



Overview of the PARIS Project


O. Stézowski

- IPN Lyon -

on behalf of the PARIS collaboration



More informations  <http://paris.ifj.edu.pl>

Orsay, 14/11/2011  16/11/2011

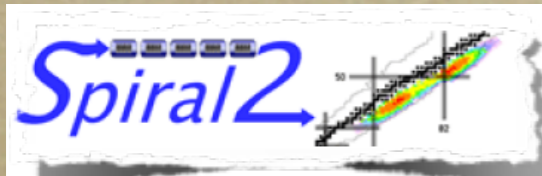


The PARIS Project



4-5-6th October, 2005 «Future prospects for high resolution gamma spectroscopy at GANIL»
Convenors : Bob Wadsworth and Wolfram Korten

WG «Collective modes in continuum»
Convenors: Silvia Leoni & Adam Maj



GANIL

SAC open session October 19th, 2006

Title: High-energy γ -rays as a probe of hot nuclei and reaction mechanisms

Spokesperson(s) (max. 3 names, laboratory, e-mail - please underline among them one corresponding spokesperson):

Adam Maj, IFJ PAN Krakow, Adam.Maj@ifj.edu.pl

Jean-Antoine Scarpaci, IPN Orsay, scarpaci@ipno.in2p3.fr (EXL and R3B contact)

David Jenkins, University of York (UK), dj4@york.ac.uk

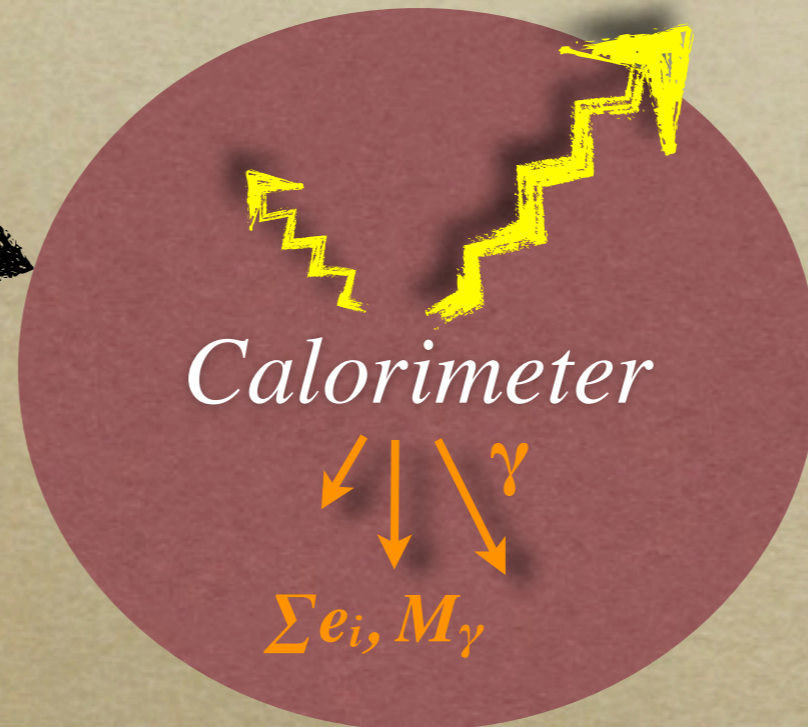
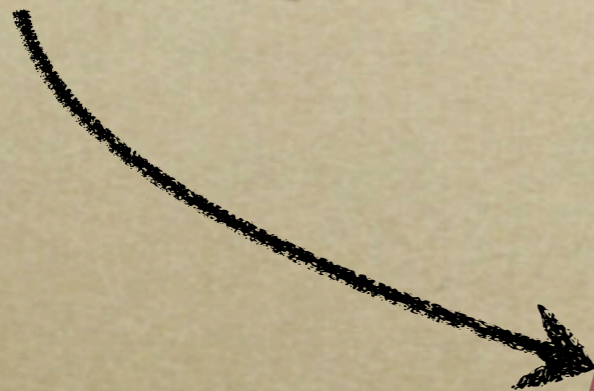
GANIL contact person

Jean-Pierre Wieleczko, GANIL, wieleczko@ganil.fr

Letter of Intent

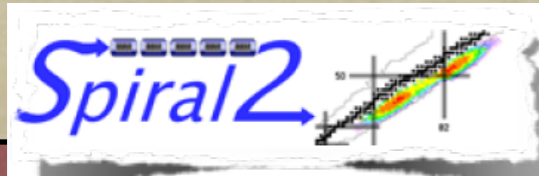


The PARIS Project

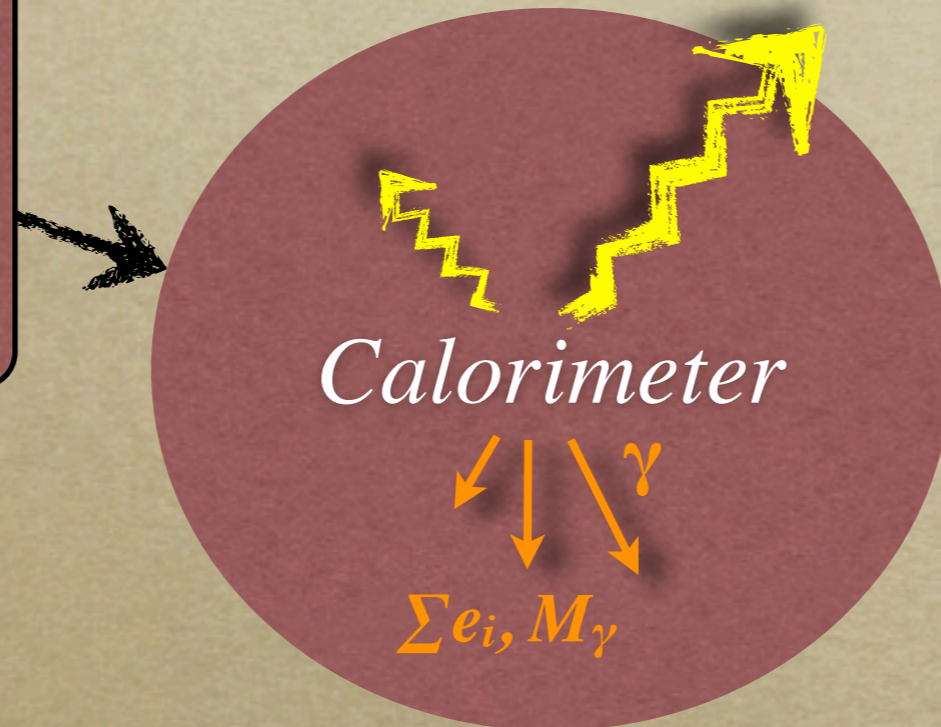




The PARIS Project

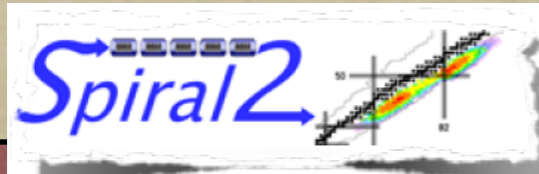


- **High energy γ -ray**
GDR, radiative capture
- **Sum-spin spectrometer**
- **Discrete γ -ray**
low multiplicity

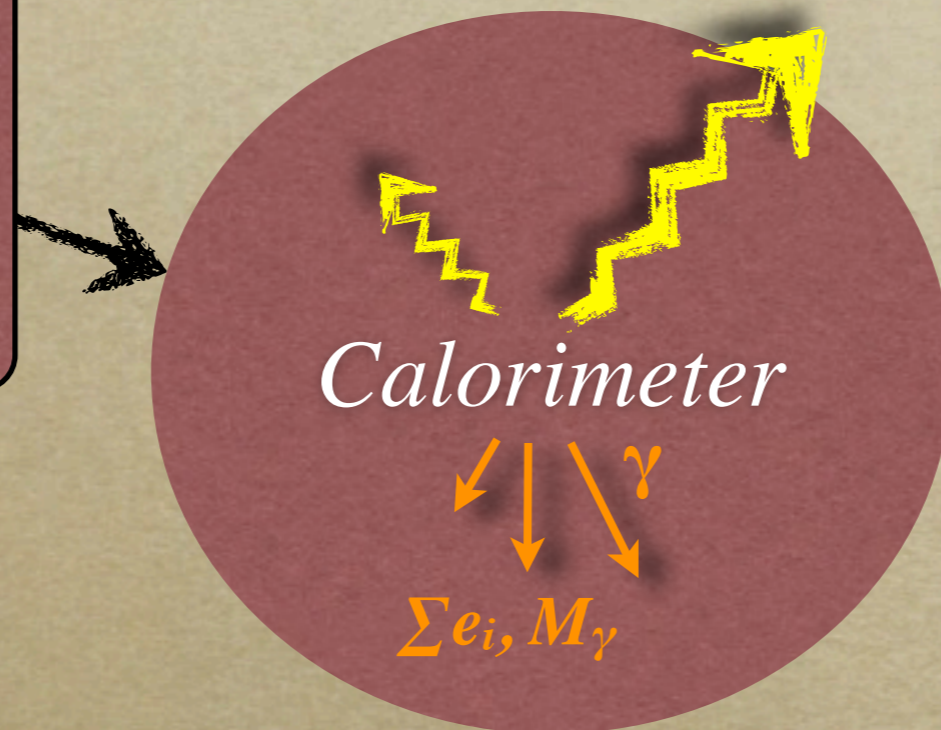




The PARIS Project

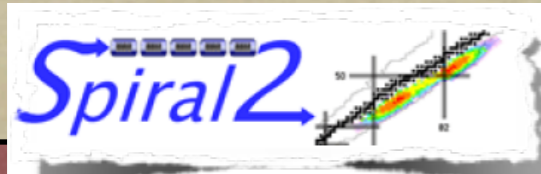


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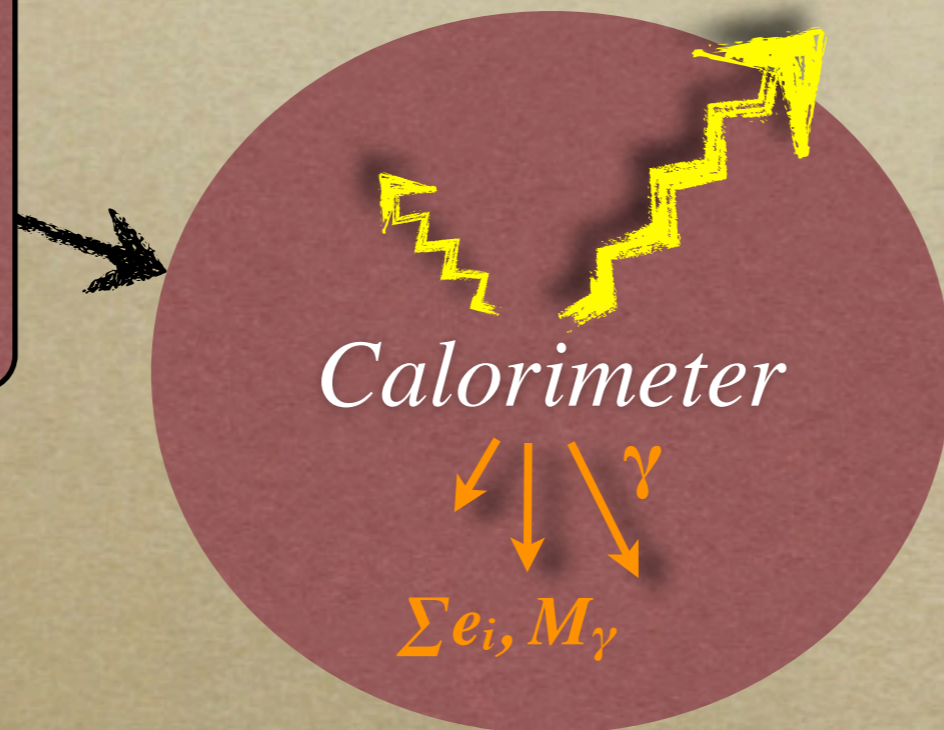




The PARIS Project



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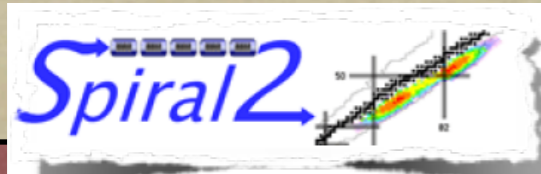
general design



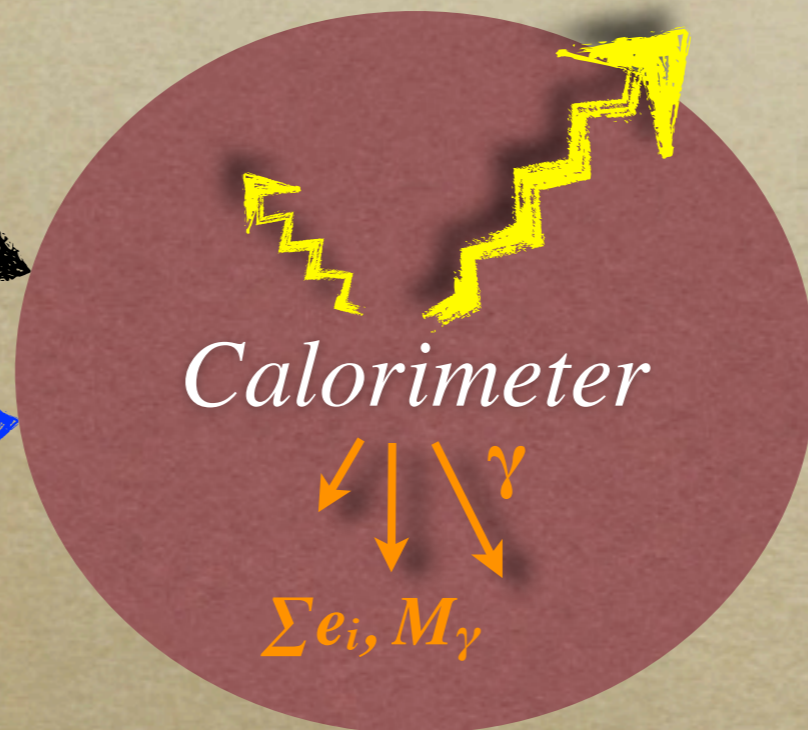
*Keep interesting
LaBr3 characteristics !??*



The PARIS Project



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low multiplicity



signal processing

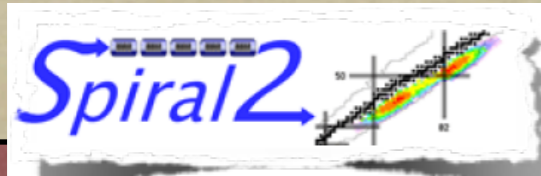
general design



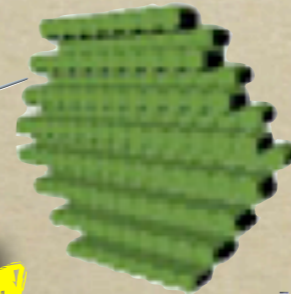
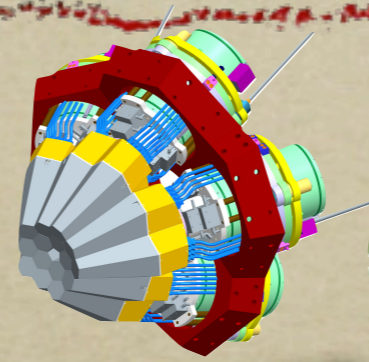
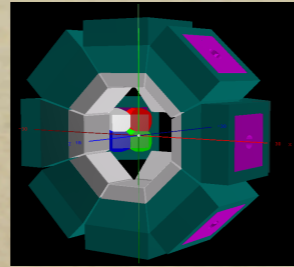
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The PARIS Project

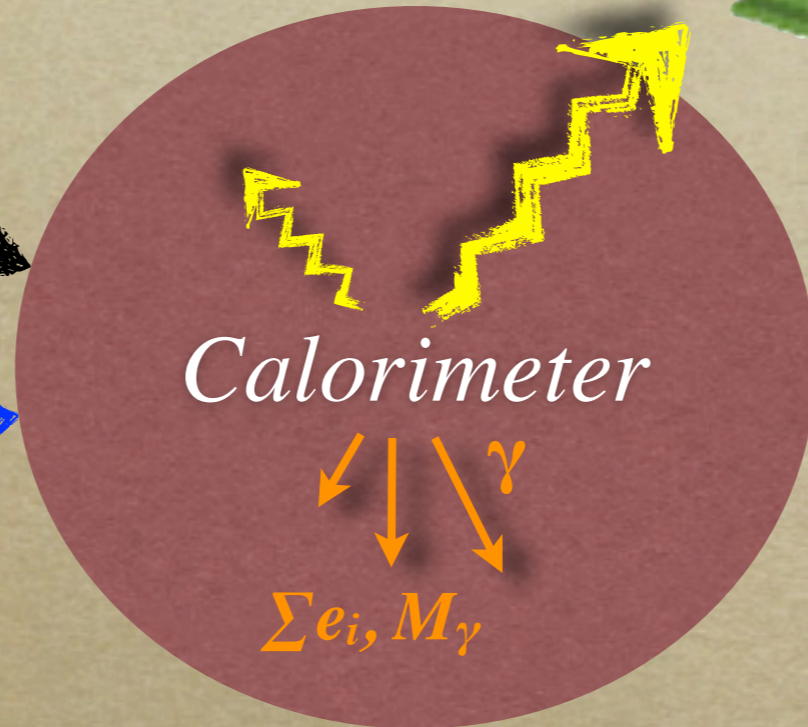


- **High energy γ -ray**
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Compatible with :

- **EXO GAM2**
- **AGATA**
- **NEDA**
- **GASPARD**
- **S3**

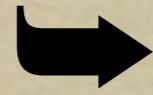


signal processing

general design



*Keep interesting
LaBr3 characteristics !??*



PARIS collaboration



PARIS Management board

A. Maj - project spokesman; D.G. Jenkins, J.P. Wieleczo, J.A. Scarpaci - deputies

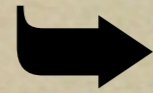
Working groups

1. Simulations (O. Stezowski et al.)
2. PARIS mechanical design scenarios (S. Courtin, D. Jenkins et al.)
3. Physics cases and theory background (Ch. Schmitt et al.)
4. Detectors (O. Dorvaux et al.)
5. Electronics (P. Bednarczyk et al.)
6. PARIS-GASPARD synergy (J.A. Scarpaci et al.)
7. Financial issues (J.P. Wieleczo et al.)
8. PARIS in FP7 projects (A. Maj, F. Azaiez et al.)

PARIS Advisory Committee

F. Azaiez (F) - chairman, D. Balabanski (BG), W. Catford (UK), D. Chakrabarty (India), Z. Dombradi (H), S. Courtin (F), J. Gerl (D), D. Jenkins (UK) - deputy chairman, S. Leoni (I), A. Maj (PL), J.A. Scarpaci (F), Ch. Schmitt (F), J.P. Wieleczo (F)

J. Pouthas – PARIS liaison to SPIRAL2 project management



PARIS collaboration



PARIS Management

A. Maj - project

Working groups

- 1. Simulation
- 2. PARIS
- 3. Physics
- 4. Detection
- 5. Electronics
- 6. PARIS
- 7. Finance
- 8. PARIS

PARIS Advisory

F. Azaiez (F) -
 Z. Dombardi (H)
 S. Leoni (I), A.

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 Nuclear Physics Group, The University of Manchester (UK): A. Smith
 RIKEN Tokyo (JP): P. Doornenbal

J.A. Scarpaci - deputies

D. Jenkins et al.)
Schmitt et al.)

40 institutions, 17 countries
 ≈ 100 physicists,
 engineers, PhD students

(UK), D. Chakrabarty (India),
 (K) - deputy chairman,
), J.P. Wieleczko (F)

ject management



Physics cases, some numbers



List of requirements related to the different physics cases to be addressed at PARIS

Physics Case	Recoil mass	v/c [%]	E _g range [MeV]	DE _g /E _g [%]	DE _{sum} /E _{sum} [%]	DM _g	W coverage	DT [ns]	Ancillaries	Comments
Jacobi transition	40-150	<10	0.1-30	4	<5	4	2p-4p	<1	AGATA HI det.	High eff. Beam rej.
Shape Phase Diagram	160-180	<10	0.1-30	6	<5	4	2p-4p	<1	HI det.	High eff. Differential method Beam rej.
Hot GDR in n-rich nuclei	120-140	<11	0.1-30	6	<8	4	2p-4p	<1	HI det.	Beam re.
Isospin mixing	60-100	<7	5-30	6	-	-	4p	<1	HI det.	High eff. Beam rej.
Reaction dynamics	160-220	<7	0.1-25	6-8	<8	4	2p	<1	n-det. FF det.	Complex coupling
Collectivity vs. multi-fragmentation	120-200	<8	5-30	5	-	-	2p	<1	LCP det. HI det.	Complex coupling
Radiative capture	20-30	<3	1-30	<4	5	-	4p	<1	HI det.	High eff.
Multiple Coulex	40-60	<7	2-6	5	-	-	2p	<5	AGATA CD det.	Complex coupling
Astrophysics	16-90	0.1	0.1-6	6	5	-	4p	<1	Outer PARIS shell as active shield	High eff. Back-ground
Shell structure at intermediate energies (SISSI/LISE)	16-40	20-40	0.5-4	3	-	-	3p	<<1	SPEG or VAMOS	High eff. Low I _{beam} g-g coinc
Shell structure at low energies (separator part of S ³)	30-150	10-15	0.3-3	3	-	-	3p	<<1	Spectrometer part of S ³	High eff. Low I _{beam} g-g coinc
Relativistic Coulex	40-60	50-60	1-4	4	-	1	Forward 3p	<<1	AGATA HI analyzer	Ang. Distr. Lorentz boost



Physics cases, some numbers



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Not especially design for high recoil velocities!!!



Physics cases, some numbers



1-40MeV

~4%

good $\Delta\Sigma e_i, \Delta M_\gamma$

< 1ns

List of requirements related to the different physics cases to be addressed at PARIS

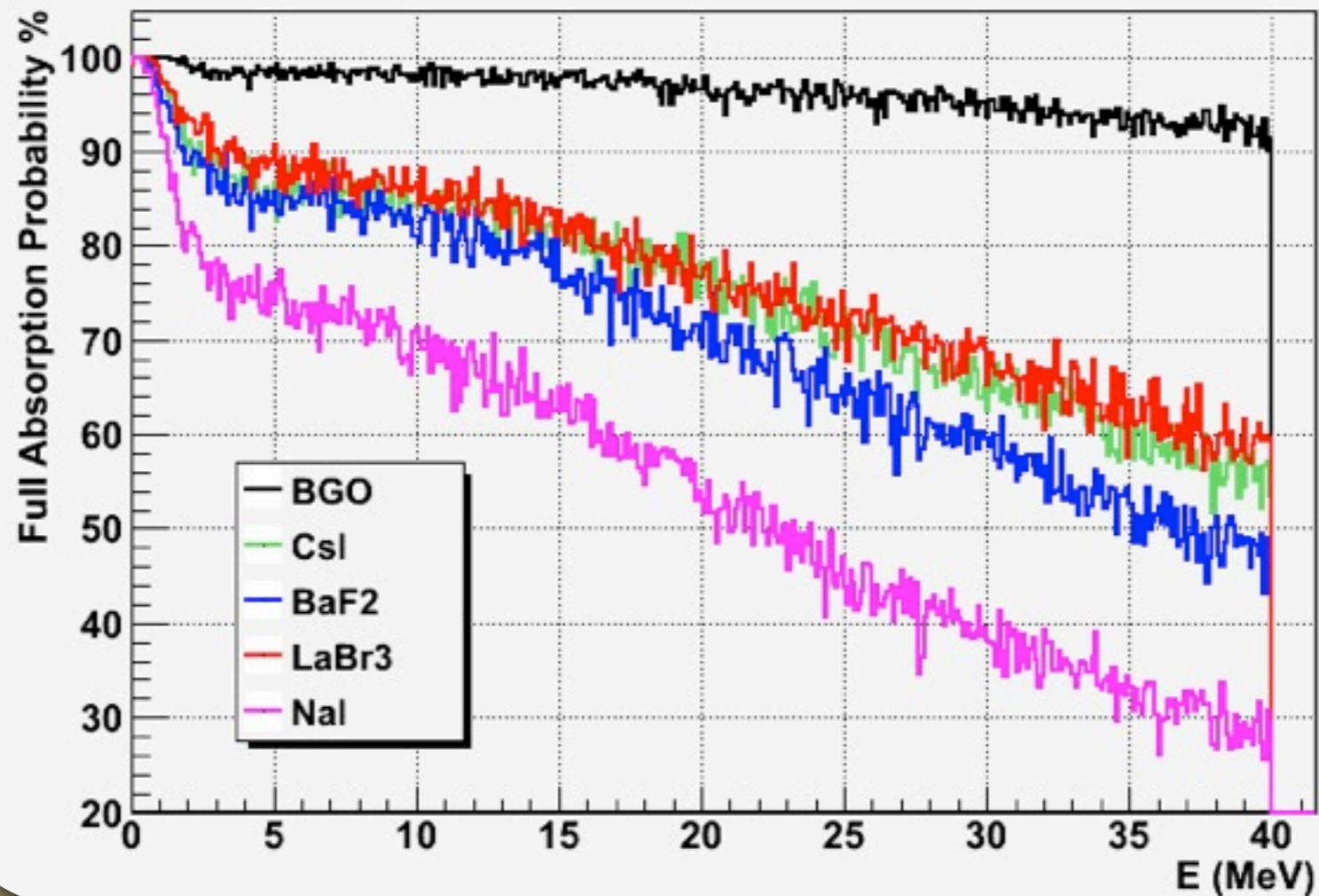
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Calorimeter based on LaBr3

Geant4 simulations





Calorimeter based on LaBr3



Geant4 simulations

Resolution @ 662 keV

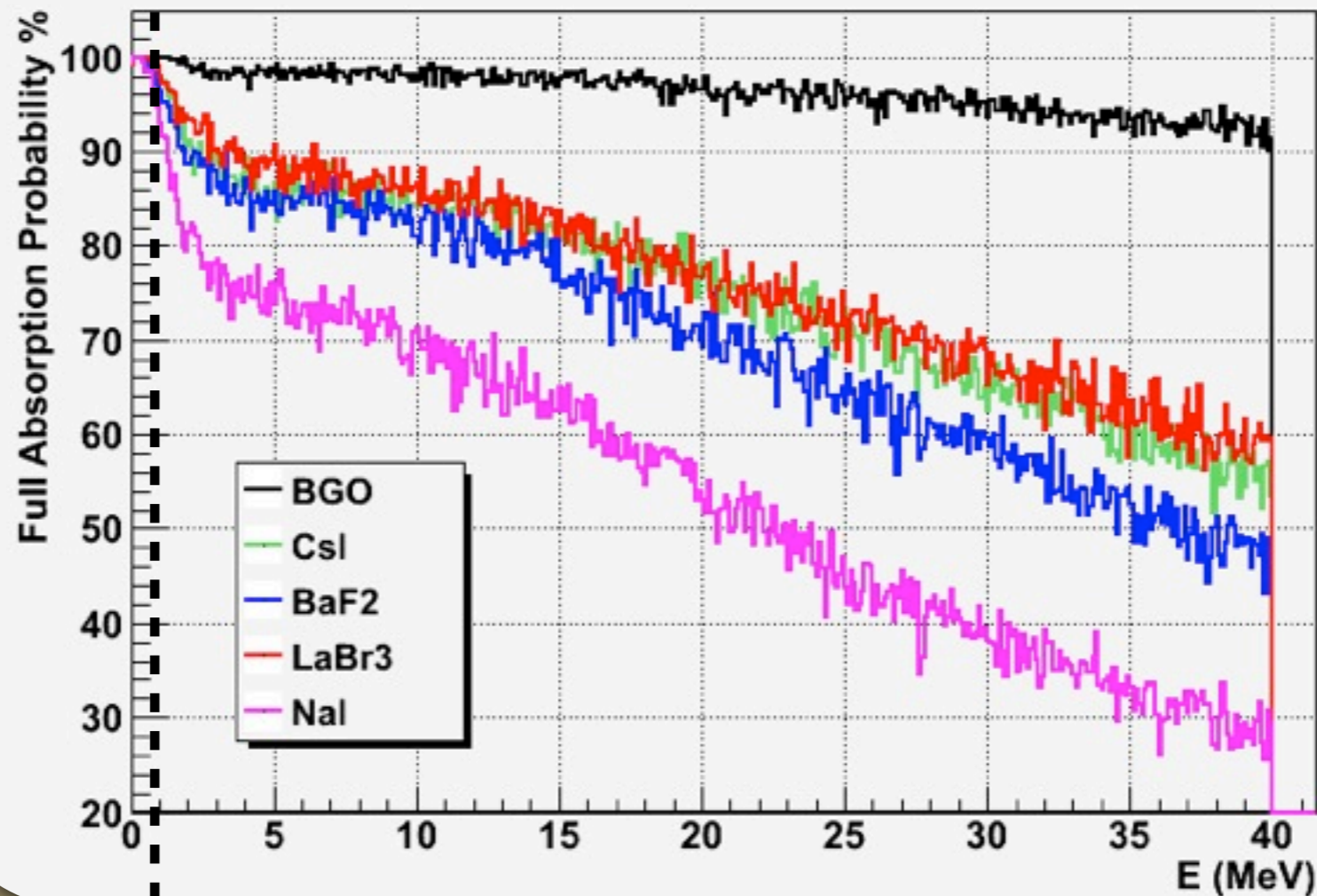
~12%

~3%

~8%

~10%

~7%





Calorimeter based on LaBr3



Geant4 simulations

Resolution @ 662 keV

~12%

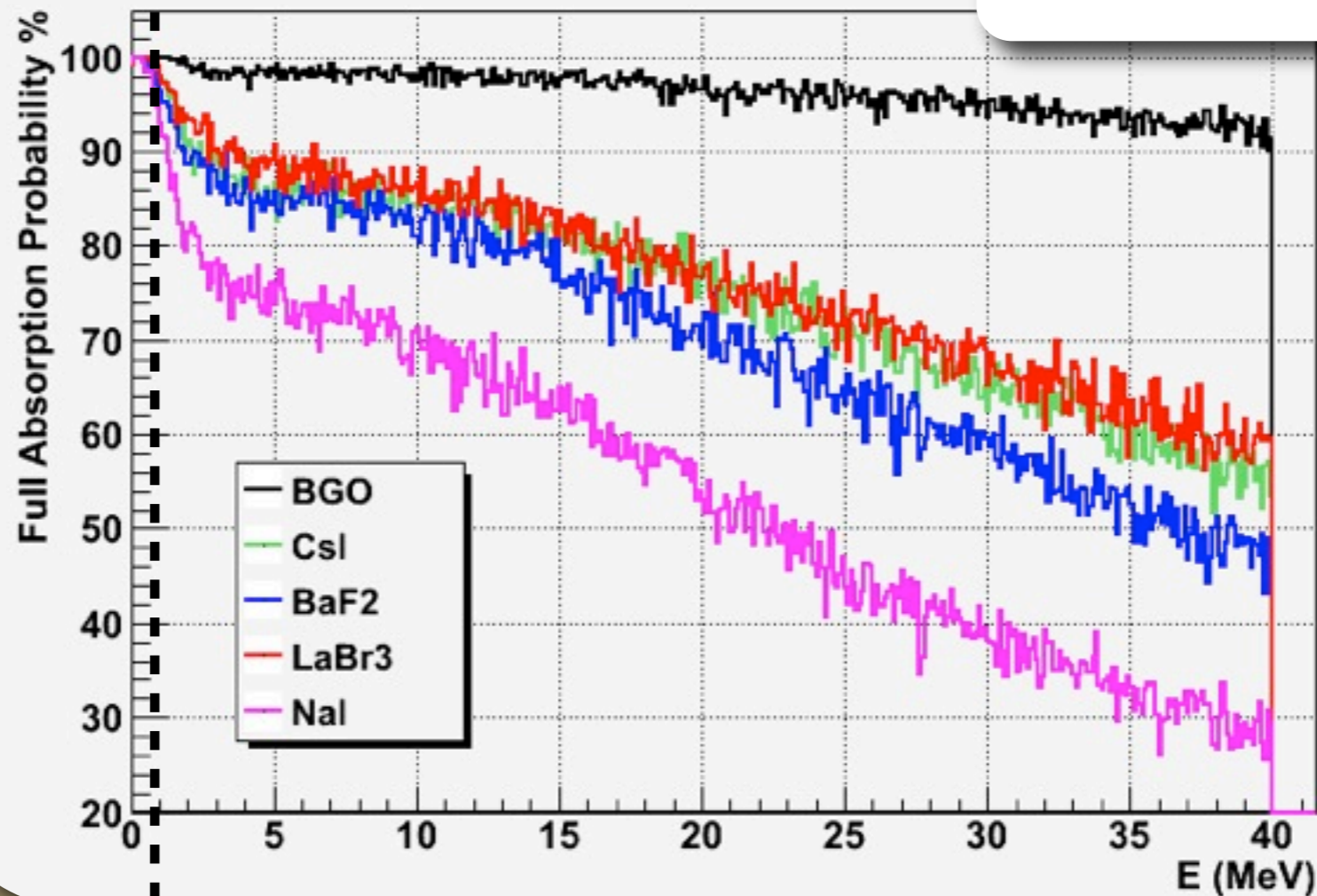
~3%

~8%

~10%

~7%

+ fast decay time (~ 16ns)
+ good timing resolution (~ 250ps)





