TRIUMF

Canada's national centre for particle and nuclear physics and accelerator-based science

Project Introduction and Current Status of ARIEL

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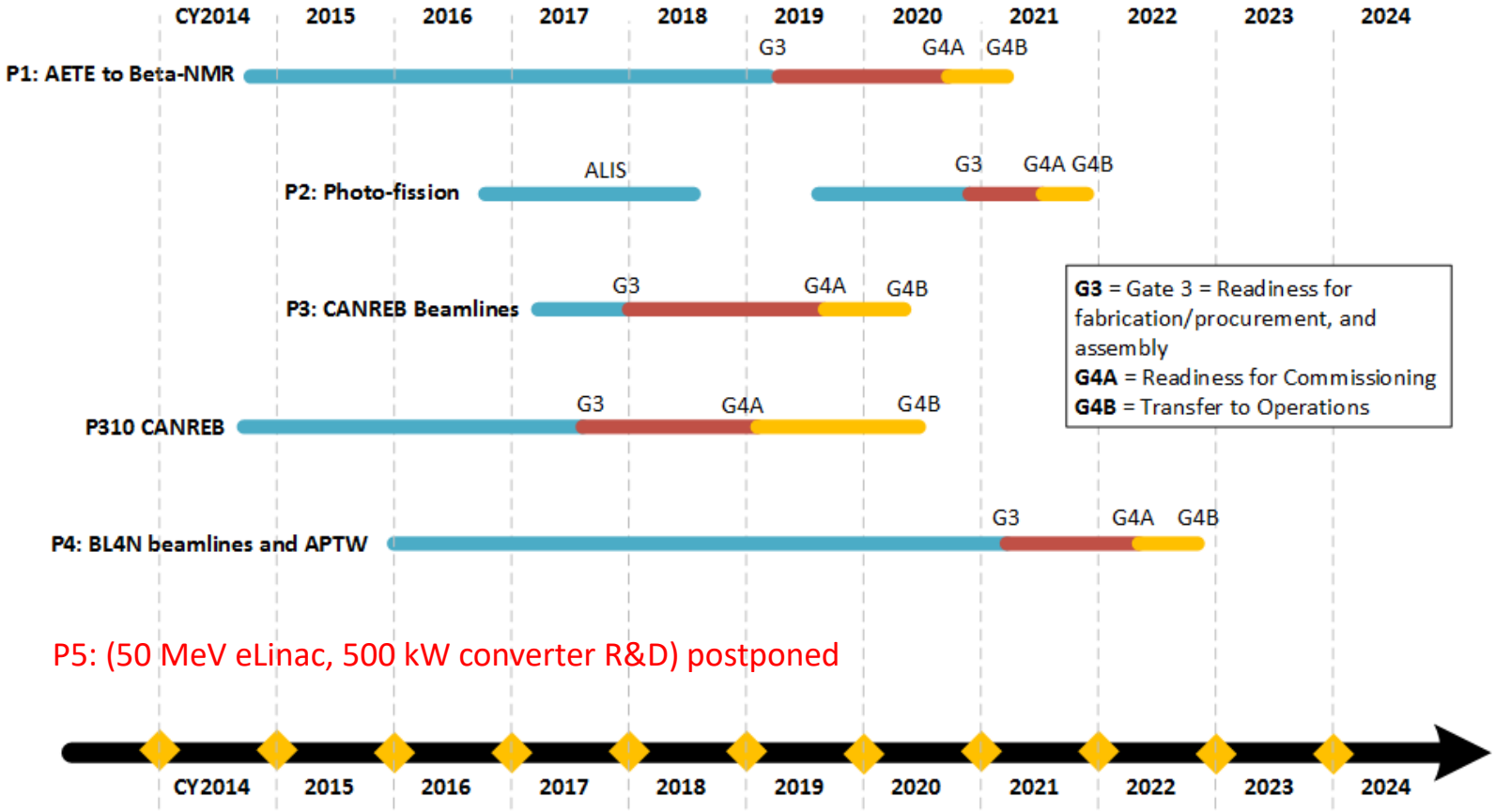
ARIEL-II baselined schedule



