

# NSERC Long Range Plan Status

Achieving Canada's Research Goals &  
Leading the Knowledge-Based Economy

Une Vision pour la prochaine décennie  
atteindre les objectifs de recherche du Canada  
et paver le chemin de l'économie du savoir

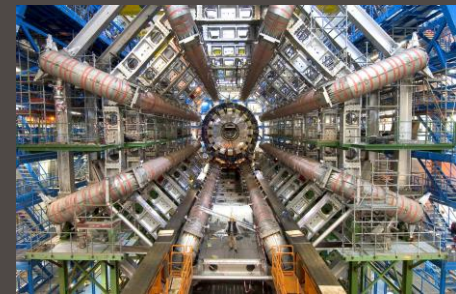
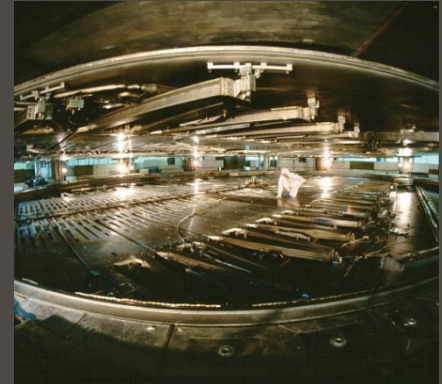


Jean Michel Poutissou | TRIUMF

IUPAP W9 Boston | July 24th, 2011

Accelerating Science for Canada  
Un accélérateur de la démarche scientifique canadienne

Owned and operated as a joint venture by a consortium of Canadian universities via a contribution through the National Research Council Canada  
Propriété d'un consortium d'universités canadiennes, géré en co-entreprise à partir d'une contribution administrée par le Conseil national de recherches Canada



# TRIUMF Canada's planning process for Subatomic physics

- National Laboratory
- NRC and TRIUMF
- 5 year cycle (yyy0-5)
- Current 2010-2015
- New plan in year 2 and 3
- Mid term international review. (fall 2013)
- Cabinet decision in last year of the current plan
- Granting council NSERC
- Subatomic physics community plan(LRPC).
- 5 year cycle (yyy1-6)
- Community driven plan
- Input to NSERC and to TRIUMF management
- Input to the peers managed funding envelope

# LRPC(2011) Membership

Name	Institution
Butler, Malcolm – <i>Chair</i>	Carleton University
Äystö, Juha	University of Jyväskylä
Burgess, Clifford	McMaster University / PITP
Garrett, Paul	University of Guelph
Hallin, Aksel	University of Alberta
Huber, Garth	University of Regina
Karlen, Dean	University of Victoria / TRIUMF
Luke, Michael	University of Toronto
O'Neil, Dugan	Simon Fraser University
Robertson, Steven	McGill University
Scholberg, Kate	Duke University

TRIUMF ex-officio Gordon Ball

# LRP Committee's Mandate

Based on a broad consultation with the Canadian subatomic physics community, the LRP Committee is asked to:

- Identify subatomic physics scientific ventures and *priorities* that should be pursued by the Canadian community and that would ensure continuous Canadian global scientific leadership.
- *Provide budgetary estimates, including funding ranges for prioritized endeavours.*
- *Funding ranges should include funding levels that would allow for a restrained, yet efficient, contribution to the ventures, as well as levels that would enable a more extensive contribution.*

The plan is to cover the period 2011-2016 and include a look ahead to 2021.

# LRP Committee's Mandate (cont'd)

- The Committee's assessment must be guided only by the current and future science in subatomic physics.
- The Committee must assess the feasibility, technical readiness and risks associated with particular endeavours.
- The Committee is also asked to consider and discuss factors that affect the subatomic physics community and to make recommendations on how to possibly lessen any negative impacts they may have, or enhance any positive ones.
  - E.g., NSERC programs other than those in the purview of the subatomic physics Evaluation Section; the relationship between NSERC and other agencies and organizations; the activities of national research organizations.

