



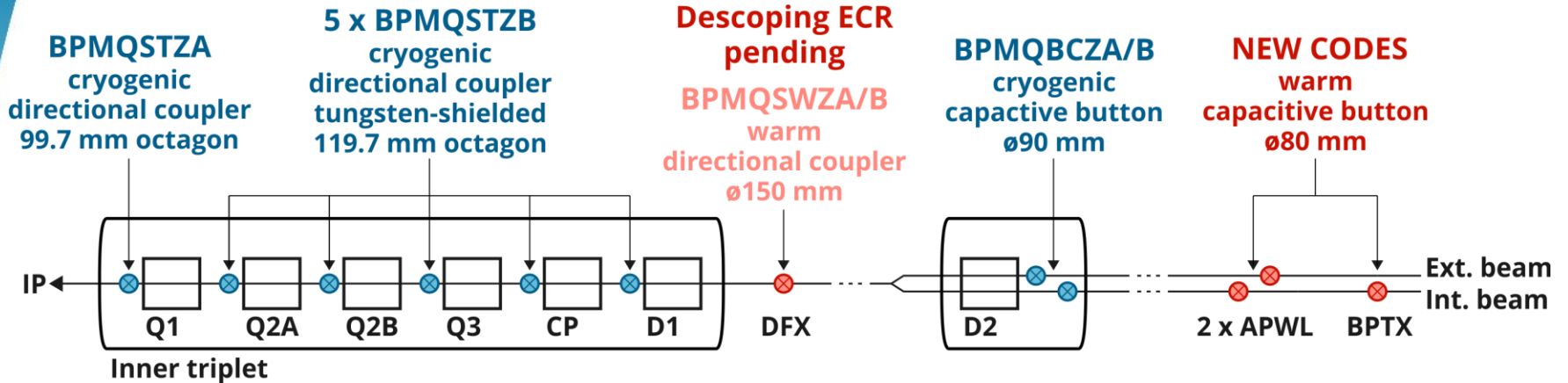
Schedule and budget

M. Krupa for the BPM team



HL-LHC BPM Design Review – 18/11/2020

New HL-LHC BPMs



	BPMQSTZA (A Type)	BPMQSTZB (B type)	BPMQSWZA/B	BPMQBCZA/B (D2 type)	APWL	BPTX	TOTAL
Series	4	20	4	8	8	4	44
Spares	2	2	2	2	2	1	9
Prototypes	2	2	2	2		1	7

BPM installation sequence

- Cryogenic BPMs (A type, B type and D2) are installed by WP3, WP12 and WP13 during the cryomagnet assembly
 - Responsibility share covered by memorandum EDMS 2105453
 - BPMs are installed after cold tests of the magnet
 - Beam screen must be inserted before BPM installation
 - Needed-by dates driven by WP3 and WP12 schedules
- Warm pick-ups (APWL, BPTX) are installed by WP13 during LS3
 - Series delivery needed latest when the LHC de-installation is completed
- The rest of the presentation focuses only on the cryogenic BPMs

Beam screen insertion dates

- WP12 BS insertion schedule from April 2020
- WP3 and WP12 delays due to COVID-19 not implemented
- WP12 agreed to update WP13 when the schedule changes
- These are assumed as BPM needed-by dates

A type BPM	B type BPM					D2 BPM
Q1	Q2 (1)	Q2 (2)	Q3	CP	D1	D2
16 Feb 24	29 Mar 24	28 Jun 24	03 Aug 23	05 Apr 22	16 Mar 23	04 Aug 22
02 Feb 24	19 Apr 24	27 Sep 24	29 Nov 23	03 Jun 22	30 Mar 23	29 Sep 22
12 Apr 24	03 May 24	29 Nov 24	28 Feb 25	02 Feb 23	28 Jul 23	12 Jan 23
12 Nov 24	24 May 24	16 Aug 24	28 Feb 25	16 Feb 23	27 Oct 23	29 Mar 23

3D models and drawings readiness

- 3D designs are ready for releasing manufacturing drawings for pre-series production preparation at CERN Workshop
 - Only the A type and B type electrode design to be updated without any impact on the rest of the design
- Some changes in the 3D models made over the last 3 months
 - Feedback from thermal simulations
 - Feedback from WP3 and WP12
- Additional changes might be implemented as an outcome of the review and BINP technologist/workshop feedback
- Existing drawings are sufficient for discussions with BINP

