



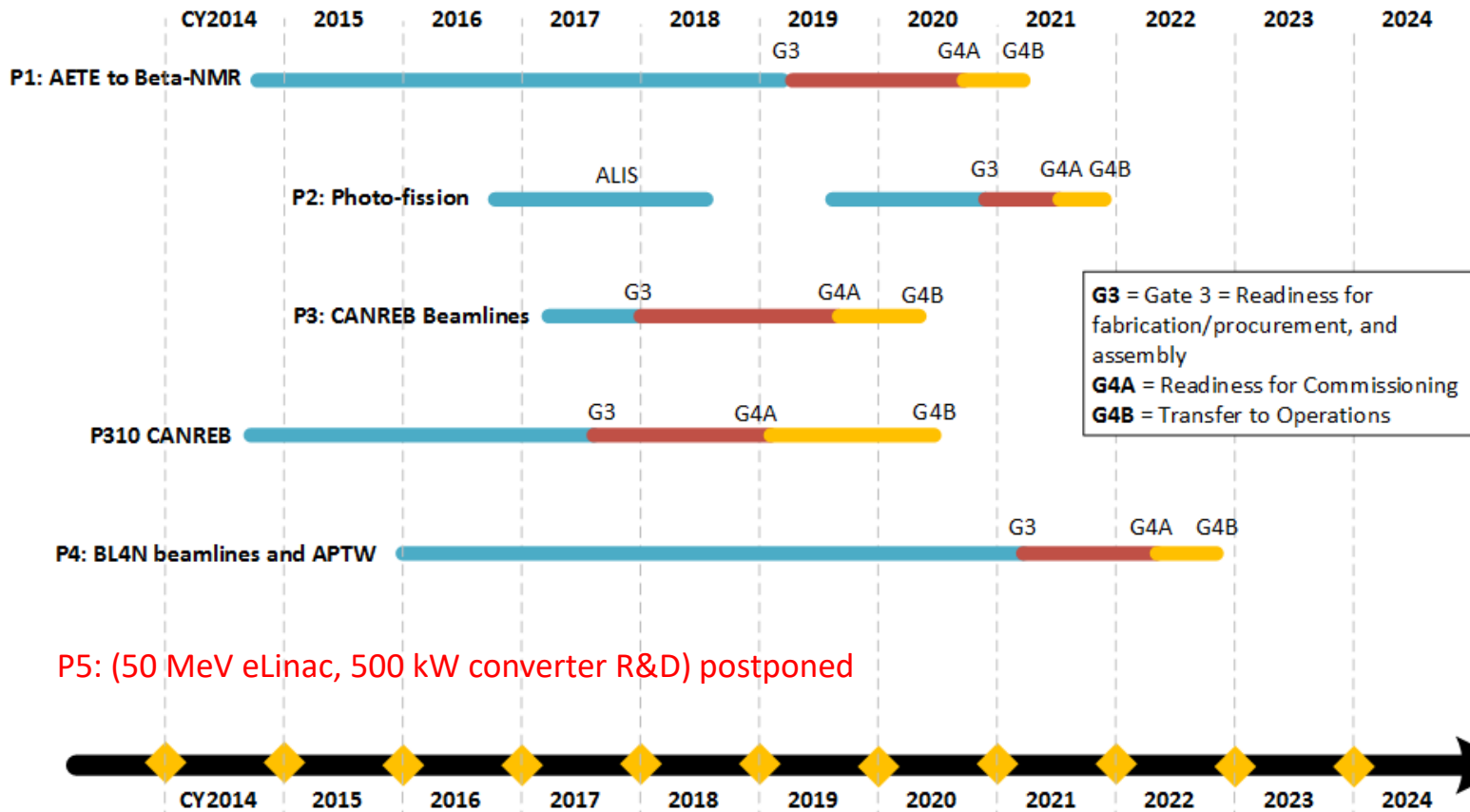
Canada's national centre for
particle and nuclear physics
and accelerator-based science

