

We need ^{150}Nd for the $\beta\beta_{0\nu}$ experiment

$$\frac{1}{T_{1/2}^{0\nu}} = G_{0\nu} M_{0\nu}^2 \langle m_\nu \rangle^2$$

SuperNEMO
SNO++
DCBA
etc.

Shell Model: Caurier et al.
QRPA: Feasler Rodin Simkovic
Vogel 2005

Isotope	$Q_{\beta\beta}$ (MeV)	$G_{0\nu}$ (y^{-1})	$T_{1/2}(0\nu)$ with $m_\nu=50\text{meV}$	
			Shell Model	QRPA
^{48}Ca	4.271	2.44	$9.2 \cdot 10^{26}$	$2.9 \cdot 10^{27}$
^{76}Ge	2.040	0.24	$7 \cdot 10^{27}$	$2.4 \cdot 10^{27}$
^{82}Se	2.995	1.08	$9.6 \cdot 10^{26}$	$7.4 \cdot 10^{26}$
^{96}Zr	3.350	2.24		$1.5 \cdot 10^{28}$
^{100}Mo	3.034	1.75		$1.4 \cdot 10^{27}$
^{116}Cd	2.802	1.89		10^{27}
^{130}Te	2.528	1.70	$3.6 \cdot 10^{26}$	10^{27}
^{136}Xe	2.479	1.81	$5.2 \cdot 10^{26}$	$2\text{-}5 \cdot 10^{27}$
^{150}Nd	3.367	8.00		$1.2 \cdot 10^{26}$

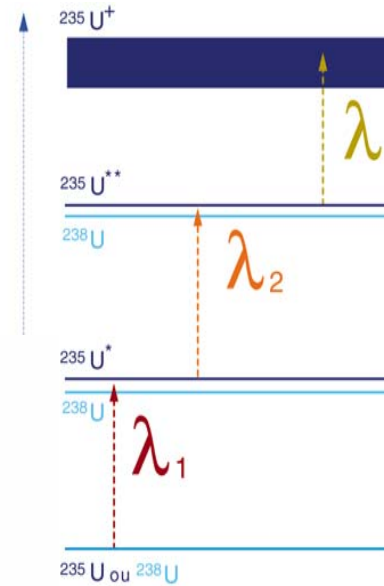
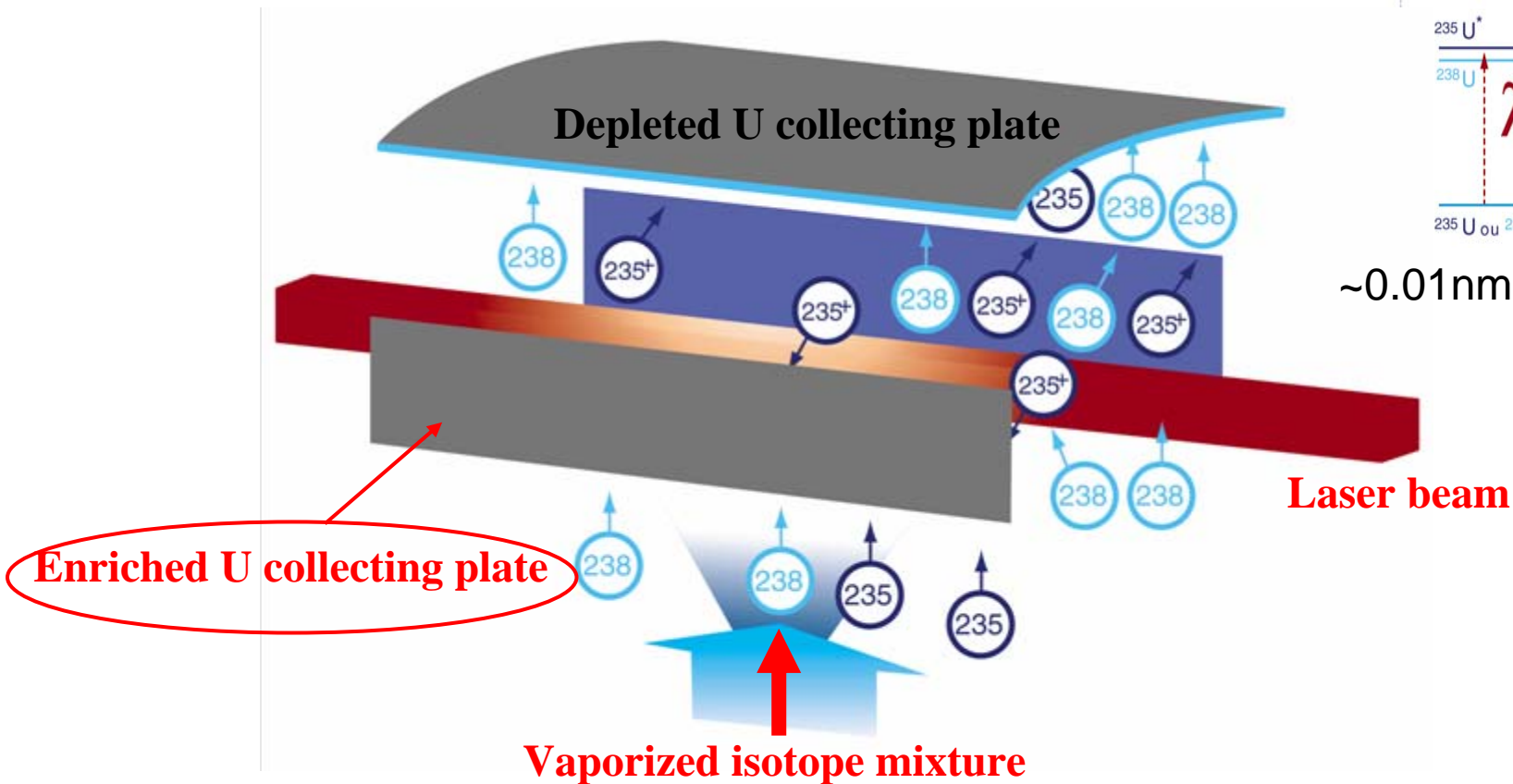
$Q_{\beta\beta}^{150}\text{Nd}$
Beyond the γ of
 $2.614 \text{ MeV} (^{208}\text{Tl})$
Beyond ^{214}Bi Q_β
(3.2 MeV)

