ARIEL II: Completion to Science

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ARIEL will be TRIUMF's flagship Rare Isotope Beam facility for the production of isotopes for physics and medicine. ARIEL uses proton-induced spallation and electron-driven photo-fission of ISOL targets for the production of short-lived, rare isotopes that are delivered to multiple experiments simultaneously at the ISAC facility.
Completing and operating ARIEL is absolutely central to realizing laboratory vision.

ARIEL substantially expands RIB program:
- three simultaneous beams
  - increased number of hours/yr delivered
  - increased beam dev capabilities
  - enables sensitive and long beam time experiments
- new isotope species:
  - “clean” n–rich
  - proton-rich

Implementation:
- Complementary electron linac driver for photo-fission
- New target stations and front end
- New proton beamline
Time line (funding)

- Funded now: **ARIEL I** (to be complete Sept 2014):
  - Electron beam at 30 MeV, 100 kW from SRF linac
  - Civil construction to encompass objectives of both ARIEL I&II

- Secured funding in this 5YP (2010-2015) to initiate:
  - ARIEL Electron Target Station
  - ARIEL Front-end for ISAC

VECC MoU Add-3 CANREB
Next five-year plan – **ARIEL II** (2015-2020):

- Completion of the ARIEL project will proceed in **five phases**
- Each phase enables:
  - new scientific capabilities
  - technical developments (e.g. 500 kW e-linac and photo-converter, remote handling) towards the final ARIEL configuration
ARIEL II Phases
Phase 1: Li-8 for $\beta$-NMR

Goals:

- Photo-production of Li-8 in a Be-9 target using bremsstrahlung photons produced by stopping 100 kW electron beam in a solid metal target, and delivered to $\beta$-NMR.
- Construction of a new Control Centre

Requires:

- ARIEL e-linac 30 MeV 100 kW
- West Target station (non-actinides) $4.4$M
- Pre-separator & beamline to $\beta$-NMR $1.8$M
- Control Centre $2$M

=> TOTAL: $8.2$M
Phase 1 will be done in collaboration with VECC - Kolkata:

- In August 2013 MoU Add-3 was signed => project began
- Scope ($10.4M) includes two ARIEL target modules, tested in ARIEL, and front-end beamlines
Phase 2: Purified accelerated high mass RIBs

Goals:
- Transport ISAC RIBs with A>29 to the ARIEL Mass Separator Room, purify, charge breed and deliver them to the ISAC medium and high energy experimental areas.
- A collection station for medical isotopes will be implemented.

CFI-funded CANREB project (scope $4.5M) provides the essential components required for the ARIEL front-end: EBIS, HRS, RFQ cooler.

Requires:
- Beamlines $1.6M
Phase 3: Photo-fission for r-process studies

Goals:
- Production and delivery of neutron-rich fission fragments by implementing actinide targets in conjunction with the solid photo-converter.
- Two simultaneous electron-produced RIBs delivered to users.

Requires:
- West Target station w/ actinides $8M
- East Target station $3.4M
- 2\textsuperscript{nd} pre-separator and beamline $1.1M
- MRS $0.7M

=> TOTAL: $13.2M

Milestones:
- Three independent RIB beams to ISAC
- Two simultaneous electron-produced RIBs to users
Phase 4: Actinide Production for Fundamental Symmetry Tests

Goals:
- Implement new proton beamline (BL4N) from cyclotron, delivering up to 100 μA at 500 MeV of proton beam to the West Target Station.
- Isotope production from e-linac shifts to East Target Station only.

Requires:
- Proton beamline $4.3M
Phase 5: Full power e-linac to reach most exotic neutron rich nuclei

Goals:
- Increase the energy and power of the e-linac beam to full design specification $50\text{ MeV}$, $500\text{kW}$, producing up to $10^{14}$ fissions per second.

Requires:
- e-Linac completion $5.1\text{M}$
ARIEL II Project: WBS & Budget

**ARIEL II**

- **Project Management Office**
  - EH&S
  - Finance
  - Communications

- **E-Linac** $5.1M
- **BL4N** $4.3M
- **Target Stations & Photo-converter** $15.8M
- **Separator & Front End** $5.2M
- **Control Center** $2M

*CANREB MoU3

*VECC MoU3

CANREB and VECC MoU Addendum 3 funding secured $32.4M CFI application submission June 27, 2014, decision March 2015
### ARIEL II Schedule – Science enabled

<table>
<thead>
<tr>
<th>PHASE</th>
<th>FY 2015</th>
<th>FY 2016</th>
<th>FY 2017</th>
<th>FY 2018</th>
<th>FY 2019</th>
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### ARIEL 10 YEAR PLAN

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<th>Year</th>
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<th>Fundamental Symmetries</th>
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Jens Dilling
Thank you!
Merci