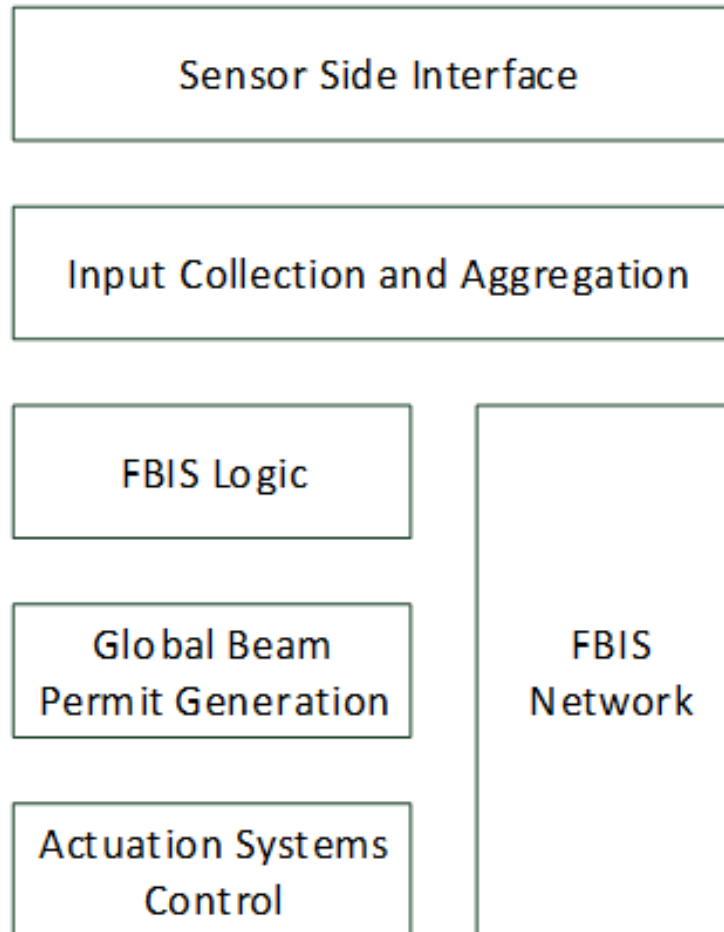




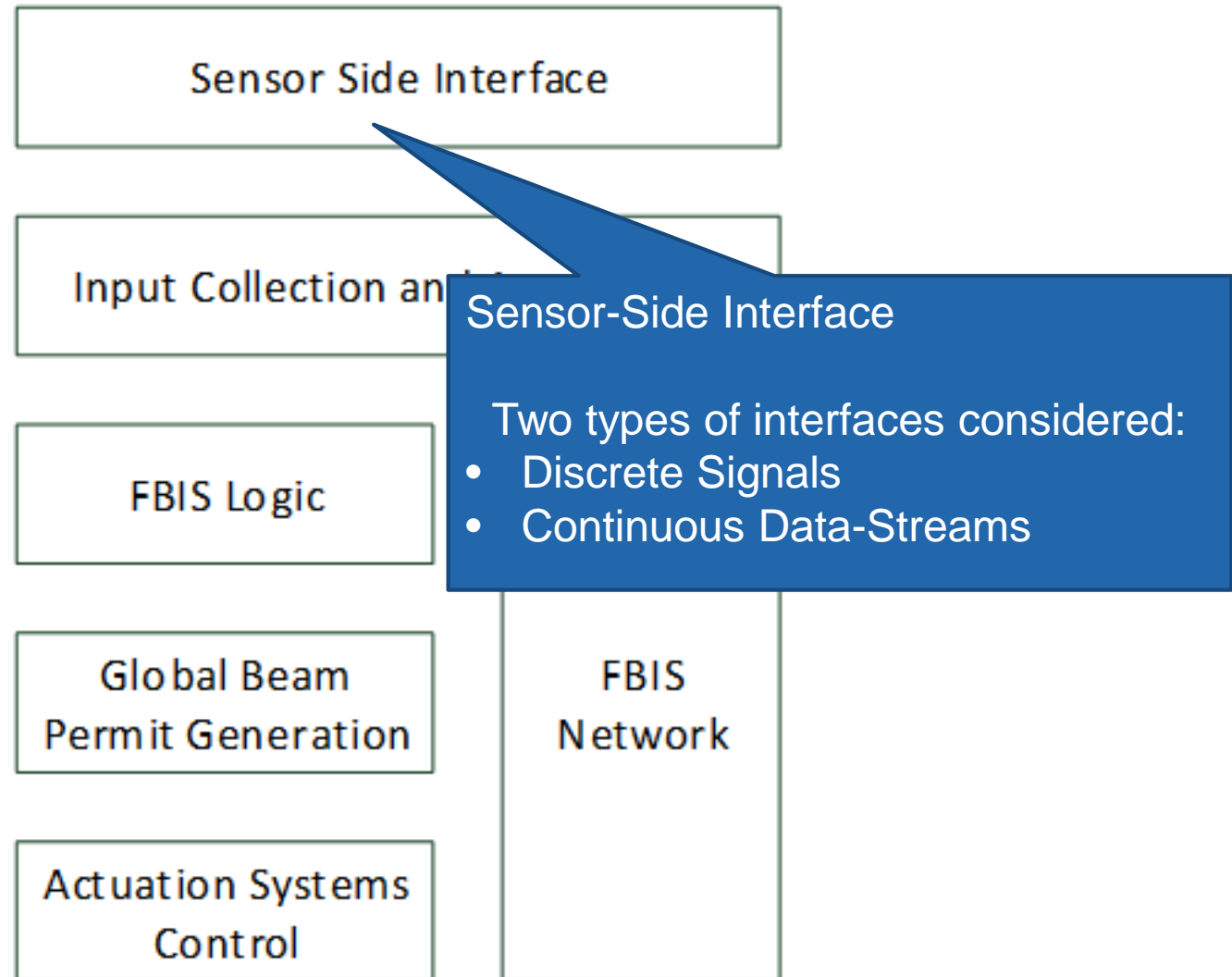
# FBIS Architectural Design Options

14.08.2017

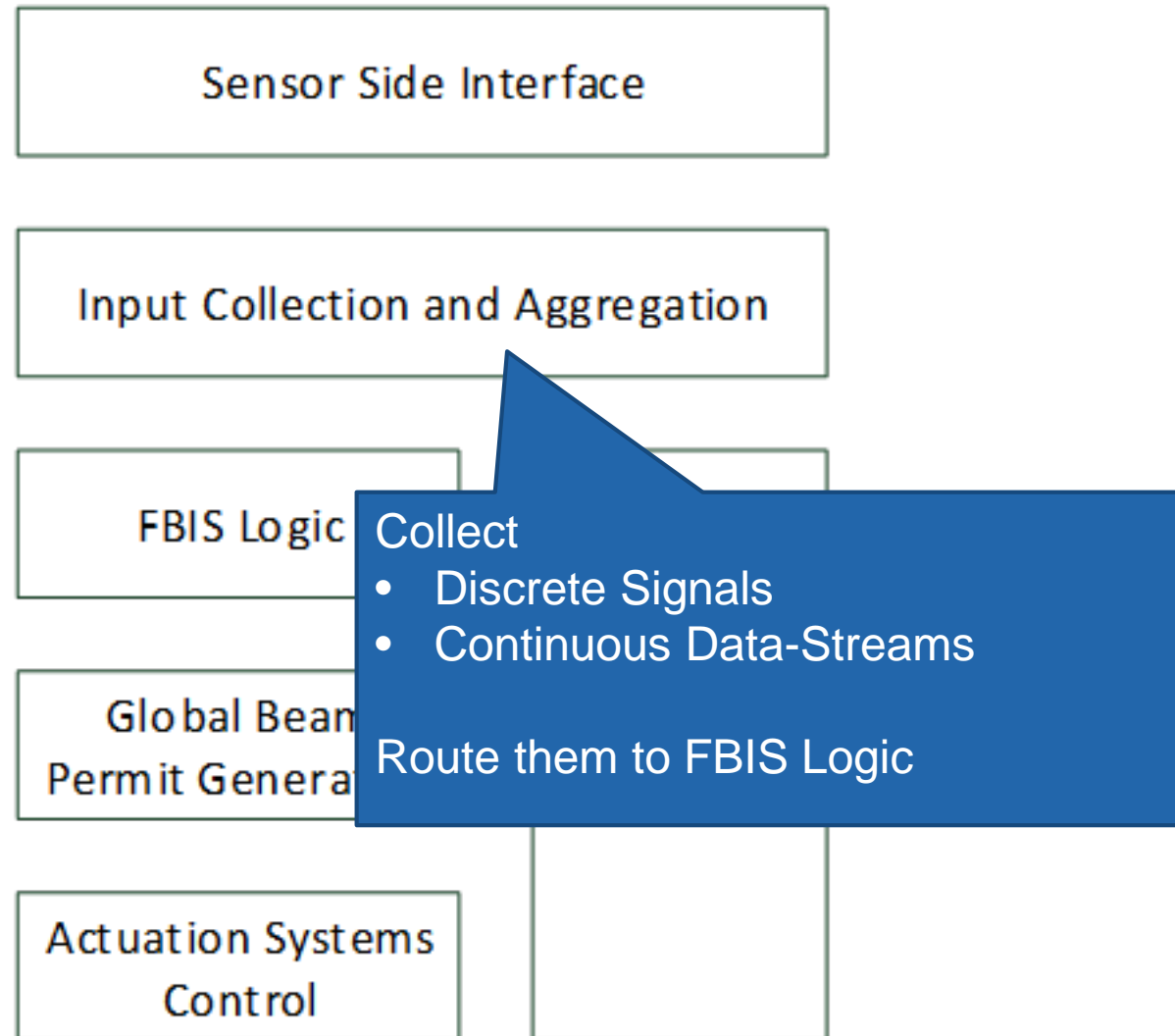
Goal: Collect and discuss main architectural design options for FBIS