Calorimeter based on LaBr3



Geant4 simulations

Resolution @ 662 keV

~12%

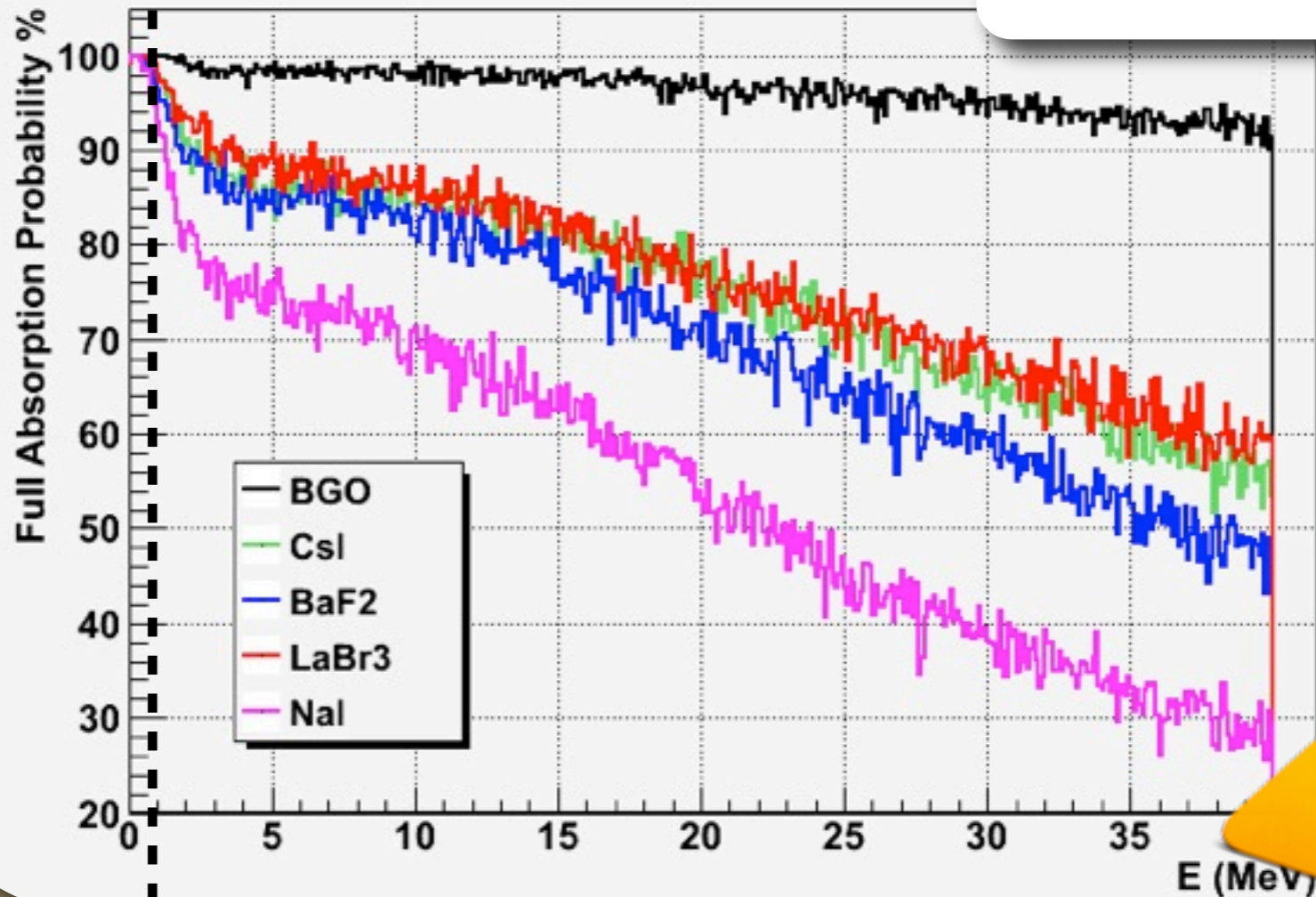
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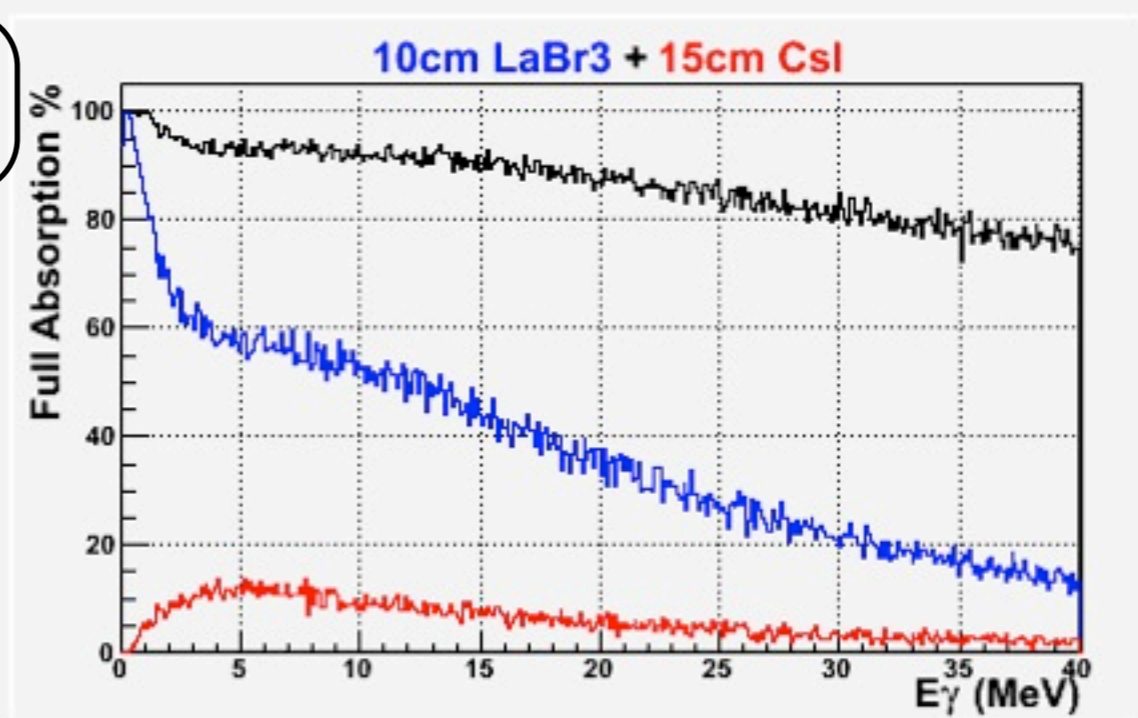
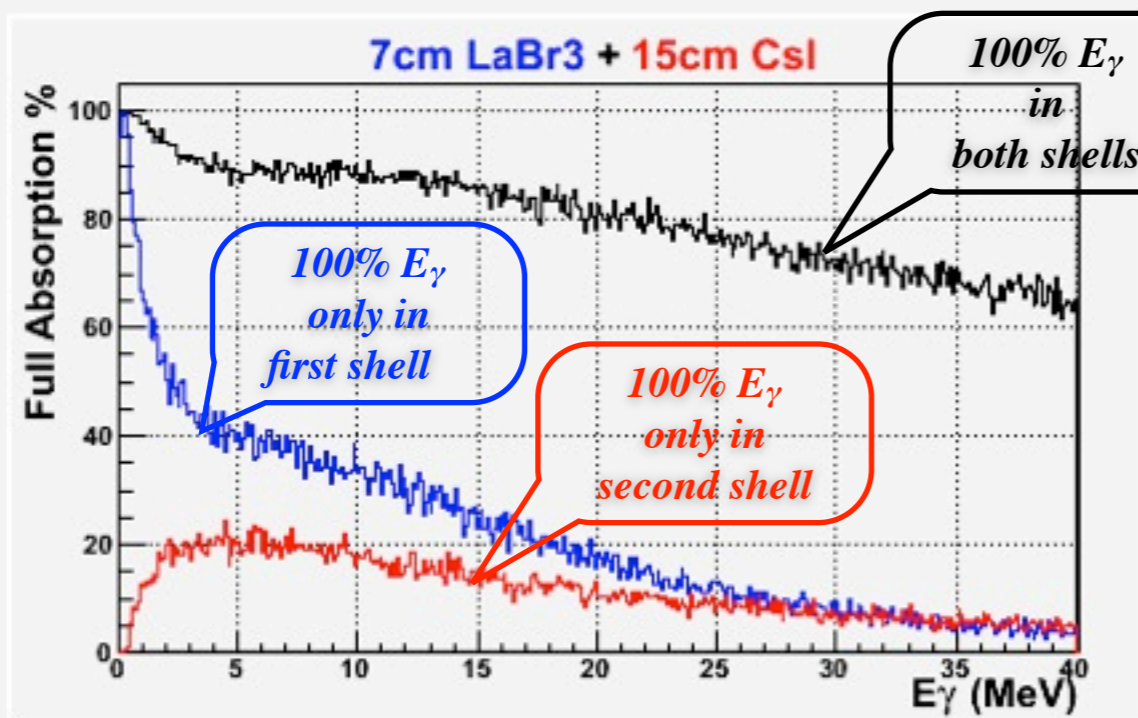
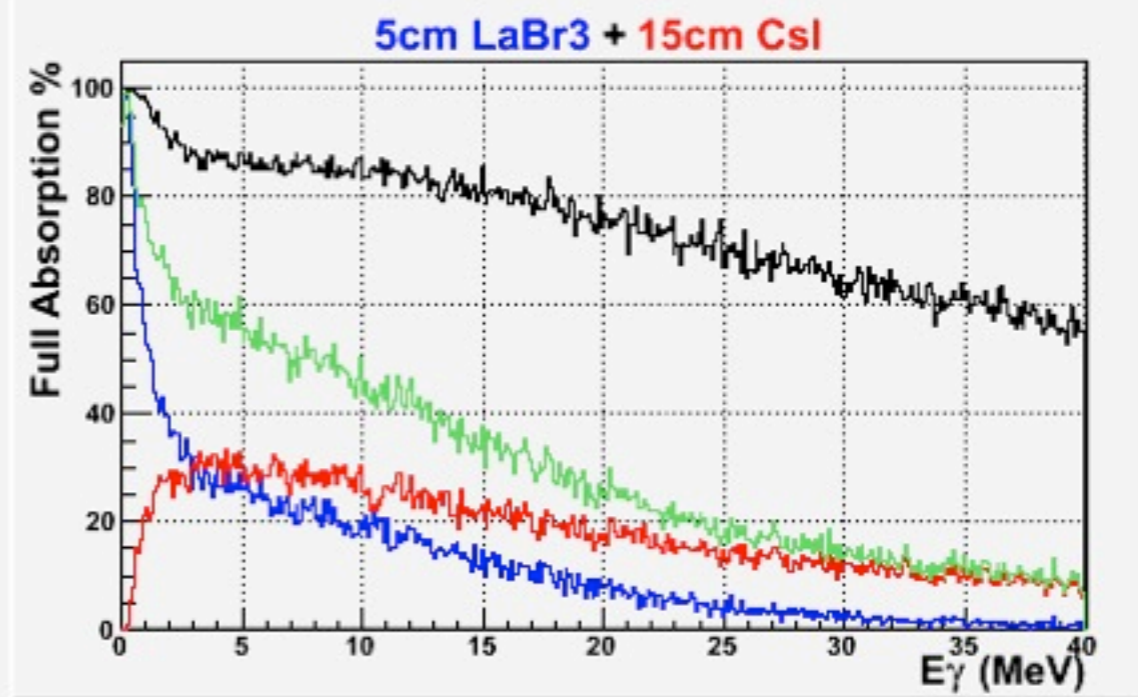
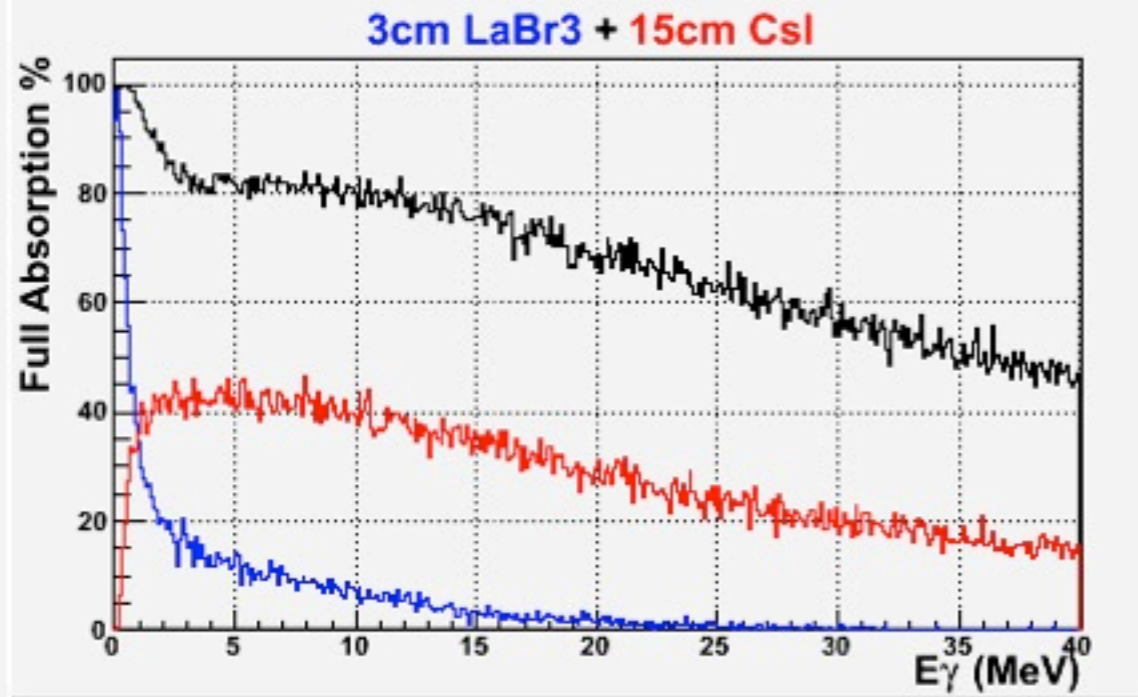
PRICE !





Two Layers : LaBr3 + ... ???

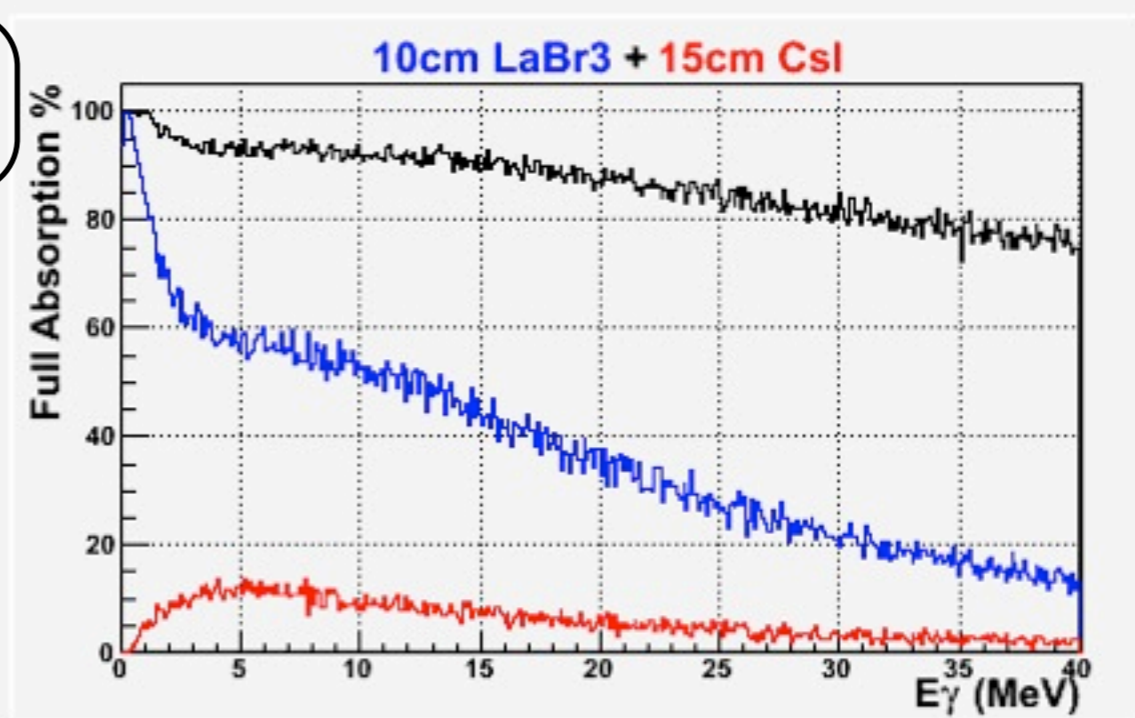
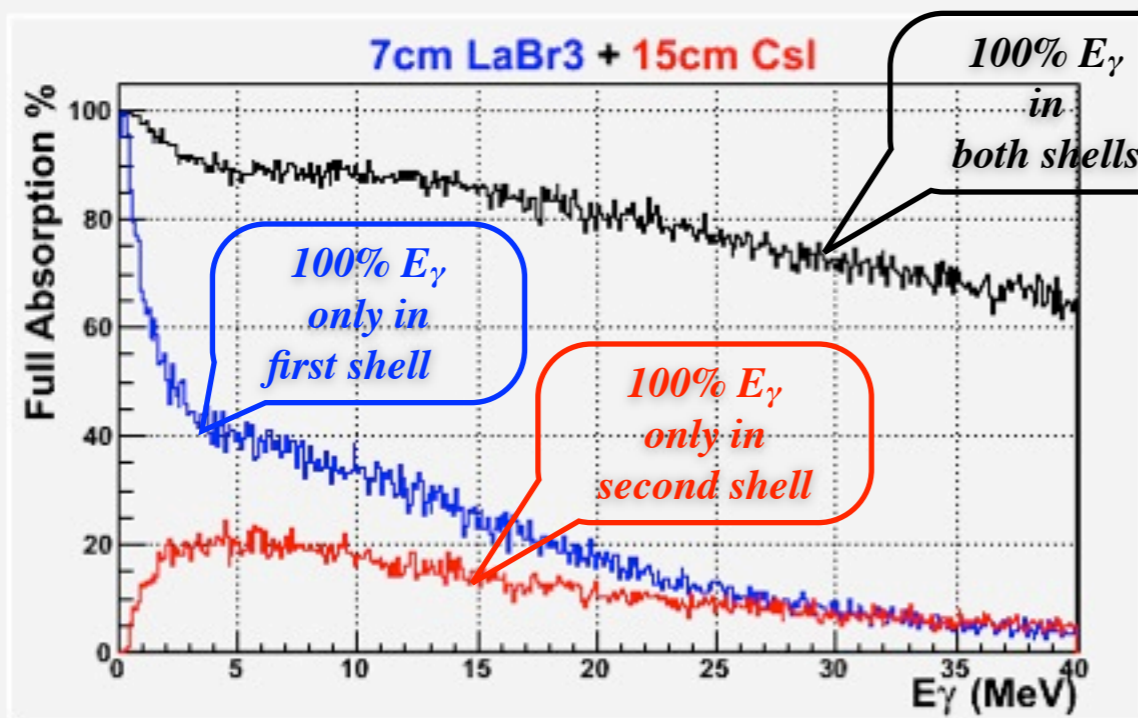
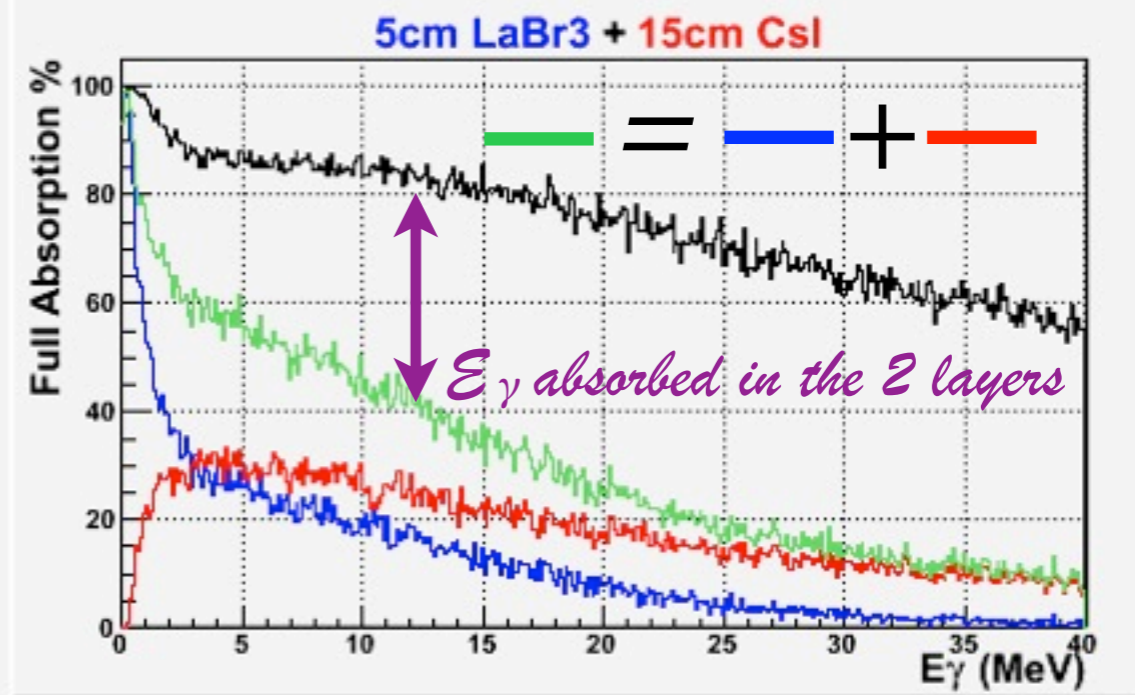
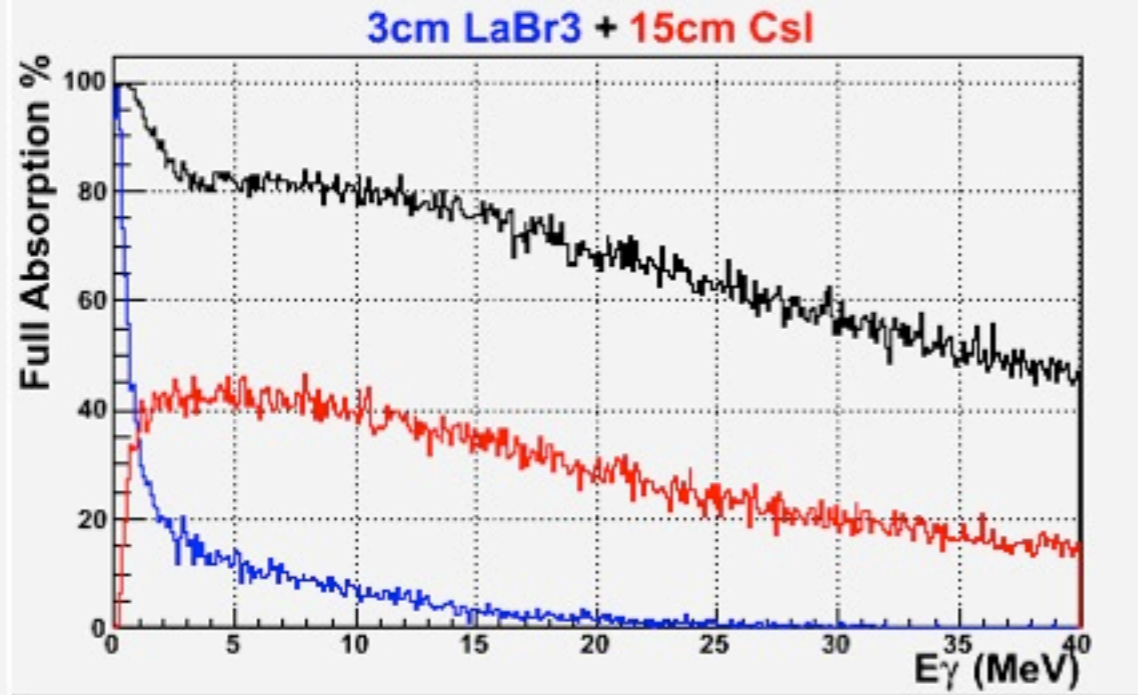
Geant4 simulations





Two layers : LaBr3 + ... ???

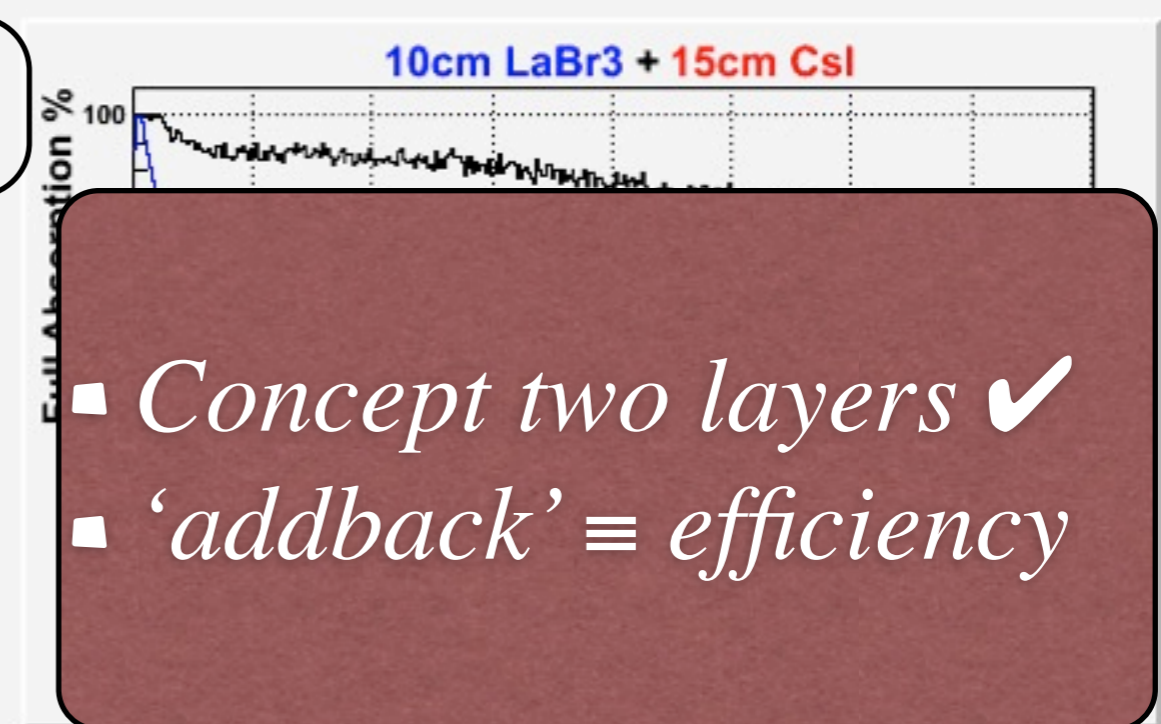
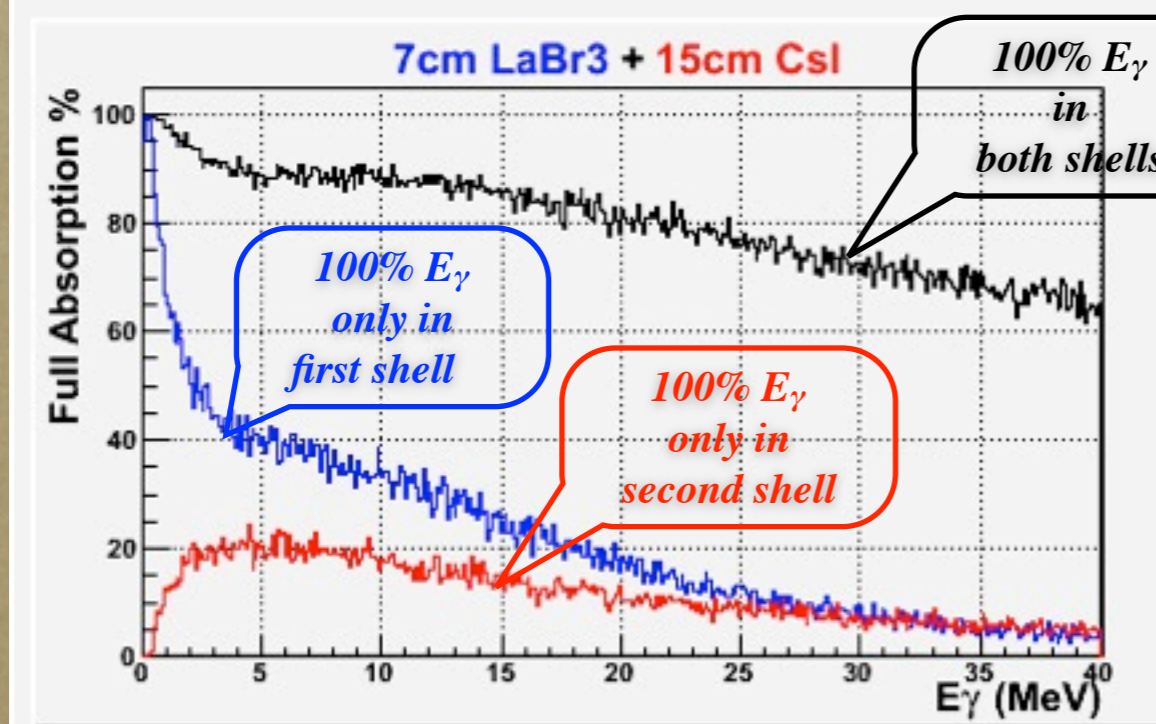
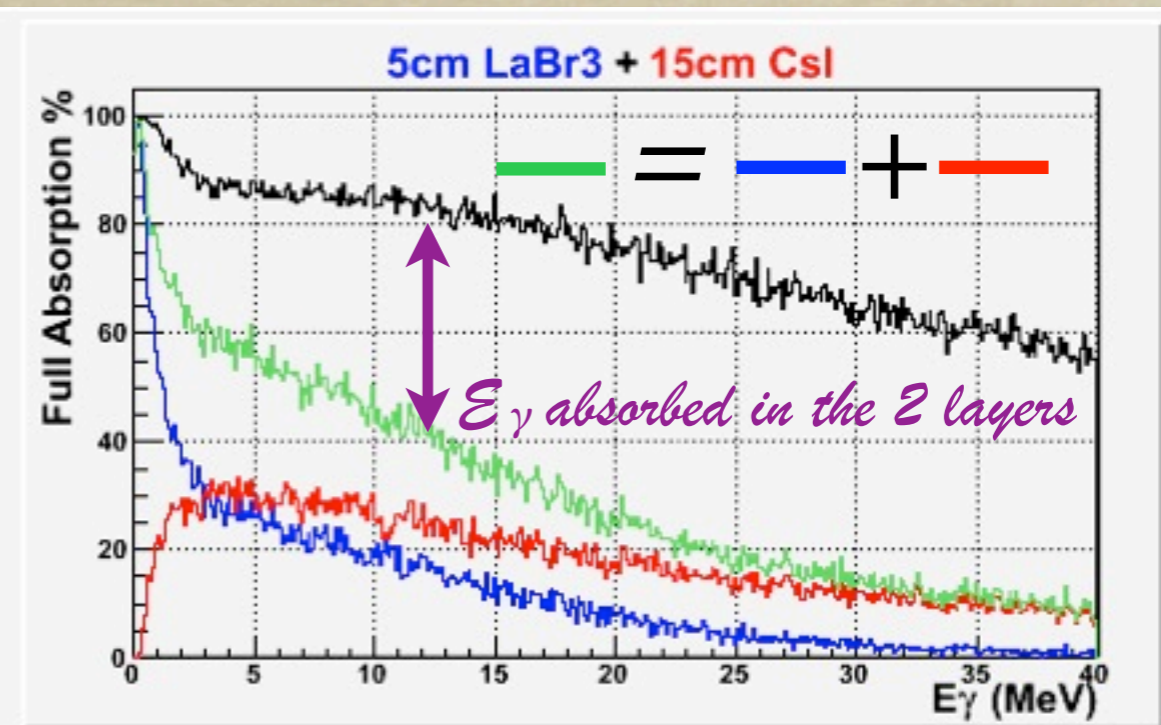
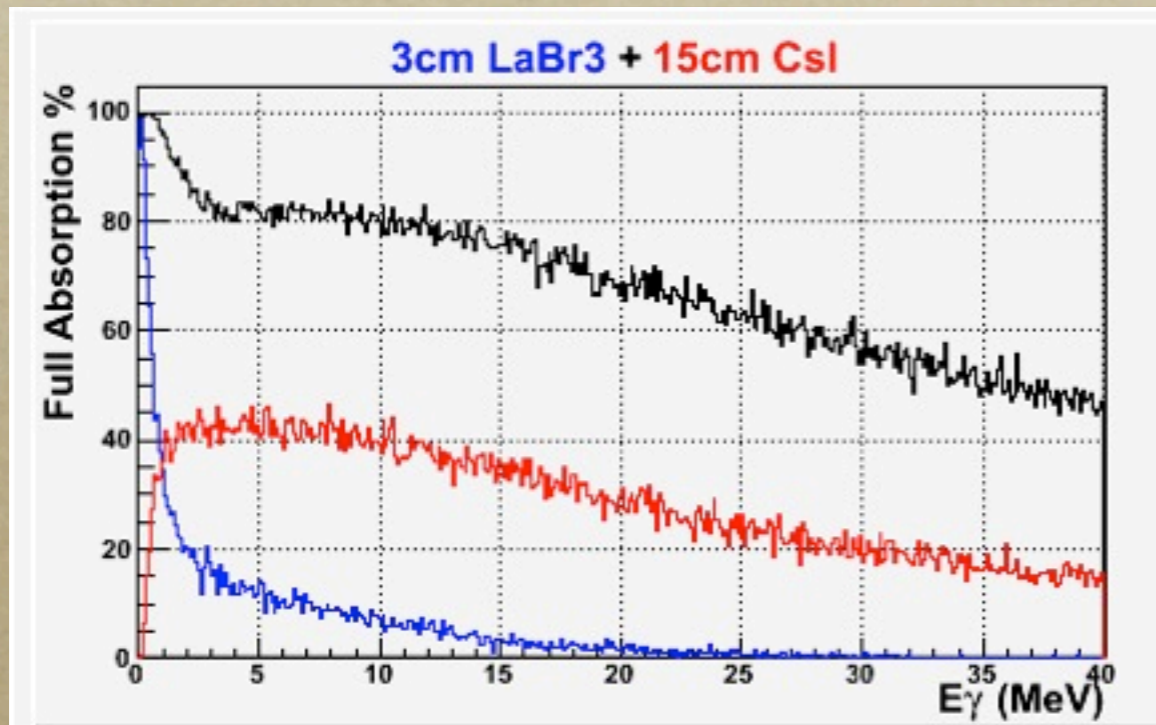
Geant4 simulations





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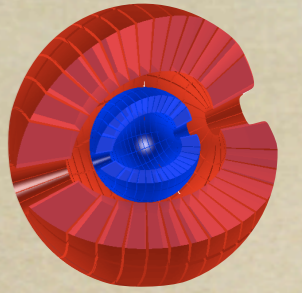
Geant4 simulations



