

DOE ONP Program Managers Briefing

ATLAS Operations

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*A U.S. Department of Energy
Office of Science Laboratory
Operated by The University of Chicago*



Presentation Outline

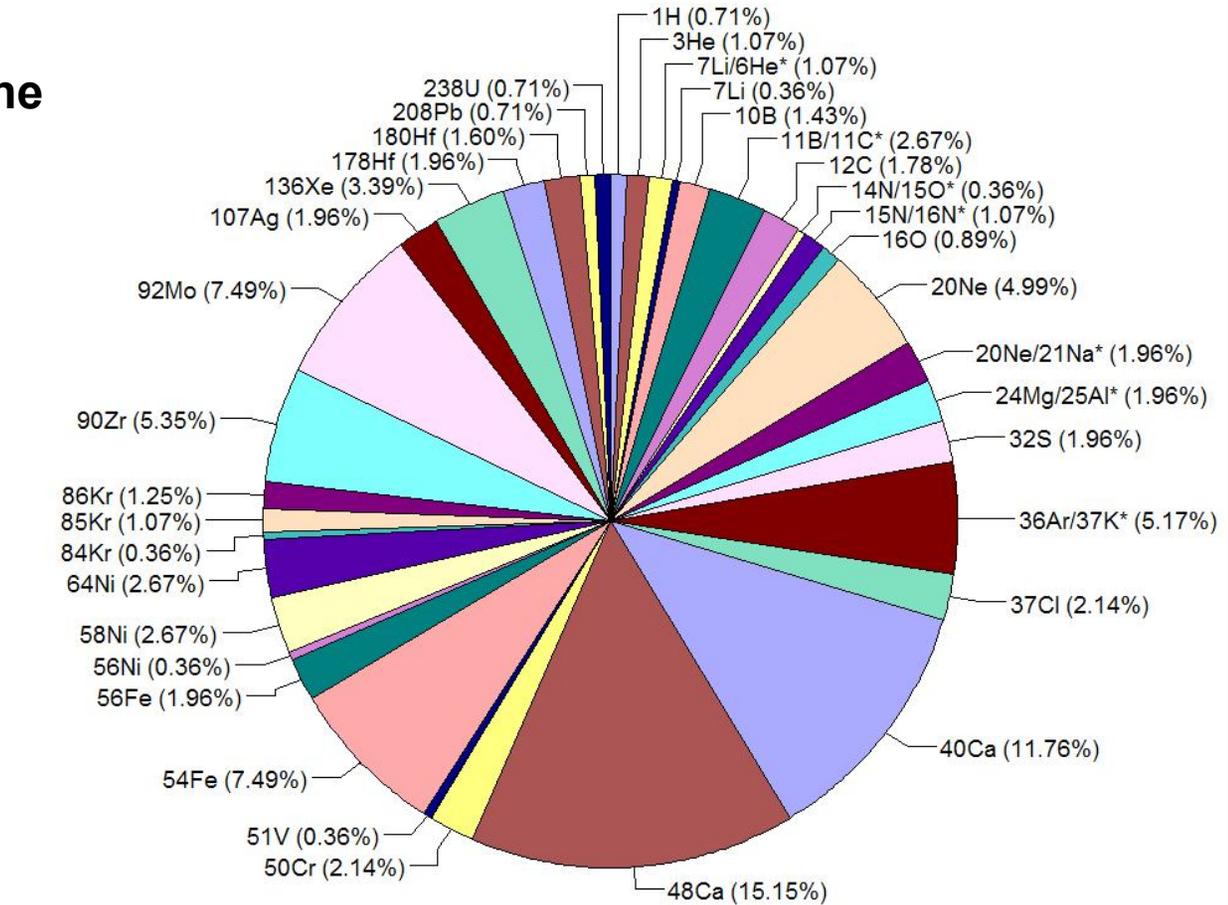
The mission of the ATLAS facility at Argonne is to perform research of the highest quality on probing the properties of atomic nuclei using the capabilities of the accelerator and associated research equipment and the talents of its users and staff...

