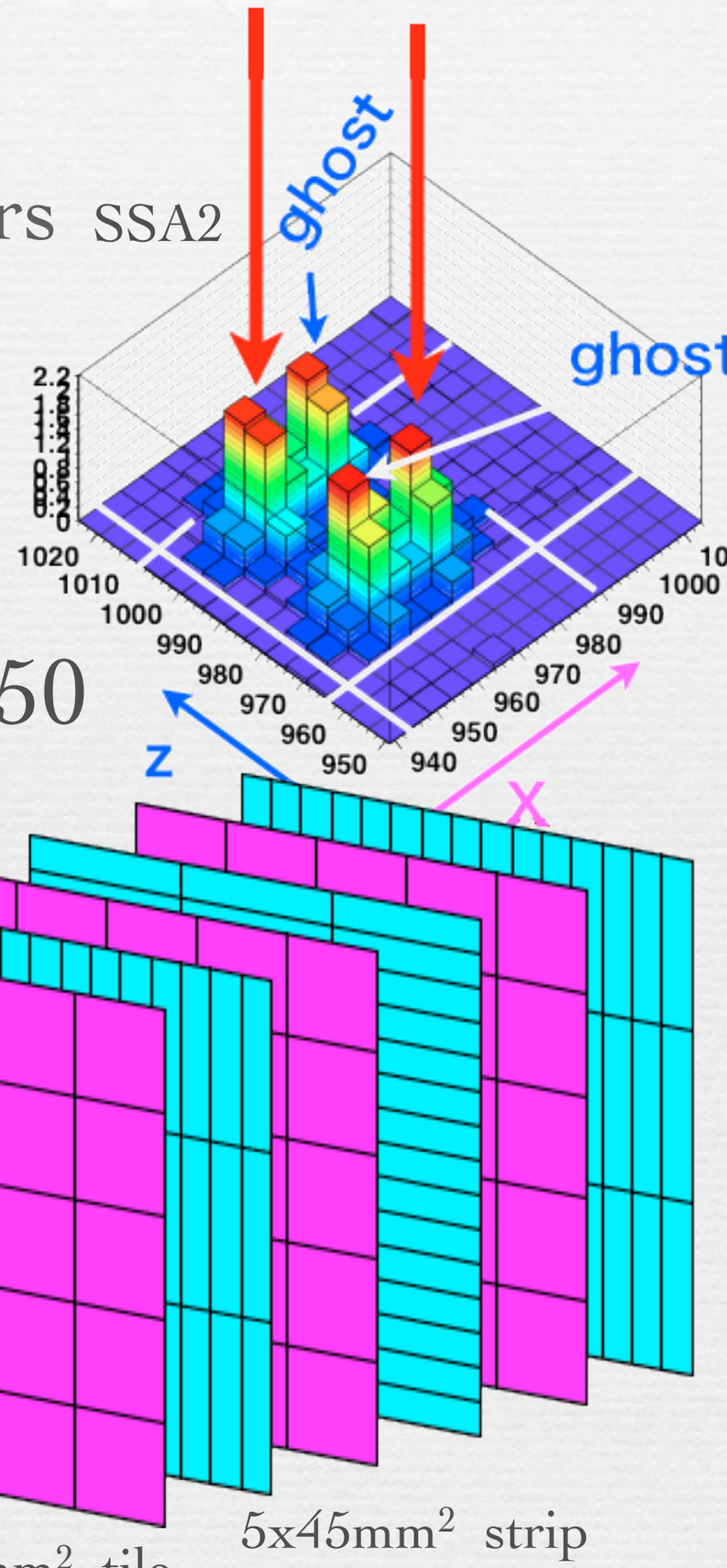
we have shown to be achievable technically

strip ghost problem

- strip segmentation arise ghost problem
- to escape from ghost, we install tile layers SSA2
- JERs are almost the same for 5x5



