



ALICE

A JOURNEY OF DISCOVERY



Future plan for Inha group

-ITS (silicon detector) point of view

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Inha University

12th ALICE ITS upgrade, MFT and O2 Asian workshop
November 19-21, 2018

Since 2013

- Very lucky (and good decision) to participate ITS upgrade project together with other Korean institutes.



from no space



Shielding room

Shielding room interior

Shielding box interior

Chip test system

Shielding box

Chip & DAQ board

Cooling system

Cooling pipe

Started to setup experimental place

During last 6 years (ITS project related)

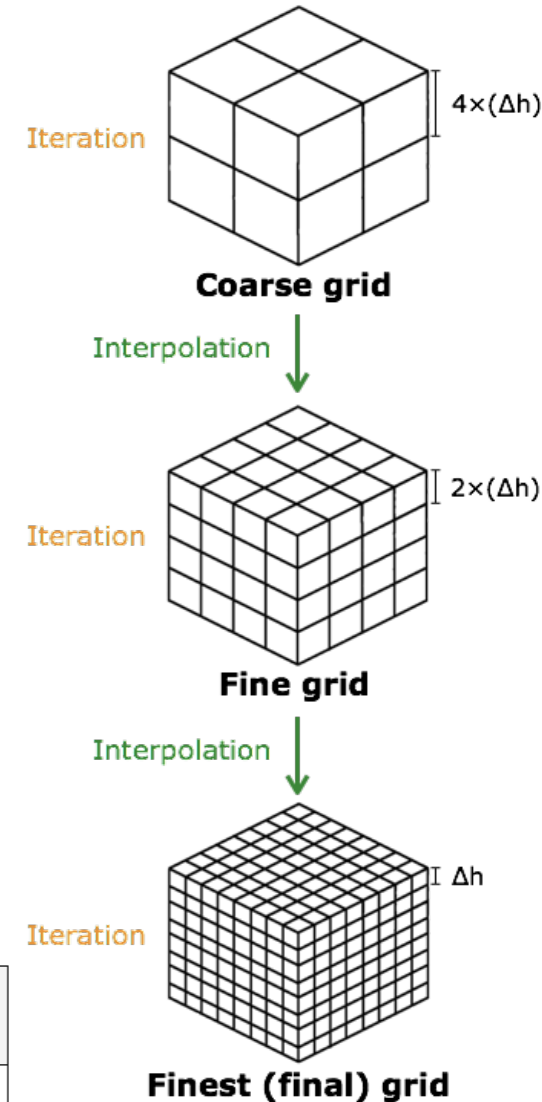
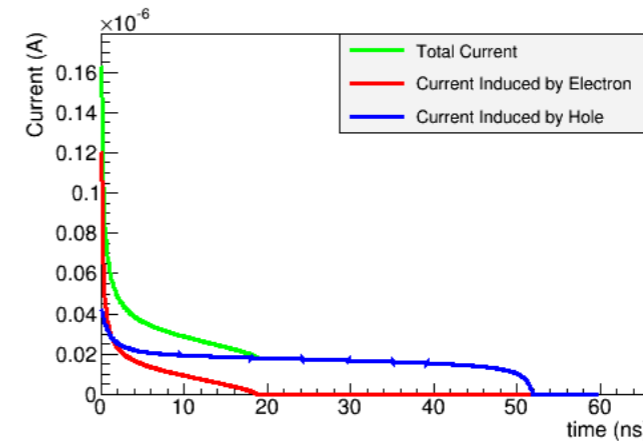
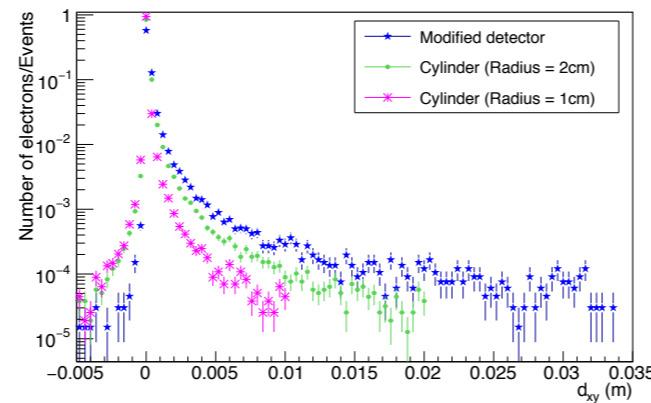
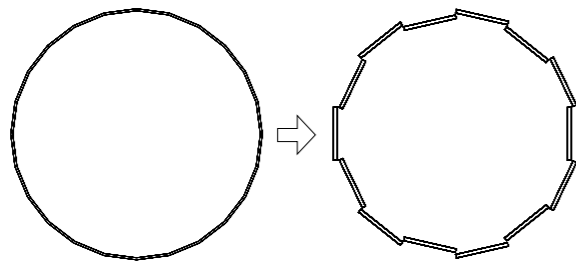
Focused project

- Chip characterization (on site)
- Mass chip test together with Pusan
- HIC assembly together with Pusan

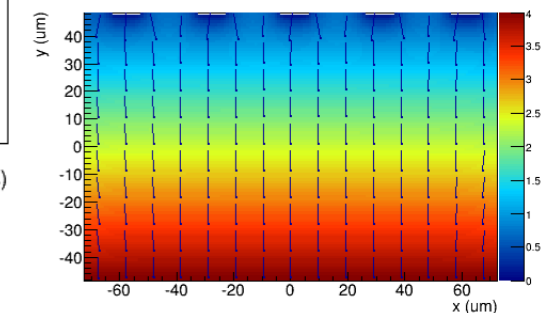


Additional academic study to understand silicon chips

- Silicon detector simulation using ROOT based program
- photon conversion study in the detector materials using GEANT4 & analytical function



. Multigrid and iteration method.