- Facility Performance
- Operations staffing
- Components upgrade and improvements
- Energy upgrade AIP project
- Californium source upgrade



ATLAS Beams for FY2003

- Beam variety, type and properties are driven by the experimental program.
- Medium mass has been recent focus



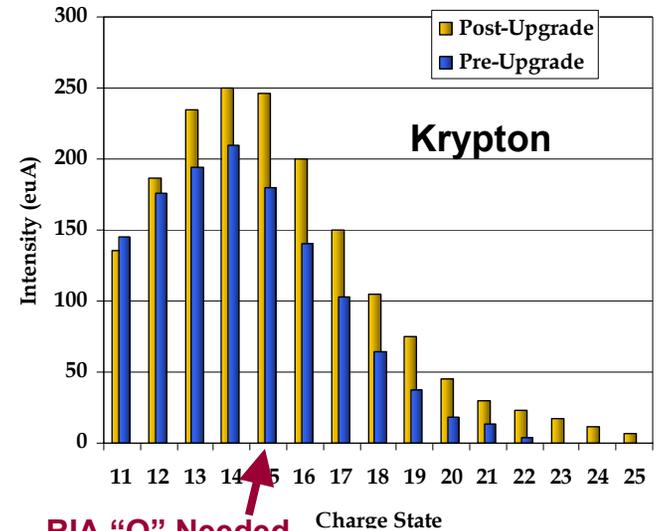
36 Different Isotopes

***14.3% beam time for Exotic Beams** ₃

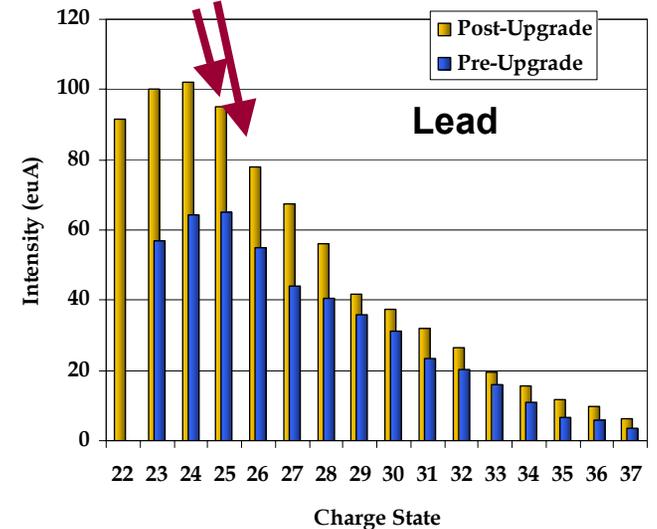
ATLAS Beams for FY2003

ECR Source Performance/Activity

- Three new beams
 - $^{178}, ^{180}\text{Hf}$ & ^{107}Ag
- Continued demand for higher beam current
 - New hexapole design for ECR-II
 - Significant gain in currents
 - But new cooling design required
 - New hexapole chamber in construction
- Improved Deck HV monitoring and control
 - More stable long-term operation
 - More precise configuration reload



RIA "Q" Needed



ATLAS Performance

Operating Statistics

Machine Operation	FY1999	FY2000	FY2001	FY2002	FY2003	First ½ FY2004	Projected FY2004
Scheduled Research Hours	6096	5496	5576	4586	5500	3012	5000
Research Hours (on Target)	5998	5384	5619	4311	5468	3159	4900
Accelerator Devel. Hours	48	76	97	105	22	35	100
Total R & D Hours	6046	5460	5716	4416	5490	3194	5000
Scheduled Maintenance	300	597	465	665	333	249	400
Experimental Downtime	440	296	300	242	256	95	250
Availability (%)	93.2	94.9	95.5	95.1	96.1	97	95
Num. of Experiments	56	51	42	37	46	25	45

- **5.3-day operation started in June 2001**
- **7-day operation resumed in April, 2003**

ATLAS Operations Staff Status

Recent ATLAS Operations Review confirmed “lean” nature of ATLAS staffing for continued 7-day operation.

Two operators resigned in March, 2004.

Also lost a control system programmer in April.

New operator-trainees are on-board.

Therefore summer operation will mix 5-day and 7-day operation periods.

Return to 7-day operation is contingent on the actual FY05 budget.

Group	FTE
Electronics	3
Cryogenics	2
Operations	7
Vac/Tandem/Utilities	2
ECR Ion Sources	2
Control Computers	2
Safety	0.3
Secretarial	1
Management	2
Total	21.3

Major Facility Improvement: Tandem Injector Rebuild

Tandem continues to be valuable for:

- **Light-ion ($A \leq 40$) stable beams.**
 - ✓ Higher energy than Positive Ion Injector for $A < 30$.
 - ✓ Adequate beam currents for most experiments.
- **Long lived, near to stability ions.**
 - ✓ ^{44}Ti , ^{56}Ni , ^{18}F , ^{56}Co .

