Presented at the Workshop on Heavy Ion
Inertial Fusion, Argonne National
Laboratory, Argonne, Illinois, September
19-26, 1978

LBL-8415

ION SOURCE GROUP SUMMARY

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November 1978

Prepared for the U. S. Department of Energy
under Contract W-7405-ENG-48

Reference Designs

In Table 2 the sources for the various lab reference designs are summarized, giving estimated confidence levels for each one. The confidence levels are below "high" where the design calls for performance which is a significant extrapolation from standard demonstrated performance. It is quite likely that these lower confidence cases will rise after the coming year's R & D.

Measurement Description Guidelines

In our discussions of ion sources from various labs, we have found that it is sometimes difficult to make direct comparisons. So we make the following suggestions for future discussions and publications of ion source development work. Accurate measurements of beam current and emittance of these high current beams is not easy. Various methods are used at different labs. For beam current measurement, collector cups or plates are used, sometimes with a bias on the collector, sometimes with a bias ring upstream which is shielded from the beam and sometimes with magnetic suppression. Size on a phosphor and thermocouple readouts are also used. Electrical readouts can be misleading because of secondary electrons and plasma produced by the beam. For understanding and evaluation of the measurements the authors should describe the measuring system and also show data of beam vs. strength of electric or magnetic suppression, whenever they are used. Emittance measurements also have difficulties. They are made by slit and scanning systems which interrupt most of the beam, by beam size on a phosphor, or by beam through collimators into a cup. Here again the method should be described. Pulse width of the beam is important for estimating space charge compensation. The background pressure and the fraction of the beam converted to neutral atoms are also useful in understanding the transport. Authors of ion source papers should describe as many of the above parameters as possible.

References

1. ERDA Summer Study of Heavy Ions for Inertial Fusion. LBL-5543. (July 1976).

2. Proceedings of the Heavy Ion Fusion Workshop. BNL-50769. (Oct. 1977).

Table 1. Source Test Results.

Group	Source	Ion	No. Aper.	I (peak mA)	D.C. or Pulsed	Energy (keV)	Ions or Atoms	Dist.	ε_n (cm-mr)	$B = I/\varepsilon_n^2 \left[\frac{A}{(cm\text{-}mr)^2}\right]$	Accel.	Ref.
							Transport					
ANL/ Hughes	Penning	Xe^{1+}	1	2.5	D.C.& Pulsed	80	Ions	.7m	.001	2500		This Conf.
	"	Xe^{1+}	Mult.	100	Pulsed	2.5						"
	"	Xe^{1+}	1	30/100	"	100/200			/<.01	/>1000		"
*	"	Xe^{1+}, Hg^{1+}	1	[illegible]	"	200	Ions	Source on Column	<.01		1.5 MV Column	"
BNL	Duoplas.	Xe^{1+}	1	2	Pulsed	500	Ions	"	.01	20	500 kV Column	This Conf.
*	New	Hg^{1+}		40	"		"	1m	.02	100	400 kV Column	"
LBL	LBL CTR +LLL Extr.	Xe^{1+}	13	35	Pulsed	20	Ions	1.4m	.035	29		This Conf.
	"	Xe^{1+}	13	60	"	500	"	1.2m To Column			500 kV Column	"
	Contact ioniz.	Cs^{1+}	1	400/1000	"	200/500	"		/.01 Thermal	/10,000	/Drift Tube	"
*	"	Cs^{1+}	1	7500	"	5000	"				"	"
LBL-Mobley	LBL CTR (Slit Extr.)	Xe^{1+}	105/3	6500/180	Pulsed	35	Ions+ Atoms	3.3m	.28x.013/.01	/1800		Ref. 1, p. 50; This Conf.
LLL-Osher	MATS III	Kr^{1+}	25	75	D.C.	20	Ions + Atoms	1.1m	~.02	190		Ref. 2 p. 92

*Planned

A/B = Measured/Expected

Table 2. Sources for Reference Designs.

Lab	Source: Ion	Source: I (peak mA)	Source: Type	Source: Confidence Level	Pre. Accel.: Type	Pre. Accel.: Confidence Level
ANL-2	Hg^{1+}	50	Hughes Penning	High	1500 kV Column	Medium
ANL-3	Xe^{1+}	20	Hughes Penning	High	1500 kV Column	Medium
BNL	U^{1+} (Hg^{1+})	40		U^{1+} Low Hg^{1+} High	500 kV Column	High
LBL	U^{1+}	4000	Surface Ioniz.	Low, Needs R&D	Drift Tubes	Low Needs R&D