Kept doing physics analysis very much related to ITS performance

- $B \rightarrow e$ production in pp, p-Pb and Pb-Pb (published last year)
- Ξ_c production in pp and p-Pb using electron decay channel

LS2 and Run3 plan (short term?)

2018	2019	2020	2021	2022	2023
	LS2		RUN3		

HIC assembly together with Pusan

Man power (for the rest of the period)	Nirbhay Kumar Behera	Jiyeon Kwon	Jinjoo Seo
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ITS detector commissioning

- Participating the activity at Point 2 (or any onsite commissioning work) from the beginning of 2019 to 2020

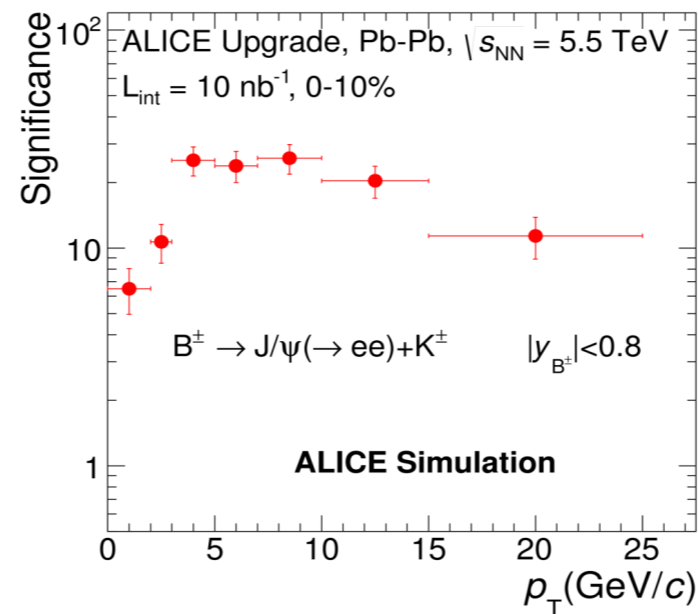
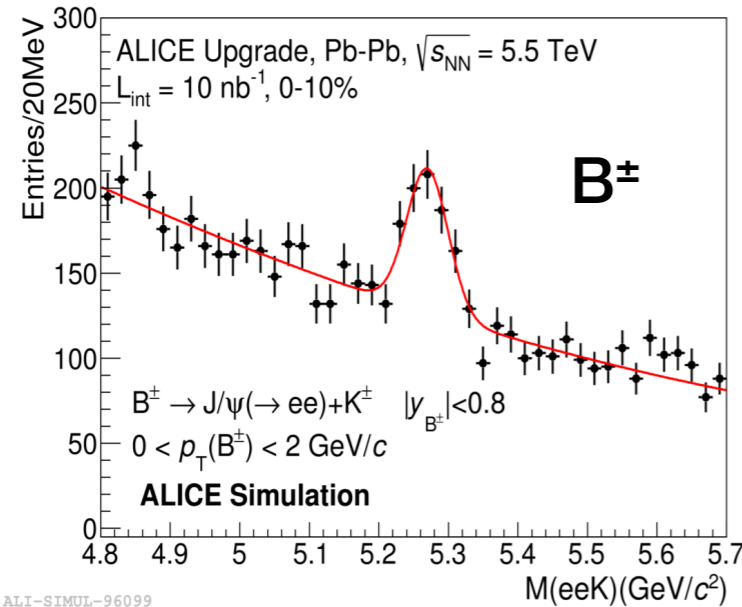
STAYING ON SITE (CERN)		STARTING FROM	PERIOD	DUTY FACTOR
Jonghan Park	Ph.D student	2019.01~	1 year (or 1.5 year)	70%
Jiyeon Kwon	Ph.D student	2019.07~	1 year (or 1.5 year)	70%
Jinjoo Seo	Master student	2019.07~	6 months ~ 1 year	70%

- Dedicated work (with responsibility) to be assigned for each student (service work)
- Not only shift at 2020 but also works on various topics listed in Felix's list

