

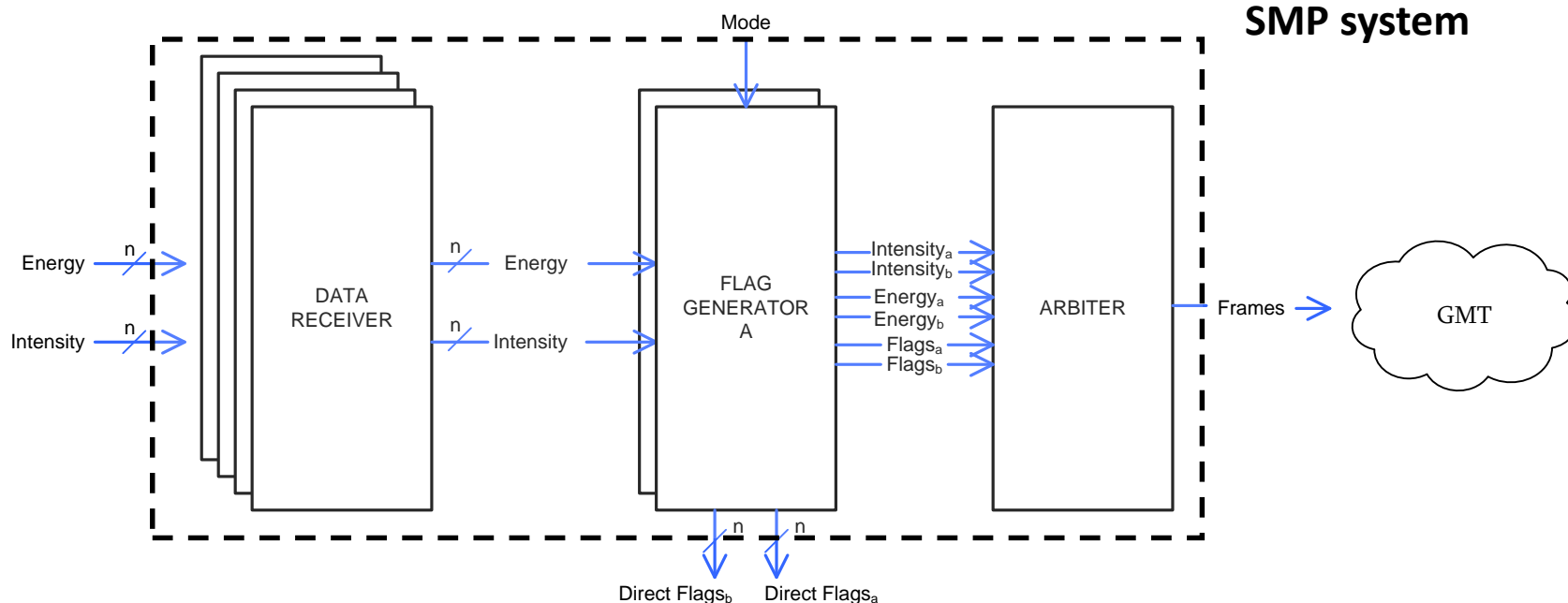


Safe Machine Parameters
STABLE_BEAMS
MOVEABLE_DEVICES



SMP Team TE/MPE/MI 11th September 2009





- Hardware Process (VHDL)
- VME system: One for LHC another for SPS
- Multiple data sources to increase dependability
- Duplication of critical process
- Arbitration of the data from the two sources
- GMT output cross-checked with the original data
- FESA class for monitoring and MODE

SPS SYSTEM

Inputs:

Energy

Intensity (10^8)

Intensity (10^{10})

Direct Outputs:

E400_FLAG linked to BA4

E450_FLAG linked to BA4

SPS_PROBE_BEAM_FLAG linked to BA4

SPS_PROBE_BEAM_FLAG linked to BA6

Serial Outputs (through GMT):

SPS_SAFE_BEAM flag

LHC SYSTEM

Inputs:

Energy

Intensity-1 (10^8) Intensity-1 (10^{10})

Intensity-2 (10^8) Intensity-2 (10^{10})

Machine Mode

Direct Outputs:

BEAM_PRESENCE_FLAG_1 linked to BA6

BEAM_PRESENCE_FLAG_2 linked to BA4

SAFE_BEAM_FLAG_1 linked to BA6

SAFE_BEAM_FLAG_2 linked to BA4

Serial Outputs (through GMT):

ENERGY

INTENSITY 1

INTENSITY 2

All Flags above +

STABLE_BEAMS flag

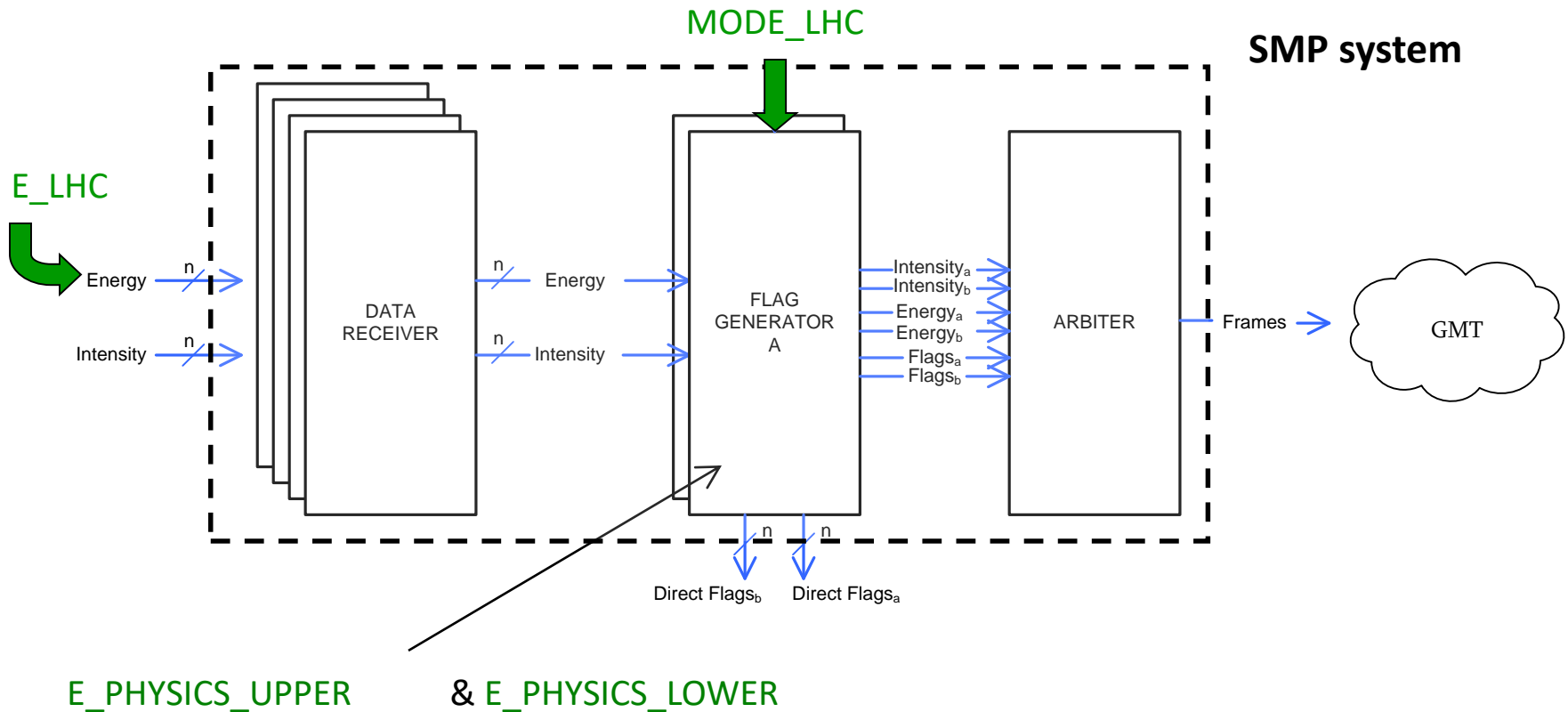
MOVEABLE_DEVICES_ALLOWED_IN flag

STABLE_BEAM & *MOVEABLE_DEVICED_ALLOWED_IN* flags need:

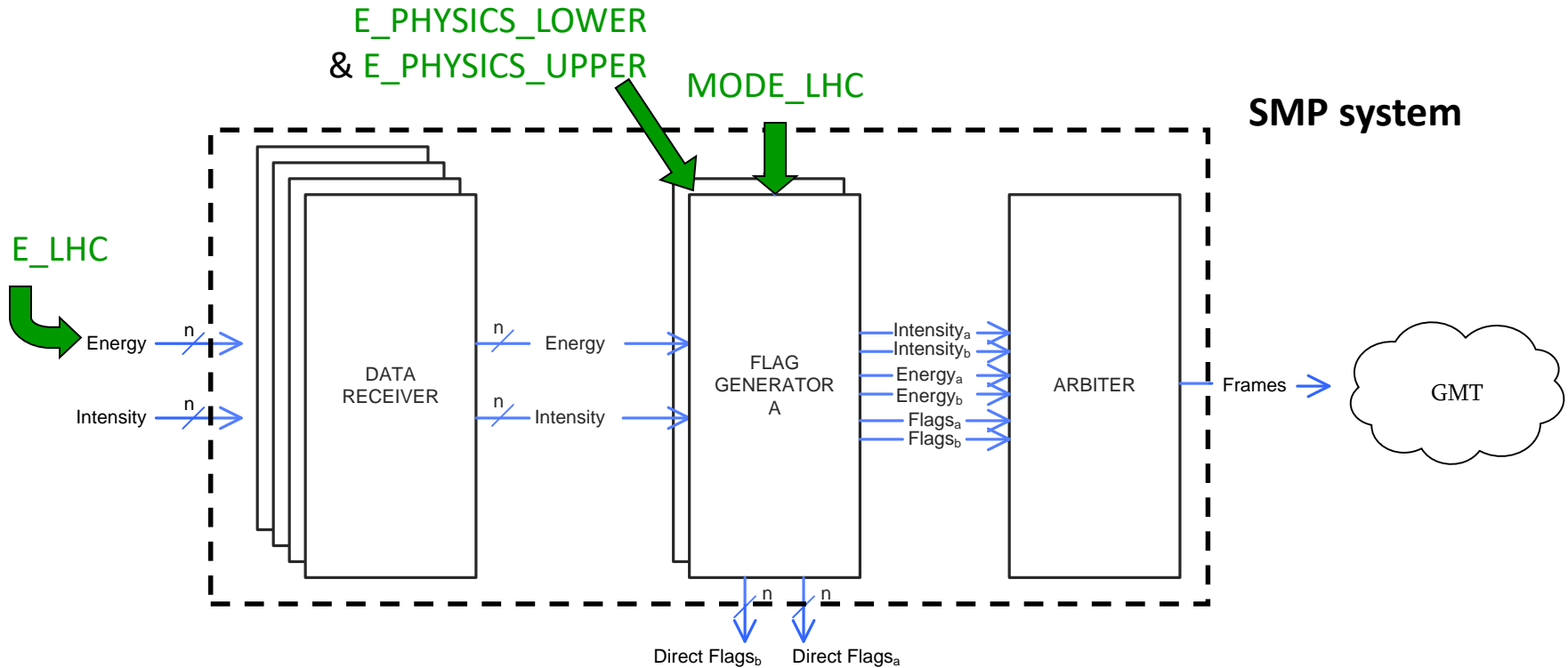
- Machine Energy: **E_LHC**
- Machine Mode: **MODE_LHC**
- Upper Limit of “Physics Energy”: **E_PHYSICS_UPPER**
- Lower Limit of “Physics Energy”: **E_PHYSICS_LOWER**

STABLE BEAM FLAG = “TRUE” when
(**E_PHYSICS_LOWER** < **E_LHC** < **E_PHYSICS_UPPER**)
AND
MODE_LHC = “STABLE”

MOVEABLE DEVICES ALLOWED IN FLAG = “TRUE” when
(**E_PHYSICS_LOWER** < **E_LHC** < **E_PHYSICS_UPPER**)
AND
(**MODE_LHC** = “STABLE” OR
MODE_LHC = “UNSTABLE”)



Stored in I2C FLASH,
 can only be changed by expert...
 (dis-assemble SMP system to access)
 Redundant... Check sum... very robust!



