Two detector options today .... SD vs TDR [*]

	SD	TDR
TRACKER	Silicon tracker	TPC and Si envelope
CALORIMETRY		
ECAL	tungsten-silicon both options	
HCAL	Digital (RPC,GEM,..)	Digital / Tile AHCAL

Partly the same people

[*] J.Jaros at ALCPG-SLAC04

The 2 options
following J.Jaros

Silicon area TDR / Silicon area SiD ~ 2.6

The only(main) justification for the **SD** detector ??!!

	TESLA	SD	LD	JLC
Tracker type	TPC	Silicon	TPC	Jet-cell drift
ECAL				
R_{min} barrel (m)	1.68	1.27	2.00	1.60
Type	Si pad/W	Si pad/W	scint. tile/Pb	scint. tile/Pb
Sampling	$30 \times 0.4X_0$ $+10 \times 1.2X_0$	$30 \times 0.71X_0$	$40 \times 0.71X_0$	[illegible] $\times 0.71X_0$ 2
Gaps (active) (mm)	2.5 (0.5 Si)	2.5 (0.3 Si)	1 (scint.)	1 (scint.)
Long. readouts	40	30	10	3
Trans. seg. (cm)	≈ 1	0.5	5.2	144
Channels ($\times 10^3$)	32000	50000	135	5
Z_{min} endcap (m)	2.8	1.7	3.0	1.9
HCAL				
R_{min} (m) barrel	1.91	1.43	2.50	2.0
Type	T: scint. tile/S.Steel D: digital/S.Steel	digital	scint. tile/Pb	scint. tile/Pb
Sampling	$38 \times 0.12\lambda$ (B), $53 \times 0.12\lambda$ (EC)	$34 \times 0.12\lambda$	$120 \times 0.047\lambda$	1[illegible] $\times 0.047\lambda$ 3
Gaps (active) (mm)	T: 6.5 (5 scint.) D: 6.5 (TBD)	1 (TBD)	2 (scint.)	2 (scint.)
Longitudinal readouts	T: 9(B), 12(EC) D: 38(B), 53(EC)	34	3	4
Transverse segmentation (cm)	T: 5–25 D: 1	1	19	14
θ_{min} endcap	5°	2°	2°	8°
Coil				
R_{min} (m)	3.0	2.5	3.7	3.7
B (T)	4	5	3	3
			option: Si pad shower max. det.	scint. strip (1 cm) shower max. det. (2 layers)

TDR geometry

Radius, length, size, …

Tracker size

Reason for 2.50m for the TPC length

- Covering at low angle ? but the FTD is doing it with FCH

Reason for the TPC radius of 1.60m

- Single track resolution ?
- Separability ?

ECAL size

Reason for 1.70m for the ECAL radius

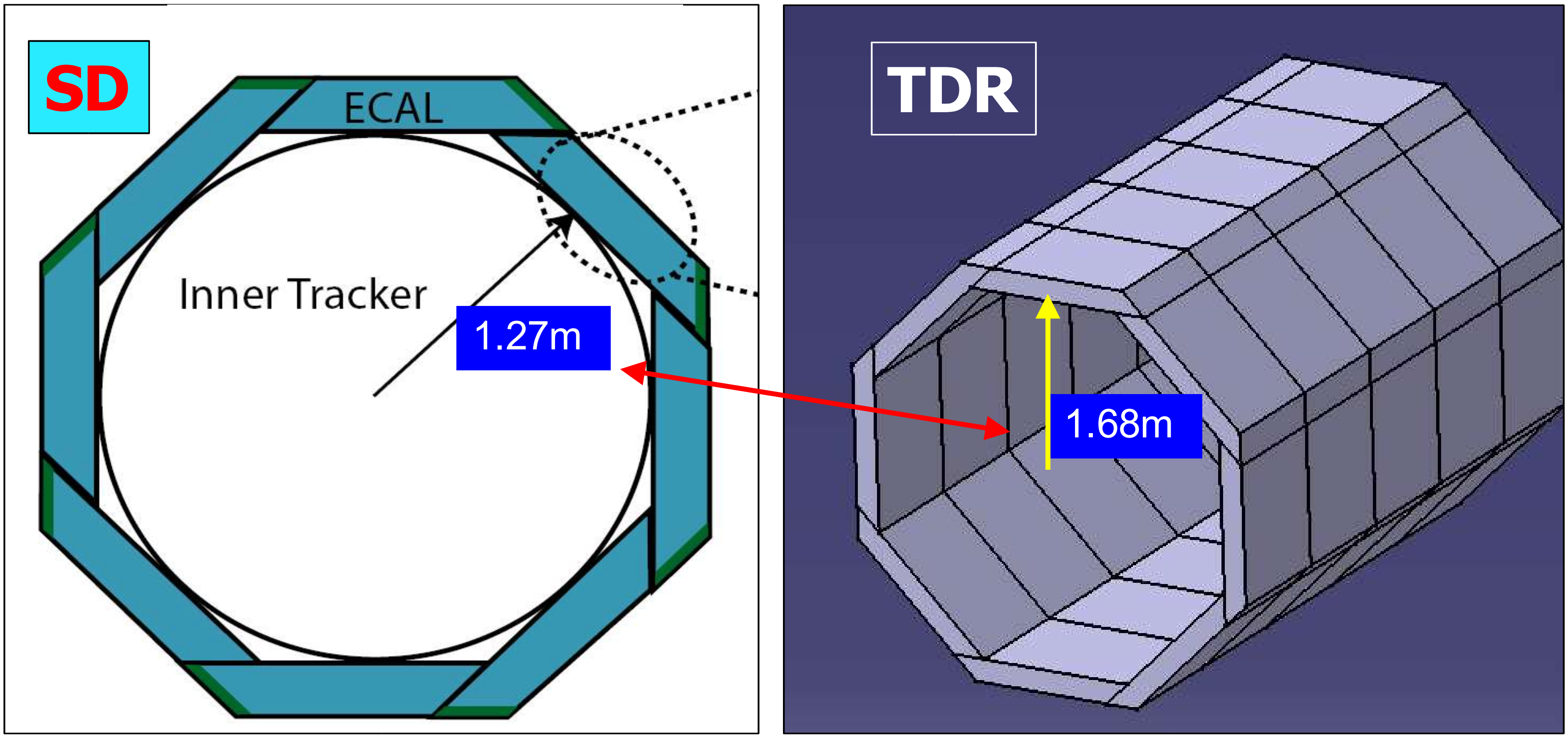
- TPC radius + 10cm
- Compact ECAL to save space for HCAL inside coil

Reducing the external radius of the TPC (reduce the cost of the overall detector)

- Impact on the momentum resolution ?
- if needed a precise point outside TPC can be added ??
- what about the charged-neutral separation ??

