



# Study of runaway electrons with a new detector in Gamma-ray Camera

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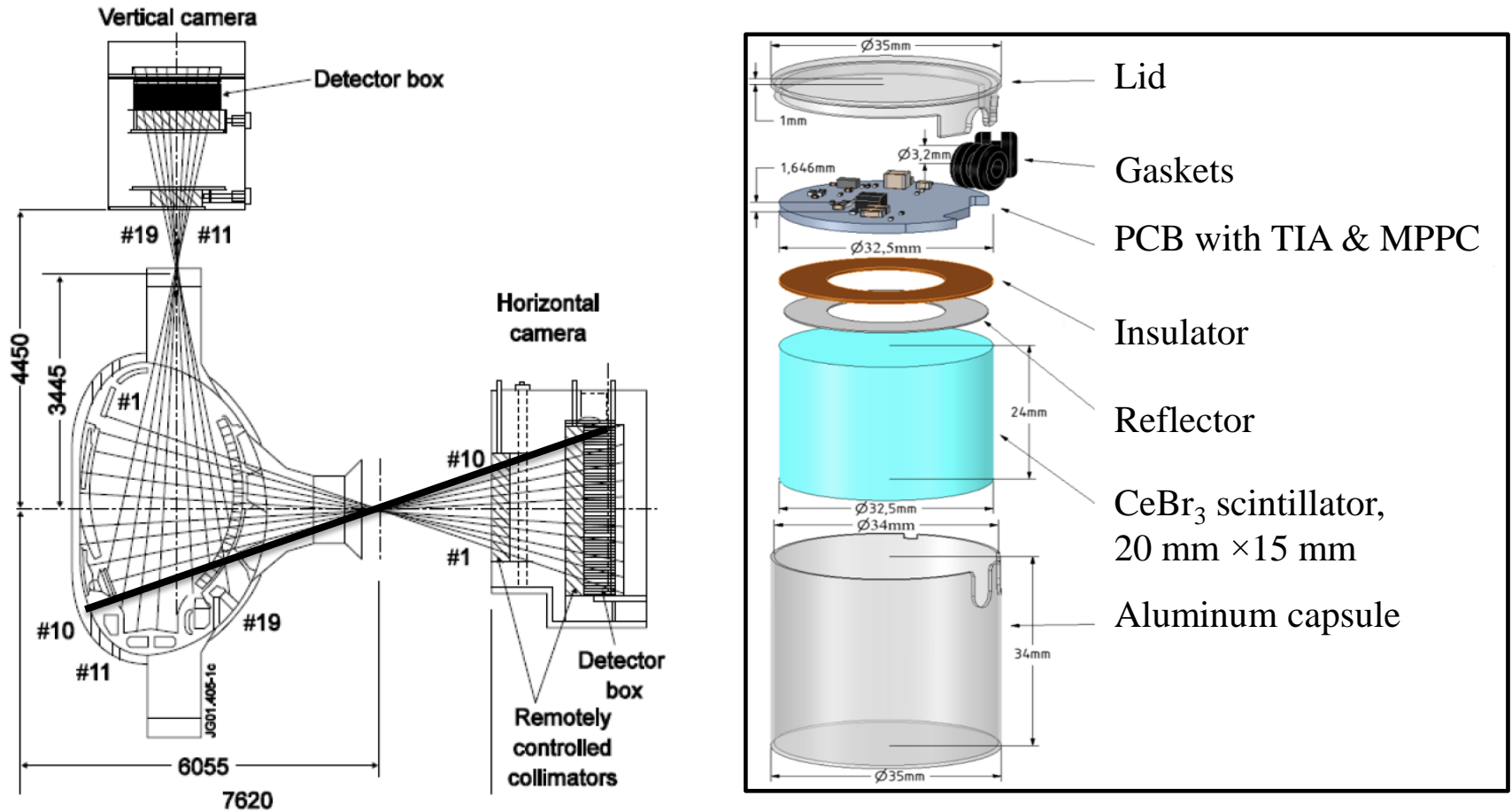
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# New detector in Gamma Camera