Project Introduction and Current Status of ARIEL

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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 ${}^8\text{Li}$	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

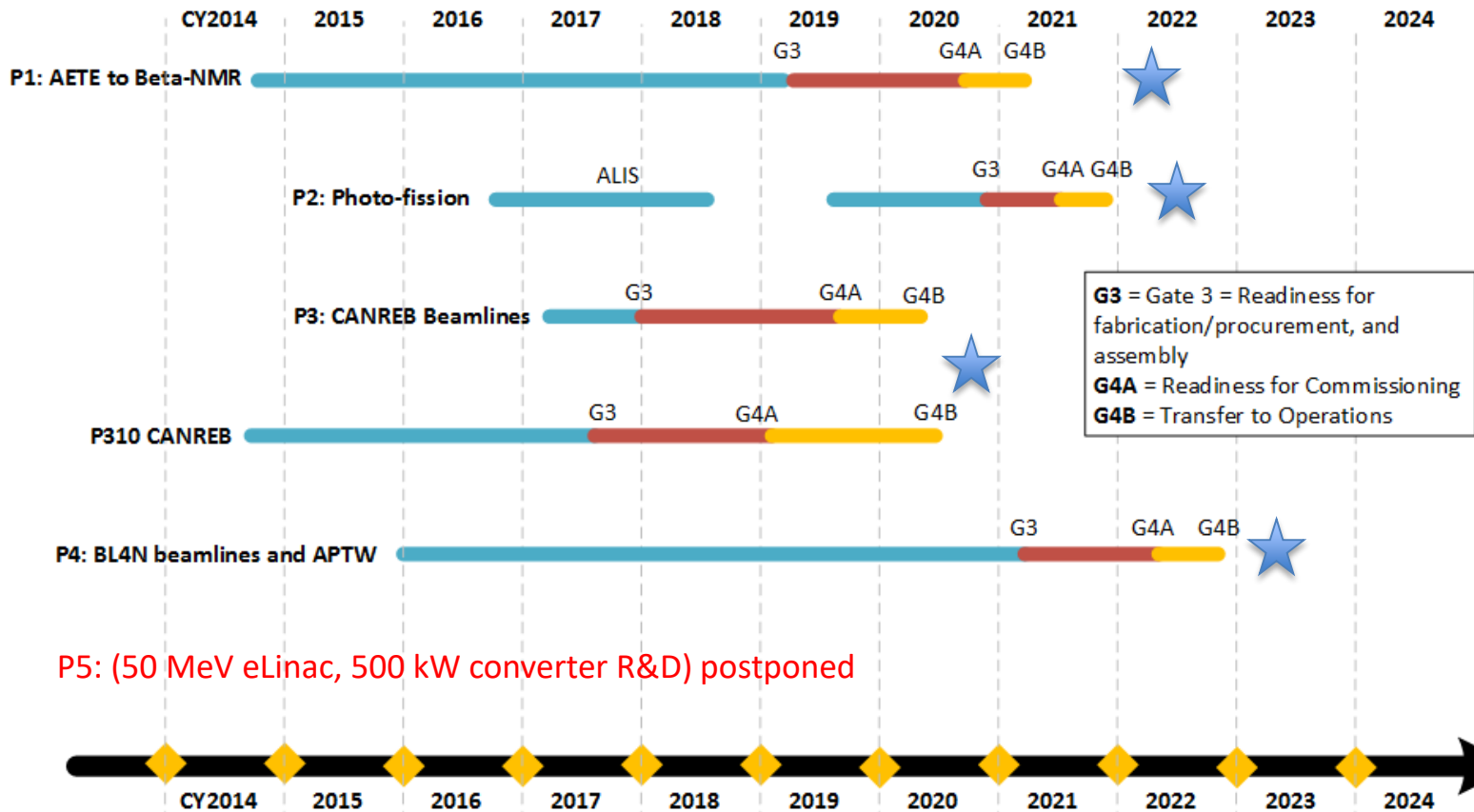