- Concept two layers ✓
- 'addback' ≡ efficiency



segmentation



pile up

Doppler

absorption

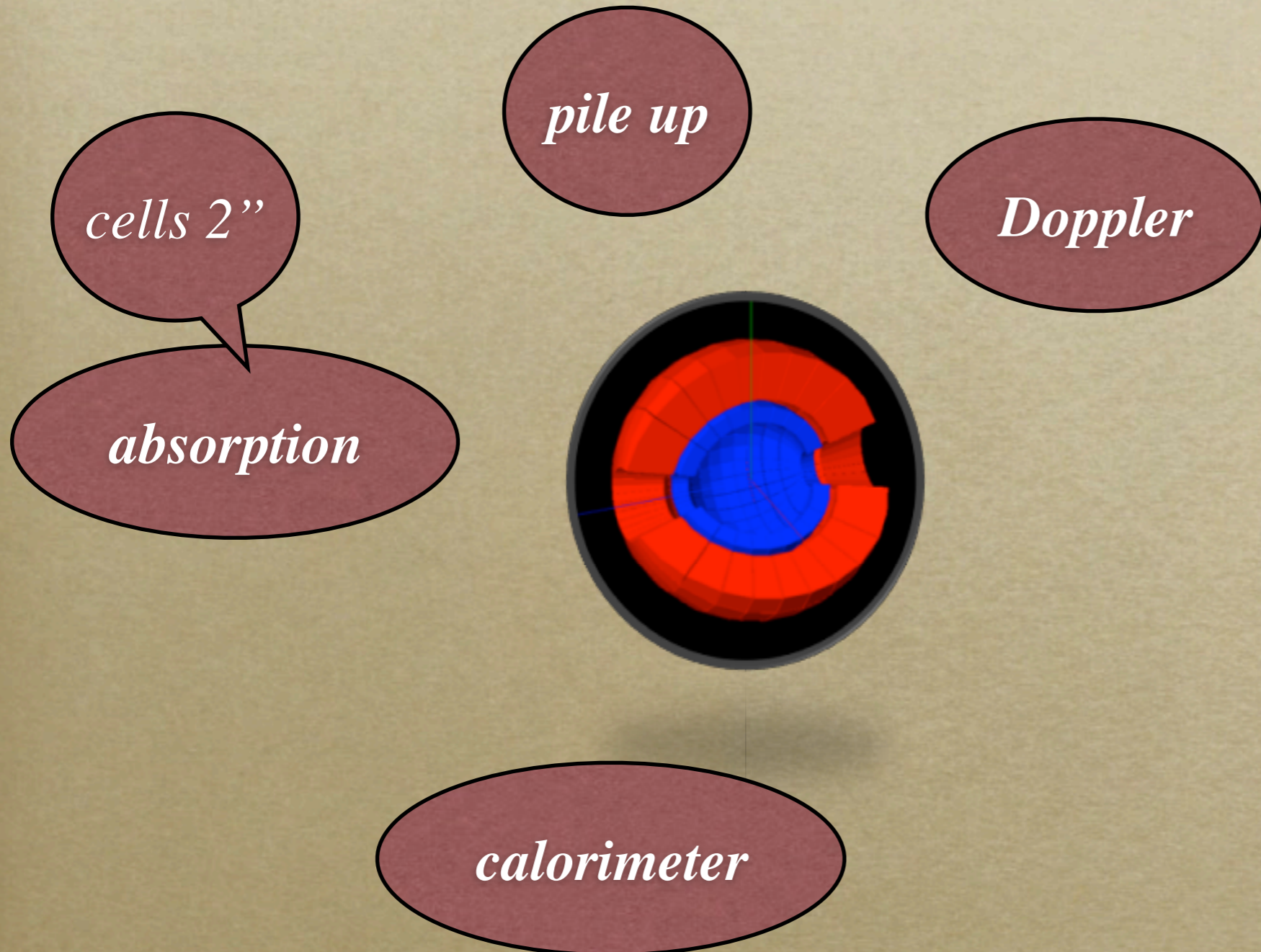
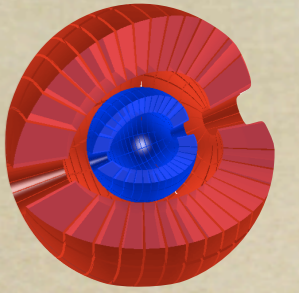


calorimeter

Geant4 simulations



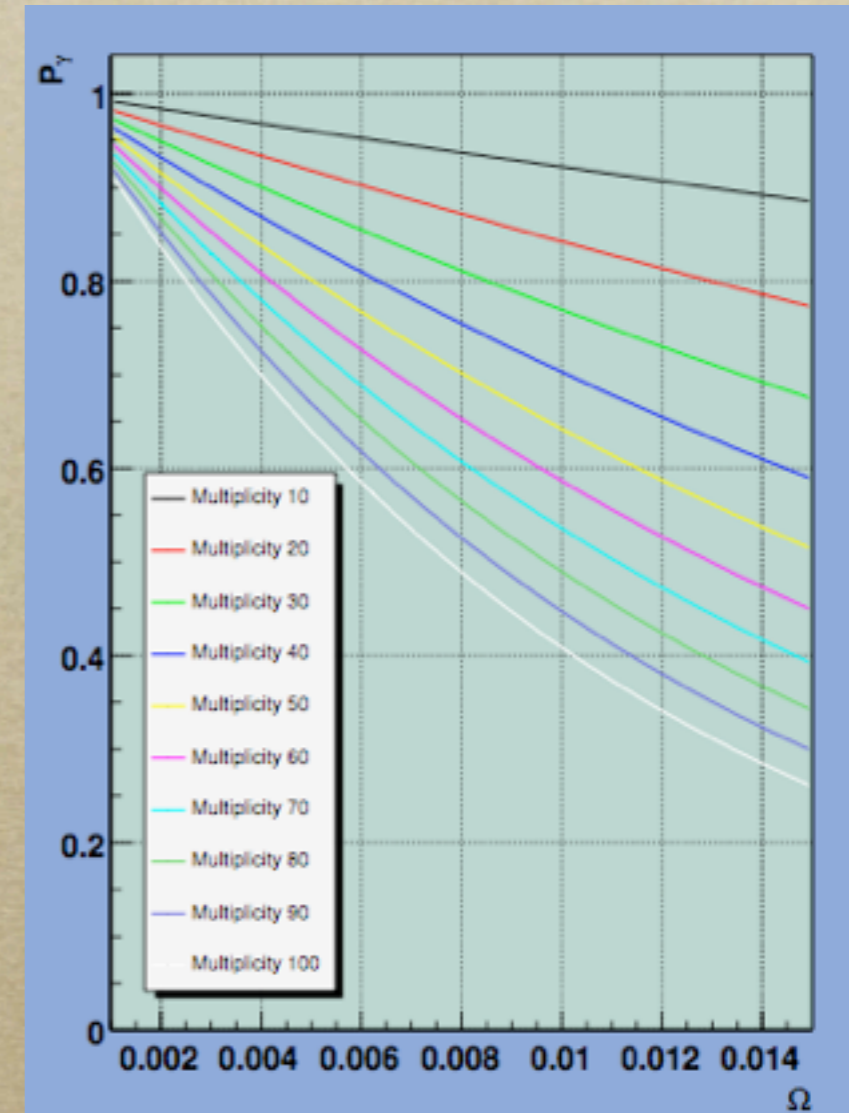
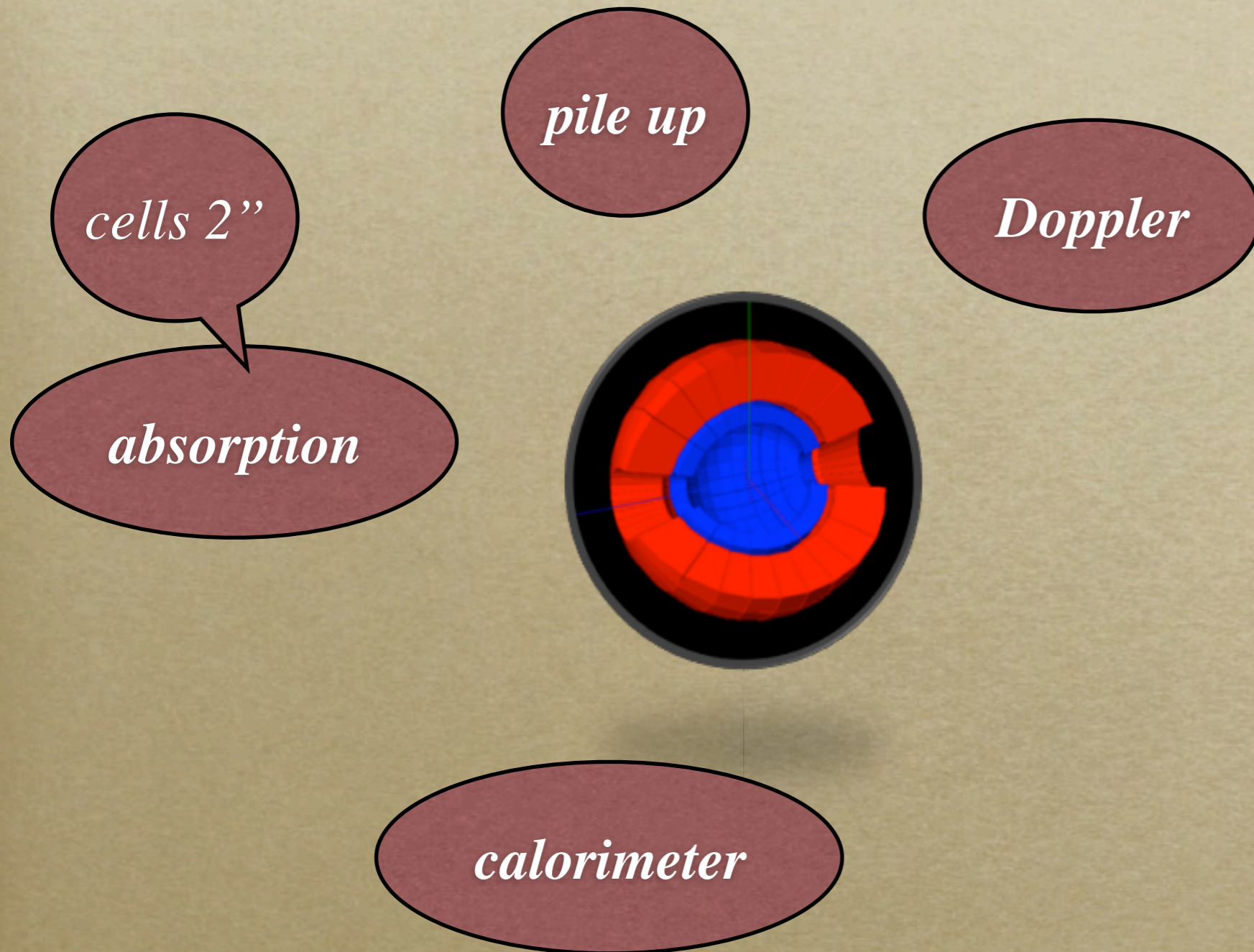
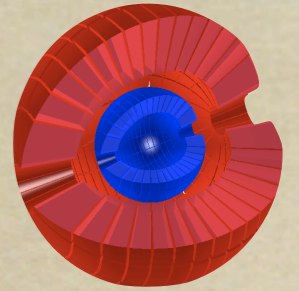
Segmentation



Geant4 simulations

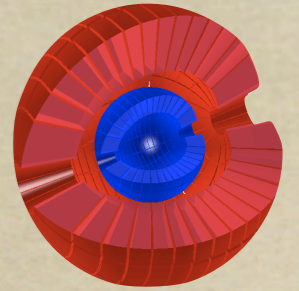


segmentation





Segmentation



pile up

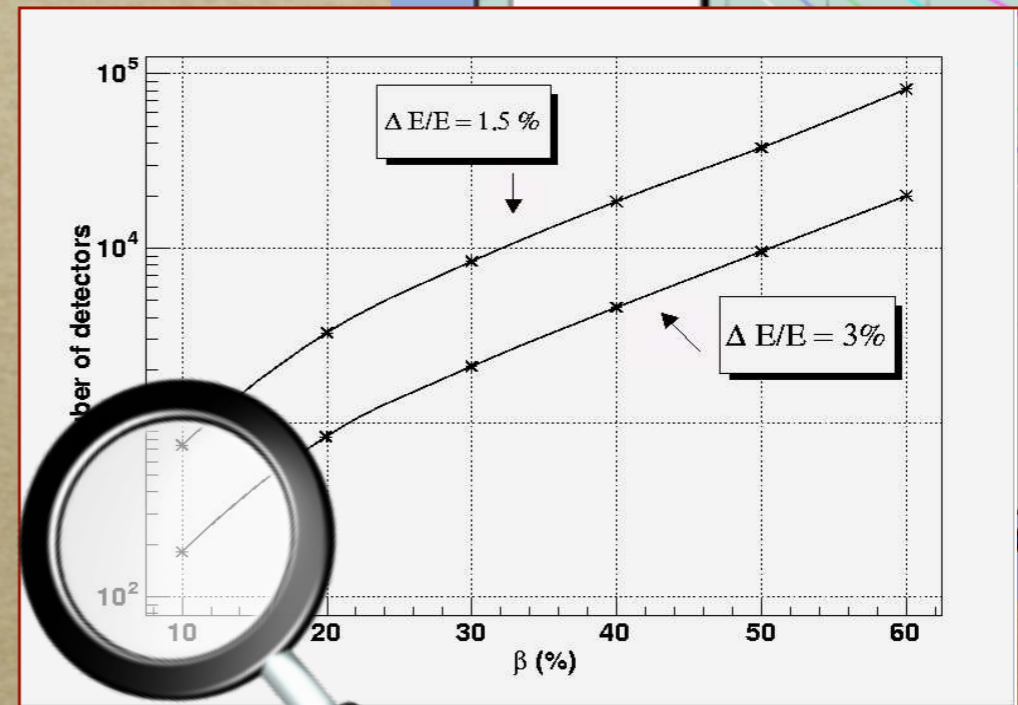
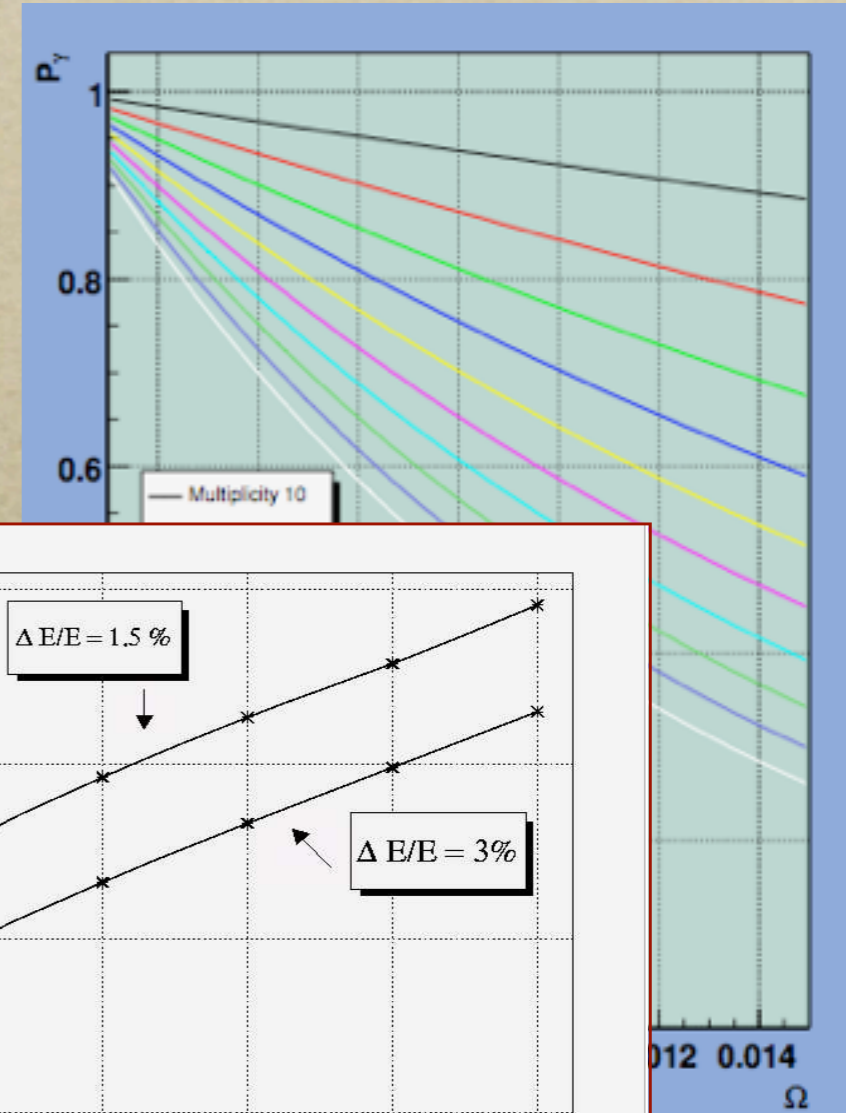
cells 2''

absorption

Doppler



calorimeter

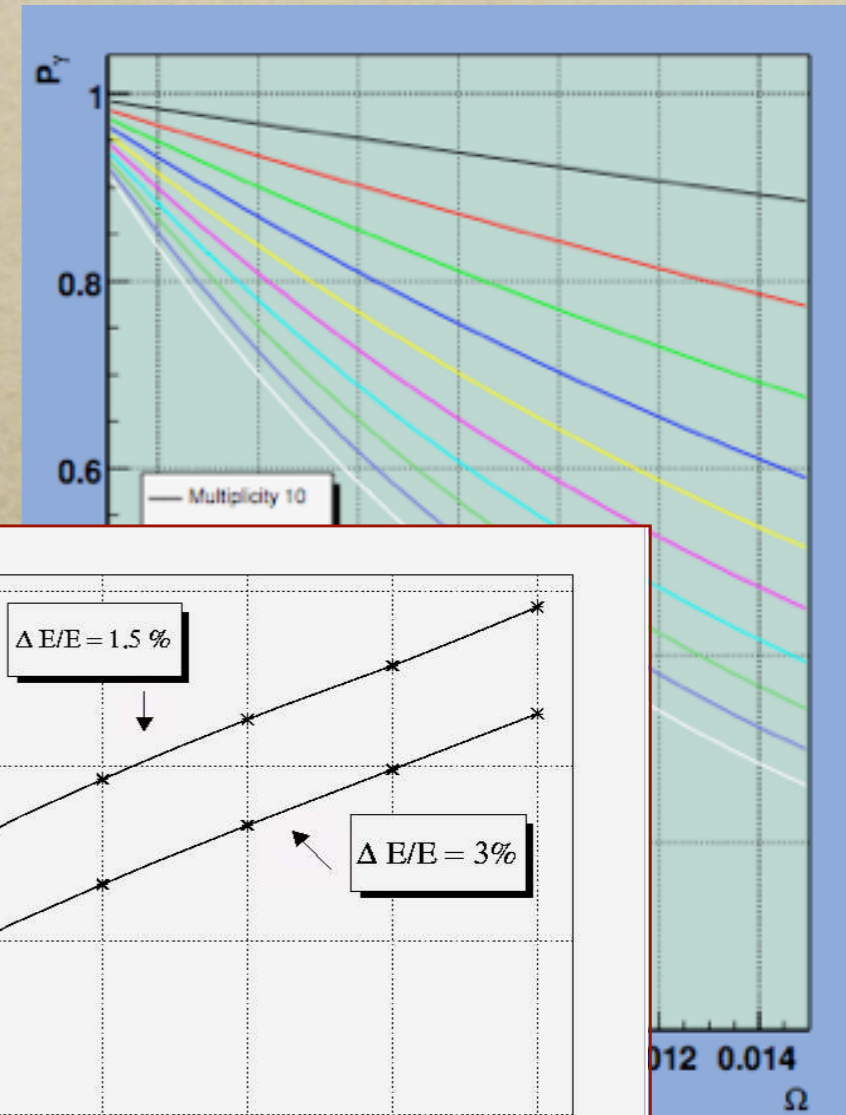
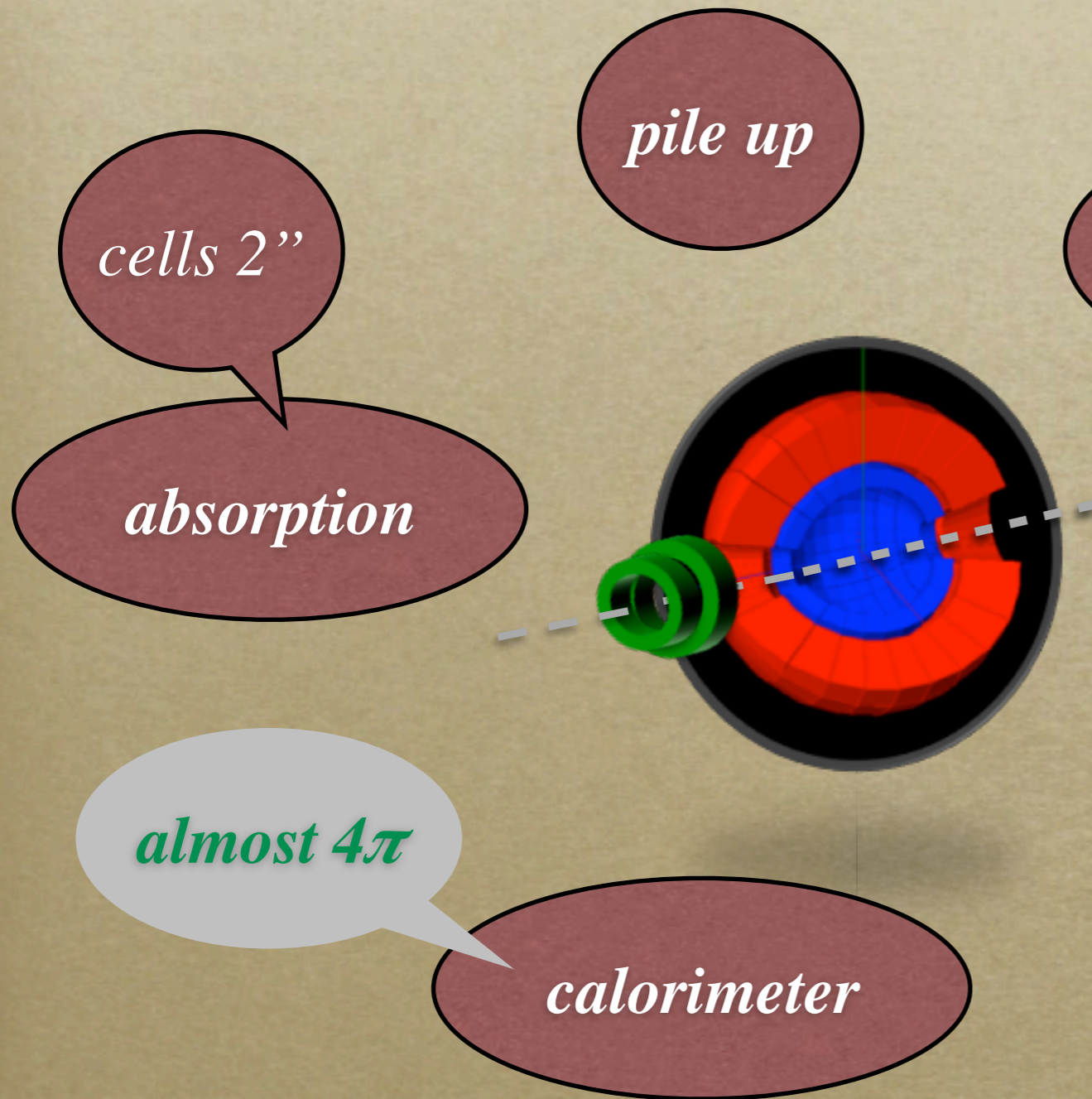
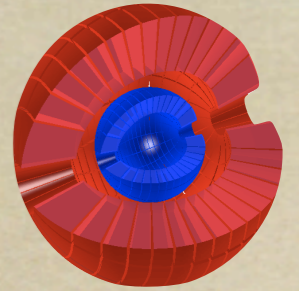


~ few 100 cells

Geant4 simulations



Segmentation



Geant4 simulations

~ few 100 cells



Evolution of PARIS

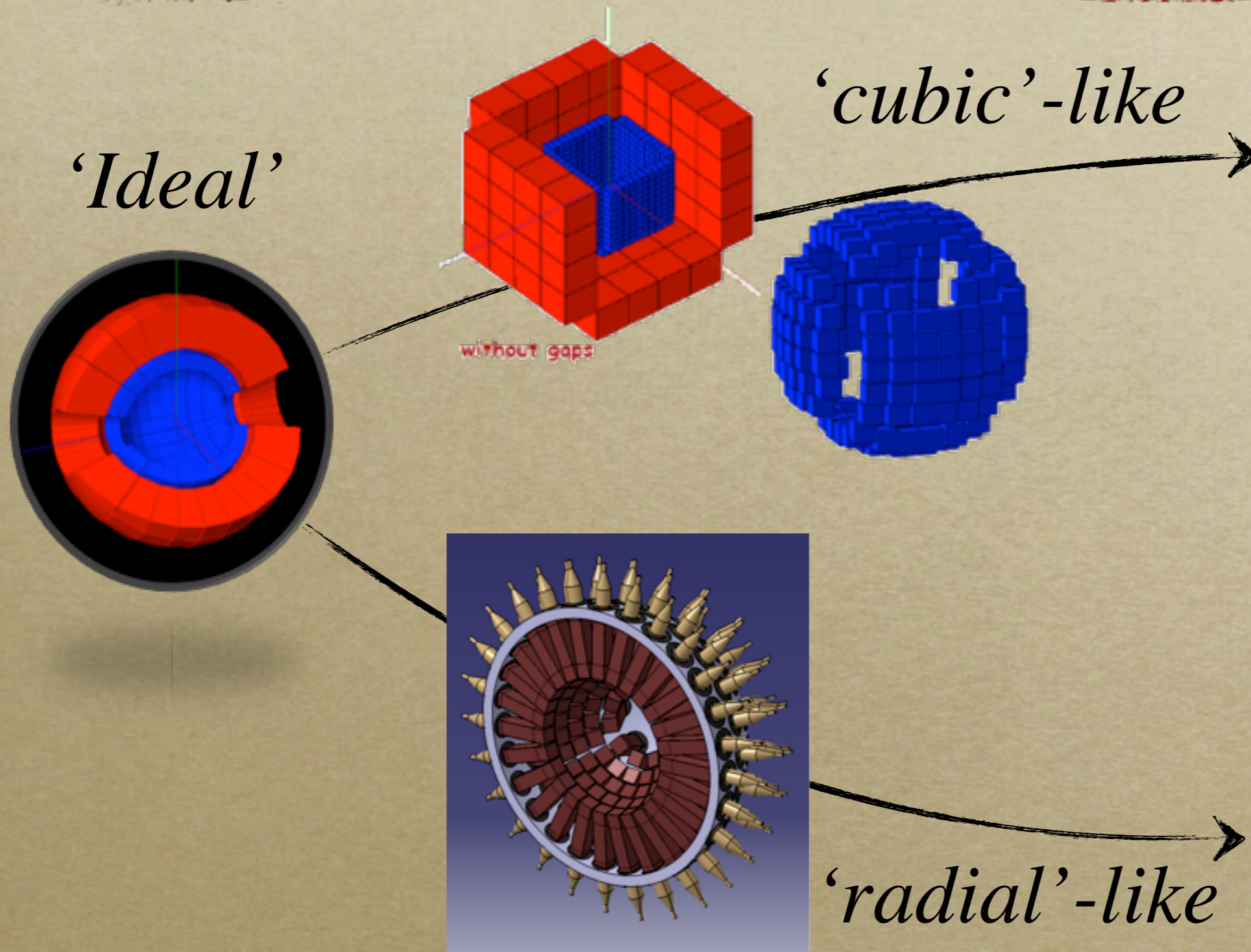


'Ideal'



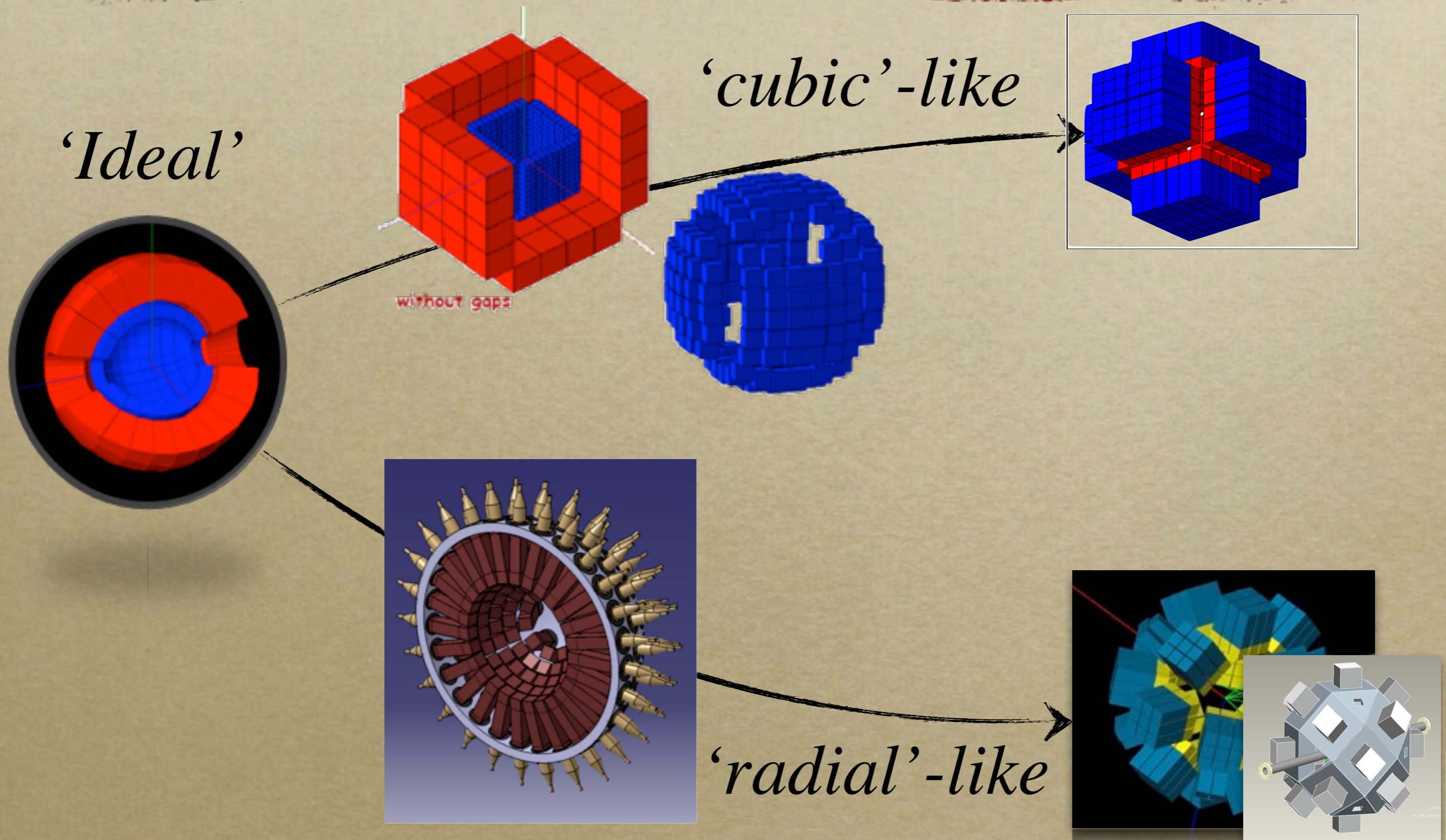


Evolution of PARIS



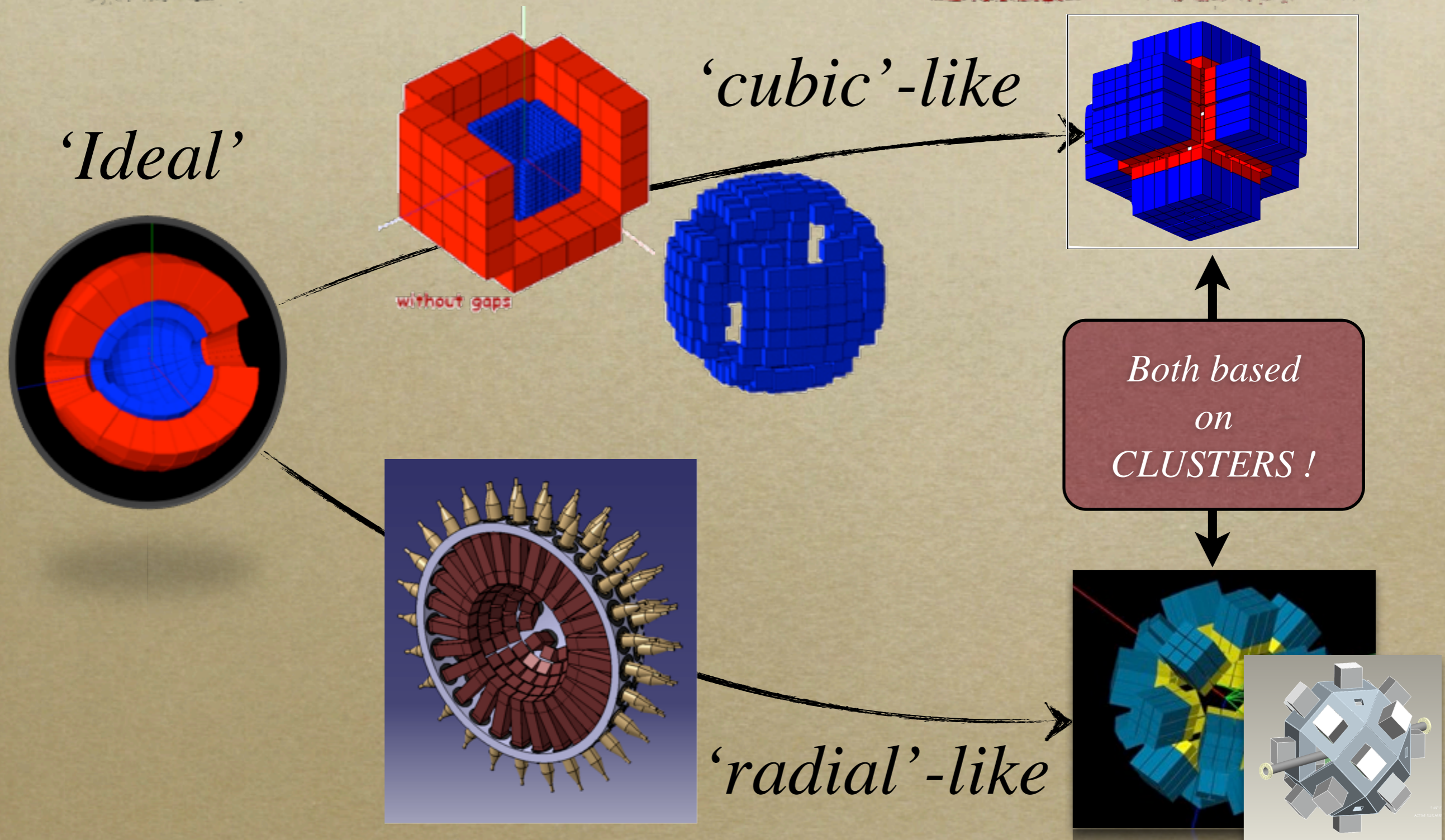


Evolution of PARIS



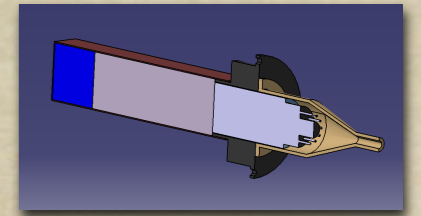


Evolution of PARIS

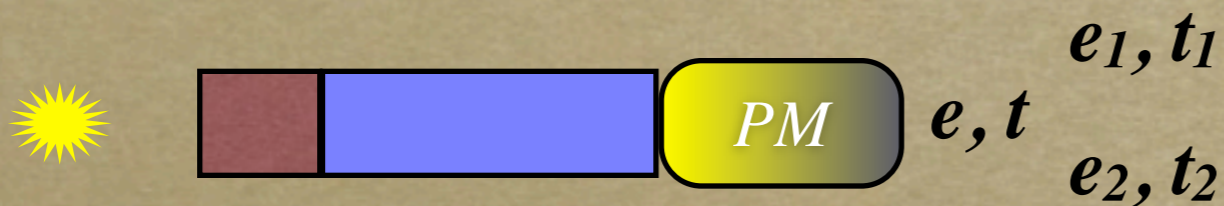
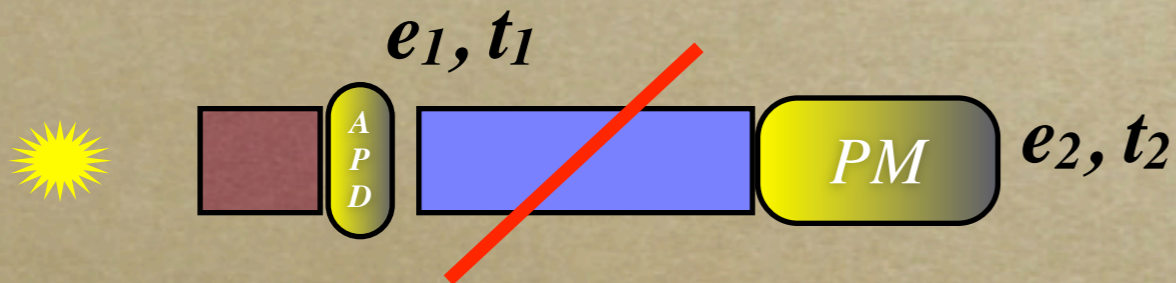
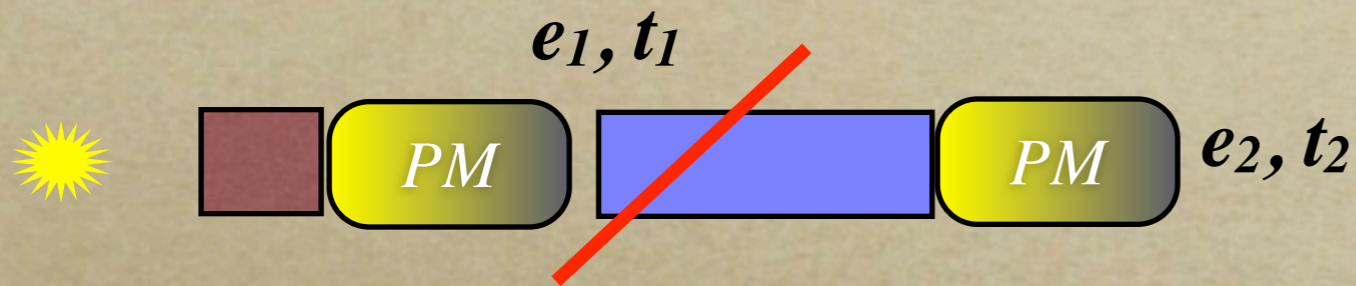




Signals



Possibilities for the PARIS modules



Cubic 1"x1"x2" LaBr3(Ce)
 Cubic 2"x2"x2" LaBr3(Ce)
 Cubic 2"x2"x4" LaBr3(Ce)

SP2PP &
 PROVA funds

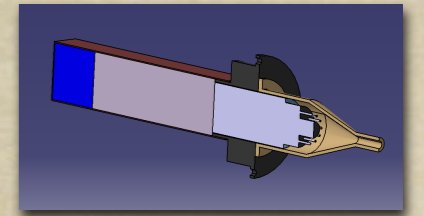
Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" CsI
 Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" NaI

