Dual Phase Drift Cage Production Status Update

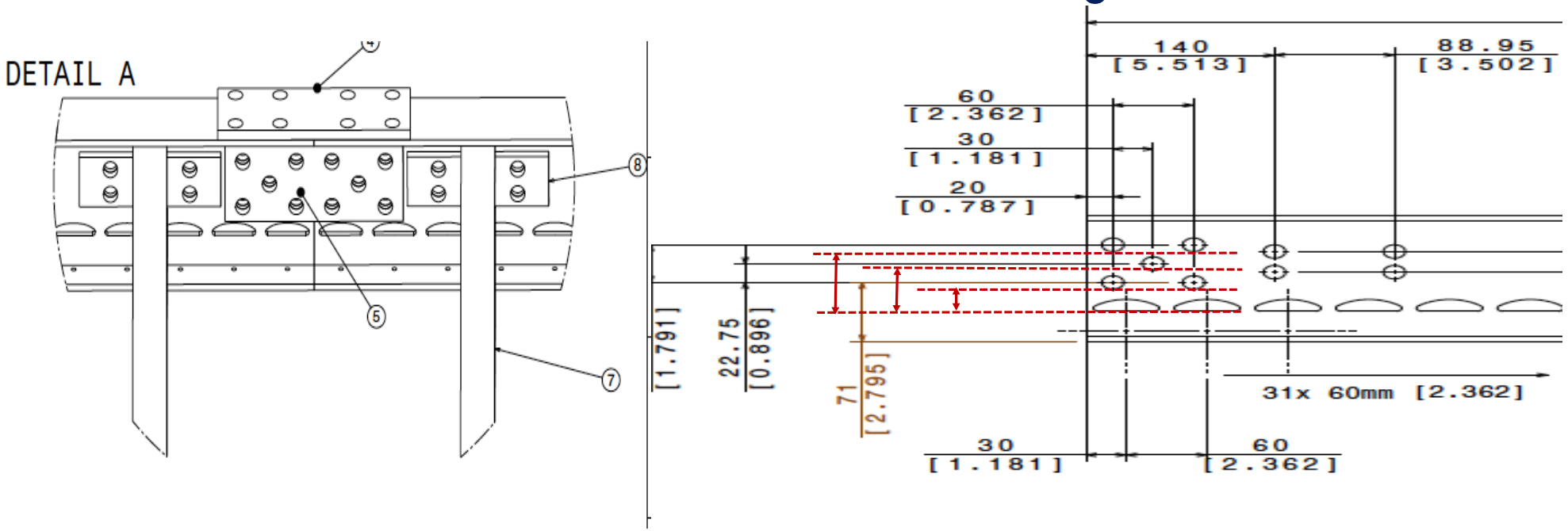
WA105 Joint TB Meeting
May 10, 2017

Jaehoon Yu for
A. Chatterjee, S. Shshsavarani, G. Brown & UTA Team
A. Gendotti, S. Murphy, C. Cantini & ETH Team
F. Pietropaolo & CERN Team