P5: (50 MeV eLinac, 500 kW converter R&D) postponed

ARIEL: Science enabling milestones

Science enabling milestone	Month/Year
First EEC approved experiments with high-mass accelerated beams from ISAC utilizing the CANREB/ARIEL EBIS charge breeder	10/2020
First EEC approved beta-NMR experiments with photo-produced ^{8}Li	03/2022
First EEC approved experiments with photo-fission RIBs from the e-Linac	06/2022
First EEC approved experiments with RIBs from ARIEL Proton target	03/2023

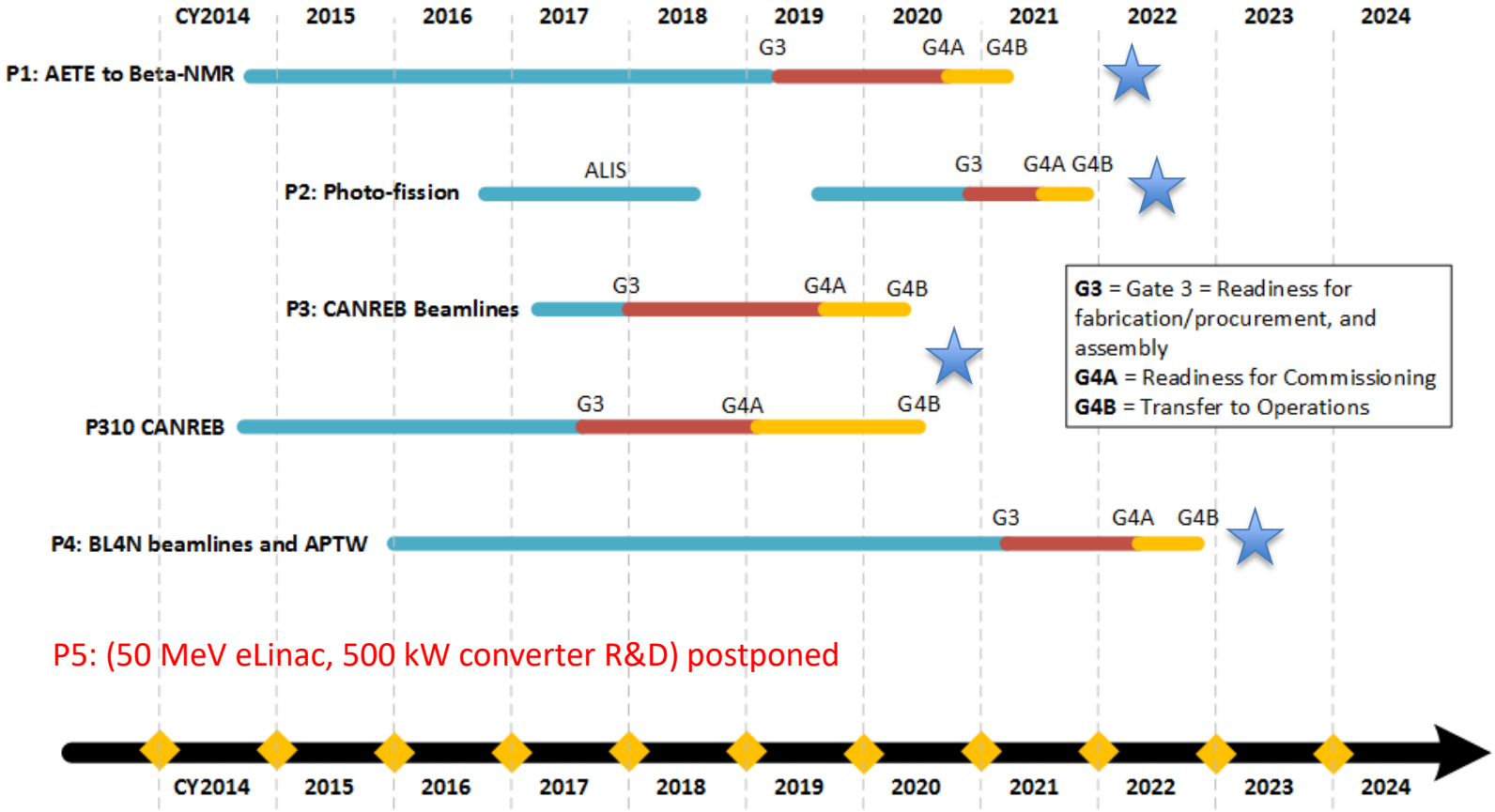
→ Higher intensity, cleaner high-mass accelerated beams

