

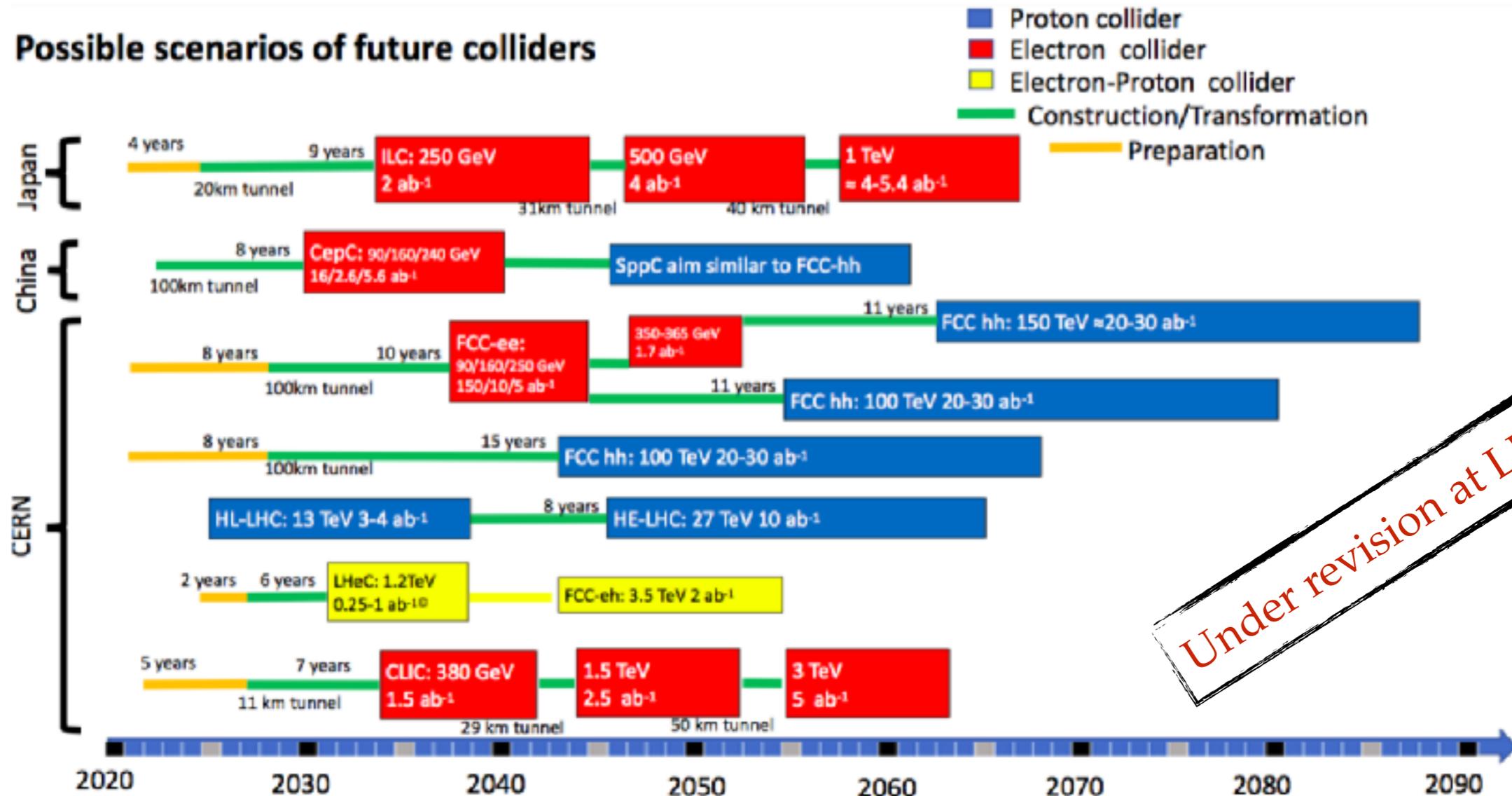
# Why are we Here Today?

