EUROPEAN SPALLATION SOURCE

NMX Data Read Out and Software Processing

DMSC
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Experiment control

Stream

Reduce

Visualise

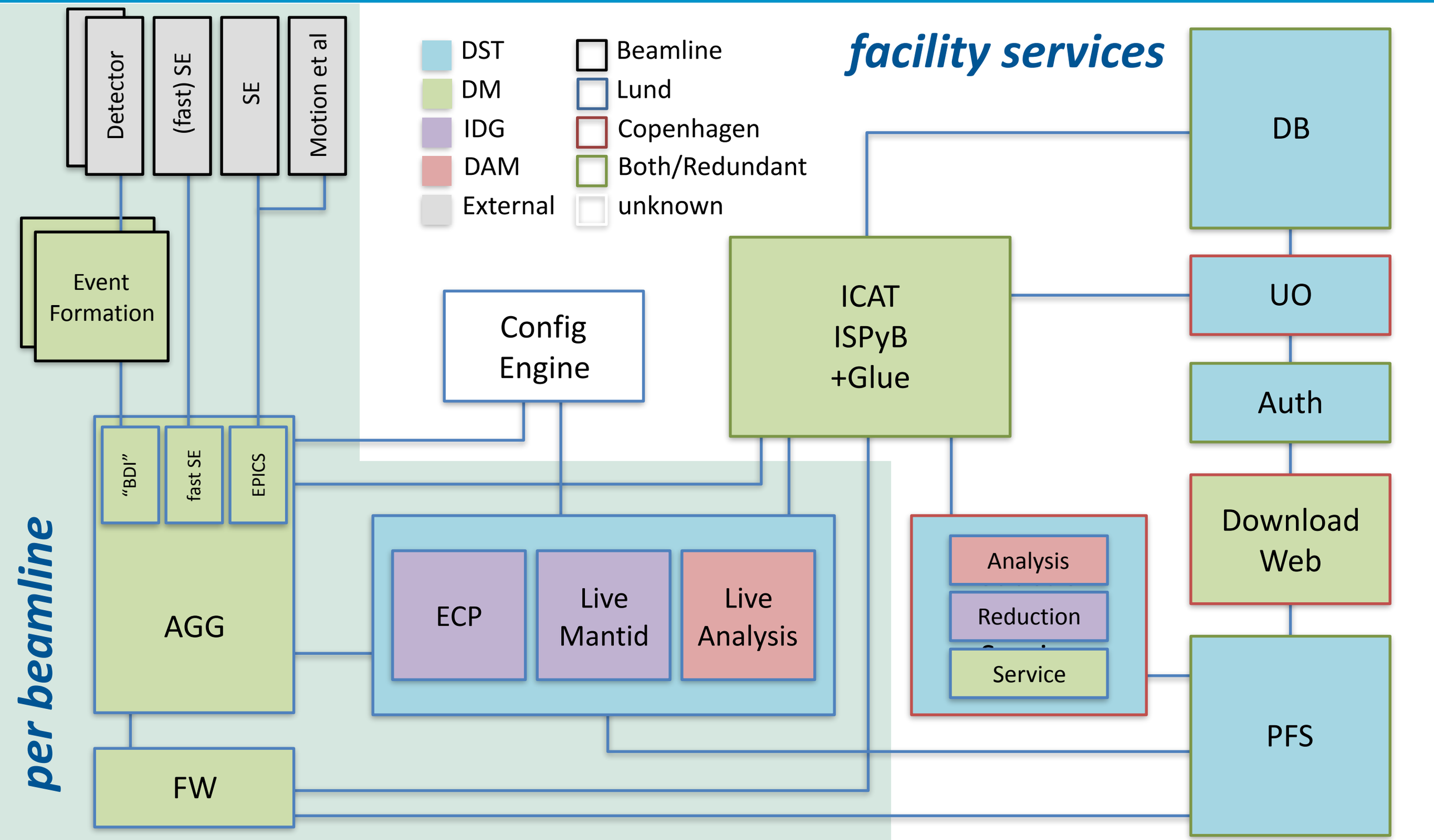
Analyse

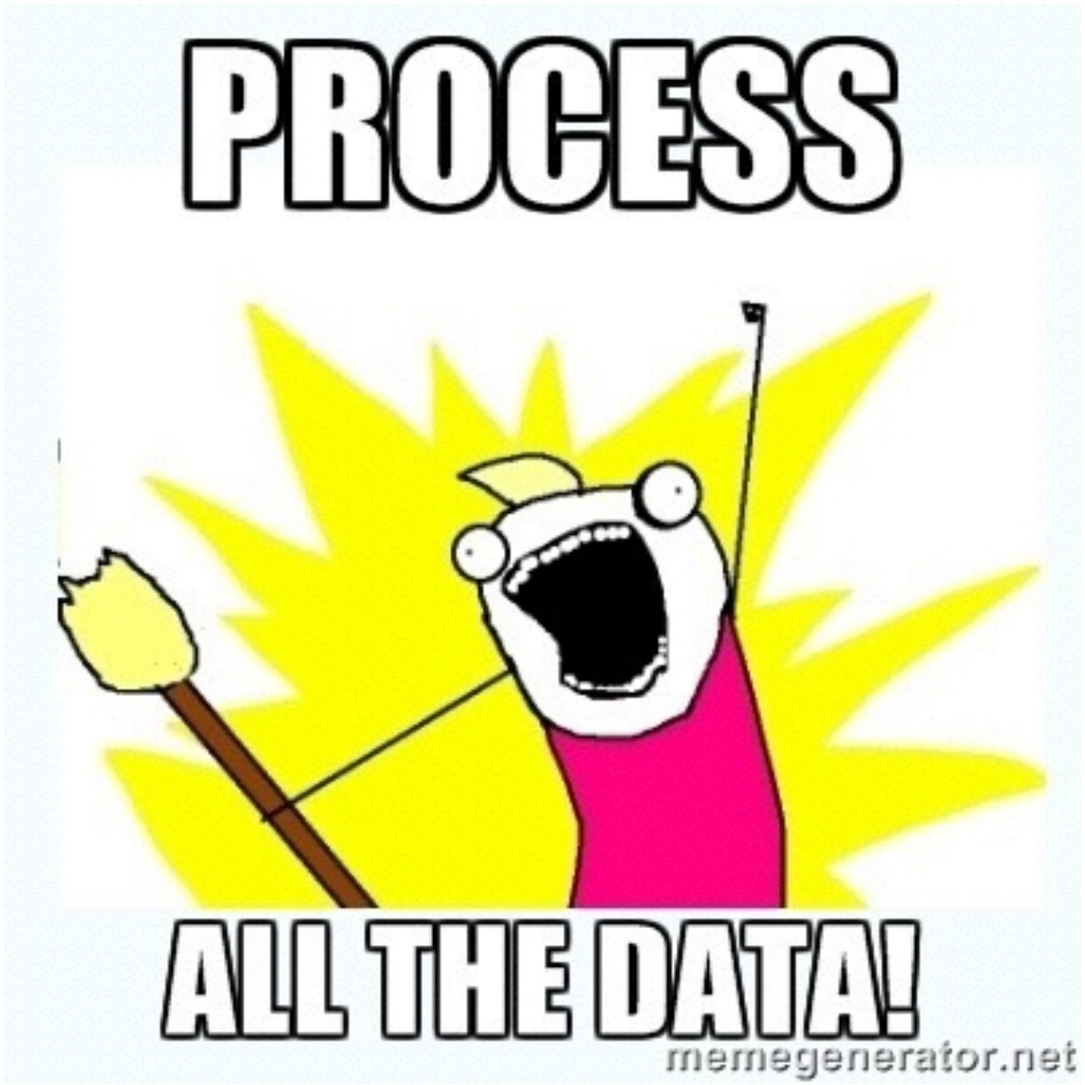
Set-up beam line configuration:: trigger DAQ	Instrument data group
Data stream to “listener” Listener is a file writer Listener is Mantid	Data Management group
Data reduced from *tof* to S(q,w), $I(q_x,q_y,q_z)$…	Instrument data group 
Visualisation of data 1D, 2D, 3D, 4D	
Analysis of reduced data	Data analysis and modelling. SasView McStas

Phase 1 Instrument: Requirements Scope Schedule

DMSC Architecture

EUROPEAN SPALLATION SOURCE





Event Formation

What do we want?

