Simulation Update

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Geant4

Computing Time Performance

Valgrind Profiling

- G4 full event (Tracks 3.41M, Steps 13.34M (x 3.9))
- Process run 1074G
  - Initialisation 57.2
  - Event Loop 1017 (3.0 x Geant3)
    - PreUserTrackingAction 66.1 (6.5%)
      - PreTrack 35.8 (3.5%)
      - FinishPrimary 9.5
      - TrackToStack 11.0
    - SetInitialStep 54.9 (5.4%)
      - ResetHiearchyAndLocate 53.0 (5.2%)
    - ProcessOneTrack 849 (84%)
      - DefinePhysicalStepLength 559 (55%)
        - AlongStepGetPhysicalInteractionLength 505
          - PropagatorInField::ComputeStep 413
            - CordFinder 295
              - AliMagF 235. (23%)
          - ComputeStep 84.3
          - Compute Safety 3.4
        - PostStep 25.2
      - InvokePostStepDoltProcs 182 (17.9%)
        - HadronElastic 14.2
        - Transportation 12.1
        - Hadronic 4.5
        - EnergyLoss 0.6
      - InvokeAlongStepDoltProcs 46.4 (4.6%)
      - ProcessHits 39.6 (3.9%)
      - TG4SteppingAction::UserSteppingAction 14.2 (1.4%)
    - PostUserTrackingAction 37.5 (3.7%)
      - PostTrack 35.8 (3.5%)

- too many MagField Calls
- void Pre(PostTrack)

valgrind –tool=callgrind aliroot -b -q sim.C

Performance Tuning

	time* per 100 events (s)
before corrections (Geant4 10.0)	485
TGeo clean-up of warnings	368
no Pre(Post)Tracking Calls minimum field caching (avoid multiple calls)	361
Nystrom Stepper	350
including optical processes	362
Geant4 10.1	336
Increased Transport cuts in beam pipe	273
distance for field caching 1mm	263
Geant3 (old cuts)	220
Geant3 (higher cuts for beam pipe)	170

*Intel Xeon E3-1275
gcc version 4.8.2 (Ubuntu 4.8.2-19ubuntu1)

Other issues

- Frequent crashes in G4MultiLevelLocator
  - https://sft.its.cern.ch/jira/browse/SIM-542
- Small memory leak
  - being investigated
  - part of the leak can be reproduced with G4 stand-alone
- Response differences
  - mainly TRD (tuning needed)
  - needs coloration wide effort, … push from management

Multi-Threading Test-Suite

- Based on geant4_vmc example A01
    - full ALICE geometry
    - realistic central field
    - TPC hits
    - realistic generator

Scaling Tests

A) vmc application program linked with Geant4 static libraries

```
this requires Geant4 libraries built with:
  -DBUILD_SHARED_LIBS=OFF
  -DBUILD_STATIC_LIBS=ON
  -DGEANT4_BUILD_TLS_MODEL=initial-exec
```

B) vmc application program linked with Geant4 shared libraries

```
this requires Geant4 libraries built with:
  -DBUILD_SHARED_LIBS=ON
  -DBUILD_STATIC_LIBS=OFF
  -DGEANT4_BUILD_TLS_MODEL=initial-exec
```

C) vmc macro run from root with dyn. loading of Geant4 libraries

```
this requires Geant4 libraries built with:
  -DBUILD_SHARED_LIBS=ON
  -DBUILD_STATIC_LIBS=OFF
  -DGEANT4_BUILD_TLS_MODEL=global-dynamic
```

Scaling Tests

(A)

3000 particles, 16 events

#threads	exe time (s)	per event*	speedup
1	38981.9	812.12	1.00
2	23234.8	484.06	1.68
4	12123.7	252.58	3.22
8	6081.07	126.69	6.41
16	2659.43	55.40	14.66

(B)