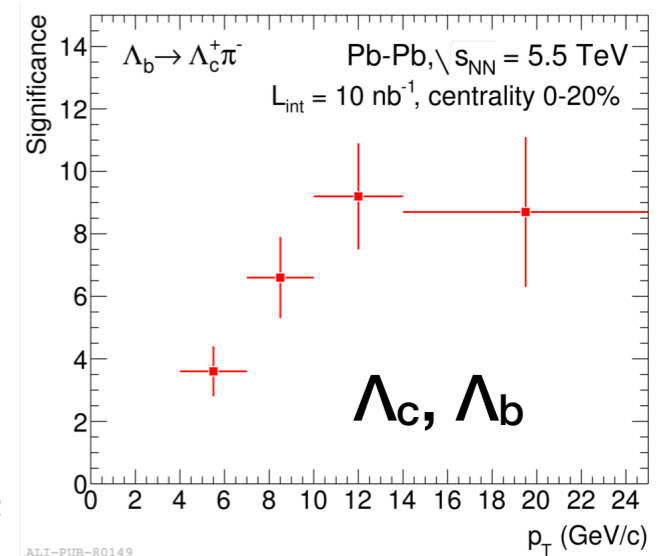
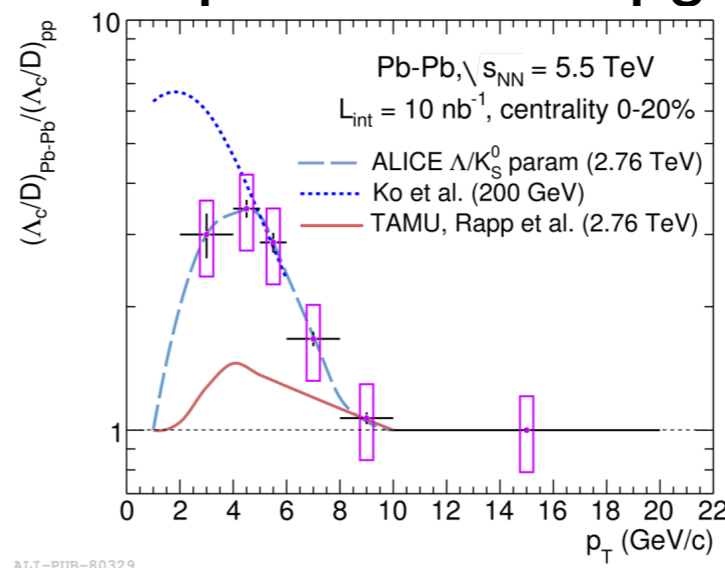
LS2 and Run3 plan (short term?)

2018	2019	2020	2021	2022	2023
	LS2		RUN3		

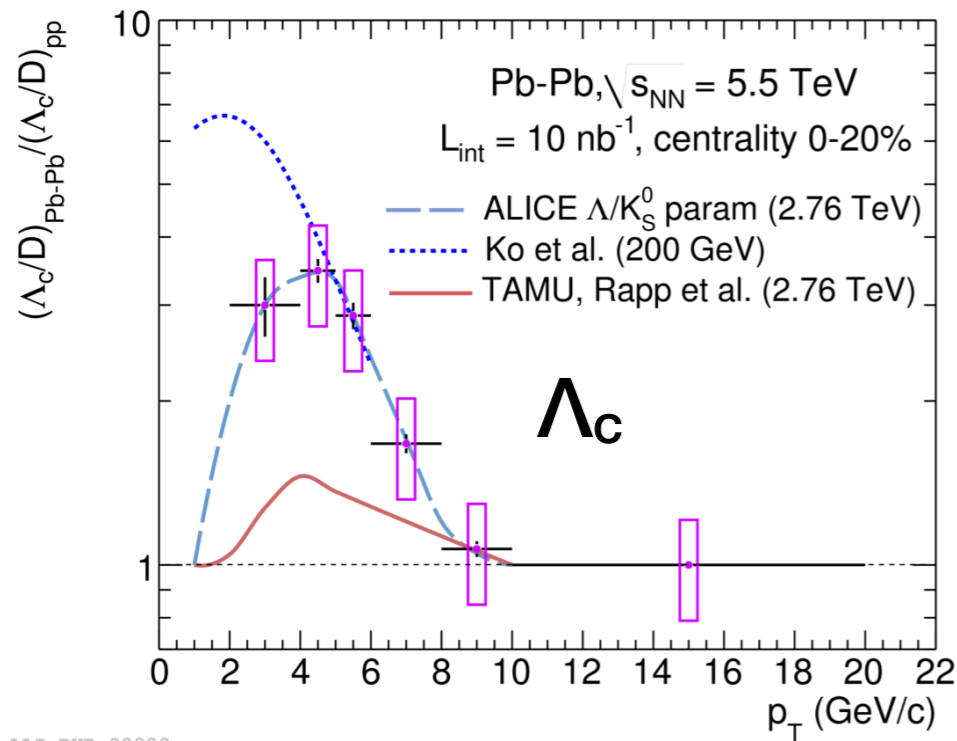
Heavy flavour using Run3 data



- B^\pm , Λ_c , Λ_b , Ξ_c , ... (not all but some of them)
- Important play ground to demonstrate ITS performance upgraded