# Consultation Process

- CanInstNP and InstPP submitted briefs in Fall 2010
- Receipt of responses to briefs
- Additional community input eg. TRIUMF, Snolab, etc
- Town Halls in Vancouver and Montreal, January 2011
- Further feedback received prior to March LRPC meeting
- Presentation of *draft* report to community at 2011 at CAP Congress (June)
- Final report due in fall 2011

- A number of testimonials on successes of students
- Industrial spin-offs, including those from TRIUMF
- Look at technological and knowledge impact of the field in general
- Formalizing links to CERN is a political and economic opportunity as well as a scientific one.
- Potential to link this to government's initiative for closer ties with Europe

- Reap the scientific reward from ATLAS, T2K, and the SNOLAB and ISAC experimental programs
- Maintain a strong theoretical program
- Be strategic and engage in selected discovery-potential experiments

# Priorities (cont'd)

- Engage in Research and Development for the next-generation experiments that will be the future
- Ensure continued access to, and support for, the key domestic and international laboratories

# Opportunities

There are many opportunities for the future, and we cannot predict them all.

- Use notable examples to help us prepare
- More importantly put forward the exciting prospects that could strengthen Canada's leadership on the international stage .....

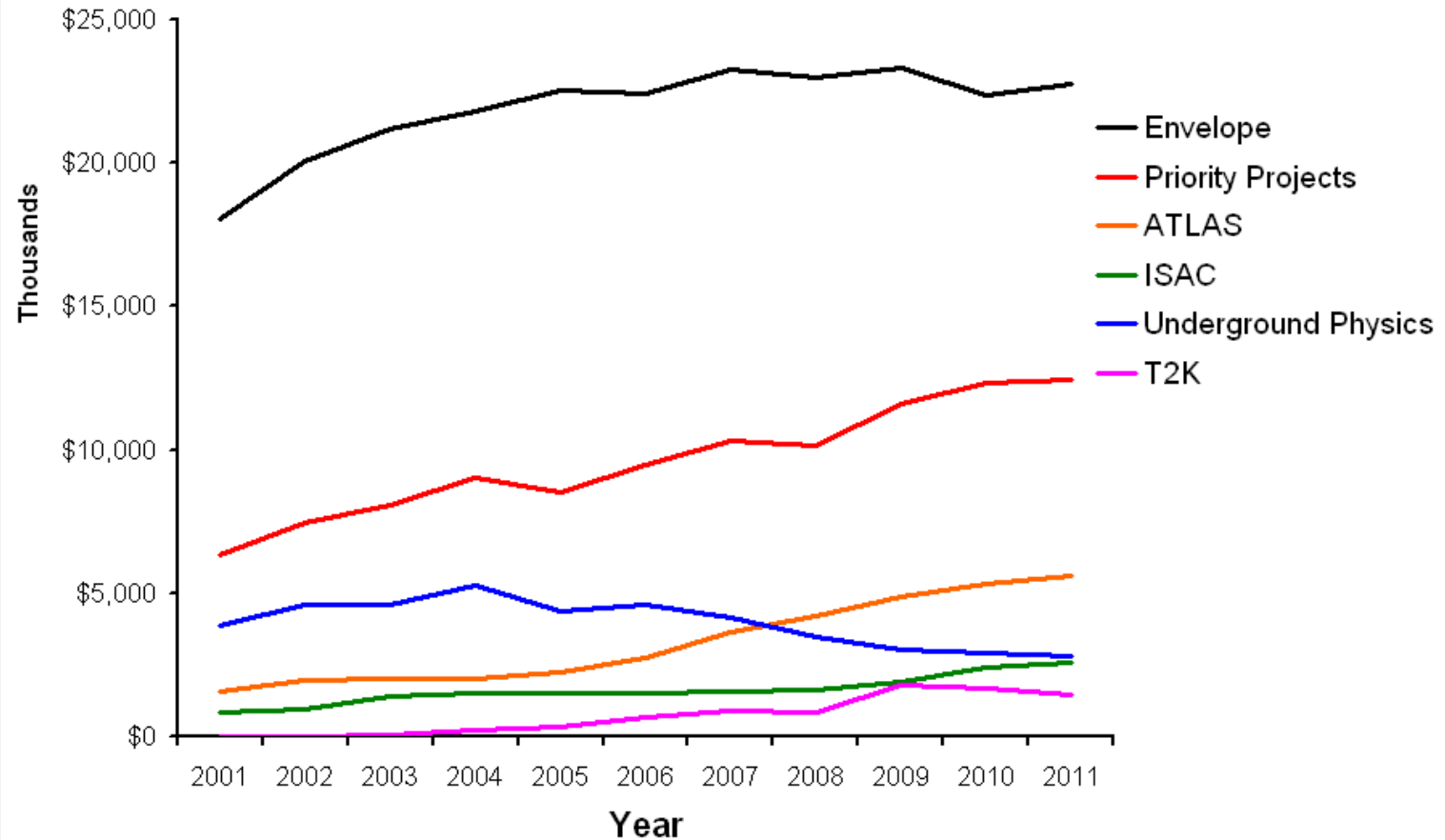
# Examples

- By 2013, results from the ATLAS experiment at the LHC will drive a decision as to whether to upgrade the LHC to higher luminosity, or pursue a linear collider project.
- The ARIEL project will bring new beams and experimental opportunities to ISAC, coupled to the actinide target program at TRIUMF

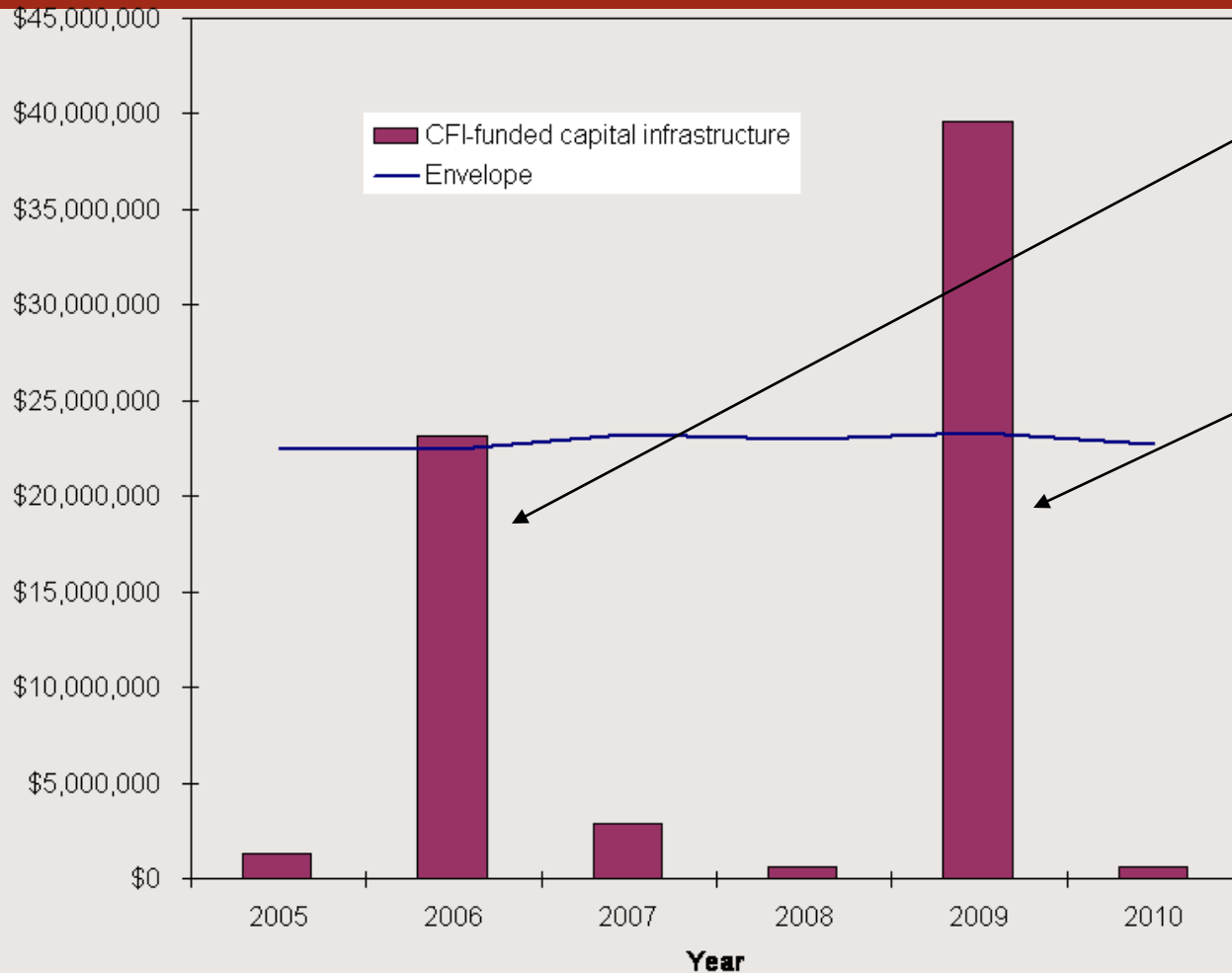
# Examples (cont'd)

