

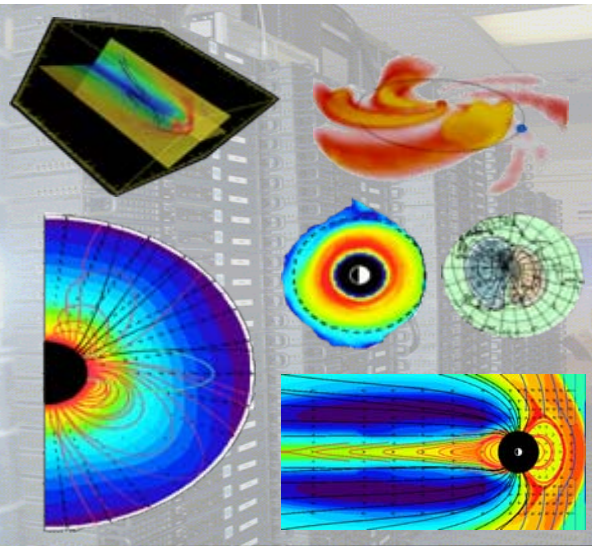
COMMUNITY
COORDINATED
MODELING
CENTER

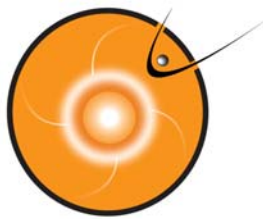
Kinetic Models at CCMC

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Lutz Rastaetter, Alex Klimas*

<http://ccmc.gsfc.nasa.gov>

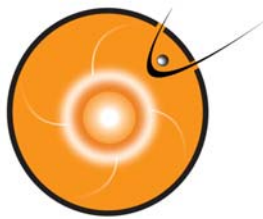
NASA Goddard Space Flight Center





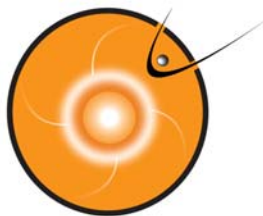
Motivation

- Getting asked frequently: do you have kinetic models at CCMC
- Some missions, e.g., Magnetospheric MultiScale, require kinetic models
- Future large-scale models may be kinetic
- Downside: no immediate relevance for SWx applications