More RIB hours,
cleaner n-rich RIBs



3 parallel RIBs

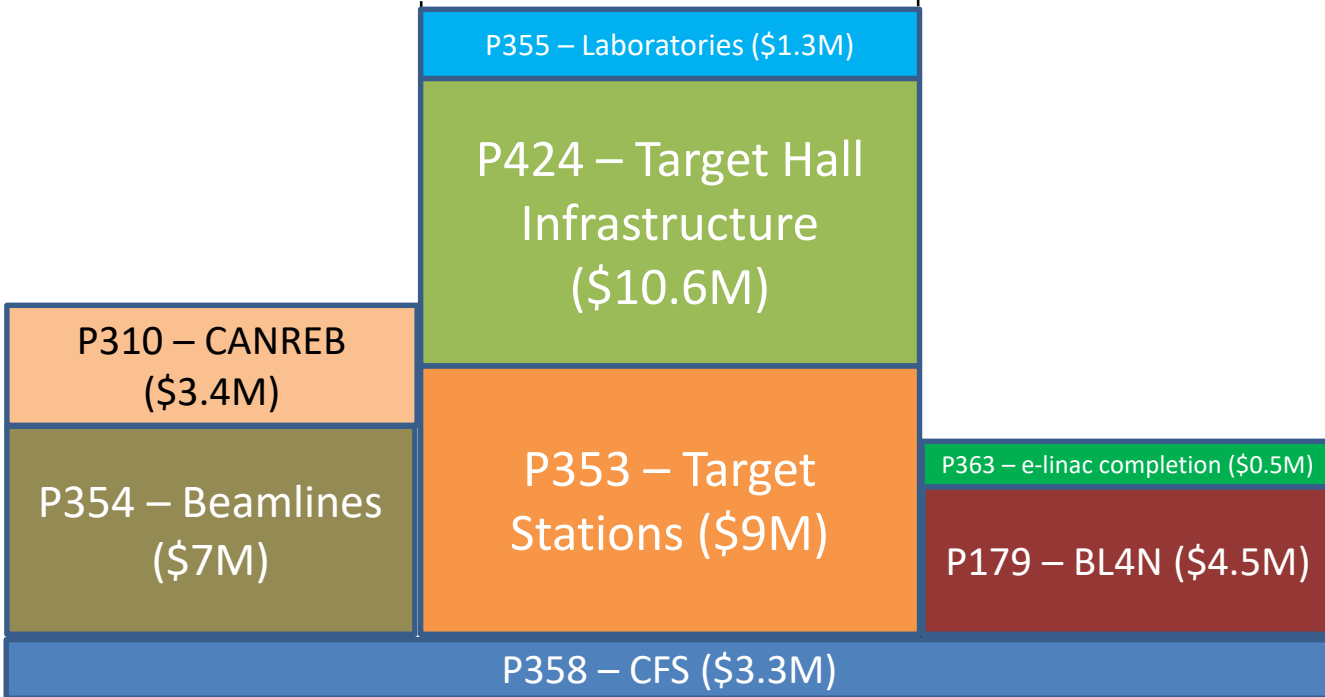
- Dates based on Monte Carlo analysis of schedule
- Current best estimates but with high confidence
- Efforts under way to accelerate schedule