#threads	exe time (s)	per event	speedup
1	70608.6	1471.01	1.00
2	36618.2	762.88	1.93
4	18763.68	390.91	3.76
8	8970.56	186.89	7.87
16	4800.37	100.01	14.71

(C)

#threads	exe time (s)	per event	speedup
1	77242.3	1609.21	1.00
2	36897.5	768.70	2.09
4	18533.5	386.11	4.17
8	9454.96	196.98	8.17
16	5307.67	110.58	14.55

*normalised to 1k particles

Time per Event*

Test Case	A)		B)		C)	
1k primaries, 16 events	864	1.00	1206	1.39	1266	1.46
3k primaries, 8 events	1058	1.00	1205	1.14	1253	1.18
5k primaries, 8 events	1250	1.00	1323	1.06	1351	1.08
3k primaries, 16 events	812	1.00	1471	1.81	1609	1.98
Average	**996**	**1.00**	**1300**	**1.31**	**1370**	**1.38**

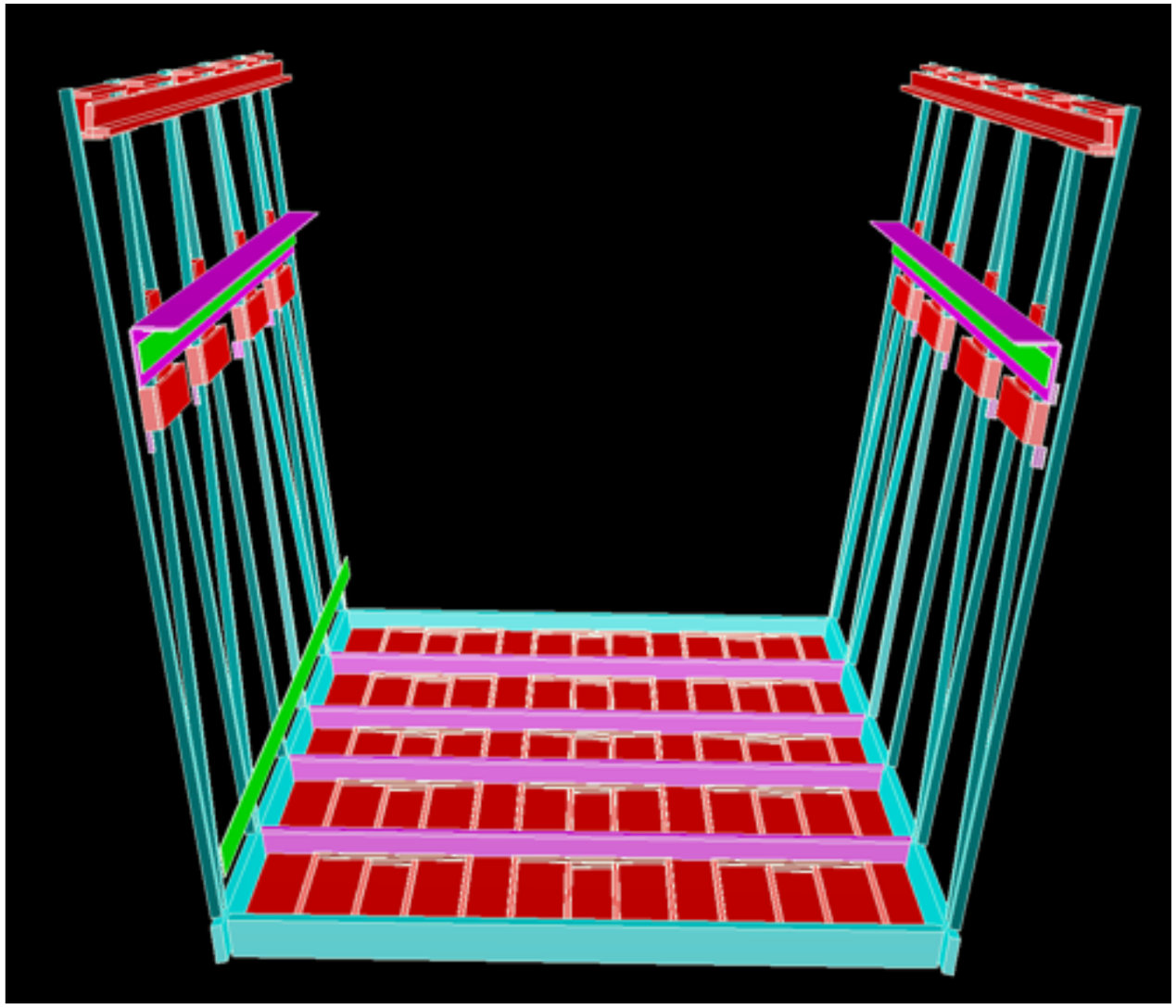
Potentially large gain with static libraries

