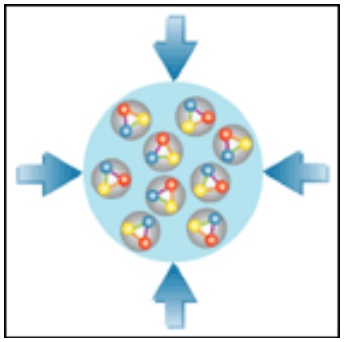
CBM Project



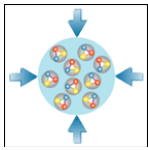
Walter F.J. Müller, FAIR, Darmstadt

CBM-India Meeting, BI, Falta
15-17 February 2018

FAIR Construction on Track

picture taken February 7th, 2018

Major External Milestones for CBM



- G014 (CBM building)
  - shell completed — Nov '20
  - installation window — Dec '21 to Mar '22
  - transition to 'user mode' — Dec '22

Notes:
- during 'installation window' building is still in 'construction site' mode
- only very basic ventilation and power services available
- mainly useful for bringing in robust mechanical structures

- Cryogenics and Accelerator
  - Cryogenics ready in G014 — Mar '23
  - SIS-100 ready for beam — Apr '24
  - HEBT ready for beam — Aug '24
  - SIS-100 pilot beam — Nov '24
  - SIS-100 '1 user, low intensity' — Feb' 25

Cryo plant still on commissioning

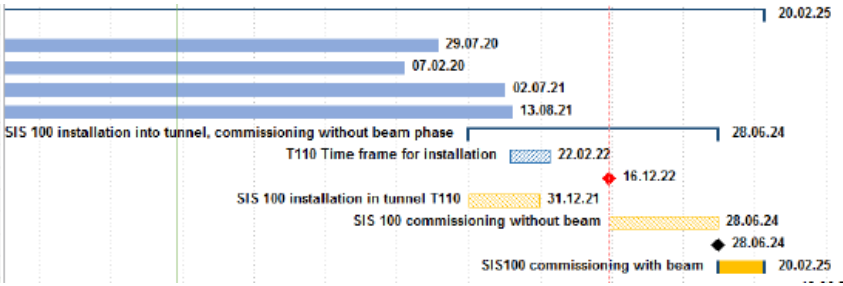
Depending on whom one asks first opportunistic test beam (few hours parasitic to SIS-100 commissioning) might start between Jul and Nov '24.

Go for CBM M11 Mar'24

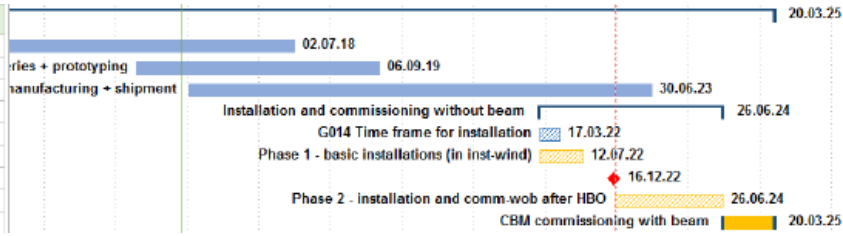
FAIR Schedule: SIS100 and CBM

Slide shown on Spring 17 CBM Week in plenary on 23rd March 2017

120	**SIS100**	**174,17 mons**	**17.10.2011**	**20.02.2025**
121	SIS 100 planning phase	114,6 mons	17.10.2011	29.07.2020
122	SIS 100 manufacturing of pre-series phase	99,25 mons	02.07.2012	07.02.2020
123	SIS 100 manufacturing of series phase	97,2 mons	21.01.2014	02.07.2021
124	SIS 100 shipment, SAT A phase	101,1 mons	14.11.2013	13.08.2021
125	**SIS 100 installation into tunnel, commissioning without beam phase**	**45,6 mons**	**31.12.2020**	**28.06.2024**
126	T110 Time frame for installation	6,75 mons	29.07.2021	22.02.2022
127	Acceptance by HBO	0 mons	16.12.2022	16.12.2022
128	SIS 100 installation in tunnel T110	13,06 mons	31.12.2020	31.12.2021
129	SIS 100 commissioning without beam	20 mons	19.12.2022	28.06.2024
130	SIS 100 ready for beam	0 mons	28.06.2024	28.06.2024
131	**SIS100 commissioning with beam**	**8,42 mons**	**28.06.2024**	**20.02.2025**



