

# Plastic scintillators for the g-RISING experiments

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# Introduction

- **Detectors :**
  - Sci21 (sci21L, sci21R)
  - Sci41 (sci41L, sci41R, sci41O(up), sci41U(down))
- **Purpose:**
  - Beam ID : ToF  $\rightarrow$  beta  $\rightarrow$   $A/Q$  (online analysis code)
  - Position : sci21LR, (sci41LR, sci41UpDown)
  - Trigger : sci41R
  - Energy : QDC (sci21L, R, sci41L, R, Up, Down)

# Specification

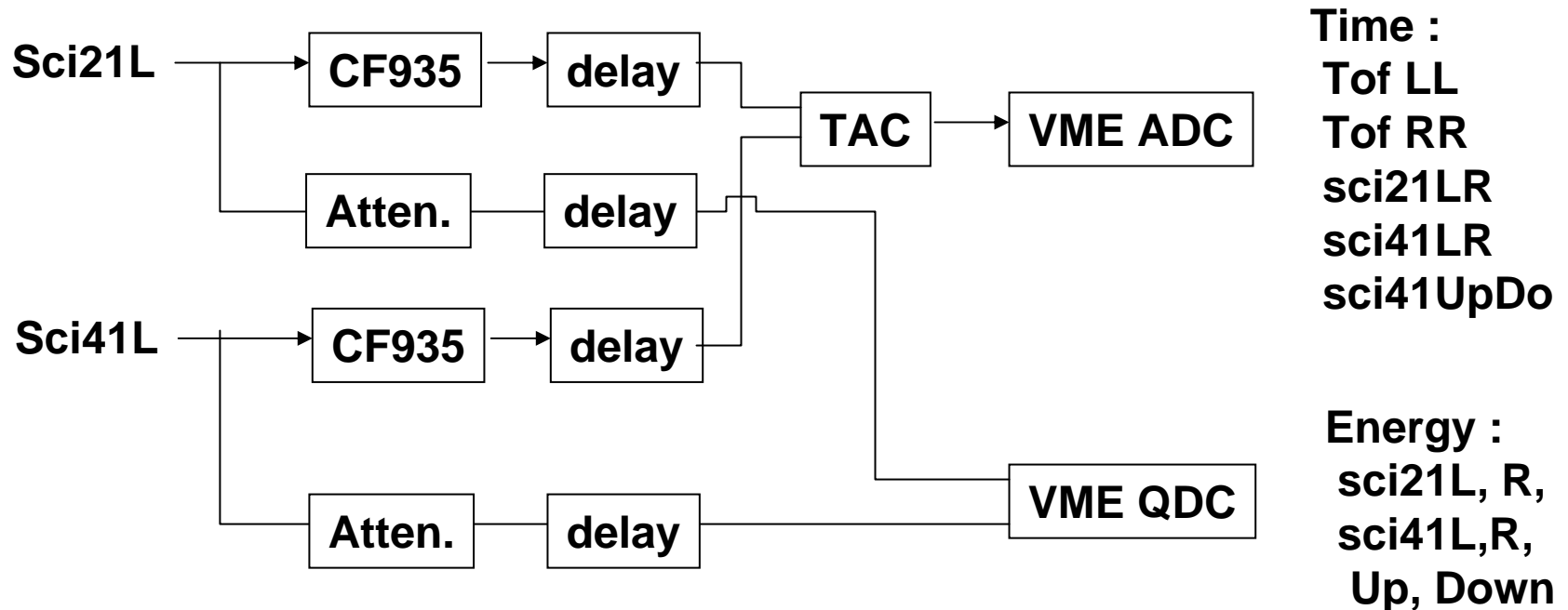
- Sci21 : FRS standard detector
  - 9 scintillators on a S2 Scintillator Ladder (TS3ESA\_S)
    - BC420 or BC400 typical size 220 x 45 mm, 0.5 - 5 mm thick  
[http://www-w2k.gsi.de/frs-setup/FRS%20Areas/S2%20\(dispersive%20focus\).htm](http://www-w2k.gsi.de/frs-setup/FRS%20Areas/S2%20(dispersive%20focus).htm)  
Movable by remote control (< 1 min)
  - PMT : H2431 (high rate, good time resolution)
  - HV : remote control in FRS electronics room
    - max - 2800V, usual operation -1500V--~2000V
  - Time resolution : 80ps with a beam (FWHM)
  - Position resolution : 6mm with a beam (FWHM)

# Specification

## ● Sci41 : RISING scintillator

- Scintillator : fixed in a S4 chamber (No black film on sci!)
  - Round type  $\phi$ 250 mm, ~0.3, 0.5, or 1 mm thickness
  - No remote control to move, replaceable (> 1 h)
- PMT : H2431-50 (good time resolution)
- HV : remote control at FRS electronics room
  - max - 3000V, usual operation -2500V--~2800V
- Time resolution : 300ps with a beam (FWHM)
- Position resolution : ~2cm with a beam (FWHM)

- Simple Scheme for Time and Energy



# HV and signals

Example of signal height (RISING fast beam)

Sci21 (3mm)

Energy (in)  $\sim 200\text{MeV/u}$ , Energy\_deposit\_cal  $\sim 30\text{MeV/u} = \sim \mathbf{4000\text{MeV}}$

- sc21L: HV=1450V, Signal 5V, signal\_CFD\_input=**2.5V**
- sc21R: HV=1630V, Signal 5V, signal\_CFD\_input=**2.5V**

Sci41 (0.5mm)

E\_in  $\sim 100\text{MeV/u}$ , E deposit cal  $\sim 8\text{MeV/u} = \sim \mathbf{1000\text{MeV}}$

- sc41L: HV=2500V, Signal At MH Pannel=5V, SigCFDIn=**2.5V**
- sc41R: HV=2500V, Signal At MH Pannel=4V, SigCFDIn=**2.5V**
- sc41U: HV=2550V, Signal At MH Pannel=2.5V, SigCFDIn=**2.5V**
- sc41D: HV=2600V, Signal At MH Pannel=2.5V, SigCFDIn=**2.5V**

RISING fast beam (Minimum Energy loss  $\sim 110\text{ MeV}$  gave up signal splitting)

**Note: E-loss Cal. is needed for each beam including FRS calibration run**

# g-RISING Energy loss estimation

Beam	Sci21: 3.51mm			Sci41 : 0.5mm			:1mm
	E in MeV/u	dE MeV/u	dE MeV	E in MeV/u	dE MeV/u	dE MeV	dE MeV
130Sn	715.6	17.3	2249	582.8	2.6	338	689
94Pd	391.4	25.9	2435	279.6	4.3	404	818
196Po	882.8	31.7	6213	691	4.8	941	1882

**Note: E-loss Cal. is needed for each beam including FRS calibration run.  
U beam gives large E-loss, it is difficult to combine with light ions.**

# Discussion

- Thickness of 3mm (sci21) and 1mm (sci41) would be suitable for the given cases from a signal height point of view. (A test in a Lab is needed before it is mounted at S4.)
- All beams including primary beam for FRS calibration have to be considered by using simulation of LISE or Mocadi for the required energy loss, time resolutions.
- Trigger signal from sci41? (sci41R only or coincidence?)
- Slit before sci21 and sci41? (Pulse height x4 at 10cm from center)