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Produkujemy wiedze – dzisiaj na jutro

SREM extended database and software Analysis package

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OUTLINE

New SREM Monte Carlo Simulations

PYTHON code for SREM analysis

PYHON interface with Spenvis

SREM Species discrimination

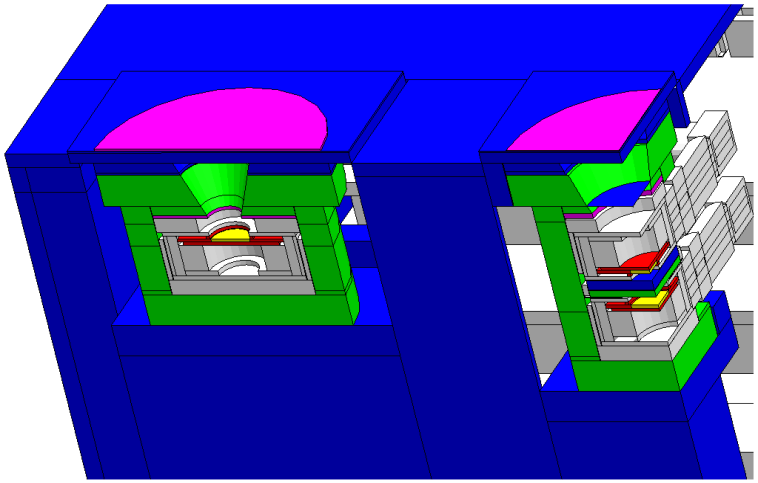
Deconvolution of SREM count rates

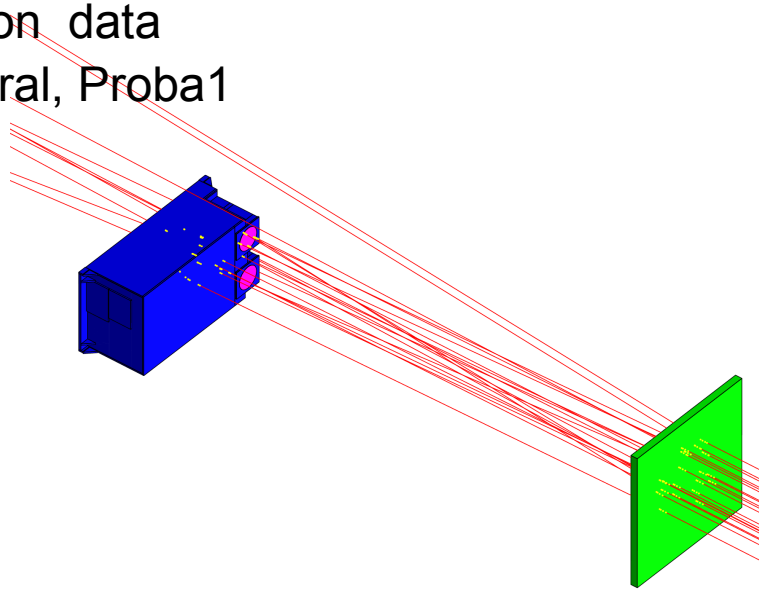
Updated SREM CDF files

SREM Example analysis

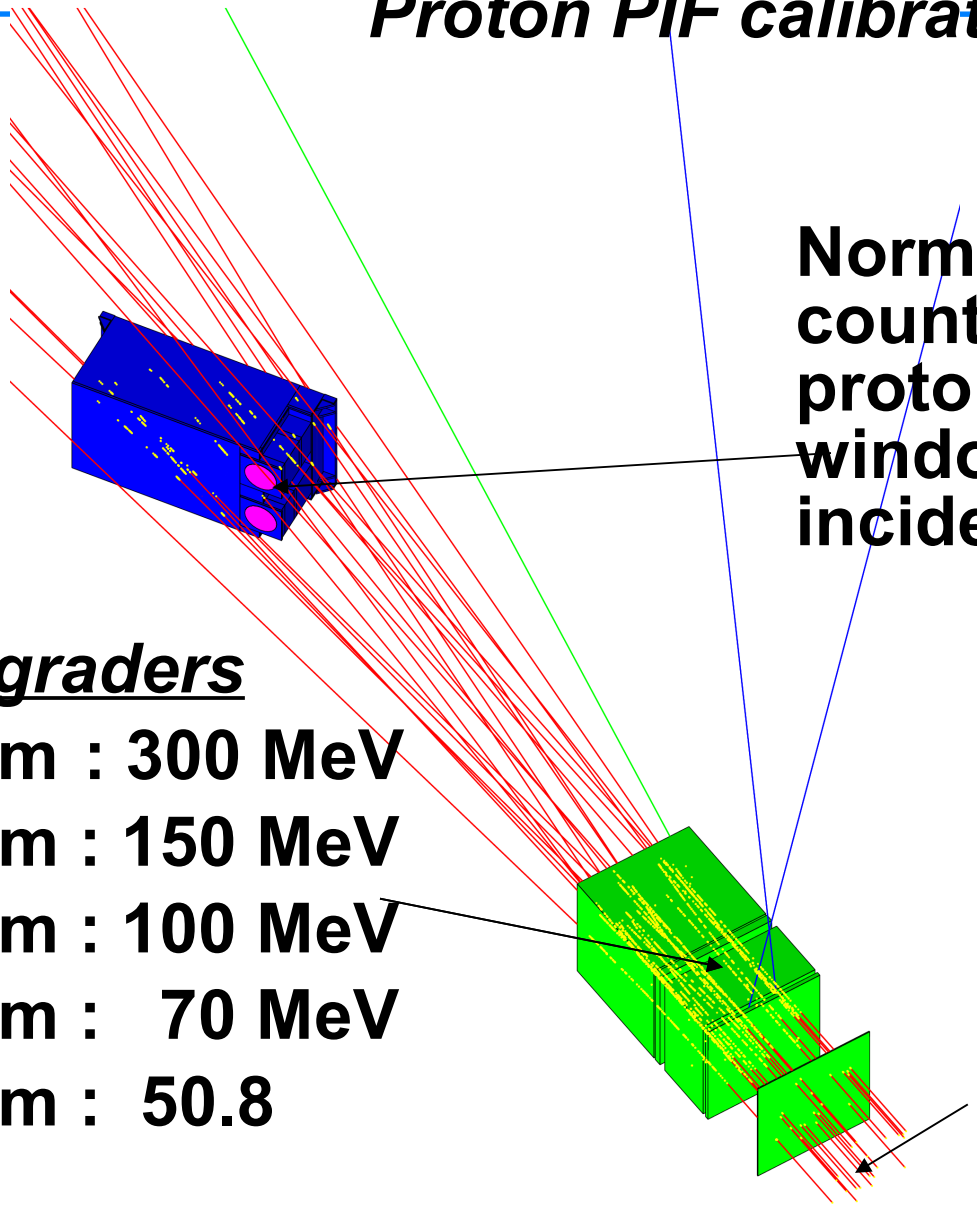
Full Geant4 Monte Carlo simulations of all SREMs

- Fitting of some geometrical parameters for all SREMs by comparing MC results with energy treshold measurements at PSI :
  - entrance windows, Ta absorber, ….
- Correction of effective area in mass model
- Validation of Geant4 results with Proton calibration data
- Transfer of sattellite mass model in GDML: Integral, Proba1
- Full 3D simulations of all SREMs





Full Simulation of Proton PIF calibrations



Normalisation of the count rates to the mean proton flux at entrance windows during normal incidence

Al degraders

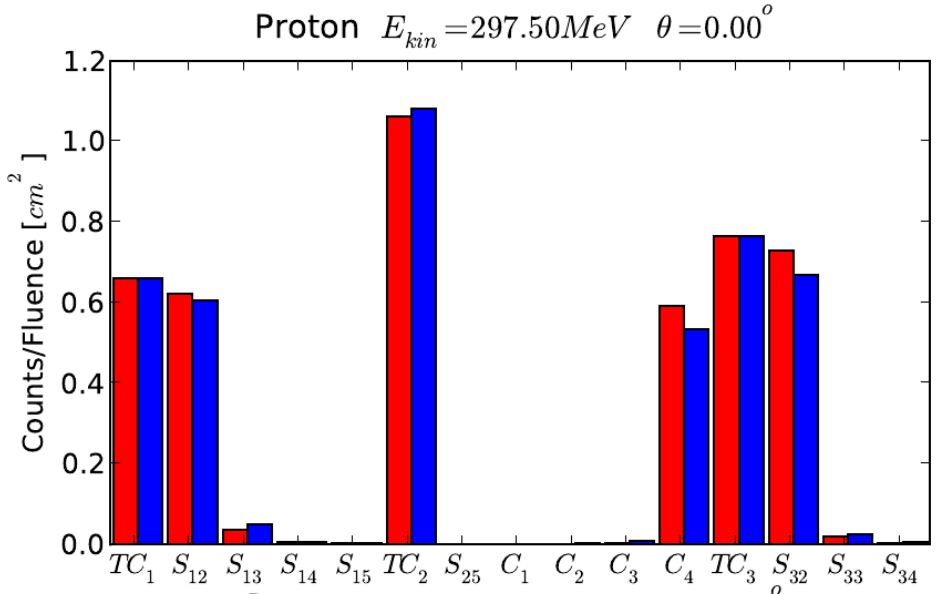
0 mm : 300 MeV
167 mm : 150 MeV
205 mm : 100 MeV
222 mm : 70 MeV
231 mm : 50.8 MeV