Geometry of the calorimeter

ECAL-SiD- ALCPG ⟷ ECAL-TDR- CALICE



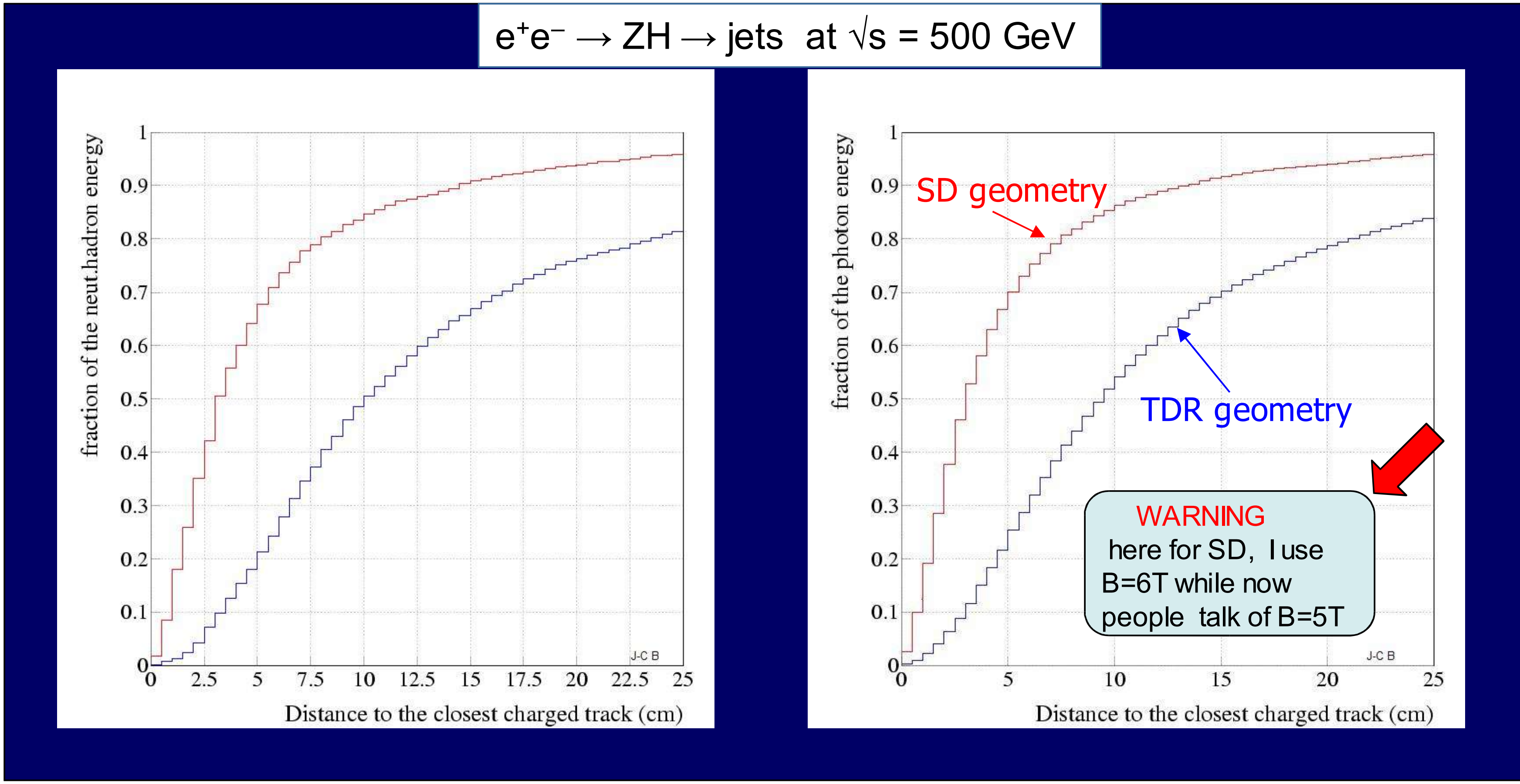
Is it so different ?