#1 RIB delivery

#2 ARIEL target stations & infrastructure

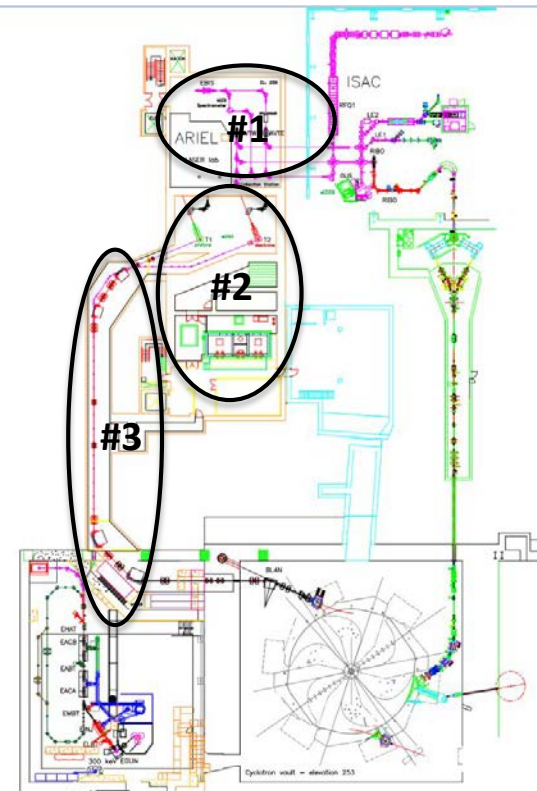
#3 Driver beam lines