Recal=1850

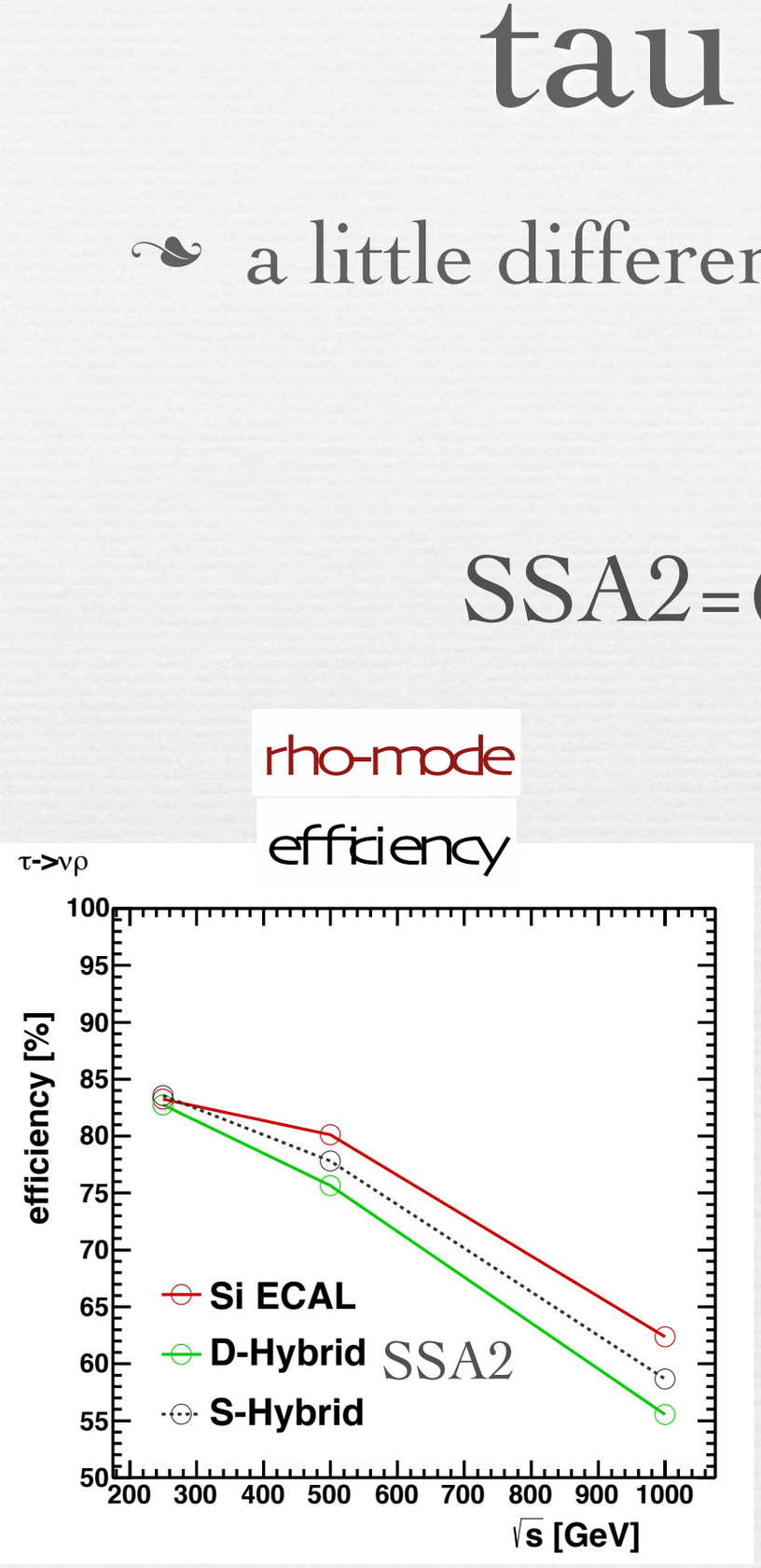


tau performance

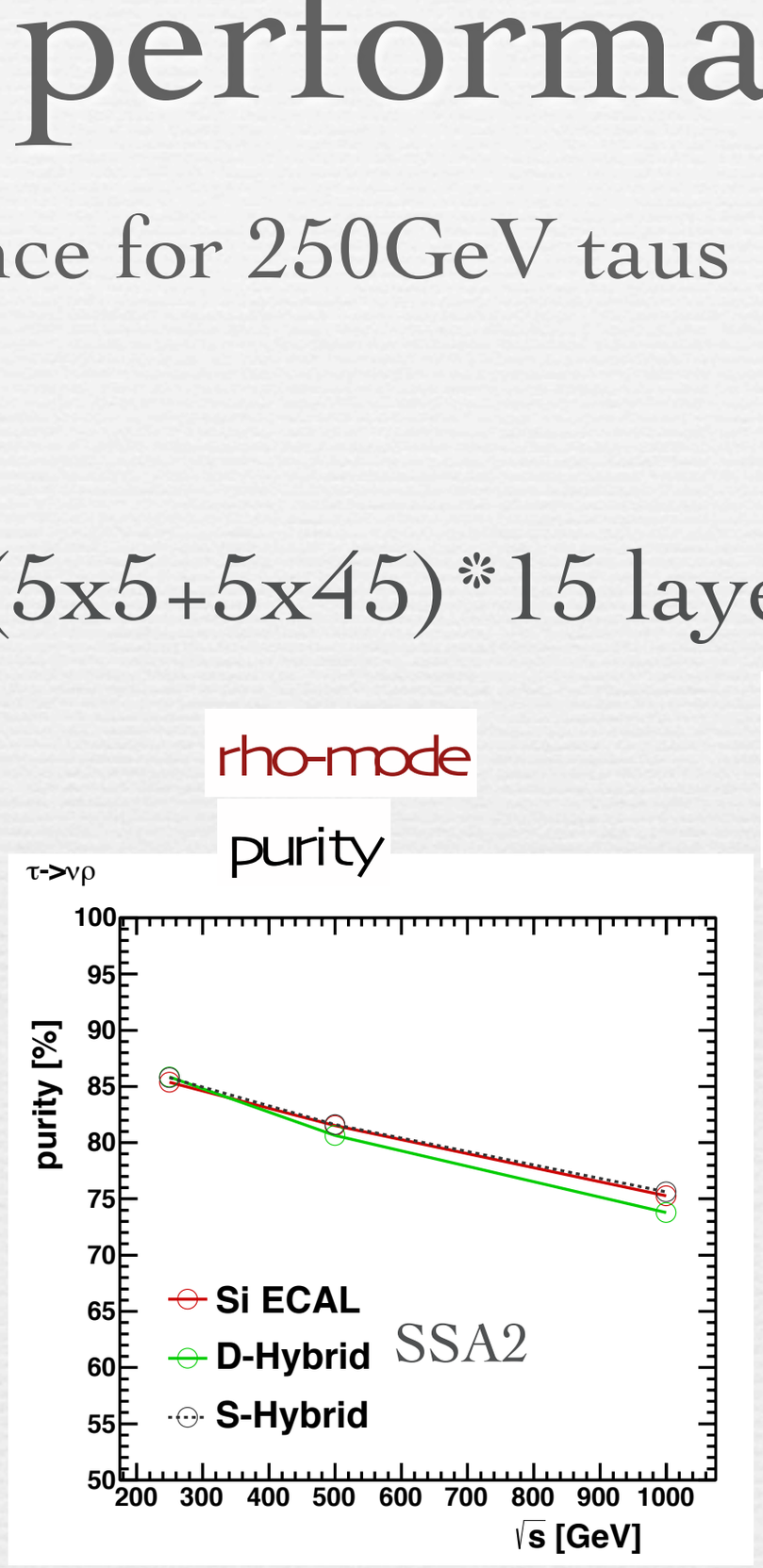