“Threshold” Values written through FESA..
can only be changed by expert... ‘soft’ process...

Not as safe as specification requires

-good compromise for coming months

I2C FLASH thresholds act as absolute upper and lower limits

I2CFLASH : E_PHYSICS_UPPER = 3510 GeV

I2CFLASH : E_PHYSICS_LOWER = 440 GeV

OPERATOR then writes required upper and lower limits

OPERATOR : OPER_PHYSICS_UPPER = ??? GeV

OPERATOR : OPER_PHYSICS_LOWER = ??? GeV

RULES for STB and MDI (otherwise blocked FALSE)

OPERATOR must write both _UPPER and _LOWER

OPER_PHYSICS_UPPER <= E_PHYSICS_UPPER

OPER_PHYSICS_LOWER >= E_PHYSICS_LOWER

OPER_PHYSICS_UPPER > OPER_PHYSICS_LOWER

OPER_PHYSICS_UPPER – OPER_PHYSICS_LOWER < 20 GeV

Then we use this OPERATOR window...

440 – 460 GeV

Sequencer has ultimate control of the flags...

MODE written

If SMP DOES NOT receive a new mode

FLAGS may be TRUE during INJECTION.

EDMS document = signatures = all parties accept this risk

flags change at $E = \text{INJ}$

CMS

ATLAS

LHCb

Yes

ALICE

TOTEM

Yes

LHCf

TEST MODE = FORCE flags TRUE = NOT part of SMP specification

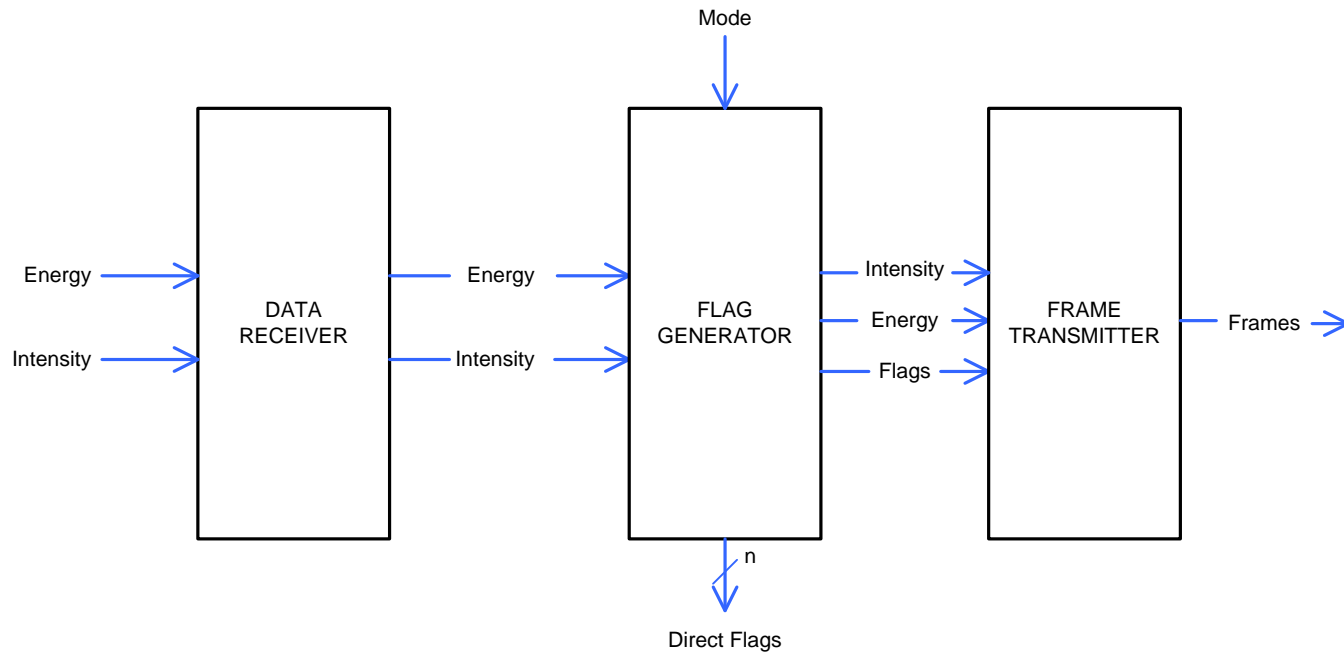


FIN

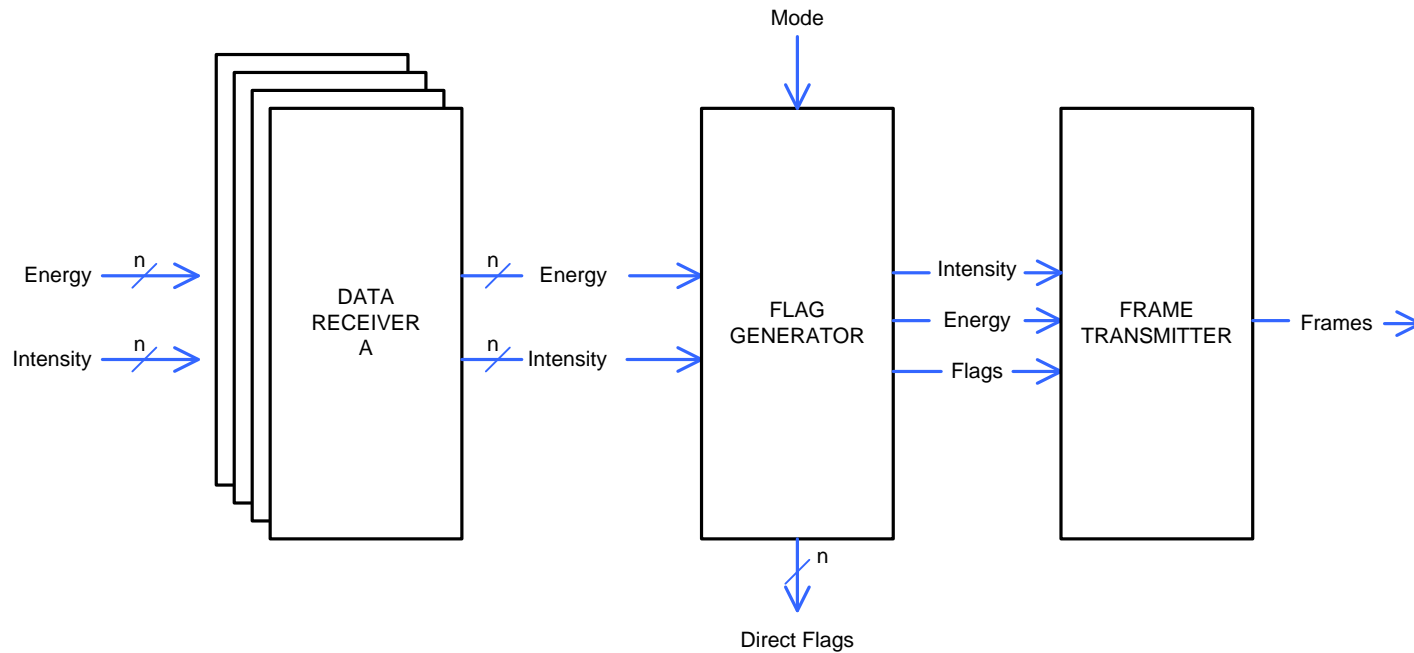
flags change at E = INJ

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TOTEM	M. Deile
LHCf	A-L. Perrot D. Macina