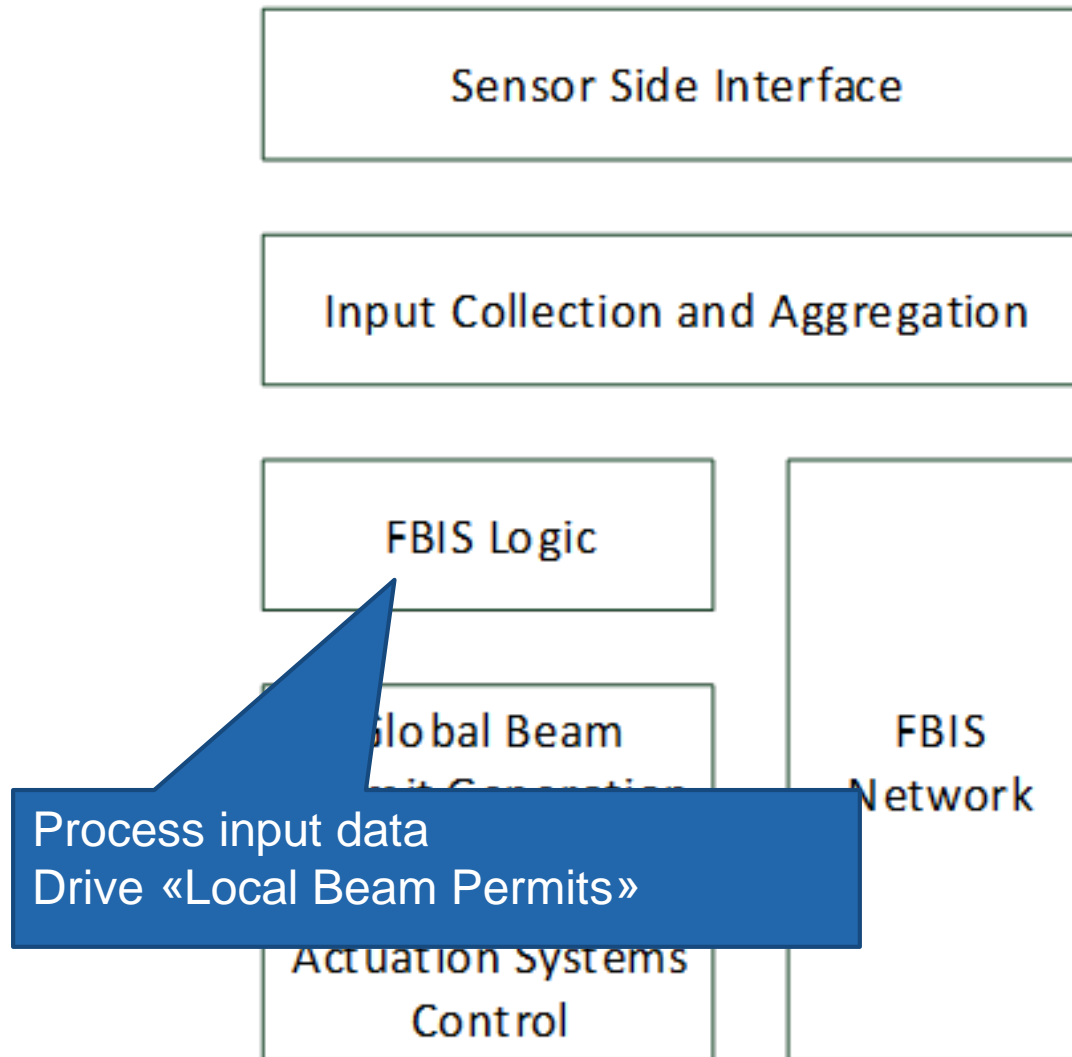
# Approach – Design Elements



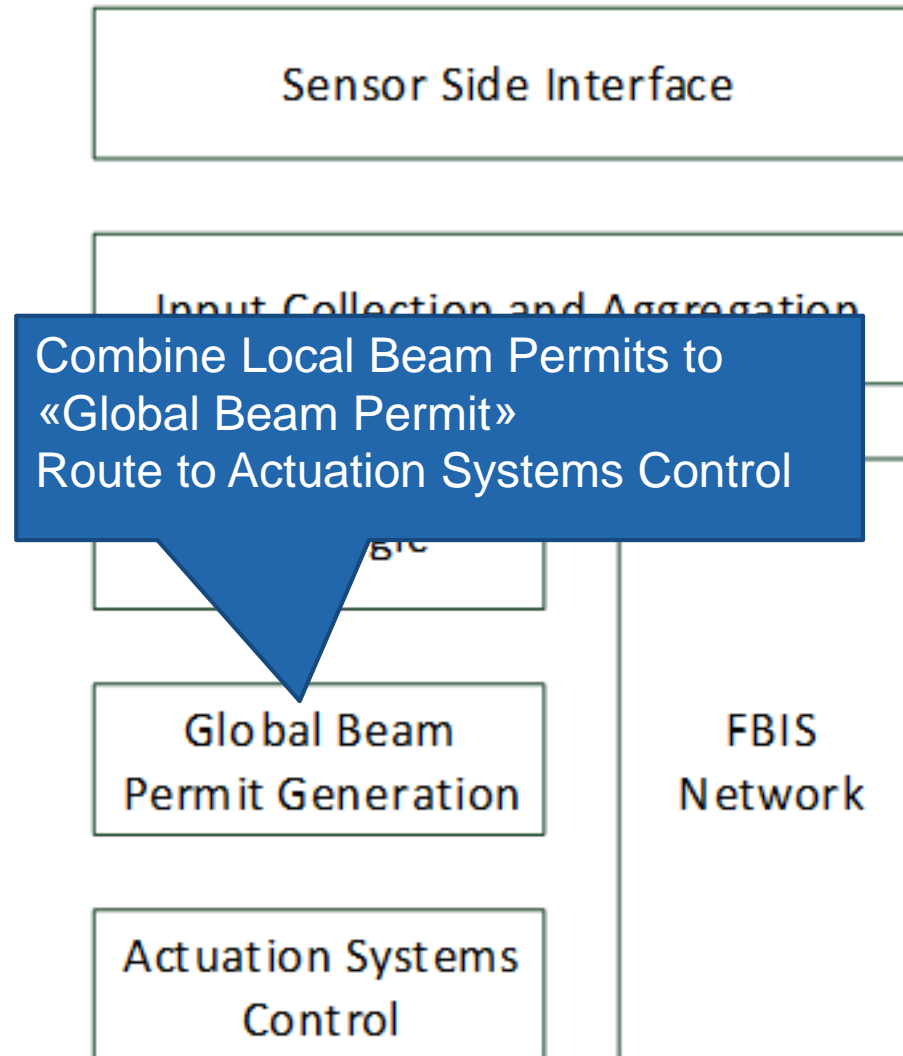
# Approach – Design Elements



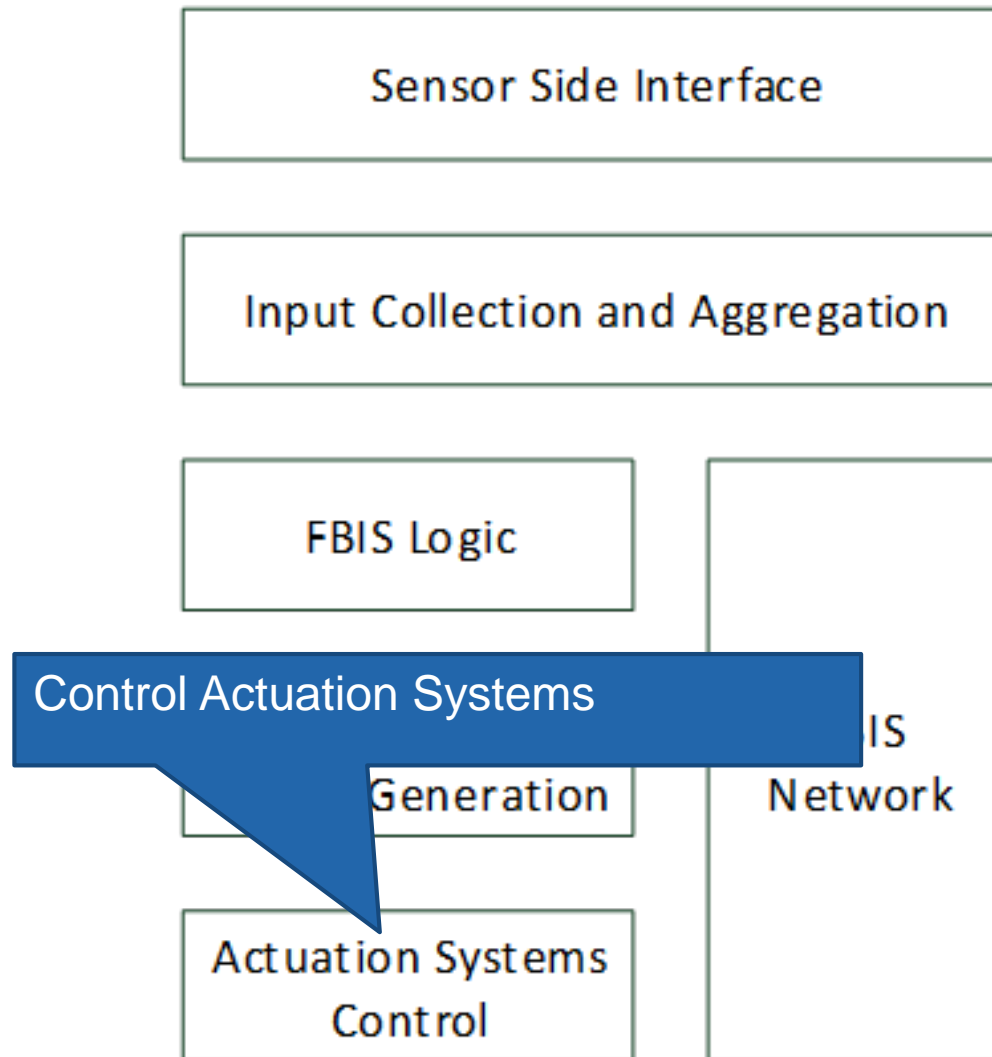
# Approach – Design Elements



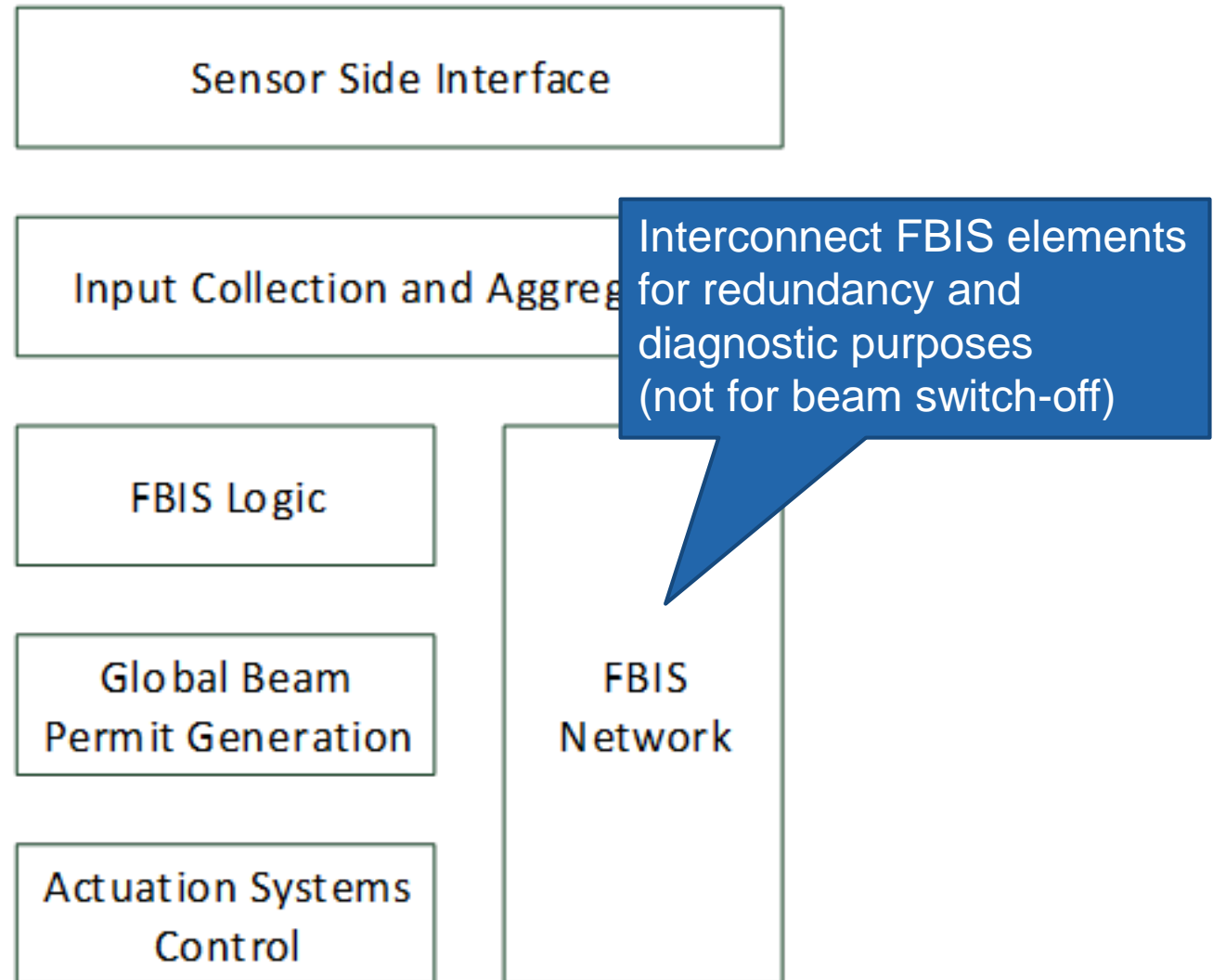
# Approach – Design Elements



# Approach – Design Elements



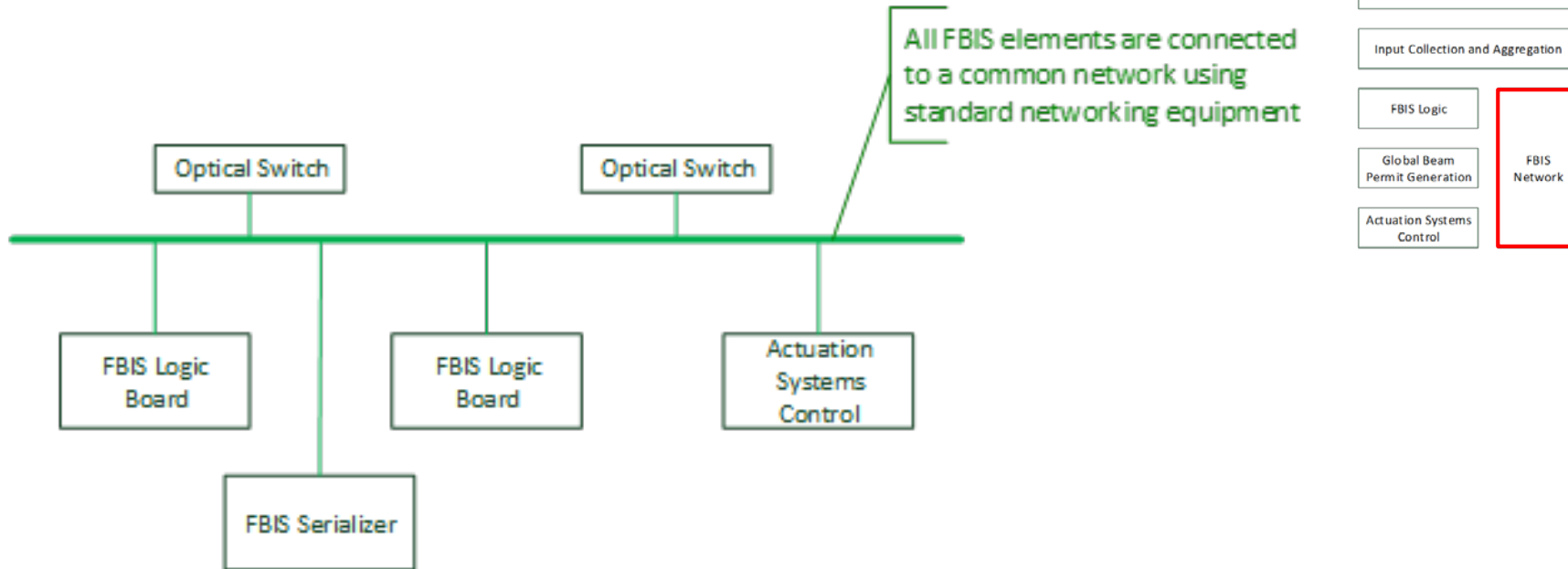
# Approach – Design Elements





# FBIS Network

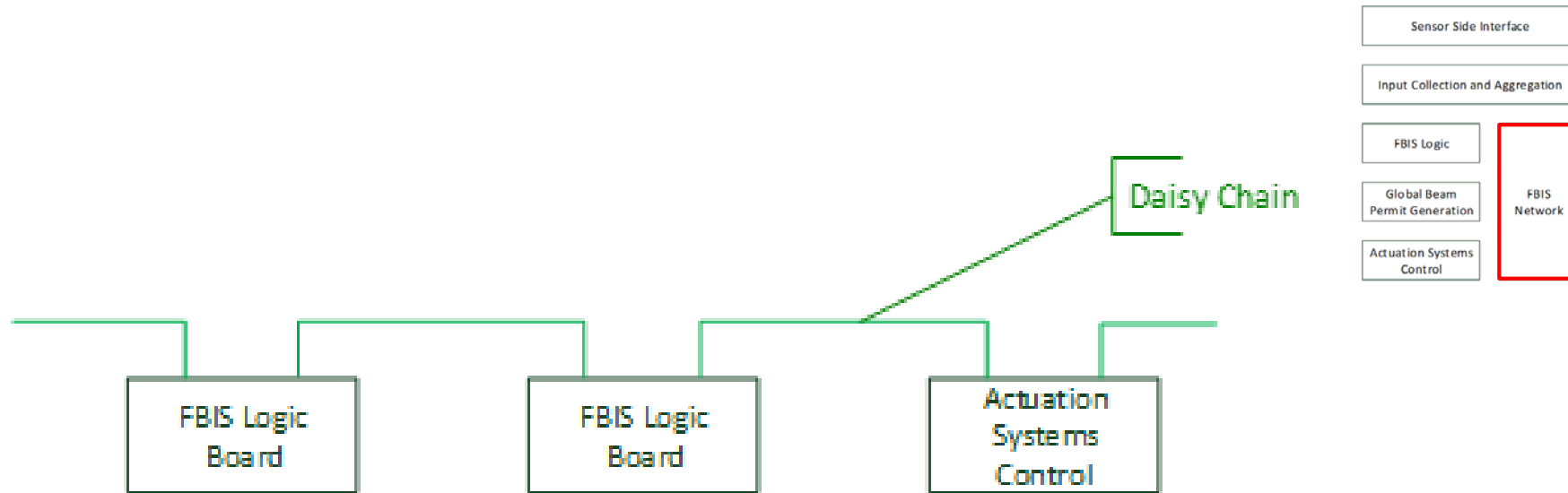
