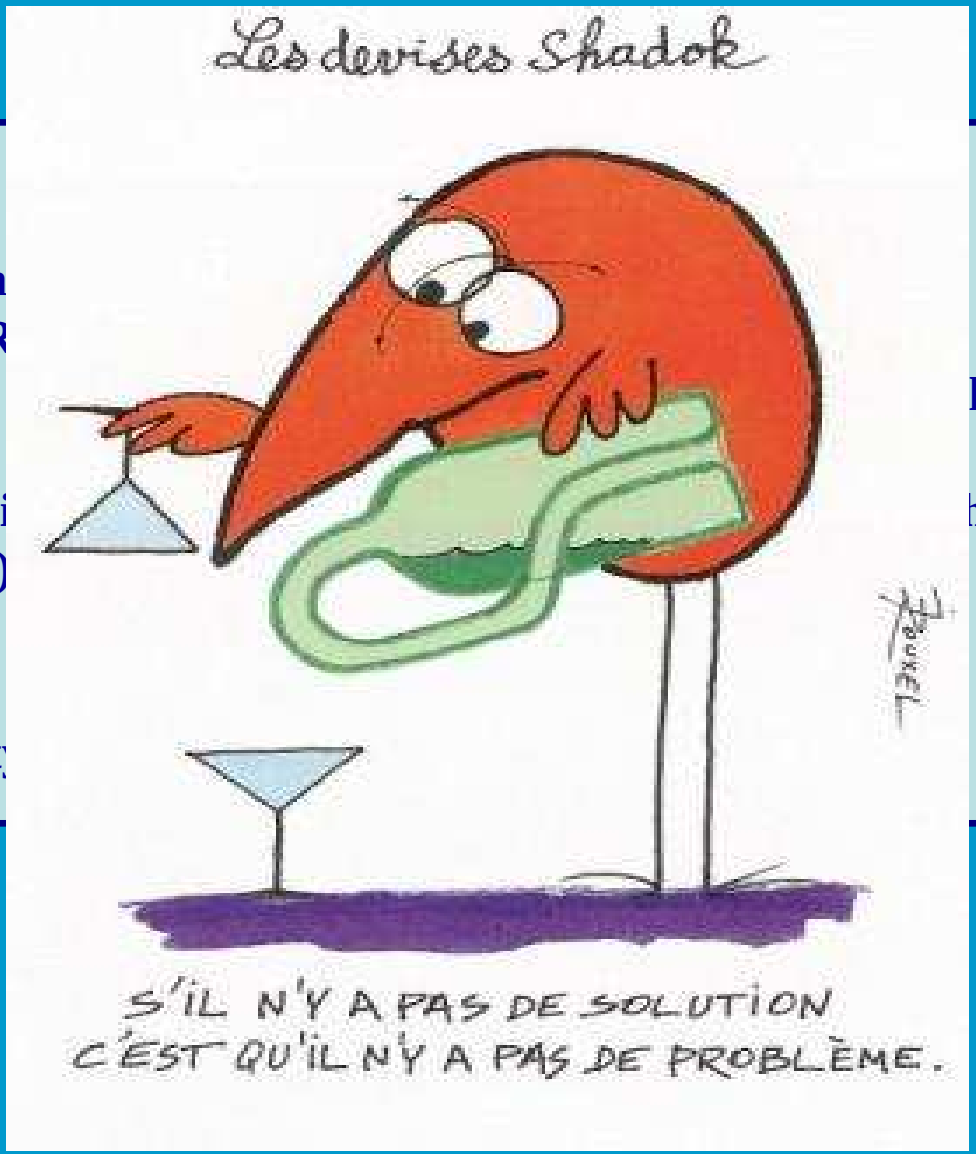
DESIR SAFETY ISSUES

Milestones

- **DESIR Techn**
  - **Basic DESIR**
  - **Technically:** **lfilled**

  -> basic princi **hnical aspects**
  (to be refined)

- **DESIR safety**
  - **DESIR safet**



DESIR SAFETY ISSUES

Safety requirements

- **Accessibility: possibility to work inside the DESIR building while RIBs are delivered**
  -> DESIR building AND interfaces = green zones (DeD < 25 µSv/h, < 2 mSV/year)
  -> At any time, we know what total activity is contained in DESIR (preferably less than 100 MBq at any time)
  -> Activity always confined in beam pipes, vacuum chambers, dedicated storage devices (0 LPCA in the building at any time)

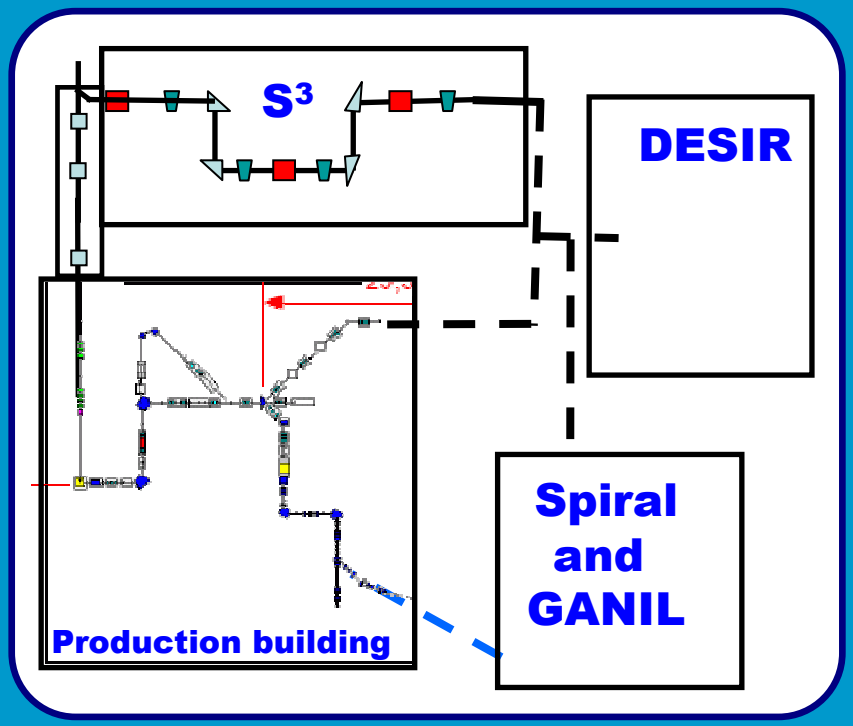
- **Limited impact in case the confinement fails (vacuum breakdown)**
  -> Accidentally released activity < 1 LPCA
  -> Activity < 0.4 Bq/cm^2 everywhere in DESIR

  Confinement class C1

- **Limited impact on the environment (people living close by) in case the confinement fails**
  -> DESIR in low depression (air flow from outside)
  -> low impact in case the confinement fails and a fire starts

The Dose rate issue (DeD)

- ✓ working area: DeD < 7.5 µSv/h
  < 2 mSv/year
- ✓ temporary working area (< 10 min): DeD < 100 µSv/h



- ✓ RIB from S^3: I < 10^6 pps, N~Z nuclei
  -> not an issue
- ✓ RIB from S1: I ≤ 10^9 pps (^{19}Ne)
  -> definitely an issue but: short lifetime and temporary shielding to be mounted (access limitation)
- ✓ RIB from Bât. prod: if of high intensity, must be short-lived AND must induce less than 1 LPCA in case of confinement failure

The accidental situation (LPCA)

- ✓ RIB intensity limitation to stay below 1 LPCA
- ✓ Only (?) a concern for A~90, 130 and 140 n-rich beams coming from the Prod. Build.