At least , there is a good agreement on the global geometry

Impact on EFLOW

The ECAL internal radius

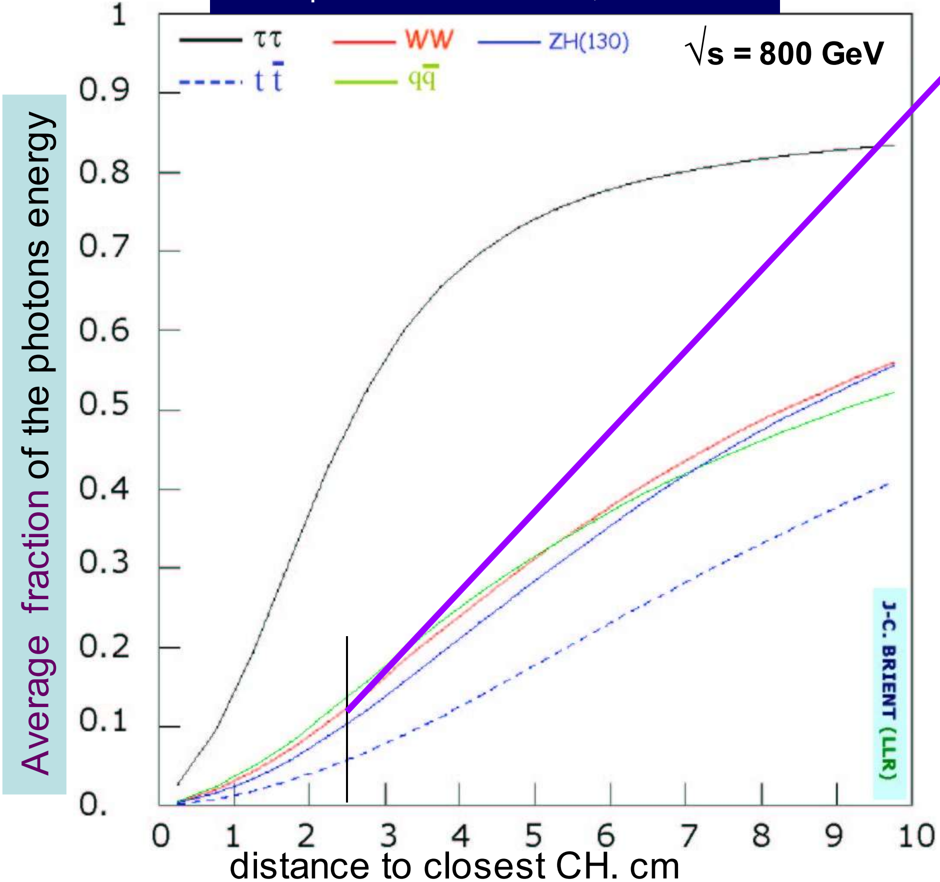
Presentation JCB at LBL 2000 – ALC meeting



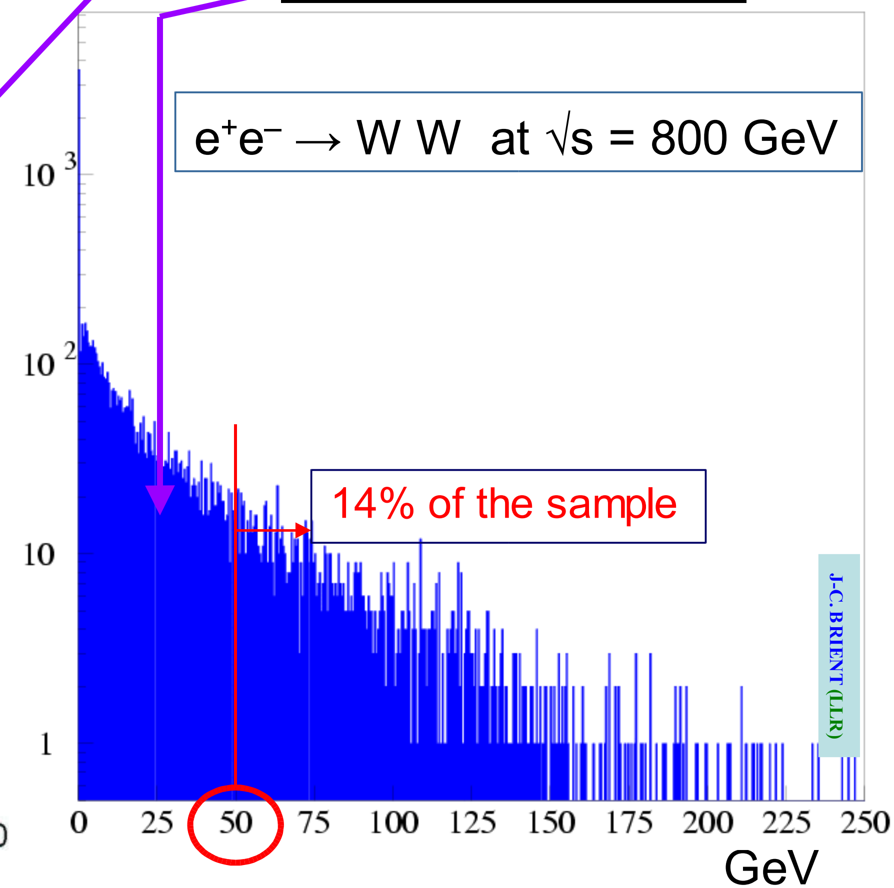
For SD geometry, there is an average of **~65GeV** of photons closer than 2.5 cm versus **~20 GeV** for the TDR geometry