## - Dedicated FBIS Network



Pro	Con
P104 Very scalable approach	C92 Latency might be difficult/impossible to «forecast»

# FBIS Network

## - Daisy-Chained FBIS Elements Communication

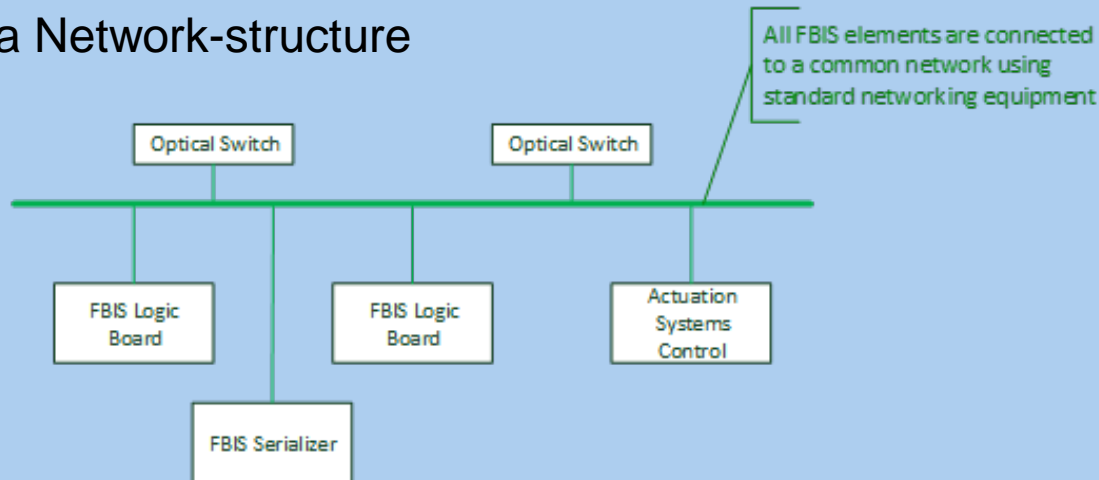


Pro	Con
	C93 If one node fails, the communication is interrupted → more clever topology needed
	C94 Every node might introduce latency

