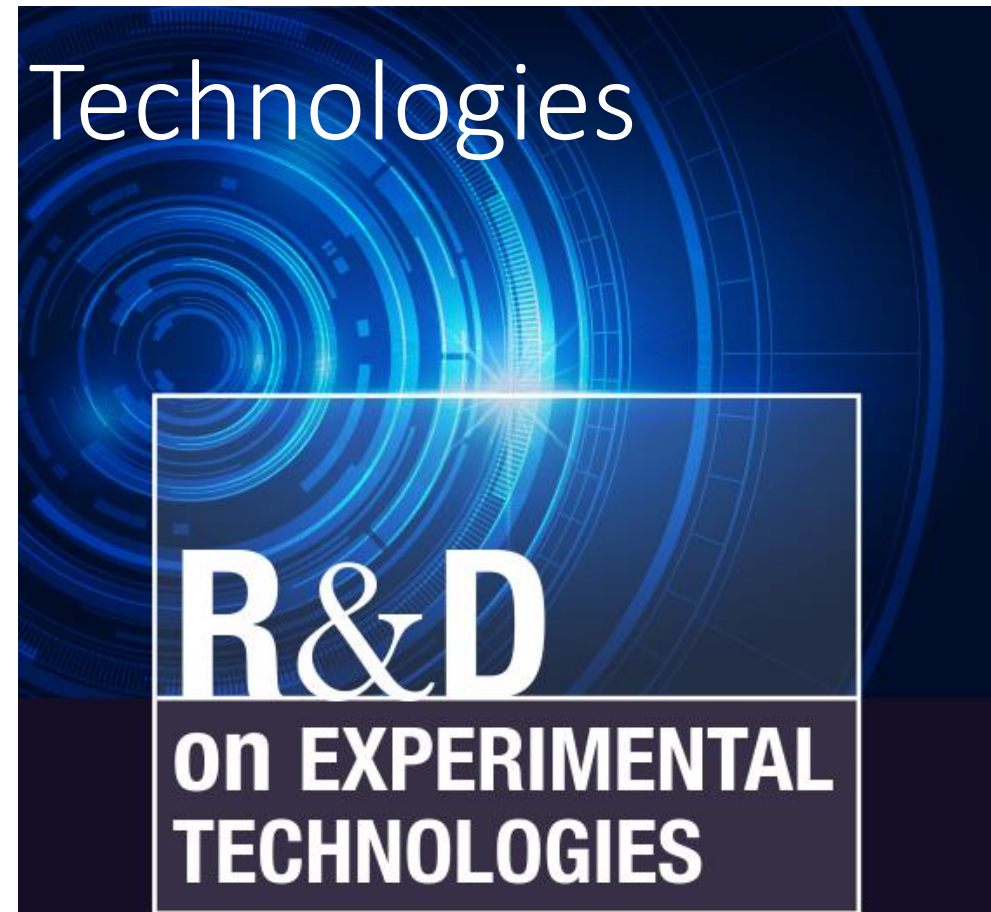


Strategic R&D Programme on Technologies for future Experiments

- Short chronology
- Implementation
- Budget
- Proto-Website (thanks to Panos Charitos)

<https://ep-dep.web.cern.ch/rd-experimental-technologies>

(you find some more links there)



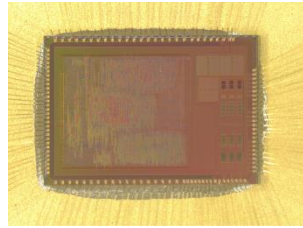
A selection of recent CERN developments and facilities