To be tested with full AliRoot

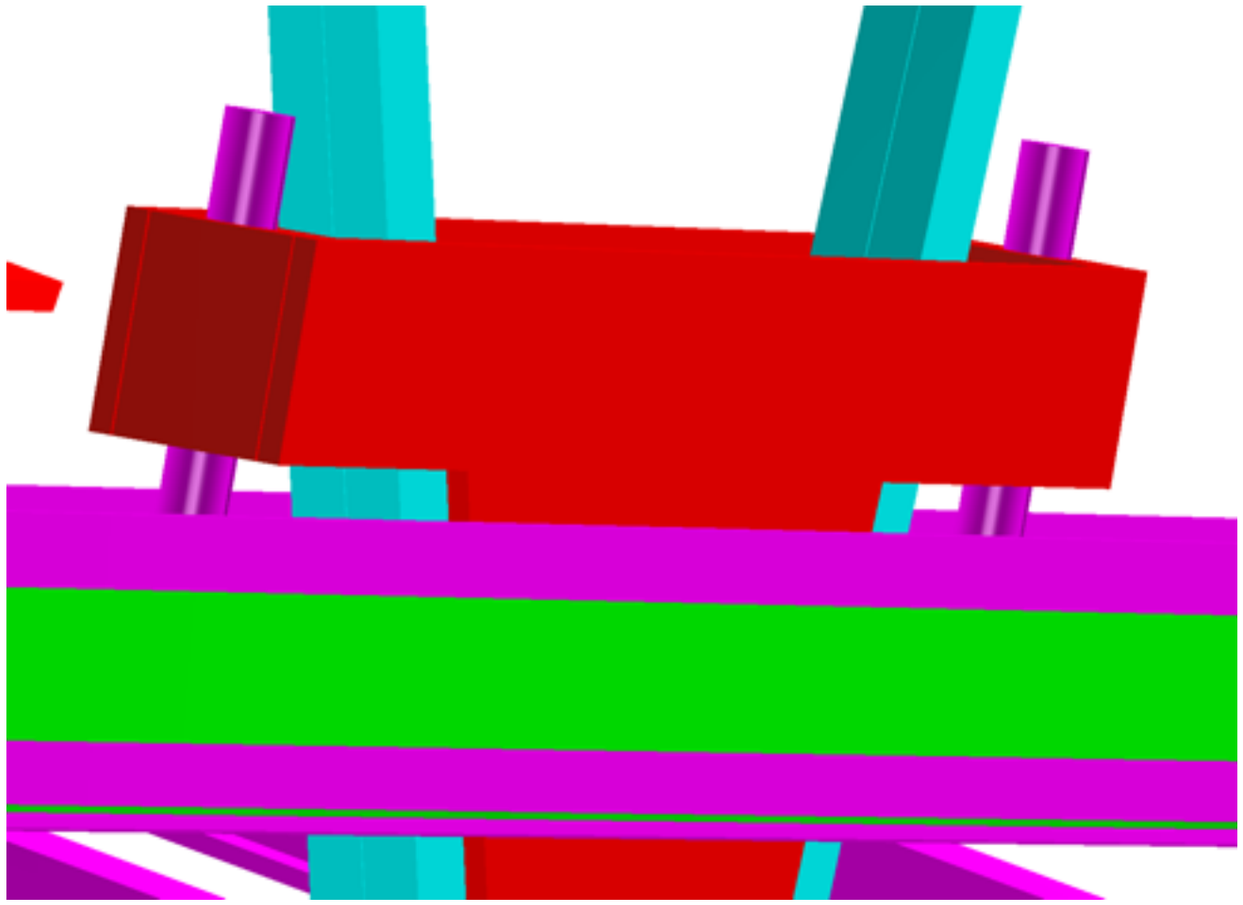
