

V2000

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INFN PD

Broggini - 01

MUNU

GRENOBLE
NEUCHÂTEL
PADOVA
ZÜRICH

$$\bar{\nu}_e + e \rightarrow \bar{\nu}_e' + e'$$

$$\frac{d\sigma}{dT}^{\text{TOT}} = \frac{d\sigma}{dT}^{\text{WEAK}} + \left(\frac{d\sigma}{dT}^{\text{E.N.}} \right) = f(\mu_\nu^2)$$

$$\mu_\nu \gtrsim 5 \times 10^{-11} \mu_B$$

$$\left. \begin{array}{l} \sigma^W \div E_\nu \\ \sigma^{\text{E.N.}} \div \log E_\nu \end{array} \right\} \Rightarrow E_\nu \downarrow \Rightarrow \text{NUCLEAR REACTOR}$$

$$\frac{d\sigma}{dT}^{\text{E.N.}} \div \frac{1}{T} \Rightarrow T \downarrow$$

DETECTOR: e^- ENERGY + TRACK $\Rightarrow E_{\bar{\nu}}$

FORWARD ANGLE: $\bar{\nu}$ EVENTS + BACKGROUND

BACKWARD ANGLE: BACKGROUND

SIMULTANEOUS MEASUREMENT OF SIGNAL AND BACKGROUND

BACKGROUND SUBTRACTION

■ CENTRAL DETECTOR: 1 m^3 ACRYLIC VESSEL TPC

$90 \text{ cm } \phi \times 162 \text{ cm}$, $\sim 100 \text{ Kg}$ $\Delta P = \pm 100 \text{ mbar}$

Broggini - 02

ACRYLIC SELECTED BY n -ACTIVATION

$$U < 3 \times 10^{-12} \text{ gr/gr}, T_h < 4 \times 10^{-12} \text{ gr/gr}, K = 2 \times 10^{-7} \text{ gr/gr}$$

■ CF_4 AT 3 bar ($\sim 11 \text{ Kg}$)

HIGH DENSITY ($\rho = 3.7 \text{ gr/l. S.T.P.}$)

LOW Z ($X_0 = 92 \text{ m S.T.P.}$)

NO HYDROGEN ($\bar{\nu}_e + p \not\rightarrow e^+ + n$)

■ X- γ STRIPS WITH 3.5 mm PITCH

512 ADC CHANNELS ($\uparrow 25 \text{ MHz}$)

$$\lambda > 16 \text{ nm}$$

$$\frac{\Delta E}{E} (\text{FWHM}) = 20\% \text{ AT } 370 \text{ keV } ({}^{113}\text{Sn})$$

■ ANTI COMPTON: $\sim 10 \text{ m}^3$ NE 235, λ (430 nm) $> 8 \text{ nm}$

24 + 24 PMs (THORN EMI 9354 WITH B53 GLASS)