Example of ^{131}I: $T_{1/2}$ = 8.02 d

LPCA = 400 Bq/m^3 assuming a 100 % release at room temperature

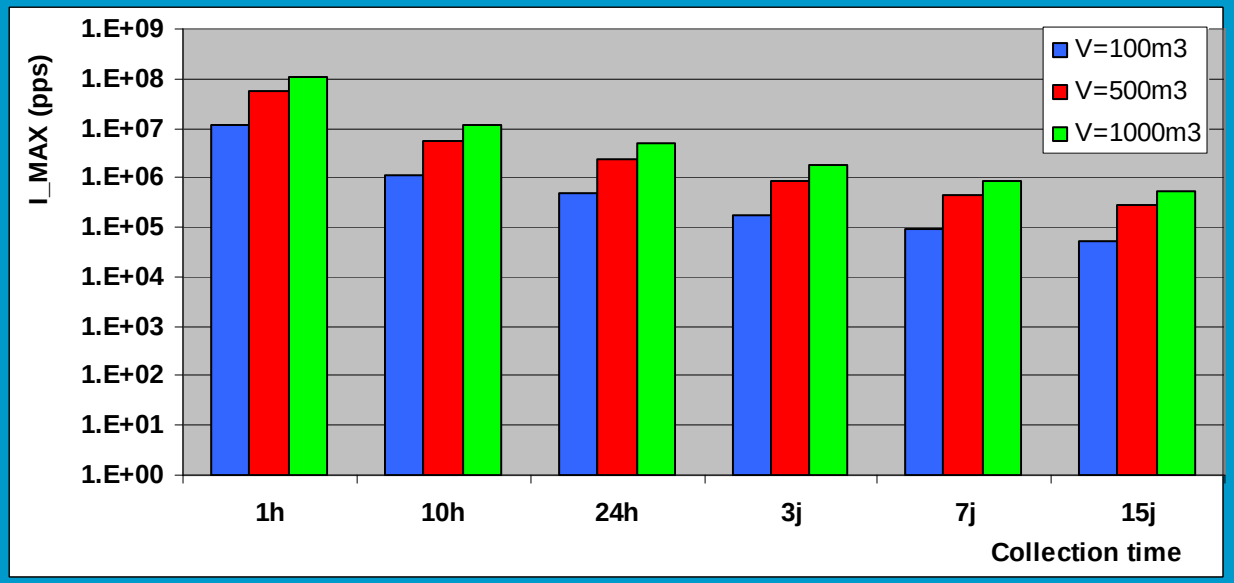
-> Considering a release volume of 10*10*5 = 500 m^3, the maximum ^{131}I activity in DESIR at any time is 2.E+05 Bq i.e. 2.4E+06 pps during 1 day

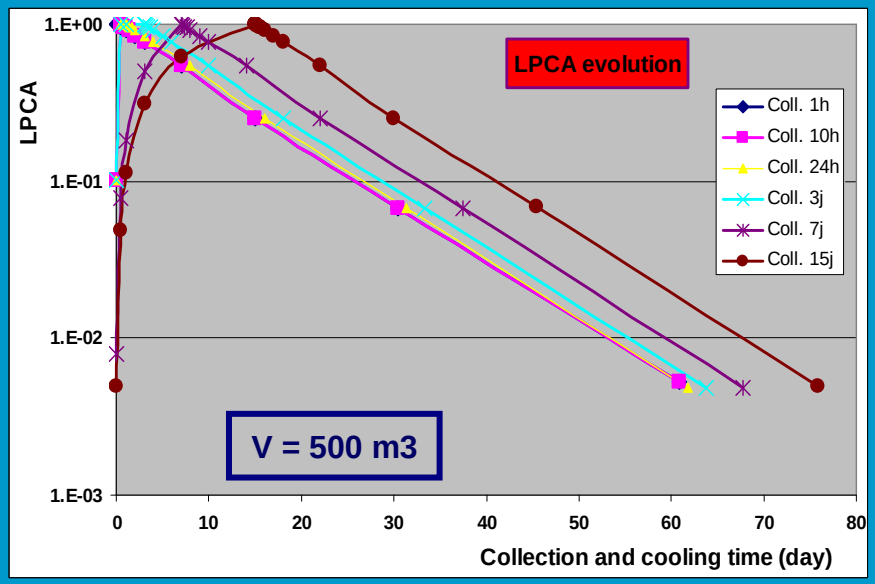
$T_{1/2}$ = 8.02 d
LPCA = 400 Bq/m3

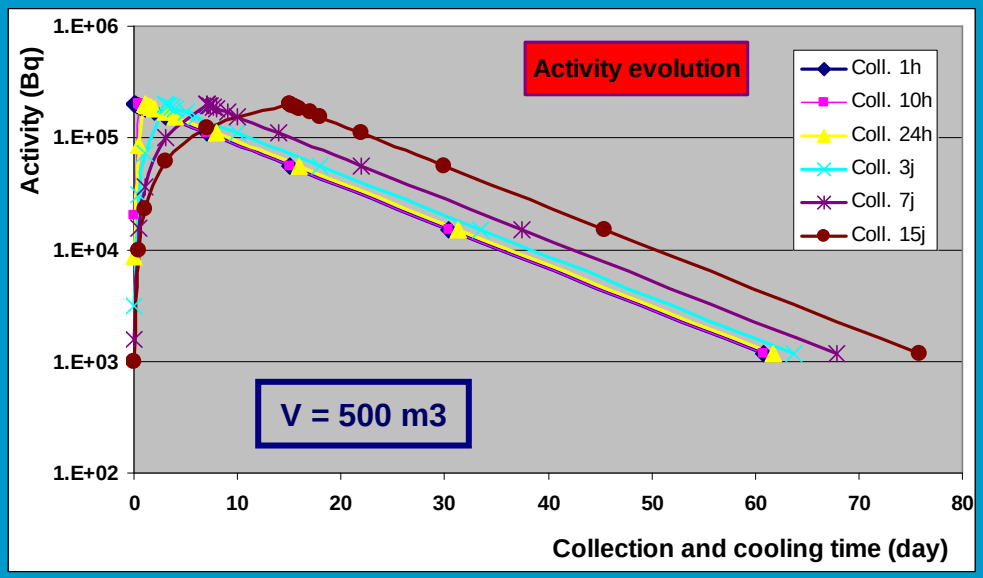
^{131}I only

In target yield (10^{14} f/s)
9.2 10^{9} to 3.810^{12}

V = 500 m³		
Collection time	I^{MAX} (pps) for 1 LPCA	Cooling time to reach 0.01 LPCA
1 h	5.6E+07	54 d
10 h	5.7E+06	54 d
1 d	2.4E+06	54 d
3 d	8.8E+05	56 d
7 d	4.4E+05	60 d
15 d	2.7E+05	68 d







^{131}I only – Dose rate

I^{MAX} for 1 LPCA reached in 1 day in 500 m^3 = 2.4E+06 pps
-> maximum activity = 2.0 E+05 Bq

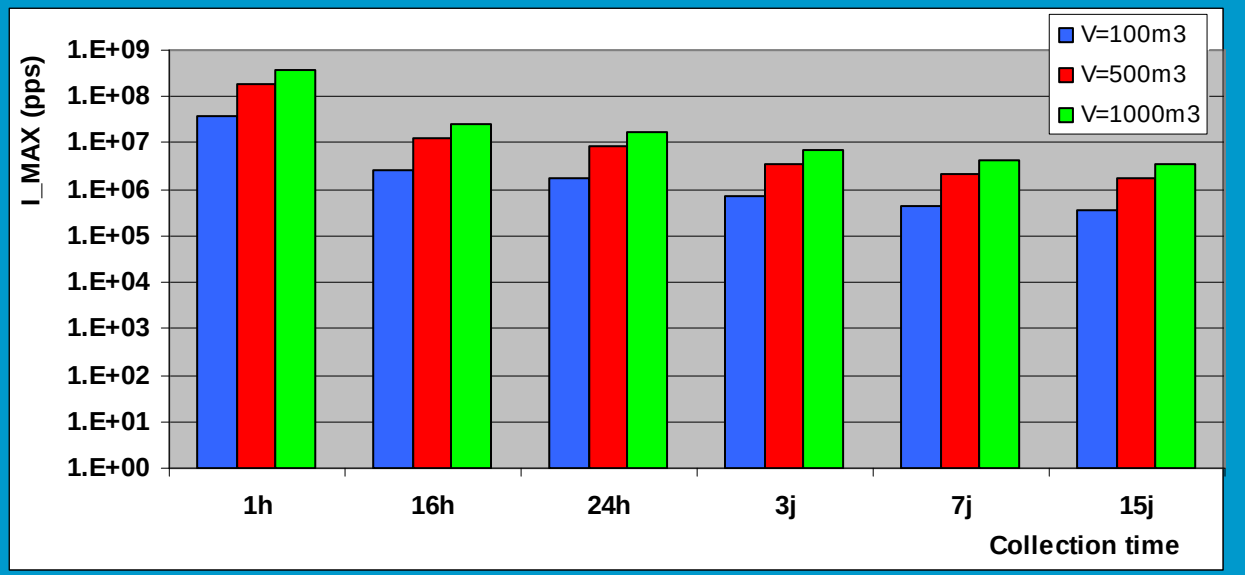
	DeD in air (µSv/h)		
Activity (Bq)	10 cm	30 cm	100 cm
1.0E+08	561	62.6	5.6
2.0E+05	1.1	0.13	0.011