*normalised to 1k particles

Run2 Geometry

Space-Frame Updates

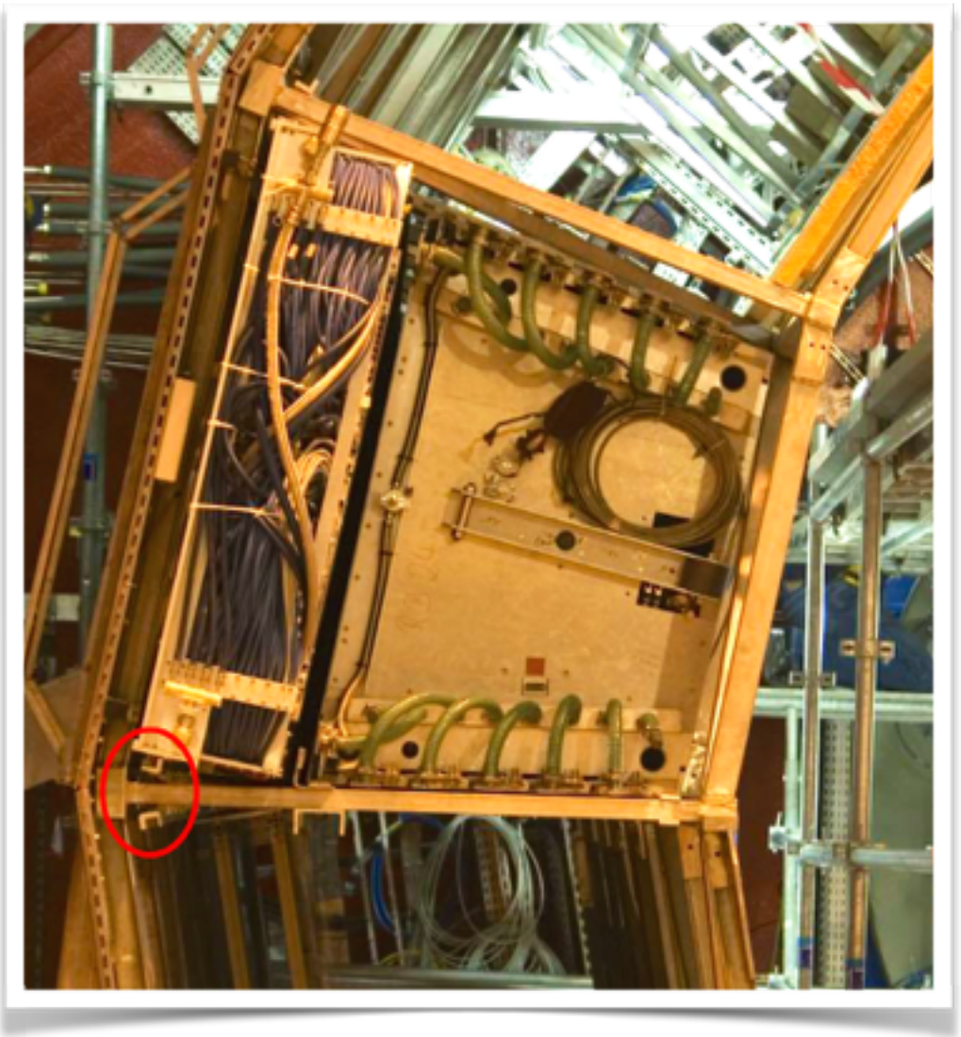


