Scintillator module prototyping plans

Andy Furmanski

Preliminary Design Review

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Introduction

- While the module design relies on previous concepts as much as possible, this specific design has not been built before
- The sliding cassette concept has also not been done before (to my knowledge)
- Prototyping plans will ensure risks are mitigated early, and failure points can be identified and fixed

Prototype motivation

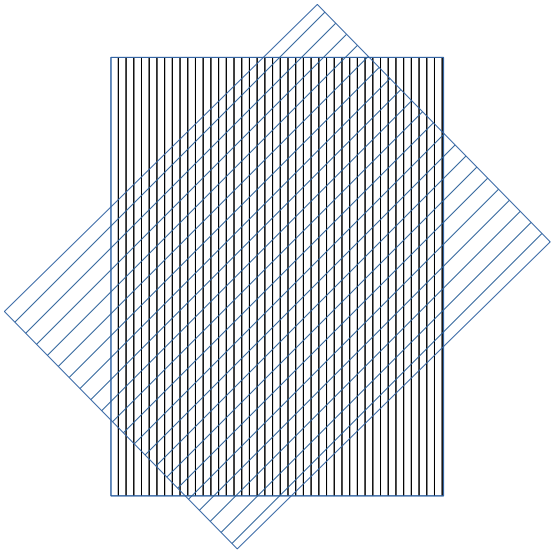
- Fiber manifold and end-cap is a new design
  - Ensuring reproducible light sealing is important
- Confirmation of light yield with full design
- Determine if components can be shrunk (in beam direction)
- Cassette structure is expected to be weak against out-of-plane bending
  - We believe it will be stiff enough to handle, but experimental confirmation is important
- Sliding mechanism is a single-point failure
  - Need to ensure this is a robust system

Mini-modules

- We plan to construct three mini modules
  - At least one will be full-width, but shorter (1/3 length)
  - Considering a full-length, half-width module too
- This will confirm:
  - Design is light tight
  - Design is fast and easy to assemble
  - Light yield is sufficient
    - Full-length module would provide >3m attenuation lengths
  - Readout end is mechanically robust

Mini-module measurements

- Stacking mini-modules allows 3D “tracking” of cosmics
- Measure (confirm) light yield and attenuation lengths
- Real data to tune electronics readout options, thresholds, etc



Non-functional cassette

- Construct a single, non-functional cassette
- Fill with non-scintillating extrusions
- Reduce module width slightly
  - Significant reduction in cost if sheet metal can be <48 inches wide, for small orders
- No WLS fibers
- Real cable extraction mechanism (at least one)

Non-functional cassette tests

- Practise assembling/handling full-size cassette
- Confirm robust sliding mechanism
  - Determine optimal “pull angle”
  - If sliding is inconsistent, design and test alternatives (teflon, rollers, etc)
- Determine real-world tolerances that impact envelope in steel
  - Flatness
  - Out-of-plane twisting
- Determine if extra rigidity is needed

Functional cassette

- Assuming mini modules and non-functional cassette are successful
- Build a “first cassette” using factory equipment
- Confirm factory processes, expected throughput
- Provides additional test-bench for electronics, if needed
- Cassette can be used as a spare, in principle

Prototyping summary

- Mini modules will validate active detector design
- Non-functional cassette will validate construction/installation of mechanical structure
  - Importantly, sliding a large thin cassette (“piece of paper”) into the steel gaps
- Both of these will begin this summer, giving us time to re-design components if necessary, and still construct/install on time
- Final functional cassette demonstrates full factory process, in advance of 2nd factory construction and full scale production