Photomultipliers

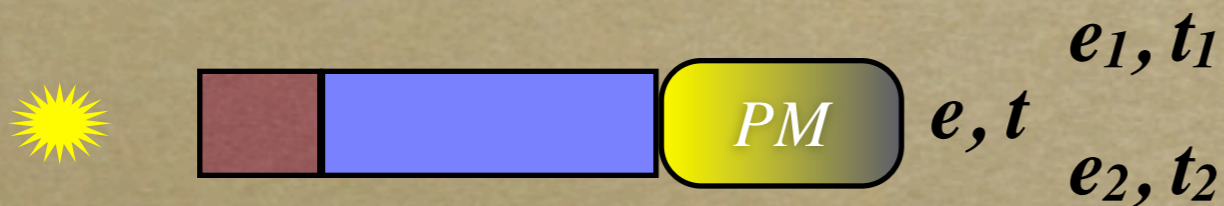
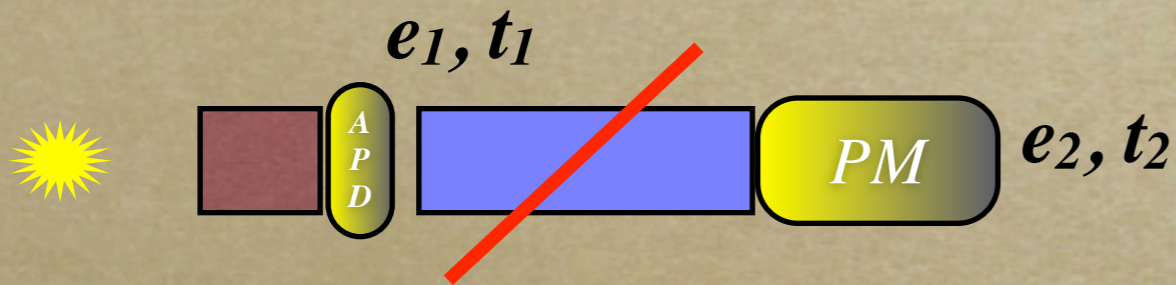
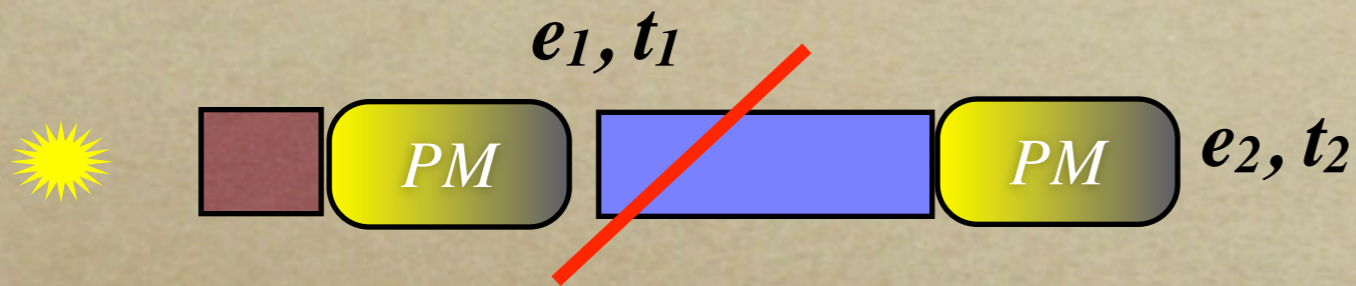
R5505-70, R7723-100, R6236-100, R2083,
 R7899-01, R6236-01, X..., +



Signals



Possibilities for the PARIS modules



Cubic 1"x1"x2" LaBr3(Ce)
 Cubic 2"x2"x2" LaBr3(Ce)
 Cubic 2"x2"x4" LaBr3(Ce)

SP2PP &
 PROVA funds

Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" CsI
 Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" NaI

Photomultipliers

R5505-70, R7723-100, R6236-100, R2083,
 R7899-01, R6236-01, X..., +

Cubic phoswich 2"x2"x2" LaBr3(Ce) + 2"x2"x6" NaI

2 ANR Prova (Orsay, Strasbourg)

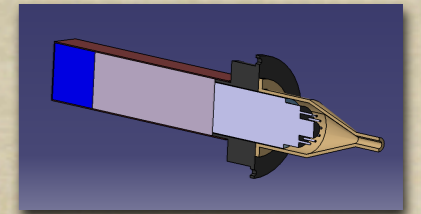
3 SP2PP (Krakow - september)

4 to be ordered by Mumbai

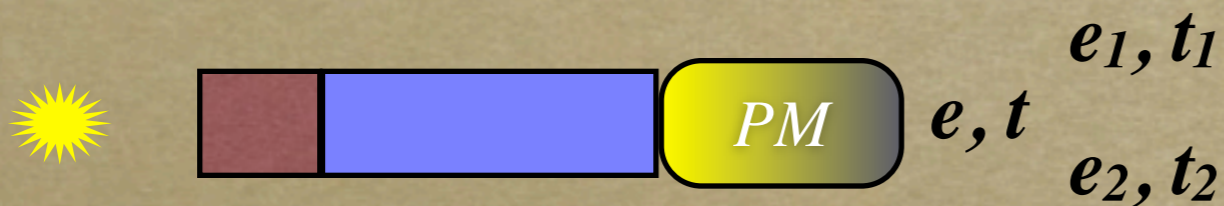
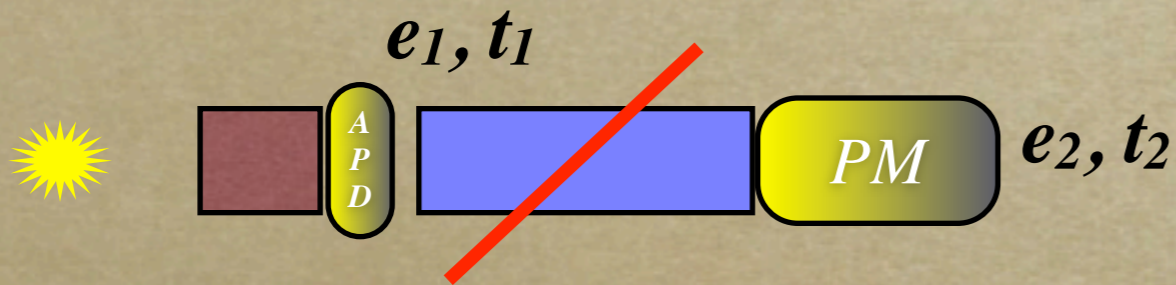
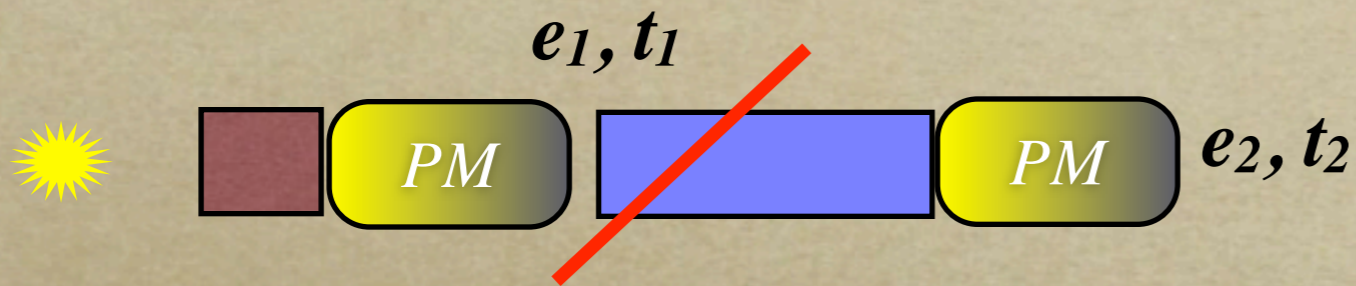
👉 CLUSTER 3x3



Signals



Possibilities for the PARIS modules



Cubic 1"x1"x2" LaBr3(Ce)
 Cubic 2"x2"x2" LaBr3(Ce)
 Cubic 2"x2"x4" LaBr3(Ce)

SP2PP &
 PROVA funds

Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" CsI
 Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" NaI

Photomultipliers

R5505-70, R7723-100, R6236-100, R2083,
 R7899-01, R6236-01, X..., +

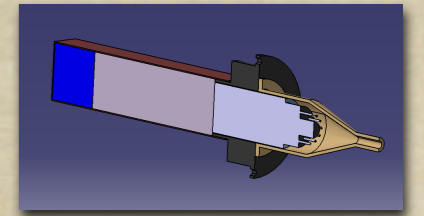
Cubic phoswich 2"x2"x2" LaBr3(Ce) + 2"x2"x6" NaI
 2 ANR Prova (Orsay, Strasbourg)
 3 SP2PP (Krakow - september)
 4 to be ordered by Mumbai

NEW !!!!

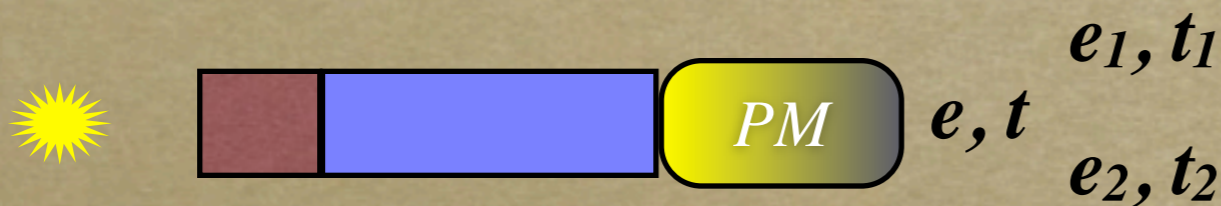
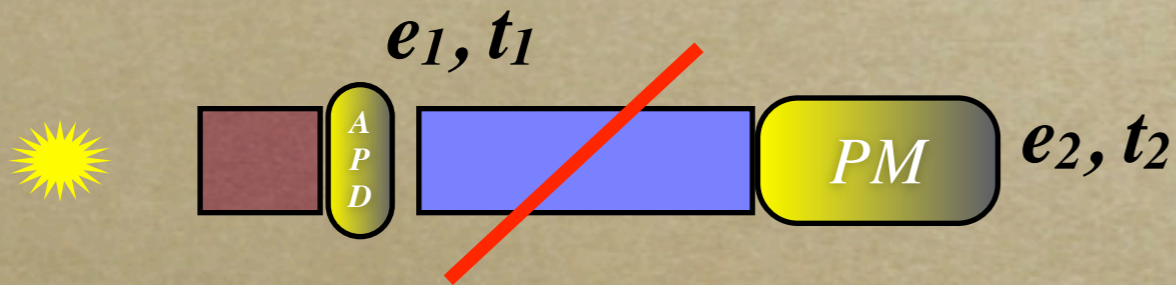
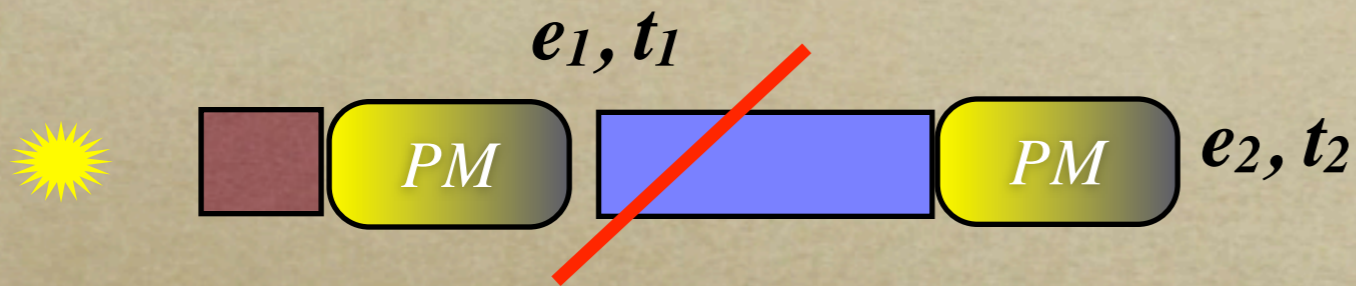
👉 CLUSTER 3x3



Signals



Possibilities for the PARIS modules



Cubic 1"x1"x2" LaBr3(Ce)
 Cubic 2"x2"x2" LaBr3(Ce)
 Cubic 2"x2"x4" LaBr3(Ce)

SP2PP &
 PROVA funds

Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" CsI
 Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" NaI

Photomultipliers

R5505-70, R7723-100, R6236-100, R2083,
 R7899-01, R6236-01, X..., +

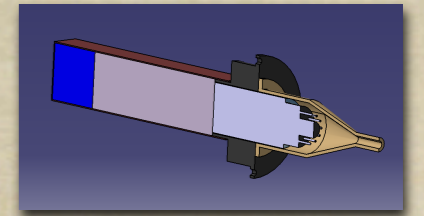
Cubic phoswich 2"x2"x2" LaBr3(Ce) + 2"x2"x6" NaI
 2 ANR Prova (Orsay, Strasbourg)
 3 SP2PP (Krakow - september)
 4 to be ordered by Mumbai

NEW !!!!

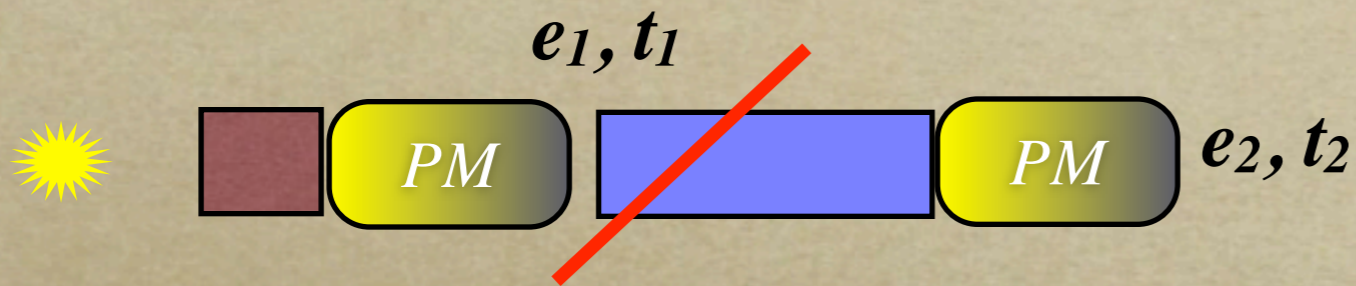
👉 CLUSTER 3x3



Signals



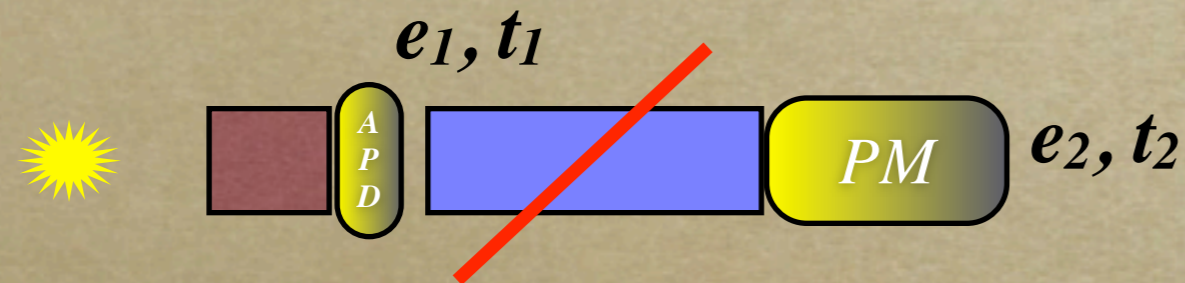
Possibilities for the PARIS modules



Cubic 1"x1"x2" LaBr3(Ce)
 Cubic 2"x2"x2" LaBr3(Ce)
 Cubic 2"x2"x4" LaBr3(Ce)

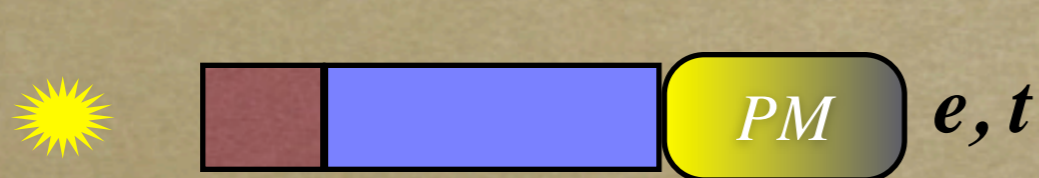
SP2PP &
 PROVA funds

Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" CsI
 Cylindrical phoswich 1"x2" LaBr3(Ce) + 1"x6" NaI



Photomultipliers

R5505-70, R7723-100, R6236-100, R2083,
 R7899-01, R6236-01, X..., +



Phoswich 2"x2"x2" LaBr3(Ce) + 2"x2"x6" NaI
 Prova (Orsay, Strasbourg)
 P (Krakow - september)
 ordered by Mumbai

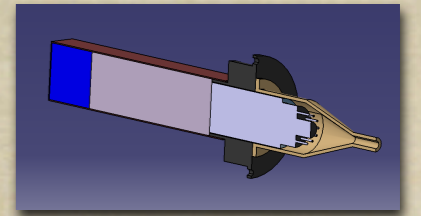
NEW !!!!



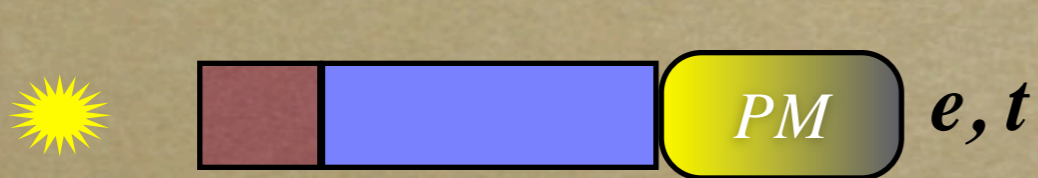
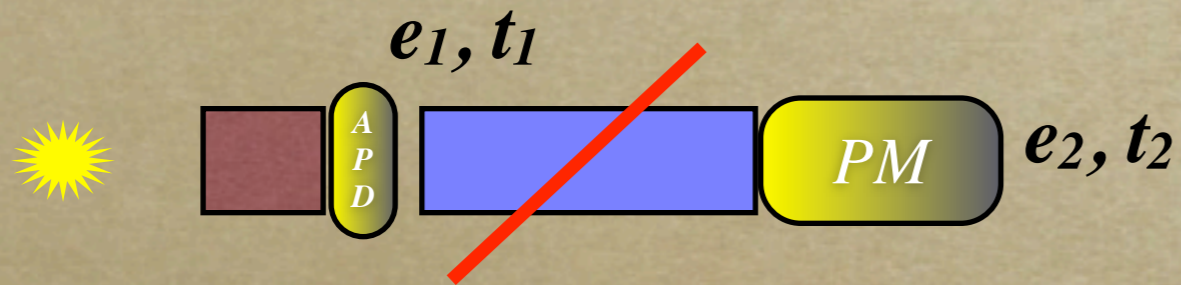
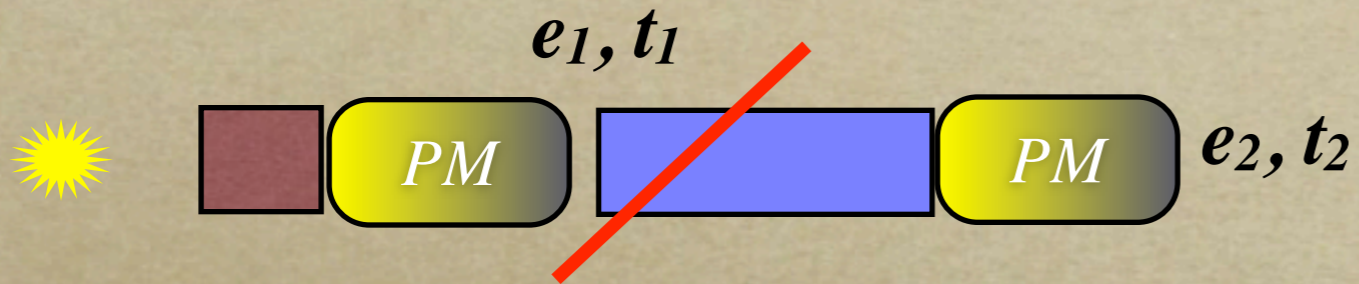
CLUSTER 3x3



Signals



Possibilities for the PARIS modules



Cubic
Cubic
Cubic

Cylindrical
Cylindrical

Photo
R55
R78

CsI
NaI

switch 2"x2"x2" LaBr3(Ce) + 2"x2"x6" NaI
 Prova (Orsay, Strasbourg)
 P (Krakow - september)
 ordered by Mumbai

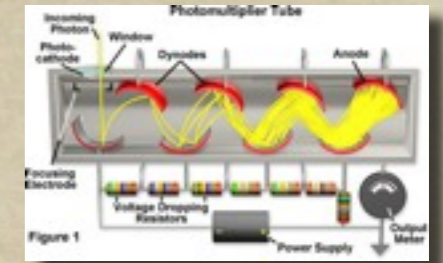
NEW !!!!

👉 CLUSTER 3x3



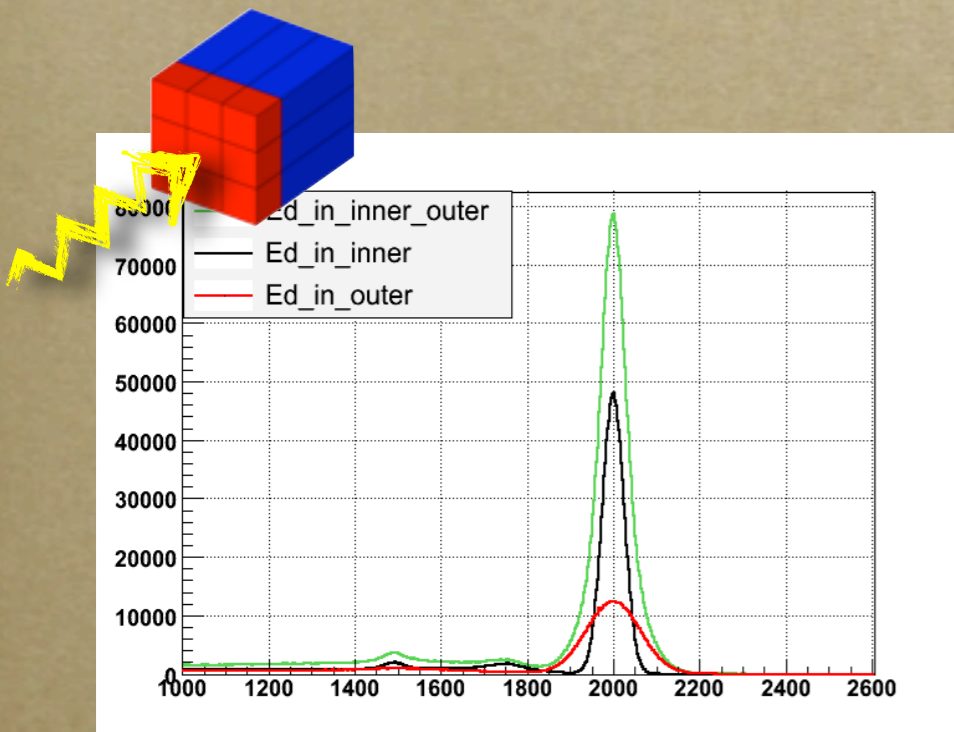
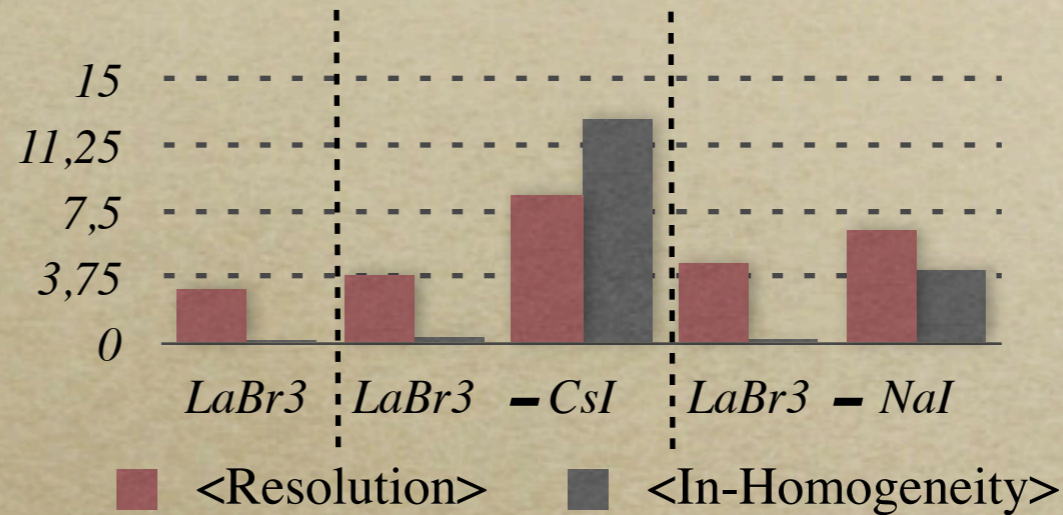
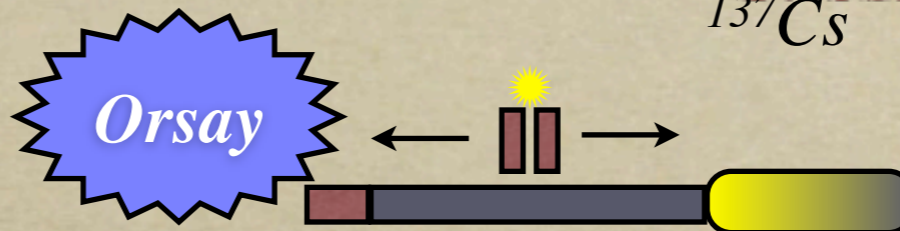
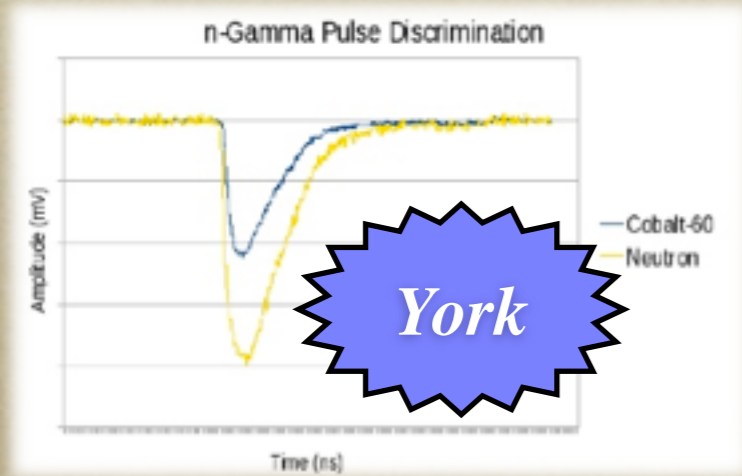


Signal collection



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

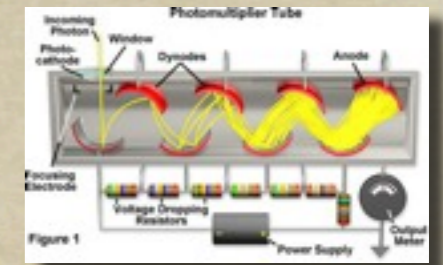
Discrimination γ -n ...



Energy sharing between the two layers *simu*

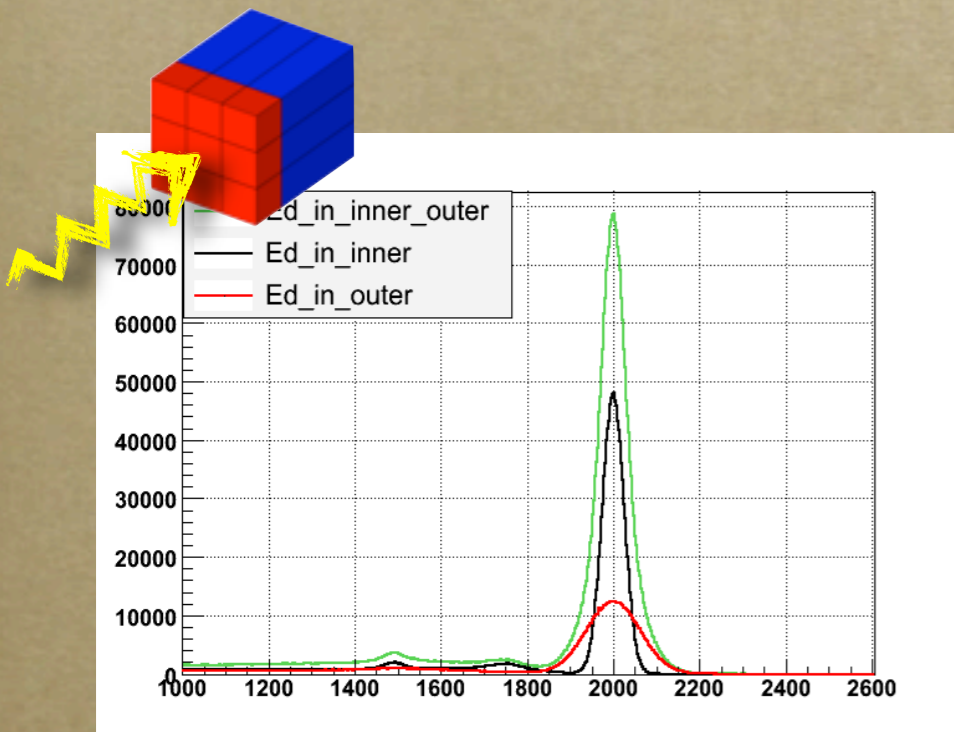
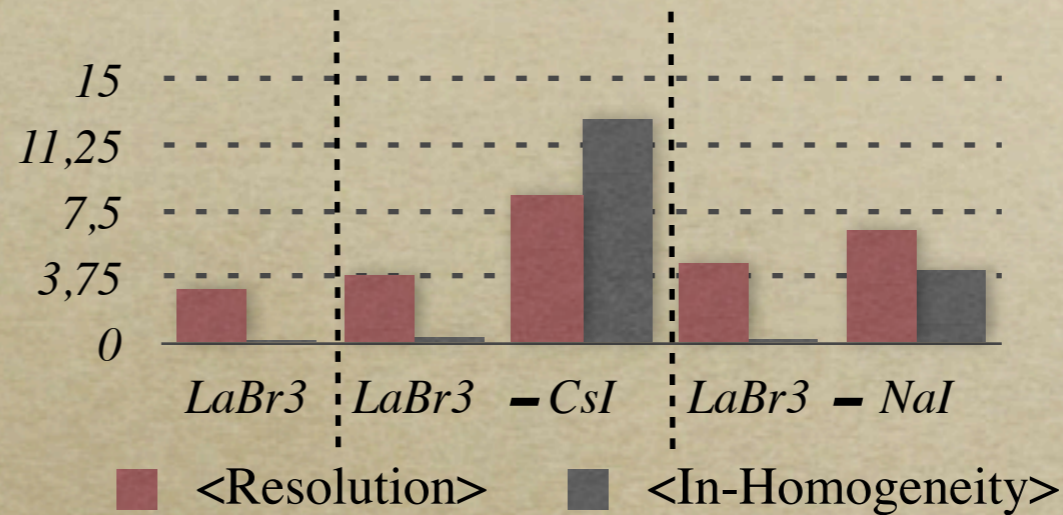
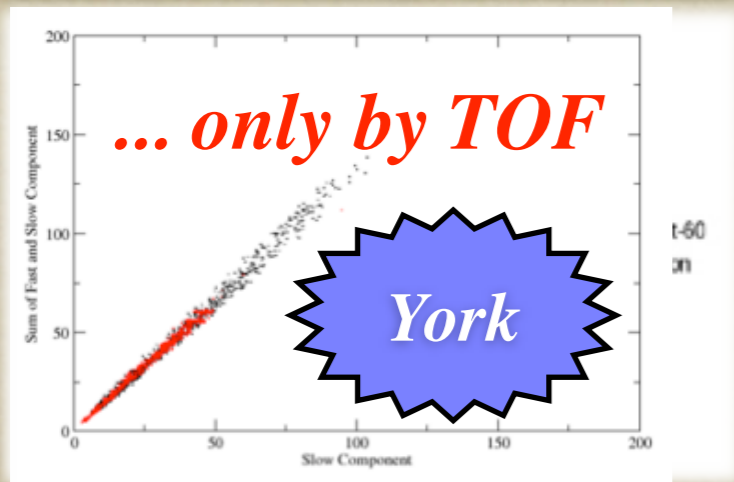


Signal collection



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

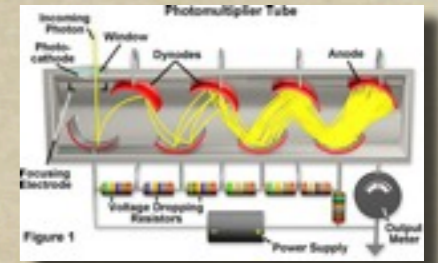
Discrimination γ -n ...



Energy sharing between the two layers *simu*

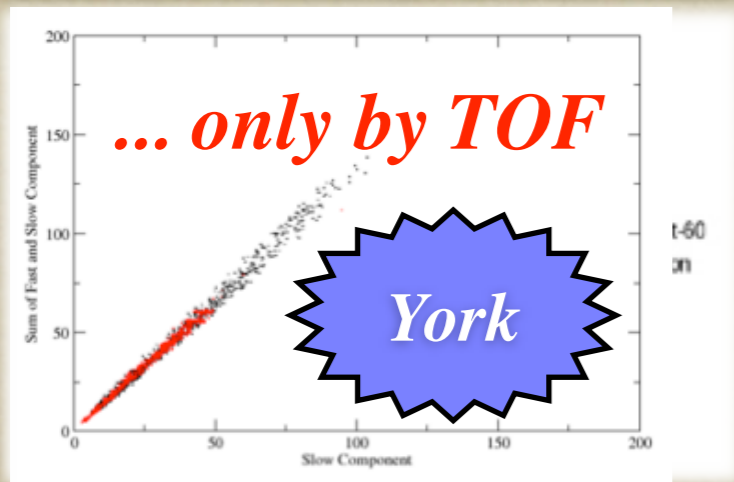


Signal collection



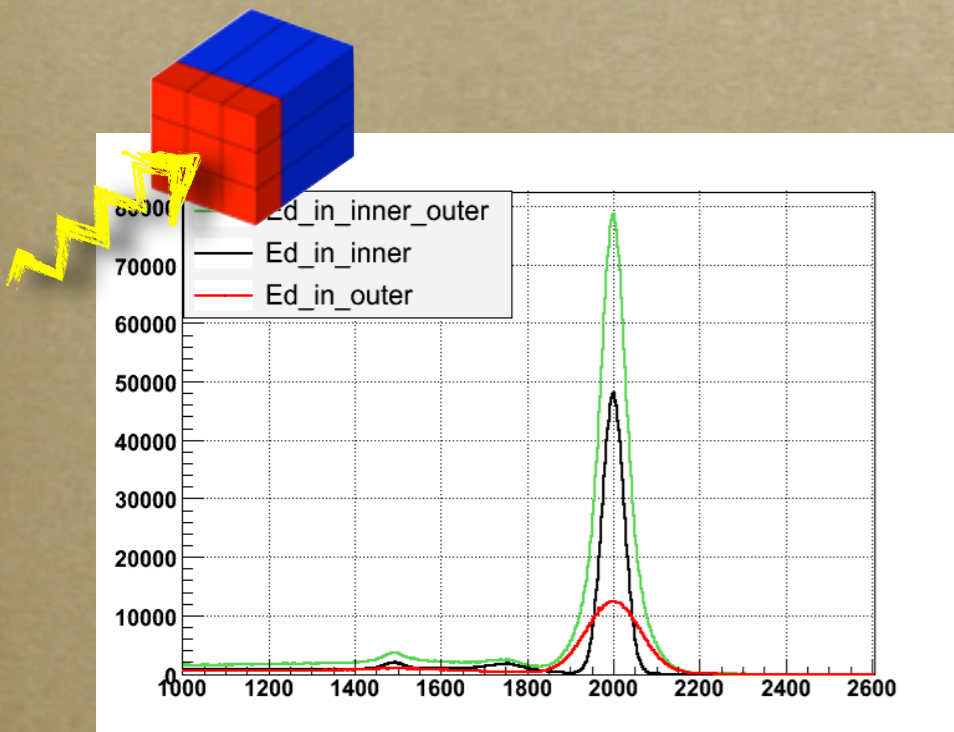
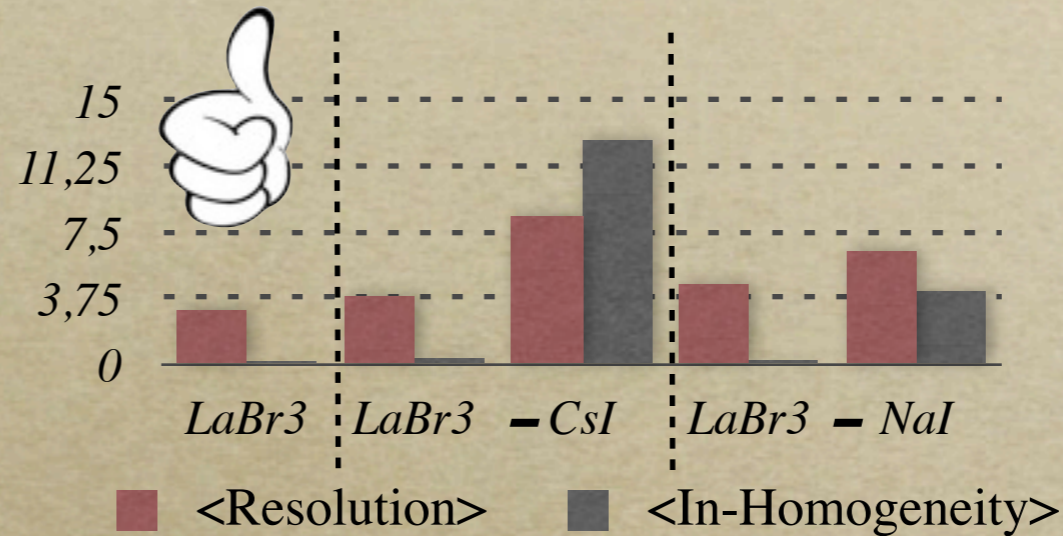
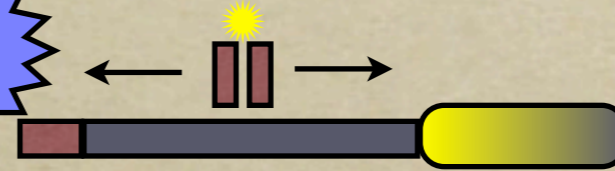
1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Discrimination γ -n ...