What for different physics process

Example here with B=4T, R=170cm



The average is here



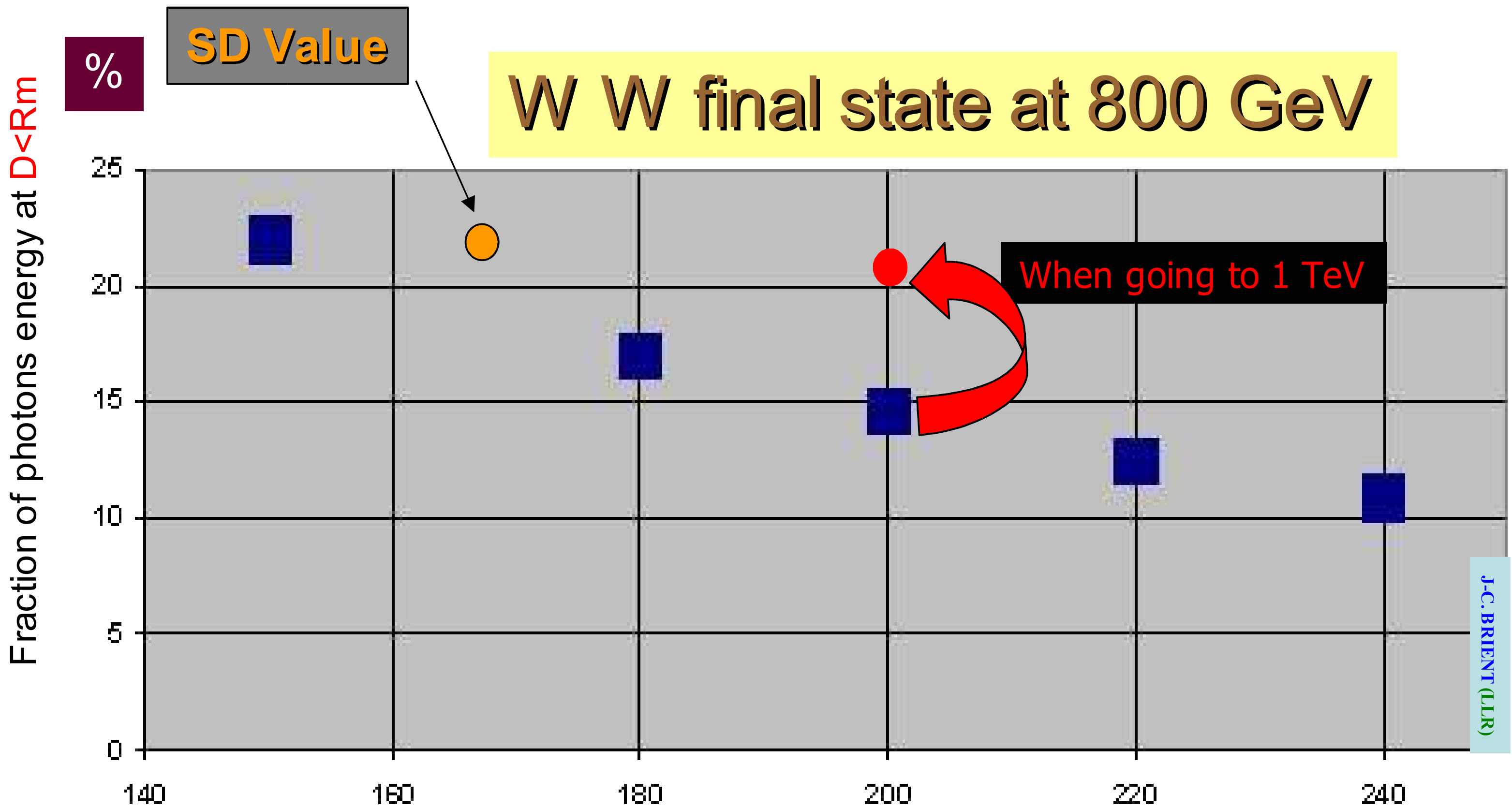
Efficiency of reconstructing photons close to ch. track (D<Rm) is **<<100%**