→ More RIB hours, cleaner n-rich RIBs

→ 3 parallel RIBs

- Dates based on Monte Carlo analysis of schedule
- Current best estimates but with high confidence
- Efforts under way to accelerate schedule

ARIEL-II baselined schedule



ARIEL is divided geographically

#1 RIB delivery

#2 ARIEL target stations & infrastructure

#3 Driver beam lines

P355 – Laboratories ($1.3M)

P424 – Target Hall Infrastructure ($10.6M)

P310 – CANREB ($3.4M)

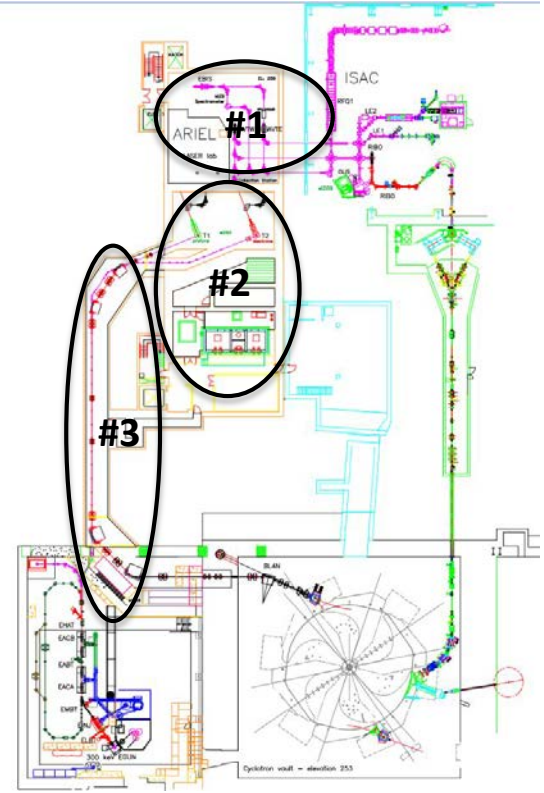
P354 – Beamlines ($7M)

P353 – Target Stations ($9M)

P363 – e-linac completion ($0.5M)

P179 – BL4N ($4.5M)

P358 – CFS ($3.3M)