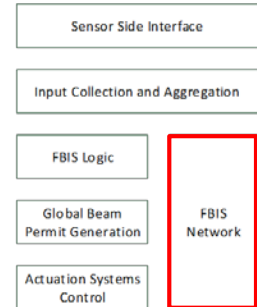
# FBIS Network

## Conclusion

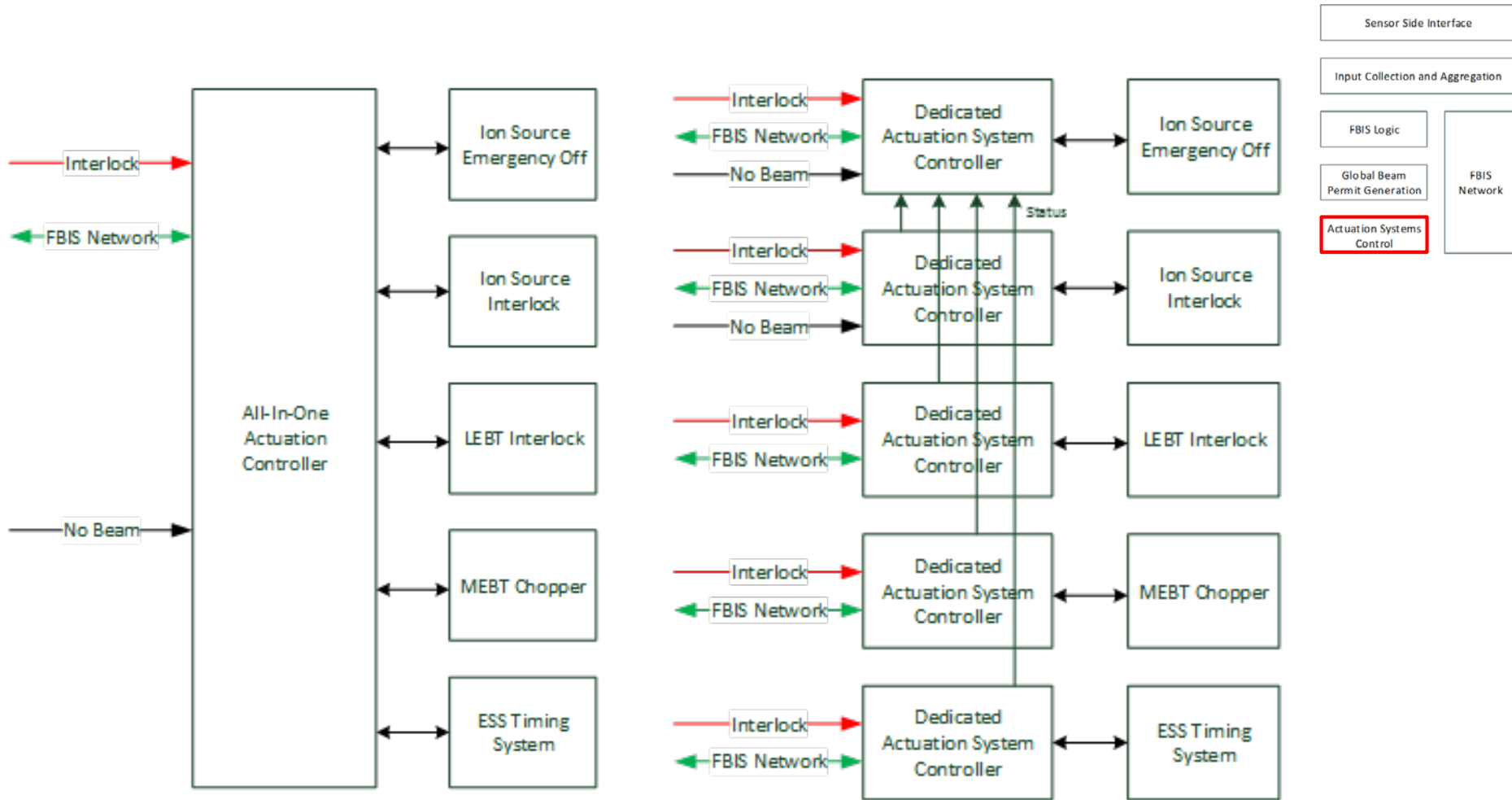
- Use a Network-structure



- It is expected that today's state of the art technology has low enough latencies such that they can be neglected (for diagnostic purposes). However, this has to be confirmed (↓C92)
- Use a separate dedicated (low latency) interface to request a beam-switch-off