20 cm ϕ

180 p.e./MeV

98% EFFICIENCY AT 100 keV

+ 8 cm POLYETHYLENE + B
+ 15 cm Pb

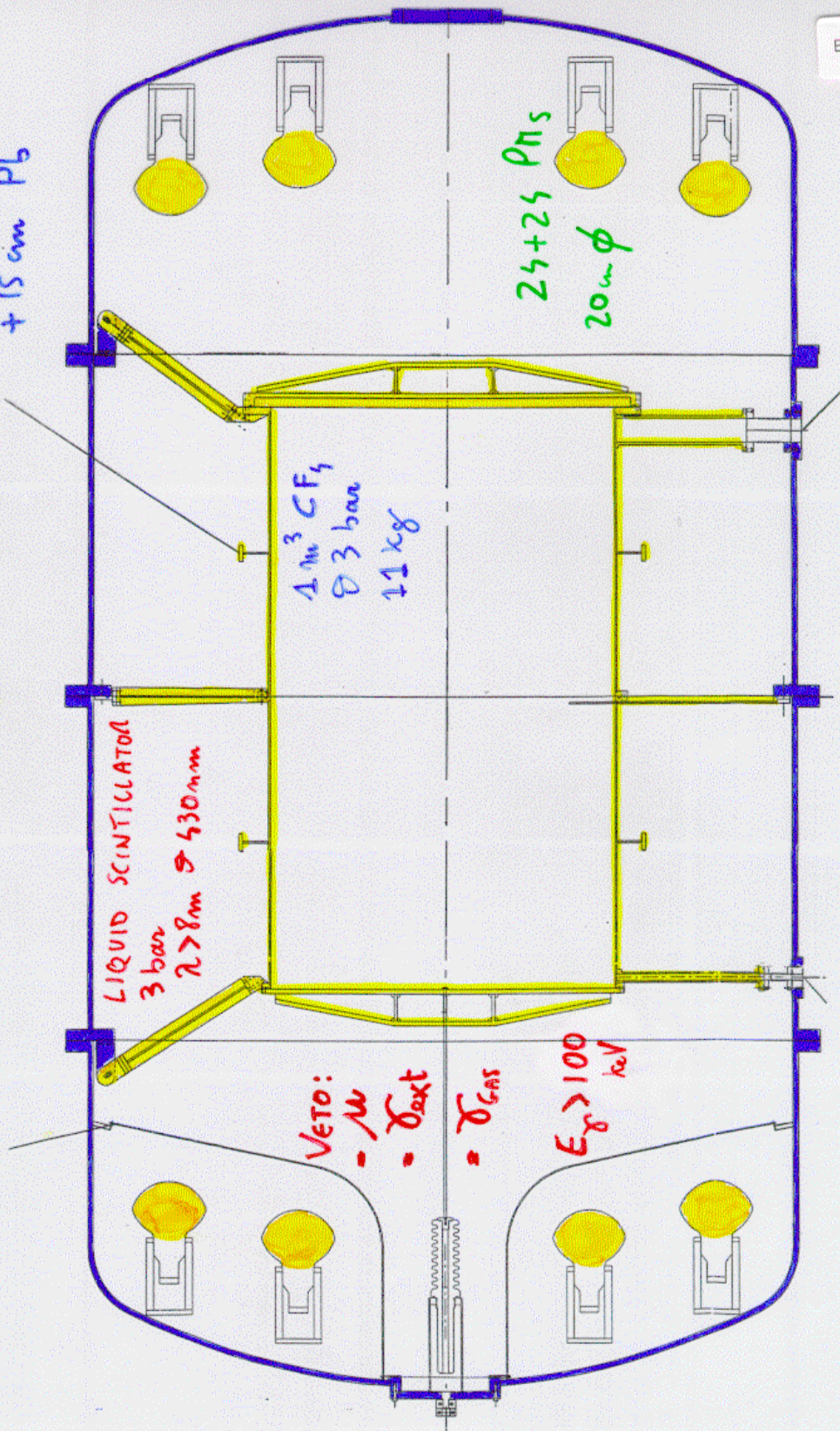
23+23 PMS
20 cm ϕ

1 m³ CF₄
3 bar
11 kg

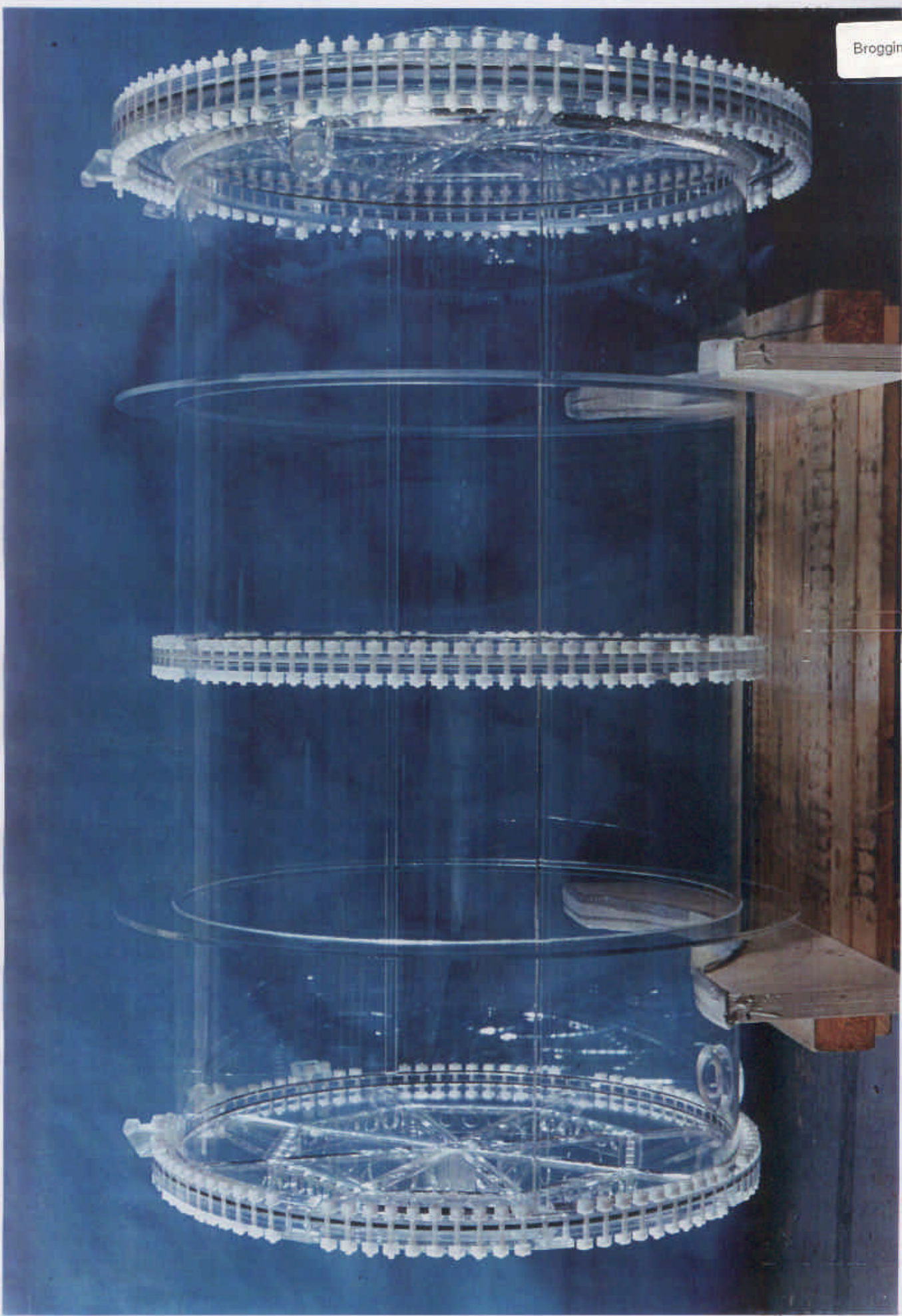
LIQUID SCINTILLATOR
3 bar
 $\lambda > 8$ m ϕ 430 nm