Variation with the ECAL endcap entrance

Internal radius fixed at 1.50 m and B=4T

Length of the TPC

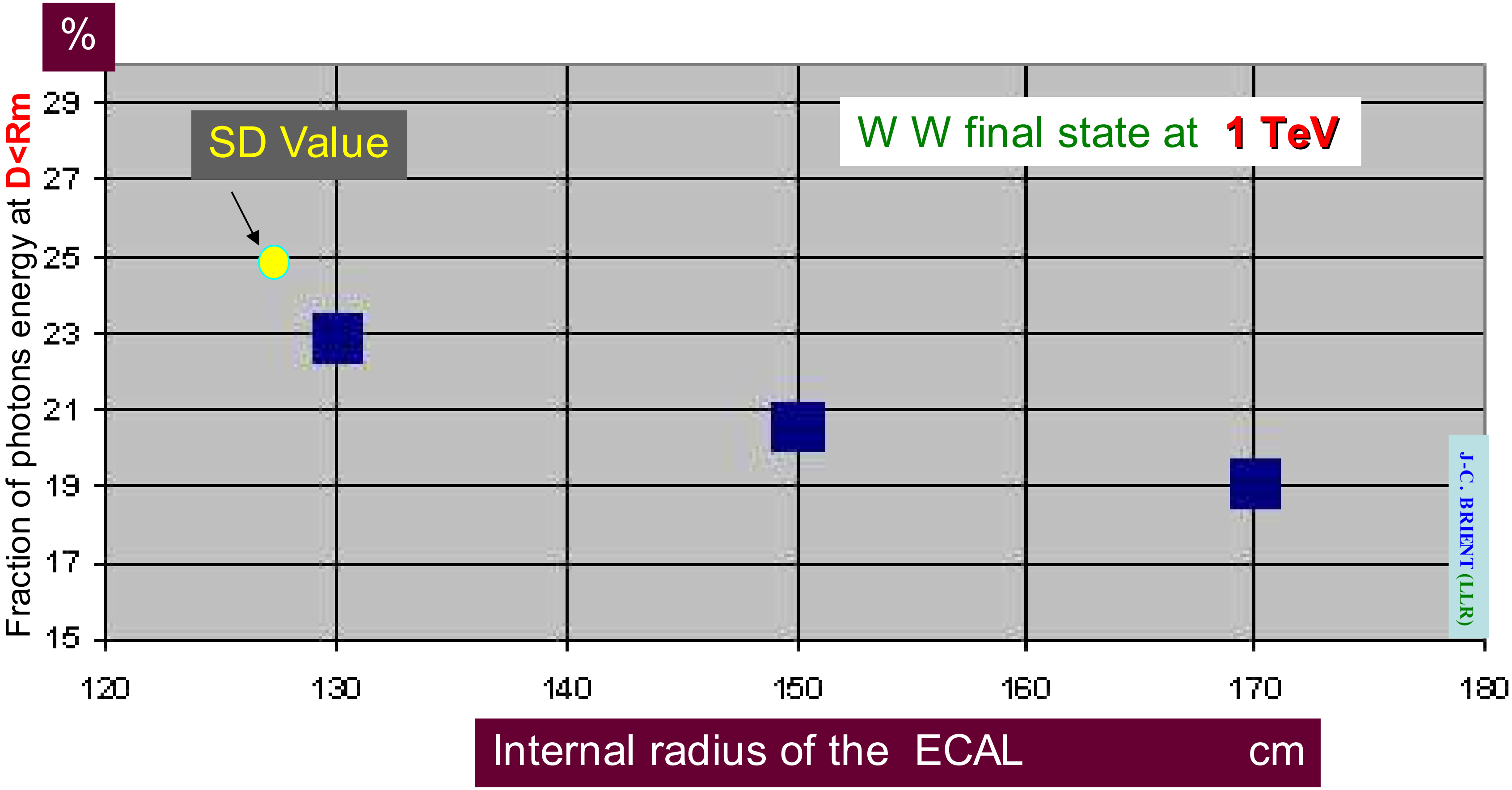
We define Rm at 2cm



Distance of the ECAL endcap

Variation with the internal ECAL radius

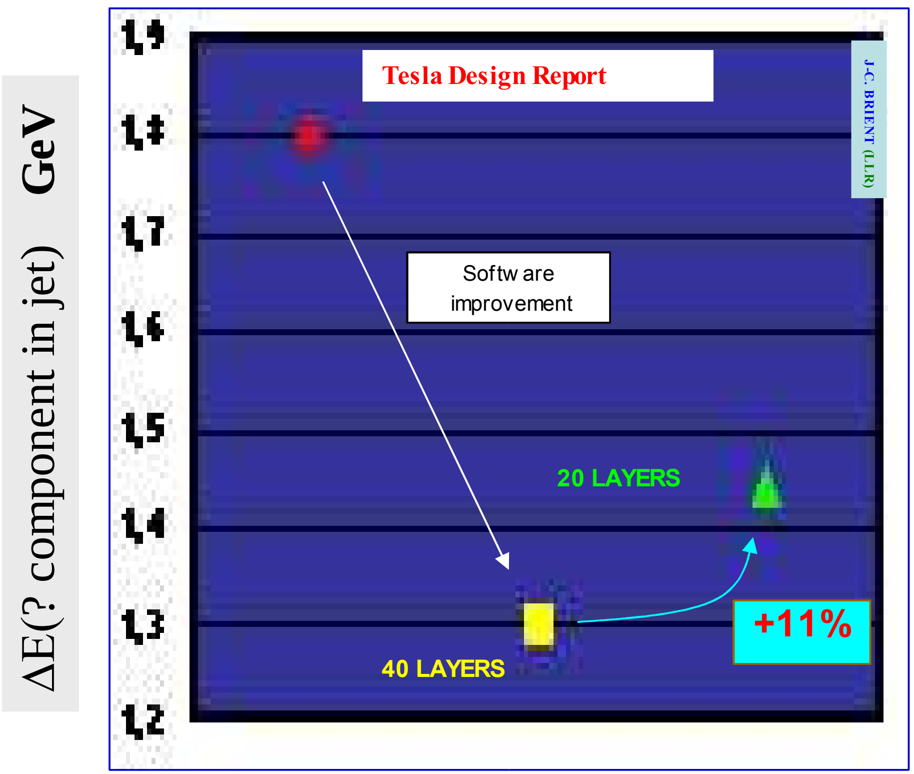
Z endcap at 2.00 m and B=4T



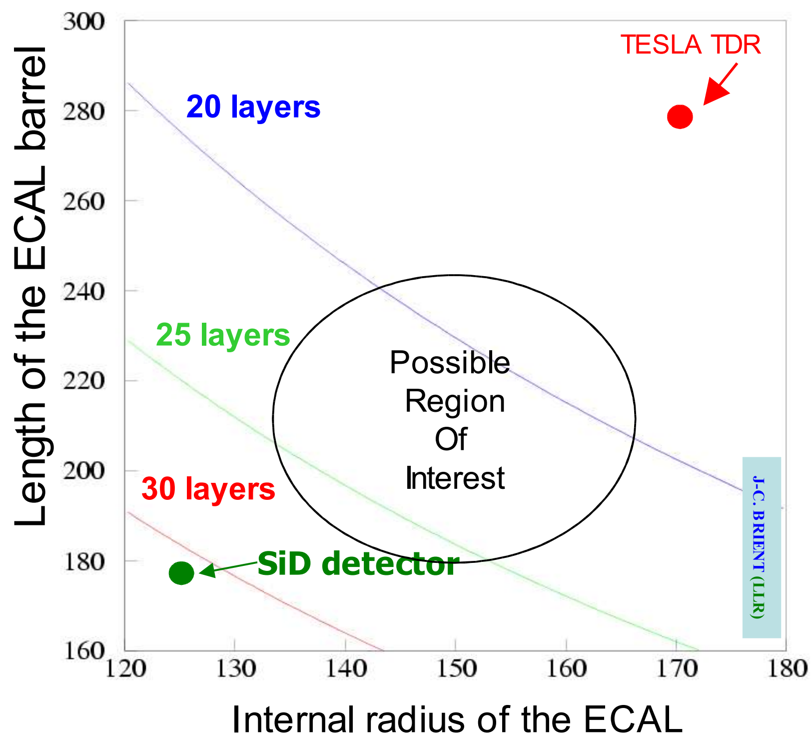
SD Values Rint=125, Zec=170 and B=5T

Is it possible reducing the calor. cost ? **AND** saving the EFLOW performances

ECFA Krakow Sept. 2001



Curves ISOCOST(area) versus SiD



W W at 800 GeV

The relevant law is in BR^2/Rm

VERY IMPORTANT NUMBERS

For the TDR type of detector (R=170cm and 4T)
14% of the events have more than **50 GeV** in the difficult region

For the SiD detector (R=125cm and 5T)
32% of the events have more than **50 GeV** in the difficult region

Due to the large value of the WW cross section,
Any signal in jets could be overflowed ?!