Rebuild:

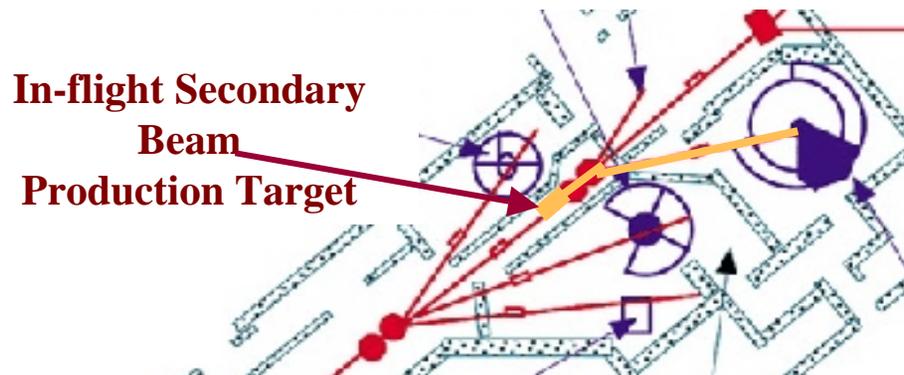
- **Replace corona voltage-grading system with resistors.**
- **New terminal communication for foil and lens control.**
- **Completed November, 2003.**
- **Excellent operation with improved timing stability.**



Major Development Activities: In-flight Radioactive Beam Program

Complements programs at other labs:
Beams or energies not available elsewhere

- **In-flight production beams**
 - ✓ Inverse kinematics
 - ✓ Production of wide variety of beams
- **15 radioactive beam species developed since 1994**
 - ✓ Hear X. Tang talk later

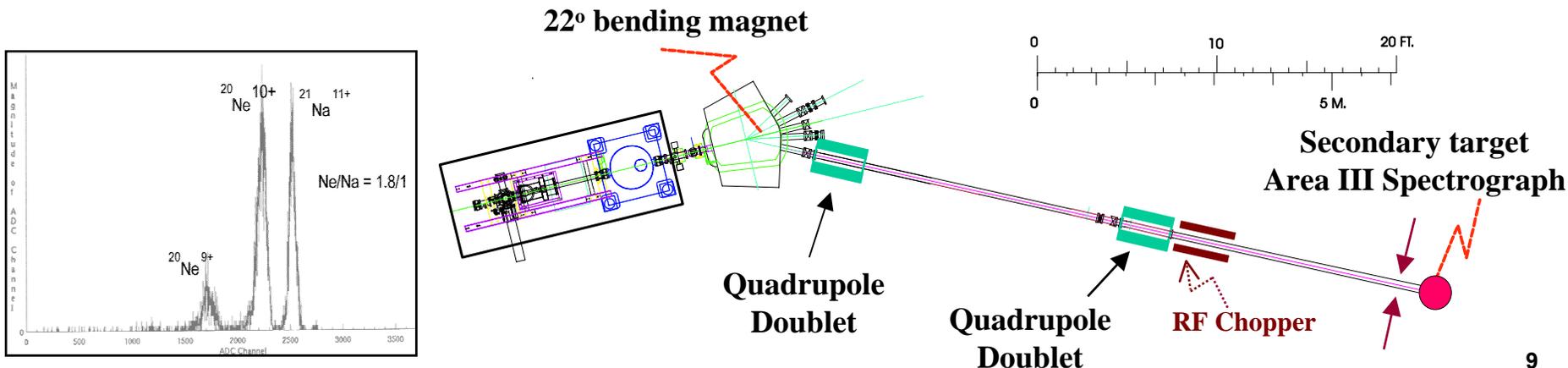


Major Development Activities: In-flight Radioactive Beam Program

In-flight beam line improvement project

Phased upgrade to improve transport efficiency and purity

1. Redesign beamline using available quadrupoles (Completed 11/2003)
2. Add RF beam sweeper to reject more primary beam tails
 - (\$250k) additional funds were requested in FY05
 - Detailed design and prototyping underway