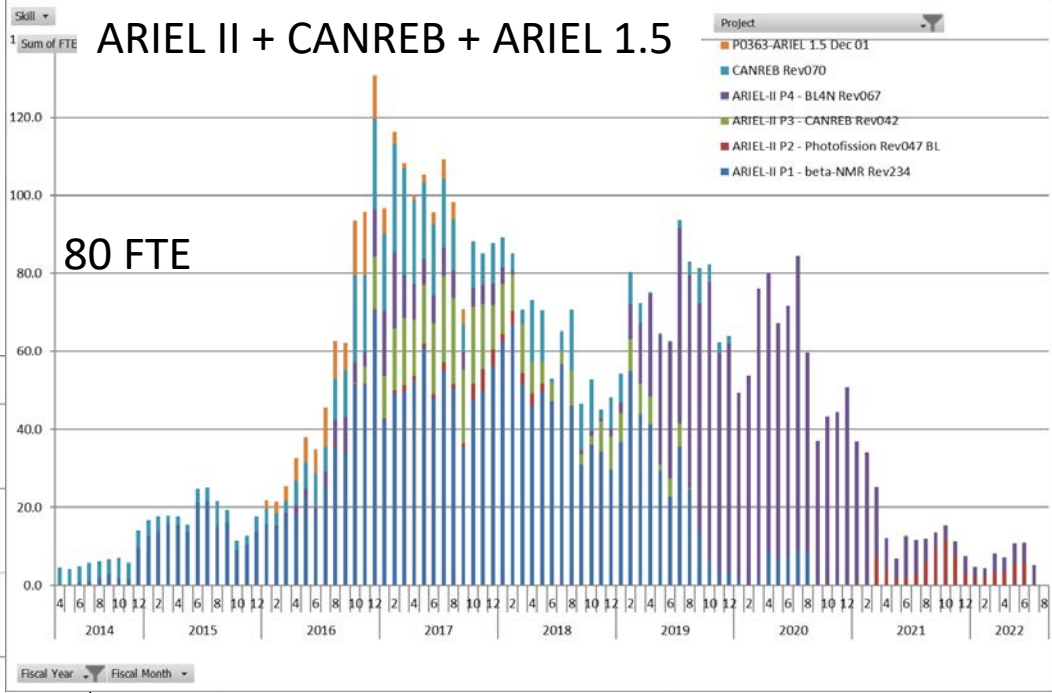
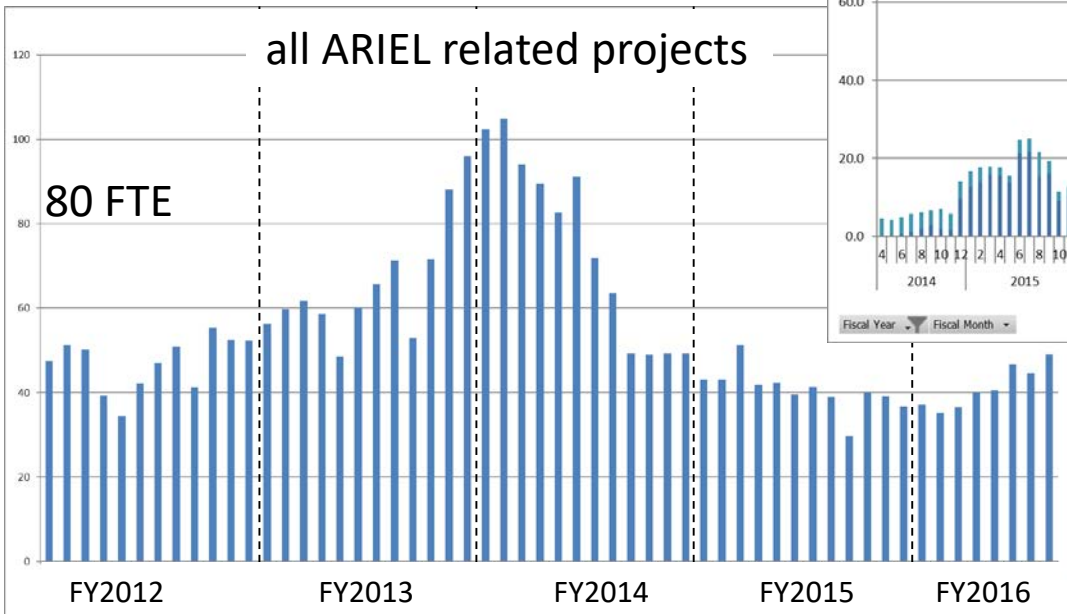
Least risk: complete asap