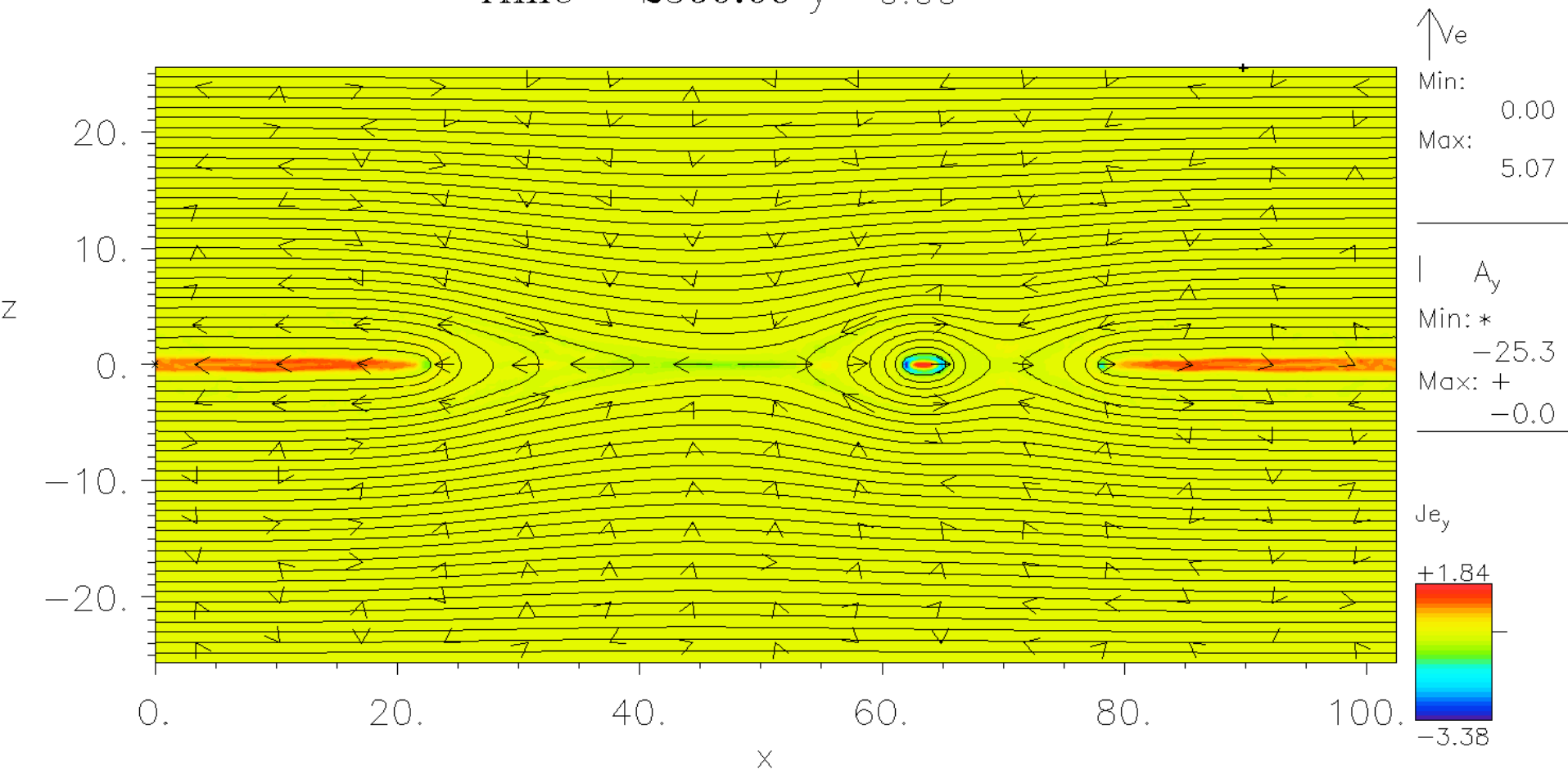
Kinetic models

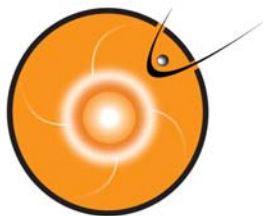
- One or more particle species represented by macro-particles or as a Vlasov fluid
- Prime examples:
 - Vlasov codes
 - Hybrid codes
 - Full particle in cell
- 1D, 2.5D, 3D
- First example: 2.5D, Hesse et al. code
- Experimental at this time, targeting MMS applications
- No RoR yet (very expensive), only access to canned runs
- All visualizations by L. Rastaetter