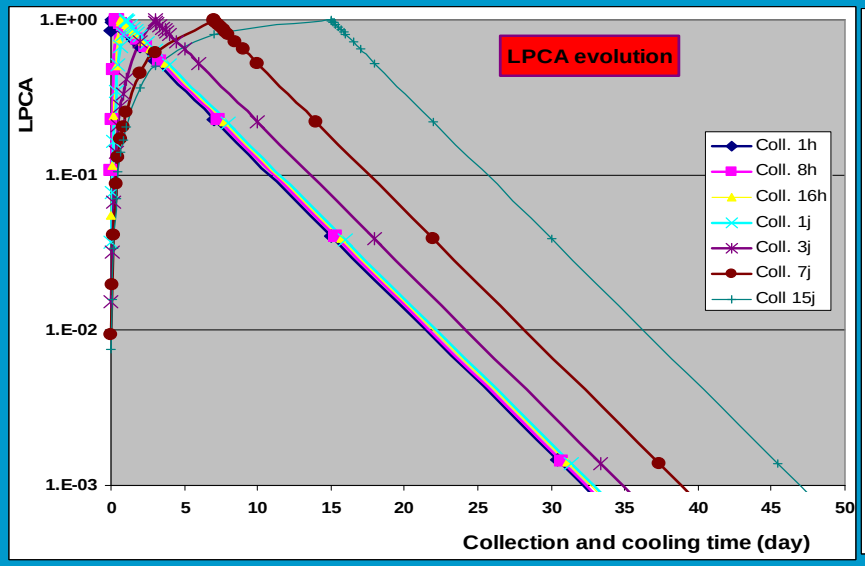
LPCA after 1 day = 4.10^4 Bq/m³

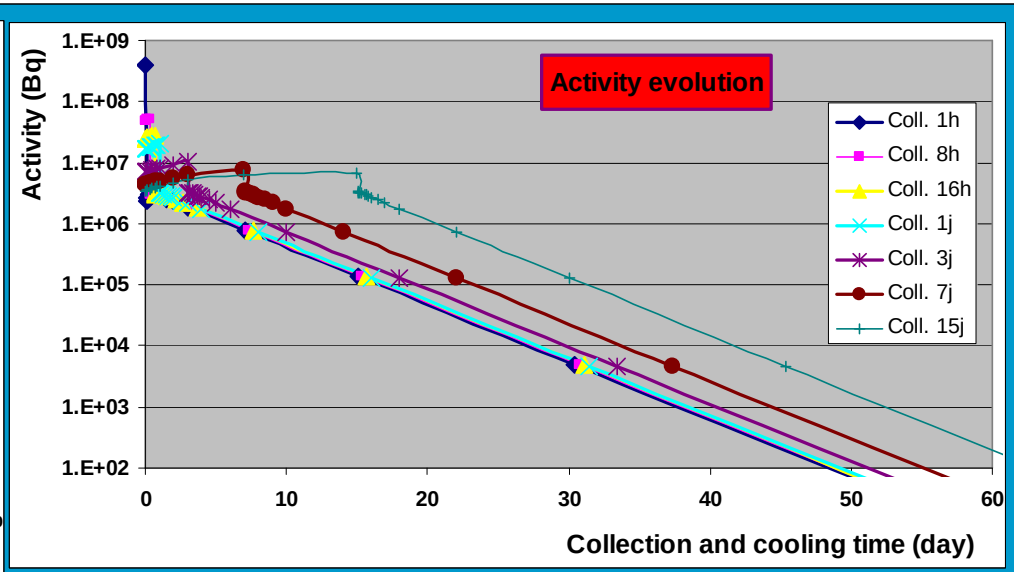
^{132}Sn only

In target yield (10^{14} f/s) $7.7\ 10^{11}$ to $7.9\ 10^{11}$

V = 500 m³		
Collection time	I^{MAX} (pps) for 1 LPCA	Cooling time to reach 0.01 LPCA
1 d	8.5E+06	22 d