... playing now major roles in phase-I and II upgrades

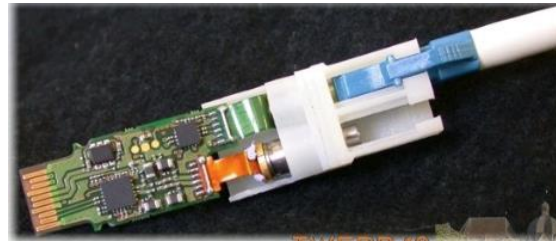
Rad hard DC-DC converters



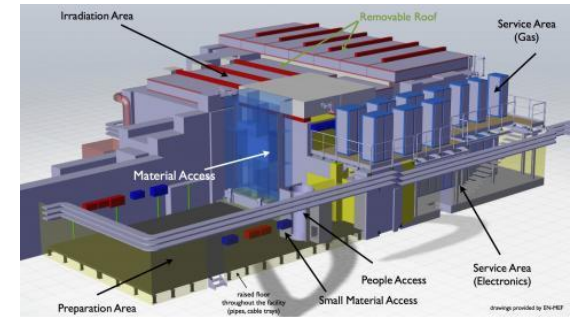
ASICs in 130 nm technology



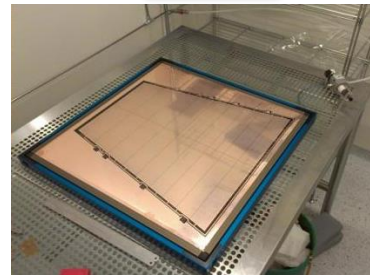
Versatile links



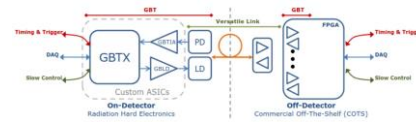
GIF++



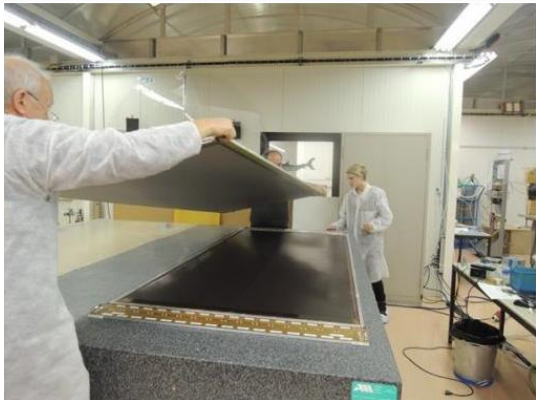
RD51



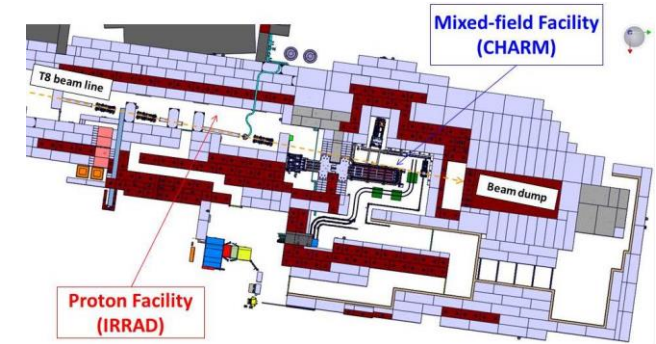
GBT



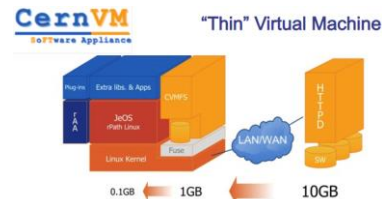
MPGD fabrication techniques



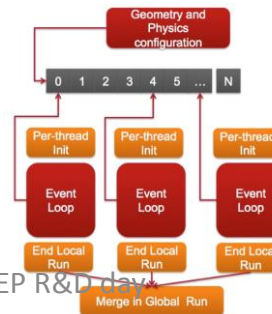
PS Irrad upgrade



Virtualisation

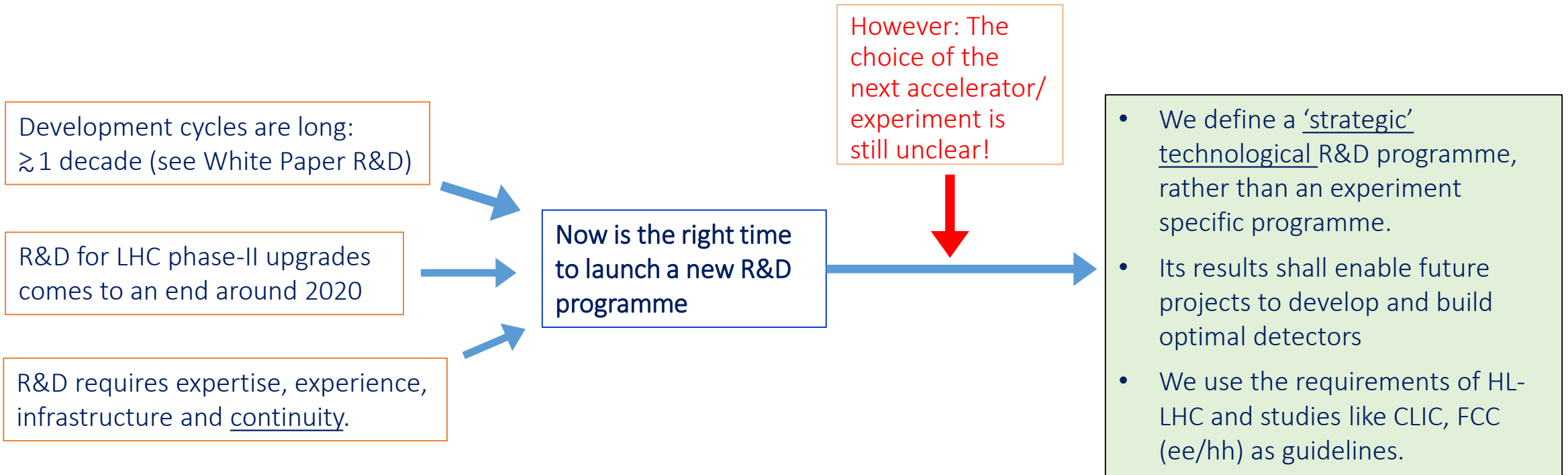


Multi core architectures



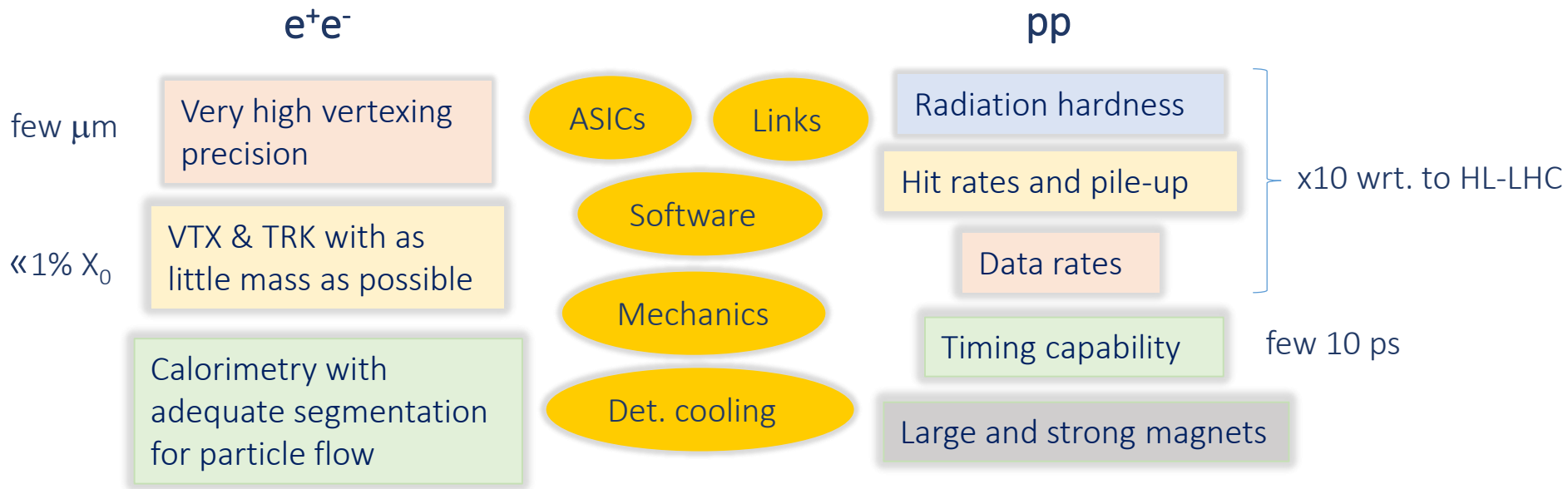
All were initiated/boosted during the "White Paper" R&D program (2008-2011), initiative of CERN DG Robert Aymar, PH budget ~20 MCHF.

Considerations for a new EP R&D programme



If the European Strategy Update process results in a clear recommendation (early 2020), we may need to align our priorities accordingly.