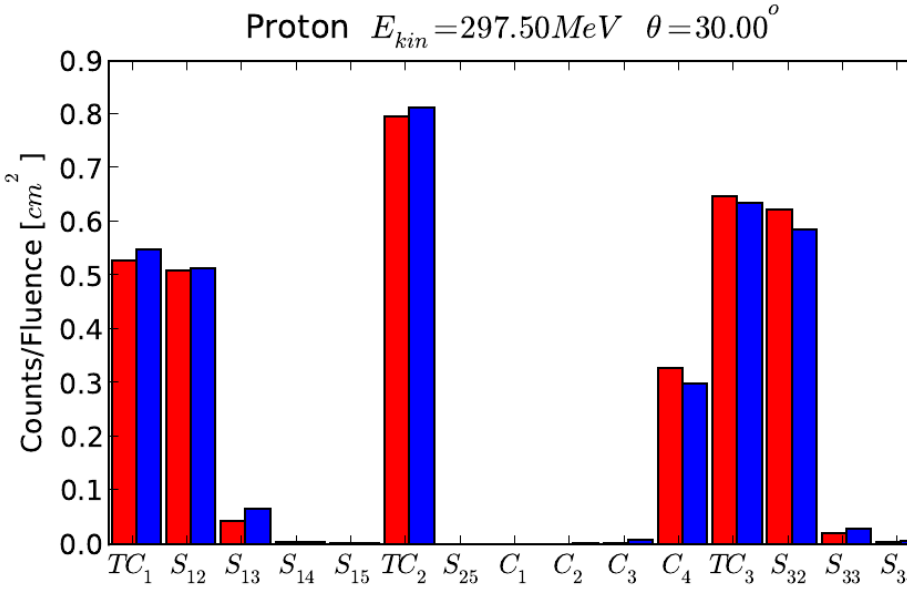
PIF beam

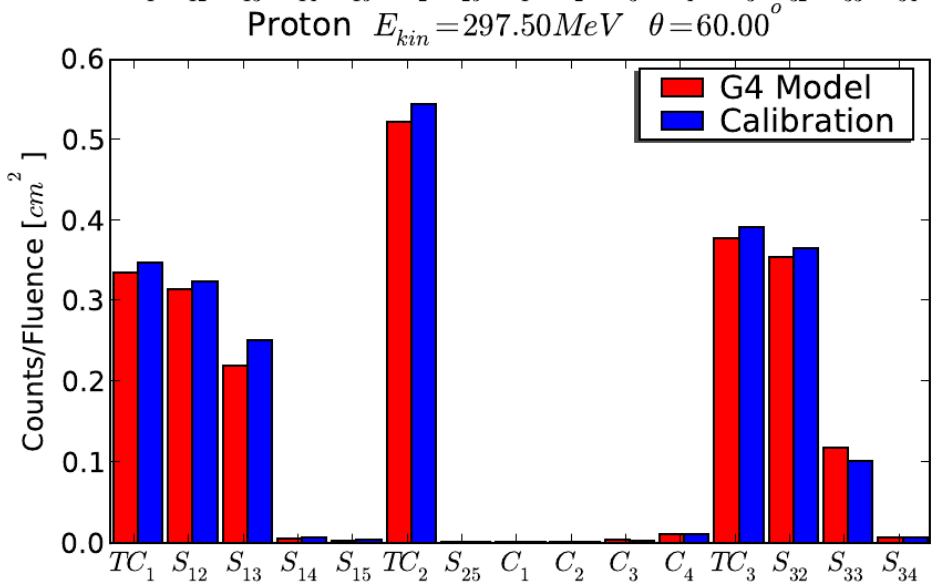
300 MeV

Different directions o incidence

Comparisons @ 300 MeV







Good agreement within ~5 % for mostly all channels

Good agreement of angular dependence

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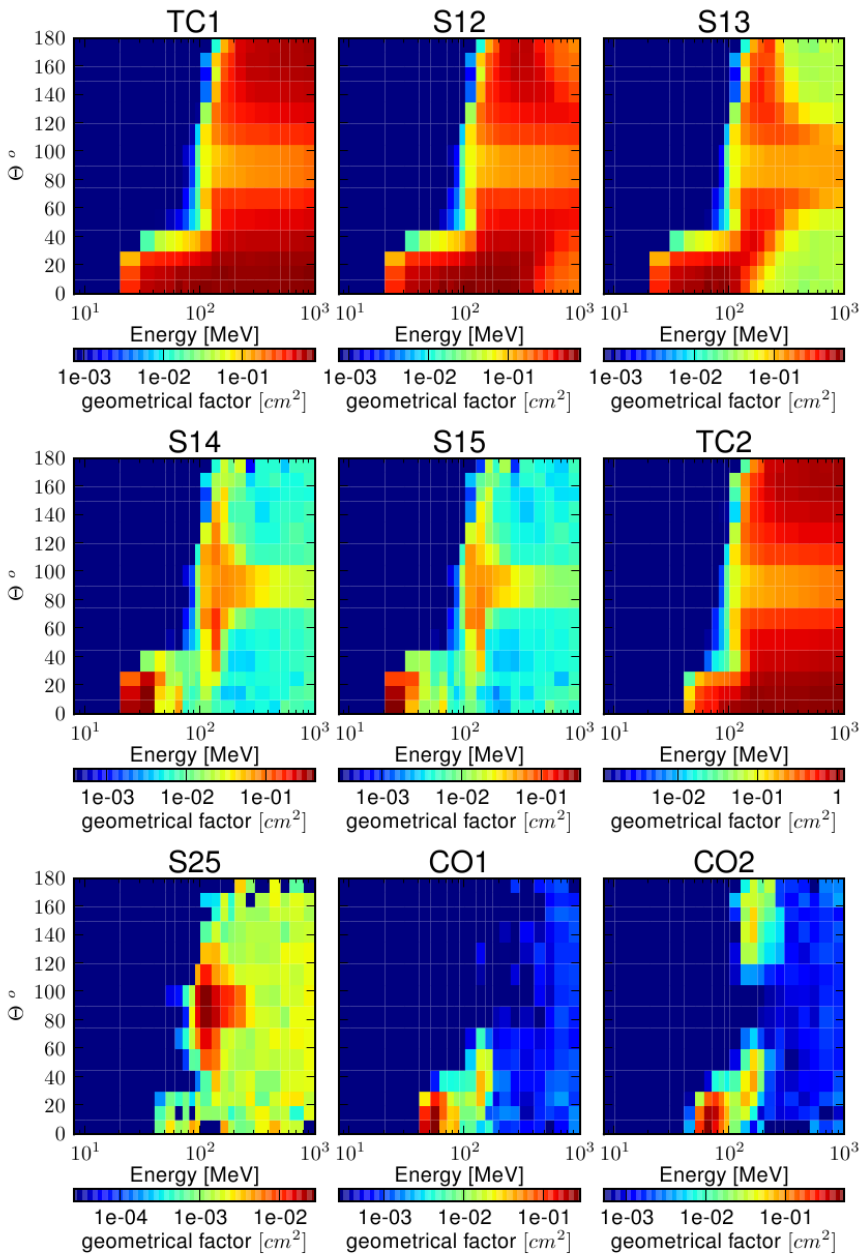
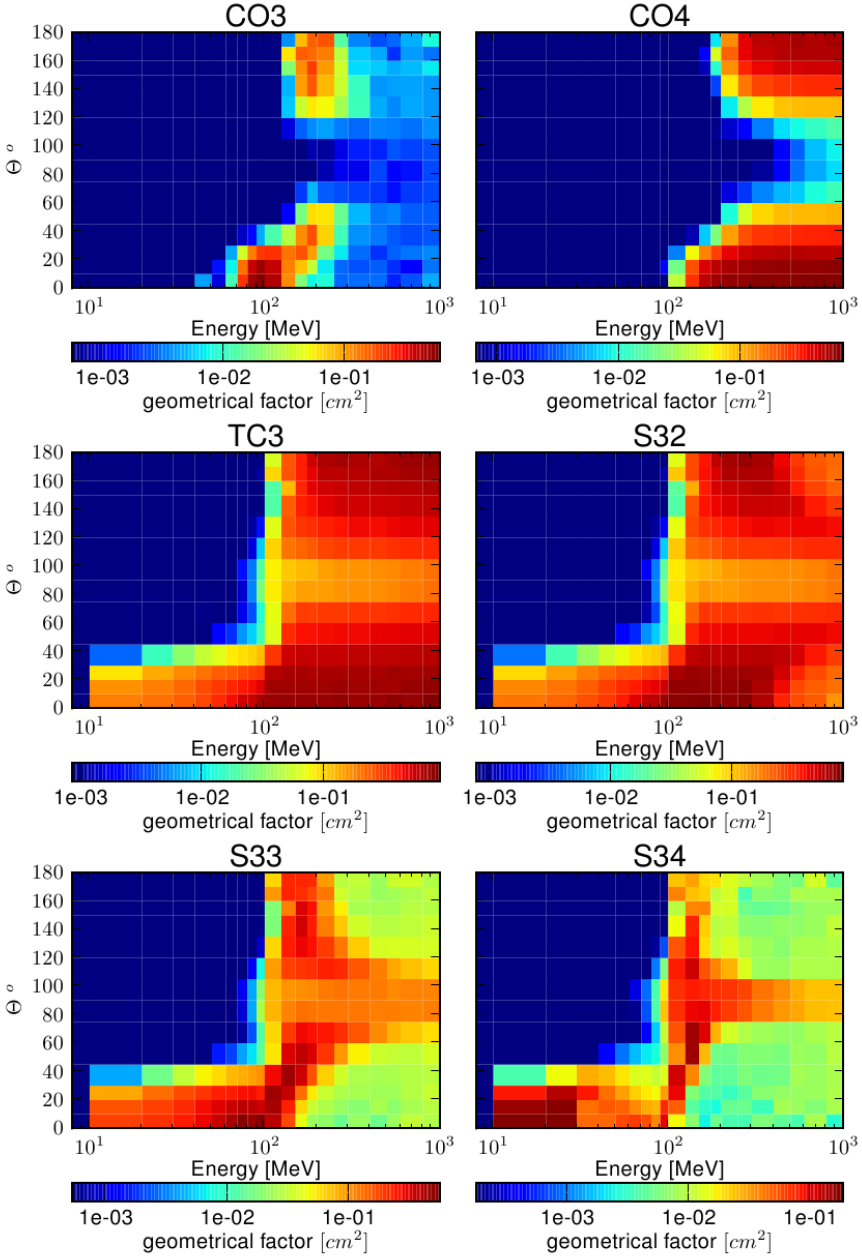
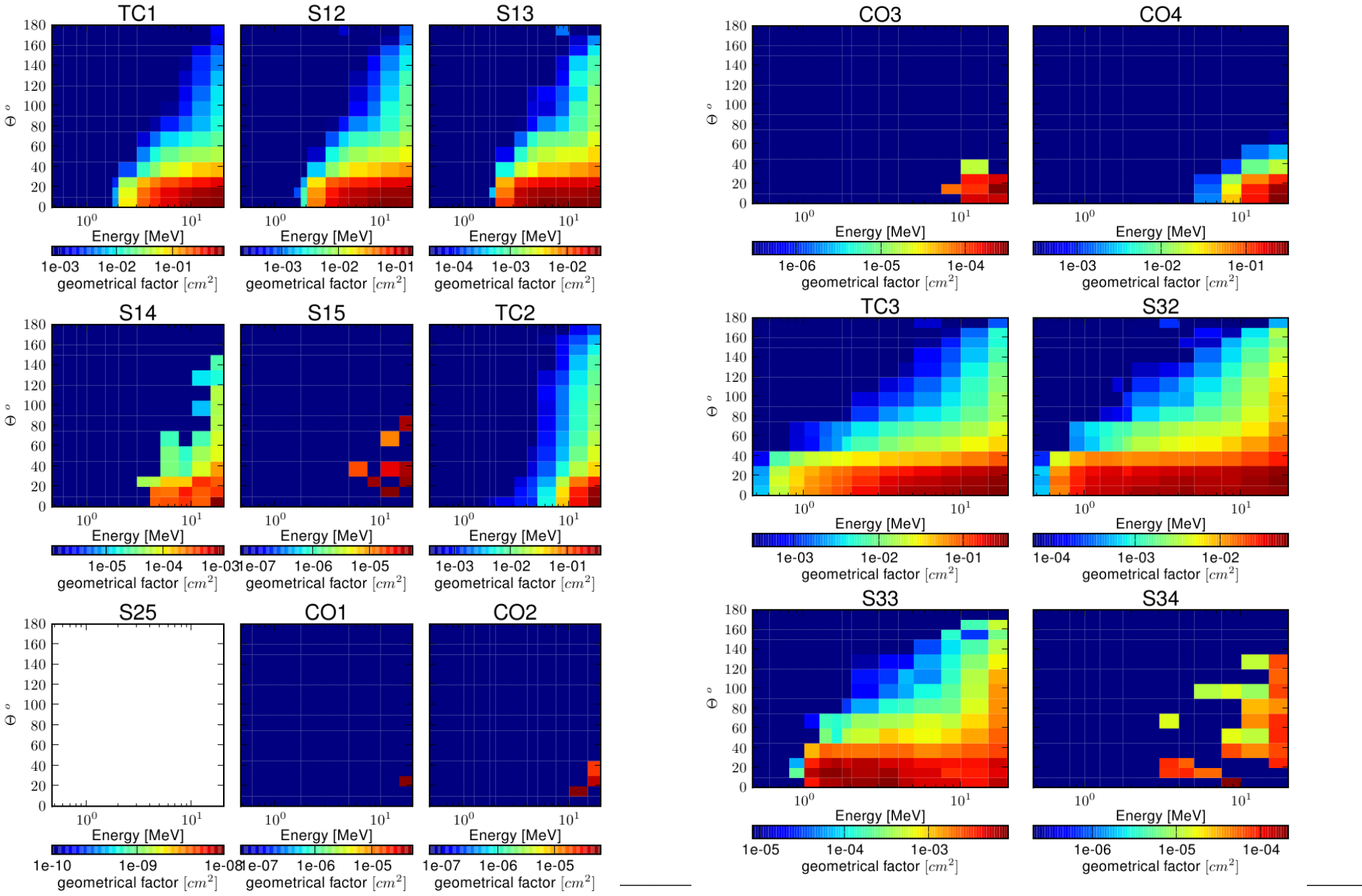
Full Proton response Matrix PROBA1 3D





Full electron response Matrix PROBA1 3D



PYTHON analysis code package for SREM/Space data

- PYTHON Interface with NASA CDF C library
- Reading of CDF time series
- Data available
  - SREM : PROBA1, INTEGRAL,
  - OMNIDATA
- Use numpy PYTHON to work on time series like with MATLAB, IDL
- Use PYTHON matplotlib for plotting
- Script example

```
theSremDataHandler=srem_data_handler()
theSremDataHandler.select_srem_unit("PROBA1")
dt1=datetime(2004,3,8,22,0)
dt2=datetime(2004,3,8,23,59)
data=theSREMDataHandler.read_data(dt1,dt2,[“COUNTRATE”,”LSHELL”])
pl.subplot(2,1,2)
TC1=np.reshape(data["COUNTRATE"][0,:],n)
date=data["date"]
pl.semilogy(date,TC1,label="TC1")
pl.plot(date,TC2,label="TC2")
pl.plot(date,TC3,label="TC3")
```

PYTHON Interface with SPENVIS

- Interface with SPENVIS using python mechanize library
- Possibility to run SPENVIS analysis directly from your PYTHON script
- Very powerfull for automatization of radiation analysis based on SPENVIS
- Set of functions implemented:
  - set_user_authentification
  - create_project
  - select_geo_orbit, ……
  - run_ape8, run_cress,...
  - get_results
  - run_spenvis_for_proba1(dt1,dt2):
    - Produce PROBA1 trajectory file in SPENVIS format from CDF file
    - upload of trajectory still form the web interface
    - Run CRESS and APE8 model
    - Get the spenvis CSV files,change their name, and store them in analysis framework