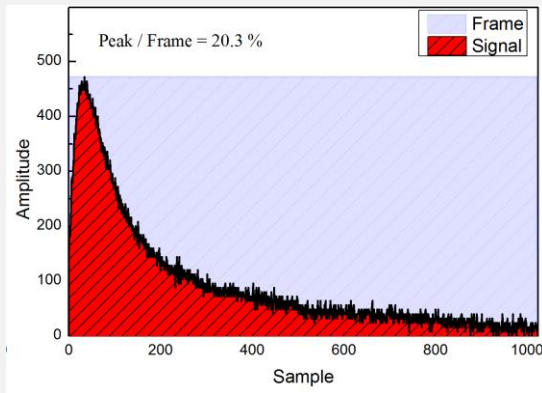


# How does the program *AU\_main* work?



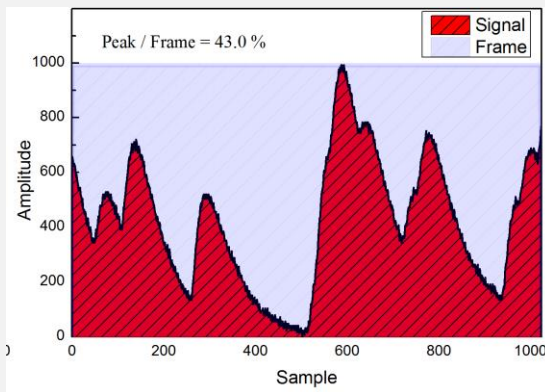
During analysis we extract time and energy for each event during a shot:

- read time and amplitude data from a DAQ file
- perform energy calibration
- use a proper code depending on a scintillator type (CsI or CeBr<sub>3</sub>/LaBr<sub>3</sub>:Ce) to obtain an amplitude and to find single (not pile-up) and pile-up events
- apply a code *AU\_main* to unfold pile-up events
- split events into two parts: with energy  $\leq 520$  keV and  $> 520$  keV. With such a value, all events from a 511 keV peak, corresponding to an annihilation process, are only in the lower part
- plot two spectra:
  - number of counts vs. channel, corresponding to energy (if a reliable energy calibration is available)
  - number of counts vs. time for each energy range as well as for a full energy range
- all results of the analysis are available in the text files



For low rates, a single signal comes:

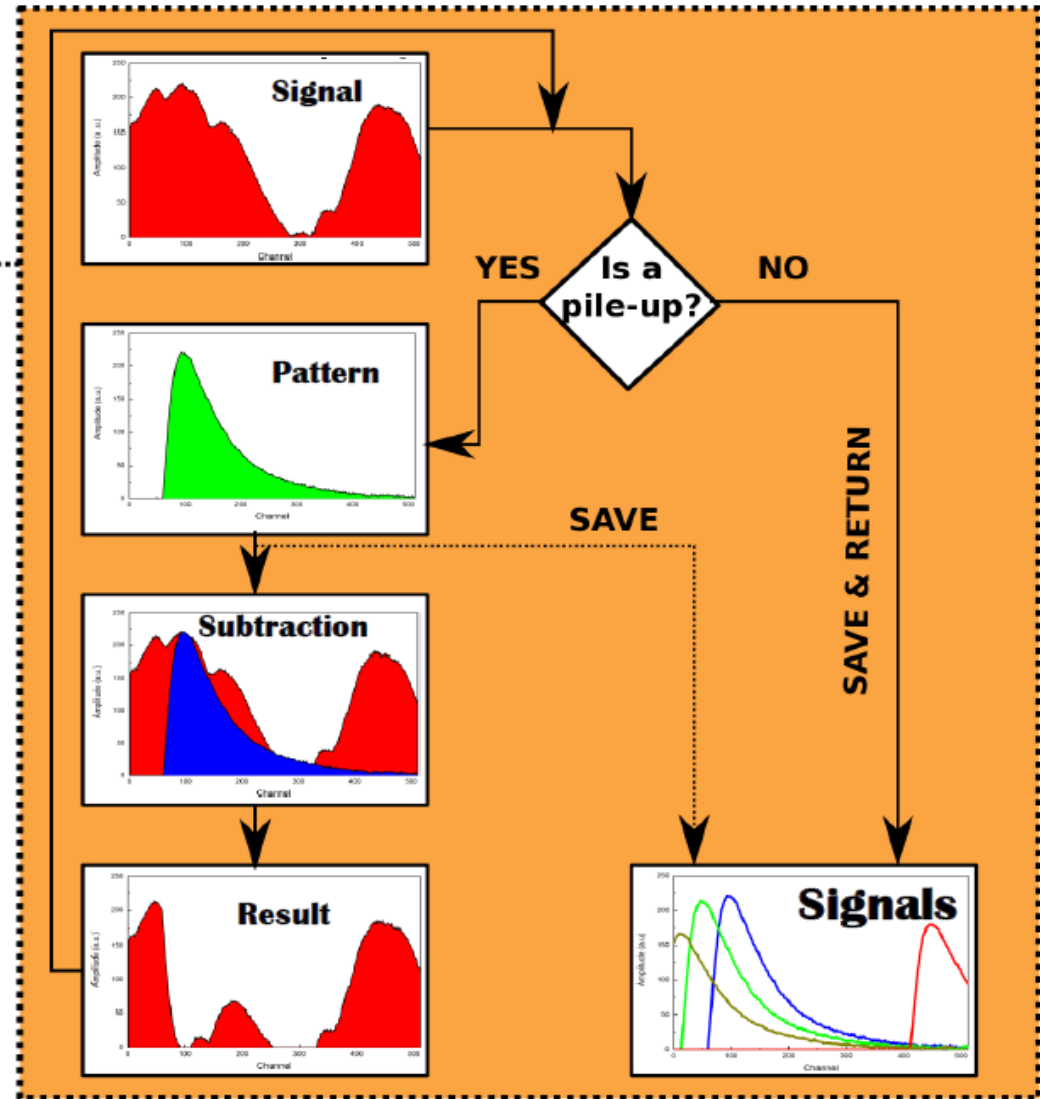
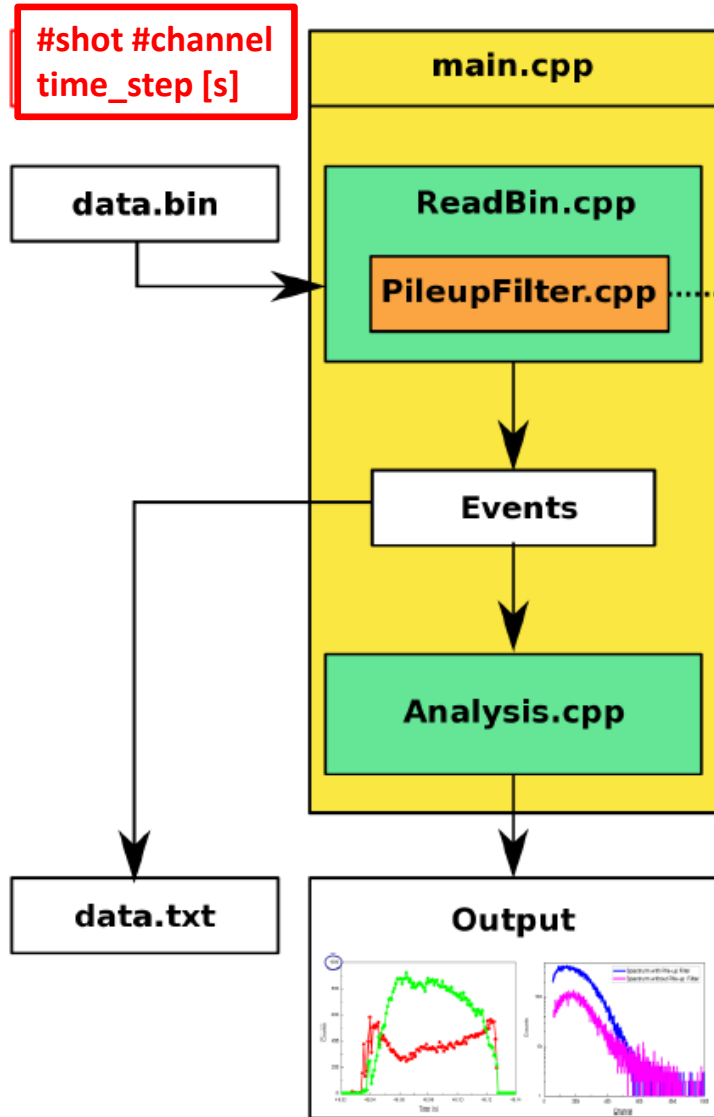
**time** and **amplitude** are saved.