Instrumentation challenges in future detectors

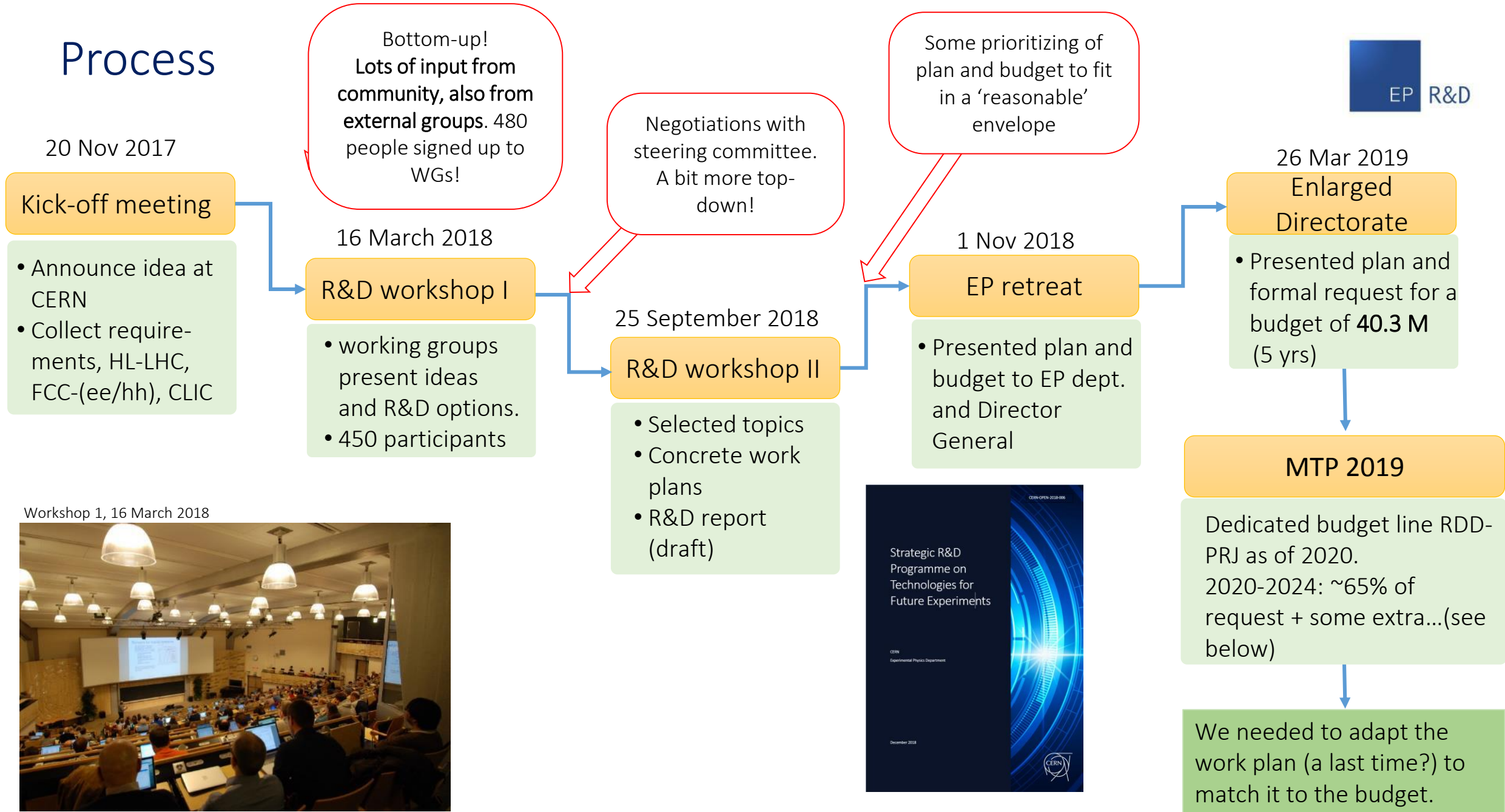


We want to concentrate on key detector technologies, but equally important are mechanics, infrastructure, electronics, software and experimental magnets

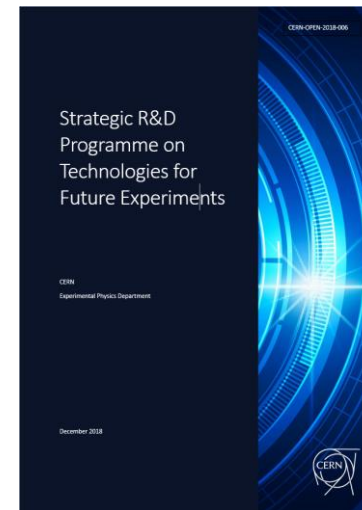
Resources are limited \rightarrow Selection and priorities is needed. Focus on areas...

- where CERN has already significant expertise and infrastructure
- where CERN plays (needs to play) a leading/ unique role
- which will be key for the success of future projects

