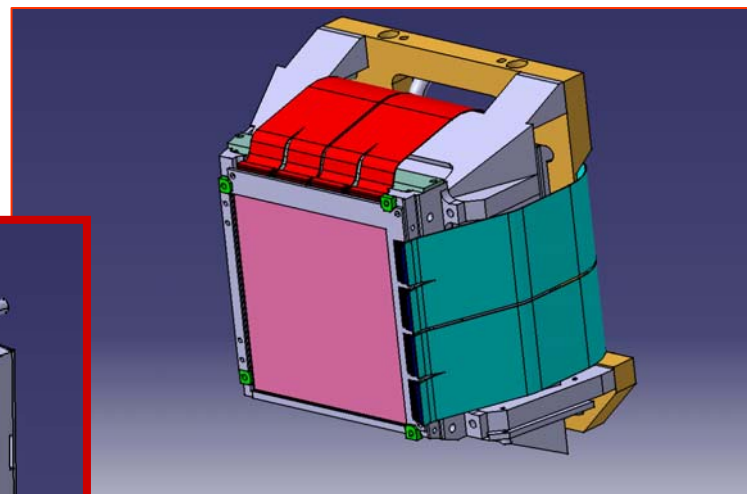
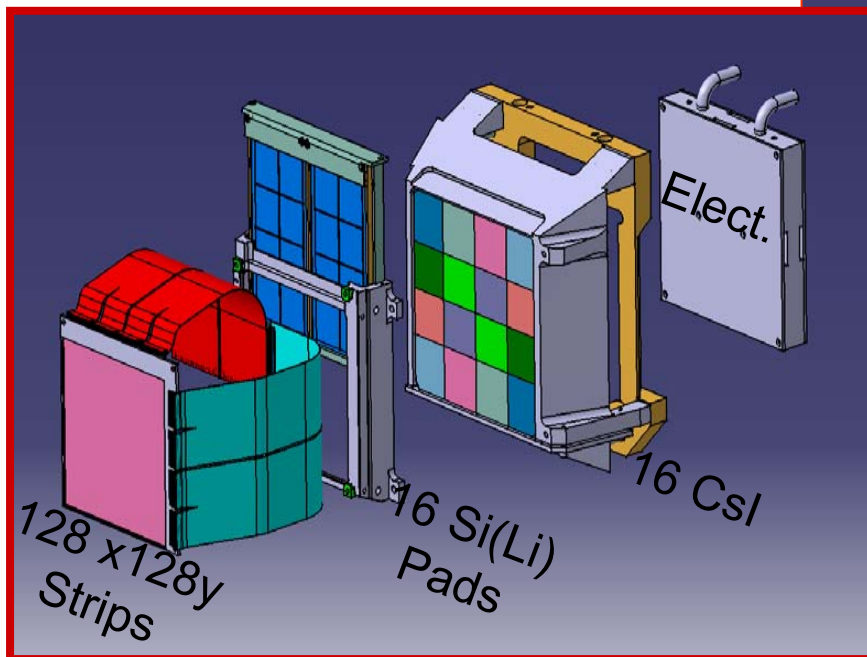
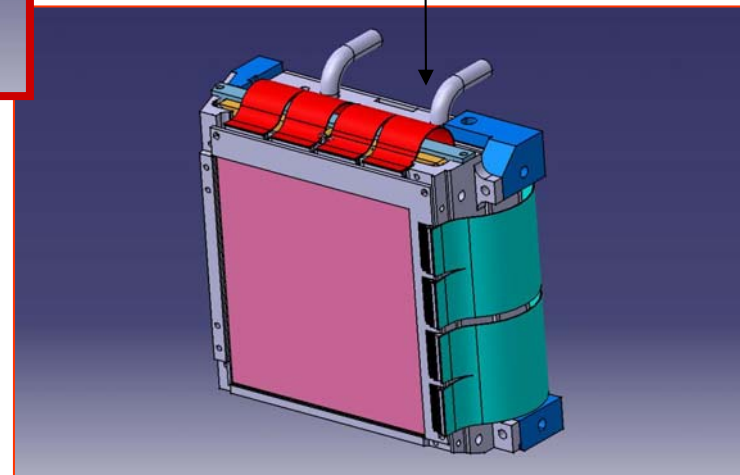


- PLAN
- BASICS
- Exp. Method
  - . Inv Kinematics
- MUST II
  - . Geometry
- MATE (ASIC)
  - . Signals process
  - . Slow Control
- Data Acquisition
  - . Trigger
  - . Dead-Time
- WHO

# MUST II



↑  
With CsI  
↓  
Without CsI



10cm x 10cm active area  
+/- 18° angular cover

# Single ASIC Soln: Si, Si(Li) & CsI

- Channels 16 (Fast & Slow)
  - Bipolar (slow & fast)
  - Slow Control
  - Energy (Track & Hold)
    - $1\mu\text{s}/3\mu\text{s}$  RC-CR
    - 11MeV/50MeV/110MeV
      - X2 the energy range
    - 20/45 KeV resolu.
  - Time
    - Disc Leading Edge
    - TAC (300 & 600 nsec)
    - 240 psec jitter
- Chip  $36\text{mm}^2$ 
  - BCMOS  $0.8\ \mu$
  - 16000 transistors
  - 35 mWatt/channel
- Serial output 2 MHz

## So What is so New ?

- In Nuclear Phys. Env.
- Dynamic Range
- Time & Energy
- Need to build a **test** system.

- PLAN
- BASICS
- Exp. Method
  - . Inv Kinematics

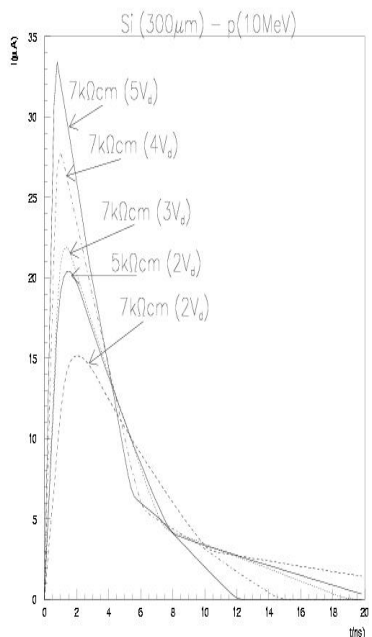
- MUST II
  - . Geometry

- MATE (ASIC)
  - . Signals process
    - Bipolar
    - Dynamic
  - . Slow Control