Orsay

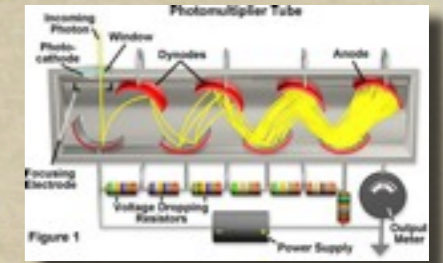
^{137}Cs



Energy sharing between the two layers *simu*

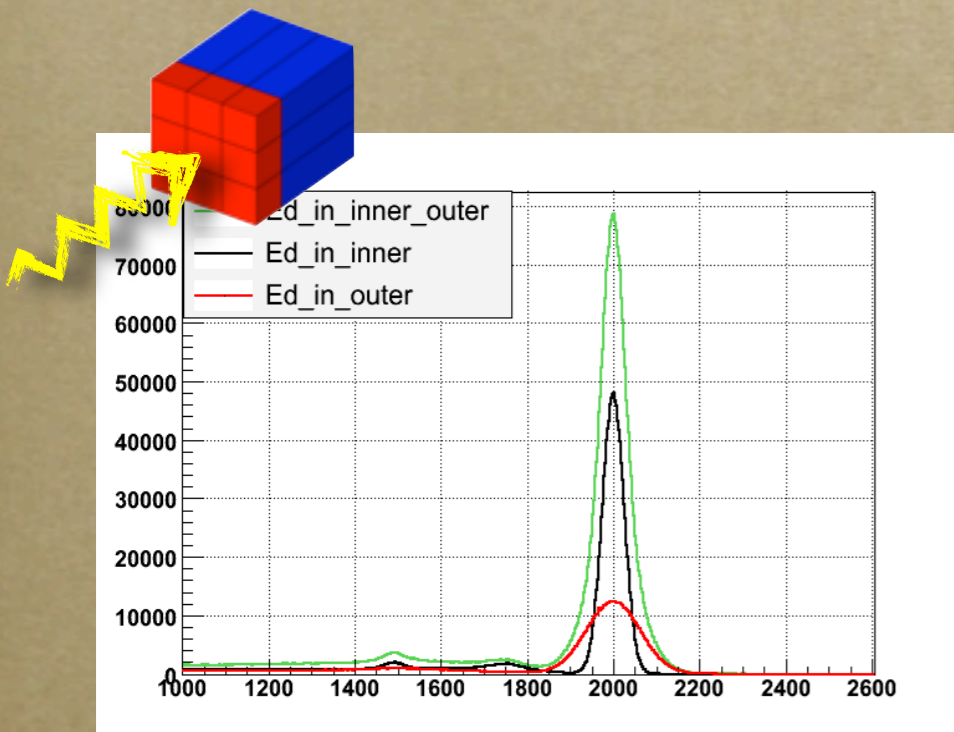
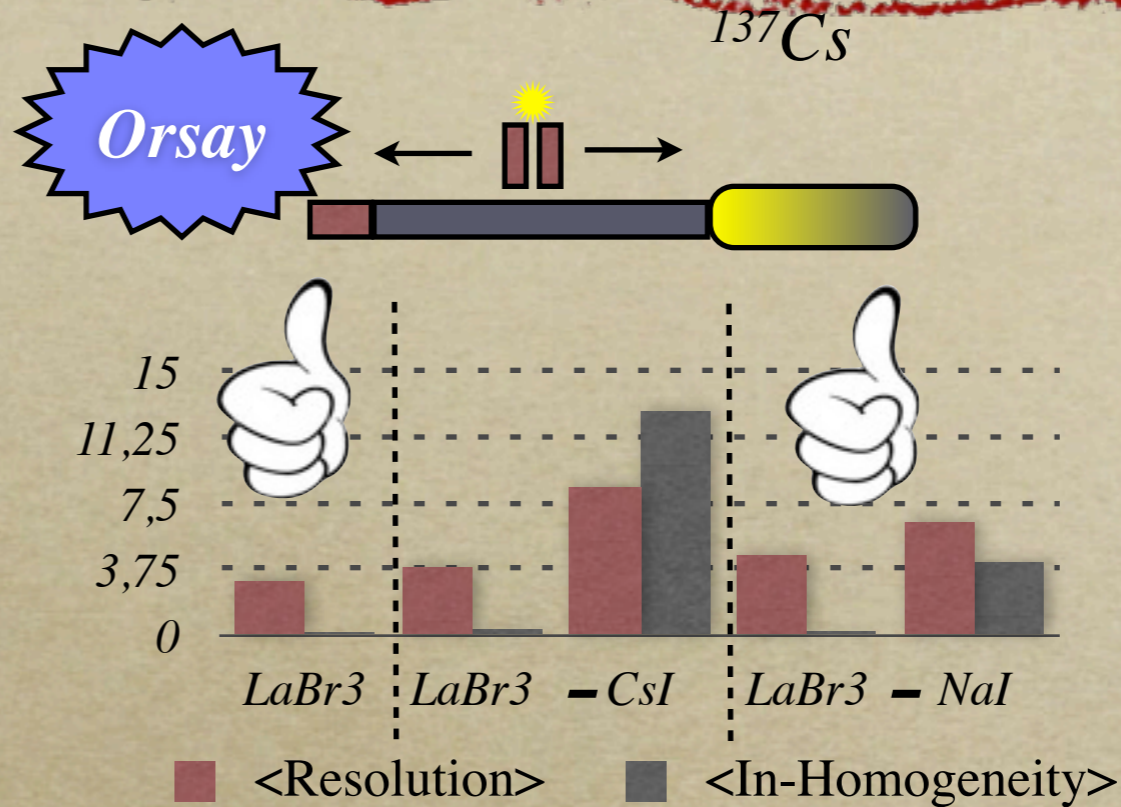
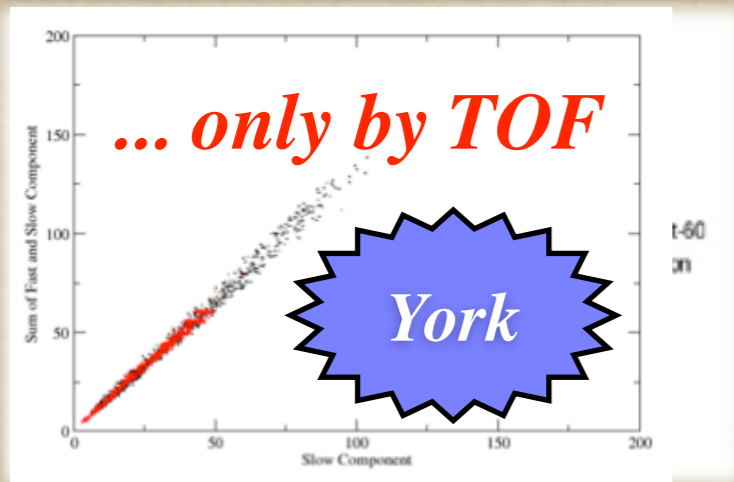


Signal collection



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

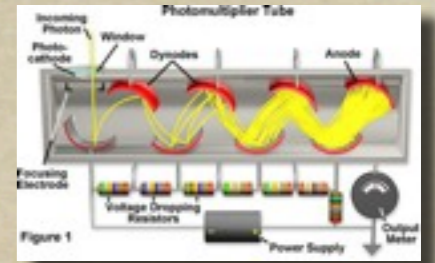
Discrimination γ -n ...



Energy sharing between the two layers *simu*

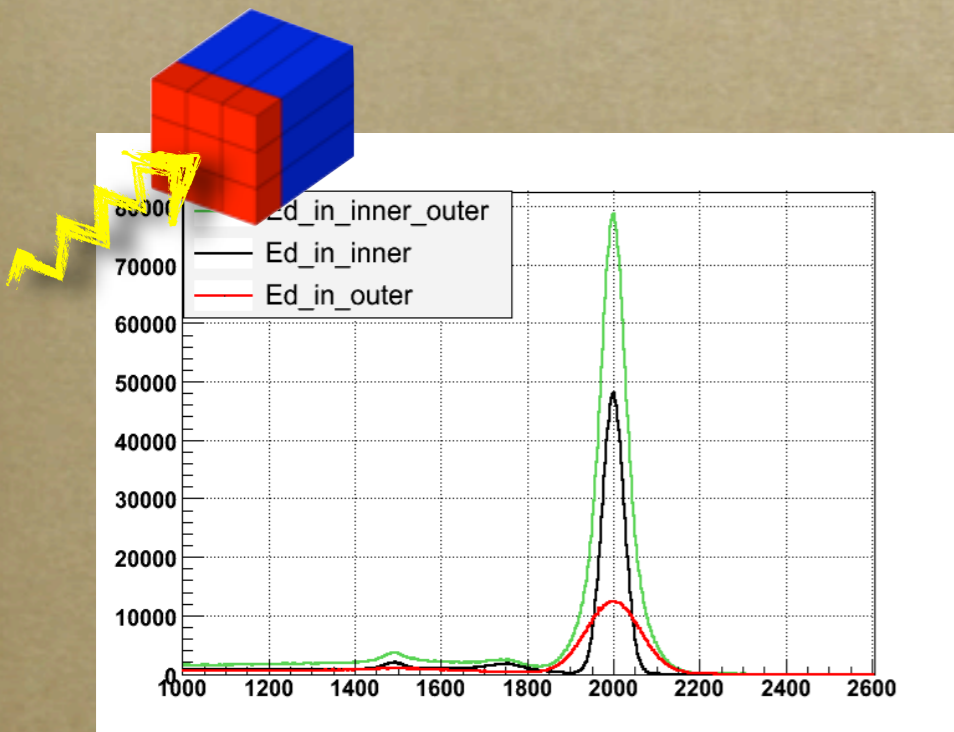
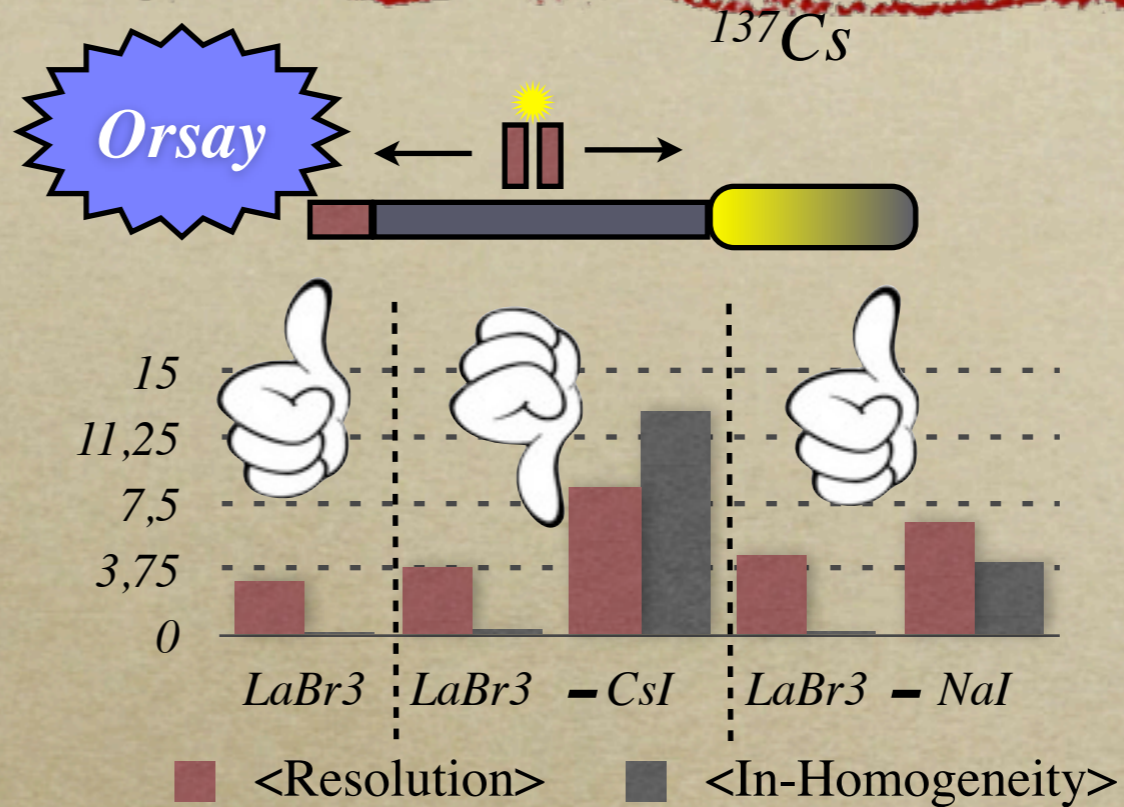
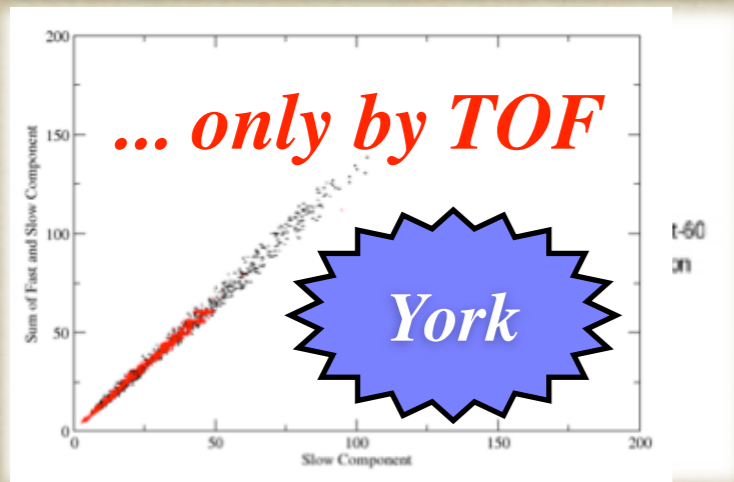


Signal collection



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

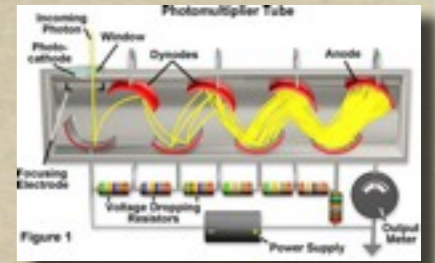
Discrimination γ -n ...



Energy sharing between the two layers *simu*

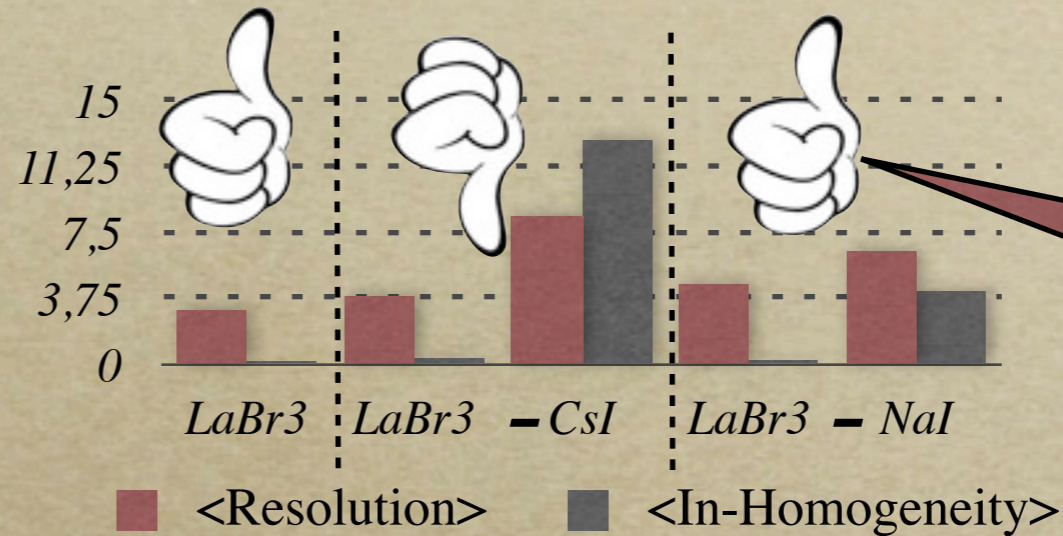
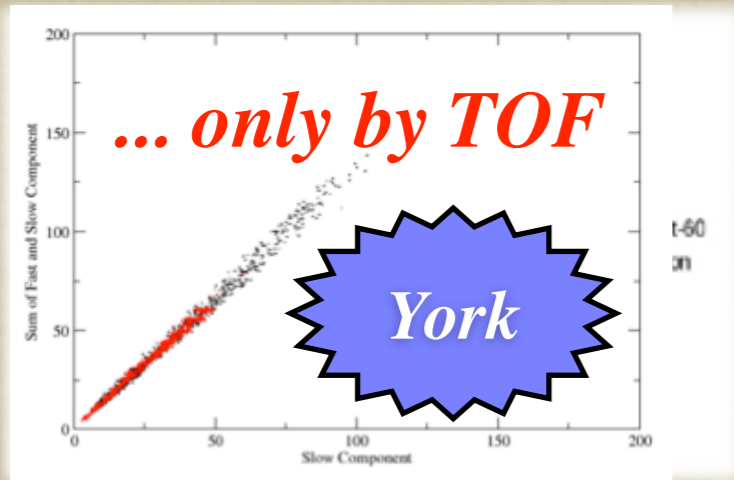


Signal collection

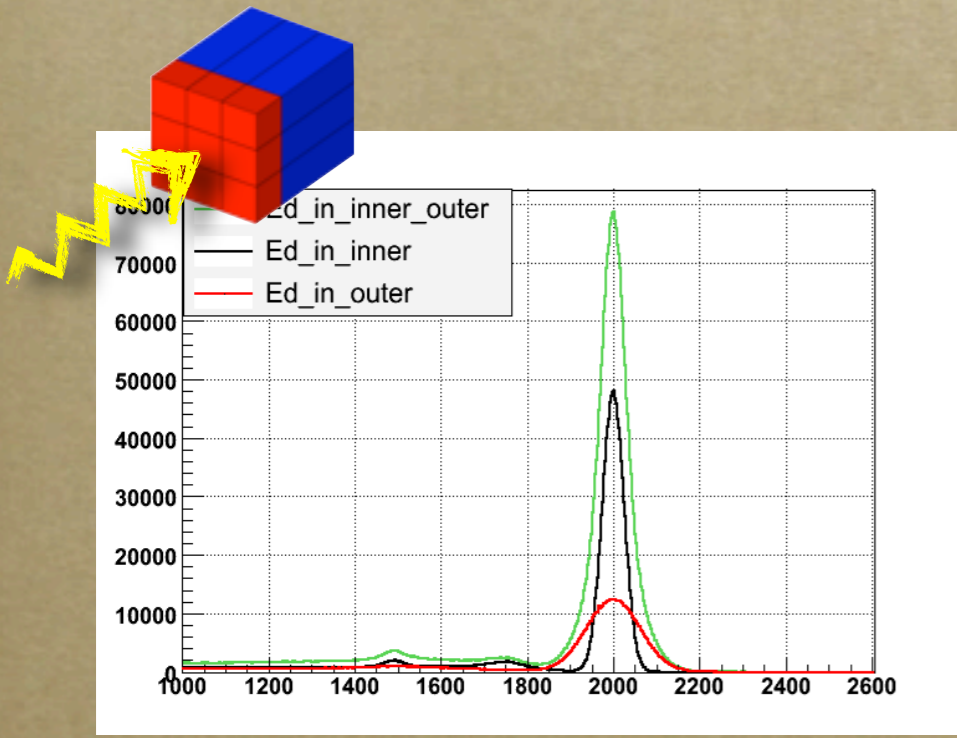


1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Discrimination γ -n ...



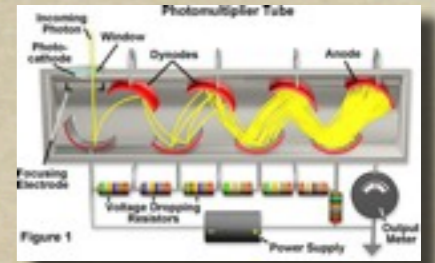
$\Delta T \sim 680$ ps



Energy sharing between the two layers *simu*

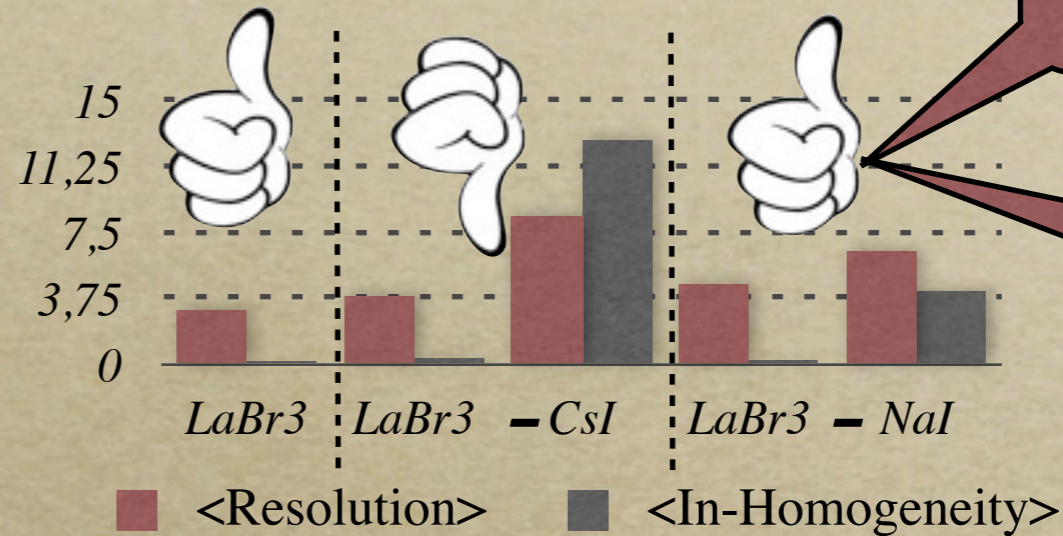
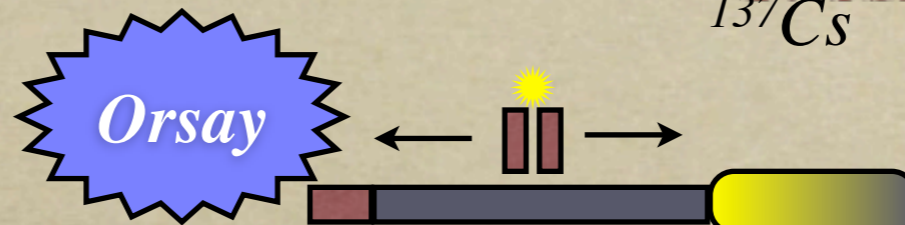
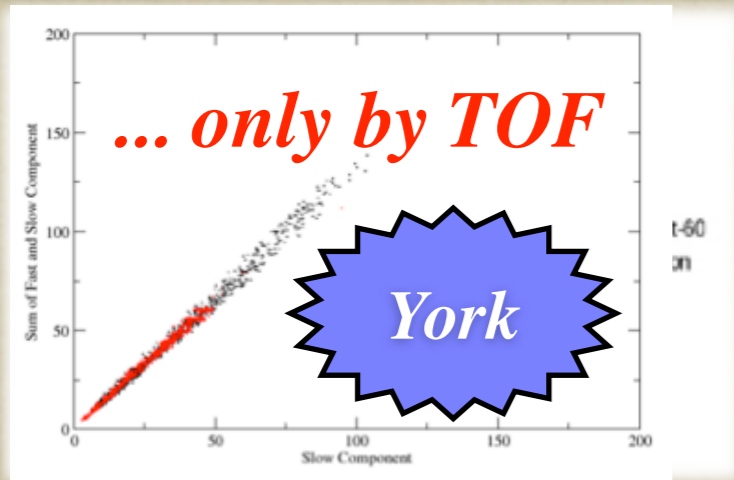


Signal collection



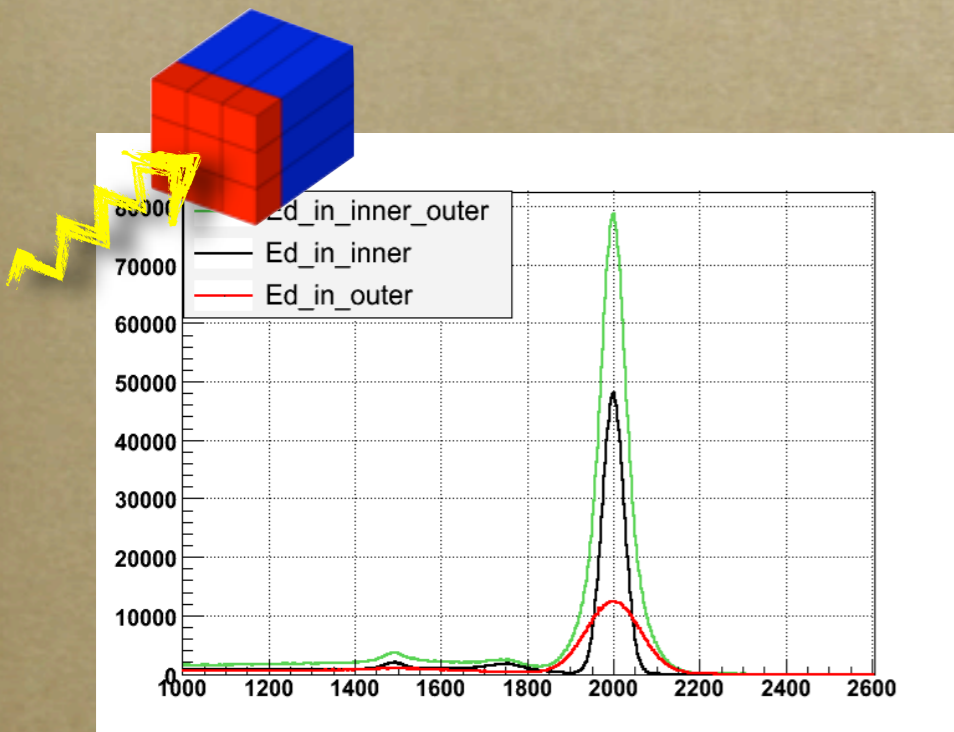
1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Discrimination γ -n ...



linearity (<12MeV)
PM R7723

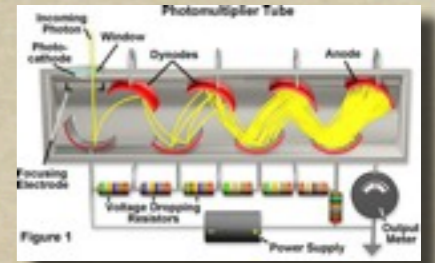
$\Delta T \sim 680$ ps



Energy sharing between the two layers *simu*

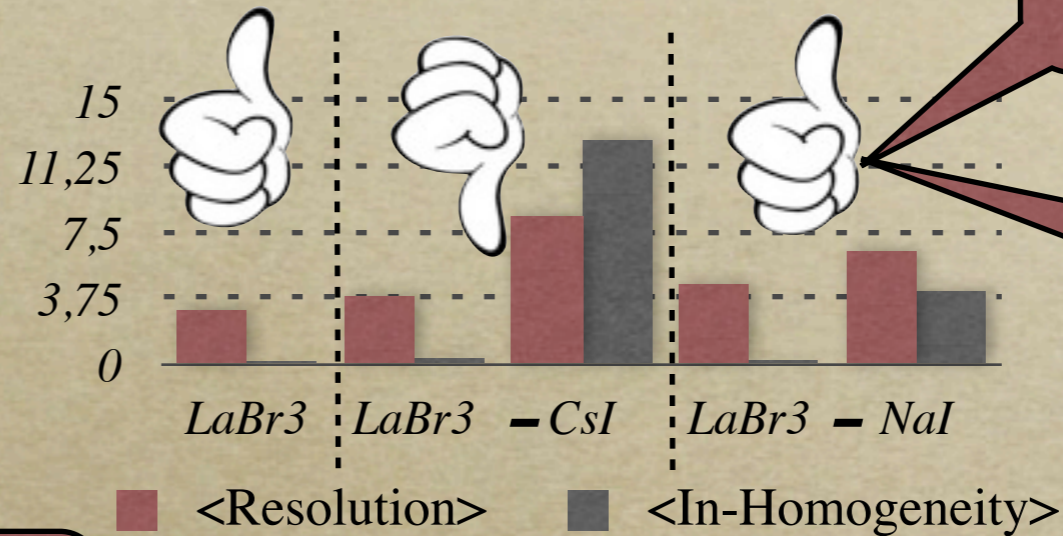
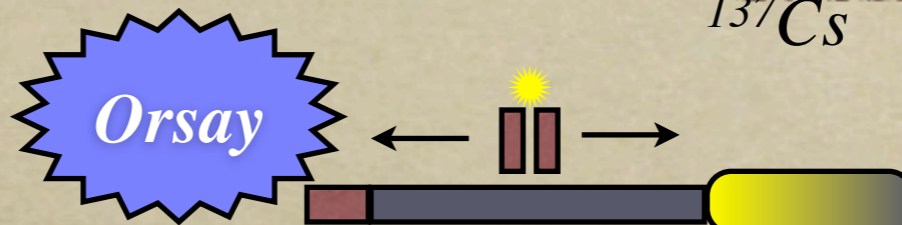
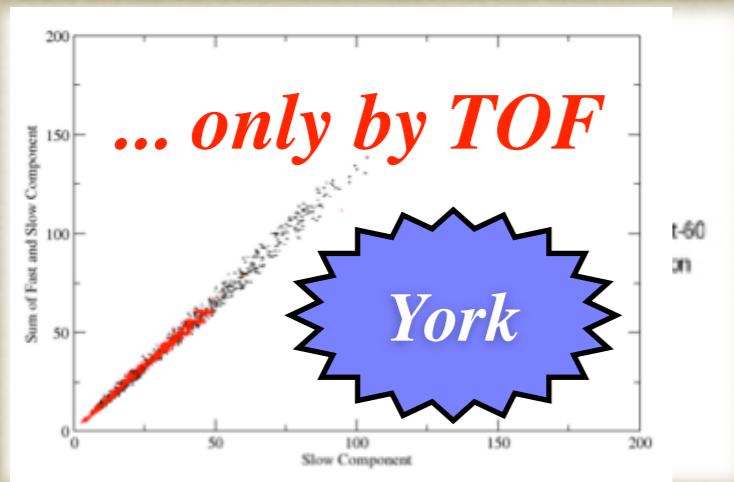


Signal collection



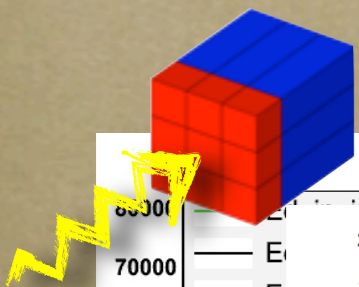
1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Discrimination γ -n ...