- a little difference for 250GeV taus

SSA2=(5x5+5x45)*15 layers Recal=1850

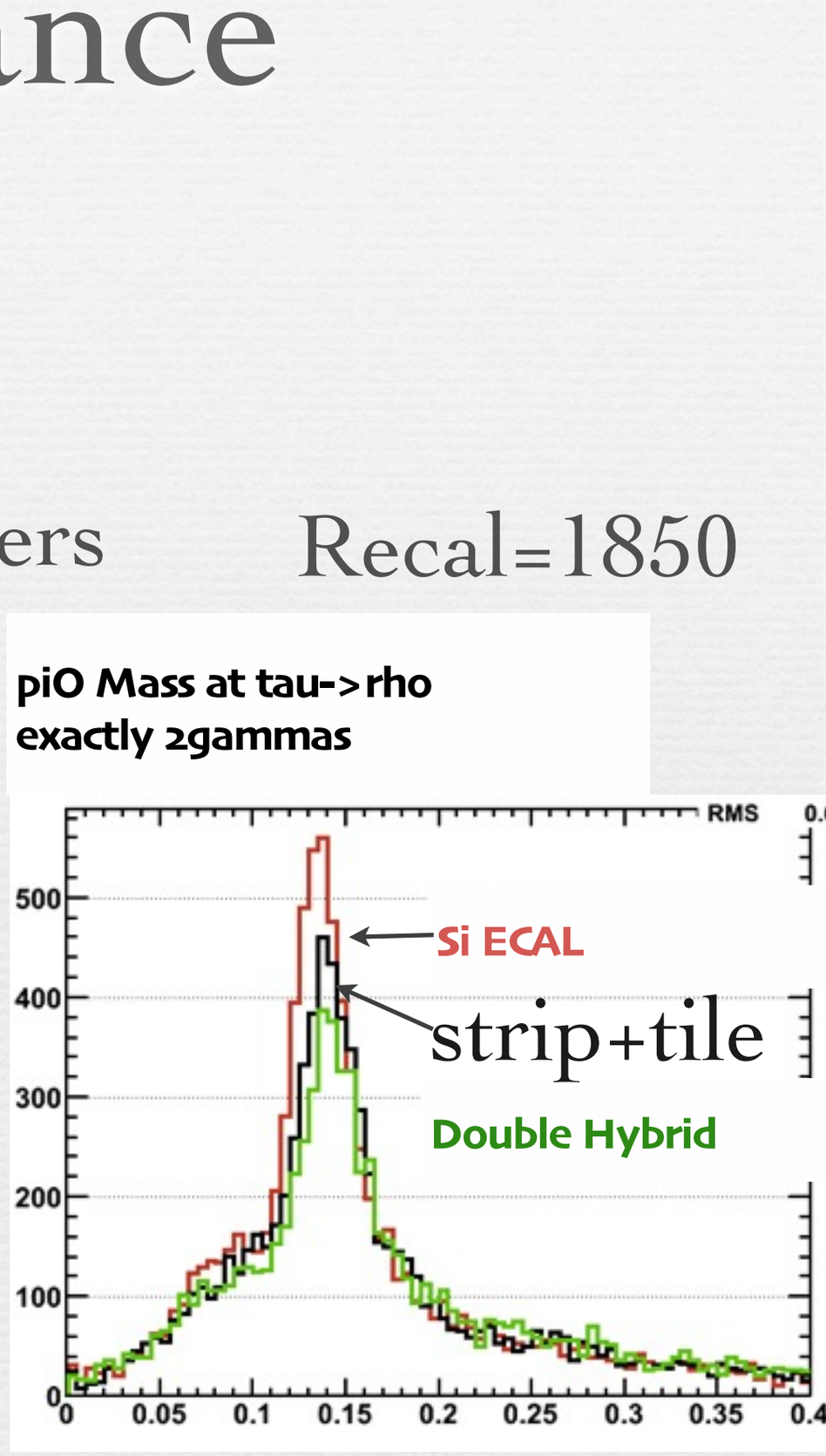