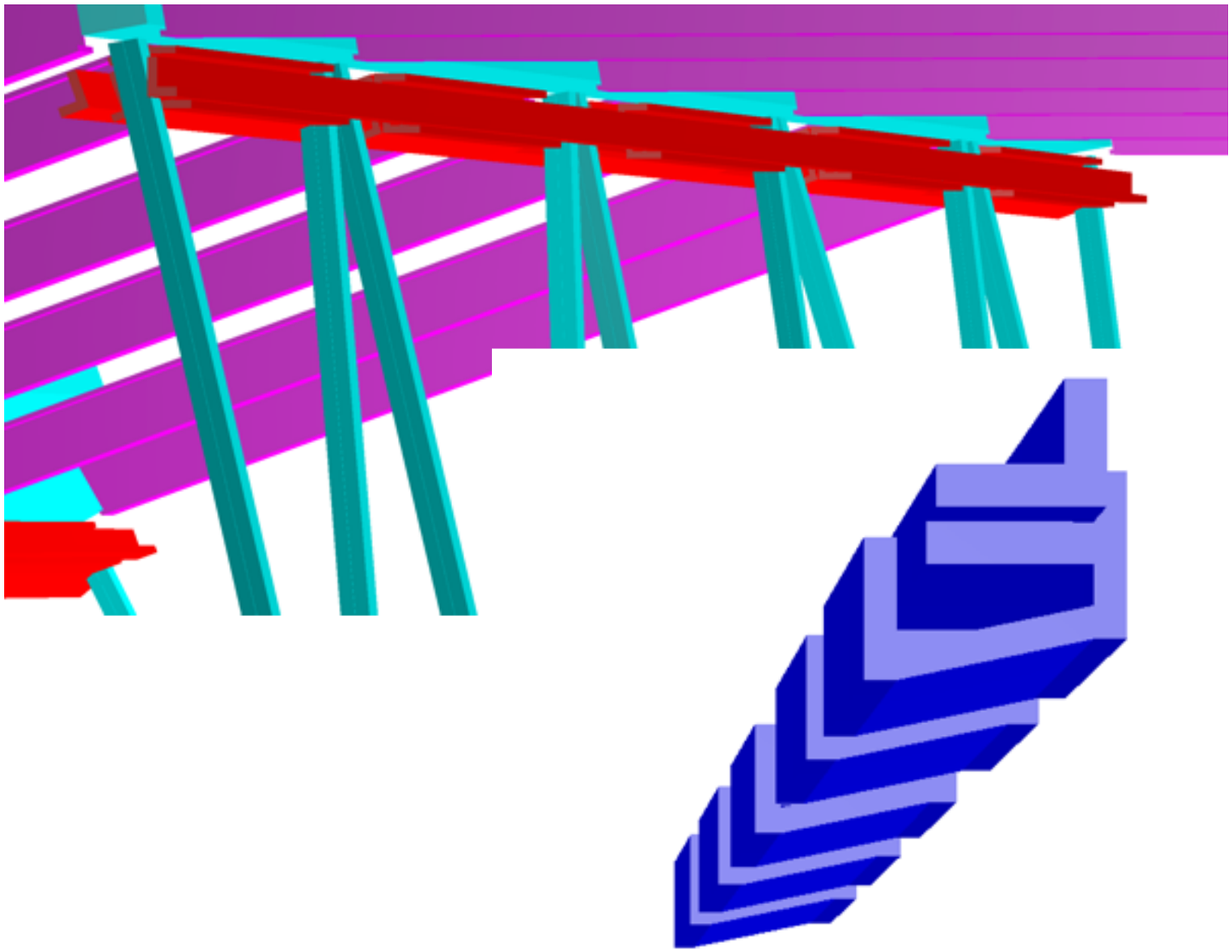
Fixation Blocks and Tie Anchors