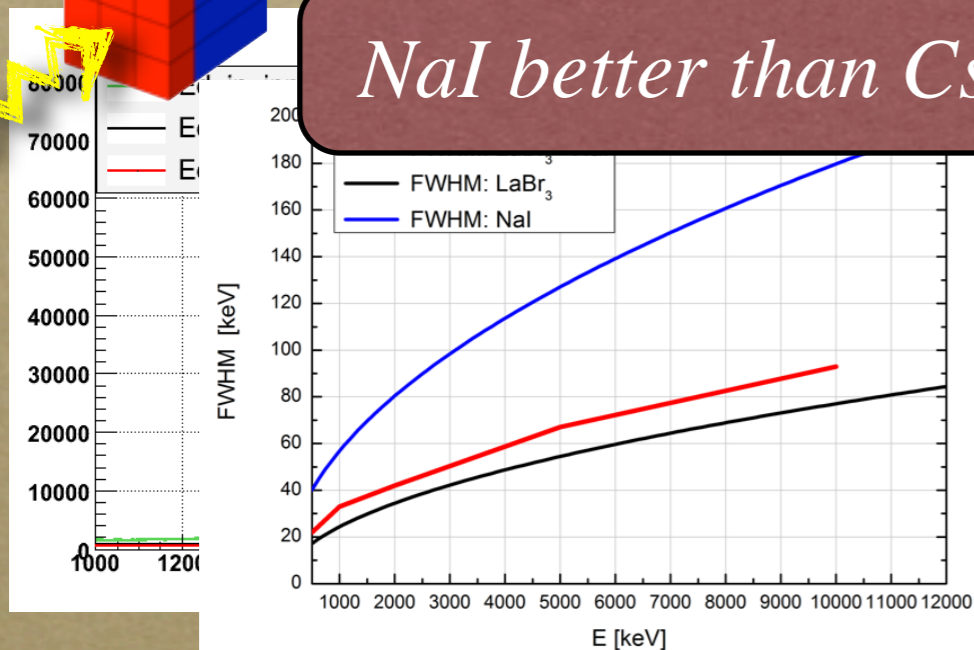


linearity (<12MeV)
PM R7723

$\Delta T \sim 680$ ps



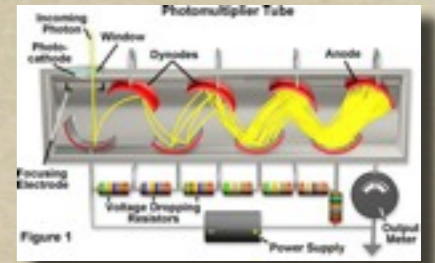
NaI better than CsI



Energy sharing between the two layers *simu*

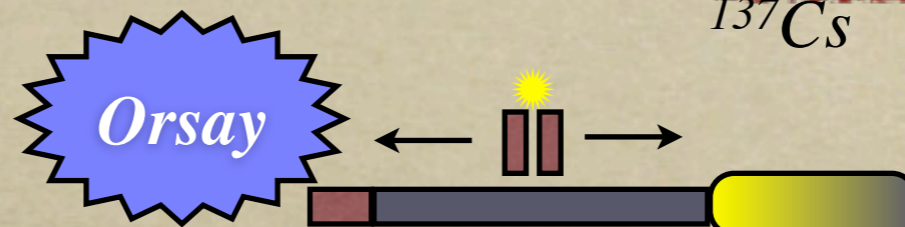
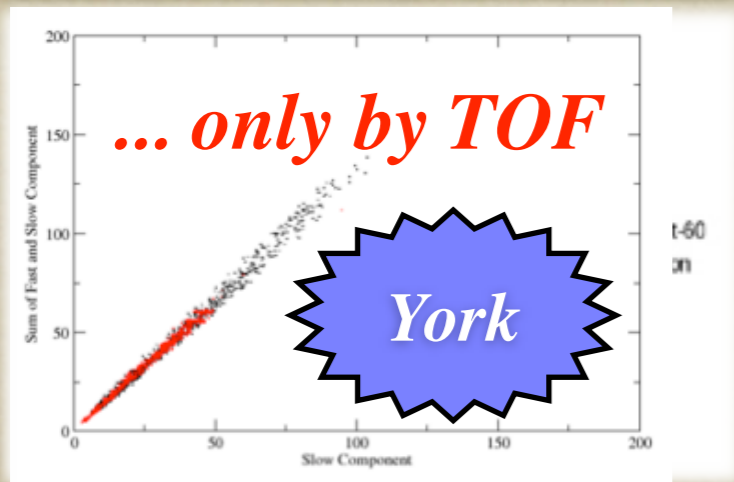


Signal collection

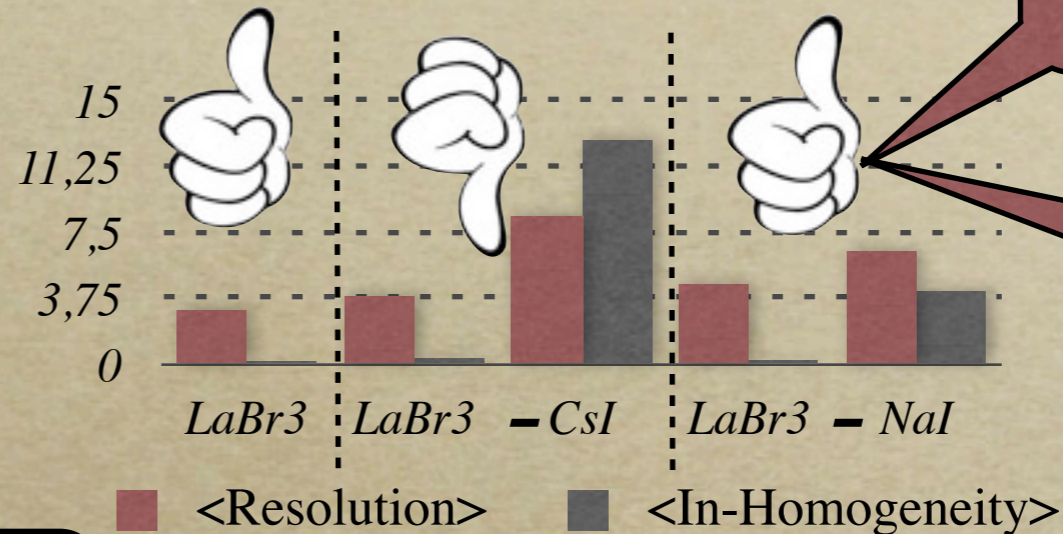


1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

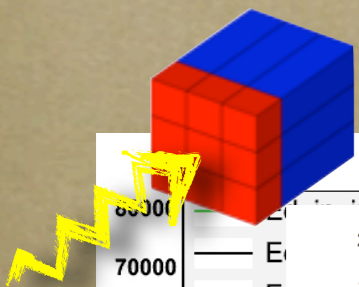
Discrimination γ -n ...



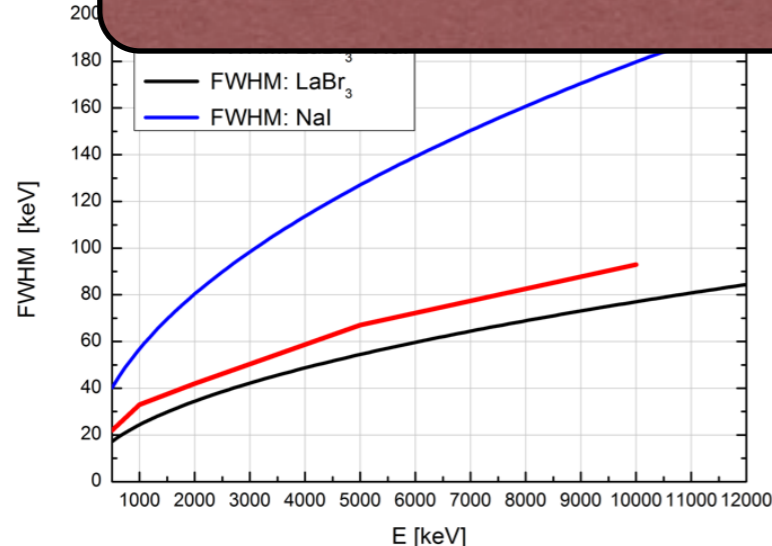
linearity (<12MeV)
PM R7723



$\Delta T \sim 680$ ps



NaI better than CsI



Pure LaBr3 or LaBr3::NaI

9 phoswich ordered

To be done :

full Δe - Δt measurements (source+beam)

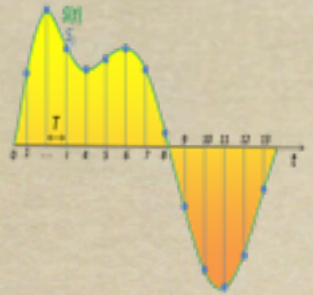
choice of the best PM

resolution, linearity, efficiency, addback

Energy sharing between the two layers *simu*

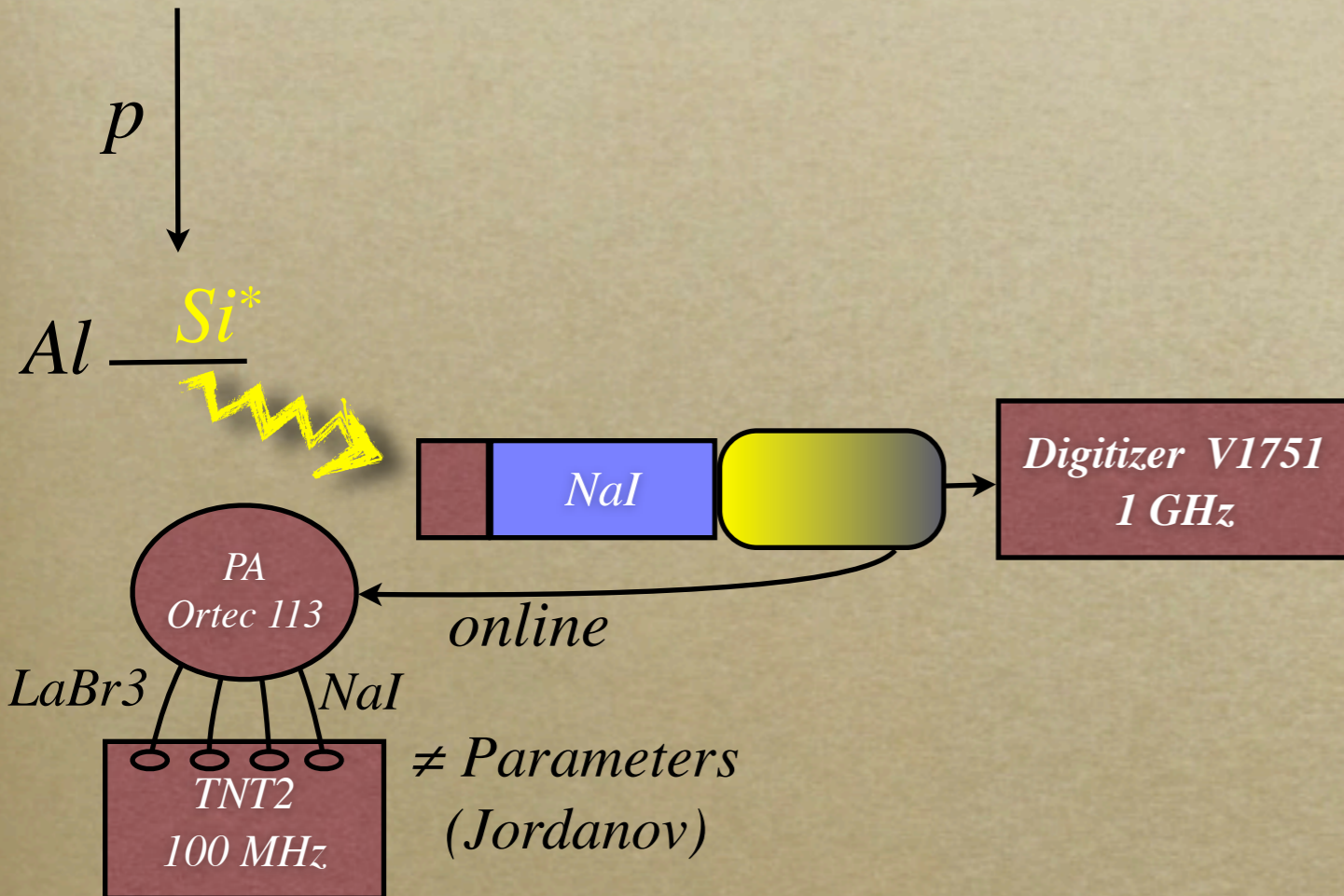


Signal processing



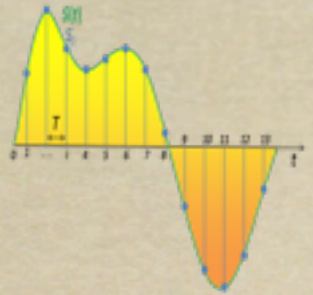
1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Strasbourg



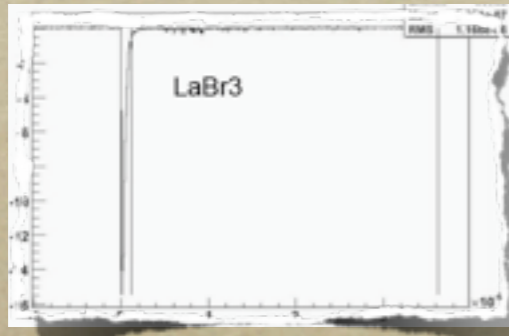


Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Strasbourg



p

Al $\xrightarrow{Si^*}$



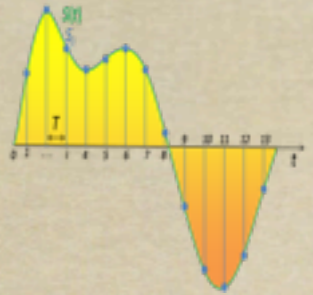
online

\neq Parameters
(Jordanov)

TNT2
100 MHz

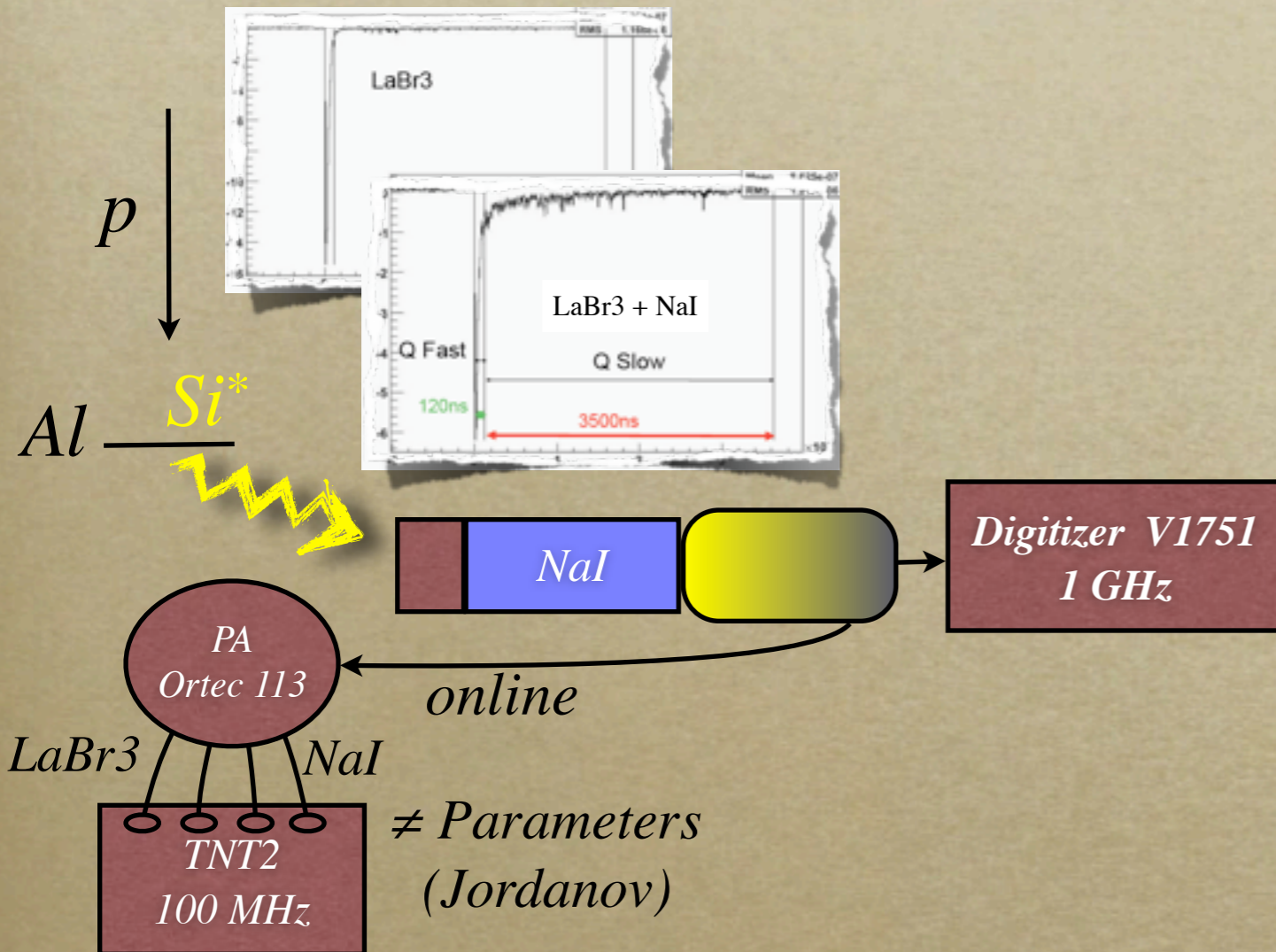


Signal processing



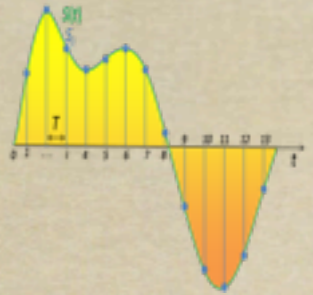
1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Strasbourg



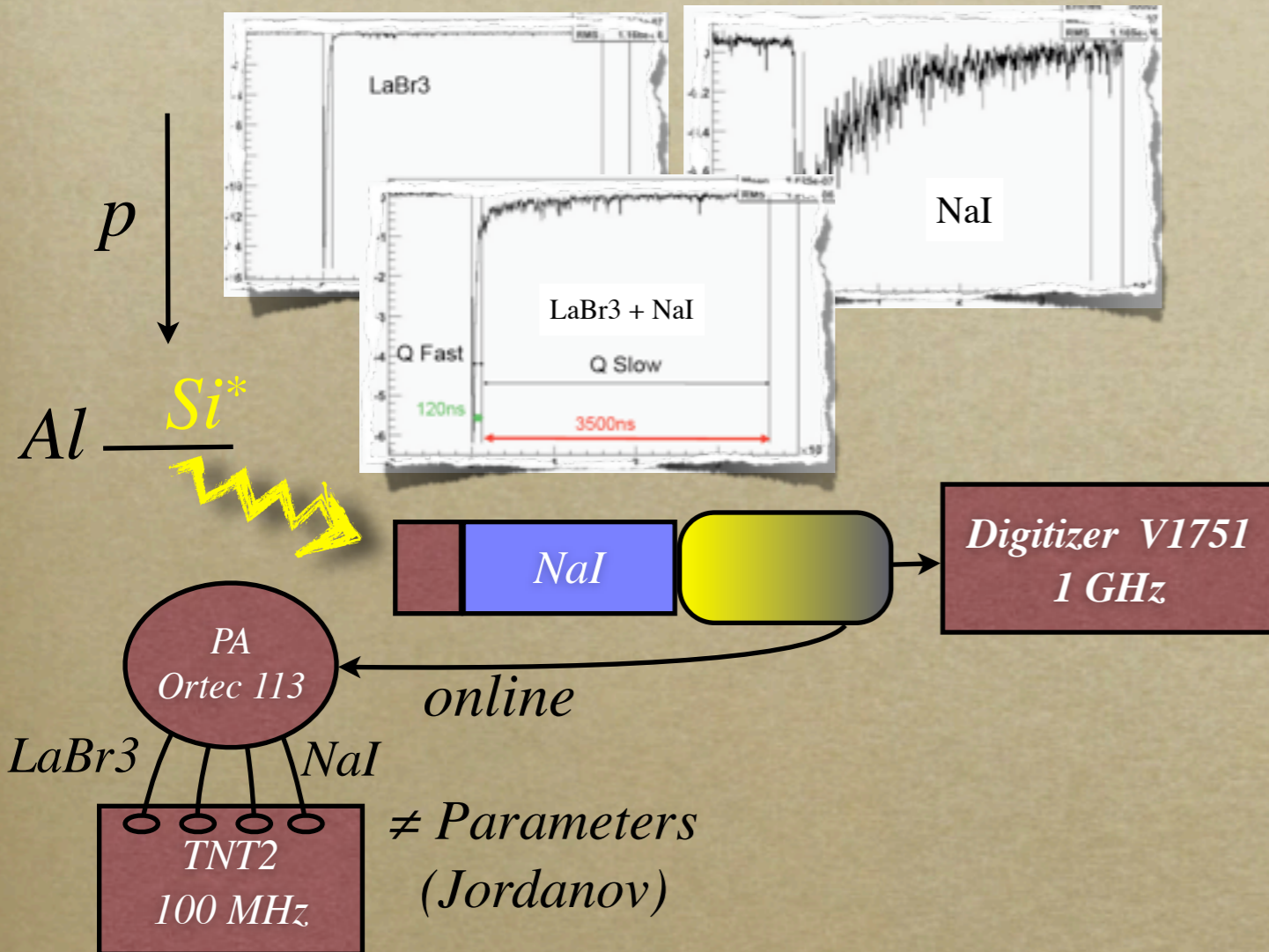


Signal processing



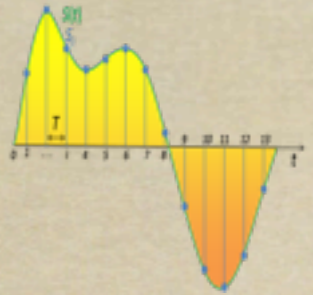
1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Strasbourg



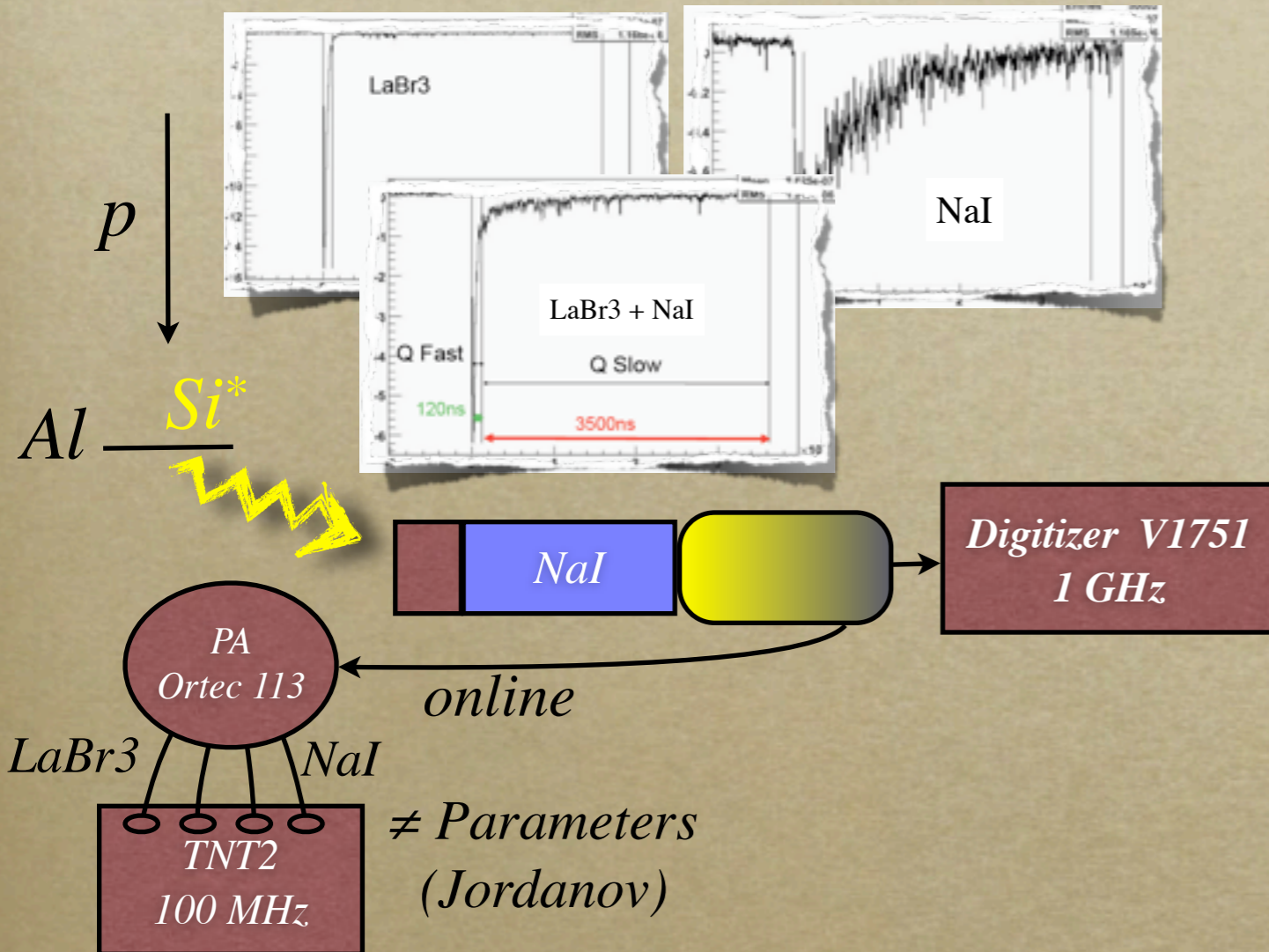


Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Strasbourg



LaBr3

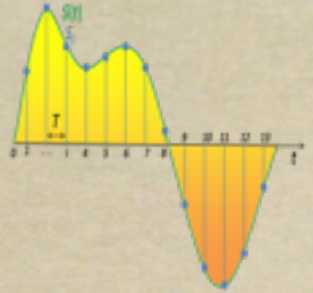
$$R_{511 \text{ keV}} = 5.3\%$$

$$R_{1778 \text{ keV}} = 2.7\%$$

$$R_{10762 \text{ keV}} = 1\%$$

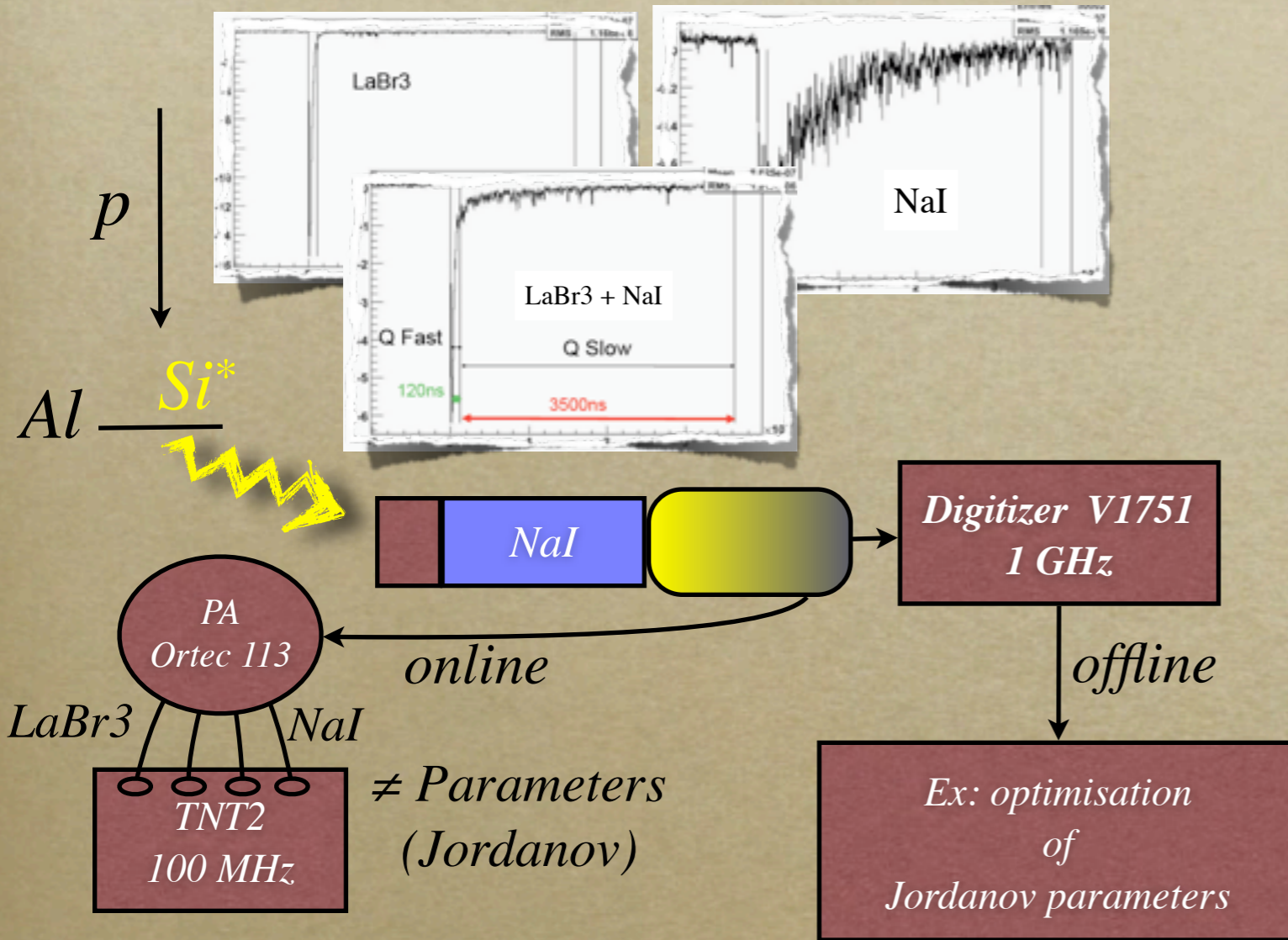


Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Strasbourg



LaBr3

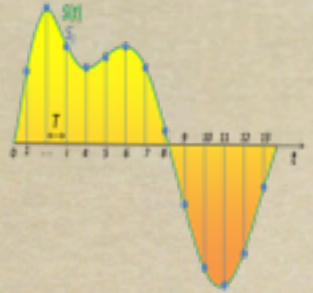
$$R_{511 \text{ keV}} = 5.3\%$$

$$R_{1778 \text{ keV}} = 2.7\%$$

$$R_{10762 \text{ keV}} = 1\%$$

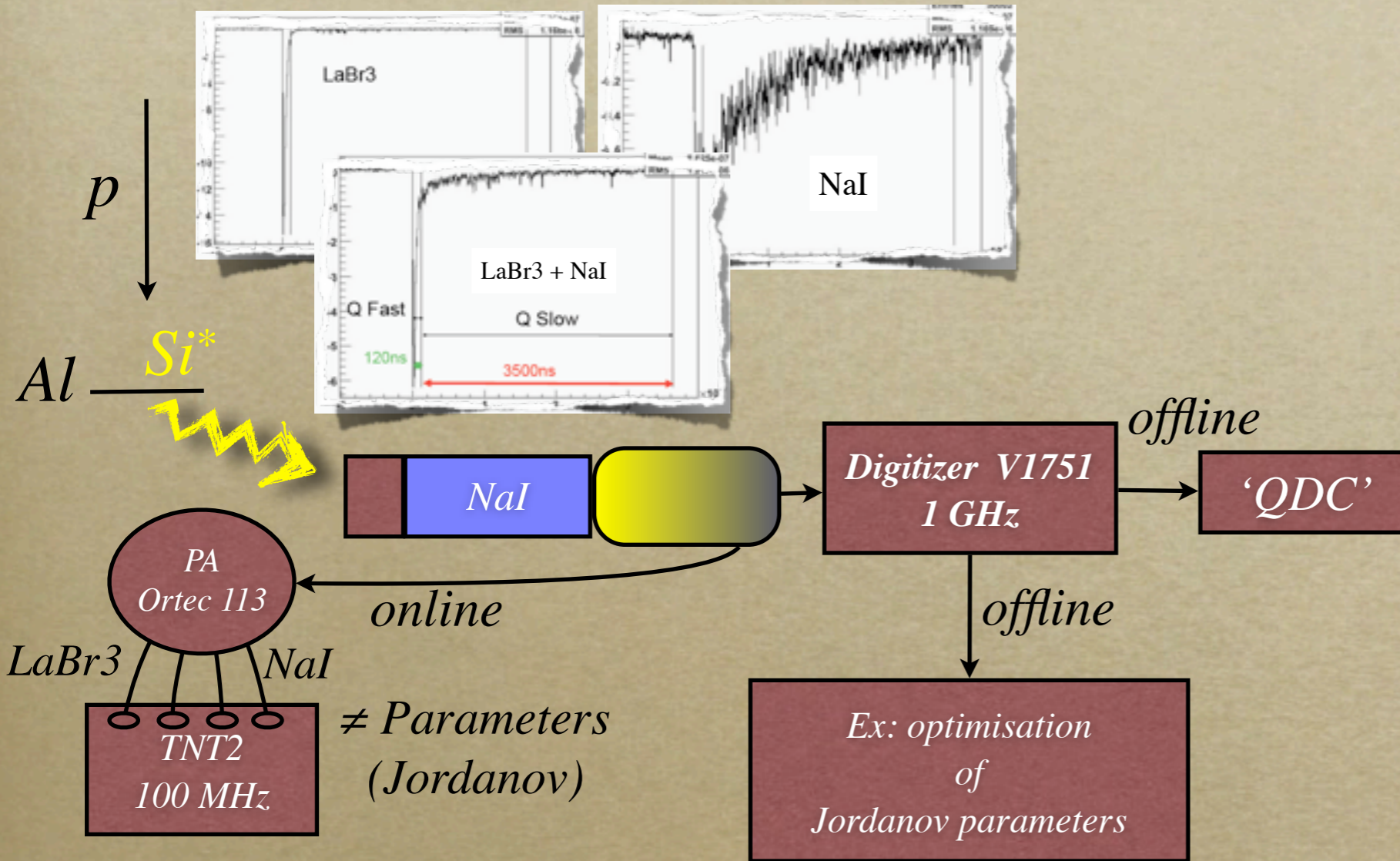


Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI

Strasbourg



LaBr3

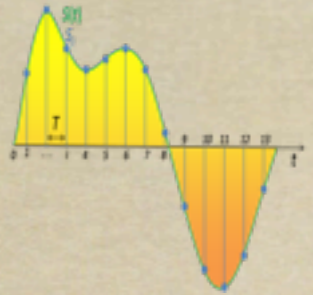
$$R_{511 \text{ keV}} = 5.3\%$$

$$R_{1778 \text{ keV}} = 2.7\%$$

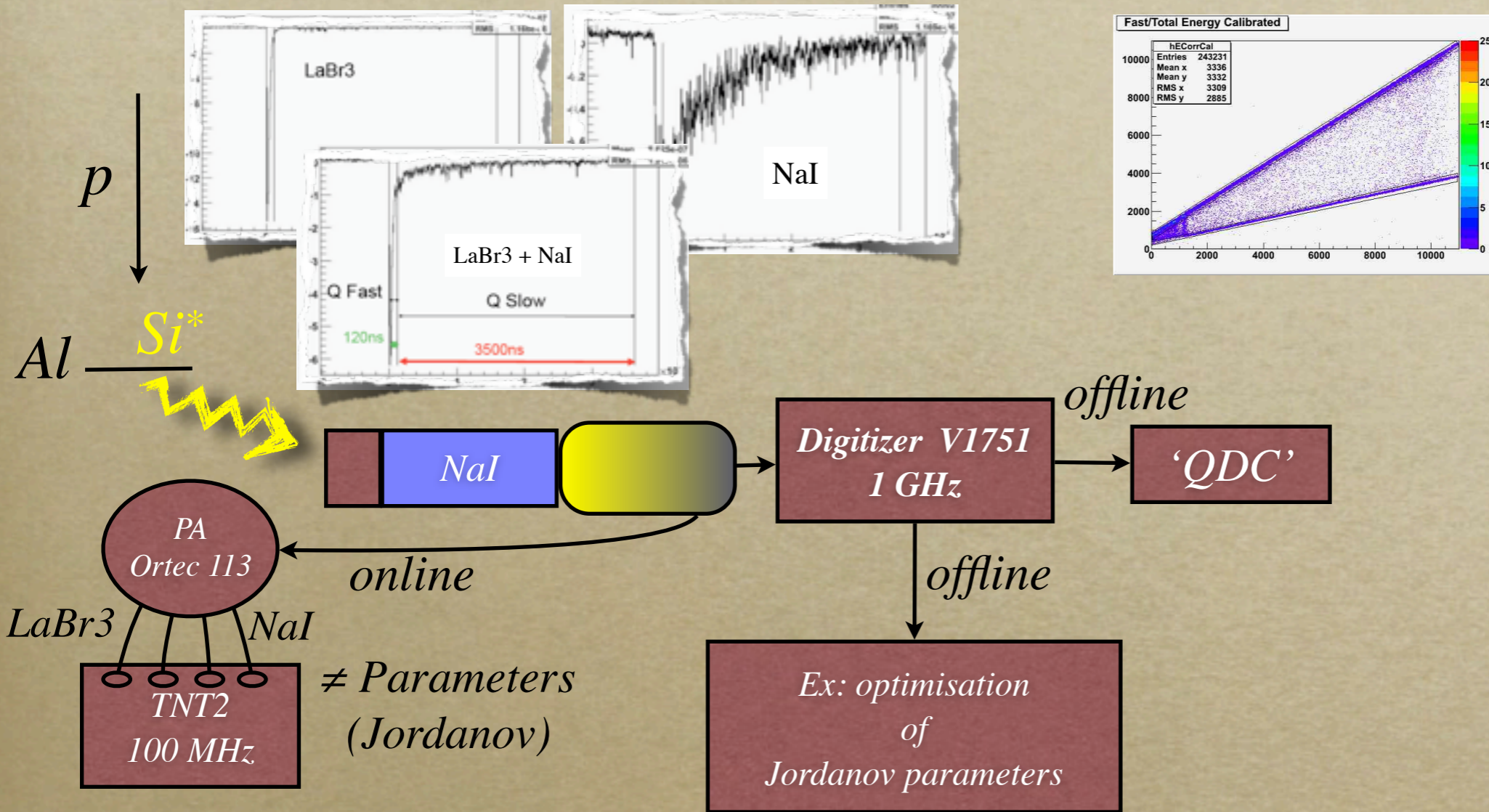
$$R_{10762 \text{ keV}} = 1\%$$



Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI



Strasbourg

LaBr3

$$R_{511 \text{ keV}} = 5.3\%$$

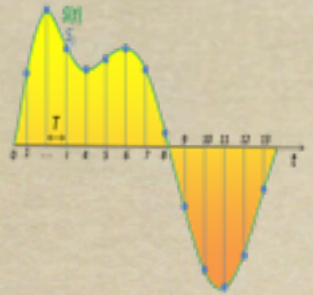
$$R_{1778 \text{ keV}} = 2.7\%$$

$$R_{10762 \text{ keV}} = 1\%$$

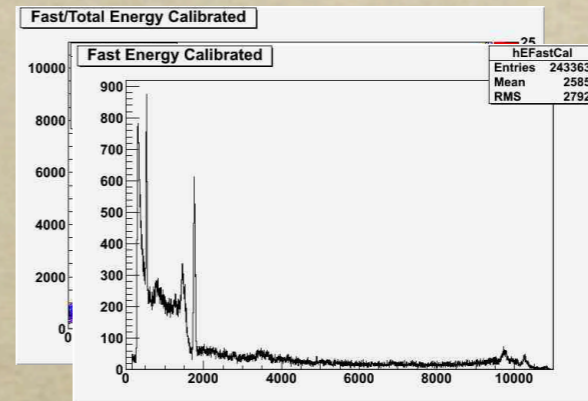
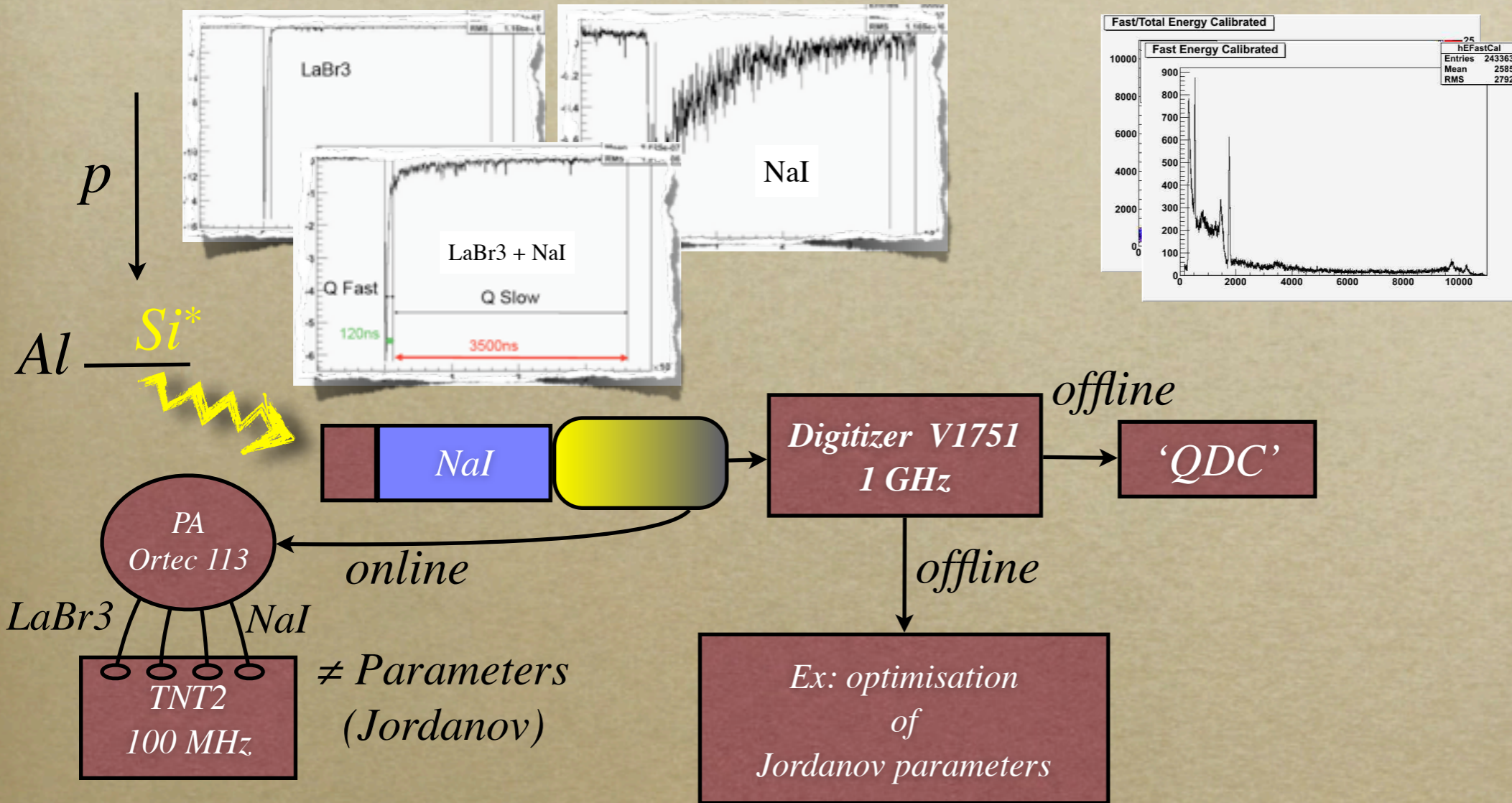
\neq Parameters
(Jordanov)



Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI



Strasbourg

LaBr3

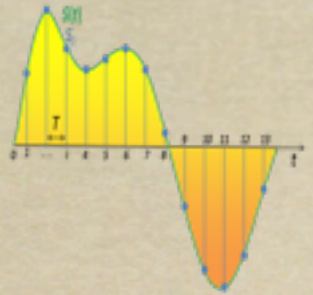
$$R_{511 \text{ keV}} = 5.3\%$$

$$R_{1778 \text{ keV}} = 2.7\%$$

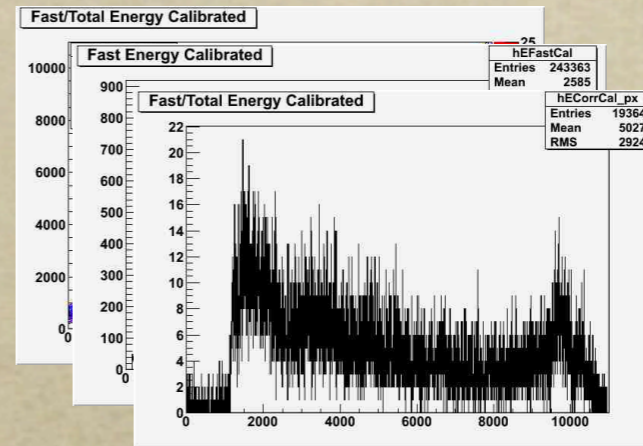
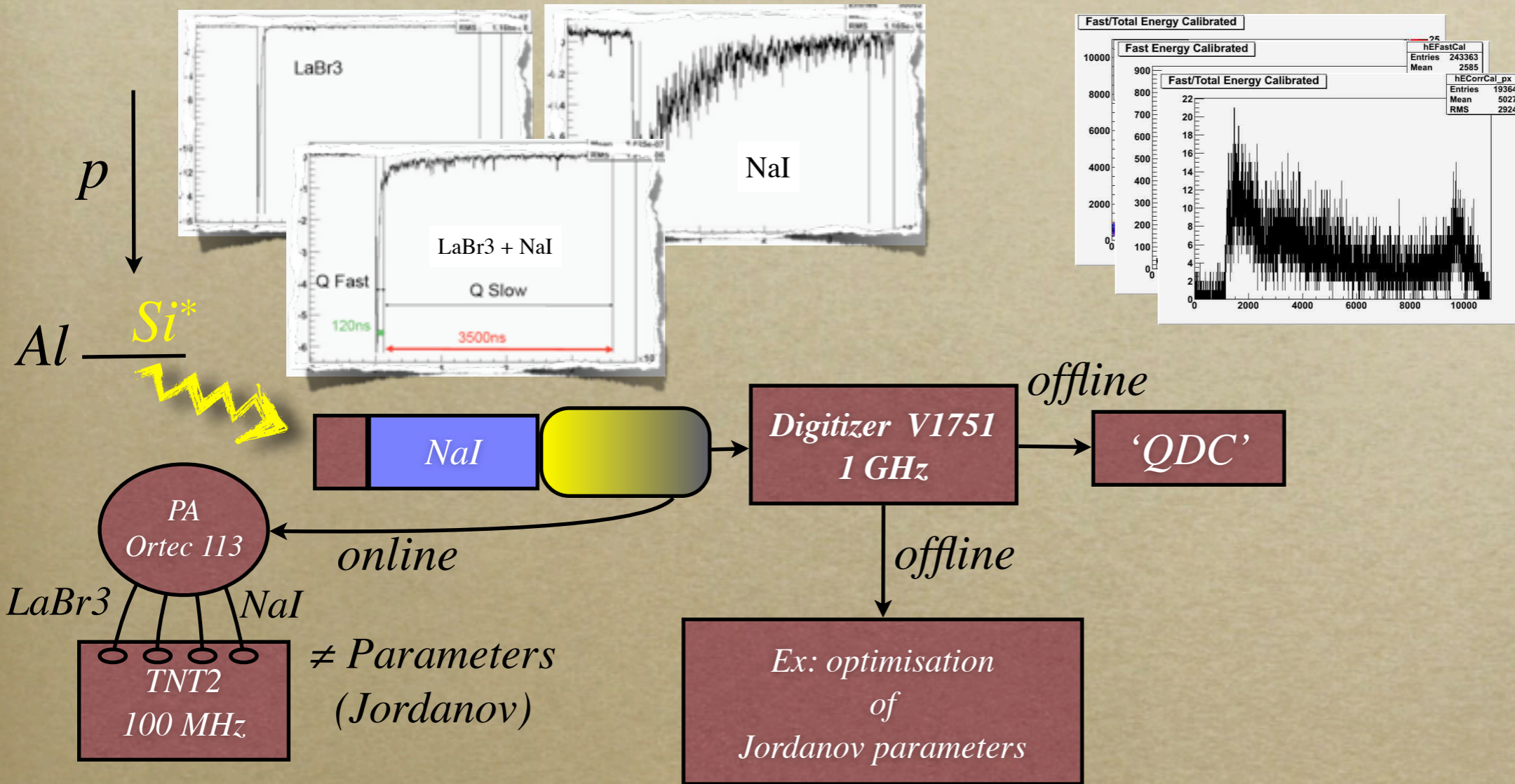
$$R_{10762 \text{ keV}} = 1\%$$



Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI



Strasbourg

LaBr3

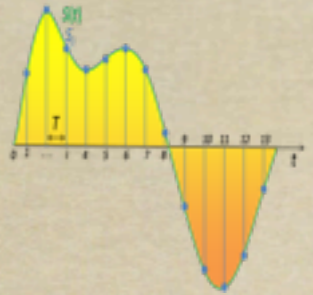
$$R_{511 \text{ keV}} = 5.3\%$$

$$R_{1778 \text{ keV}} = 2.7\%$$

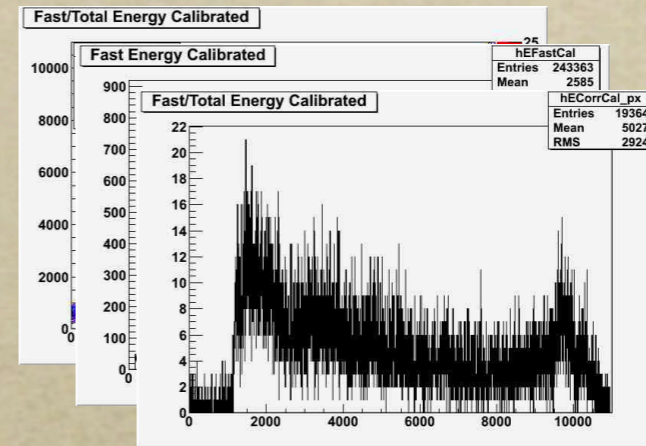
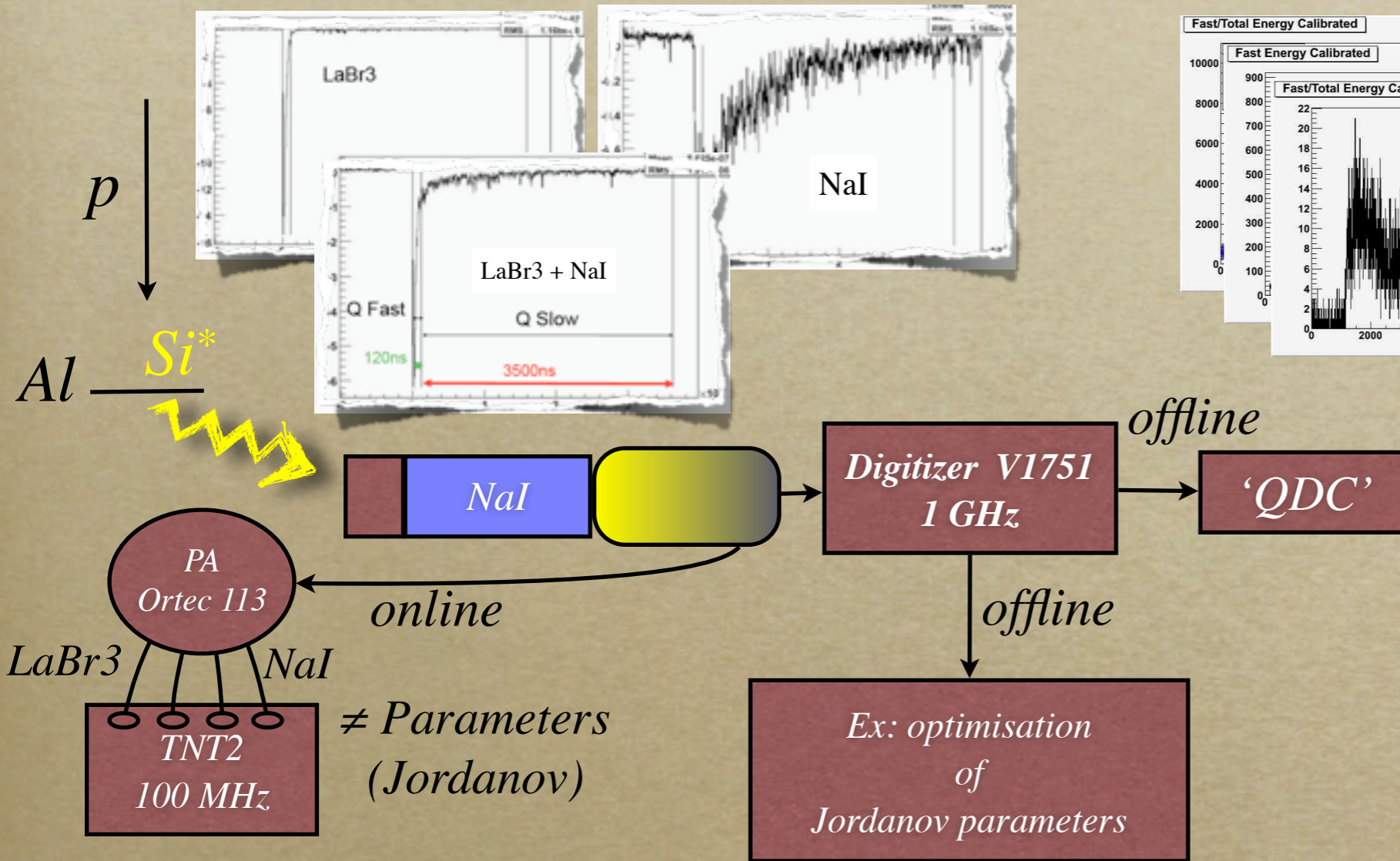
$$R_{10762 \text{ keV}} = 1\%$$



Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI



Strasbourg

LaBr3

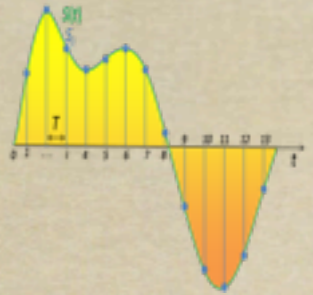
- $R_{511 \text{ keV}} = 4.5\%$
- $R_{1778 \text{ keV}} = 2.4\%$
- $R_{10762 \text{ keV}} = 1\%$

LaBr3

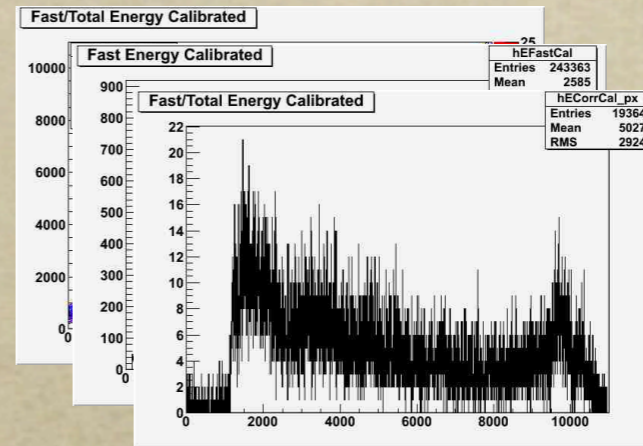
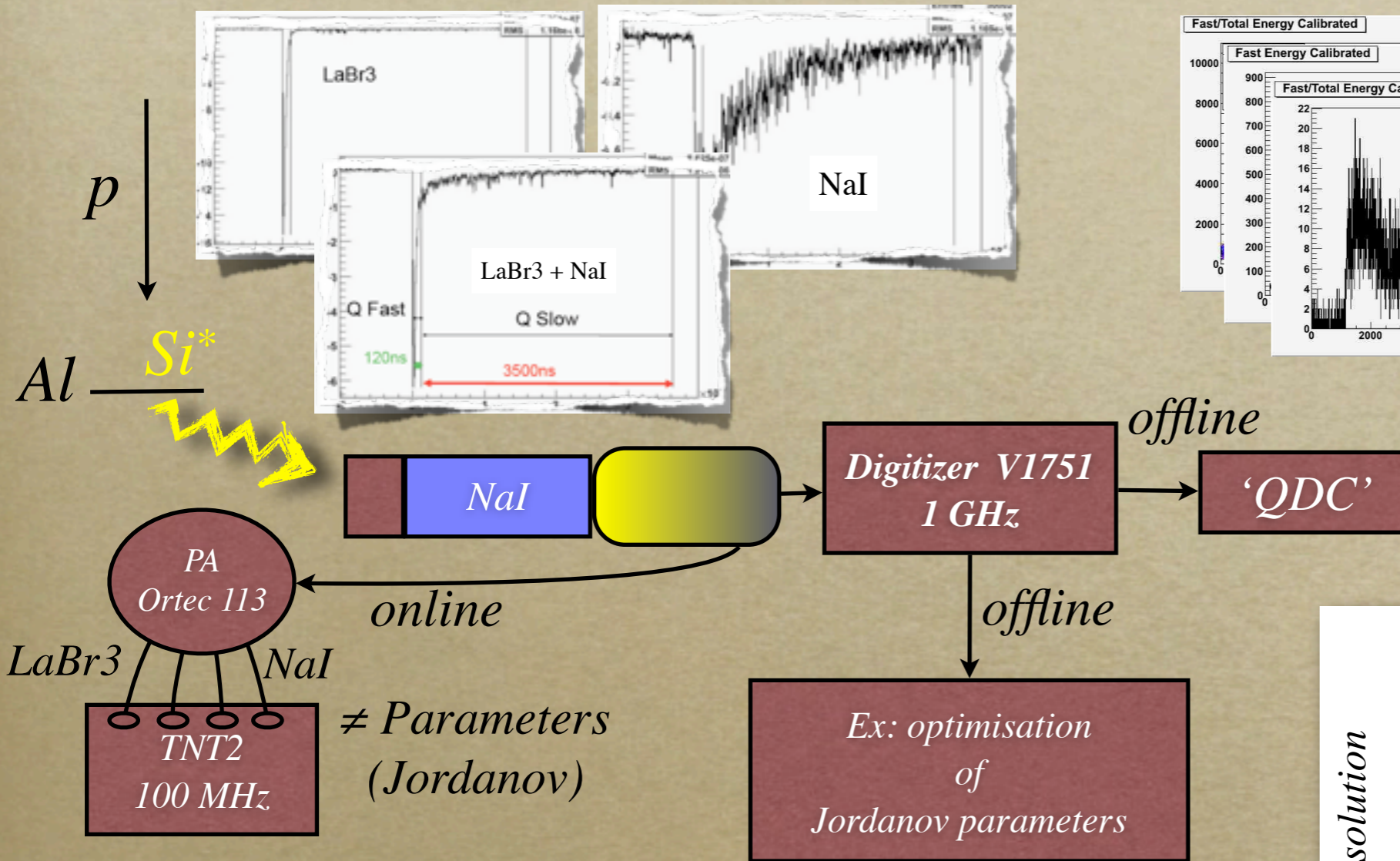
- $R_{511 \text{ keV}} = 5.3\%$
- $R_{1778 \text{ keV}} = 2.7\%$
- $R_{10762 \text{ keV}} = 1\%$



Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI



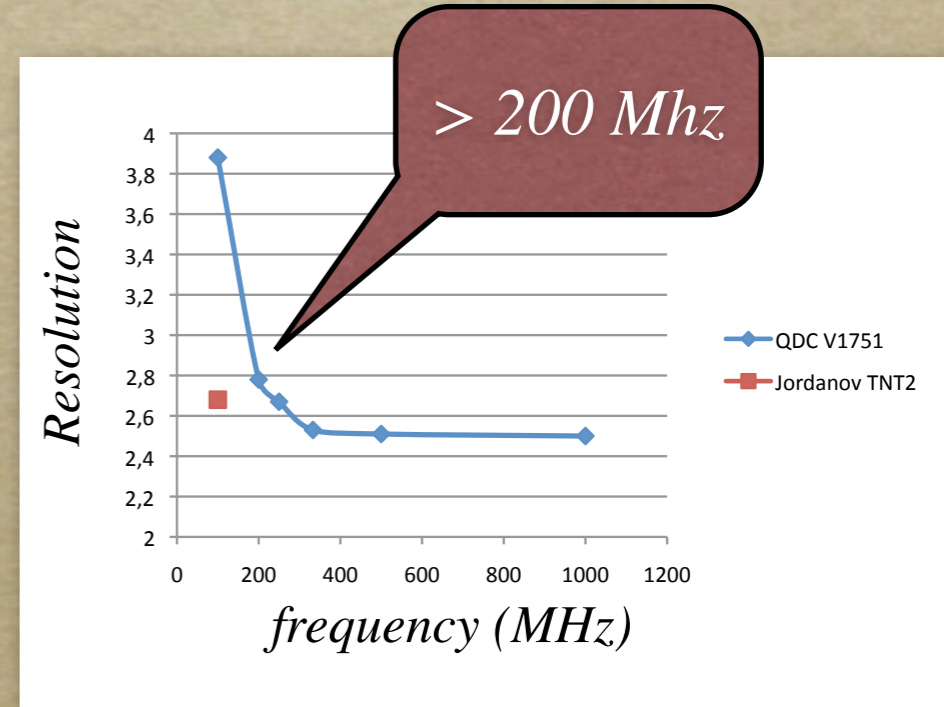
Strasbourg

LaBr3

$R_{511 \text{ keV}} = 4.5\%$
 $R_{1778 \text{ keV}} = 2.4\%$
 $R_{10762 \text{ keV}} = 1\%$

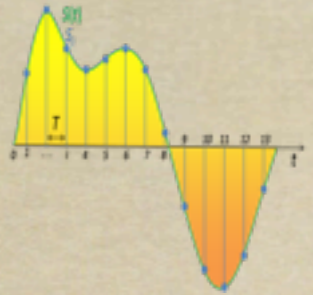
LaBr3

$R_{511 \text{ keV}} = 5.3\%$
 $R_{1778 \text{ keV}} = 2.7\%$
 $R_{10762 \text{ keV}} = 1\%$

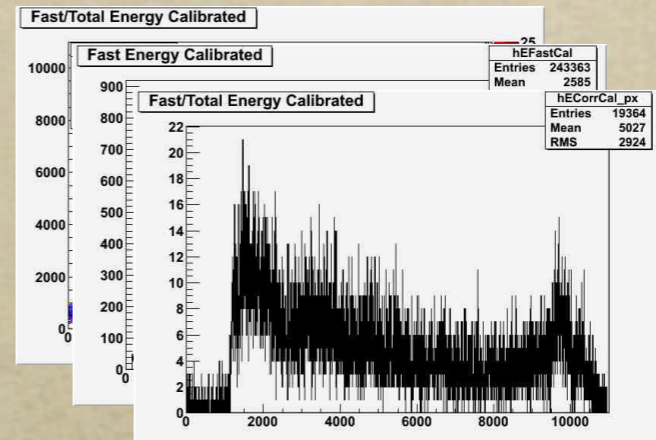
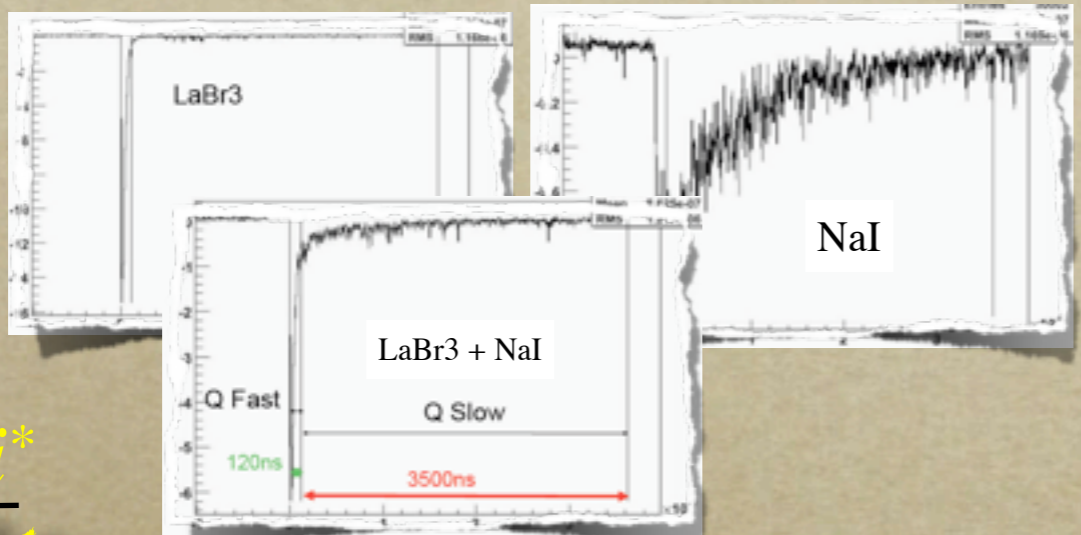
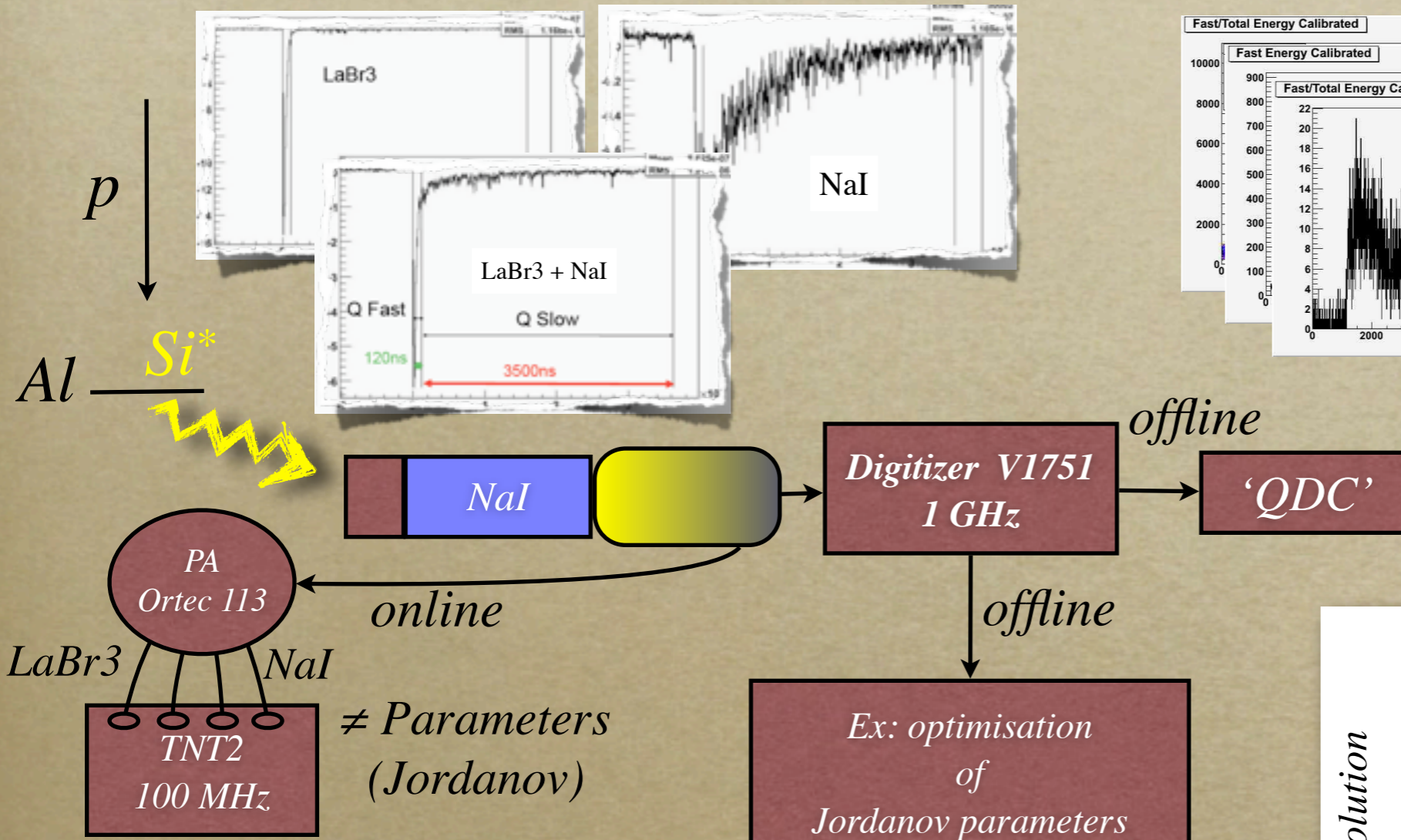




Signal processing



1"x2" LaBr3(Ce) + 1"x6" CsI/NaI



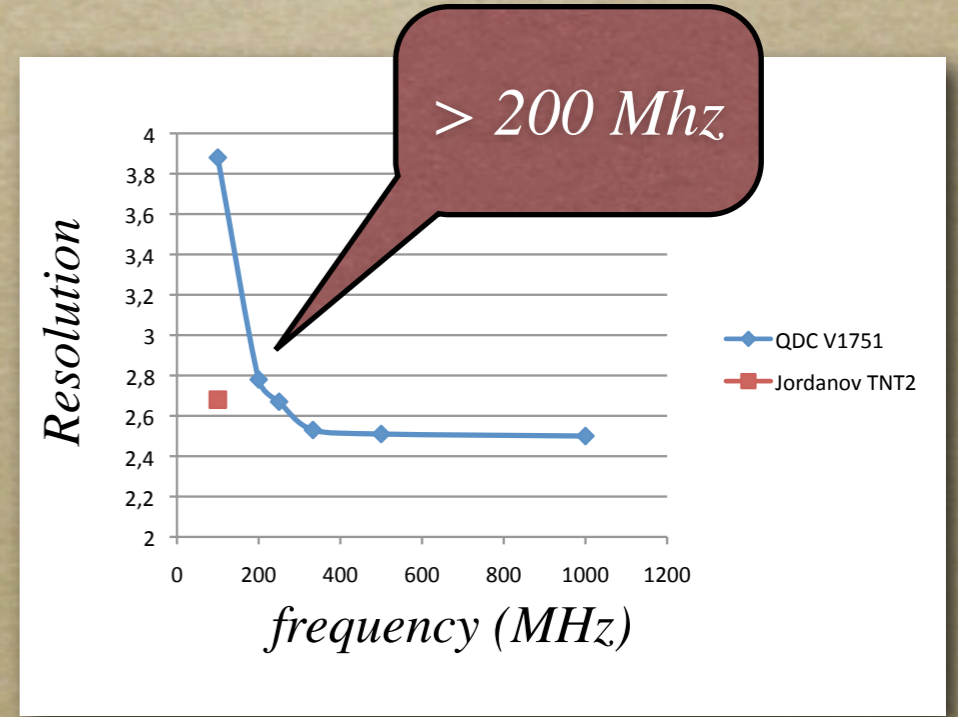
Strasbourg

LaBr3

- $R_{511 \text{ keV}} = 4.5\%$
- $R_{1778 \text{ keV}} = 2.4\%$
- $R_{10762 \text{ keV}} = 1\%$

- LaBr3
- $R_{511 \text{ keV}} = 5.3\%$
 - $R_{1778 \text{ keV}} = 2.7\%$
 - $R_{10762 \text{ keV}} = 1\%$
- LaBr3
- $R_{662 \text{ keV}} = 3.9\%$

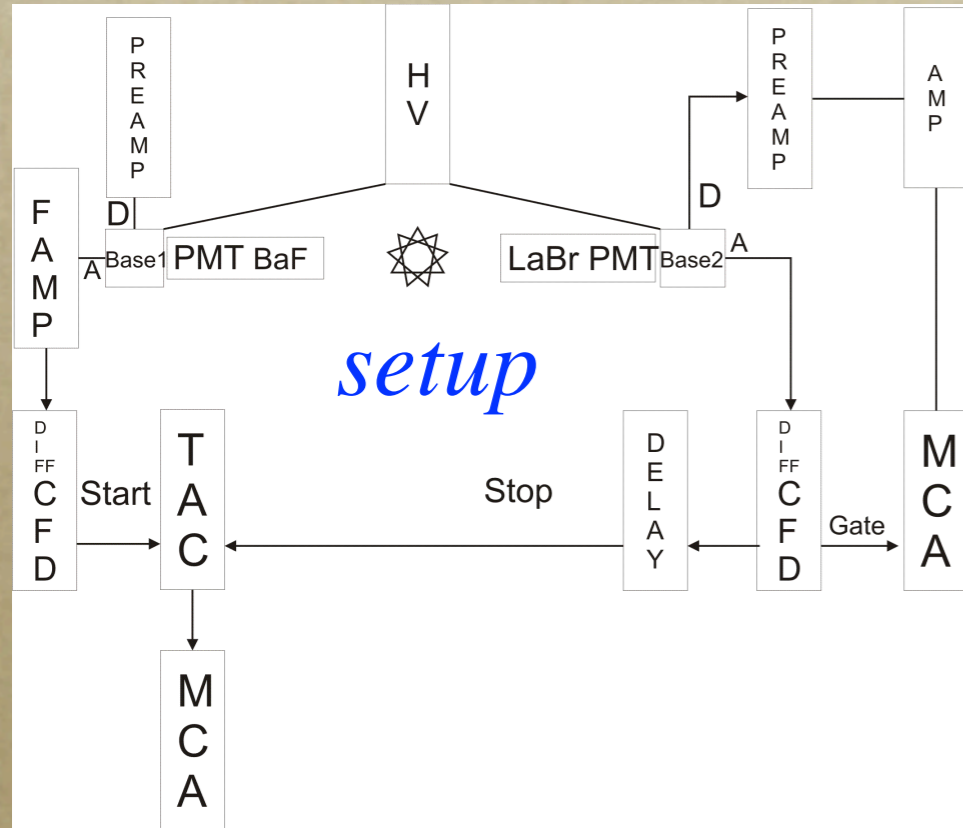
PA cremat 113
TNT2



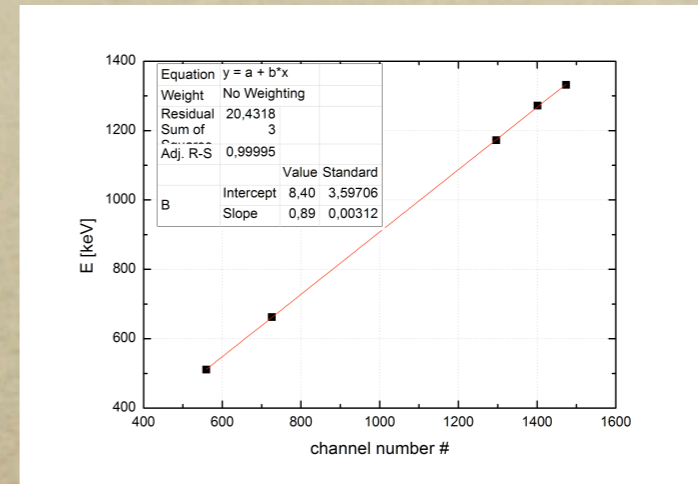


First Tests on LaBr3:NaI

2"x2"x2" LaBr3 + 2"x2"x6" NaI

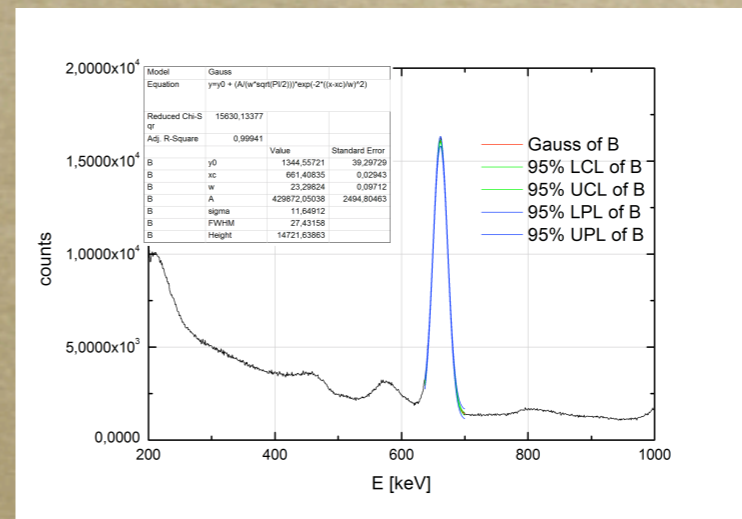
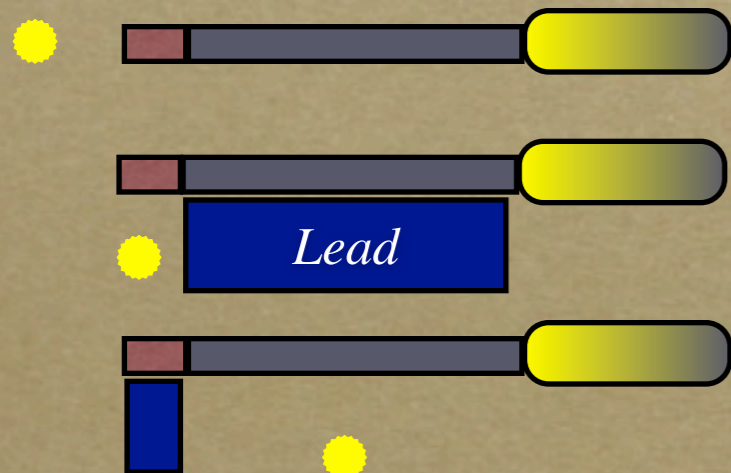