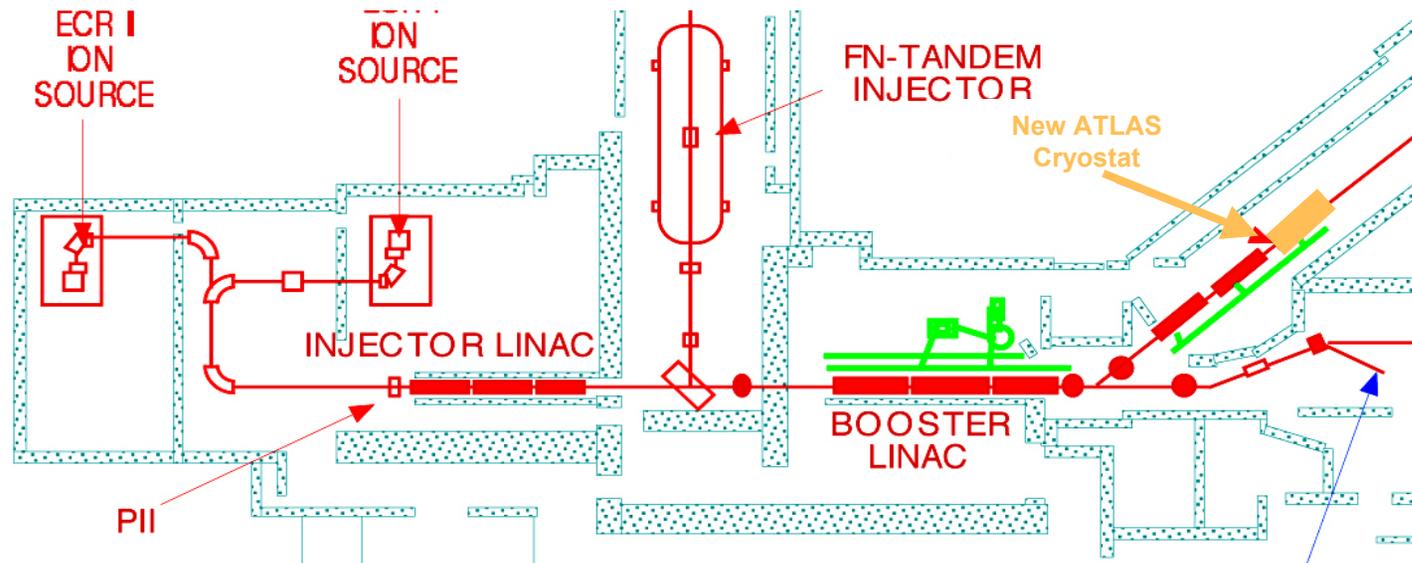
ATLAS AIP Energy Upgrade

ATLAS Energy Upgrade will replace the last ATLAS cryostat with:

New RIA-style cryostat containing
New RIA-class resonators:

$\beta=0.14$ quarter-wave resonator

$\beta=0.26$ half-wave resonator



ATLAS Energy Upgrade

Complete Upgrade Project will consist of:

- 7 $\beta=0.14$ Quarter-wave resonators
- 1 $\beta=0.26$ Half-wave resonator

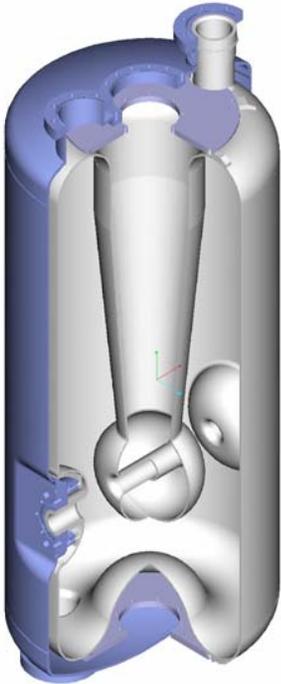
Expected performance improvement from Energy Upgrade

A	Current ATLAS		ATLAS Upgrade	
	No Strip	Strip	No Strip	Strip
1	24.08	24.08	38.50	38.50
2	15.71	15.71	23.20	23.20
16	12.98	15.66	18.50	21.48
40	12.37	13.35	17.49	19.91
58	9.94	11.79	13.49	17.87
78	9.49	11.19	12.78	16.71
132	7.96	9.33	10.37	13.38
197	6.65	7.89	8.37	10.94
238	6.36	7.39	7.94	10.04