Least risk: complete asap

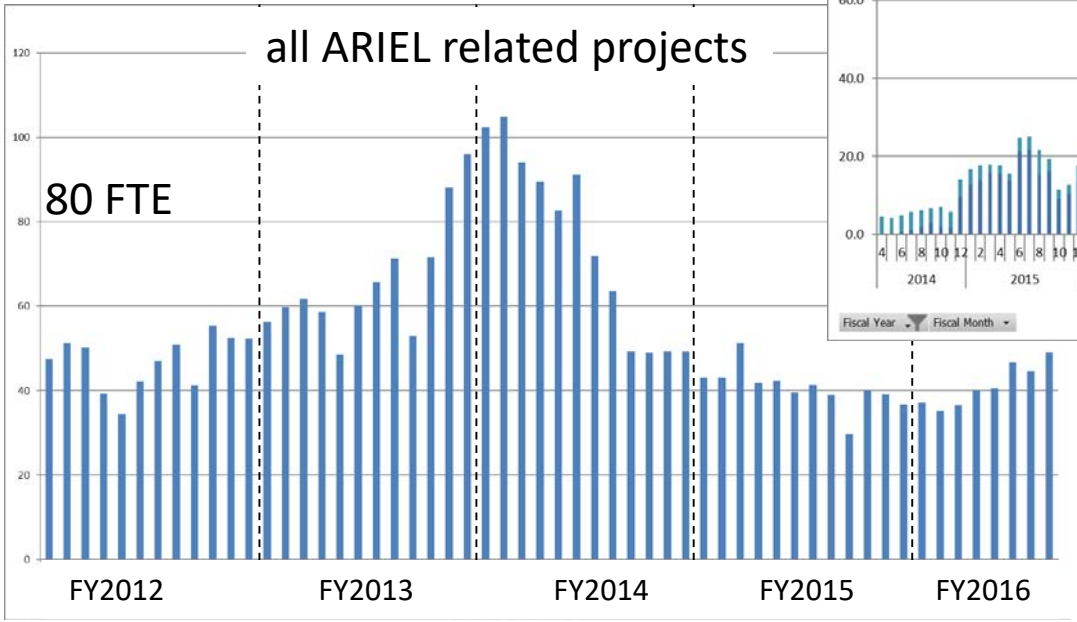
AETE is new tech: higher risk

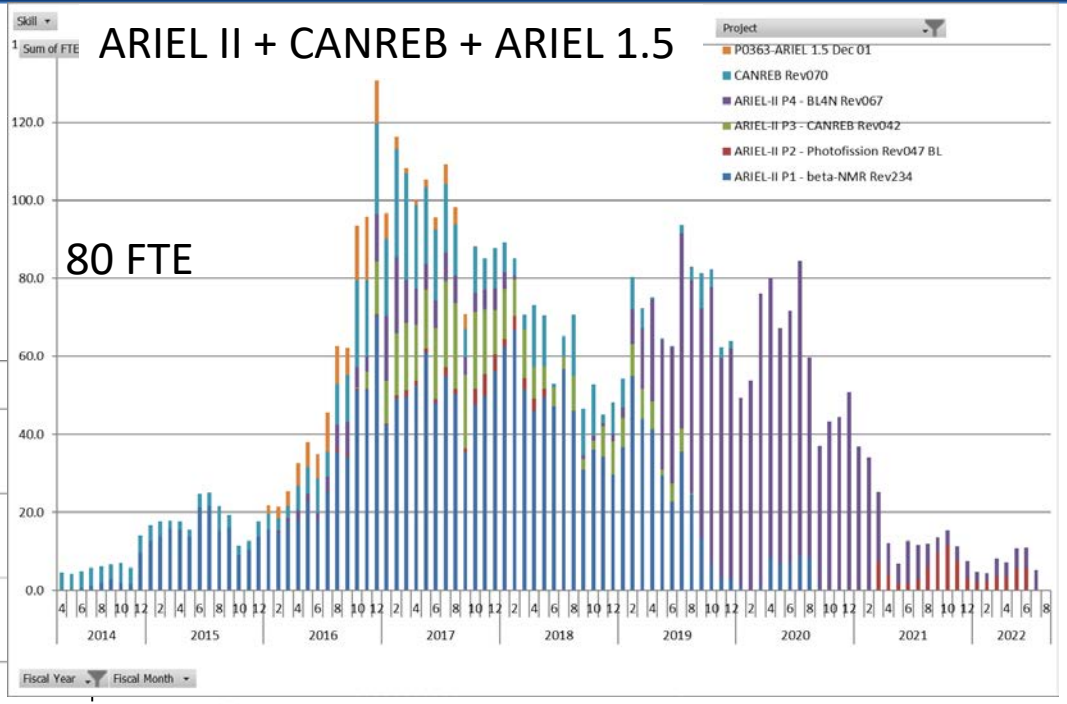
Depends on target stations

ARIEL Resource Load by Fiscal Year