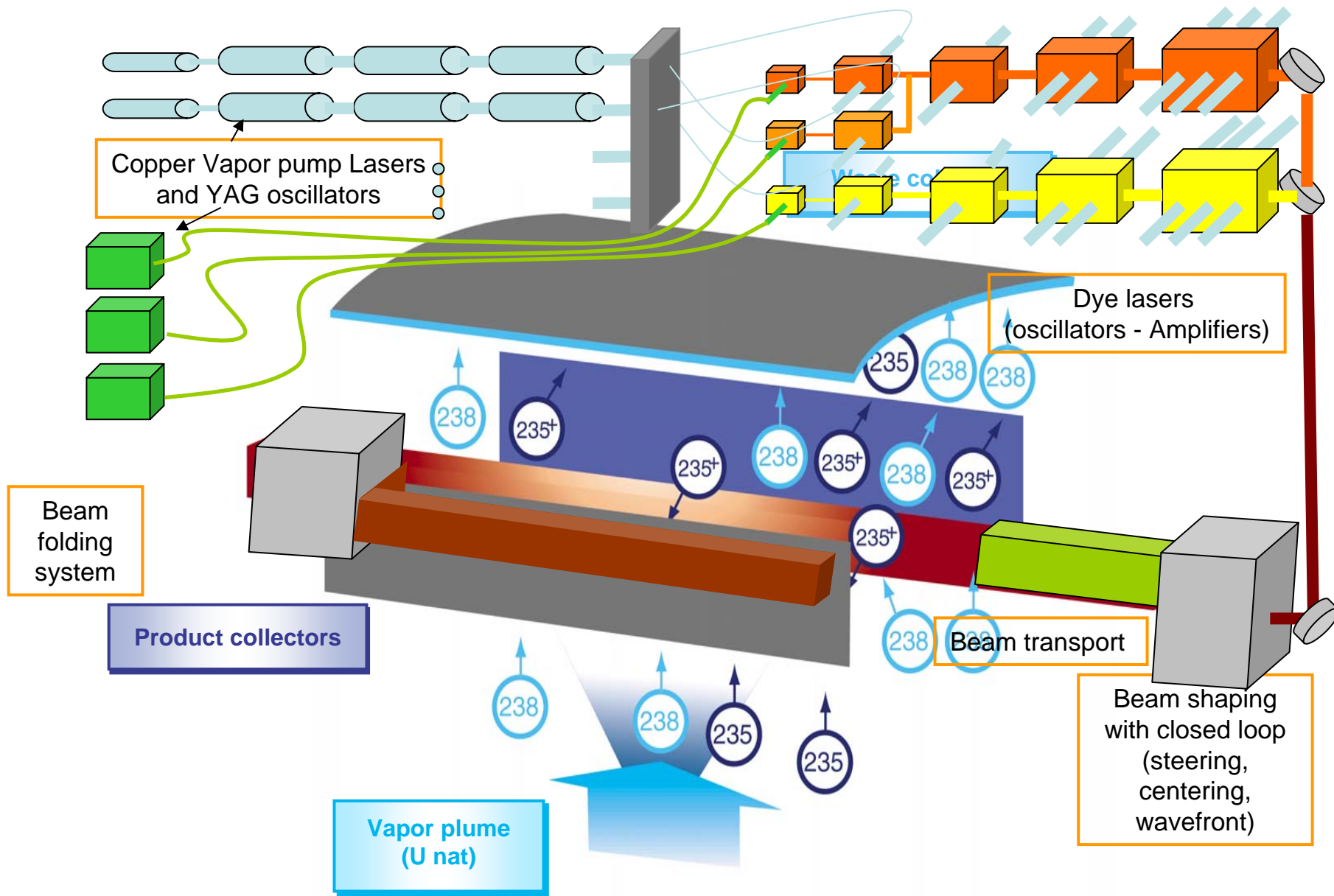
-Possibility to produce ^{150}Nd with laser enrichment method (use MENPHIS) under study.
S. Jullian (LAL, Orsay, Organizer of the Project), here only presentation by H. Ohsumi