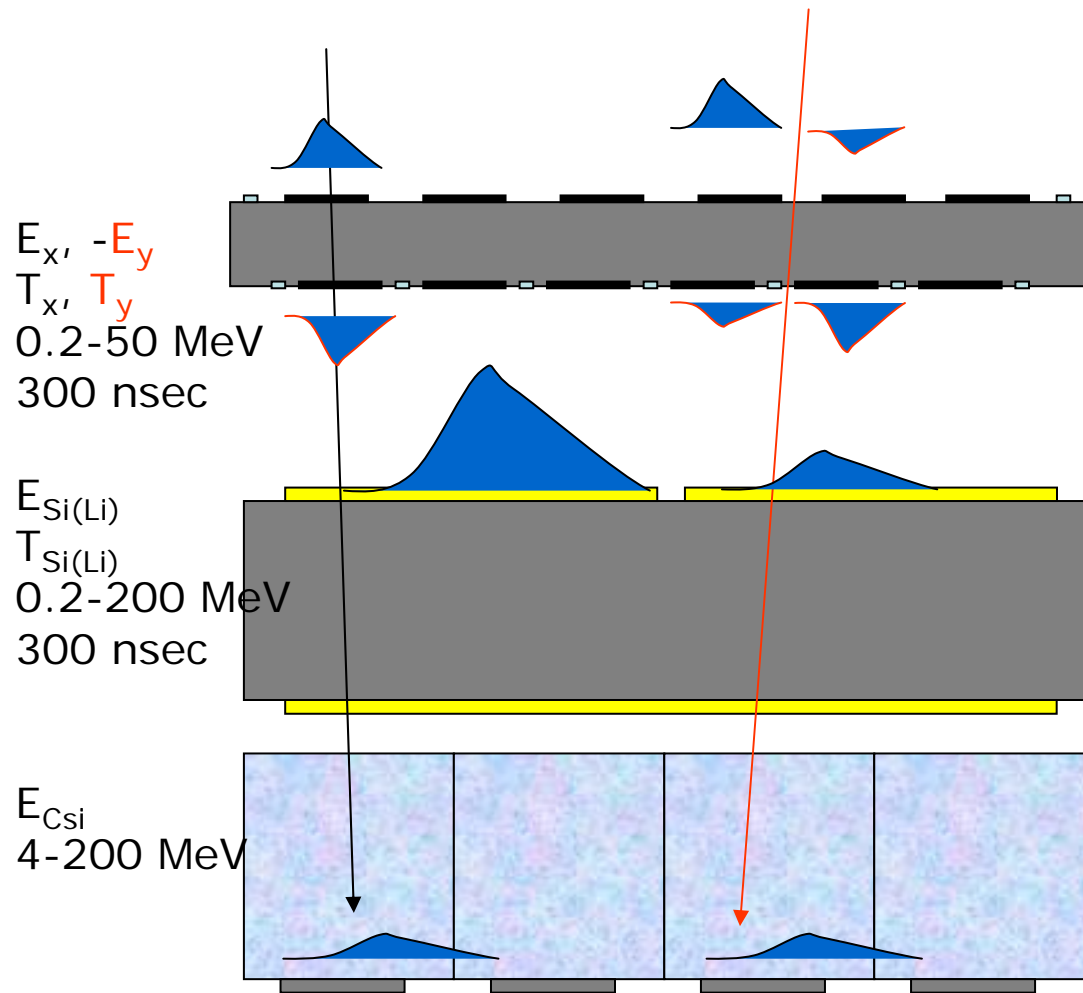
- Data Acquisition
  - . Trigger
  - . Dead-Time

