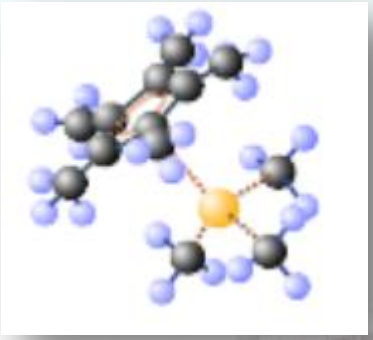
GANIL Contribution to Metallic Beam Developments

- Results for ^{50}Ti with ECR4 (MIVOC)
- Ionization efficiencies vs production method
- Further possible / required developments

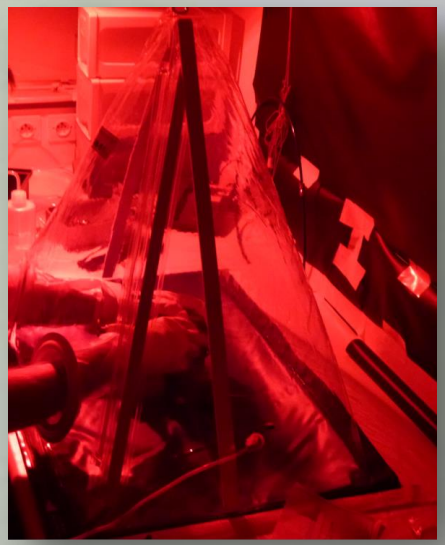
- **SYNTHESIS :**

$C_5(CH_3)_5Ti(CH_3)_3$

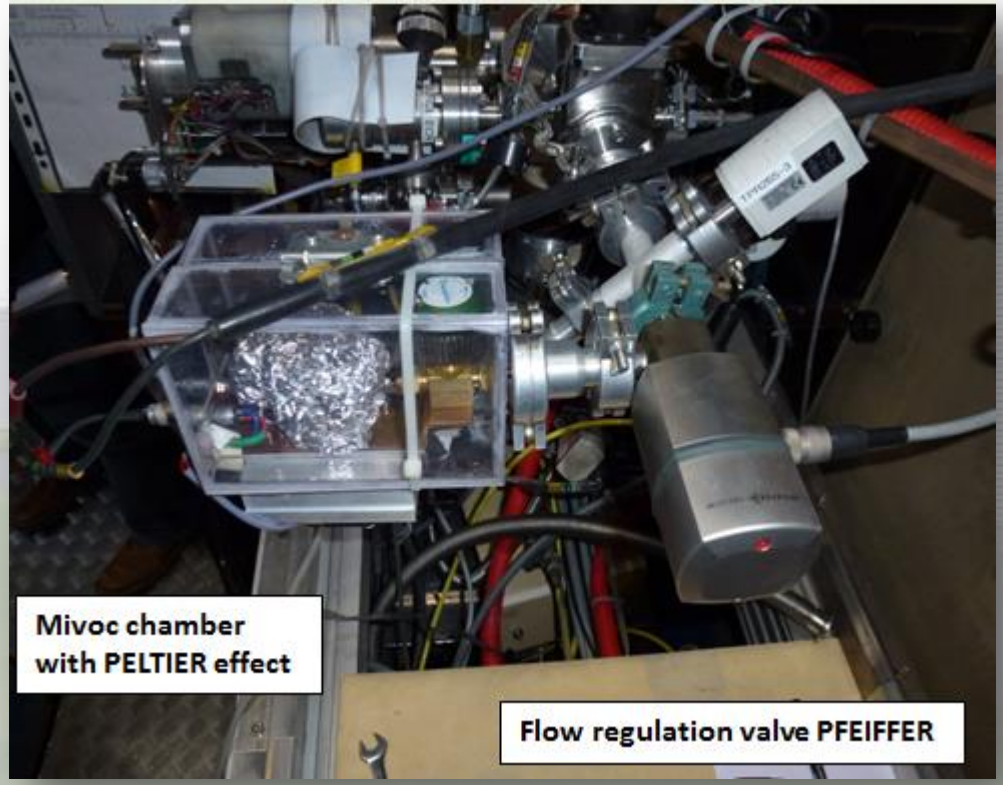


Successfuly realized at IPHC-Strassbourg from ^{50}Ti isotopically enriched sample (% -> 93%)