few correction of dimension still needed

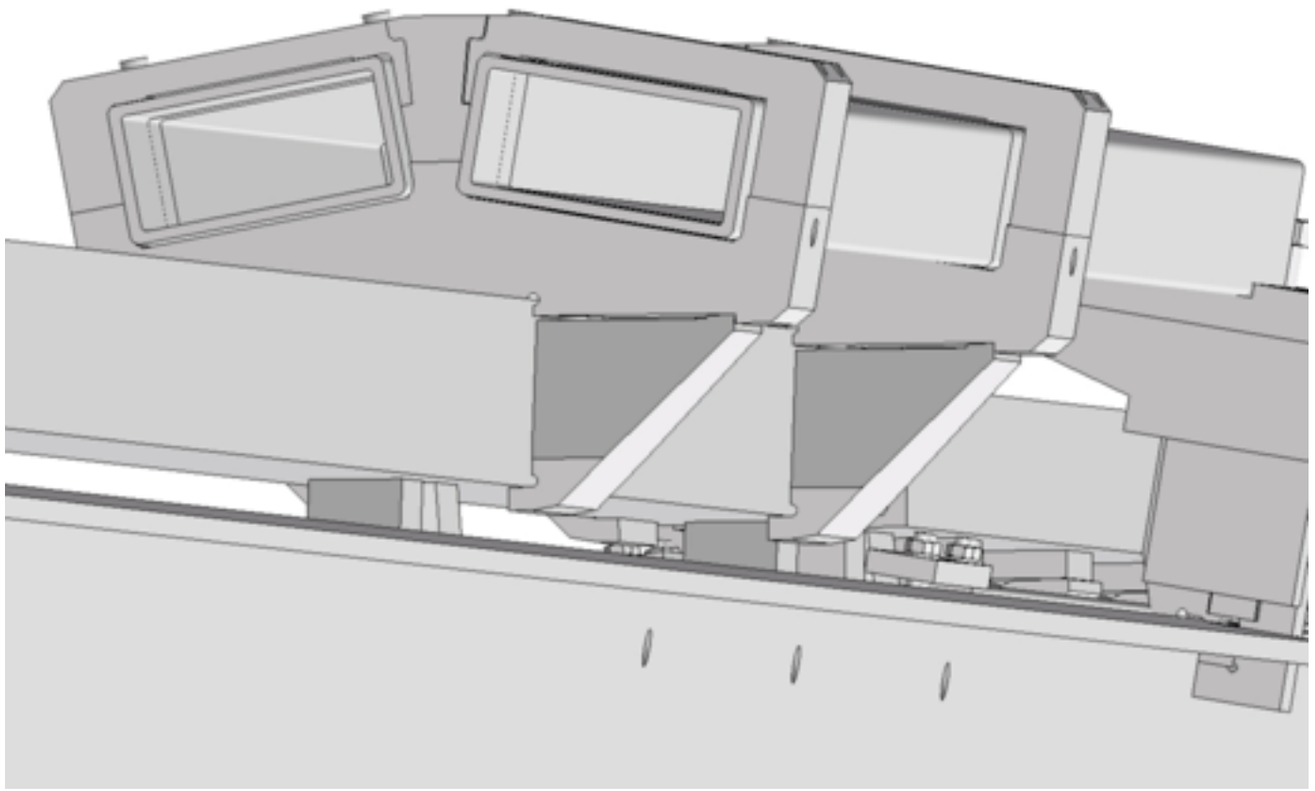