For the photon(s) reconstruction , the ECAL radius and Z endcap is much more important !!!
Impact on the jets to be quantified ?

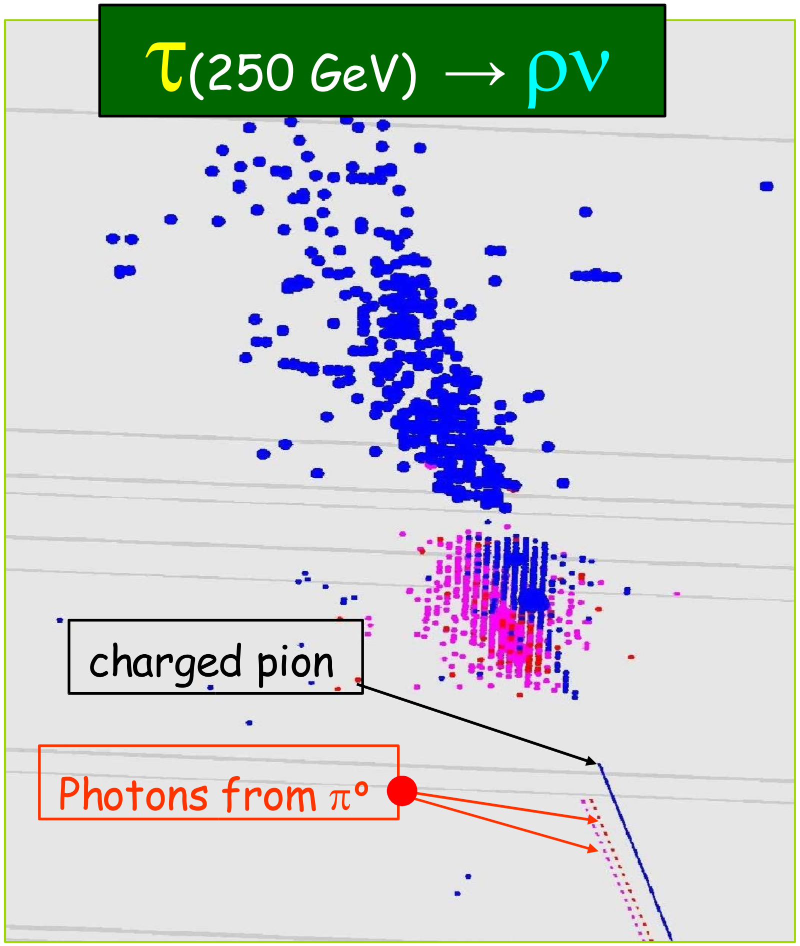
To reduce the ECAL cost,
Playing with layers number is more efficient and less penalizing for the performances on jet , τ ,... ?!

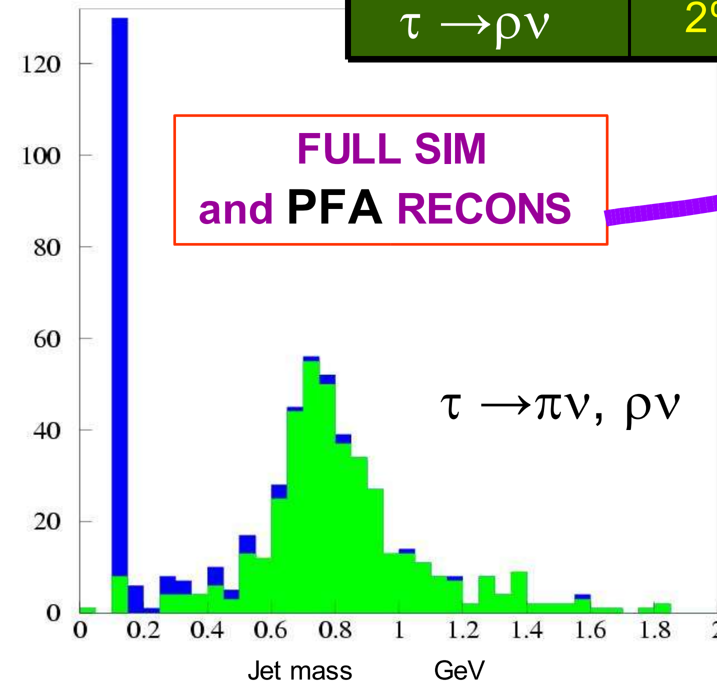
A new detector proposal

~ 20-25 layers ECAL at R≈1.55m ?? Z_{ECAL} ??

Tau decays ID is essential for τ ID and polarisation measurement

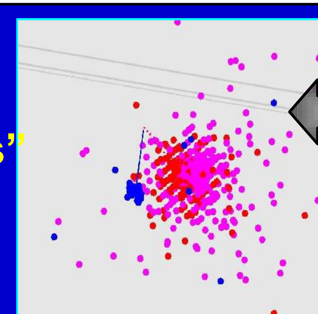
	Jet mass < 0.2	Jet mass in 0.2-2
$\tau \to \pi\nu$	82%	17%
$\tau \to \rho\nu$	2%	90%