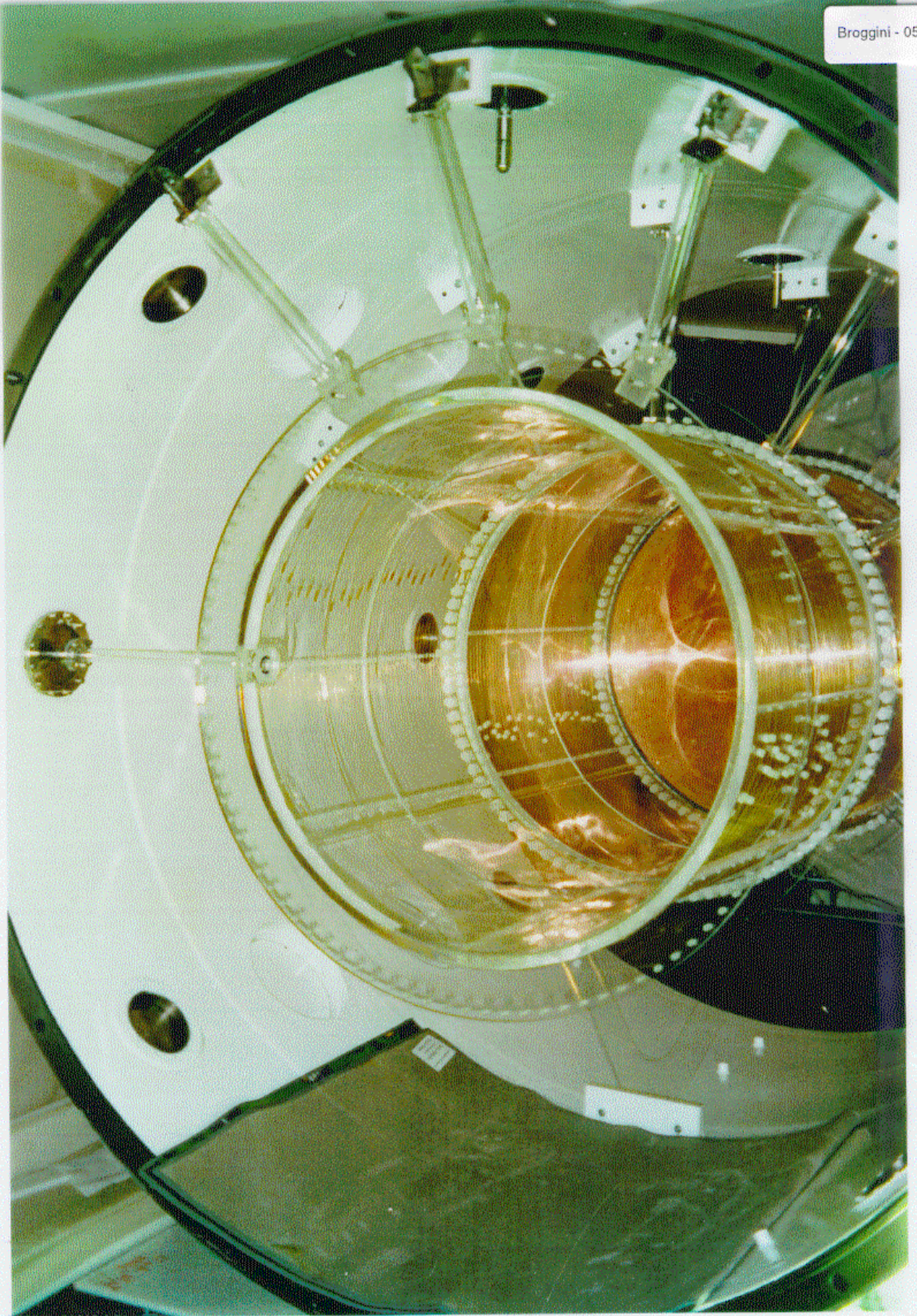
VETO:
- μ
- σ_{ext}
- σ_{GAS}

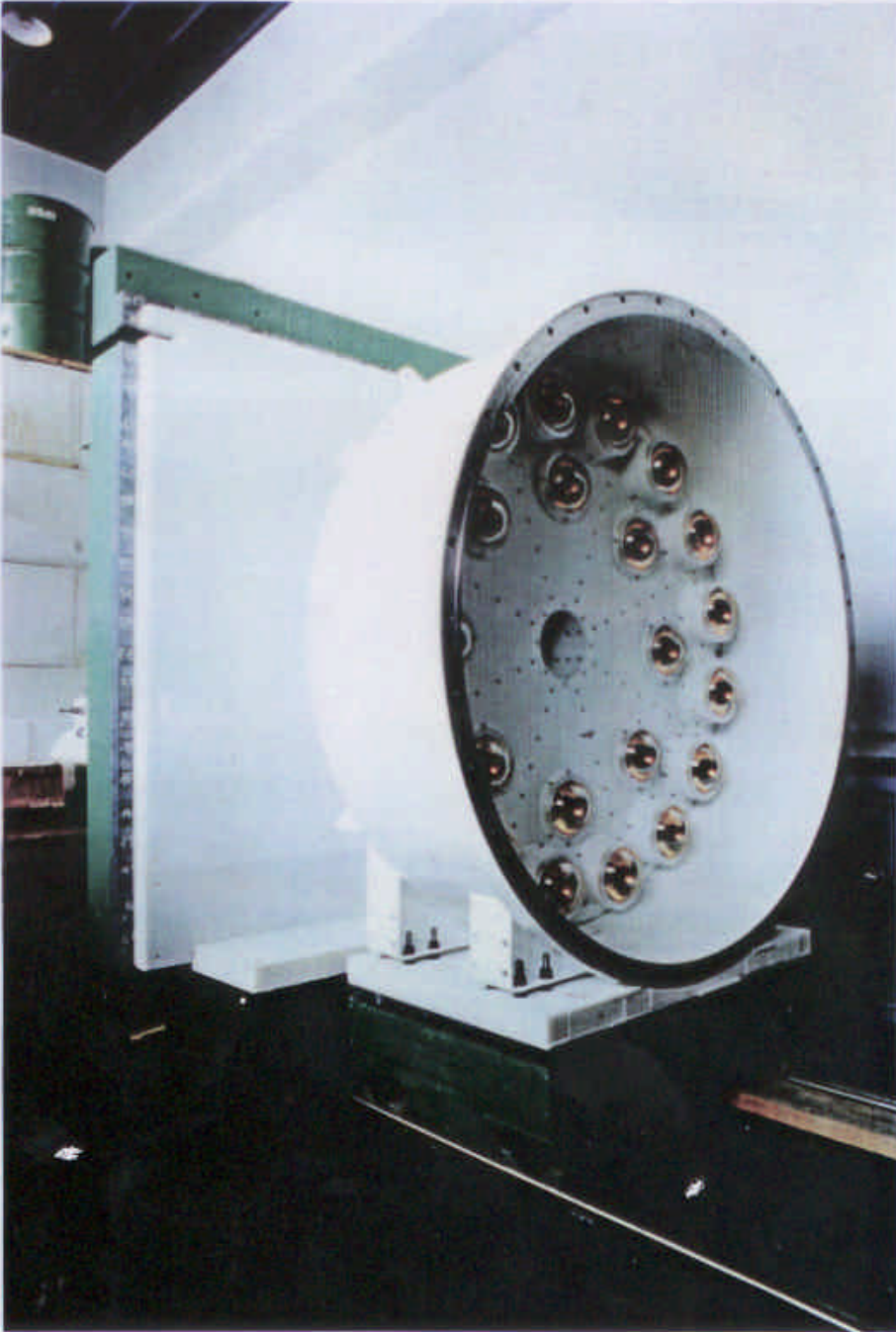
$E_{\gamma} > 100$ keV

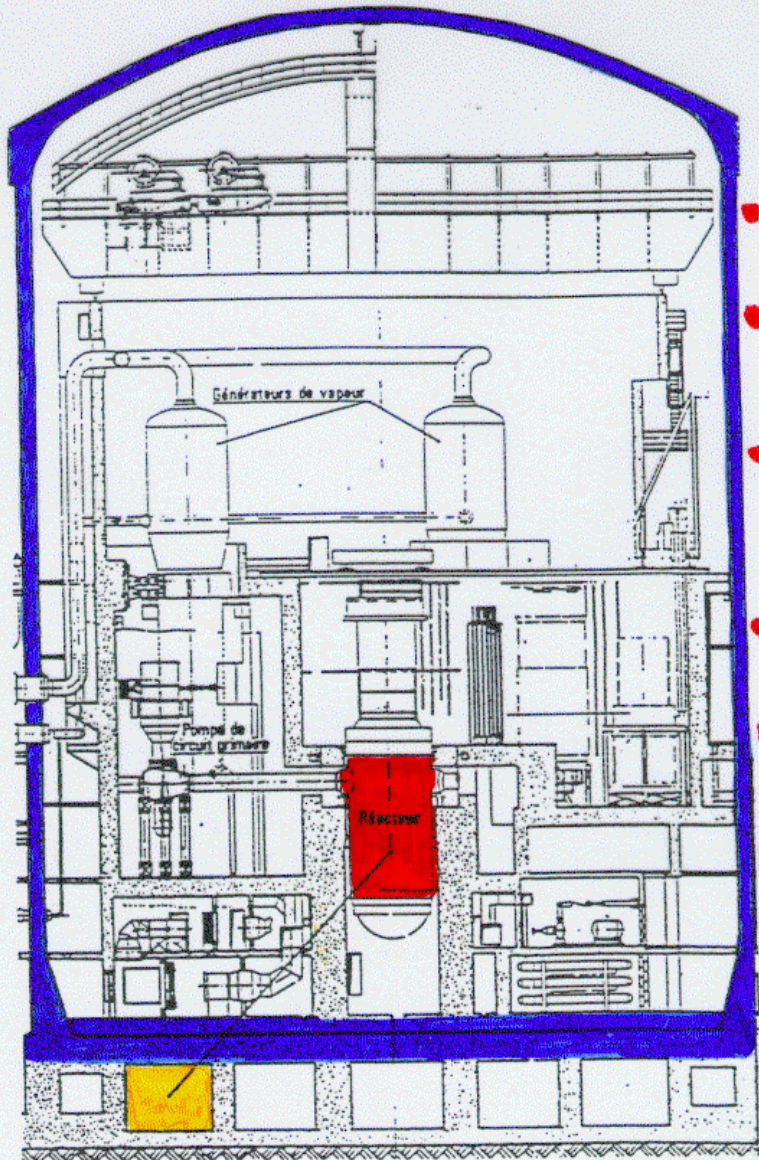


Broggini - 04









- $W = 2800 \text{ MW}_{th}$

- $\bar{V} \approx 5 \times 10^{20} / s$

