Few infos from ITk week

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Thursday Morning: Management Discussion

2 heures de discussions:
Agenda + transparents de résumé:
https://indico.cern.ch/event/1665319/

- → **Nouvelle date de "end date" 14 Juillet 2027 (normalisation avec le Japon qui finit plus tot)**
- → **Progrès mais toujours pas suffisant car dans leur planning Paris assemble le dernier module ~Juillet 2027 → Pour finir le module c'est Septembre/octobre**
  Pas de planning detaillé par cluster pour le moment → à venir (pour coller avec ce que nous calculons)
- → **64% de Yield attendu, Paris entre 76%-84% → Bien**
- → **Travaille sur les composants pour que Paris soit prioritaire:**
  Bare module >108/mois
  Flex → accord avec Lecce pour continuer à combler les manque

Thursday Morning: Management Discussion

Nouvel achat de Flex:

From Sneha via Stephanie, with updates from Koji et al.

Populated flexes of existing order
N7- 400 f – End of April
N8-400 – End of May
N9- 400 – End of June (Includes 300 being QCed in Glasgow)
N10*- 1000- Mid July
*Assuming the baking machine arrives at Norbit → 1000 populated per batch.

New order for 3000 flexes from Tecnomec
1000 - end of May
1000 – end of June
1000 - end of July

New order for 3000 populated flexes from Norbit
1000- Mid August
1000- Mid September
1000-Mid October

In addition, we will get 1000 flexes from Yamashita+HR. These will arrive (populated) to CERN starting in mid-July.

→ Chile avec 50 flex/semaines yield de 64%
→ Pas assez pour finir avant Octobre 2027 → Augmente le yield?
Surveillance pour que Chile ait toujours des flexes + renfort de Lecce
→ A la limite, investigation de possibilités supplémentaires (aide de Lecce etc)

Production Plan

On going and need to add flexes:

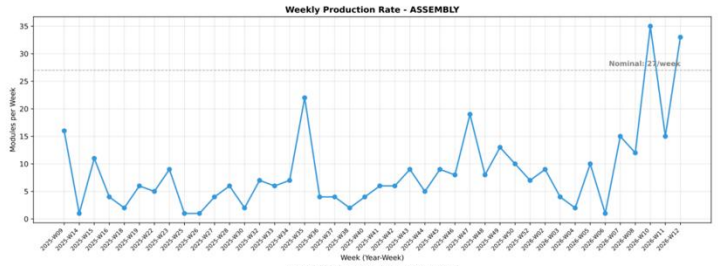
https://docs.google.com/spreadsheets/d/1Dxv-c7Q5BHpNqP0bKUkgQa0at1Y9v-lfa0lowZeaupQ/edit?gid=1780921716#gid=1780921716