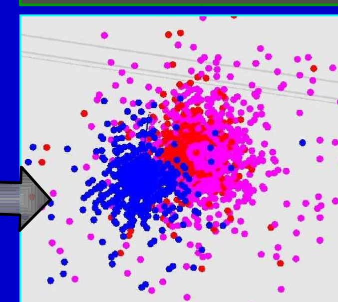


FULL SIM and PFA RECONS

Why "continuous" readout is needed



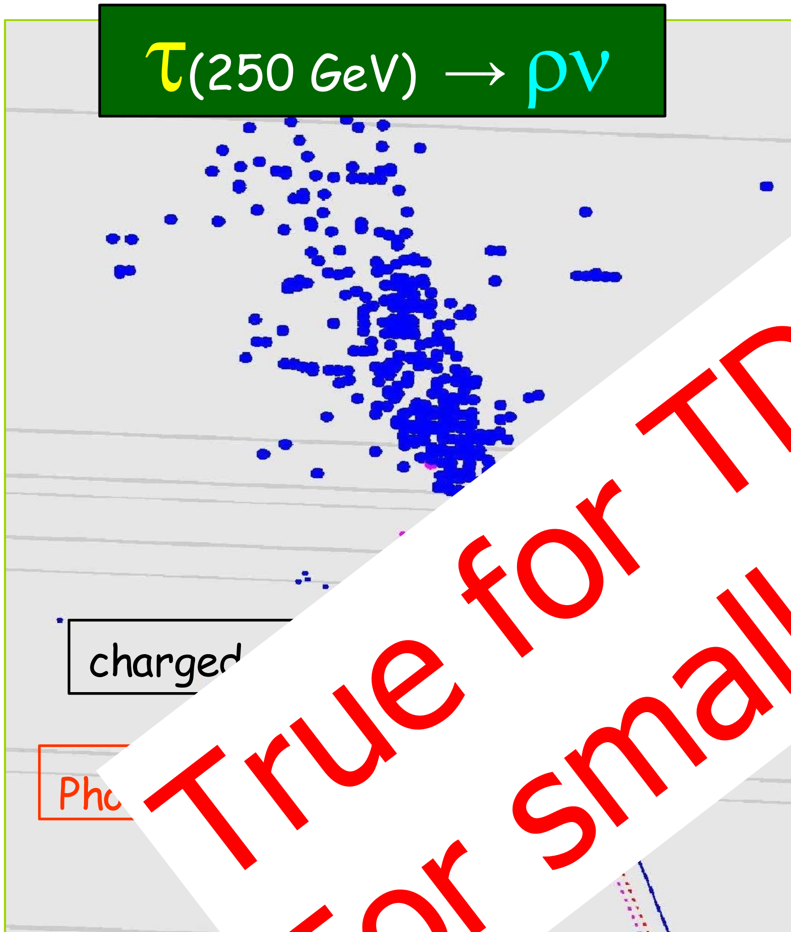
Looking along the charged track in the first 4 X0

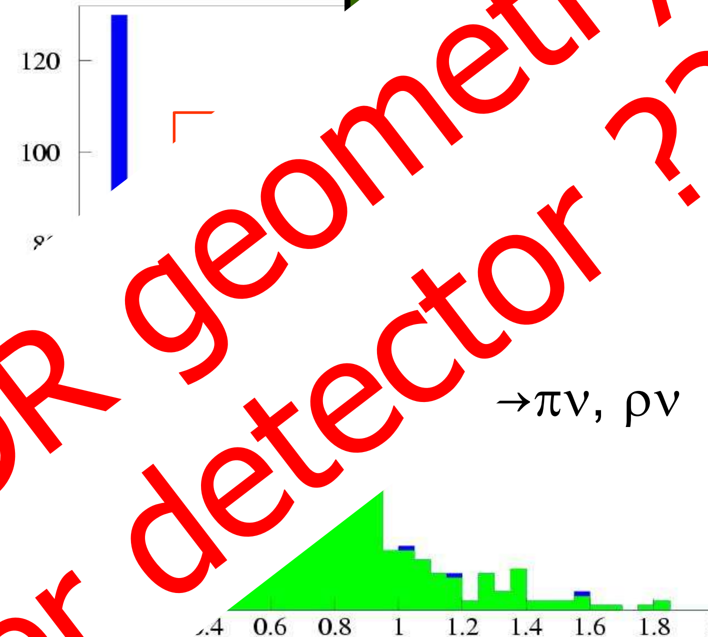


Looking along the charged track in 5-12 X0

Tau decays ID is essential for
τ ID and polarisation measurement

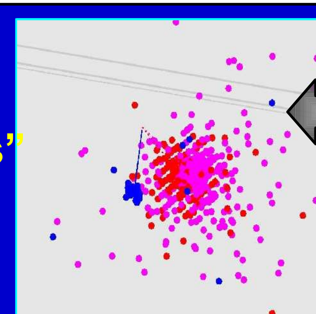
	…t mass …0.2	Jet mass in 0.2-2
τ …	…%	17%
		90%



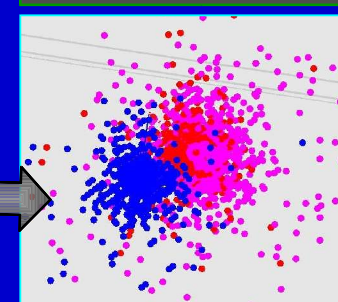


True for TDR geometry
For smaller detector ??

Why “continuous” readout is needed



Looking along the charged track in the first 4 X0



Looking along the charged track in 5-12 X0

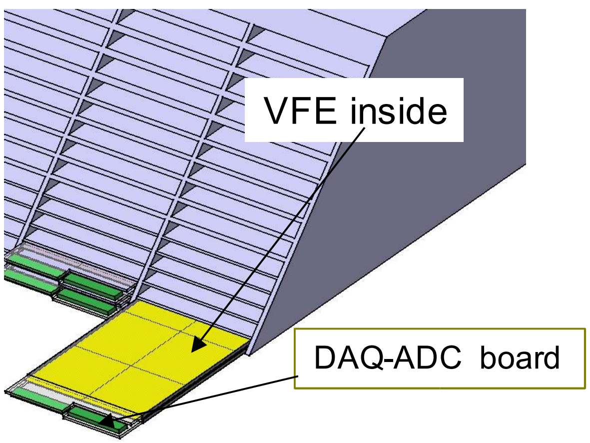
Summary of the ECAL change vs TDR

- ► VFE inside for the ECAL, alveoli thinner , better eff. Molière radius
- ► For the simulation, I propose to use 30 layers to be consistent with the SiD ECAL and with the prototype in construction

Changing the general geometry

- ► VFE inside for the HCAL (Si-PM, or digital readout for DHCAL)
  - → NO SPACE for fibbers in overlap !!! ☺
  - → NEW distance TPC-ECAL in endcap !!!!