- $\frac{\Delta \phi}{\phi} = 3\%$

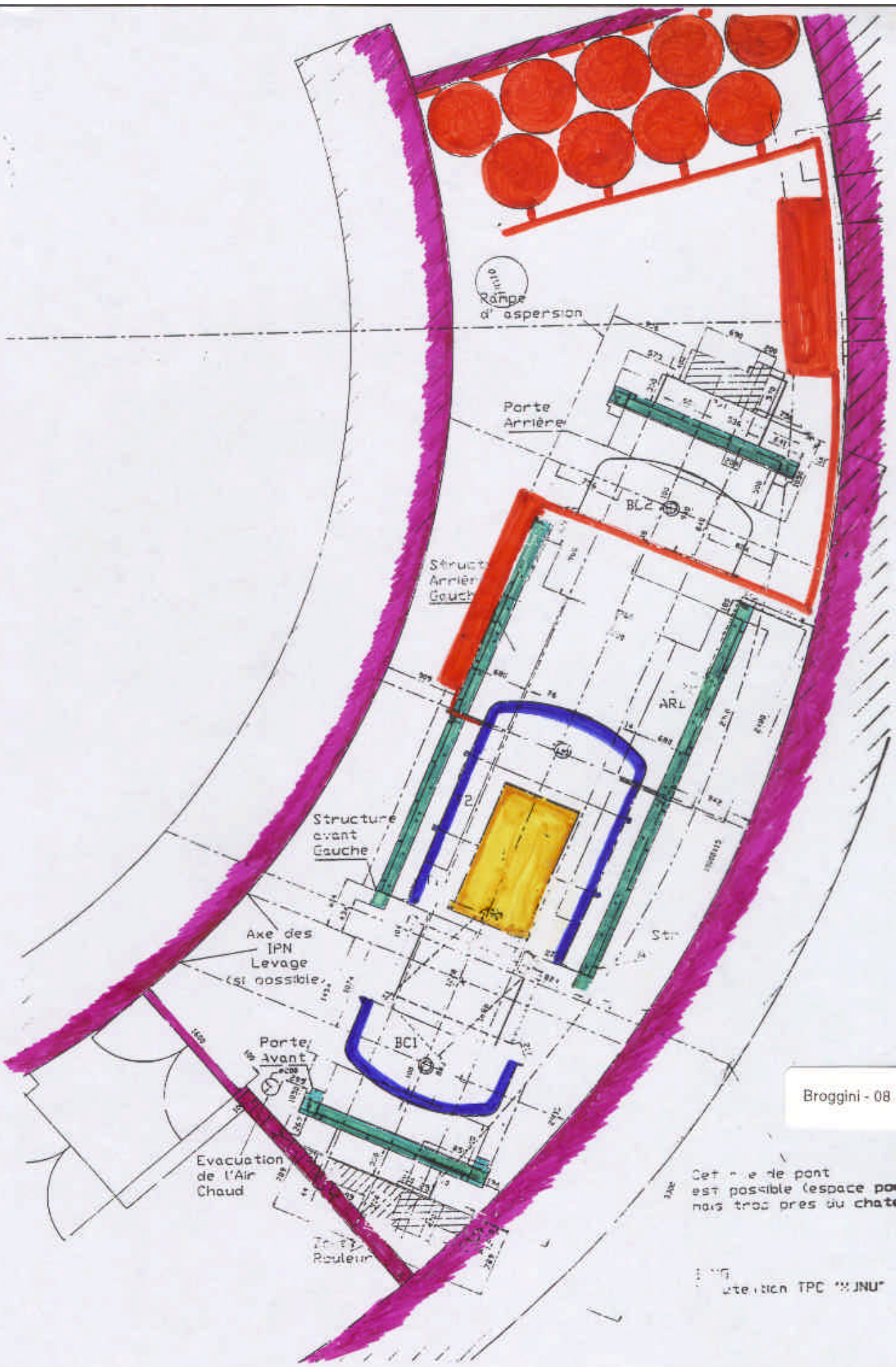
- $d = 18 \text{ m}$

- 20 mwe DEPTH

- No $\phi(m, \delta)$
REACTOR CORRELATED

- $\mu = 32 / \text{m}^2 \text{ s}$

Figure 5: The Bugey Reactor Building



Brogini - 08.