rho-mode efficiency



rho-mode purity



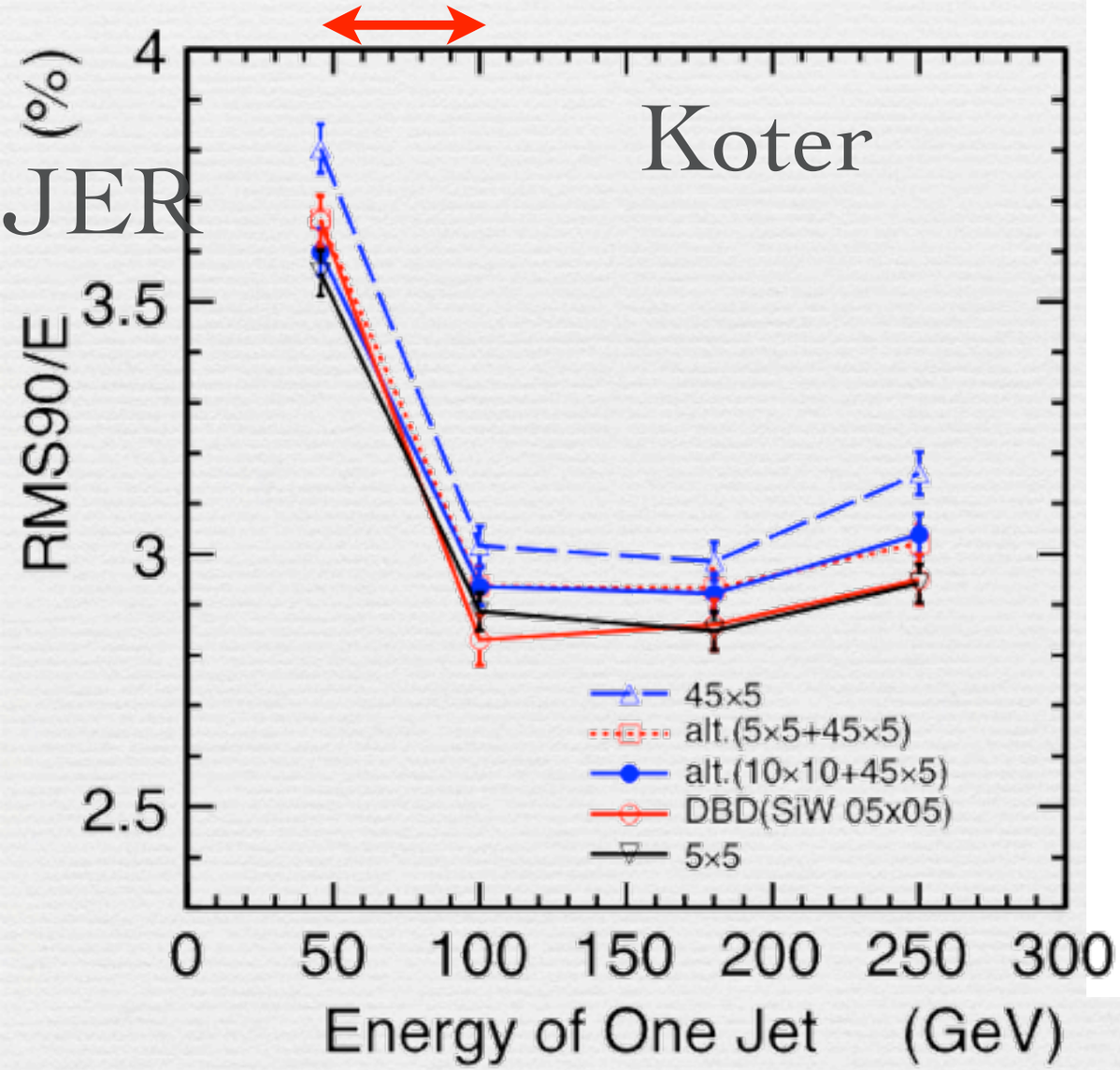
piO Mass at tau->rho exactly 2gammas