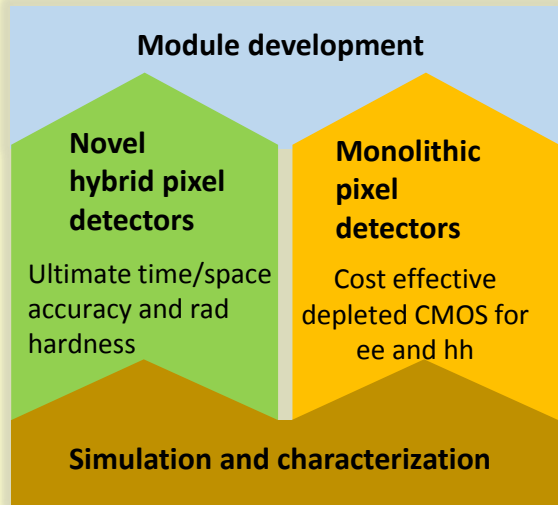
Process



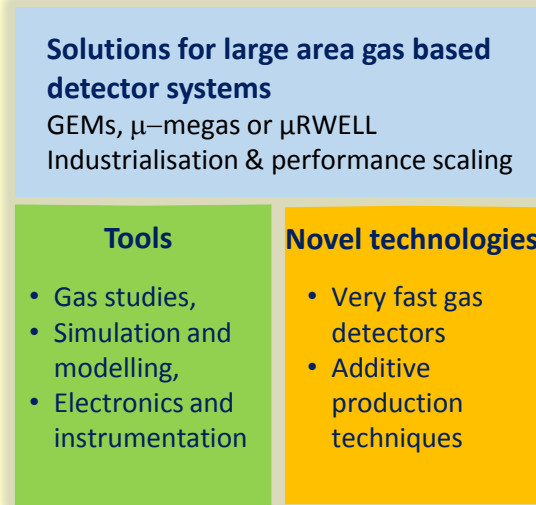
Workshop 1, 16 March 2018



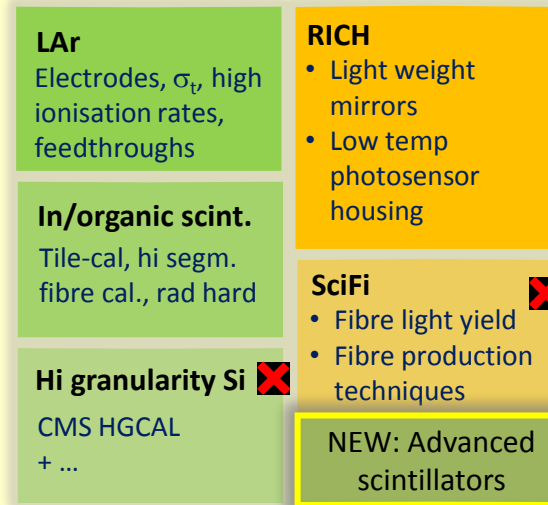
WP1: Silicon Sensors



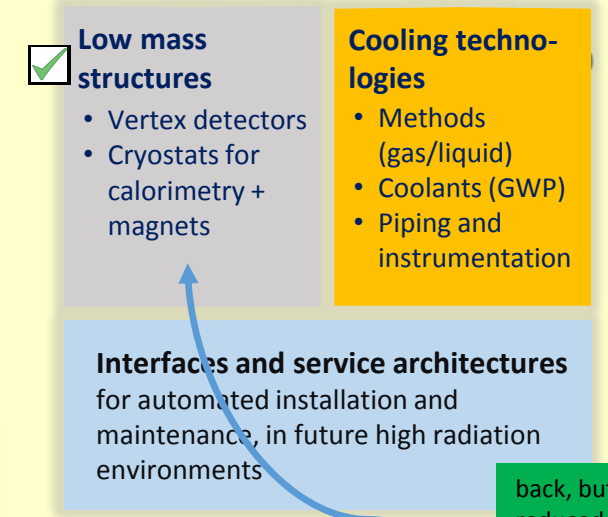
WP2: Gas Detectors



WP3: Calorimetry + Light based



WP4: Mechanics⁺⁺



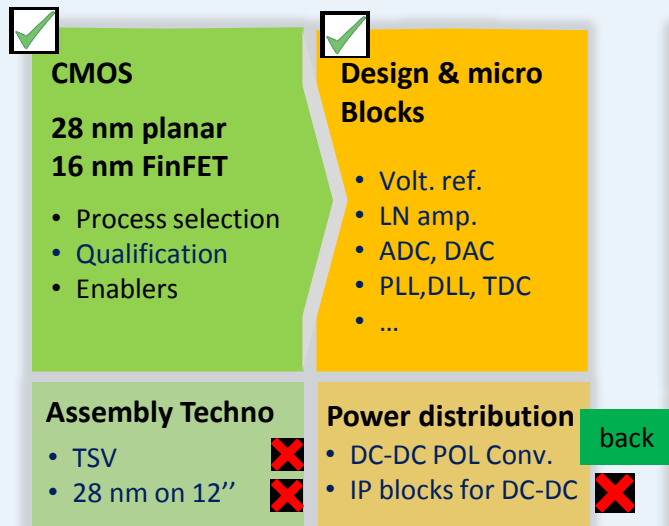
Essentially all tasks reduced in scope, except those marked

almost as originally proposed

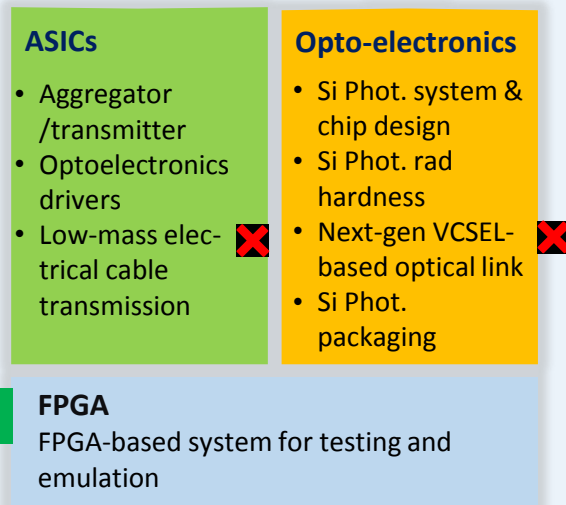
❌ suppressed

back, but reduced

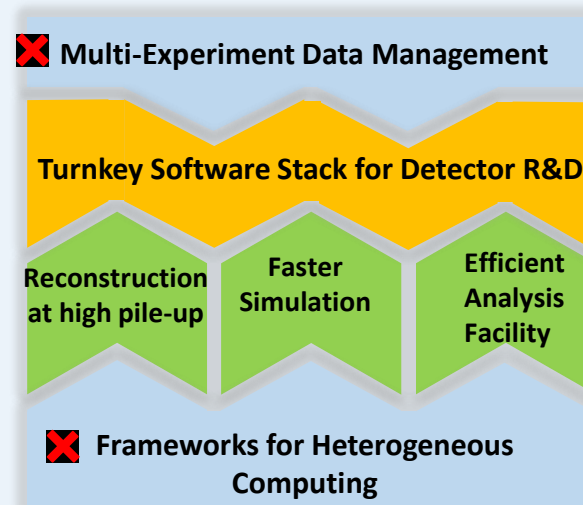
WP5: IC Technologies



WP6: High Speed Links



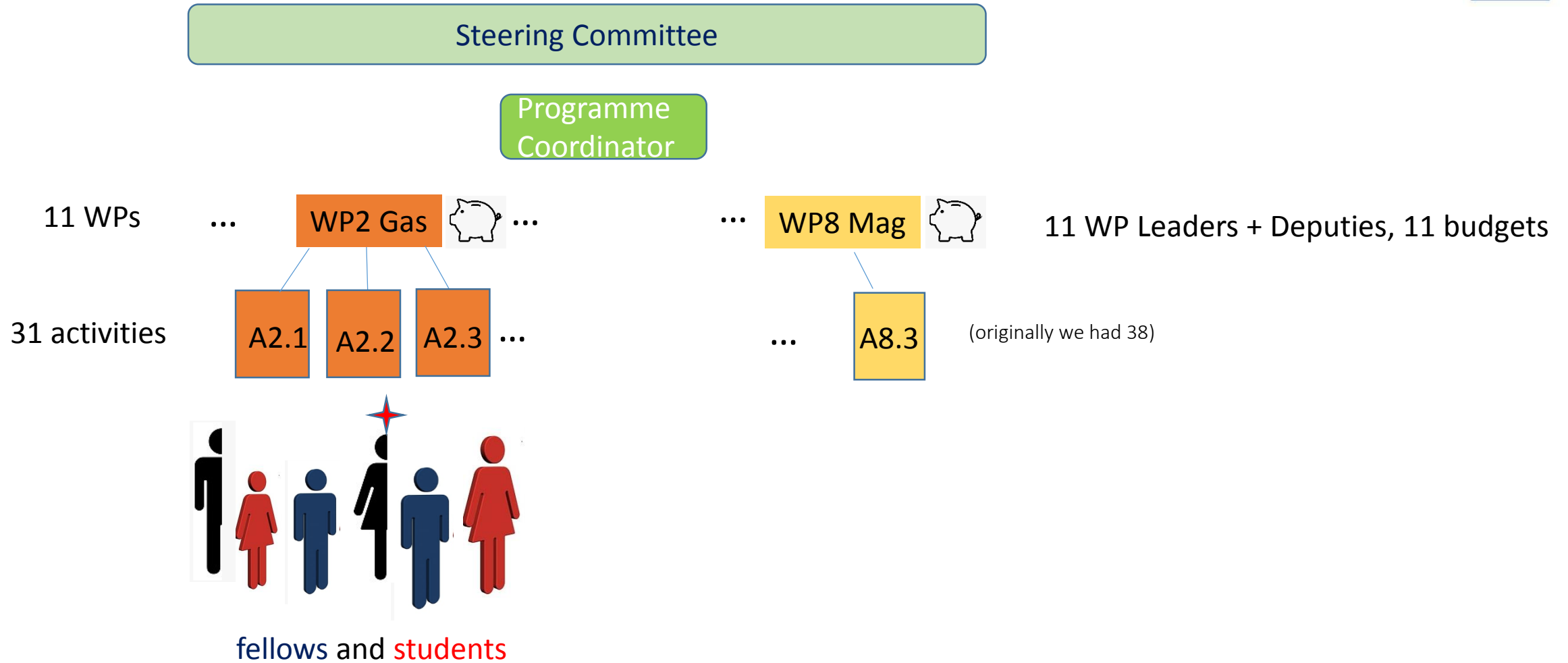
WP7: Software




WP8: Exp. Magnets



EP R&D implementation model



fractions of experts (existing staff)

- as F/S supervisors 
- or just participants

Implementation (1)

... in the background: **the Steering Committee**

Barney, David (CMS) ★ (★ =new member)

Forty, Roger (dept.)