New way of the ECAL readout



VFE (with ADC?) send each BX to DAQ board (with/without ADC)
DAQ-ADC board digitise, store in digital memory, MUX to optical link

- VFE time occupancy is about 1/200 for TESLA
- VFE On-Off take about 100 µs

⇒ Simulation gives **~100µW**/channel !!! (source CdIT)

Passive cooling would be sufficient (source JB)

R&D in CALICE ECAL **(IN2P3,KNU,MSU)**
to quantify this **passive cooling limit**

Modify Simulation
(better R_m^{eff})

Other open questions

- ► Quantitative variation of performances on jet(s)
  (and impact on physics program) with TPC size

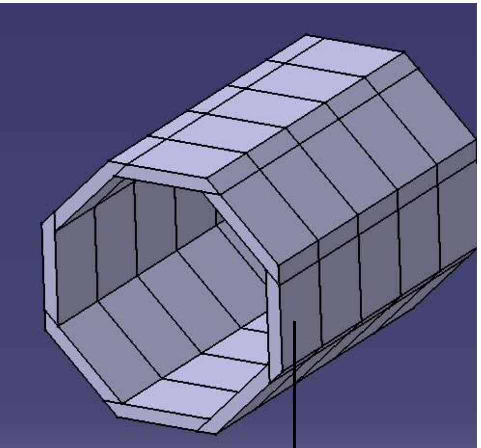
- ► Is there a way to avoid the hole between Forward CAL and ECAL together with the possibility to open the detector ?

- ► A dedicated study of the CALOR. endcap geometry

- ► Using ECAL to seed the high Pt track in the SiD tracker ?
  a kind of substitute for the large number of points in a TPC

- ► FCH (SET?) in silicon device inserted in ECAL CFi frame ? **See next slide**

- ► What is the **number of X0** of the endplate and readout electronics ?
  what is the distance TPC-ECAL ?



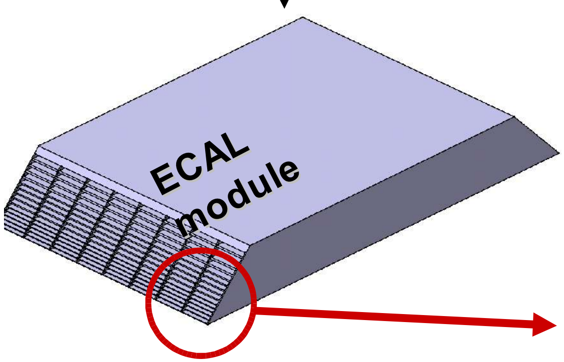
If precise point(s) outside TPC is mandatory

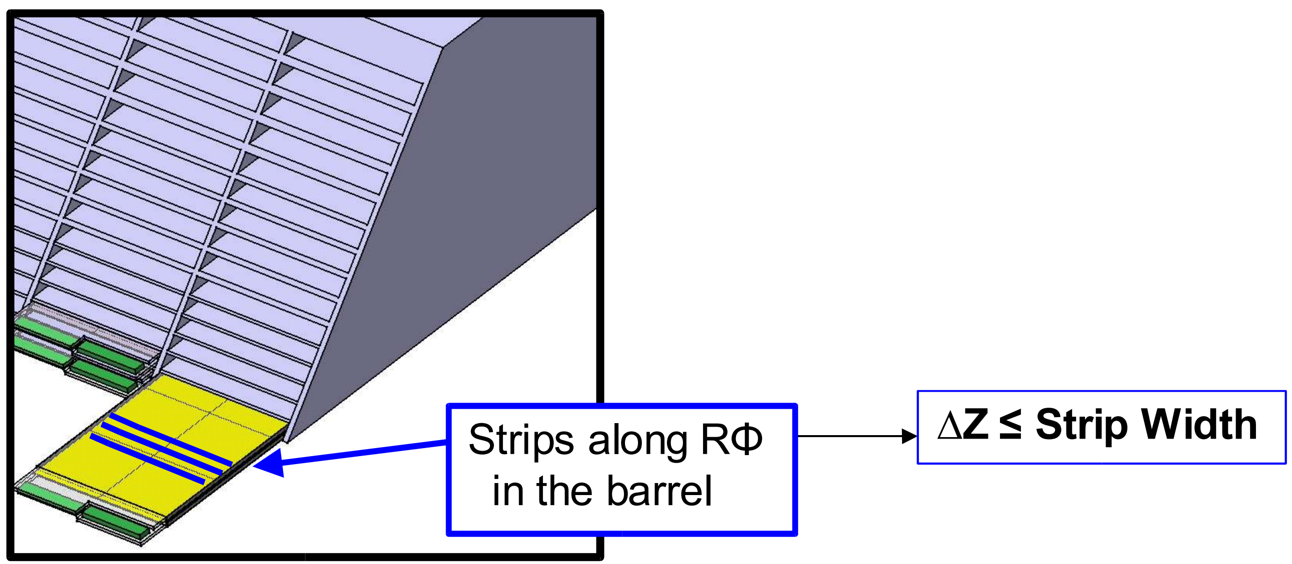
Add alveoli with 2 double side strips without tungsten

- Minimize the thickness/"tracker point"
- Minimize the distance to the ECAL
- Minimize the inter alignment tracker-ECAL

and

ASSEMBLING SIMPLICITY





A lot of questions , Just few answers/guess

I propose you my preliminary ***personal conclusions***

- For CALOR. geometry , the TDR detector is not so different from the SD detector, but the size
- The PFLOW is **very** probably more difficult with the SD detector (to be quantified)
- The impact on the performances from different TPC size, with/without precise points, etc… has to be QUANTIFY

May be it is time to begin the second round of detector optimisation

- Inter-regional proposal would be **VERY WELCOME** !!
- a proposal at the next LCWS ?