- **HANDLING AND OFF-LINE ANALYSIS :**

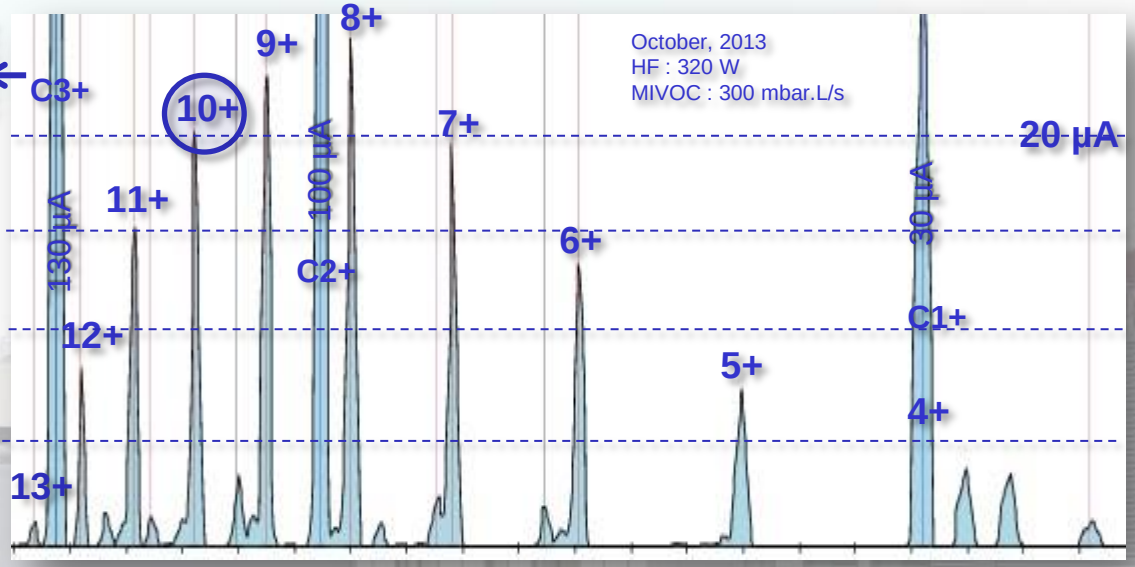


➢ TEMPERATURE REGULATION :



Ti results with ECR4 ion source

C4+ : 110 µA
C5+ : 20 µA
H_2+ : 100 µA



Q	I (pµA)
3+	0.7
4+	1
5+	1.5
6+	2.3
7+	2.8
8+	3.1
9+	2.6
10+	2.0
11+	1.4
12+	0.6
13+	0.15