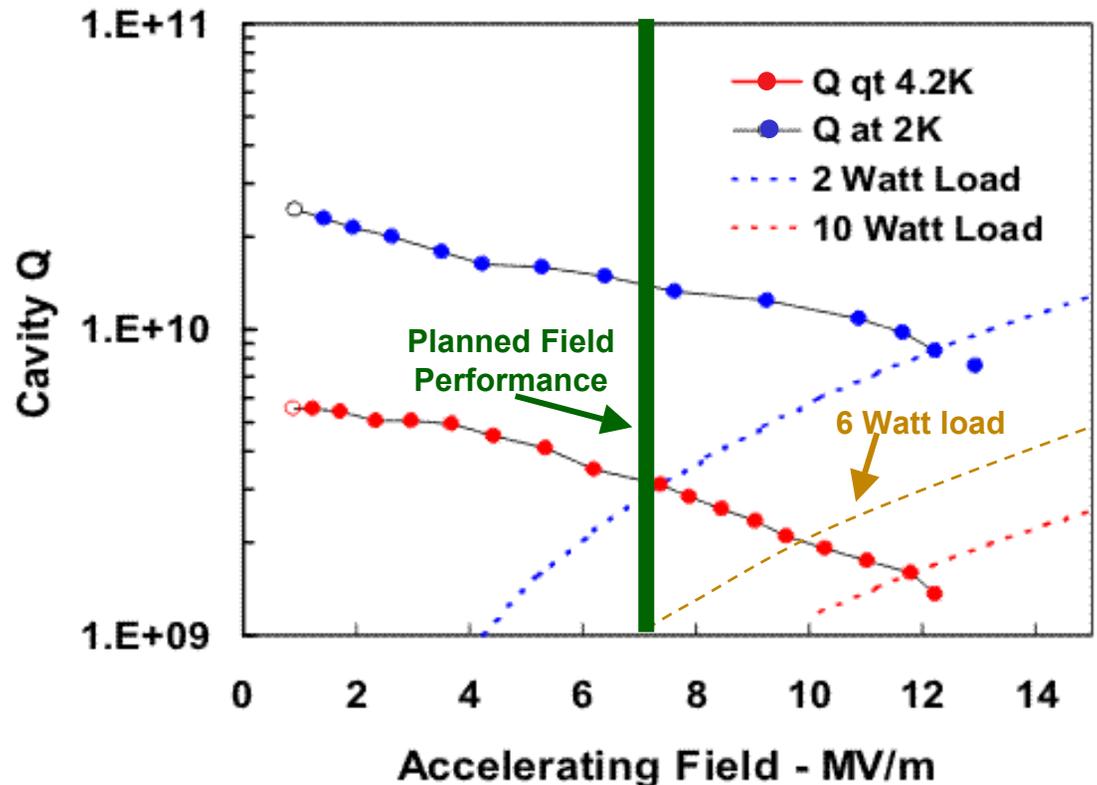


ATLAS Energy Upgrade

Initial Test of Prototype 109 MHz QWR Cavity for RIA and ATLAS



QWR 109 Parameters		
Frequency	109.125	MHz
Geometric Beta	0.144	v/c
Active Length	25	cm
QRs	40	ohm
E _{peak} /E _{eacc}	3.2	MV/m
B _{peak} /E _{eacc}	58.3	Gauss
RF Energy/E _{eacc} ²	0.1662	Joule