- ▶ Many thanks for your interest and participation
  - ▶ Identifying a well-defined 'UK community' in electronics and integration (E&I) has not been straightforward – thanks Craig and Rob
- ▶ Executive summary
  - ▶ International community is examining the case for, and routes to, significantly greater levels of R&D activity in detector and accelerators
  - ▶ Decisions made in the next six months (internationally and in the UK) will have long-lasting consequences
  - ▶ There is the opportunity to make the case for new funding in STFC
  - ▶ UK has traditional strengths in the areas of advanced electronics (on-detector and off-detector) and systems integration
  - ▶ But: the UK is currently only peripherally engaged in the discussions
    - ▶ Notably less so than every other major player in the field
    - ▶ We do not actually have an 'PP R&D strategy' in STFC, and PPAP is not talking about this
  - ▶ We now need to react to this, and urgently, to maximise opportunities
- ▶ My mission today: provide a wake-up call
  - ▶ Inform you about the actions in progress; request your concrete input and views

# European Strategy

- ▶ We produced, by consensus, an R&D-focussed strategy
  - ▶ *The success of particle physics experiments relies on innovative instrumentation and state-of-the-art infrastructures. To prepare and realise future experimental research programmes, the community must maintain a strong focus on instrumentation.*
  - ▶ *Detector R&D programmes and associated infrastructures should be supported at CERN, national institutes, laboratories and universities.*
  - ▶ *Collaborative platforms and consortia must be adequately supported to provide coherence in these R&D activities.*
  - ▶ *The community should define a global detector R&D roadmap that should be used to support proposals at the European and national levels.*
  - ▶ *A vigorous new experimental programme in the long term, requires significant investment in detector and accelerator R&D in the medium term. The case for this investment should be clearly spelt out in the European Strategy. (STFC input)*
- ▶ It is up to us to follow up on these points
  - ▶ STFC / CERN / ECFA will not and cannot organise our R&D strategy
  - ▶ Nor will funding be allocated without a clear plan and structure
  - ▶ Paula will say more about the UK consultation process

# Future Projects



## ▶ Many areas of UK interest yet to be added

- ▶ ERL; muon beams / collider; EIC; long-baseline neutrinos; dark matter
- ▶ Many (not all) of these projects depend *fundamentally* on E&I developments
- ▶ Today, we *cannot build* a detector for a high-energy, high-luminosity machine
  - ▶ Industry will not address (all) our issues; and the time to start is now

# Roadmapping

- ▶ Large-scale basic R&D requires:
  - ▶ Significant investment in people and infrastructure
  - ▶ Cooperation across the international field (this is practically axiomatic)
  - ▶ Demonstrators, opportunities, and way markers
- ▶ R&D roadmaps currently being drawn up
  - ▶ Coordinated by ECFA / LDG for detectors / accelerators respectively
- ▶ Roadmap purpose (LDG phrasing, ECFA is very similar)
  - ▶ Provide an agreed structure for a coordinated and intensified programme of R&D including into new technologies, to be coordinated across institutes
  - ▶ Be compatible and commensurate with corresponding roadmaps in detectors, computing and other developments, with a compatible timeline and deliverables
  - ▶ Be based on the goals of the European Strategy, but defined in its implementation through consultation with the community and through the work of expert panels
  - ▶ Take into account, and coordinate with, international activities and work being carried out in other related scientific fields, including development of new large-scale facilities
  - ▶ Specify a series of concrete deliverables, including demonstrators, over the next decade
  - ▶ Inform, through its outcomes, subsequent updates to the European Strategy.

# National Context

- ▶ UK has traditionally been very strong in E&I areas
  - ▶ Front-end readout developments, closely linked to sensors R&D
  - ▶ Back-end developments in trigger and DAQ
  - ▶ Some activity on links, optoelectronics, and powering
  - ▶ Design / fabrication of complex detector assemblies and sub-components
  - ▶ Simulation and modelling work in support of the above
  - ▶ Sustained UK personal leadership on relevant areas of the largest projects
- ▶ Work has always been cooperative between universities and labs
  - ▶ We also rely heavily on 'back end' support such as Europractice
  - ▶ Engagement of TD in PP / PA developments at a fairly low level currently
- ▶ How will this look in the future?
  - ▶ Shorter-term projects (Higgs factory) -> major challenges in integration
  - ▶ Long-term projects (high energy) -> major challenges in electronics
- ▶ Do we want to lead in the E&I area? Or put our effort elsewhere?
- ▶ Are we preparing the next generations of experts in this area?
  - ▶ And what do they need expertise in?

# UK Positioning

- ▶ We currently do not have a UK 'R&D strategy'
  - ▶ Even in past times, basic R&D funding was usually in responsive mode
    - ▶ i.e. basic fundamental developments - 'blue skies'
  - ▶ There was substantial funding into LHC construction / upgrade R&D phases
    - ▶ i.e. focussed at an increasing level on specific challenges
  - ▶ There was never much coverage of 'early systems-level R&D' for PP detectors
- ▶ This is a notable contrast to other countries
  - ▶ Typically a somewhat more 'managed' / 'prioritised' / top-down approach
- ▶ Input to the ECFA roadmapping process
  - ▶ UK has been extremely quiet in this process – despite us leading it!
  - ▶ Of >350 participants in the ECFA electronics symposium, < 20 from the UK
    - ▶ And concentrated in specific institutes
  - ▶ No written inputs from university community to E&I panels
  - ▶ Difficulty in gathering input to PPTAP (see Paula's talk)
- ▶ We are in danger of letting others make our decisions for us
  - ▶ Both in detectors, and perhaps even more so in accelerators - but, crucially, in E&I
- ▶ These roadmaps *may* be directly relevant to future EC funding structures
  - ▶ Note also the inverse effect: 'Is your proposal on the European roadmap? No? Ah.'