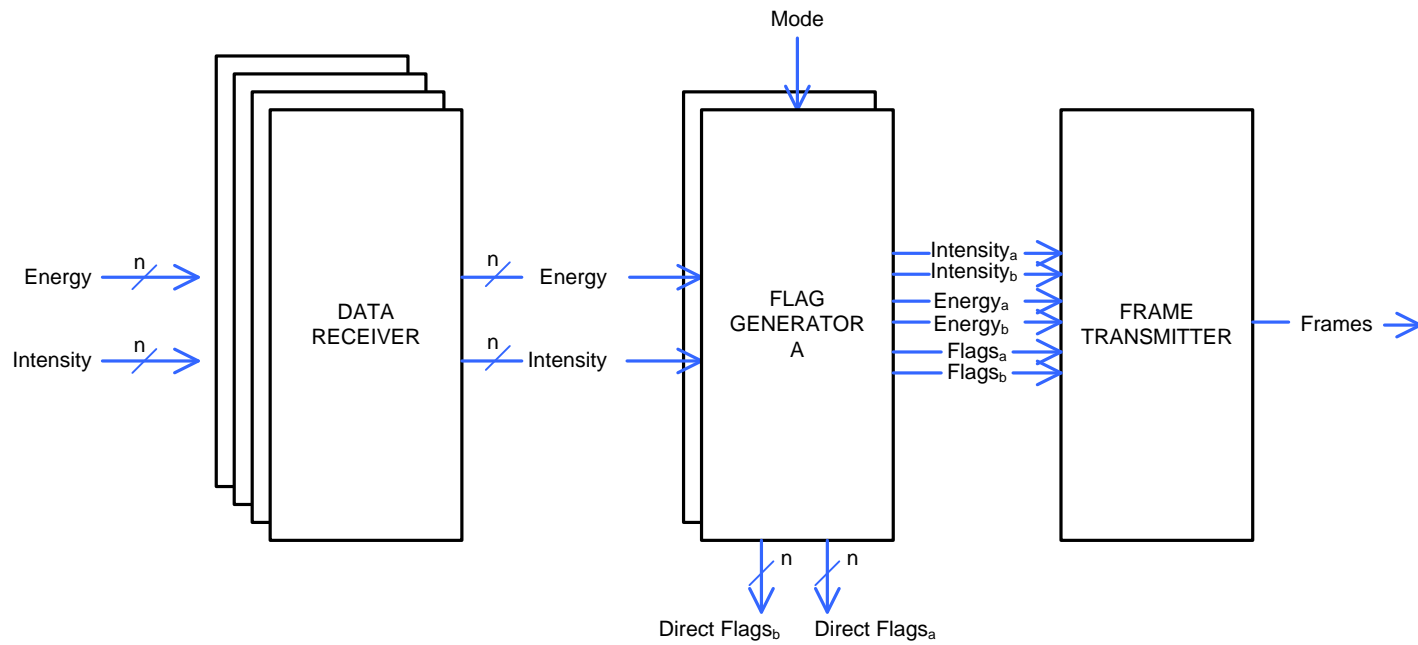
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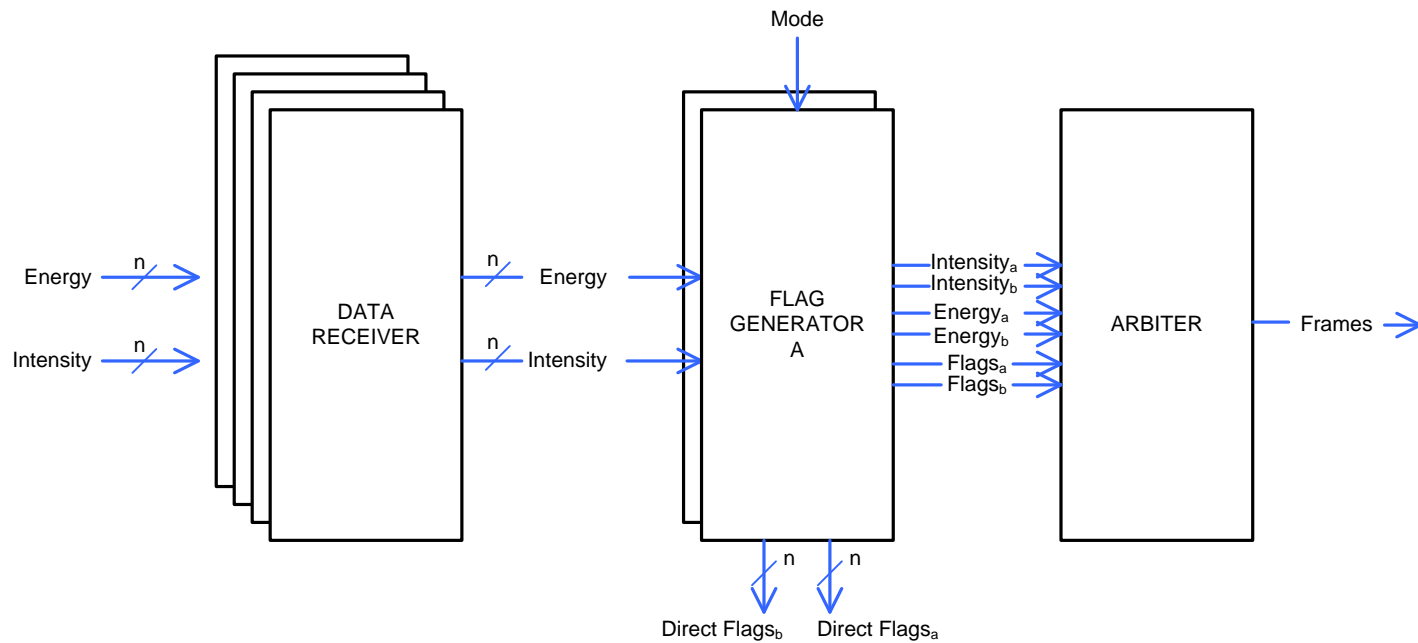
The basic function of the SMP...