For high rates, a pile-up comes:

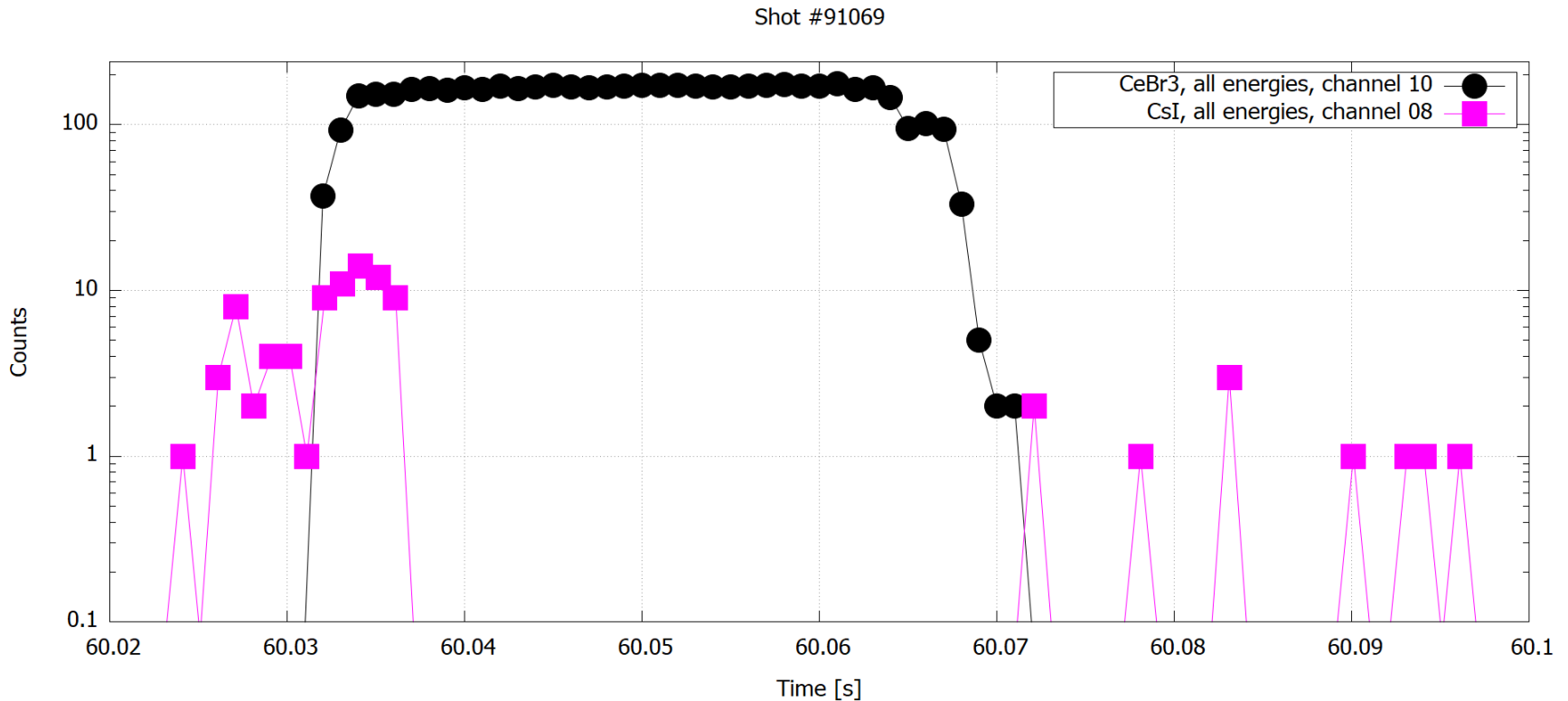
**pile-up decomposition** and then  
**time** and **amplitude** are saved for each component  
signal.