UNIVERSITY OF TEXAS ARLINGTON

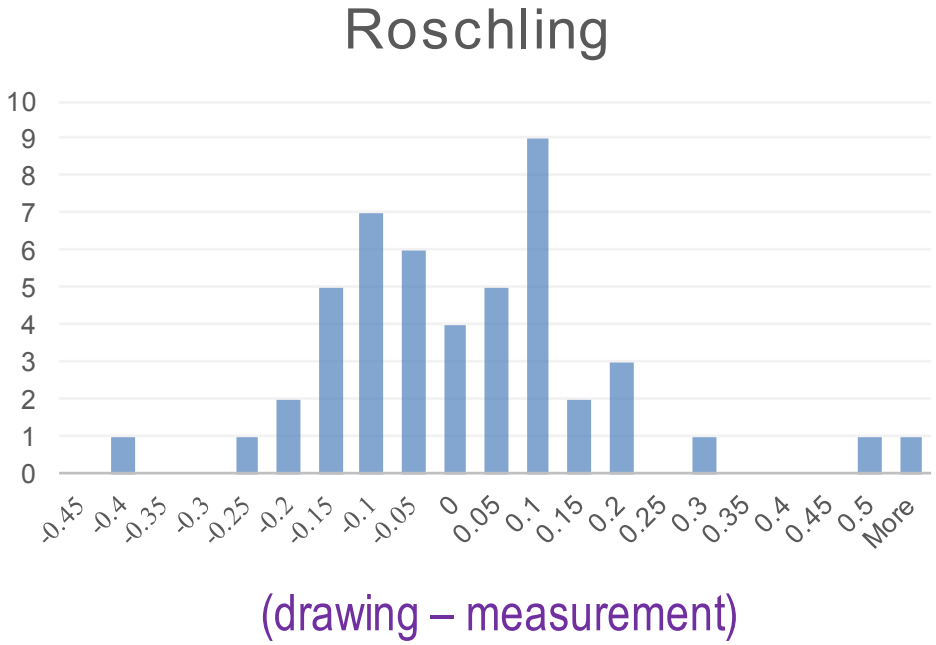
Critical Dimension

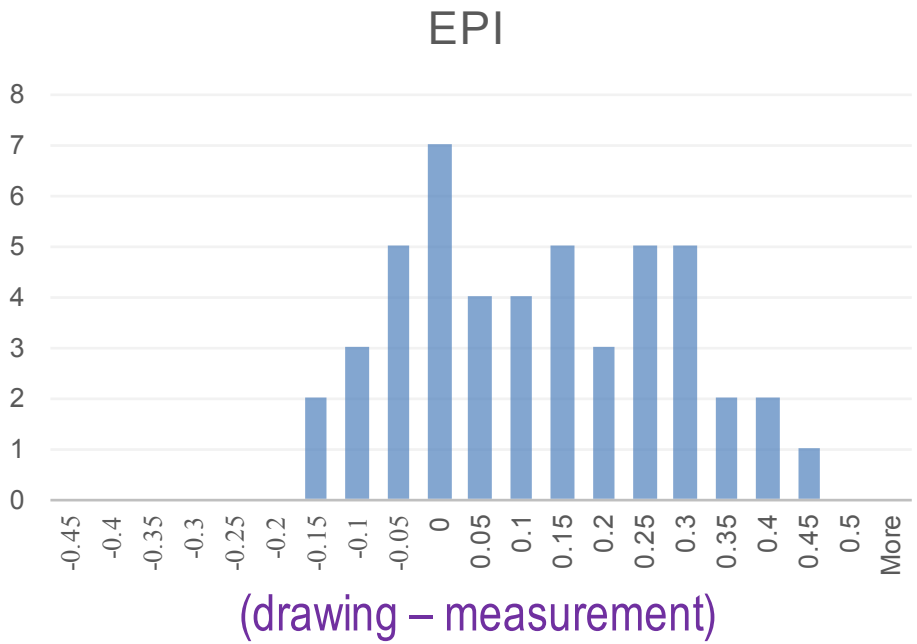
- The most important dimension is the distance between the holes for the inter-submodule connecting plates and the profile slots
- Since we've seen that the slots are well aligned amongst themselves, for the critical dimension measurement, we measure the distance as shown red in the figure



Critical Dimensional Mesurement

- Each position was measured 4 – 6 times: Measurement uncertainty: 0.22mm for Roschling and 0.19mm for EPI
- The difference between measurements and the drawing is: -0.01mm +/- 0.19mm Roschling & 0.09+/-0.16mm
- Both within the measurement uncertainty
- Spread is +/- 0.4mm for Roschling and 0.3mm for EPI