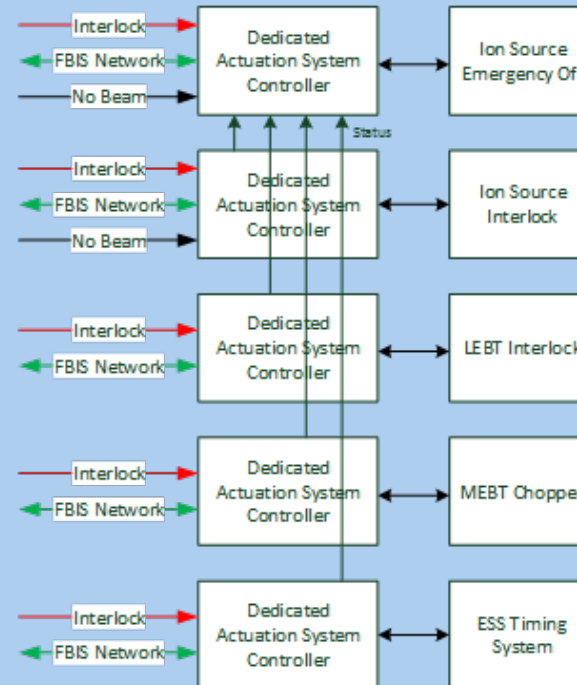
# Actuation Systems Control



# Actuation Systems Control

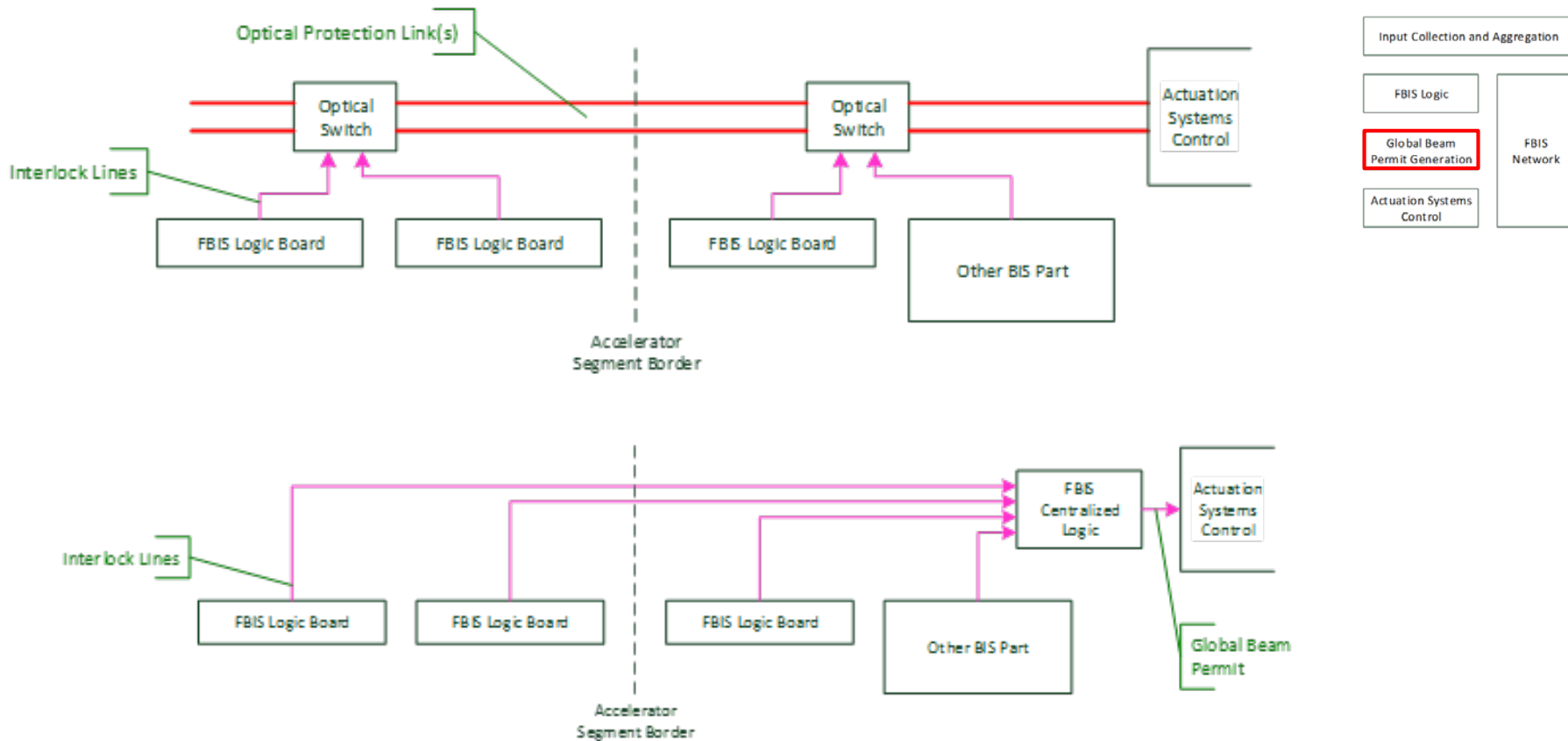
## Conclusion

- Use dedicated controllers



- Failures of Actuation Systems and Controllers shall be detected and lead to the protected state
- If possible: The same hardware framework as for Interface to Sensor Systems