# New algorithm



# Comparison of two detectors: CsI and CeBr<sub>3</sub>

#91069 1.5MA / 3.0T. DMV1 argon 7.6 bar @60.0s. DMV2 Krypton 45 bar @60.039s. Good! Runaway plateau ends at 60.065s. The end is not exactly in the middle between the 2 previous pulses, but it still goes in the right direction. 700 degC impact on the dump plate from KL7 [\[TF Wiki/M15-19\]](#)

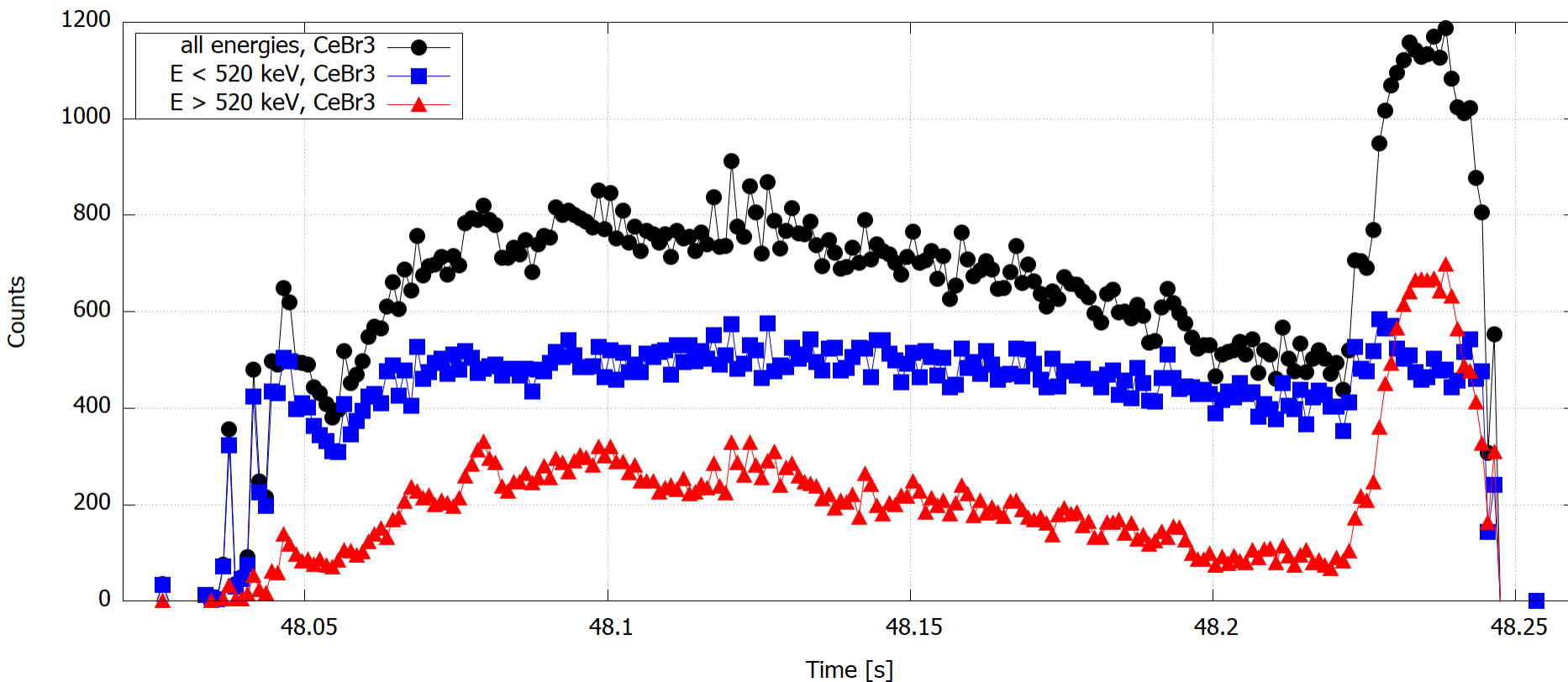


# Exemplary graph made during analysis of $\text{CeBr}_3$



Shot number	Ip/Bt	First gas injection	Second gas injection	Shape	Runaways	Comment
92459	1.5MA/3T	DMV3 0.24 bar 100% Ar	DMV2 45bar 100% Kr. t+200ms.	Modified Limiter. ID2=ID3=0. IIm=0.0	Plateau. 670-720 kA. 105 ms.	DMV3-triggered beam, very low pressure. Late mitigation.