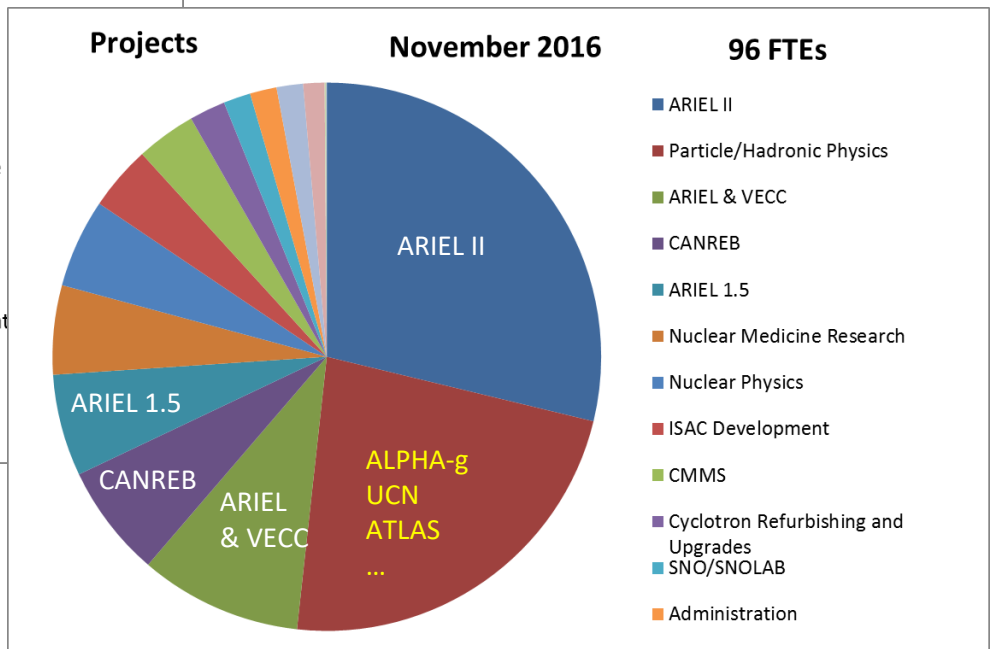
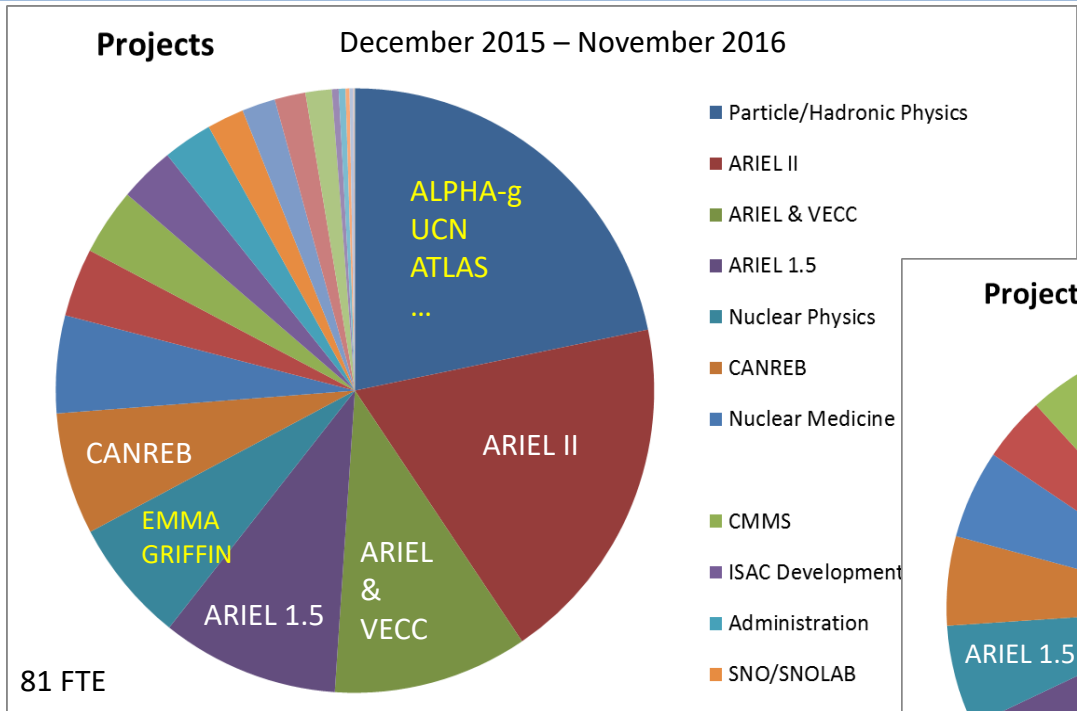
AETE is new tech: higher risk