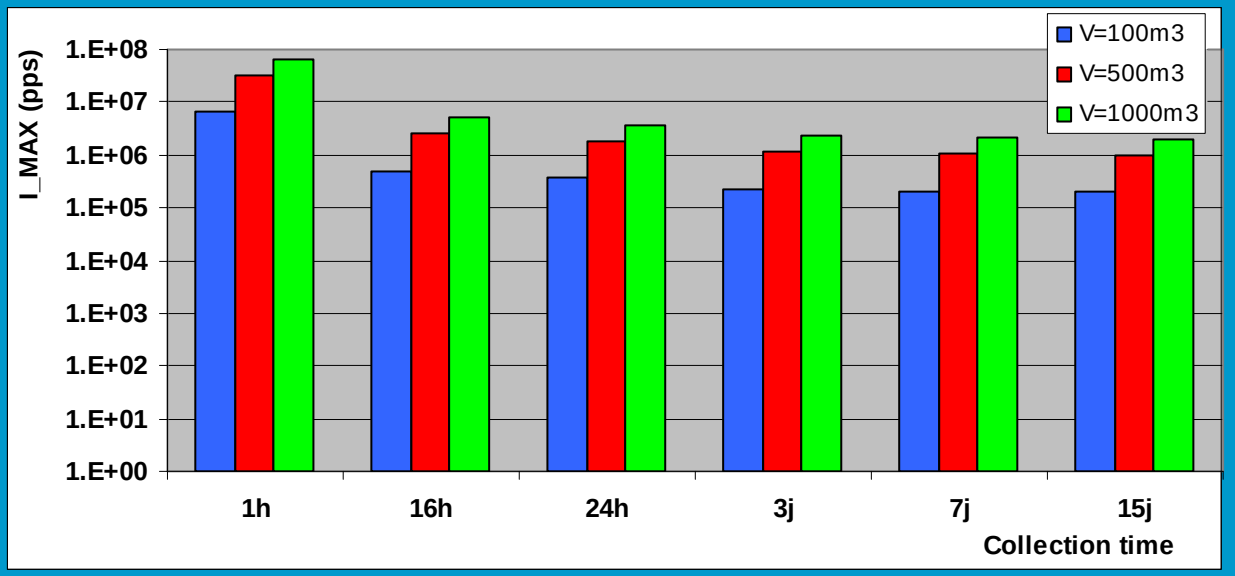


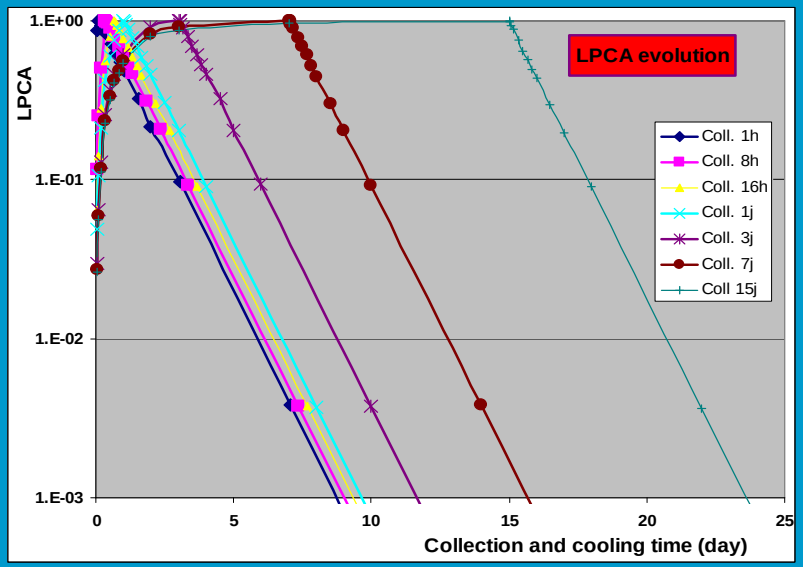
LPCA after 1 day = $1.4 10^4$ Bq/m^3

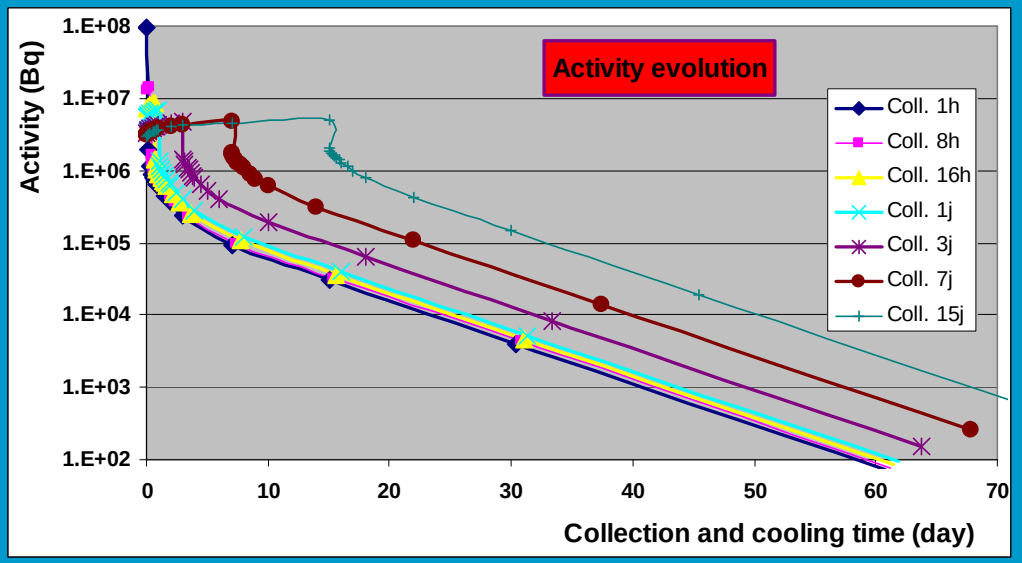
^{133}Sn only

In target yield (10^{14} f/s) 2.6 10^{11}

V = 500 m^3		
Collection time	I^{MAX} (pps) for 1 LPCA	Cooling time to reach 0.01 LPCA
1 d	1.9 E+06	7 d





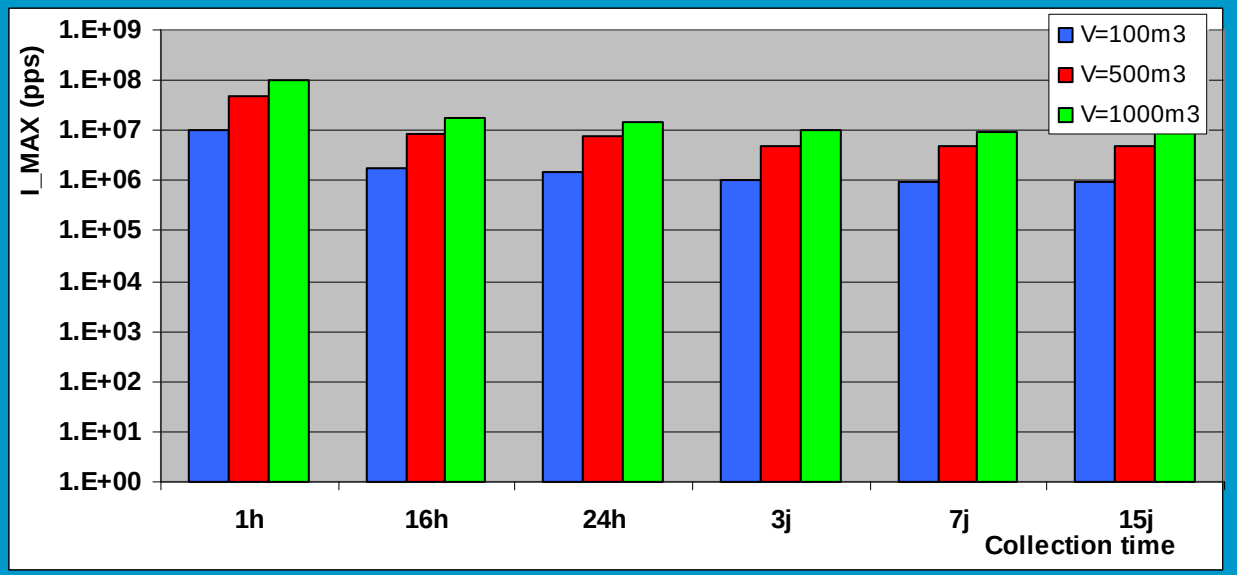


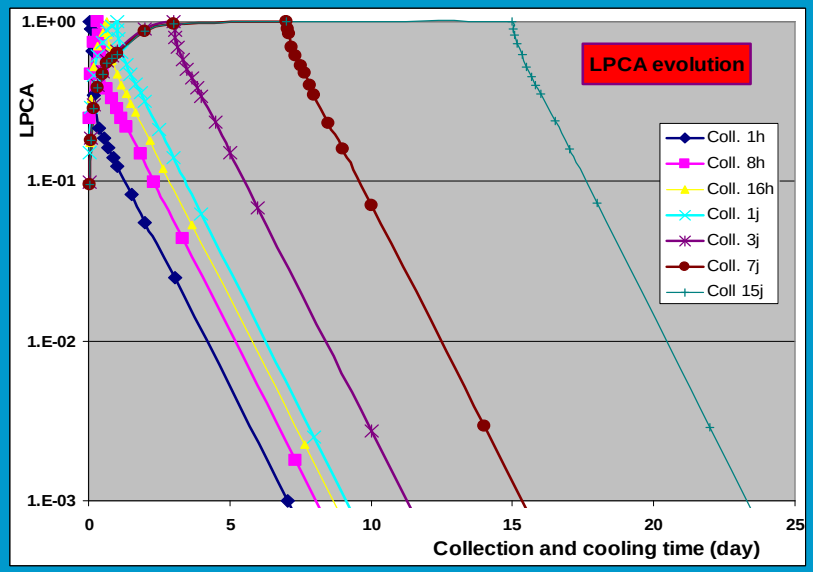
LPCA after 1 day = 6. 10^4 Bq/m^3

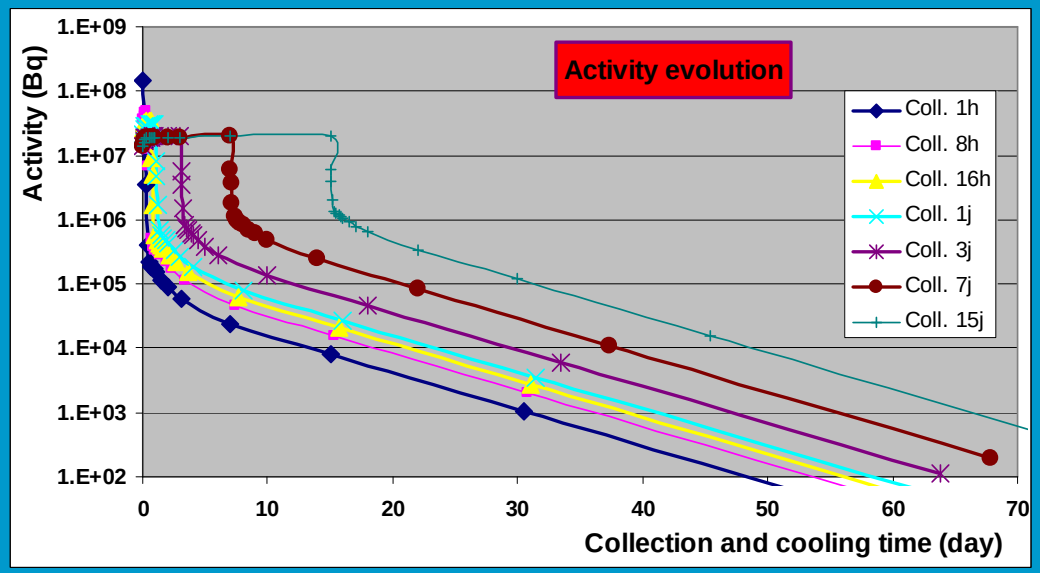
^{134}Sn only

In target yield (10^{14} f/s) 5.6 10^{10}

V = 500 m^3		
Collection time	I^{MAX} (pps) for 1 LPCA	Cooling time to reach 0.01 LPCA
1 d	7.6 E+06	7 d