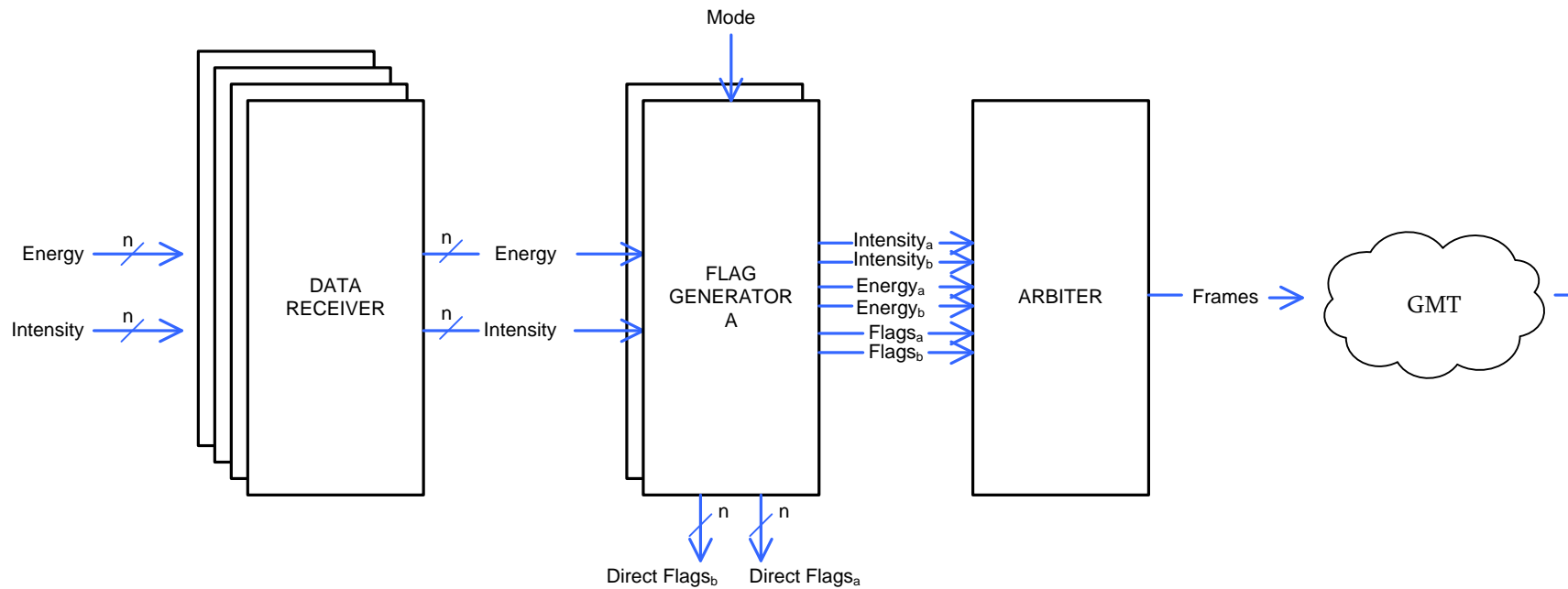
The first step is to accommodate multiple data sources to increase dependability...