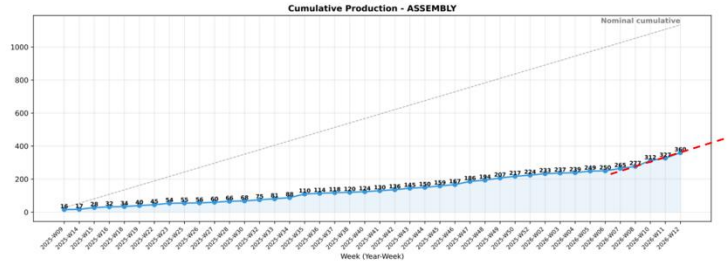
B	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
[Index]		2026												2027											
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Accepted flex	24	65	52	9	139	139	139	139	139	139	139	726	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative flex	225	290	342	351	490	629	768	907	1046	1185	1324	2050	2050	2050	2050	2050	2050	2050	2050	2050	2050	2050	2050	2050	2050
Delivered bare modules	27	54	36	95	120	114	114	114	118	118	118	130	118	130	180	180	0	0	0	0	0	0	0	0	0
Cumulative bare modules	319	373	409	504	624	738	852	966	1084	1202	1320	1450	1568	1698	1878	2058	2058	2058	2058	2058	2058	2058	2058	2058	2058
Assembly capacity	81	81	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108
Parylene capacity	81	81	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108
OBWBP capacity	40	60	80	80	108	108	108	108	108	108	108	108	81	81	108	108	108	108	108	108	108	108	108	108	108
Final QC capacity	81	81	108	108	108	108	108	108	27	108	108	108	81	81	108	108	108	108	108	108	108	108	108	108	108
Paris OB																									
# assembled	33	17	54	90	106	108	108	108	108	108	108	108	108	108	108	108	108	108	108	48	0	0	0	0	0
cumulative assembled modules	223	240	294	384	490	598	706	814	922	1030	1138	1246	1354	1462	1570	1678	1786	1894	2002	2050	2050	2050	2050	2050	2050
%	11%	12%	14%	19%	24%	29%	34%	40%	45%	50%	56%	61%	66%	71%	77%	82%	87%	92%	98%	100%	100%	100%	100%	100%	100%
# parylene	44	0	72	27	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	81	12	0	0	0
cummulative parylene	130	130	202	229	337	445	553	661	769	877	985	1093	1201	1309	1417	1525	1633	1741	1849	1957	2038	2050	2050	2050	2050
# OBWBP	15	38	35	32	102	54	108	108	108	108	108	108	81	81	108	108	108	108	108	108	108	108	39	0	0
cummulative OBWBP	76	114	149	181	283	337	445	553	661	769	877	985	1066	1147	1255	1363	1471	1579	1687	1795	1903	2011	2050	2050	2050
# Final QC	5	39	26	31	108	70	108	108	27	108	108	108	81	81	108	108	108	108	108	108	108	108	108	12	0
cumulative finished modules	63	102	128	159	267	337	445	553	580	688	796	904	985	1066	1174	1282	1390	1498	1606	1714	1822	1930	2038	2050	2050
	3%	5%	6%	8%	13%	*16%*	*22%*	*27%*	*28%*	*34%*	*39%*	*44%*	*48%*	*52%*	*57%*	*63%*	*68%*	*73%*	*78%*	*84%*	*89%*	*94%*	*99%*	*100%*	*100%*
#Unhappy	*0*	*0*	*0*	*18*	16	11	16	16	4	16	16	16	12	12	16	16	16	16	16	16	16	16	16	2	0
#Graveyard	*0*	*0*	*0*	*33*	11	7	11	11	3	11	11	11	8	8	11	11	11	11	11	11	11	11	11	1	0
Cummulative Good	63	102	128	108	189	241	322	403	423	504	585	666	727	788	869	950	1031	1112	1193	1274	1355	1436	1517	1526	1526
Shipped	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cummulative shipped	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%

Francesco's Talk

Lien:
https://indico.cern.ch/event/1540036/contributions/6995566/attachments/3246199/5791967/ITkWeek-ClusterReport-26032026.pdf

Assembly rates





Production activity over the whole year almost without interruptions

Nominal reached in the last weeks
Before: rate auto-limited to avoid lack of activities

Rate is determined by incoming components:
PCB Flex

Very far from the nominal cumulative

Probably unrealistic nominal, to be adjusted to track better our performances

Parylene coating

Paris modules are parylened at an external company located in Paris region: APS Coating Solutions


Paris1021


Paris1031

Some issues of bended wires, dust, contamination.

Improved at each batch

Batch	Bended/ disconnected wires	Important contamination trapped below parylene	Module electrical degradation **post parylene**
Sept. 2025 batch	16/74	8/74	9/74 → **88%** electrical yield
Dec. 2025 batch	0/58	22/58	6/58 → **90%** electrical yield
Jan./Feb. 2026 batch	3/70	0/70	1/70 → **99%** electrical yield
Total	**19/202**	**30/202**	**16/202 → 92% electrical yield**

Francesco's Talk

A crude real yield computation

- We process modules more or less in order of Alternative ID
- If we take the last module completed* we can make the hypothesis that all previous modules are either complete or problematic (graveyard or unhappy)
- We completed 159 modules
- We reached index 81 in LPNHE
- We reached index 1153 (starting from 1001) in IJCLab-IRFU
- Real yield up to FINAL_* tests: **68% (159/234)**
  - **To be multiplied by eQC yield at FINAL COLD**

Crude real yield breakdown

- Pessimism: all UNHAPPY or not yet completed modules of the past are bound to GRAVEYARD. Factor: 0.8
- Assembly: 0.93
- IV (breakdown at INITIAL_WARM): 0.98
- Parylene coating operations: 0.92
- Wirebond protection: 0.93
- Yield factors in the list are **not independent**, **lower bound**: 0.8*0.93*0.98*0.92*0.93 = **0.62**

Francesco's Talk

Crude real yield forecast

Realistic: we could recover most of the modules left behind and maybe few of UNHAPPY

- Pessimism: all UNHAPPY or not yet completed modules of the past are bound to GRAVEYARD. Factor: *0.9*
- Assembly: *0.96*
- IV (breakdown at INITIAL_WARM): *0.99*
- Parylene coating operations: *0.99*
- Wirebond protection: 0.97
- Yield factors in the list are **not independent**, lower bound: 0.9*0.96*0.99*0.99*0.97 = **0.82**

Driven by handilng/gluing accidents, improving with rate

Improved greatly in the last batch: 0.99

Improved with new tools and higher rate (same as assembly)