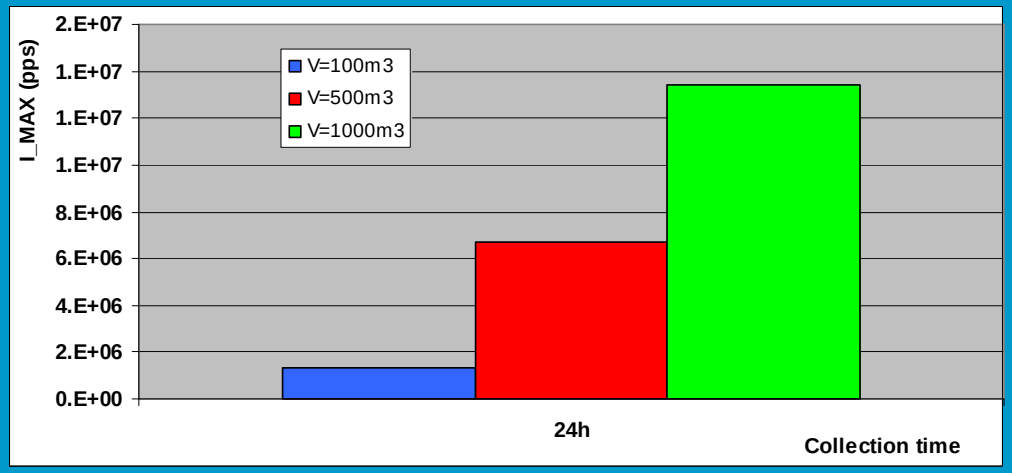


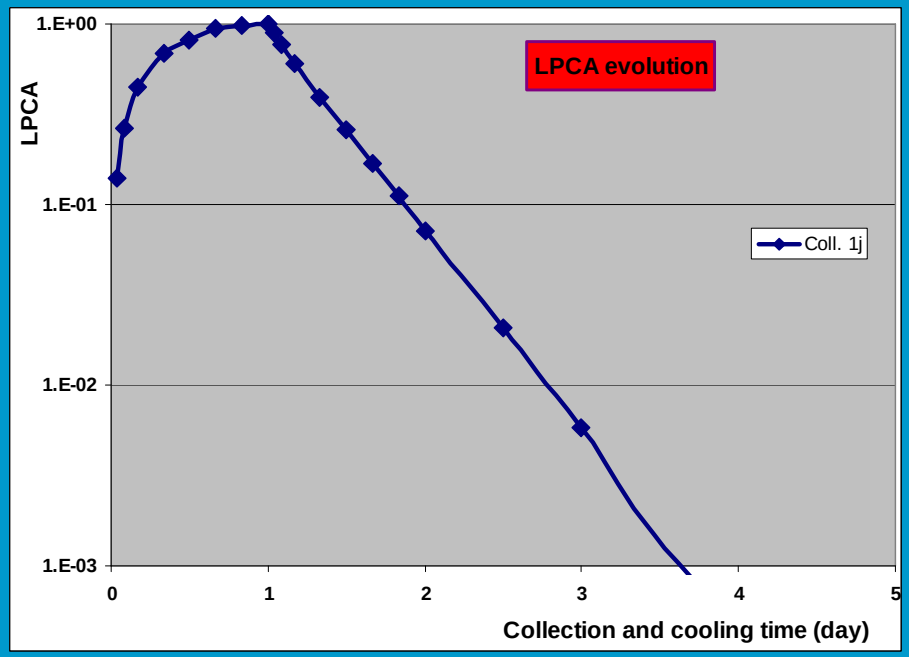
LPCA after 1 day = 6. 10^4 Bq/m^3

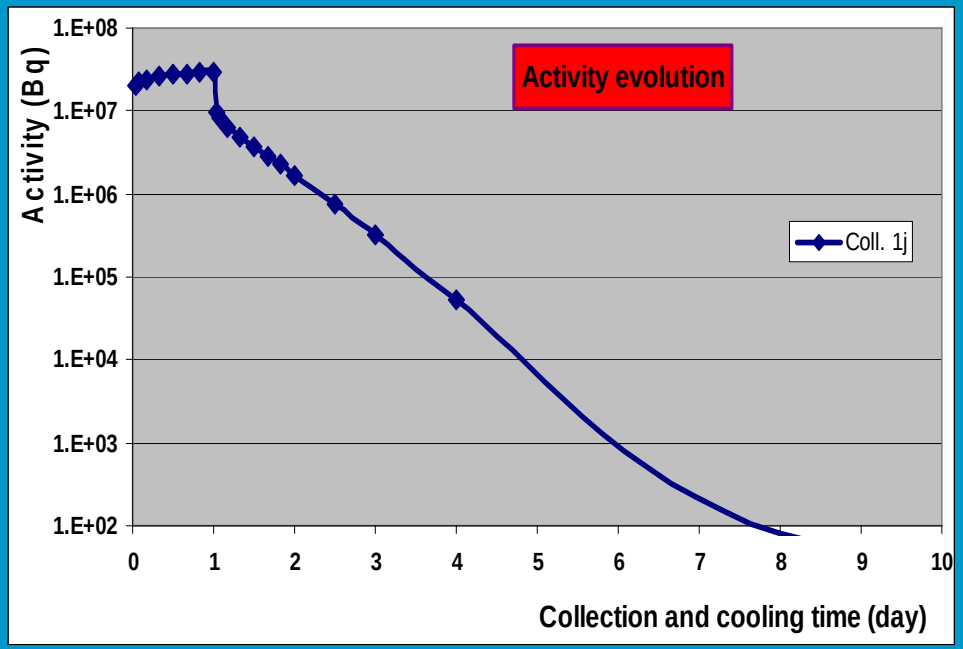
^{135}Sn only

In target yield (10^{14} f/s) 5.8 10^9

V = 500 m^3		
Collection time	I^{MAX} (pps) for 1 LPCA	Cooling time to reach 0.01 LPCA
1 d	6.7 E+06	3 d