Integration tests

- WP13 is preparing “simplified” BPMs for integration and installation checks (e.g. aperture round instead of octagonal)
- Representative interconnection mock-ups needed to validate BPM design, integration, alignment, and installation
 - Ongoing discussion with WP3 and WP12 on schedule and possible tests – some COVID-related delays
- WP3, WP12 and WP13 are checking details using 3D models
 - Interface dimensions and tolerances
 - Aperture transitions
 - Welding and cutting machines
 - Cryogenic cable routing and installation

316LN quantities

BPMs	Type A	Type B	D2	TOTAL
Series (BINP)	4	20	8	32
Spares (BINP)	2	2	2	6
Pre-series (CERN)	2	2	2	6

Blanks	Type A + Type B	D2	TOTAL
Already procured	4 + 4	4	12
To be procured	4 + 20 + 2	8 + 1	35

spare blanks



316LN procurement

- 12 x 316LN blanks already purchased for CERN / BINP pre-series
- Need 35 more blanks for series production - 2+ months lead time
- Once the blanks are ordered, any significant change to the BPM dimensions will have a large impact on cost and delay production
- Note freezing the blank dimensions approved by WP3, WP12, WP13, WP15 (EDMS 2395068)
- Excess material:
 - +5 mm radius: 4 mm (machining) + 1 mm (design change)
 - +10 mm length: 2x4 mm (machining) + 2 mm (design change)
- Any future changes with an impact on the blank dimensions will have to be approved on the HL-LHC level through an ECR
- SMB/SSL already very advanced with the price enquiry

Other material procurement

- 100 tungsten blocks procured through WP12 contract
 - 10 pre-series (already at CERN), 90 series
- Waterjet-cut OF copper for aperture transitions will be procured through CERN Stores
 - Good availability, short lead times
- RF contacts for aperture transition procured through WP12
- Fasteners, other standard components will be procured through standard channels
 - Small cost, good availability, short lead times

RF components procurement

- RF feedthroughs for A type and B type BPMs
 - Procurement ongoing, delays due to some design changes
- Button electrodes for D2 BPMs
 - Preliminary design ready, procurement to be launched in 2021
- Cryogenic coaxial cables
 - Preliminary routing done but will likely change
 - Severe problems in the past, suppliers now more reliable
 - Will be procured in a larger order with collimator BPM cables
- Cryostat flanges
 - Procurement to be launched in 2021

Pre-series production

- 2 pre-series campaigns planned
 - At CERN: 2 BPMs of each type (6 in total)
 - At BINP: 2 BPMs of each type (6 in total)
- CERN pre-series production will start when the design is frozen
 - Everything that can be, will be subcontracted
 - Electron-beam welding will be done in-house
- **CERN pre-series BPMs will be our safety margin in case of delays in series production – requires freezing the design!**
- To avoid excessive spares, compliant CERN pre-series units could be removed from the final BINP production quantities

BINP collaboration

- COVID-19 impact on BINP similar to CERN
 - Only limited activities on-site, scientific staff working remotely
 - We can progress with all pre-production work
- Official travel between BINP and CERN unlikely anytime soon
 - Visit to BINP necessary before green-lighting the series production
- Communication with BINP ongoing
 - Official collaboration contract has not been signed yet
 - BINP informally approved our 316LN blank dimensions
 - Regular zoom meetings to discuss pre-series preparation and production started in September
 - Contract amendment to be updated with current schedule and APWL/BPTX included
- Raw material for BINP pre-series is ready for shipping

Budget

- Budget presented at the PSM in August
 - Total 1.646 MCHF, no issues identified
 - 88 kCHF requested as extra scope (BPTX) – to be presented to the TCC and approved through ECR
 - Production cost will be an in-kind contribution from BINP
 - Ongoing discussions if material cost can be (partly) in-kind too
- Latest news
 - Tungsten absorber – thermal link assembly likely to be done at CERN (existing know-how and production line): 25 kCHF
 - Welding of cooling tubes to the BPM body also to be done at CERN: no precise cost estimate yet

Review summary

- 3D designs of A type, B type and D2 BPMs are ready for releasing manufacturing drawings for pre-series production preparation
 - Various simulations done or ongoing by relevant WPs
 - Design optimisation done with EN/MME and TE/VSC
 - Integration and interfaces checked using 3D models
 - A type and B type electrode model to be updated (no impact on parts)
- Functional spec for A type and B type circulated, D2 to be circulated soon
- Studies done to validate the foreseen manufacturing methods
- Discussions with BINP ongoing but final contract not yet signed
- First BPM installation (CP magnet) scheduled in April 2022
 - ~ 1 BPM per month until February 2025 (Q3 magnet)
- **WP13 goal for the review is to approve launching the pre-series production phase at CERN main workshop**



Thank you for your attention

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