Visualization examples

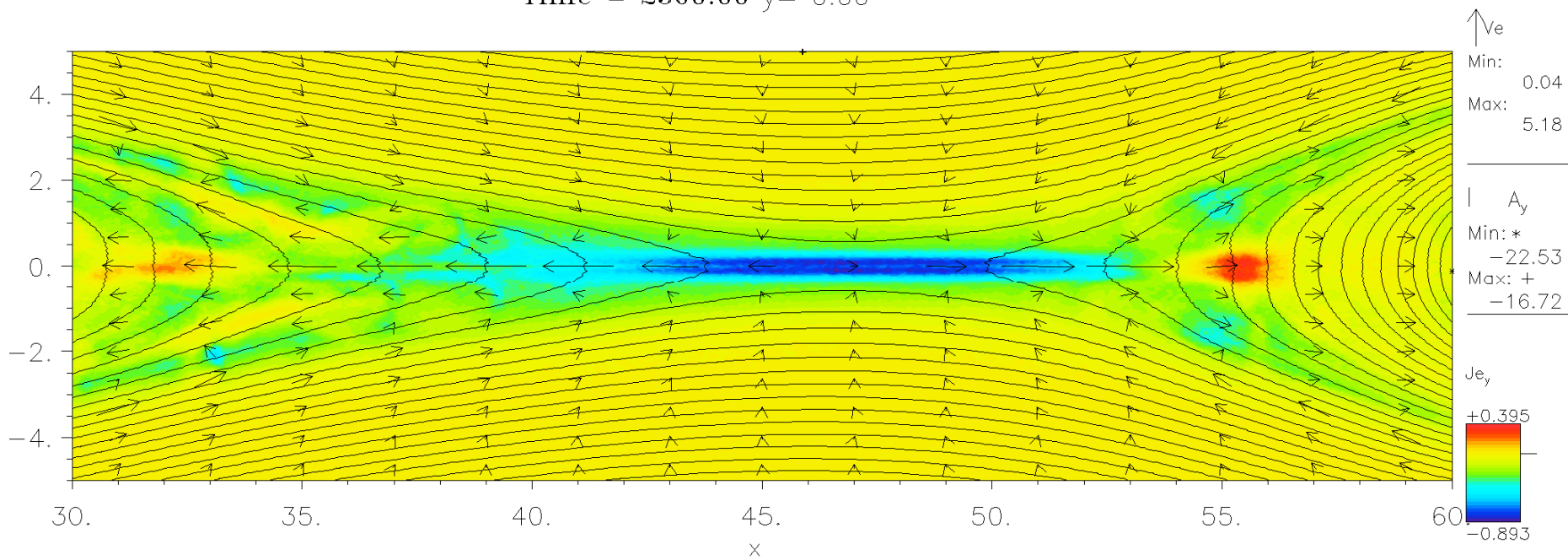
Time = 2500.00 $y = 0.00$





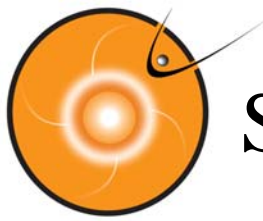
Visualization examples

Time = 2500.00 y= 0.00



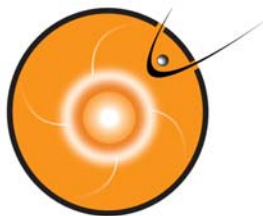
Model at CCMC: MH_PIC2D

Electron current sheet



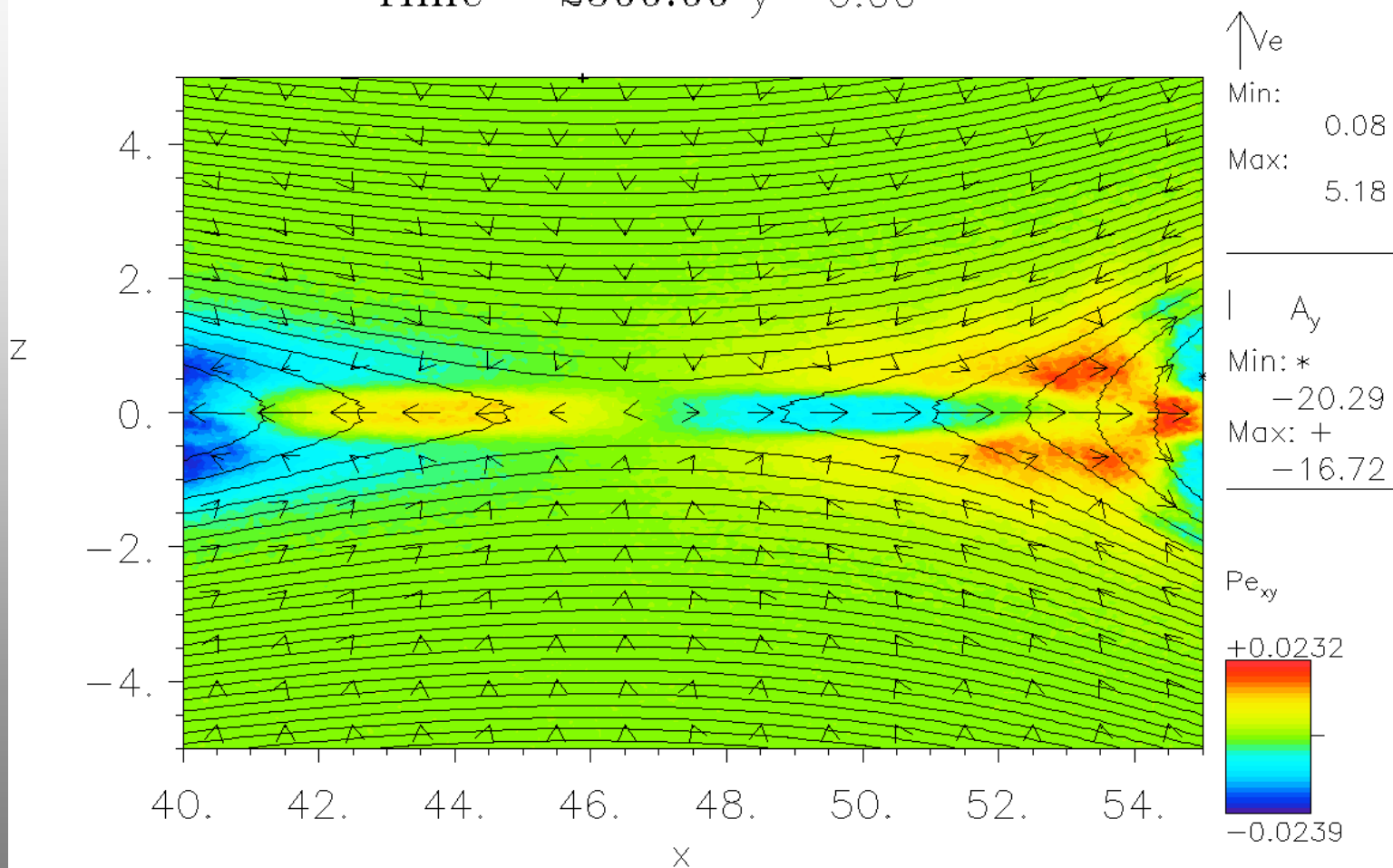
Science analysis: reconnection electric field