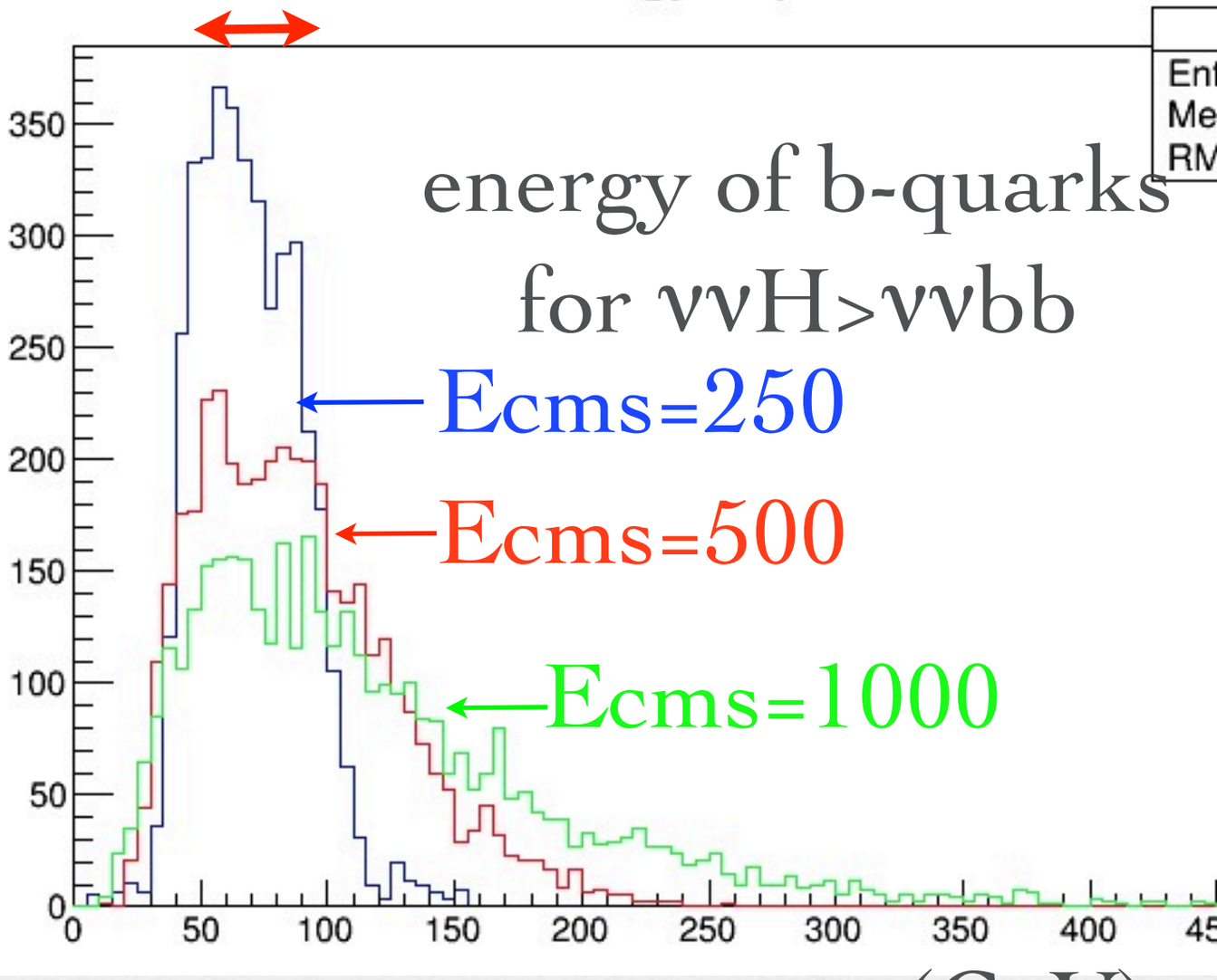


T.Ogawa

ILD optimization

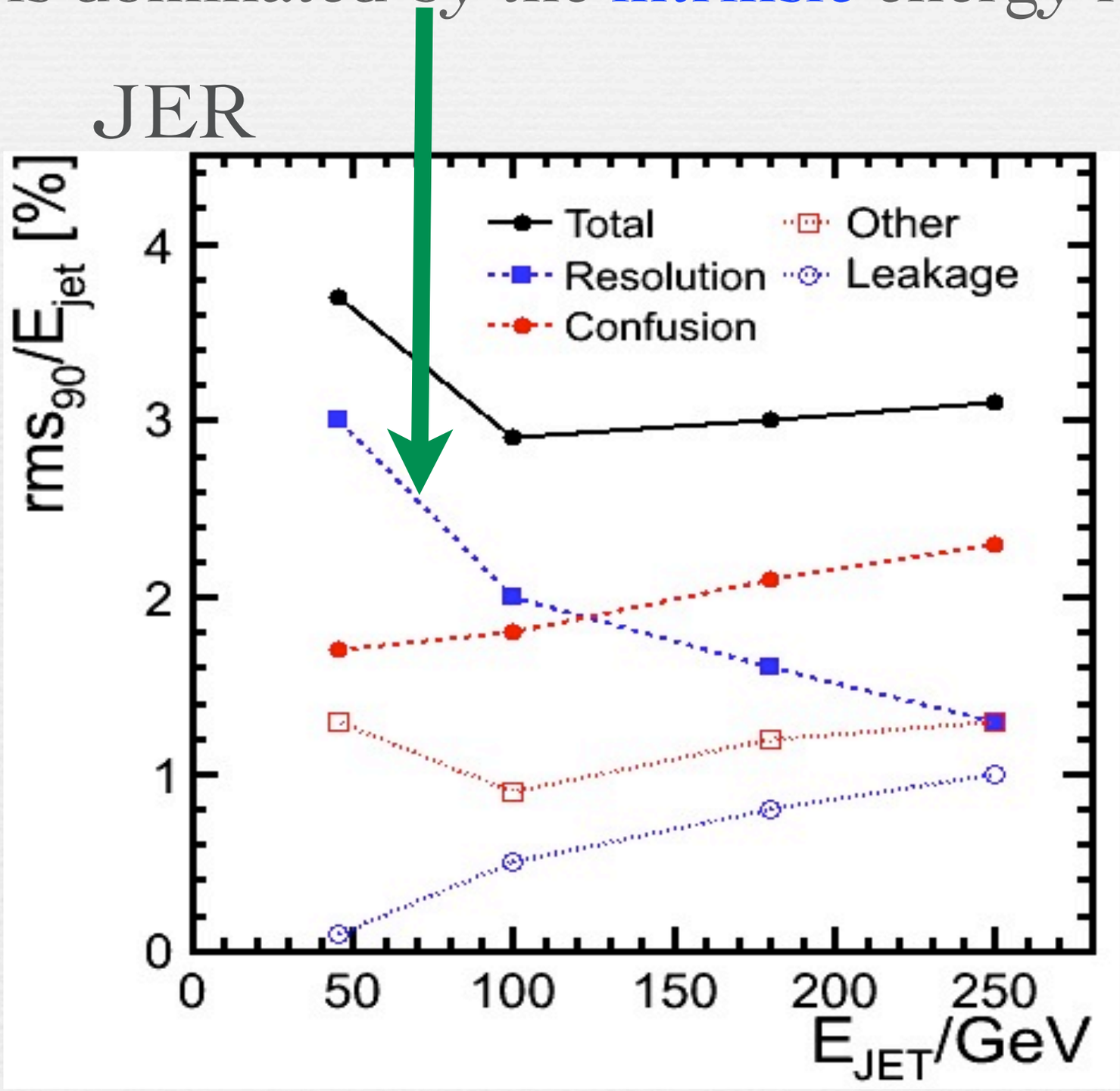
- should account for the performance and cost
- optimized for the physics cases such as
- ννH_{bb} νν$_{bb}$ most relevant at 50-100GeV