Shot #92459 channel 10

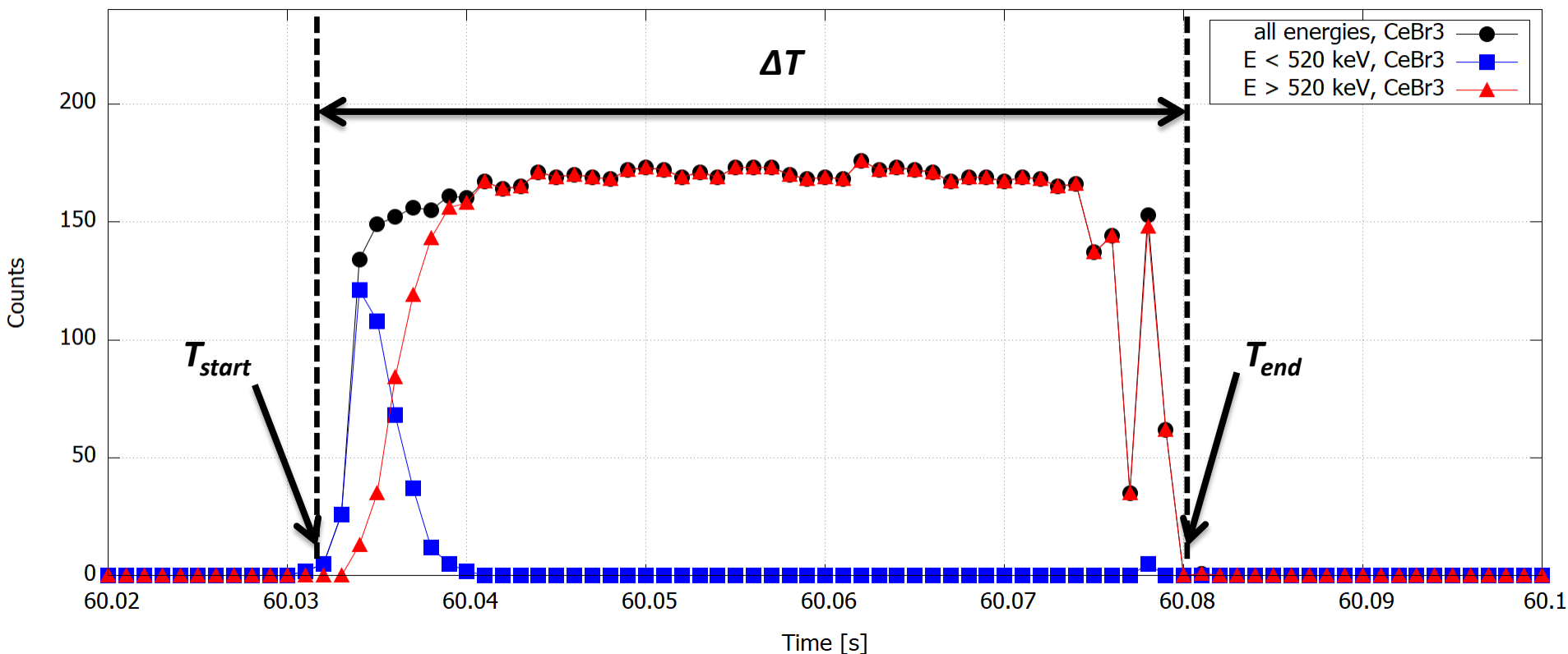


# Exemplary graph made during analysis of $\text{CeBr}_3$



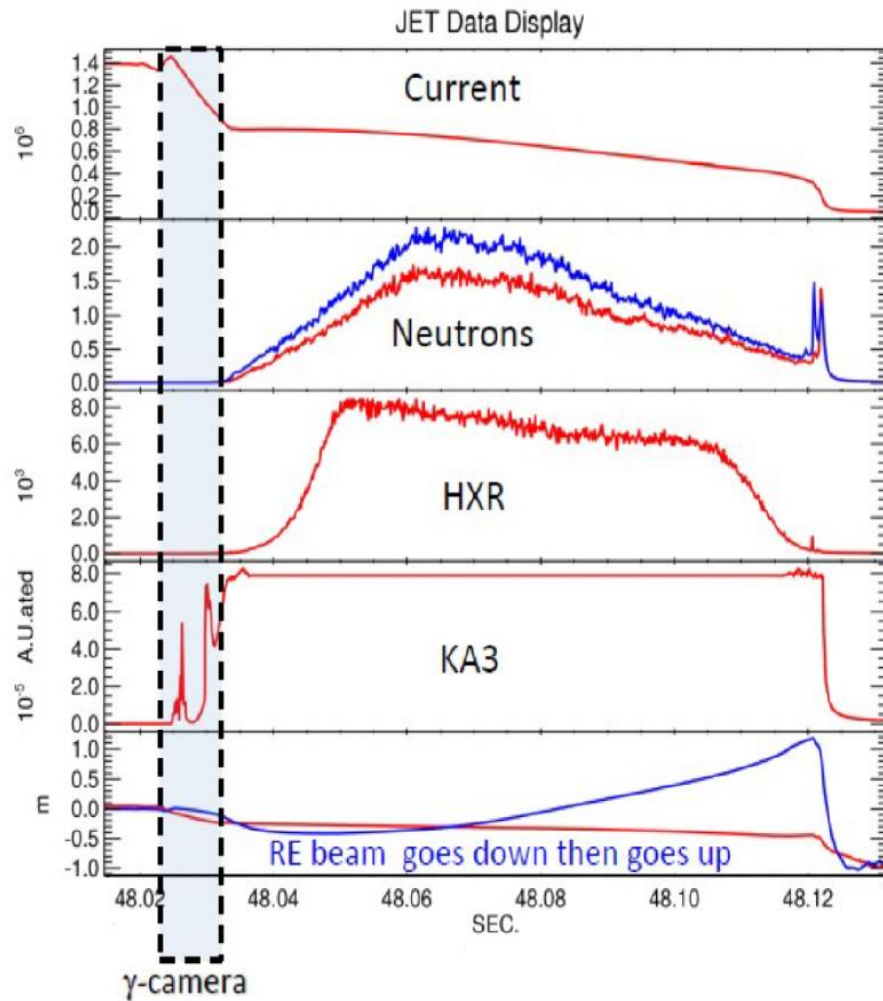
Shot number	$I_p/B_t$	First gas injection	Second gas injection	Shape	Runaways	Comment
91066	1.0MA/3T	DMV1 7.6 bar 100% Ar	DMV2 45bar 100% Kr. t+50ms.	Limiter	Plateau.	Reference runaway plateau at 1.0 MA pre-disruption current. Late mitigation.