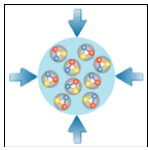
233	**CBM**	**152,67 mons**	**08.07.2013**	**20.03.2025**
234	Phase 2: design and planning	65 mons	08.07.2013	02.07.2018
235	Phase 4: pre-series + prototyping	44,5 mons	11.04.2016	06.09.2019
236	Phase 5+6: manufacturing + shipment	84,6 mons	05.01.2017	30.06.2023
237	**Installation and commissioning without beam**	**33,55 mons**	**01.12.2021**	**26.06.2024**
238	G014 Time frame for installation	3,1 mons	02.12.2021	17.03.2022
239	Phase 1 - basic installations (in inst-wind)	160 dys	01.12.2021	12.07.2022
240	Acceptance by HBO	0 mons	16.12.2022	16.12.2022
241	Phase 2 - installation and comm-wob after HBO	398 dys	19.12.2022	26.06.2024
242	**CBM commissioning with beam**	**9,52 mons**	**26.06.2024**	**20.03.2025**



- The CBM bottom line:
  - Dec 2021 to Jul 2022 — 1st installation window
  - Dec 2022 — Building acceptance
  - Dec 2022 to Jun 2024 — Installation & commissioning w/o beam
  - Jun 2024 to Mar 2025 — Commissioning beam from SIS100