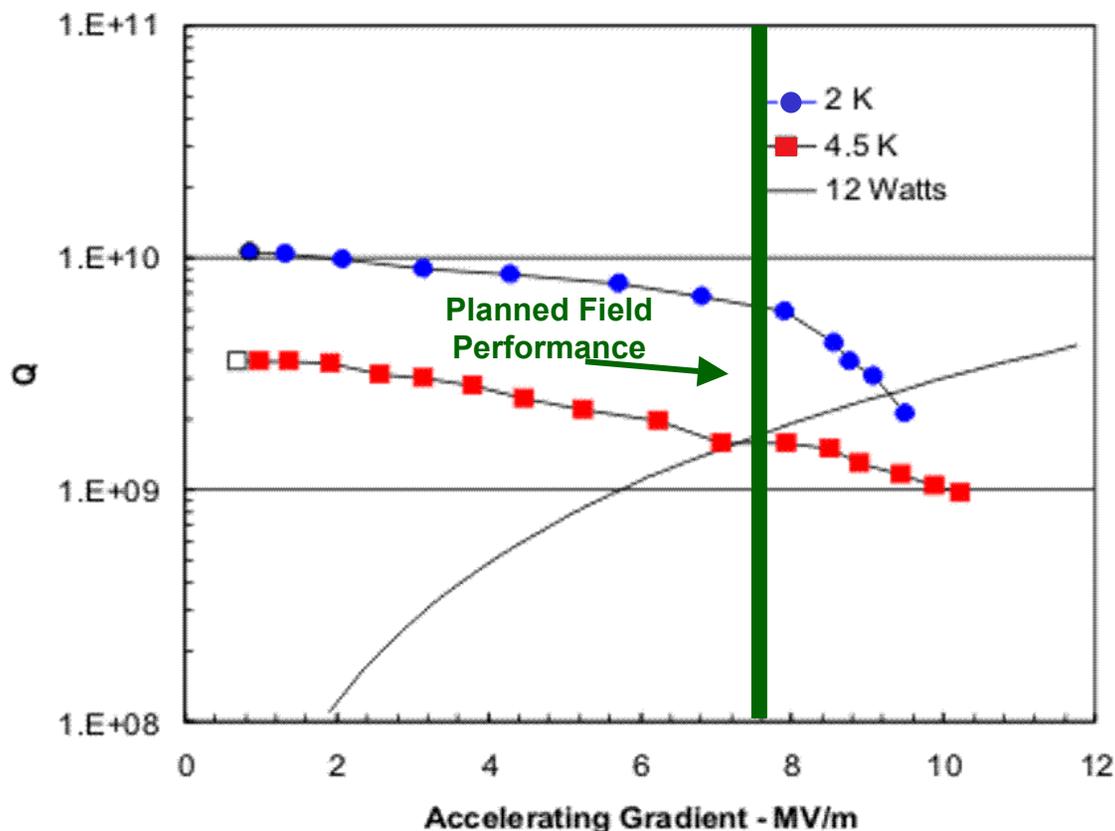
ATLAS Energy Upgrade

Initial Test of Prototype 170 MHz HWR Cavity for RIA and ATLAS



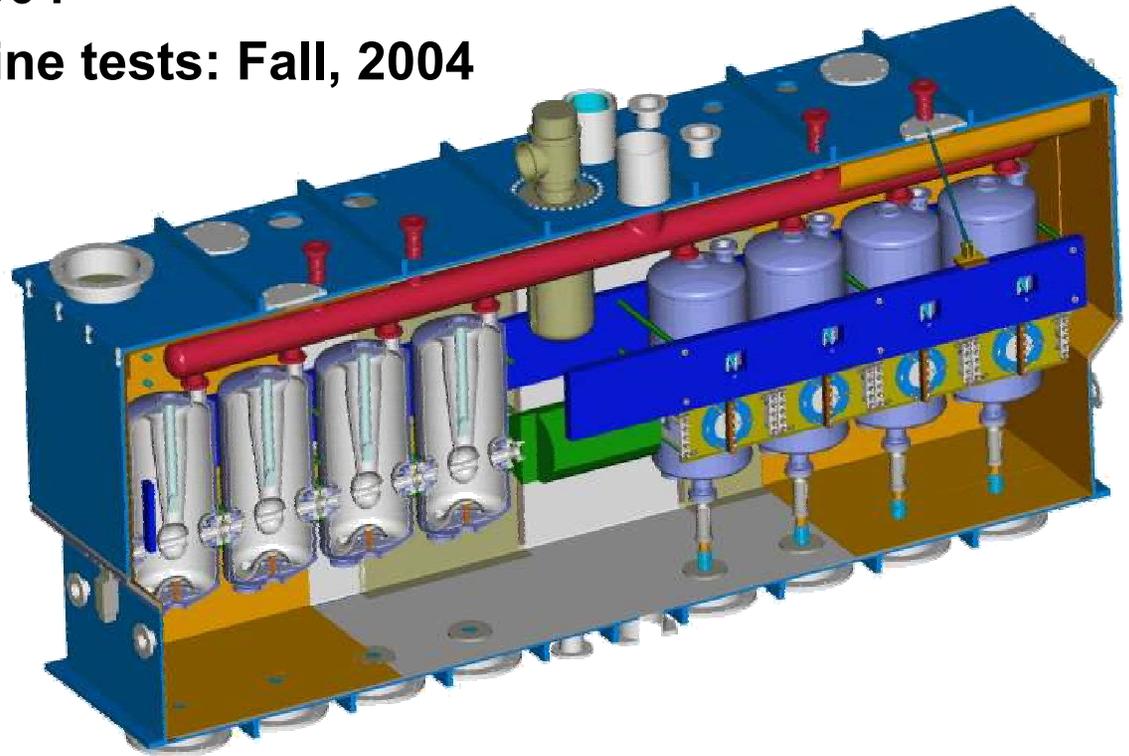
HWR 170 Parameters

Frequency	170	MHz
Geometric Beta	0.26	v/c
Active Length	30	cm
QRs	57.4	ohm
Epeak/Eacc	2.9	MV/m
Bpeak/Eacc	78	Gauss
RF Energy/Eacc ²	0.338	Joule



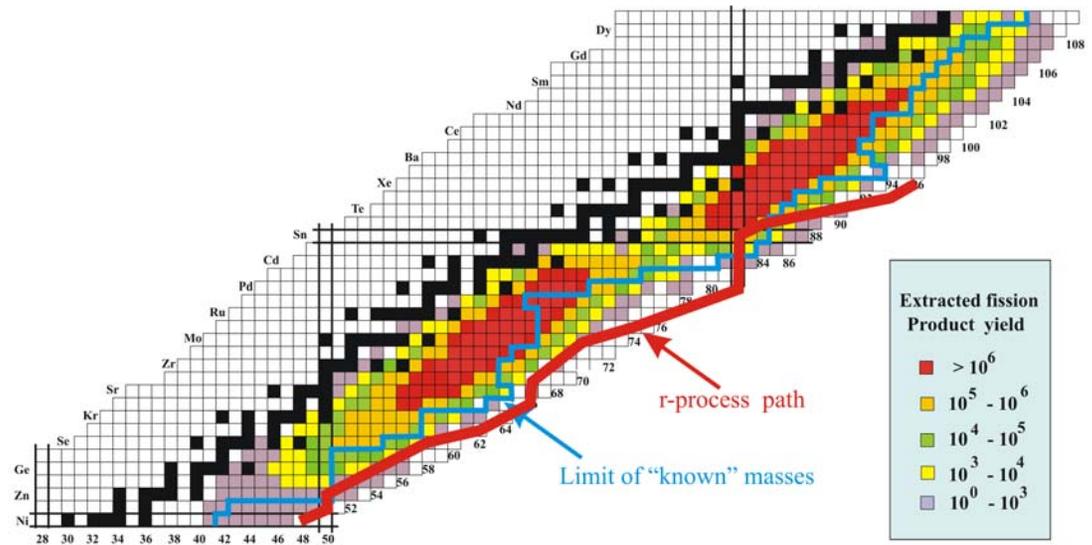
ATLAS Energy Upgrade Status

- $\beta = 0.14$ quarter-wave resonator prototype complete
- $\beta = 0.26$ half-wave resonator prototype complete
- Cryostat under construction
- Assembly: Summer, 2004
- Initial cool down & offline tests: Fall, 2004



Californium fission source upgrade

- 1 Ci ^{252}Cf fission source + gas catcher
- Injects ECR-I modified to a ‘charge breeder’
- Builds on extensive ATLAS weak beam experience
- Technology and experience useful for RIA
- Provides access to unique, important areas of N/Z plane
- Yields up to 10^7 ions/s
- Estimate cost ~\$2 M



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Summary

“...ATLAS is a first class stable beam facility that is at the low energy nuclear physics forefront.”

➤ **Continued development & modernization keeps facility modern**

- New beams and source techniques
- Increased beam currents (Improved ECR design)
- Component modernization (tandem upgrade)

➤ **New Capabilities**

- Increased energy availability (Energy upgrade project)
- Improved RIB performance (RF sweeper project)
- ^{252}Cf RIB facility

➤ **Insufficient funds limit operational resilience**

- Operator resignations will reduce operating hours for summer
- Available beam time for research will be reduced ~10% for FY
- Return to 7-day operation contingent on FY05 actual budget