- As soon as 2012, T2K will have results indicating whether it should pursue a more advanced program in lepton CP violation
- A decision is expected as soon as 2012 as to whether the EXO collaboration will move to developing Full EXO (the full-scale experiment) and whether to deploy a liquid or gas phase version.

# N SERC Funding of Subatomic Physics



# Capital Funding through CFI



Includes:

ISAC detectors, CDMS infrastructure and ATLAS Tier-1 Centre

Includes:

SNO+, DEAP, ARIEL, UCN, IRIS

Excludes CFI funding for facility maintenance and operation

# LPRC Summary

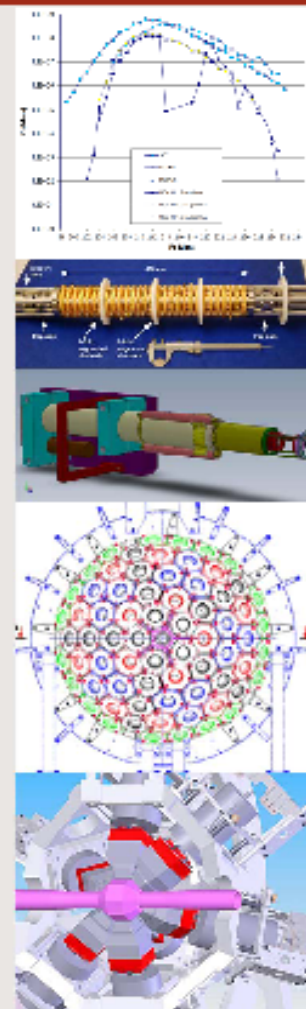
- Final report expected out this fall
- First revision of draft underway after community input
- Subatomic physics community well organized in Canada
- Goals are relatively straight forward since we must reap benefits from major investments such as ATLAS, ARIEL, and SNOLAB

# TRIUMF status

- Five year funding assured to 31 march 2015
  - Flat level mainly for operation and salaries
- New Electron Linac funded (\$17M) plus new buildings (\$31M)
- New Japan/Can UCN source funded
- Two new instruments for ISAC:
  - GRIFFIN replacement for 8Pi spectrometer
  - IRIS solid Hydrogen target