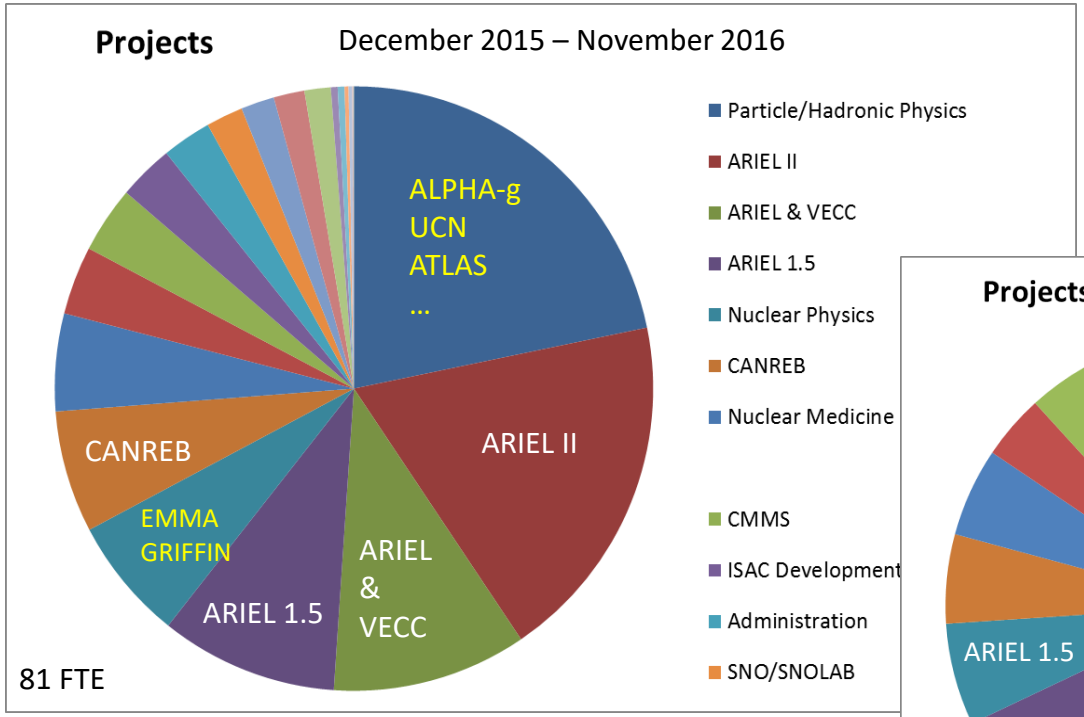
ARIEL-II schedule is manpower limited

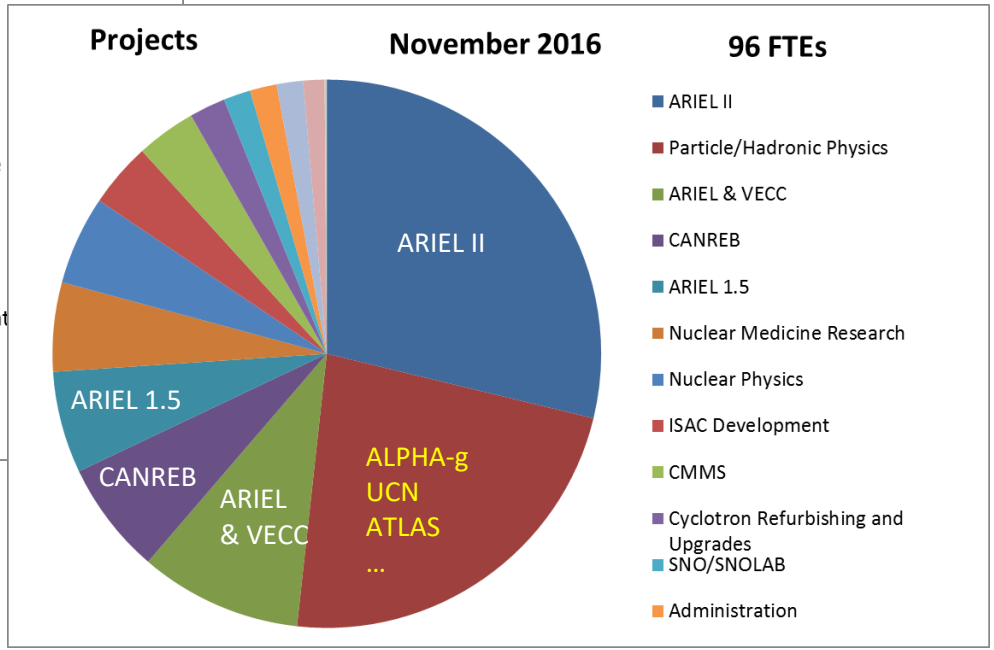
Action: schedule was levelled to limit times with > 80 FTE