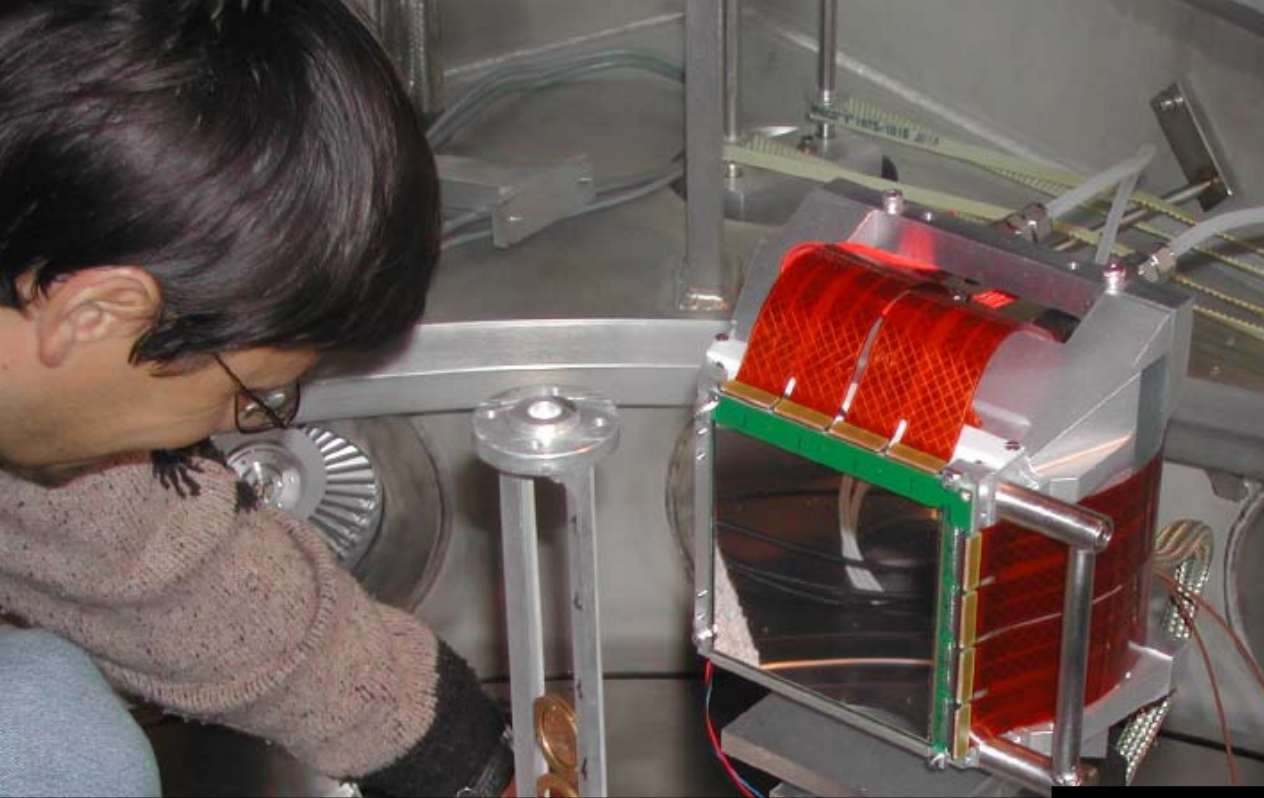
- WHO

# MATE



**A. Drouart**  
**CEA Saclay**

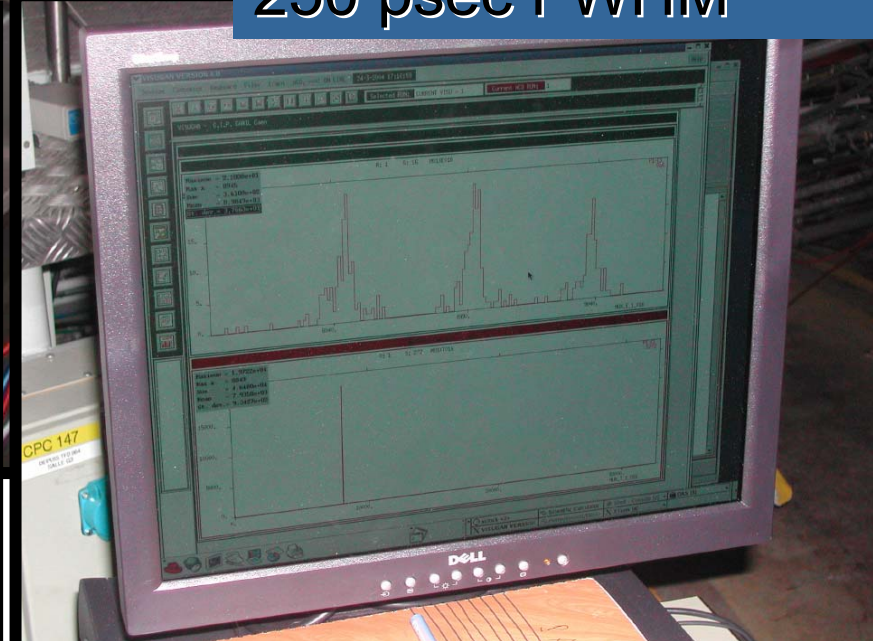
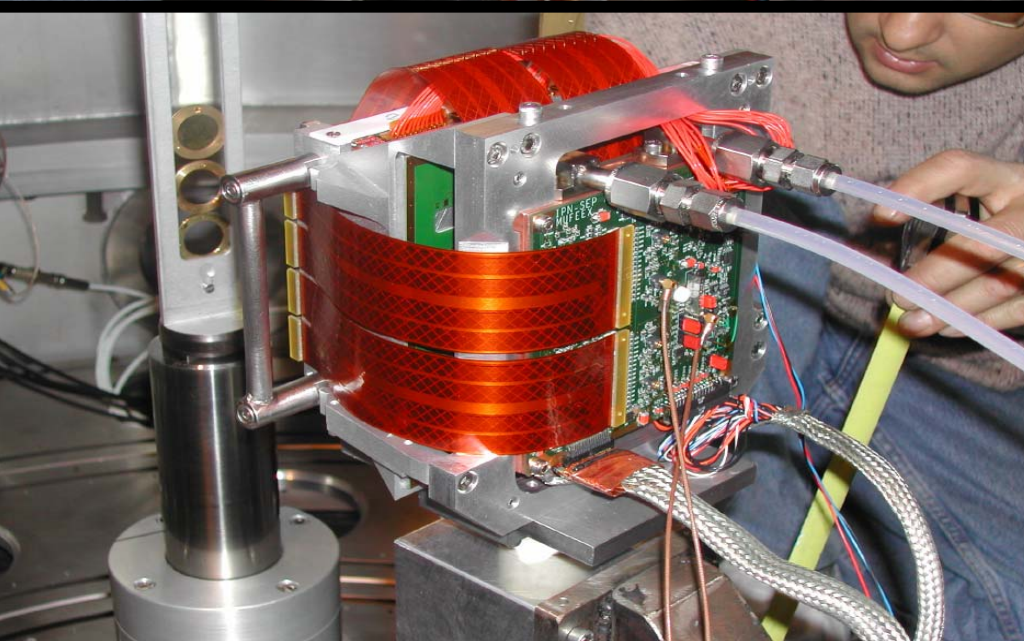




**27 Mars 2004**

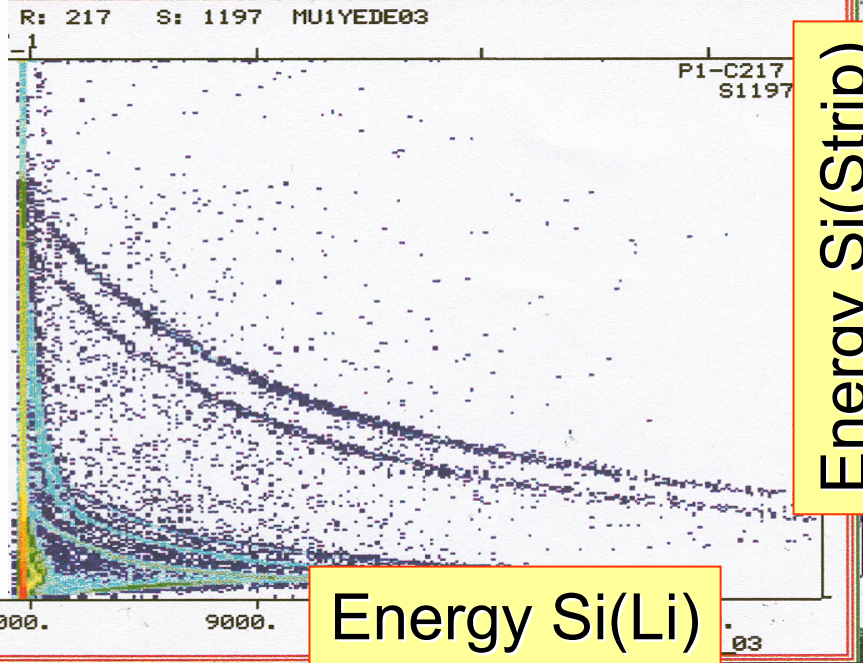
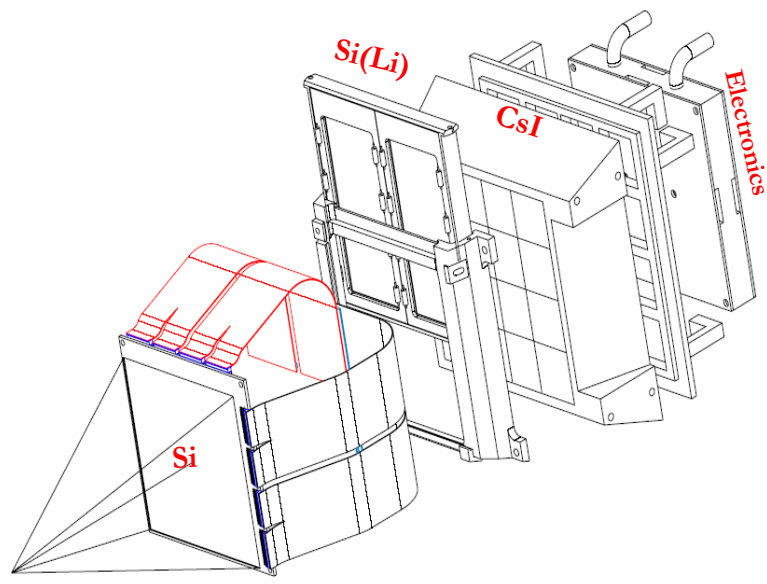
**256 Energy Spectra  
256 Time Spectra**