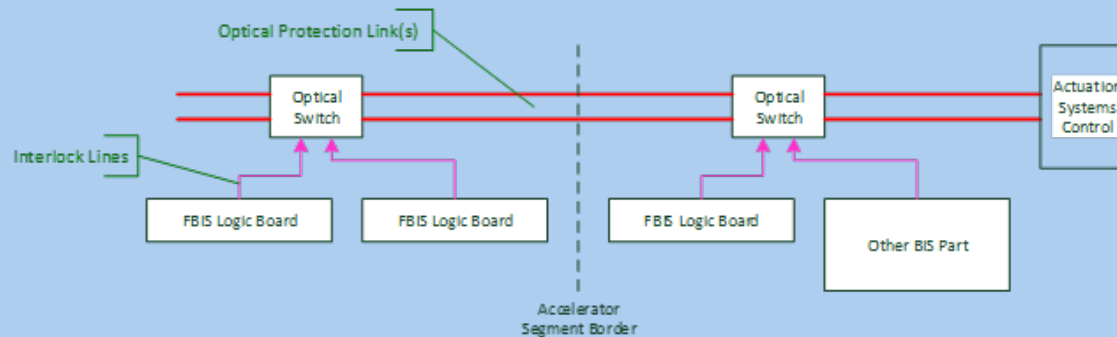
# Global Beam Permit Generation



# Global Beam Permit Generation

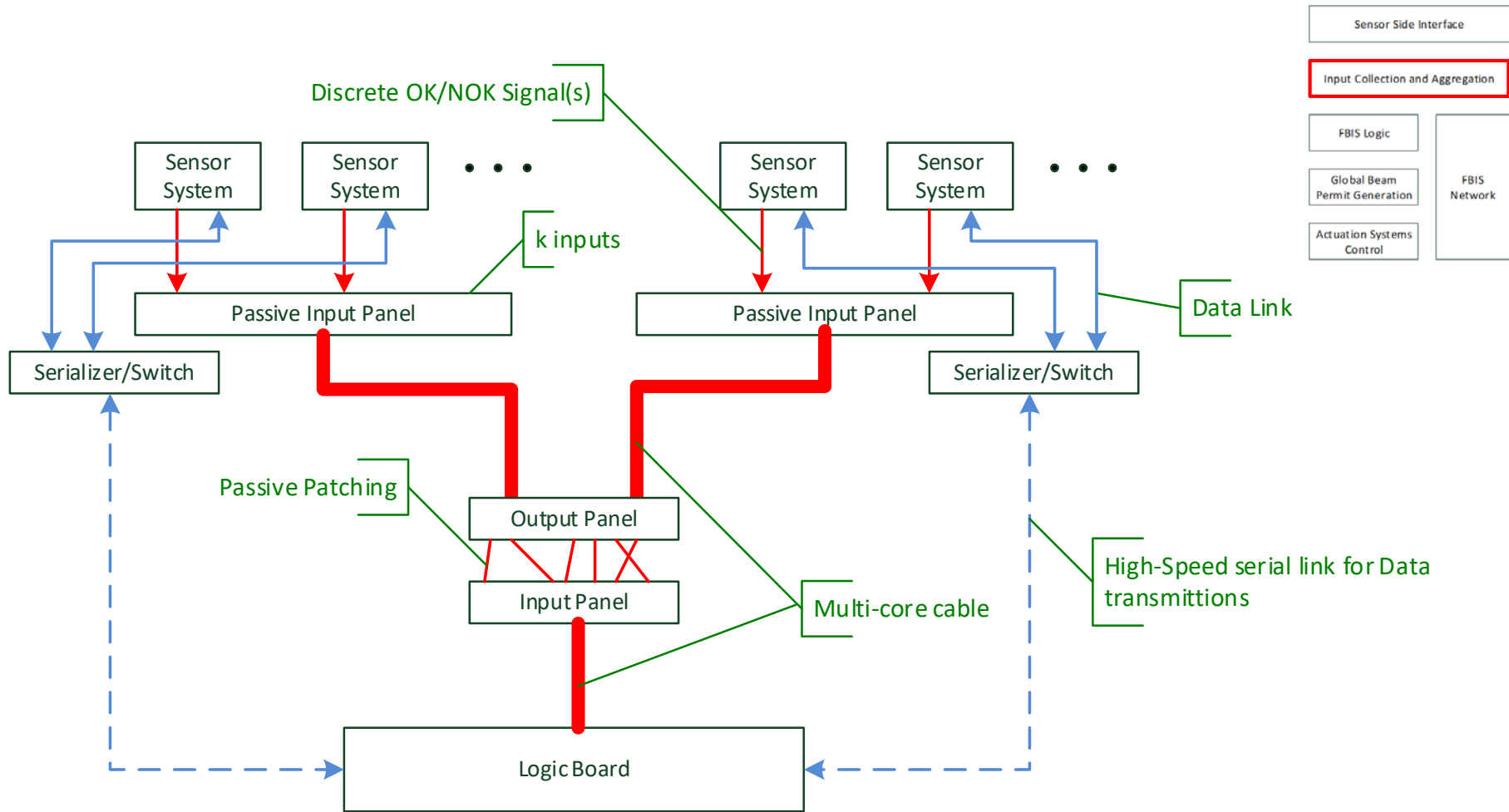
## Conclusion

- Use an (Optical) Protection Line



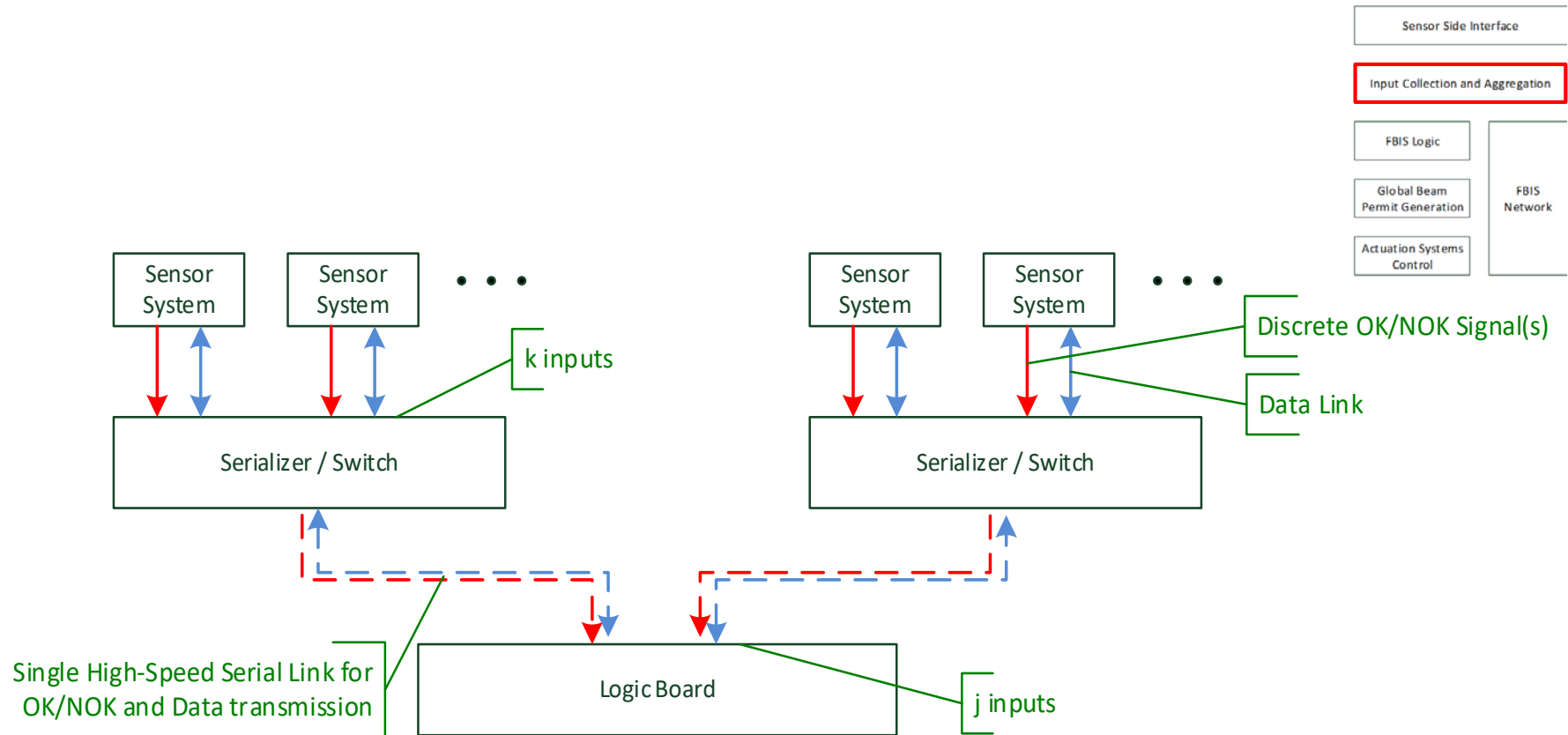
- Make the Protection Line bi-directional
- Make the Protection Line redundant
- Foresee a degraded mode (operation with one one line)
- Latency introduced by a Repeater is considered to be low
- Realize the Repeater such that:
  - it can be «attached» to different FBIS elements
  - other BIS Parts have direct access to the Protection Line