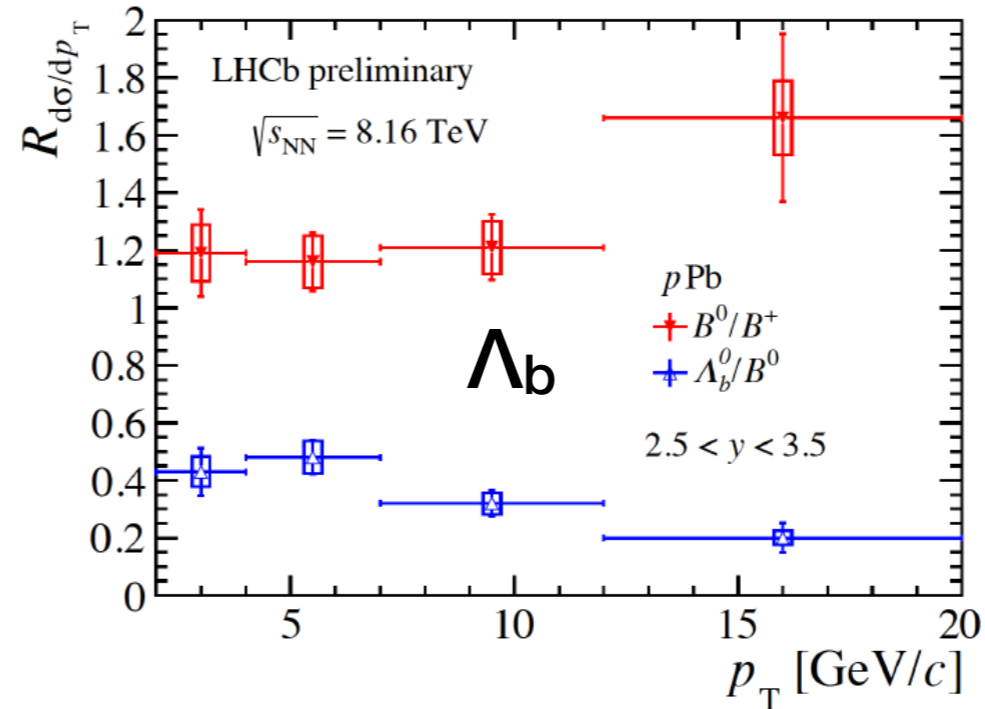


Going further on energy loss & hadronization mechanism



ALI-PUB-80329

Recently at LHCb



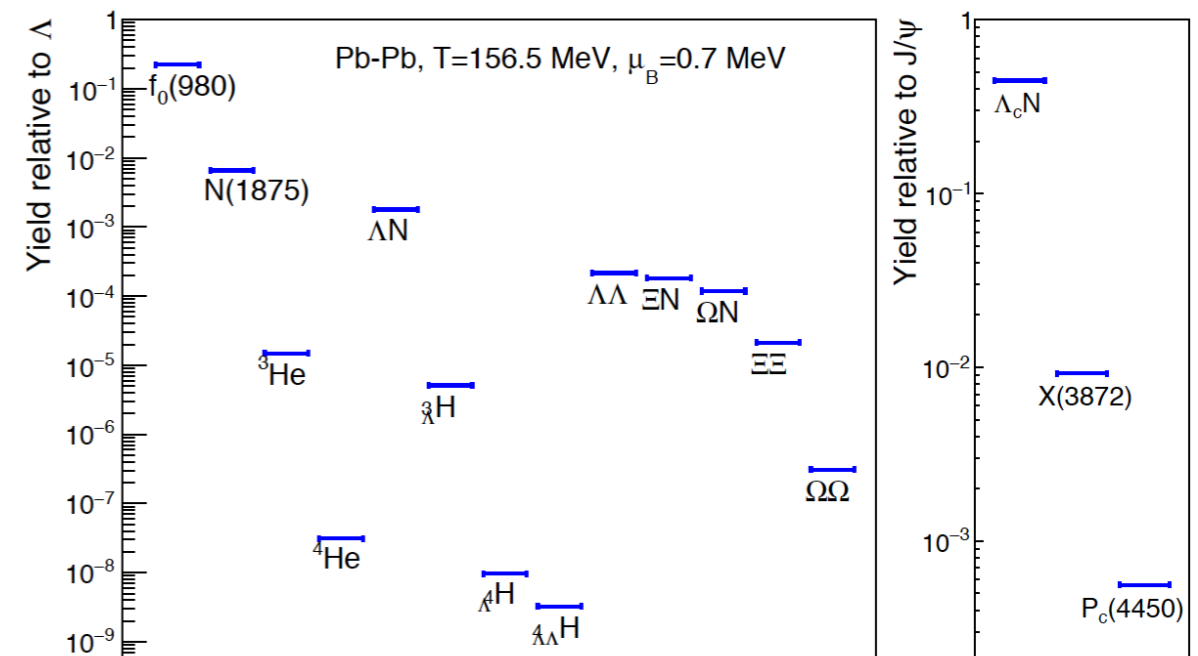
Further more

Hadrons: measured, unmeasured in heavy-ion collisions!

thermal production yields of exotic states in central Pb-Pb collisions at 5 TeV/u