Electron Proton Identification

SREM PROBA1 9th March 2004

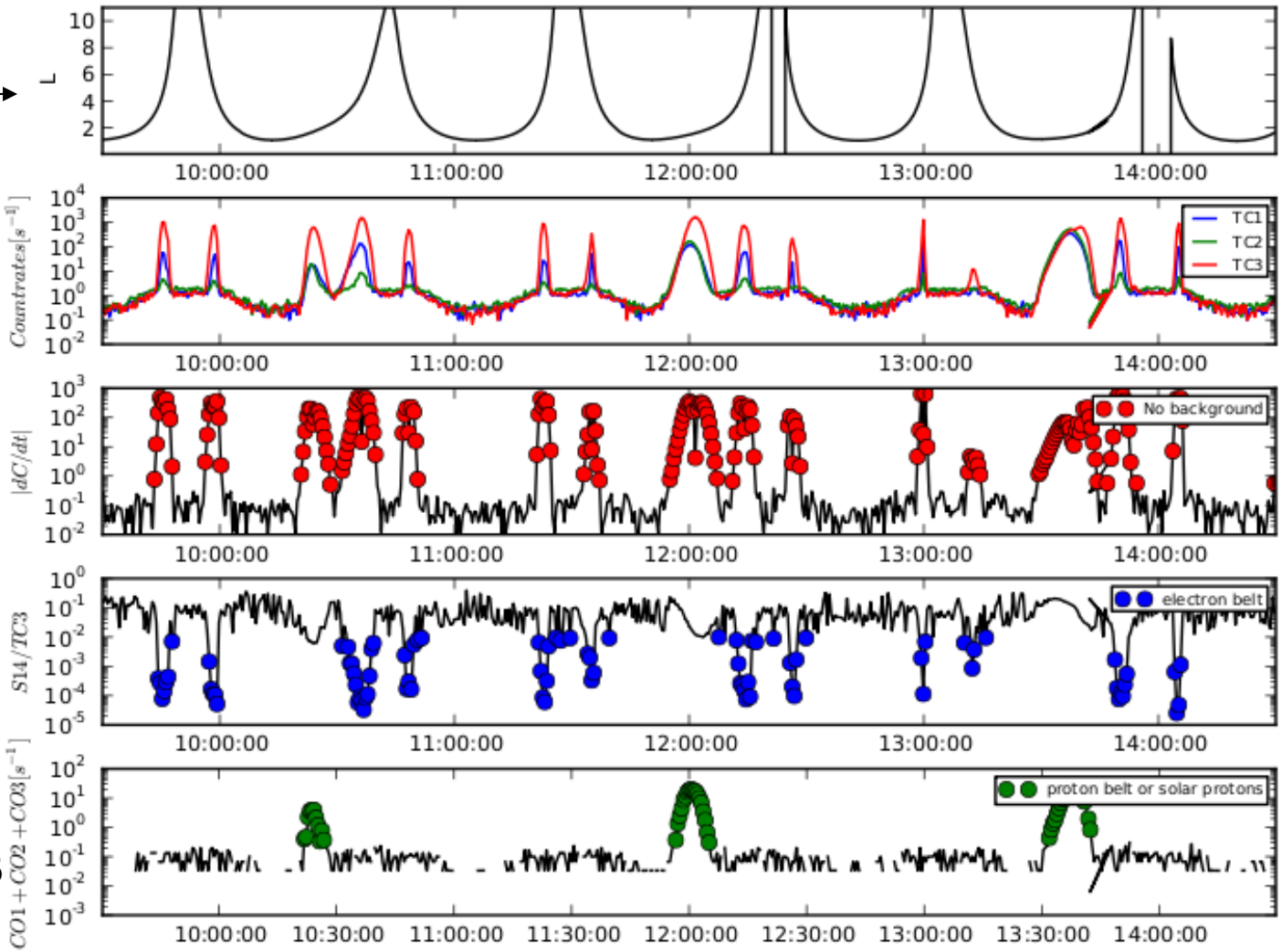
Lshell

TC1,TC2,TC3

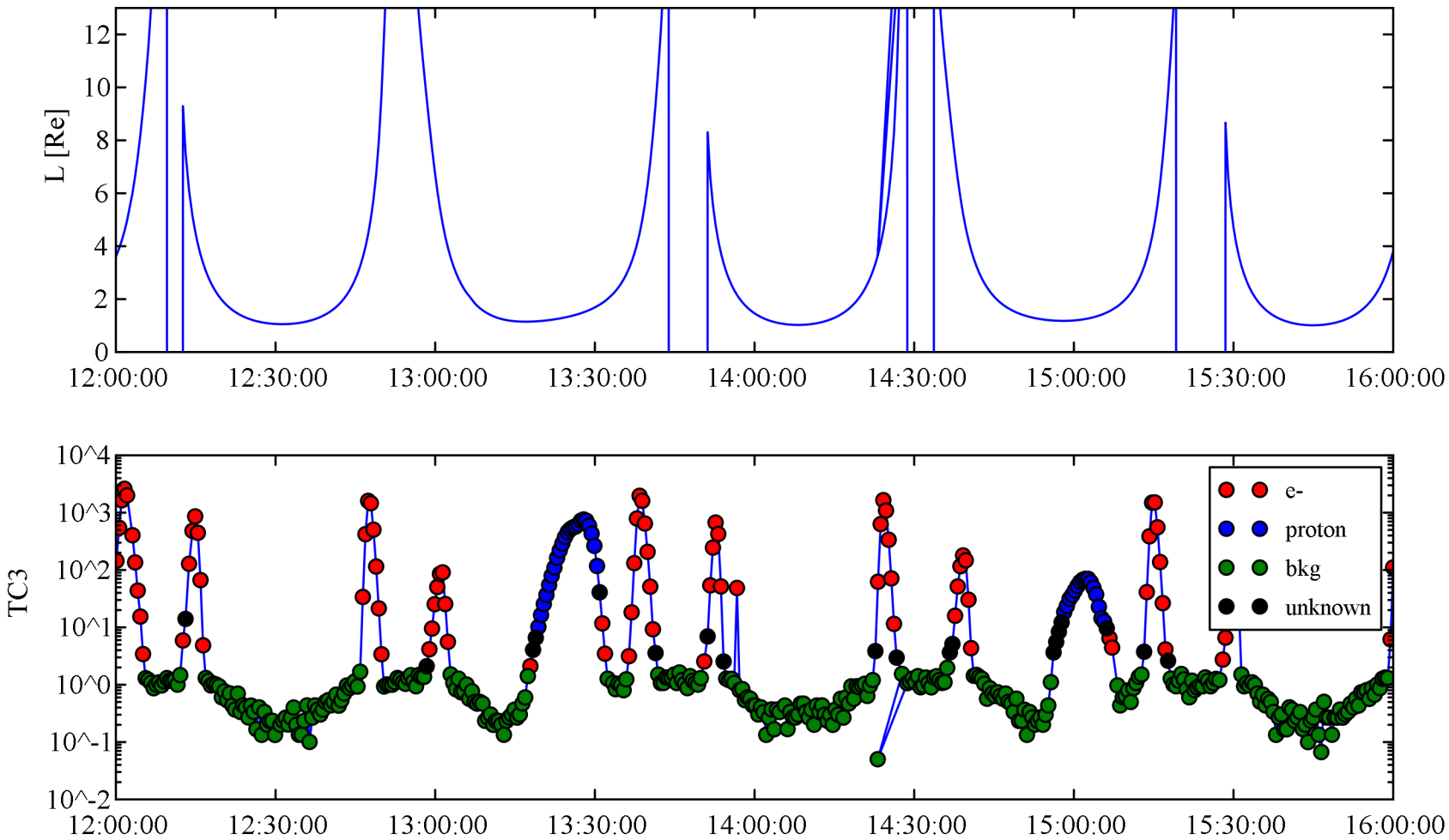
|dTC3/dT|>0.5
No background

S14/TC3 <0.05
electrons

C01+C02+C03>0.3
protons



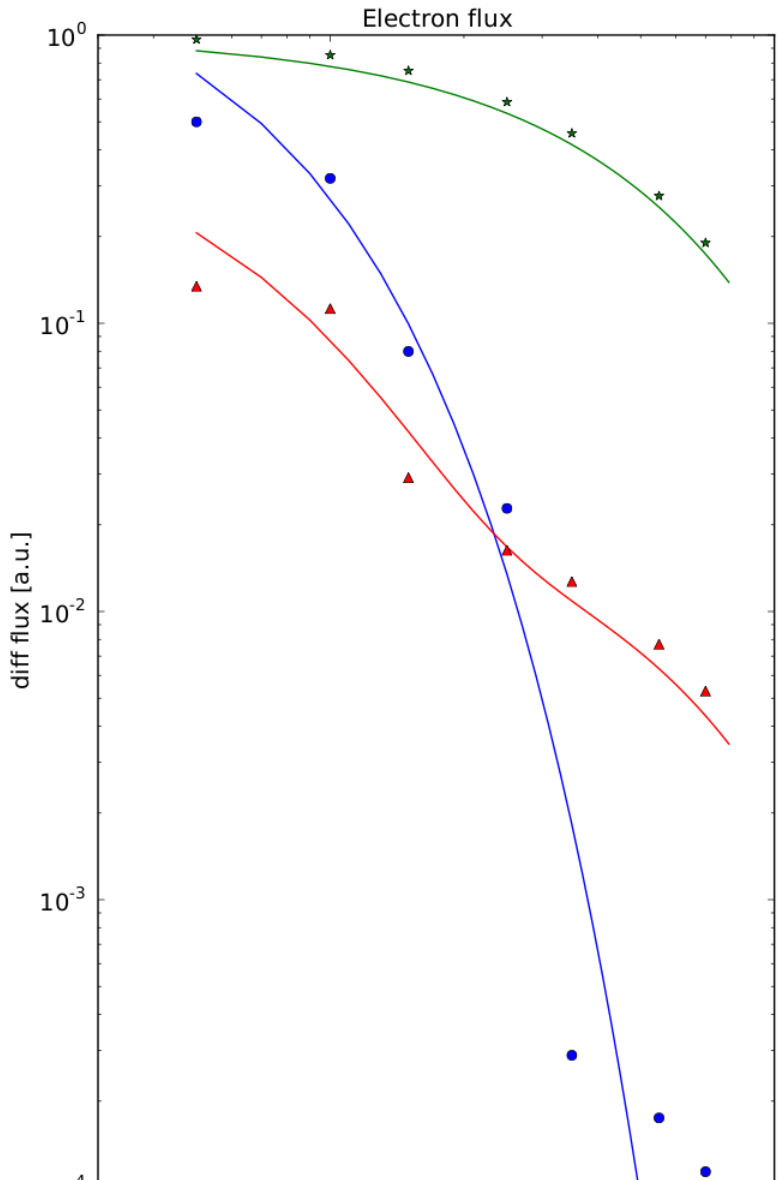
Electron and Proton Flags for Space Data