3+ .... 13+ : 18 pµA

Comsumption 430 µg/h ⇔ 230 pµA injected into the source

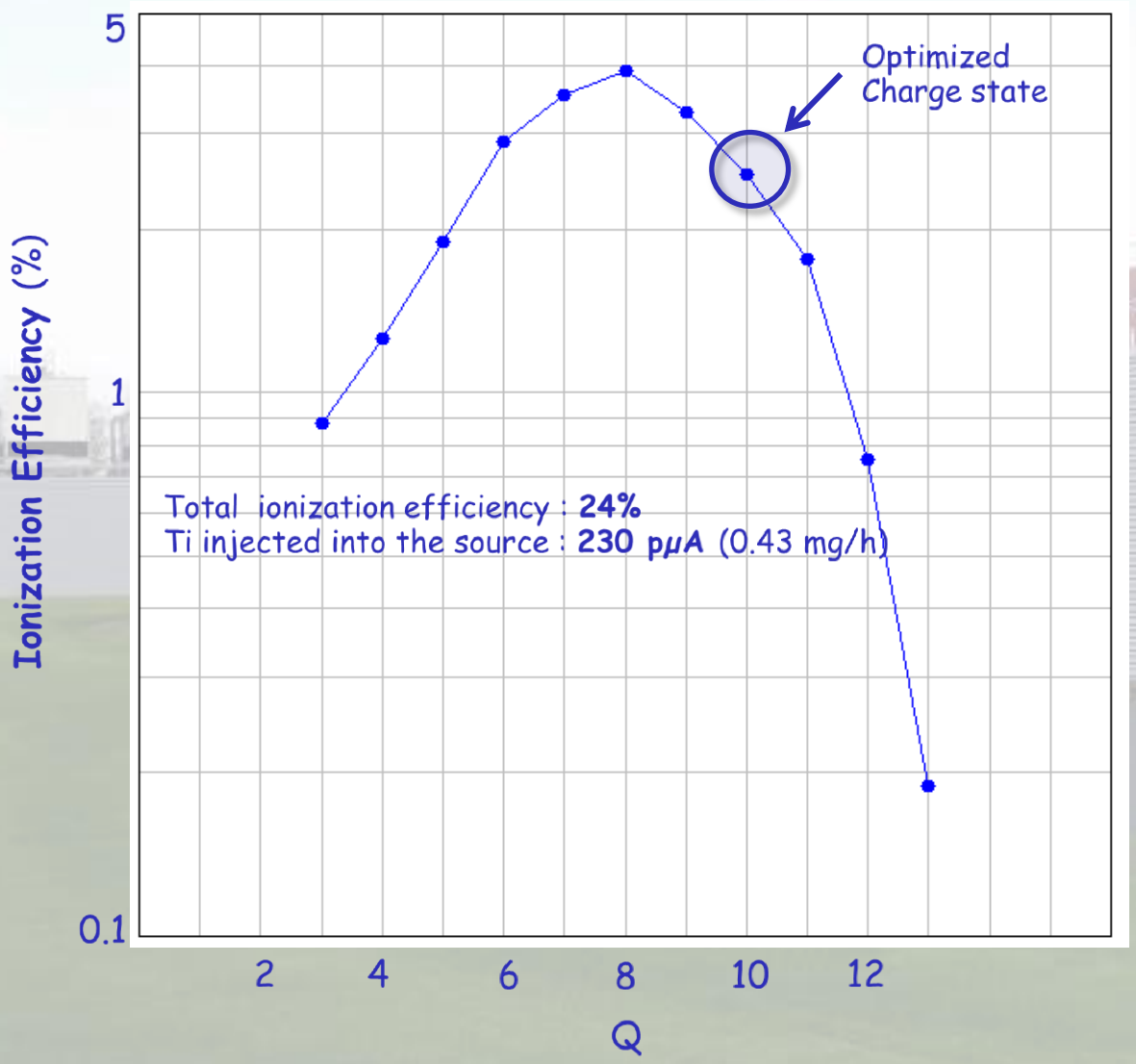
Σq ~ 19 pµA

Total ionization efficiency 8%

Transport 33%

Total ionization efficiency 24% (with transport correction)