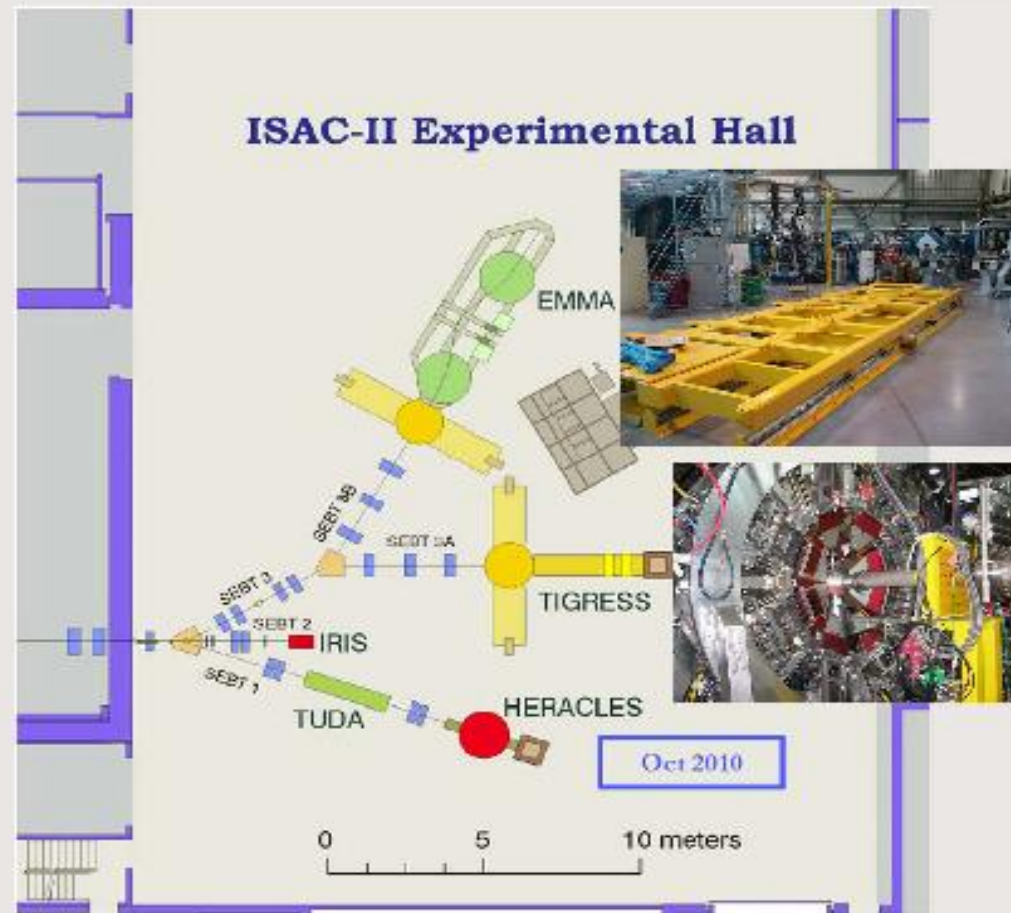
- The ISAC Radioactive Ion Beam (RIB) program is the key scientific research area for TRIUMF
- Highest power proton driver and target (50kW)
- Post-accelerators deliver high quality beams fully variable in energy
  - With addition of ISAC-II Phase II upgrade in March 2010 all ions can be accelerated above the Coulomb Barrier
- Some past limitations are being addressed
  - Accelerated beams limited to  $A \leq 30$ 
    - charge breeder (CSB added) – developing beam purification schemes
  - Production targets limited to  $Z < 82$ 
    - Actinide (Uranium Carbide) targets now delivering for low proton current (few  $\mu\text{A}$ ) production for heavier RIBs
- We want to grow ISAC into the true world leader in ISOL based science as CARIBU, SPIRAL-II, HIE-ISOLDE and FRIB become realities

- **Francium room**
  - Fr yields established from UCx target
  - Installation starts summer/fall 2011
- **TITAN-EC and CPET**
  - Matrix elements for  $\beta\beta$ -decay, operational 2011
  - higher precision masses using cooled ions, commissioning 2012
- **TIP Plunger for TIGRESS + Csl**
  - Lifetimes of Nuclear Excited states, Csl for charged particles
  - Construction progressing at SFU – completion by 2012
- **DESCANT**
  - Neutron detector array for TIGRESS and GRIFFIN
  - Parts completed by end 2011, assembly spring 2012
- **IRIS**
  - Solid H-target, commissioning starting spring 2012
- **SPICE**
  - Electron conversion spectrometer, 2012
- **GRIFFIN**
  - Phase 1 (w/o BGO's) CFI funded – completion by 2015