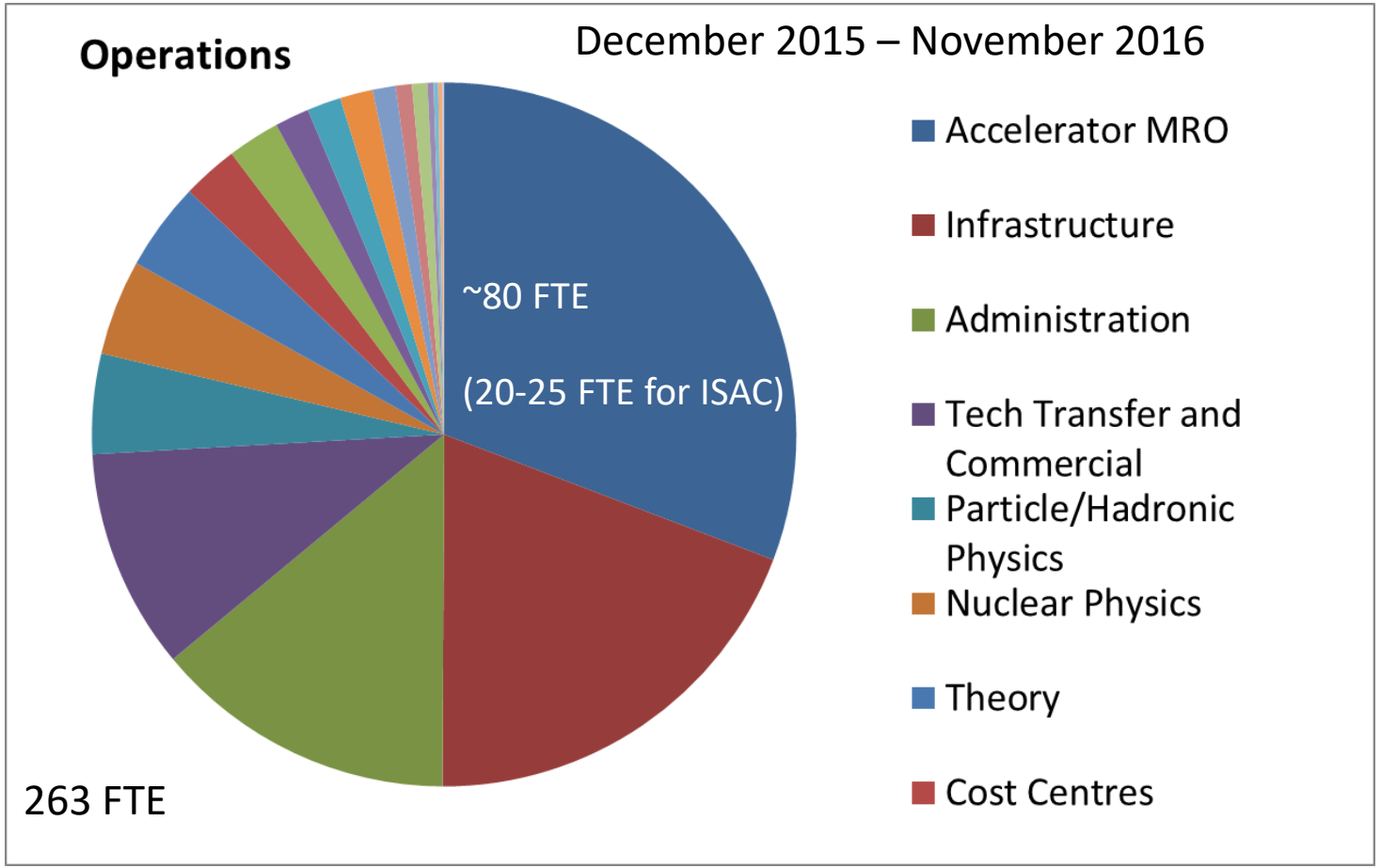


TRIUMF Project Manpower (NRC funds)





Operations manpower



Existing Resource Action Plan

ARIEL-II schedule is manpower limited

Action: schedule was levelled to limit times with > 80 FTE

Measures already taken to allow planned project delivery

- We have identified obstacles in the project organization

  Action: restructured project to decouple project components

- We have identified over-allocated resources

  Action: hired 13 FTE (engineers, scientists, technicians) to alleviate immediate pressures (~$2M), more might be necessary.