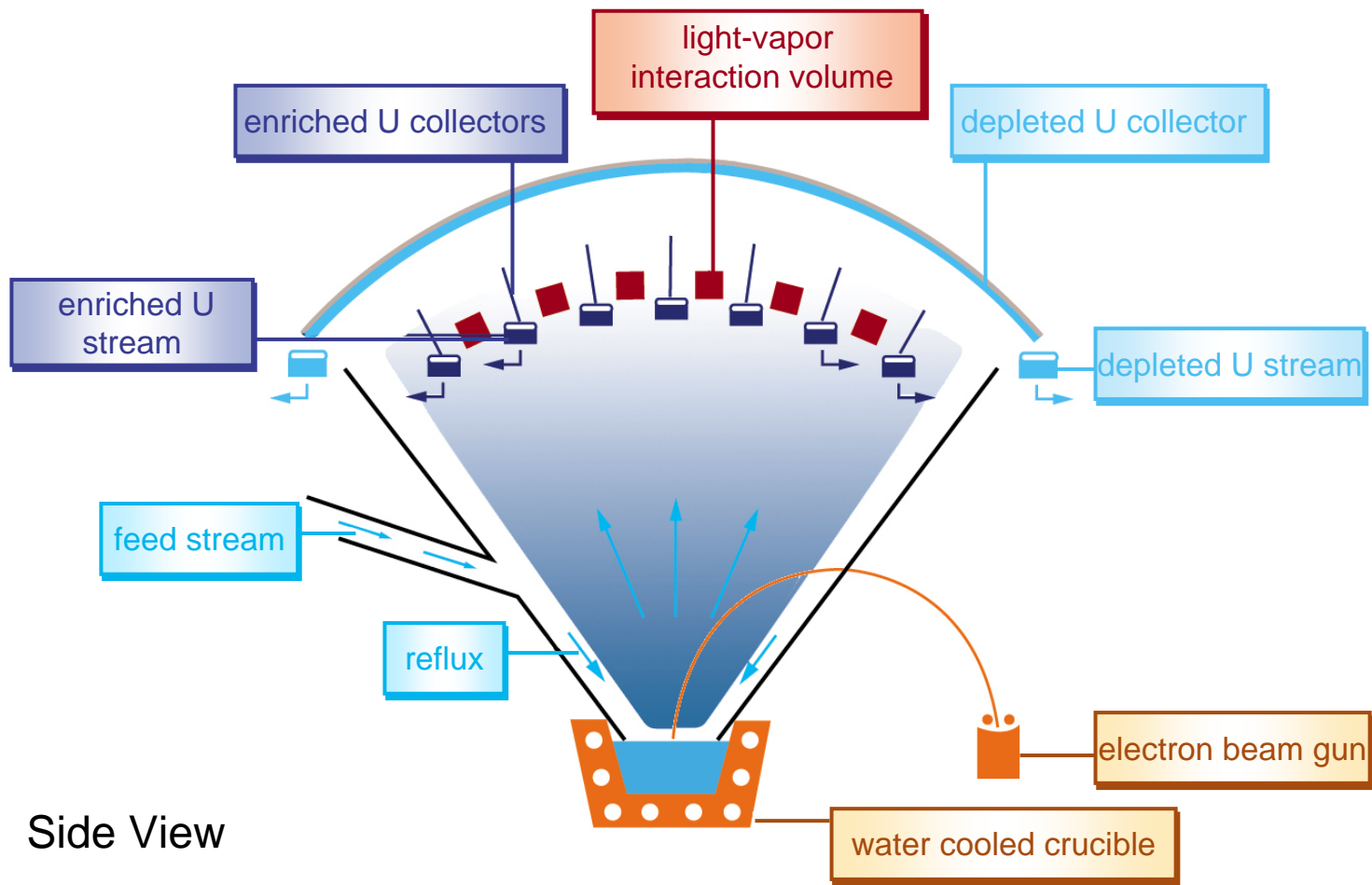
^{150}Nd production: The Laser Method (AVLIS)