Cet axe de pont est possible (espace par mais trop près du chat)

Attention TPC "JNU"

<u>EVENT RATE</u>	(EV/DAY)	$P = 3 \text{ bar}$
$T \text{ (mV)}$	WEAK	E.M. ($m_\nu = 10^{-10} m_B$)
> 0.3	6.0	3.2
> 0.8	1.7	0.5

BACKGROUND:

μ DIS
 μ^- CAPTURE } \Rightarrow RADIOACTIVE NUCLEI $\Rightarrow \beta \gamma$

(μ, m) IN THE SCINTILLATOR
IN THE LEAD SHIELDING } (m, γ)
 $\bar{\nu}_e + p \rightarrow e^+ + n$ IN THE SCINTILLATOR } $\sim 2 \text{ e/d}$
 $\downarrow 2.2 \text{ MeV}$

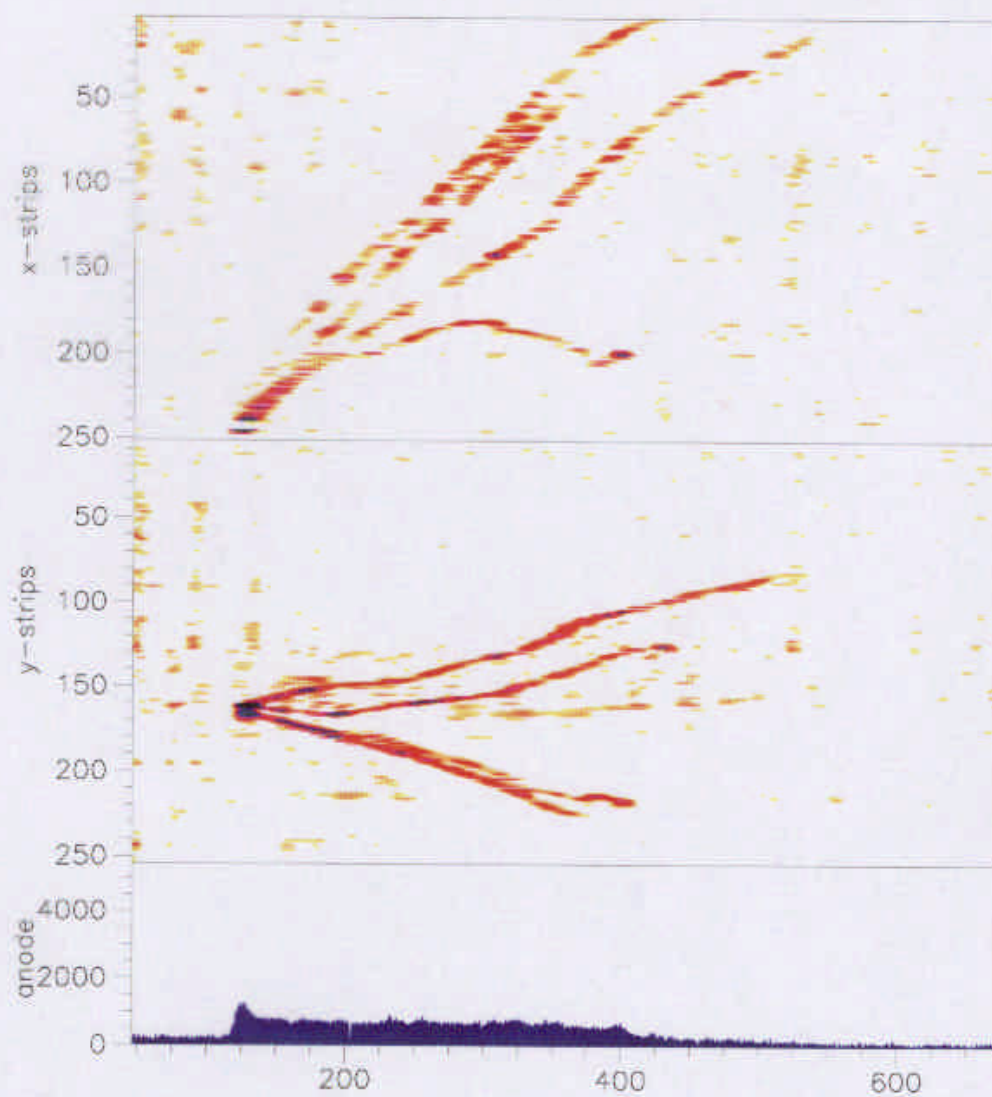
EXTERNAL RADIOACTIVITY } $\Rightarrow \gamma \sim 4 \text{ e/d}$
TPC RADIOACTIVITY

1! ELECTRON WITH

$E_{\text{TPC}} > \underline{300} \text{ keV} + E_{\text{SCINT.}} < \underline{100} \text{ keV}$
 $\leq 6 \text{ e/d}$

$\rightarrow \underline{m_\nu \geq 5 \times 10^{-11} m_B}$ IN 1 YEAR DATA TAKING

RUN_268.fz run # 268 event # 7 Sat 25. Sep 1999 12:19:55
 trigger = anode delay = 70 μ s anode \geq 0 asym \geq 0 length \geq 0