Andronic, pbm, Koehler, Redlich, Stachel preprint in preparation

	Light	Charm	Bottom
Mesons	A lot of !	D mesons	B mesons
Baryons		Charmonia	Bottomonia
Exotics		Hypernuclei, Dibaryons, ...	$\Lambda_{cI}, \Xi_{cI}, \Omega_c$ $\Xi_{cc}, \Omega_{ccc}, \dots$

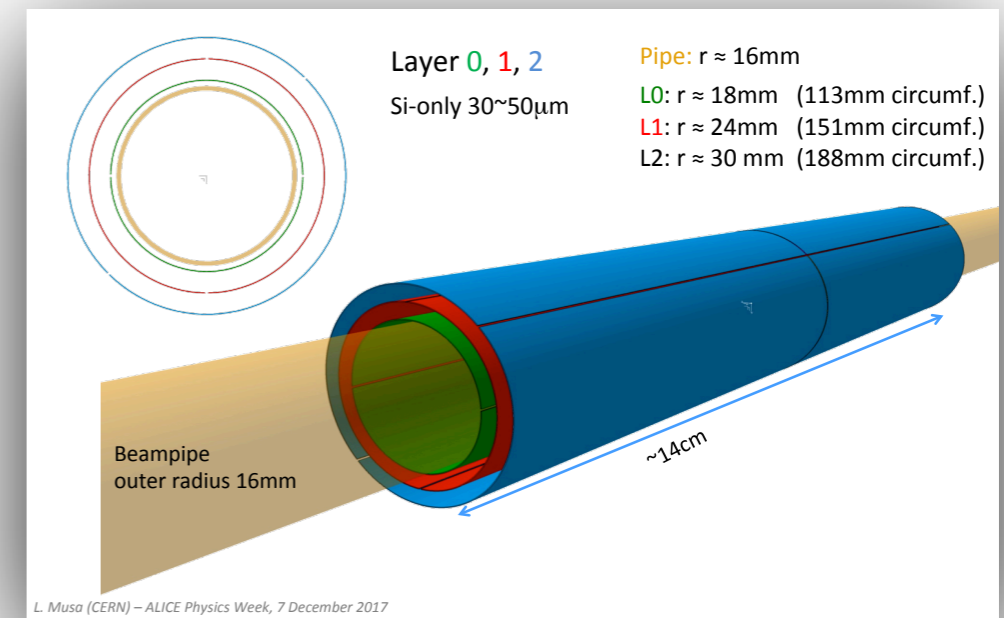


Towards LS3 and LS4 (long term)

2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	LS2		RUN3			LS3		RUN4				LS4	RUN



- We cannot tell explicitly yet where we participate and can contribute
- Very much interested into the technology & coming R&D process
- As far as we understand, a lot of work required for the R&D but less construction work
- In the end, interested in importing(?) the technology into detector in Korea



«NOTE» we may be able to contribute already

- Recently, we bought TCAD package from Silvaco for silicon detector simulation
 - ▶ Device simulator (3D)
 - ▶ Interactive tool (based on GUI)
 - ▶ REM 3D (module for the radiation simulation including modeling of SEU effect)

Brief idea of importing technology

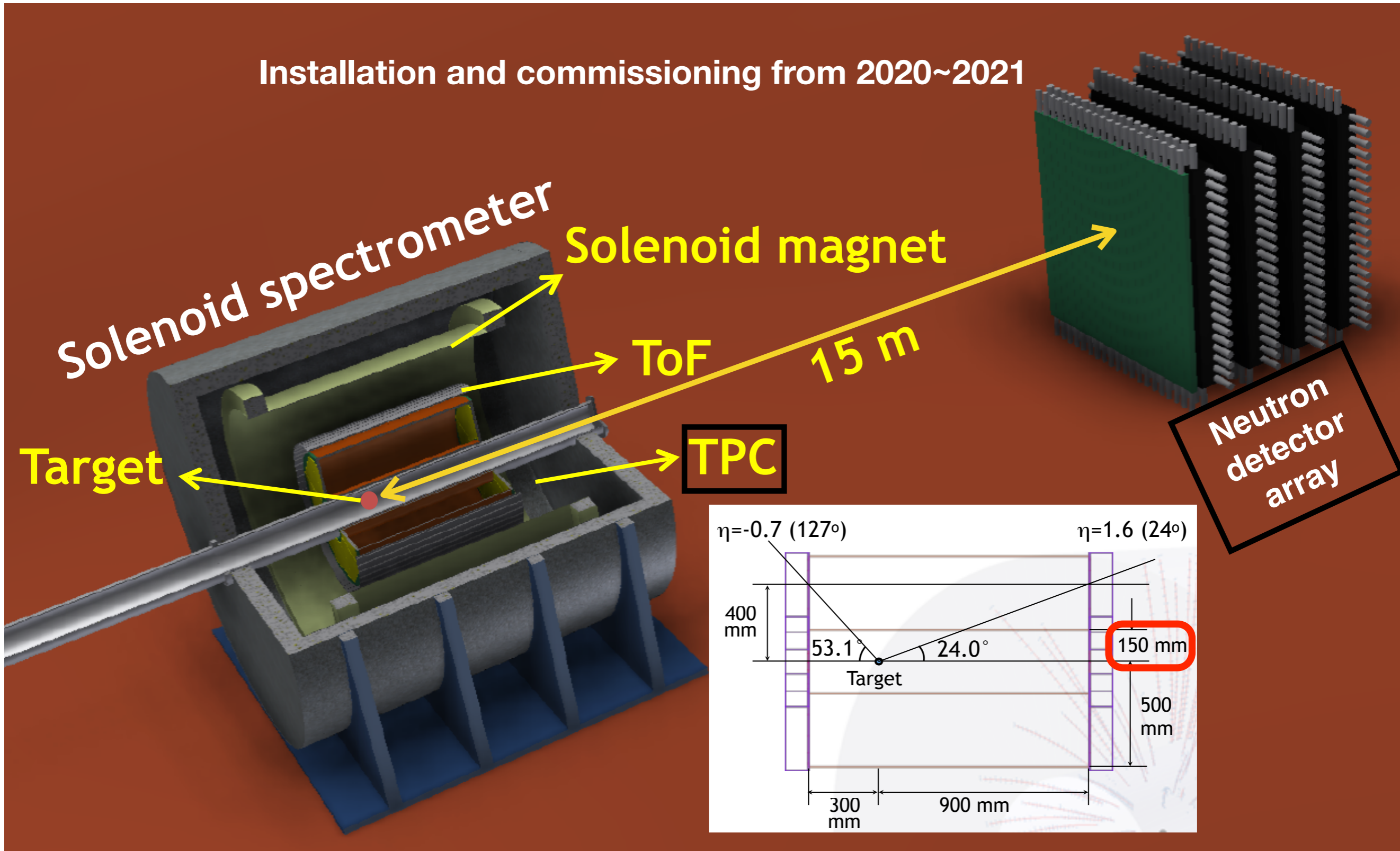
Rare isotope Accelerator complex for ON-line experiment