Janot, Patrick (FCC-ee)

Krammer, Manfred (chair)

Linssen, Lucie (CLIC)

Mato Vila, Pere (SFT, software)

Rembser, Christoph (ATLAS) ★

Riegler, Werner (ALICE & FCC-hh)

Schmidt, Burkhard (DT, det. HW)

Schopper, Andreas (LHCb) ★

Vasey, Francois (ESE, electronics)

Joram, Christian (programme coordinator)



The **steering committee** (SC), chaired by the EP Department Head, defines the principles and guidelines of the programme and oversees its execution, financial governance and reporting. The SC appoints a Programme Coordinator (PC).

The **Programme Coordinator** is in charge of the overall organisation and implementation of the R&D programme.

He/she reports to the Steering Committee and implements decisions and measures within the guidelines defined by the SC.

The PC is the **budget holder** of the R&D programme. He/she assigns annual budgets to the work packages.

Implementation (2)

The programme is organized in 11 Work Packages, with typically ~3 tasks

	WP name	WP Leader	Deputy WP Leader
The large Si WP has been split up in 4 (related) WPs	1.1	Novel Hybrid Si detectors	Victor Coco
	1.2	Depleted Monolithic Si	Christian Joram
	1.3	Si Modules	Petra Riedler
	1.4	Si Simulation & Characterisation	Michael Moll
	2	Gas Detectors	Eraldo Oliveri
One new activity was added to WP 3	3	Calorimetry & Light based	Martin Aleksa
	4	Mechanics	Corrado Gargiulo
	5	Integrated Circuits Development	Michael Campbell
	6	Fast Links	Paulo R. S. Moreira
	7	Software Development	Graeme Stewart
	8	Detector Magnets	Herman Ten Kate

The **WP leader** ensures that the WP is run according to the agreed work plan and within the allocated budget envelope. The WPL guarantees the coherence of the tasks and, if needed, proposes adaptations. He/she is in **regular contact** with the staff, fellows and students working on the tasks. He/she appoints supervisors and agrees with them on the job descriptions for the recruitment of fellows and students. The WP leader **holds the annual WP budget** and agrees with the supervisors on the annual expenditures in the tasks. The WPL reports to the PC and contributes activity summaries for the annual report.

Implementation (3)

On the task level, **fellows and students** are supervised by staff. In most cases the fellows and students are affiliated to the group of the supervisor.

An **availability of typically 20%** or more allows the supervisor to be in regular (daily) contact with the fellows and students and to guide their scientific work.

The supervisor judges the need for training or other support and is signatory for EDH requests by the fellows and students (leave, travel,...).

Some concerns ...

EP R&D fellows and students will be affiliated to many different groups and teams. Their supervisors will normally work only part time on R&D.

How can we make sure that they feel 'at home' in their environment?

Subject to agreement between the fellow, WP leader and supervisor, fellows can spend a fraction of up to 25% of their time on other thematically related topics, outside the EP R&D scope.

How can we give these F & S a common identity ?

- Organise some common events, e.g. training events like in EU projects, internal R&D seminars, site/lab visits, some outings
 - An active webpage to allow them to show what they are doing
- ... more ideas are very welcome!

Budget

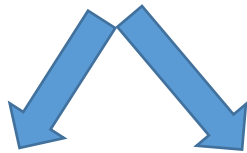
- Request (ED): 40.3 M (5 yrs)
- MTP 2019: 23.3 M (5 yrs) + a bit more



- Contribution of LHC exp. + support groups: 25 Fellow-years + 28 Student-years (3.9 M)
- EP-dept. reserve: up to ~40 Fellow-years (~4 M)
- CREMLINPLUS EU project approved. $\Sigma \sim 321$ KEUR for CERN, essentially to support WP7 software stack Key4HEP development.

! Some resources are needed to pay existing fellows and students on no longer existing budgets (phase-II R&D, LCD)

But all in all, we can count on a budget of ~30 M.



~17 M material
(incl. students)

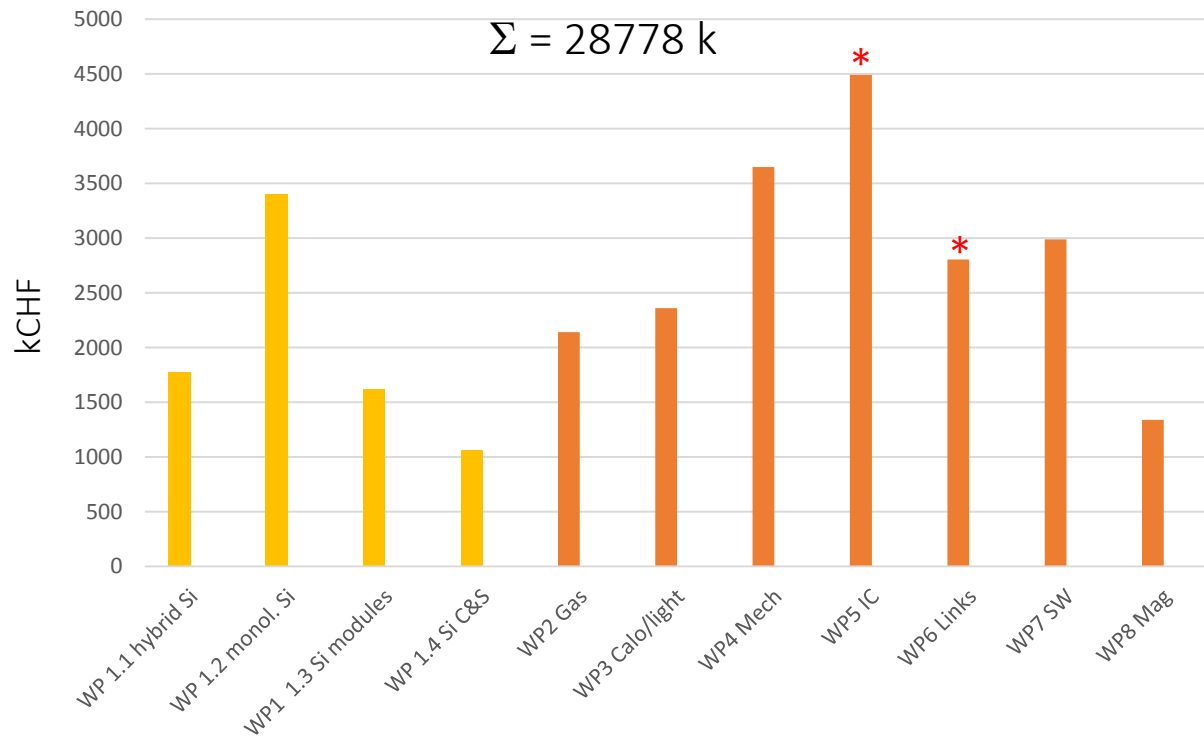
~13 M fellows

How do we come from a need of 40 M to a budget of 30 ?
SC decision:

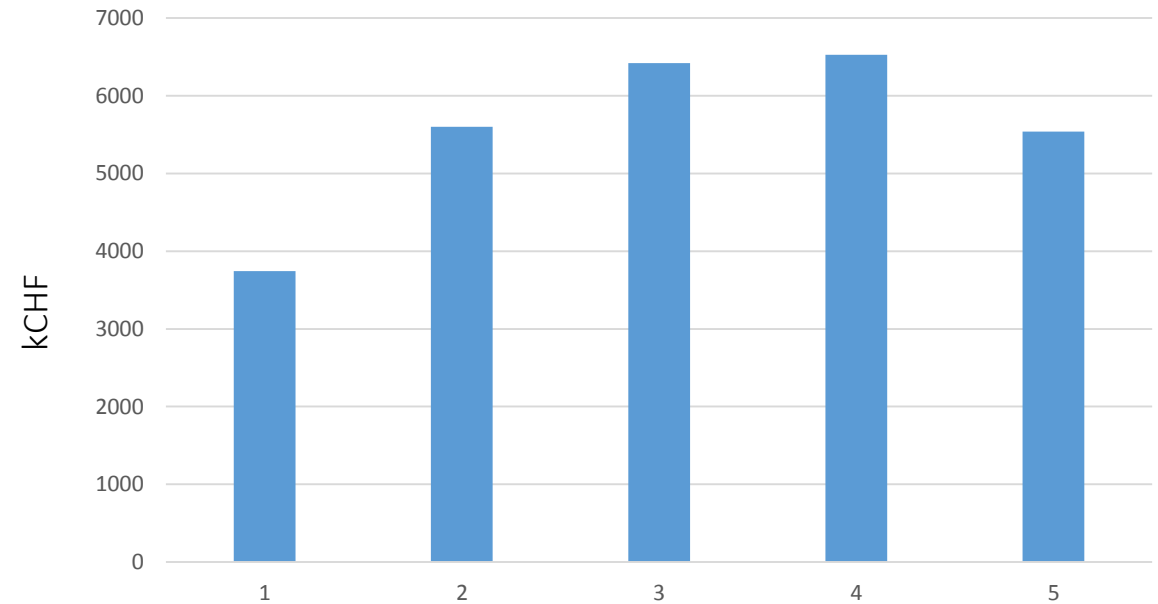
- highest priority but still 20% cut for Si and IC.
- all other WPs had to be reduced more (~50%).

Budget Plan

5 yr budget per WP



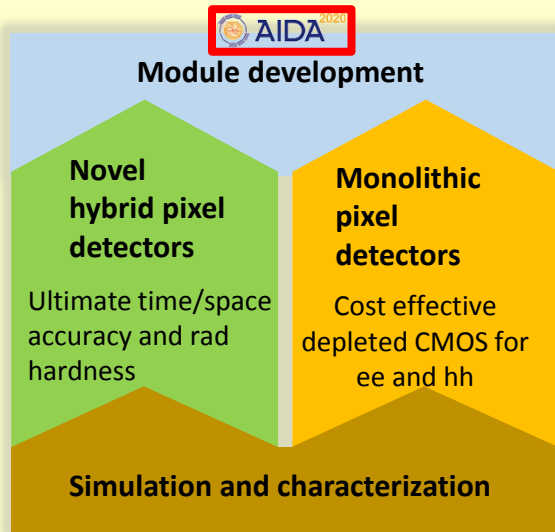
Total vs Year



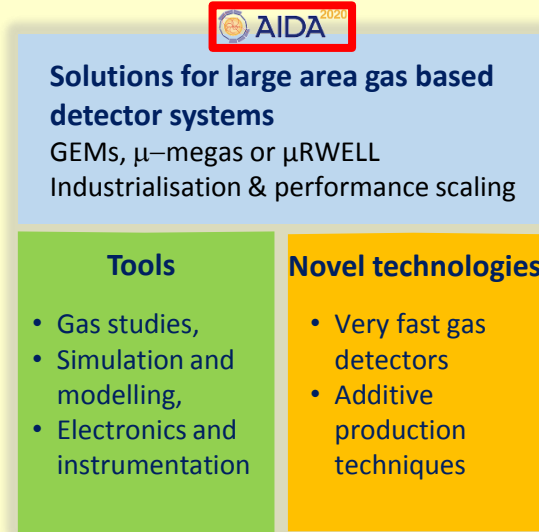
* WP5 and WP6 budgets include a (small) requested increase which is not yet approved by the SC

In any case: budgets are subject to revisions and will be allocated year by year.