P = 3.0 bar
 $\Delta P = 92$ mbar \checkmark

deadtime
 100 %

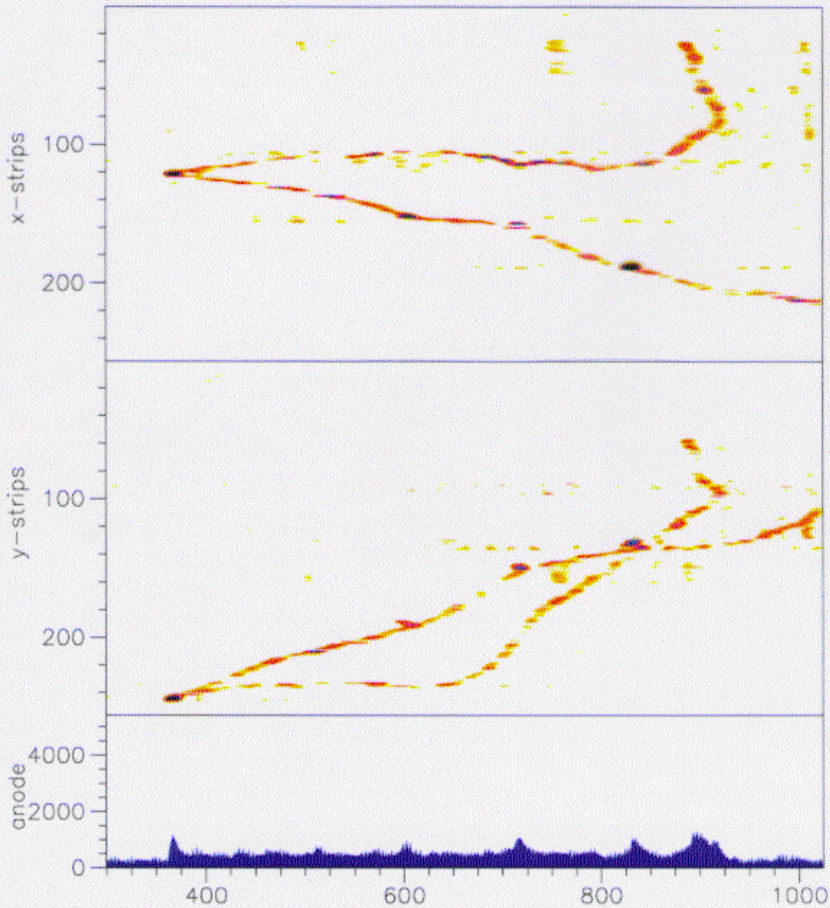
anodesum
 11627
 stripsums
 65672
 82438

E_γ 28338
 T_γ 19

event

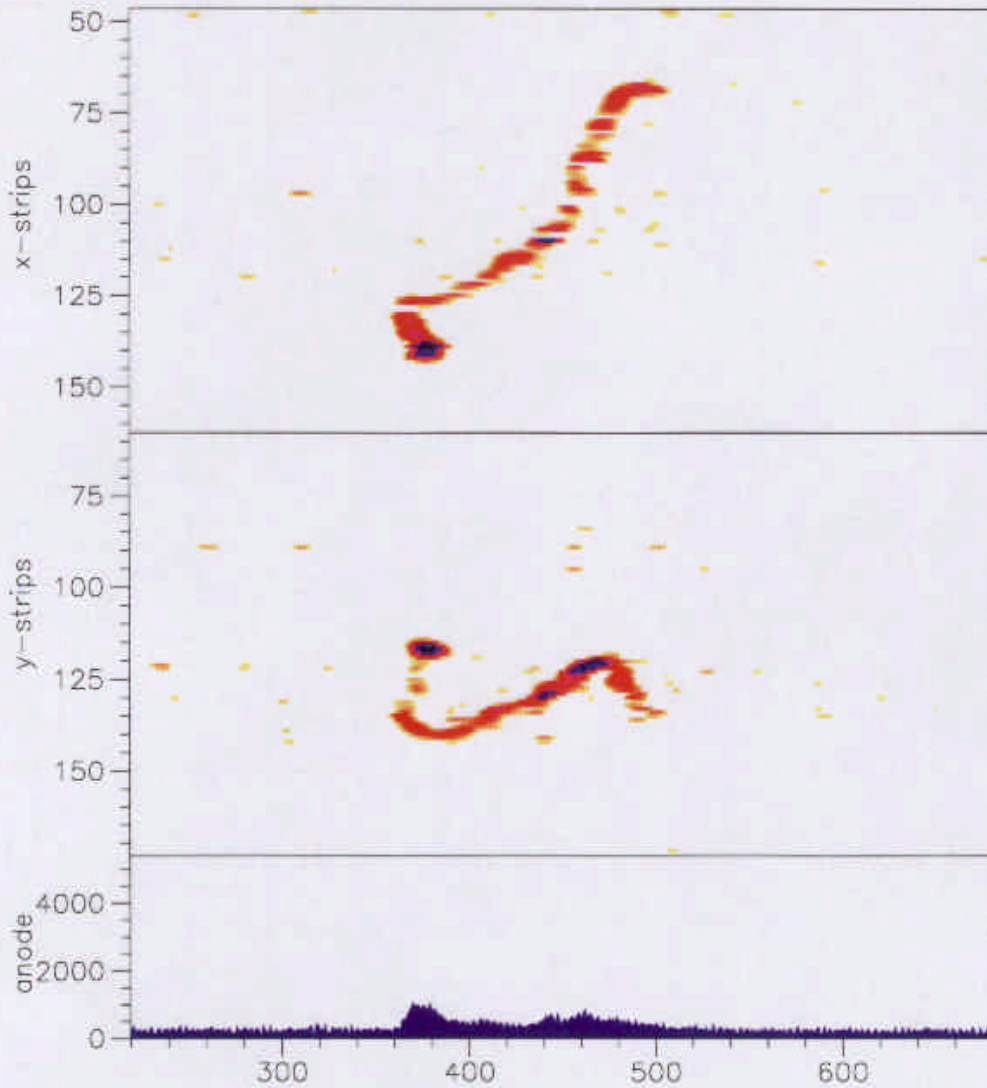
veto μ on

filter_800kev_118.fz run # 118 event # 1700 Wed 4. Aug 1999 12:12:22
 trigger = neutrino delay = 50 μ s anode \geq 1250 asym \geq 0.25 length \geq 10



P = 3.0 bar	
$\Delta P = 92$ mbar	✓
deadtime	29 %
filter factor	
acc. = 39	%
anodesum	17063
stripsums	51565
	35716
E_γ	0
T_γ	0
event	
veto μ	off

filter_105.fz run # 105 event # 170 Mon 2. Aug 1999 18:09:05
 trigger = neutrino delay = 50 μ s anode \geq 0 asym \geq 0 length \geq 0



P = 3.0 bar
 $\Delta P = 92$ mbar ✓

anodesum
 4413
 stripsums
 14180
 12961

E_γ 0
 T_γ 0

event

veto μ off

PRELIMINARY RESULTS :

(~ 1 YEAR OF RUNNING)

ANTI COMPTON RATE: 900 Hz FOR $E_V > 100$ keV

AS EXPECTED (μ_s + RADIOACTIVITY)