AVLIS: Atomic Vapor Laser Isotope Separation

Selective photoionization based on :
isotope shifts in the atomic absorption optical spectra







Side View

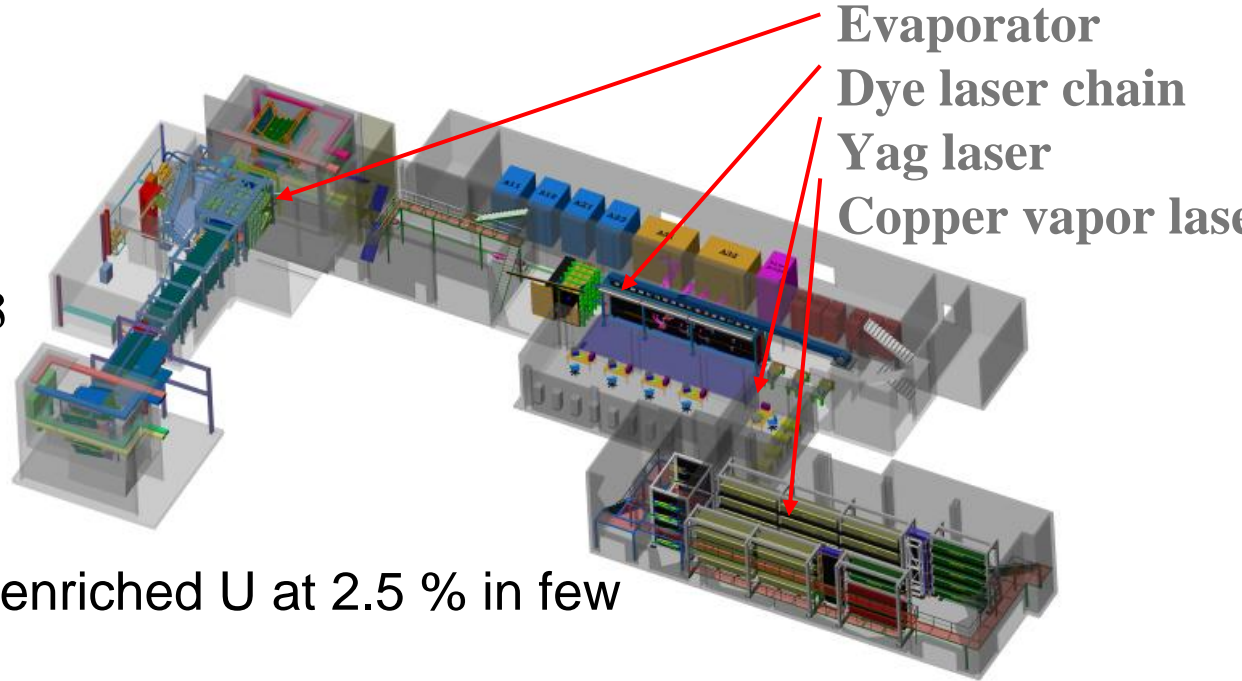
2000 - 2003 Program: MENPHIS Facility

Design : 2001

Building : 2002

1st test : early 2003

1st full scale exp. : june 2003



- Production of 200 kg of enriched U at 2.5 % in few days
- Results in agreement with simulation expectation

MENPHIS simulation shows that enrichment of ^{150}Nd is doable (ton scale), ~ 100 kg in few weeks !!!

^{48}Ca enrichment is theoretically doable. Studies must be done

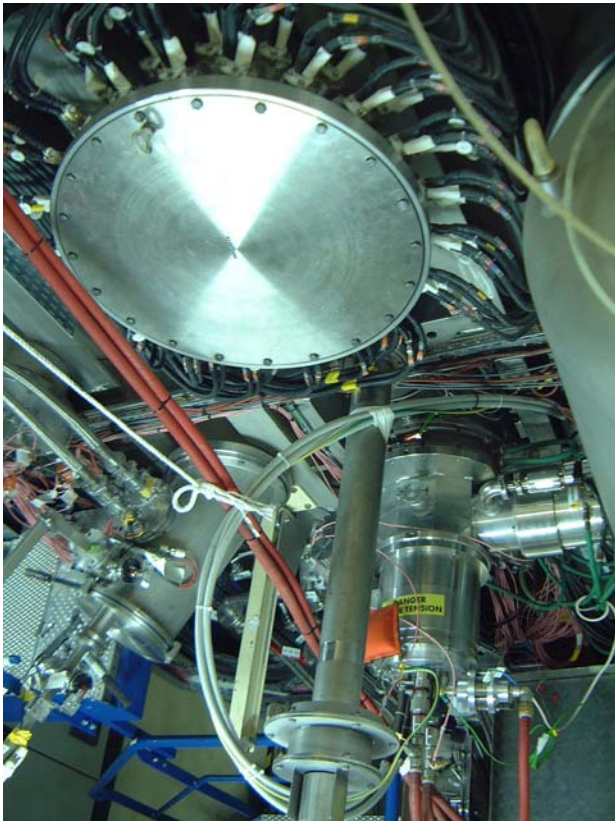


Expression of Interest of SuperNEMO, SNO++ and Japan to keep MENPHYS for Nd enrichment

Memphis experiment technological results

LASER :

- ≥ 600 hours for each CVL
- 170 hours for dye laser at full power



SEPARATOR :

- Several hundred hours at the operational temperature and extractor voltage without significant failures nor material damages
- Long time evaporation

MENPHIS (2000-2003 Program): CONCLUSIONS

- Many countries have demonstrated with AVLIS a g/h production of low enriched uranium
- But only a few have been able to raise the production up to a few kg/hour (USA, Japon, France)
- To get such a production level : 20 years :
 - high power electron gun
 - high laser power
- Nd has been enriched in ^{150}Nd at 60% with a production yield of 40mg/h
(Kurchatov Institute QE 35(10), 879 (2005))