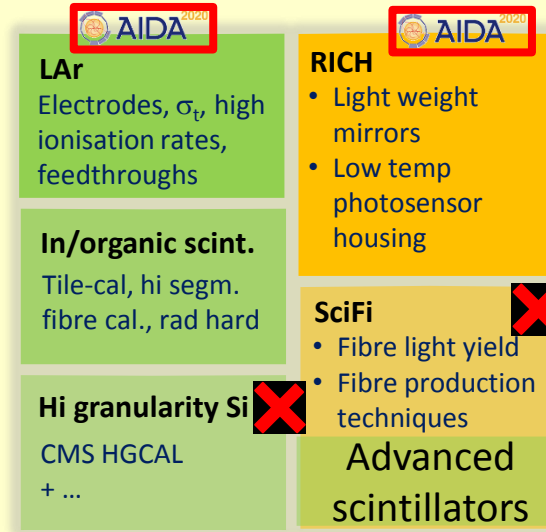
WP1: Silicon Sensors



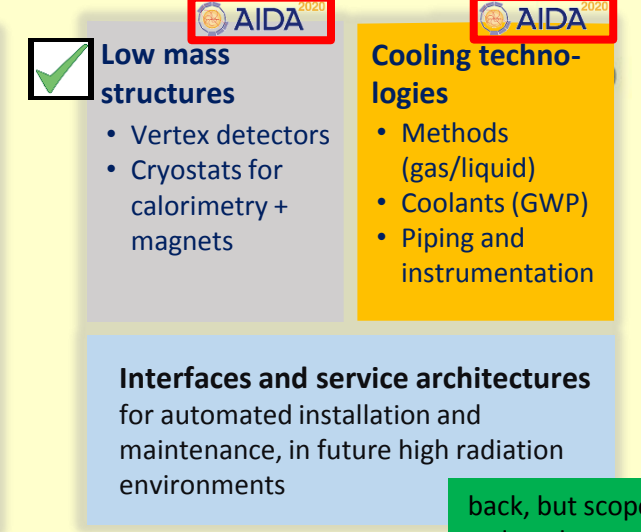
WP2: Gas Detectors



WP3: Calorimetry + Light based

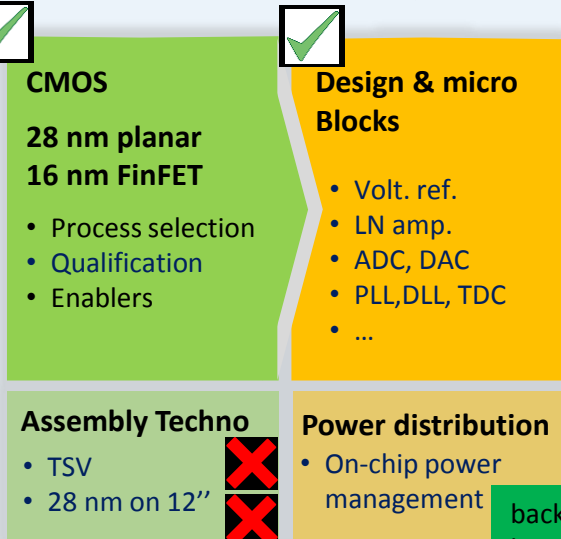


WP4: Mechanics++

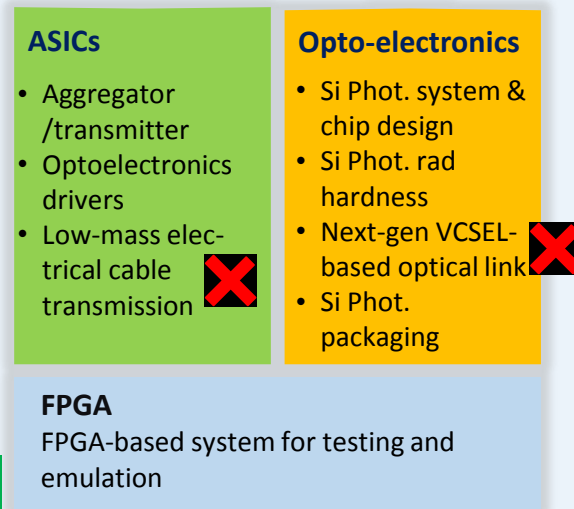


Submission of AIDA++ Expressions of Interests

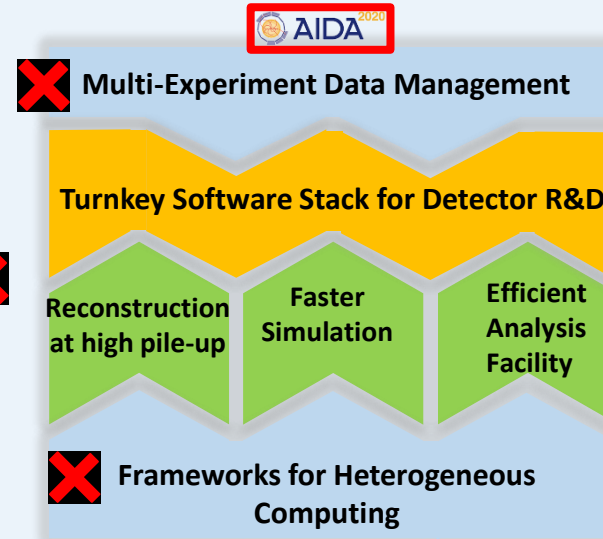
WP5: IC Technologies



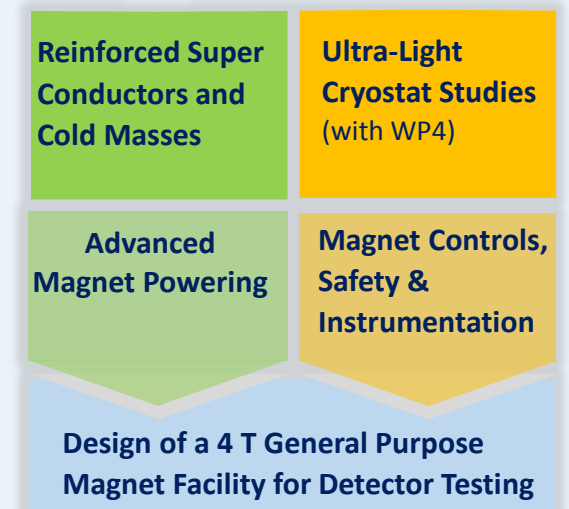
WP6: High Speed Links



WP7: Software



WP8: Exp. Magnets



24/10/2019

back, but no IP blocks

C. Joram EP R&D day

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Proto-website
(not yet public)

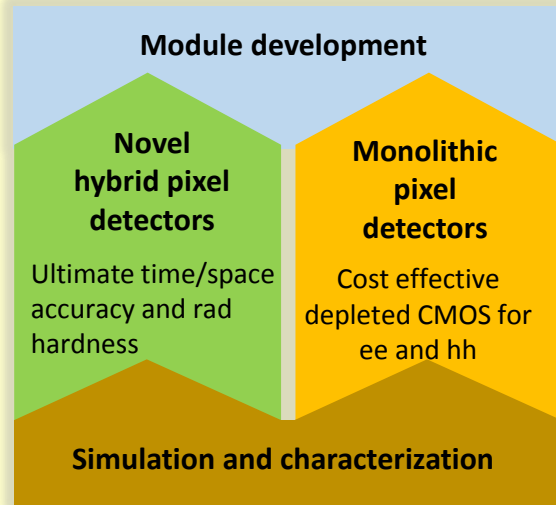
<https://ep-rnd.web.cern.ch/>

Thanks

... to all who have contributed over the past two years
... to all who will contribute over the next 5+ years
to make this R&D programme a great success