TOF Rails

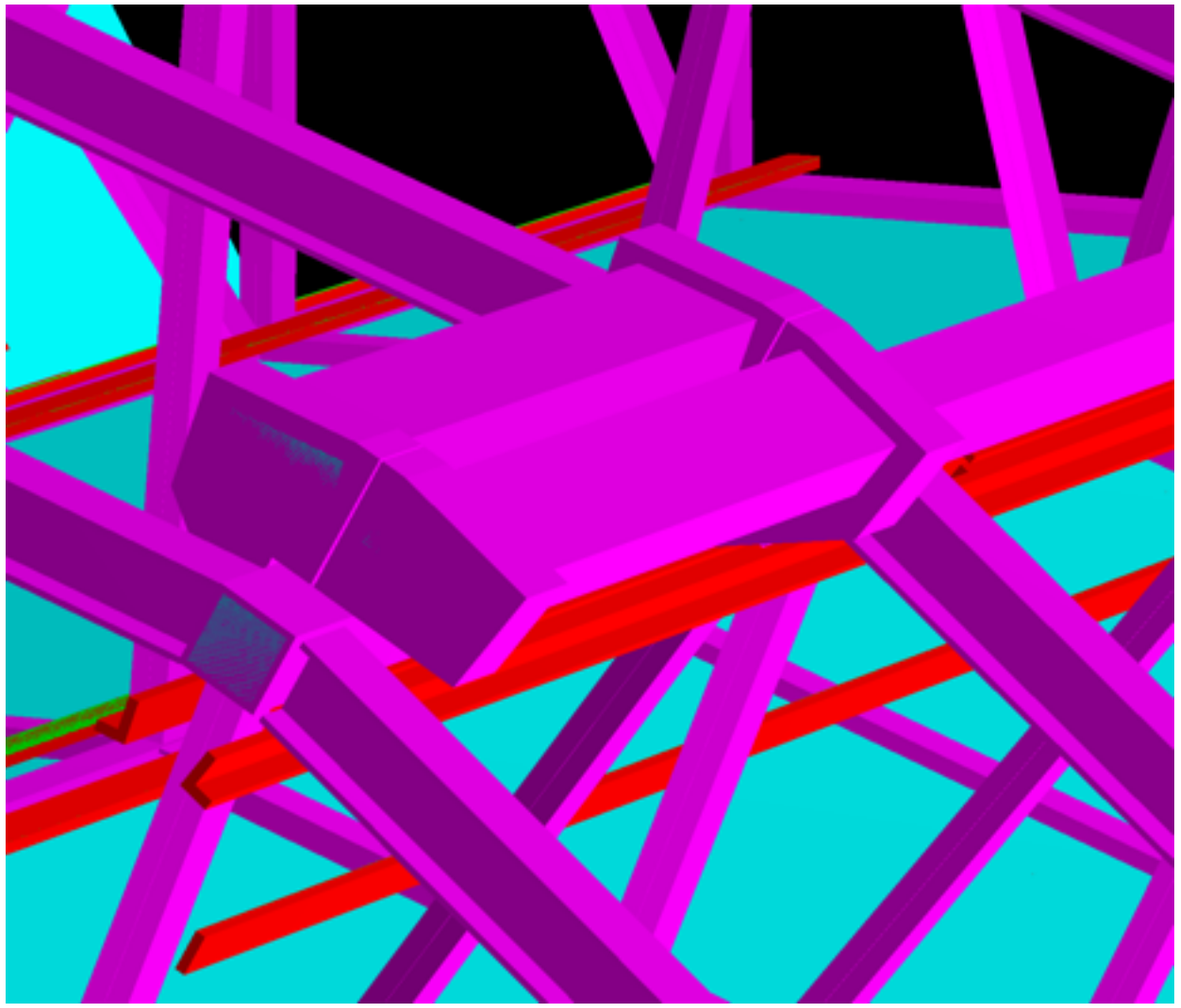




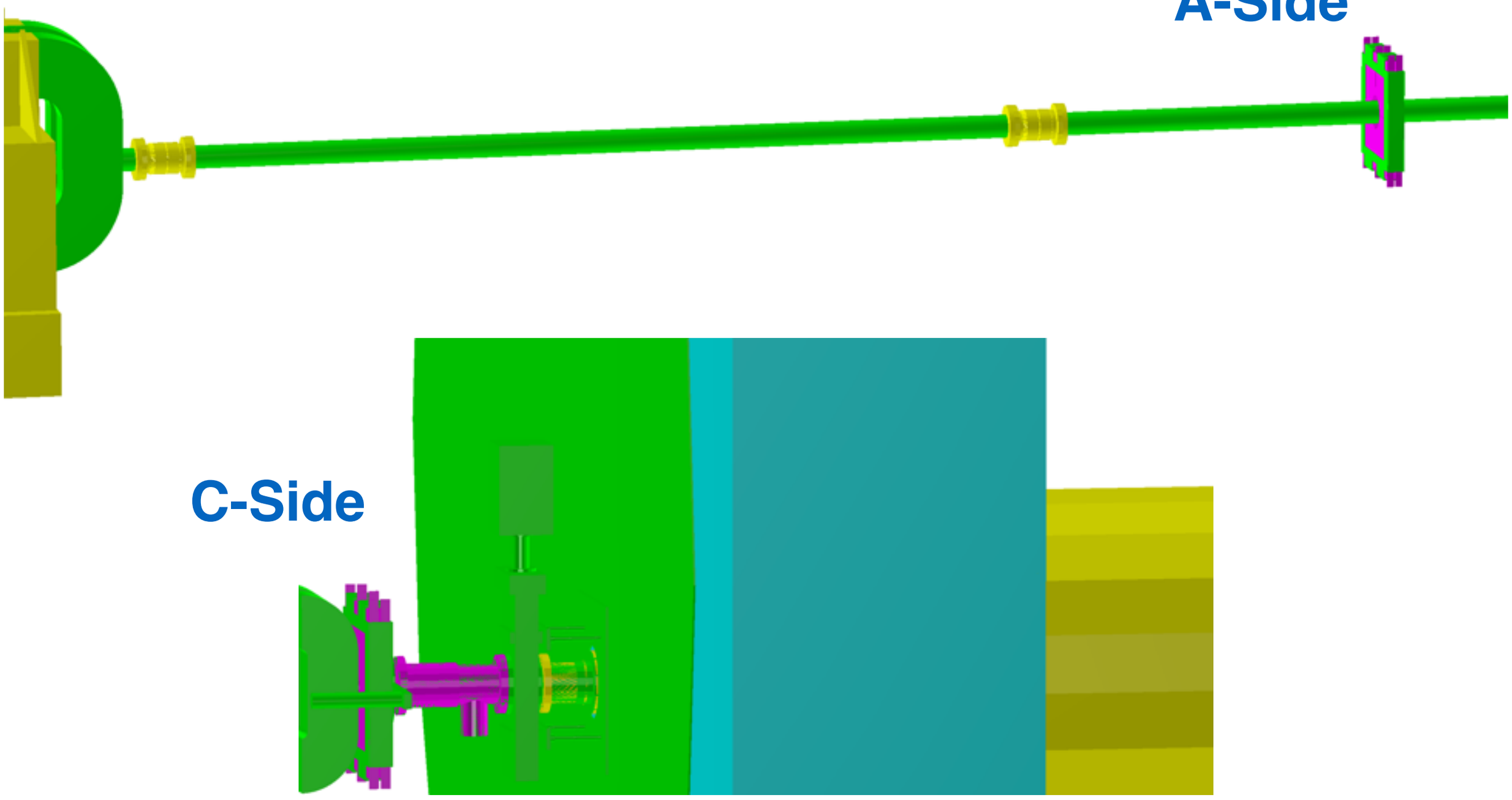
Barbara Guerzoni

Space-Frame Extensions





New detector: AD



DCAL