# Input Collection and Aggregation





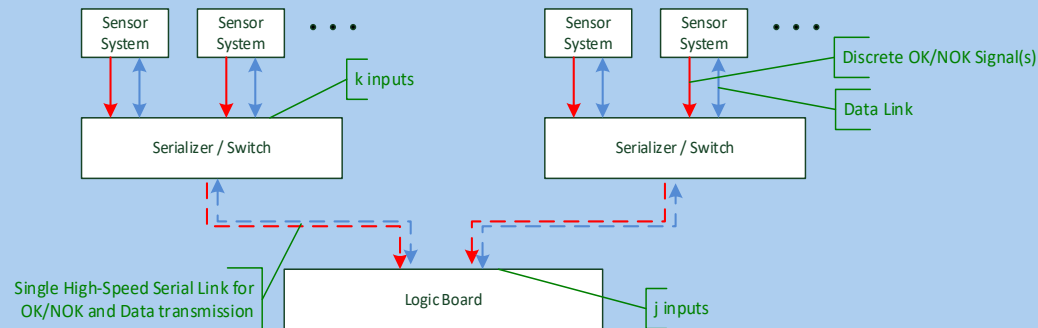
# Input Collection and Aggregation



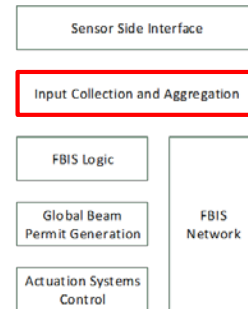
# Input Collection and Aggregation

## Conclusion

- Signal collection and aggregation to high-speed serial link

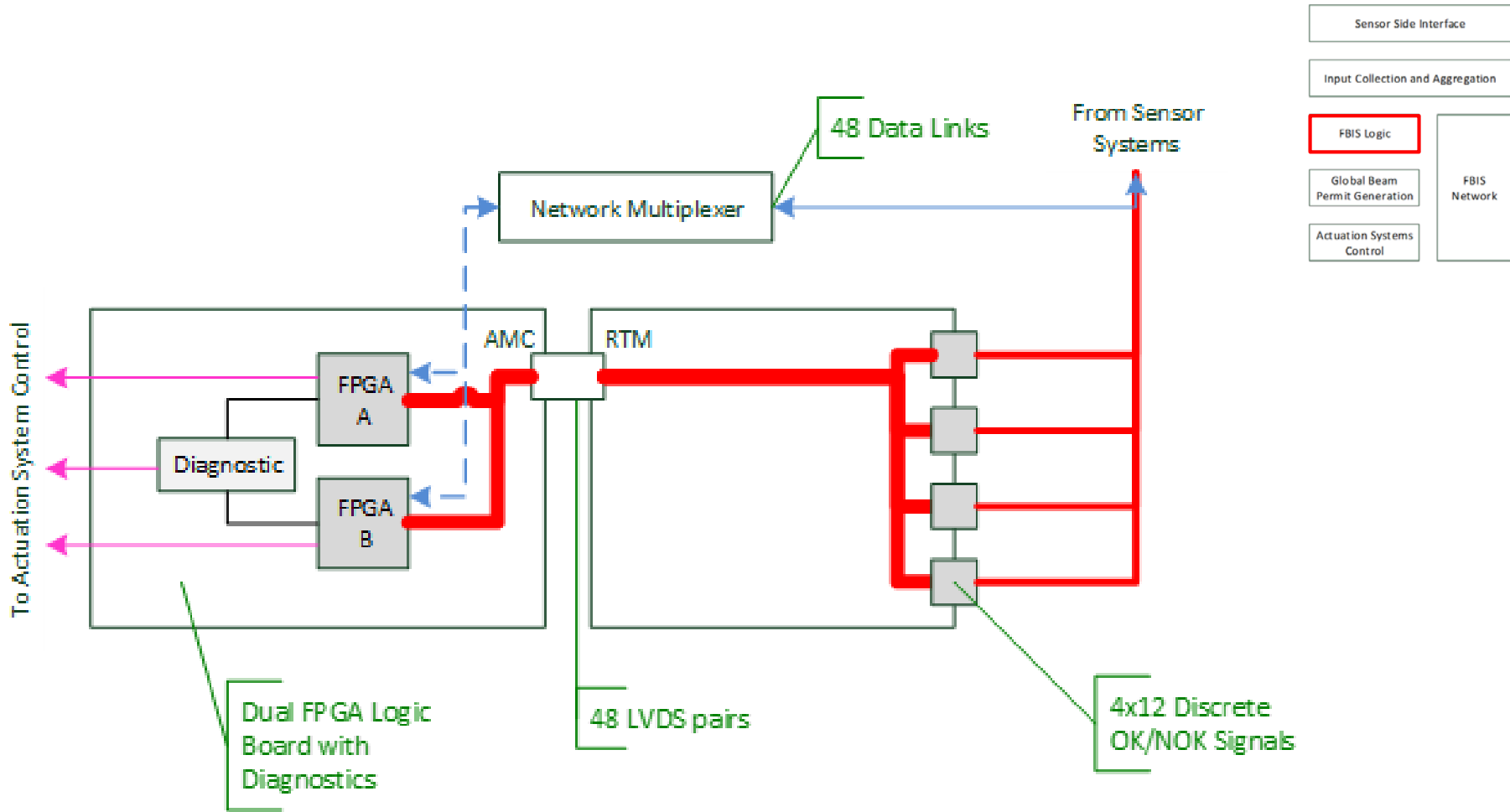


- Serializer shall be fully redundant
- It is expected that latency introduced by serialization is low enough (to be confirmed)
- One Serializer shall feature multiple serial links
- Serializer shall be realized such that it can read and generate signals
- Serializer firmware shall be generic for all Serializers (if possible)