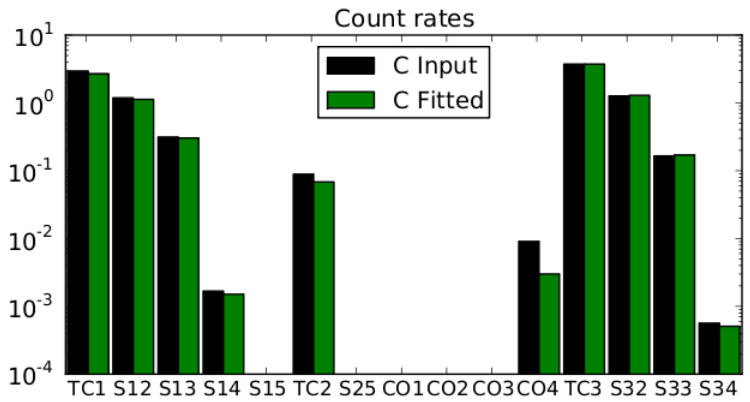


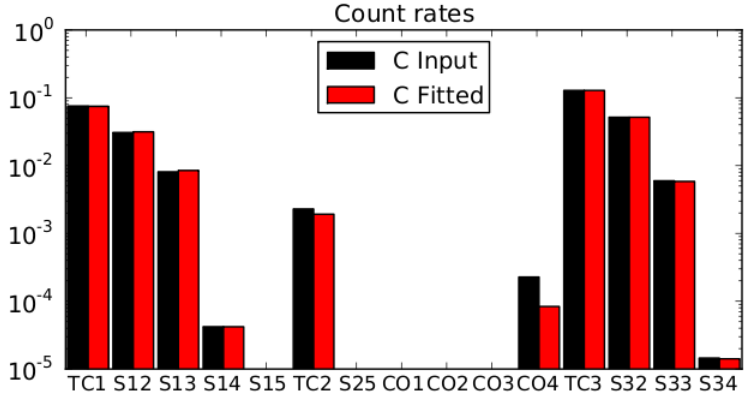
SREM count rate deconvolution

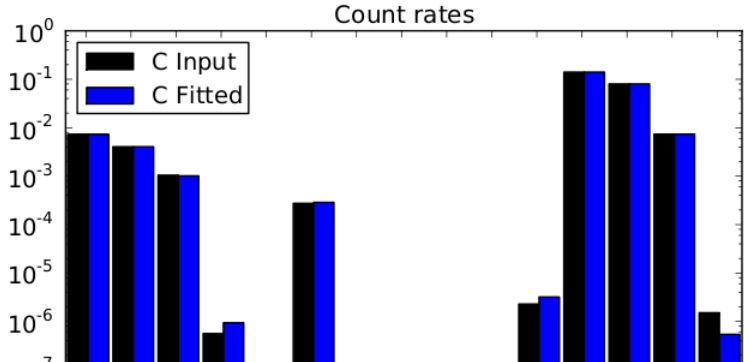
- Computation of the flux over different energy bins [$E_{i,}E_{j+1}$]
- Flux approximation
  - Decreasing over an energy bin
  - Exponential flux over energy bin *i* for electron f=A_i exp(-E/$E0_i$)
  - Power law flux over energy bin *i* for proton f=A_i $E^{-\alpha i}$
- Precise Response Matrix (RM) used to compute the count rates $C_j = \int RM_j(E) f(E) dE$
- Find f0, $E0_i$,... (alpha_i for protons) that gives the C_j that fit the best with the measured count rates C^m_i
- Fitting method:
  - Minimization of $\sqrt{\sum (C_i - C_i^m)^2}$ using the ROOT minuit package
  - Possibility to put weights on the different count channels