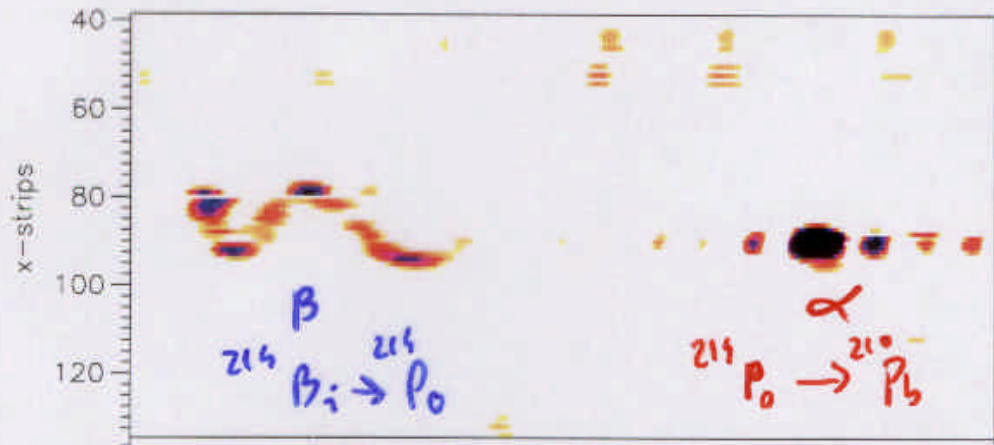
TPC RATE :

e	T > 300 keV	10 Hz
	T > 800 keV	0.15 Hz
α	GAS	35 Hz
	CATHODE	0.05 Hz

SOURCE: ^{222}Rn FROM THE OXISORB

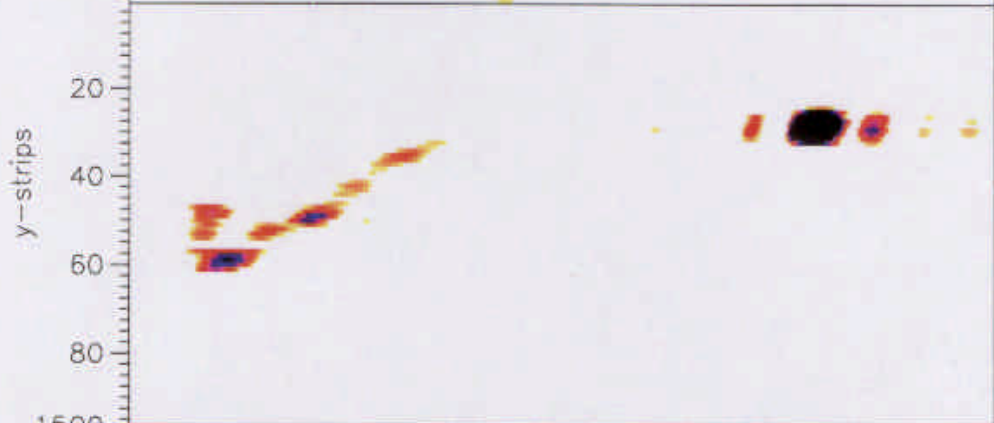
OXISORB \rightarrow GETTER

scanout_b_a_155-327.fzun # 0 event # 221 Mon 18. Jan 1999 20:02:15



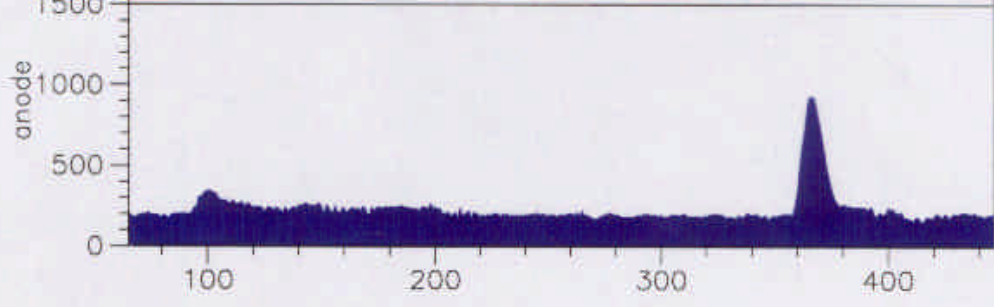
P = 3.1 bar
 $\Delta P = 95 \text{ mbar} \checkmark$