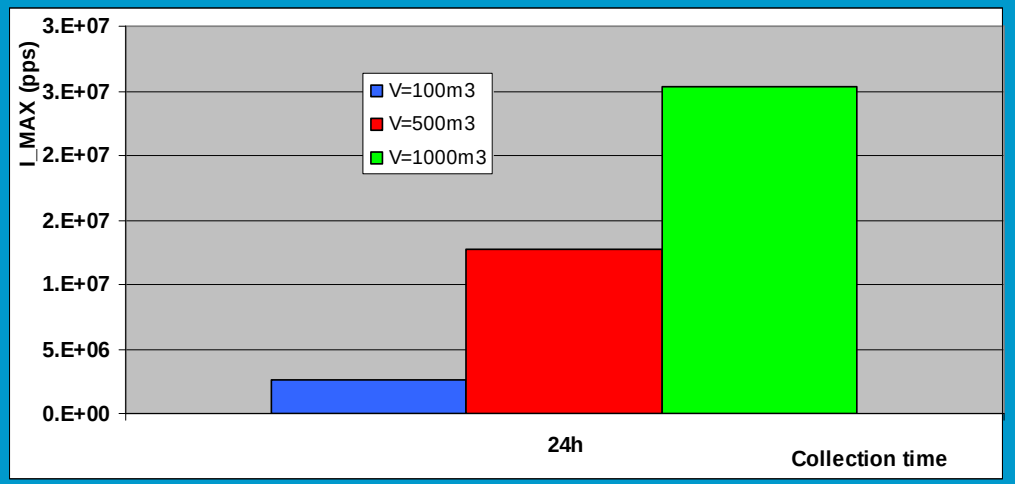


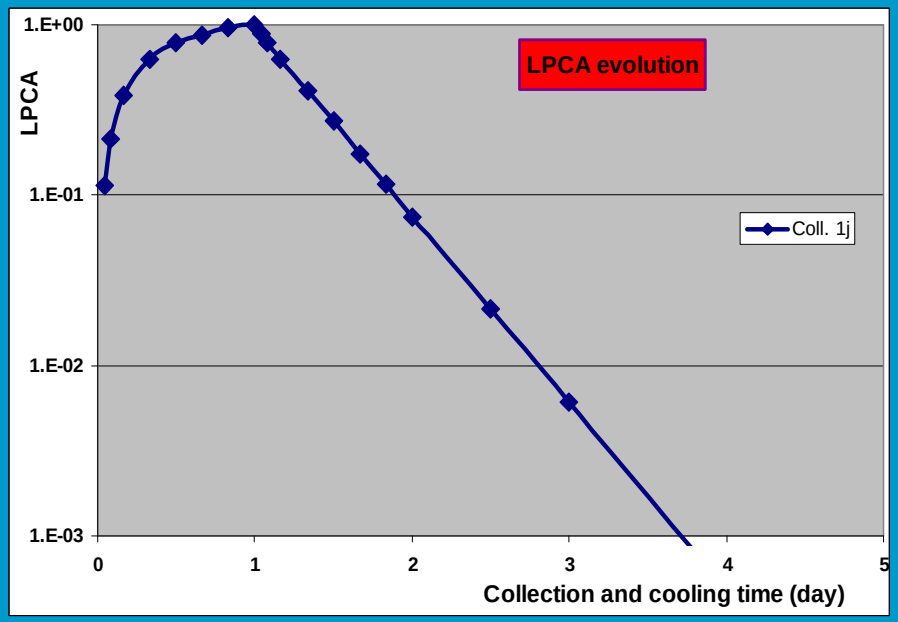
LPCA after 1 day = 1. 10^5 Bq/m^3

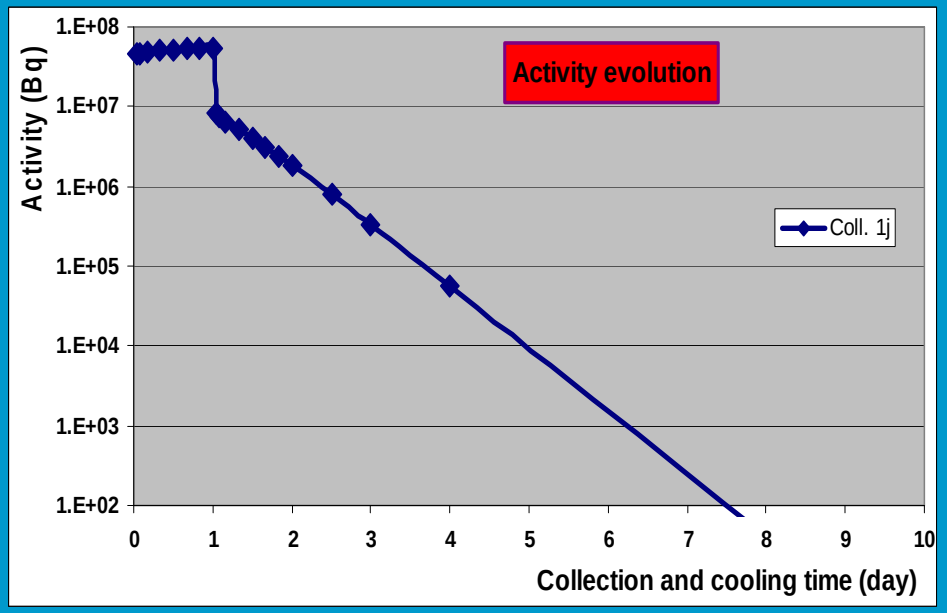
^{136}Sn only

In target yield (10^{14} f/s) 4.4 10^8

V = 500 m^3		
Collection time	I^{MAX} (pps) for 1 LPCA	Cooling time to reach 0.01 LPCA
1 d	7.6 E+06	3 d