Deconvolution for e- virtual spectra

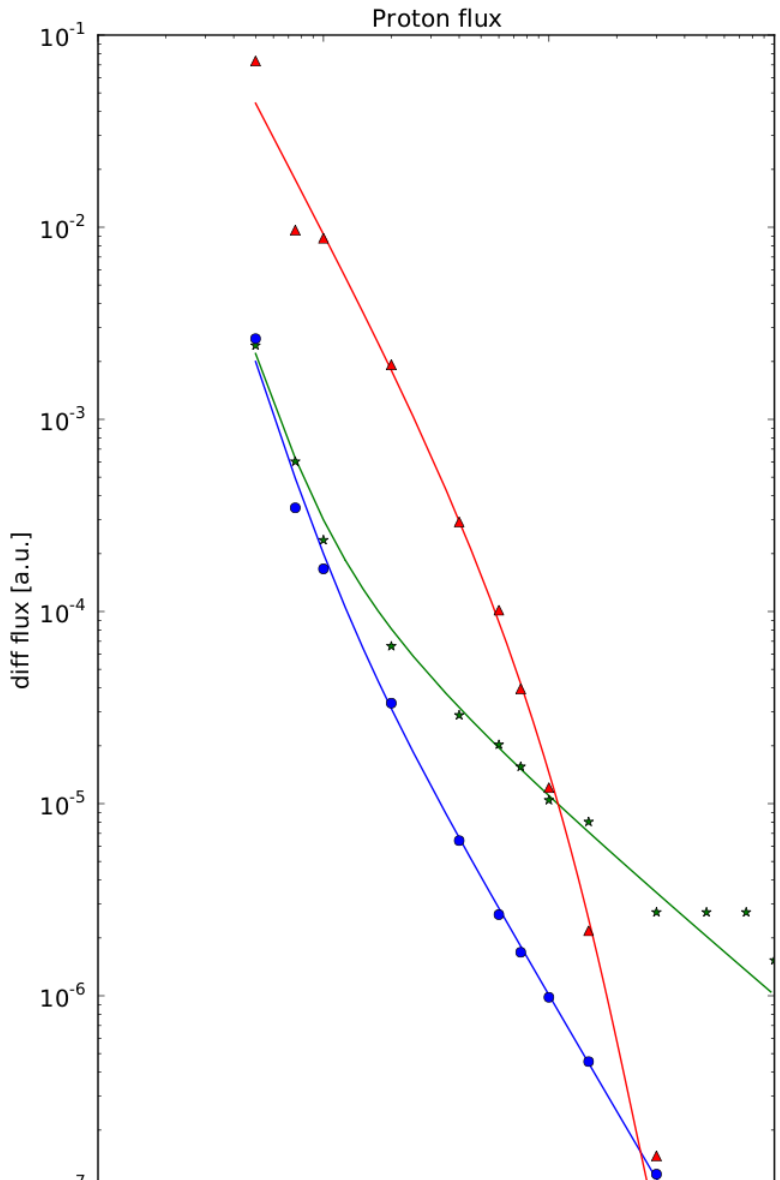


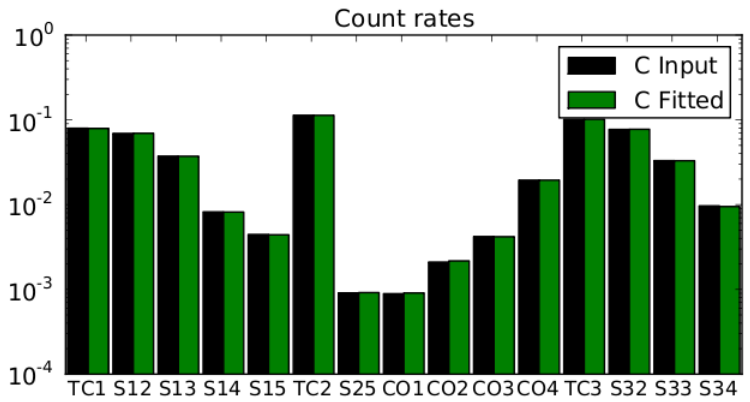


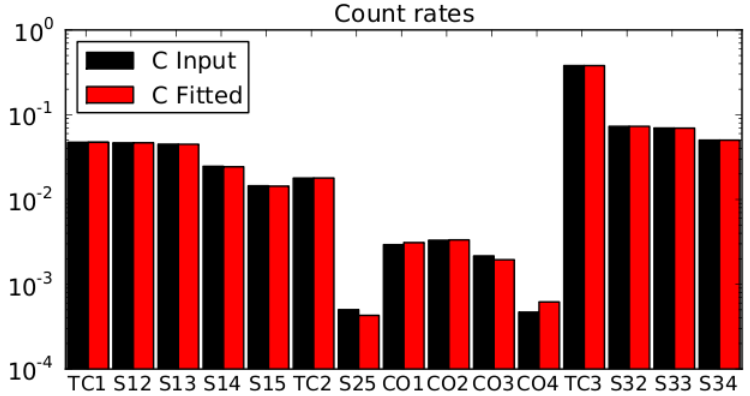


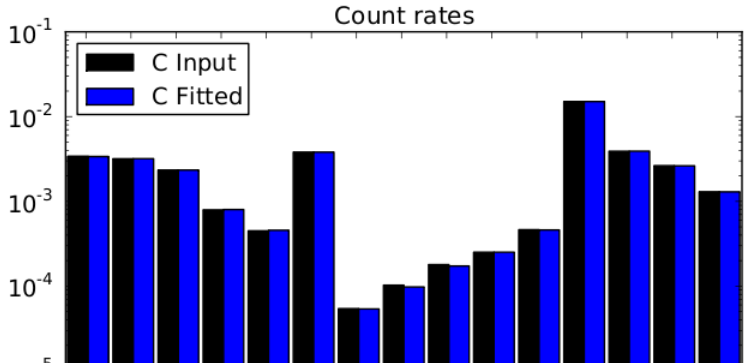


Deconvolution for proton virtual spectra



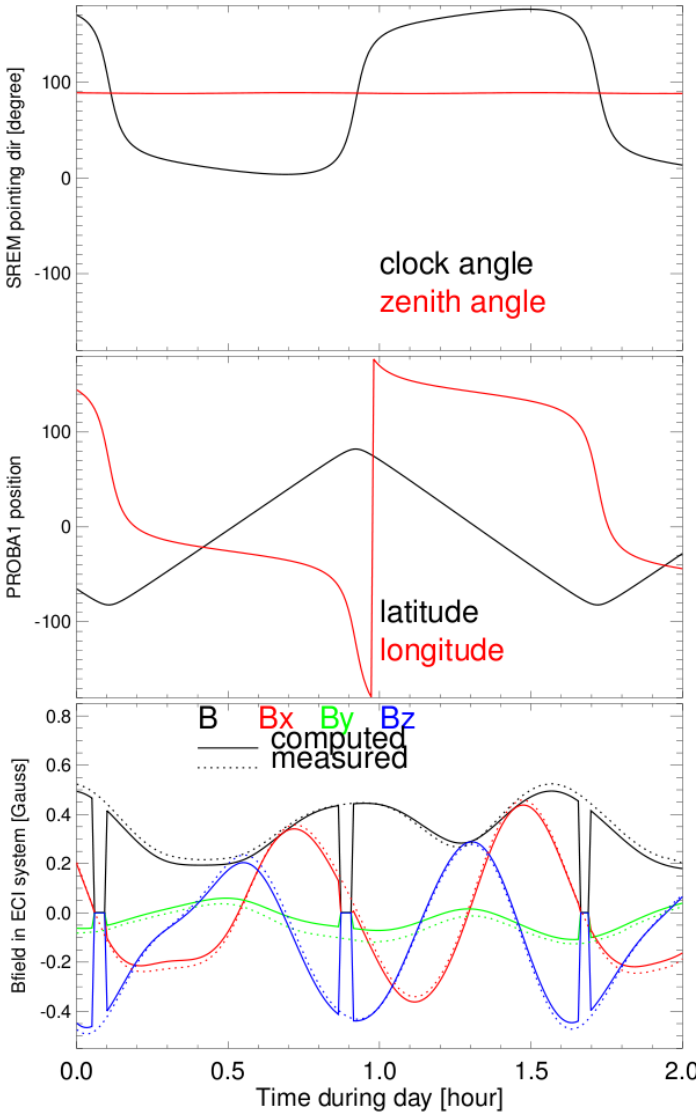




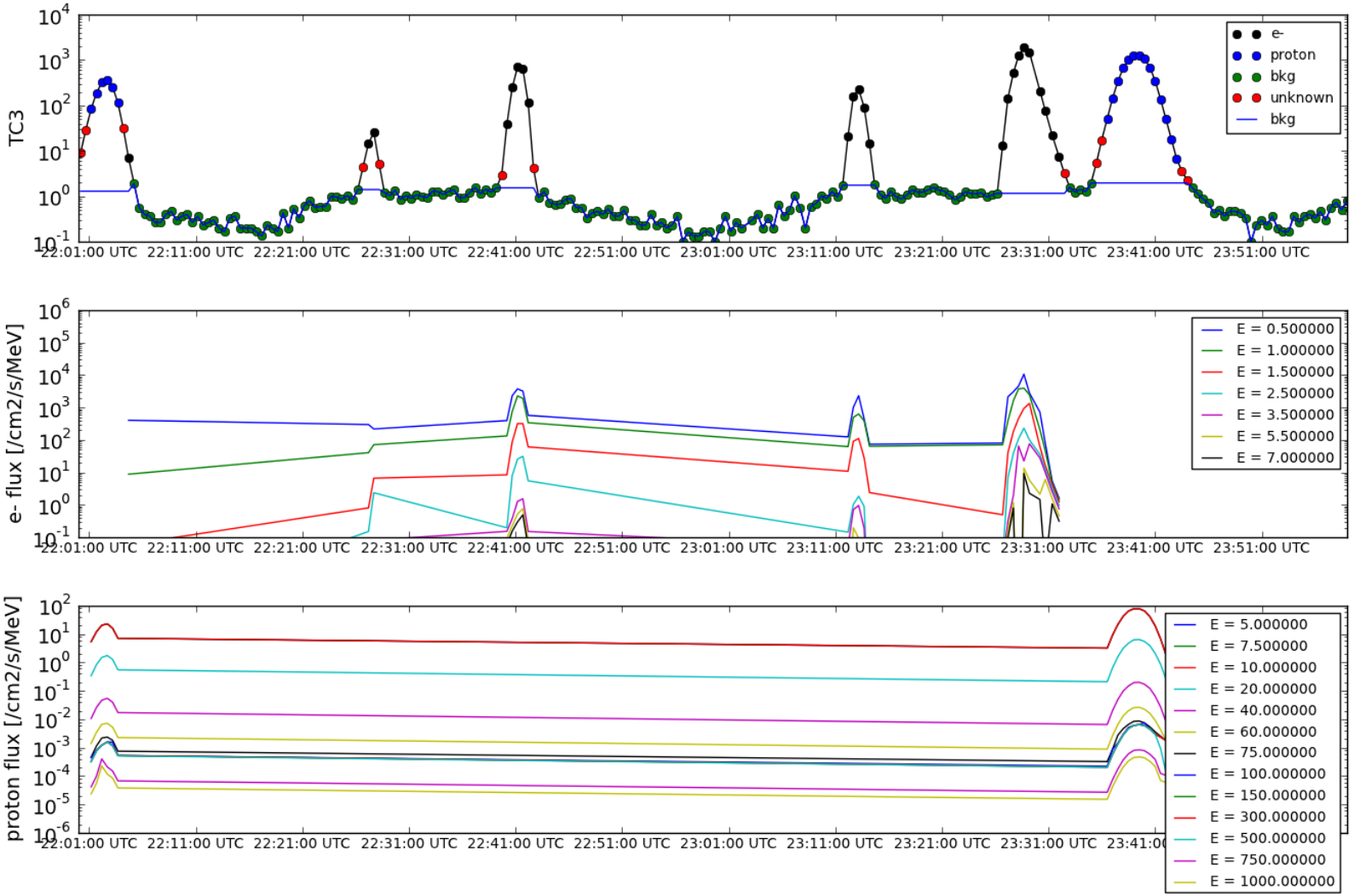


New CDF Files – Data Set for SREM

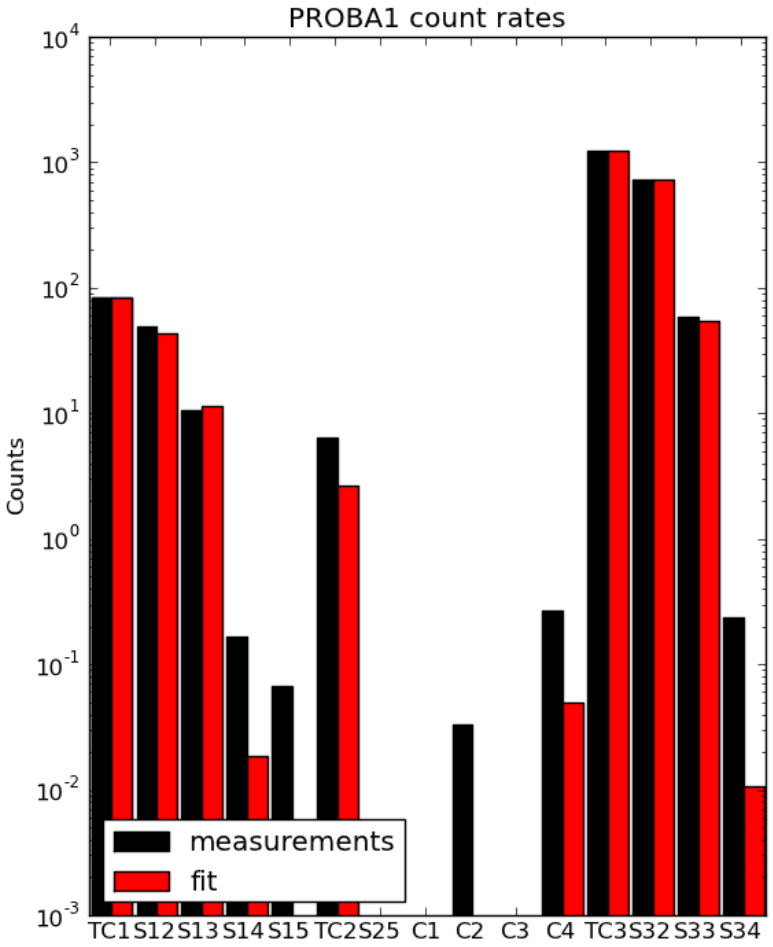
- Add SREM pointing direction
- Add latitude longitude
- Add measured B field
- Add magnetic coodinates: L*,B_{eq}, ….
- Add computed fitted flux
- Rename variables for compliance with COSPAR PRBEM