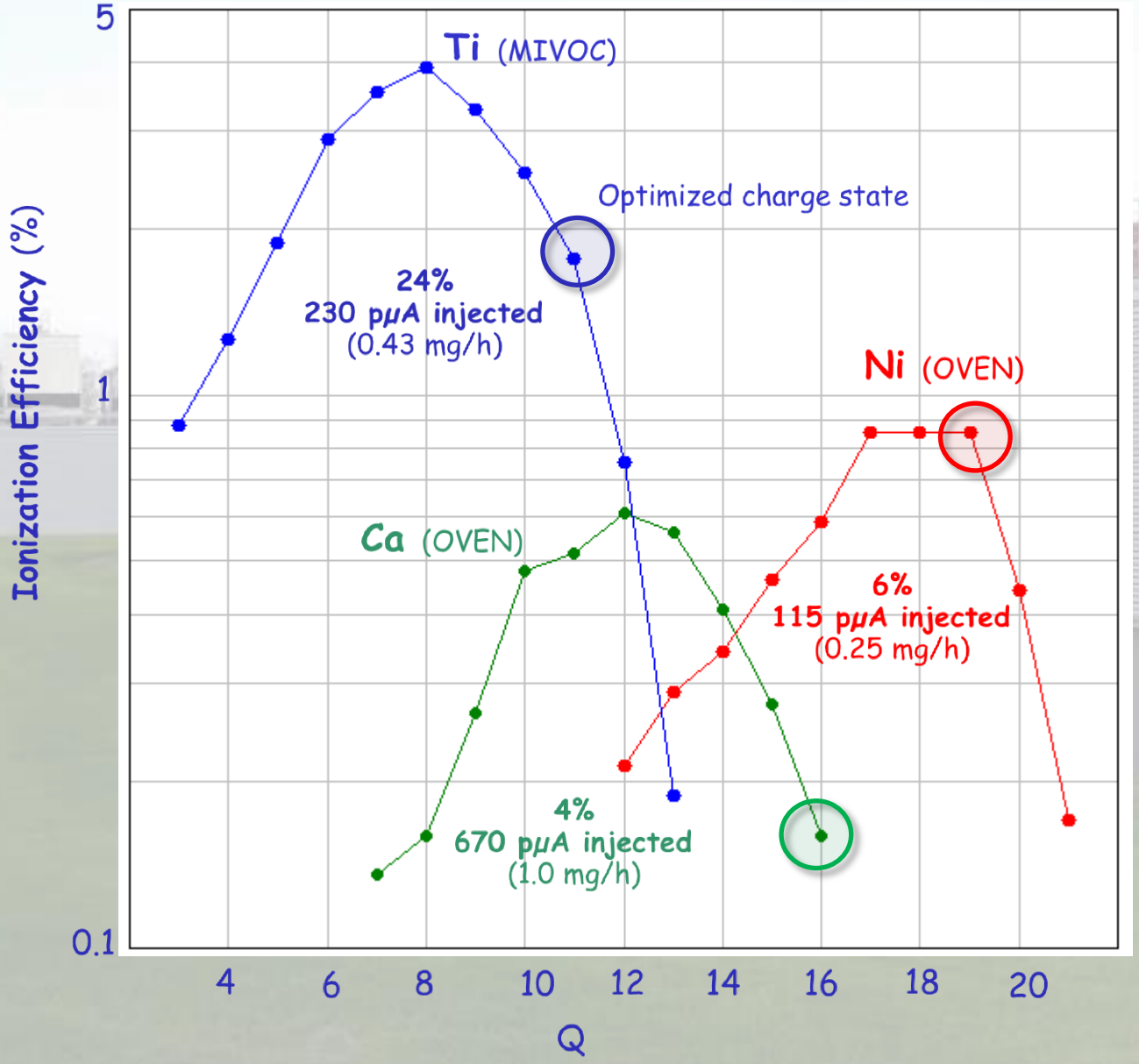
Ionization efficiency



Q	Ionization Efficiency %
3+	0.88
4+	1.26
5+	1.89
6+	2.90
7+	3.54
8+	3.92
9+	3.28
10+	2.53
11+	1.77
12+	0.76
13+	0.19

- Unfortunately no comparison could be done with the oven method (GANIL oven limited to 1500°C)

Ionization efficiencies : MIVOC / Oven



Previous GANIL publications about ionization efficiencies

Table 1
Ionization efficiencies, corrected from transport, and injected flux rate of particles from various production methods measured in operation conditions