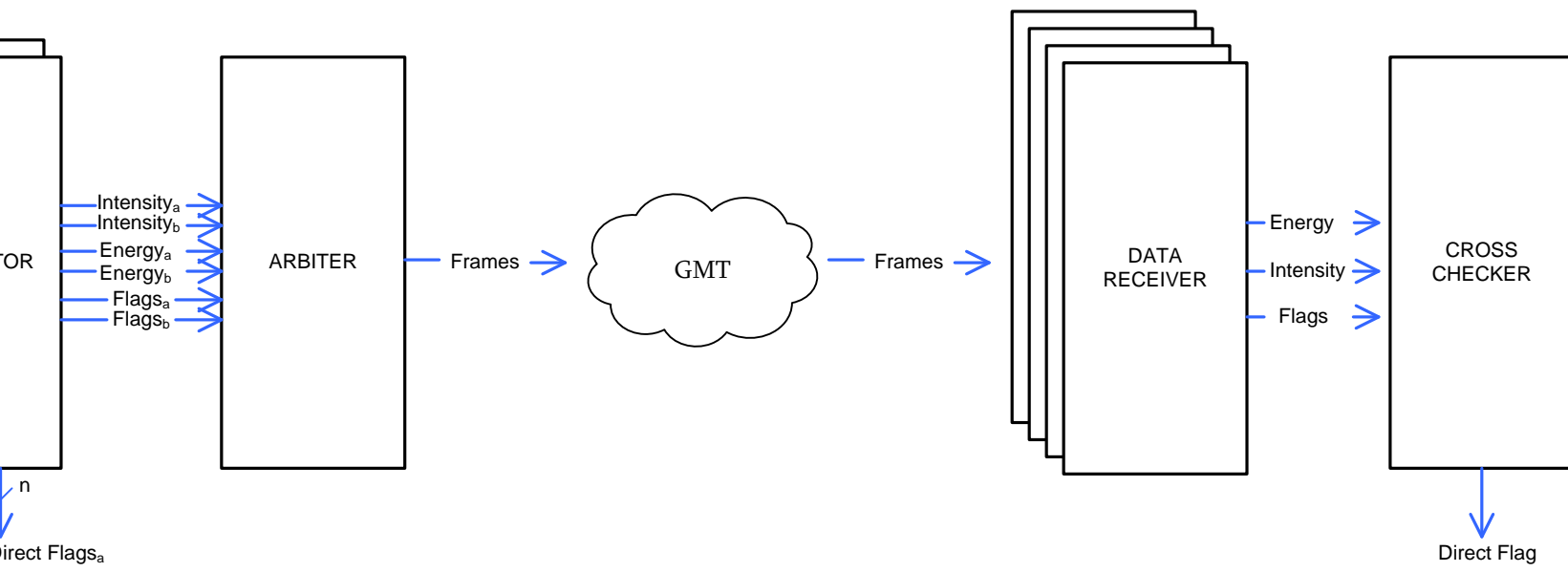
Then duplicate the critical processes



The transmitter must then arbitrate the data from the two sources



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Finally the output GMT must be cross-checked with the original data

LHC system:

Produces

- LHC Safe Beam Flags
- *Stable Beam Flag*
- *Movable Dev. Allowed in Flag*

Retransmits:

- LHC Energy
- (Beam Intensities)
- Beam Presence Flags

SPS system:

Produces

- SPS Beam Flags

Retransmits:

- Beam Intensity

Produces “Direct Flags”:
(not sent to GMT)

- SPS Probe Beam Flag
- CNGS Beam Flag
- LHC Beam Flag