Ejet between 50-100GeV

- JER is dominated by the intrinsic energy resolution



MarkT
IWLC2010

ILD-DBD

- costs for ECALs in table 5.3.4 as
- difference comes form the sensor cost

Recal=1850

Table 5.3.4: Cost table of the electromagnetic calorimeter.

SiECAL		ScECAL	
Item	Cost [kILCU]	Item	Cost [kILCU]
Tungsten	16310	Tungsten + carbon parts	18500
Carbon fiber structure	2130	Module realisation	1700
Silicon sensors 3ILCU/cm2	75000	Scintillators	1030
Readout ASIC	16500	Photo Detectors	10200
Readout Board	21000	Readout ASIC	2500
Materials	1300	Readout Board	25000
Cables, connectors	2220	Readout System	6200
Tooling	9300	Cables, connectors	1000
Assembly	13500	Power supplies	4100
Integration	500	Tooling	3800
Sum SiECAL	157760	Sum ScECAL	74000

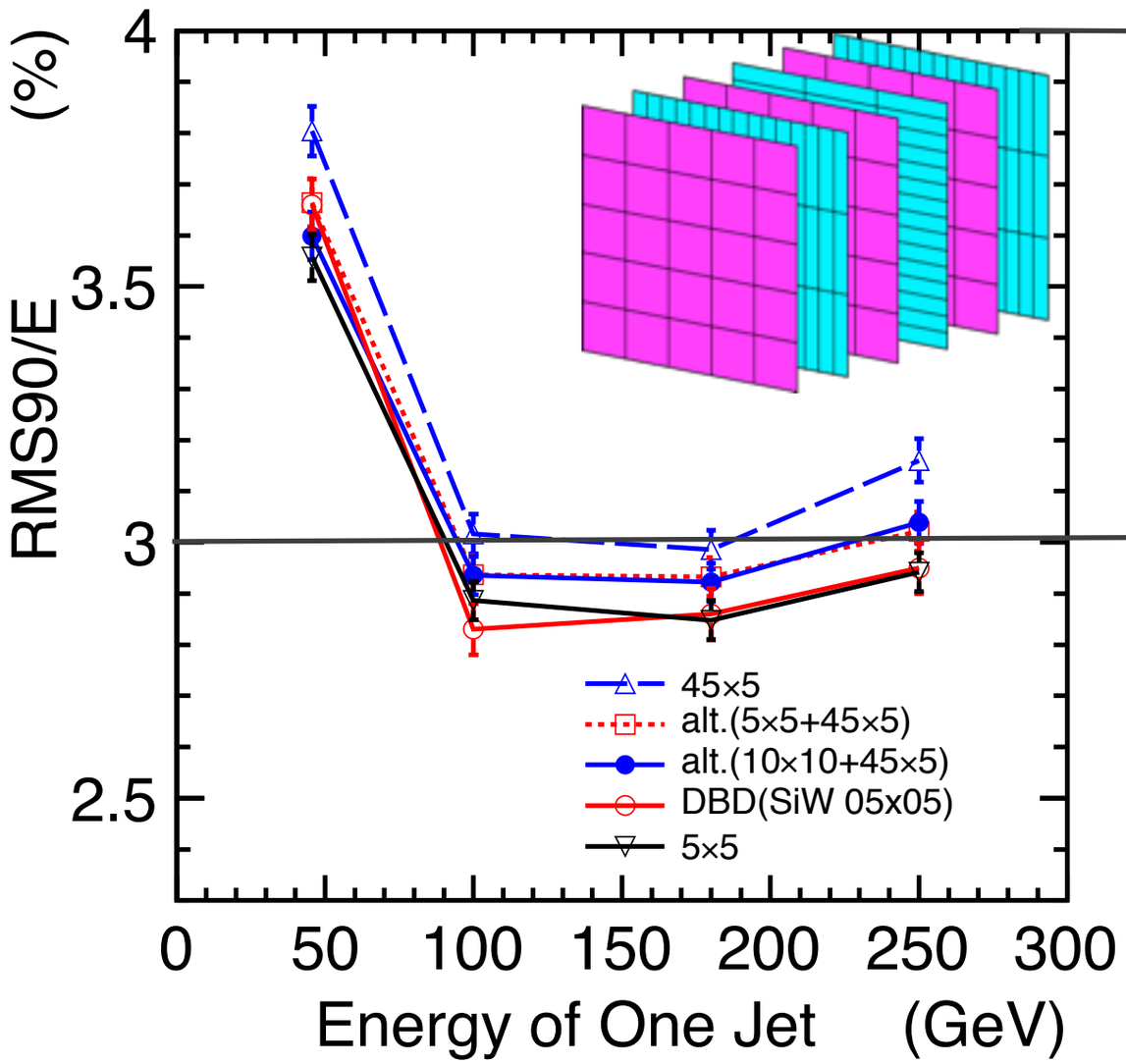
what we have to optimize

- physics performance comparison
- wrt Recal & B field
- LOI: we have assumed the seize parameters
- DBD: got reasonable performance with them
- TDR (The Detector Realistic): the size and B will be optimized by taking into account the cost in the physics cases, such as LOI bench mark processes

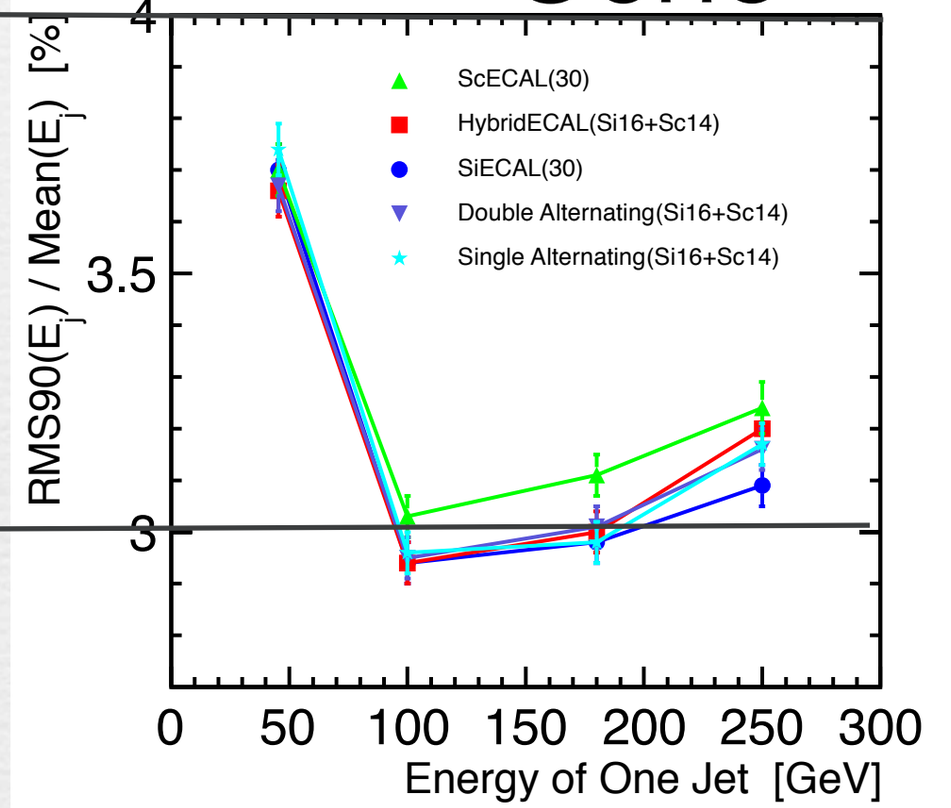
double checked

- K.Kotera & H.Ueno

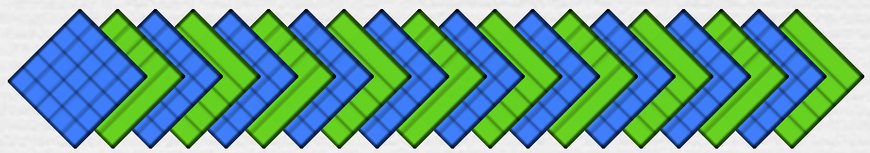
Kotera



Ueno



with tiles



ECAL size by John M.

improved
JER
at small R