RAON



- To understand nuclear symmetry energy (totally different topic)

Installation and commissioning from 2020~2021



LAMPS detectors

- Possible upgrade: install silicon detector inside TPC
- Ambitious idea to import the outcomes(?) coping with LS3 R&D

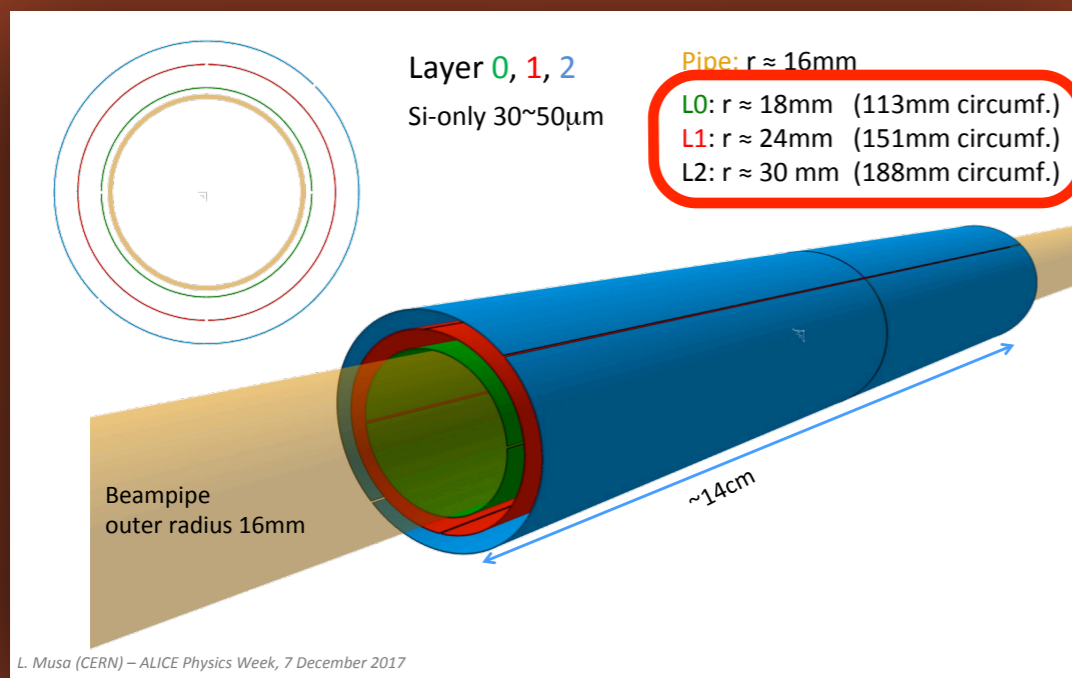
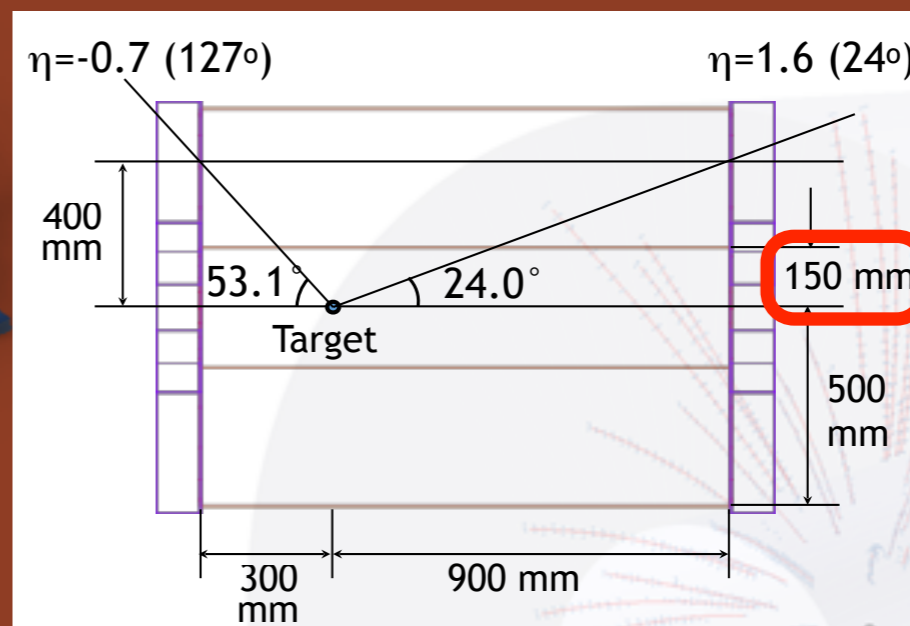