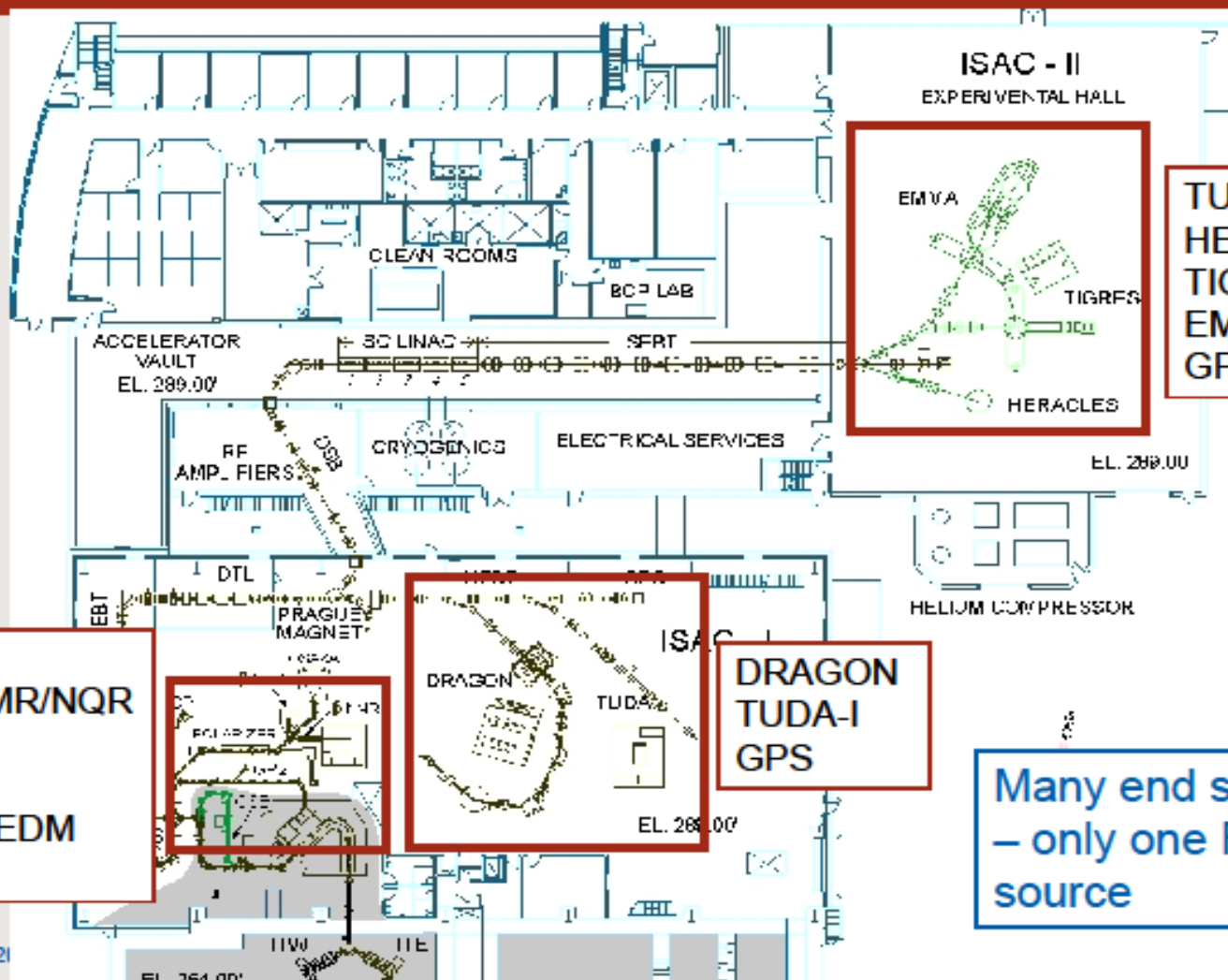


# Recent ISAC-II developments

- 12 A MeV  $^{20}\text{Ne}$  beam to HERACLES in Dec 2010
- TIGRESS+ SHARC fully operational
  - Further upcoming ancillary detectors: SPICE, DESCANT, TIP, CsI-array, Bragg
- $A > 30$  RIB to ISAC-II
  - CSB commissioned : eff ~ 2 %
  - cocktail beams dominated by stable beam contaminant at every  $A/q$
  - new Al CSB chamber installed
- Established High- Mass Task Force
  - a joint Accelerator-Science Division team
  - towards "routine" operation by 2012
- EMMA components to be delivered 2011