$$E_{rec} = -\frac{1}{en_e} \left(\frac{\partial \mathcal{P}_{xye}}{\partial x} + \frac{\partial \mathcal{P}_{yze}}{\partial z} \right)$$



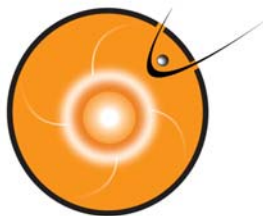
Visualization examples

Time = 2500.00 $y = 0.00$



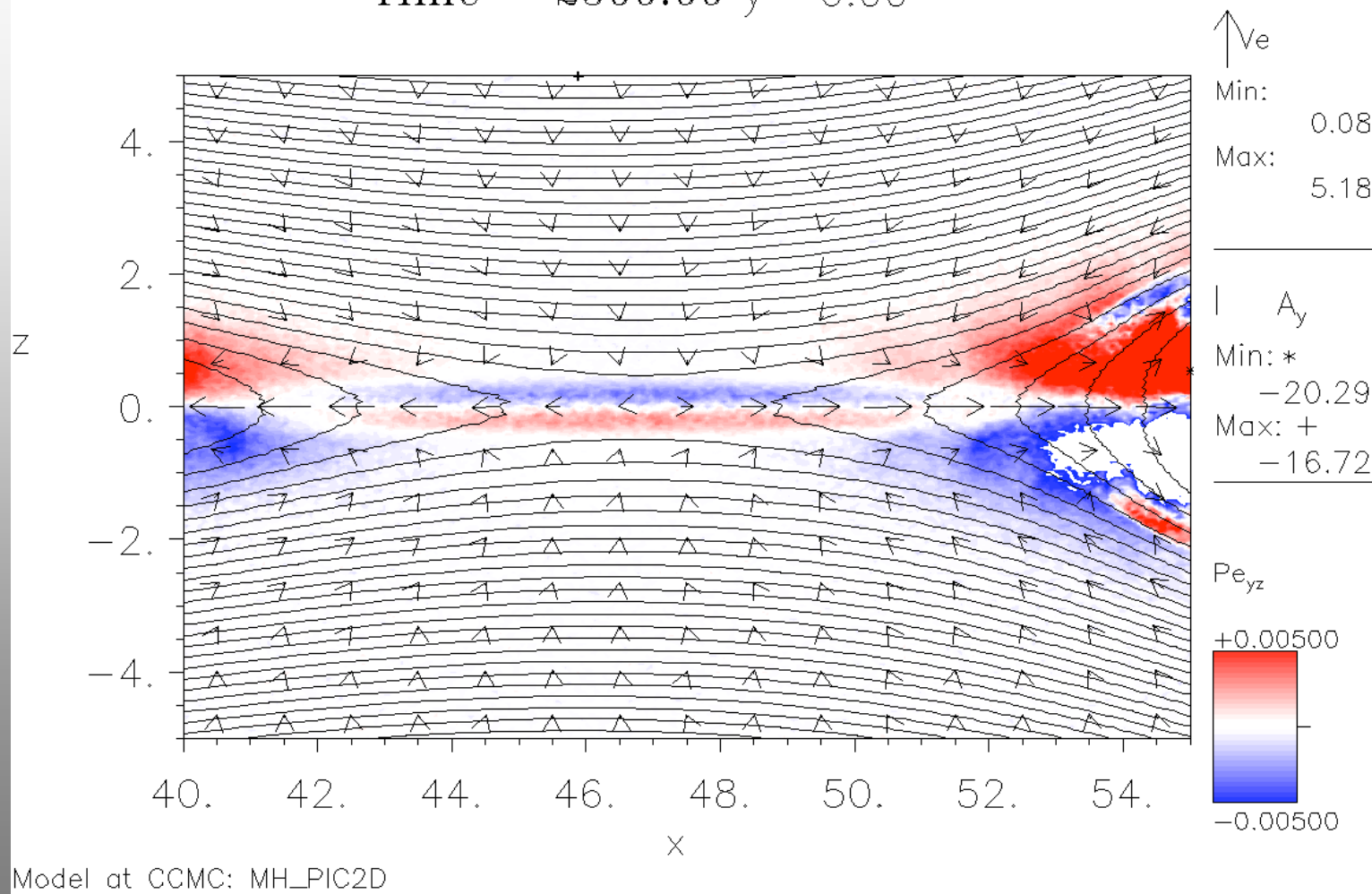
Model at CCMC: MH_PIC2D

xy component of electron pressure tensor

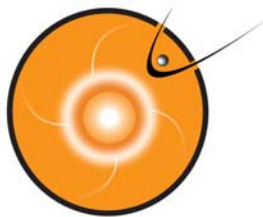