**200 KeV Threshold  
40 KeV FWHM  
250 psec FWHM**

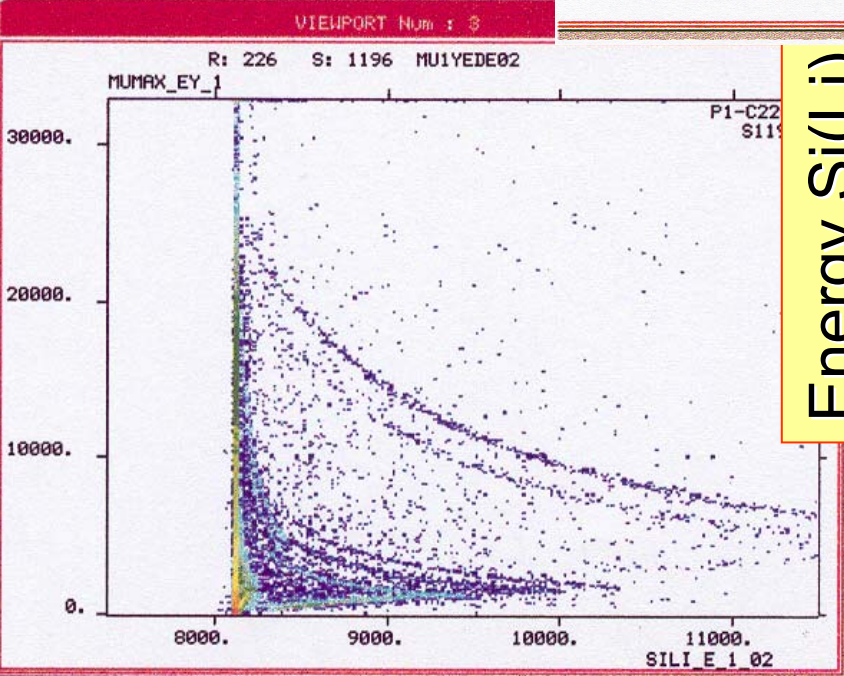


VIEWPORT Num : 1

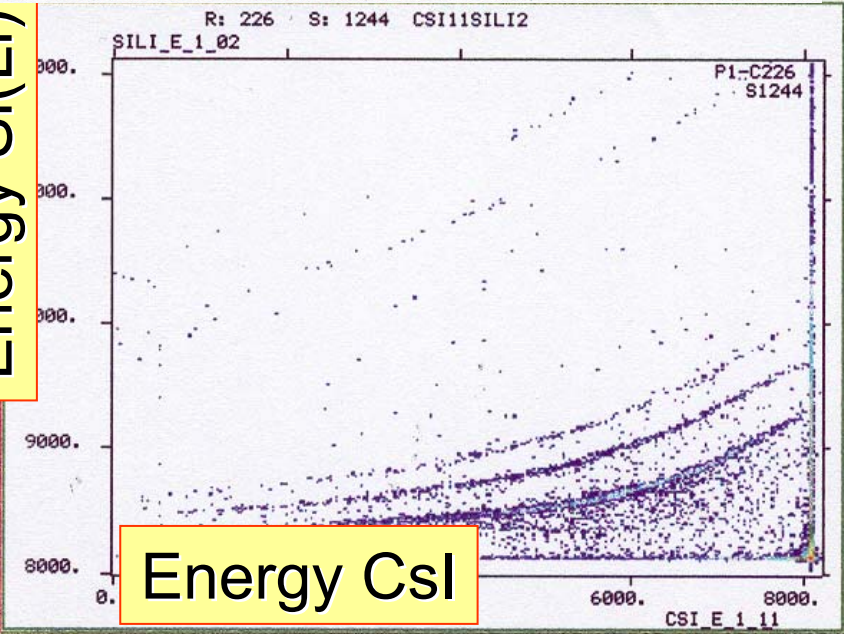
VIEWPORT Num : 2



Energy Si(Li)



Energy Si(Li)



Energy CsI

# Pre-Amp

## Structure:

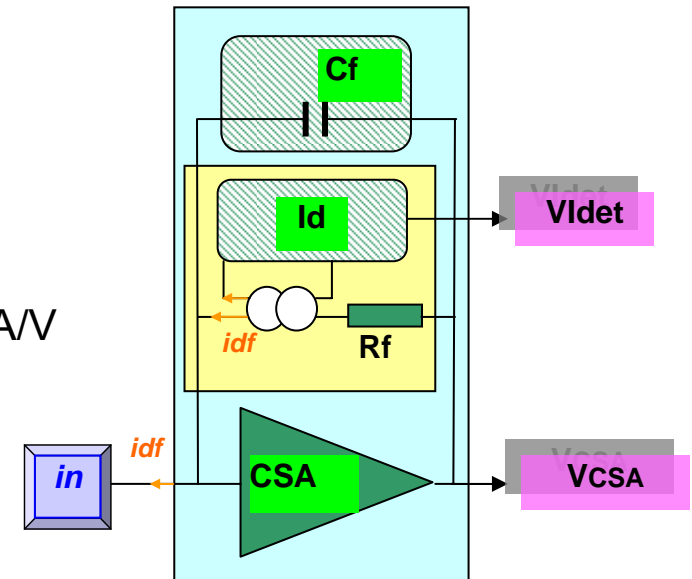
- \* Temps de montée: 10ns
- \* Transistor d'entrée: PMOS;  $G_m=28.38 \text{ mA/V}$
- \* Puissance: 10mW(+/-2.5V)

## Gain (Cf):

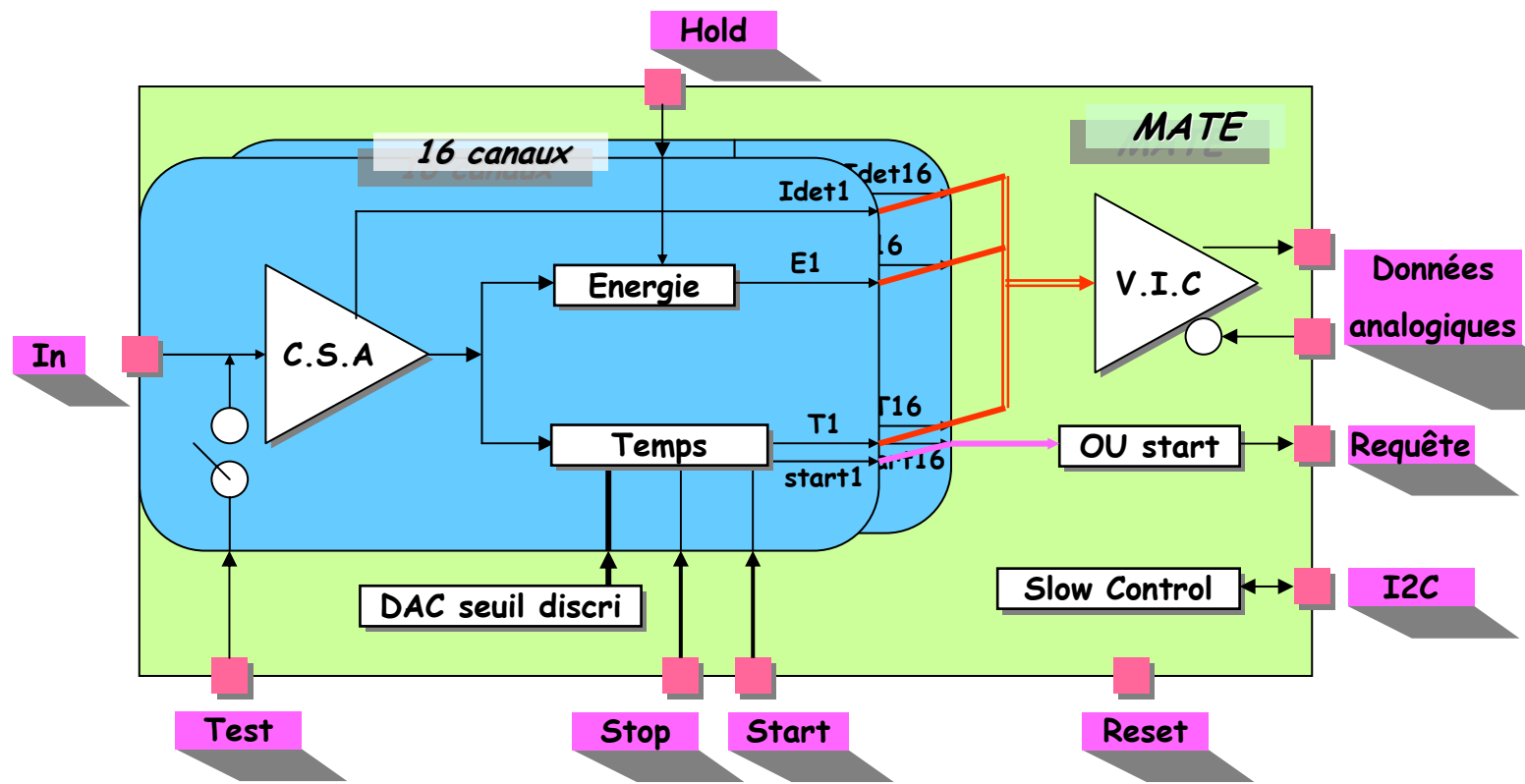
- 0.6pF (Csl 11 MeV); 2.6pF (Si 50MeV)
- 4.6pF (80MeV); 6.6pF(Si(Li) 120MeV)