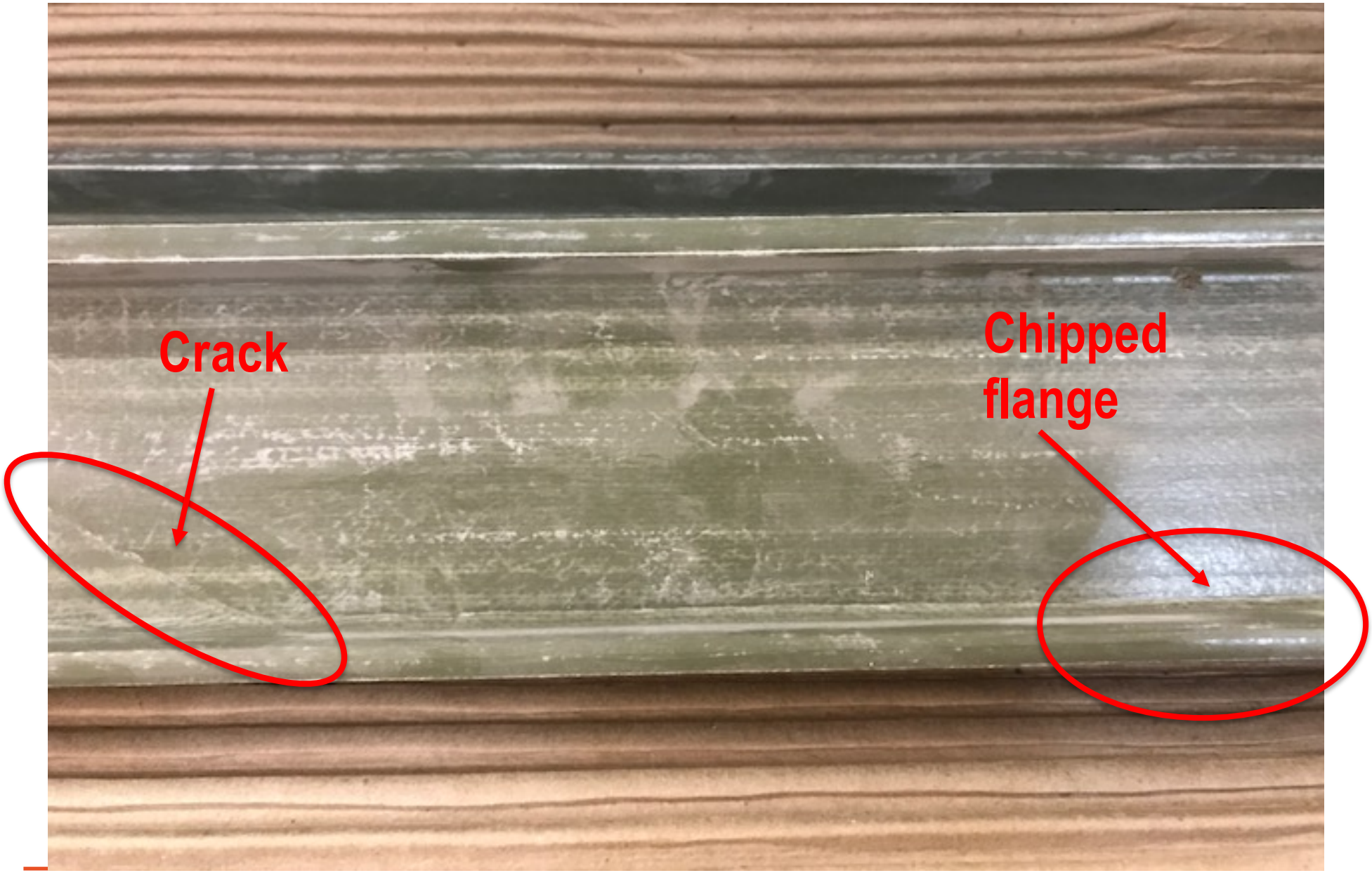




Decision on the Vendor

- We have decided to go with **Roschling** for the following reasons
- EPI
  - Delivered quickly but
  - Their part dimensions were incorrect: Delivered 4" I-beams instead of 3" and ¼" L-bracket thickness instead of 3/8" as clearly indicated in the drawing
  - They delivered new 3" I-beams quickly but these do not have fire retardant coat and do have many cracks that could impact structural integrity
  - Cost is a bit cheaper but no more than 5%
  - Communication at times is difficult.
  - The position of certain holes are shifted to the level that could impact structural integrity
  - The 6" I-beams have much more flaps in the profile slots, burrs and fibers than Roschling

New EPI 3 in I-beam



Decision on the Vendor

- Roschliing
  - Much more precise and careful in their machining and adhere to the drawing as much as they can
  - Their spread from the drawing much more regular than EPI's
  - Willing to work with us on pricing and replacement parts
    - They will send us the hex FRP nuts for free to replace the existing square nuts and drop the price by 30% to match that of the square nuts
  - They provide FRP threaded rods and FRO nuts to SP groups
  - FRP parts have no flaps and much small amount of burrs
  - Good communications

Time Needed for Parts Cleaning

- Based on our experience with four 6" I-beams, four 3" I-beams, 32 L-brackets, threaded rods, FRP nuts, etc, we estimate the following amount of time necessary for complete cleaning process
- 6" I-beams: 2 hours for two people ➔ Total of 8 Man-Hours (Mh) for 2 I-beams per submodule
- 3" I-beams: 30min for two people ➔ Total of 1 Mh/submodule
- L-brackets: 30min for 8 brackets for two people ➔ 1 Mh/submodule
- Total time for cleaning parts for each submodule: 12 Mh w/ 20% contingency
- Can speed up using the deburring tool
- If we have to use resin to further suppress small fiber, curing time needs to be added