Table 3: Project cost estimate breakdown.

Item	R&D (kCHF)	Construction (kCHF)	Total Cost (kCHF)
Total	2000	3300	5300
Beampipe	600	900	1500
Pixel CMOS Sensors	700	700	1400
Sensor test	100	150	250
Thinning & dicing	200	300	500
Hybrid printed circuit	100	100	200
Mechanics	150	350	500
Assembly & test	50	200	250
Installation tooling	0	200	200
Air cooling	100	150	250
Services	0	100	100
Patch panels	0	150	150



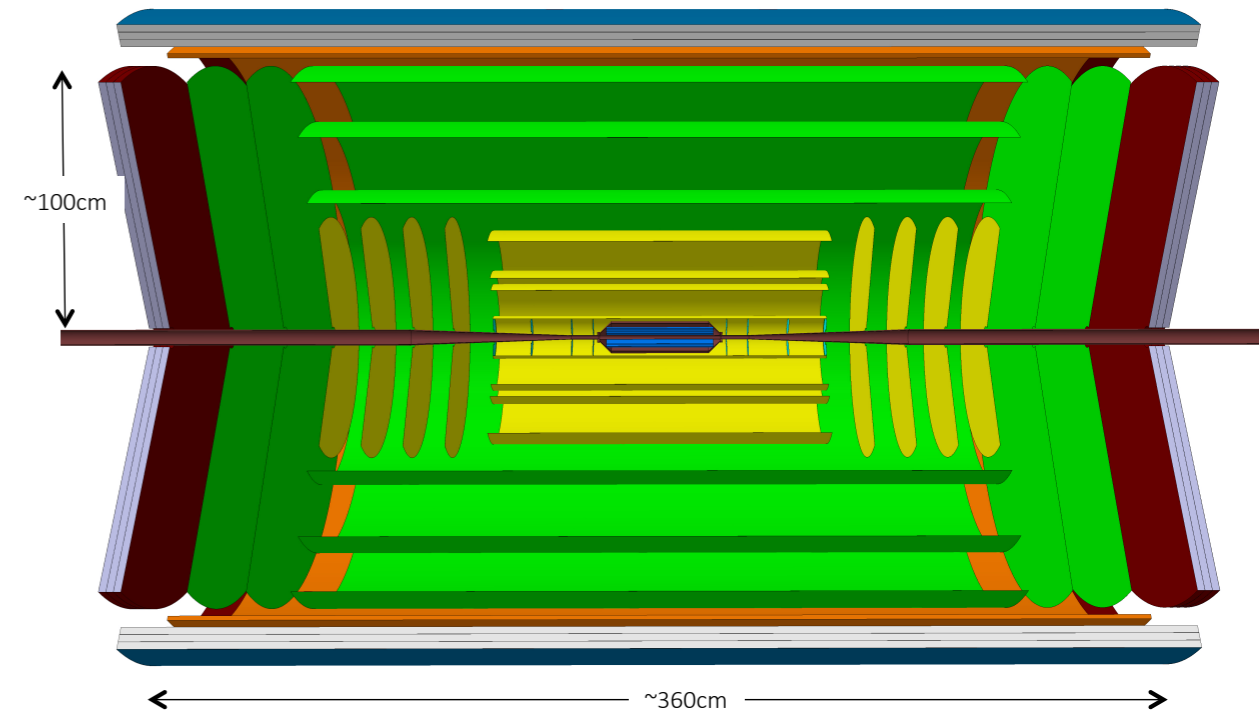
Originally, silicon detector was in the plan, but it was canceled due to a budget issue. For upgrade? Rooms to be included.