# ISAC RIB Facility – End stations



**TITAN**  
 beta-NMR/NQR  
 8PI  
 GPS  
 Radon-EDM  
 Osaka

**DRAGON**  
 TUDA-I  
 GPS

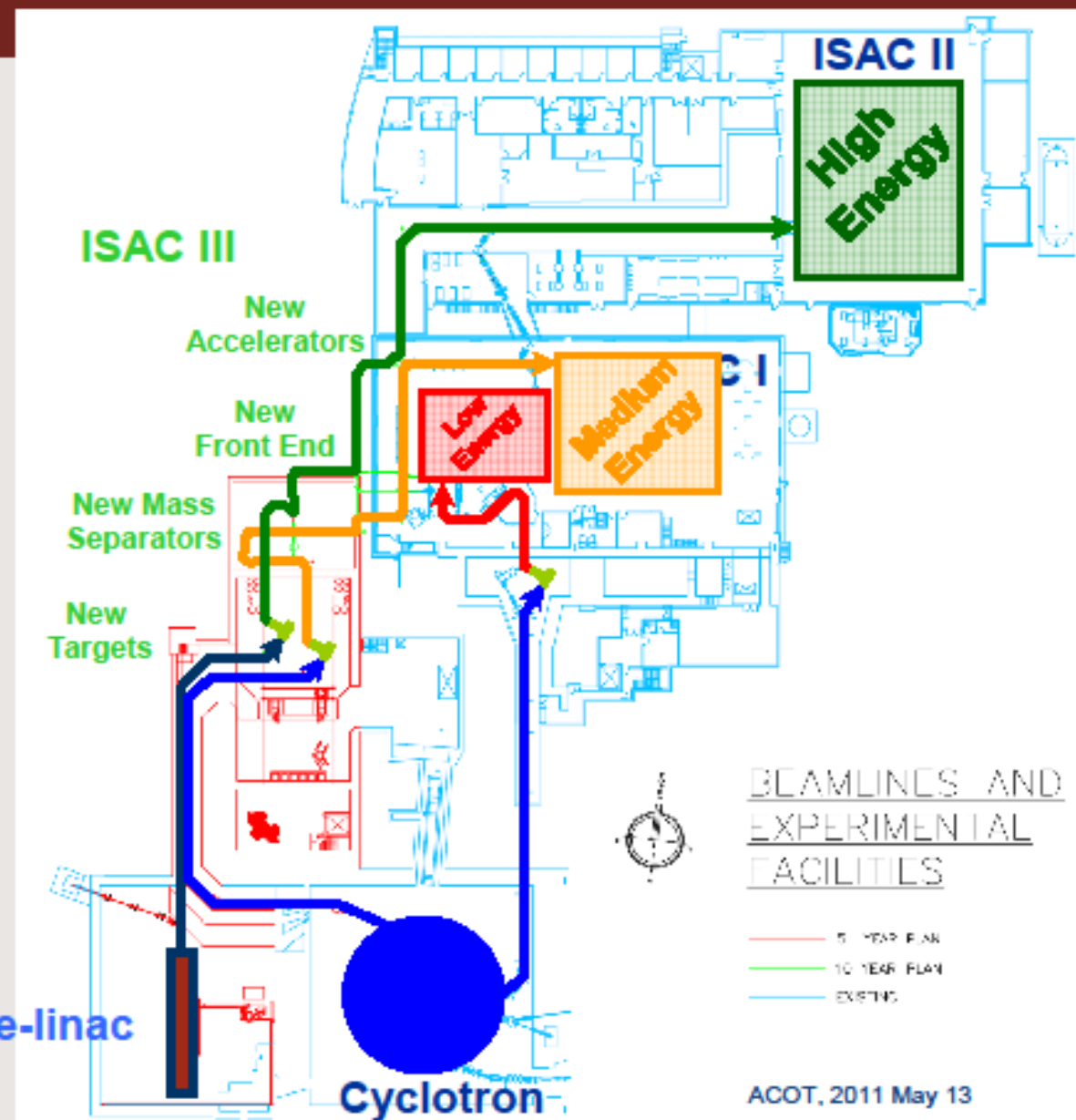
**DRAGON**  
 TUDA-I  
 GPS

**ISAC - II**  
 EXPERIMENTAL HALL  
 EMVA  
 TIGRESS  
 HERACLES

**TUDA-II**  
 HERACLES  
 TIGRESS,  
 EMMA  
 GPS

Many end stations  
 – only one RIB  
 source

# ARIEL Project 10-Year Plan: Motivation



- To substantially expand RIB program with:
  - 3 simultaneous beams
  - increased number of hrs/yr delivered
  - new beam species
  - increased beam development capabilities
- New complementary electron linac (e-linac) driver for photo-fission
- New proton beamline
- New target stations and front end
- Staged installation



## Funding

- Total funding \$62.9 M
  - CFI (e-linac) \$17.8 M
  - BC government (site infrastructure) \$30.7 M
  - TRIUMF (salaries) and partners (in-kind) \$14.4 M
  