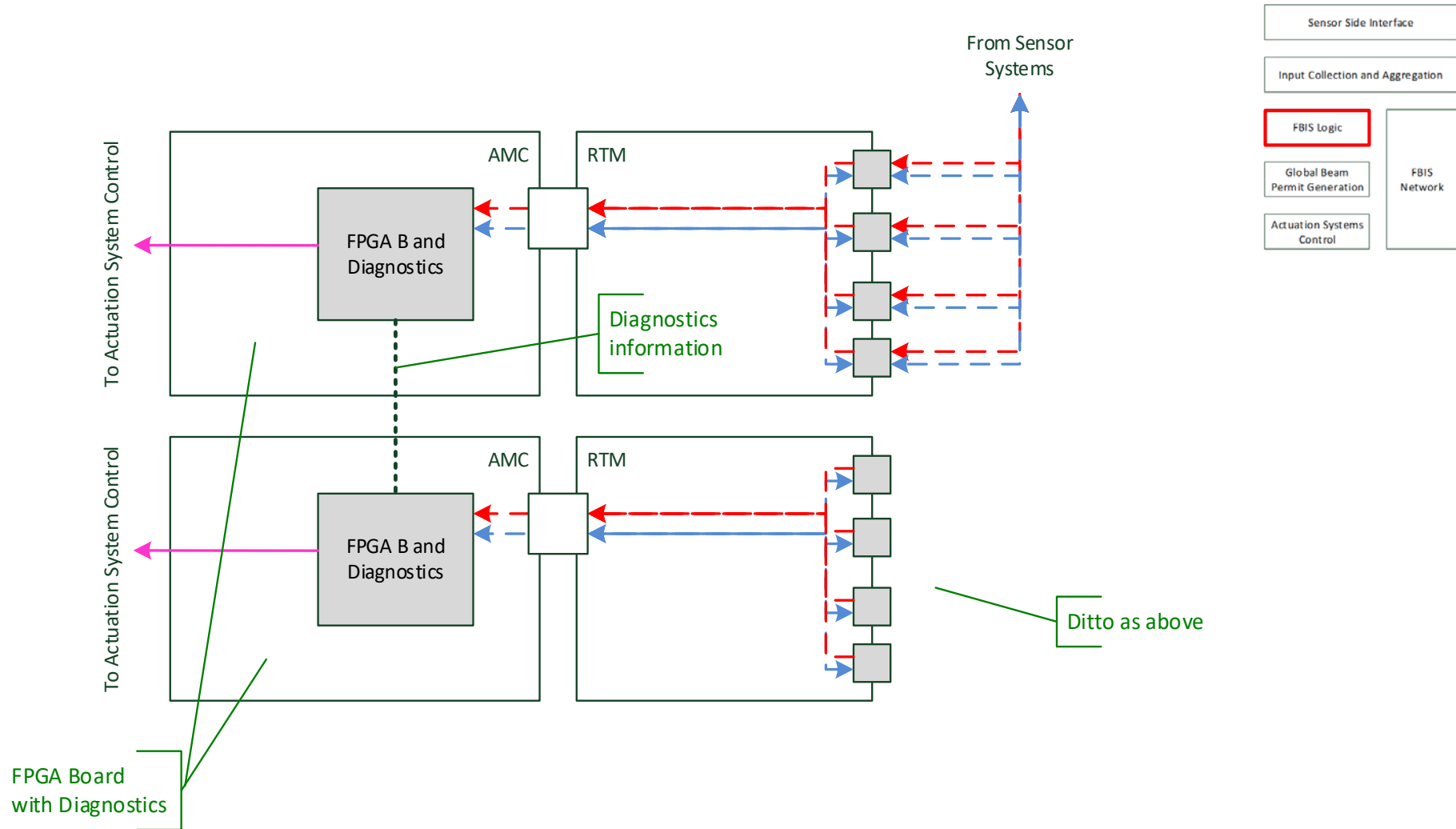
# FBIS Logic

## - Point-to-Point Discrete On Board 1002



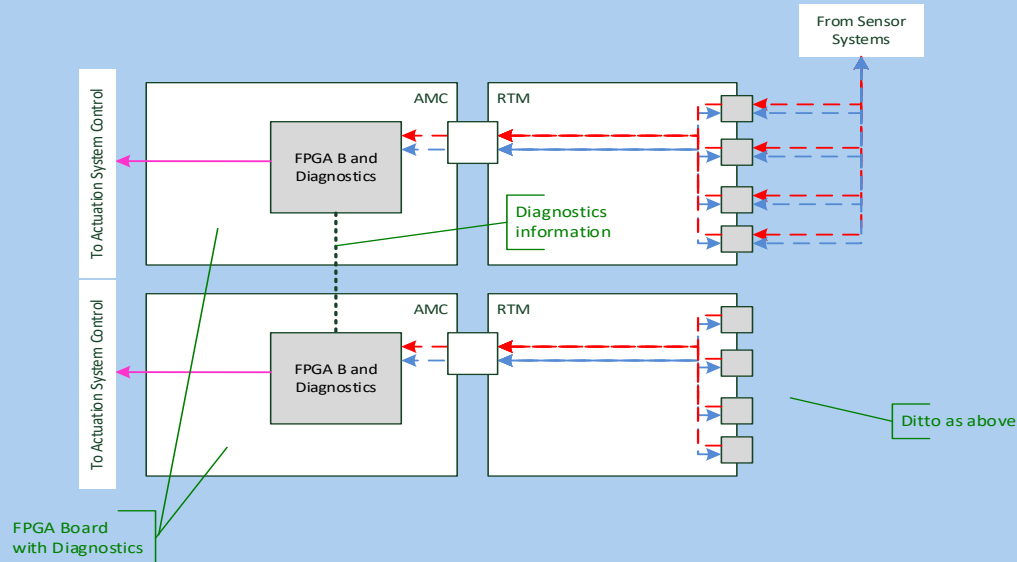
# FBIS Logic

## - Fully Serialized Dual Board 1002

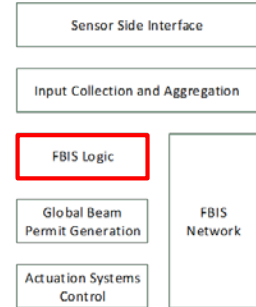


## Conclusion

- Follow the «Fully Serialized Dual Board 1oo2» pattern



- Both boards shall redundantly compute decision logic
- Cross-verification between the boards
- Foresee a Degraded Mode (operation with a single board only)



# Sensor Side Interface

- Discrete Interface
  - 3-Wire Current Loop Interface
  - 2-Wire Differential RS-422 with Error-Detection
  - Optical Transmission
- Data Link Interface
  - Ethernet
  - RS-422
  - High-Speed Serial Link



# Sensor Side Interface

## Conclusion

- Different types of interfaces shall be supported
- For Discrete Signals:
  - RS422 with Error Detection
- For Data Links:
  - Network with low-level protocol
- Galvanic Isolation shall be foreseen



For more information see document:

**FBIS\_Architectural\_Design\_Options**

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