Time Needed for Assembly

- For more detailed estimate of assembly time, two of our team worked on the assembly of a sub-module:
- Assembly of the I-bream frames: 25min
  - This process can be shortened by repeated practice
  - Insertion of the 3" I-beams to the pre-mounted L-brackets takes the most time
  - The frame is still a bit flimsy even after tightening the FRP nuts harder but we will test this again when we receive hex nuts.

Time Needed for Assembly, cnt'd

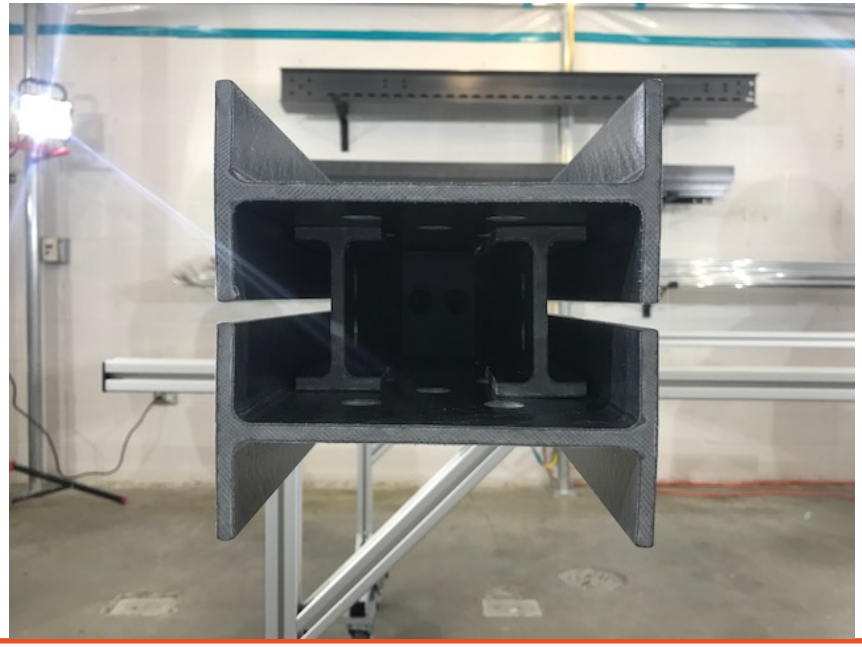
- Insertion of the nuts and placement of profiles: 25min
  - Insertion and placement of the nuts in the profile takes the most time
  - A method can be developed to shorten this time
- Profile alignment and tightening the screws: 25min
  - Tightening the screws to the correct torque required since too much torque on one of the screws will bow the entire profile one way or the other
- The total time for assembly: 1.5Mhr

Time Need for Dis-assembly

- For more detailed estimate of disassembly time, two of our team disassemble a sub-module:
- Unscrewing the M4 screws and collecting them all in a bag: 10min
- Unseating the profiles and sliding the nuts out: 15min
- Unscrewing the FRP nuts from the threaded rods: 10min
- Total time: 0.5MHr

Production – Packaging & Shipping

- We stacked I-beams, L-brackets and the bags of screws, nuts, threaded rods and FRP nuts into as small a package as possible shown below
  - 16”x16.5”x2m
- This package will then be sealed with shrink wrapped, bubble wrapped, edge protected and plastic strapped



Sub-module Construction Sequence

- Given the way the order is processed, to expedite the process for parts preparation, we will ask Roschling to ship the parts as they finish in the following sequence:
  1. 3" Horizontal I-beams: 2x27 = 54
  2. 6" I-beams for top submodile = 2x8=16
  3. 6" I-beams for middle submodile = 2x8=16
  4. 6" I-beams for bottom submodile = 2x8=16
  5. All connecting plates

Conclusions

- We are ready to place an order for the full contingent of I-beams as soon as green light is given
- The production review visit is confirmed to be on May 24
- Procedure for each step is being refined
- Different teams are practicing the assembly, disassembly and packaging to familiarize the procedure
- A bit concerned about the flimsiness of the I-beam frame