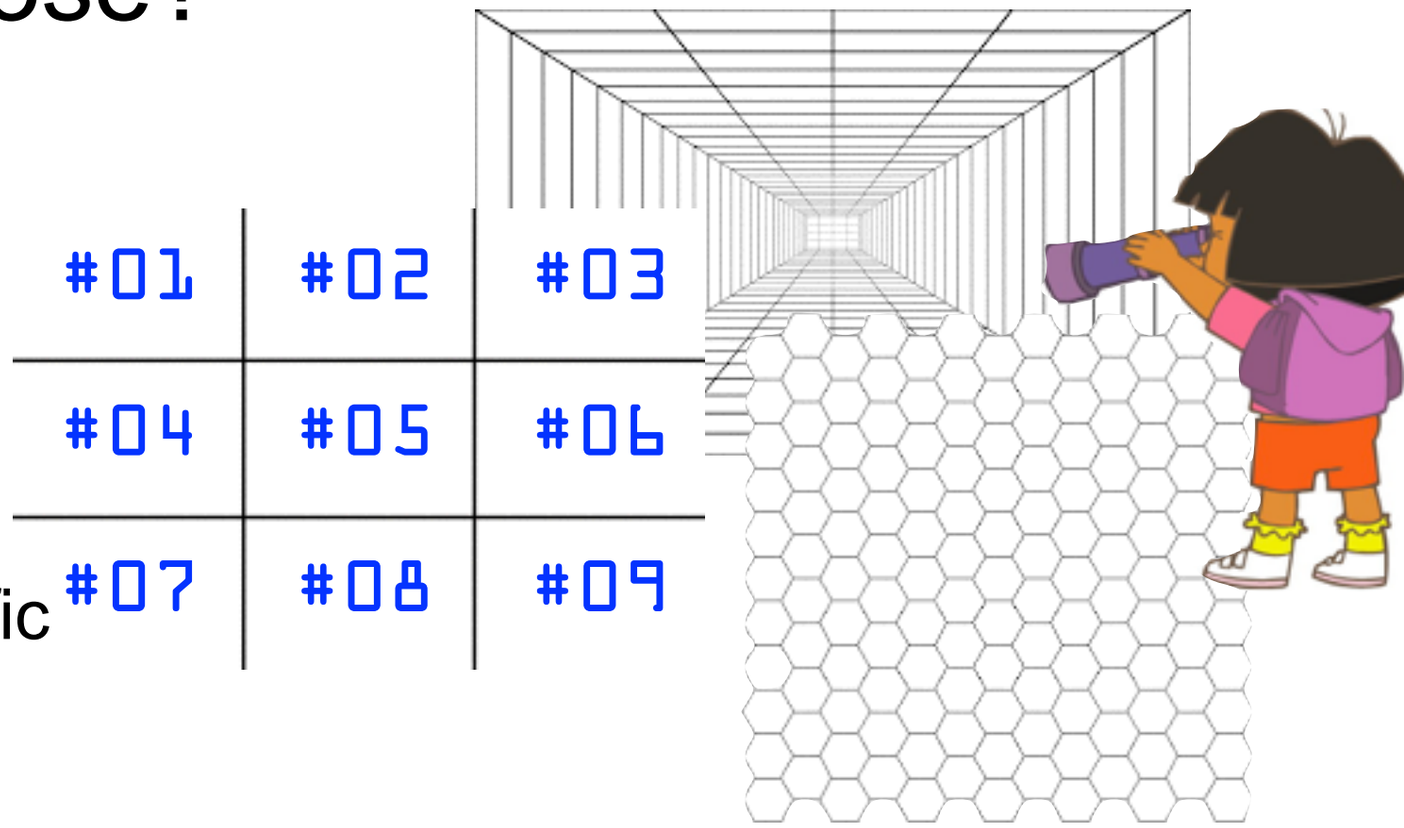
- events
- format and volume or rate
- algorithms
- trial data

When do we want it?