Lineary (Photonis XP3292B PMT) checked



E, T measured with standard NIM electronics

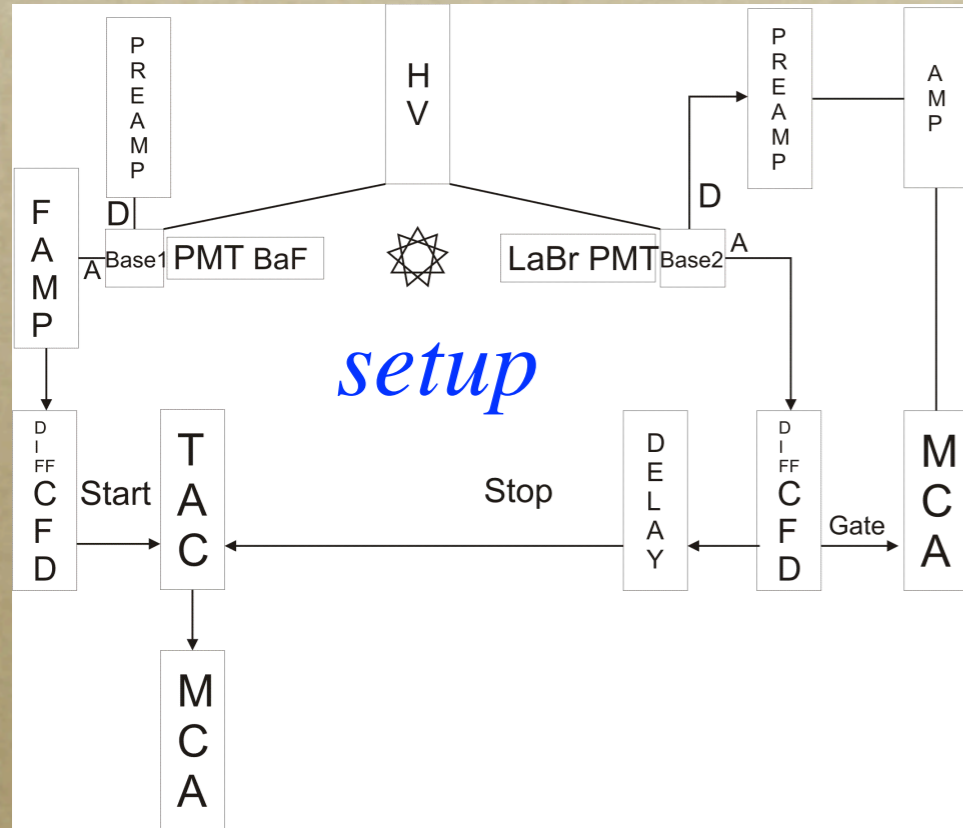
With :



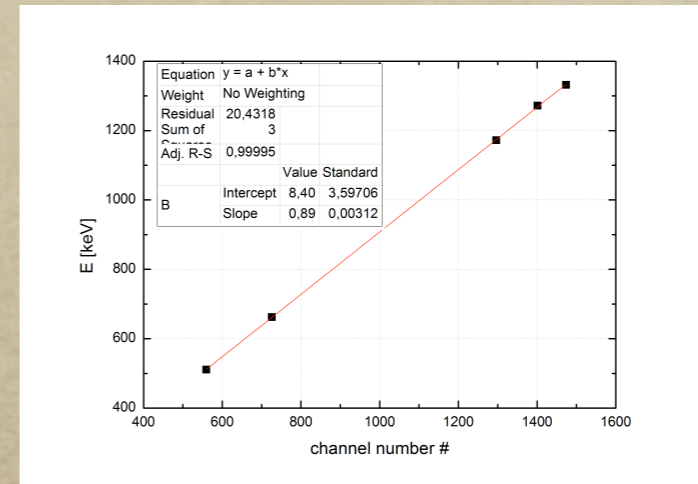


First Tests on LaBr3:NaI

2"x2"x2" LaBr3 + 2"x2"x6" NaI

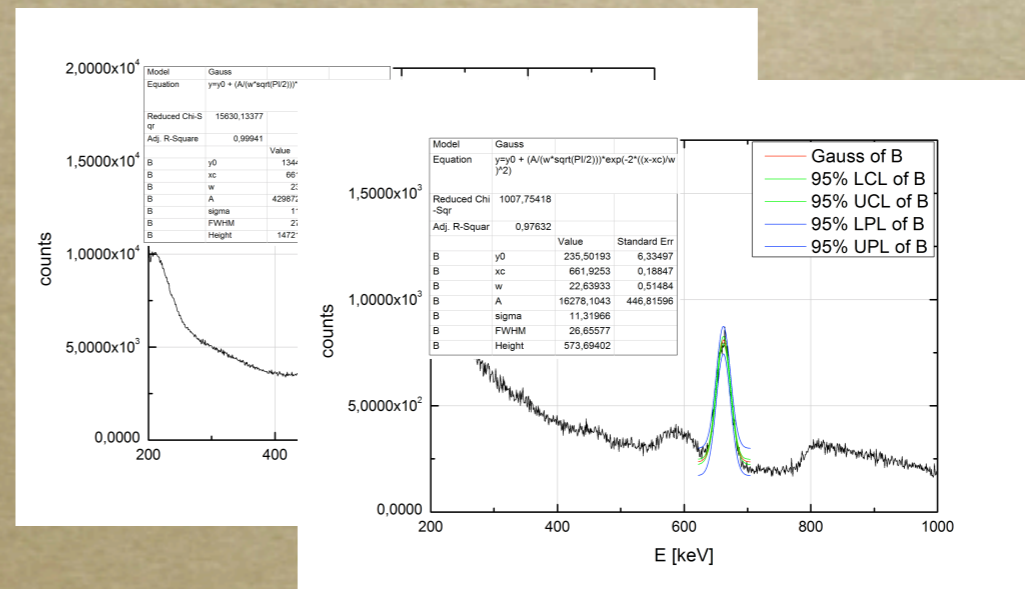
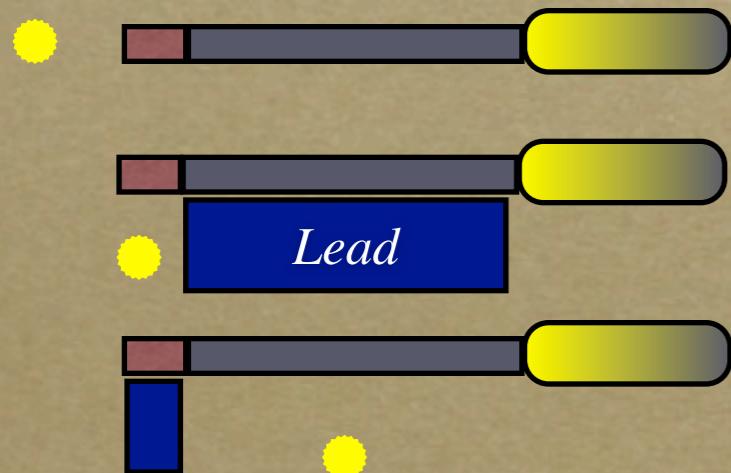


Lineary (Photonis XP3292B PMT) checked



E, T measured with standard NIM electronics

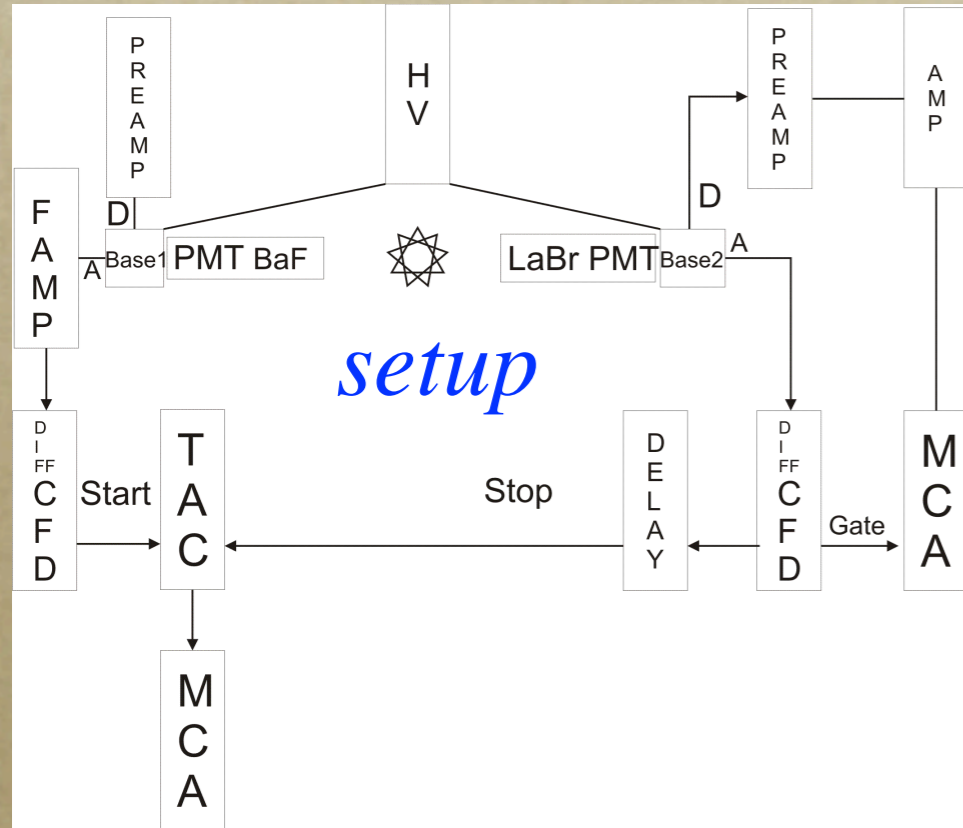
With :



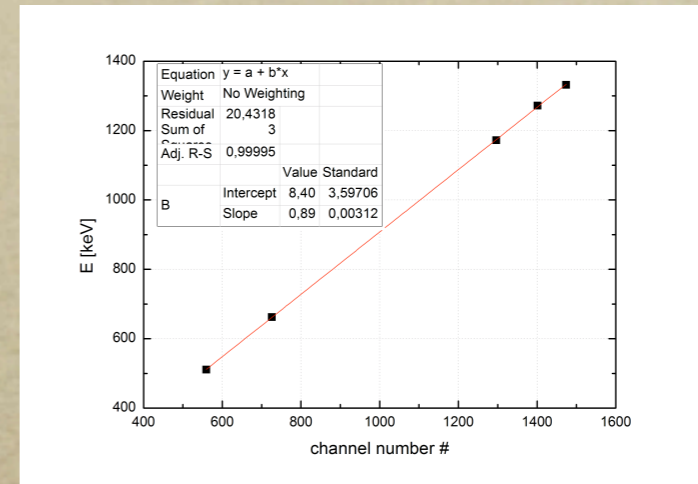


First Tests on LaBr3:NaI

2"x2"x2" LaBr3 + 2"x2"x6" NaI

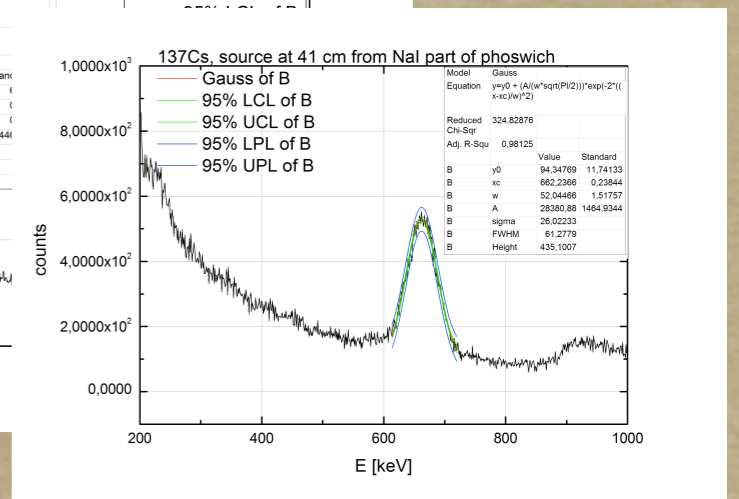
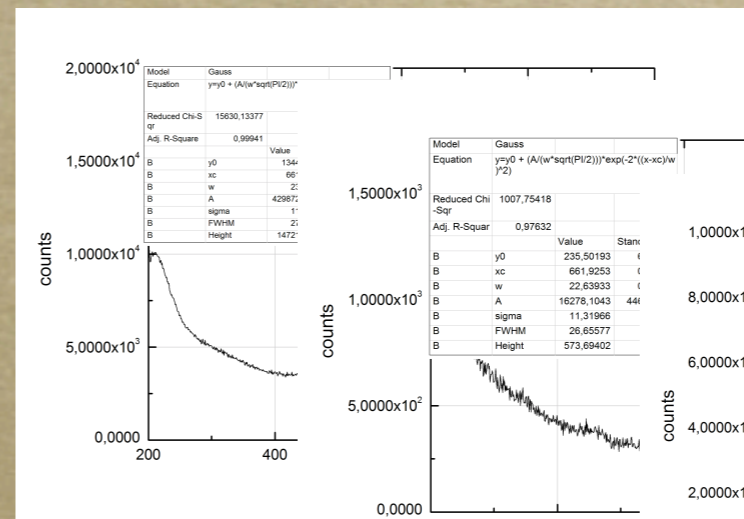
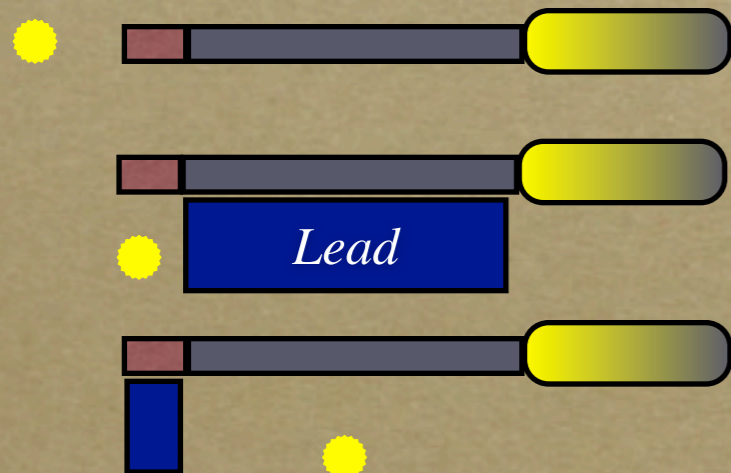


Lineary (Photonis XP3292B PMT) checked



E, T measured with standard NIM electronics

With :





First Tests on LaBr₃:NaI

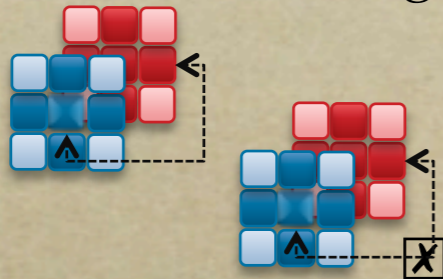
2"x2"x2" LaBr₃ + 2"x2"x6" NaI

Phoswich/ PMT	Energy resolution (%)					Energy Gated Timing Resolution (ps)		Linearity ¹³⁷ Cs, ⁶⁰ Co
	@662keV			@1332keV		@511keV	@1.1- 1.4MeV	
	St. Gobain	LaBr ₃	NaI	LaBr ₃	NaI			
IFJ PAN A0_207/ XP3292B	4.1	4.0	~11 side	2.9 side	6.0 side	710	530	Very good
IFJ PAN A0_209/ XP3292B	4.3	4.1	8.9 side	3.0 side	5.6 side	770	580	Very good
IPNO/ R7723-100	4.5	4.3	6.5-7 side	3.3		500	400	Very good
IPHC/ R7723-100	4.8	4.7	7.5-8	3.4	5.3			Very good
Single cubic 2"x2" LaBr ₃ / XP3292B	3.6	3.6	X	2.8	X	520	370	Very good

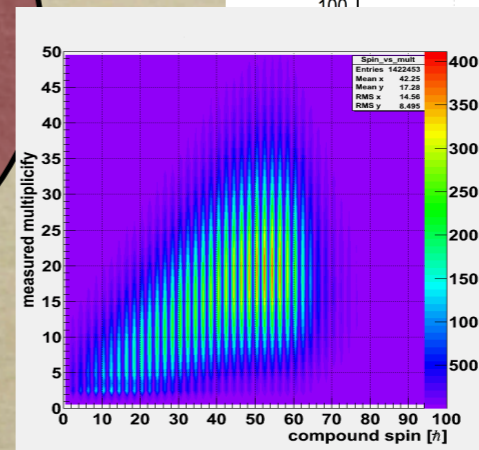
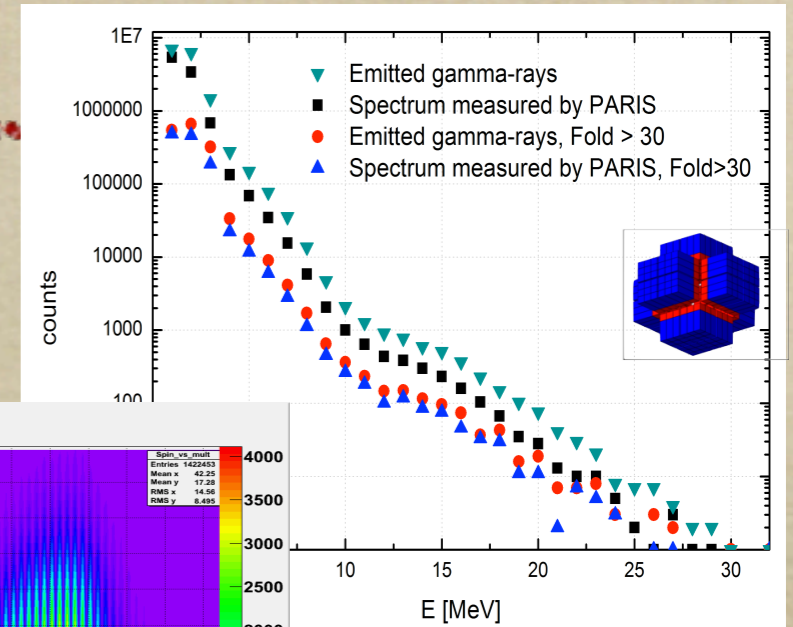


Other activities

Studies in reconstruction algorithms



Simulations



*GDR event generator
(Cascade MC)*



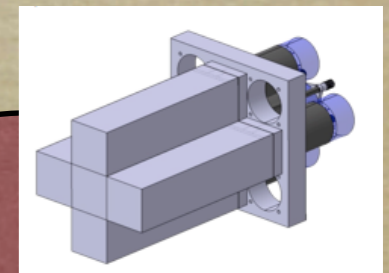
**Study of collective modes of excitations
in the neutron-rich Ba region
via fusion-evaporation reactions**

Spiral2 Day1-Phase2 Lol

Adam Maj (Kraków), Silvia Leoni (Milano) - spokespersons
Christell Schmitt - GANIL Liaison

A. Maj^a, K. Mazurek^{ac}, M. Kmiecik^a, P. Bednarczyk^a, M. Ciemala^a, B. Fornal^a, W. Meczynski^a,
J. Grebosz^a, J. Styczeń^a, M. Zieblinski^a et al.,
S. Leoni^b, A. Bracco^b, G. Benzoni^b, F. Camera^b, F.C.L. Crespi^b, N. Blasi^b, B. Million^b,
O. Wieland^d, P.F. Bortignon^b, G. Colo^b, E. Vigezzi^b et al.,
Ch. Schmitt^e, J.P. Wieleczko^e, M. Lewitowicz^e, G. de France^e, M. Reimund^e

*Tests on
detectors*



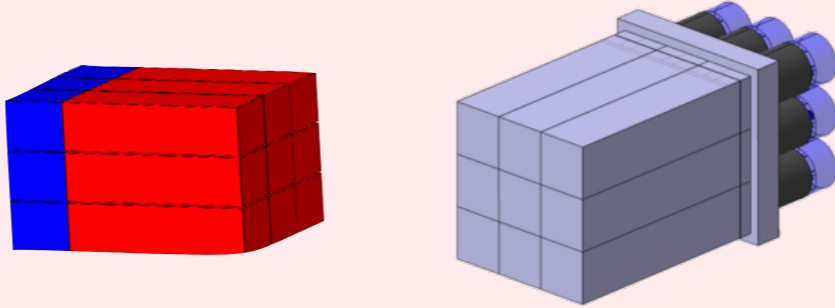
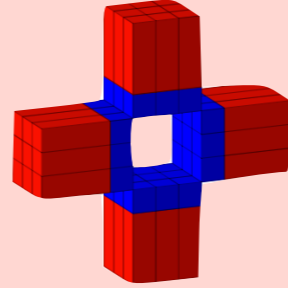
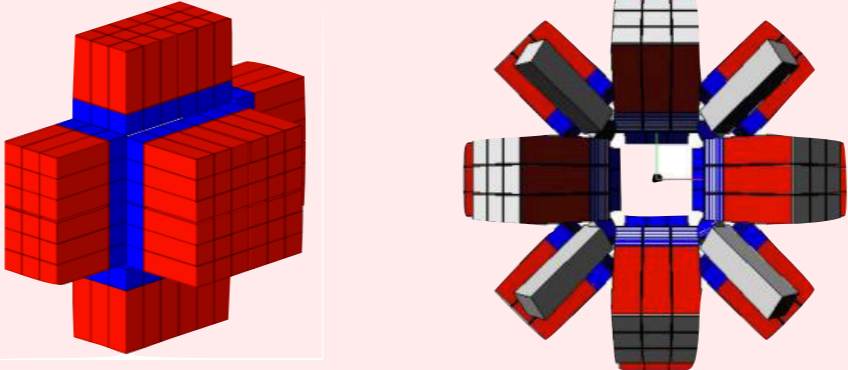
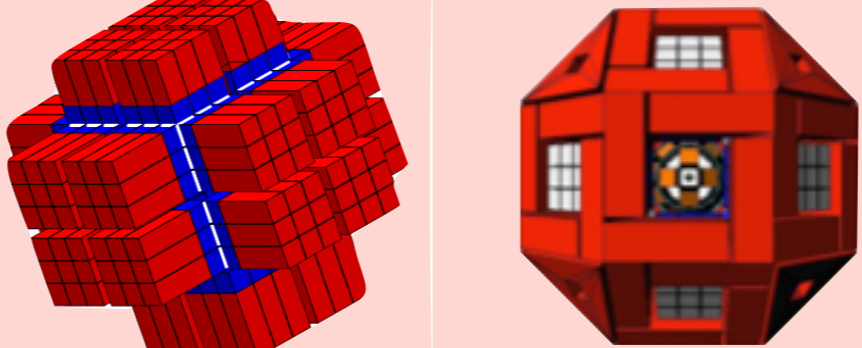
Physics cases

Mechanics



PARIS phases & costs

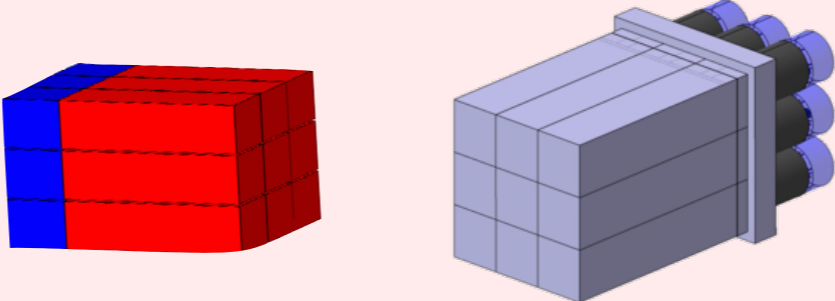
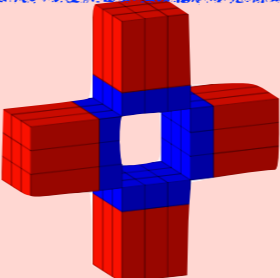
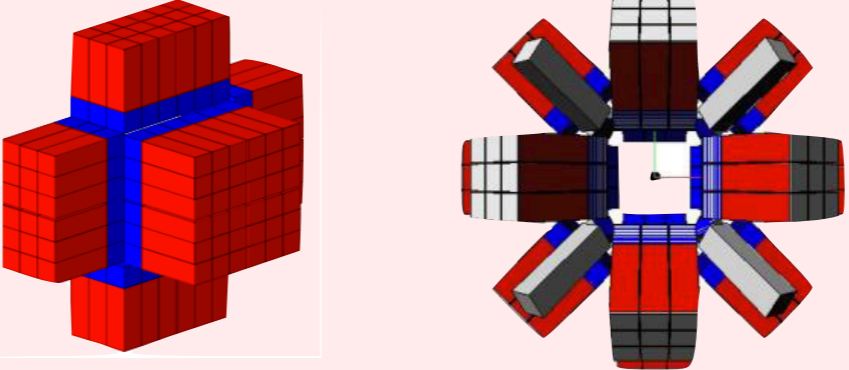
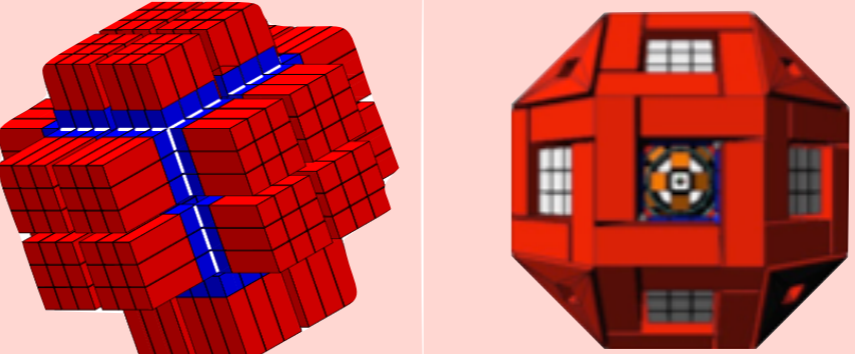


<p><i>Phase 1</i></p> <p>PARIS Prototype</p>	<p>1 cluster: 9 phoswiches</p>		<p>200 k€</p>	<p>Decided Funds: SP2PP, ANR, Orsay, Strasbourg, Kraków, Mumbai</p> <p>Tests in-beam and with sources</p>
<p><i>Phase 2</i> 2013</p> <p>PARIS Demonstrator</p>	<p>4 clusters: 36 phoswiches</p>		<p>800 k€</p>	<p>Only if Phase1 validated Funds: MoU</p> <p>Ph1Day1 exp@S3</p>
<p><i>Phase 3</i> 2017</p> <p>PARIS 2π</p>	<p>12 clusters: 108 phoswiches</p>		<p>~ 2M€</p>	<p>Only if Phase2 validated Funds: MoU, PARIS consortium</p> <p>Ph2Day1 exp. with AGATA and GASPARD Other exp.</p>
<p><i>Phase 4</i> 2019</p> <p>PARIS 4π</p>	<p>≥24 clusters: ≥216 phoswiches</p>		<p>~ 4M€</p>	<p>Only if Phase3 validated Funds: PARIS consortium</p> <p>Regular experiments in various labs</p>



PARIS phases & costs

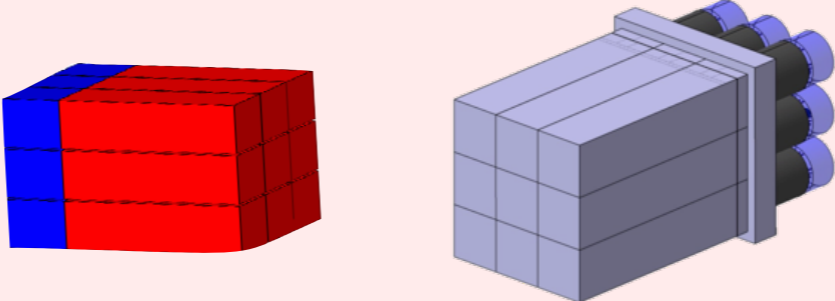
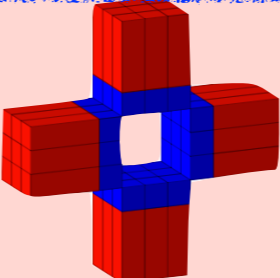
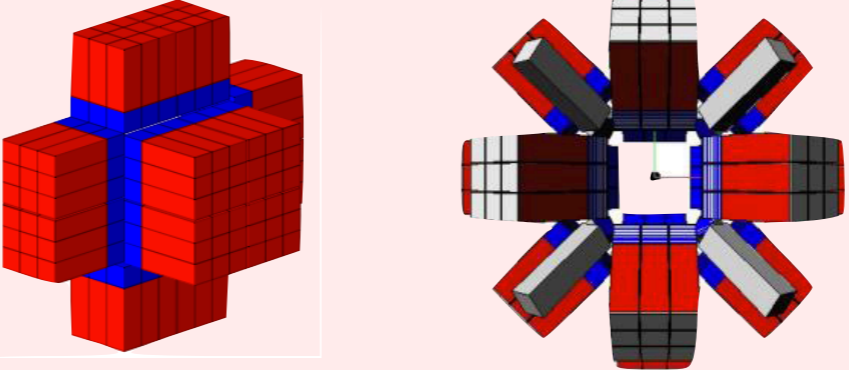
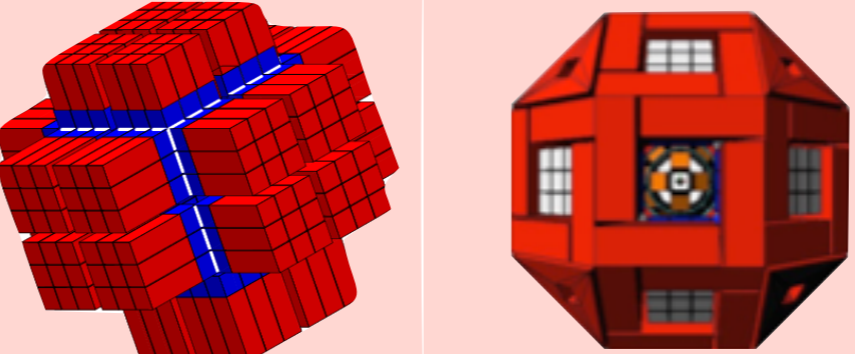


<p><i>Phase 1</i></p> <p>PARIS Prototype</p>	<p>1 cluster: 9 phoswiches</p>		<p>200 k€</p>	<p>Decided Funds: SP2PP, ANR, Orsay, Strasbourg, Kraków, Mumbai</p> <p>Tests in-beam and with sources</p>
<p><i>Phase 2</i> 2013</p> <p>PARIS Demonstrator</p>	<p>4 clusters: 36 phoswiches</p>		<p>800 k€</p>	<p>Only if Phase1 validated Funds: MoU</p> <p>Ph1Day1 exp@S3</p>
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<p><i>Phase 4</i> 2019</p> <p>PARIS 4π</p>	<p>≥24 clusters: ≥216 phoswiches</p>		<p>~ 4M€</p>	<p>Only if Phase3 validated Funds: PARIS consortium</p> <p>Regular experiments in various labs</p>



PARIS phases & costs



<p>Phase 1</p> <p>PARIS Prototype</p>	<p>1 cluster: 9 phoswiches</p>		<p>200 k€</p>	<p>Decided Funds: SP2PP, ANR, Orsay, Strasbourg, Kraków, Mumbai</p> <p>Tests in-beam and with sources</p>
<p>Phase 2 2013</p> <p>PARIS Demonstrator</p>	<p>4 clusters: 36 phoswiches</p> <p>Decision to sign MoU</p>		<p>800 k€</p>	<p>Only if Phase1 validated Funds: MoU</p> <p>Ph1Day1 exp@S3</p>
<p>Phase 3 2017</p> <p>PARIS 2π</p>	<p>12 clusters: 108 phoswiches</p>		<p>~ 2M€</p>	<p>Only if Phase2 validated Funds: MoU, PARIS consortium</p> <p>Ph2Day1 exp. with AGATA and GASPARD Other exp.</p>
<p>Phase 4 2019</p> <p>PARIS 4π</p>	<p>≥24 clusters: ≥216 phoswiches</p>		<p>~ 4M€</p>	<p>Only if Phase3 validated Funds: PARIS consortium</p> <p>Regular experiments in various labs</p>



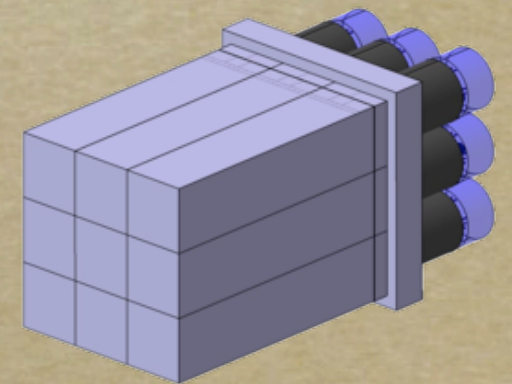
Conclusions



found best

Studies for a new calorimeter for SPIRAL 2 (2006 → 2012) :
based on LaBr₃
single LaBr₃ or phoswich LaBr₃:NaI in clusters

Cluster 3x3 LaBr₃::NaI ordered, to be fully tested :
 $\Delta e, \Delta t$, homogeneity, efficiency, linearity, neutrons
[source, beam, high counting rates]
[pulse shape analysis]
[comparison with simulations]



↪ *choices : detector, PM, electronics, etc ...*



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+ ...