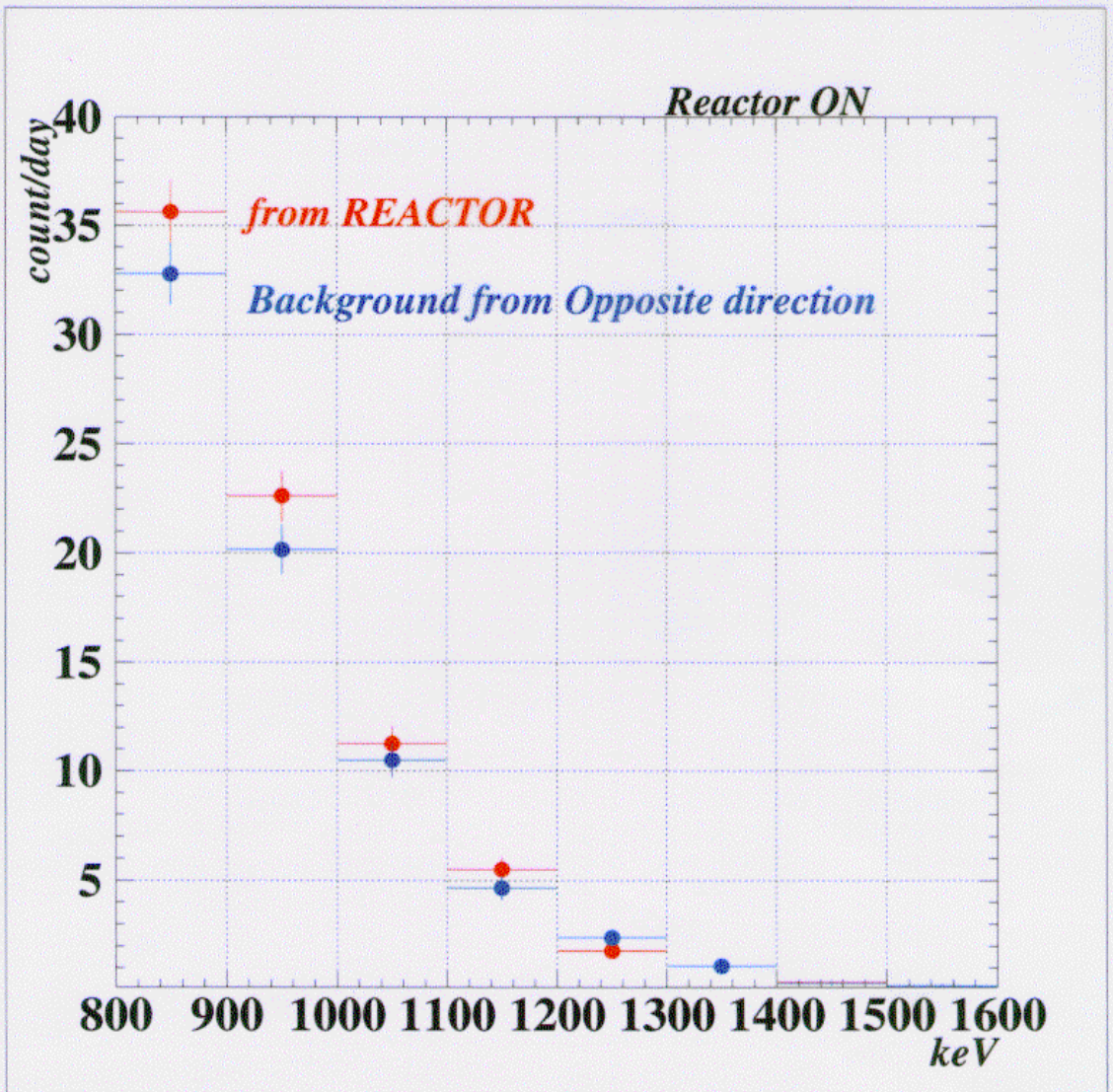
anodesum
1737



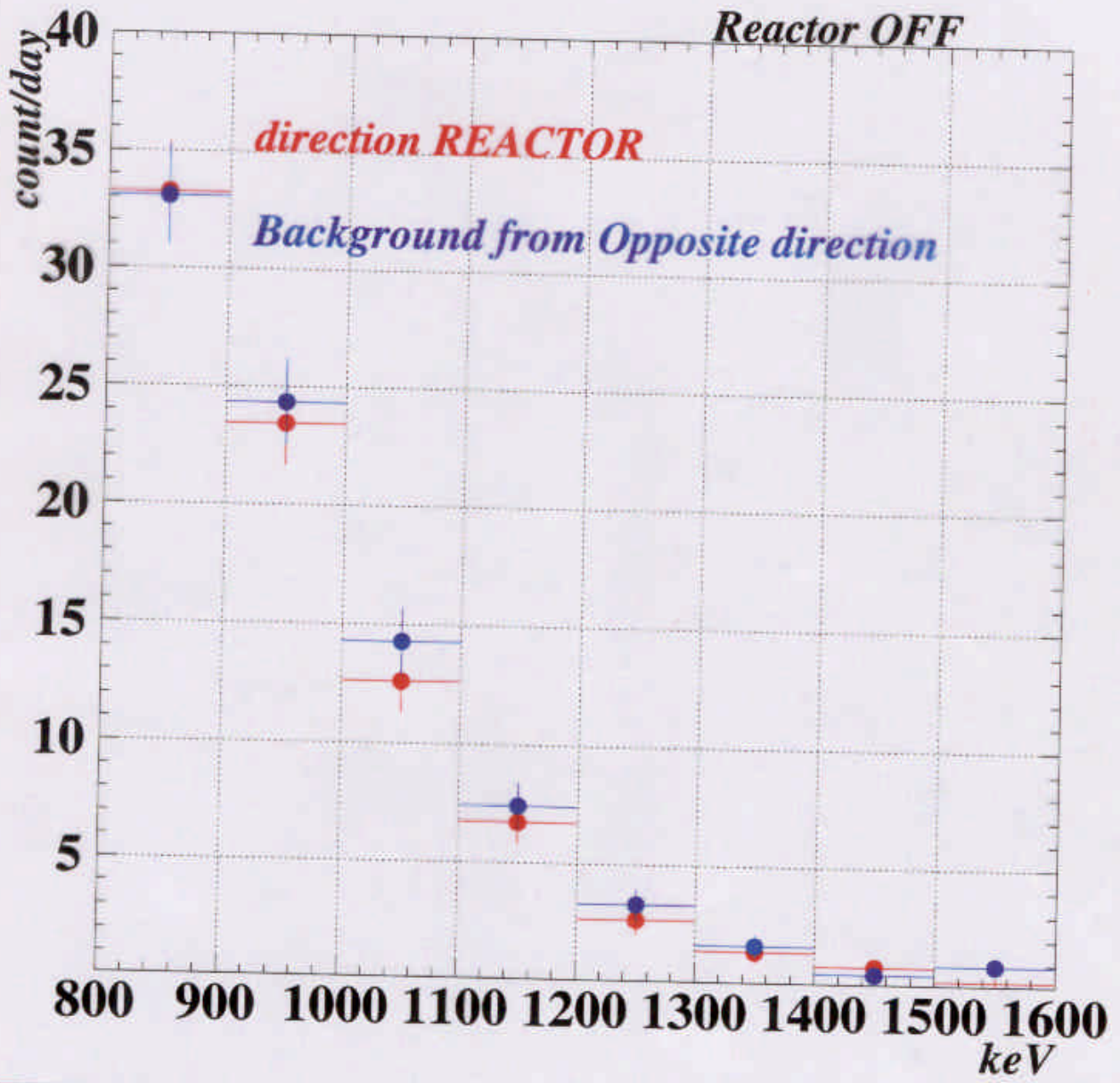
stripsums
31322
23449

event





Reactor OFF



$$e \quad T > 300 \text{ keV} \quad 0.1 \text{ Hz}$$

$$T > 800 \text{ keV} \quad 1.5 \times 10^{-3} \text{ Hz} \quad \sim 10^2$$

$$\alpha \quad \text{GAS} < 5 \times 10^{-3} \quad \sim 10^5$$

$$\text{CATHODE} \quad 0.05 \text{ Hz} \quad =$$

CATHODE CONTAMINATION

→ NEW CATHODE

$$\alpha \quad \text{CATHODE} \quad 5 \times 10^{-5} \quad 10^2$$

SUMMARY:

- MUNU IS RUNNING SINCE ~ 1 YEAR
- THE DETECTOR IS WORKING AS EXPECTED
- WE HAD SERIOUS PROBLEMS DUE TO ^{272}Rn
- BACKGROUND REDUCTION $\sim 10^4$
- IT IS THE FIRST DETECTOR DOING γ SPECTROSCOPY IN THE 1 MeV REGION