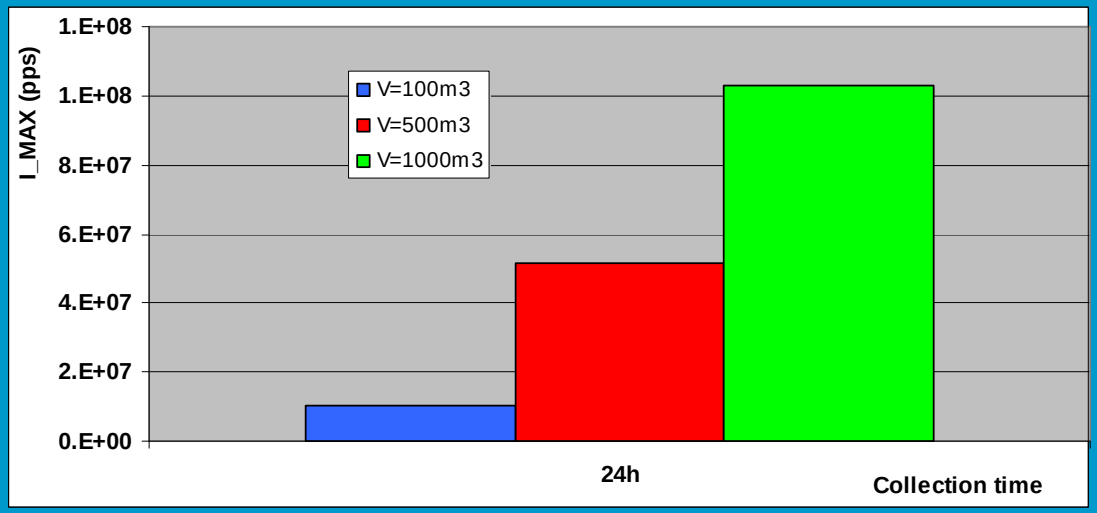


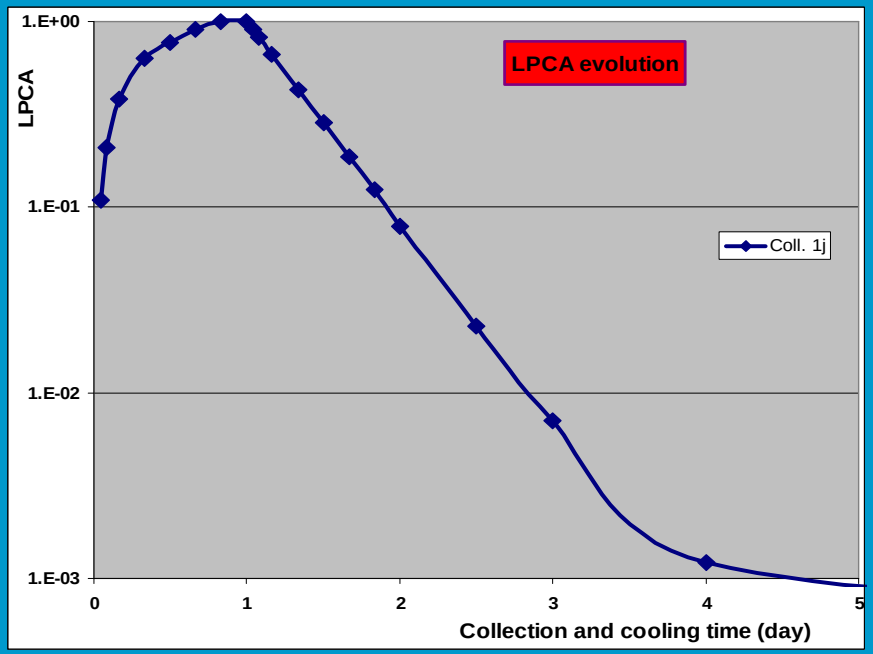
LPCA after 1 day = 4.4 10^5 Bq/m^3

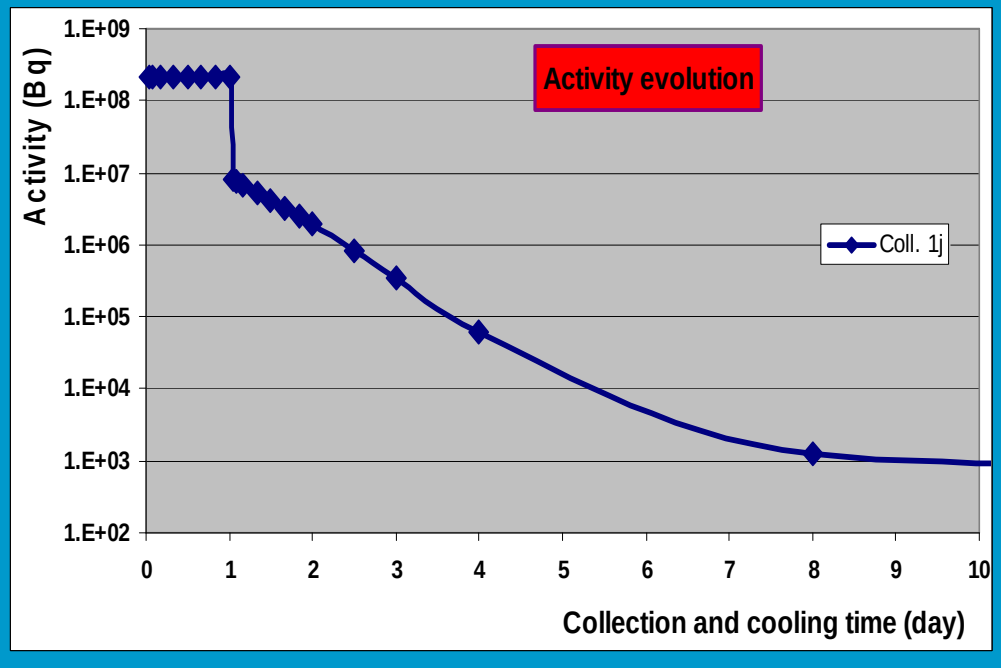
^{137}Sn only

In target yield (10^{14} f/s) 2.2 10^7

V = 500 m^3		
Collection time	I^{MAX} (pps) for 1 LPCA	Cooling time to reach 0.01 LPCA
1 d	5.2 E+07	3 d

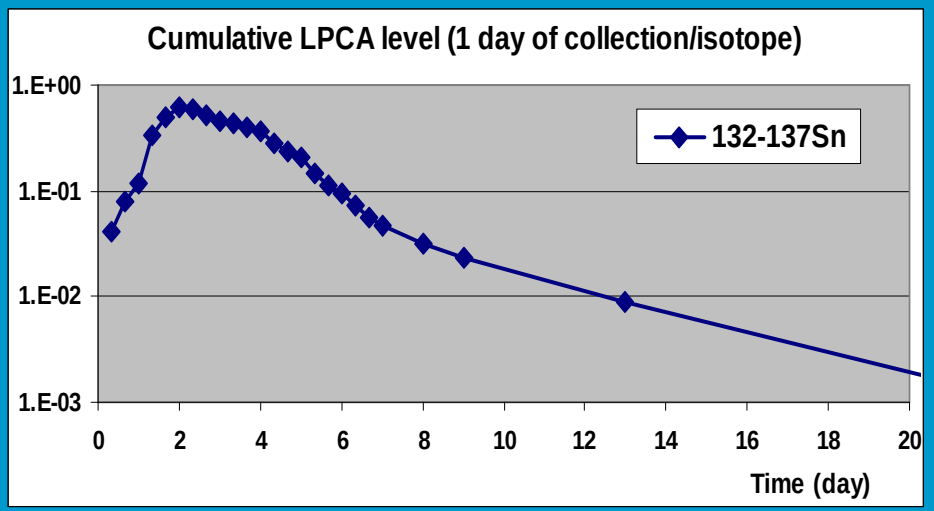


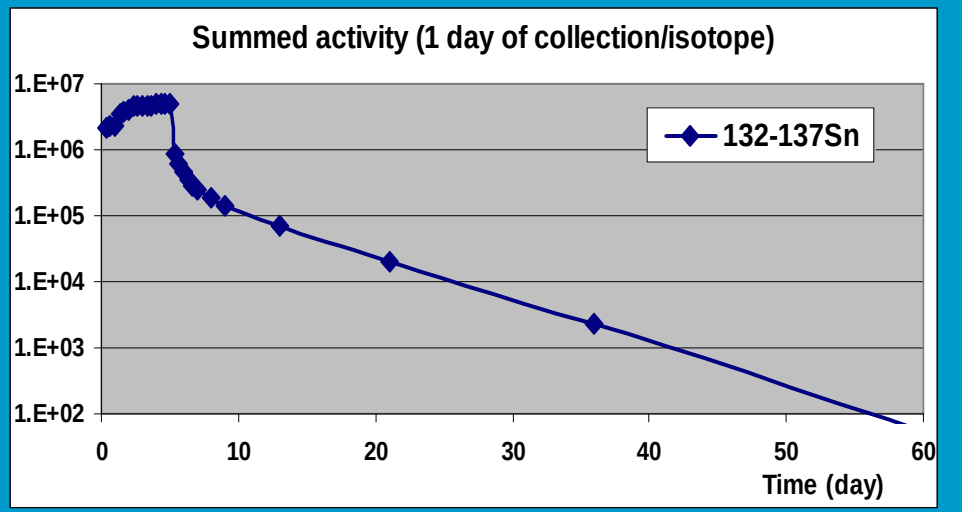




Simulation of a laser spectroscopy experiment:
6*1 day run on $^{132\text{-}137}$Sn, delivered as pure beams

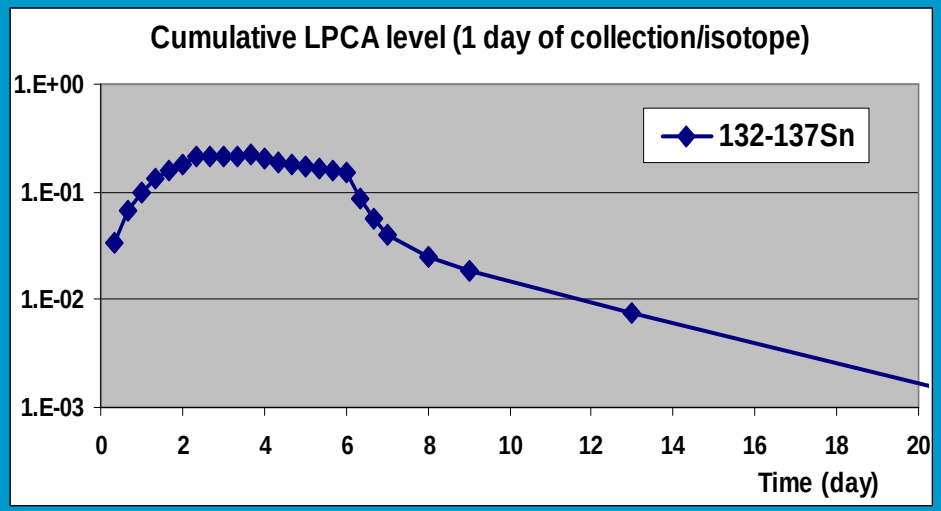
V = 500 m^3		
Beam	I^{MAX} (pps) for 1 LPCA	I^{RED} (pps) for 1 day
^{132}Sn	8.5E+06	1.E+06
^{133}Sn	1.9E+06	1.E+06
^{134}Sn	7.6E+06	1.E+06
^{135}Sn	6.7E+06	1.E+06
^{136}Sn	1.3E+07	1.E+06
^{137}Sn	5.2E+07	1.E+06