# The Goals of R&D

- ▶ In order of ‘concreteness’:
  - ▶ Generate, test and develop novel ideas
    - ▶ Demonstrating their feasibility for future experiments
    - ▶ Sometimes over an extended time period (10 years+)
  - ▶ Prepare directly for detector design and construction
  - ▶ Build collaboration and partnerships
  - ▶ Exploit PP detector technology in other areas
  - ▶ Engage early with industry and suppliers
  - ▶ Maintain skills base in our institutes
  - ▶ Provide societally-relevant training for young researchers
- ▶ My view: all aspects need to come into the ‘case for R&D’
- ▶ These issues are well known to the E&I community in the UK
  - ▶ Traction has so far been limited due to lack of sustained funding
  - ▶ We should think about how we want to address this whole list of topics

# New Challenges

- ▶ E&I R&D will not look the same in the coming years
- ▶ Many developments are now very complex and expensive
  - ▶ Front-end ASICs an obvious example... but aggregate investment in firmware and software also huge
  - ▶ We do not have access to the latest / greatest technology
- ▶ Parallel developments often increase, not decrease risk
  - ▶ Having 10 partially-working devices is not better than one working one
- ▶ Some key areas progressed by only a handful of groups
  - ▶ Optolinks, advanced cooling, microcontrollers, core firmware components
- ▶ Back-end custom electronics may be less of a focus – much talk of ‘triggerless DAQ’
  - ▶ But: data ‘straight onto the network’ has its own obvious challenges
  - ▶ But: just keeping up with industry in co-processing technologies requires a large effort
- ▶ Many clever ideas have now been on the shelf for a decade
  - ▶ Photonics, wireless, intelligence on the detector, advanced readout buffering, cryoelectronics
- ▶ Access to tools, processes, vendors, skills is not uniform
  - ▶ We expect to find firmware and online software experts ‘off the shelf’, but we don’t train them
- ▶ And an old challenge:
  - ▶ “Let’s focus on the detector and sensors, it’s too early to think about electronics and DAQ”
  - ▶ This is demonstrably untrue for almost every future project

# Key Questions for Us

- ▶ What are the key technical challenges for the UK in these R&D areas?
- ▶ What are the organisational / logistical barriers for us?
  - ▶ Centralisation vs complete freedom? Focus vs diversity?
  - ▶ Project-led versus blue-skies? PP-focussed versus generic?
- ▶ How much is all this going to cost? Is it justified?
  - ▶ What is the likely UK participation in E&I areas for future projects?
  - ▶ What is the length, breadth and scale of R&D activities leading to them?
  - ▶ Are there commonalities we can exploit?
  - ▶ What demonstrator / exemplar projects should we target, and when?
- ▶ How do we ensure and maintain efficiency?
  - ▶ Design and IP re-use; Commonalities between projects; Reduction of internal competition
- ▶ What happens if we do nothing?
- ▶ What is the relationship with industry and other research areas?
- ▶ How do we convince people to act on this?
- ▶ How do we sustain a community?
  - ▶ UK E&I community is currently stretched – but what happens after 2026?

# Next Steps

## ▶ Today

- ▶ Paula Chadwick: PPTAP and UK organisation (thanks Paula)
- ▶ Rob Halsall: Report on ECFA TF7 (electronics) activities
- ▶ Craig Sawyer: Report ECFA TF8 (integration) activities
- ▶ Volunteers: commentary on R&D organisation in other contexts
- ▶ Discussion

## ▶ What do we want from this?

- ▶ The collective view of the UK E&I community (is it a single community?)
- ▶ A steer to the PPTAP members on where we want this to go
- ▶ Generation of (last minute) written national input to ECFA process
- ▶ The route forward to well-structured 'generic' R&D proposals
  - ▶ Identification of primary topics / focal points
  - ▶ Formation of an organisation / collaborative structure
  - ▶ Recommendations on skills / careers / training aspects
- ▶ Volunteers to take this forward in the longer term

## ▶ Please give your candid comments...