Towards LS3 and LS4 (long term, if happens)

2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	LS2		RUN3			LS3		RUN4				LS4	RUN



- We cannot tell explicitly yet where we participate and can contribute
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Tracker: ~10 tracking barrel layers (blue, yellow and green) based on CMOS sensors

Hadron ID: TOF with outer silicon layers (orange)

Electron ID: pre-shower (outermost blue layer)

«NOTE»

- Starting with detector simulation for quantitative expectation of the performance until next May?

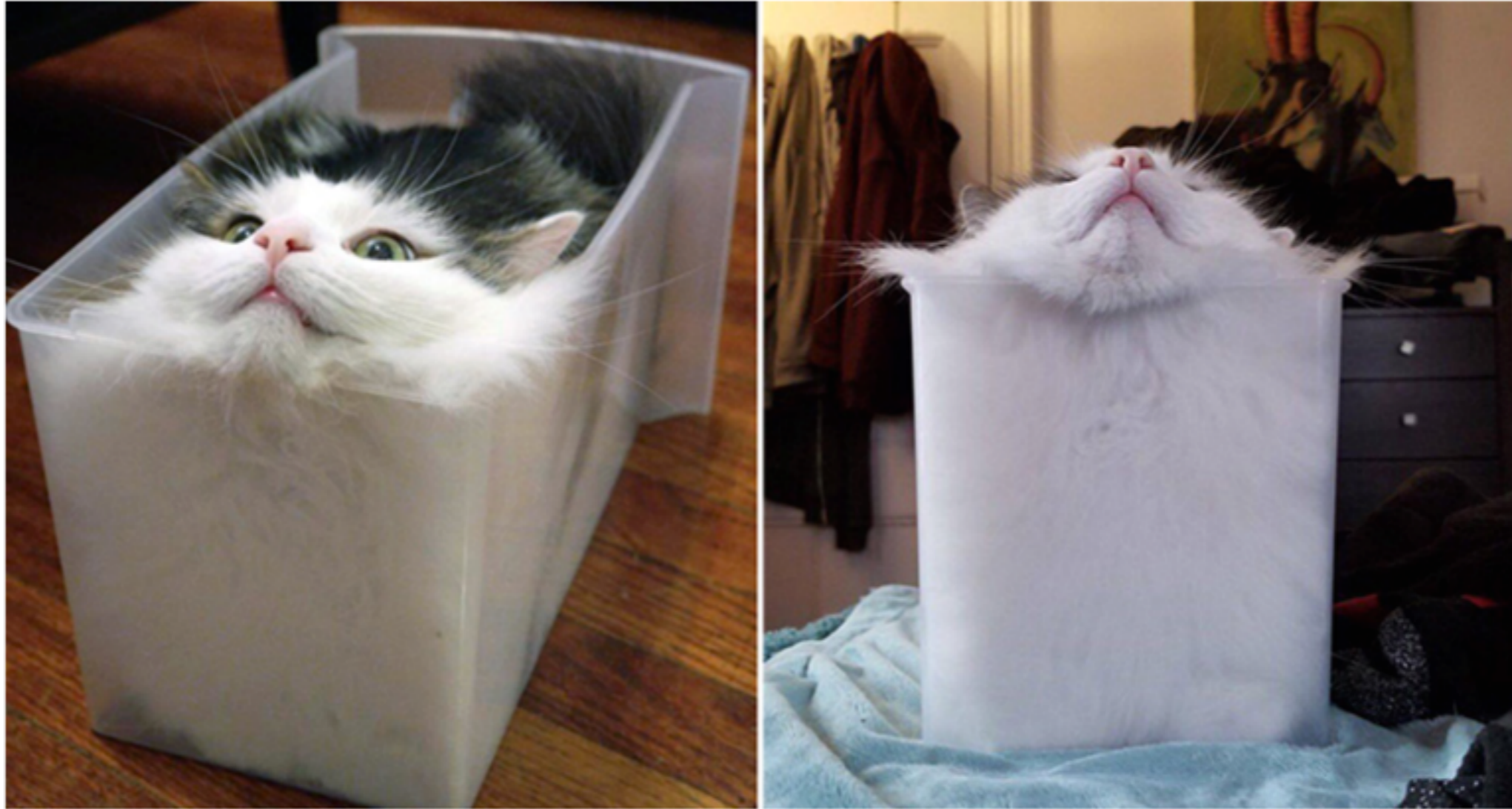
Manpower and budgets

2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	LS2		RUN3			LS3		RUN4				LS4	RUN

- Besides personal grant & koALICE grant, another common grant of 7M dollar for continuous 7 years sharing with 9 faculties (CENuM). In the proposal, future silicon detector development was included in general.
- Plan to have at least one hardware expert (post. doc.)

Why do we (I) do this?

Physicist Wins Ig Noble Prize For Study On Whether Cats Should Be Classified As Liquids Or Solids (Nov. 2018)



"If we take cats as our example, the fact is that they can adapt their shape to their container if we give them enough time. Cats are thus liquid if we give them the time to become liquid."

Calculated relaxation time, experimental time, the type of container, and the cat's degree of stress

The conclusion? Cats can be either liquid or solid, depending on the circumstances

Many thanks for being a collaboration!

Extra slides