- Additional funding to be secured for:
  - second proton beamline
  - target station equipment

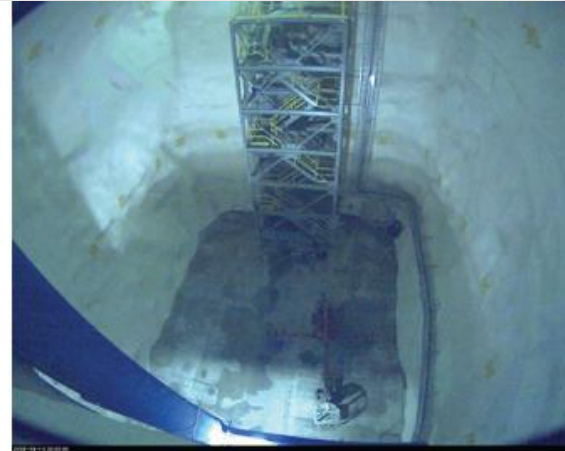
# ARIEL E-linac milestones

- 300 keV Gun complete: 2012 February
- ACM final design approved: 2012 May
- Low Energy BL installed in E-hall: 2013 June
- E-Dump BL installed in E-hall: 2013 October
- ICM commissioned in E-hall: 2013 December
- ACM installed in E-hall: 2014 February
- E-linac full equipment test: 2014 February
- E-linac low-power beam test: 2014 March
- Tunnel transport BL to target installed: 2014 April
- E-linac 100 kW beam test: 2015 January
- E-beam to tunnel transport: 2015 March

# Underground science

## SNOLAB Facility Status Summary

- SNOLAB facility complete
- All major infrastructure in place
- Facility is now in transition to experimental programme
  - Deployment of support systems for first experiments underway (SNO+, DEAP-3600, MiniCLEAN, HALO)
  - Smaller scale experiments and R&D programmes underway (COUPP-4, DEAP-I, PICASSO-III)
  - Infrastructure requirements for additional systems being developed (COUPP, CDMS)
- **SNOLAB is looking forwards to contributing to the world programme of underground science**





# SNOLAB Overall Status



- Surface Facility (3100 m<sup>2</sup>)
  - Operational from 2005 - Provides offices, conference room, dry, warehousing, IT servers, clean-room labs, detector construction labs, chemical + assay lab
  - 440m<sup>2</sup> class 1000 clean room for expt setup
- Underground Construction (Cube Hall, Cryopit, Ladder Labs)
  - Phase I excavation complete and outfitting began June 2007.
  - General outfitting in Phase I areas complete 2009, final clean 2010.
  - Phase-II excavation complete June 2008
  - Phase-II integration complete March 2011, final clean completed.
  - SNO cavity, Cube Hall and Ladder Labs hosting and developing experiments.
- Experimental Programme
  - Relocation / continued operation of DEAP-1 & PICASSO-III (and EXO-gas R&D).
  - New experiment deployed: COUPP-4
  - Construction support for HALO, SNO+, DEAP-3600, MiniCLEAN
  - Current allocations to: **PICASSO-III**, **DEAP-I**, SNO+, DEAP-3600, MiniCLEAN, SuperCDMS TF, SuperCDMS, **COUPP**, HALO.
- Operational funding currently secured to 2013

# SNOLAB

## Experimental Programme



Experiment	Solar nu	OnuBB	Dark Matter	SuperNovae	Geo nu	Other	Space allocated	Status
SNO+	√	√		√	√		SNO Cavern	Underway
PICASSO-III			√				Ladders Labs	Underway
DEAP-1			√				J'-Drift	Underway
DEAP-3600			√				Cube Hall	Underway
MiniCLEAN			√				Cube Hall	Underway
HALO				√			Halo Stub	Underway
PUPS						Seismicity	Various	Completed
SuperCDMS			√				Ladder Labs	Request
EXO-gas		√					Ladder Labs	Request
COUPP			√				Ladder Labs	Underway
DarkSide			√				Ladder Labs	Request
COBRA		√					Ladder Labs	Request

# Merci

# Thank You

Thanks to Malcolm Butler, Chair NSERC  
 Long range Plan Committee for input and  
 ARIEL team

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