To be addressed:

- Ensure fully adequate resourcing based on up-to-date integrated schedules
- Reduce multitasking and focus team members

How to accelerate ARIEL-II

- Identify one major goal for each year and focus effort on it
  - 2018: Focus on CANREB & RIB Transport installations
  - 2019: Focus on Target Hall installation
  - 2020: Focus on BL4N installation

- Take advantage of spatial separation of project parts and form dedicated ARIEL-II assembly & installation teams, starting 2H2017, to prevent multi-tasking
  - 1 team for Target Hall
  - 1 team for RIB and driver beams

- Make more manpower available for the project by
  - Hire more contract labour … only possible within available budget, will be fully utilized
  - delaying other projects [big ones: ALPHA-g, UCN, EMMA (completed), M9 reconnect]
  - Involvement of university resources
  - Reduced beam delivery

… need to consider graded approach

Potential user involvement

- Well defined engineering / manufacturing packages for university workshops (utilization of NSERC SAP MRS funded support groups)
- Assembly / test of electronics components, e.g. for diagnostics elements
- Simulations, e.g. targets/ion-sources
- Materials tests, e.g. photo converter and targets test stand
- Support during commissioning of certain components
  - E.g. CANREB charge breeder
  - HRS
  - Beam lines
  - Diagnostics set-ups

Scenarios for reduced beam delivery

#	Measure to be considered	Advantages	Disadvantages
1	full shutdown for one year (e.g. 2019)	- Reduced power bill (~$2.5M) ➔ would allow for hiring contract labor - Frees ~80FTE for 9 months - No distraction by maintenance ➔ can focus teams on project work	- Loss of commercial revenue (~$3M) - Loss of customers and users - Loss of science output and delayed HQP training - Not all 80FTE can be utilized for project work
2	6 months operation for several years	- Slightly reduced power bill ($~1.25M) ➔ would allow for hiring contract labor - Frees ~80 FTE for 3 months - No distraction by maintenance ➔ can focus teams on project work	- Significantly reduced commercial revenue - Potential loss of customers and users - Reduced of science output and delayed HQP training - Not all 80FTE can be utilized for project work

Scenarios for reduced beam delivery

#	Measure to be considered	Advantages	Disadvantages	
3	12 months ISAC shutdown in one year (e.g. 2019)	- Frees up to 20 FTE for 9 months - frees key personnel from operational duties (Accel. Phys., Rem. Handling)	- Loss of ISAC science output - Loss of ISAC users - Not all ISAC operations personnel can be utilized for project	
4	6 months ISAC operation in 2018-2022	- Frees up to 20 FTE for 3 month per year - Allows to advance ARIEL and ISAC Target Module Strategy - frees key personnel from operational duties (Accel. Phys., Rem. Handling)	- Reduced science output - Not all ISAC operations personnel can be used for project	
5	Shorter running in 2017 (April-October)	- Frees up to 20 FTE for 2 month - frees key personnel to focus on important goals for ISAC refurbishments, T2M9 fix, Main Magnet Power Supply	- Reduced science output	

Scenarios for reduced beam delivery

#	Measure to be considered	Advantages	Disadvantages	
6	Reduced/ focussed ISAC operations	TRILIS only in 2nd half of 2017 - Frees a few FTE in first half 2017 - allows Laser Team to focus on ALIS clean room installation (before CANREB equipment is installed)	- Frees only a few FTE - Somewhat constraint science program, difficulty scheduling	
7	Reduced/ focussed ISAC operations	No accelerated beam in 2019 - Frees < 10 FTE in 2019 - frees some technical personnel for assembly, installation - Allows ion source experts and operations teams to focus on commissioning of CANREB	- Frees only a < 10 FTE - Insufficient impact on accelerating the project? - Constraint science program, difficulty scheduling	

Conclusion

- Delivery of ARIEL project is challenging and ultimately manpower limited
  - We are taking every step possible to optimize schedule and resource usage

- Acceleration of the schedule is only possible with substantial additional interventions with negative impact on science program
- Next steps we are taking:
  - Further improve project planning and supplement resources as required (within available budget)
  - Reduced Beam Delivery
    - Carry out more detailed analysis of the impact of reduced beam delivery on ARIEL schedule
    - Propose detailed plan at Science Week 2017
  - Identify concrete opportunities for involvement of users

Communication with the user community is critical ….. stay engaged ….

TRIUMF

Canada's national laboratory for particle and nuclear physics

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Thank you!
Merci!

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