Shot #91066 channel 10

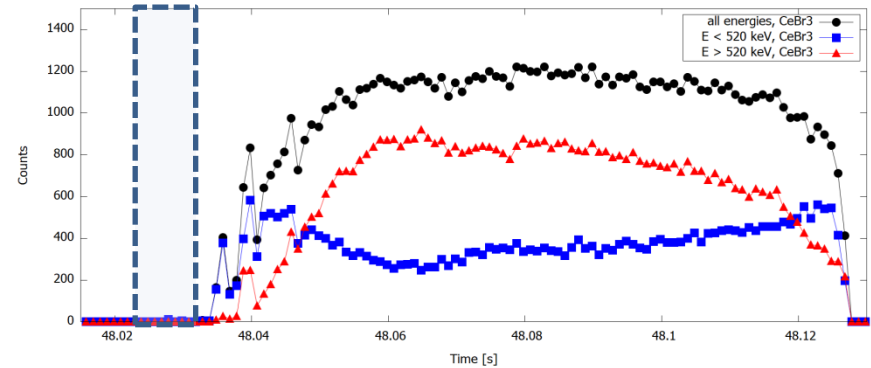




# Comparison of CeBr<sub>3</sub> and other diagnostics



Shot #92449, channel 10



# Analysis



The following shots were analysed

# shot	$T_{start}$ [s] $\pm 0.001$	$T_{end}$ [s] $\pm 0.001$	$\Delta T$ [ms]	$N$	$N_{low}$	$N_{high}$	$N / \Delta T$ [kcps]	$N_{low} / \Delta T$ [kcps]	$N_{high} / \Delta T$ [kcps]
91066	60.032	60.079	47	7396	395	7001	157	8	149
91067	60.032	60.084	52	8285	245	8040	159	5	155
91068	60.032	60.066	34	4579	262	4317	135	8	127
91069	60.032	60.071	39	5622	351	5271	144	9	135
91071	60.031	60.075	44	6450	429	6021	147	10	137
91076	60.031	60.118	87	12915	298	12617	148	3	145
91077	60.031	60.070	39	5468	477	4991	140	12	128
91079	60.032	60.082	50	6777	322	6455	136	6	129
91081	60.032	60.070	38	5379	473	4906	142	12	129
92448	48.032	48.130	98	107059	35263	71796	1092	360	733
92449	48.028	48.129	101	95139	35232	59907	942	349	593
92454	48.025	48.146	121	116759	51444	65315	965	425	540
92456	48.024	48.100	76	66543	26637	39906	876	350	525
92457	48.023	48.100	77	69236	25222	44014	899	328	572
92458	48.023	48.143	120	120335	46571	73764	1003	388	615
92459	48.034	48.247	213	142589	97251	45338	669	457	213
92460	48.034	48.109	75	62356	31151	31205	831	415	416
92461	48.034	48.091	57	44512	25637	18875	781	450	331



- Program to read and analyse data from the Gamma Camera has been prepared.
- Program is used to analyse data registered with both CsI (old) and CeBr<sub>3</sub> (new)-based detectors.
- More information about this program will be available in a dedicated report.
- Good agreement with other diagnostics used at JET.