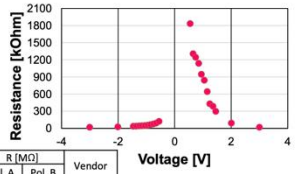
Estimated on a recent batch (Advafab batch 5)

Loading Sites

OB Module-to-Cell Isolation Issue: Introduction

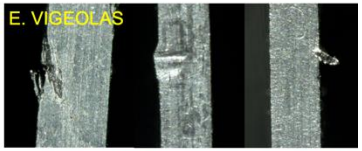
- Module-to-Cell isolation problem discovered in the final preparation stages for the Cell Loading PRR (see link)
- Non-IZM pre-production module cells exhibited non-ohmic behaviour of the FE Chip-PGT interface, with resistance values << 1MΩ for normal operating conditions
- We verified experimentally that a 75-100μm thick layer of STYCAST 2850FT/Cat 9 should be enough to provide the required isolation (resistance>10GOhm)
- **Our studies indicate that small graphite fragments protruding from the PGT surface, particularly around the edges of the PGT, can contact the backside of the module, bypassing the isolation provided by the STYCAST layer**

A. ZOGRAFOS
S. KUEHN



Module Cell SN	R [MΩ]		Vendor
	Pol. A	Pol. B	
20UPGM22601041	2.14	1.02	HPK

E. VIGEOLAS



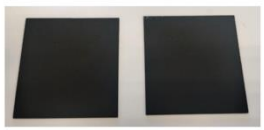
Examples of graphite fragments protruding beyond the edges of PG Tiles

Cell Coating: Epoxy Primer

- Good, uniform coverage obtained with two-component, epoxy primer **2K PRO** (airless)
- 2 layers + intermediate cleaning step required to ensure electrical insulation
- Manual mechanical cleaning is critical to remove graphite "flakes" and achieve good isolation with thin layers (see link)
- Process:
  - Mechanical cleaning of bare cell and edges
  - Apply 1st layer and dry @ RT
  - Mechanical cleaning of bare cell
  - Apply 2nd layer and dry @ RT
  - Isolation checks
- Mixed thermal results:
  - Variability across batches (thickness 30-70μm)
  - Learning curve/operator dependency?
  - Unclear if it can meet L2 requirements consistently

R. REGO

Mechanical Cleaning



Examples of coated PGT with epoxy primer 2K PRO

Cell Coating: Sol Gel

- Sol-Gel coating with AlOx & SiOx nano-particles developed by DTI (**TAP Coat 010**)
- Several process variations studied (e.g. multi-layer spray coating with/without edge dipping)
- Manual mechanical cleaning step critical to achieve good isolation with thin coating
  - Cleaning step allows reducing number of layers from 6 to 2-3 and improves thermal performance (layer thickness currently estimated as ~8-15μm, see EDMS 3401271)
- Edge dipping adds robustness but increases process complexity
  - "2 layers + edge dipping" are enough to guarantee isolation
  - Some coating build-up around edges
  - Without edge dipping 3 layers may be required for consistent isolation (under study)

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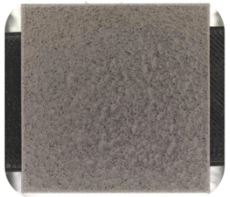
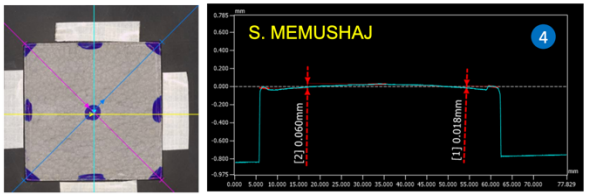


Example of coated PGT with Sol-Gel solution



Example of surface profiles in a cell coated with the Sol-Gel method with edge-dipping

Loading Sites

Cell Isolation: Next Steps

- Delivery of new batch of coated cells expected shortly to continue with qualification:
  - ~20x Sol-Gel Cells (2 Layers + edge dipping)
  - ~20x 2KPRO Cells (2 layers)

- Tests with these cells:
  - Loading new heaters (~5 cells of each type) → Thermal tests before and after cycling
  - Loading non-IZM pre-production modules using Method I, Method II and Method III followed by isolation tests and electrical & thermal QC tests before and after cycling
    - ➢ Some of these non-IZM modules will be installed in pre-production Local Supports (L34 Longeron/L3 IHR)

- Optimise the coating process and tooling for production scaling
  - Sol-Gel: Investigate different spraying directions to avoid edge-dipping
  - Epoxy Primer: Optimise tooling to improve repeatability

- Finalise cost/timeline estimates for full production

Marseille est confiant de pouvoir loader debut Juin
→ Discussions a venir durant les JUAF…