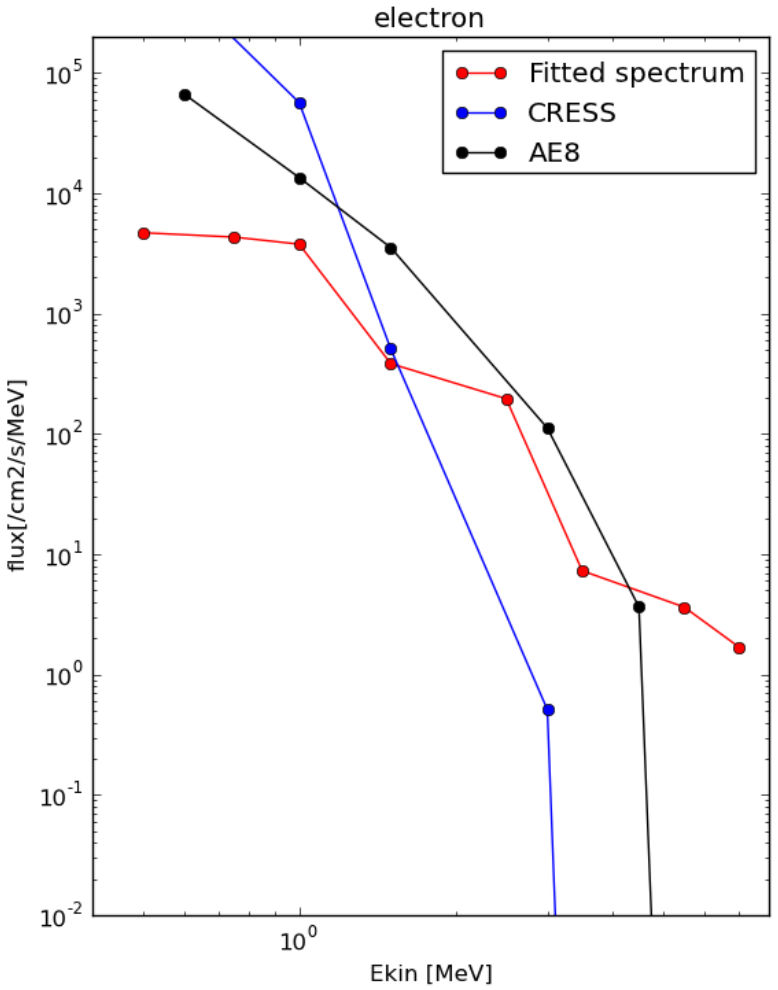


SREM on PROBA1

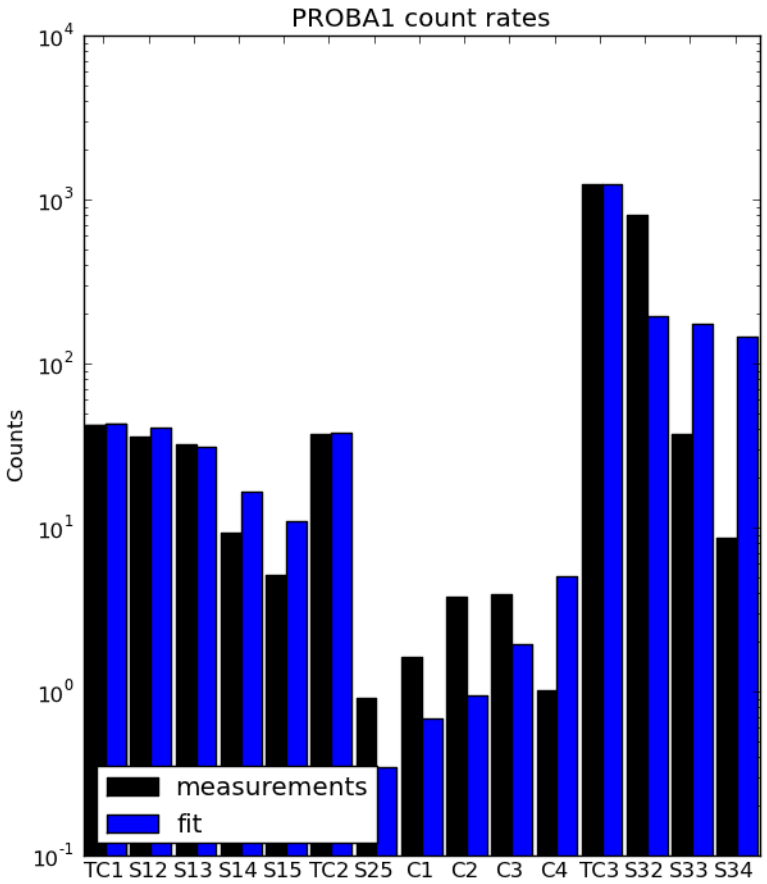


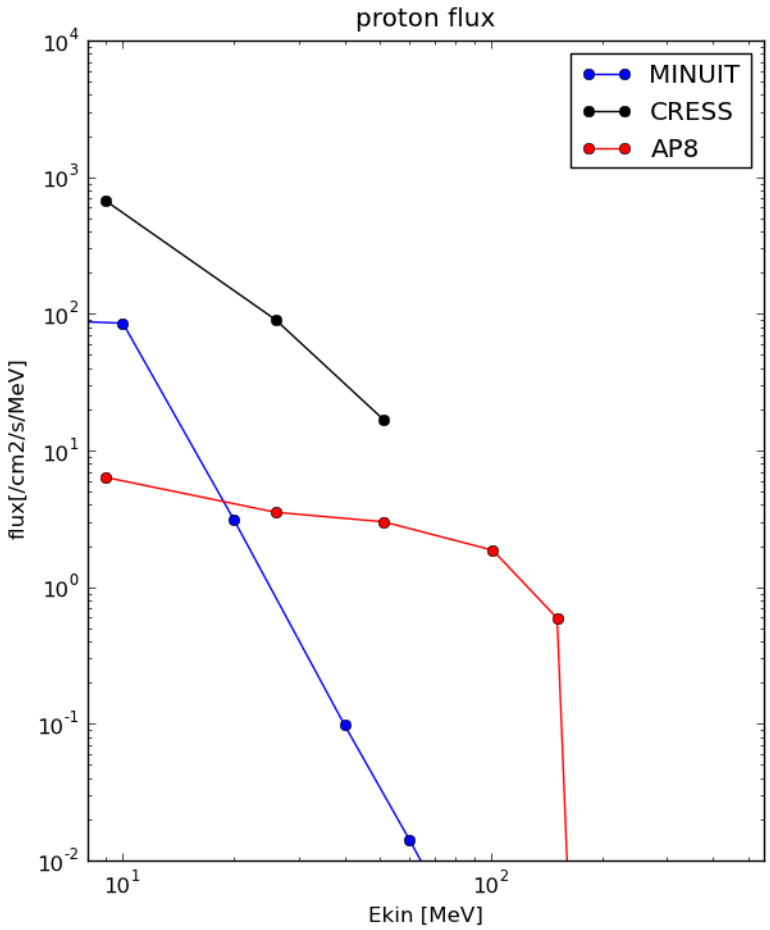
SREM on PROBA1 electron spectrum



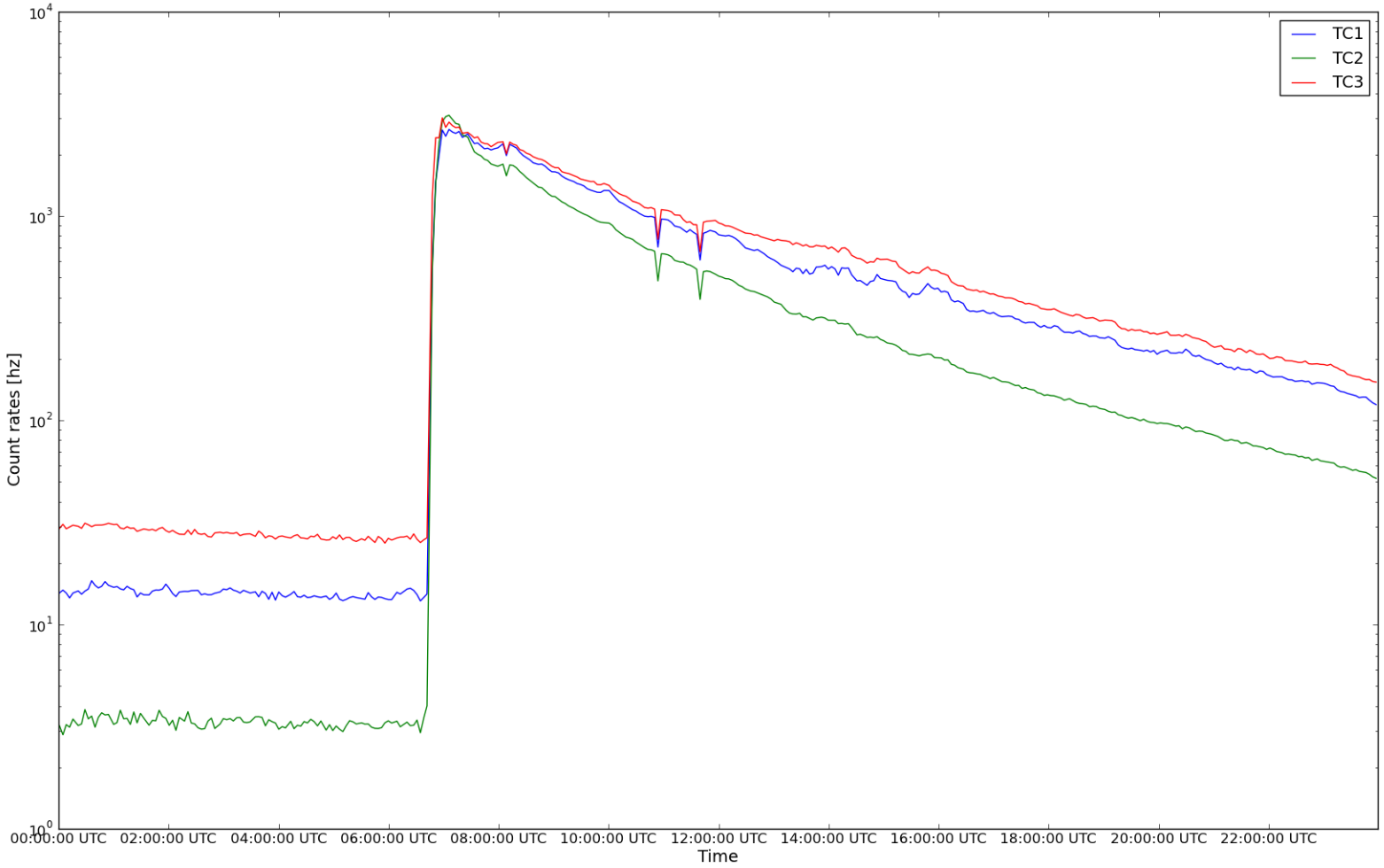


SREM on PROBA1 electron spectrum

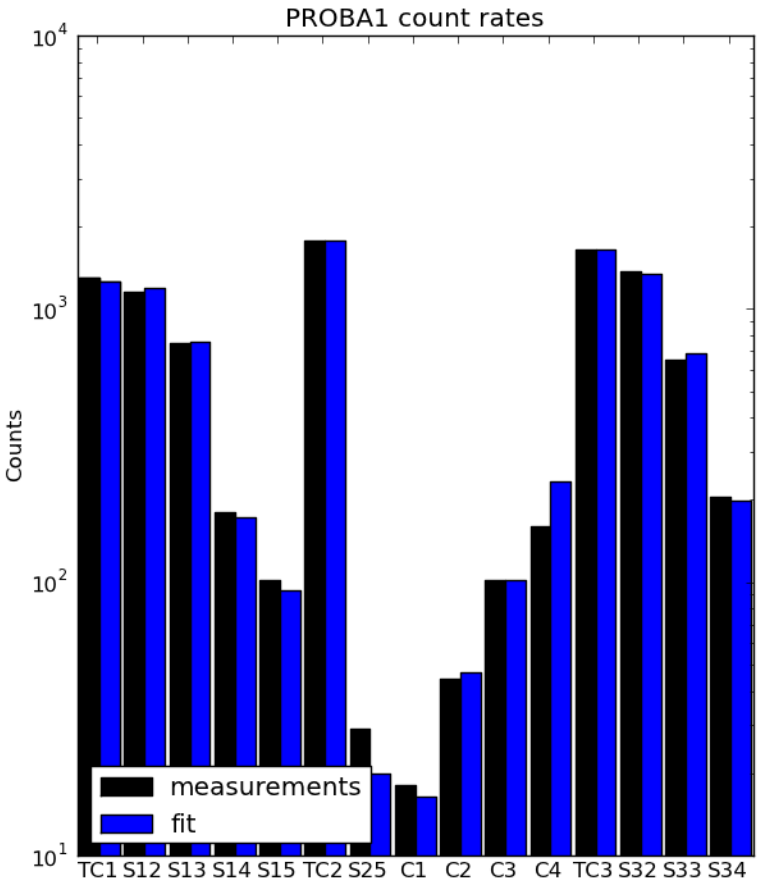


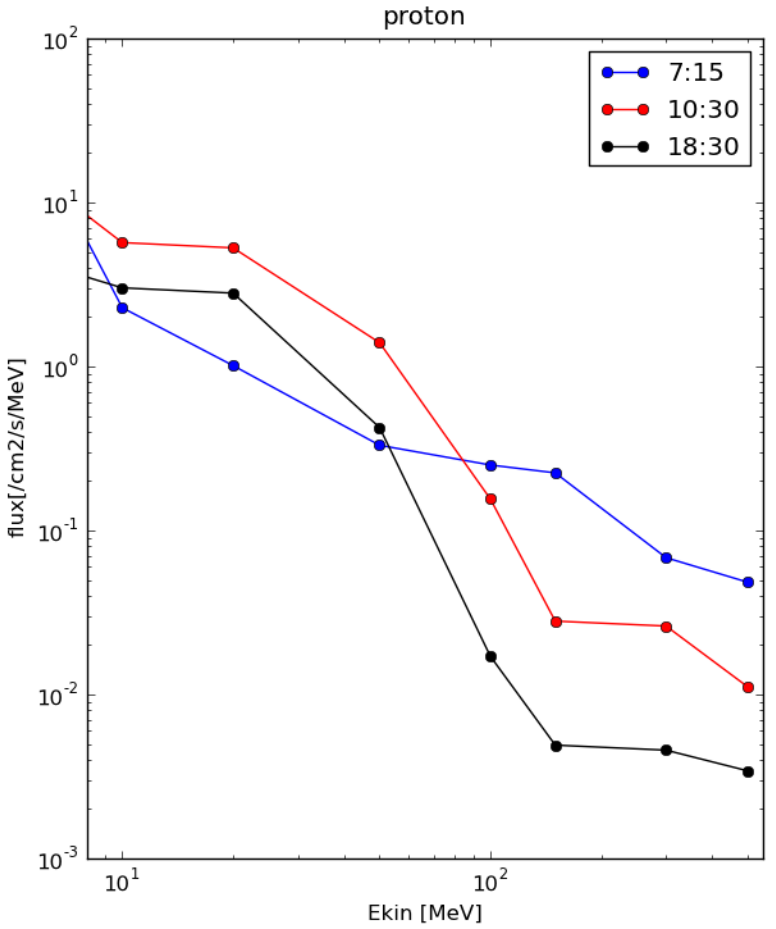


20 January Solar protons events as seen from IREM



20 January Solar protons events as seen from IREM





Conclusions

- We have done full Geant4 simulations of all SREM units with satellite models where available
- We have developed a PYTHON package for SREM data analysis together with an interface with SPENVIS
- We have developed deconvolution methods to extract flux information from SREM count rates

- We are updating the SREM cdf database with extra data needed for scientific analysis :
  - Orientation, magnetic field,...
  - Computed flux