## Bloc Rf:

- \* Valeur de la résistance de feedback (60M $\Omega$ )
- \* Valeur de la tension D.C en sortie du C.S.A (0V; polarité + & -)
- \* Courant D.C du détecteur (250nA max.) [Si(strips) face Ohmique]



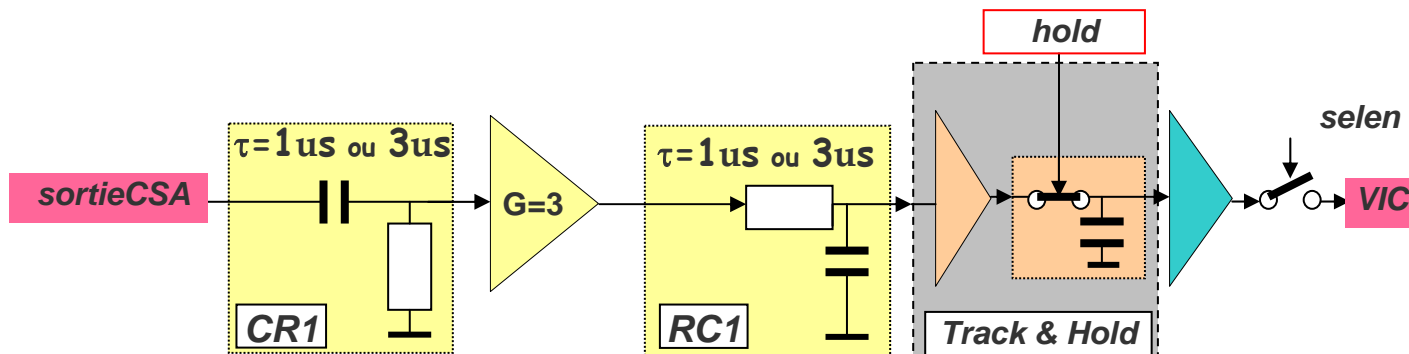
- PLAN
- BASICS
- Exp. Method
  - . Inv Kinematics
- MUST II
  - . Geometry
- MATE (ASIC)
  - . Signals process
    - Bipolar
    - P&Amp
    - Time
    - Energy
  - . Slow Control
    - Control
    - Calibration
  - . Performance
- Data Acquisition
  - . Trigger
  - . Dead-Time
- WHO



- PLAN
- BASICS
- Exp. Method
  - . Inv Kinematics
- MUST II
  - . Geometry
- MATE (ASIC)
  - . Signals process
    - Bipolar
    - PAmp
    - Time
    - Energy
  - . Slow Control
    - Control
    - Calibration
  - . Performance
- Data Acquisition
  - . Trigger
  - . Dead-Time
- WHO

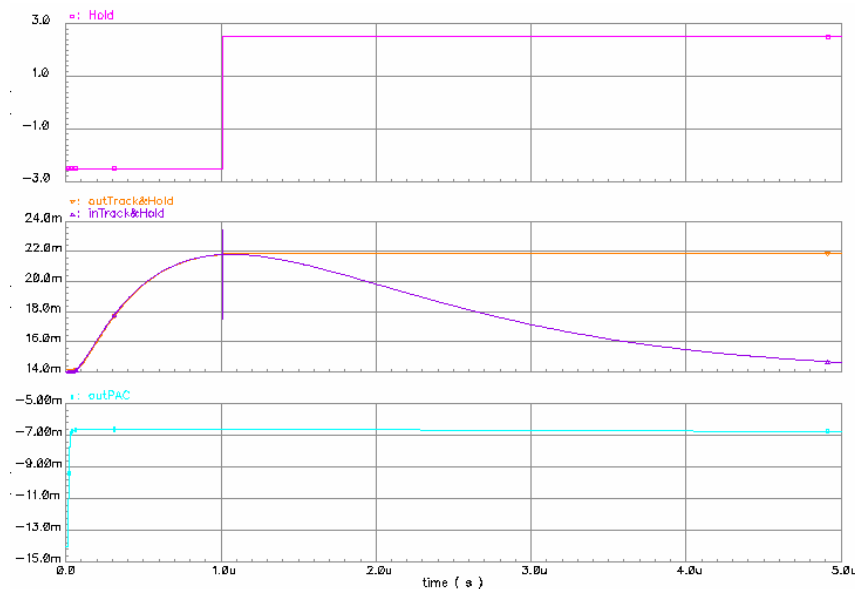
# Energy Channel

● filtrage: CR-RC;  $1\mu\text{s}$  [Si(strips)] ou  $3\mu\text{s}$  [SiLi & CsI]



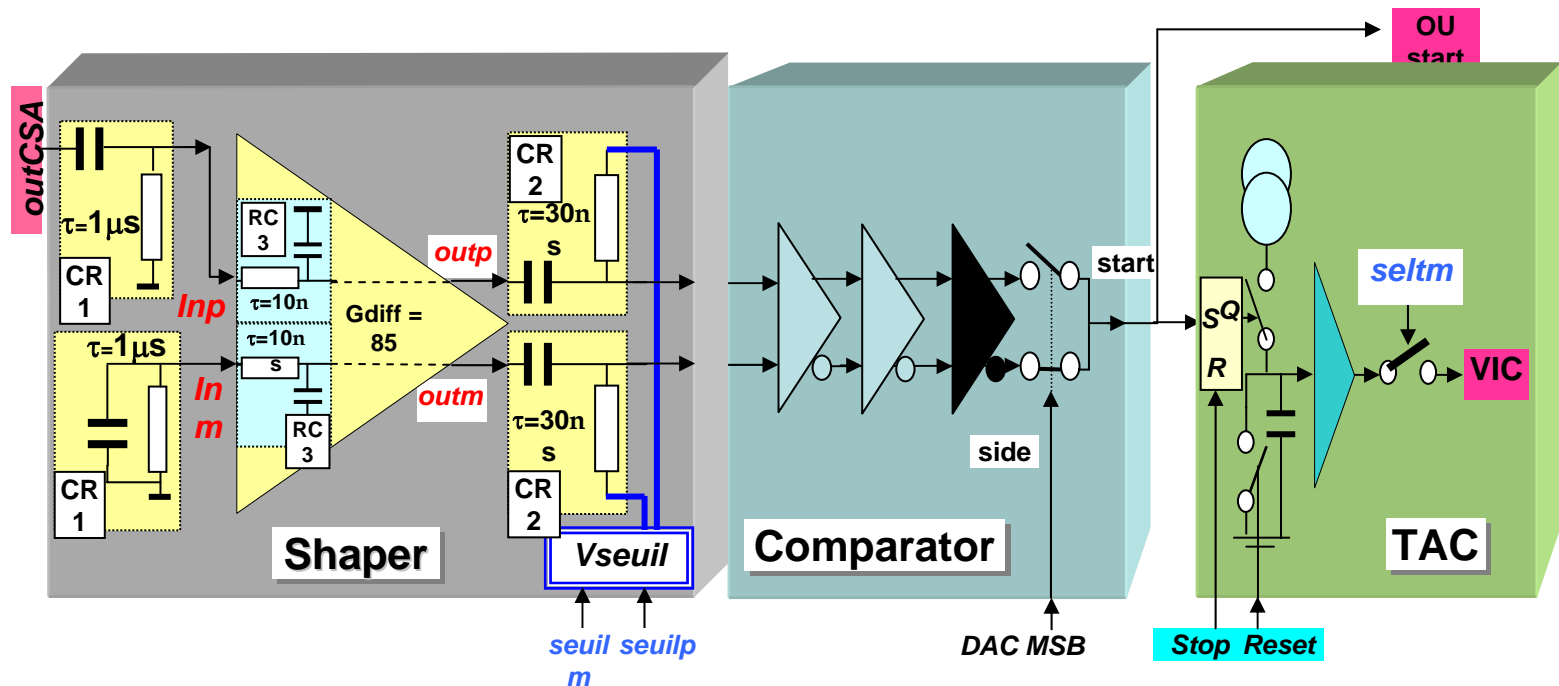
● polarity +/-

● Peak solution Track&Hold





# Time Channel



● **Shaper:** Bipolaire; Différentiel;  $G=85$ ;  $T_{\text{sommet}} = 22\text{ns}$ ;  
 NLI [300keV-700keV proton]=0.84%;