- now (obviously)

Events - What are those?

Neutron Scattering needs two items:



Pixel-ID

- discrete location
- precision instrument specific
- any geometry (in principle)
- can be in 2D or 3D
- 32bit likely

	datetime	datetime2	UTC_datetime	UTC_date	datetimeoffset
1	2013-12-26 20:06:10.620	2013-12-26 20:06:10.6208135	2013-12-26 20:06:10.620	2013-12	20:06:10.620 2 12-26 20:06:10.62 5 -05:00
2	2013-12-26 20:06:10.623	2013-12-26 20:06:10.6268138	2013-12-26 20:06:10.623	2013-	20:06:10.623 2 12-26 20:06:10.626 -05:00
3	2013-12-26 20:06:10.627	2013-12-26 20:06:10.6278139	2013-12-26 20:06:10.627	2013	s 20:06:10.627 26 20:06:10.6278 05:00
4	2013-12-26 20:06:10.630	2013-12-26 20:06:10.6328142	2013-12-26 20:06:10.630	2013	s 20:06:10.630 26 20:06:10.6328 05:00
5	2013-12-26 20:06:10.630	2013-12-26 20:06:10.6338142	2013-12-26 20:06:10.630	2013	s 20:06:10.630 12-26 20:06:10.6338 05:00
6	2013-12-26 20:06:10.633	2013-12-26 20:06:10.6348143	2013-12-26 20:06:10.633	2013-	20:06:10.633 2013-12-26 20:06:10.634 -05:00
7	2013-12-26 20:06:10.633	2013-12-26 20:06:10.6358143	2013-12-26 20:06:10.633	2013-12	06:10.633 2013-12-26 20:06:10.6 43 -05:00
8	2013-12-26 20:06:10.633	2013-12-26 20:06:10.6368144	2013-12-26 20:06:10.633	2013-12-26	10.633 2013-12-26 20:06:1 8144 -05:00
9	2013-12-26 20:06:10.637	2013-12-26 20:06:10.6378145	2013-12-26 20:06:10.637	2013-12-26 20	2013-12-26 6378145 -05:00
10	2013-12-26 20:06:10.637	2013-12-26 20:06:10.6388145	2013-12-26 20:06:10.637	2013-12-26 20:06:10	6:10.6388145 -05:00
11	2013-12-26 20:06:10.637	2013-12-26 20:06:10.6398146	2013-12-26 20:06:10.637	2013-12-26 20:06:10.637	2013-12-26 20:06:10.6398146 -05:00
12	2013-12-26 20:06:10.637	2013-12-26 20:06:10.6408146	2013-12-26 20:06:10.640	2013-12-26 20:06:10.640	2013-12-26 20:06:10.6408146 -05:00

Timestamp

- discrete relative time
- relative to proton pulse start
- 10 ns resolution, 32 bits likely

Data Rate Estimation

Expected: up to 10^8 neutron/s detected per instrument (with some uncertainty)

