



MONASH
University

WG2 – Accelerator Particle Physics

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WG2

- The conveners of the group are Matthew Dolan and Ulrik Egede
 - Matt became a Dad this week which is why I make the presentation!
- The working group has had three meetings where we discussed the structure of the roadmap document
- Editors so far:
 - Paul Jackson, Martin Sevier, Pat Scott, Kevin Varvell, Matthew Dolan, Ulrik Egede, Mark Smith, German Valencia, Raymond Volkas and Martin White
- More are encouraged
- Status is that we have a draft but also some missing sections

Structure

- We have split the chapter into 3 broad sections
 - Flavour physics
 - High Energy
 - Neutrinos
- In each section we then discuss
 - The physics motivation (briefly)
 - Current status within Australia
 - Future opportunities
- At the end we summarise the effort in each of the current experiments

Flavour Physics

- The current involvement of Australia is in Belle II, LHCb and COMET
- All of these have a long data taking period ahead of them
- All have upgrade plans that will make them continue until mid 2030s
 - For Belle II this could involve vertex detector and accelerator developments
 - For LHCb Upgrade II, already signed up to developments for the replacement of the EM calorimeter. Accelerator developments required are small.
 - For COMET this requires building a whole new part of the detector

High Energy

- The current involvement from Australia is in ATLAS
 - The largest Australian involvement in accelerator Particle Physics
- The future physics involvement will be in
 - Higgs self-coupling measurements
 - Direct BSM searches
 - Precision SM measurements
- Both the detector upgrades and the accelerator upgrades are approved and well into the construction phase
 - Will run well into the 2030s

High Energy

- The future of the High Energy frontier is unclear at the moment with multiple well progressed designs but no funding to indicate time lines
 - ILC (linear e^+e^-) in Japan the most progressed but still no funding approved for actual construction
 - FCC (circular e^+e^- and pp) at CERN
 - CEPC (circular e^+e^-) in China
- The European Strategy on Particle Physics will have a big influence on direction that will be taken – wrap-up of current round delayed due to current health crisis
- Australia itself will have minor influence on direction
 - When do we become involved with significant effort?
 - Are we harmed if picking “wrong” project for now? What involvement?

Neutrinos

- There is a new generation of accelerator based neutrino experiments coming online
 - DUNE in the USA and Hyper-K in Japan are both funded and will come online in the mid 2020s
- Significant theory involvement in Australia but no experimental involvement
 - Is it too late to become involved in these experiments?
 - They are still actively seeking collaborators
 - Would require diversion of significant academic effort (or creation of new) on a short time scale.

Time lines

- This is all pre-COVID19, there will be (unknown) delays

Experiment	Start	End
Belle II	2019	2029
Belle II upgrades	2025	2035
LHCb Upgrade I	2021	2031
LHCb Upgrade II	2032	2036
COMET	2021	2032
ATLAS	2010	2027
ATLAS upgrade	2027	2036
Future e^+e^-		
Future pp		
Hyper-K / Dune	2024?	

Current effort

- The table below shows the current effort on the different experiments.
 - It is still missing the ATLAS numbers from Melbourne
 - Numbers are in flux ...

Experiment	Academic	Post-doc	PhD
Belle II	1.15	3.0	10.0
LHCb	1.6	1.0	1.0
COMET	0.2	1.0	2.0
ATLAS	1.1+X	2.4+X	5.4+X
Future e^+e^-			
Future pp			
Hyper-K / Dune			

The future

- Current activities
 - ATLAS is approved for running to the end of the High luminosity LHC era
 - LHCb upgrade II is at the TDR level with hopeful approval in 2021
 - BELLE II polarized beam and lumi upgrade is under investigation
 - COMET phase II is at the approval status
- New activities
 - Neutrinos and future e^+e^- or pp are all very exciting opportunities for involvement
 - Are we already too late for joining DUNE or HyperK?

Where do we go from now

- The WG2 document itself needs a significant amount of editorial work
- Physics case and possible involvements in future e^+e^- and pp colliders should be written
- A dream would be to expand to
 - Join a neutrino experiment
 - Expand involvement in LHCb
 - Join an experiment on a future collider that will actually happen
- How will this impact on involvement in current experiments?