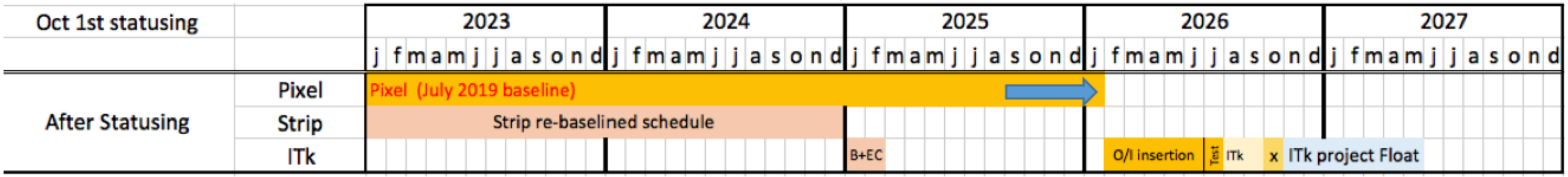
Silicon Tracker R&D

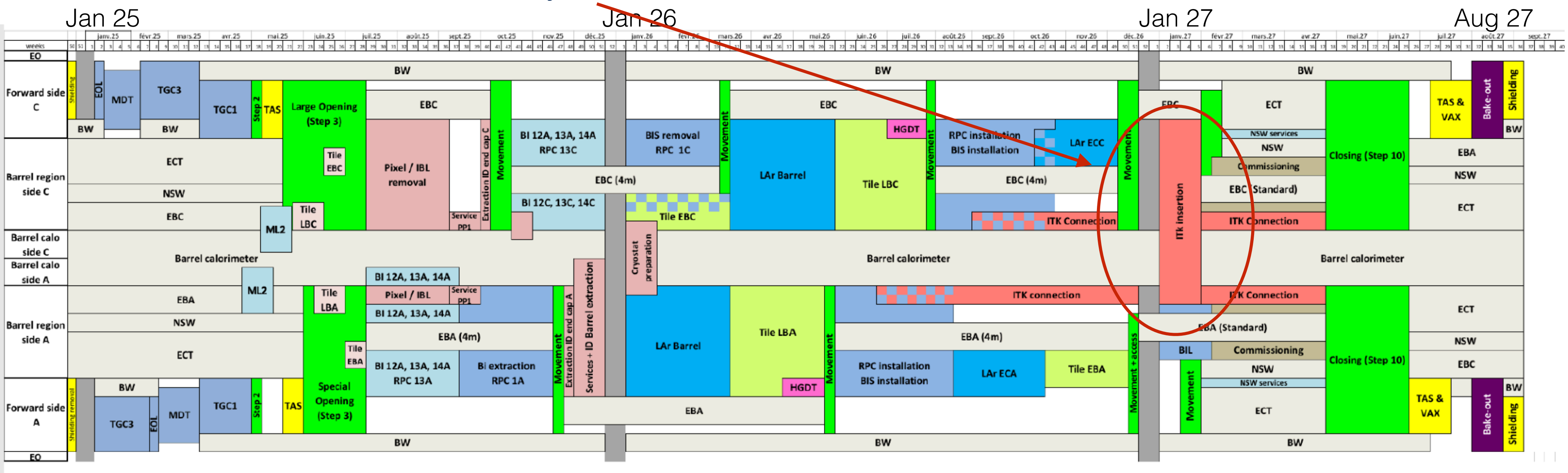
UK Meeting 10 January 2020, Edinburgh

Harald Fox

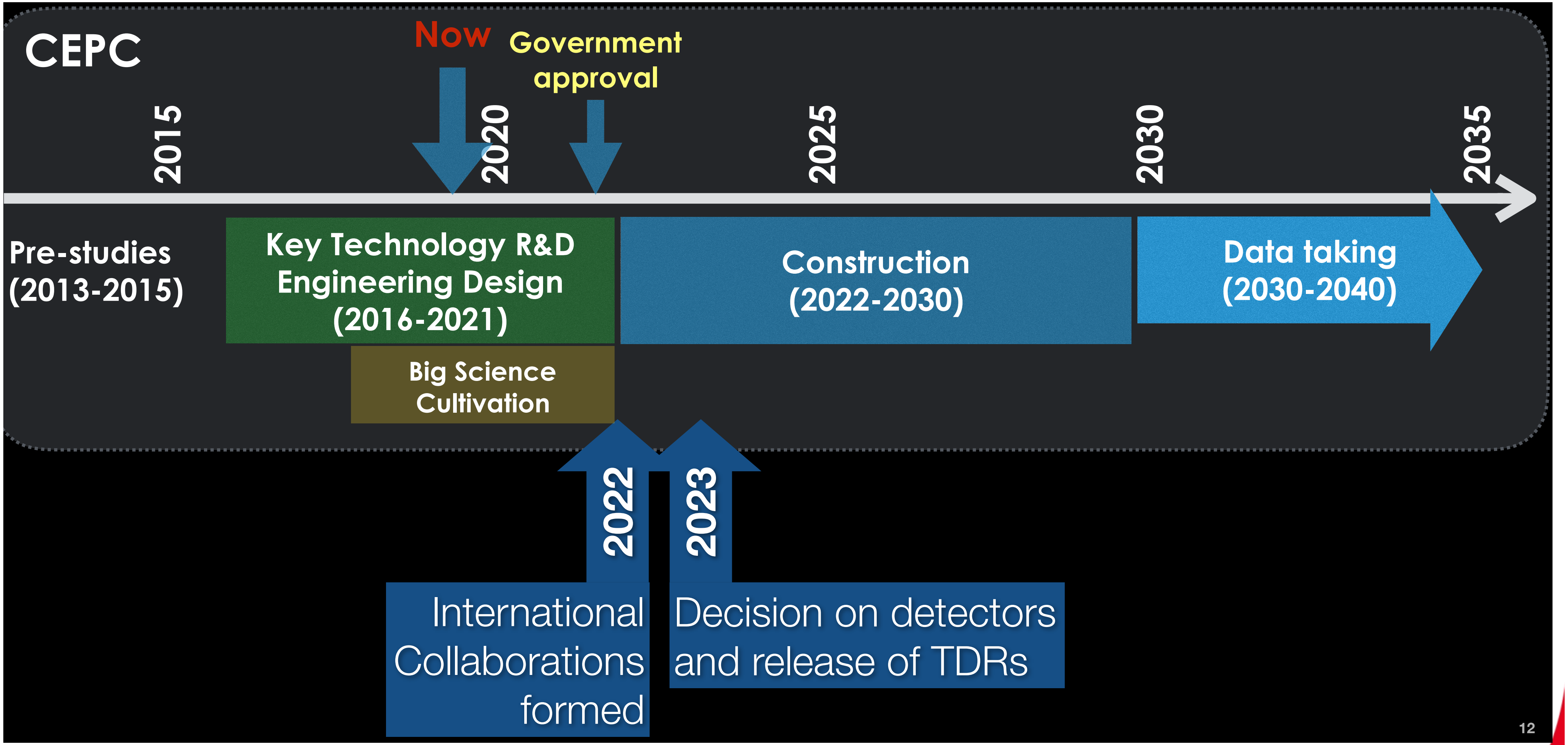
ATLAS Schedule



- ITk insertion in ATLAS January 2027



CEPC Schedule



CEPC International Detector R&D Committee (IDRC)

Committee: 16 members

In Beijing

Dave Newbold, UK, RAL (chair)
Jim Brau, USA, Oregon
Brian Foster, UK, Oxford
Liang Han, China, USTC
Andreas Schopper, CERN, CERN
Steinar Stapnes, CERN, CERN
Hitoshi Yamamoto, Japan, Tohoku

By Vidyo

Valter Bonvicini, Italy, Trieste
Ariella Cattai, CERN, CERN
Cristinel Diaconu, France, Marseille
Abe Seiden, USA, UCSC
Laurent Serin, France, LAL
Roberto Tenchini, Italy, INFN
Ivan Villa Alvarez, Spain, Santader

Excused from first meeting

Harvey Newman, USA, Caltech
Marcel Stanitzki, Germany, DESY

CEPC International Detector R&D Committee (IDRC)

First meeting happened on Tuesday, Nov 19

https://indico.ihep.ac.cn/event/10941/

Organizational Meeting:

Key tasks of this inaugural meeting were:

- To establish the working mode of the panel
- To review the current catalogue of R&D activities
- To provide initial feedback to the project leadership on the shape and scale of the R&D programme, and on short-term priorities
- To identify further information the committee will need in the future.