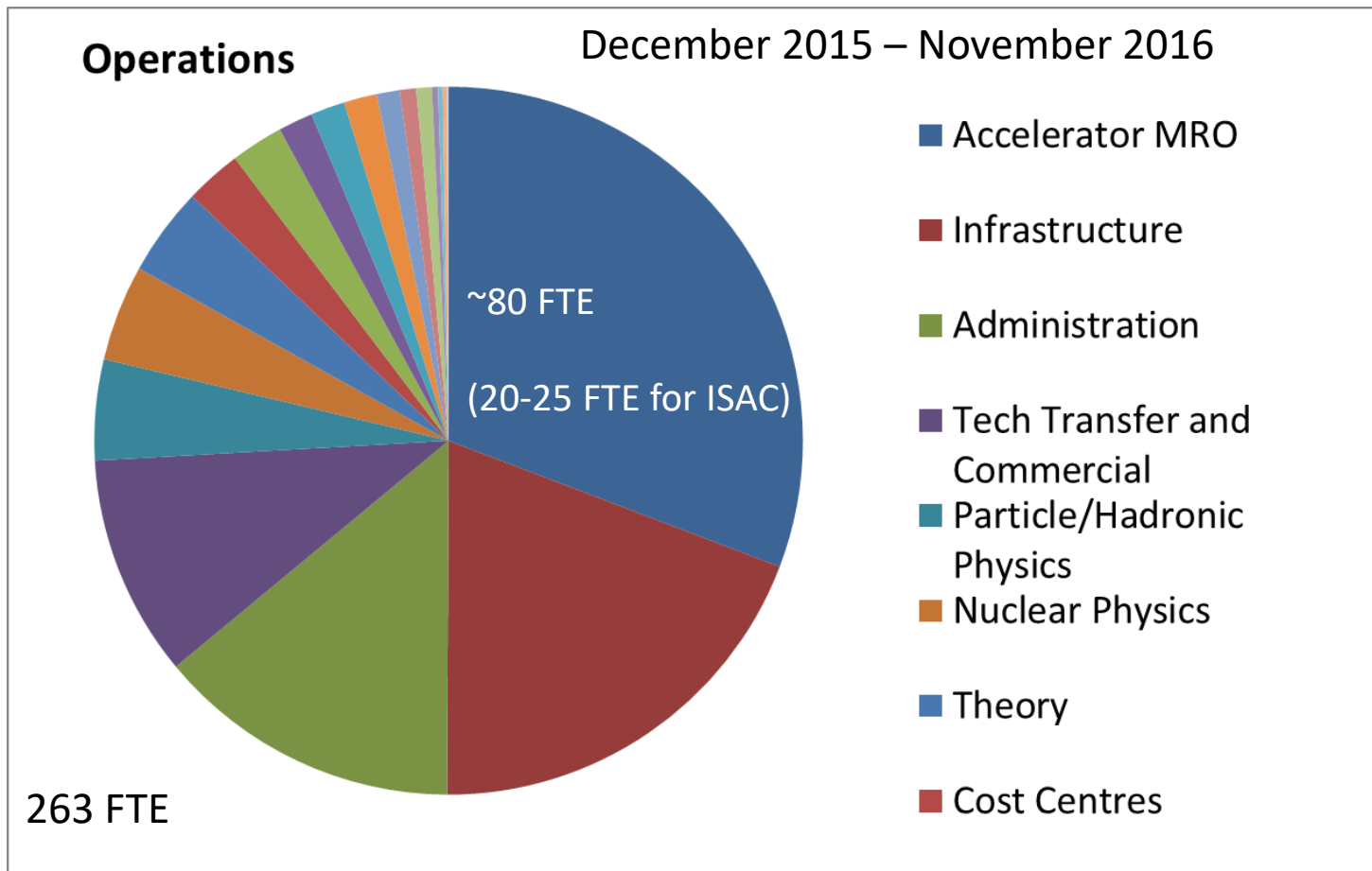
Depends on target stations



ARIEL-II schedule is manpower limited
Action: schedule was levelled to limit times with > 80 FTE







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

- 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

- 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

#	Measure to be considered	Advantages	Disadvantages
1	full shutdown for one year (e.g. 2019)	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - 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

#	Measure to be considered	Advantages	Disadvantages	
3	12 months ISAC shutdown in one year (e.g. 2019)	<ul style="list-style-type: none"> - Frees up to 20 FTE for 9 months - frees key personnel from operational duties (Accel. Phys., Rem. Handling) 	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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) 	<ul style="list-style-type: none"> - Reduced science output - Not all ISAC operations personnel can be used for project 	
5	Shorter running in 2017 (April-October)	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - Reduced science output 	

#	Measure to be considered	Advantages	Disadvantages
6	Reduced/ focussed ISAC operations	<p>TRILIS only in 2nd half of 2017</p> <ul style="list-style-type: none"> - Frees a few FTE in first half 2017 - allows Laser Team to focus on ALIS clean room installation (before CANREB equipment is installed) 	<ul style="list-style-type: none"> - Frees only a few FTE - Somewhat constraint science program, difficulty scheduling
7	Reduced/ focussed ISAC operations	<p>No accelerated beam in 2019</p> <ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - Frees only a < 10 FTE - Insufficient impact on accelerating the project? - Constraint science program, difficulty scheduling

- 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



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Thank you!
Merci!

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