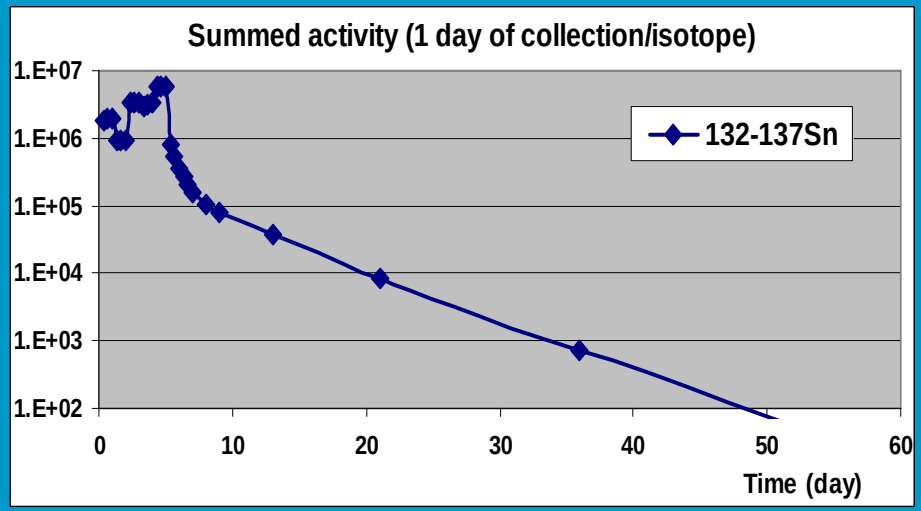




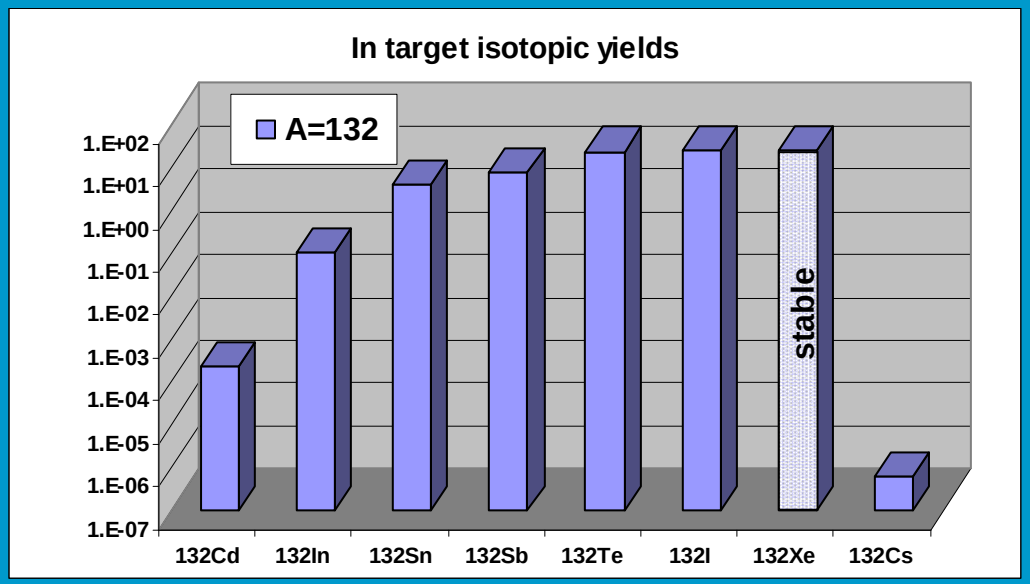
Simulation of a laser spectroscopy experiment:
6*1 day run on $^{132\text{-}137}$Sn, delivered as pure beams

V = 500 m^3		
Beam	I^{MAX} (pps) for 1 LPCA	I^{RED} (pps) for 1 day
^{132}Sn	8.5E+06	8.5E+05
^{133}Sn	1.9E+06	1.9E+05
^{134}Sn	7.6E+06	7.6E+05
^{135}Sn	6.7E+06	6.7E+05
^{136}Sn	1.3E+07	1.3E+06
^{137}Sn	5.2E+07	5.2E+06

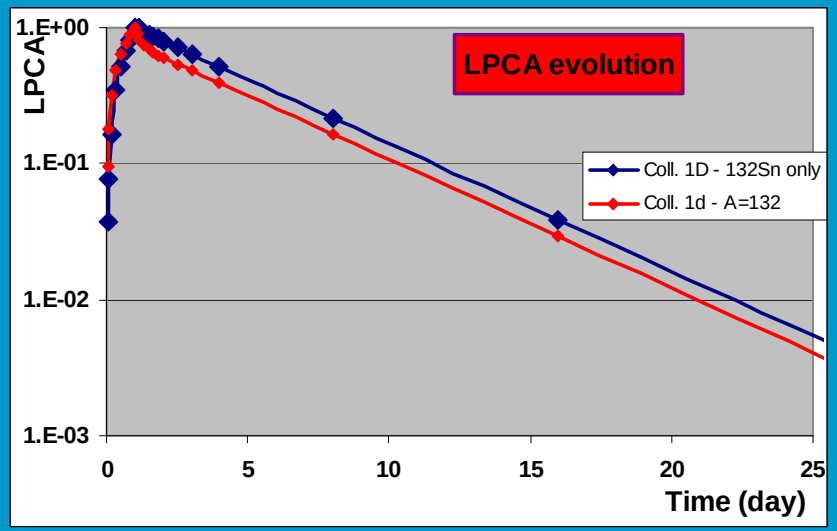


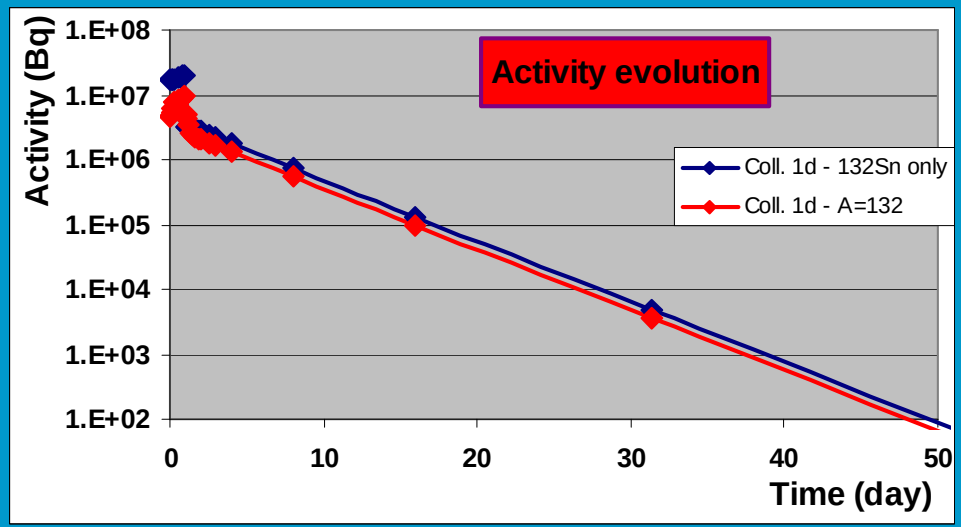


Without isotopic separation: ^{132}Sn case



V = 500 m³	
Beam	I^{MAX} (pps) for 1 LPCA
^{132}Sn only	8.5E+06
^{132}Sn without isotopic separation	5.7E+05





Simulation of a laser spectroscopy experiment:
6*1 day run on $^{132\text{-}137}$Sn, without isotopic separation

V = 500 m^3		
	Sn only	No isotopic separation
Beam	I^{MAX} (pps) for 1 LPCA	I^{MAX} (pps) for 1 LPCA
^{132}Sn	8.5E+06	5.7E+05
^{133}Sn	1.9E+06	3.3E+04
^{134}Sn	7.6E+06	9.5E+04
^{135}Sn	6.7E+06	3.1E+03
^{136}Sn	1.3E+07	1.3E+05
^{137}Sn	5.2E+07	2.1E+04

V = 500 m^3	
	No isotopic separation
Beam	I^{MAX} (pps) for 1 LPCA
^{132}Sn	5.E+04
^{133}Sn	1.E+04
^{134}Sn	1.E+04
^{135}Sn	3.E+03
^{136}Sn	5.E+03
^{137}Sn	1.E+04