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Recommendations:

1. The project leadership and IDRC should assemble a coherent list of R&D activities, such that the presence of gaps and overlaps can be determined and addressed

2. Each current R&D project should provide, before the end of 2019, key information to the IDRC:
   - The objectives of the project
   - The anticipated schedule on which the objectives will be met
   - The funding available to the project, and the leadership arrangements within it
   - The extent to which the project is a CEPC-specific development

We added:

- Manpower resources available for the project, including type (student, faculty, engineer, etc) and FTE

Joao, CEPC Day 30 December 2019

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Plan:

1 - Vertex
2 - Tracker
2.1 - TPC
2.2 - Silicon Tracker
2.3 - Drift Chamber
3 - Calorimeter
3.1 - ECAL Calorimeter
3.2 - HCAL Calorimeter
3.3 - DR Calorimeter
4 - Muon Detector
5 - Solenoid
6 - MDI
7 - TDAQ
8 - Software and Computing

1) Collect missing documents by mid January

2) Compile into one single document
and
provide to detector R&D committee before end of January

3) Discuss with committee next steps,
including proposal submission procedure

Some key R&D topics

- Machine Detector Interface
- Luminosity meter (LumiCal)
- Silicon Vertex (material budget versus resolution versus cooling)
  - Services design and integration
- Tracker

Transparency <—> reliability/resolution

  - Time Projection Chamber
    - Ion back flow and field distortion is a major problem to operate at the Z pole and 2 Tesla
  - Drift Chamber
    - Can it cope with the high rates at the Z pole? Enough resolution?
  - Full silicon tracker → need manpower increase to exploit this option
    - Are we adding too much material?
    - What about particle identification? Does it really matter?

Strawman's Proposal

Task numl	Name	Description
2.2.1	**CMOS pixel sensor**	Full size CMOS pixel sensor for the silicon tracker detector
2.2.1.1	ATLASPix3/FCEPCPix1	Evolving Chip Design of ATLASPix3
2.2.1.2	FCEPC40Pix	40nm/50nm design with SMIC
2.2.1.3	SUPix	Bottom-up chip design
2.2.1.4	Sensor Powering	Serial/DC-DC powering
2.2.2	**Readout electronics & DAQ**	Data throughput and 680ns / 25ns readout of the detector
2.2.2.1	Stave Flex	Design and test of bus tape
2.2.2.2	YARR	Adaption and running of YARR
2.2.2.3	Felix	Adaption and running of Felix
2.2.3	**Low-mass staves**	Low-mass support and cooling structure for sensors
2.2.3.1	Ti-pipes/CO2 cooling	Manufacture and testing of Ti cooling pipes and stave design
2.2.3.2	Water cooling	Manufacture and testing of water cooling pipes and stave design
2.2.3.3	Microchannel cooling	Manufacture and testing of micro channel cooling and stave design
2.2.3.4	End-of-stave cooling	Manufacture and testing of end of stave cooling option
2.2.3.5	Air cooling	Manufacture and testing of air cooled staves and overall design
2.2.3.6	Evaluation and measuremen	Powering and measurements at various prototypes
2.2.4	**Mechanical structure**	Low-mass mechanical support structure
2.2.5	**Module building**	Pick and Place options for automatic building
2.2.6	**Detector Simulation**	Investigate the detector design with physics benchmark processes.
2.2.7	**System test**	Test of full system, including beam tests

Joao’s Manpower List

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Ac=Academic
AP=Applied Physicist
Eng=Engineer
Tech=Technician
St=Student

Fraction of time averaged over the year in FTEs
FTE = Full Time Equivalent
Example:
An egineer works full time on a flex design for 5 week
The FTE is (about) 5/50=0.1

Institute	Name	Type	Task	Task Short	Comment	2020	2021	2022	2023
MyInstitute	MyName	Ac	2.2.3.1	Ti/CO2	Stave design with Ti-pipes	0.2	0.2	0.2	0.2
MyInstitute	MyName	Ac	2.2.7	System	Cosmic and beam tests			0.2	0.2
MyInstitute	Senior Staff Name	AP	2.2.1.3	SUPix	Analog amplifier design	0.1			
MyInstitute	Senior Staff Name	AP	2.2.1.4	Serial/DC-DC	Determining voltage drops for serial powering				
MyInstitute	PostDoc1Name	AP	2.2.3.5	Air	Cooling power estimation				
MyInstitute	PostDoc2 Name	AP	2.2.2.2	YARR	Adaptin YARR fo SUPix	0.1			
MyInstitute	Engineer Name	Eng	2.2.2.1	Flex	Design of data bus	0.1			
MyInstitute	Student Name	St	2.2.6	Simulation	X0 as function of eta for CO2 stave	0.5	1	0.75	

Organisation

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