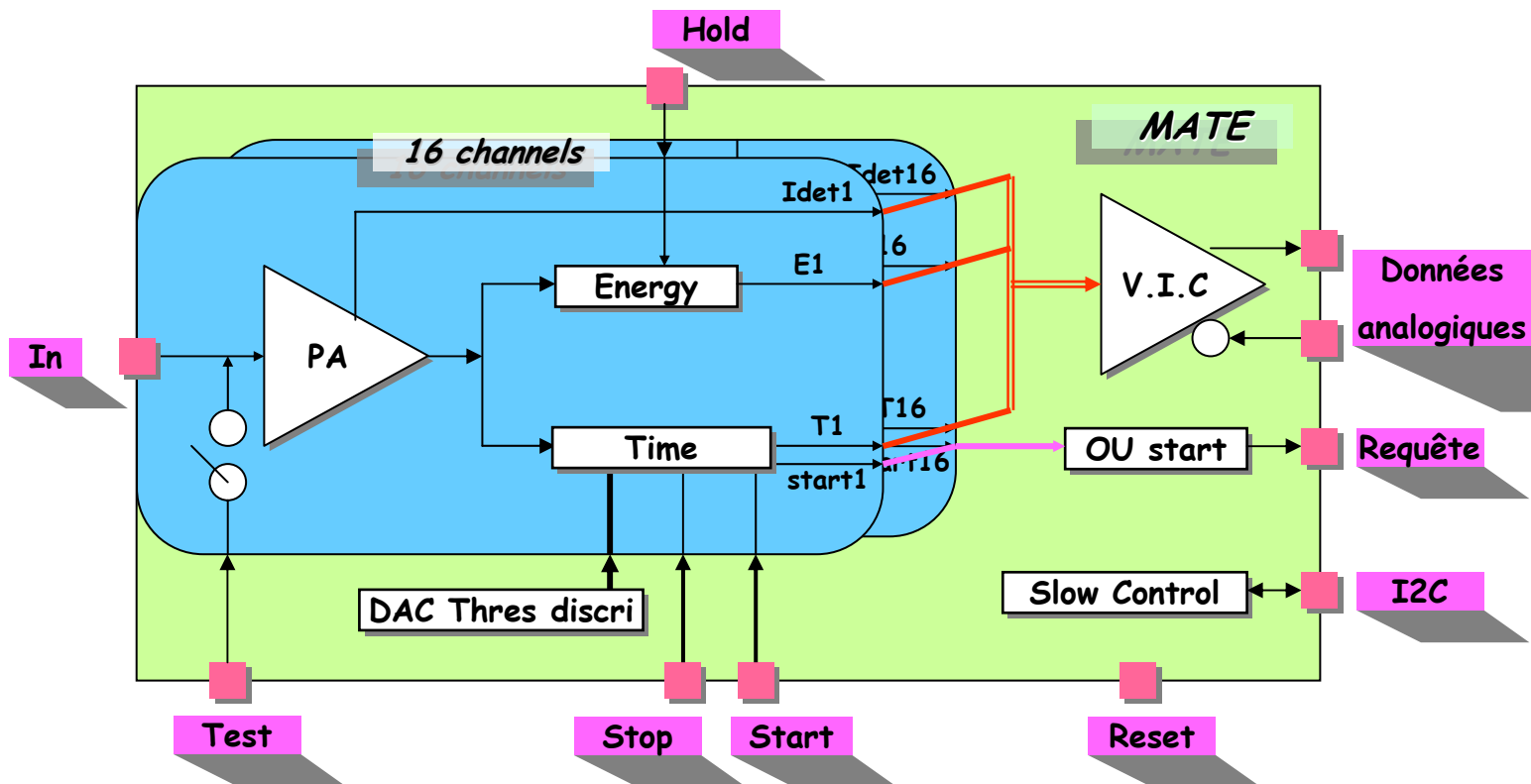
Variations des 16 canaux à 300keV = +/- 30keV

● **Comarateur:** Bipolaire; Différentiel; Leading Edge;  $G=5000$ ; Puissance=7mW

● **TAC:** Gamme de conversion: 300ns; NLI=2.3E-2%; Jitter=18ps FWHM

- PLAN
- BASICS
- Exp. Method
  - . Inv Kinematics
- MUST II
  - . Geometry
- MATE (ASIC)
  - . Signals process
    - Bipolar
    - PAmp
    - Time
    - Energy
  - . Slow Control
    - Control
    - Calibration
  - . Performance
- Data Acquisition
  - . Trigger
  - . Dead-Time
- WHO