Ion beam	% Isotope	Production method	Operation intensity (e μA)	Injected flux rate (p μA)	Transport efficiency (%)	Overall ionization efficiency (%)
36 Ar^{10+}	99	Gas	95	360	67[a]	50
36 S^{8+}	63	MIVOC	30	180	56[b]	23
48 Ca^{10+}	65	Oven	17	67	69[a]	11
58 Ni^{11+}	68	MIVOC	24	290	39[b]	18
76 Ge^{13+}	75	Oven	5	60	43[b]	11
76 Ge^{13+}	75	Recycling	29	<124	75[a]	>40
78 Kr^{16+}	99	Gas	17.5	86	65[a]	61
78 Kr^{16+}	99	Gas	29	140	67[a]	40

2003 NIMB - GANIL - P. LEHERISSIER - Recycling effect of germanium

TABLE II. Performances with the microoven and the large capacity oven on ECR 4M.

	Microoven		Large-capacity oven	
	Intensity	Total ionization efficiency	Intensity	Total ionization efficiency
24 Mg 7+	10 eμA	11%	34 eμA	14%
40 Ca 9+	30 eμA	1%	30 eμA	4%
120 Sn 21+	3 eμA	1.5%	8 eμA	11%
208 Pb 23+	5 eμA	10%	8 eμA	14%

2005 ICIS 11th (Caen) - GANIL - P. LEHERISSIER - Metallic beams with large-capacity oven

Further developments : required / possible

- **Low temperature oven** (required) :

  Ca16+ optimization needs RF power as high possible, but evaporation was too high with Phoenix-V2 at 800 W RF power (oven power :0).

- **Hot Liner for recycling Ca** (required) :

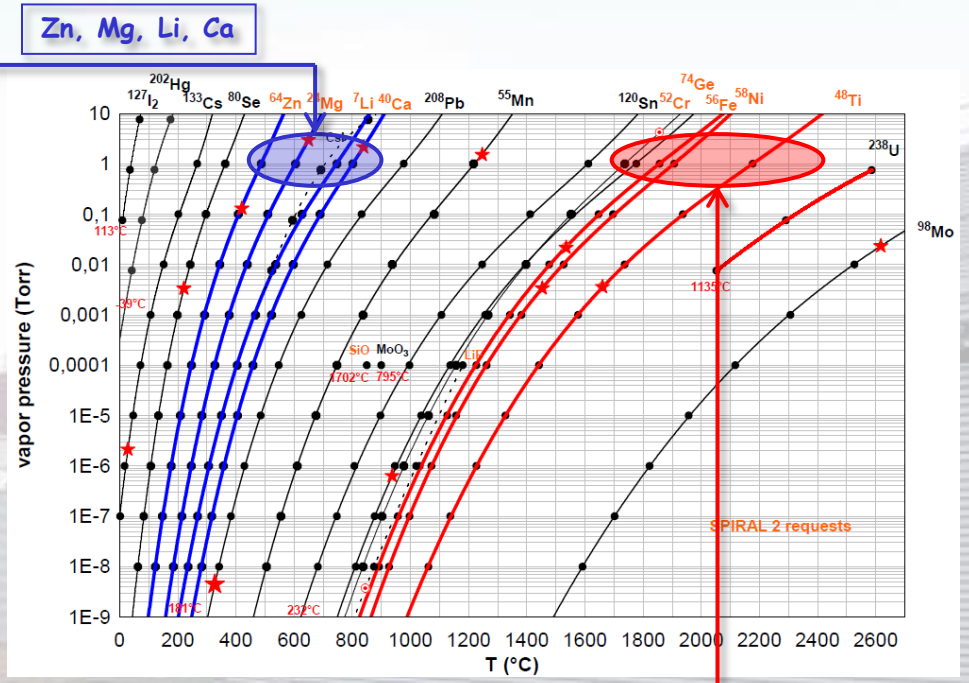
  To reduce ^{48}Ca consumption

- **High Temperature oven** (required) :

  For Cr, Ni, Ti

- **New injection method** (possible) : **1+ -> N+**

  To improve ionization efficiency / reduce contamination



SPIRAL 2 Progress - Building

SPIRAL 2 Progress – Ion source caves