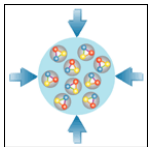
→ Schedule Stable

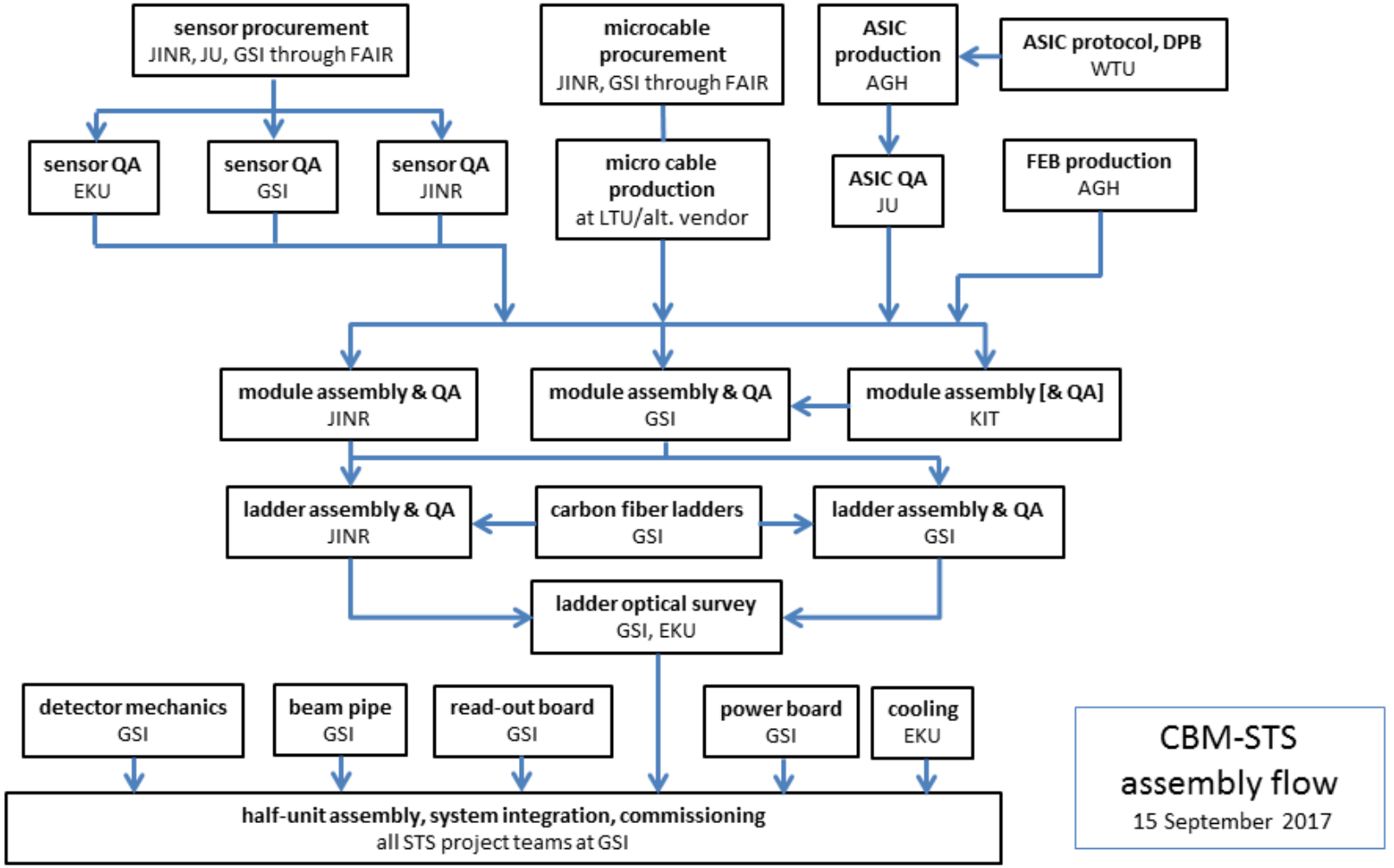
CBM Construction Planning I



- Construction planning priorities
  - get it right
  - get it in time
  - → use the available time wisely
  - → always remember: construction can only be spend once
- Ensure that
  - responsibilities are all defined
  - essential dependencies are understood
  - essential decision points are defined

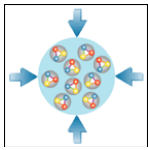
Example: STS Construction Flow





CBM-STS assembly flow
15 September 2017

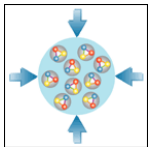
CBM Construction Planning II



- Milestones
  - have clear list of objectives and acceptance criteria
  - follow a modular approach (handle sub-topics separately)
  - use several levels
    - M5: CDR (conceptual design)
    - M6: PDR (e.g. full 3D model)
    - M7: FDR (e.g. manufacturing drawings) (aka PRR)
    - M8: FOS (First-of-Series acceptance)
    - M9: FAT (Factory acceptance test)
    - M10: SAT (Site acceptance test → ready for installation)
    - M11: Ready for beam

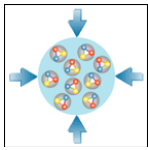
Notes:
- apply the levels as appropriate for an entity
- define clear objectives and acceptance criteria
- there are several M10 per detector: mechanics, services, detectors

Example: STS Milestones



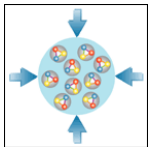
- M6 (PDR)
  - LDO ASIC — Feb '18
  - STS-XYTER V2.1 updates — Mar '18
  - STS-XYTER final — Nov '18
  - STS core ('... the big one...') — Nov '18
- M7 (FDR/PRR)
  - sensors — Apr '18
  - LDO ASIC
  - STS-XYTER ASIC — Jan '19
  - FEB — Apr '19
  - micro cables — Apr '19
  - ROB/POB
  - and 12 more .... (services, mechanical key structures,....)

CBM Construction Planning III



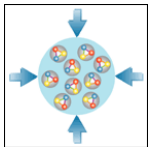
- change planning mode …
  - there is no need to impress anymore with aggressive time scales anymore (as we tried so often in the past)
  - we'll be finally judged by the quality of the detectors, and not by how many year we were early, as long we stay in time
- … and use the time wisely
  - do proper long term testing (long = 1 year)
  - do proper beam testing (mCBM, ….)
- Examples of schedule updates
  - STS: STS-XYTER PDR after mCBM 2018 run (Nov '18)
  - TOF: counter PRR after 20 weeks STAR-BESII (Jun '19)

CBM Installation Planning



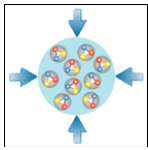
- It's also time to review the installation planning
- Separate between
  - Mechanics
    - could/should be brought in during installation window (Dec '21)
  - Services (LV/HV, gas, cooling)
    - installed in service areas, can start on Dec '22
  - Detectors
    - usually done after services are in place (test after install)
    - in general starting in Q2'23
- Plan **Pre-Assembly** activities at FAIR
  - that covers all activities on FAIR site, but outside of Cave
    - e.g. RICH mirror mounting or MUCH station assembly
  - **Space must be allocated now !!**

CBM MUCH Specifics



- Consolidate Station 1+2 planning
  - steps toward st 1+2 PRR
  - include new HV concept and it's validation
  - potentially separate between chamber and readout
- Setup station 3+4 planning
  - timeline and criteria for CDR
  - involve external experts on CDR
- Setup pre-assembly planning
  - what needs to be done at FAIR site ?
  - are there significant activities outside of Cave area ?
- Review Assembly sequence
  - is a field map with mounted MUCH absorber needed ?
    (this is the 500 pound gorilla dictating the time planning around the magnet)