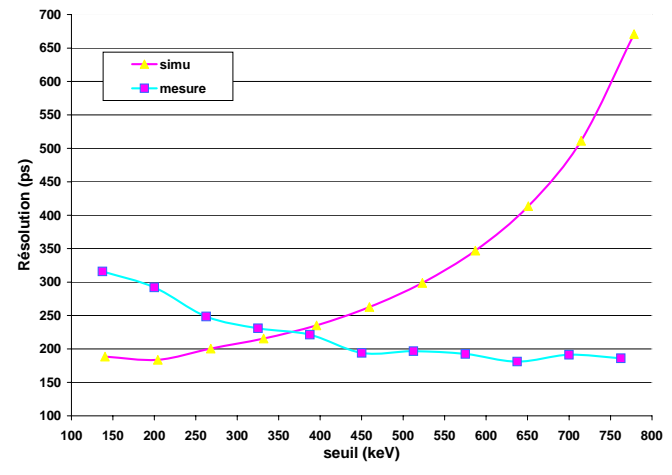
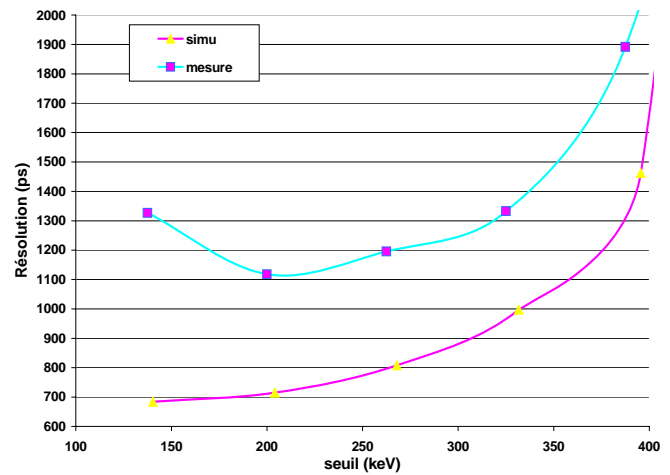
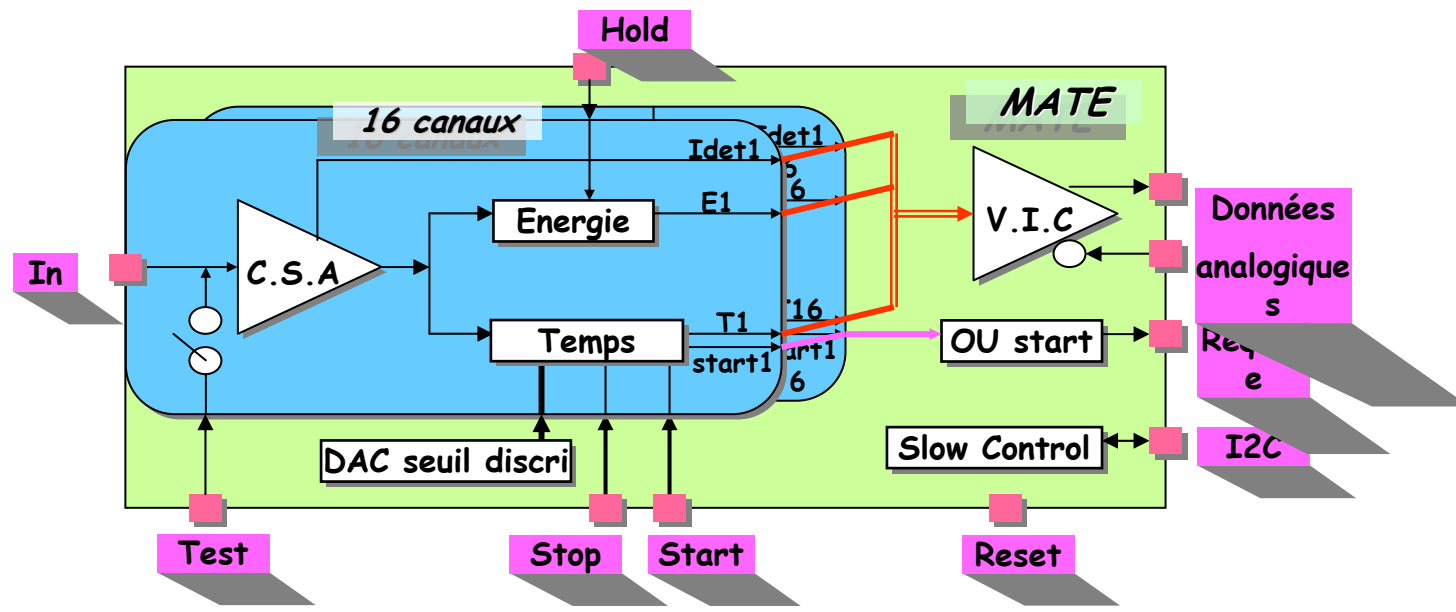
- PLAN
- BASICS
- Exp. Method
  - . Inv Kinematics
- MUST II
  - . Geometry
- MATE (ASIC)
  - . Signals process
    - Bipolar
    - . **Slow Control**
      - Control
      - Calibration
  - . Performance
- Data Acquisition
  - . Trigger
  - . Dead-Time



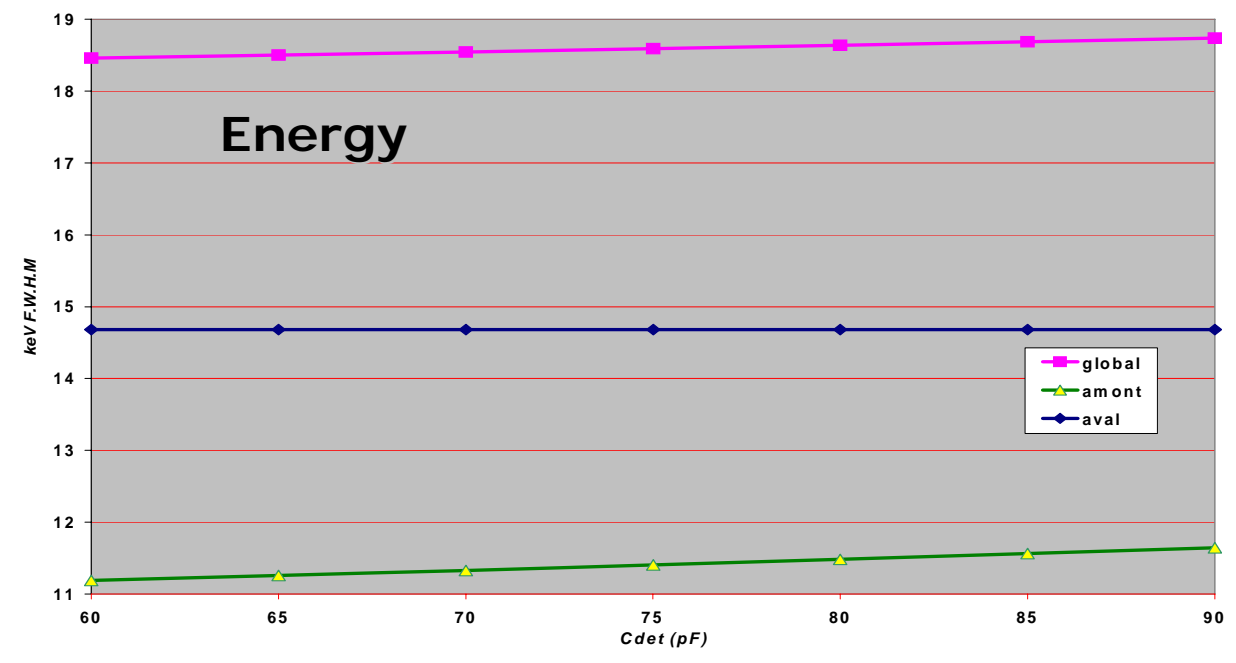
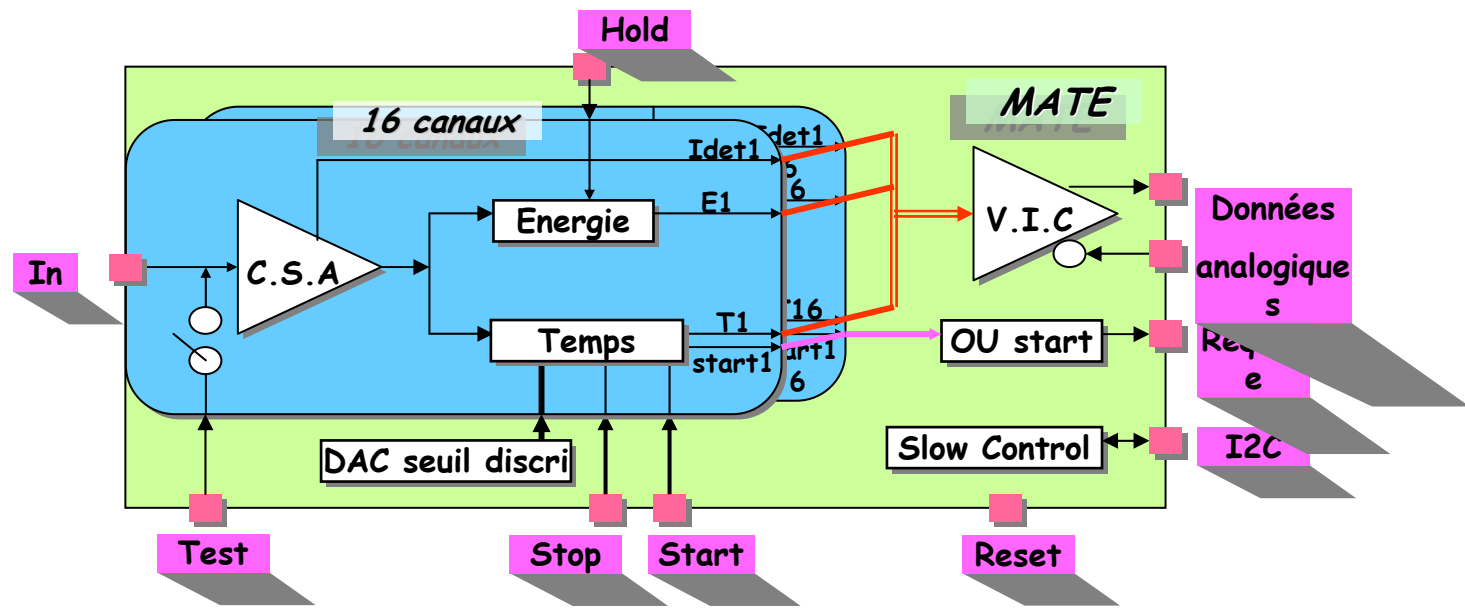
### Slow Control via I2C (Full reconfiguration of 3000ch below 1sec)