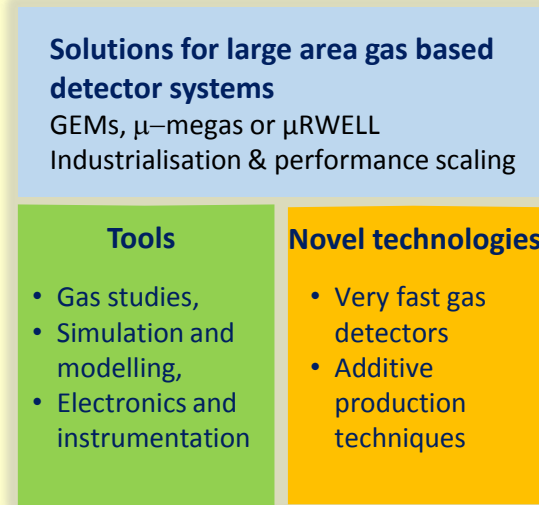
Back-up slides

WP1: Silicon Sensors

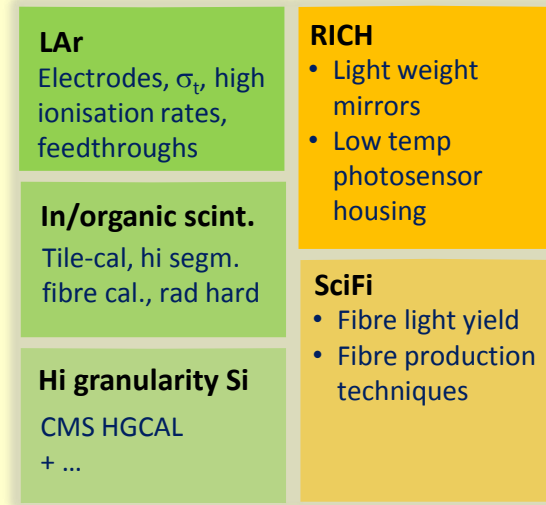


Focus on Pixel Detectors

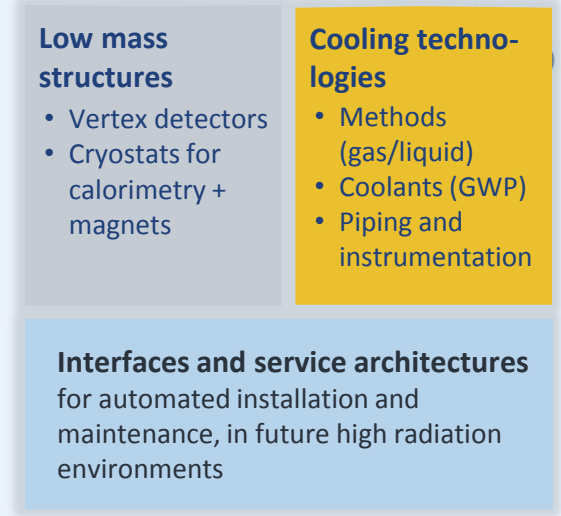
WP2: Gas Detectors



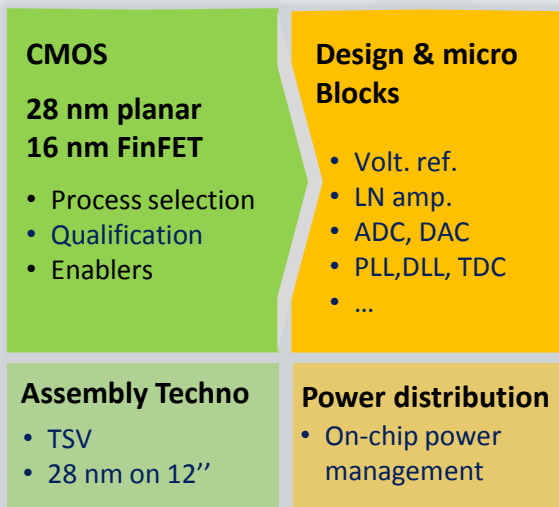
WP3: Calorimetry + Light based



WP4: Mechanics⁺⁺

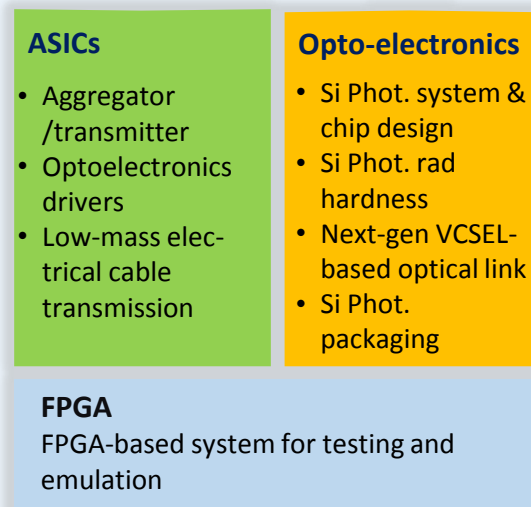


WP5: IC Technologies



24/10/2019

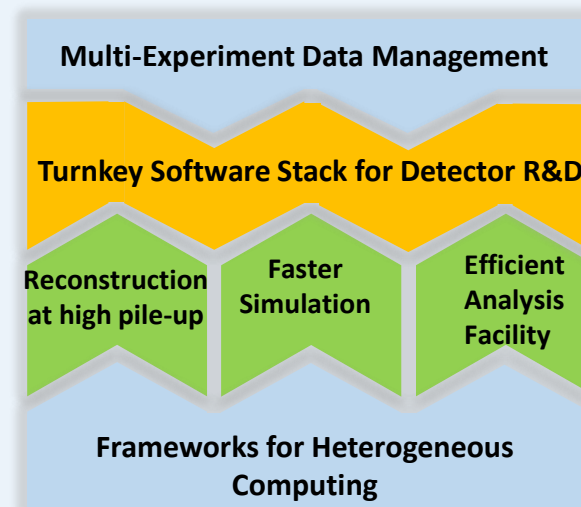
WP6: High Speed Links



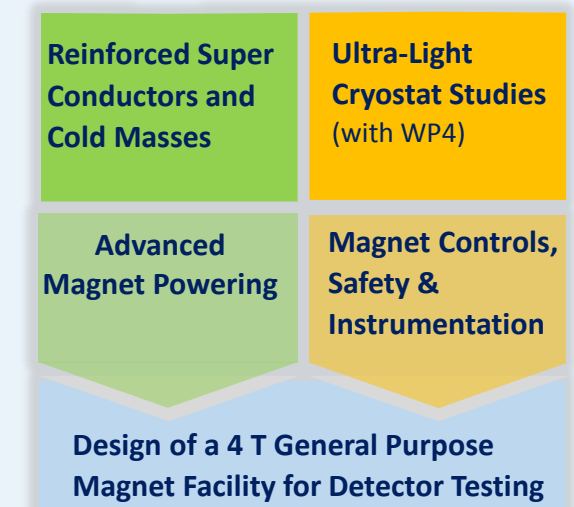
Focus on bandwidth + rad hardness

C. Joram EP R&D day

WP7: Software



WP8: Exp. Magnets



18
18

Table 3: PPA, sub-PPA, budget codes and budget holders

WP		Activity	PPA	Sub-PPA	Budget code	Budget Holder	Deputy BH
-		EP R&D for Future Experiments	RDD-PRJ	-	34750	Christian Joram	Roger Forty
1.1		Novel Hybrid Si detectors	RDD-PRJ	NHS	34751	Victor Coco	Paula Collins
1.2		Depleted Monolithic Si	RDD-PRJ	DMS	34752	Christian Joram	Francois Vasey
1.3		Si Modules	RDD-PRJ	MOD	34753	Petra Riedler	Dominik Dannheim
1.4		Si Simulation & Characterisation	RDD-PRJ	SIC	34754	Michael Moll	Dominik Dannheim
2		Gas Detectors	RDD-PRJ	GAS	34762	Eraldo Oliveri	Christoph Rembser
3		Calorimetry & Light based	RDD-PRJ	CAL	34763	Martin Aleksa	Carmelo D'Ambrosio
4		Mechanics	RDD-PRJ	MEC	34764	Corrado Gargiulo	Paolo Petagna
5		Integrated Circuits Development	RDD-PRJ	ICD	34765	Michael Campbell	Federico Faccio
6		Fast Links	RDD-PRJ	FLI	34766	Paulo Rodrigues Simoes Moreira	Sophie Baron
7		Software Development	RDD-PRJ	SWD	34767	Graeme Stewart	Jakob Blomer
8		Magnets	RDD-PRJ	MAG	34768	Herman Ten Kate	Benoit Cure

Reminder: contribution of LHC teams and SG to R&D budget = transfer from DGP quota to EP R&D

Fellows

	2020 ^{*)}	2021	2022	2023	2024
Total transfer (PY)	2	4	7	7	7
ATLAS share (PM)	6	12	20	20	20
CMS share	6	12	20	20	20
ALICE share	3	6	10	10	10
LHCb share	3	6	10	10	10
DT share	2	4	8	8	8
ESE share	2	4	8	8	8
SFT share	2	4	8	8	8
Sum shares (PM)	24	48	84	84	84

*) It was decided to not reduce the 2020 fellow quota of the experiments and take it from the EP reserve quota instead.

Students

	2020	2021	2022	2023	2024
Total transfer (PY)	2	5	5	8	8
ATLAS share (PM)	6	15	15	24	24
CMS share	6	15	15	24	24
ALICE share	3	7.5	7.5	12	12
LHCb share	3	7.5	7.5	12	12
DT share	2	5	5	8	8
ESE share	2	5	5	8	8
SFT share	2	5	5	8	8
Sum shares (PM)	24	60	60	96	96