Data Structure

32 Bit pixel id

32 Bit timing id - aka timestamp

---

64 Bit = 8 byte

@ 10^8 1/s 800 MB/s or approx 1 TB in 20 min

1 Data Frame (1 pulse):

800 MB/s / 14 Hz = 57 MB
+ Proton charge (32 Bit)
+ absolute timestamp

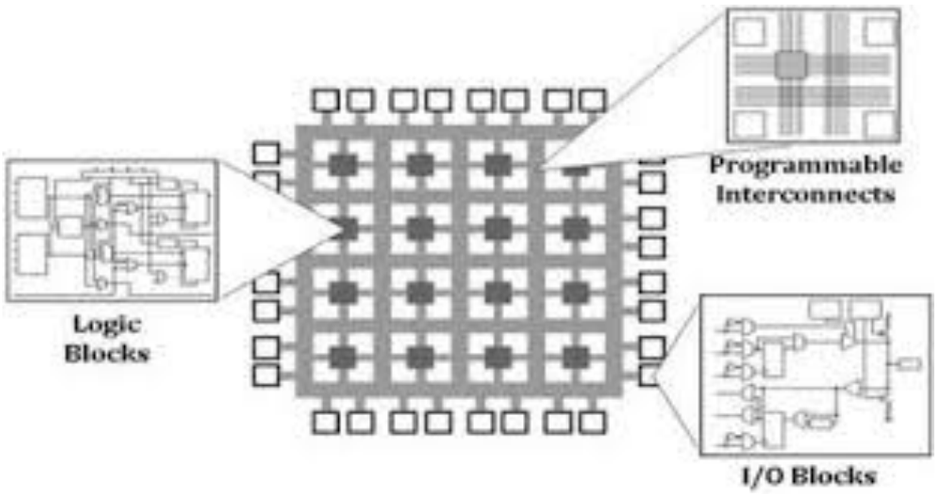
Notes: Average rates will (hopefully) be much lower. Imaging is different.

Data Format, Volumes or Rates

If we get more than 64 bits per event…

… how much to we get?

… what format is it in?



We need to plan!

- network, bandwidth and topology
- develop the right framework
- are we CPU limited?
- I/O limited?
- would GPGPUs make sense?
- would Xeon+FPGAs be an option?

Algorithms - What are those?

- What language are they in?
- What framework do they require?
- What is their life cycle?
- Who is responsible for them?
- How can we test, accept or reject an algorithm or an implementation ?

```
'DEBUT''REEL'FA,QA,RA        ◇
'ENTIER'NK,NC,NKK    ◇
'REEL''TABLEAU'LO,L1,L2,L3$(0:319)$,CAN$(0:3,0:99)$,
CAN2$(0:3,0:99)$,
ENS,FON,SEC,TIE,QUA,QUI,SIX,SEP$(0:49)$    ◇

'PROCEDURE'LECTURE(L3) ◇ 'REEL''TABLEAU'L3 ◇ 'DEBUT'
 'ENTIER'M,K      ◇ K:=DONNEE ◇
'POUR'M:=0'PAS'1'JUSQUA'K'FAIRE''DEBUT'
       L3$(M)$:=DONNEE      ◇
'FIN' ◇ 'FIN' ◇

'PROCEDURE'MARIE THERESE(LO)◇'REEL''TABLEAU'LO◇
'DEBUT''REEL'A,X,QN,RN       ◇       'ENTIER'L,M,N,P       ◇
     M:=0◇N:=0◇P:=0◇L:=DONNEE◇
ORG: A:=LO$(M)$◇X:=(A-ENT(A))×100◇
     'SI'X=FON$(P)$'ALORS'CAN$(L,N)$:=1
     'SINON''SI'X=TIE$(P)$'ALORS'CAN$(L,N)$:=3
     'SINON''SI'X=QUI$(P)$'ALORS'CAN$(L,N)$:=5
     'SINON''SI'X=SIX$(P)$'ALORS'CAN$(L,N)$:=6
     'SINON'CAN$(L,N)$:=7◇
     M:=M+4◇'SI'M>NKK-7'ALORS''ALLER A'ENDE◇
     N:=N+1◇QN:=ENT(N/2)◇RN:=N-QN×2◇
     'SI'RN=0'ALORS'P:=P+1◇'ALLER A'ORG◇
ENDE:'FIN'◇
```

Trial Data

- Can we get all the raw data for the uTPC paper?
  We do not care what format that is in!
- Or is there more representative data?
- Will there be?

Timescale: NMX - now?, Other detector types - ASAP

Important Points

- We need well defined interfaces
- Responsibilities need to be clear
- Even software processing costs money
- Budget and therefore scope is limited
- Timescales are crucial - BrightnESS has a fixed lifetime