- Positive or Negative
- Shaping 1 & 3μsec peaking time
- Gain 11, 20, 50, 110 and 220 MeV selection
- Threshold DAC & inhibit channel(s)
- "SPY" channel N°16 PA, Fast-amp, ...
- Read-out configuration Energy-Time or Energy
- Calibration:-Test Energy & Start/channel
  - Internal(numeric)/external pulser – Single Capacitance

- PLAN
- BASICS
- Exp. Method
  - . Inv Kinematics
- MUST II
  - . Geometry
- MATE (ASIC)
  - . Signals process
    - Bipolar
  - . Slow Control
    - Control
    - Calibration
  - . Performance



- PLAN
- BASICS
  - Exp. Method
  - . Inv Kinematics
- MUST II
  - . Geometry
- MATE (ASIC)
  - . Signals process
    - Bipolar
  - . Slow Control
    - Control
    - Calibration
  - . Performance
- Data Acquisition
  - . Trigger
  - . Dead-Time
- WHO



- PLAN

-BASICS

-Exp. Method

. Inv Kinematics

-MUST II

-MATE (ASIC)

.Signals process

.Slow Control

.Performance

-Front-end Board

.Fast trigger  $\Sigma$

.I2C

.Temperature

.Generator

.Memory

-Data Acquisition

. Trigger

. Dead-Time

. Time-Stamp

-Software

. Calibration

. Slow Control

: HT

: Temp

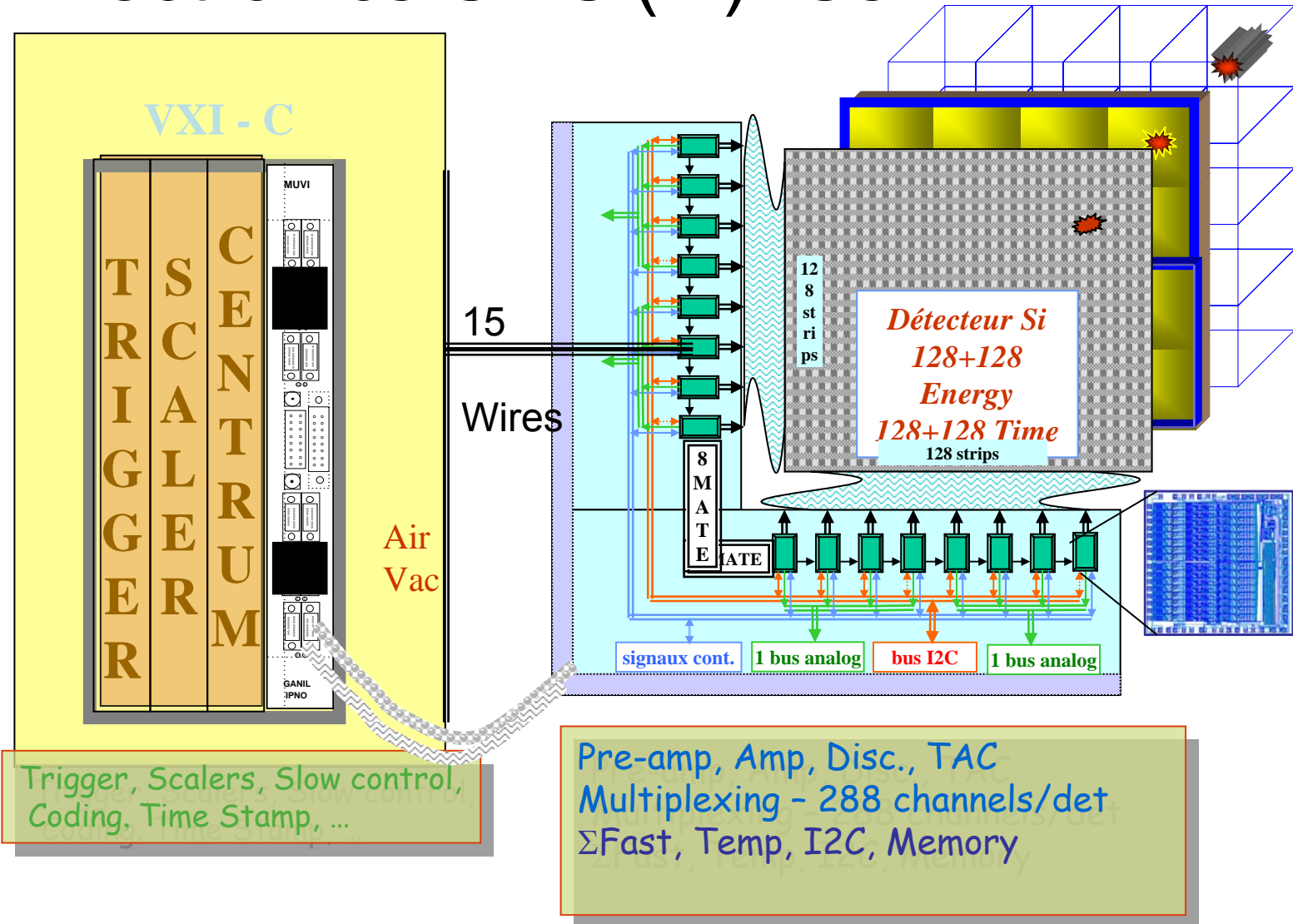
: Vacuum

- WHO

# MUVI & Data Acquisition

- Trigger ( $\Sigma$  all ch.) & (Start)
- Multiplexing
  - 0.5  $\mu$ s/parameter
  - (16x2x0.5)x5MATE par. = 80 $\mu$ s – ADC1 & 2
  - (16x2x0.5)x4MATE par. = 64 $\mu$ s – ADC2 & 4
- ADC's at 2MHz – 14bits
- Zero Suppression, Calibration ... (DSP)
- Data Transfer etc =
- RESET
- MODES
  - Common Dead Time all detector
  - Common Dead-Time individual MUST II
- Time-Stamp (CENTRUM – 100MHz)

# Electronics Si+Si(Li)+CsI



- PLAN

-BASICS

-Exp. Method  
. Inv Kinematics

-MUST II

-MATE (ASIC)  
.Signals process  
.Slow Control  
.Performance

-Data Acquisition  
. Trigger  
. Dead-Time  
. Time-Stamp

- WHO

# WHO

- CEA Saclay
  - Physicists
  - $\mu$ -electronics
- IPN Orsay
  - Physicists
  - Mechanics
  - Detectors
  - Electronics
- GANIL
  - Physicists
  - Electronics
  - Software