Visualization examples

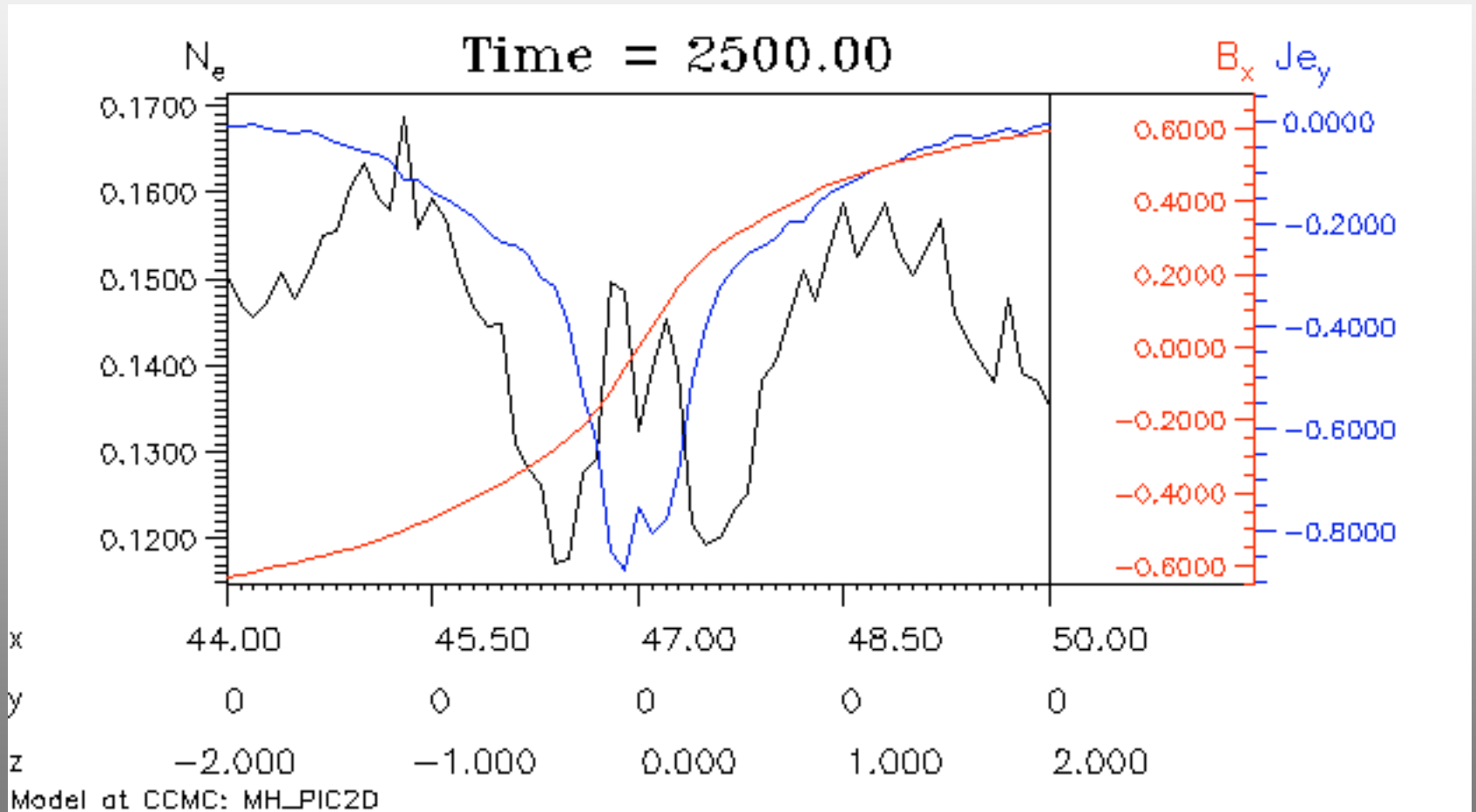
Time = 2500.00 $y = 0.00$

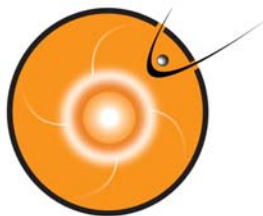


yz component of electron pressure tensor



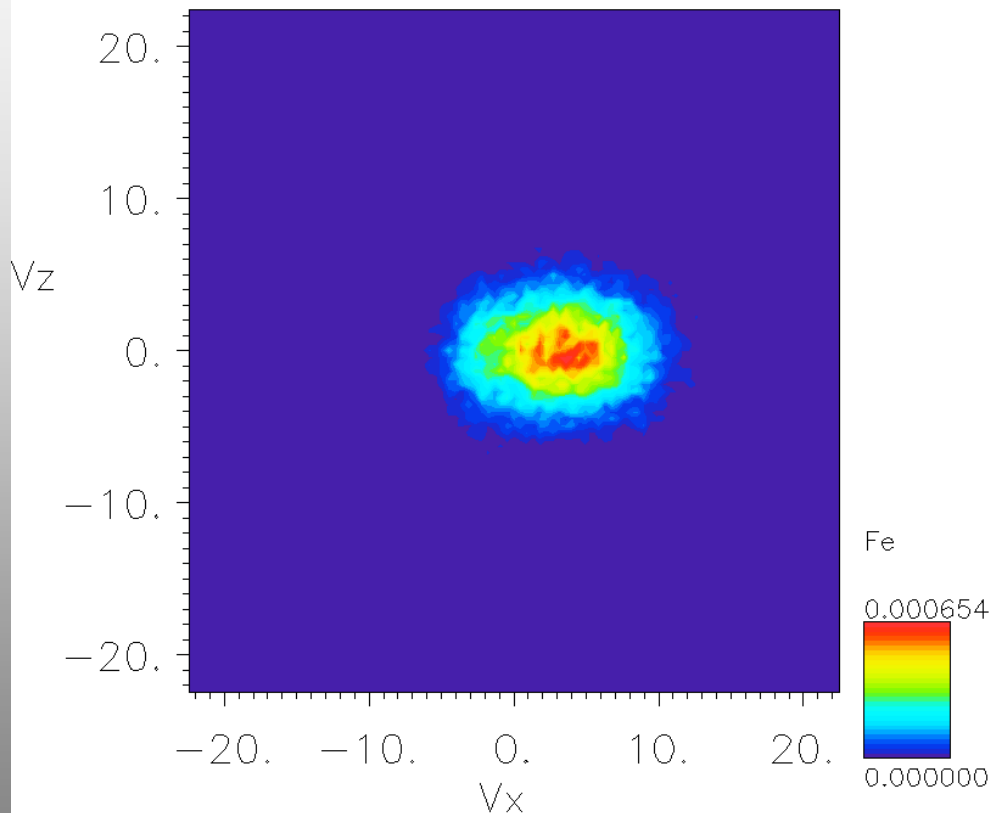
Visualization examples: burst mode triggers





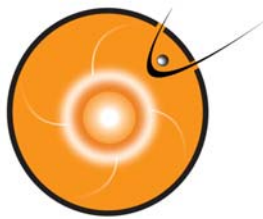
Next steps

Time = 00:40:30 UT $v_y = 0.00$



Model at CCMC:

$F(v_x, v_z)$ distribution, beta version



Next steps

- Put it out there with more runs to support MMS
- Gauge customer reception, incl. by MMS community
- If successful, add other PIC models, e.g., Pritchett, Daughton
- Add hybrid models, e.g., Omid
- Offer RoR for 1D runs, 2.5D (more distant future)

**MMS-SMART:
A multi-s/c mission
to study magnetic reconnection**

Michael Hesse