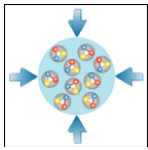
Late and Next Milestone Report



Report on Late and Next-to-come Milestones now send monthly to CBM TB

PSPCode	ctivityCoc	Startup-Pl	Name	Anfang	Ende
			% Complete: 0%	29.12.17	22.03.24
1.1.1.3.2.3.1	S002.M5		MUCH PNPI-1 Plan Review [M5]	29.12.17	29.12.17
1.1.1.5.1	S005.M9	Exp Ph. 1a / A	TOF - STAR ROC FAT [M9]	01.01.18	01.01.18
1.1.1.5.1	S005.M9	Exp Ph. 1a / A	TOF - STAR GET4 TDC FAT [M9]	11.01.18	11.01.18
1.1.1.7	S002.M6	Exp Ph. 1a / A	Magnet PDR accepted [M6]	15.01.18	15.01.18
1.1.1.3.2.3.1	S002.M7		MUCH PNPI-1 FDR station 1+2 gas system [M7]	31.01.18	31.01.18
1.1.1.5.2	S005.M9	Exp Ph. 1a / A	TOF - STAR Counter 3a FAT [M9]	09.02.18	09.02.18
1.1.1.2	S007.M11		Ready for beam COSY 2018 [M11]	19.02.18	19.02.18
1.1.1.2	S002.M6		STS - LDO ASIC PDR accepted [M6]	21.02.18	21.02.18
1.1.1.2.1	S002.M4		Contract STS GSI signed [M4]	01.03.18	01.03.18
1.1.1.2.2	S002.M4		Procurement agreement STS JINR signed [M4]	01.03.18	01.03.18
1.1.1.2.3	S002.M4		Contract STS AGH-ASIC signed [M4]	01.03.18	01.03.18
1.1.1.2.3	S002.M6		STS - Review V2.1 updates	15.03.18	15.03.18
1.1.1.2.6.2	S002.M4		Contract STS AGH-FEB signed [M4]	02.04.18	02.04.18
1.1.1.3.2.2	S002.M4		Contract MUCH VECC signed [M4]	02.04.18	02.04.18
1.1.1.5.1	S002.M4		Contract TOF GSI signed [M4]	02.04.18	02.04.18
1.1.1.3.1	S006.M10		RICH - MAPMT, SAT accepted	03.04.18	03.04.18
1.1.1.2	S002.M7	Exp Ph. 1a / A	STS - sensors PRR accpeted [M7]	04.04.18	04.04.18
1.1.1.5.2	S005.M9	Exp Ph. 1a / A	TOF - STAR Counter 3b FAT [M9]	13.04.18	13.04.18
1.1.1.7	S002.M7	Exp Ph. 1a / A	Magnet FDR accepted [M7]	23.04.18	23.04.18
1.1.1.7	S005.M81		Series production started [M81]	23.04.18	23.04.18
1.1.1.2.7	S002.M4		Contract STS WUT signed [M4]	01.05.18	01.05.18
1.1.1.3.2.3.1	S002.M7		MUCH PNPI-1 FDR platform & rail system [M7]	31.05.18	31.05.18

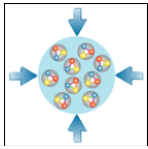
Progress Summary for Higher-Ups



Frist **Draft** of an 'all-in-one-slide' overall status summary shown in **ECE** on February 12th

	Component/ Sub-System	TDR	Cost [k€ 2017]	Funding	Construction	Date completion	Test/ Commissioning
CBM - Day 1 setup	Micro Vertex Detector (MVD)		1280			12/2023	
	Silicon Tracking System (STS)		13305			12/2023	
	Ring Image Cherenkov Detector (RICH)		5176			12/2023	
	Muon Detector (MUCH)		8593			12/2023	
	Transition Radiation Detector (TRD)		3562			12/2023	
	Time of Flight System (TOF)		8200			12/2023	
	Projectile Spectator Detector (PSD)		1322			12/2023	
	Dipol MAGNET		5261			12/2023	
	Online Systems (DAQ and FLES)		3162			12/2023	
	Infrastructure		3182			12/2023	
		79% *value weighted*	53043	86% *secured*	9% *value weighted*		

… and a Final Word

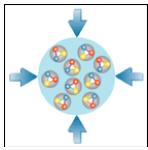


- Don't equate planning == reporting !
- Yes, the higher-ups love look at milestone-trend-analysis
- But key purpose of planning is **to help us** !
- Only with good planning we
  - know objectively where we stand
  - can decide on priorities
  - can use the time wisely
  - understand impact of changes quantitatively
- And keep in mid
  - a plan is a living document, can and will be changed

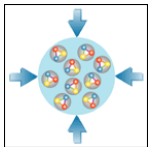
Planung ersetzt den Zufall durch Irrtum – und aus Irrtum kann man lernen
attributed to Albert Einstein

Planning replaces coincidence with error – and from errors one can learn

The End



Thanks for your attention



Backup Slides